

**ENERGY TECHNOLOGY INNOVATION AND
DEPLOYMENT—OPPORTUNITIES FOR
ALASKA’S ENERGY FUTURE**

FIELD HEARING
BEFORE THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
ONE HUNDRED FOURTEENTH CONGRESS
SECOND SESSION

FEBRUARY 15, 2016



Printed for the use of the
Committee on Energy and Natural Resources

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ENERGY TECHNOLOGY INNOVATION AND DE- PLOYMENT—OPPORTUNITIES FOR ALASKA’S ENERGY FUTURE

Monday, February 15, 2016

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Bethel, AK.

The Committee met, pursuant to notice, at 3:53 p.m. AKST at the Yupiit Piciryarait Cultural Center, 420 Chief Eddie Hoffman Highway, Bethel, Alaska, Hon. Lisa Murkowski, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

The CHAIRMAN. Good afternoon. The Committee on the Senate and Natural Resources Committee field hearing will come to order.

We are here this afternoon in Bethel to conduct a field hearing that has been convened focusing on energy innovation.

Before we begin, we have just a few housekeeping items to address. We have a translator and headsets that are available for those who would like to utilize the translation services. I believe they are located over to my right here if anyone would like to take advantage of that.

I want to begin my comments with a thank you to the people of Bethel for helping us to host this gathering here this afternoon and to all of the local residents that have come together. Hearings like this do not come about by accident. They constitute a great deal of coordination and that coordination has gone on across 4,000 miles. So for those of you that have helped in so many different ways, thank you for that. And a very special thank you to my Senate colleagues and to the Secretary of Energy who have all traveled a long way to be with us here in Alaska, in Bethel, within your region and in February. Although I must say it is a beautiful February day here in Bethel. Thank you for rolling out the great weather for us as well.

I am proud to really be showing off the beauty that we know as Alaska, this amazing place that we call home. It is an opportunity to not only showcase the natural beauty, but to showcase the people that make us the amazing state that we are.

We know that we face challenges. We know that we face significant challenges, and the opportunity to share not only the challenges but what we are doing to address that in a way that is innovative in a way that is pioneering. This is an opportunity to open

the eyes, I think, and minds of some colleagues who have not had an opportunity to see and be part of this.

Today we are joined by my Ranking Member on the Committee, Senator Maria Cantwell, from the State of Washington. Senator Cantwell has been a very strong partner on the Committee as we have worked to advance energy legislation. It is important not only for our sake, but for the entire country. So I thank Senator Cantwell. This is not her first visit to the region. We were here a couple years ago—here in Bethel and then up to the Cross Gap, so today she got to see yet another village and we just included our first visit to Oscarville.

Next to Senator Cantwell is Senator John Barrasso. Senator Barrasso is from the State of Wyoming. He is also the Chairman of the Senate Indian Affairs Committee and is a great ruler in that capacity. I appreciate all that he does on that Committee.

Next to him is Senator Steve Daines. Senator Daines is from the State of Montana. He is on the Appropriations Committee with me. He is also on the Indian Affairs Committee and on our Energy Committee. Again, a Westerner, who understands what big, open spaces are all about.

Next to Senator Daines we have Senator Angus King. Senator King is from the other end of the country. He is from the State of Maine. He has been a great colleague to work with on Arctic issues. He and I co-chair the Arctic Caucus, and he is a member of our Energy Committee.

At the end we have our colleague from West Virginia, Senator Capito, who is also on the Appropriations Committee as well as the Committee on Environment and Public Works.

Of course we have our first panelist today, a member of President Obama's Cabinet, the Head of the Department of Energy, Secretary Ernest Moniz. It is important to let people know that this is not Secretary Moniz's first trip to Alaska. It is now his fifth trip, and we appreciate all that he has done to lead on energy issues.

We say that Alaska is just different. Alaska is just different and rural Alaska is different beyond that. I think you all, who live and work and raise your families here, know that there is no substitute for being here in person to see, understand and to listen. Meeting the people who live here in Bethel and having the opportunity to go down river, to go see Oscarville, seeing the unique challenges that this region faces, it really does become real when you can see it first-hand.

What you learn is that what most Americans may take for granted, whether it is just being able to afford the heat when you turn it on in the winter or having access to running water or to flush a toilet. That is not guaranteed in rural Alaska, and we know that first-hand.

This field hearing is really an opportunity to examine both our needs and our opportunities when it comes to a particularly important subject for rural Alaska and that is energy. We could use this field hearing to highlight Alaska's leadership on innovation and also the hard work that remains ahead for us.

I think the conversation will help everyone understand why I have been so intent on passing a broad, bipartisan energy bill that really helps to update and modernize our energy policies. A big

part of what I am doing in Washington, DC will have a positive impact for communities like Bethel and the region out here.

Fuel costs are exorbitant in so many areas. That affects not only the price of transportation but everything, the price of electricity, the price of heating, the price of laundry detergent and the price of milk. I am hopeful that we get our colleagues out to the store so they can see what you pay to just live here. We heard some of that today.

But one of the things that we are looking to do is not help rural Alaska with temporary solutions but real solutions that will be long lasting and enduring. If we can harness more of our local resources and if the Federal Government can be with us as a partner, we can empower Alaskans, we can unleash our ability to innovate and we can make energy far more affordable and reliable for Bethel, for Oscarville and for communities all around the state.

We have written a pretty good bill. I think Senator Cantwell would concur with me, that has considerable input from Alaskans. It is a measure that will help us produce more energy. It will help to reduce our energy costs and hopefully lighten the burden that energy places on our families. We provide greater certainty in new mechanisms to continue the important work that we see underway here in this state.

People do not often think of Alaska as pioneering and innovative. What they don't understand is that we innovate because our alternatives are really not acceptable. Just saying that we are going to continue to rely on costly diesel is not a path to sustainability. It is not a path that helps our families, so we innovate. Maybe it is a little bit of duct tape. Maybe it is just great, brilliant minds thinking outside the box, but what we are seeing is a future that through engineering and ingenuity of smart and dedicated people coming together.

We have not only opportunities to help us here but to truly help the rest of the country and the globe. There are places all over the globe that are rural, that are isolated, that are small, that are not connected to anybody else's grid. I want us to be that pioneer for so many.

So I am excited to introduce a group of witnesses that we have asked to join us today, a great group of Alaskans.

I mentioned that Secretary Moniz will lead off our panel.

He will be followed by our Governor, Governor Bill Walker, who is with us today. He is also joined by First Lady, Donna Walker. It is always good to have both of them around the state, and they truly are everywhere. Their taking the time to be here at this field hearing and join us in Oscarville is greatly appreciated. Governor, we thank you for that.

Your own State Representative, Bob Herron, will also be testifying. Mike Hoffman will be testifying on behalf of the Association of Village Council Presidents, Ralph Andersen is here representing Bristol Bay Native Association, Mike Black is with the Alaska Native Tribal Health Consortium, Steve Gilbert is with the Alaska Village Electric Cooperative, and Gwen Holdmann is from the Alaska Center for Energy and Power.

It is a pretty strong group of witnesses to help tell Alaska's story, so again, I am pleased that you all have made the effort to be with us today.

I also do want to note that there is one individual who wanted to be here today, but had family obligations and that is your State Senator, Lyman Hoffman. He has truly been a champion on these energy issues, always pushing me along, which is a good thing. So I wish him and his family well. We will be filling him in on the conversation that we have today.

I want to thank the community of Bethel for having us, our Senators and the Secretary for traveling so far to be here and our witnesses for agreeing to share their expertise.

I neglected to mention Jack Hébert, who is also one of our star witnesses, sitting right in the middle of everybody right up front there. Jack, we look forward to your leadership and comments as well. Don't think you are going to get out of testifying here just because I didn't mention your name.

I am going to turn to Senator Cantwell for her opening remarks because I have talked long enough, and then we will do a little bit of housekeeping and go to Secretary Moniz.

Senator Cantwell, welcome to Bethel. It is good to have you back here. Thank you for your leadership on the Committee as well.

STATEMENT OF HON. MARIA CANTWELL, U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Well thank you, Chairwoman Murkowski, and thank you for holding this oversight hearing and having all of us come to Bethel.

As you mentioned, this is my second time here. We came in 2003, and it was a great opportunity to meet a lot of people from the Bethel community and to talk about another important issue that faces all of us and that was access to health care. I was very glad that the legislation that allowed for the transfer of land so that we could continue to be a destination site for maternity health care for the region was passed and that that is moving forward because we certainly want to make sure the community continues to have those resources.

I thank you for your good work on the energy bill. It is something that has been a long time process, modernizing the energy needs of our nation and we were able to pass it out of Committee for the first time since 2007 and take up on the Senate floor a bipartisan energy bill. While it got stalled with some other national items, I am very confident that we will get back to that legislation and some of the very subjects we are talking about here today will be fulfilled in that legislation.

I, too, thank the people of Bethel for inviting us all here and for the welcome hospitality and really for the wonderful celebration of schoolchildren in Oscarville. That was quite a treat for all of us to see what is happening here in Alaska.

Obviously Alaskans use goods and services and they are more expensive than the lower 48 and anywhere from two to ten times more expensive. We are here today to talk about one particular aspect of that being energy and the costs of energy. That is for house-

holds in rural Alaska nearly half of total expenses sometimes go to pay energy costs. That is astounding.

Nearly 90 percent of rural communities are dependent on diesel fuel for their primary energy needs, but as a result of the potential benefits of diversification Alaska is also home to a variety of other energy solutions. We are here today to hear from our witnesses about those unique challenges and the solutions that you would like to see in this community.

We will talk a lot about, obviously, the fact that energy efficiency should be part of the solution. I know that is why I am so interested in what Jack Hébert has to say, people want to hear.

I know the Governor, today, has mentioned several times, he is a good carpenter. Well there is a lot going on in the building area that also is leading to energy efficiency and to saving power. Saving one electron is about a third of the cost of actually producing the electron. It is cheaper so we definitely want to see what we can do here in Alaska.

Rural residents use half of the energy in these communities, and the energy costs are very high. I don't have to tell anybody in this room, you know what the roller coaster is like of fluctuation in oil prices and what it does to your economy. So that is why we need to look at issues of diversification.

Obviously Alaska's harsh climate and remoteness means that we cannot just come up with any solution, that the solutions we are talking about today have to perform in extreme conditions and obviously are challenged by maintenance.

The good news, I think, of that is if it works here in Alaska the chances are it could work at a lot of different places in the lower 48. So thank you for being pioneers on some of these solutions of distributed generation.

Obviously we are looking at the innovation of technologies and resiliencies to issues of weather and maintenance requirements. Alaska's high price of electricity means that we need to look at power control costs but also how to look at these issues of energy storage.

I also applaud the state's results from an energy innovation program, the Emerging Energy Technology Fund and the Renewable Energy Fund, that are focused on giving resources to the communities.

One thing I want to make sure that we talk about today is how we can be a better partner to that fund from the Federal level. This is something that we want to make sure, I know it was passed in your state legislature on a bipartisan basis in 2010. We want to continue to work with you on those kinds of solutions to bolster the partnership between the Federal Government and that State fund.

The lower 48 obviously has a lot of solutions, but we know there is no cookie cutter solution for the lower 48 that is going to fit right here in Alaska. So we need to look at these issues of limited local economies, cold climate state heating needs, isolated electricity grids and other challenges that are here in Alaska if we are going to create solutions.

I know that the room is full of people who have already been harnessing some of these challenges. The University of Alaska Fairbanks Energy System Leadership Program and DOD-funded Island

Grid Regional Resource Center which is a partnership between nonprofits in Alaska and Maine. I think these are important things. In the energy bill that we have already passed, we are very focused on what we can do for regional energy development. One of the commitments we are also going to be talking about in the future is how we can give more funds to regional demonstration projects.

We heard back in July about the obstacles to deploying energy solutions in both Alaska and Hawaii and the U.S. territories—what our challenges are as a nation and what it means to actually have reliable, affordable energy in those parts of the United States. That is why I am also glad that our colleagues toured with us today.

I think coming from the State of Washington you see the economic relationship between Alaska and Washington. You see the challenges a little more closely. But I think some of our other colleagues in the U.S. Senate and the House of Representatives need to understand that these are energy solutions we need to focus on for these regions of the United States that are harder to serve.

Newer, lower cost electricity generation, transportation technologies are things that we have to think of, but there are barriers to deployment such as lack of technical expertise to operate and maintain new technologies and the lack of capital or credit to finance the transition to these other opportunities. I know we are going to hear from Secretary Moniz about that and from Governor Walker, who is going to talk about what the State of Alaska is doing.

We need energy solutions that are developed by Alaskans for Alaskans, and we want to make sure that it is a robust network. While I say by Alaskans and for Alaskans, I want to make sure our national laboratories and academia and the private sector are all working hard to work on these solutions. As I said, whatever can be pioneered here in Alaska I am sure will work in other parts of the United States.

One example is the Pacific Northwest Laboratory which is in Richland, Washington. They have been pioneering smart grid technologies that will be helpful in balancing energy loads and those kinds of systems could be used for smart building technologies that are being applied to commercial buildings, schools and health clinics to make sure that they are more energy efficient.

I look forward to talking about some of these ideas and to look at this successful state effort like the Cold Climate Housing Research Center that is reducing energy use in homes by 80 percent with new building designs in Arctic communities. So I look forward to hearing about that.

As I said, I know that there is a lot for us to do when we return to Washington. There are many things that we are going to be talking about including hydro power, geothermal and marine hydrokinetics, biomass and R and D to the grid including microgrid systems. These are all things that are primary issues, I think, to Alaskans, but also to Washingtonians and other people throughout the United States.

I hope that DOE's loan guarantee program which is being expanded in this bill for the first time is a good candidate to look at the state's emerging energy technology fund and see how we can

partner with that and to make sure that local projects that have not previously gotten access to the DOE program also make sure that we are understanding why and look again for a better partnership.

Then last, the Secretary of Energy did a tremendous job with what is called our Quadrennial Energy Review. I thank him for doing that. He would think well, that is the Quadrennial Energy Review of the United States. Of course that is his daily work. Well, actually he has to think for the entire nation. That every Cabinet Secretary, President, Vice President and everybody saying okay, here is what you need to think about, the energy needs of our nation. So you did that and produced this report which is a very forward looking assessment of where we are in our country in the transitioning of our energy needs.

One of the key things in the report is the need to train and seal a work force for the new jobs. The report basically says we will need 1.5 million new energy jobs for the future, so we definitely want to hear as well about how we seal Alaskans and Washingtonians and others for these jobs of the future so we can be best prepared to take advantage of these technologies.

Again, I look forward to hearing from all the witnesses. It is great to be in Alaska again today, particularly when it is warmer here than in the other Washington, in Washington, DC, and to see just the great beauty that exists both outside and inside with so many people participating in today's events.

Thank you very much, Madam Chair.

The CHAIRMAN. Thank you, Senator Cantwell. I so appreciate that.

At this time, we will turn to our panel of witnesses.

For those who have gathered here we are following the format for this field hearing that we follow back in Washington, DC as if this was a meeting of the Energy and Natural Resources Committee held in our committee room. It is different than what we do in Juneau, if you have ever been to Juneau to testify or been to an LIO where you know that after presentations have been made the public has an opportunity to come to the microphone and make a statement. We do not structure our hearings that way, unfortunately. What you will hear today is a select panel of witnesses. I have already identified who will present, and Secretary Moniz will be on the first panel. We will ask each of the witnesses that have been invited to provide us with about 5 minutes of oral testimony. Their full statements are included as part of the record.

To those of you who wish to provide comment to the Committee on anything that you may have heard today or just something that you think needs to be part of the Committee record, you are welcome to submit comments in writing to the Committee. We hold the record open. I believe we are going to hold it open for two weeks after today's date. So even though the process does not allow for that public comment from you, which I regret, know that we are interested in receiving comments from the people here in the Bethel region.

After the witnesses have testified, there will be an opportunity for members of the Energy Committee to ask questions of our wit-

nesses, and we will probably do that most exclusively to panel three.

With that, Mr. Secretary, it is indeed a pleasure to welcome you back to Alaska. Thank you for your leadership on all things energy. If you would like to commence this hearing, we would be honored to add your comments.

Thank you for making this long trek.

**STATEMENT OF HON. ERNEST MONIZ, SECRETARY, U.S.
DEPARTMENT OF ENERGY**

Secretary MONIZ. Great. Well thank you, Chairman Murkowski, Ranking Member Cantwell, members of the Committee.

I would like to start by saying that the leadership of the Chair and Ranking Member is really extraordinary. The working relationship that we have, the opportunity to work together on hard problems. As you know this has not always been the case in Washington, DC more recently, but I think we have just an excellent working relationship. I think we will get things done, including the people of Alaska, of course.

I especially want to thank the community of Bethel for opening the Elders facility to us for a wonderful lunch and even more important, wonderful input for us to take back and also acknowledge the excursion to Oscarville as being extremely important, I think. I have to say that I think the holistic approach, the——

[Laughter.]

Secretary MONIZ. I think the holistic approach being highlighted in Oscarville is very much what we need to do more of. In fact, a week ago today the National Academy of Sciences held a workshop DOE took part in, a number of Alaskans took part in, which had a similar theme about how communications and energy and water and waste and health and education really should be thought of in a way of community building. And we look forward to seeing what happened in Oscarville and how that can be scaled further.

As the Chairman said, this is my fifth visit. First when I came here in the Clinton Administration at the invitation of another Senator Murkowski. But in 2014 I joined Lisa Murkowski in a variety of places including the Chena Hot Springs, the University of Alaska Fairbanks and for the tour of the Cold Region's Research and Engineering laboratories, Permafrost Tunnel Research Facility near Fairbanks. The Permafrost Facility was fascinating but also alarming in reminding us about the doubled pace of global warming that we are seeing in the Arctic and what those implications are for energy and for many other aspects of life here in Alaska.

Global warming has no say in its march to higher temperatures. The core elements of the climate change science are well established and key energy innovation is central to meeting the climate challenge while also providing security, economic growth and increased access to affordable clean energy for all, obviously, a critical issue here in Alaska.

Today I'll just talk briefly about some of the ways the Department of Energy is working with Alaskans to address those challenges and then connect back to some wider efforts by the Administration to invest in energy technology research and development

and ensure that the United States remains economically competitive and certainly energy secure over the coming decades.

In many ways what happens in Alaska is a preview of the future for the rest of the country and the world with rising temperatures, threats to infrastructure and the need for clean, affordable and reliable energy solutions and in particular distributed energy solutions. While it is resource rich, we heard today how Alaska's vast size and rugged terrain make energy access for many communities a significant challenge. But these challenges are not left for Alaska to tackle alone. We are fully committed to driving energy components for the National Strategy for the Arctic Region.

We were active participants in crafting the Executive Steering Committee established by the President in 2015.

The Arctic is a very dynamic region. I just came from Winnipeg, meeting with the Energy Minister there, and I want to say there's a strong shared interest to work together on issues involving the Arctic, most specifically including energy provision to isolated communities. That's something that people want to pursue with the Committee and with our Canadian colleagues.

We want to partner with Alaska. I reestablished a physical office for the Department in the Arctic region in January 2014 to better listen to Alaskans and to apply your insights and needs into our programs ranging from research to engineering to financial and technical assistance. We now plan to add new staff members in our office in Alaska in light of what has been a very, very active and I think, productive discussion.

The Chair noted that this session is being run as it was in Washington. But if I may deviate I think it would be worth it to the audience if I could just introduce my Indian Energy members.

Chris Deschene has now, for the last ten months, headed our office. He's, among other things, a Naval Academy Mechanical Engineering graduate and brings a great skill set to the position.

Doug MacCourt, another member of our office. And then here a head of a local office, Givey Kochanowski, roughly speaking.

[Laughter.]

That many of you have gotten to meet. And as I say, he will now be joined by a couple of colleagues later on this year because we think this is a place where we can really get stuff done.

So moving on, DOE's Tribal Energy Programs have funded numerous tribal energy projects in Alaska, projects valued at over \$30 million with DOE investing over \$11 million of that.

Today, about an hour ago, we announced up to \$7 million for the establishment of Inter-Tribal Technical Assistance Energy Providers Network. Its funding opportunities seeks inter-tribal organizations and Alaska Native Regional Corporations interested in training individuals to provide expertise and technical energy assistance to tribes and Alaska Native villages in their regions.

We also released today a new analysis prepared by the National Renewable Energy Laboratory entitled, "Solar Prospecting in Remote Alaska: An Economic Analysis of Solar Photovoltaics in the Last Frontier State." It demonstrates that installing and operating moderately sized solar PV systems is a potentially competitive way to reduce high fuel costs and make remote energy systems more resilient and effective for Alaska Native villages. And I think this

role of solar in Alaska is one that's really just dawning on us now, I think, is quite, quite important.

Last year the President announced the Remote Alaska Communities Energy Efficiency, or RACEE, competition. More than 60 remote Alaskan communities have now pledged to reduce their per capita energy use by 15 percent by 2020. As part of the competition these community efficiency champions will have access to a peer network and up to 20 will receive technical assistance to develop energy efficiency plans. We then expect to award over \$3 million for up to five communities to implement those RACEE energy efficiency plans.

Through our Energy Efficiency and Renewable Energy Office DOE will work with Alaska officials to support energy efficiency in public facilities in underserved rural communities. We, in turn, expect a savings of half a million dollars in annual energy costs.

Energy efficiency solutions do tend to be applicable broadly but, of course, particularly for energy generation, there's no one size fits all, particularly in a state as diverse as Alaska. But some of these examples, our Geothermal Technologies Program has invested over \$68 million across 13 projects in the last decade for geothermal research and development in Alaska. And this includes support for the innovative geothermal project that we saw in 2014 at Chena Hot Springs which was a R and D award winner for innovation and reduced electricity costs there from \$0.30 to \$0.06 per kilowatt hour.

We are fully committed to drive the energy components of the national strategy, whoops, excuse me, it's this page. DOE also funded a study by the Council of Athabascan Tribal Governments and later a grant to help build at Fort Yukon a biomass combined heat and power project with sustainable harvesting of wood. DOE helped deploy the RivGen turbine in the Kvichak River providing clean renewable power while allowing, according to Alaskan officials, an estimated one and a half million adult sockeye salmon to migrate past the turbine area.

Through the Weatherization Assistance Program Alaska received more than \$1.6 million in FY'16 to support weatherization of 150 homes.

Two microgrid project awards of three quarters of \$1 million each were made to our national laboratories to design, of a design support tool for remote off grid microgrids and to address an issue with a \$1 million effort with the labs and the state to examine in developing island power systems for rural Alaska.

The Department's Office of Science, the basic research arm of DOE, has a long standing presence in Alaska conducting Arctic research to understand the complex set of scientific issues responsible for Arctic climate change and relevant to Alaska's Arctic ecosystems.

So this is just a small sample of the innovative work happening in and directly relevant to Alaska. We could go on but I want to finish up by moving on to a broader innovation effort that we are launching.

We feel that innovation in clean energy technologies is, again, a solution to many, many of our challenges. So we, at the end of November, the President and 19 other world leaders launched some-

thing called Mission Innovation, a committee of 20 countries, including ours, representing over 80 percent of global clean energy R and D budgets to double those budgets over a five-year period. The idea is to open up the innovation pipeline, to provide more investable opportunities and that initiative is complemented by an independent initiative spearheaded by Bill Gates called the Break-through Energy Coalition.

So this is a coalition of 28 investors from ten countries putting millions of dollars on the table to invest in that expanded innovation pipeline. This coalition will be distinguished by being a more patient in getting financial returns, more risk tolerant and willing to take the most promising technologies from end to end, all the way to deployment and scale.

Last week's Fiscal Year 2017 budget request to Congress follows through on the Mission Innovation commitment including the request for a 21 percent increase in DOE's energy R and D appropriations.

I want to just mention one other feature of our proposal on Mission Innovation, and this is Regional Energy Innovation Partnerships which we proposed to start the first year at \$110 million. The idea is that we believe different regions in Alaska is a case in point. Different regions have very, very different needs in their energy portfolio and we feel part of this increase in budget should be managed, led or led regionally in terms of structuring the portfolio. And again, Alaska shows that.

We all know necessity is the mother of invention, and there's a lot of Alaska innovation that we can learn from as you pursue your needs.

So Alaska occupies a unique position at the crossroads of energy production, energy use and climate change. We look forward to partnering in this innovation work, working with the Committee, working with the state and working with all the stakeholders and there, as are so many here today.

Thank you.

[The prepared statement of Secretary Moniz follows:]

Testimony of Secretary Ernest Moniz
U.S. Department of Energy
Before the
Committee on Energy and Natural Resources
United States Senate
Field hearing to examine Energy Technology Innovation and Deployment –
Opportunities for Alaska's Energy Future
Bethel, Alaska
February 15, 2016

Thank you, Chairman Murkowski, Ranking Member Cantwell, members of the Committee and the community of Bethel, Alaska. I am pleased to be here to discuss energy technology innovation and the opportunities and challenges for Alaska's energy future. This is my fifth visit to this great state, with the first being during the Clinton Administration at the invitation of then-Chairman Frank Murkowski, and most recently in 2014. It is a pleasure to be back.

Alaska is often referred to as the "Last Frontier", but in many ways it is actually the "First Frontier". You are the first Americans to witness the destructive impacts of climate change that will ultimately be felt around the globe – and, thus, you stand to greatly benefit from technologies to both mitigate and adapt to climate change. On my last visit, I joined you, Senator Murkowski, for a tour of the Cold Regions Research and Engineering Laboratory's (CRREL) Permafrost Tunnel Research Facility, run by the U.S. Army Corps of Engineers near Fairbanks. It was fascinating and, frankly, alarming. Global warming is marching the planet toward ever higher temperatures, and the Arctic region is the canary in the coal mine; warming twice as fast as the global average. The fundamental science of climate change is unchanged, and the threat remains the same. We are already seeing the devastating effects of the rise in temperatures on communities, ecosystems and infrastructure here in Alaska.

However, this rapid warming coupled with the high costs and limited access to energy, along with the ingenuity and resourcefulness of Alaskans, puts the state on the leading edge of distributed energy and energy efficiency technology development and deployment, providing a critical service as the rest of the world transitions to a more sustainable energy future. Alaska offers the rare opportunity to demonstrate the feasibility of technologies for regions and nations of the world that do not have central grids – this includes some regions of the U.S. and many of the under-developed countries. Innovation in this arena will not only help Alaska communities, but could provide new technology export opportunities and competitive market advantages for homegrown U.S. companies that develop these technologies.

As the Secretary of Energy, I have the honor of heading up an agency that is one of the world's leading supporters of scientific discovery and energy research and development. It is our mission at the Department of Energy to ensure America's security and prosperity by addressing energy, environmental, and nuclear security challenges through transformative science and

technology solutions. As such, our investments play a critical role in enhancing innovation, economic growth, and national security in the United States, and we are particularly proud of our role in providing Alaska with the innovative tools to help meet these objectives.

ALASKA ENERGY CHALLENGES

Rich in energy resources such as oil and natural gas, Alaska is well known for its long history of providing energy security to the United States and our allies. The United States Geological Survey (USGS) estimates that the Arctic holds 412 billion barrels of oil equivalent (BOE), 210 billion barrels in North America alone, and 60 percent of that is in Alaska.¹ The industries here, in partnership with state and federal agencies, continue to develop technologies and practices to mitigate the harsh environmental conditions and the unique environmental risks of Arctic exploration and production. Beyond oil and gas, Alaska also boasts extensive hydropower, wind, geothermal, and even solar resources.

Despite these abundant energy resources, given its vast size and rugged terrain, much of Alaska deals with the constant challenge of accessing clean, reliable, and affordable energy for heat and power. The harsh Alaskan climate, relatively small scale of energy demand and the vast distances between communities - in many cases only reached by air or boat - can make conventional forms of energy infrastructure uneconomic. For the many remote communities that have no access to an interconnected electric power grid, independent micro-grids powered by expensive diesel fuel are the norm.

Consumers in Alaska pay some of the highest energy prices in America.² For example, in July 2015, the unsubsidized cost of heating oil averaged \$5.27 per gallon across the state, and up to \$9 per gallon in some regions.³ Likewise, in these remote regions of Alaska the average electricity cost is more than \$0.50 per kWh, and as high as \$1.50 per kWh in some locales. For comparison, the national average for the continental United States is \$0.10 per kWh.⁴

Last week, in Washington, D.C. the National Academy of Sciences hosted a workshop on electricity use in rural and islanded communities, so the DOE could hear directly from people working to address these unique challenges. Alaska co-ops have learned to be very resourceful in providing services to their members.

At the workshop, DOE heard from Alaska electricity experts, including Meera Kohler, the President and CEO of the Alaska Village Electric Cooperative, which recently added Bethel as the largest of the 56 communities it serves. Henri Dale, the former manager of Golden Valley Electric Association described how they are using battery electric storage to reduce blackouts

¹ U.S. Geological Survey, "Circum-Arctic Resource Appraisal: Estimates of Undiscovered Oil and Gas North of the Arctic Circle," USGS Fact Sheet 2008-3049 Washington, DC (2008), Table 1, page 4

² Energy Information Administration, "Alaska Price Differences from U.S. Average, Most Recent Monthly," Petroleum Marketing Monthly; Natural Gas Monthly; Electric Power Monthly, October 2015

³ Alaska Department of Commerce, "Alaska Fuel Price Report: Current Commodity Conditions," July 2015 https://www.commerce.alaska.gov/web/Portals/4/pub/FuelPriceReport_July2015.pdf

⁴ Alaska Energy Authority, "2014 Power Cost Equalization Program Report," March 2015 <http://www.akenergyauthority.org/Content/Programs/PCE/Documents/FY14PCEStatisticalRptByComtAmended.pdf>

and improve reliability of their system. Marc Mueller-Stoffels of the University of Alaska discussed the costs and benefits of diesel-powered generation in communities isolated from the larger electricity grid.

Speakers at the workshop described the challenges of providing electricity services and meeting regulatory requirements; discussed the need for broadband access to allow rural co-ops to access improved grid management technologies; and, asked for federal agencies to work cooperatively with Alaskans in the development and implementation of policies. A summary of the workshop will be released to the public, and will be referred to by the Quadrennial Energy Review Task Force as it produces the next QER report on electricity from generation to end-use.

The high costs and limited access to energy drives Alaskans to seek out innovative solutions that others may not. Low cost and reliable distributed generation and energy storage technologies that can be scaled to meet the needs of small, rural communities could be a game-changer here in Alaska.

These challenges are not left for Alaska to tackle alone. At the Department of Energy we consider ourselves to be the “solutions” agency, and we, along with other federal agencies, want to build upon the long experience here with unique and complex energy challenges, as well as the wealth of Alaskan ingenuity and resolve, to do the research, engineering and technical assistance needed for a sustainable, productive, and competitive state economy. Our comprehensive efforts over the past two years in both National Strategy for the Arctic Region and tribal energy program, are strong first steps in a long and enduring relationship DOE seeks with Alaska. For these reasons, I reestablished a physical office here in January 2014 and we've been running full speed ahead since then, listening to you, and applying your insights and needs into our programs.

DEPARTMENT OF ENERGY RESOURCES IN ALASKA

What follows are examples of recent, ongoing and planned activities that illustrate the range of the Department's work in the State of Alaska, but, I assure you, this does not represent all of DOE activities that are relevant to Alaska. With unique energy resources and needs, and seeing the present and looming dangers of climate change, the equities for Alaska span the Department's clean energy and basic research portfolio.

The Office of Indian Energy

Since 2002, the Office of Indian Energy's Tribal Energy Program and its predecessor, the Energy Efficiency and Renewable Energy Tribal Energy Program, have funded numerous tribal energy projects in Alaska - valued at over \$30 million, with DOE investing over \$11 million - through financial assistance for renewable energy and energy efficiency projects. These projects aim to address many of the high energy cost issues facing Alaska. DOE's work in Native Alaska is based on strong partnerships with local communities, their utilities, their governments, Native Corporations, non-profits, the state, and federal partners.

In the last three years, the Office has responded to sixty technical assistance requests from forty-seven Alaska Native communities and organizations. Last year, Indian Energy conducted

workshops across the State, providing education and information to nearly 150 people, and training 36 State and regional organization representatives as Alaska Energy Ambassadors. The Office also issued in 2015 the “*Tribal Energy System Vulnerabilities to Climate Change and Extreme Weather*” report — providing a resource to assist tribes and Alaska villages in identifying risks to their energy systems. This year, the Department will continue to expand its services to Alaska through the addition of several new full-time staff to Indian Energy’s Alaska Program Office.

Today, I am announcing up to \$7 million for the establishment of an Inter-tribal technical assistance energy providers network. This funding opportunity announcement seeks Inter-Tribal Organizations and Alaska Native Regional Corporations interested in training individuals to provide expertise and technical energy assistance to Indian tribes and Alaska Native villages in their region. To expand the technical assistance being provided by the Department and to support of the Obama Administration’s commitment to strengthening partnerships with tribal nations, this initiative initially aims to capitalize on the unique relationship Alaska Native Regional Corporations and Inter-tribal Organizations have with their member Indian tribes and Alaska Native communities by providing support for the development of trained energy experts. Successful applicants will receive five weeks of intensive training through DOE, the National Labs and other entities. The outcome will be a national network of regional, tribal energy experts who can provide technical energy assistance and informational resources to their member Indian tribes and Alaska Native villages, and give tribal communities and Alaska Native villages the knowledge, skills, and resources needed to implement successful strategic energy solutions.

Today I am also announcing the release of new analysis that we hope will prove foundational to Alaskan communities’ pursuit of reliable and sustainable energy solutions. Indian Energy is releasing *Solar Prospecting in Remote Alaska: An Economic Analysis of Solar Photovoltaics in the Last Frontier State* prepared by the National Renewable Energy Laboratory (NREL). The *Solar Prospecting* report demonstrates the potential competitiveness of installing and operating moderately sized solar PV systems to reduce high fuel costs and make remote energy systems more resilient and effective for Alaska native villages.

Indian Energy’s Alaska Strategic Technical Assistance Response Team (START) Program aims to help selected Alaska Native villages reduce the cost of energy and displace diesel oil by increasing community capacity, evaluating specific projects to prepare for funding opportunities, identifying additional funding opportunities, and providing continued assistance through the grant application and financing process. Since its inception in 2012, the Program has assisted 16 communities with long-term technical assistance and provided \$1.25 million to five of those Alaska Native villages to retrofit community buildings and install small renewable systems, resulting in immediate impacts to those communities.

The Remote Alaska Communities Energy Efficiency (RACEE) Competition

In response to energy needs in Arctic communities, the President announced the Remote Alaska Communities Energy Efficiency Competition (the Competition) in September 2015. Today, more than 50 remote Alaskan communities have pledged to reduce their per capita energy use by 15

percent by 2020 as part of the Competition. These Community Efficiency Champions will have access to a peer network, and will be eligible to compete for technical assistance. The Department anticipates announcing up to 20 recipients of the targeted technical assistance at the end of April 2016. Technical assistance provided through the Competition will deliver tailored education and training to participating communities to develop viable energy efficiency project plans that may include, but are not limited to, energy use data collection, building audits, business plan development, financial feasibility assessments, engineering studies, and available funding and financing tools for implementing economic efficiency measures. These Community Efficiency Champions will then be eligible to compete for a total of up to \$3.3 million awarded to up to five communities to implement the energy efficiency plans developed throughout the RACEE Competition.

EERE - Energy Transition Initiative

DOE is proposing for FY 2017 to deepen coordination across DOE and with the Department of Interior to reduce or eliminate the total dependence on imported fuels that many Alaskan communities have recognized as a threat to their sustainability. Activities would provide resources to help Alaskan communities bridge the gap between DOE-funded technology deployment, like the RivGen Power System turbine in the Kvichak River, and strategic planning efforts funded by other federal programs. Based on prior DOE investments, the EERE Strategic Programs Office has developed a replicable planning and deployment model called the “Energy Transition Initiative” that will be adapted with FY 17 funds to enable Alaskan communities to set and achieve their own sustainable energy goals. This model, and related decision support resources, can help communities evaluate the costs and benefits of different advanced energy portfolios, complementing on-going efforts to deploy small-scale, hybridized conventional fuel-renewable generation platforms in islanded grids.

EERE - State Energy Program (SEP)

Alaska received more than \$881,000 in Formula Funds in 2013-2015 to support energy efficiency activities, including improvements in multi-family housing units and planning for rural communities with high energy costs. This is on top of the funding from the Recovery Act, in which Alaska received \$28 million in State Energy Program funds to increase the energy efficiency of public facilities, commercial operations and low-income homes. The Alaska Energy Authority (AEA) received \$300,000 in State Energy Program Competitive Funds in FY 2015. Under the award, the AEA and the Alaska Housing Finance Corporation will partner with the Alaska Native Tribal Health Consortium to establish a program to kick-start small project energy efficiency development in public facilities located in underserved rural communities.

The SEP award leverages Alaska’s existing financing efforts for public buildings, some of which were developed under the American Recovery and Reinvestment Act. The state estimates that the award will result in an aggregate annual savings of 17 billion British thermal units (Btu), and \$500,000 in annual energy-cost savings.

EERE - Geothermal Technologies

Given Alaska's tremendous geothermal potential, the DOE Geothermal Technologies program has invested over \$16 million across 13 projects since 2005 for geothermal research and development in this state. Of this, the Department has awarded \$1.7 million in funding to Chena Hot Springs Resort to make it the first geothermal power plant to come online in Alaska. In 2014, I had the opportunity to visit Chena and observe firsthand the advances made by this project. The power plant demonstrated the compelling economics of this technology, reducing the cost of electricity from about 30 cents to less than six cents per kWh, a more than an 80 percent savings. In 2007, only a year after installation, it received an R&D 100 Award as one of the most innovative new projects of the year.

Other projects include one led by the University of Alaska-Fairbanks, which received \$4.3 million in funding to evaluate the geothermal potential of Pilgrim Hot Springs, 60 miles north of Nome, AK. DOE is also supporting the Akutan Geothermal Development Project with \$951,000, with non-federal partners including the Alaska Energy Authority contributing \$1.57 million. The goal is to allow the city of Akutan to replace the five million gallons of diesel used annually to generate electricity for the city and its seafood processing plant, the largest in North America.

EERE - Water Power

In July 2015, the Ocean Renewable Power Company deployed its RivGen turbine in the Kvichak River and provided power to Igiugig, a remote village in southwestern Alaska. The companies advanced control systems are being developed in collaboration with the University of Washington, Maine Technology Institute, and NREL with support from the DOE Water Power Program. In addition, the Igiugig Village Council is one of six organizations to receive funding under EERE's FY 2015 Durability and Survivability funding opportunity announcement. The Council will work with Ocean Renewable Power Company as a follow-on to the 2015 RivGen deployment project to develop a river turbine system that will demonstrate installation, operation, and maintenance (IO&M) design improvements to simplify maintenance and make system components more durable during operations.

Developing local renewable energy resources like power from marine and hydrokinetic (MHK) systems is critical to achieving sustainability in these villages. The project can demonstrate that commercially viable power systems that will reduce environmental impacts of electricity generation remote river communities. Since being deployed in July, the Alaska Department of Fish and Game has estimated that over 1.5 million adult sockeye salmon have migrated past the turbine area.

EERE - Weatherization Assistance Program (WAP)

Through the Weatherization Assistant Program, Alaska will receive more than \$1.6 million in Formula Funds in fiscal year 2016 to support the weatherization of 150 homes. WAP's mission is to increase the energy efficiency of dwellings owned or occupied by low-income persons, reduce their total residential energy expenditures, and improve their health and safety.

Office of Fossil Energy – LNG Export

Natural gas is an important energy resource in Alaska, and the export of LNG from Alaska is a very different proposition than that of the lower 48. Alaskan natural gas is disconnected (or “stranded”) from lower 48 markets, and as such DOE considers LNG export applications from Alaska differently than others. In fact, just last week, the Department renewed the FTA and non-FTA authorizations for the Kenai facility, which has exported LNG for decades. Prior to this, in May 2015, DOE issued a conditional authorization for the Alaska LNG Project to export LNG. The conditional approval is subject to environmental review and final regulatory approval, but, as we heard from the Chairman and others here in Alaska when our Deputy Secretary made the announcement in Anchorage, this conditional approval was an important step for the project.

Office of Electricity Delivery and Energy Reliability – Microgrid and Storage

In FY 2015, two *Microgrid Project* awards of \$750,000 each were made to DOE national laboratories for the development of a Design Support Tool for Remote Off-grid Microgrids (ROMDST). This is being used to develop the Distributed Energy Resources Customer Adoption Model (DER-CAM) into a support tool for remote, resilient and reliable microgrids, and is being done in partnership between the Alaska Center for Energy and Power, Lawrence Berkeley National Lab, Los Alamos National Laboratory, Brookhaven National Laboratory, Argonne National Laboratory, General Electric, and Burns Engineering.

In addition, in FY 2016, the Office is conducting a technical and economic feasibility study for a load-leveling energy storage system, in partnership with the City of Cordova, Alaska, and the Alaska Center for Energy and Power.

Also in FY2016, we have just initiated a \$1 million effort with our national laboratories and the State to examine developing islanded power systems for rural Alaska. The plan is to develop a standard design for resilient microgrids using at least 50% less diesel fuel and demonstrate at three Alaskan communities. Partners include NREL, LBNL, PNNL and SNL on DOE laboratory side and the Alaska Center for Energy and Power(ACEP), Renewable Energy Alaska Project(REAP), Intelligent Energy Systems, University of Alaska Anchorage Institute for Social and Economic Research(ISER) and the Alaska Energy Authority. At DOE our Offices include Indian Energy, Alaska; Electricity Delivery and Energy Reliability, and Energy Efficiency and Renewable Energy.

The Office of Science - Basic Research and Climate

The Department’s Office of Science — known as the basic research arm of DOE — has a longstanding presence in Alaska, supporting Arctic research to understand the complex set of scientific issues responsible for Arctic climate change and relevant to Alaska’s arctic ecosystems.

The Office of Science is supporting multi-lab/university research to develop high resolution models and general understanding of sea ice, ice sheets, atmospheric pollutants and physics, ocean biogeochemistry, ocean turbulence and circulation, and the role that methane hydrates play in the carbon cycle. The goal is to make more accurate predictions about the impacts of climate

change, including inter-annual variabilities and extremes on Arctic ecosystems, with a special focus on Alaska.

In addition to climate modeling, the Department supports a multi-platform, multi-site system of Atmospheric Radiation Measurement observatories around the globe, with one permanent observatory in Barrow, and a second mobile facility observatory on long term deployment to Oliktok, AK. Collectively, these activities address two major areas of uncertainty in climate change model projections: the role of clouds and the effects of aerosols on precipitation, and the atmospheric radiation balance. The unique qualities of Arctic atmospheric processes require dedicated Arctic observations and research activities.

MISSION INNOVATION

The energy landscape for the U.S. has changed dramatically in recent years, and largely for the better as domestic energy production has increased and significant progress has been made in cost reduction and deployment of many clean energy technologies. Nonetheless, the pace of innovation and the scale of transformation is simply not enough. A rapid acceleration of clean energy technology breakthroughs is essential if we are to provide affordable and reliable clean energy to consumers, ensure our long-term energy security, and enhance the competitiveness of American companies in the global marketplace. This cannot be realized without involvement of the private sector at the early stages of the innovation cycle.

In November, President Obama and other world leaders came together to launch **Mission Innovation**, a landmark commitment to dramatically accelerate public and private global clean energy innovation. Through this initiative, 20 countries representing at least 80 percent of global clean energy research and development (R&D) budgets have agreed to double their governments' R&D investments in this domain over five years. These additional resources will dramatically accelerate the availability of the advanced technologies that will define a future global energy mix that is clean, affordable, reliable, and accessible. Each country in Mission Innovation is tailoring its commitment to its own clean energy needs, resources, infrastructures, security needs and innovation ecosystems.

Mission Innovation is complemented by a separate private sector-led effort called the Breakthrough Energy Coalition, spearheaded by Bill Gates. The Breakthrough Energy Coalition is a group of 28 influential investors from 10 countries that has committed to invest patient capital in early-stage technology development coming out of Mission Innovation countries that has the best chance of providing reliable, affordable energy for everyone to help build energy solutions at scale. Mission Innovation and the Breakthrough Energy Coalition constitute powerful complementary efforts to expand research and development for cutting-edge clean energy technologies.

As part of Mission Innovation the U.S. Government will seek to double federal investment in clean energy research and development from \$6.4 billion in FY 2016 to \$12.8 billion in FY 2021. This amounts to a roughly 15 percent annual increase for an investment portfolio that spans the full range of research and development activities — from use-inspired basic research to demonstration.

Last week, in the FY 2017 President's Budget, the Administration took a significant first step toward meeting the Mission Innovation pledge by proposing \$7.7 billion for clean energy R&D. These investments span across 12 Federal agencies – including DOE, NSF, NASA, USDA, HUD and USAID⁵ - with roughly 76 percent of that supporting DOE research, development, and demonstration activities across the spectrum of clean energy technologies. A broad focus that includes low- and no-carbon technologies including renewables, nuclear, CCS for coal, gas and industrial applications, energy efficiency, demand and the range of end use options, is essential for success and will create commercial opportunities in the US and around the world. DOE highlights for Mission Innovation include significant new investments in:

- Basic clean energy research on energy production, conversion, storage, and use;
- New R&D initiatives to accelerate the rate of invention of sustainable transportation, renewable power, and energy efficiency technologies, including expanded partnerships with the National Laboratories;
- Electric grid modernization, resiliency, and integration of clean energy into the grid;
- Advanced clean energy manufacturing R&D projects and facilities, including two new National Network for Manufacturing Innovation Institutes;
- Programs that expand the use and reduce the costs of clean renewable power from solar, wind, water, and geothermal energy, including support for the SunShot Initiative mission to make solar energy fully cost-competitive with traditional energy sources before the end of this decade;
- Programs and infrastructure that support the advancement of nuclear energy technologies, including R&D in advanced nuclear reactor technologies, life extension for existing power plants, and advanced nuclear fuels; and
- Research focused predominantly on development and deployment of carbon capture and storage technologies as well as other approaches to improve the emissions performance of energy generated from fossil fuels.

Another DOE program that sees a significant increase in support in Mission Innovation is the *Advanced Research Projects Agency – Energy (ARPA-E)*. Since 2009, ARPA-E has established a remarkable track record advancing transformational technologies towards commercialization. At least 34 of its projects have received follow-on funding and 30 new companies have formed. The FY 2017 Budget Request includes \$350 million in Mission Innovation discretionary funding for DOE's ARPA-E, which supports transformational applied clean energy R&D across a wide array of technologies. Beyond these discretionary funds the Budget Request also includes \$150 million in mandatory funding for ARPA-E in 2017 as part of the ARPA-E Trust proposal, which seeks to grow to \$1.85 billion over five years in mandatory funding for the program.

⁵ National Science Foundation (NSF); National Aeronautics and Space Administration (NASA); Department of Agriculture (USDA); Department of Housing and Urban Development (HUD); U.S. Agency for International Development (USAID).

All of the 20 country participants in Mission Innovation, as well as Bill Gates and his colleagues in the Breakthrough Energy Coalition, share a common goal of scaling breakthrough technologies and dramatically reducing their costs enough to mitigate the impacts of climate change, support economic development, strengthen energy security, and, ultimately, increase access to clean, reliable and affordable energy.

Some of our Mission Innovation partners, such as Canada and Norway, share very similar climactic conditions with Alaska. It is my hope that through this initiative we can solidify international cooperation to leverage the expertise and technical resources of partners in researching solutions that address the critical needs of these areas

REGIONAL ENERGY INNOVATION PARTNERSHIPS

Accelerating clean energy development requires us to be innovative not only in the technology solutions we pursue, but also in how we do business. The Administration's FY 2017 budget proposes \$110 million to establish a new *Regional Energy Innovation Partnerships* that represents a new pathway for innovators to leverage the expertise and resources of the Department for the unique clean energy R&D challenges of individual regions.

These partnerships will draw upon the strengths of each region's innovation ecosystem, linking the needs of industry and energy decision-makers with the unique R&D capabilities at nearby universities and laboratories. They can serve as forums for end-to-end coordination across the scope of clean energy innovation from fundamental research to demonstration and technology validation. A regionally-focused, technology-neutral approach to innovation can also attract clean energy stakeholders and RD&D performers not typically engaged through other government-funded research programs.

I intend to designate up to 10 innovation regions based on a range of analytically-derived factors such as energy resources and uses, markets, infrastructure, building stock, geopolitical boundaries, industry base and economic characteristics, and the regional presence of major innovation activities such as research universities and DOE national labs and other available innovation infrastructure. Public private R&D partnerships play an essential role in technology adoption.

CLIMATE AND ARCTIC

As noted, Alaska stands on the front lines of global climate change, with Arctic temperatures climbing twice as fast as the world average. Last month saw the Arctic sea ice extent at its lowest January level in the satellite record, continuing a pronounced downward trend, while much of Alaska is seeing record low snowfall and warmer-than-average temperatures this winter.

Warming oceans, coastal storms, erosion, melting glaciers and thawing permafrost can have profound effects on the health of Alaska's ecosystems and Native Alaskan communities. The Government Accountability Office reports that federal, state and village officials have identified over 30 villages that face imminent threats. Many villages will need to be relocated to higher

ground to avoid falling into the sea or flooding. DOE's modelling of the complex dynamics at play in the Arctic is critical to predicting what the future climate holds not only for Alaskans, but the entire world.

Climate change also undermines the safety and stability of energy-related infrastructure in Alaska, increasing costs and complicating investment and long-term planning in already-challenging circumstances. As the first Quadrennial Energy Review highlighted, thawing permafrost can have very serious consequences for energy infrastructure such as the Trans-Alaska Pipeline System, transmission lines and fuel storage facilities, and it could increase the cost of maintaining and operating public infrastructure—such as roads, harbor and airports—by up to 20 percent. The drilling season on the tundra has decreased by 50 percent since the 1970s, due in large part to permafrost thaw and its effects on transportation systems and infrastructure.

At the same time, reduction in summer sea ice extent and thickness expands the time window for offshore hydrocarbon exploration and production, and, potentially opens up new shipping routes through the Arctic. Though the risks of transiting the region will remain prohibitively high for most shippers in the near-term, opening a commercial lane through the Northwest Passage would dramatically reduce the time, distance and costs of shipping between Asia and Europe. It is expected that the coming years will see heightened international competition for Arctic resources, and it is imperative to cooperate in developing rules of the road now to ensure a sustainable and peaceful path forward in the region.

ARCTIC ACTIONS BY THE ADMINISTRATION

In 2013, the President issued the National Strategy for the Arctic Region. The strategy was followed by an Implementation Plan issued in January of 2014 which is updated on a yearly basis in an effort to keep pace with the changing Arctic environment. In January of 2015, the President released an Executive Order entitled “Enhancing Coordination of National Efforts in the Arctic” which among other things established a Deputies-level governing body known as the Arctic Executive Steering Committee (AESC). This Deputies-level governance body enhances coordination of Federal Arctic policies across agencies and offices and, where applicable, with State, local, academic, private, nonprofit, and Alaska Native tribal governments and similar Alaska Native organizations.

The AESC has established a set of working groups to focus on key issues, one of which is the Energy Working Group, the mission of which is to enhance coordination of Federal efforts, coordination of Federal investment with non-federal partners, and collaboration with international partners, with the aim of improving remote energy access, increasing clean energy deployment, and reducing energy costs in Alaska.

The United States assumed the chairmanship of the Arctic Council from Canada in April 2015, affording us a unique opportunity to advance the administration's broad Arctic strategy. In September of last year, the Arctic Executive Steering Committee hosted the GLACIER conference in Anchorage, focused on global leadership in the Arctic. Seven foreign ministers as well as delegations from 12 other countries and the European Union participated. Coincident

with GLACIER, President Obama made his historic visit to Alaska, including the first-ever visit by a sitting President above the Arctic circle in Alaska. Moving into 2016, the AESC will be advancing international collaborations focused on science: to include observations and research, impact and resilience, and science-based decision-making.

CONCLUSION

With its people, its natural resources, its environment, and its location, Alaska occupies a unique position at the crossroads of energy production, energy use and climate change. The trends we see in Alaska ultimately affects us all, for better and for worse. You no longer have a front row seat to global warming – you are in it – and we at DOE are committed to providing innovative tools and unparalleled scientific capabilities to predict, combat and adapt to this changing world. The technologies and practices proven under the difficult conditions of this region will ultimately benefit not just Alaska, but also the broader U.S. economy. Our resources and challenges may be regionally-defined, but we fit into a global market and if we don't compete and support our best and brightest and advance homegrown technologies, we will watch China and others take the lead and reap the economic rewards. Because of this, Alaska is an important focus for a range of programs at the Department of Energy. Our work here is based on strong partnerships with local communities, utilities, businesses, governments, Native Corporations, educational institutions, non-profits, the State, and our federal partners, and I look forward to working with the Committee and the people of Alaska to see these activities to fruition.

Thank you.

The CHAIRMAN. Secretary Moniz, thank you.

Thank you for, again, not only attending this field hearing but for your leadership in recognizing that truly when we are talking about energy solutions for a state like Alaska there is no one-size-fits-all. How we work together to collaborate is truly going to be key to our success, and we appreciate that.

I think we also appreciate the fact that perhaps a few more bodies that are attached to Alaska from the Department of Energy is a positive sign as well. We love that.

Secretary MONIZ. May I say, Madam Chair?

The CHAIRMAN. Certainly.

Secretary MONIZ. I would say the extra staff were earned by Alaskans.

The CHAIRMAN. We appreciate that even more so.

[Laughter.]

Do my colleagues have any quick questions for the Secretary? With that, Mr. Secretary, thank you so very much. We look forward to working with you.

Senator BARRASSO. You said it was like a regular hearing. Are we going to have questions?

The CHAIRMAN. Yes, we are. Typically, we can move through some of our esteemed witnesses but I am certainly happy to have you ask any questions you may have for the Secretary, Senator King.

Senator KING. Well I know that Senator Barrasso has some first, so I will defer to him.

The CHAIRMAN. Okay, Senator Barrasso?

Senator BARRASSO. Well, thank you very much, Madam Chairman.

I actually wanted to talk about, Madam Chairman and Mr. Secretary, the Department's experimental program to stimulate competitive research, ESPCR. It is a program designed to improve energy-related research in 24 largely rural states including Wyoming, Alaska, Maine, Montana, and West Virginia, just to name five.

[Laughter.]

During your confirmation process you talked about the programs that have a strong educational component and in your opinion you said succeeds in building basic research infrastructure across the country. Are you at all committed to looking for new opportunities for the program because it is certainly within the Office of Science in the Department of Energy?

Since the confirmation funding for this Office of Science is increased by hundreds of millions of dollars but funding for EPSTCR during that time is increased only \$5 million. In fact, the Department budget request is now well below what Congress even appropriated for ESPCR for 2016.

So, if the program, in your opinion, succeeds then I wonder if you can tell us why the Department is asking actually for less funding for this program that we think is important in rural areas?

Secretary MONIZ. Well first of all I agree, Senator Barrasso. I stand by my statement that I believe ESPCR is a hugely valuable program. As you know it has state matching funds involved, and I believe it's done a lot.

I particularly think it has been strong in providing research opportunities for undergraduates who then go on to scientific graduate studies. With regards to the budget there are always trade-offs, but I am happy to work with the Committee to reexamine that.

ESPCR, of course, is carried out by many agencies with NSF as the lead agency, but I'm certainly happy to work with the Committee to look at that.

Senator BARRASSO. Well I really would appreciate it because it's one of the things I would like to highlight a little bit is in Fiscal Year 2014 that the Department's Office of Science awarded about \$900 million in competitive research grants and programs of universities and the entities from the ESPCR space one only got \$54 million of the \$900 million. That means 24 of our states received about six percent of the Office of Science's Competitive Research Grant, so I appreciate your willingness to work with us.

Then in a light way, states like Wyoming and Alaska, I believe, are underrepresented on the Department of Energy's major advisory board. For example, the Secretary of Energy Advisory Board has not included anyone from an ESPCR state during the Administration. We just find some of this troubling. We think we can have a lot to offer. Most of our top energy producing states including Wyoming, Alaska and West Virginia are ESPCR states, so can we expect to continue to work closely with you on increasing that representation?

Secretary MONIZ. Yes and certainly perhaps some suggestions we could go over.

Senator BARRASSO. I would like to think about it, Chairman.

Thank you, Mr. Secretary.

The CHAIRMAN. Senator Daines? King? Capito?

Senator KING. Just one quick question.

In thinking about Alaska and also we have islands in Maine that have similar non-grid attributes, it seems to be that this kind of setting is exactly appropriate for distributed energy, locally generated and in the process you save the whole cost of transmission and distribution.

So in Maine anyway, transmission distribution is almost half the cost of energy. If the energy can be generated locally through solar, wind, hydrokinetic, as you mentioned, I would like to mention the River Gen project is a Maine company, Ocean Renewable.

Secretary MONIZ. Yes.

Senator KING. I am happy that they are out here as well. But give me your thoughts about distributed energy, particularly in this kind of rural setting.

Secretary MONIZ. Well, we are strongly emphasizing, Senator King, the DG. We believe that it is almost by definition, essential, in isolated communities, islands. And we did put together a playbook on islands that, I think, could be of interest to you.

But island communities here are, in many ways, islands in terms of energy. Around the world a place like India is very highly dependent upon developing DG. And in the Mission Innovation we intend to increase our focus on DG including working with privates and with some other countries like India.

I would note, however, just to emphasize that, in my view, distributed generation is not only for isolated communities. I think it is extremely important in the grid of the future that a smart and resilient grid is going to rely upon central station, sometimes distant sources, but certainly also, distributed sources that are local.

Energy storage will be a big, transformative technology as the costs come down for namely, even more, DG.

I'll just give one example of DG in a non-isolated case that was very important. During Hurricane Sandy in New Jersey a critical transportation corridor was wiped out because the grid, the big grid, had gone down. We worked with the state. We put in modest funding, pro funding, to develop a plan which has now been implemented through a bigger grant from transportation.

So the idea now is that transportation system is essentially a microgrid so that if the big grid goes down that critical transportation corridor can still function.

So I'm a big fan of DG, and I think it just has even more applications than isolated communities.

Senator KING. Thank you, Madam Chair.

The CHAIRMAN. Further questions? Thank you all.

Secretary Moniz, again, thank you so very much.

Secretary MONIZ. Thank you.

The CHAIRMAN. You are cleared to join us over on this side. Again, we are going to depart a little bit from the norm and give you an opportunity to ask questions of the next two panels. So prepare to join us over here.

At this time I would like to invite up for panel two, the Honorable Governor Bill Walker, who is the Governor of our fair state. Again, with great appreciation to you, Governor Walker, for spending the day with us, and the chance to see Oscarville. It was a first, I think, for both of us and an important visit.

Governor Walker will also be joined by Representative Herron here in Bethel. Representative Herron has not only served this region well but at one point in his history, I had an opportunity to benefit from him when he was assisting in my office.

I also want to acknowledge Senator Lisil McGuire, who is also here in Bethel today and joined us out in Oscarville. Senator McGuire and Representative Herron have been leading on Arctic issues and on energy issues, and I appreciate that you are here representing the state senate as well. So thank you, Senator McGuire, for that.

With that, Governor Walker, if you would like to give your comments. We are so appreciative of your leadership on this issue. Thank you.

STATEMENT OF HON. BILL WALKER, GOVERNOR, STATE OF ALASKA

Governor WALKER. Thank you.

For the record, Bill Walker, Governor of Alaska.

Madam Chair Murkowski, welcome home. I know it's always good to see you in Washington but it's better to see you at home.

The CHAIRMAN. I am very glad I am here.

Governor WALKER. So, welcome home.

Ranking Member Cantwell, good to see you again, good to see you back in Alaska. I enjoyed our discussion in Washington, DC and I lent my necktie to Cantwell of Alaska. I will find a momento for you from Alaska that says Cantwell.

Members of the Senate Committee, it is an honor to have six percent of the U.S. Senate in Bethel. This is an honor that is very exciting.

Secretary Moniz, we first met at next to Bernie Karl at Chena Hot Springs, where you're the Secretary of Energy and he's the Secretary of Enthusiasm.

The CHAIRMAN. Amen.

Governor WALKER. And the combination was very powerful with what you had to say at that energy conference in Chena Hot Springs. I knew you had a passion for energy, and what you have done as Secretary has certainly underscored that passion. So thank you very much. You have, well, you walk the talk like no other. Thank you very much for that.

You know, in preparing for this I looked at the number of programs that we have available for the Federal Government that benefits Alaska, and in particular, rural Alaska. I say thank you to you and to the Committee for that.

As you have heard you couldn't hear it any better than you did at lunch today when you heard people in the lunch tell about energy issues. You know, Ralph Henderson from Dillingham explained why he lives here, why it's his home. It was very moving too. So I can't come close to explain the passion in rural Alaska because you heard it first-hand and from the best. So I am so appreciative of you being here. It means the world to us that you would come to Alaska.

We have lots of groups of Congress who come to Alaska, but usually it's when the silver are running in late August and they usually hook up with us.

[Laughter.]

So we are an—too, but we're fine with that.

But you come with a very specific mission, and that means a lot to us that you would do that. It doesn't go unnoticed across the state when we have six percent of the U.S. Senate and the Secretary of Energy in our great state, so thank you very much for making that happen.

This is a field hearing, and it feels good to have a field hearing in Bethel, Alaska. I'll just say that.

You know, when I first met President Obama six days after I was sworn in as Governor of this great state, he said to me in the Oval Office. There were about eight of us there, brand new Governors. I explained to him the cost of energy in Alaska that we're the most energy rich state in the nation and we have the highest cost of energy. And he said, "Governor, that makes no sense." I said, "Mr. President, I couldn't agree more."

It doesn't make sense. We need to change that. As you heard today about many areas of the region where we see a barge load of fuel once a year. It's like buying a commodity and you're stuck with that commodity price for an entire year. And if it's at the high end I know in New Jersey the price of gas is less than a \$1.00. Here we vary \$5, \$6, \$7, \$8, and \$9 a gallon.

You know, there's not much that can be done but we like to, we sort of like to solve our problems ourselves in some respects. We appreciate the programs, they're phenomenal, but we like to build.

I was so pleased to hear that you've hired additional Alaskans in your department. We very much appreciated that because we think that those that are closer to the solution are closer to the answer. And I'm so close to the problem, I'm close to the answer. I think that's the case. I think we've seen that today.

You know, the trip out to Oscarville was something I wanted to do for a while. I've been to a number of rural Alaskan communities and villages throughout this past year and there is a common theme. The cost of energy is killing some of our rural villages.

When we have school, the energy costs are so high that they end up leaving. The young people leave, the school gets below the magic number of ten, and suddenly the school has to close and that's a death in the village. The village loses a bit of purpose. The cost of energy rises significantly when the school closes because sometimes the school is the largest consumer of energy in that village. It's a spiraling impact that we don't want and that we are working hard to turn around.

We have a bit of a financial challenge in Alaska. Somewhere like West Virginia where on coal, we're oil, is 90 percent of our resource. As I've said many times every Governor gets to spin the oil wheel. One Governor landed on 147. This Governor landed on 26.

[Laughter.]

Some Governors have landed on nine.

But that's okay. We don't define ourselves by—Alaska's not about a balance sheet. It's about a land of opportunity, and the opportunity comes from Alaskans working together and much like I've seen you, Senator Cantwell and Senator Murkowski, working together on an energy bill. We're doing the same in Juneau. We're pulling together to address the physical challenge that we have today.

You know, the cheapest energy, savings with energy, is not that it's not used. As you'll hear from Jack Hébert what they've done on cold climate housing research is phenomenal as far as weatherization and those kinds of opportunities.

I like that we're harnessing energy in rivers, the hydrokinetic energy.

We should be a petri dish of innovation, the state with the coldest temperature. We're, well we used to have, the coldest temperature, now it seems to be changing a bit.

[Laughter.]

When I was born in Fairbanks it was pretty darn cold but with the highest cost of energy. And so, we really should be able to do that.

One of the concerns we have on the oil side is that I'm a bit competitive. Now if you watched me play basketball in Oscarville today you wouldn't have known that.

[Laughter.]

That's not a really good example, but I used to be. But anyway, I'm a little competitive.

I had a meeting with Governor Mead of the great State of Wyoming, and the State of Wyoming is about the same size as the

North Slope region where much of our oil and gas is. Wyoming has drilled 16,000 wells. We have drilled less than 600 wells.

We have a bit of some challenges in that regard. We have an oil pipeline that is three quarters empty and sitting about 30 miles from about 16 billion barrels of oil. We need access to our land and access for our resources. We need to fill that pipeline. We need to fix our economy.

We can self-heal if we have access to our resources, responsible access. No one is more concerned about our environment than we are. It's our front yard. It's our back yard. It's our side yard. It's our land. So we are very concerned about that. But we don't have access to it to fill that pipeline.

Last time we went through a down turn in the economy we had 2.1 million barrels a day going into the Trans Alaska oil pipeline. Today we have under 500,000 barrels a day. And with all sorts of challenges of keeping the oil warm by adding heat to it and all sorts of challenges as it continues too. Yet it's sitting right next to the most prolific oil opportunities in the world.

So we need access to that, responsibly, and I will continue to address that. I will continue to address that because that is a mainstay.

The other, in an energy issue, is our natural gas. We reinject more gas in the North Slope. It's 8.6 billion cubic feet a day. That's more gas than is consumed in the states of Oregon, Washington and California combined.

We are in the process of advancing a Trans Alaska oil, I mean, gas pipeline to bring it to Tidewater for the market. These are challenging times right now on advancing those projects, but we're looking at 2024, 2025.

But one of my favorite provisions of Senate bill 138 put in by Senator Lyman Hoffman provided 20 percent of the revenues to the state of the royalties would be dedicated to rural Alaska for energy projects to be able to spread the benefit of that resource out across the state. Oh how I wish we had done that on an oil pipeline. We didn't. We learned from that. And now we're going to do that with a gas line to make sure that all Alaskans can benefit equally from the development of that resource.

As I look at the—energy with natural gas the more economical energy with natural gas, that is the energy of the future of the state for some time. Certainly the legislature has done a great job of 50 percent of our energy by, renewable energy by 2050, I believe it is. Is that right? And that's a laudable goal. But the natural gas is, you know, being in the situation we're in, the \$4 billion deficit, the trillions of dollars of resources in the ground we cannot get out is very difficult.

When we became a state in 1959 the Statehood Compact said we would be able to develop. We had to live off our resources. We are the only state we cannot sell the resources in the ground. We can only lease them. And if we sold it in the ground they would have to revert back to the Federal Government.

So as a result of that we are our own state. But that only works if you can develop the resources. And if you can't develop the resources we can't live off the resources. So my, I know I'm not or maybe a bit off target with this Committee, but I can't, you know,

I've seen before six percent of the you know the U.S. Senate and I'm going to say what I want to say before them.

[Laughter.]

How I feel about what needs to happen in this state.

We are pretty aggressive when it comes to taking care of ourselves, and we appreciate the assistance from the Federal Government. They've been great, sometimes, many times, but there's a point we need to be able to have access to our resources in a responsible way.

We enjoyed, very much, the President's visit last summer. He was in route to Bristol Bay to Dillingham and got up close and personal with the salmon while he was there. And he had a great time in the mountain that was renamed to Denali as we flew in he was at the window tweeting. I looked at it and I said, "Mr. President, you're, that's forward you need to move a little bit to the right there." That's Denali and so he did. So I can say that I moved President Obama a little bit to the right.

[Laughter.]

Unfortunately it referred to Alaska.

But it was a great opportunity for us to have a President that came up with Alaska as the destination. Often Presidents will come by, will stop and refuel and stuff. And we'll take whatever we can get. But to have an actual destination we very much appreciated that.

I think that was reflected in the budget that he submitted. There were many, many areas of funding for rural Alaska. The \$400 million attempted for coastal resiliency. We have as many as 12 villages that need to be relocated. Kivalina is the most notable. It needs to be relocated because of the lack of—I should protect the shore. It's an island that's getting smaller. And I was—do you have it. It's one of those. It's kind of like Oscarville. You understand Oscarville when you go to Oscarville. You understand Kivalina when you go to Kivalina. Madam Chair, I know that you have been there a number of times, so thank you very much for that.

So we have some challenges in Alaska. But we have some really innovative, thoughtful people that have a passion for, not just a passion for Alaska but a passion for making Alaska better. You will hear from some of those today.

I think you've got an excellent panel ahead to hear from. We are our best when we work together, when we pull together.

I want to close with a comment about Lieutenant Governor Byron Mallott. You may not have met him. If you ever do, you'll be a better person having met him.

He gave me a gift recently of a picture of the Village of Metlakatla. People were in the river and there was a road but there was mud and I didn't understand exactly what it was when I first saw it. Well on the bottom he explained it. It said, early 1900s in Metlakatla when you wanted to pull out stumps the whole village would show up and form a single row and pull out the stumps. And at the bottom of the picture Lieutenant Governor Mallott had written, Governor, this is what we're doing.

That's exactly what we need to be doing as a state is to be pulling together, and when we pull together we can solve these prob-

lems. So I like what has happened on the energy bill very much. I see a sign of pulling together. I'm encouraged by that.

I see that happening with the Alaska legislature pulling together, doing some things that are unprecedented, and we're going to be a better state because of that. But I wanted to just thank you again for coming to Alaska, for what you've done, the programs you have initiated that we're able to take advantage of.

I'm probably supposed to be sitting here being at the table being frustrated with the Federal Government but I'm here in front of 6 percent of the U.S. Senate, who came to Bethel to listen and to continue to find ways you can improve our situation in Alaska, our costs of energy. It is disproportionately high. There's no question about it. I think working together we can solve that.

Thank you very much. I'll stand for questions.

[The prepared statement of Governor Walker follows:]

Testimony of Governor Bill Walker, State of Alaska
Senate Energy & Natural Resources Committee
 February 15, 2016
 Bethel, Alaska

Chairwoman Murkowski, Ranking Member Cantwell, and honorable committee members. Welcome to the great state of Alaska. Thank you for this opportunity to share Alaska's energy challenges and opportunities.

When I first met President Obama in December of 2014, shortly after I had been sworn in to office, I told him that Alaska is the most energy-rich state in the country, but we pay some of the highest energy costs in the country, if not the world.

He was surprised to hear that. It is indeed ironic that Alaska is rich in oil and gas reserves and potential, yet too many Alaskans struggle in so-called third-world conditions.

Last summer, I traveled through rural parts of the state—to villages like Akiachak, Tuluksak and Chalkyitsik. The residents there power their homes and schools with diesel generators. In some rural communities, residents spend 50 percent of their household income on heat and electricity. Imagine half your family's income going to your heat and electric bill. It's just not sustainable.

The high costs of energy are driving many young people out of their communities. In Chalkyitsik, so many families are leaving that the local school is on the brink of closure—which means the price of electricity will be even higher for the rest of the community. Worse still, the loss of the school can mean the loss of the community's heart and soul.

The high cost of energy affects every part of rural life. In many of our villages, \$10 for a gallon of milk is not uncommon. That's because of high transportation and energy costs. It's all connected.

We have a program to help rural residents cope with the high costs of energy, called Power Cost Equalization. But it's only a Band-Aid. A better solution is to produce cheaper power. And we're doing everything we can to make that happen.

Alaska is blessed with natural resources beyond compare – oil, natural gas, hydro, wind energy, solar energy, geothermal energy, tidal energy. You name it, we have it in abundance.

But it can be difficult to develop. You've gotten a sense of our vast landscape flying here. If you split Alaska into two states, Texas would still be the third-largest state. This remoteness, combined with our harsh weather and limited infrastructure make development of our energy resources challenging.

But it's absolutely critical for our economic future that we do. We're committed to being a leader not only in traditional energy but renewable and alternative energy. And we've put our money where our mouth is.

- In 2008, the Alaska Legislature established the Renewable Energy Fund, supported by state funds. We've provided a quarter-billion dollars in grants for projects around the state. Those projects now displace more than 20 million gallons of diesel per year and reduce carbon emissions by 147,000 metric tons.
- We've shown what can be accomplished. Kodiak Island, for example, now produces 99.7 percent of its energy from renewables.
- Alaska established the Emerging Energy Technology Fund in 2010 to help advance innovative demonstration projects. The fund has awarded more than \$16 million in mostly state monies for 20 innovative projects.
- We adopted an energy policy in 2010 aiming to achieve 50 percent of the state's electric generation from renewable and alternative energy sources by 2025.
- That policy also calls for a 15 percent increase in energy efficiency by 2020.
- We demonstrated our commitment to that goal just this month. The Alaska Energy Authority and my office were pleased to support and cooperate with the President's Remote Alaska Community Energy Efficiency (RACEE) competition. I thank Secretary Moniz for your role in that program, which will help Alaska communities reach or exceed their goal of increasing energy efficiency by 15 percent by 2020.
- We passed legislation directing 20 percent of our royalties from the state's natural gas pipeline project to an Alaska affordable energy fund to support development of much-needed energy infrastructure across the state.

Don't just take it from me about all we're doing. The *Washington Post* wrote last summer:

Alaska, a vast landmass with harsh winters and many remote Native towns and villages facing dramatic electricity costs, has become an important and unique innovator in renewable energy. The implications extend far beyond the state. From Africa to small Pacific Island chains, successfully powering gridless, remote or underdeveloped communities with renewable energy, and easing their reliance on fossil fuels, is one of the biggest energy challenges of the century.¹

¹ "Alaska's quest to power remote villages – and how it could spread clean energy worldwide," by Chris Mooney, *Washington Post*, August 14, 2015.

I'm proud of the leadership and commitment Alaska has shown when it comes to energy innovation.

I want to thank all of you for the hard work your committee put into the Energy Modernization Policy Act. I have a lot of respect and appreciation for the collaborative and open approach you took. I strongly support the bill – of course I wish it included access to the nation's oil reserves in the Arctic National Wildlife Refuge, but I understand that will have to wait for another day.

As you may know, more than 60 percent of our state land is under federal control. Outside of Alaska and the 11 western states, the federal government controls just 4 percent. Alaska has 86 percent of the nation's Fish and Wildlife Service lands. Sixty-six percent of all National Park land in the nation is in Alaska. We simply cannot meet our challenges and continue to live up to the promise of self-sufficiency without reasonable access to our resources.

I urge your committee to continue working to provide that opportunity for Alaska to continue to supply the nation with the petroleum and mineral resources, and reduce our dependence on foreign supplies.

The Obama Administration has wisely embraced an "all-of-the-above" energy strategy. Renewable energy, energy efficiency, natural gas, and oil are all part of it.

And Alaska has a role to play in all of it. We want to self-heal our fiscal challenge. We want to contribute to the nation's energy security. We want to lead and innovate. The Senate energy bill will help us get there. The bill would help Alaska produce more of our abundant energy and minerals.

I also want to thank President Obama and acknowledge the Department of Energy for your commitment to Alaska. We appreciate the \$40 million for Arctic-focused investments in your FFY 17 budget, including \$4.5 million for much-needed onsite technical support. That funding would help us build on the momentum we've created in Alaska, and I urge the Senate to support it.

I also want to note that with all the energy needs and potential in Alaska, we would welcome greater DOE presence here. DOE has a one-person Office of Indian Energy in Alaska. That is the sole fulltime DOE employee based in Alaska. We need a broader DOE presence here to maximize our partnership and make sure federal energy money for Alaska's needs actually reaches Alaska, and is used as effectively as possible.

This is a partnership. Your energy bill along with proposed federal funding can help ensure that Alaska has the ability and means to develop our energy resources. We can become a world leader in renewable, alternative and microgrid energy technologies. We can bring down the

high costs of living in rural Alaska. We can solve our budget problems and continue to support ourselves in the 49th state.

Thank you again for your interest in Alaska's unique energy challenges and opportunities. I look forward to ongoing collaboration between the state and federal partners to maximize these opportunities.

The CHAIRMAN. Governor, thank you very much. Your message in pulling together is one that is important here in this region. It is important around the state and certainly important to the country.

Thank you very much.

We will have an opportunity for questions after we hear from Representative Bob Herron.

Welcome, or I should say, thank you for welcoming us to your town.

STATEMENT OF HON. BOB HERRON, REPRESENTATIVE, STATE OF ALASKA

Mr. HERRON. Well, thank you, Senator and thank you to the Committee.

Mr. Secretary, it is an honor for you to come to the White Cape Delta, and my hometown, to listen and for us to learn how you feel about the strategies that Alaska and the Federal Government working together can do to solve problems.

So Madam Chairman, it is that you mentioned that I used to be a staff person. So is it okay if I call you, Boss?

The CHAIRMAN. Absolutely. [Laughter.]

Mr. HERRON. So Boss, I have submitted my written testimony in full and much longer than my summary I'll give today. But I want to say that it isn't this legislator that wrote it up it was the work of a lot of people in the House and I'll recognize them.

An individual that's worked on energy policy for the legislature for many years but since the 26th Legislature, Bryce Edgmon from Dillingham; Charisse Millitt from Anchorage; Neil Foster and Lance Pruitt, Neil from Nome and Lance from Anchorage; Doug Isaacson from North Pole; and Charisse, again, that's the second time around. She is on the Energy Committee in the House. And then currently it's Jim Colver from Palmer and Liz Vazquez from Anchorage. They all contributed to this summary and to the full written support.

On the Senate side, her name has been mentioned a couple of times, but she's my friend. And she, like Governor Walker mentioned today at lunch, was my co-chair on the Alaska Arctic Policy Commission. And the Alaska Arctic Policy Commission is very important to Alaska, not only because of the Arctic Council chairmanship currently, but it's about how because our nation is an Arctic nation, because of Alaska, is that the legislature had to figure out what our Arctic policy was.

The Governor has already mentioned a lot of things. You know, access to our resources, having Alaskans included in the conversation so that we're a part of the decision of our future.

So when we started out I gave out three envelopes. The two smaller ones are pins that the Alaska legislature gives to visitors. There's seven of them and six of them are symbols of our state, state flower, state mammal, etcetera. But the one that's not a state symbol officially in the statutes is one where Alaska is transposed on top of the lower 48.

[Laughter.]

And it puts it at scale because it is that Alaska on most U.S. maps is because the map makers usually have the lower 48, we call

you the outside, the lower 48, is the map makers want to make the lower 48 center of the universe. So Alaska and Hawaii are dragged over and placed out of scale next to San Diego.

And so if you look at it on the pin, Madam Chair was born in Ketichan, down by Savannah. My wife was born here in Bethel. Right now we're somewhere in the Midwest. And then the Aleutian chain goes all the way to San Francisco, and I had the privilege of representing the Aleutians for two years.

That's why Senator Sullivan, Senator Murkowski and Congressman Young have a tremendous challenge convincing the rest of the nation how important, not only energy policy, strategic policy, every policy you can imagine. They have a very difficult job convincing good colleagues that want to do the best for not only the nation, but us.

So, you know, today we were given both the travel to Oscarville and to lunch versus the costs of energy. I guess to put it in a real, easy perspective, Madam Chair, is that whatever consumable that we like to buy, go to the grocery store to buy bread and just food. But if you want to buy a pair of jeans or if you want to buy mostly anything locally, it has to be shipped in and a lot of that is flown in. So whatever the price is in Anchorage you can guarantee that the markup, the extra cost of that consumable is going to be between 35 percent to 50 percent and even higher in villages outside of the region. So that's what we're talking about.

We've put lots of money into energy, renewable energy and efficiency programs but much more needs to be done.

Now the Governor has already mentioned we're at a fiscal reality that nobody would want to be in. We're going to deal with it, and the reason we're going to deal with it is because we have to. But these high energy costs are very onerous to rural Alaskan families and they hinder economic development everywhere in Alaska.

So, the Alaska Arctic Policy Commission has given us a report. It's been many years since we delivered to the legislature. And we had three target audiences, ourselves, the Executive Branch and the Federal Government.

But first, the legislature had to figure out what is our, what do we think our policy is? And we've done it. The Governor has already mentioned one, access to development. That's the key for our sustainable future in these little villages and more importantly, the sustainability of Alaska for the future.

But one of the recommendations was to reduce power and heating costs in rural Alaska. So how do we do that with our Federal partners? And the thing is that probably what we should do in Alaska Center for Energy and Power, Alaska Energy Authority, AEA, we meet and they created a macro grid statement of needs. We need new technology goals, we need fuel sipping on our diesel operations and improved power reliability. These are things that are what we need to do. And it's been mentioned and I would thank Senator Cantwell to talk about the programs that we are, that are successful in this state today. But I'd also like to thank the Federal Government for U.S. Senate bill 2012, the Energy Policy Modernization Act. Those are provisions that have positively affected Alaska, reauthorization of weatherization, reauthorization of state energy programs, state loan eligibility and several programs

promoting renewable energy technology. These are the positives that have come out of that Modernization Act.

So in recent years the Alaska renewable energy program has funded dozens of projects that demonstrate an impressive degree of ingenuity and innovation. And later in the next panel we'll get more into the details because these individuals that are here that, Madam Chair, you brought together are going to, in many ways, are going to send you very positive results from the past but they're also going to ask you for your help so that we can stay on that path.

We can divide the efforts to achieve a sustainable and affordable energy for all Alaskans into four categories, technology, finance, human capacity building and policy. Now Alaska is a world leader in wind-diesel hybrid systems. In fact, there's one system that's in this region, that's a super success story.

We also can be a leader in renewable microgrid systems. Using several vocation training initiatives spearheaded by Alaska Center of Energy and Power, renewable energy at Alaska Project and others can build a knowledge-based industry partly based on microgrid development.

Now this state, Alaska, the Chairwoman's home state, with Federal help should seize the opportunity to use innovative technology to lower energy costs but also grow those Alaska businesses that provide the technical assistance to microgrids worldwide. And as the Secretary earlier has said, these are the things that we are going to move forward with and we welcome that.

In finance we need to, we must move toward equity and debt financing. Renewable energy grant funding soon is going to decrease and will not likely to include money for construction projects. But in the Energy Policy Modernization Act it would give us access to borrow from the Department of Energy loan programs. The state can pass those loans on to small communities that often can't get ones.

Human capacity. We need people. We need training local operators. We must build this capacity. Through Alaska Energy Smart REAP is promoting K-12 energy efficiency curriculum that teach about the importance of energy efficiency. Finally, in human capacity, the holistic approach, in a lot of ways what we saw in Oscarville. It's let's go in and use—it's almost like this pilot project. It's really a test tube baby. If we can do it on a small scale, we will succeed. So a holistic approach to technical assistance and community development is important.

Madam Chair, I know I am speaking to the choir, but this model is for sustainable northern communities. And so long-term predictable energy policy is needed for private sector investment, human capacity, technology innovation and new financing approaches.

In conclusion I'd like to tell a great story. It is the work of Bethel, a lot of people don't really think of it that way, but Bethel is in the Arctic. The reason that we're in the Arctic is because of the Porcupine Yukon Kuskokwim line, and that's a line that goes down the Porcupine at the Canadian-Alaska border. That line goes down the Yukon all the way to Pineview, then over to Kalstag on the old trading area road, route, then out the Kuskokwim, everything north of that is considered Arctic.

When we were fighting for statehood President Eisenhower did not want it to be a state in holding. He wanted it to be a territory above that line and below that line it would be, could become a state. We fought hard. We fought really hard.

And Alaskans, with the Governor's mentor, Wally Hickel, a fiery Senator, John Butrovich from Fairbanks and Bob Atwood were visiting with the President. And the fiery, I'm being polite, the fiery Senator said, explained to the President why that's not possible. And President Eisenhower turned to Wall Hickel and said, doesn't he know I'm an American.

So that's the fight we're fighting today. It's we're to be involved in the conversation and one of our biggest partners is the Federal Government.

And with that, thank you, Madam Chair.

[The prepared statement of Mr. Herron follows:]

Representative Bob Herron
Alaska State Legislature

Written testimony for the Senate Committee on Energy and Natural Resources field hearing, February 15, 2016 in Bethel, Alaska

Introduction

I truly appreciate Senator Murkowski and her fellow Senators of the Senate Committee on Energy and Natural Resources for traveling to hold this hearing in a very rural western Alaska setting of Bethel. In recent years, Alaska has enjoyed some of the most ambitious and well-funded state renewable energy and energy efficiency programs in the U.S. Unfortunately, only a fraction of what needs to be done to make rural Alaskan communities sustainable has been accomplished, and Alaska's current revenue shortfalls will make funding these programs at a level commensurate to the needs difficult to say the least. Meanwhile, the high cost of fuel continues to be very onerous for rural Alaskan families and depresses opportunities for economic development.

The Alaska State Legislature has been active in striving to address the high cost of energy through capital investment and forward-thinking policies. Three of the more prominent policy initiatives are mentioned below, as well as some relevant work of the Alaska Arctic Policy Commission and a statement on Alaska's perspective on The Energy Policy Modernization Act:

Alaska Renewable Energy Fund (REF)

In 2008 the Legislature established the Renewable Energy Grant Program. The program was extended 10 years in 2012. The REF is managed by the Alaska Energy Authority (AEA) and provides public funding for the development of qualifying and competitively selected renewable energy projects in Alaska. Appropriations totaling \$257 million have been issued since 2008. This funding has been matched with hundreds of millions in funding from local sources. Today a total of 52 REF-funded projects displace 20 million gallons of diesel a year.

Alaska's Statutory Energy Policy

Since June of 2010 the State has had a declared energy policy in statute. The policy promotes, *inter alia*:

- Development of renewable and non-renewable energy resources;

- Economic development through cost-effective, long-term sources of energy for communities statewide;
- Energy research, education, and workforce development;
- Coordination of governmental functions and streamlining of regulatory processes.

The policy also calls for a 15% increase in state energy efficiency per capita by 2020 and for 50% of electrical generation to be supplied from renewable and alternative sources by 2025.

Emerging Energy Technology Fund

In 2010 the Legislature created the Emerging Energy Technology Fund (EETF) to promote the expansion of energy sources available to Alaskans. EETF grants are for demonstration projects of technologies that have a reasonable expectation of becoming commercially viable within five years. Thus far, \$11.6 Million has been committed to the Program with Alaska and the Denali Commission investing \$6.8 and \$4.8 Million of State and Federal funds respectively. Projects can:

- test emerging energy technologies or methods of conserving energy;
- improve an existing technology; or
- deploy an existing technology that has not previously been demonstrated in the state.

Alaska Arctic Policy Commission (AAPC)

The Alaska Arctic Policy Commission was legislatively created in April 2012, and held its first meeting March 23, 2013. The Commission was tasked with creating an actionable Arctic policy for Alaska. The AAPC was comprised of 26 commissioners, including 10 Legislators and 16 experts from throughout the state. It was co-chaired by Senator Lesil McGuire and Representative Bob Herron.

A common refrain at public hearings held throughout the state during the course of the AAPC's work was the extremely high cost of energy in rural Alaska.

Just before disbanding, the AAPC produced an Implementation Plan (available at akarctic.com) in January of 2015. Under strategic line of effort number 3 (The state of Alaska will support healthy communities) the AAPC included strategic recommendation 3B:

- Reduce power and heating costs in rural Alaskan Arctic communities.

Easier said than done, but through hearings of the Legislature's Arctic Committees and with further legislative direction, the Alaska Department of Commerce, Community and Economic Development continues to make incremental progress

toward achieving this goal. And it's an obvious goal shared by many other departments, agencies and non-profits.

A lower cost of energy, of course, would help facilitate a number of the AAPC's other strategic recommendations, such as those relating to economic development, sustainable communities, and food security.

Senate Bill 2012 – The Energy Policy Modernization Act (EPMA)

This federal Act builds on recent technological breakthroughs and promises substantial benefits. It would save energy, expand domestic supplies, facilitate infrastructure investment, protect the grid, boost energy trade, and improve performance of federal agencies, and renew programs that have proven effective. The goal is more affordable and abundant energy, and more functional energy systems throughout the U.S. The Energy Policy Modernization Act would also achieve these goals in a fiscally-responsible manner.

This bill provides a welcome opportunity for the Federal Government to partner with the State of Alaska on energy projects. Alaska has been a leader in energy policy and programs and this bill complements many of our existing programs, like:

- The Emerging Energy Technology Fund
- The Renewable Energy Grant Fund
- The Sustainable Energy Transmission and Supply Development Fund
- Several statewide energy efficiency programs

Alaska has been a leader in these innovative programs – we need a federal partner that will help us focus on local solutions, not top-down ideas that fit a one-size-fits all box.

Specific provisions in the EPMA that positively affect Alaska include:

- Reauthorization of the weatherization assistance program
- Reauthorization of the state energy program (SEP)
- State Loan eligibility
- Several programs promoting renewable energy technologies
- Grid storage research
- Promotion of hybrid micro-grid technologies
- E-prize competition for the development of new technologies

Several Non-Governmental Organizations also play important roles and spearhead important programs to address Alaska's energy issues:

Alaska Center for Energy and Power (ACEP)

ACEP is an applied energy research program based at the University of Alaska Fairbanks. ACEP provides leadership in developing energy systems for islanded, non-integrated electric grids and their associated oil-based heating systems. Integration is a central feature of our program. ACEP's mission is to "Develop and disseminate practical, cost-effective, and innovative energy solutions for Alaska and beyond."

The Arctic Remote Energy Networks Academy (ARENA) is an ACEP program that will be piloted at the University of Alaska, Fairbanks in the Spring and Summer of 2016. The Arctic Remote Energy Networks Academy seeks to increase human capacity and promote leadership through the creation of a knowledge exchange program emphasizing the development, operation, and management of remote energy networks (microgrids) incorporating renewable resources. ARENA is designed to promote exchange of information and ideas between arctic nations and the developing world. Its objectives and approach build on four years of multinational discussions by the Alaska Center for Energy and Power with communities, utilities, energy agencies and academic institutions to understand stakeholder needs, values and interests.

Cold Climate Housing Research Center (CCHRC)

CCHRC is an industry-based, nonprofit corporation created to facilitate the development, use, and testing of energy-efficient, durable, healthy, and cost-effective building technologies for polar residents around the globe. The Research Center was conceived and developed by members of the Alaska State Home Builders Association and represents more than 1,200 building industry firms and groups. Since 2006, the CCHRC Research and Testing Facility has been operating on land leased from UAF. The building contains research facilities and allows staff to work closely with students, faculty, and researchers at the university.

Renewable Energy Alaska Project (REAP)

Renewable Energy Alaska Project (REAP) is a coalition of large and small Alaska utilities, businesses, conservation and consumer groups, Alaska Native organizations, and municipal, state and federal entities that promote energy efficiency and the development of Alaska's vast renewable energy resources. REAP's goal is to increase clean energy and bring the benefits of local, stably priced energy to the citizens of Alaska through long-term policy and programs.

AK EnergySmart is an energy efficiency curriculum that REAP is promoting statewide with AHFC support. The goal is to improve energy literacy among K-12 students by teaching where energy comes from, why it's needed, and how to lower energy consumption.

For the last two years REAP has been working with **the Sustainable Southeast Partnership (SSP)**, a collaborative effort to develop prosperity, sustainability and resilience in Southeast communities. Through this collaboration, REAP is consulting on clean energy best practices in Kake, Hoonah, Hydaburg, Kasaan, Sitka, Yakutat and Klawock. REAP has also been able to leverage funding from the USDA (Rural Business Enterprise Grant) to bring additional energy efficiency focus to businesses in the target SSP communities.

Energy workforce development hinges on a connected strategy that unites K-12 education, University and vocational education opportunities. Many important, discrete energy education and training programs exist in Alaska, but virtually all operate independently. REAP is now working to launch **the Alaska Network of Energy Educators (ANEE)** in order to bring disparate energy education programs and opportunities together under one network to build a workforce development strategy. The ANEE network will connect vocational training with K-12 and University opportunities to allow Alaskans to chart careers in clean energy from an early age.

Conclusion

The federal government's involvement in energy technology innovation and deployment in Alaska is as urgent as it has ever been. Sophistication in these arenas has increased immensely in Alaska during the past decade. Dozens of projects developed in communities across the state demonstrate an impressive degree of ingenuity and innovation – Alaska's Renewable Energy Fund has made many of these projects possible. Alaska's programs have spurred the growth of considerable expertise here and have helped set the stage for ever more effective renewable energy deployments.

The U.S. government should continue to regard Alaska as a promising proving ground for opportunities to transform energy sustainability in remote communities. Where feasible, local resources should be developed for electrical generation and/or heat generation, thereby reducing logistical costs, and creating local markets and energy independence.

We can divide efforts to reach the goal of achieving sustainable and affordable energy for all Alaskans into four categories:

1. **Technology:** Alaska is world leader in wind-diesel hybrid systems. We could also be a leader in other renewable microgrid systems. There are a few groups working toward this goal. DoE sees the need for a resource center for small microgrids and so is helping fund the Islanded Grid Resource Center. The Center was started in 2014 by the Renewable Energy Alaska Project (REAP) and the Island Institute in Maine as a way to connect island and islanded communities across the United States to share information and expertise on energy challenges and opportunities.

Alaska Center for Energy and Power (ACEP) is working to optimize technology with a Power Systems Integration Laboratory at UAF. ACEP's Arctic Remote Energy Networks Arena (ARENA) will allow energy leaders from other arctic countries to learn about successes in Alaska. And the Alaska Network of Energy Education could facilitate Alaska's opportunity to build a knowledge-based economy partly based on microgrid development thru increased vocational training. Alaska has a huge opportunity here, not only to use innovative technology to lower the cost of energy for Alaskans but also to sustain and grow Alaska-based businesses that could provide technical assistance to microgrids worldwide. Now more than ever, Alaska, with federal assistance, should seize this opening.

2. **Finance:** Alaska is at a turning point on how it finances projects, and in the near term must move toward equity and debt financing. Soon Renewable Energy Grant funding will decrease and will likely not include money for construction projects. One provision in the Energy Policy Modernization Act (EPMA) would give the state access as a borrower to DOE loan programs, so that the state could pass on those loans to small communities that often find it difficult to get loans.

3. **Human Capacity Building:** Without local operators who understand the systems they are operating, even the best technology can fail. Alaska must continue to promote energy literacy and build the human capacity to operate energy systems in small communities around the state. These efforts must include K-12 curricula, vocational and technical training and university programs that focus on science, technology, engineering and math (STEM). Currently REAP is promoting the AK *EnergySmart* K-12 energy efficiency curriculum that it developed with ACEP with the support of the Alaska Housing Finance Corporation (AHCF) to teach about the importance of energy efficiency. REAP is also working to launch a network of energy educators (ANEE) that will bring together interested and enthusiastic educators in the K-12, voc-tech and university realms to create a career path for individuals interested in learning about the latest cutting-edge energy developments and education curricula. And this spring ACEP is set to pilot its ARENA program to share Alaska's

operational and technical expertise in microgrids with aspiring energy leaders from across the Arctic.

It's also important to take a very holistic approach to technical assistance and community development. The Office of Indian Energy at Dept. of Energy is doing some fine work along these lines with their capacity building program: Strategic Technical Assistance Response Team (START). START, the Sustainable Southeast Partnership (SSP), and the work being done to make Oscarville a model for sustainable northern communities are all examples of an approach to technical assistance that looks at the community as a whole.

4. **Policy:** Of course, all this falls under the umbrella of Policy. State, federal and local policies must synergize and work in concert harmoniously. Without long-term, predictable energy policy, the kind of private sector investment that is necessary in all successful economies will not be made. Federal energy programs should support human capacity building, technology innovation and new financing approaches. Alaska encourages any federal policies that support these programs, especially in rural Alaska where the need is most acute.

Acknowledgements

Special recognition to the contributions to Alaska's energy policy and to this report go to former and current Alaska House Committee on Energy Co-Chairs: Representatives Jim Colver and Liz Vazquez of the 29th Alaska Legislature; Representatives Doug Isaacson and Charisse Millett of the 28th Legislature; Representatives Neal Foster and Lance Pruitt of the 27th Legislature; and Representatives Bryce Edgmon and Charisse Millett of the 26th Legislature. Also, special thanks to my fellow Alaska Arctic Policy Commission Co-Chair and Alaska energy advocate, Senator Lesil McGuire.

The CHAIRMAN. Thank you, Representative Herron.

Thank you both for your words this afternoon and your leadership.

Governor Walker, you testified before the Energy Committee in early December when we had an oversight hearing on ANILCA. I think my question to the overall panel that afternoon was what can be done to really help Alaska? Your comments at that time were bring more Members of Congress to Alaska to see and understand, to listen and to learn. You may have included members of the Cabinet as well.

So I heard you loud and clear. I am so pleased that we are able to do a field trip where it is more than just listening, it is observing with their eyes. So thank you for your words on that.

I don't have any questions for either of you because I get to see a lot of you, so I will turn to my colleagues and ask if they have any questions of either the Governor or Representative Herron.

Senator CAPITO.

Senator CAPITO. Thank you both. It is wonderful to be here in your beautiful state.

Governor, I just had a clarification question. You mentioned LNG, liquefied natural gas, that you are moving in that direction. You mentioned, and I was not sure that I heard you correctly and I asked my colleague here, Senator King. Did you say you are trying to build a pipeline and take it from here to the tide waters?

Governor WALKER. Correct. We are taking it from Prudhoe Bay to Andreafsky which is located on a peninsula.

Senator CAPITO. Alright, not the tide water in Virginia. I was like, whoa. [Laughter.]

Senator CAPITO. Okay, good.

Let me ask you because we were—so I would like to stay on the Energy Modernization bill that we have been working on with the leadership of your Senator and Senator Cantwell. There are some provisions in there that should help with some of the permitting that is connected with the LNG permitting. I think it would be particularly useful to all states, but probably I don't know if you are aware of this and what impact it might have on Alaska.

Governor WALKER. We've been pretty, very pleased with the reception we've had on the permitting thus far and others, some routing issues that are being dealt with that Senator Murkowski is working on. We appreciate that. But overall we've been very pleased. The pipeline permitting has not in any way been an obstacle to us at all in the navigation of the pipeline at all.

Senator CAPITO. Okay.

Finally I would say you mentioned that you have great hopes for, in terms of bringing prices down and availability of energy to Alaskans in terms of natural gas again. I guess my question would be how are you going to get these pipelines out to these areas? That, to me, is difficult in the lower 48 in some congested areas for a totally different reason. But I did not realize, since this is my first visit here, how far apart everything is. No roads, no existing infrastructure. What kind of, I guess, solutions would you come up with for that?

Governor WALKER. There are a couple ways that could be done and it's done all over the world. When the pipeline crosses a body

of water such as the Yukon River, certainly the gas will be taken off there and moved up and down the river on barges and moved in, sort of, moved in and out somewhere to swap it out of propane bottom of your barbeque. So there could be ways of moving it on the river, on the coastal communities certainly can do it that way by barges, specific barges for moving liquefied natural gas or compressed natural gas.

And the third is first by way of highway. It can, natural gas is moved, liquefied natural gas is moved all over the United States by road. That's why Senator Hoffman was so wise, as usual, when he put in the 20 percent provision that some areas of Alaska would not be able to have access to because of transportation and so that there would be some opportunity for funding for alternative energy. Kodiak is an example with 99.7 percent renewable energy between hydro and wind. And so that would be funding a vehicle, an ongoing funded vehicle for not just responsible but maybe bringing the cost of energy down, but also putting in an alternative energy for that area.

So that's, sort of the way, the three ways of spreading the benefit out across the state.

Senator CAPITO. Thank you.

Senator KING. One question.

Governor, both of you mentioned if only we had access. I mean, is that about the pipeline going by a lot of oil? Could you be more specific what you are referring to?

Governor WALKER. Oh, I certainly can.

[Laughter.]

Senator KING. I got the feeling you were talking and everybody got it.

Governor WALKER. Let me pull the mic a little closer.

[Laughter.]

You know, there's an area on the North Slope. It's in the ANWR area. And, you know, there's was one section of it, the 10-02 section which is four percent, I'm sorry, eight percent of ANWR but the coastal plain was set aside for potential development. That's eight percent of it.

We only need half of that. So we need four percent of ANWR to have access to that which happens to be adjacent to our own development field at Fort Thompson. So that's the very small area in the coastal plain that we need access to be able to have access to that 16 billion barrels of oil.

So it's, you know, I'm looking across the fence line and see where we need to be. And it's very frustrating to have a pipeline that is three-quarters empty that close. You can even look one way to see the pipeline and look the other way to see where that resource is.

So it's a very specific delineated. There's been one well drilled there already. We don't know the results of that. Only a few people know the results of that. One of them works for me, and he still won't tell me what they found because it was something they shared about 8 years ago and can't be divulged.

But so it's a very specific area, very close to our current infrastructure. It would really be about a three-mile pipeline to tie into the Trans Alaska oil pipeline. So we know exactly where it's at. Happy to take, I'd love to take any of you there to view it, to see.

I know there's a lot of things that have changed, the technology in drilling over the years, the directional drilling.

Senator KING. I was going to ask a question.

Because is it close enough to be accessed with directional drilling instead of having to drill in the wildlife refuge?

Governor WALKER. We have a lot of press here, let me prepare my answer? Maybe. As somebody who doesn't want my view——

Senator KING. Is that a definite maybe, Governor?

Governor WALKER. That's a strong maybe.

There's advantages of directional drilling and there's some disadvantages as far as being able to fully explore an area. So we're going to look at all options. I am laser focused on that issue because that's my job, to make sure that that's our lifeblood of our economy is developed to the national benefit, responsibly, safely, environmental sound conditions. If we can do offshore, we can certainly do onshore responsibly. So.

Mr. HERRON. So Madam Chair, I'd like to just add a little to Senator King's question as this is the second time that I've had the privilege of testifying in front of this Committee and it was in Washington, DC and it was about, mostly about, Arctic policy.

But one of your Senators made a statement. I'll leave that individual's name alone for now. But he brought up our community—and he was incredulous that Alaskans wanted access to develop their resources so they could, we could have sustainable communities.

And the comment by that U.S. Senator was I don't get it. You want to have access to your resources so you can put more carbon in the atmosphere and drown out—and I was, so he allowed me to rebut that, is that he almost answered the same question is it doesn't matter what state you're from if someone else. And that's what I tried to share in my comments, if someone else tries to tell you how to live your lives without including you in the conversation it only hurts Alaska. And that's, well Senator Murkowski has heard this probably ad nauseam from me and Lisil, this is what we're talking about.

The CHAIRMAN. Secretary Moniz was going to comment, I think, on the pipeline.

Secretary MONIZ. Well thank you, Chairman.

Just to go back to Senator Capito's question about the natural gas pipeline from the North Slope to a future LNG facility. I guess I'll just reiterate the position that we put out in terms of providing what's called a conditional approval which is something we do not do for the lower 48 projects but we specifically recognize the very different situation here in Alaska.

So I thought it might just be worth it to reiterate that position. It certainly remains our position. Clearly there will be future environmental reviews, etcetera, to be sure upon its review but the conditional has been approved.

The CHAIRMAN. Other questions?

Senator DAINES.

Senator DAINES. First of all, Governor Walker, I love your state, and that is saying something from a Montanan. You have got an amazing state. Thank you for your warm and gracious hospitality, truly.

It is just a follow up from Senator King's comment. Again, this is Governor to Governor conversations when we had Senator King speaking. With all due respect, there is six percent of the U.S. Senate here today, but there is actually two percent of the nation's Governors here today.

Governor WALKER. Yes, that's true.

Senator DAINES. It just takes one to get to two percent. It takes six to get to six percent. So it is very important.

Senator KING. Sixty-six percent of us, of the independents. [Laughter.]

Senator DAINES. And 6.7 percent of the President's Cabinet is here today.

Secretary Moniz, I looked and you are actually 15th in succession to the presidency right here. So we have got to keep an eye on you— [Laughter.]

Senator DAINES. Yes, I would love for you to—

[Many people talking at once.] [Laughter.]

Senator DAINES. So anyway, get yourself mirandized here, if nothing else. [Laughter.]

UNKNOWN SPEAKER: A non-disclosed location during the State of the Union. [Laughter.]

Senator DAINES. So with all of this fire power here, we are from DC. We are here to help. That is a full on quote. But we face these small challenges in a state like Montana where we want to make sure Montana's voice is heard in the debate about how our lands are used. I hope our Committee takes away what you have said here just recently. I can tell you working alongside the Chair of this Committee, Lisa Murkowski, she is fighting for Alaskan's voice in sovereignty of Alaska in this discussion and so does your new Senator, Dan Sullivan. But it does seem like it is out of balance. Look at ANWR, that 96 percent of ANWR would still be protected.

Governor WALKER. Right.

Senator DAINES. You are asking for four percent with the infrastructure readily available to hook up. If there is something we could do as a Committee—we have the Secretary of Energy here, we have a significant part of the Energy Committee here today. What should we put on our to-do list so that we can hear the people of Alaska? The U.S. Senate is the guardian of the states in many ways, the voice of the state back in Washington. What should be put on our to-do list, specifically, that relates to allowing Alaskans access to that four percent?

Governor WALKER. You can't imagine how much I appreciate that question and how, I know, Governors Bullock and Mead, both—that Governor Mead, the Chair of the Western Governors Conference. Governor Bullock from Montana, the chair or Co-Chair of the Western Governors Association. We talk about this a lot as far as how do we engage with Washington on our situation. It's not a matter of being heard, but let us control our own destiny. Thank you.

So I think the message of that and no one has been a bigger champion of this than, you know, Chairwoman Murkowski. I mean, she has led the charge on this. We have gotten things to the House. You had, sometimes had, a chance of total of the Senators all getting permission to have access to that.

You know, I would say it's just a matter of we won't stop. I know that Senator Murkowski, you won't. And thank you for not.

We are going to continue to ask you too. I mean, I sometimes try baiting the First Lady when I say, you know, sometimes asking for forgiveness might be better than asking for permission. And she's afraid I might have to—institution or something. [Laughter.]

Is always the result of doing something I shouldn't do but I'm working for it now by saying, I mean, if we can't have access to four percent. So we will ask once more. And I mean, I know you're going to introduce legislation. I guess we would just ask you to support that and understand.

I can't imagine, I remember well. You don't have anyone here from California so I'm using that example. Driving down Highway 101 a couple of years ago and when I left there was a roadway, 100 yards on the left and to the right was offshore drilling. I went on thinking, really? I mean, this is Highway 101 and I am not being critical of them doing that.

But I just have a problem when we cannot control our own destiny because of a higher interest or natural interest. The higher interest says 100 percent of that area has to be off limits to any resources whatsoever. I have to have this conversation with Secretary Jewell way more often than she would want me to have it with her. But I'll do it again on Friday because I will not, will not, stop until that message is clear. Four percent is all we're talking about. And that will fill an energy pipeline. That will create an economy that's safe, that we need to have, we need to have rebuilt. We don't have the cushion anymore. So the price of oil will rise.

Yes, the world is going to turn over to alternative energy. But now the President himself said, there will be a big issue. Oil will be the big issue. Why not from one of our states? Why not from our country?

And so, I appreciate your offer of support. I certainly had been asked and will ask and you can ask for support of others in Washington. And you're someone in a position to be able to say.

And then again, there's nothing like, I remember so well another Senator Murkowski that brought through to ANWR. They got off the plane and one particular Senator looked around and said, my goodness if you can't drill here where can we drill. He went back to Washington and voted against opening that up for drilling.

So it's just, we have been out of—I don't know, it's just, we're kind of like the second home for some that say, you know, I might never visit the second home, but I just don't want anybody there doing anything that would in any way look like activity. We need some activity. And the North Slope, Dead Horse, is the Las Vegas strip of Alaska where 90 percent of our income comes from. Every vehicle has a drill pad underneath it, every vehicle has that. I mean, it's the most protected area you could ever imagine.

So I really hope sometime we'll have a, really have a hearing, a field hearing at Prudhoe Bay so people can see first-hand the kind of care and caution that goes in to what goes on up there and allow us to have access to that 4 percent. I really thank you very much for that question.

Thank you, Senator.

The CHAIRMAN. Governor, thank you.

I loathe to cut off this conversation because, as you know, this is clearly an issue that we have tried to advance for decades now.

I am cognizant that there are some on our third panel that are actually going to be trying to catch the seven o'clock jet.

I know Senator Barrasso had a question, so I'd like to turn to you now, please.

Senator BARRASSO. Governor and Representative, the President in his budget recommended an over \$10 a barrel fee with a tax on American-produced oil. I just wondered what that impact would be here for Alaska in terms of state revenue, jobs, the economy, the things that you are concerned about. This would be some brief comments because people are obviously concerned about——

Governor WALKER. In a word it would be absolutely devastating to do that. When you have oil already that's at 26. Now if he wanted to impose that on oil being brought in from foreign countries I would support that. But on U.S. oil development, no. I just, I'm very sorry to see that. That's a very painful pill for those of us that are tied into that, so we will oppose that. At least that's why I don't think.

Mr. HERRON. Senator, the Alaska legislature, both House and the Senate, both sides of the aisle are questioning, "Now we need to do more," but it really is on top of everything else that—right now many of us cannot accept it.

Senator BARRASSO. Okay.

The CHAIRMAN. Further questions?

Governor, Representative Herron, thank you both for your leadership. Thank you for being here and for your comments today.

Governor WALKER. Thank you very much.

Mr. HERRON. Thank you, Boss.

The CHAIRMAN. We will now bring up panel three, to provide an opportunity to listen to Alaskans from around this region, around the state.

Our first witness this morning will be Ralph Andersen. Ralph is President and CEO of Bristol Bay Native Association, and he hails from Dillingham.

He will be followed by Mr. Michael Black. Mike is the Director of Rural Utilities Management Services at the Alaska Native Tribal Health Consortium.

Mr. Black will be followed by Steve Gilbert who is the Manager of Projects Development at the Alaska Village Electric Co-op. You hear us use the AVEC acronym, and that is what we are talking about, the Alaska Village Electric Co-op.

We will then hear from Jack Hébert. Jack is the CEO of the Cold Climate Housing Research Center located in Fairbanks.

Mike Hoffman is the Executive Vice President for the Association of Village Council Presidents, and he was also our tour guide this afternoon as we went off to Oscarville. He did an exceptional job, and we thank you for that, Mike.

Gwen Holdmann is the Director for the Alaska Center for Energy and Power at the University of Alaska Fairbanks. Gwen told me that she has just arrived, literally, from Finland. So to come from Finland to Bethel is no small feat in and of itself. We thank you for your participation as well.

Again, I would ask you, and I know that this is unfair, but please try to keep your comments limited to five minutes each so that we will have an opportunity for questions and answers and the exchange after that we are all looking forward to.

Ralph, if you would like to lead off, please. Thank you.

**STATEMENT OF RALPH ANDERSEN, PRESIDENT & CEO,
BRISTOL BAY NATIVE ASSOCIATION**

Mr. ANDERSEN. Good afternoon, Senator, members of the Committee. As the Senator introduced me, my name is Ralph Andersen, I'm the President and CEO of Bristol Bay Native Association (BBNA). Thank you for inviting me to testify today.

I'll summarize my written testimony which I already submitted for the record. I'd like to start with some background information about Bristol Bay and our energy situation.

BBNA is a consortium of 31 tribes. Our region covers 44,000 square miles. It is about the size of the State of Ohio. Dillingham is nearly the geographic center of the region. It is our regional hub.

In the spring heating fuel, diesel and gas are shipped by barge from Seattle to Dillingham and sub-regional hubs and distributed to surrounding villages from there. Prices go up each time the fuel is handled. We're stuck all winter with prices, with fuel prices, over the last margin of fall.

Our homes, all of our homes, are heated with home heating fuel or propane which is expensive. The electricity is generated in our villages by diesel power plants where many of them are more than 40 years old. It's common to hear about a village losing power for days or weeks because replacement parts are hard to find.

The vast majority of our villages are not on power grids, although some of them are just a few miles apart. So with high production costs, small consumer populations, the cost of electricity per household in our villages is very high. In Dillingham we pay close to \$0.50 per kilowatt hour. My electric bill for January was over \$500.

In 2010 we got our village residents together for dialogs about the future of our region. We held over 50 meetings in schools and community halls in 26 villages. We finally resolved the Bristol Bay Regional Vision. I have already submitted a copy of that for the record.

Our people said the high cost of energy prevents local business development and that reducing energy should be the top priority or top strategy to create sustainable economies. The top recommendation to reduce energy costs is to develop renewable energy sources, to generate electricity including wind, solar, hydro, tidal and geothermal.

We realize we have no control over the price of fuel but we can control our uses of smoke machines, ATVs, boats, outboards and other equipment that are essential for our survival. We know that we can help bring down home heating costs by weatherization. We also know that we cannot control the cost of electricity. We have small alternative or renewable power projects throughout the region designed to meet local village needs and household demands.

Senator Murkowski is familiar with the project at Igiugig. Thank you for spending the time with us there last summer. Igiugig is a

village of about 70 people at the mouth of the Kvichak River at Iliamna Lake. Igiugig is a test ground for Alaska's first ever river-powered electrical generator. It's powered by the current of the Kvichak River. The machine looks like a giant wheat thresher.

There are wind generators either installed or underway in other of our villages such as an array of 15 operating in Perryville and single wind generators in other communities. Families are also installing wind generators at their homes and fish shacks because they're becoming more affordable.

In keeping with the Bristol Bay Regional Vision, BBNA is working with our Bristol Bay partners, the Alaska Energy Authority, Information Insights and the Southwest Alaska Regional or Municipal Conference on the three based Bristol Bay Regional Energy Plan. I submitted a copy of that for the record already.

Phase One was an inventory of energy-related issues such as high fuel prices, high construction and maintenance costs, high space heating costs, heavy dependence on diesel for power production or power generation.

Phase Two is now underway and includes a benchmarking project which is an inventory of all non-residential buildings in 27 communities. A regional energy efficiency and conversion strategy will be developed at this stage.

Phase Three will develop a list of energy projects and priorities to carry out the strategy.

I want to spend a few minutes talking about LIHEAP. Due to high costs, few jobs and low family incomes many village members rely on LIHEAP to heat their homes. The Alaska heating assistance program, AKHAP, also helped many families, but Governor Walker recently cut that program all together.

We'd like to modify LIHEAP so we can meet other home heating needs such as helping to cover the costs of weatherization for energy efficient appliances and modern heating systems. We need to help families at the borderline to qualify for LIHEAP under current law so they don't fall through the cracks because the Governor cut AKHAP.

LIHEAP is just families up to 100 percent of the poverty guidelines and AKHAP assistance goes between 150 and 225. There are families that qualify for AKHAP that don't for LIHEAP because they are just a few dollars above the LIHEAP guidelines. AKHAP is now gone so they'll receive no assistance at all. Either that or to qualify for LIHEAP one of the family members immediately quits work.

We need to solve our existing heating and electrical problems. We need action to improve our current situation.

Thank you, Senator Murkowski and Senator Cantwell for developing S. 2012, the Energy Policy Modernization Act. My first take on it is pretty simple. I like it.

The CHAIRMAN. Good. [Laughter.]

Mr. ANDERSEN. We don't need any more studies or plans to build mega projects that will never reach Bristol Bay or Alaska. We need to have hydro projects such as the project at Igiugig designated as a renewable energy project, we need to weatherize homes and public facilities, and we need to have villages that are just short distances apart connected together on grids.

Through the Bristol Bay Energy Plan we're just now beginning to find ways to meet our energy needs, but our plan is not yet done and we'll need help putting it into action.

The Secretary mentioned regional energy partners. Well, we want to be one.

Basic energy efficient infrastructure is a top priority at Bristol Bay, and we're mindful of the role of fossil fuels in climate change. The transitions to other energy sources are taking place, but they're taking place slowly.

We need to keep our villages alive. We keep them alive by continuing to fund our supplies of diesel and home heating fuel until other energy sources are in place.

I'd like to highlight six of the recommendations I have listed in my written testimony. Two of them are for the Secretary.

Tribal energy needs to be priority and aligned at the highest level of DOE. We suggest the Deputy Secretary position for a level.

Tribal energy must be a dedicated line in the DOE budget.

And for the panel on before the Committee and even for DOE, we think that every home in Bristol Bay should be weatherized by 2025. We volunteer to be a pilot project or a demonstration project that can be used as a result for the entire state. I think all the homes in rural Alaska would be an absolutely phenomenal legacy to have every home in rural Alaska weatherized.

Establish an energy revolving loan fund for individuals to make energy efficient home improvements.

Support transmission lines that connect rural villages for greater economies of scale.

Establish energy clearinghouses in rural Alaska to gather and share information.

Again, thank you for the invitation to testify, and I'll be happy to answer any questions. I'm sorry if I over extended my five minutes.

[The prepared statement of Mr. Andersen follows:]

**TESTIMONY OF RALPH ANDERSEN
PRESIDENT & CEO, BRISTOL BAY NATIVE ASSOCIATION
MONDAY, FEBRUARY 15, 2016**

**Field Hearing: Energy Technology Innovation and Deployment – Opportunities
for Alaska’s Energy Future**

Before the SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

Good afternoon Senator Murkowski and members of the Committee. My name is Ralph Andersen. I’m the President & CEO at the Bristol Bay Native Association.

Thank you for inviting me to testify at this important hearing today. I’d like to start with some background about BBNA and Bristol Bay.

Background

BBNA is a tribal consortium of 31 tribal villages. Our region covers 44,000 square miles and is about the size of the State of Ohio. Our region stretches from Perryville and Chignik on the southern end of the Alaska Peninsula, north to 6 villages around Lake Iliamna; and from Togiak and Twin Hills in the west to Naknek and King Salmon to the east. Dillingham is near the geographic center of our region and is our regional hub. We also have six sizeable communities that serve as sub-regional hubs.

Many of our residents are seasonally employed in the commercial fishing industry or on construction projects during the summer months. It’s very hard to find jobs in the villages during the winter. Many of our residents rely on their commercial fishing pay and summer jobs to help make it through the winter. Big salmon returns and the resulting low salmon prices in recent years have caused financial problems for many families. State budget cuts and fewer construction projects have also impacted families and the State’s financial picture looks very grim.

High costs of fuel and electricity are the biggest challenges in our region. The high costs impact every aspect of life and is one of the main obstacles to keeping villages in our region sustainable.

While fuel prices in America dropped dramatically with the recent glut of crude oil, in Dillingham we’re paying \$4.75 a gallon for gas – about double the price of gas in Anchorage. The price for home heating fuel is about \$3.00 a gallon. Some

of our villages are still paying up to \$8.00 a gallon for gas and \$4 to \$6 dollars a gallon for home heating fuel.

Our fuel deliveries start in the spring. Heating fuel, diesel, and gas are shipped by barge from Seattle to Dillingham and sub-regional hubs and distributed to surrounding villages from there. Prices go up each time the fuel is handled.

We're stuck all winter with fuel prices of the last barge in the fall. Barging used to be the most economical way of delivering fuel. But fuel prices were so high in recent years that some villages paid less per gallon by having their fuel delivered by cargo plane from Anchorage. Some stopped barging fuel altogether because it cost too much and now have weekly fuel deliveries by air.

Due to high costs, few jobs, and low family incomes, many village members are sometimes faced with either paying an electric or oil bill, or buying groceries or gas for subsistence hunting. Many rely on LIHEAP to heat their homes, which is critical during the winter months. The State's Alaska Heating Assistance Program (AKHAP) also helped many families keep warm during the cold winter months, but Governor Walker recently announced cutting that program altogether. AKHAP was funded at \$9 million. Bristol Bay received about \$787,000.

In many of our villages, electricity is generated by stand-alone diesel-power plants, many of them are more than 40 years old. Replacement parts are hard to come by. It's common to hear about a village losing power for weeks at a time because their generators are outdated and replacement parts are hard to find.

The vast majority of villages in our region are not on power grids, although some are just a few miles apart. So with high production costs and small consumer populations, the cost of electricity per household in all of our communities is very high. In Dillingham we pay close to 50 cents per kilowatt hour. My January electric bill was over \$500.00.

The disparity between costs in urban Alaska and rural Alaska was demonstrated in a study not long ago by the University of Alaska's Institute of Social & Economic Research that found urban residents (Anchorage, Juneau and Fairbanks) pay 4% of their household budgets on energy (heat and lights) while rural Alaskans pay 40% of their total household budgets.

Bristol Bay Regional Vision

In 2010 residents of the Bristol Bay region engaged in a dialogue about the future. We held over 50 meetings in 26 villages in schools and community halls across the

region. We shared our values and hopes for our families and communities. The result is the Bristol Bay Vision and I would like to submit a copy of the final report on the project for the record.

People throughout the region said the foundation of their lives is strong families connected to the land and waters. We want excellent schools, safe and healthy families, local jobs, access to subsistence resources, and a strong voice in determining the future of our region.

Our people recognize that true economic development requires a regionally coordinated approach to reduce energy costs. The largest costs for any business in our region are the costs for heat and electricity.

Our people said the high cost of energy prevents local business development, and that reducing energy costs should be the top strategy to create sustainable economies. The top recommendation regarding reducing the costs of energy is to explore and develop renewable energy resources to generate electricity including wind, solar, hydro, tidal, and geothermal resources.

Bristol Bay Energy Projects

In Bristol Bay, we realize we have very little control over the prices of fuel and petroleum products, but we can control our uses of snow machines, ATV's, boats, outboards, and other equipment.

We know we can help bring down our home heating costs by weatherizing our homes, and are trying hard to meet the high costs for weatherization, but many of our families simply can't afford the costs.

We also know we have some control over what we pay for electricity and power production. So throughout our region, we have small energy projects specifically designed to meet local village needs and household demands.

Senator Murkowski is familiar with a project at Igiugig – a village at the mouth of the Kvichak River at Iliamna Lake. Thank you Senator for traveling there last July.

Igiugig was the test ground for one of Alaska's first river-powered electrical generators. The generator is powered by water current of the Kvichak River, taking the river's current and producing renewable energy for the village of 70 people. The machine looks like a giant underwater wheat thresher.

As I understand it, the company, Ocean Renewable Power, began discussing a small operation in rural Alaska, where expensive fuel oil drives up energy costs.

The idea of a river generator started to make sense in Igiugig because of its location.

It was a desperate situation. Heating fuel costed about \$7 a gallon at the time. Power in the community costed \$1 per kilowatt hour. In Anchorage, it's about 16 cents.

There were significant up-front costs of about \$4 million to \$5 million to develop and build the first generator. The company invested about \$2 million in the project, but much of the funding came from the U.S. Department of Energy and from the Alaska Energy Authority, which provided just under \$1.5 million through its Emerging Technology Fund. I understand the next version of the generator will cost about \$500,000 per unit.

There are wind generator projects either completed or planned in many of our villages, such as an array of 15 at Perryville and single wind generators at other smaller communities. Families are also installing their own wind generators at their homes and fish camps throughout the region as they are becoming more affordable.

Bristol Bay Energy Plan

In keeping with the Bristol Bay Regional Vision, BBNA has been working with the Alaska Energy Authority, Information Insights, and the Southwest Alaska Municipal Conference on the Bristol Bay Regional Energy Plan to identify energy projects and priorities that will reduce the long-term cost of energy and dependence on fossil fuels. I would like to submit copies of the most recent project reports for the record.

Phase I provided an inventory of energy-related issues and resources in the region. The report identified key issues in the region such as:

- High and volatile fuel prices
- High construction and maintenance costs for renewable energy projects due to remote location and distance between communities.
- High space heating costs for homes, businesses, and public facilities due to cold climate; and
- Heavy dependence on diesel fuel for electricity generation (96%); however, more renewable projects are under development or have recently come online.

The goal of Phase II was to engage community and regional leaders, residents, utilities, industry representatives, and other key stakeholders in a dialog about their priorities for addressing energy needs in the region.

This phase also requires conducting a “benchmarking” project which is a complete building inventory of non-residential buildings in each community. The goal is to create an inventory of public facilities in up to 27 Bristol Bay communities for use in developing a regional energy efficiency and conversion (EEC) strategy. Data will include at a minimum, building type, age, square footage, fuel type, owner and EEC audit/renovation status and energy usage.

Phase III will be developing a list of projects and priorities to be assessed for economic and technical feasibility. The objective is to develop a structured process to implement regional and community energy priorities, supported by agencies with technical skills to identify a roadmap for determining the activities and infrastructure communities should pursue to improve their energy systems.

LIHEAP

On behalf of many families in Bristol Bay, thank you Senator Murkowski for always being a champion for us on LIHEAP funding. When fuel prices went out the roof not long ago, you came through for us by increasing the LIHEAP appropriation and helped our families make it through a very difficult cold winter.

We are coming to you and the committee for help again. The price of fuel is not at crisis levels or the problem. Now that the price of fuel has dropped a bit and is not at crisis levels, we’d like to modify the program so we can meet other home energy needs, such as helping to cover the costs for weatherization, for energy efficient appliances, and for modern cost-effective heating systems.

We need to provide help for families at the borderline of qualifying for LIHEAP under current law so they don’t fall through the cracks now that AKHAP is no longer available.

LIHEAP assists families up to 150% of the poverty guidelines and AKHAP serves those between 150% and 225%. In Bristol Bay, there are families who qualify for AKHAP but don’t for LIHEAP because they are just a few dollars above the LIHEAP guidelines. They would qualify for LIHEAP only if a family member took a pay cut or quit working. With AKHAP now gone, they will not receive any assistance at all.

Weatherization

The average home energy cost in Bristol Bay is about \$7,000 a year, which is about 2.5 times more than the cost in Anchorage and 3 times more than the national average. About 21 percent of households in Bristol Bay spend 30% or more of their total income on housing costs – rent, utilities and energy. More than a third of our households have completed energy efficient upgrades through low-income weatherization programs or through AHFC's Home Energy Rebate Program which is a cost-reimbursable program.

But not all residents meet the low-income guidelines or can afford the up-front costs for the energy rebate program.

Collectively, Bristol Bay residents are saving about \$1.3 million per year from residential energy upgrades. If all remaining homes were upgraded, there would be an additional \$2.3 million savings on fuel costs.

There are about 4,000 homes in our region. 852 homes have been weatherized since 2008. 43 homes were weatherized last year. There are 1,500 homes yet to be weatherized. It costs about \$30,000 just for the building materials to weatherize a home.

S.2012 The Energy Policy Modernization Act

Thank you Senator Murkowski for working with Senator Cantwell on developing S.2012 the Energy Policy Modernization Act. We don't need any more studies. We need solutions to our energy problems. We need action.

We need to have hydro projects, such as the project at Igiugig, designated as a renewable energy project. We need to weatherize homes and public facilities. We need to have villages that are just short distances apart put on a common grid. Families also need energy efficient appliances and modern heating systems. We need an energy clearinghouse that can provide information to our people regarding programs and opportunities.

Natural gas pipelines, revenues from off-shore oil and gas development, and building big mega-projects are important, but they all take years to build and decades to come online. It's hard to imagine any of them ever reaching Bristol Bay anytime soon.

We have been desperate for solutions to our energy problems, and we are trying to catch up to the rest of America.

Through the Bristol Bay Energy Plan, we are just beginning to find ways to meet the energy needs of Bristol Bay residents. But our plan is not yet done and we will need help putting it into action.

Many, if not all, of our communities are still powered by diesel generators. Nearly all of our homes use home heating fuel because we can't afford the cost of electric heat and natural gas is non-existent.

Transitions to other energy sources are slowly taking place, but they are expensive. We need to continue funding for our supplies of diesel and home heating fuel during the transition period until other sources are in place.

Providing basic energy efficient infrastructure – homes, schools, and public facilities -- is a top priority in Bristol Bay. We have major salmon processing facilities, schools, village clinics, and a regional hospital that are at various stages of needing improvements.

This is all very expensive.

Most local homeowners can't afford to buy, ship and install weatherization materials on their own.

We don't expect the state to provide any funding for upgrades. Local businesses would have to raise prices of their goods and services even higher to cover the costs of energy upgrades. Many of our power plants are decades out of date, are very expensive to replace, and replacement parts are hard to find.

This bill will help us catch up with the rest of America in terms of energy efficiency and maybe bring down our power costs.

Recommendations

I have a few recommendations that I hope will be considered. Some can be accomplished in the next 6 months:

1. Tribal energy needs to be a priority and aligned at the highest level at DOE. We suggest at the Deputy Secretary level.
2. Tribal energy must be a dedicated line in the DOE budget.
3. There needs to be better coordination amongst local, state and federal agencies on rural projects to improve cost effectiveness and energy efficiency.
4. Change the LIHEAP eligibility guidelines to 200% above poverty for those who are only a few dollars away from qualifying since AKHAP is now gone.

5. Allow more LIHEAP funds to be used to purchase energy efficient home heating systems and appliances.
6. Weatherize every home in Bristol Bay by 2025.
7. Provide funding through low interest loans or grants for renewable and alternative energy projects.
8. Establish an energy revolving loan fund to encourage individuals to make energy efficient improvements to their homes including high efficiency, low emission wood stoves.
9. Support transmission lines to connect rural villages for greater economies of scale.
10. Establish energy clearinghouses in rural Alaska to gather and share information.

Again, thank you for the invitation to testify. I will be happy to answer any questions you may have.

Thank you.



A PROJECT OF
 Bristol Bay Native Association
 Bristol Bay Native Corporation
 Bristol Bay Area Health Corporation
 Bristol Bay Housing Authority
 Bristol Bay Economic Development Corporation

WITH SUPPORT FROM
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 Alaska Conservation Foundation
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 Tiffany & Co. Foundation
 Bristol Bay Native Corporation

PREPARED BY
 Information Insights, Inc.
www.ilalaska.com

WWW.BRISTOLBAYVISION.ORG

Bristol Bay Regional Vision

Final Report

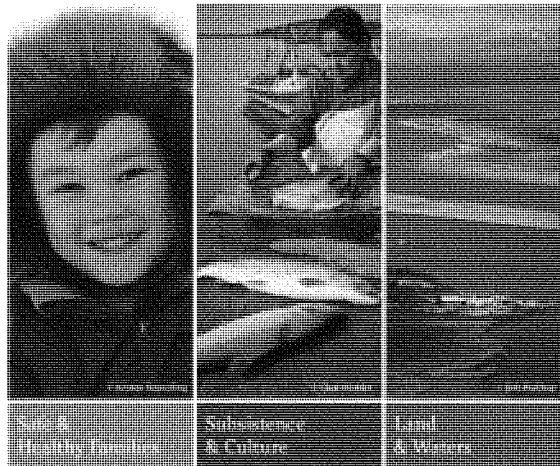
November 2011

Celebrating Our Unity

Over the past year, the residents of the Bristol Bay region have engaged in a dialog about the future. In schools and community halls across the region, we spoke about our values and shared our hopes for our families and communities. The Vision that emerged is one of optimism and common values.

Throughout the region people said the foundation of their lives is strong families connected to the land and waters of the area. We want excellent schools, safe and healthy families, local jobs, access to subsistence resources, and a strong voice in determining the future direction of the region. We are willing to work together so our grandchildren can live successful lives here.

The Vision we created will become a guiding document for communities, regional organizations and all entities that have an interest in the Bristol Bay region. It is time to celebrate all that unites us!



The Bristol Bay Regional Vision Project convened over 50 meetings in 26 communities. Participants in every community were asked the same questions about their vision for the future. Many common themes emerged.

Culture & Subsistence

- Family, connection to the land and water, and subsistence activities are the most important parts people's lives today and in the future
- Maintaining a subsistence focus by teaching children how to engage in subsistence activities and encouraging good stewardship practices is important.
- Gatherings that include instruction by Elders about culture-based skills are important tools in maintaining cultural values.

Economic Development

- People welcome sustainable economic development that is based largely on renewable resources. Any large development must not threaten land and waters.
- True economic development will require a regionally coordinated approach to reduce energy costs, provide business training, and ensure long-term fish stock protection.
- Residents want to see increased access to limited entry permits, continued quality improvement of fish, and regional efforts to expand markets. Young people need to be able to afford entry into the fishing business.

Safe & Healthy Families

- People would most like to change alcohol/drug abuse and/or fear of domestic violence.
- Strengthening wellness efforts is a strong way to reduce substance abuse and family violence.
- Community gatherings help to create stronger families and healthier communities.
- The vast majority believe, "We can live healthy and productive lives here in the next 25 years."

Education

- Education should prepare youth with skills needed for success in college or vocational schools.
- To create success for our students, adults need to model the values and behaviors we expect from them. Modeling how to live is the most important factor for creating successful students.
- Families and communities need to communicate values and priorities to the schools.

Fostering Cooperation

- To create community-wide agreement on initiatives or projects there should be joint planning meetings among tribes, local governments and corporations.

The Vision

The foundation of the Bristol Bay Region is committed families, connected to our land and waters.

We believe future generations can live healthy and productive lives here. Across our region, we share common values of community, culture, and subsistence.

We see a future of educated, creative people who are well prepared for life. This requires:

- Excellent schools
- Safe and healthy families
- Local jobs
- Understanding our cultural values and traditions

We assert the importance of local voices in managing our natural resources to continue our way of life.

We welcome sustainable economic development that advances the values of Bristol Bay people. Our future includes diverse economic opportunities in businesses and industries based largely on renewable resources. Large development based on renewable and non-renewable resources must not threaten our land, our waters, or our way of life.

We foster cooperation among local and regional entities to coordinate infrastructure planning for stronger, more affordable communities. Investments in energy, housing and transportation promote sustainable communities and spur economic development.

We recognize the need to locate new sources of capital to implement this vision with a goal of generating self-sustaining regional economies.

We are unified to secure a prosperous future.



The Vision reflects the common hopes and values expressed by Bristol Bay residents in community meetings across the region. It was endorsed by 89 percent of residents who participated in a second round of community meetings. It now carries the authority of the people of Bristol Bay.

"When we have similarities we should be partners. We're more effective if we can work together."
— Naknek resident

The Bristol Bay Partners invited nine well-respected leaders from across the region to serve as commissioners for the project. The commissioners became the "eyes and ears" of the project: they convened community meetings and listened to residents' aspirations for the future of their region.

Members of the commission included:

- Hjalmar "Ofi" Olson, Dillingham
- Luki Akelkok, Ekwok
- Molly Chythlook, Dillingham
- Annie Christensen, Port Heiden
- Helen Gregorio, Togiak
- John D. Nelson, Kokhanok
- Erin Peters, Naknek
- AlexAnna Salmon, Igiugig
- Annie Fritze, Dillingham

Round 1: Fall/Winter 2010-11

Between September 2010 and January 2011, visioning meetings were held in 26 communities. Small teams consisting of one or two commissioners, BBNA project staff, and facilitators from the Alaska public policy and management consulting firm of Information Insights, traveled throughout the region to meet with residents. In each community, participants responded to an identical set of questions designed to encourage meaningful dialog and to track opinions across the region in a consistent format.



Residents of all ages attend a community meeting and potluck in New Stuyahok.

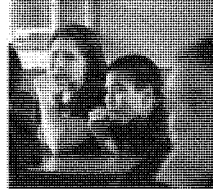
To ensure every participant had an equal voice in the conversation, Consensor™ audience polling was used to capture individual responses to questions. Participants used handheld keypads to vote for their first, second and, in some cases, third priorities from a set of choices developed by commissioners and project staff. Meeting facilitators then engaged community members in discussions about key issues.

Nearly 1,400 participants attended the community meetings. Every age group was well represented, with the greatest participation (23 percent) among residents 46 to 55 years of age, followed by 16 percent aged 56 to 65. The lowest participation rate (9 percent) was for residents over age 65. Forty-five percent of participants were male, and 55 percent female. Commissioners also met with secondary school students

© Bob Waldrop

Nine commissioners became the "eyes and ears" of the project. They traveled to villages and listened to residents' aspirations for the future of their region.

Nearly 1,400 participants attended meetings in their community. Electronic polling ensured each had an equal voice in the conversation.



© Bob Wadrop

in four communities to hear about their values, hopes and visions for the future.

Project teams left behind paper surveys so those who missed the community meeting could mail in their viewpoints. An online survey was also available to residents of the region who could not attend a local meeting. Polling results and summaries of community conversations were posted throughout the project on the project website at bristolbayvision.org.

Round 2: Spring 2011

Following the first round of meetings, commissioners met in Anchorage with project staff and consultants from Information Insights to review the findings and draft a Vision statement that reflected the shared hopes and values expressed by Bristol Bay residents from across the region.

Commissioners returned to communities in the spring to share the Vision and discuss how best to implement it in the community and the region. Audience polling was again used to gather input on the best actions to take in five key areas identified in the Vision: *Safe and Healthy Families, Subsistence, Education, Economic Development and Fostering Cooperation*. Choices offered within each area were taken from the suggestions made by Bristol Bay residents during the first round of community meetings.

Following the second round of meetings, members of the Bristol Bay Regional Vision commission again met to consider what they had heard. They drafted recommendations for implementing the Vision, based on findings from the entire process. They forwarded their recommendations to the Bristol Bay Partnership.

"You might have a community that works together, but we're up against challenges at the regional, state, and federal level." — Igiugig resident

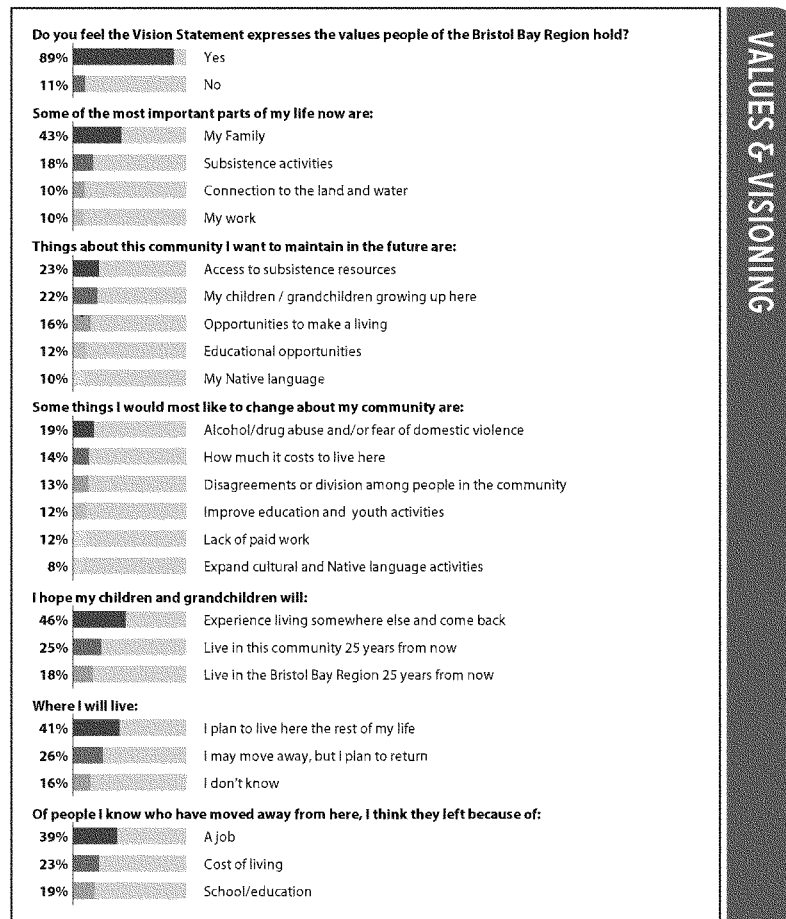
Below: Bristol Bay Regional Vision commissioners at work. Top of page: Young participants at a meeting in Levelock.

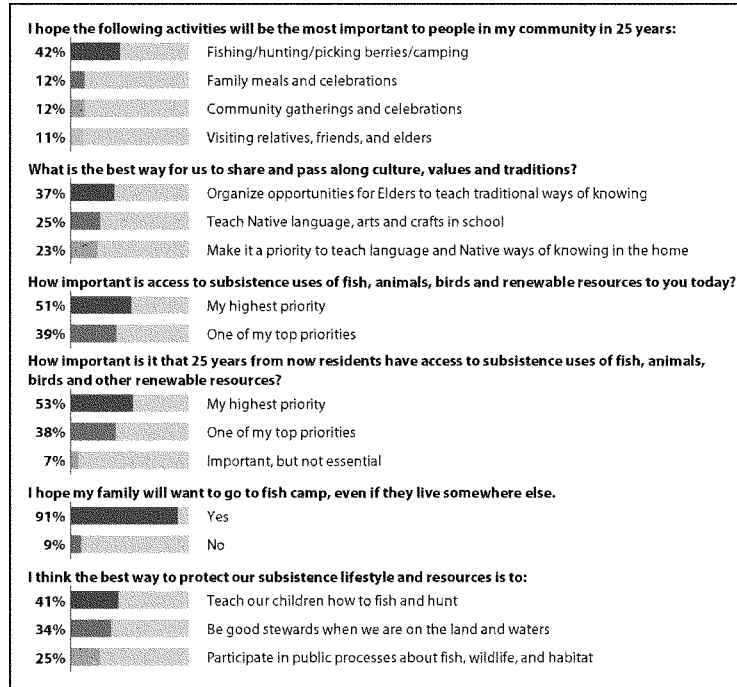




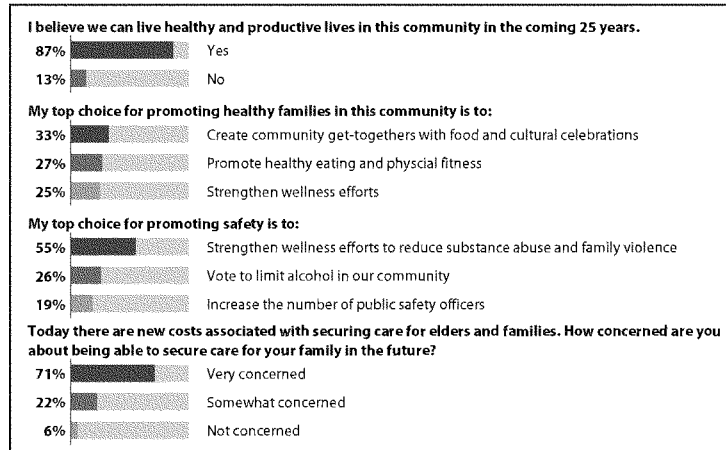
A sampling of the responses of Bristol Bay region residents to questions asked at community meetings appears on the following pages. The numbers represent totals across all communities. The top responses to each question are shown (those totaling 75% or more of the vote). Complete results, including polling and discussion summaries for individual communities, are available at:

www.bristolbayvision.org/downloads





CULTURE & SUBSISTENCE



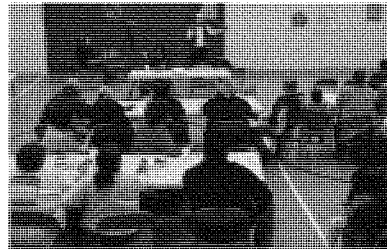
SAFE & HEALTHY FAMILIES



ECONOMIC DEVELOPMENT ... CONTINUED ON NEXT PAGE



Port Heiden



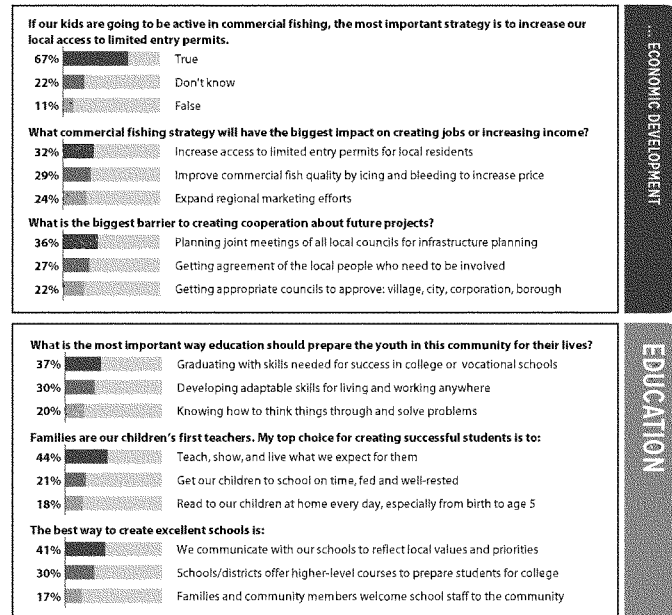
Ekwok

© Joseph Davis



Togiak

© Joseph Davis



Share the Vision:

ENGAGE LEADERSHIP ACROSS THE REGION

The Vision is a bold beginning. It will take the work of both local and regional leaders to help make it a reality.

Commissioners recommend that Bristol Bay Partners add presentations about the Vision to their board or annual meetings and to meetings with villages and other local and regional entities, including boroughs, school districts, the UAF Bristol Bay Campus, and others.

Response to the Vision should include coordinated and collaborative initiatives. To make it a reality, we must focus on communication between community residents, community leaders and regional organizations, and cultivate leadership within our communities, village corporations, tribal councils, and local governments. Bristol Bay Partners should take a leadership role in these efforts.

Partner for Success:

COORDINATE AND SUPPORT CAPACITY-BUILDING

The Vision will succeed with individual commitment, local and regional collaboration, and the participation of many organizations and agencies. Communities must define their priorities for addressing the issues highlighted during the meetings, but support from regional organizations and policy-makers is also essential to success.

Commissioners recommend developing a collaborative, regional approach to capacity building, including seeking financial assistance to enhance existing oppor-

tunities and explore new initiatives in training and technical assistance, particularly in grantwriting and strategic planning.

Building capacity will require training and supporting new leaders, especially young people, and strategically integrating results of the Bristol Bay Regional Vision project into existing programs like health and safety initiatives.

Good assessment and communication of what is happening with implementation of the Vision will be essential to long-term capacity building across the region.

While there is strong consensus across the region about values and hopes for the future, communities varied on the best ways to achieve the goals outlined in the Vision. Commissioners met in May 2011 to discuss ideas for implementing the Vision and made these recommendations to the Bristol Bay Partners.

Implement the Vision:

PROGRAMS AND INFRASTRUCTURE

See detailed recommendations on pages 14-15

Culture and Subsistence

- Ensure effective participation from the Bristol Bay Region in all state and federal regulatory processes that effect subsistence resources.
- Encourage celebration of our cultures through community gatherings, culture camps, and exchanges between youth and elders. Explore creating community culture centers.
- Establish a Bristol Bay Regional Elders Council

Safe and Healthy Families

- Address alcohol/drug abuse and domestic violence through community wellness teams in every community.
- Coordinate public health and public safety efforts in communities to strengthen families

Economic Development

- Explore job development opportunities by drawing from the Comprehensive Economic Development Strategy (CEDS) and local village plans to increase sustainability in our communities
- Identify investment opportunities from BBNC and other businesses to create sustainable job opportunities in the region
- Collaborate with regional entities, such as BBEDC, Boroughs and the UAF Bristol Bay campus to identify economic development opportunities throughout the region. Emphasize training in business development
- Coordinate infrastructure development across the region to reduce energy costs and enhance broad band communication systems
- Increase access to limited entry permits for local residents so young people can enter commercial fishing
- Enhance the quality of fish so price of the product can increase

Education

- Create excellent schools by applying practices of successful schools, such as Manakotak
- Increase opportunities for student internships, and increase dual credit opportunities so students can earn college credit for high school classes
- Implement Fisheries Education Kits and collaborate with UAF Marine Advisory Program to expand interest in fisheries

Vision Summit



© Thomas Woods, BBNA

A regional summit on November 3 and 4 brought over 150 people to the Dillingham elementary school to celebrate shared values revealed through the Bristol Bay Regional Vision project. Participants were invited from all communities of the region. They were joined by seven project Commissioners, leaders of the region, state and federal agency representatives, local government and school district officials, and a state legislator.

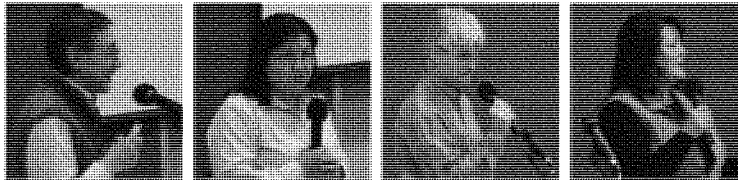
Summit participants heard results of the 16-month Bristol Bay Regional Vision project. Throughout the region people said the foundation of their lives is strong families who are connected to the land and waters of the region. They want continued access to subsistence resources, a strong voice in determining the future direction of the region, excellent schools, local jobs

and preservation of cultural values. Overwhelmingly, the 1,400 participants in 26 communities believe future generations can live healthy and productive lives here.

During the Summit, people identified steps to implement key aspects of the Vision. Beginning with the five essential themes that emerged from over 50 community meetings during the regional vision process, summit participants used Consensor™ audience polling technology to narrow the topics for small group discussions.

Wide-ranging discussions in small groups tackled how to make a difference in the next year and brainstormed lists of people and groups that need to be involved. Each small group also brought questions back to the full summit audience.

The evening of November 3 featured a community potluck dinner, which includ-



From left: Ralph Andersen, BBNA; Sandra Moller, AEA; Peter Crimp, AEA; Karen Johnson, Denali Commission

Summit participants identified steps to implement key aspects of the Vision, beginning with the five essential themes that emerged from community meetings.

ed many kinds of salmon, agutag, herring eggs, beaver feet and moose. Native dancing topped off the celebratory evening.

On November 4th participants reassembled for a panel on energy projects that may transform the region, followed by thoughts presented by the CEOs of BBNA, BBNC, BBAHC, BBHA and BBEDC. They committed to use the Vision to guide the programs of their agencies and corporations.

Above all, people took the opportunity to talk with each other about how to foster

collaboration and cooperation within and among communities and with government agencies. When asked "Will you commit to carrying the Vision to your community or organization?", 96 percent of participants said yes. Evaluations at the Summit showed that participants valued the process and are personally committed to take action to implement the Bristol Bay Regional Vision.

Full results of the project can be reviewed on the website at bristolbayvision.org.

Small Group Discussion Topics

safe and healthy families/cultural expression: Teaching about, encouraging, and supporting healthy relationships. Addressing alcohol and drug abuse.

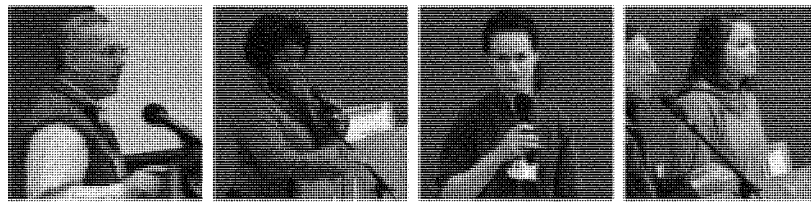
subsistence and resource management: Protecting fish stocks and habitat with effective management practices. Increasing local participation in land and watershed planning projects.

economic development: Creating a more diversified economy; expanding renewable resource, and other opportunities in addition to fishing.

education: Making sure students are prepared for post-secondary education and training.

energy: Exploring and developing renewable energy resources to generate electricity including wind, solar, hydro, tidal and geothermal resources.

housing, transportation, and infrastructure: Improving infrastructure coordination (roads, electrical, housing water/sewage) among agencies (HUD, BIA, IHS/ANTHC/VSW, AEA, Boroughs, Cities, tribes and BBHA).



From left: Rep. Bryce Edgmon; Rosie Ricketts, AHFC; Tom Marsik, UAF Bristol Bay Campus; BBNA staff distribute doorprizes

SAFE AND HEALTHY FAMILIES

- 1 The foundation of the region is committed families.
- 2 Teach children and young adults how to have healthy relationships.
- 3 Address alcohol/drug abuse and domestic violence through community wellness teams in every community.
- 4 Provide support for community wellness teams in every community. Include village resource people to assess and implement prevention action, share information, work together and provide intervention.
- 5 Increase public safety officers in communities.
- 6 Coordinate public health and public safety efforts in communities to strengthen families.
- 7 Encourage Native families to become foster parents.
- 8 Provide children with safe and caring places to go after school, where they can do homework.

CULTURE AND SUBSISTENCE

- 1 Ensure continued access to subsistence resources for residents of the region.
- 2 Celebrate and preserves the cultures and languages of the region.
- 3 Ensure effective outreach and public notice for any state or federal advisory council and other meetings affecting resource management. Meetings need to be held in region.
- 4 Maintain participation on regional advisory councils and boards. Advise residents why their involvement is important.
- 5 Residents should be good stewards when using the land and waters of the region.
- 6 Establish a Bristol Bay Regional Elders Council .
- 7 Encourage and support Culture Camps.
- 8 Get more people involved in Environmental Impact Study processes by collaborating with the Bristol Bay Campus for classes to assist with understanding the National Environmental Protection Act (NEPA) processes and new developmental efforts.
- 9 Encourage celebration of our cultures through community gatherings and exchanges between youth and elders. Explore creating community culture centers.
- 10 Insist that managers gather sound scientific data to guide land and water management of fish, game and habitat (like the Nushagak River Watershed Traditional Use Area Conservation Plan).

ECONOMIC DEVELOPMENT AND ENERGY

- 1** Encourage economic development based largely on renewable resource development.
- 2** Create jobs by drawing from the Comprehensive Economic Development Strategy (CEDS) and local village plans to increase sustainability in our communities.
- 3** Reduce the cost of energy by encouraging renewable, such as solar, wind and geothermal sources.
- 4** Teach communities how to conserve electricity.
- 5** Weatherize houses and businesses across the region.
- 6** Construct energy efficient buildings.
- 7** Identify investment opportunities from BBNC and other businesses to create economic opportunities in the region.
- 8** Increase access to limited entry permits for local young people.
- 9** Enhance the quality of fish so the price of the product can increase.
- 10** Create internships and apprenticeships in our communities. Expand VISTA opportunities for villages.
- 11** Expand Broadband to remaining communities in the region. BBs upgrade software to meet new systems requirements.
- 12** Support and encourage group projects to plan and launch businesses, such as Laundromats, arts & crafts stores with web-based sales, recycling, gardening, and fly-tying.
- 13** Collaborate with regional entities, such as BBEDC, Boroughs and the UAF Bristol Bay campus to identify economic development opportunities throughout the region. Emphasize training in business development.

Continued on page 16.

Final recommendations of the project cover 5 key areas. They include those forwarded to the Bristol Bay Partnership by Commissioners following two rounds of community meetings and others suggested by local, state and federal agency staff. These recommendations were later affirmed by participants at the regional Vision Summit in November 2011.



EDUCATION AND YOUTH

- 1 Create excellent schools by applying practices of successful schools, such as Manokotak. (Manokotak earned recognition as top Title I school in the nation: use their methods in other communities.)
- 2 Get kids to school well rested, fed and on time.
- 3 Create open communication between the community and the school teachers and administrators.
- 4 Offer challenging science and math classes so kids who strive to go to college and vocational school may be successful.
- 5 Offer more vocational choices in high school.
- 6 Increase opportunities for student internships, increase career pathways for students, and increase dual credit opportunities so students can earn college credit for high school classes.
- 7 Continue seeking involvement of young people, especially ages 14-25. School board and other committees can offer more than one youth seat.
- 8 Implement Fisheries Education Kits curriculum assistance for all Bristol Bay schools. Collaborate with UAF Marine Advisory Program.
- 9 Encourage celebration of our cultures through community gatherings and exchanges between youth and elders. Explore creating community culture centers.
- 10 Encourage bilingual/bicultural and other programs in schools to help children learn about subsistence and stewardship of resources.

COLLABORATION AND INFRASTRUCTURE

- 1 Foster collaboration among tribes, corporations and cities to maximize infrastructure development.
- 2 Coordinate infrastructure planning and development across the region to reduce energy costs and enhance broad band communication systems.
- 3 Partner with state and federal agencies on infrastructure development.
- 4 Expand capacity building of communities through technical assistance in grant writing and grant management.
- 5 Link regional Vision to Comprehensive Economic Development Strategies (CEDS) and Individual Development Accounts (IDAs). Develop Capital Improvement Projects lists in community meetings consisting of tribes and local governments.
- 6 Collaborative as subregions on transportation and housing projects.
- 7 Prioritize transportation projects to maximize connectivity between communities.

Vision Summit Response

I am personally ready to commit my energy to implementing the regional Vision.

95%
Agreed

We are collectively willing to coordinate multi-village projects to maximize the available funding.

88%
Agreed

The best place to put our emphasis to improve education is planning and implementing career pathways.

52%
Agreed

I am personally willing to get involved and be committed to work on substance abuse issues.

74%
Agreed

A group of Commissioners from across the region should carry implementation of the Vision forward.

90%
Agreed

A region-wide working group should be empowered to address energy needs.

91%
Agreed

We should explore how to use our fisheries as an economic engine for our region (i.e. own processing plants)?

93%
Agreed

Combining support of all 6 advisory committees in the region is the best way to strengthen our voice in fisheries management.

52%
Agreed

State law should be changed to give local advisory committees regulatory power.

75%
Agreed

I will commit to carrying the Vision to my community or organization.

96%
Agreed

As a stakeholder in the region, my voice was heard in the Visioning process and reflected in the Summit.

80%
Strongly Agreed / Agreed

I participated in a visioning meeting in my community.

58%
Agreed

For complete results, go to www.bristolbayvision.org/docs/BBRV-Summit-Consensor.pdf

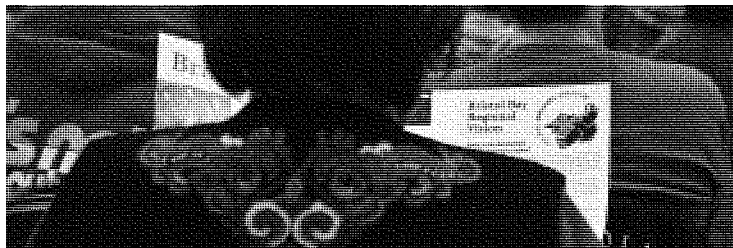


Community Meeting Participation

Community	Meeting Dates		Attendance		% of Round 2 Participants who attended Round 1	Population	Percent of Population Attending ¹
	Round 1	Round 2	Round 1	Round 2			
Aleknagik	9/7/2010	4/7/2011	40	15	57%	223	21%
Chignik Bay	9/28/2010	3/29/2011	23	14	60%	62	46%
Chignik Lagoon	9/30/2010	3/31/2011	22	11	77%	73	34%
Chignik Lake	9/29/2010	3/30/2011	14	10	60%	105	17%
Clarks Point	9/9/2010	4/14/2011	29	19	83%	61	53%
Dillingham	11/4/2010	4/11/2011	67	20	58%	2,264	8%
Egegik	1/12/2011	5/6/2011	14	12	50%	73	27%
Ekuk	12/6/2010	4/6/2011	13	33	33%	-	-
Ekwok	10/29/2010	3/26/2011	42	20	90%	109	40%
Iguigig	12/13/2010	4/26/2011	23	19	72%	64	44%
Kokhanok	12/14/2010	4/26/2011	21	19	54%	184	16%
Kolliganek	10/28/2010	3/25/2011	30	50	30%	182	36%
Levelock	9/8/2010	5/7/2011	41	19	47%	88	58%
Manokotak	12/6/2010	4/13/2011	44	20	78%	438	18%
Naknek/King Salmon	10/11/2010	5/7/2011	28	7	67%	516	20%
New Stuyahok	10/28/2010	3/24/2011	53	17	54%	519	12%
Newhalen/Iliamna	12/16/2010	4/25/2011	14	7	57%	162	11%
Nondalton	12/15/2010	4/25/2011	25	34	35%	186	25%
Pedro Bay	12/14/2010	4/27/2011	21	17	75%	48	53%
Perryville	9/27/2010	3/28/2011	24	19	59%	122	26%
Pilot Point	1/13/2011	5/5/2011	12	19	26%	66	39%
Port Alsworth	12/15/2010		7			118	6%
Port Heiden	10/1/2010	4/1/2011	30	9	89%	83	37%
South Naknek	1/10/2011	5/4/2011	14	10	50%	68	28%
Togiak	11/1/2010	4/12/2011	51	27	50%	820	14%
Ugashik	1/14/2011	5/6/2011	9	8	100%	15	60%
Dillingham School	11/4/2010		71				
Manokotak School	12/6/2010		51				
Naknek School	10/11/2010		42				
Togiak School	11/1/2010		56				
Community Meeting Attendance (total)			931	455	1386		
Vision Summit					150+		
Project Participation					1536+		
Iliamna King Salmon		Invited to Newhalen Meeting Invited to Naknek Meeting		Portage Creek Twin Hills		Elected to do printed questions Elected to do printed questions	

1) Based on unduplicated total for both rounds of community meetings.

About the Project



In spring 2009, five regional organizations in Bristol Bay, Alaska partnered to design a process through which residents could envision the future of their region.

By engaging residents in meaningful dialog about their values and hopes for their families and communities and for the land and resources of the region, the partners sought to develop a long-range vision that truly reflects the shared values and aspirations of the people of the region.

Working together as the Bristol Bay Partnership, the organizations include the Bristol Bay Native Association (BBNA), Bristol Bay Native Corporation (BBNC), Bristol Bay Economic Development Corporation (BBEDC), Bristol Bay Housing Authority

(BBHA), and Bristol Bay Area Health Corporation (BBAHC).

The Alekta Conservation Foundation and the Gordon and Betty Moore Foundation made the project possible through generous grants. Additional funding was generously provided by the Oak Foundation, Kimmison Foundation (through BBNA), Tiffany & Co. Foundation and BBNC.

The Vision statement that emerged from the project received very strong endorsement from residents of the region. It now carries the authority of the people of Bristol Bay. It is presented here as a guiding document for communities and regional organizations and for all entities that have an interest in the Bristol Bay region.

Project Staff

BBNA

Ralph Andersen, CEO
Patty Heyano, Project Director
Norman Anderson, Project Manager
Joyce "Pinky" Armstrong,
Community Meeting Coordinator
Gwen Wilson, Media Outreach

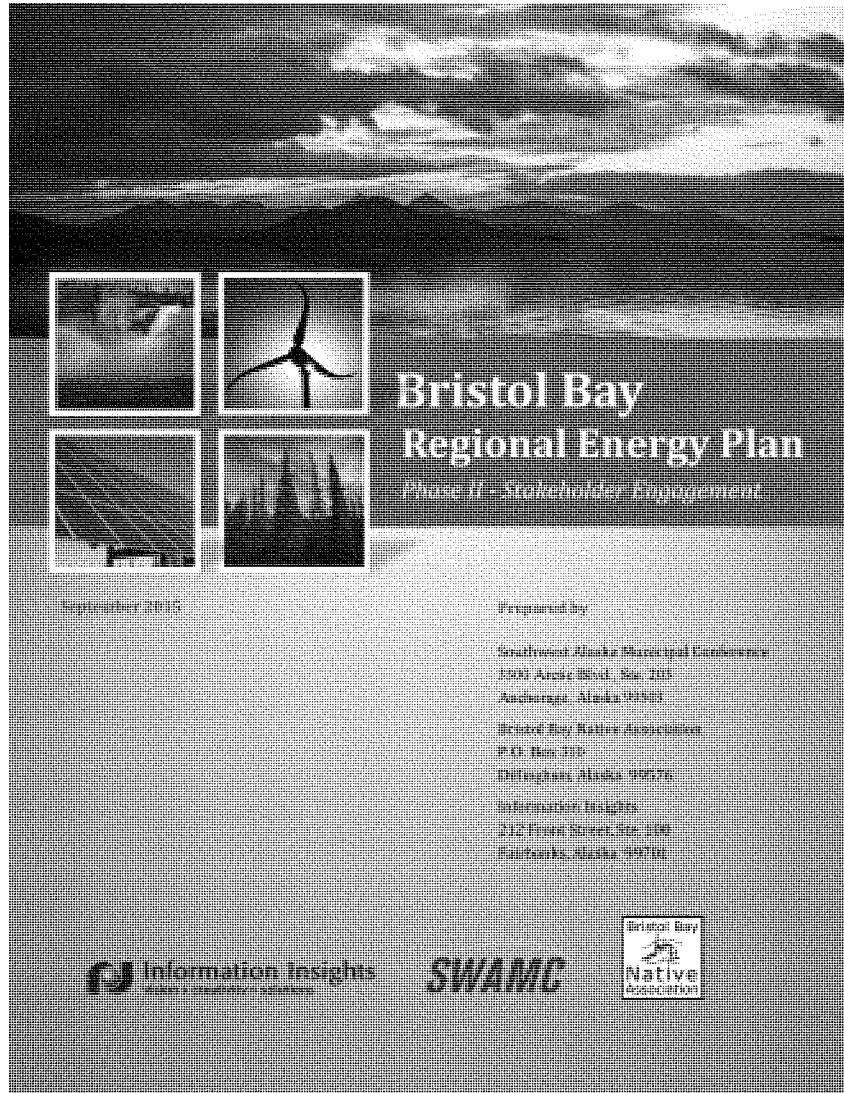


Information Insights

Cady Lister, Project Manager
Facilitation Team: Sherry Modrow,
Jane Angvik, Jessica Holden,
Jana Peirce, Sylvan Robb, Chris Rogers
Emma Funk, Intern
Joseph Davis, Videographer
Dr. Steven Langdon, Anthropologist

Information Insights
vision + creativity = solutions





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AUTHORS

Lawrence Sorensen, Tribal Energy Manager, Bristol Bay Native Association
 Doug Griffin, Executive Director, Southwest Alaska Municipal Conference
 Laura Vaught, Energy Coordinator, Southwest Alaska Municipal Conference
 Jamie Hansen, Consultant, Information Insights
 Jana Peirce, Senior Consultant, Information Insights
 Richard Raines, Researcher, Information Insights

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ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
ACDC	Alaska Community Development Corporation
ACEA	Alaska Commercial Energy Audit (AEA)
ACEP	Alaska Center for Energy and Power (UAF)
ADOLWD	Alaska Department of Labor and Workforce Development
ADEC	Alaska Department of Environmental Conservation
AEDG	Alaska Energy Data Gateway (ISER)
AHFC	Alaska Housing Finance Corporation
AkAES	Alaska Affordable Energy Strategy (AEA)
ALARI	Alaska Local and Regional Information (ADOLWD)
ANCSA	Alaska Native Claims Settlement Act
ARIS	Alaska Retrofit Information System (AHFC)
AEA	Alaska Energy Authority
ANTHC	Alaska Native Tribal Health Consortium
AVEC	Alaska Village Electric Cooperative
AVTEC	Alaska Vocational Technology Center (ADOLWD)
AWEDTG	Alaska Wood Energy Development Task Group
BBAHC	Bristol Bay Area Health Corporation
BBB	Bristol Bay Borough
BBBSD	Bristol Bay Borough School District
BBEDC	Bristol Bay Economic Development Corporation
BBHA	Bristol Bay Housing Authority
BBHC	Bristol Bay Housing Corporation
BBNA	Bristol Bay Native Association
BBNC	Bristol Bay Native Corporation
B/C	Benefit-Cost Ratio
BEES	Building Energy Efficiency Standard
BTU	British Thermal Unit
CCHRC	Cold Climate Housing Research Center
CDR	Conceptual Design Report
DCCED	Alaska Department of Commerce, Community, and Economic Development
DCRA	Alaska DCCED Division of Community and Regional Affairs
DMVA	Alaska Department of Military and Veterans Affairs

DOE-IE	United States Department of Energy Office of Indian Energy
EE or EE&C	Energy Efficiency, or Energy Efficiency and Conservation
EECBG	Energy Efficiency and Conservation Block Grant Program
ESCO	Energy Savings Company
EUI	Energy Use Intensity
FAA	Federal Aviation Administration
GW	Gigawatt (1,000 megawatts)
HDD	Heating Degree Days
HER	Home Energy Rebate program (AHFC)
HUD	United States Department of Housing and Urban Development
INNEC	Iliamna Newhalen Nondalton Electric Cooperative
ISER	Institute of Social and Economic Research (UAA)
kBTU	Thousand BTUs
kW	Kilowatt
kWh	Kilowatt hour
LED	Light-Emitting Diode
LMI	Low and Moderate Income (HUD)
LNG	Liquefied Natural Gas
LPB	Lake and Peninsula Borough
LPSD	Lake and Peninsula School District
Met Tower	Meteorological Tower (affixed with equipment to assess wind resource)
MMBTU	One million BTUs
MW	Megawatt
MWh	Megawatt hour
N/A	Not Applicable, or Not Available
NEA	Naknek Electric Association
NEC	Nushagak Electric Cooperative
NV	Native Village
NAHASDA	Native American Housing Assistance and Self Determination Act (HUD)
NPS	National Park Service
N/O	Not Operating
NREL	National Renewable Energy Laboratory
O&M	Operations and Maintenance
PCE	Power Cost Equalization
PV	Photovoltaic
PVWatts	PVWatts Calculator (NREL)

R&R	Renewal and Replacement (accounts)
REAP	Rural Energy for America (USDA)
REF	Renewable Energy Fund (AEA)
RPSU	Rural Power System Upgrade (AEA)
RUBA	Rural Utility Business Advisor Program (DCRA)
SCADA	Supervisory Control and Data Acquisition
SWAMC	Southwest Alaska Municipal Conference
START	Strategic Technical Assistance Response Team (DOE)
UAA	University of Alaska Anchorage
UAF	University of Alaska Fairbanks
USDA	United States Department of Agriculture
VEEP	Village Energy Efficiency Program (AEA)
WEAR	Waste Erosion Assessment and Review (ADEC)

EXECUTIVE SUMMARY

The Bristol Bay Regional Energy Plan is part of a statewide effort led by the Alaska Energy Authority to identify energy projects and priorities that will reduce the long-term cost of energy and dependence on fossil fuels in Alaska. The process is designed to look at the total mix of energy needs in rural Alaska, including electricity, heating and transportation, and consider all local and regional energy resources as well as energy efficiency and conservation.

This document summarizes public input received in Phase II. The goal of this phase has been to engage community and regional leaders, residents, utilities, industry representatives, and other key stakeholders in dialog about their priorities for addressing energy needs in the region and to develop a list of projects and priorities to be assessed for economic and technical feasibility in the final phase of the planning process, Phase III.

The Phase III report will identify broadly supported strategies and a list of fundable projects that can reduce energy costs in the Bristol Bay region while developing local and regional energy resources.

Phase I Resource Inventory

Phase I provided an inventory of energy-related issues and resources in the region. While this inventory necessarily represented a snapshot in time, it was designed as a tool to focus conversations during Phase II on the most technically feasible and economically realistic projects, given the region's mix of resources and the current state of technology.

The Phase I report identified key issues in the region:

- High and volatile fuel prices
- High construction and maintenance costs for renewable energy projects due to remote location and the distances between communities
- High cost of building roads and transmission lines has resulted in few interconnections and preponderance of “islanded systems.” Combined with small populations, this makes it difficult to achieve economies of scale or to create a truly “regional” plan
- High space heating costs for homes, businesses, and public facilities due to a cold climate
- Heavy dependence on diesel fuel for electricity generation (96%). However, more renewable projects are under development or have recently come online
- Declining population trends in some areas makes it difficult to plan for future demand
- Uncertainty about potential new large industrial loads and “megaconceptual” projects
- Uncertainty about future availability of natural gas
- Patchwork of land ownership with federal, state, and tribal lands. Location of many renewable resources is on protected lands or too far from communities to develop economically

Phase II Stakeholder Engagement and Public Input

In Phase II the planning team spoke with regional stakeholders, village and community leaders, and residents about energy projects and priorities with the potential to advance the broad strategies outlined in Phase I. Outreach activities included utility and community phone

interviews, subregional meetings, an industry survey, and a regional energy summit in Dillingham on May 4, 2015. During these activities, common themes that unite the region were identified, as well as instances where energy needs or priorities differ. Based on this input, the planning team developed focus areas for projects and activities designed to meet regional energy goals.

This proposed roadmap represents a synthesis of community/utility interest and resource potential, meaning that it includes those items identified as local or regional priorities which offer a clear path to reduce the long-term cost of energy and dependence on fossil fuels in the region. This determination is based on currently available technology and community support demonstrated by leadership and/or funding support for active and proposed projects. As this report is a snapshot in time, this roadmap must be re-visited on a regular basis to ensure opportunities are not missed and effort not wasted.

Table 1: Proposed Regional Energy Roadmap

Resource	Next Steps	Actions
Planning and Collaboration		
Energy Planning	Establish Energy Committee	- Establish regional and/or subregional energy committees to continue the work of energy planning, support implementation of priorities, and share information on energy projects and needs - Seek representation of all communities by soliciting resolutions from local governing bodies appointing a local energy champion to the committee - Engage regional and subregional organizations and government entities to ensure a regionwide perspective in energy planning and integrate work on energy priorities into the mission and daily operations of governing bodies and service providers across the region - Secure organizational support from regional entities for holding regular meetings or teleconferences and an annual face-to-face meeting
Bulk Fuel		- Move forward on a cooperative purchasing structure with interested communities to increase competition and reduce costs of bulk fuel - Assess feasibility of a bulk fuel storage area at Williamsport
Workforce Development	Training	- Develop a subregional or regional partnership model to cross-train and share locally-based utility operator/mechanics capable of handling routine technical and some electronic issues in utility operations and maintenance - Develop training resources at the regional and subregional level to incorporate site-specific experience
Energy Infrastructure		
Bulk Fuel	Upgrade & Repair	Secure funds and technical assistance to re-site and repair bulk fuel storage tanks that are located on eroding land in Igiugig, Port Heiden, and Togiak
	Reconnaissance and Feasibility	Assess options for alternative fuel delivery due to low river levels in Koliganek, New Stuyahok, and Twin Hills
Diesel Efficiency	Upgrade & Repair	Implement training and equipment upgrades and develop maintenance plans to achieve increases in generator diesel efficiency with a concentrated focus on independent utilities
Heat Recovery	Upgrade & Repair	- Maintain installed heat recovery systems and expand where additional waste heat is available - Assess feasibility of expansion to heat additional facilities in Igiugig, Levelock, Port Alsworth, and Dillingham

Resource	Next Steps	Actions
Transmission & Distribution	Design & Construction	Complete projects in New Stuyahok and Togiak
	Reconnaissance & Feasibility	- Develop new heat recovery projects in Manokotak and Twin Hills - Investigate stack heat recovery in Naknek - Assess opportunities for heat absorption technology for summer ice production and flash freezing in Naknek and Levelock. Consider potential pilot project for adapting technology for small-scale use.
	Upgrade & Repair	- Replace transmission line from Newhalen to Nondalton with armored submarine cable - Repair or replace deteriorating transmission lines in Chignik, Chignik Lagoon, and Chignik Lake - Address high line loss (over 12%) in Igiugig, Koliganek, Levelock, Perryville, and Pilot Point. Assess economic options for reducing line loss in communities with moderate line loss (6-11%) - Remedy issues in Manokotak generation & distribution system to prepare for integration of renewable power if suitable wind site is located
	Training	Develop a partnership model to cross-train and share locally-based linemen capable of addressing short & medium term issues across a subregion or the entire Bristol Bay region
	Reconnaissance & Feasibility	Continue to monitor and assess the feasibility of subregional interties to increase economies of scale and reduce costs of small-scale, independent generation where feasible.
Energy Efficiency		
Energy Efficiency	Residential	- Conduct outreach and education through energy fairs, school programs or other means to promote awareness of EE&C savings opportunities, including grants and loans - Assist homeowners with signing up for programs, and provide information on do-it-yourself resources - Leverage federal funds from USDA and other sources to expand BBHA weatherization services to more homes and communities - Oversight of weatherization contractors to ensure high quality of work and professionalism
	Non-residential	- Complete inventory and benchmarking of non-residential buildings in every community in order to establish baseline data and identify projects with the greatest savings potential - Encourage use of loans to complete commercial and public facility retrofits with short to medium payback periods - Investigate public ESCO model to fund retrofits in large high-energy use buildings or across multiple buildings - Develop or adopt building codes or standards to ensure new state- and federally funded facilities built in the region meet a high standard of energy efficiency. Consider changes to local building codes - Leverage federal funds from USDA and other sources to expand the number of non-residential audits and retrofits - Undertake regional or subregional projects to replace remaining high energy-use streetlights with LEDs - Secure funds and technical assistance to train staff and repair or replace ageing and inefficient water and sewer systems in Aleknagik, Chignik, Chignik Lake, Koliganek, Manokotak, New Stuyahok, Nondalton, and Togiak

Resource	Next Steps	Actions
Local Energy Generation		
Biomass	Upgrade & Repair	Look at feasibility of expanding Kokhanok's biomass system to additional community buildings
	Design & Construction	- Install biomass heat loop in Clark's Point to connect Community Center, CPVC office and City Office - Install high efficiency wood stoves in 3 community buildings in Nondalton - Install Tarm wood boiler(s) and/or high efficiency wood stove at the Booster Club in New Stuyahok
	Reconnaissance & Feasibility	- Update 2012 pre-feasibility study in Aleknagik - Conduct feasibility study for wood boilers at BBNA Main office and Family Resource Center building in Dillingham - Assess community interest for continuing investigation of viable biomass options in Iliamna
Geothermal	Reconnaissance & Feasibility	- Assess interest and risk tolerance for additional reconnaissance and feasibility work for geothermal in Chignik Lagoon, Chignik Lake, Perryville, Port Heiden, and Naknek - Assess economics of using air, ground, or seawater heat pumps to reduce space heating costs in interested communities (Chignik Lagoon, Chignik Lake, Perryville, Port Heiden, and Naknek) at current electrical rates
	Monitor Developments	- Continue to assess feasibility of heat pumps in reducing heating costs in the region as electric rates change and technology develops - Monitor developments in low temperature geothermal technology
Hydro	Upgrade & Repair	- Install electric boilers for space heating at Chignik Lagoon and address erosion issues on hydro access road - Increase river intake at INNEC plant and hook up additional electric boilers
	Design & Construction	- Address outstanding issues in Chignik Bay (Indian Creek Hydro) to proceed with design and permitting, including upgrade of existing powerhouse - Complete design and permitting of Knutson Creek Hydro in Pedro Bay (expected 2016). Identify funds for construction
	Reconnaissance & Feasibility	Conduct feasibility studies in Chignik Lake, Port Heiden, and Togiak to assess opportunities for small-scale hydro, including sites identified in 1980s screening studies
Hydrokinetic	Feasibility & Licensing	Pursue licensing of Igiugig in-river hydrokinetic pilot project based on economic and technological viability and community interest
	Monitor Developments	Monitor technological advances in hydrokinetic energy, including tidal and wave power. Pursue screening studies and site-specific feasibility if and when technology matures
Natural Gas	Reconnaissance & Feasibility	Assess local and regional interest and risk tolerance for exploratory drilling in the North Aleutian sedimentary basin
	Monitor Developments	Continue to monitor opportunities to import LNG. Assess detailed economic feasibility of regasification and conversion if opportunities emerge
Solar	Feasibility, Design & Construction	- Develop solar PV and solar thermal projects where economically feasible, especially in off-grid areas and in facilities with high summer energy use - Expand use of solar PV and solar thermal to additional buildings in Igiugig, Perryville, and Dillingham depending on owner-interest and economics - Provide information and resources to other communities interested in developing solar projects: Aleknagik, Chignik Lake, Kokhanok, Pedro Bay, Port Alsworth, and Twin Hills

Resource	Next Steps	Actions
Wind	Upgrade & Repair	Complete redesign of Kokhanok wind system and use as model for future wind projects
	Design & Construction	- Work with AEA to integrate Clark's Point residential turbines with grid - Based on review of submitted CDR in Pilot Point for a 100 kW wind farm with dispatchable electric boiler, proceed to final design and construction, including powerhouse controls - Complete powerhouse upgrade and finalize CDR in Koliganek. Identify suitable site for turbine and assess funding options for construction - Upgrade powerhouse and distribution system in Port Heiden to support a utility-scale wind system. Work with AEA wind managers to finalize a fundable conceptual design
	Reconnaissance & Feasibility	- Expand Igiugig vertical axis turbines if technology proves viable - Complete met tower studies in Egegik, Levelock, and New Stuyahok - Investigate alternative sites in Chignik Lake, Chignik Lagoon, and Manokotak after discussions with AEA on small load concerns - Continue wind feasibility investigation in South Naknek depending on community and utility interest
	Planning	Collect high-quality electrical load data in order to understand power/energy uses and better model wind turbine options in the future.
Transportation		
Transportation	Design & Construction	- Complete construction of access roads to Wood River Bridge (Aleknagik) - Secure construction funds for road between Clark's Point and Ekuk - Complete new dock in Iliamna and Levelock - Extend airport landing strips in Pedro Bay, Port Alsworth (also build public landing strip), and Chignik Lagoon
	Reconnaissance and Feasibility	Continue to monitor or assess feasibility of new roads and bridges to meet transportation needs between Iliamna and Nondalton, Ekwoke and New Stuyahok, and Manokotak and Dillingham

Next Steps

In Phase III, estimates of project costs and benefits will be developed for projects for which sufficient data exist. The Phase III report will also provide an implementation plan with steps local communities, utility owners, and regional stakeholders can take to implement their priorities. It will be up to those in the region to decide which actions they would like to pursue based on community/utility interest and available funding or financing options. The cost-benefit information along with detail on available financing options provided in Phase III will help with these decisions.

State support for implementing priorities will continue through AEA's Community Assistance program, which provides hands-on assistance in developing energy projects and addressing local issues, and through the Alaska Affordable Energy Strategy (AkaES), which could provide a future funding mechanism for energy infrastructure in areas of the state that do not have direct access to a North Slope natural gas pipeline.

The Bristol Bay region is unique in that it has multiple subregional governing bodies and well-established regional groups, including the Bristol Bay Partnership. Drawing on suggestions provided in energy planning outreach efforts, the next step for BBNA, SWAMC, and AEA in fostering the creation of regional and/or subregional energy committees will involve consultation

with all interested regional and subregional organizations. AEA is recommending the creation of energy committees to assist with implementation and continue the work of energy planning into the future. The agency has committed to helping support the creation of these groups as part of the final phase of the regional planning process.

1 | REGIONAL ENERGY PLANNING

The Bristol Bay Regional Energy Plan is part of a statewide effort led by the Alaska Energy Authority to identify energy projects that will reduce the long-term cost of energy and dependence on fossil fuels in Alaska. The process is designed to look at the total mix of energy needs in rural Alaska, including electricity, heating and transportation, and consider all local and regional energy resources as well as efficiency and conservation.

This document summarizes public input received in Phase II. The goal of this phase has been to engage community, subregional, and regional leaders; residents; utilities; boroughs; school districts; industry representatives, and other key stakeholders in dialog about their priorities for addressing energy needs in the region, and to develop a list of projects to be assessed for economic and technical feasibility in the final phase of the planning process.

The Phase III report will identify a list of fundable projects based on State criteria and broadly supported strategies with the potential to reduce energy costs in the Bristol Bay region while developing local and regional energy resources. This phase will include technical and economic analysis of priority projects using standard statewide methodology and development of a regional implementation plan.

In the Bristol Bay region, implementation will likely involve regional and/or subregional committees addressing multiple energy issues with the support and guidance of regional groups, including Bristol Bay Native Association, SWAMC, Bristol Bay Borough, Bristol Bay Economic Development Corporation, Bristol Bay Partnership, Lake and Peninsula Borough, and others.

Once complete, the plan is intended to serve as both a guiding document for communities and stakeholders and as a practical tool with information on the steps needed to move energy projects forward. Completed plans will also be used as an input to AEA's own statewide energy planning efforts, such as the Alaska Affordable Energy Strategy (AkAES) established by the Alaska Legislature in 2014 (Senate Bill 138).

Beyond the Current Planning Process

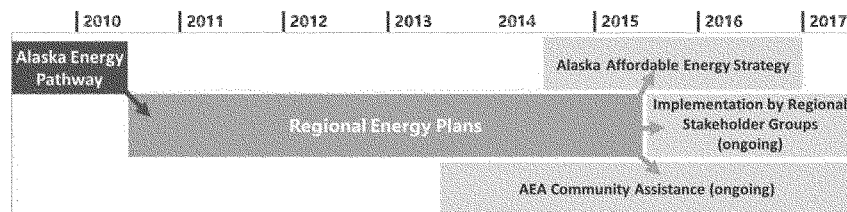
Although the state's Regional Energy Planning project will close in 2015, each regional plan is intended to continue as a living document and be updated as projects are implemented and circumstances change. To this end, a goal of the statewide project has been to develop regional capacity to continue the planning process. In the Bristol Bay region, where there are multiple government structures, regional organizations may be capable of bringing together subregions to ensure consistency and coordination and will be approached to serve as critical partners in this process.

State support for implementing priorities identified through Regional Energy Planning will continue through AEA's Community Assistance program, which provides hands-on assistance to communities in developing projects and addressing issues, and the Alaska Affordable Energy Strategy (AkAES), which could provide a future funding mechanism for energy infrastructure needed to deliver affordable energy to areas of the state that will not have direct access to a North Slope natural gas pipeline (Figure 1).

The AkaES is a long-term, state-directed effort to help provide affordable energy to all areas of the state if a natural gas pipeline is built from Alaska's North Slope using revenues from a 20 percent set-aside of pipeline revenue.

In 2017, AEA will make recommendations to the Legislature on infrastructure needed to deliver affordable energy to areas in the state that will not have direct access to a natural gas pipeline. To assist in the identification of infrastructure projects, AEA plans to draw on the data collected and publicly vetted through the Regional Energy Planning process.

Figure 1: Regional Energy Planning timeline



PLANNING AREA

The planning area for this project includes the communities within AEA's Bristol Bay energy planning region. This area overlaps entirely with the Bristol Bay Native Corporation boundaries established under the Alaska Native Claims Settlement Act (ANCSA) (Figure 2).

Six communities in the region are largely seasonal villages or have year-round populations under 25. They are Ekok, Ivanof Bay, Kanatak, Pope-Vannoy Landing, Portage Creek, and Ugashik. None have local electric utilities. While these communities have not been actively included in Phase II, they appear in the Phase I resource inventory when a known renewable energy resource exists or when they have a notable residential or community-scale energy projects.

Figure 2: Bristol Bay regional energy planning area

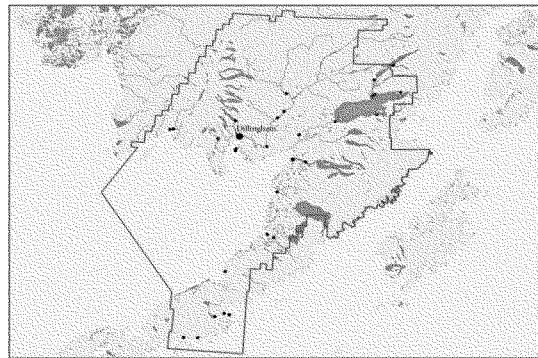


Table 2: Bristol Bay region boundaries

ANCSA Region ^a	Local Health Jurisdiction ^b	Borough and Census Area	School District	Alaska D-4 Program	Seniors District
For Profit: Bristol Bay Native Corporation	Bristol Bay Area Health Corporation	Bristol Bay Borough	Bristol Bay Borough School District	Bristol Bay Economic Development Corporation 117 communities	Seneca District 5 House District 32
Nonprofit: Bristol Bay Native Association		Lake & Peninsula Borough	Lake & Peninsula School District		
Bristol Bay Housing Authority		Dillingham Census Area	Dillingham City School District		
^a Excluding Port Arisworth			Southwest Region School District		

Subregions

The six subregions used throughout this plan are the ones used by the Bristol Bay Native Association (BBNA). The communities included in each subregion are shown in Table 3.

Table 3: Bristol Bay subregional groupings

Bristol Bay Subregions		
Nushagak Bay Subregion Aleknagik Clark's Point Dillingham	Nushagak River Subregion Ekwok Kotigenek New Stuyahok	Togiak Bay Subregion Manokotak Togiak Twin Hills
Lakes Subregion Iglood Ilamna Kotchanok Levanock Nerahalen Nondalton Pedro Bay Port Arisworth	Peninsula Subregion Chignik Bay Chignik Lagoon Chignik Lake Perryville	Ketchik Bay Subregion Igapak Pilot Point Fort Heiden King Salmon Maknek South Maknek

OTHER PLANNING EFFORTS IN THE BRISTOL BAY REGION

The Alaska Energy Authority's regional energy planning process is not the only energy planning effort in the Bristol Bay region. As with many other regions in the state, there are other community, regional, and federal initiatives that deal specifically with energy or touch on similar issues. Though outside the scope of the AEA regional energy plan, efforts have been made and will continue to be made to coordinate and include findings of other planning processes in the regional energy planning effort. A brief sketch of these efforts is below.

The DOE Office of Indian Energy and the Office of Energy Efficiency and Renewable Energy provide federally recognized Alaska Native villages or regional and village corporations with technical assistance designed to advance renewable energy and energy efficiency projects. This has been accomplished through two competitive programs open to tribal groups:

- **Alaska START Program.** Starting in 2011, the Alaska START Program has provided intensive community planning efforts focused on verifying economic and technical viability of projects' power and revenue generation; developing a communication and outreach strategy to communicate the costs and benefits of a project to the broader Tribe and other community stakeholders; establishing terms and strategies for negotiating land-lease, energy off-take, and/or power purchase agreements; selecting project ownership options, partnership arrangements, and financing structures; developing requests for proposals with appropriate technical guidelines and selection criteria; and developing operations and maintenance or measurement and verification plans.

Table 4: Bristol Bay Communities in U.S. DOE START Program

Community	Subregion	Date
Native Village of Kokhanok	Lakes	2015

Data source: (1)

- **U.S. DOE Technical Assistance.** Similar to the START program, DOE provides on-demand technical assistance limited to 40 hours per community on priority areas such as strategic energy planning, grantee support, transmission/interconnection, project development, finance, and lease agreements.

Bristol Bay Partnership (BBAHC, BBEDC, BBHC, BBNA, BBNC) commissioned two energy plan documents in 2008: Bristol Bay Energy Policy and Energy Crisis Recovery Plan: Phase One and Implementation Strategies for the Bristol Bay Energy Policy and Energy Crisis Recovery Plan: Phase Two. The reports, prepared by Nils Anderson, Jr. and Greta Gotoof Co-Man Services, provide short, medium, and long-term strategies for all Bristol Bay communities to attain affordable, reliable, safe and long term energy options. BBNA released an update, Bristol Bay Energy Policy & Implementation Strategies – Status Report Update, in 2014.

The Lake & Peninsula Borough completed a regional energy plan in 2008 to evaluate energy opportunities in the region focusing on electric generation, space heating, and transportation. A screening study was conducted to identify projects with the highest potential for reducing energy costs.

Community plans for several communities in the region have been developed independently or with assistance from BBNA. Many of these plans include elements of energy planning and inventories of energy infrastructure.

STRATEGIES FOR NEAR AND MID-TERM PROJECTS

Look at Many Small Solutions rather than Focus on One Big Project

AEA designed the Regional Energy Planning process to facilitate bottom-up, short- to medium-term energy planning driven by the needs and priorities of communities and regions. That means an emphasis on community-focused planning and solutions that can be implemented at the local level and sustained over the long term. Large, capital-intensive projects take years in planning and development and may leave small communities with infrastructure that is expensive to maintain and requires outside expertise to operate.

Like other forms of community planning, the goal of energy planning should be to create sustainable, thriving communities. Rather than focus on one big energy project (or while waiting for it to pass through bureaucratic and funding hurdles), communities and regional stakeholders should consider the universe of smaller projects that can be completed more quickly and cheaply, but which cumulatively can have a big impact.

Focus on Energy Efficiency in the Short Term

Given the current Alaska state budget crisis and the relatively low price of oil, there are strong reasons to focus on energy efficiency opportunities in the near term:

- The outlook for new State investment in major infrastructure projects is poor, but the State is still funding popular programs to help pay for energy efficiency audits and upgrades.
- Even without state funding, many EE&C projects often pay for themselves within a few months or years. In the long-run, it costs more to wait to do efficiency upgrades than doing them now, even if a loan is needed to cover up-front costs.
- A good time to invest in energy efficiency is when oil prices are down. By using some of the money not being spent on fuel (due to lower prices) on energy efficiency measures, the pain of high energy costs will be less when oil prices do go back up.

Take Advantage of Federal Programs, especially for Tribally Affiliated Groups

The Department of Energy has recently increased its staffing and outreach in Alaska through the Office of Indian Energy (DOE-IE). This is a good time to take advantage of federal energy programs, especially for any entity with an Alaska Native affiliation (including federally recognized tribes, ANCSA regional and village corporations, and Native nonprofits and energy resource development organizations). Utilities may be able to partner with tribally affiliated entities to leverage these federal funds. To date, one community in the region has participated in the DOE-IE START program.

USDA Rural Development provides a source of federal funding open to all rural communities regardless of Native affiliation. Rural Energy for America (REAP) and Rural Utilities Service (RUS) are two USDA programs that can be used by Alaska utilities and small businesses to fund clean energy and energy infrastructure projects.

Create Energy Committees to Advance Shared Goals

While there is not a unified regional governing body in Bristol Bay, there are many unifying ideas and structures in place. The creation of regional or subregional energy committees is one way to advance shared energy goals in areas where there are similar resources and significant potential for savings.

As part of the planning process, AEA has committed to help support the creation of energy committees in the region. At the end of the project, committees will need to be self-sustaining or find support from regional partners or entities. Broad goals and objectives for committees include:

- Bring energy champions together from across the region.
- Track progress on accomplishment of plan goals, objectives, and activities.
- Identify similar local priorities and opportunities to create economies of scale.
- Share local knowledge and capacity to create the structure and relationships needed to carry ideas forward.
- Seek broad sustainable engagement that includes youth.
- Keep a clear focus on regional energy goals and priorities.
- Look for ways stakeholders can support the long-term sustainability of energy committees and regional energy planning.
- Periodically assess need to revise plan goals and objectives in light of new information.

Pay Attention to Factors for Success

Energy planning and project development are slow and iterative processes. A spirit of optimism is useful for keeping everyone focused on the goal, but it should not prevent clear-eyed vetting of proposed projects in which risks are analyzed as well as benefits. The following lessons learned about developing successful energy projects came from regional energy planners and project developers at the 2013 Alaska Rural Energy Conference (Table 5).

Table 5: Factors for successful energy projects

TO BE SUCCESSFUL...		
Energy projects must be	Energy projects must have	Energy planners must have
▪ Economically viable ▪ Technologically feasible ▪ Supported by the local community, resource carriers, utility operators, and state and local governing entities	▪ A local champion ▪ Long-term, reliable and sustainable fuel sources	▪ Hope and optimism ▪ Many conversations with stakeholders

2 | ENERGY SUPPLY AND DEMAND

Alaska's Regional Energy Planning process is intended to look at the total mix of energy needs in rural Alaska for electricity, heating and transportation and to consider all local and regional energy resources including efficiency and conservation. However, data issues prevent a consistent level of detail and analysis.

Good data is available on supply and demand for electrical power from the Power Cost Equalization (PCE) program, the Regulatory Commission of Alaska (RCA), and from utilities themselves.

Space heating costs account for over 80 percent of home energy budgets in Alaska and around 55 percent of the energy costs in public and commercial buildings. Good data on heating fuel use, including heating efficiency and types of fuels used for heating, is increasingly available from the Alaska Housing Finance Corporation through the Alaska Retrofit Information System (ARIS). Data is better for residential buildings.

While we know that transportation costs directly affect total energy and food costs, especially in rural areas, there is little data routinely or consistently collected on transportation costs and fuel consumption. Wholesale fuel cost and sales data is largely the proprietary data of fuel vendors.

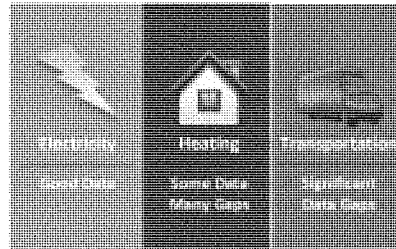


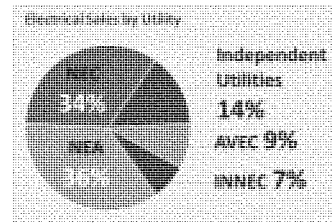
Figure 3: Data availability by energy sector

ELECTRIC POWER PRODUCERS

Alaska Village Electric Cooperative

Alaska Village Electric Cooperative (AVEC) is a nonprofit, member-owned cooperative supplying electricity for 56 communities in Alaska. AVEC serves three Bristol Bay communities: Ekwok, New Stuyahok, and Togiak. AVEC manages and operates a small powerhouse in each community. At present, all electricity is generated from diesel generators. In 2014, AVEC sold 4,746 MWh of electricity, 9 percent of total regional sales.

Figure 4: Electrical Sales by Utility



Data source: (2)

Iliamna-Newhalen-Nondalton Electric Cooperative

Iliamna-Newhalen-Nondalton Electric Cooperative, Inc. (INNEC) is a member-owned, non-profit rural electric cooperative supplying electricity to three communities: Iliamna, Newhalen, and Nondalton. Since 1983 INNEC has produced electricity using diesel generators in Newhalen. With the completion of the Tazimina Hydroelectric Facility in 1998 a significant amount of electricity has been generated from hydroelectric, moving from less than 50 percent in 1998 to over 99 percent in 2013. In 2014, INNEC sold 3,755 MWh of electricity in the region, about 7 percent of total regional sales.

Naknek Electric Association

Naknek Electric Association (NEA) serves three communities: King Salmon, Naknek, and South Naknek. NEA generates electricity using diesel generators. In 2014, NEA sold 19,119 MWh of electricity in the region, about 36 percent of total regional sales.

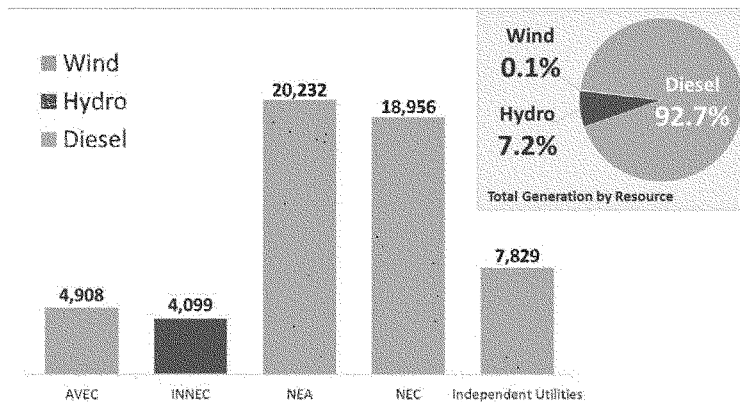
Nushagak Electric Cooperative

Nushagak Electric & Telephone Cooperative (NEC), Inc. is a member owned and operated cooperative that provides electric, telephone, cable TV, and internet services. Two communities, Dillingham and Aleknagik, are connected via intertie and are supplied with electricity from diesel generators in Dillingham. In 2014, NEC sold 18,183 MWh of electricity in the region, about 34 percent of total regional sales.

Independent Utility Generation

Sixteen Bristol Bay communities included in this report have independent utilities. Though covering the majority of communities in the region, independent utilities are in the region's smallest communities. In 2014, independent utilities sold 7,647 MWh of electricity in the region, about 14 percent of total regional sales.

Figure 5: Regional electric generation by utility and resource, 2014 (MWh)

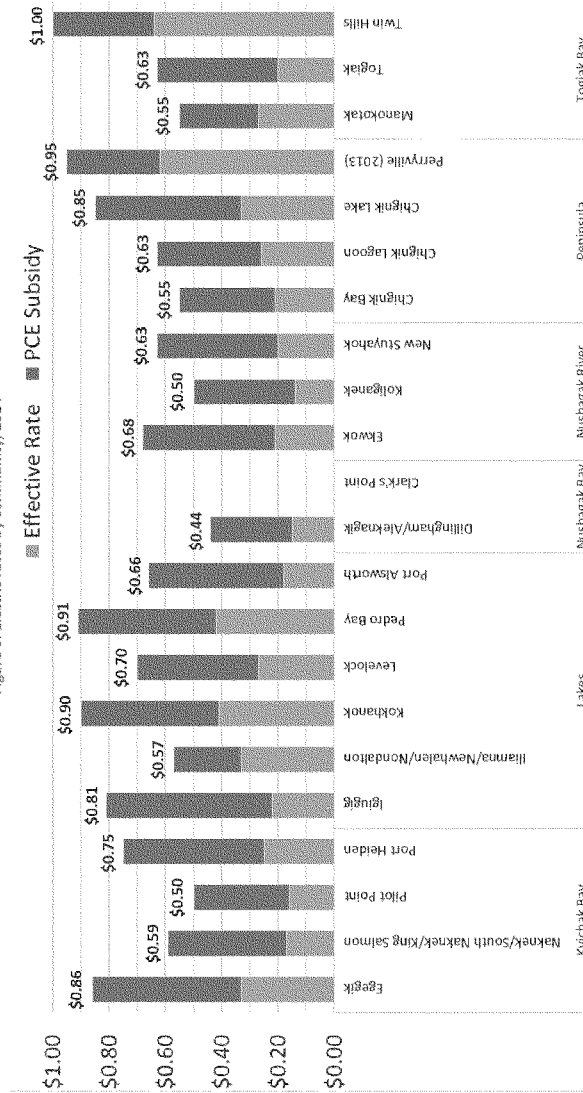


ELECTRIC RATES

For most communities in the Bristol Bay region, there are two sets of electric rates: the residential electric rate, which is set by the utility based on cost of electricity production and profit share (if applicable); and the effective rate of electricity, which is a reduced rate paid by residents in communities enrolled in the Power Cost Equalization Program (PCE). All Bristol Bay communities are eligible for PCE. Two communities, Clark's Point and Perryville, were not enrolled in PCE in 2014.

Both rates vary considerably across the region. Unsubsidized residential rates range from \$0.44/kWh in Dillingham and Aleknagik on Nushagak Electric Cooperative's grid to \$1.00/kWh in Twin Hills, which is an independent utility. The PCE effective rates (the subsidized rates) range from \$0.14/kWh in Koliganek to \$0.64/kWh in Twin Hills for the first 500 kWh of monthly residential use (Figure 6). For comparison, residential rates were \$0.15/kWh in Anchorage and \$0.18/kWh in Fairbanks in July 2015.

Figure 6: Electric rates by community, 2014



Notes: Perryville rates are from 2013 because this is the last year in which Perryville participated in the program; Clark's Point is not currently enrolled in the PCE program. Data source: (2)

Power Cost Equalization and Community Facilities

The Power Cost Equalization Program (PCE) also subsidizes the rates of community buildings and facilities. The PCE statute defines a community facility as a water, sewer or charitable educational facility, public outdoor lighting, or a community building whose operation is not paid for by the State or Federal government or by a private commercial organization. A community building is a community facility that is not operated for profit and is open to the general public. The Alaska Energy Authority determines eligible community facilities based on applications and information submitted by the facility owner and utility provider.

As with the residential PCE program, there are limits on the amount of PCE-eligible electricity (kWh) that may be used by a community facility. This monthly limit is set based on the number of residents in a community and comes to no more than 70 kWh per resident per month. In a community with 100 residents the total amount of electricity (kWh) that is eligible for PCE cost reductions is equal to 700 kWh per month, spread across all eligible community facilities.

In this region several communities are not using the PCE program to the fullest extent, leaving significant opportunity for communities to save thousands of dollars on electricity bills for public facilities and buildings (Table 6). In other regions, planners identified several reasons that communities are not able to take advantage of this program. This relates to turnover in utility management, lack of training, lack of coordination between community facility owners and utilities as well as the lengthy processing time of PCE community facility applications and rejection notices that do not provide information on why an application was rejected.

Clark's Point is not shown in Table 6 because it has not been enrolled in the PCE program in recent years, meaning their participation for both residential buildings and community facilities is zero. The analysis for Perryville is based on 2013 data. At present, Perryville receives no PCE subsidies for residential buildings or community facilities.

Table 6: Savings potential for community facilities through PCE

Subregion	Community or Utility	PCE kWh per person Eligible	# of Buildings Used	PCE Savings Potential
Kivichak Bay	Egegik	70	70	At/Near Max
	NEA	70	70	At/Near Max
	Pilot Point	70	64	1 to 5 buildings
	Port Heiden	70	35	1 to 5 buildings
Lakes				
Nushagak Bay	NEC	70	24	10+ buildings
	Chignik Lake	70	43	1 to 5 buildings
	Chignik Lake	70	16	10+ buildings
	Perryville	70	0	5+ buildings
	Manokotak	70	1	10+ buildings
Togiak Bay	Togiak	70	27	10+ buildings
	Twin Hills	70	38	1 to 5 buildings
Legend				
				High Savings Potential (5+ buildings)
				Medium Savings Potential (1 to 5 buildings)
				Limited savings potential (At or near max)

Data source: (2)

FUEL VENDORS AND PRICES

Diesel fuel, home heating oil, unleaded gas, and other petroleum products are available from multiple vendors due to the sheer size of this region. Delta Western, Vitus Marine, Crowley, and Everts Air Fuel are some of the fuel suppliers serving Bristol Bay communities via barge and air. Several communities do not buy directly from fuel vendors, buying instead through Trident Seafoods or development corporations. As with the rest of rural Alaska, high fuel costs are a continuing concern and problem. Previous work in the region detailed significant interest in bulk fuel purchasing groups (3). This concept along with siting a bulk fuel depot at Williamsport, which would provide access to Cook Inlet, offer the potential for increasing competition and reducing prices in the fuel market.

Fuel Prices

Figure 7: Price of #1 fuel oil in hub communities



Note: Prior to 2011, fuel price data was not always collected in the same month for all communities. In Figure 7, price data for the closest month (up to 3 months) was used when data from the same month as other communities was not available. Data source: (4)

Looking at the retail price of #1 fuel oil, most hub communities experienced a steady rise in prices between 2010 and 2014 with a leveling or decrease in prices in 2013 and 2014. Two exceptions to this are Togiak and Naknek, which have experienced steady price increases since 2011. The difference between Anchorage fuel prices and all Bristol Bay hub communities is larger in 2014 than in 2005 (Figure 7).

Bulk Fuel Storage

All communities in the region have bulk fuel storage facilities; the community representatives contacted through the energy planning process indicated the storage capacity is adequate at present. Two primary issues affecting multiple communities are: erosion and, at times urgent, relocation needs of bulk fuel storage facilities and the difficulty of securing delivery of bulk fuel.

Details on storage capacity and community-specific storage concerns are in the Community and Energy Profiles (starting on page 61).

Natural Gas

Regional interest in natural gas ranges from drilling in the Peninsula and Kvichak Bay subregions to monitoring access to LNG regionwide. A 2014 study investigating factors of market viability for LNG use in remote coastal communities found the combined demand for LNG in King Salmon, Naknek and South Naknek and the total demand in Dillingham may offer a sufficiently large electric load to support economically efficient LNG storage options (5).

CURRENT AND PROJECTED DEMAND

Over 53 GWh of electricity are produced and sold in the region annually (Figure 8). The overwhelming majority of electricity sold in the Bristol Bay region is produced by diesel generators. The notable exception to this is the INNEC grid in which less than one percent of electricity is produced using diesel generators; the primary source being the Tazimina hydroelectric facility. Large and medium scale utility expansion projects are not planned for the near term. INNEC is investigating additional intake options but this is largely to maintain current capacity.

Electric Sales by Customer Type

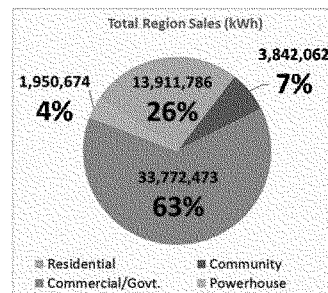
Regionwide 63 percent of electricity is used by commercial and government customers, 26 percent by residential customers, and seven percent by community buildings. Utility use accounts for the remaining four percent (Figure 8).

There is considerable variation by subregion, with commercial and government customers accounting for 74 percent of electric sales in Kvichak Bay and 63 percent in Nushagak Bay where Naknek and Dillingham, respectively, are located (Figure 9).

Residential sales are a more significant component of demand, accounting for 42-43 percent of demand, in the southwest Bristol Bay subregions of Togiak Bay and Nushagak River. Community facilities use 14 percent of the electricity produced in the Peninsula, and powerhouse consumption is greatest, at 12 percent, in the Lakes subregion.

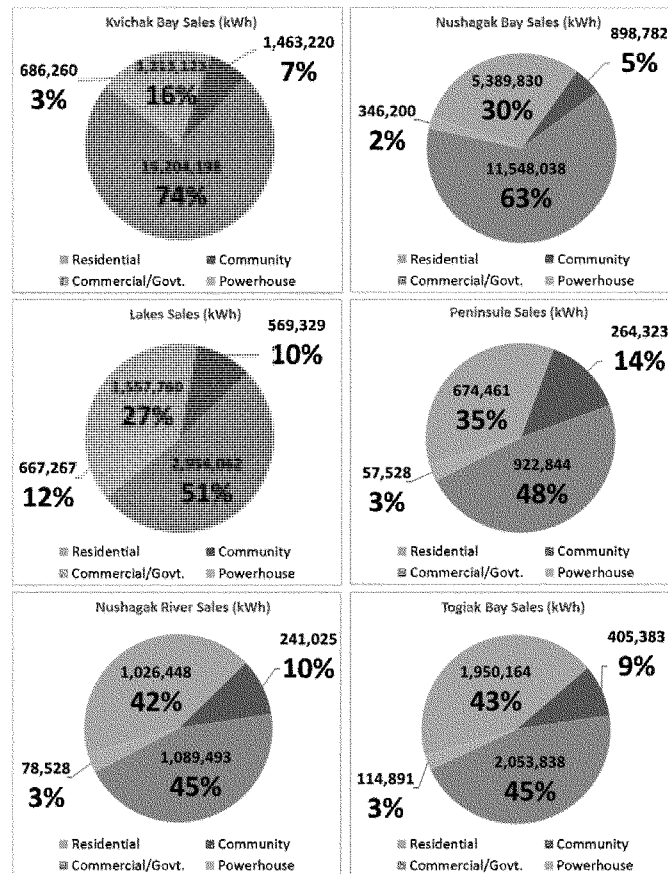
Tracking electric use by customer type is an important first step in targeting energy efficiency and conservation efforts. The following charts are helpful in showing variations between subregions, but the community-level data provided in the community profiles starting on page 61 are the best tool to determine whether residential, community or commercial customers are the top electricity users and where the greatest opportunity is for energy efficiency or conservation measures.

Figure 8: Regional sales by customer type, 2014



Data source: (2)

Figure 9: Subregional electrical sales by customer type, 2014

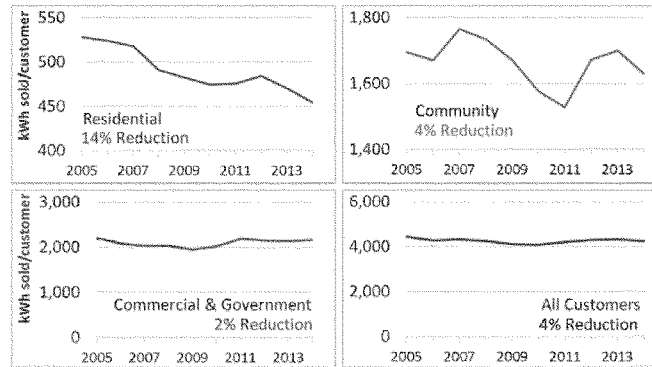


Data source: (2)

Trends in Electric Demand by Customer Type

A look at average monthly use per customer in the Bristol Bay region shows that trends in electric consumption over the past ten years have also varied by customer type. Trend data for Nushagak Electric, which serves Dillingham and Aleknagik, show an overall reduction of 4 percent in average monthly use with the steepest drop over this period among residential customers. This is likely due in part to the impact of higher energy costs, the resulting ramp up of energy efficiency and weatherization programs, and increased individual conservation efforts.

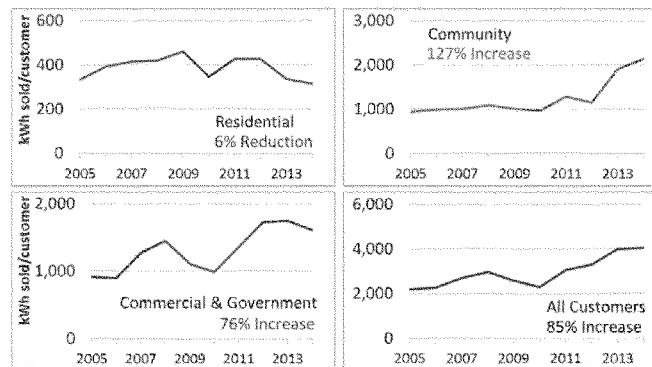
Figure 10: Trends in average monthly use by customer, Nushagak Electric Cooperative 2005-2014



Data source: (4)

In the communities on the INNEC grid—Iliamna, Newhalen, and Nondalton—the trend is striking with significant increases in commercial and community use starting in 2009 offset by much smaller declines in average residential use. This increase corresponds to the years of intensive investment and build up for the Pebble Mine project.

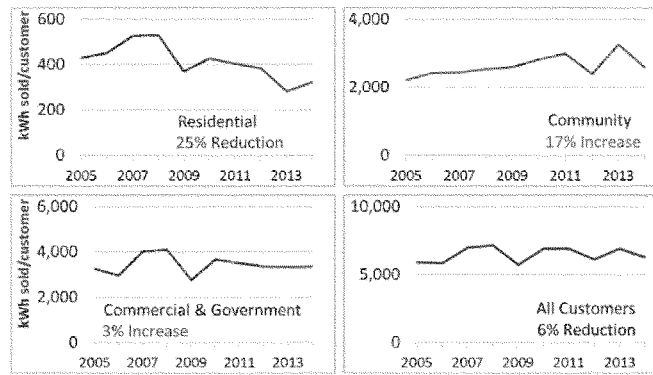
Figure 11: Trends in average monthly use by customer, INNEC 2005-2014



Data source: (4)

The NEA grid, serving King Salmon, Naknek, and South Naknek, shows a 25 percent reduction in average electrical use among residential customers and a 17 percent increase in average use by community facilities.

Figure 12: Trends in average monthly use by customer, NEA 2005-2014

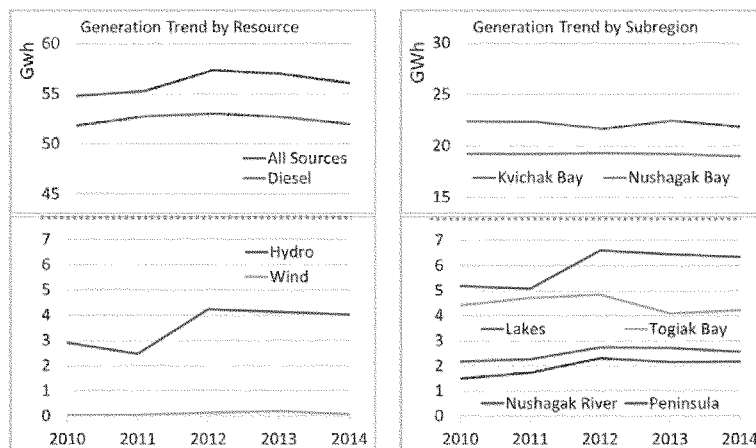


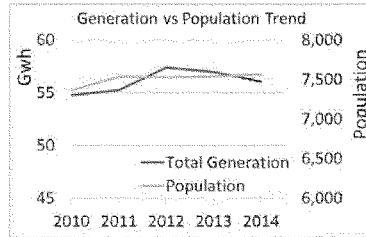
Data source: (4)

Recent Trends in Electrical Generation

Overall regional generation has increased slightly (2.3 percent) since 2010, following a similar trend in population (a gain of 2.7 percent). The relatively flat generation trend is even more apparent when generation is broken out by subregion—with only the Lakes subregion showing an increase of more than 1 GWh from 2010 to 2014 (Figure 13).

Figure 13: Generation trends, 2010-2014





Data sources: (4) (6)

Population Trends and Projections

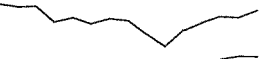
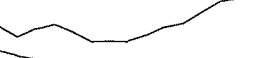
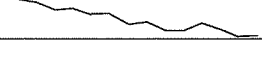
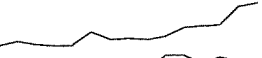
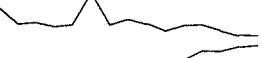
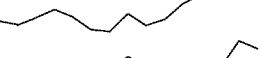
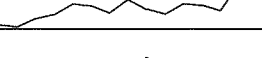
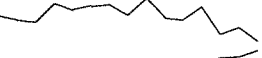
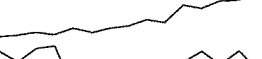
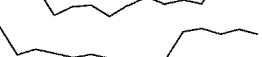
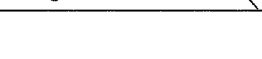
Since 2000, the population in the Bristol Bay region has fallen by three and a half percent. This change has not been even across the region. Areas with the sharpest declines are also the communities with 200 residents or less. Over the next 25 years, Alaska's state demographers predict an increase in population in the Dillingham Census Area and Lake and Peninsula Borough (6 and 4 percent, respectively) and a 19 percent decline in the Bristol Bay Borough (7).

Load Forecasts

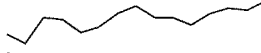
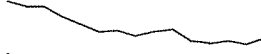
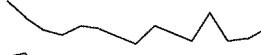
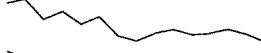
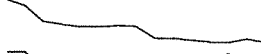
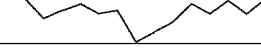
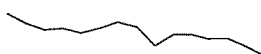
Load forecasting in a region as large as Bristol Bay is challenging. However, tracking population changes at the community level is one of the best tools for load forecasts. Population growth means new housing subdivisions, stores, and facilities all of which use electricity. While reductions in population do not reduce electricity usage on a one-to-one basis, we expect the electrical load trend to generally follow population trends.

Disruptions to this established load trend may occur due to losses or additions of major commercial customers or community wide energy efficiency steps. For example, a new fish processing plant will be setting up in Levelock. The community has been investigating the most cost effective way to meet the large energy needs of a summer-only consumer. The loss scenario is when a major customer, partially or entirely, closes or switches to independent electrical production. In the end all of these changes, whether it is population change or the addition or loss of large users, will have the same effect of increasing or decreasing efficiency and cost of diesel generation systems.

Figure 14: Historical population trends by community, 2000-2014

Population	2000 Census		2014 Est.	Change Since 2000	Avg. Annual Growth
Over 500					
Dillingham	2,466		2,431	-1.4%	-0.1%
Togiak	809		876	8.3%	0.6%
Naknek	678		523	-22.9%	-1.5%
201 to 500					
Manokotak	399		500	25.3%	1.7%
New Stuyahok	471		499	5.9%	0.4%
King Salmon	442		335	-24.2%	-1.6%
Koliganek	182		231	26.9%	1.8%
Newhalen	160		207	29.4%	2.0%
101 to 200					
Aleknagik	223		197	-11.7%	-0.8%
Port Alsworth	104		179	72.1%	4.8%
Kokhanok	174		167	-4.0%	-0.3%
Nondalton	221		164	-25.8%	-1.7%
Ekwok	130		119	-8.5%	-0.6%
Port Heiden	119		114	-4.2%	-0.3%
Egegik	116		106	-8.6%	-0.6%
Perryville	112		101	-9.8%	-0.7%

51 to 100

Iliamna	102		97	-4.9%	-0.3%
Chignik Bay	79		96	21.5%	1.4%
Twin Hills	69		87	26.1%	1.7%
South Naknek	137		84	-38.7%	-2.6%
Levelock	122		80	-34.4%	-2.3%
Pilot Point	100		78	-22.0%	-1.5%
Chignik Lagoon	103		72	-30.1%	-2.0%
Chignik Lake	145		70	-51.7%	-3.4%
Igiugig	53		53	0.0%	0.0%
50 or Under					
Clark's Point	75		48	-36.0%	-2.4%
Pedro Bay	50		47	-6.0%	-0.4%

Data source: (6)

Transportation and Heating Fuel

No public data is available on the volumes of fuels used for transportation and space heating.

DIESEL POWERHOUSE AND DISTRIBUTION**Fuel for Electrical Generation**

Over 3.6 million gallons of diesel fuel are used per year to generate electricity in the Bristol Bay region (Figure 15).

Diesel Efficiency

Diesel efficiency in the region currently ranges from 4.0 to 18.2 kWh per gallon (Figure 16). The red line showing AEA's benchmark performance targets—12.5 kWh per gallon for small (less than two million kWh generated per year) and 14.5 kWh per gallon for large systems—indicates that diesel efficiency particularly in small independent utilities is not within range of performance benchmarks.

A 10 percent increase in diesel efficiency across all utilities would realize substantial savings, amounting to an average \$0.02 savings for each kWh of electricity generated on the INNEC,

Company	Number of Employees
AVEC	376,571
INNEC	5,123
NEA	1,258,272
NEC	1,253,779
Independent Utilities	706,390

The scatter plot displays Diesel Efficiency (kWh per gallon) on the Y-axis (ranging from 3.0 to 19.0) against Annual Electrical Generator (MWh) on the X-axis (ranging from 0 to 25,000). The data points are categorized by utility type: Independent Utilities (solid circles), AVEC (open circles), INNEC (circles with a dot), NEA (circles with a cross), and NEC (circles with a plus). A horizontal line at approximately 14.5 kWh per gallon represents the AEA Benchmark (based on utility size). The data points show a general trend of decreasing efficiency as generator size increases, with some outliers at lower generator sizes.

Utility	Annual Electrical Generator (MWh)	Diesel Efficiency (kWh per gallon)
Independent Utilities	~1,000	~4.8
Independent Utilities	~1,500	~10.5
Independent Utilities	~1,800	~11.2
Independent Utilities	~2,000	~11.8
Independent Utilities	~2,200	~12.2
Independent Utilities	~2,500	~13.5
Independent Utilities	~2,800	~13.8
Independent Utilities	~3,000	~13.2
Independent Utilities	~3,500	~13.0
Independent Utilities	~19,000	~15.0
Independent Utilities	~20,000	~16.2
Independent Utilities	~20,500	~18.0
Independent Utilities	~21,000	~16.5
Independent Utilities	~21,500	~17.5
Independent Utilities	~22,000	~18.5
Independent Utilities	~22,500	~19.0
Independent Utilities	~23,000	~18.0
Independent Utilities	~23,500	~17.0
Independent Utilities	~24,000	~16.0
Independent Utilities	~24,500	~15.0
Independent Utilities	~25,000	~14.0
Independent Utilities	~25,500	~13.0
Independent Utilities	~26,000	~12.0
Independent Utilities	~26,500	~11.0
Independent Utilities	~27,000	~10.0
Independent Utilities	~27,500	~9.0
Independent Utilities	~28,000	~8.0
Independent Utilities	~28,500	~7.0
Independent Utilities	~29,000	~6.0
Independent Utilities	~29,500	~5.0
Independent Utilities	~30,000	~4.0
Independent Utilities	~30,500	~3.0
Independent Utilities	~31,000	~2.0
Independent Utilities	~31,500	~1.0
Independent Utilities	~32,000	~0.5
Independent Utilities	~32,500	~0.2
Independent Utilities	~33,000	~0.1
Independent Utilities	~33,500	~0.05
Independent Utilities	~34,000	~0.02
Independent Utilities	~34,500	~0.01
Independent Utilities	~35,000	~0.005
Independent Utilities	~35,500	~0.002
Independent Utilities	~36,000	~0.001
Independent Utilities	~36,500	~0.0005
Independent Utilities	~37,000	~0.0002
Independent Utilities	~37,500	~0.0001
Independent Utilities	~38,000	~0.00005
Independent Utilities	~38,500	~0.00002
Independent Utilities	~39,000	~0.00001
Independent Utilities	~39,500	~0.000005
Independent Utilities	~40,000	~0.000002
Independent Utilities	~40,500	~0.000001
Independent Utilities	~41,000	~0.0000005
Independent Utilities	~41,500	~0.0000002
Independent Utilities	~42,000	~0.0000001
Independent Utilities	~42,500	~0.00000005
Independent Utilities	~43,000	~0.00000002
Independent Utilities	~43,500	~0.00000001
Independent Utilities	~44,000	~0.000000005
Independent Utilities	~44,500	~0.000000002
Independent Utilities	~45,000	~0.000000001
Independent Utilities	~45,500	~0.0000000005
Independent Utilities	~46,000	~0.0000000002
Independent Utilities	~46,500	~0.0000000001
Independent Utilities	~47,000	~0.00000000005
Independent Utilities	~47,500	~0.00000000002
Independent Utilities	~48,000	~0.00000000001
Independent Utilities	~48,500	~0.000000000005
Independent Utilities	~49,000	~0.000000000002
Independent Utilities	~49,500	~0.000000000001
Independent Utilities	~50,000	~0.0000000000005
Independent Utilities	~50,500	~0.0000000000002
Independent Utilities	~51,000	~0.0000000000001
Independent Utilities	~51,500	~0.00000000000005
Independent Utilities	~52,000	~0.00000000000002
Independent Utilities	~52,500	~0.00000000000001
Independent Utilities	~53,000	~0.000000000000005
Independent Utilities	~53,500	~0.000000000000002
Independent Utilities	~54,000	~0.000000000000001
Independent Utilities	~54,500	~0.0000000000000005
Independent Utilities	~55,000	~0.0000000000000002
Independent Utilities	~55,500	~0.0000000000000001
Independent Utilities	~56,000	~0.00000000000000005
Independent Utilities	~56,500	~0.00000000000000002
Independent Utilities	~57,000	~0.00000000000000001
Independent Utilities	~57,500	~0.000000000000000005
Independent Utilities	~58,000	~0.000000000000000002
Independent Utilities	~58,500	~0.000000000000000001

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Table 7: Projected savings from 10% increase in diesel efficiency

Community or Utility Owner	Fuel Use Gallons per Year	Fuel Diesel Efficiency (100/year)	10% Increase in efficiency (100/year)	Total Fuel Use (gallons)	2013 Fuel Savings (gallons)	Annual Savings \$	Savings per Gallon
Ekwok	46,990	11.3	12.5	42,718	4,272	18,454	\$ 0.03
New Stuyahok	101,469	13.6	14.9	92,245	9,224	40,403	\$ 0.03
Togiak	228,112	13.1	14.5	207,375	20,737	90,001	\$ 0.03
AVEC	376,571	13.0	14.3	342,337	34,234	148,858	\$ 0.03
Chignik Bay	42,113	11.6	12.9	38,466	3,647	16,853	\$ 0.03
Chignik Lagoon	39,284	10.8	11.9	35,713	3,571	16,106	\$ 0.04
Chignik Lake	37,232	10.4	11.4	33,867	3,365	17,431	\$ 0.03
Egegik	33,836	11.7	12.8	30,760	3,076	13,480	\$ 0.04
Elsie	29,439	11.4	12.5	26,763	2,676	\$ 17,583	\$ 0.03
Kilgishnoo	39,466	10.3	11.3	35,879	3,587	\$ 21,383	\$ 0.03
Kilgishnoo	60,031	10.8	11.9	54,575	5,456	\$ 24,504	\$ 0.04
Lensok	40,060	11.7	12.8	36,564	3,496	\$ 15,055	\$ 0.03
Lenoxoktak	113,256	9.3	10.2	102,915	10,341	\$ 43,013	\$ 0.04
Pedro Bay	37,247	10.7	11.8	33,679	3,568	\$ 8,368	\$ 0.03
Perryville	30,920	17.6	19.3	28,481	2,439	\$ 11,114	\$ 0.03
Port Point	36,248	11.4	12.6	32,563	3,685	\$ 12,950	\$ 0.03
Port Alsworth	33,848	12.3	13.4	30,562	3,286	\$ 29,633	\$ 0.04
Port Hadden	34,180	9.3	10.1	30,381	3,799	\$ 20,645	\$ 0.04
Twit Hills	29,180	4.9	5.4	26,527	2,653	\$ 11,115	\$ 0.03
Independent Utilities	706,260	11.0	12.1	642,173	64,087	\$ 196,179	\$ 0.04
Iliamna/Newhalen/ Nondalton	5,123	18.2	20.0	4,657	466	\$ 2,175	\$ 0.02
INN Electric Cooperative	5,123	18.2	20.0	4,657	466	\$ 2,175	\$ 0.02
Haknek/Ving Salmon/ S. Haknek	1,253,779	15.1	16.6	1,143,684	110,095	\$ 396,650	\$ 0.03
Haknek Electric Association	1,253,779	15.1	16.6	1,143,684	110,095	\$ 396,650	\$ 0.03
Dillingham/ Aleknagik	1,253,779	15.1	16.6	1,139,799	113,980	\$ 396,650	\$ 0.02
Nushagak Electric Cooperative	1,253,779	15.1	16.6	1,139,799	113,980	\$ 396,650	\$ 0.02

Notes: 1/ Perryville data from FY2013 PCE Annual Report. Data source: (2)

Heat Recovery

Heat recovery lowers community energy costs by reducing the cost of heating public buildings near the powerhouse. Fifteen communities in the Bristol Bay region have operational heat recovery systems and another two have active development projects to install heat recovery systems (Table 8).

Even when generators operate at maximum efficiency, 60% of all energy in the diesel fuel will be released as heat. The waste jacket heat can be run through a heat exchanger that transfers the heat to a heat loop that can warm nearby buildings. This process can recover 10 to 20% of the energy in the fuel. The heat can be measured and, if a heat sales contract is developed, sold to consumers, providing another revenue source for the utility. Potential users are often schools.

While excess or waste heat is primarily a byproduct of diesel generation, heat can be harnessed from hydro plants in situations where there is excess hydro (e.g. water going over the spillway) that can be used as a dump load to power an electric heater.

Table 8: Heat recovery systems completed or in development

Kvichak Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Egegik	City of Egegik	Provides excess heat to the school and adjacent community center		
	Naknek	NEA	Provides excess heat to the BBB school and a few adjacent homes		
	Pilot Point	Pilot Point Electric	Provides excess heat to the school		
	Port Heiden	Port Heiden Utilities	Provides excess to the fire department and VPSO buildings		
Lakes Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Igiugig	Igiugig Electric	Provides excess heat to pumphouse and recreational center buildings	Expand system to heat water tank	
	Kokhanok	City of Kokhanok	Provides excess heat to the school		
	Levelock	Levelock Electric	Provides excess heat to the school	Expand to community, tribal buildings, and youth recreational center	
	Newhalen	INNEC	Provides excess heat to the city office and fire hall		
	Pedro Bay	Pedro Bay Village Council	Provides excess heat to multiple community buildings; originally connected to school which closed		

	Port Alsworth	Tanalian Electric Cooperative	Provides excess heat to old school, duplex, and teacher's house	Need to connect new school, school housing, and community building.	Unknown (funding is a concern)
Nushagak Bay Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Dillingham	NEC	Provides excess heat to school, court, DOT, and utility buildings	Determine feasibility for expansion to UAF-BB campus	
Feasibility	Dillingham	SWAMC	Capturing excess heat used to heat school when in session for ice making during summer/fishing season	Determine technical and economic feasibility	
Nushagak River Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Koliganek	Village Council	Provides excess heat to school, clinic, & city offices		
Design & Construction	New Stuyahok	SRS/D/AVEC	Project to capture the recovered heat from the AVEC power plant cooling system by installing heat exchangers at the plant and school boiler module and ~700 feet of underground piping	Construction in 2015	\$548,000/ AEA REF & Local Match
Peninsula Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Chignik Lagoon	Village Council	Provides excess heat to the school		
	Chignik Lake	Village Council	Provides excess heat to the school		
	Perryville	Village Council	Provides excess heat to the school		
Togiak Bay Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Design & Construction	Togiak	City	Heat recovery between AVEC power plant and multiple buildings: Water Treatment Plant, Clinic, Police Station, City Office, and Old School Community Activity Building	Construction in 2016	\$486, 180/ AEA REF & Local Match

LINE LOSS

Line loss reflects the percent of electricity (kWhs) generated by a utility that is not sold. Line loss may be due to physical losses in the distribution network (possibly caused by deteriorating lines and old or under-sized transformers) or unmetered use. The result is a direct financial loss to the utility and waste of thousands of gallons of diesel fuel per year. Line loss also affects the PCE rate available to a utility; losses above 12 percent reduce the PCE subsidy. As of 2014, five communities had line loss above 12 percent. Four communities (Clark's Point, Manokotak, Port Heiden, and Twin Hills) are not included in the analysis because of discrepancies in reported line loss.

Table 9: Line loss by community and subregion

Subregion	Community or Utility	Total kWhs generated	Line loss	kWhs lost	Diesel lost (gals.)
Kachak Bay	Egegik	650,903	7%	48,253	4,139
	NEA	20,231,754	6%	1,112,943	69,217
	Pilot Point	461,228	19%	89,669	7,047
	Twin Hills	3,363,881	1%	33,639	2,839
Ladue	Manokotak	4,093,287	8%	344,385	4,359
	Port Heiden	437,918	7%	31,449	2,870
	Port Moller	1,779,293	1%	17,793	1,474
	Port Moller Bay	185,117	10%	17,949	1,674
Nushagak Bay	Port Moller	602,350	6%	36,141	3,371
	NEC	18,956,000	4%	773,150	51,137
Nushagak River	Chignik Bay	845,836	11%	94,096	6,910
	Chignik Lagoon	424,463	1%	3,505	324
	Chignik Lake	386,321	10%	37,056	3,571
	Peddyville	531,604	22%	113,241	5,998
Togiak Bay	Togiak	2,997,095	4%	109,454	8,331
	Legend				
					High Savings Potential (12%+ line loss)
					Medium Savings Potential (6% to 11% loss)
					Limited Savings Potential (5% or less line loss)

Data source: (2)

RENEWABLE ENERGY

Renewable resources currently used to meet energy needs in the region include wind and hydro for electricity and woody biomass for space heating (8) (9). (For information on the potential for other renewable resources, see Table 24.)

Biomass

The Bristol Bay region has been the site of multiple studies and inventories of biomass potential at the regional, subregional, and community levels. From 2004 to 2007, BBNA oversaw a regionwide project on woody biomass, the Bristol Bay Region Native Allotment Forest Inventory. The inventory, performed by Tanana Chiefs Conference Forestry Program, selected 261 native allotment parcels in three regional subunits. In 2013, BBNA conducted a survey of woody biomass uses in Dillingham and Aleknagik.

Five Bristol Bay communities have taken advantage of the Alaska Wood Energy Development Task Group grants to complete pre-feasibility assessments of local wood biomass resources. Another four in the Lake and Peninsula Borough conducted feasibility studies using an AEA Renewable Energy Fund grant. Kokhanok is the only community with an operational biomass heating system for two community buildings. Other communities including Iliamna, Nondalton, Clark's Point, and New Stuyahok have completed pre-feasibility studies that show pursuing a biomass project at present may be economically viable (Table 10). Depending on the decision of city and tribal governments, additional biomass projects may start-up in the region.

Table 10: Community-scale wood biomass heating projects completed or in development

Lakes Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Kokhanok	Lake and Peninsula Borough	A GARN cordwood boiler heats Kokhanok Village Council Building and the Community Building.	Study feasibility of expanding to nearby buildings.	Past funding: \$391,375 AEA REF/Local Match (includes feasibility studies for 4 other communities)
Pre-feasibility Completed	Iliamna	Village Council	Pre-feasibility completed in 2013. Investigated heating village office and adjacent shop building.	Found not economically viable; but prudent to continue investigation.	AWEDTG
	Nondalton	City & Village	Pre-feasibility completed in 2013 for installing high efficiency wood stoves at tribal office, community building, and St. Nicholas Church.	Found to be economically justified. Seeking funds for installation.	AWEDTG
Nushagak Bay Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Pre-Feasibility Completed	Aleknagik	City	Pre-feasibility study completed in 2012. Not currently viable. May revisit after	Update 2012 pre-feasibility study. New application has been submitted to AWEDTG.	AWEDTG

Nushagak Bay Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
			washeteria or other new buildings constructed or using 10,000+ gallons of fuel.		
	Clark's Point	City	Pre-feasibility study completed in 2013. Not recommended for Water Treatment Plant and clinic, but viable for other buildings studied.	Design and install heat loop to connect Community Center, CPVC, and City Office	AWEDTG
	Dillingham	BBNA	Studies on interest and wood availability completed.	Conduct feasibility study of wood boiler heating for BBNA Main office and Family Resources center.	
Nushagak River Subregion					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Pre-Feasibility Completed	New Stuyahok	Stuyahok Limited	Pre-feasibility study completed in 2013 for cordwood system.	Install two Tarm Solo 40 wood boilers and one high efficiency wood stove in the Booster Club	AWEDTG

Hydroelectric

The Bristol Bay region has two operating conventional hydroelectric projects: Tazimina hydro on the INNEC grid serving Iliamna, Newhalen, and Nondalton and Packer's Creek hydro which started operation in 2015 serving Chignik Lagoon. Two projects are in the design and permitting phase: Chignik Bay and Pedro Bay.

Table 11: Hydroelectric projects in Bristol Bay region

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Chignik Lagoon	Village Council	Packer's Creek Hydro: 177 kW run-of-river with 9-ft dam.	- Monitor to see if able to produce estimate of 90% of power - Erosion control on access road to hydro facility - Install dispatchable boilers for space heating	\$5,541,171/ AEA REF/Local match
	Iliamna, Newhalen, Nondalton	INNEC	Tazimina Hydro: 824 kW run-of-river project. Expandable to 1.5 MW. Dispatchable electric boilers installed in Newhalen & Nondalton.	- Maintain current capacity, increase river intake - Hook-up additional electric boilers	\$12,000,000/ AEA REF, Federal, INNEC loan

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Design & Permitting	Chignik Bay	City	Indian Creek Hydro: Restoring antiquated 60 kW hydropower System. 520 kW facility proposed. Recommended for design and permitting.	Upgrade existing powerhouse and address outstanding environmental, geotechnical, and historic preservation issues.	\$207,500/ AEA REF
	Pedro Bay	Village Council	Knutson Creek Hydro: 150 kW run-of-river	Complete design and permitting in 2016	\$292,500/ AEA REF/Local match
Previously Considered	Dillingham, Aleknagik	NEC	Nushagak Area Hydropower Project. Proposed capacity: 1.5 MW Lake Elva; 2.7 MW Grant Lake	Feasibility complete, NEC not pursuing	\$1,904,705/ AEA REF
	Port Alsworth		Tanalian River Hydro- 75-200 kW, run-of-river	Reconnaissance study not completed due to federal land accessibility issues	

Hydrokinetic (In-River, Tidal and Wave)

Igiugig is the only community in the Bristol Bay region with a hydrokinetic in-stream pilot project. The project had two turbines assembled and deployed in the summer of 2014 in the Kvichak River. The device was retrieved after a month deployment. The project is continuing with re-design and continued testing in 2015. The energy output capacity is small (5 to 40 kW).

Table 12: Hydrokinetic energy projects operational or in progress

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
In Progress	Igiugig	Village Council	Pilot project using 25 kW turbine for in-river electricity generation.	Pursue licensing for project; Determine technical and economic feasibility for village-wide electricity generation.	

Solar

Solar is not a year-round energy resource in the Bristol Bay region. However, less expensive solar panels, federal tax credits and grant support, and net metering programs have combined to shorten the payback period for solar projects. This combined with the increase in electricity demand in the summer, due to fish processing and packing operations, means solar both small-scale and community-scale may be an option. This is particularly the case in smaller communities with very high costs of diesel fuel and electricity or for residents not connected to utility lines.

Utilities in the Bristol Bay region do not have any installed solar arrays. However, homes, commercial buildings, and community buildings are installing small solar PV arrays on their own (Table 13). There are few residential solar thermal systems installed in the region. Using solar thermal technologies to reduce heating costs is often economic; however, these systems are

significantly more complex to set up and maintain than solar PV arrays, making the lack of trained and knowledgeable operators in the region a potential barrier to expanding use.

Table 13: Community-scale solar energy projects operational or in progress

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Dillingham	Multiple Entities	Solar arrays on UAF Bristol Bay Campus, USFW building, and commercial buildings		
	Igiugig	Multiple Entities	Solar thermal installed on 3 buildings	Expand use of solar thermal	
	Perryville	Native Village	3 kW solar array on community building	Expand use to homes and community buildings	

Wind

Bristol Bay has few operational utility-scale wind projects, but several communities are in the process of developing wind projects (Table 14). In Perryville and Igiugig, both with operational wind systems, electricity generation is small scale with turbines with under 3 kW capacity. The project in Perryville uses small-scale turbines for residential electricity generation, unconnected to the utility. The system in Igiugig is a pilot project using vertical-axis wind turbines. Four communities have utility scale wind projects in development or re-design, in the case of Kokhanok and one, Clark's Point, is in the process of installing residential scale turbines in a system similar to Perryville.

Communities with met towers installed prior to 2010 that have not pursued further design and development of wind systems include Chignik Lagoon, Chignik Lake, and Manokotak. These communities are mentioned because the decision not to pursue wind is not fully accepted by the communities as noted during outreach visits by the planning team and leadership at BBNA. In all cases, AEA has specific reasons for not continuing development ranging from small loads that will make integration and maintenance of wind systems technically complicated, plans for changes in maintenance and upkeep of existing diesel systems, and concern that the wind resource is not viable for utility scale electricity generation. BBNA and communities involved have disagreed with AEA's positions particularly as it relates to sites for met towers. Details are noted in Table 14.

Table 14: Wind projects in the Bristol Bay region

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Operational	Igiugig	Village Council	6 - 1.2 kW vertical axis wind turbines installed as pilot project	If proven, will be expanded	
	Perryville	Village Council	10 residential (2.5-2.9 kW each) turbines installed		
Design & Installation	Clark's Point	City	Installing 7 residential turbines	Work with AEA on integration with powerhouse	

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
	Kokhanok	Local Utility & Borough	2 - 90kW wind turbines, originally planned as high penetration system. System redesign in process. First commissioned in 2010.	Electrical & generator upgrades; test wind system at low and medium level penetration	\$190,000 AEA REF/local match 000 (re-design costs only)
	Koliganek	Village Council	Wind and heat recovery system. Draft CDR complete.	Complete powerhouse upgrade & finalize CDR; identify suitable sites for wind.	\$112,050/ AEA REF/Local Match (for assessment & CDR only)
	Pilot Point	City	100 kW wind farm with dispatchable electric boiler, powerhouse upgrades needed to integrate the wind farm into the Pilot Point grid.	CDR submitted. City of Pilot Point will complete a met tower study, final design, permitting, construction and startup of wind farm	\$1,571,240/ AEA REF, Local Match
	Port Heiden	Lake and Peninsula Borough	LPB proposed a high penetration 330 kW design and construction project.	Limited funding for permitting and design until conceptual design is approved. The current diesel powerhouse and distribution system are not capable of supporting a utility-scale wind system.	\$250,000/ AEA REF
Feasibility	Egegik	Lake and Peninsula Borough	Wind feasibility study, met tower installed 8.2014 and 1 year of data needed	Determine wind resource and if sufficient, continue with project development	\$65,666/ AEA REF, Local Match
	Levelock	Lake and Peninsula Borough	LPB has added money to install a 34 meter met tower to collect bankable data. The met tower was installed in July 2014.	Determine wind resource and if sufficient, continue with project development	\$11,000/ AEA REF, Local Match
	New Stuyahok	AVEC	Feasibility assessment for a proposed 300kW wind project with associated integration components	Identify site for met tower and conduct new feasibility study.	\$150,000/ AEA REF, Local Match
Met Tower Installed	Chignik Lagoon	Village Council	2 met towers installed & studies completed in 2005 & 2011. 2013 feasibility study map shows level 6 wind class but 2011 study found level 1 wind class	Community interested in investigating alternative sites; AEA concerned by small load and believes alternative sites are not developable.	
	Chignik Lake	Village Council	Met tower installed in 2011, found level 4 wind class with high turbulence	Community interested in investigating alternative sites; AEA concerned by small load.	
	Manokotak	City	Met tower installed in 2009, found level 2 wind class	Community interested in investigating alternative sites; AEA is waiting for utility plan to remedy condition of generation & distribution system to ensure sustainable project.	

Bristol Bay Region					
Status	Community	Lead	Project Description	Next Step	Cost/Funding
Previously Considered	Chignik Bay	Village Council	1 met tower installed in 2004-6, found level 6 wind class with high turbulence.	Community focusing on hydro power	
	Togiak	City	Met tower installed 2004-6, found level 3 wind class	Community not pursuing wind resource development at present	

ENERGY EFFICIENCY AND CONSERVATION

Energy Characteristics of Regional Housing Stock

The 2014 Alaska Housing Assessment by the Cold Climate Housing Research Center (10) profiled the residential energy use and cost in the Bristol Bay region:

- **Energy Use:** The average home in the region is 1,232 square feet and uses 136,000 BTUs of energy per square foot annually. This is close to the statewide average of 137,000 BTUs per square foot per year. Two-thirds (66%) is used for space heating, 16 percent for hot water, and 18 percent for electricity.
- **Energy Efficiency:** The average annual energy rating in the region is 2-star plus, based on data from over 830 homes. Not surprisingly, newer homes have better energy performance. On average, homes built in the 1940s are currently rated at 1-star plus, compared to an average rating of 3-star plus for homes built after 2000.
- **Housing Quality:** Within current housing stock, newer homes are tighter. On average, homes built in the last decade nearly meet the 2012 BEES standard of 4 air-changes per hour at 50 Pascals (ACH50). In contrast, homes built in the 1940s are 3.4 times leakier than those built since 2000.
- **Energy Cost and Affordability:** The average annual home energy cost in the region is \$7,054, which is approximately 2.5 times more than the cost in Anchorage, and 3.3 times more than the national average. Approximately 21% of households in the Bristol Bay region spend 30% or more of total income on housing costs, including rent, water, sewer, and energy costs.

Figure 17: Bristol Bay residential energy use

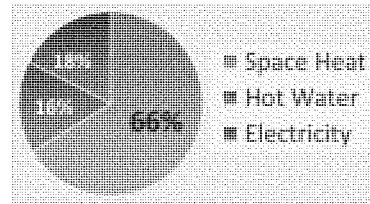


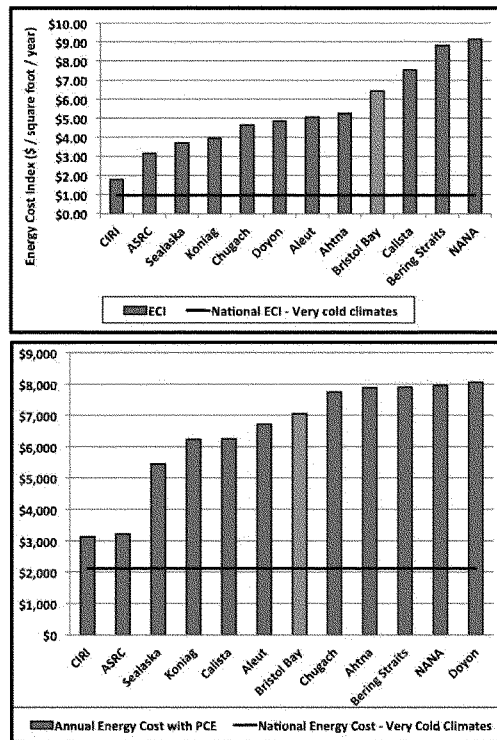
Table 15: Summary of energy characteristics of regional housing stock

Energy Efficiency Rating	Avg. Home Size (sq. ft.)	Avg. Annual Energy Consumption (BTU)	Avg. Annual Energy Cost (\$)	Avg. Energy Efficiency (BTU per sq. ft. per year)	Avg. Energy Cost (\$ per sq. ft. per year)	Avg. Home Age (years)
2-star plus	1,232 square feet	136,000 BTU	\$7,054 per year	136,000 BTU per square foot per year	\$6.42 per square foot per year	8.2

Notes: 1/ Includes all end uses, estimated using January 2013 energy prices and including reductions from the PCE program. 2/ The amount of money spent on energy per year divided by square footage. 3/ The energy used per square foot per year divided by the area's heating degree days. Data source: (10)

Regional Comparison: Of the 12 ANCSA regions, average annual home energy costs in the Bristol Bay region are sixth highest overall and the fourth highest per square foot (10).

Figure 18: Bristol Bay residential energy costs compared with other ANCSA regions



Source: (10)

Residential Energy Efficiency & Conservation (EE&C)

More than a third of all occupied homes in the region have completed energy efficiency upgrades either through the Home Energy Rebate (HER) program, a low-income weatherization program, or with a recently built and BEES-certified home (Figure 19). Bristol Bay Housing Authority (BBHA) builds all homes new homes in the region above BEES standards.

Participation in AHFC's Home Energy Rebate program is open to homeowners for their primary residence; there is no upper income limit. The HER program requires homeowners to pay for recommended upgrades up front and reimburses them for direct labor and materials up to a certain amount once work is done and a "post" audit is completed. In the Bristol Bay region about 35 percent of homeowners receiving HER audits have completed upgrades and received rebates.

AHFC's weatherization services in the region are provided by Bristol Bay Housing Authority (BBHA) and the Alaska Community Development Corporation (ACDC). There is no cost to the resident or community for participation in the program.

Energy efficiency and weatherization measures completed since 2008 have reduced energy consumption in participating Bristol Bay households by 27% to 29% per year, according to AHFC program data. That translates to 300 to 450 gallons of heating oil per retrofitted home (Table 16). Most of the energy savings is in home heating, although lighting upgrades result in some electrical savings.

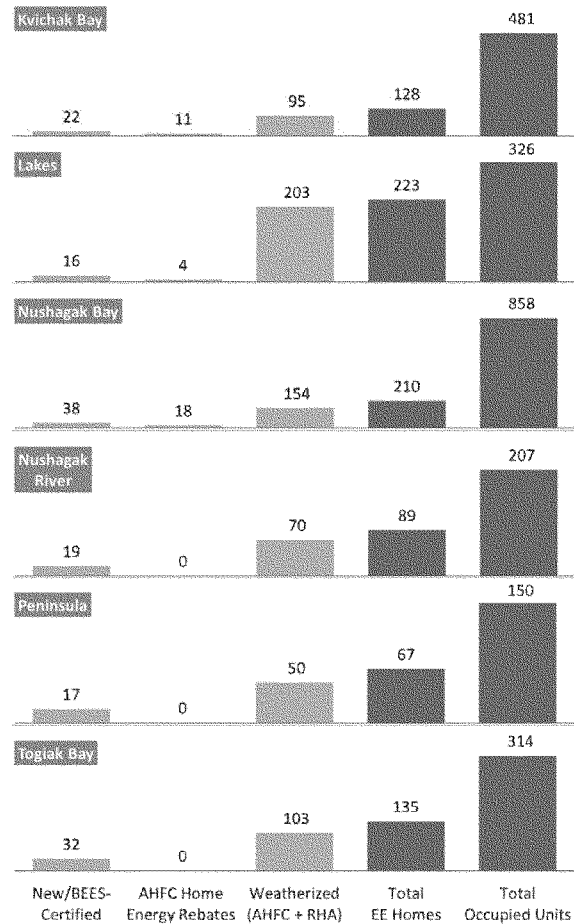
Collectively, Bristol Bay residents are saving almost \$1.3 million per year from residential energy-efficiency upgrades already completed. If all remaining older homes were upgraded, an additional \$2.3 million in annual fuel savings could be captured (Table 16).

Table 16: Average EE&C savings per household in the Bristol Bay region

Program	Program Details	Annual Energy Savings	Energy Savings Percent	Annual Fuel Savings	Annual Savings
Home Energy Rebate	33 rebates + 5 in process out of 99 audits (25% completion rate)	60.8 MMBtu	27%	437 gallons	\$1,946 per year
Weatherization ²	575 homes	43.4 MMBtu	29%	311 gallons	\$1,401 per year

Note: 1/ Assumes all heating is done with fuel oil. It does not include savings in diesel fuel from reductions in electrical generation. 2/ Includes AHFC weatherization projects plus homes weatherized by BBHA with other funding. Average annual savings is based on AHFC weatherization data only. Data source: (11)

Figure 19: Energy Efficient Housing Stock



Data sources: (11) (10) (12)

On a regional basis, residential energy efficiency (EE) measures account for over 28,000 MMBTU (1 MMBTU = 1 million British Thermal Units) annually in energy savings, over 200,000 gallons of heating fuel per year and \$1.28 million in avoided fuel costs for the region (Table 17). If the remaining energy inefficient housing stock is upgraded (or in some cases rebuilt), the savings from residential EE&C could save another 55,000 MMBTU per year. This

would save another 394,000 gallons of heating oil and nearly \$2.3 million more in avoided fuel costs annually. This does not include savings from lighting or appliance upgrades or other measures that reduce electrical use (or the diesel used to generate electricity).

Table 17: Estimated energy savings and potential energy savings from residential EE&C

Subregion	EE&C Savings Achieved			EE&C Savings Opportunity			
	Annual Energy Savings (MMBTU)	Annual Diesel Savings (Gallons)	Annual Fuel Cost Savings (\$)	Remaining Residential EE&C Opportunity	Annual Energy Savings (MMBTU)	Annual Diesel Savings (Gallons)	Annual Fuel Cost Savings (\$)
Kvichak Bay	3,967	\$ 28,484	\$168,750	74%	12,764	91,646	\$536,949
Lakes	7,838	\$ 56,278	\$375,428	33%	3,533	25,369	\$75,070
Nushagak Bay	6,780	\$ 48,679	\$286,256	76%	22,508	161,609	\$950,990
Nushagak R.	3,038	\$ 21,813	\$147,673	59%	4,937	35,447	\$227,422
Peninsula	2,127	\$ 15,269	\$85,260	57%	3,531	25,352	\$125,617
Togiak Bay	4,470	\$ 32,096	\$215,368	57%	7,639	54,848	\$363,636
Bristol Bay	28,220	\$ 202,620	\$1,278,735	64%	54,912	394,271	\$2,279,685

Notes: Assumes all non-BEES-certified, income-eligible homes are weatherized and remaining owner-occupied homes participate in Home Energy Rebate program. Assumes average energy savings for region based on 2008-14 ARIS data. Assumes retail heating fuel costs for communities as of August 2014.

Public and Commercial Facilities

NON-RESIDENTIAL BUILDING AUDITS

The savings from energy efficiency and conservation changes in non-residential buildings is also large, though harder to quantify. Public and commercial building owners can typically save 20 percent on energy costs by performing both behavioral changes (like setting back thermostats) and efficiency upgrades identified in energy audits (Table 18).

Table 18: Savings potential for public and commercial facilities

Energy Efficiency Measures	Energy Efficiency Measures	Energy Efficiency Measures
10-15% Savings	15-25% Savings	25-35% Savings

Data source: (13)

COMMUNITY ENERGY EFFICIENCY PROGRAMS

Since 2005, a sequence of state and federal programs have funded community-scale, energy efficiency improvements in public facilities in rural Alaska, including indoor lighting retrofits, LED street lighting, heating system upgrades, insulation and sealing, and installation of programmable thermostats and other energy saving building controls.

Table 19: Participation by Community in Energy Audit Programs since 2008

Community	Community EE/Clean	EE Lighting Upgrades	Other Building EE Audits and Upgrades	Water and Sewer System EE		
Grouped by Subregion	VEEP / EECBS / VUEEP#	LED Street lighting	School EE Audit ¹	Health Clinic EE	Sanitation EE Audit	Sanitation EE Retrofits ²
Kivikuk Bay						
Egegik	X		A			
King Salmon						
Natnek	X	P				
Pilot Point	X	A				
Port Henderson	X					
South Naknek	X			A	A	
Lakes						
Igiugig					A	
Iliamna						
Kokhanok	X					
Levelock	X	P				
Newhalen	X	X	A			
Nondalton	X	P	A		A	P
Pedro Bay	X					
Port Alsworth						
			A			
Nashikuk Bay						
Alakanuk	X		A			
Clark's Point	X	A				
Dillingham	X					
Elkadek	X		A		A	
Kuligarnuk	X	P	A		A	
New Stuyahok	X	P			A	
Peninsula						
Chignik Bay	X					
Chignik Lagoon		X				
Chignik Lake	X	X	A			
Perryville	X		A			
Togiak Bay						
Manokotuk	X	A	A		A	
Togiak	X	P	A			
Twin Hills	X		A		A	P
Region	20	12	12	1	2	2

Notes: X=Completed, A=Audit, P=Planned or in Progress. 1/ ANTHC study funded building audits. Additional funding or local investment may be needed to finance recommended improvements. 2/ VEEP improvements in Manokotak included community-wide lighting upgrades. 3/Water and Sewer audits and work performed and reported by ANTHC. Data sources: (14) (15) (16)

Communities, tribes and boroughs in the Bristol Bay region have taken significant action on energy efficiency audits and upgrades using the community-scale programs. As of early 2015, at least 22 Bristol Bay communities had participated in the popular EECBG and VEEP programs (Table 19).

ENERGY EFFICIENT LIGHTING UPGRADES

Many communities in the region completed interior or exterior lighting retrofits on multiple community buildings as part of VEEP and EECBG-funded projects. They are saving an average of \$1,650 and 3,100 kWh per building per year, based on data from seven Bristol Bay communities. Lighting upgrades generally have shorter payback periods than other building efficiency measures making them smart investments even without the incentive of grant funding (15). While a majority of Bristol Bay communities have participated in the EECBG and VEEP programs there is still savings opportunity for more lighting retrofits in the region—both for communities that have not participated in the programs as well as communities in which only schools or only city- or tribal-owned buildings received lighting retrofits.

Table 20: Savings from Energy Efficient Lighting Upgrades in 7 Bristol Bay communities

	One-time Investment	Annual Savings	Annual Electricity Saved (kWh)	Average Simple Payback Period
Average per community	\$19,652	\$9,187	17,289	
Average per Building	\$3,527	\$1,649	3,103	2.1 years
Total	\$137,561	\$64,309	121,026	

Data source: Based on lighting upgrades completed with VEEP and EECBG grants through 2013 in Aleknagik, Chignik, Clark's Point, Egegik, Manokotak, Newhalen, and Togiak (15).

Table 21: Savings from energy efficient lighting upgrades in 33 small communities

	One-time Investment	Annual Savings	Annual Electricity Saved (kWh)	Average Simple Payback Period
Average per Community	\$26,414	\$7,359	17,249	
Average per Building	\$4,737	\$1,320	3,094	3.6 years
Total	\$871,664	\$242,840	569,219	

Data source: Based on VEEP and EECBG-funded lighting upgrades completed through 2013 (15).

LED STREET LIGHTING

Rural Alaska communities that have replaced street lights with LEDs are saving an average of \$10,000 per year, with an average payback period of 3.7 years. In the Bristol Bay region, six communities reported during outreach visits or interviews having completed full LED retrofits, and another four reported partial retrofits that will continue as old lights burnout. The data presented in Table 22 is based on two communities for which data was available.

Table 22: Savings from LED street lighting retrofits in 2 Bristol Bay communities

	One-time Investment	Annual Savings	Annual Electricity Saved (kWh)	Average Simple Payback Period
Average per Community	\$14,440	\$4,579	8,326	
Total	\$28,880	\$9,159	16,652	3.2 years

Data source: Based on VEEP and EECBG-funded lighting upgrades completed through 2013 in Clark's Point and Manokotak (15).

SCHOOL AND OTHER BUILDING AUDITS

Many of the region's schools, clinics, and some other community buildings been audited through AHFC's commercial energy audit program or with other funding. Because these programs typically pay for audits but, unlike VEEP or residential EE programs, do not pay for retrofits, many of the potential savings identified in audits have not been achieved and there is not good information on which EE upgrades have been done.

The Lake and Peninsula Borough approved a school package in 2013, designating that 10% of a \$20 million bond be used for energy efficiency upgrades in Lake and Peninsula School District (LPSD) schools. Working with Siemens, Inc., LPSD applied for and received the VEEP grant for lighting and window upgrades in two of the LPSD's eleven schools in Perryville and Egegik. Siemens conducted investment grade energy audits on all eleven schools and in spring 2014 began work on LED lighting and control replacements in eleven schools and building automation upgrades in nine schools. The project wrapped up in May 2015. Siemens estimates the costs savings across all schools will total \$165,000 in year 1 with a 12.5 year simple payback and an overall energy savings of 15.6%. With assistance from Siemens, the Lake and Peninsula Borough was able to fund this project through school bonds, state energy grants, and a 70% reimbursement for the cost of the work from the Alaska Dept. of Education and Early Development.

AEA's Commercial Building Energy Audit (CBEA) program funds whole-building energy audits for privately-owned buildings up to a limit based upon the size and type of building. Results from participants indicate average energy savings of roughly one-third as a result of energy efficiency investments. Most commercial building audits are done in urban areas of Alaska, data on participation by Bristol Bay communities was not found.

WATER AND SEWER

Alaska Native Tribal Health Consortium (ANTHC) has performed energy audits of sanitation systems in eight rural communities in the Bristol Bay region. Sanitation systems are one of the single largest energy users in rural communities, accounting for 10 to 35 percent of a community's energy use. ANTHC estimates that for every one dollar spent on energy retrofits of rural sanitation facilities (including the cost of audits) there will be a 50 cent return each year to communities plus a 50 cent annual return to the State's operating budget through lower PCE payments (17). Table 23 shows estimated cost savings from EE upgrades based on analysis of over 50 rural communities in the Interior, Southwest, and Western Alaska. To date, no sanitation system retrofits have been completed in the region and two are in progress or planned (Table 19).

Table 23: Potential savings from sanitation system EE&C based on statewide audits

Number of communities audited	Estimated potential energy savings (\$/year)	Estimated potential energy savings (Btu/year)	Estimated potential energy savings (kWh/year)	Estimated potential energy savings (PCE/year)	Estimated potential energy savings (PCE/year)
51	\$107,214	22,010	1,663	\$25,404	4.2

Data source: (18)

3 | RESOURCE POTENTIAL

Table 24: Energy resource potential and certainty for new, community-scale projects

	Egegik	King Salmon	Naknek	Pilot Point	Port Heiden	South Naknek	Igiugig	Iliamna	Kokhanok	Levelock	Newhalen	Nondalton	Pedro Bay	Port Alsworth	Chignik	Chignik Lagoon	Chignik Lake	Perryville
Biomass	L	L	L	L	L	L	H	H	H	L	H	H	H	L	L	L	L	L
Geothermal	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Hydro	L	L	L	L	M	L	L	H	M	L	H	H	M	M	H	H	M	M
Solar																		
Wind	L	M	M	M	L	M	L	M	H	L	M	M	L	L	L	L	L	M
Coal	M	L	L	M	M	L	L	L	L	L	L	L	L	L	M	M	M	M
Oil & Gas	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Heat Recovery	L	L	H	H	H	L	L	H	H	M	H	H	L	H	L	L	H	H
Energy Efficiency	H	H	H	H	H	H	M	H	M	H	H	M	M	H	H	H	H	M
Kvichak Bay						Lakes						Peninsula						

	Aleknagik	Clark's Point	Dillingham	Elkwok	Koliganek	New Stuyahok	Manokotak	Togiak	Twin Hills
Biomass	L	H	M	H	H	H	L	L	L
Geothermal	L	L	L	L	L	L	L	L	L
Hydro	L	L	L	L	L	L	L	L	L
Solar									
Wind	M	L	M	L	M	M	M	M	L
Coal	L	L	L	L	L	L	L	L	L
Oil & Gas	L	L	L	L	L	L	L	L	L
Heat Recovery	L	L	H	L	H	L	L	L	L
Energy Efficiency	H	H	H	H	H	M	M	H	H
Nush. Bay			Nush. River			Togiak Bay			

Color Key

Potential →

High	H _{Low}	H _{Med}	H _{High}
Med	M _{Low}	M _{Med}	M _{High}
Low	L _{Low}	L _{Med}	L _{High}
	Low	Med	High

← Certainty

The first letter in each square represents resource potential. The subscript indicates the level of certainty in the resource potential rating.

Phase I of the Regional Energy Planning process included an inventory of all potential energy resources in the Bristol Bay region. In Phase II, a preliminary assessment of resource potential was performed. The goal was to develop a consistent set of criteria for rating resource potential that could be applied across communities and regions. This assessment looks at the resource potential for producing energy savings from *new, community-scale* project development given the best available information (i.e. projects that are already in operation or under development are

not counted towards the resource's potential to generate additional savings in a community). These *Potential* ratings of Low (L), Medium (M), or High (H) are accompanied by a *Certainty* rating (also L, M, H) which indicates the amount of feasibility work that has been done or the availability of other information. Low certainty generally signifies that no reconnaissance or other resource assessment has been performed. See Appendix E for a detailed description of the criteria used in the analysis.

4 | PUBLIC OUTREACH

OUTREACH ACTIVITIES

Public outreach and stakeholder engagement are major components of the second phase of AEA's regional energy planning process. In the Bristol Bay region, these goals were met through a variety of activities:

- Bristol Bay Regional Energy Summit (2015)
- Subregional Energy Meetings (2015)
- Community and Utility Interviews (2015)
- Bristol Bay Industry Survey (2015)
- Breakout Sessions at SWAMC Annual Meetings (2014, 2015)
- Energy Session at Bristol Bay Village Leadership Workshop (2013)
- Project Website: www.bristolbayenergy.org (2012-2015)

The input received through these outreach activities have been incorporated throughout this report and included in the Community and Energy Profiles, which start on Page 61.

Bristol Bay Regional Energy Summit | May 2015

An Energy Summit on May 4, 2015 in Dillingham was the capstone event for Phase II of the regional energy planning process. Over 40 representatives from across the region attended, along with regional and statewide organizations. Most communities were represented. See Appendix B for a list of participants. Summit topics were tailored to the needs and issues raised during subregional energy meetings held in March. Presentations were provided by AEA's technical staff, ANTHC, Bristol Bay Development Fund, Bristol Bay Housing Authority, Lake and Peninsula School District, Marsh Creek, Siemens, Inc, and by community and regional representatives.

A roundtable discussion with regional organizations explored current projects, services, and ideas for regional energy solutions. Topics covered electric utilities, governance, health care, and water and sewer. The summit ended with two interactive sessions. The first focused on identifying a regionwide energy vision. The group did not reach consensus on a final vision statement, but provided several areas which they would like to see addressed in future energy meetings. The second session used audience polling technology to rank regional energy strategies and assess overall interest in the structure and make-up of future energy planning committee(s) in the Bristol Bay region. Polling results appear in Appendix D.

Subregional Energy Meetings | March 2015

In March 2015, members of the planning team held meetings in Chignik Lagoon, Dillingham, Iliamna, and King Salmon to discuss energy projects and priorities. The meetings were scheduled in consultation with communities, and three representatives from every community in the region

were invited to attend the closest meeting to their community. Travel arrangements were provided for those who needed it. The agenda included presentations on the Phase I Resource Inventory and on community and technical resources from AEA. Roundtable discussions explored community/utility energy issues and goals. Representatives were also asked to review and update the draft Community and Energy Profiles. See Appendix B for a list of participants.

Table 25: Subregional energy meetings

Dates	Subregional Meetings	Community
March 23	Iliamna	Iliamna, Kokhanok, Newhalen, Nondalton, Port Alsworth, Pedro Bay
March 24	Chignik Lagoon	Chignik, Chignik Lagoon, Chignik Lake, Perryville, Pilot Point, Port Heiden
March 25	King Salmon	Egegik, Igiugig, King Salmon, Levelock, Naknek, South Naknek, Ugashik
March 26	Dillingham	Aleknagik, Clark's Point, Dillingham, Ekuk, Ekwok, Koliganek, Manokotak, New Stuyahok, Togiak, Twin Hills

Community and Utility Interviews | Jan – Feb 2015

The community-level outreach for the Phase II planning effort included telephone interviews with community and utility representatives from each Bristol Bay community in January and February 2015. The purpose of the interviews was to review the draft Community and Energy Profiles.

Bristol Bay Industry Survey | Feb – May 2015

Project team members designed an online survey requesting information on energy usage, generation sources, expected load changes, and energy efficiency measures related to commercial facilities. Businesses in fish processing, air service, fuel delivery, tourism, and large public service were contacted to complete the survey. The survey tool is presented in Appendix C. Significant outreach in the form of phone calls and emails was conducted. Three businesses completed the survey. Due to the small pool of responses, additional data on energy usage was not collected or analyzed for this report.

Bristol Bay Village Leadership Workshop | Dec 2013

The project team partnered with the Bristol Bay Native Corporation to host a half-day workshop in Anchorage in conjunction with the regional corporation's Village Leadership Workshop on December 5, 2013. The agenda included presentations on energy resources and opportunities in the Bristol Bay region and energy project financing options. Audience polling was used to engage participants and gather input on energy priorities and policy options. Participants in the annual workshop typically include about 200 village corporation officers and directors and village/city council officers and members. See polling results in Appendix D.

5 | ENERGY PRIORITIES AND NEEDS

In addition to providing a comprehensive list of energy projects and initiatives in the region, the subregional meetings and stakeholder interviews in Phase II enabled planners to identify additional priorities and needs that are not currently part of an active project. The timeframes shown in Table 26 indicate a best guess for project timing given available resources, technology readiness, community/utility interest, and competing priorities.

- Short range: expected to start within 1-5 years
- Medium range: expected to occur between 5-10 years
- Long range: expected to occur beyond 10 years

Table 26: Community energy priorities & needs identified by Bristol Bay regional stakeholders

Community/Utility	Subregion	Timeframe	Notes
Planning			
Egegik	Ketchikan Bay	Ongoing	Anticipate and plan for impacts of efficiency in very small communities. A lot of villages are getting smaller – if people get too efficient, it gets harder to get fuel delivered.
Holmerik	Ketchikan Bay	Ongoing	Net metering, integrating renewable energy production with the grid
Igiugig	Lakes	Ongoing	Planning for efficiency – the more efficient individuals get, the less efficient the power plant gets.
Levelock	Lakes	Ongoing	Plan for erosion affecting river front and infrastructure
Aleknagik	Nushagak Bay	Ongoing	Need a planner to facilitate & administer plans in prepared for the future. Update 2013 strategic plan – do not have an energy component currently
Dillingham	Nushagak Bay	Ongoing	Explore the feasibility of developing renewable sources of energy including wind, hydro, geothermal, biomass, tidal, and solar, and of developing non-fossil sources of energy including peat and natural gas. Work with Nushagak Cooperative, Chignikung and other entities to develop feasibility assessments and a capital plan for developing new energy sources to supplement or replace existing infrastructure
Utility Infrastructure/Programs			
Port Heiden, Port Point	Ketchikan Bay	Short	Strong potential to add more community facilities to the PCE program
Port Point	Ketchikan Bay	Short	Initial meter focus on homes; no back-up power at present
Igiugig	Lakes	Short	Generator training – funding for AVTEC or regional training
Kokhanok, Levelock, Pedro Bay, Port Alsworth	Lakes	Short	Strong potential to add more community facilities to the PCE program
Kokhanok, Levelock, Pedro Bay, Port Alsworth	Lakes	Short	Subregional on-call utility operator, fully trained and able to have full-time work by responding to regular needs and emergencies
Clark's Point, Dillingham, Aleknagik	Nushagak Bay	Short	Strong potential to add more community facilities to the PCE program
Ekwok, Koliganek, New Stuyahok	Nushagak River	Short	Strong potential to add more community facilities to the PCE program

Community/Village	Location	Time Frame	Notes
Chignik Lagoon, Chignik Lake, Portville	Peninsula	Short	Strong potential to add more community facilities to the PCI program
Chignik Bay, Chignik Lagoon, Chignik Lake, Portville	Peninsula	Short	Submerged stream – on roll to deal with routine maintenance and emergencies
Manokotak, Togiak, Twin Hills	Togiak Bay	Short	Strong potential to add more community facilities to the PCE program
Energy Infrastructure (Powerhouses, Distribution Lines, Bulk Fuel)			
Bulk Fuel			
Port Heiden	Kvichak Bay	Short	Bulk fuel tanks on edge of eroding area, solution needed ASAP
Igiugig	Lakes	Short	New site for bulk fuel tank farm, current site is eroding into river; new diesel delivery truck
Kokhanok	Lakes	Medium	Need new fuel truck
New Stuyahok	Nushagak River	Short	Additional work on fuel storage and transport planned, but no current funding
Togiak	Togiak Bay	Short	Tank farm upgrade, tanks are old and threatened by erosion since it's near the coast and the seawall. Upgrade wasn't funded in the past due to environmental concerns.
Powerhouse			
Dillingham	Nushagak Bay	Medium	Interest in pilot studies for distributed energy systems; Determine a practical strategy and possible incentives to develop shared energy systems within small subdivisions and commercial campuses.
Chignik Lagoon	Peninsula	Short/Medium	Re-size generators to ensure efficient electricity production; new fuel truck needed
Chignik Lake	Peninsula	Medium	2 new generators needed
Twin Hills	Togiak Bay	Medium	New, low-maintenance generators needed
Heat Recovery			
NEA	Kvichak Bay	Medium	Investigate stack heat recovery, increasing capacity by using same BTU from diesel; Investigate heat absorption for ice production in summer
Levelock	Lakes	Medium	Investigate heat absorption for flash freezing; technology currently used at larger scale but need pilot project for small scale use
Manokotak	Togiak Bay	Medium	Interest in installing heat recovery system
Twin Hills	Togiak Bay	Medium	Interest in installing heat recovery system
Transmission & Distribution			
Egegik, Pilot Point, NEA	Kvichak Bay	Short	Line loss above 6% in all communities, potential for significant savings
Pilot Point	Kvichak Bay	Short	Investigate meters, upgrade distribution lines and transformers
Igiugig, IMAC, Kokhanok, Levelock, Pedro Bay, Port Alsworth	Lakes	Short	Line loss above 6% in all communities, potential for significant savings
IMAC	Lakes	Short	Upgrade distribution infrastructure Nekeham to Khatatkon - replace with armored submarine cable
Kokhanok	Lakes	Medium	Powerline cables need to be replaced
Levelock	Lakes	Medium	Expand distribution system, additional powerlines need for more residents

Community/Utility	Subregion	Timeframe	Priority
Aleknagik	Nushagak Bay	Medium	Funding for substation construction; Consider energy when designing new public facilities. They will require energy which requires transmission lines and potentially more electrical capacity (3 phase).
Ekrook, Koliganek	Nushagak River	Short	Line loss above 10% in both communities, potential for significant savings.
New Starapook & Ekrook	Nushagak River	Short	Interim between Ekrook & New Starapook to establish an economy of scale; connect Ekrook to renewable generation once New Starapook's wind project is operational.
Chignik, Chignik Lake, Perryville	Peninsula	Short	Line loss at high levels up to 22% in Perryville, significant savings are available to all three communities.
Chignik	Peninsula	Short	Transmission lines need attention; requested lineman through AEA, never heard a response.
Chignik Lagoon	Peninsula	Short/Medium	Transmission lines are in poor condition, need look at distribution lines as well; upgrade needed for metering.
Chignik, Chignik Lake, Chignik Lagoon	Peninsula	Medium	Previously studied, interest remains in connecting three communities via intertie to take advantage of renewable power.
Alamodortak, Twin Hills	Toplak Bay	Medium	No other community reported line loss in 2014, significant savings may be available but require complete reporting.
Alamodortak	Toplak Bay	Long	Interest in intertie to Dillingham.
Toplak, Twin Hills	Toplak Bay	Long	Interest in intertie connecting Twin Hills and Toplak.
Energy Efficiency & Conservation			
Naknek	Kvichak Bay	Short	Increase EE of school buildings is top priority, working on a proposal for funding, Additional weatherization.
Pilot Point	Kvichak Bay	Short	More weatherization needed; unsure if best to tear down or weatherize dilapidated homes.
South Naknek	Kvichak Bay	Short	Weatherization and energy efficiency.
Uptaga	Lakes	Short	ANTHC Rural Energy Initiative has been funded to conduct an energy audit for the distribution system, compile and implement recommendations; more weatherization in homes in village.
Umanu	Lakes	Short	New community building that is energy efficient.
New Tolovik	Lakes	Short	Increase energy efficiency by remodeling school and school gym.
Aleknagik	Nushagak Bay	Medium	Increase use of weatherization and EE programs; incorporate EE into facility design.
Dillingham	Nushagak Bay	Short/Medium	Increase education & awareness on EE and building energy use; improve EE of homes, businesses and public buildings, promote energy conservation in heating, electricity, & transportation.
Chignik	Peninsula	Short	New round of weatherization.
Chignik Lagoon	Peninsula	Short	Commercial/Community building weatherization, secure funding.
Chignik Lake	Peninsula	Short	Additional energy efficiency measures in homes & buildings.
Perryville	Peninsula	Short	Weatherization needed in older homes.
Water & Sewer			
Nondalton	Lakes	Short	Water system – half replaced in project with ANTHC but remaining old system has serious leaks (losing up to 70,000 gallons of water per day); need funds to finish water system upgrade.
Aleknagik	Nushagak Bay	Medium	Piped septic system needs upgrade, 27 years old and does not connect to all homes in community.
Koliganek	Nushagak River	Short	Need an upgraded water & sewer system. There are many leaks and there are homes that don't have any water or sewer; water quality is being monitored for 2 nd year.

Community/Utility	Subregion	Timeframe	Priority
New Stuyahok	Nushagak River	Medium	Water/sewer lines need upgrading
Chignik	Peninsula	Short	Water reservoir is falling apart, expected fix in April 2015. Water/sewer leaks: pipes need to be replaced
Chignik Lake	Peninsula	Short/Medium	Water and sanitation system upgrade
Manokotak	Togiak Bay	Medium	Water/Sewer pipes near the end of their useful life
Togiak	Togiak Bay	Medium	Water and sewer lines within township were put in 1974
Local Energy Communities			
Geothermal			
Chignik			
NEA	Kvichak Bay	Medium	Conduct site tests to determine resource potential
Port Heiden	Kvichak Bay	Medium	Continue geothermal project pre-feasibility study, need more temperature monitor wells
Chignik Lagoon	Peninsula	Medium	Investigate geothermal potential and/or ground source heat pumps
Chignik Lake	Peninsula	Medium	Expand buildings to which ground source heating is available
Chignik	Peninsula	Medium	Expand buildings to which ground source heating is available
Port Heiden	Kvichak Bay	Medium	Conduct new study on hydro potential
Chignik Lake	Peninsula	Medium	Explore hydro possibilities
Togiak	Togiak Bay	Medium	Explore options for small hydro
Hydrokinetic			
Igiugig	Lakes	Medium	Monitor hydrokinetic turbine; if successful expand use
Natural Gas			
Chignik, Chignik Lake, Chignik Lagoon	Peninsula	Long	Interest in natural gas drilling in North Aleutian sedimentary basin
Solar			
Igiugig	Lakes	Short	More solar for residences and community buildings
Kokahnok	Lakes	Short	More solar for residences and community buildings
Pedro Bay	Lakes	Short	Expand use of solar thermal
Port Alsworth	Lakes	Short	Add solar arrays to residences and public buildings
Aleknagik	Nushagak Bay	Short	Add solar PV arrays to provide electricity for landfill or laundry facility
Dillingham	Nushagak Bay	Short	Add solar arrays on residential and public buildings
Chignik Lake	Peninsula	Short	Install solar PV arrays on residences and community buildings
Twin Hills	Togiak Bay	Short	Add solar arrays to homes and community buildings
Wind			
South Naknek	Kvichak Bay	Medium	Investigate wind power
Aleknagik	Nushagak Bay	Medium	Interest in installing anemometer to collect wind data, there needs to be a plan in place given the terrain
Chignik Lagoon	Peninsula	Short	Investigate wind power to supplement hydro and reduce diesel use; new sites available due to land clearing for transmission and access road to hydro facility
Chignik Lake	Peninsula	Short	Met tower removed in 2011, interested in exploring wind potential at other sites
Manokotak	Togiak Bay	Short	Community interested in new wind study

Community/Utility	Subregion	Timeframe	Priority
Transportation			
Iliamna, Nondalton	Lakes	Medium	Bridge between Iliamna and Nondalton; Dock/Barge landing & staging area in Iliamna
Levelock	Lakes	Medium	Need new dock, current is being affected by erosion
Pedro Bay	Lakes	Medium	Airport extension to enable larger shipments of fuel
Port Alsworth	Lakes	Medium	Public airstrip would reduce freight/fuel costs
Shook, New Shipashok	Nushagak River	Medium	Port needed between Shook and New Shipashok
Shipashok	River		
Shipashok	Nushagak River	Medium	Low water levels make barging in fuel increasingly difficult, now considering piping in fuel
New Shipashok	Nushagak River	Medium	River used for fuel transport to New Shipashok has low water, it is easier to bring fuel via barge to Shook
Chignik Lagoon	Peninsula	Medium	Airport lighting/runway expansion
Iditarokutuk	Togiak Bay	Medium	Access road to Darlington
Town Hill	Togiak Bay	Medium	Low water on river making it increasingly difficult to barge in fuel. Road past area of bunks and moos at risk of serious deterioration

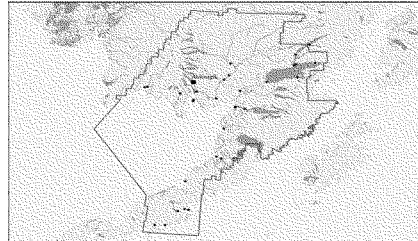
6 | COMMUNITY AND ENERGY PROFILES

This section contains profiles for communities in the Bristol Bay region. The first part contains general information about the location, economy, historical and cultural resources, planning, demographics, contacts and infrastructure in each community. It provides a broad overview of community size, location and resources to give context to the energy profile.

The second part of each profile is the energy profile, which provides an overview of energy production and distribution. It is intended to provide a snapshot of local energy conditions. The energy profile also includes a partial inventory of non-residential buildings in the community and its participation in state and federal energy efficiency programs.

The data sources used to compile the profiles are shown in Appendix F. Though based on the latest available data from state and federal sources, we know that not all information is accurate due to sampling and reporting errors. To try to correct these inaccuracies, we emailed draft versions of the Community and Energy Profile to contacts in each community in April through July 2015 in preparation for subregional energy meetings and follow-up community interviews. The profiles in this report include the revisions we received.

Community Profile: Aleknagik



Alaska Native Name (definition)

Aleknagik

Historical Setting / Cultural Resources

Aleknagik is a traditional Yup'ik Eskimo area, with historical influences from the Seventh-Day Adventists, Russian Orthodox, and Moravians. Fishing and subsistence activities are practiced.

Incorporation 2nd Class City (inc. 1973)

Location

Aleknagik is located at the head of Wood River on the southeast end of Lake Aleknagik, 16 miles northwest of Dillingham.

Longitude -158.6178 Latitude 59.2731

ANCSA Region Bristol Bay Native Corporation

Borough/CA Dillingham Census Area

School District Southwest Region School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

Sales (5%), Bed (9%) N/A

Economy

Subsistence & commercial fishing village. Summer fishing camps. 20 commercial fishing permits. 16 business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	40.3	7	11,751

Natural Hazard Plan Year

No

Notes Future Plan Development

Community Plans Year

Community Plan 2005

Energy Priorities and Projects

Energy efficiency for all buildings from design stage; more weatherization for homes; install anemometer/interest in community wind power; biomass pre-feasibility study; Add solar PV arrays to provide electricity for community buildings; include energy in community planning

Local Contacts

City of Aleknagik cityalekclerk@gmail.com

Native Village of Aleknagik aleknagiktraditional@yahoo.com

Aleknagik Natives Limited

Phone Fax

907-842-5953 907-842-2107

907-842-2080 907-842-2081

907-842-2385 907-842-1662

Demographics 2000 2010 2013

Population 221 219 (228) Percent of Residents Employed 58.1%

Median Age 29 22 Denali Commission Distressed Community No

Avg. Household Size 4 4 Percent Alaska Native/American Indian (2010) 75.8%

Median Household Income N/A \$51,705 Low and Moderate Income (LMI) Percent (2014) 86.6%

Electric Utility Generation Sources Interties PCE?

Nushagak Electric Co-op Diesel Dillingham Yes

Landfill Class 3 Permitted? Yes Location 1.85 miles north of N. shore

Water/Wastewater System Homes Served System Volume

Water Well 14

Sewer Piped, Septic Energy Audit? Yes

Notes Septic system ~27 y/o, upgrades/plant needed

Access

Road No

Air Access Public; Gravel/Dirt/Turf Runway 1,200'x25' 2,030'x60' 1,250'x50'

Dock/Port Yes Barge Access? Yes Ferry Service? No

Notes

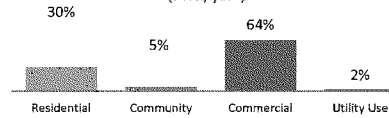
Energy Profile: Aleknagik

Diesel Power System

Utility	Nushagak Electric Cooperative		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	N/A		
Unit 2			
Unit 3			
Unit 4			
Line Loss		4.1%	
Heat Recovery?		No	
Upgrades	Priority	Projects	Status
Powerhouse			
Distribution		Substation	Complete 2015
Outage History/Known Issues			
Receives power from Dillingham. PCE includes both.			
Operators	No. of Operators	Training/Certifications	

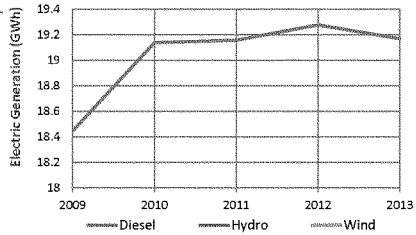
Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	989	5,389,830	5,450
Community	46	898,782	19,539
Commercial	446	11,548,038	25,892
Utility Use		346,200	

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	18,956,000	Avg. Load (kW)	174
Wind (kWh/yr)	0	Peak Load (kW)	387
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	15
Total (kWh/yr)	18,956,000	Diesel Used (gals/yr)	1,253,779



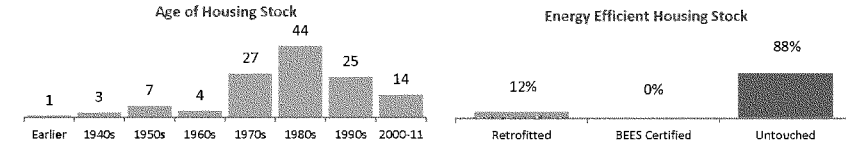
Electric Rates (\$/kWh)

Rate with PCE	\$0.17	Cost per kWh Sold (\$/kWh)	
Residential Rate	\$0.44	Fuel Cost	\$0.24
Commercial Rate		Non-fuel Cost	\$0.19
		Total Cost	\$0.44
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.85	\$6.26	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
Wood (1 cord)			
Pellets			
Discounts?	None		

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low	Dillingham Area Wind/Hydro Assessment	Hydro Not Feasible
Wind Diesel	Medium	Aleknagik feasibility/met tower	Investigating Wind Options
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High	EECBG	Complete
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Moody's Mar.		44,700	
City		11,000	
Miss. Lodge		18,000	
SW Reg. School		10,000	
Bulk Fuel Upgrade	Priority	Project	Status
Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge			
By Air			
Cooperative Purchasing Agreements			
Notes			
Competitive bidding from Dillingham vendors. Barge delivery.			

Energy Profile: Aleknagik

Housing Units	Occupied 65	Vacant 60	% Owner-Occup. 58%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 15.4%		1-star 6.8%	Energy Use	Average Home Energy Rating 3-star
Data Quality	High				Average Square Feet 914
					Avg. EUI (kBtu/sf) 120



Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	Utility	11-12			

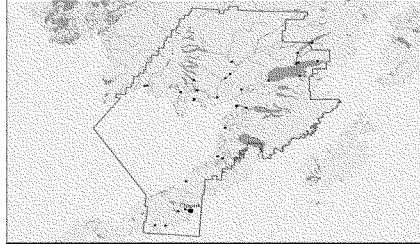
Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
ADF&G Bunk House 1					No
ADF&G Bunk House 2					No
ADF&G Shed					No
Airport Storage	1981	336			No
Aleknagik K-8 School	1982	12,426	Yes		Yes
Chuck Hoyt Seasonal Cabin					No
City Dock					No
City Office		3,315			No
City Office	1982	3,300			No
Clinic	2007	2,562			No
Coho Cove LLC 1					No
Coho Cove LLC 2					No
Community Center	1972	1,730			No
Mark Smith Rental					No
Mission Creek Lodge - Steam Bath					No
Mission Creek Lodge (Employee Housing)					No
Mission Creek Lodge Bldg. 1					No
Mission Creek Lodge Bldg. 2					No
Moody's Marina					No
Moravian Church					No
Municipal North Shore City Hall					No
Municipal North Shore Community Center/Office					No
Municipal North Shore Maint. Bldg.	1982	2,300			No
Municipal South Shore Maint. Bldg.	1982	2,250			No
Municipal Warm Storage Facility	2007	950			No
Orthodox Church					No

Energy Profile: Aleknagik

Non-residential Building Inventory (continued)					
Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
School Garage					No
School House Inn					No
School House Inn B&B					No
School Pumphouse					No
School Storage 1	1958	192			No
School Storage 2	1995	293			No
Silver Finn					No
South Shore City Shop 2		2,251			No
South Shore Office Bldg. 1	1999				No
South Shore Office Bldg. 2	1988				No
Traditional Council Bldg.					No
Wood River Escape (Seasonal)					No
W-T State Park Garage					No
W-T State Park House					No
Yutanna Barge					No

Community Profile: Chignik Bay



Alaska Native Name (definition)

Cirniq ("big wind")

Historical Setting / Cultural Resources

A village called "Kalwak" was originally located here; it was destroyed during the Russian fur boom in the late 1700s. Chignik was established in the late 1800s as a fishing village and cannery. Coal mining occurred from 1899 to 1915. Today, two of the historical canneries are still in operation. The community is presently a mixture of non-Natives and Alutiiq. Subsistence on fish and caribou is important to residents' livelihoods.

Energy Priorities and Projects

Secure funds for design and construction of Indian Creek Hydro; upgrade/repair on distribution system; new round of weatherization; Water reservoir & distribution system need significant repairs; Additional housing needed; street light & airport lighting upgrade to LEDs; new dock construction

Notes	Email	Phone	Fax
City of Chignik		907-749-2280	907-749-2300
Chignik Bay Tribal Council	cbaytc@aol.com	907-749-2445	907-749-2423
Bristol Bay Native Assoc. Inc.		907-842-5257	907-842-5932
Demographics	2000	2010	2013
Population	79	91	Percent of Residents Employed 69.1%
Median Age	37	45.3	Denali Commission Distressed Community No
Avg. Household Size	3	2.22	Percent Alaska Native/American Indian (2010) 59.0%
Median Household Income	N/A	\$97,500	Low and Moderate Income (LMI) Percent (2014) 52.8%
Electric Utility	Generation Sources		Interties PCE?
City of Chignik	Diesel		Yes
Landfill	Class 3	Permitted?	No Location Chignik
Water/Wastewater System	City of Chignik	Homes Served 38	System Volume
Water	Piped	Energy Audit?	
Sewer	Piped		
Notes	Dam for reservoir leaks; needs upgrade		Yes
Access			
Road	No		
Air Access	State owned; gravel		Runway 2600'x60'
Dock/Port	Yes	Barge Access? Yes	Ferry Service? Yes
Notes			

Incorporation 2nd Class City

Location
Located on Anchorage Bay on the south shore of the Alaska Peninsula. It lies 450 miles southwest of Anchorage and 260 miles southwest of Kodiak.

Longitude -158.4022 Latitude 56.2953

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

None

Economy

Fishing is the primary industry. Local government, education/health services, and manufacturing are large employers.

Climate Avg. Temp. 38.4° Climate Zone 7 Heating Deg. Days N/A

Natural Hazard Plan Year

No

Notes Expired

Community Plans Year

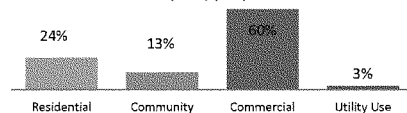
Chignik Bay Community Plan 2006

Energy Profile: Chignik Bay

Diesel Power System

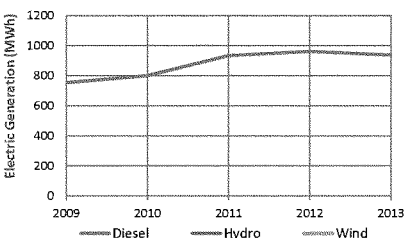
Utility	City of Chignik		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Fair/12,527	230
Unit 2	John Deere	Good/10,934	230
Unit 3	John Deere	Good/6,844	117
Unit 4			
Line Loss	11.1%		
Heat Recovery?	Yes; Not in use		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low	2009 upgrade	Complete
RPSU Distribution	Med.		
Outage History/Known Issues			
High cool. temp., pump fail., batt. explosion. Dist. Cond. damage.			
Operators	No. of Operators	Training/Certifications	
	1	APPO, BFO, PPO, Clerk	

Maintenance Planning (RPSU)	Good		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	65	180,318	2,774
Community	10	97,040	9,704
Commercial	57	453,736	7,960
Utility Use		20,646	

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	845,836	Avg. Load (kW)	62
Wind (kWh/yr)	0	Peak Load (kW)	138
Hydro (kWh/yr)	0	Efficiency (kWh/g)	14
Total (kWh/yr)	845,836	Diesel Used (gals/yr)	62,113



Electric Rates (\$/kWh)	Cost per kWh Sold (\$/kWh)		
Rate with PCE	\$0.21	Fuel Cost	\$0.33
Residential Rate	\$0.55	Non-fuel Cost	\$0.17
Commercial Rate	\$0.55	Total Cost	\$0.50

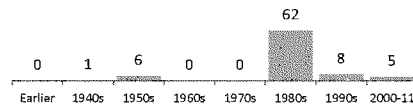
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.90	\$4.19	6-13; 3-15
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$220.24	8-14
Wood (1 cord)			
Pellets			
Discounts?	Seniors do not pay for delivery.		

Alternative Energy	Potential	Projects	Status
Hydroelectric	High	Chignik Hydroelectric Project	Seeking funds for design
Wind Diesel	Low	Met tower found high turbulence	Not pursuing, focus on hydro
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High	EECBG;VEEP	Both Complete
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
City	Heating Oil	96,000	
City	Diesel	32,000	
City (Trident uses)	Diesel	32,000	
Bulk Fuel Upgrade	Priority	Project	Status
Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	2		Delta West.
By Air			via Trident
Cooperative Purchasing Agreements			
No, purchase through Trident which gets better price.			
Notes			
Barge delivery in May & Oct.			

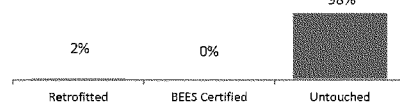
Energy Profile: Chignik Bay

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	44	38	66%	Bristol Bay HA	Bristol Bay HA
Housing Need		Overcrowded	1-star	Energy Use	Average Home Energy Rating
		11.4%	N/A		Average Square Feet
Data Quality	Low				Avg. EUI (kBtu/sf)
				N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock



Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	City				

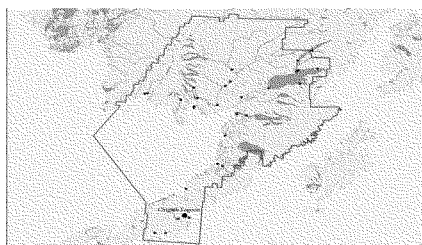
Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Adult Entertainment Bar					No
Beauty & Barber Shop					No
Boiler Building		480			No
Chignik Bay School	1995	30,000			No
City Office		4,189			No
City Shop		3,500			No
Clinic					No
Community College					No
Community Hall		2,301			No
Community. Maint. Shop					No
Cultural Center					No
Daycare					No
EMS Bldg					No
Firehall and Emergency Shelter		1,102			No
Grocery Store					No
New Fire Dept.					No
New Gym	1993	5,100			No
New Teen Center					No
Old Generator Bldg		520			No
Old Water Pumphouse		120			No
Post Office					No
Public Safety Bldg					No
Regional High school				Yes; Lights	No
School Powerhouse	1988	1,746			No
School Powerhouse					No
Senior Center					No
Small Boat Motor Service					No
Sporting Goods & Tackle Shop					No
Subregional Clinic	2009	4,456			No
Swimming Pool					No
Teacher Housing Tri-Plex		4,384			No
Tribal Council Office		1,591			No

Energy Profile: Chignik Bay

Non-residential Building Inventory (continued)					
Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
VPSO Office		1,141			No
Washeteria					No
Water Treatment Plant		600			No

Community Profile: Chignik Lagoon



Alaska Native Name (definition)

Nanwarnaq

Historical Setting / Cultural Resources

Chignik Lagoon took its name from its location and proximity to Chignik. The people of this area have always been sea-dependent, living on otter, sea lion, porpoise, and whale. During the Russian fur boom from 1767 to 1783, the sea otter population was decimated. Chignik Lagoon has developed as a fishing village, experiencing an influx of fishermen in the summer. The population swells by 200 during fishing season.

Energy Priorities and Projects

Monitor & maintain Packer's Creek Hydro; Heat Recovery- electric boilers with excess hydro; Investigate wind power (alternative sites for met tower); Re-size powerhouse, smaller more efficient generator(s); Examine distribution/ transmission lines in poor condition; geothermal/ground source heat pumps; Weatherization on community buildings; additional housing; airport lighting/runway extension

Local Contacts		Email	Phone	Fax
Chignik Lagoon Native Corp.			907-840-2225	907-840-2270
Native Village of Chignik Lagoon			907-840-2206	
Bristol Bay Native Assoc. Inc.			907-842-5257	907-842-5932
Demographics	2000	2010		2013
Population	103	78	Percent of Residents Employed	37.1%
Median Age	27	36	Denali Commission Distressed Community	Yes
Avg. Household Size	4	2.69	Percent Alaska Native/American Indian (2010)	66.7%
Median Household Income	N/A	\$138,542	Low and Moderate Income (LMI) Percent (2014)	N/A
Electric Utility	Generation Sources		Interties	
Chignik Lagoon Power Utility	Diesel		PCE?	
Landfill	Class	3	Permitted?	Yes
			Yes	Location
				Chignik Lagoon
Water/Wastewater System	Native Village of Chignik Lagoon		Homes Served	System Volume
Water	Piped		28	50,001-100,000
Sewer	Piped		Energy Audit?	gallons/day
Notes	Two operators, one more in training		No	
Access				
Road	No			
Air Access	State owned; gravel-dirt		Runway	1810'x60'
Dock/Port	Yes		Barge Access?	Yes
			Ferry Service?	No
Notes	Dock is makeshift, mostly used for personal boats.			

Incorporation	Unincorporated		
Location			
Located on the south shore of the Alaska Peninsula, 450 miles southwest of Anchorage. It lies 180 air miles south of King Salmon, 8.5 miles west of Chignik, and 16 miles east of Chignik Lake.			
Longitude	-158.5314	Latitude	56.31
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Lake and Peninsula Borough		
School District	Lake and Peninsula Borough School District		
AEA Region	Bristol Bay		

Taxes	Type (rate)	Per-Capita Revenue
None		

Economy

Local government, education/health services, and information are the only forms of employment. There are 22 fishing permits and 11 business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	

Natural Hazard Plan	Year
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Notes

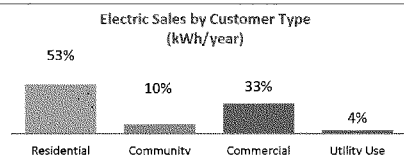
Community Plans	Year
Community Plan	2004
Chignik Lagoon Alt. Energy Action Plan	2010

Energy Profile: Chignik Lagoon

Diesel Power System

Chignik Lagoon Power Utility			
Utility	Make/Model	Condition/Hrs	Gen Capacity
Engine			
Unit 1	John Deere	Fair/33,435	148
Unit 2	John Deere	Fair/69,442	160
Unit 3	John Deere	Fair/18,279	145
Unit 4			
Line Loss		0.8%	
Heat Recovery?		Yes; School	
Upgrades	Priority	Projects	Status
RPSU Powerhouse	High		
RPSU Distribution	Med.		
Outage History/Known Issues			
Outages due to iced fuel lines, 1 engine replaced in 2014.			
Operators	No. of Operators	Training/Certifications	
	3	BFO, PPO, Clerk	

Maintenance Planning (RPSU)		Unacceptable	
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	49	224,901	4,590
Community	6	42,974	7,162
Commercial	6	138,196	23,033
Utility Use		14,887	

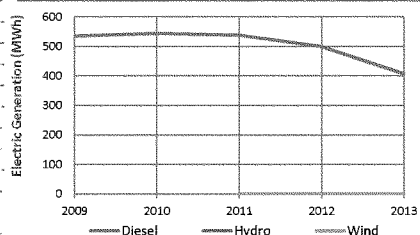


Alternative Energy	Potential	Projects	Status
Hydroelectric	High	Packers Creek Hydro Project - 167 kW	Operational in March 2015
Wind Diesel	Low	Feasibility	Not feasible; exploring alt. sites
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Medium		
Emerging Tech	Not Rated		
Heat Recovery	High	HR on diesel gensets to school; Electric boilers	Operational; In progress(hydro)
Energy Efficiency	High		

Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Village	Heating Oil	35,824	Good
Village	Gasoline	17,587	Good
Village	Diesel	22,327	Good
Bulk Fuel Upgrade	Priority	Project	Status
Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	2		Crowley
By Air			
Cooperative Purchasing Agreements			
No			
Notes			
School has own tank farm, serves generators.			

Power Production

Diesel (kWh/yr)	424,463	Avg. Load (kW)	57
Wind (kWh/yr)	0	Peak Load (kW)	128
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	11
Total (kWh/yr)	424,463	Diesel Used (gals/yr)	39,284

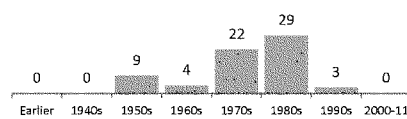


Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.26	Fuel Cost	\$0.44
Residential Rate	\$0.63	Non-fuel Cost	NR
Commercial Rate	Varies	Total Cost	\$0.44
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.50	\$4.85	6-13, 3-15
Other Fuel? (1 gal)			
Gasoline (1 gal)		\$5.00	3-15
Propane (100#)			
Wood (1 cord)			
Pellets			
Discounts?	No delivery charge for Seniors.		

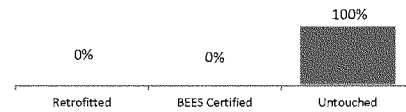
Energy Profile: Chignik Lagoon

Housing Units	Occupied 31	Vacant 36	% Owner-Occup. 68%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	N/A		N/A		Average Square Feet
Data Quality	Low				Avg. EUI (kBtu/sf)
				N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock

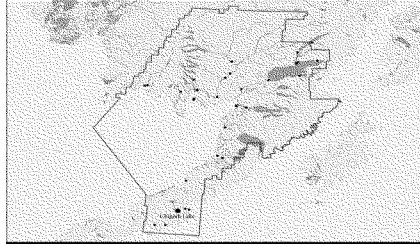


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	CL Utility	19/HPS	yes		Replaced with 14 LEDs

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
ACS Phone Co.					No
Chignik Bible Church					No
Chignik Lagoon School	1988	12,878			No
Church					No
Clinic	1985	1,302			No
Fire & Heavy Equip. Storage					No
Fire Equip. Bldg					No
GCI Phone Co.					No
Incinerator					No
IRA Office					No
New Post Office					No
New Water Pumphouse					No
Old Tank Farm					No
Old Village Post Office					No
Pumphouse					No
School Generator Building	1987	384			No
School Powerhouse	1987	240			No
Store					No
Subsistence Bldg					No
Teacher Housing					No
Village Council Office					No
Village Generator					No
Village Water Source					No
Youth Center					No

Community Profile: Chignik Lake



Alaska Native Name (definition)

Igyaraq

Historical Setting / Cultural Resources

The present population traces its roots from the Alutiiq near Ilnik and the old village of Kanatag near Becharof Lake. The community was the winter residence of a single family in 1903. Other families moved from surrounding communities in the early 1950s when a school was built. Chignik Lake is a predominantly Alutiiq fishing village.

Energy Priorities and Projects

Energy efficiency measures, determine alternative sites for wind study; Explore intertie opportunities with Chignik or Chignik Lagoon; 2 new generators; Water and sanitation system upgrade; Install solar PV arrays on residences and community buildings

Historical Setting / Cultural Resource Email			Phone		Fax	
Chignik Lake Village	chigniklakecouncil@gmail.com		907-845-2212		907-845-2217	
Chignik River Limited			907-845-2212		907-845-2217	
Bristol Bay Native Assoc. Inc.			907-842-5257		907-842-5932	
Demographics	2000	2010			2013	
Population	145	73	Percent of Residents Employed		60.0%	
Median Age	21	32.5	Denali Commission Distressed Community		No	
Avg. Household Size	4	2.7	Percent Alaska Native/American Indian (2010)		93.3%	
Median Household Income	N/A	\$66,667	Low and Moderate Income (LMI) Percent (2014)		N/A	
Electric Utility			Generation Sources		Interties	
Chignik Lake Electric Utility, Inc.			Diesel		PCE?	
Landfill	Class	3	Permitted?	No	Location	Chignik Lake
Water/Wastewater System	Lake and Peninsula Borough		Homes Served		System Volume	
Water	Piped		26			
Sewer	Piped		Energy Audit?			
Notes			Yes			
Access						
Road	No					
Air Access	State owned; gravel		Runway	2800'x60'		
Dock/Port	No		Barge Access?	No	Ferry Service?	No
Notes						

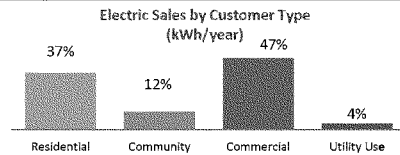
Incorporation	Unincorporated		
Location			
Located on the south side of the Alaska Peninsula next to the body of water of the same name. It lies 13 miles from Chignik, 265 miles southwest of Kodiak, and 474 miles southwest of Anchorage.			
Longitude	-158.2554	Latitude	56.2554
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Lake and Peninsula Borough		
School District	Lake and Peninsula Borough School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
None			
Economy			
Local government, education/health services, and construction are main employers. There are 4 fishing permits and 2 business licenses.			
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	9,612
Natural Hazard Plan			Year
Notes			
Community Plans			Year

Energy Profile: Chignik Lake

Diesel Power System

Chignik Lake Electric Utility			
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Poor/10,635	147
Unit 2	John Deere	Poor/3,085	125
Unit 3	John Deere	Poor/22,682	90
Unit 4	John Deere	Fair/22,959	80
Line Loss		9.6%	
Heat Recovery?		Yes; School	
Upgrades	Priority	Projects	Status
RPSU Powerhouse	High		
RPSU Distribution	High		
Outage History/Known Issues			
Numerous gen. shutdowns. No PCE data prior to 7-11.			
Operators	No. of Operators	Training/Certifications	
	2	APPO, BFO, PPO, Clerk	

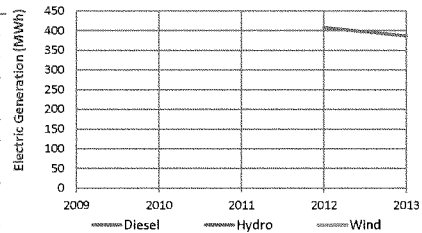
Maintenance Planning (RPSU)			
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	41	130,201	3,176
Community	9	41,035	4,559
Commercial	5	164,075	32,815
Utility Use		13,954	



Alternative Energy	Potential	Projects	Status
Hydroelectric	Medium		
Wind	Low	Met tower/Feasibility in 2011	Not feasible; exploring alt. sites
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Medium		
Emerging Tech	Not Rated		
Heat Recovery	High	HR to School	In progress
Energy Efficiency	High	Street light upgrade	Complete
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Tribe	Heating Oil	56,000	Fair
Tribe	Gasoline	15,000	Fair
Bulk Fuel Upgrade			
Priority	Project	Status	

Power Production

Diesel (kWh/yr)	386,321	Avg. Load (kW)	29
Wind (kWh/yr)	0	Peak Load (kW)	65
Hydro (kWh/yr)		D Efficiency (kWh/gal)	10
Total (kWh/yr)	386,321	Diesel Used (gals/yr)	37,232

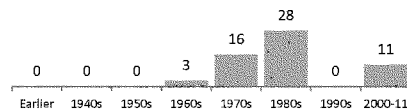


Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.33	Fuel Cost	\$0.57
Residential Rate	\$0.85	Non-fuel Cost	\$0.18
Commercial Rate		Total Cost	\$0.75
Fuel Prices (\$)		Utility/Wholesale	Retail
Diesel (1 gal)	\$4.95	\$6.01	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$220.24	8-14
Wood (1 cord)			
Pellets			
Discounts?		Free delivery for Elders.	

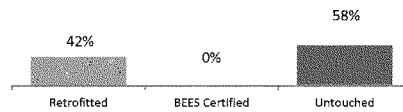
Energy Profile: Chignik Lake

Housing Units	Occupied 36	Vacant 22	% Owner-Occup. 58%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 11.1%		1-star N/A	Energy Use	Average Home Energy Rating
Data Quality	Medium				Average Square Feet
					Avg. EUI (kBtu/sf)
				N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock

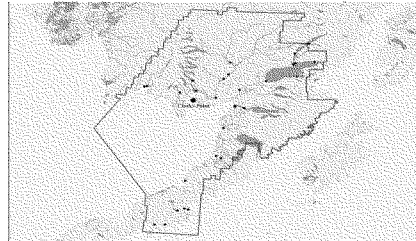


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	Tribe	16	Yes	2014	Switched to LEDs

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Bed & Breakfast					No
Boat Storage Area					No
Chignik Lake Clinic	2007	2,583			No
Chignik Lake K-12	1984	19,030	Yes		Yes
Church	1985	1,920			No
Code Red Bldg.					No
Community Bldg.					No
DOT Grader Storage					No
Equipment Storage	1964	800			No
Hotel					No
IGAP Building	1980	1,200			No
Metal Shop	1988	2,500			No
Office					No
Post Office, Store, & Dwelling					No
Power Plant/Water Laundry					No
Pump House	1980	12,000			No
Russian Orthodox Church					No
School Generator Building	1985	800			No
School Shop	1984	1,440			No
State of AK Storage Building	1993	1,104			No
Store					No
Sub Building	1998	2,500			No
Subsistence Bldg./Teen Center					No
Teacher Housing					No
Washeteria					No

Community Profile: Clark's Point



Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

The community was named for John Clark, who was the manager of the Alaska Commercial Company store at Nushagak. In 1929, a major flood occurred. The village has been plagued by severe erosion. A housing project in 1982 was constructed on high and safe ground on the bluff. The community was founded on fishing operations of non-Native settlers, although presently it is predominantly Yup'ik Eskimo. The population increases by about 300 in summer months due to the commercial fishery.

Energy Priorities and Projects

Work with AEA on integration of small wind turbines to utility grid; Investigate hydro and/or solar for more renewable power generation

Incorporation 2nd Class (inc. 1971)

Location

Clark's Point is located on a spit on the northeastern shore of Nushagak Bay, 15 miles from Dillingham and 337 miles southwest of Anchorage.

Longitude -158.5508 Latitude 58.8442

ANCSA Region Bristol Bay Native Corporation

Borough/CA Dillingham Census Area

School District N/A

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

Sales (5%) N/A

Economy

Subsistence fishing village. Seasonal fishing camps. 10 commercial fishing permits. 0 business licenses.

Climate Avg. Temp. Climate Zone Heating Deg. Days

N/A 7 N/A

Natural Hazard Plan Year

No

Notes No record

Community Plans Year

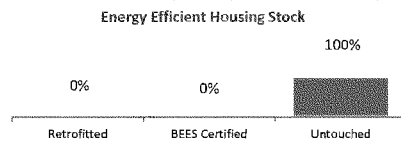
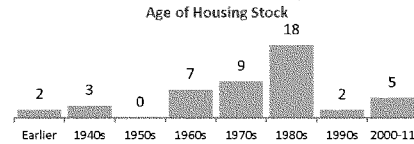
Local Contacts		Email		Phone		Fax	
City of Clark's Point		cityofclarkspoint@gci.net		907-236-1221		907-236-1412	
Bristol Bay Native Corporation				907-278-3602		907-276-3924	
Village of Clark's Point							
Demographics		2000		2010		2013	
Population		75		62		Percent of Residents Employed	
						50%	
Median Age		31		45		Denali Commission Distressed Community	
						Yes	
Avg. Household Size		4		3		Percent Alaska Native/American Indian (2010)	
						88.7	
Median Household Income		N/A		\$31,250		Low and Moderate Income (LMI) Percent (201x)	
						66.7%	
Electric Utility				Generation Sources		Interties	
Clark's Point Electric				Diesel		No	
						PCE?	
						Yes (Inactive)	
Landfill	Class	3	Permitted?	No	Location	Bluff above town.	
Water/Wastewater System		Clark's Point Water System		Homes Served		System Volume	
Water		Piped					
Sewer				Energy Audit?			
Notes				No			
Access							
Road	No						
Air Access	Public; Gravel			Runway	3,200'x60'		
Dock/Port	Yes			Barge Access?	Yes	Ferry Service?	No
Notes							

Energy Profile: Clark's Point

Diesel Power System				Power Production																																	
Utility	City of Clark's Point			Diesel (kWh/yr)	Avg. Load (kW) 53																																
Engine	Make/Model	Condition/Hrs	Gen Capacity	Wind (kWh/yr)	Peak Load (kW) 117																																
Unit 1	Caterpillar	Fair/62,524	113	Hydro (kWh/yr)	Efficiency (kWh/gal)																																
Unit 2	Caterpillar	Fair/25,431	250	Total (kWh/yr)	Diesel Used (gals/yr)																																
Unit 3	Caterpillar	Fair/45,551	113																																		
Unit 4																																					
Line Loss				Electric Generation (MWh)																																	
Heat Recovery? Yes; Users Unknown																																					
Upgrades	Priority	Projects	Status																																		
RPSU Powerhouse	In Progress																																				
RPSU Distribution	In Progress																																				
Outage History/Known Issues																																					
One outage due to blown transformer.																																					
Operators	No. of Operators	Training/Certifications																																			
	2	BFO, Clerk, PPO																																			
Maintenance Planning (RPSU) Acceptable				Electric Rates (\$/kWh)																																	
Electric Sales	No. of Customers	kWh/year	kWh/Customer	Rate with PCE																																	
Residential				Residential Rate																																	
Community				Commercial Rate																																	
Commercial				Fuel Prices (\$)																																	
Utility Use				<table border="1"> <thead> <tr> <th>Fuel Prices (\$)</th> <th>Utility/Wholesale</th> <th>Retail</th> <th>Month/Year</th> </tr> </thead> <tbody> <tr> <td>Diesel (1 gal)</td> <td></td> <td>\$6.00</td> <td>6-13; 8-14</td> </tr> <tr> <td>Other Fuel? (1 gal)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Gasoline (1 gal)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Propane (100#)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Wood (1 cord)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Pellets</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Discounts?</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year	Diesel (1 gal)		\$6.00	6-13; 8-14	Other Fuel? (1 gal)				Gasoline (1 gal)				Propane (100#)				Wood (1 cord)				Pellets				Discounts?			
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year																																		
Diesel (1 gal)		\$6.00	6-13; 8-14																																		
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Propane (100#)																																					
Wood (1 cord)																																					
Pellets																																					
Discounts?																																					
Electric Sales by Customer Type (kWh/year)																																					
Residential	Community	Commercial	Utility Use																																		
Alternative Energy Potential				Projects Status																																	
Hydroelectric	Low																																				
Wind Diesel	Low	7 residential turbines		Installing																																	
Biomass	High																																				
Solar	Pending																																				
Geothermal	Low																																				
Oil and Gas	Low																																				
Coal	Low																																				
Emerging Tech	Not Rated																																				
Heat Recovery	Low																																				
Energy Efficiency	High	1) EECBG 2) Streetlight Replacement		Both Complete																																	
Bulk Fuel				Purchasing Deliveries/Year Gallons/Delivery Vendor(s)																																	
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	By Barge																																	
City	Heating Oil	20,000	Good	By Air																																	
City	Gasoline	16,000	Good	Cooperative Purchasing Agreements																																	
Bulk Fuel Upgrade				Notes																																	
Priority	Project	Status		Delivery by barge.																																	

Energy Profile: Clark's Point

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	20	24	45%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	25.0%		N/A		Average Square Feet
Data Quality	Low				Avg. EUI (kBtu/sf)
				N/A	N/A



Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	City of CP	8/HPS	Yes	2012	Replaced with LEDs

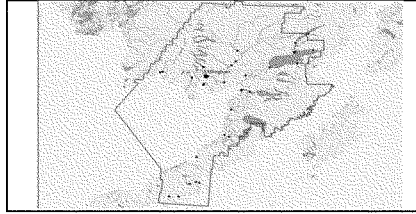
Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Carpenter Shop					No
Catholic Church					No
City Office		419			No
Clinic	2006	1,604			No
Cold Storage					No
Commercial Steakhouse					No
Fisherman Bunkhouse					No
Fishery Connexes					No
Generator Shed					No
Laundromat					No
Maint. Shop		880			No
Mechanic Bunkhouse					No
Mechanist Generator/Storage					No
Office					No
Old Bunkhouse					No
Old Mess Hall					No
Old Movie Hall					No
Old Post Office					No
Powerhouse		616			No
Rental House					No
Saguyak Inc. Bldg.					No
School					No
School	1985	9,676			No
School Fuel Pumphouse	1985	64			No
School Generator Bldg	1988	365			No
School Storage Bldg	1997	265			No
State Storage Bldg 1					No
State Storage Bldg 2					No
Storage/Bunk					No
Store					No
Trident Water Pumphouse					No
USPO					No

Energy Profile: Clark's Point

Non-residential Building Inventory (continued)					
Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Village Council Camp					No
Village Council Clinic & Center					No
Village Council Generator House					No
Village Council Office 1					No
Village Council Office 2					No
Watchman House					No
Water & Sewer Plant		600			No
Water Station					No
Way Station					No
SRE Bldg 2 West (Heated)		1,250			Yes

Community Profile: Dillingham



Alaska Native Name (definition)

Historical Setting / Cultural Resources

The area around Dillingham was inhabited by both Eskimos and Athabascans and became a trade center when Russians erected the Alexandrovski Redoubt Post in 1818. The town was named after U.S. Senator Paul Dillingham in 1904, who had toured Alaska extensively with his Senate subcommittee during 1903. The city was incorporated in 1963 as a 2nd class city. Dillingham is now a 1st class city with highly mixed population of non-Natives and Natives.

Energy Priorities and Projects

Energy efficiency (EE) in buildings, homes, and transportation; EE awareness & education; Explore the feasibility of developing renewable sources of energy; Explore the feasibility of distributed energy systems; Expand heat recovery system

Local Contacts		Email		Phone		Fax	
City of Dillingham		cityclerk@dillinghamak.us		907-842-5212		907-842-2060	
Curyung Tribal Council		dorothy@curyungtribe.com		907-842-2384		907-842-4510	
Choggiung Ltd.		inunn@choggiung.com		907-842-3511		907-842-3512	
Demographics		2000		2010		2013	
Population		2466		2329		Percent of Residents Employed	
Median Age		33		34		Denali Commission Distressed Community	
Avg. Household Size		3		3		Percent Alaska Native/American Indian (2010)	
Median Household Income		N/A		\$69,792		Low and Moderate Income (LMI) Percent (2014)	
Electric Utility		Generation Sources		Interties		PCE?	
Nushagak Cooperative		Diesel		Aleknagik		Yes	
Landfill		Class	2	Permitted?	Yes	Location	3.75 miles NW of airport.
Water/Wastewater System		City of Dillingham		Homes Served		System Volume	
Water		Piped		855		100,001-500,000	
Sewer		Piped		Energy Audit?		gallons/day	
Notes		1/2 community have on-site W/S		No			
Access							
Road		No					
Air Access		Public; Asphalt		Runway		6,400'x150'	
Dock/Port		Yes		Barge Access?		Yes	Ferry Service?
Notes						No	

Incorporation	1st class (inc. 1963)		
Location	Northern end of Nushagak Bay in northern Bristol Bay, at the confluence of the Wood and Nushagak Rivers.		
Longitude	-158.4575	Latitude	59.0397
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Dillingham Census Area		
School District	Dillingham City School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
Sales (6%), Bed (10%), Alchl (10%), Gaming (6%), prop. tax		\$2,540	

Subsistence. Major fishing, transportation, and public service hub for the Bristol Bay area. 229 commercial fishing permit holders. 248 AK business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
		7	11,306
Natural Hazard Plan		Year	

Notes	Expired
Community Plans	Year
Comprehensive Plan	2010

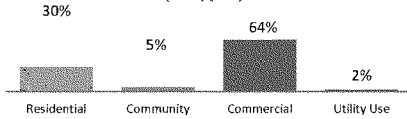
Energy Profile: Dillingham

Diesel Power System

Utility	Nushagak Electric Cooperative		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	7 generators, 5 replaced since 2005		
Unit 2			
Unit 3			
Unit 4			
Line Loss	4.1%		
Heat Recovery?	Yes		
Upgrades	Priority	Projects	Status
Powerhouse			
Distribution		Substation	Complete 2015
Outage History/Known Issues			
Produces for Aleknagik. PCE includes both.			
Operators	No. of Operators	Training/Certifications	
	6	Clerk, BFO	

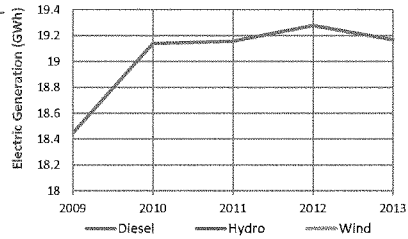
Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	989	5,389,830	5,450
Community	46	898,782	19,539
Commercial	446	11,548,038	25,892
Utility Use		346,200	

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	18,956,000	Avg. Load (kW)	1,937
Wind (kWh/yr)	0	Peak Load (kW)	4,305
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	15
Total (kWh/yr)	18,956,000	Diesel Used (gals/yr)	1,253,779



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.17	Fuel Cost	\$0.24
Residential Rate	\$0.44	Non-fuel Cost	\$0.19
Commercial Rate		Total Cost	\$0.44

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.85	\$5.86	6-13; 8-14

Other Fuel? (1 gal)

Gasoline (1 gal)	\$5.80	4-13
Propane (100#)	\$147.62	8-14

Wood (1 cord)

Pellets

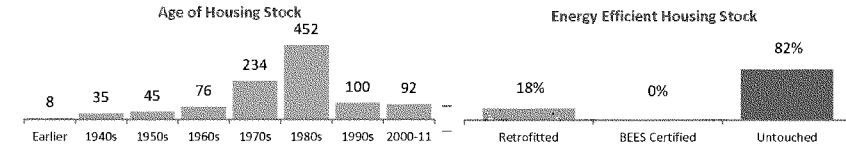
Discounts?

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low	Dillingham Area Wind/Hydro Assessment	Hydro Not Feasible
Wind Diesel	Medium	Dillingham Area Wind/Hydro Assessment	Not pursuing
Biomass	Medium		
Solar	Pending	Private use & BB Campus & USFW	
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	HR to schools, court, DOT, utility buildings	Operating, Expansion Possible
Energy Efficiency	High	EECBG	Complete

Bulk Fuel	Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	
Delta West.		44,000		By Barge
Peter Pan Seaf.				By Air
Nushagak Elec.		1,850,000		Cooperative Purchasing Agreements
Bristol Fuels				
Bulk Fuel Upgrade	Priority	Project	Status	Notes
				Vendors: Bristol Alliance Fuels, Delta, Vitus

Energy Profile: Dillingham

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	773	264	51%	Bristol Bay HA	Bristol Bay HA
Housing Need		Overcrowded	1-star	Energy Use	Average Home
		7.5%	10.0%	Energy Rating	Average Square Feet
Data Quality	High			3-star	1,597
					Avg. EUI (kBtu/sf)
					124



Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
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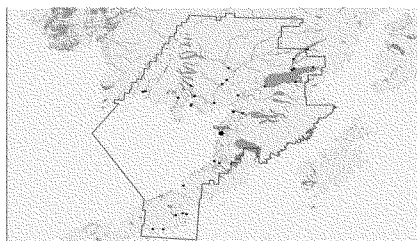
Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Admin. Bldg	1939	11,100			No
Admin. Offices, MS & HS		75,578			Yes
Admin/Classroom Bldg		12,525			Yes
AK DOT & Public Fac.					No
AKDF&G					No
Alascom					No
ARFF Bldg		7,042			Yes
Bahai Church					No
Ball Bros. Inc. Bldg.					No
Big Foot Retail					No
Boat Storage					No
Bristol Inn					No
City Dock Bldg.					No
City Hall		7,515			No
Commercial Company Bldg.					No
Court Bldg.					No
Dillingham Health Center		1,296			Yes
Dillingham Post Office					Yes
Dillingham RTH Unit					Yes
Electric Coop.					No
Elementary School	1990	29,659			Yes
Fire Hall					No
Garage					No
George/Joann Nelson Commercial Rental					No
Hotel					No
Icicle Seafoods					No
Jim B. Storage					No
Kallstrom Camp					No
Kanakanak Hospital		125,996			No
Kanquiquaq Bldg.					No
L&M Supply					No
Library		4,722			No
Maintenance Shop		4,800			Yes

Energy Profile: Dillingham

Non-residential Building Inventory (continued)					
Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Medical Office					No
Middle/High School	1990	75,578			Yes
Moravian Church					No
N&N Market					No
Office Bldg.					No
Peter Pan Seafoods Bldg.					No
PHS Quonset Bldg.					No
Police Dept.					
Public Safety Dept.		7,200			No
School ATCO Trailer	1980	960			No
School Dist. Office	1984	4,598			No
School Shop	1980	8,500			No
School Storage	1980	1,600			No
Schroeder Garage					No
Sea Inn					No
Senior Center		7,500			No
Shop		1,200			Yes
Smith's Duplex		720			Yes
South Shore House		720			Yes
SW Region School					No
Territorial School	1990	11,375			Yes
University of Alaska Bldg.					No
Village Corp. Office					No
Ward Bldg.					No
Warm Sand Storage		2,800			Yes
Warm Storage (Heated)		3,000			Yes
Water Treatment Plant					No
Wells Fargo					No
Wren Aircraft					No
Youth Center					No

Community Profile: Egegik



Alaska Native Name (definition)

Egegik ("Throat")

Historical Setting / Cultural Resources

The village was reported by Russians as a fish camp called "Igagik" (meaning "throat") in 1876. Local people would travel each year from Kanatak on the gulf coast through a portage pass to Becharof Lake and then hike or kayak on to the Egegik Bay area for summer fish camp. In 1895, an Alaska Packers Association salmon saltery was established at the mouth of Egegik River, and a town developed around the former fish camp. Egegik incorporated as a second-class city in 1995.

Energy Priorities and Projects

Determine wind resource & develop if feasible

Incorporation 2nd Class City (inc. 1995)

Location

Located on the south bank of the Egegik River, near base of Aleutian Chain. 100 miles southeast of Dillingham and 326 miles southwest of Anchorage by air.

Longitude -157.3758 Latitude 58.2156

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

Raw Fish (3% + 2% Bor.), Bed (6%) Guide Tax (\$3/p/d)

\$12,109

Economy

Major salmon production port. Twelve commercial fishing permit holders. Four business licenses.

Climate Avg. Temp. Climate Zone Heating Deg. Days

N/A

7

N/A

Natural Hazard Plan

Year

Notes Expired

Community Plans

Year

Community Action Plan

2012

Local Contacts	Email	Phone	Fax
City of Egegik	cityofegegik@starband.net	907-233-2400	907-233-2231
Egegik Village		907-233-2211	907-233-2312
Becharof Corporation		907-561-4777	907-561-4778
Demographics	2000	2010	2013
Population	116	109	Percent of Residents Employed 67.7%
Median Age	36	49	Denali Commission Distressed Community No
Avg. Household Size	3	3	Percent Alaska Native/American Indian (2010) 39.5%
Median Household Income	N/A	\$77,917	Low and Moderate Income (LMI) Percent (2014) 42.2%
Electric Utility	Generation Sources	Interties	PCE?
City of Egegik	Diesel	No	Yes
Landfill	Class	Permitted?	No
Water/Wastewater System	City of Egegik	Homes Served	Location 15,000 ft. SE of community
Water	Well	System Volume	50,001-100,000 gallons/day
Sewer		Energy Audit?	
Notes		Yes	
Access			
Road	No		
Air Access	Public & Private; Gravel	Runway	1,500'x75 5,600'x100
Dock/Port	Yes	Barge Access?	Yes Ferry Service? No
Notes			

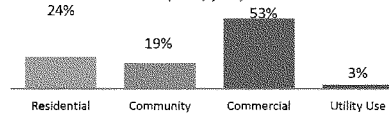
Energy Profile: Egegik

Diesel Power System

Utility	City of Egegik		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	Mitsubishi	Good/6,322	200
Unit 2	John Deere	Good/7,659	180
Unit 3			
Unit 4			
Line Loss	7.4%		
Heat Recovery?	Yes; School & Community Center		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low	2013 Upgrade	Complete
RPSU Distribution	In Progress		
Outage History/Known Issues			
Operators	No. of Operators	Training/Certifications	
	3	APPO, PPO	

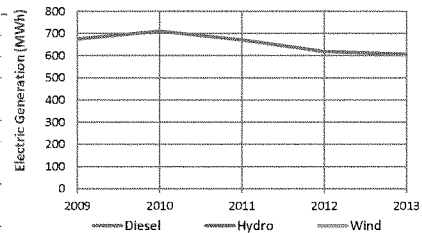
Maintenance Planning (RPSU)

Good			
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	74	146,389	1,978
Community	17	117,375	6,904
Commercial	16	321,001	20,063
Utility Use	17,885		

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	650,903	Avg. Load (kW)	69
Wind (kWh/yr)	0	Peak Load (kW)	153
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	12
Total (kWh/yr)	650,903	Diesel Used (gals/yr)	55,836



Electric Rates (\$/kWh)

Rate with PCE	\$0.33	Cost per kWh Sold (\$/kWh)	
Residential Rate	\$0.86	Fuel Cost	\$0.44
Commercial Rate		Non-fuel Cost	\$0.19
		Total Cost	\$0.63

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.59	\$4.95	6-13; 8-14

Other Fuel? (1 gal)

Gasoline (1 gal)			
Propane (100#)		\$308.81	8-14
Wood (1 cord)			
Pellets			
Discounts?	None		

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	High	Egegik Wind Feasibility Study	Met tower installed, In Progress
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low	HR to school and community center	Operational
Energy Efficiency	High	VEEP - LPSD	In progress
Bulk Fuel		Purchasing	Deliveries/Year
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
City	Heating, #1, #2	100,000	Good
		Gallons/Delivery	Vendor(s)
		2	Crowley
		Cooperative Purchasing Agreements	
		None	
		Notes	
		Delivery by barge in Spring & Fall. No bid.	

Energy Profile: Egegik

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider		
	15	261	73%	Bristol Bay HA	Bristol Bay HA		
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBtu/sf)
	N/A		N/A		N/A	N/A	N/A
Data Quality	Low						

Age of Housing Stock

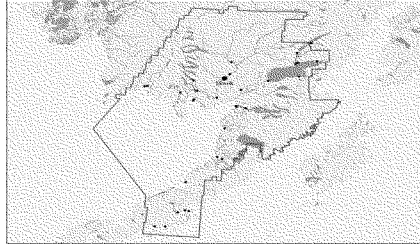
Energy Efficient Housing Stock

Lighting	Owner	Number/Type	Retrofitted?	Year	Notes	
	City		yes		Replaced with 80W LEDs	

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Church (Baptist)					No
City Hall/Office		2,500			No
City Shop/Maint. Building		4,000			No
City Warehouse	1994	1,104			No
Clinic	2003	2,497			No
Egegik K-12 School	1962	9,651	Yes		Yes
Egegik School/Multi-Purpose/Powerhouse	1971-1997	7,182			Yes
Fisherman's Lodge		4,124			No
Incinerator Bldg.		1,200			No
Post Office					No
Power Plant					No
School Gym	1997	3,600			No
Store					No
Village Council					No
Water Plant		2,160			No

Community Profile: Ekwok



Alaska Native Name (definition)

Iquaq ("end of the bluff")

Historical Setting / Cultural Resources

The oldest continuously-occupied Yup'ik Eskimo village on the river. During the 1800s, the settlement was used in the spring and summer as a fish camp and in the fall as a base for berry picking. Many of the earliest homes in Ekwok were located in a low flat area near the riverbank. After a severe flood in the early 1960s, villagers relocated to the current location on higher ground.

Incorporation 2nd Class City

Location

Ekwok is located along the Nushagak River, 43 miles northeast of Dillingham and 285 miles southwest of Anchorage.

Longitude -157.4753 Latitude 59.3497

ANCSA Region Bristol Bay Native Corporation

Borough/CA Dillingham Census Area

School District Southwest Region School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

None

Economy

Local government, education/health services, and financial activities are the main employers. There are 3 commercial fishing permits and 9 business licenses.

Climate Avg. Temp. Climate Zone Heating Deg. Days

N/A 7

Natural Hazard Plan Year

Notes

Community Plans Year

Ekwok Community Comprehensive Plan 2005

Energy Priorities and Projects

Intertie with New Stuyahok; Road between Ekwok & New Stuyahok; Alternative method fuel delivery due to low river level

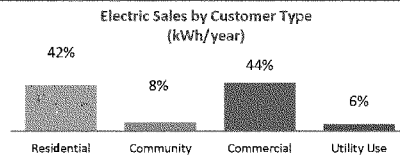
Local Contacts	Email	Phone	Fax
Ekwok Natives Limited		907-464-3336	907-464-3378
City of Ekwok	clark25crystalclaire@yahoo.com	907-464-3311	907-464-3328
Bristol Bay Native Corporation		907-278-3602	907-276-3924
Demographics	2000	2010	2013
Population	130	115	67.9%
Median Age	32	27.3	
Avg. Household Size	4	3.11	
Median Household Income	N/A	\$31,667	
Electric Utility	Generation Sources	Interties	PCE?
Alaska Village Electric Cooperative - AVEC	Diesel	No	Yes
Landfill	Class	3	Permitted?
Water/Wastewater System	N/A	No	Location
Water		Homes Served	Ekwok
Sewer		Energy Audit?	System Volume
Notes		Yes	
Access			
Road	No		
Air Access	State owned; gravel	Runway	3319'x75'
Dock/Port	No	Barge Access?	Ferry Service?
Notes			

Energy Profile: Ekwok

Diesel Power System

Utility	AVEC		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	Perkins	Fair/1,322	70
Unit 2	Perkins	Fair/2,657	124
Unit 3	John Deere	Fair/7,173	220
Unit 4			
Line Loss	6.2%		
Heat Recovery?	No		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low		
RPSU Distribution	Medium Intertie		
Outage History/Known Issues	None since AVEC started operation		
Operators	No. of Operators	Training/Certifications	
	2	APPO, BFO, PPO, Clerk	

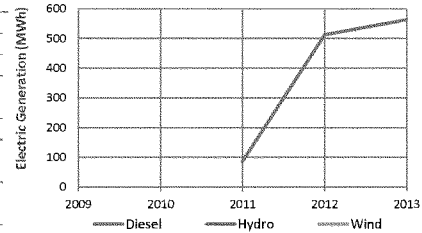
Maintenance Planning (RPSU)	Good		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	52	208,445	4,009
Community	5	39,258	7,852
Commercial	22	220,515	10,023
Utility Use	31,466		



Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Low		
Biomass	High		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High	1) VEEP 2) Street light retrofit 3) ANTHC Sanitation EE Audit 1&2) Complete 3) Funded	
Bulk Fuel		Purchasing	Deliveries/Year
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
City	Heating Oil	20,000	Good
City	Gasoline	20,000	Good
Bulk Fuel Upgrade	Priority	Project	Status

Power Production

Diesel (kWh/yr)	532,671	Avg. Load (kW)	63
Wind (kWh/yr)	0	Peak Load (kW)	127
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	11
Total (kWh/yr)	532,671	Diesel Used (gals/yr)	46,990

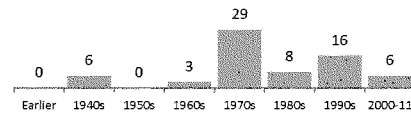


Electric Rates (\$/kWh)	Cost per kWh Sold (\$/kWh)		
Rate with PCE	\$0.21	Fuel Cost	\$0.43
Residential Rate	\$0.68	Non-fuel Cost	\$0.23
Commercial Rate		Total Cost	\$0.67
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.26	\$6.75	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
Wood (1 cord)	\$300 to \$350		
Pellets			
Discounts?	None		

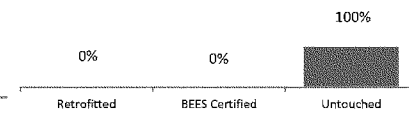
Energy Profile: Ekwok

Housing Units	Occupied 52	Vacant 16	% Owner-Occup. 58%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 17.3%		1-star N/A	Energy Use	Average Home Energy Rating
Data Quality	Low				Average Square Feet
					Avg. EUI (kBtu/sf)
				N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock

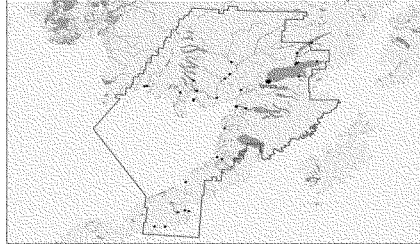


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
City Office Bldg					No
City Shop					No
Clinic	2011	1,636			No
Clinic (Old)					No
Country Time Store					No
Ekwok K-12 School		15,795			Yes
ENL Bldg.					No
Fuel Tank Farm					No
Green Chapel					No
Maaluq Lodge					No
R. Orthodox Church					No
School Gen. Bldg.	1932	720			No
SRE Bldg (Heated)		1,200			Yes
Storage Bldg (Heated)					No
Village Council					No
William Nelson School	1979	9,644			No

Community Profile: Igiugig



Alaska Native Name (definition)

ig ee uh' gig ("like a throat that swallows water")

Historical Setting / Cultural Resources

Kiatagmuit Eskimos originally lived on the north bank of the Kvichak River in the village of Kaskanak and used Igiugig as a summer fish camp. Today, about one-third of residents can trace their roots back to the Branch River village. A post office was established in 1934 but was discontinued in 1954. Historically an Eskimo village, the population is now primarily Alutiq and depends upon commercial fishing and a subsistence lifestyle. Sport fishing attracts visitors during summer months.

Energy Priorities and Projects

Pilot wind project, if proven will be expanded; Solar thermal for homes; Hydrokinetic potential of Kvichak River; Energy efficiency and conservation in village; new site for tank farm (eroding into river); generator training; More solar for residences and community buildings

Energy Priorities and Projects

Igiugig Village Corporation

Email
igiugig.vc@gmail.com

Incorporation Unincorporated

Location

Igiugig is located on the Alaska Peninsula on the south shore of the Kvichak River, which flows from Iliamna Lake. It is 50 air miles northeast of King Salmon and 48 miles southwest of Iliamna.

Longitude -155.8947 Latitude 59.3278

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate)

None Per-Capita Revenue \$0.00

Economy

Local government and construction are the main employers. Thirteen business licenses. Four commercial fishing permits and subsistence fishing sustain the community.

Climate Avg. Temp. Climate Zone Heating Deg. Days

N/A 7 11,306

Natural Hazard Plan

Year

Notes

Community Plans

Bristol Bay Regional Vision 2010

Lake and Peninsula Borough Comp. Plan 2012

Energy Plan 2009

Demographics 2000 2010 2013

Population 53 50 (64) Percent of Residents Employed 83%

Median Age 37 22 Denali Commission Distressed Community No

Avg. Household Size 4 3.13 Percent Alaska Native/American Indian (2010) 40%

Median Household Income N/A \$14,423 Low and Moderate Income (LMI) Percent (2014) N/A

Electric Utility Generation Sources Interties PCE?

Igiugig Electric Utility Diesel No Yes

Landfill Class 3 Permitted? Yes Location Igiugig

Water/Wastewater System Village Homes Served System Volume

Water Piped 16

Sewer Piped Energy Audit?

Notes Yes

Access

Road No

Air Access State owned; gravel

Runway 3000'x75'

Dock/Port Yes

Barge Access? Yes Ferry Service? None

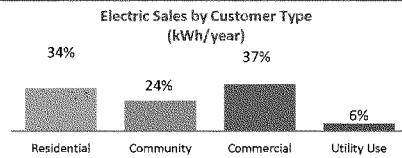
Notes

Energy Profile: Igiugig

Diesel Power System

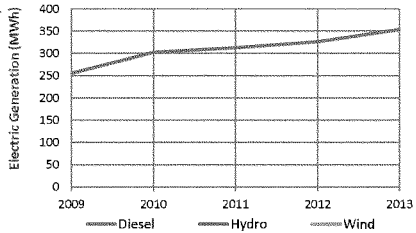
Utility	Igiugig Electric Utility		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Good/3,263	67
Unit 2	John Deere	Good/2,384	67
Unit 3	John Deere	Good/4,983	67
Unit 4			
Line Loss	13.3%		
Heat Recovery?	Yes; Pump House, Rec. Hall		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low		
RPSU Distribution	Low		
Outage History/Known Issues			
Adding 2 generators to meet demand			
Operators	No. of Operators	Training/Certifications	
	1	APPO, BF Bus Train, BFO, PPO, Utility Clerk	

Maintenance Planning (RPSU)	Good		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	28	97,829	3,494
Community	12	69,551	5,796
Commercial	12	107,141	8,928
Utility Use	17,175		



Power Production

Diesel (kWh/yr)	336,581	Avg. Load (kW)	22
Wind (kWh/yr)	0	Peak Load (kW)	48
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	11
Total (kWh/yr)	336,581	Diesel Used (gals/yr)	29,439



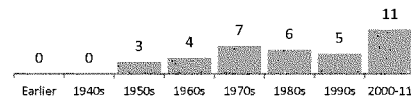
Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.22	Fuel Cost	\$0.70
Residential Rate	\$0.81	Non-fuel Cost	\$0.14
Commercial Rate	\$0.91	Total Cost	\$0.84
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$6.57	\$7.96	6-13; 3-15
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
Wood (1 cord)	\$400		
Pellets			
Discounts?			

Alternative Energy	Potential	Projects			Status
Hydroelectric	Low				
Wind Diesel	Low	6 - 1.2 kW vertical axis wind turbines installed			3 functional
Biomass	High	Residential Biomass Projects			
Solar	Pending	Solar thermal on 3 buildings			Operational
Geothermal	Low				
Oil and Gas	Low				
Coal	Low				
Emerging Tech	Not Rated	Kvichak River - 25 kW hydrokinetic system			Pilot project, operating 2016
Heat Recovery	Low	Diesel Generator HR, expanding to water tank			Operational
Energy Efficiency	Medium	ANTHC EE Audit			Funded
Bulk Fuel					
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	Purchasing	Deliveries/Year
Village	Heating Oil	73,800		By Barge	0
Village	Gasoline	22,400		By Air	Year Round
				Cooperative Purchasing Agreements	
				L&P School Dist & Construction camp	
Bulk Fuel Upgrade	Priority	Project	Status	Notes	
Comp. bid. All available vendors contacted for quotes.					

Energy Profile: Igiugig

Housing Units	Occupied 14	Vacant 9	% Owner-Occup. 36%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 28.6%		1-star N/A	Energy Use	Average Home Energy Rating 4 star plus
Data Quality	Medium			Average Square Feet	1,209
				Avg. EUI (kBtu/sf)	92

Age of Housing Stock



Energy Efficient Housing Stock

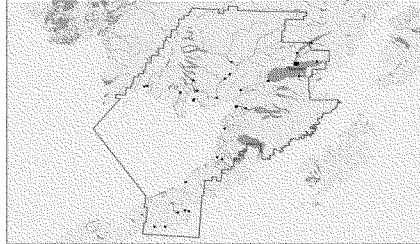


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
		2			No plans to upgrade

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Aircraft Hanger & Council Office					No
Airport/Tourism Facility	1998			Yes; Lights	No
AKDF&G Bunkhouse					No
Community Hall/EPA Office/Post Office/Store					No
DOT&PF Storage Bldg					No
Igiugig Boarding House B&B					No
Kvichak Cabins B&B					No
Lodge 1					No
Lodge 2					No
New Village Health Clinic	2011	1500	Yes; DOE		No
Old Creek Lodge					No
Old Village Health Clinic	1980	1100			No
Orthodox Church					No
Power Plant					No
School & Library					No
School (New)	2008	9384			Yes
School Generator Bldg	1997	800			No
Sewage Lift Station					No
Smokehouse					No
Smokehouse & Fish Racks					No
SRE Bldg		1,104			No
Storage Bldg	1994	1104			No
Teacher Housing					No
Village Council Multipurpose Bldg	1970	2130			No
Washeteria/Pumphouse	1970	1400			No

Community Profile: Iliamna



Alaska Native Name (definition)

il ee am' nuh

Historical Setting / Cultural Resources

Prior to 1935, "Old Iliamna" was located near the mouth of the Iliamna River, a traditional Athabaskan village. Around 1935, villagers moved to the present location, approximately 40 miles from the old site. Iliamna's current size and character can be attributed to the development of fishing and hunting lodges. Iliamna has become a recreational and tourist attraction due to the excellent fishing at Iliamna Lake. The population is mixed, with non-Natives, Tanaina Athabascans, and Alutiiq and Yup'ik Eskimos.

Energy Priorities and Projects

INNEC: Maintain year round capacity of Tazimina, increase river intake; INNEC: Upgrade distribution infrastructure Newhalen to Nondalton; Hook-up additional electric boilers; bridge between Iliamna & Nondalton; dock/barge landing; energy efficiency measures in community buildings

Local Contacts	Email	Phone	Fax
Village of Iliamna	ivc@iliamnaivc.org	907-571-1246	907-571-1256
Bristol Bay Native Assoc. Inc.		907-842-5257	907-842-5932

Demographics	2000	2010				2013
Population	102	109	Percent of Residents Employed			68.99%
Median Age	32	29.9	Denali Commission Distressed Community			No
Avg. Household Size	3	2.79	Percent Alaska Native/American Indian (2010)			58%
Median Household Income	N/A	\$83,250	Low and Moderate Income (LMI) Percent (2014)			N/A
Electric Utility	Generation Sources		Interties			PCE?
I-N-N Electric Cooperative	Hydropower, diesel		Yes, Iliamna-Newhalen-Nondalton			Yes
Landfill	Class	3	Permitted?	Yes	Location	Iliamna
Water/Wastewater System	City		Homes Served			System Volume
Water						
Sewer	Hauled to disposal site		Energy Audit?			
Notes	Septic plant not feasible due to bedrock.		No			
Access						
Road	No					
Air Access	State owned; asphalt		Runway	5085'x100'	4800'x100'	2998'x400'
Dock/Port	Yes		Barge Access?	Yes	Ferry Service?	No
Notes	Community land locked after October. Air access only.					

Incorporation	Unincorporated		
Location	Iliamna is located on the northwest side of Iliamna Lake, 225 miles southwest of Anchorage. It is near the Lake Clark Park and Preserve.		
Longitude	-154.9061	Latitude	59.7547
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Lake and Peninsula Borough		
School District	Lake and Peninsula School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
N/A			
Economy			
Local government, professional/business services, and education/health services are main employers. Thirty-two business licenses and 15 fishing permits issued.			
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	35.8°	7	11,130
Natural Hazard Plan		Year	
No			
Notes	No record		
Community Plans		Year	

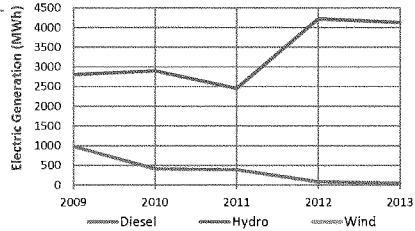
Energy Profile: Iliamna

Diesel Power System

Utility	I-N-N Electric Coop, Inc		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	N/A		
Unit 2			
Unit 3			
Unit 4			
Line Loss	8.4%		
Heat Recovery?			
Upgrades	Priority	Projects	Status
RPSU Powerhouse			
RPSU Distribution			
Outage History/Known Issues	PCE data includes Iliamna, Newhalen, & Nondalton.		
Operators	No. of Operators	Training/Certifications	

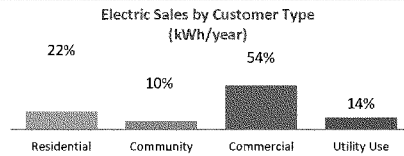
Power Production

Diesel (kWh/yr)	93,226	Avg. Load (kW)	51
Wind (kWh/yr)	0	Peak Load (kW)	113
Hydro (kWh/yr)	4,006,061	Efficiency (kWh/gal)	18
Total (kWh/yr)	4,099,287	Diesel Used (gals/yr)	5,123



Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	215	810,980	3,772
Community	15	382,730	25,515
Commercial	105	2,017,376	19,213
Utility Use		543,936	



Electric Rates (\$/kWh)

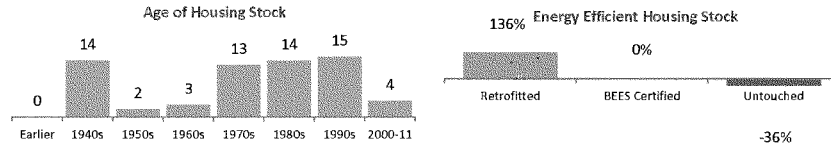
Rate with PCE	\$0.33	Cost per kWh Sold (\$/kWh)	
Residential Rate	\$0.57	Fuel Cost	\$0.01
Commercial Rate	None	Non-fuel Cost	\$0.22
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.67	\$6.42	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)	\$151.43		8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects	Status
Hydroelectric	High	Tazimina, 824 kW, Intertie	Operational
Wind Diesel	Medium		
Biomass	High		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		Boilers operational/2 35kW
Heat Recovery	High	Electric boilers, 25kW-residence, 35kW-triplex	boilers for city building
Energy Efficiency	High	EECBG	Complete
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
IDC	multiple	50,000	
Rain. K. Lodge		19,000	
Gen. Store		11,855	
Iliamna Lodge		10,900	
Paul McDowell		7,000	
Misc. Others		40,500	
Bulk Fuel Upgrade	Priority	Project	Status

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	1		IDC
By Air	Fall to Spring		
Cooperative Purchasing Agreements			
None			
Notes			

Energy Profile: Iliamna

Housing Units	Occupied 25	Vacant 29	% Owner-Occup. 40%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded N/A			Energy Use	Average Home Energy Rating 3 star
Data Quality	Medium		1-star 3.7%	Average Square Feet 1,061	Avg. EUI (kBtu/sf) 150

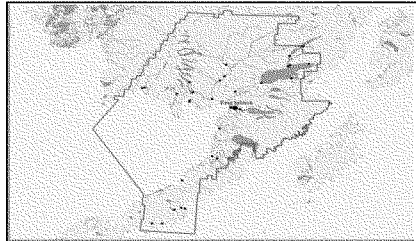


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
		None			

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
10,000 G. Fuel Station					No
2,000 G. Fuel Storage					No
Air Taxi					No
Airport Hotel Weathered Inn					No
Baptist Church		4,000			No
BB Sports Fishing					No
Clinic	1980	1,044			No
Council Office Bldg 1&2		3,600			No
Council Office Bldg 3		2,100			No
DOT Maint. & Fire Station					No
Fisheries Research Instit.					No
FlyFish AK Red Quill Lodge					No
GC Sat. Dishes					No
Gram's Café & B&B					No
Iliaska Lodge					No
INL Offices/Village Shop					No
Maint. Shop		5,495			Yes
Post Office		3,500			No
Rainbow King Lodge					No
Roadhouse B&B					No
SRE/Office		5,495			Yes
Storage		1,920			Yes
Talarik Creek Lodge					No
TelAK Tower					No
Test Wells					No
Trading Co.		5,000			No
Trading Co.					No
Village Council & Comm. Bldg					No
Warm Storage		480			No

Community Profile: King Salmon



Alaska Native Name (definition)

Historical Setting / Cultural Resources

Present-day tribal members are descendants of a group that was forced to relocate to King Salmon due to the eruption of Mount Katmai, on the east coast of the peninsula. The Native population is a mixture of Aleuts, Indians, and Eskimos. Although King Salmon was not included in the 1972 Alaska Native Claims Settlement Act (ANCSA), the King Salmon Tribe became a federally recognized entity as of December 29, 2000.

Energy Priorities and Projects

NEA: Investigate heat absorption for ice production in summer;
NEA: Stack heat recovery

Incorporation	Unincorporated		
Location	located on the north bank of the Naknek River on the Alaska Peninsula, 15 miles upriver from Naknek and 284 miles southwest of Anchorage.		
Longitude	-156.6614	Latitude	58.6883
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Bristol Bay Borough		
School District	Lake and Peninsula Borough School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
Bed Tax (10% Bor.), Raw Fish (3% Bor.)		N/A	
Economy	Transportation hub for larger Bristol Bay area. 37 commercial fishing permit holders. 105 active business licenses.		
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	35.2F	7	11,716
Natural Hazard Plan			Year
Yes			10/6/2011
Notes	Update required 10/6/2016		
Community Plans			Year

Local Contacts	Email	Phone	Fax
King Salmon Tribe	kstvc@starband.net	907-246-3553	907-246-3449
Bristol Bay Native Corporation		907-278-3602	907-246-6259

Demographics	2000	2010	2013
Population	442	374	
Median Age	38	46	
Avg. Household Size	3	3	
Median Household Income	N/A	\$90,313	
Electric Utility		Generation Sources	Interties
Naknek Electric Association		Diesel	Naknek, South Naknek
Landfill	Class	2	Permitted?
		Yes	Location
Water/Wastewater System	USAF King Salmon Water		Between Naknek & town.
Water	Well	Homes Served	System Volume
Sewer	Piped	Energy Audit?	100,001-500,000 gallons/day
Notes		No	
Access			
Road	No		
Air Access	Public; Asphalt/Gravel		Runway
		8,901'x150'	
Dock/Port	Yes		Barge Access?
		Yes	Ferry Service?
Notes		No	

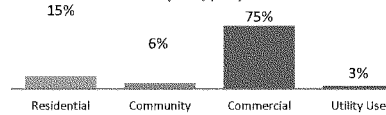
Energy Profile: King Salmon

Diesel Power System

Utility	Naknek Electric Association		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	N/A		
Unit 2			
Unit 3			
Unit 4			
Line Loss		5.5%	
Heat Recovery?			
Upgrades	Priority	Projects	Status
RPSU Powerhouse			
RPSU Distribution			
Outage History/Known Issues	Feeders from NEA substation		
Generation & sales for Naknek, South Naknek, & King Salmon			
Operators	No. of Operators	Training/Certifications	

Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	738	2,840,685	3,849
Community	40	1,234,998	30,875
Commercial	359	14,431,075	40,198
Utility Use		612,053	

Electric Sales by Customer Type
(kWh/year)

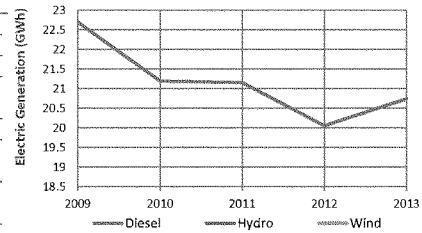
Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Medium		
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High		

Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition

Bulk Fuel Upgrade	Priority	Project	Status
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Power Production

Diesel (kWh/yr)	20,231,754	Avg. Load (kW)	416
Wind (kWh/yr)	0	Peak Load (kW)	924
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	16
Total (kWh/yr)	20,231,754	Diesel Used (gals/yr)	1,258,272



Electric Rates (\$/kWh)

Rate with PCE	\$0.17	Fuel Cost	\$0.24
Residential Rate	\$0.59	Non-fuel Cost	\$0.20
Commercial Rate	\$0.59	Total Cost	\$0.44

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.61	\$5.96	6-13; 8-14

Other Fuel? (1 gal)

Gasoline (1 gal)	\$5.70	4-13
Propane (100#)	\$277.38	8-14

Wood (1 cord)

Pellets		
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Discounts?

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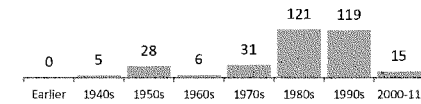
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Energy Profile: King Salmon

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	161	164	43%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	6.2%		0.6%		Average Square Feet
Data Quality	Medium				2-star plus
					1,688
					140

Age of Housing Stock



Energy Efficient Housing Stock

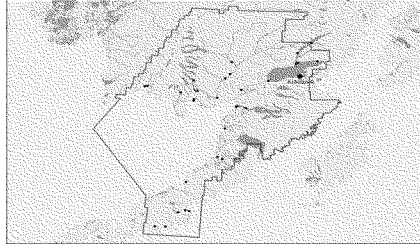


Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
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Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
AC Comp. Store	1980	7,718			No
Airport Light Building					No
Airport Terminal					No
AK Fish & Game					No
AK State Troopers					No
ARFF/Maint. Bldg.	1996	8,611			Yes
Becharof Refuge Admin. Building					No
Borough Police Dept.	1988				No
Bristol Bay Telephone					No
Chain Storage Bldg.	1973				No
Church					No
Community Church & Parsonage					No
District Central Office	1983	12,000			Yes
DOT & PF Building					No
Electrical Storage Shed	1973				No
FAA Building					No
Fitness Center					No
Health Clinic	1994	1,098			No
King Salmon Public Safety (PS) Office					Yes
Lake & Penn. Borough Admin. & School Dist. Bldg.					No
Paug-Vik Inc.					No
Post Office					No
Restaurants					No
Sand Storage	1973	2,160			Yes
SAVEC Bldg					No
School Storage Bldg.	1984	1,400			No
United Pent. Church	1984	1,200			No
US Fish & Wildlife					No
US Parks Service Housing					No
US Parks Service Housing					No
Village Council & Clinic					No
Visitor Center					No
White Storage Bldg.	1973	629			No
Yellow Storage	1973				No

Community Profile: Kokhanok



Alaska Native Name (definition)

Qarr' unaq

Historical Setting / Cultural Resources

This fishing village was first listed in the U.S. Census in 1890 by A.B. Schanz. The community was relocated to higher ground a few years ago when the rising level of Iliamna Lake threatened several community buildings. The village has a mixed Native population, primarily Alutiiq and Yup'ik. Subsistence activities are the focal point of the culture and lifestyle.

Incorporation Unincorporated

Location

Kokhanok is located on the south shore of Iliamna Lake, 22 miles south of Iliamna and 88 miles northeast of King Salmon.

Longitude -154.7551 Latitude 59.4416

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue
N/A

Economy

Local government, education/health services, and professional/business services are main employers. Twelve commercial fishing permits and eleven business licenses.

Climate Avg. Temp. Climate Zone Heating Deg. Days
7 11,610

Natural Hazard Plan
No

Notes No record

Community Plans
A Well Made basket: Kokhanok Com. Plan 2004

Energy Priorities and Projects

Re-design & test wind system build up to medium or high penetration; Expand GARN cordwood boiler system to heat additional buildings; Add solar to buildings and residences; Power lines need upgrading; need more homes

Local Contacts	Email	Phone	Fax
Kokhanok Village Council	kokhanok_vc@yahoo.com	907-282-2202	907-282-2264
Bristol Bay Native Corporation		907-278-3602	907-276-3924

Demographics	2000	2010	2013
Population	174	170	72%
Median Age	30	27	Denali Commission Distressed Community
Avg. Household Size	4	3.27	Percent Alaska Native/American Indian (2010)
Median Household Income	N/A	\$18,906	82%
Electric Utility	Generation Sources	Interties	PCE?
Kokhanok Village Council	Diesel, Wind-	No	Yes
Landfill	Class	Permitted?	Yes
Water/Wastewater System	3	Yes	Location
Water	Piped	Yes	Kokhanok
Sewer	Piped	Homes Served	System Volume
Notes	Ageing pipes. 10-15 house off system.	52	
		Energy Audit?	
		Yes	

Access

Road No

Air Access State owned; gravel

Dock/Port No

Runway 3300'x75'

Barge Access? No Ferry Service? No

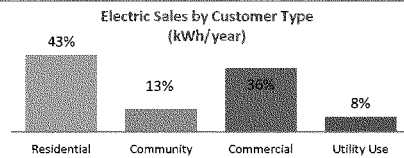
Notes

Energy Profile: Kokhanok

Diesel Power System

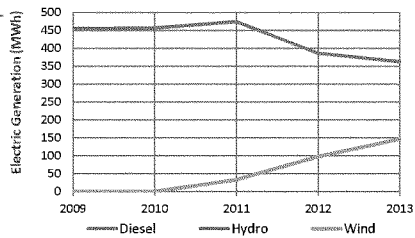
Kokhanok Village Council			
Utility	Make/Model	Condition/Hrs	Gen Capacity
Engine Unit 1	John Deere	Good/14,993	60
Unit 2	John Deere	Good/44,717	115
Unit 3	John Deere	Good/4,529	160
Unit 4	John Deere	Good/4,137	117
Une Loss	7.3%		
Heat Recovery?	Yes; School		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low	New Gen., 2009	Complete
RPSU Distribution	Med.		
Outage History/Known Issues			
Apx. 40 outs. last year, mostly due to wind integration issues.			
Operators	No. of Operators	Training/Certifications	
	1	OJT	

Maintenance Planning (RPSU)		Good	
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	54	174,710	3,235
Community	9	52,497	5,833
Commercial	14	145,120	10,366
Utility Use		33,752	



Power Production

Diesel (kWh/yr)	406,000	Avg. Load (kW)	43
Wind (kWh/yr)	31,928	Peak Load (kW)	96
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	10
Total (kWh/yr)	437,928	Diesel Used (gals/yr)	39,466



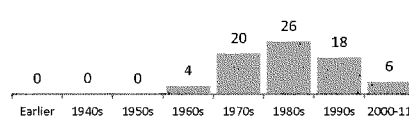
Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.41	Fuel Cost	\$0.63
Residential Rate	\$0.90	Non-fuel Cost	\$0.32
Commercial Rate	\$0.90	Total Cost	\$0.95
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$6.63	\$8.21	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$245.24	8-14
Wood (1 cord)	\$400.00		
Pellets			
Discounts?		None	

Alternative Energy	Potential	Projects		Status			
Hydroelectric	Medium						
Wind Diesel	High	Kokhanok High-Pen, Wind Energy, 2 Turbines		Re-design			
Biomass	High	GARN boiler heating 2 community buildings		Operational			
Solar	Pending						
Geothermal	Low						
Oil and Gas	Low						
Coal	Low						
Emerging Tech	Not Rated						
Heat Recovery	High	HR on diesel generator		Operational			
Energy Efficiency	Medium	VEEP/BBHA Weatherization on 70% homes		Complete			
Bulk Fuel				Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	By Barge			
Village	Diesel	120,000	Good	By Air	2		
Village	Gasoline	75,000	Good	Cooperative Purchasing Agreements L&P School Dist. & Village Council			
Bulk Fuel Upgrade	Priority	Project	Status	Notes			
				Delivery by barge or plane in Aug. or Sept. Power purchase and			

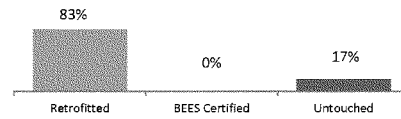
Energy Profile: Kokhanok

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	48	17	92%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home
	18.8%		3.1%		Energy Rating
Data Quality	Medium				Average Square Feet
					4 star
					915
					Avg. EUI (kBtu/sf)
					116

Age of Housing Stock



Energy Efficient Housing Stock

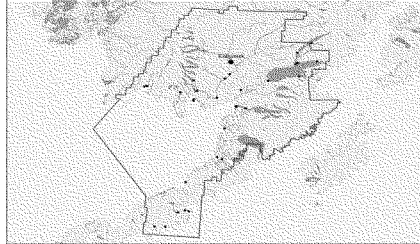


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
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Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Clinic	2007	2,583			No
Community Building	1950s	1,679			No
EPA Office	1957	759			No
Kokhanok School (2008)	1985	21,880			Yes
Old Clinic (VPSO housing/office and itinerant housing)					No
Old Powerhouse (Electrical Storage)					No
Old Pre-School (Shop/Library/Itinerant Housing)	1984	1,449			No
Pump house		361			No
School Duplex 1		1,053			No
School Duplex 2		2,152			No
School Duplex 3		1,396			No
School Generator Building	1985	800			No
SRE Bldg.					Yes
Store					No
Village Council Office	1982	1,173			No

Community Profile: Koliganek



Alaska Native Name (definition)

Qalirneq

Historical Setting / Cultural Resources

It is an Eskimo village first listed in the 1880 Census as "Kalignak." The name is local, recorded by the U.S. Geological Survey in 1930. Since that time, the village has relocated two times. The first location is about 12 miles upriver from the current location. Koliganek is a Yup'ik Eskimo village with Russian Orthodox practices. Subsistence activities are an important part of the lifestyle.

Energy Priorities and Projects

Finalize wind project design; update water & sewer system; determine alternative fuel delivery method due to lower river level; more homes needed

Incorporation	Unincorporated		
Location	Located on the left bank of the Nushagak River and lies 65 miles northeast of Dillingham. The village hopes to get its own zip code, although it currently shares one with Dillingham.		
Longitude	-157.2844	Latitude	59.7286
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Dillingham Census Area		
School District	Southwest Region School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
None			
Economy			
Local government, education/health services, and trade, transportation/utilities are the main employers. There are 19 commercial fishing permits and 7 business licenses.			
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	11,306
Natural Hazard Plan			Year
No			
Notes			
Future Plan Development			
Community Plans			Year
Koliganek Comprehensive Plan			2005
A Community Development Plan is in the works (3/2015)			

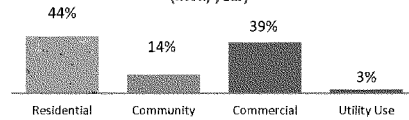
Local Contacts		Email	Phone	Fax		
Koliganek Natives Limited			907-596-3440	907-596-3462		
New Koliganek Village Council		newkqkvc@hotmail.com	907-596-3434	907-596-3462		
Bristol Bay Native Corporation			907-278-3602	907-276-3924		
Demographics	2000	2010		2013		
Population	182	209	Percent of Residents Employed	67.1%		
Median Age	26	21.3	Denali Commission Distressed Community	Yes		
Avg. Household Size	4	3.8	Percent Alaska Native/American Indian (2010)	95.7%		
Median Household Income	N/A	\$66,250	Low and Moderate Income (LMI) Percent (2014)	N/A		
Electric Utility	Generation Sources		Interties	PCE?		
New Koliganek Village Council	Diesel			Yes		
Landfill	Class	3	Permitted?	No	Location	Koliganek
Water/Wastewater System	New Koliganek Village Council		Homes Served		System Volume	
Water	Piped		50			
Sewer	Piped & Septic		Energy Audit?			
Notes			Yes			
Access						
Road	No					
Air Access	State owned; gravel		Runway	3000'x75'		
Dock/Port	No		Barge Access?	Seasonal	Ferry Service?	No
Notes	Koliganek is upgrading to a new approx. 5,000' runway					

Energy Profile: Koliganek

Diesel Power System

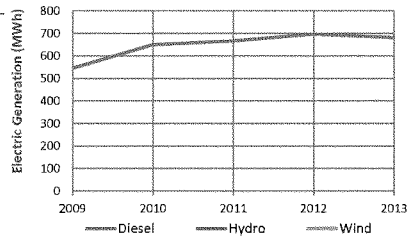
Utility	New Koliganek Village Council		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Fair/29,411	220
Unit 2	John Deere	Poor/15,892	200
Unit 3			
Unit 4			
Line Loss	11.2%		
Heat Recovery?	Yes; Garage, Office, Clinic, New School		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	In Progress		
RPSU Distribution	In Progress		
Outage History/Known Issues			
5-6 per year.			
Operators	No. of Operators	Training/Certifications	
	1	OJT	

Maintenance Planning (RPSU)				Acceptable
Electric Sales	No. of Customers	kWh/year	kWh/Customer	
Residential	69	253,035	3,667	
Community	10	81,151	8,115	
Commercial	20	227,721	11,386	
Utility Use		14,935		

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	649,836	Avg. Load (kW)	59
Wind (kWh/yr)	0	Peak Load (kW)	132
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	11
Total (kWh/yr)	649,836	Diesel Used (gals/yr)	60,032



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.14	Fuel Cost	\$0.48
Residential Rate	\$0.50	Non-fuel Cost	Not Reported
Commercial Rate	\$0.50	Total Cost	\$0.48

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.51	\$7.00	-13; 8-14; 3-1

Other Fuel? (1 gal)

Gasoline (1 gal)	\$6.75	3-15
Propane (100#)	\$275	3-15

Wood (1 cord)

N/A		
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Pellets

Discounts?

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
	Medium	New Koliganek Wind Diesel & Heat Recovery	Draft CDR complete, commence after powerhouse upgrades
Wind Diesel			
Biomass	High		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	Diesel Generator HR	Operational
Energy Efficiency	High	ANTHC EE Audit	Funded

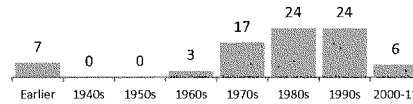
Bulk Fuel				Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	By Barge	2		Vitus Marin.
Village Council	Heating Oil	140,000		By Air			
Village Council	Gasoline	35,000					

Bulk Fuel Upgrade				Cooperative Purchasing Agreements			
	Priority	Project	Status	Togiak Native Ltd.			
			Done	Notes			
				Barge delivery in May/June & Aug. Sept. Competitive bid (fixed			

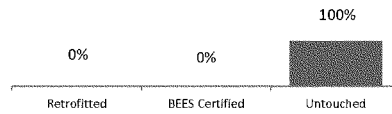
Energy Profile: Koliganek

Housing Units	Occupied 58	Vacant 23	% Owner-Occup. 62%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA		
Housing Need	Overcrowded 29.3%		1-star N/A	Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBtu/sf)
Data Quality	Medium				N/A	N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock

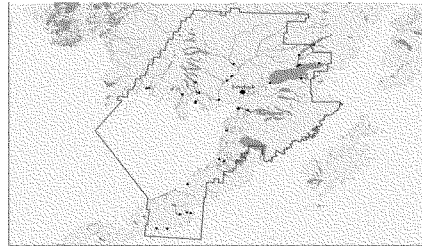


Street Lighting	Owner	Number/Type 10	Retrofitted? Partial	Year	Notes Some with LEDs, USDA funding expected
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Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport Maint. Bldg.	1995				No
Assembly of God Church					No
AT&T Facility/Council House					No
Aviation Storage		576			No
Child Welfare Office (Old Clinic)		1,280			No
Church Parsonage					No
Church Warehouse					No
City Maintenance Shop		770			No
Clinic	2008	2,500			No
Comm. Bldg.					No
Comm. Center					No
Generator Building	1981	618			No
Koliganek Clinic	2007	2,583			No
Koliganek K-12 School		4,705			Yes
Koliganek School	1959	11,332	Yes		No
Lift Station					No
M&H Variety Store	1980	1,920			No
Old Armory					No
Police Station/VPSO		580			No
Power Plant					No
Pumphouse					No
R. Orthodox Church					No
School Power Plant					No
Storage Building #3	1996	251			No
Village Council Building		1,600			No
Warehouse					No

Community Profile: Levelock



Alaska Native Name (definition)

Livlek

Historical Setting / Cultural Resources

Early Russian explorers reported the presence of Levelock, which they called "Kvichak." The smallpox epidemic of 1837 killed more than half of the residents of the Bristol Bay region and left entire villages abandoned. A measles epidemic hit the region in 1900. The worldwide influenza epidemic in 1918-19 again devastated area villages. Levelock is a mixed Alutiq and Yup'ik village. Commercial fishing and subsistence activities are the focus of the community.

Energy Priorities and Projects

Continue wind study & if feasible, develop; Expand heat recovery to community and tribal buildings; Expand distribution system to reach all residents; Investigate heat absorption for flash freezing; Need new dock, current is being affected by erosion; build more homes

Local Contacts		Email	Phone	Fax
Levelock Village		levelock@gci.net	907-287-3030	907-287-3032
Levelock Natives Limited			907-287-3040	907-287-3032
Bristol Bay Native Corporation			907-278-3602	907-276-3924
Demographics		2000	2010	2013
Population		122	69	69%
Median Age		28	32.5	Denali Commission Distressed Community
Avg. Household Size		3	2.56	Yes
Median Household Income		N/A	\$40,000	Percent Alaska Native/American Indian (2010)
Electric Utility			Generation Sources	Interties
Levelock Electric Cooperative, Inc.			Diesel	No
Landfill		Class	3	Permitted?
Water/Wastewater System				Yes
Water		Individual wells		Location
Sewer		Individual septic		Levelock
Notes		Village operates pump truck		System Volume
Access				
Road		No		
Air Access		State owned; gravel	Runway	3284'x60'
Dock/Port		Yes	Barge Access?	Yes
Notes			Ferry Service?	No

Incorporation Unincorporated

Location

Located on the west bank of the Kvichak River, 10 miles inland from Kvichak Bay. It lies 40 miles north of Naknek and 278 air miles southwest of Anchorage. It is located near the Alagnak Wild and Scenic River Corridor.

Longitude -156.8567 Latitude 59.115

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

N/A

Economy

Local government, trade, transportation/utilities, and professional/business services. Six commercial fishing permits and eight business licenses.

Climate Avg. Temp. N/A Climate Zone 7 Heating Deg. Days N/A

Natural Hazard Plan Year

Notes

Community Plans

Levelock Strategic Plan

Levelock Watershed Comm Planning Project

Year 2000

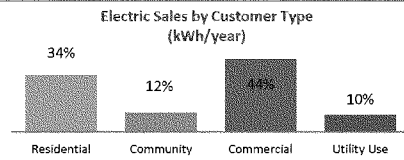
Year 2005

Energy Profile: Levelock

Diesel Power System

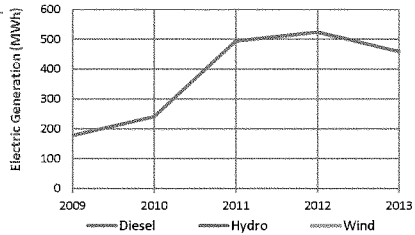
Utility	Levelock Electrical		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Good/17,125	100
Unit 2	John Deere	Good/6,470	67
Unit 3	John Deere	Good/4,636	67
Unit 4			
Line Loss	19.0%		
Heat Recovery?	Yes; School		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low		Upgraded 2008
RPSU Distribution	Low		
Outage History/Known Issues	Pre-paid meters installed		
8 outages due to generator controls, has since been remedied. No			
Operators	No. of Operators	Training/Certifications	
	2, + 1 on-call	PPO, Lineman	

Maintenance Planning (RPSU)	Acceptable		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	33	129,555	3,926
Community	7	44,111	6,302
Commercial	24	165,798	6,908
Utility Use	38,691		



Power Production

Diesel (kWh/yr)	466,860	Avg. Load (kW)	37
Wind (kWh/yr)	0	Peak Load (kW)	83
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	12
Total (kWh/yr)	466,860	Diesel Used (gals/yr)	40,000



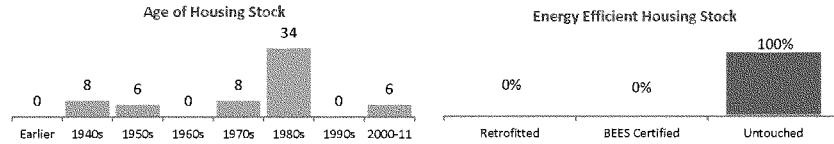
Electric Rates (\$/kWh)	Cost per kWh Sold (\$/kWh)		
Rate with PCE	\$0.27	Fuel Cost	\$0.49
Residential Rate	\$0.70	Non-fuel Cost	\$0.37
Commercial Rate	\$0.95	Total Cost	\$0.86
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.96	\$6.20	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$191.67	8-14
Wood (1 cord)			
Pellets			
Discounts?	None		

Alternative Energy	Potential	Projects	Status
Hydroelectric	Medium		
Wind Diesel	Low	Levelock Wind Reconnaissance Study	Met tower installed in 2014
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Medium	HR to school	Operational
Energy Efficiency	High	Installing LED street lights	
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Village	Heating Oil	120,000	Good
Village	Gasoline	18,000	Good
Bulk Fuel Upgrade	Priority	Project	Status

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	1		Delta W./Vitu
By Air			
Cooperative Purchasing Agreements			
None			
Notes			
Delivery by barge each July.			

Energy Profile: Levelock

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	33	27	33%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	24.2%		N/A		Average Square Feet
Data Quality	Low				Avg. EUI (kBtu/sf)
				N/A	N/A

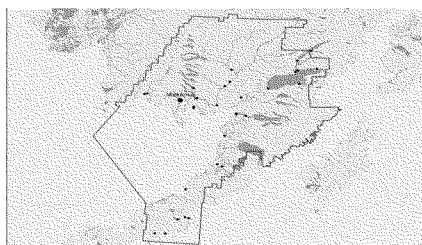


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	Utility	22	Yes, partial		Some LEDs, more swapped as can be afforded.

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport Equip. Storage	2008	336			No
Andrews Provisions Store					
AT&T Alascom					No
Baptist Church		1,200			No
Clinic	2009	1,679			No
Generator Bldg	1996	1,200			No
Levelock K-12	1985	22,942			Yes
LNL Office/Hotel					No
LNL Storage					No
LNL Storage 2					No
Old Portable Classroom (Kitchen)	1970	2,160			No
Orthodox Church					No
Post Office					No
Rainbow Hall Rec. Center	2002	3,280			No
SRE Bldg. #2 (Heated)		1,200			Yes
State of AK Storage Bldg. 2					No
Village Council Office	1982				No
Village Council Storage					No

Community Profile: Manokotak



Alaska Native Name (definition)

Manuquutag

Historical Setting / Cultural Resources

Manokotak is one of the newer villages in the Bristol Bay region. It became a permanent settlement in 1946-47 with the consolidation of the villages of Igushik and Tuklung. People also migrated from Kulukak, Togiak, and Aleknagik. Igushik is now used as a summer fish camp by many of the residents of Manokotak. Trapping has been an attractive lure to the area, although it has declined since the 1960s. Manokotak is a Yup'ik Eskimo village with a fishing, trapping, and subsistence lifestyle.

Energy Priorities and Projects

Continue with wind power development; install heat recovery system; interest in intertie to Dillingham; road access to Dillingham; water/sewer system in need of repairs

Incorporation 2nd Class City
 Location
 Located 25 miles southwest of Dillingham on the Igushik River. It lies 347 miles southwest of Anchorage.

Longitude -159.0583 Latitude 58.9814
 ANCSA Region Bristol Bay Native Corporation
 Borough/CA Dillingham Census Area
 School District Southwest Region School District
 AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue
 None

Economy

Local government, trade transportation/utilities, and construction are the main employers. There are 91 fishing permits and 11 business licenses.

Climate Avg. Temp. 33.8° Climate Zone 7 Heating Deg. Days 11,306

Natural Hazard Plan Year

Notes Future Plan Development

Community Plans Year
 Manokotak Comprehensive Plan 2005
 Manokotak Comm Plan Jan 2001-May 2002 2002

Local Contacts	Email	Phone	Fax
Manokotak Village	kmno_villagecouncil@yahoo.com	907-289-2067	907-289-1235
City of Manokotak		907-289-1027	907-289-1082
Bristol Bay Native Corporation		907-278-3602	907-276-3924

Demographics	2000	2010	2013
Population	399	442	68.1%
Median Age	22	26.4	
Avg. Household Size	5	3.65	
Median Household Income	N/A	\$32,344	

Electric Utility	Generation Sources	Interties	PCE?
Manokotak Power Company	Diesel		Yes

Landfill	Class	3	Permitted?	Yes	Location	Manokotak
Water/Wastewater System	City of Manokotak					
Water	Piped			121		System Volume N/A
Sewer	Piped					
Notes	W/S almost done. Pipes near end of useful life					

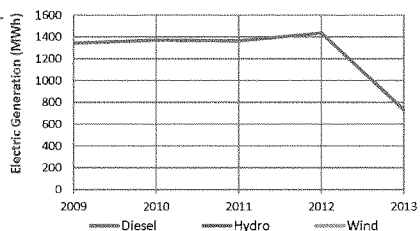
Access

Road	No
Air Access	State owned; gravel
Dock/Port	No
Runway	3300'x75'
Barge Access?	No
Ferry Service?	No

Notes

Power Production

Diesel (kWh/yr)	1,056,361	Avg. Load (kW)	128
Wind (kWh/yr)	0	Peak Load (kW)	285
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	9
Total (kWh/yr)	1,056,361	Diesel Used (gals/yr)	113,206

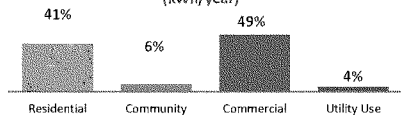


Electric Rates (\$/kWh)	Cost per kWh Sold (\$/kWh)
Rate with PCE \$0.27	Fuel Cost \$0.36
Residential Rate \$0.55	Non-fuel Cost \$0.03
Commercial Rate \$0.57	Total Cost \$0.40

Other Fuel? (1 gal)

Propane (100#)

Pellets



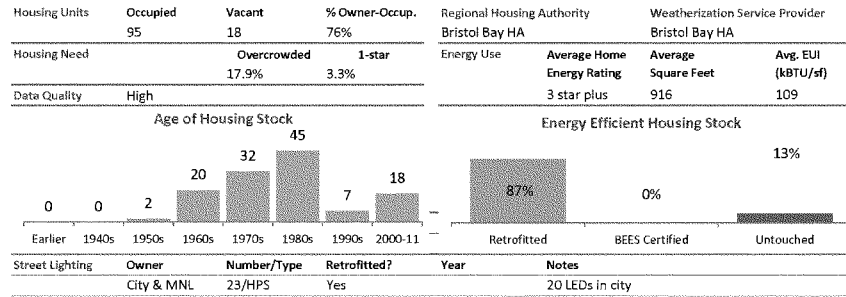
Bulk Fuel	Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
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SWR Schools	20,000	By Air
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Power Co.	21,400	Togiak Native Ltd. & SW Regional School Dist.
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Trading Co.	1,459	Barge delivery in Spring & Fall. Comp. bid (fixed price). Fuel tanks
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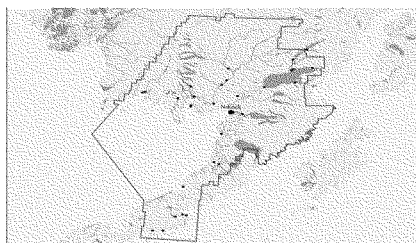
Energy Profile: Manokotak



Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport Waiting Room	2008	960			No
BBNA Head Start					No
BBNA Youth, TCSW, & Health Families					No
Central Water/ Sewer Plant	1967/68	780			No
City-KMD Pump Station					No
GCI-Earth Station					No
Housing Water/ Sewer Plant	1987	780			No
Manokotak K-12	2001	39,200	Yes		No
Manokotak School Buildings	1985-2003	41,740			No
Manokotak Village Clinic	2007	2,583			No
Manuquutag Trading Co.	1996				No
MNL Gas Pumphouse					No
MNL Powerplant	2001				No
Moravian Church					No
Moravian Church Parsonage					No
Natives Ltd. Office					No
Natives Ltd. Shop					No
Natives Ltd. Shop 2					No
New Fire Hall					No
Nushagak Telephone Earth Station					No
Old Condemned School					No
Old Head Start					No
Old High School					No
Old SWRS Maint. Bldg					No
Other		2,600			No
Pumphouse 1 VEEP	2002	336			No
USPS					No
Village Council Office					No
VPSO/Police Station					No
Water Tank Valve House VEEP		96			No

Community Profile: Naknek



Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

This region was first settled over 6,000 years ago by Yup'ik Eskimos and Athabaskan Indians. In 1821, the original Eskimo village of "Naugeik" was noted by Capt. Lt. Vasiliev. By 1880, the village was called Kinuyak. It was later spelled Naknek by the Russian Navy. The first salmon cannery opened on the Naknek River in 1890. By 1900, there were approximately 12 canneries in Bristol Bay. Naknek has developed over the years as a major fishery center.

Energy Priorities and Projects

NEA: Investigate heat absorption for ice production in summer;
NEA: Stack heat recovery; Increase energy efficiency of school buildings; more affordable housing; more weatherization in homes

Local Contacts		Email	Phone	Fax
Naknek Native Village		nncvpresident@gmail.com	907-246-4210	907-246-3563
Paug-Vik Incorporated, Limited			907-246-4277	907-246-4419

Demographics	2000	2010	2013
Population	678	554	
Median Age	35	38	
Avg. Household Size	3	3	
Median Household Income		\$88,125	
Electric Utility	Generation Sources		Interties
Naknek Electric Association	Diesel		King Salmon, South Naknek
Landfill	Class	2	Permitted?
			Yes
Water/Wastewater System	BBBSD Naknek Water System		Homes Served
Water	Piped		219
Sewer			Energy Audit?
Notes			
Access			
Road	No		
Air Access	Public/Private; Gravel		Runway
			1,950'x50'
Dock/Port	Yes		Barge Access?
			Yes
			Ferry Service?
			No
Notes			

Incorporation	Unincorporated		
Location	Located on north bank of the Naknek River, at the northeastern end of Bristol Bay. It is 297 miles southwest of Anchorage.		
Longitude	-157.0139	Latitude	58.7283
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Bristol Bay Borough		
School District	Bristol Bay Borough School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
Bed (10% Bor.), Raw Fish (3% Bor.)		N/A	
Economy	Subsistence community. Large fishing related economy. 100 commercial fishing permit holders. 116 current business licenses.		
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	11,716
Natural Hazard Plan			Year
Notes			
Community Plans			Year

Energy Profile: Naknek

Diesel Power System

Utility Naknek Electric Association

Power Plant

10 stationary generators, 2 mobile generators
Working on system upgrade plan

Line Loss 5.5%

Heat Recovery? Yes, BBB School District, Pool, 8 residences

Upgrades Priority Projects Status

RPSU Powerhouse

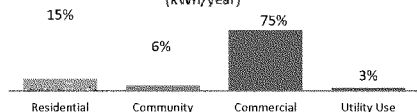
RPSU Distribution

Outage History/Known Issues Very reliable, very few outages
Generation & sales for Naknek, South Naknek, & King Salmon

Operators	No. of Operators	Training/Certifications
	1 Foreman	PPO
	5 Operators	3 temp. laborers in summer

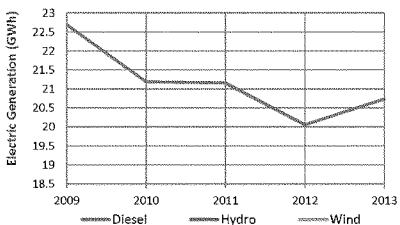
Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	738	2,840,685	3,849
Community	40	1,234,998	30,875
Commercial	359	14,431,075	40,198
Utility Use		612,053	

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	20,231,754	Avg. Load (kW)	1,317
Wind (kWh/yr)	0	Peak Load (kW)	2,927
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	16
Total (kWh/yr)	20,231,754	Diesel Used (gals/yr)	1,258,272



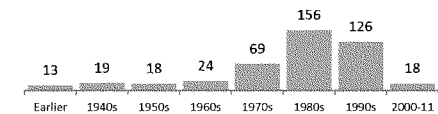
Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.17	Fuel Cost	\$0.24
Residential Rate	\$0.59	Non-fuel Cost	\$0.20
Commercial Rate	\$0.59	Total Cost	\$0.44
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.61	\$5.96	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)		\$5.70	4-13
Propane (100#)		\$257.38	8-14
Wood (1 cord)	N/A		
Pellets			
Discounts?	None		

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Medium		NEA not pursuing currently
Biomass	Low		
Solar	Pending		
Geothermal	Low	NEA Geothermal Project	Site tests
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	NEA Stack Heat to Power Project; HR to school	Investigating; Operational
Energy Efficiency	High	VEEP - BBBSD	In progress
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Naknek Elec.		1,660,000	
Borough		485,000	
Trident Seafood		31,000	
AK Gen. Seafood		24,200	
SW AK Constr.		6,000	
Others		11,700	
Bulk Fuel Upgrade	Priority	Project	Status
Purchasing Deliveries/Year Gallons/Delivery Vendor(s)			
By Barge			
By Air			
Cooperative Purchasing Agreements			
Notes			
Fish processors with tanks not included			

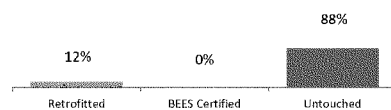
Energy Profile: Naknek

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	234	209	62%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	3.8%		7.3%		Average Square Feet
Data Quality	High				Avg. EUI (kBtu/sf)
				3-star	1,571
					141

Age of Housing Stock



Energy Efficient Housing Stock

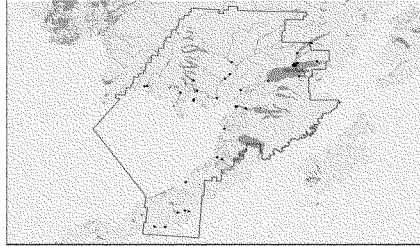


Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
		216	Partial		Working on retrofits as bulbs go out

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
BBB Fire Station					No
Boys & Girls Club					No
Bristol Bay Borough Offices					No
Camai Comm. Health Center					No
Christian Learning Center					No
Church (LDS)					No
Church (Orthodox)					No
Clinic	1994	1,098			No
Comm. Bible Camp					No
Dept. Transportation					No
District Office Bldg.	1988	2,912			Yes
DOT Bldgs.					No
Equipment Warm Storage		2,240			Yes
Equipment Warm Storage (South)		1,104			Yes
Family Fish Plant		579			No
Hilltop Church					No
Historical Orthodox Church					No
K-12 School	1982	90,200			Yes
KAKM Radio Station					No
Living Water Fellowship Church					No
Martin Monson Library					No
Museum					No
Naknek Electric Ass.					No
Other		15,636			No
Post Office					No
Public Works Bldg.					No
Seafood Processor Bldg.					No
Sewer Bldg.					No
Soul Hanson Church					No
Swimming Pool					No
Telephone Bldg.					No
Village Council Office / Clinic					No
Well House					No

Community Profile: Newhalen



Alaska Native Name (definition)

Nuurileng ("land of prosperity or abundance")

Historical Setting / Cultural Resources

The 1890 census listed the Eskimo village of "Noghelingamiut," meaning "people of Noghelin," at this location, with 16 residents. The present name is an Anglicized version of the original. The village was established in the late 1800s due to the bountiful fish and game in the immediate area. Newhalen includes Yup'ik Eskimos, Alutiiqs, and Athabascans. Most practice a subsistence and fishing lifestyle.

Energy Priorities and Projects

INNEC: Maintain year round capacity of Tazimina, increase river intake; INNEC: Upgrade distribution infrastructure Newhalen to Nondalton; Hook-up additional electric boilers; New lift station/replacement; Energy efficiency - Remodel school and renovate school gym

Local Contacts	Email	Phone	Fax
Newhalen Village	newhalentribal@yahoo.com	907-571-1410	907-571-1537
City of Newhalen	cityofnewhalen@yahoo.com	907-571-1226	907-571-1540
Bristol Bay Native Corporation		907-278-3602	907-276-3924
Demographics	2000	2010	2013
Population	160	190	Percent of Residents Employed 79.4%
Median Age	21	22.8	Denali Commission Distressed Community No
Avg. Household Size	5	3.8	Percent Alaska Native/American Indian (2010) 82.2%
Median Household Income	N/A	\$58,125	Low and Moderate Income (LMI) Percent (2014) 68.7%
Electric Utility	Generation Sources		Interties
I-N-N Electric Cooperative	Hydropower		Yes, Iliamna-Newhalen-
Landfill	Class	Permitted?	Location
Water/Wastewater System	City of Newhalen		Homes Served
Water	Piped		31
Sewer	Piped, septic systems		Energy Audit?
Notes	Ageing system & plant.		Yes
Access			
Road	No		
Air Access	State owned; asphalt	Runway	5086'x100' 4800'x100' 2998'x400'
Dock/Port	No	Barge Access?	Yes Ferry Service? No
Notes			

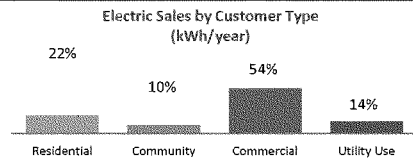
Incorporation	2nd Class City		
Location			
Newhalen is located on the north shore of Iliamna Lake, at the mouth of Newhalen River, 5 miles south of Iliamna and 320 miles southwest of Anchorage.			
Longitude	-154.8972	Latitude	59.72
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Lake and Peninsula Borough		
School District	Lake and Peninsula Borough School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
N/A			
Economy			
Local government, professional/business services, and trade, transportation/utilities are main employers. There are 11 commercial fishing permits and 7 business licenses.			
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	11,130
Natural Hazard Plan		Year	
Notes			
Community Plans			Year

Energy Profile: Newhalen

Diesel Power System

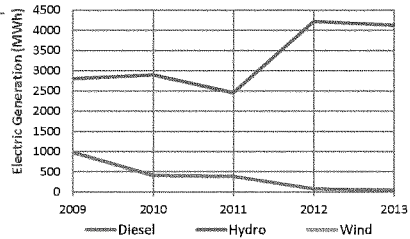
Utility	I-N-N Electric Coop, Inc		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	Marathon	New	350
Unit 2	Skania	New	350
Unit 3	Kato	New	350
Unit 4			
Line Loss	8.4%		
Heat Recovery?	Yes; City Office Bldg. & Fire Hall		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low		Complete
RPSU Distribution	Med.		
Outage History/Known Issues:			
PCE data includes Iliamna, Newhalen, & Nondalton.			
Operators	No. of Operators	Training/Certifications	
	1	Hydro, BFO, PPO	

Maintenance Planning (RPSU)		Acceptable	
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	215	810,980	3,772
Community	15	382,730	25,515
Commercial	105	2,017,376	19,213
Utility Use		543,936	



Power Production

Diesel (kWh/yr)	93,226	Avg. Load (kW)	161
Wind (kWh/yr)	0	Peak Load (kW)	358
Hydro (kWh/yr)	4,006,061	Efficiency (kWh/ga)	18
Total (kWh/yr)	4,099,287	Diesel Used (gals/y)	5,123



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.33	Fuel Cost	\$0.01
Residential Rate	\$0.57	Non-fuel Cost	\$0.22
Commercial Rate	None	Total Cost	\$0.23

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.67	\$6.68	6-13; 8-14

Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$157.38	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects	Status
Hydroelectric	High	Tazimina, 824 kW, Intertie	Operational
Wind Diesel	Medium		
Biomass	High		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	Hydro Electric Boilers, 150 kW to school	Operational
Energy Efficiency	High	EECBG	Complete

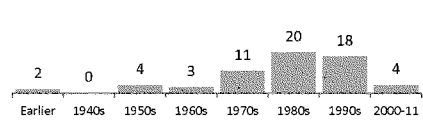
Bulk Fuel	Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	
City	Heating Oil	3,000	Good	By Barge
INN	Diesel	70,000	New	By Air
Cooperative Purchasing Agreements				
L&P School Dist.				

Bulk Fuel Upgrade	Priority	Project	Status
Notes			
City tanks not EPA compliant. LPSD agreement w/ INNEC to			

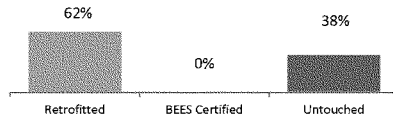
Energy Profile: Newhalen

Housing Units	Occupied 50	Vacant 11	% Owner-Occup. 58%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 22.0%		1-star N/A	Energy Use	Average Home Energy Rating
Data Quality	Medium				Average Square Feet
					Avg. EUI (kBtu/sf)
				N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock

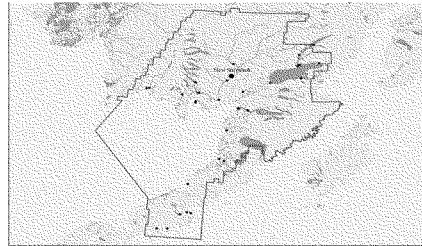


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	I-N-NEC	20/HP5	Yes	2011	Newhalen Tribe secured grant for retrofit; INN owns & maintains

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
AK State Trooper Bldg.					No
City Council					No
Clinic	1990	754			No
General Store					No
INNEC Office Building	2013	2,700		BEES certified	No
INNEC PowerPlant	1981	3,500			No
New Clinic	1995	1,440			No
Newhalen House					No
Newhalen K-12					No
Newhalen Tribal Council		1,260			No
Orthodox Church		1,053			No
Public Safety/Fire Hall	1980-1995	28,692	Yes		Yes
Pumphouse					No
Teacher Housing 1					No
Teacher Housing 2		1,768			No
Teen Center					No
Water plant					No

Community Profile: New Stuyahok



Alaska Native Name (definition)

Cetuyaraq ("going downriver place")

Historical Setting / Cultural Resources

The present location is the third site that villagers can remember. The village moved downriver to the Mulchatna area from the "Old Village" in 1918. During the 1920s and 30s, the village was engaged in herding reindeer. By 1942, the herd had dwindled to nothing, the village had been subjected to flooding, site was too far inland to receive barge service. In 1942, the village moved downriver again to its present location. Yup'ik Eskimo village with Russian Orthodox influences. Residents live a fishing and subsistence lifestyle.

Energy Priorities and Projects

Continue with wind feasibility project; complete heat recovery project; Additional work on fuel storage and transport planned, seeking funds; Water/Sewer lines need upgrading; more homes needed

Incorporation	2nd Class City	
Location	Located on the Nushagak River, about 12 miles upriver from Ekwook and 52 miles northeast of Dillingham. The village has been constructed at two elevations -- one 25 feet above river level and one about 40 feet above river level.	
Longitude	-157.3119	Latitude 59.4528
ANCSA Region	Bristol Bay Native Corporation	
Borough/CA	Dillingham Census Area	
School District	Southwest Region School District	
AEA Region	Bristol Bay	

Taxes	Type (rate)	Per-Capita Revenue
None		

Economy

Local government, trade, transportation/utilities, and education/health services are main employers. There are 20 commercial fishing permits and 16 business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	11,306

Natural Hazard Plan	Year
Yes	7/4/1905

Notes	Update due 2017
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Community Plans	Year
City of New Stuyahok Hazard Mitigation Plan	2012
New Stuyahok Comprehensive Plan	2005

Local Contacts	Email	Phone	Fax
New Stuyahok Village	newstutribes@hotmail.com	907-693-3173	907-693-3179
New Stuyahok Traditional Council		907-693-3173	
City of New Stuyahok	cityofnewstuyahok@hotmail.com	907-693-3171	907-693-3153
Demographics	2000	2010	2013
Population	471	510	63.0%
Median Age	25	22.6	Denali Commission Distressed Community
Avg. Household Size	5	4.47	Yes
Median Household Income	N/A	\$38,750	Percent Alaska Native/American Indian (2010)
Electric Utility	Generation Sources	Interties	PCE?
Alaska Village Electric Cooperative - AVEC	Diesel		Yes
Landfill	Class	3	Permitted?
Water/Wastewater System	City of New Stuyahok	Yes	Location
Water	Piped	101	New Stuyahok
Sewer	Piped	Energy Audit?	System Volume
Notes	2 operators. Sewer lines in old sections need repl	No	
Access			
Road	No		
Air Access	State owned; gravel		
Dock/Port	No	Runway	3282'x95'
		Barge Access?	No
		Ferry Service?	No
Notes			

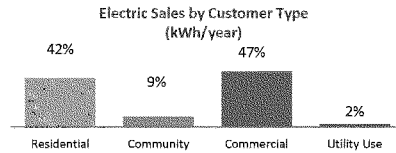
Energy Profile: New Stuyahok

Diesel Power System

Utility	AVEC		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	Cummins	Fair/18,654	499
Unit 2	Detroit Diesel	Fair/26,264	363
Unit 3	Caterpillar	Fair/39,342	457
Unit 4			
Line Loss	1.4%		
Heat Recovery?	Yes; AVEC Tool Shack, Bunk House		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	In Progress		
RPSU Distribution	In Progress		
Outage History/Known Issues:	No		

Operators	No. of Operators	Training/Certifications
	3	BFO, PPO

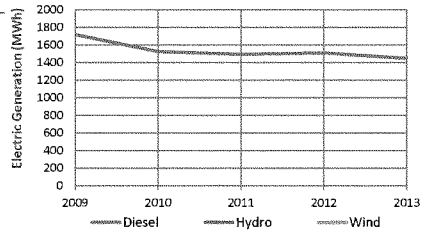
Maintenance Planning (RPSU)	Acceptable		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	103	564,968	5,485
Community	11	120,616	10,965
Commercial	41	641,257	15,640
Utility Use		32,127	



Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Medium	New Stuyahok Wind Feasibility Analysis	Site located, CDR on hold until wind resource proven
Biomass	High		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	New Stuyahok Heat Recovery	Construction
Energy Efficiency	High	1) VEEP 2) ANTHC Sanitation EE Audit	1) Complete 2) Funded
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
City	Heating Oil	140,000	
Bulk Fuel Upgrade	Priority	Project	Status

Power Production

Diesel (kWh/yr)	1,378,601	Avg. Load (kW)	162
Wind (kWh/yr)	0	Peak Load (kW)	377
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	14
Total (kWh/yr)	1,378,601	Diesel Used (gals/yr)	101,469



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.20	Fuel Cost	\$0.34
Residential Rate	\$0.63	Non-fuel Cost	\$0.23
Commercial Rate		Total Cost	\$0.57
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.26	\$6.77	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$242.14	8-14
Wood (1 cord)	Not sold, residents collect their own		
Pellets			
Discounts?		None	

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	2-3		Delta W./Vitus
By Air			

Cooperative Purchasing Agreements

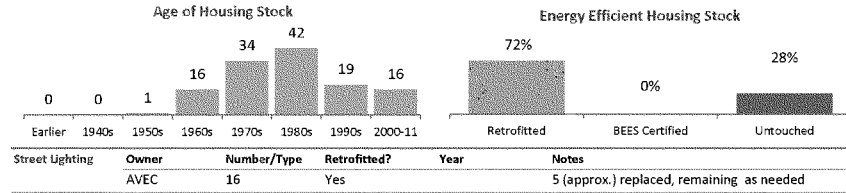
None

Notes

Comp. bidding. Droughts potentially limit barge delivery.

Energy Profile: New Stuyahok

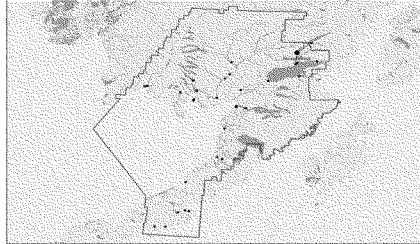
Housing Units	Occupied 97	Vacant 16	% Owner-Occup. 60%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	57.7%		19.1%		Average Square Feet
Data Quality	High				2 star plus
					845
					164



Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
AVEC Power plant					No
Boys & Girls Club					No
Church	1960	4,500			No
City Dump					No
City Equip. Shed					No
City Office					No
Clinic					No
FRC/Clinic	2010	5,314			No
Headstart	1998	2,000			No
High School					No
Orthodox Church					No
Other Bldgs.		11,567			No
P-Store	1991	4,000			No
Public Safety Building					No
Public Store					No
School Gym					No
School K-12	2009	49,738			No
School Shed					No
School Shed					No
School Storage Bldg					No
SRE Building 1 (Heated)		1,200			Yes
Sunday School					No
TANF					No
Tribal Bldg					No
Tribal Council	1990	2,500			No
USPS					No
VPSO Bldg					No
Water Pump house					No

Community Profile: Nondalton



Alaska Native Name (definition)

Nundaltin

Historical Setting / Cultural Resources

Nondalton is a Tanaina name first recorded in 1909 by the U.S. Geological Survey. The village was originally located on the north shore of Six Mile Lake, but in 1940 growing mudflats and wood depletion in the surrounding area caused the village to move to its present location on the west shore. It is a Tanaina Indian (Athabascan and Iliamna) village with a fishing and subsistence lifestyle.

Energy Priorities and Projects

INNEC: Maintain year round capacity of Tazimina, increase river intake; INNEC: Upgrade distribution infrastructure Newhalen to Nondalton; Hook-up additional electric boilers; continue with biomass feasibility, seeking funds; Complete replacement of water system

Local Contacts		Email	Phone	Fax
City of Nondalton		nondaltoncity@hotmail.com	907-294-2235	907-294-2235
Nondalton Village		nondaltontribe@yahoo.com	907-294-2257	907-294-2271
Bristol Bay Native Corporation			907-278-3602	907-276-3924
Demographics		2000	2010	2013
Population		221	164	Percent of Residents Employed 66%
Median Age		29	28.8	Denali Commission Distressed Community Yes
Avg. Household Size		4	2.88	Percent Alaska Native/American Indian (2010) 67%
Median Household Income		N/A	\$25,042	Low and Moderate Income (LMI) Percent (2014) 85.3%
Electric Utility		Generation Sources		Interties
I-N-N Electric Cooperative		Hydro, diesel		Yes, Iliamna-Newhalen-
Landfill		Class	3	Permitted? Yes
Water/Wastewater System		City of Nondalton		Location Nondalton
Water		Piped		Homes Served 51
Sewer		Piped		Energy Audit?
Notes				Yes

Access

Road No

Air Access State owned; gravel

Dock/Port No

Incorporation 2nd Class City

Location

Located on the west shore of Six Mile Lake, between Lake Clark and Iliamna Lake, 190 miles southwest of Anchorage.

Longitude -154.8478 Latitude 59.9719

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate)

None

Per-Capita Revenue

Economy

Local government, education/health, and professional/ business services are main employers. There is one commercial fishing permit and twelve business licenses.

Climate Avg. Temp. Climate Zone Heating Deg. Days

N/A

7

11,130

Natural Hazard Plan

Year

Notes

Expired

Community Plans

Year

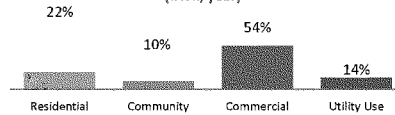
Energy Profile: Nondalton

Diesel Power System

Utility	I-N-N Electric Coop, Inc		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	N/A		
Unit 2			
Unit 3			
Unit 4			
Line Loss	8.4%		
Heat Recovery?			
Upgrades	Priority	Projects	Status
RPSU Powerhouse	N/A		
RPSU Distribution	High		
Outage History/Known Issues			
PCE data includes Iliamna, Newhalen, & Nondalton.			
Operators	No. of Operators	Training/Certifications	

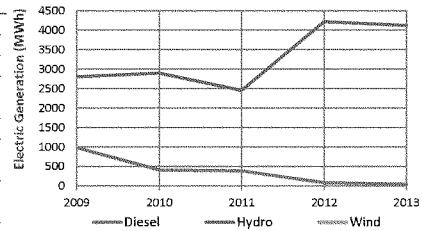
Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	215	810,980	3,772
Community	15	382,730	25,515
Commercial	105	2,017,376	19,213
Utility Use		543,936	

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	93,226	Avg. Load (kW)	59
Wind (kWh/yr)	0	Peak Load (kW)	132
Hydro (kWh/yr)	4,006,061	Efficiency (kWh/gal)	18
Total (kWh/yr)	4,099,287	Diesel Used (gals/yr)	5,123



Electric Rates (\$/kWh)

Rate with PCE	\$0.33	Cost per kWh Sold (\$/kWh)	
Residential Rate	\$0.57	Fuel Cost	\$0.01
Commercial Rate	None	Non-fuel Cost	\$0.22
		Total Cost	\$0.23

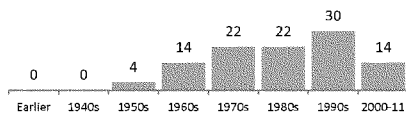
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.67	\$6.08	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$218.33	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects	Status
Hydroelectric	High	Tazimina, 824 kW, Intertie	Operational
Wind Diesel	Medium		
Biomass	High		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	Hydro Electric Boilers, 100kW	Operational
Energy Efficiency	High	ANTHC Sanitation EE Upgrades/Training	In Progress
Bulk Fuel		Purchasing	Deliveries/Year
Tank Owner	Fuel Type(s)	Capacity	Gallons/Delivery
City	Heating Oil	3,000	Vendor(s)
City	Gasoline	1,000	
Cooperative Purchasing Agreements			
L&P School Dist.			
Notes			
LPSD fuel flow in at \$0.50-\$1.00/gal. LPSP agreement w/ INNEC to			

Energy Profile: Nondalton

Housing Units	Occupied 58	Vacant 46	% Owner-Occup. 83%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 27.6%		1-star 7.2%	Energy Use	Average Home Energy Rating 2 star plus
Data Quality	Medium				Average Square Feet 949
					Avg. EUI (kBtu/sf) 129

Age of Housing Stock



Energy Efficient Housing Stock

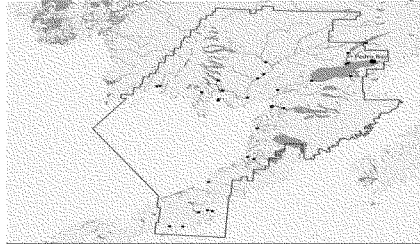


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	I-N-NEC		In progress		Nondalton Tribe secured grant for retrofits; INN owns and maintains

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Backup Gen. Shed for School					No
Chedda & Cheds B&B					No
City & Tribal Offices					No
City Hall		2,200			No
Clinic	2007	2,683			No
Grocery Store & Coop/Post Office					No
Nondalton Doll Factory					No
Orthodox Church					No
School K-12	1979-1985	21,744	Yes		Yes
SRE Bldg 1	1993	1,104			Yes
SRE Bldg 2 (Heated)		1,200			Yes
Teacher Housing					No
Village Comm. Center					No
Water Plant	1973	900			No

Community Profile: Pedro Bay



Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

The Dena'ina have occupied this area historically. The Dena'ina warred with Russian fur traders over trade practices in the early 1800s. The community was named for a man known as "Old Pedro," who lived in this area in the early 1900s. Pedro Bay is a village with a subsistence lifestyle.

Incorporation Unincorporated

Location

Pedro Bay is located on the Alaska Peninsula, at the head of Pedro Bay and the east end of Iliamna Lake, 176 air miles southwest of Anchorage.

Longitude -154.7872 Latitude 59.7872

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District N/A

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

N/A

Economy

Local government, natural resources/mining, and education/health services are the main employers. There are 3 commercial fishing permits and 13 business licenses.

Climate Avg. Temp. Climate Zone Heating Deg. Days

N/A 7

Natural Hazard Plan Year

Notes

Community Plans Year

Energy Priorities and Projects

Continue design & permitting for Knutson Creek hydro; Expand use of solar thermal devices; extension of airport runway to allow larger fuel deliveries; more houses needed

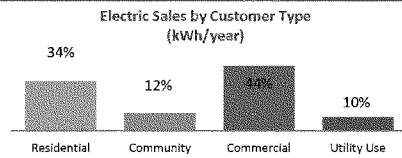
Local Contacts	Email	Phone	Fax
Pedro Bay Village	villagecouncil@pedrobay.com	907-850-2225	907-850-2221
Pedro Bay Corporation		907-277-1500	907-277-1501
Bristol Bay Native Corporation		907-278-3602	907-276-3924
Demographics	2000	2010	2013
Population	50	42	63%
Median Age	35	40	Denali Commission Distressed Community
Avg. Household Size	3	2.21	Percent Alaska Native/American Indian (2010)
Median Household Income	N/A	\$43,958	68.2%
Electric Utility	Generation Sources	Interties	PCE?
Pedro Bay Village Council	Diesel	No	Yes
Landfill	Class	3	Permitted?
Water/Wastewater System	Pedro Bay Village Council	No	Note
Water	Individual wells	Homes Served	New landfill construct. 2015
Sewer	Individual septic	Energy Audit?	System Volume
Notes	Council operates pump truck	No	
Access			
Road	No		
Air Access	State owned; gravel	Runway	3002'x60'
Dock/Port	Yes	Barge Access?	Yes
		Ferry Service?	No
Notes			

Energy Profile: Pedro Bay

Diesel Power System

Utility	Pedro Bay Village Council		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Fair/2,995	95
Unit 2	John Deere	Fair/47,142	58
Unit 3	John Deere	Fair/32,662	58
Unit 4			
Line Loss	9.7%		
Heat Recovery?	Yes; Main Office Bldg., EMS		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Med.		
RPSU Distribution	Low		
Outage History/Known Issues			
One outage in the last 2.5 years.			
Operators	No. of Operators	Training/Certifications	
	2	OJT	

Maintenance Planning (RPSU) Acceptable			
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	19	56,731	2,986
Community	5	20,440	4,088
Commercial	12	74,105	6,175
Utility Use	15,882		

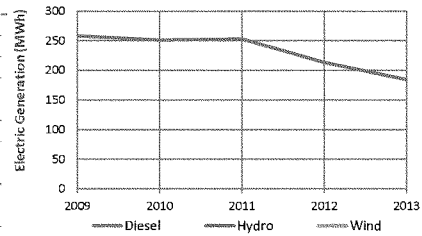


Alternative Energy	Potential	Projects			Status		
Hydroelectric	High	Knutson Creek Hydroelectric Project			Design and permitting		
Wind	Diesel	Low					
Biomass	Low						
Solar	Low						
Geothermal	Low						
Oil and Gas	Low						
Coal	Low						
Emerging Tech	Not Rated						
Heat Recovery	Low	HR System for community buildings			Operational		
Energy Efficiency	Medium						
Bulk Fuel							
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
Village	Heating Oil	56,000	Good	By Barge	2		
Village	Gasoline	8,000	Good	By Air	3-5		Everts Air Fuel
Cooperative Purchasing Agreements							
None							

Bulk Fuel Upgrade	Priority	Project	Status
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Power Production

Diesel (kWh/yr)	185,127	Avg. Load (kW)	26
Wind (kWh/yr)	0	Peak Load (kW)	57
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	11
Total (kWh/yr)	185,127	Diesel Used (gals/yr)	17,247

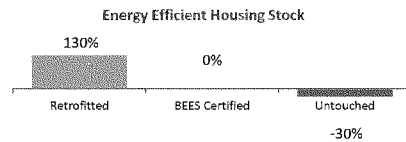
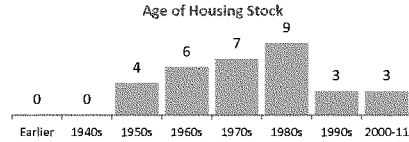


Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.42	Fuel Cost	\$0.61
Residential Rate	\$0.91	Non-fuel Cost	\$0.22
Commercial Rate	\$0.91	Total Cost	\$0.83
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$5.91	\$5.64	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)	\$169.05		8-14
Wood (1 cord)	No private sellers		
Pellets			
Discounts?	No		

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	2		
By Air	3-5		Everts Air Fuel
Cooperative Purchasing Agreements			
None			
Notes: Longer runway would allow bigger plane, price break.			
Barge delivery in Spring and Fall. Year round by air.			

Energy Profile: Pedro Bay

Housing Units	Occupied 10	Vacant 22	% Owner-Occup. 80%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 40.0%		1-star N/A	Energy Use	Average Home Energy Rating N/A
Data Quality	Low				Average Square Feet N/A
					Avg. EUI (kBtu/sf) N/A

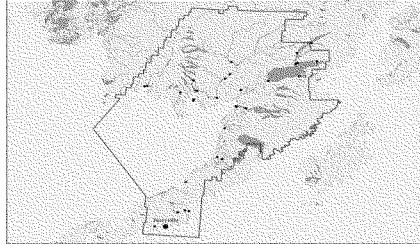


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
					None

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Boat & Barge Landing/Storage					No
Gen. Bldg.	1989	800			No
Greenhouse					No
Library & Apts.			Yes	Yes	No
Main Office			Yes	Yes	No
Post Office					No
Power Plant					No
Russian Orthodox Church					No
Russian Orthodox Church (Old)					No
School	2002	7,520			No
School Gen. Bldg.					No
SRE Bldg (Heated)	2002	1,320			Yes
Storage Shed/EMS building	2008	600			No
Village Council/Clinic/Comm. Center	1996	797			No

Community Profile: Perryville



Alaska Native Name (definition)

Perry-q

Historical Setting / Cultural Resources

The community was founded in 1912 as a refuge for Alutiiq people driven away from their villages by the eruption of Mt. Katmai. Many villagers from Douglas and Katmai survived the eruption because they were out fishing at the time. The village was originally called "Perry," but the "ville" was added to conform to the post office name, established in 1930. The village maintains an Alutiiq culture and a subsistence lifestyle. Commercial fishing provides cash income.

Energy Priorities and Projects

Expand use of solar PV on community buildings; expand use/options for ground source heat pumps; weatherization needed in older homes, alternative energy source for swimming pool

Incorporation	Unincorporated		
Location	Located on the south coast of the Alaska Peninsula, 275 miles southwest of Kodiak and 500 miles southwest of Anchorage.		
Longitude	-159.1456	Latitude	55.9128
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Lake and Peninsula Borough		
School District	Lake and Peninsula Borough School District		
AEA Region	Bristol Bay		

Taxes	Type (rate)	Per-Capita Revenue
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None

Economy

Local government, education/health services, and information are the main employers. There are 8 fishing permits and 8 business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
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Natural Hazard Plan	Year
No	

Notes	No record
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Community Plans	Year
Perryville Community Plan	2005
Update to plan (Jaylon Kosbruk)	2015

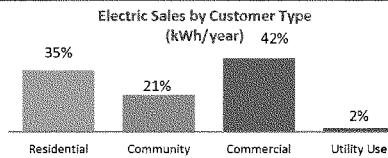
Local Contacts	Email	Phone	Fax
Native Village of Perryville	nvproads@hotmail.com	907-853-2203	907-853-2230
Oceanside Corporation		907-853-2300	907-853-2301
Bristol Bay Native Assoc. Inc.		907-842-5257	907-842-5932
Demographics	2000	2010	2013
Population	107	113	62.5%
Median Age	27	27.8	Denali Commission Distressed Community
Avg. Household Size	4	2.97	Yes
Median Household Income	N/A	\$22,344	Percent Alaska Native/American Indian (2010)
			95.7%
			Low and Moderate Income (LMI) Percent (2014)
			N/A
Electric Utility	Generation Sources	Interties	PCE?
Native Village of Perryville	Wind turbine, Diesel		Yes
Landfill	Class	3	Permitted?
		No	Location
			Perryville
Water/Wastewater System	Native Village of Perryville	Homes Served	System Volume
Water	Piped	38	
Sewer	Piped sewer, individual septic	Energy Audit?	
Notes	Septic pumped and sludged for new WTP.	Yes	
Access			
Road	No		
Air Access	State owned; gravel	Runway	3300'x75'
Dock/Port	No	Barge Access?	Yes
		Ferry Service?	No
Notes	Boat Ramp in 2014		

Energy Profile: Perryville

Diesel Power System

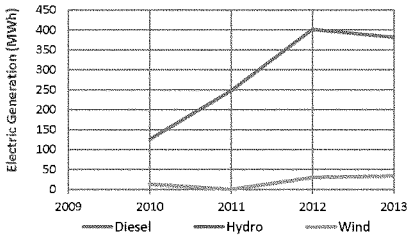
Utility	Native Village of Perryville		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Fair/Unknown	175
Unit 2	John Deere	Fair/Unknown	170
Unit 3	John Deere	Fair/Unknown	128
Unit 4			
Line Loss	22.3%		
Heat Recovery?	Yes; School		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	In Progress	New Gen., 2016	
RPSU Distribution	In Progress		
Outage History/Known Issues			
Generator hours unknown. Outages once a month			
Operators	No. of Operators	Training/Certifications	
	1	PPO, BF	

Maintenance Planning (RPSU)	Acceptable		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	52	139,041	2,674
Community	6	83,274	13,879
Commercial	14	166,837	11,917
Utility Use		8,041	



Power Production

Diesel (kWh/yr)	473,200	Avg. Load (kW)	95
Wind (kWh/yr)	37,804	Peak Load (kW)	211
Hydro (kWh/yr)	0	Efficiency (kWh/gs)	18
Total (kWh/yr)	511,004	Diesel Used (gals/yr)	26,929



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.62	Fuel Cost	\$0.31
Residential Rate	\$0.95	Non-fuel Cost	\$0.10
Commercial Rate	\$0.95	Total Cost	\$0.41
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.55	\$5.42	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)		\$5.72	3-15
Propane (100#)		\$305	3-15
Wood (1 cord)	N/A		
Pellets			
Discounts?	No		

Alternative Energy	Potential	Projects	Status
Hydroelectric	Medium		
Wind Diesel	Medium	10 Residential Turbines. 2.5-2.9 kW each	Operational
Biomass	Low		
Solar	Pending	Office/Clinic Bldg., 3 kW PV panels	Operational
Geothermal	Low	Geothermal/ Heat pumps, Office Bldg.	Operational
Oil and Gas	Low		
Coal	Medium		
Emerging Tech	Not Rated		
Heat Recovery	High	Diesel Genset HR	Operational
Energy Efficiency	Medium	VEEP, LPSD; Interior Lights - Community Bldgs	Complete

Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Village	Heating Oil	80,000	Fair
Village	Gasoline	15,000	Fair

Bulk Fuel Upgrade	Priority	Project	Status
			Complete

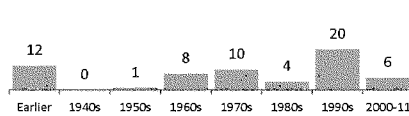
Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	1		Crowley
By Air			
Cooperative Purchasing Agreements			
None.			

Notes
Barge delivery in Spring & Fall. Dock would help with access.

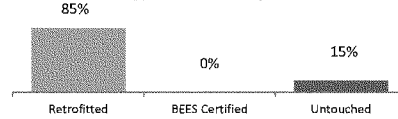
Energy Profile: Perryville

Housing Units	Occupied 39	Vacant 16	% Owner-Occup. 72%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded 17.9%		1-star N/A	Energy Use	Average Home Energy Rating N/A
Data Quality	Med.				Average Square Feet N/A
					Avg. EUI (kBtu/sf) N/A

Age of Housing Stock



Energy Efficient Housing Stock

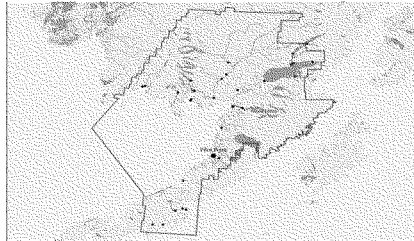


Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
					None

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
AT&T Alascom Sat. Dish	~1970s				No
Cannery - City Shops (5)					
City Office Building					
Clinic	2009	4,413			No
DOT Grader Bldg	2005				No
DOT State Buildings (2)					
Fire Station					No
GCI Sat. Dish	~1990s				No
Gen. Bldg	1985	800			No
Old Power Plant					
Perryville School (k-12)	1983	16,904			Yes
Post Office	~2000s				No
Power Plant					No
PPNC Building					
Pump Station/Water Treatment	~1970s				No
R. Orthodox Church	~1920s				No
School Tank Farm/Generator	~1990s				No
State of AK Warehouse, Storage #1	2005	800			No
State of AK Warehouse, Storage #2	2005				No
Store	1960				No
Subsistence Bldg	1993				No
Teacher Housing	~1990s				No
Teacher Housing 2	~1990s				No
Tsunami Shelter	1996				No
VC Office/Oceanside Corp. Bldg	2007	10,000			No
VPSO Office Building					

Community Profile: Pilot Point



Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

This mixed Aleut and Eskimo community developed around a fish salting plant established by C.A. Johnson in 1889. At that time, it was called "Pilot Station," after the river pilots stationed here to guide boats upriver to a large cannery at Ugashik. A post office was established in 1933, and the name was changed to Pilot Point at that time. Pilot Point incorporated as a city in 1992.

Incorporation 2nd Class City (inc. 1992)

Location

Pilot Point is located on the northern coast of the Alaska Peninsula, on the east shore of Ugashik Bay. The community lies 84 air miles south of King Salmon and 368 air miles southwest of Anchorage.

Longitude -157.5792 Latitude 57.5642

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes	Type (rate)	Per-Capita Revenue
Raw Fish (3% + 2% Bor.), Bed (6% Bor.)	Guide (\$3/p/d Bor.)	\$12,150

Economy

Subsistence & commercial fishing community. 13 commercial fishing permits. 7 current business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	10,415

Natural Hazard Plan Year

Notes Expired

Community Plans Year

Energy Priorities and Projects

Continue with wind project development; install meter boxes on homes; set-up back-up energy source; more weatherization and energy efficiency measures or replace dilapidated homes

Local Contacts	Email	Phone	Fax
City of Pilot Point		907-797-2200	907-797-2211
Native Village of Pilot Point		907-797-2330	907-797-2332
Pilot Point Native Corporation		907-797-2213	907-797-2258
Demographics	2000	2010	2013
Population	100	68	Percent of Residents Employed 91.5%
Median Age	29	17	Denali Commission Distressed Community No
Avg. Household Size	4	3	Percent Alaska Native/American Indian (2010) 66.2%
Median Household Income	N/A	\$31,563	Low and Moderate Income (LMI) Percent (201x) 67.5%
Electric Utility	Generation Sources		Interties PCE?
Pilot Point Electrical Utility	Diesel, Wind		No Yes
Landfill	Class 3	Permitted?	Yes Location 3 miles NE of town, from beach.
Water/Wastewater System	Homes Served		System Volume
Water	Well		
Sewer	Septic		Energy Audit?
Notes	No		
Access			
Road	No		
Air Access	Public/Private; Gravel/Dirt		Runway 3,280'x75' 5,280'x125'
Dock/Port	Yes		Barge Access? Yes Ferry Service? No
Notes			

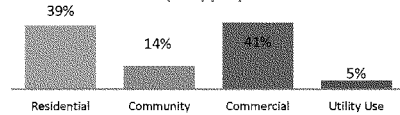
Energy Profile: Pilot Point

Diesel Power System

Utility	Pilot Point Electric Utility		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Good/15,359	101
Unit 2	John Deere	Good/12,410	67
Unit 3	John Deere	Good/255	99
Unit 4			
Line Loss	10.2%		
Heat Recovery?	Yes; School		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	Low	In progress	Complete
RPSU Distribution	Med.	In progress	
Outage History/Known Issues	Outages - unbalanced load		
Unbalanced legs causes system failure during auto switching.			
Operators	No. of Operators	Training/Certifications	
	2	PPO	

Maintenance Planning (RPSU)

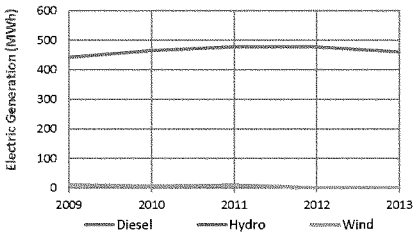
Good			
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	47	145,904	3,104
Community	10	53,361	5,336
Commercial	19	152,272	8,014
Utility Use		20,018	

Electric Sales by Customer Type
(kWh/year)

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Medium	Pilot Point Wind Power & Heat	Partially operational, CDR submitted
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Medium		
Emerging Tech	Not Rated		
Heat Recovery	High	Wind to Heat; expansion possible	In development
Energy Efficiency	High	EFCBG	Complete
Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
City	Heating Oil	145,000	Good
City	Gasoline	37,000	Good
Bulk Fuel Upgrade			
	Priority	Project	Status

Power Production

Diesel (kWh/yr)	413,589	Avg. Load (kW)	42
Wind (kWh/yr)	0	Peak Load (kW)	93
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	11
Total (kWh/yr)	413,589	Diesel Used (gals/yr)	36,248

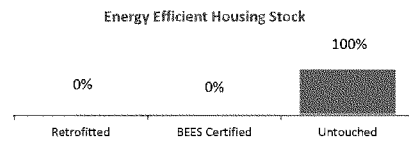
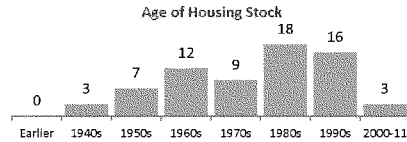


Electric Rates (\$/kWh)

Rate with PCE	\$0.16	Cost per kWh Sold (\$/kWh)	
Residential Rate	\$0.50	Fuel Cost	\$0.41
Commercial Rate		Non-fuel Cost	\$0.13
		Total Cost	\$0.53
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.31	\$5.00	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
		\$221.90	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Energy Profile: Pilot Point

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	24	10	42%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	23.5%		N/A		Average Square Feet
Data Quality	Medium				1-star plus
					1,477
					160

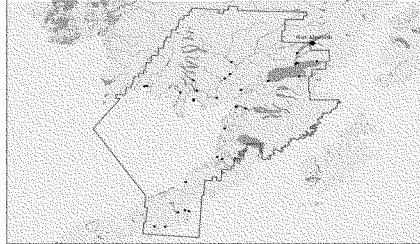


Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
	City	15/HPS	Yes		Replaced with LEDs

Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Cannery Bldg./City Shops					No
Church (Orthodox)					No
City Bldg.					No
City Hall					No
City Office Bldg.		3,400			No
City Power Plant & Tank					No
Clinic & Council Office	2010	2,540			No
Old Post Office					No
Old Power Plant					No
Pilot Point K-12	1995	10,957			Yes
Post Office					No
Power Plant					No
PPNC Bldg.					No
SRE Bldg 2 (Heated)		1,200			Yes
State Warehouse		1,600			No
Store					No
Teacher Housing					No
VPSO Housing					No
VPSO Office					No
Workshop/Storage/Powerhouse	1995	508			No

Community Profile: Port Alsworth



Alaska Native Name (definition)

Port Alsworth

Historical Setting / Cultural Resources

Originally a native village, a post office was established in 1950. Port Alsworth's population is primarily non-Native.

Incorporation	Unincorporated		
Location	Port Alsworth is on the east shore of Lake Clark at Hardenburg Bay, 22 miles northeast of Nondalton. It lies in the Lake Clark National Park and Preserve.		
Longitude	-154.3128	Latitude	60.2025
ANCSA Region	Bristol Bay		
Borough/CA	Lake and Peninsula Borough		
School District	Lake and Peninsula Borough School District		
AEA Region	Bristol Bay		
Taxes	Type (rate)	Per-Capita Revenue	
Bed (6%), Raw Fish (2%), Guide (\$3/p/d)		N/A	
Economy	Local government and trade, transportation/utilities are the largest employment industries. Three commercial fishing permit holders, and 35 current business licenses.		
Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	36.1 F	7	11,206
Natural Hazard Plan		Year	
Notes			
Community Plans		Year	

Energy Priorities and Projects

Add solar arrays to residences and public buildings; New heat recovery system to serve newly built school and buildings; Public barge and landing strip to lower cost of fuel delivery

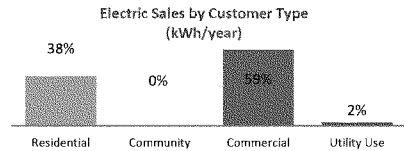
Local Contacts	Email	Phone	Fax
Tanalian Inc.		907-272-3581	907-278-7030
Demographics	2000	2010	2013
Population	104	190	53.9%
Median Age	26	26	Denali Commission Distressed Community
Avg. Household Size	4	4	Percent Alaska Native/American Indian (2010)
Median Household Income	N/A	\$56,250	Low and Moderate Income (LMI) Percent (2014)
Electric Utility	Generation Sources	Interties	PCE?
Tanalian Electric Cooperative	Diesel	No	Yes
Landfill	Class	Permitted?	Location
Water/Wastewater System	None	Homes Served	System Volume
Water	Individual wells	Energy Audit?	
Sewer	Individual septic		
Notes			
Access			
Road	No		
Air Access	Private; Gravel/Dirt	Runway	3,000'x100' 4,200'x100'
Dock/Port	No	Barge Access?	No Ferry Service? No
Notes	Private runway charges landing fees, potentially increases fuel delivery costs.		

Energy Profile: Port Alsworth

Diesel Power System

Utility	Tanalian Electric Cooperative		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Good	210
Unit 2	John Deere	Good	150
Unit 3	John Deere	Good	190
Unit 4			
Line Loss	6.5%		
Heat Recovery?	Yes; School		
Upgrades	Priority	Projects	Status
RPSU Powerhouse			In Progress
RPSU Distribution			In Progress
Outage History/Known Issues			
Outages rare.			
Operators	No. of Operators	Training/Certifications	
	2	OJT	

Maintenance Planning (RPSU)			
Acceptable			
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	75	287,955	3,839
Community	0	0	-
Commercial	59	444,522	7,534
Utility Use		17,831	

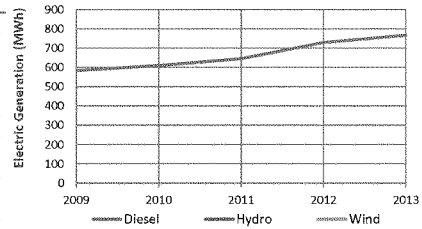


Alternative Energy	Potential	Projects	Status
Hydroelectric	Low	Tanalian Falls Hydro	Location prevents development
Wind Diesel	Low	Feasibility Assessment	Complete, Not Feasible
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	HRT to School, duplex, teacher's house	Operational
Energy Efficiency	High		

Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
L&P Air		5,500	
L&P Schools		15,000	
Lake Clark Air		8,000	
AK Wild. Lodge		6,000	
Misc. Others		10,300	
Bulk Fuel Upgrade	Priority	Project	Status

Power Production

Diesel (kWh/yr)	802,350	Avg. Load (kW)	66
Wind (kWh/yr)	0	Peak Load (kW)	146
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	12
Total (kWh/yr)	802,350	Diesel Used (gals/yr)	65,848



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.18	Fuel Cost	\$0.45
Residential Rate	\$0.66	Non-fuel Cost	\$0.16
Commercial Rate	\$0.63	Total Cost	\$0.61
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$5.15		6-13
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
Wood (1 cord)			
Pellets			
Discounts?			
None			

Energy Profile: Port Alsworth

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority		Weatherization Service Provider	
	65	32	38%	Bristol Bay HA		Bristol Bay HA	
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating	Average Square Feet	Avg. EUI (kBtu/sf)
	N/A		N/A		N/A	N/A	N/A
Data Quality	Medium						

Age of Housing Stock

Decade	Count
Earlier	0
1940s	6
1950s	0
1960s	7
1970s	28
1980s	7
1990s	39
2000-11	10

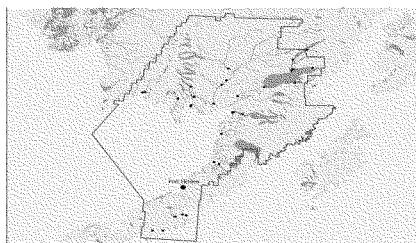
Energy Efficient Housing Stock

Category	Percentage
Retrofitted	5%
BEES Certified	0%
Untouched	95%

Street Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
					None

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Community Profile: Port Heiden



Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

The old village of Meshik was located at the current site of Port Heiden. A school was established in the early 1950s, which attracted people from surrounding villages. Port Heiden incorporated as a city in 1972. The community relocated inland, because storm waves had eroded much of the old town site and threatened to destroy community buildings. Port Heiden is a traditional Alutiiq community, with a commercial fishing and subsistence lifestyle.

Energy Priorities and Projects

Continue with wind project design; Address tank farm erosion, solution needed urgently; Interest in hydro, re-do feasibility study; Interest in drilling test sites for geothermal project

Incorporation 2nd Class (inc. 1972)

Location

Port Heiden is 424 miles southwest of Anchorage, at the mouth of the Meshik River, on the north side of the Alaska Peninsula. It lies near the Aniakchak National Preserve and Monument.

Longitude

Latitude

ANCSA Region Bristol Bay Native Corporation

Borough/CA Lake and Peninsula Borough

School District Lake and Peninsula Borough School District

AEA Region Bristol Bay

Taxes Type (rate)

Per-Capita Revenue

Bed Tax (6% Bor.), Raw Fish (2% Bor.), Guide (\$3/p/d Bor.)

N/A

Economy

Subsistence and commercial fishing community. 11 commercial fishing permits. 12 business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	36F	7	10,415

Natural Hazard Plan

Year

Notes

Community Plans

Year

Local Contacts		Email	Phone	Fax
City of Port Heiden		cityofpeth@hotmail.com	907-837-2209	907-837-2248
Native Village of Port Heiden		annie_christensen@hotmail.com	907-837-2296	907-837-2297

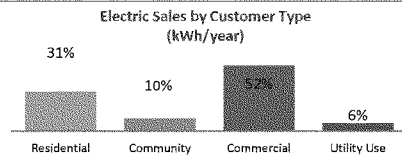
Demographics		2000	2010	2013
Population		119	102	Percent of Residents Employed 84.6%
Median Age		34	18	Denali Commission Distressed Community No
Avg. Household Size		3	3	Percent Alaska Native/American Indian (2010) 83.3%
Median Household Income		N/A	\$60,313	Low and Moderate Income (LMI) Percent (2014) 47.3%
Electric Utility		Generation Sources		Interties PCE?
Port Heiden Utilities		Diesel		No Yes
Landfill	Class	3	Permitted?	Yes Location 2.5 E of town.
Water/Wastewater System		L&PSD	Homes Served	
Water		Well	System Volume	
Sewer		Septic		
Notes		Energy Audit?		No
Access				
Road	No			
Air Access	Public; Gravel		Runway	5,000'x100' 4,00'x100'
Dock/Port	Yes		Barge Access?	Yes Ferry Service? No
Notes				

Energy Profile: Port Heiden

Diesel Power System

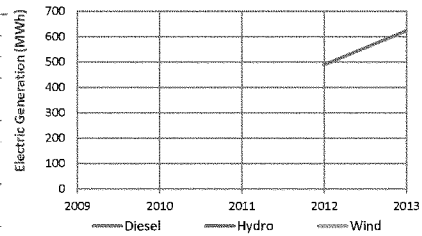
Utility	Port Heiden Utilities		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Poor/Unknown	179
Unit 2	John Deere	Good/6,143	190
Unit 3			
Unit 4			
Line Loss	Not Reported		
Heat Recovery?	Yes; Fire Dept., VPSO		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	In Progress		
RPSU Distribution	Medium		
Outage History/Known Issues			
Single engine dependent. Engine on unit 1 torn down for overhaul.			
Operators	No. of Operators	Training/Certifications	
		BF Book, BF Mgr., BFO, PPO,	
		Clerk	

Maintenance Planning (RPSU)			
Good			
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	52	180,145	3,464
Community	5	57,486	11,497
Commercial	19	299,850	15,782
Utility Use	36,304		



Power Production

Diesel (kWh/yr)	517,800	Avg. Load (kW)	75
Wind (kWh/yr)	0	Peak Load (kW)	167
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	10
Total (kWh/yr)	517,800	Diesel Used (gals/yr)	54,330



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.25	Fuel Cost	\$0.42
Residential Rate	\$0.75	Non-fuel Cost	\$0.13
Commercial Rate		Total Cost	\$0.55
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.23	\$5.80	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)		\$151.43	8-14
Wood (1 cord)			
Pellets			
Discounts?			

Alternative Energy	Potential	Projects	Status
Hydroelectric	Medium		
	Low	300 kW high penetration wind system	On Hold pending RPSU upgrade conceptual design (2015)
Wind Diesel			
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Medium		
Emerging Tech	Not Rated		
Heat Recovery	High	HR to fire dept., VPSO office	
Energy Efficiency	High	EECBG	Complete

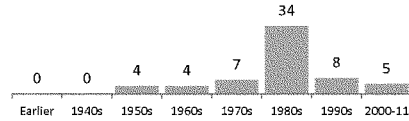
Bulk Fuel	Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
Tank Owner	Fuel Type(s)	Capacity	Age/Condition	
City	Heating Oil	64,000	Good	By Barge
City	Gasoline	44,000	Good	By Air

Bulk Fuel Upgrade	Priority	Project	Status	Notes
				Barge delivery in Spring & Fall.

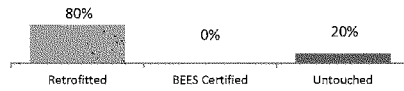
Energy Profile: Port Heiden

Housing Units	Occupied 25	Vacant 24	% Owner-Occup. 60%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need	Overcrowded N/A		1-star 4.8%	Energy Use	Average Home Energy Rating 4-star
Data Quality	Med.				Average Square Feet 1,169
					Avg. EUI (kBtu/sf) 98

Age of Housing Stock



Energy Efficient Housing Stock

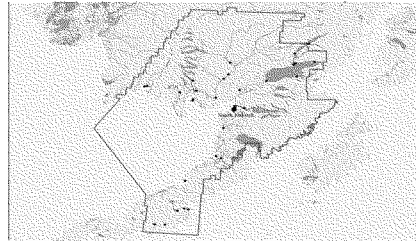


Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
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Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport ARFF Bldg.	1993	3,200			Yes
City & Village Council Bldg.					No
City Shop					No
Clinic	2000	2,099			No
GCI Bldg.					No
Gift Store					No
Grocery Store & Post Office					No
Hardware Store					No
Meshik K-12	1996	16,340			Yes
New Church (Orthodox)					No
Power Plant					No
St. Agafia Church					No
Storage	1981	336			No

Community Profile: South Naknek



Alaska Native Name (definition)

N/A

Historical Setting / Cultural Resources

South Naknek was settled permanently after the turn of the century as a result of salmon cannery development. South Naknek is a traditional Sugpiaq/Alutiq village whose residents are descendants of people displaced by the Katmai and Novarupta volcanic eruptions of 1912.

Energy Priorities and Projects

NEA: Investigate heat absorption for ice production in summer;
NEA: Stack heat recovery; weatherization and energy efficiency;
investigate wind power

Local Contacts	Email	Phone	Fax
South Naknek Village	lorianne_n@hotmail.com	907-246-8614	907-631-0949
Alaska Peninsula Corporation		907-274-2433	907-274-8694

Demographics		2000	2010	2013
Population		137	79	Percent of Residents Employed 52.1%
Median Age		36	18	Denali Commission Distressed Community No
Avg. Household Size		3	3	Percent Alaska Native/American Indian (2010) 83.3%
Median Household Income		N/A	\$65,250	Low and Moderate Income (LMI) Percent (2014) No
Electric Utility			Generation Sources	Interties PCE?
Naknek Electric Association			Diesel	Naknek, King Salmon Yes
Landfill	Class	3	Permitted?	Yes Location ~1 mile W. of town
Water/Wastewater System				Homes Served System Volume
Water	Well			
Sewer	Septic			Energy Audit?
Notes				Yes
Access				
Road	No			
Air Access	Public; Gravel/Dirt			Runway 2,264'x60' 3,314'x60'
Dock/Port	Yes			Barge Access? Yes Ferry Service? No
Notes				

Incorporation	Unincorporated
Location	South Naknek is located on the south bank of the Naknek River on the Alaska Peninsula, 297 miles southwest of Anchorage. It lies just west of the Katmai National Park and Preserve.
Longitude	-156.9981
Latitude	58.7156
ANCSA Region	Bristol Bay Native Corporation
Borough/CA	Bristol Bay Borough
School District	Bristol Bay Borough School District
AEA Region	Bristol Bay
Taxes	Type (rate)
Bed (10% Bor.), Raw Fish (3% Bor.)	Per-Capita Revenue N/A
Economy	Subsistence fishing village. 23 commercial fishing permits. 7 business licenses.
Climate	Avg. Temp. 42.1F
	Climate Zone 7
	Heating Deg. Days 11,772
Natural Hazard Plan	Year
Yes	2011
Notes	Update required 10/6/2016
Community Plans	Year

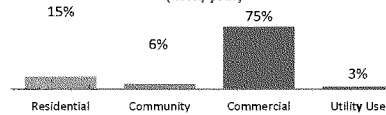
Energy Profile: South Naknek

Diesel Power System

Utility	Naknek Electric Association		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	N/A		
Unit 2			
Unit 3			
Unit 4			
Line Loss		5.5%	
Heat Recovery?			
Upgrades	Priority	Projects	Status
RPSU Powerhouse			
RPSU Distribution			
Outage History/known issues	Feeders from NEA substation		
Generation & sales for Naknek, South Naknek, & King Salmon			
Operators	No. of Operators	Training/Certifications	

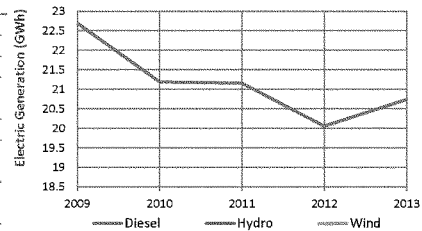
Maintenance Planning (RPSU)

Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	738	2,840,685	3,849
Community	40	1,234,998	30,875
Commercial	359	14,431,075	40,198
Utility Use		612,053	

Electric Sales by Customer Type
(kWh/year)

Power Production

Diesel (kWh/yr)	20,231,754	Avg. Load (kW)	485
Wind (kWh/yr)	0	Peak Load (kW)	1,078
Hydro (kWh/yr)	0	Efficiency (kWh/gal)	16
Total (kWh/yr)	20,231,754	Diesel Used (gals/yr)	1,258,272



Electric Rates (\$/kWh)

Rate with PCE	\$0.17	Cost per kWh Sold (\$/kWh)	
Residential Rate	\$0.59	Fuel Cost	\$0.24
Commercial Rate	\$0.59	Non-fuel Cost	\$0.20
		Total Cost	\$0.44

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$3.61	\$5.96	6-13; 8-14

Other Fuel? (1 gal)

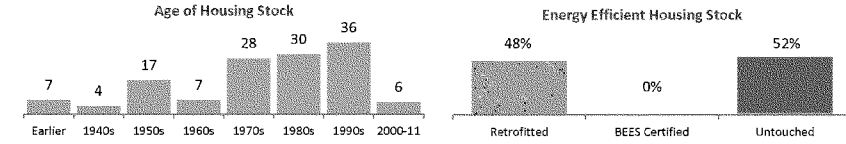
Gasoline (1 gal)	
Propane (100#)	
Wood (1 cord)	
Pellets	
Discounts?	

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Medium		NEA not pursuing currently
Biomass	Low		
Solar	Low		
Geothermal	Low	NEA Geothermal Project	Site tests
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low	NEA Stack Heat to Power Project; HR to school	Investigating; Operational
Energy Efficiency	High	ANTHC Audits-clinic, sanitation, com & trbl bldgs	Complete in 2011
Bulk Fuel		Purchasing	Deliveries/Year Gallons/Delivery Vendor(s)
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Kodiak Ventures		150,100	
BB Schools		24,000	
Trident Seafood		78,000	
Peter Pan Seafood		15,000	
Bulk Fuel Upgrade	Priority	Project	Status

Notes

Energy Profile: South Naknek

Housing Units	Occupied	Vacant	% Owner-Occup.	Regional Housing Authority	Weatherization Service Provider
	29	106	66%	Bristol Bay HA	Bristol Bay HA
Housing Need	Overcrowded		1-star	Energy Use	Average Home Energy Rating
	N/A		2.6%		Average Square Feet
Data Quality	High				3-star
					1,161
					134

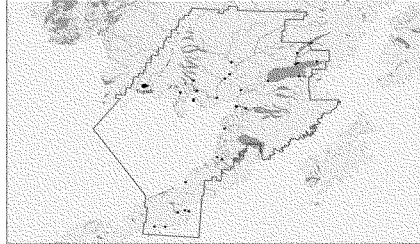


Lighting	Owner	Number/Type	Retrofitted?	Year	Notes
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Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Apt. Complex					No
Bar					No
Borough Apts.					No
Borough Shop					No
Church (Lutheran)					No
Church (Orthodox)					No
Clinic / Tribal Bldg. / Comm. Center	1995	3,020	Yes		No
Elementary School	1980	6,960			No
Fire Station					No
Fish Proc. Plant					No
Kodiak Adventures Processing Plant					No
Landfill					No
Naknek Electric Assoc. / Telephone Coop. Shop					No
Northland LLC Barge Services					No
Old Hanger					No
Old Trident Seafoods Processing Plant					No
State DOT & PF Garage					No
Telephone Coop.					No
Tribal Office Bldg.					No
Tribal Storage Garage					No
Trident Seafoods Proc. Plant					No
US Post Office					No
Water & Sewer Shop					No
Youth Center					No

Community Profile: Togiak



Alaska Native Name (definition)

Tuyuryaq

Historical Setting / Cultural Resources

In 1880 "Old Togiak" or "Togiagamute" was located across the bay and had a population of 276. Many residents of the Yukon-Kuskokwim region migrated south to the Togiak area after the devastating influenza epidemic in 1918-19. Togiak was flooded in 1964, and many fish racks and stores of gas, fuel oil, and stove oil were destroyed. Three or four households left Togiak after the flood and developed the village of Twin Hills upriver. Togiak is a traditional Yup'ik Eskimo village with a fishing and subsistence

Energy Priorities and Projects

Heat recovery project under construction; small hydro project; Interest in intertie to Twin Hills; Tank farm upgrade urgently needed due to erosion on site; Upgrade to water and sewer lines

Incorporation	2nd Class City		
Location	Located at the head of Togiak Bay, 67 miles west of Dillingham. It lies in Togiak National Wildlife Refuge and is the gateway to Walrus Island Game Sanctuary.		
Longitude	-160.3764	Latitude	59.0619
ANCSA Region	Bristol Bay Native Corporation		
Borough/CA	Dillingham Census Area		
School District	Southwest Region School District		
AEA Region	Bristol Bay		

Taxes	Type (rate)	Per-Capita Revenue
Sales (2%)		\$ 138,016

Economy

Local government, trade transportation/utilities, and education/health services are main employers. There are 126 fish permits issued and 23 business licenses.

Climate	Avg. Temp.	Climate Zone	Heating Deg. Days
	N/A	7	11,306

Natural Hazard Plan	Year
Yes	2010

Notes	Updated required 2/16/2015
Community Plans	Year
Togiak Comprehensive Plan	2006
City of Togiak, AK Multi-Hazard Mitigation	2009

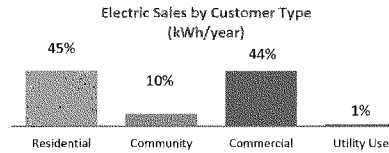
Local Contacts	Email	Phone	Fax
Togiak Natives Limited		907-493-5520	907-493-5554
Traditional Village of Togiak	tuyuryaq14@gmail.com	907-493-5003	907-493-5005
City of Togiak	city.of.togiak.alaska@hotmail.com	907-493-5820	907-493-5067
Demographics	2000	2010	2013
Population	809	880	Percent of Residents Employed 49.7%
Median Age	24	24.5	Denali Commission Distressed Community Yes
Avg. Household Size	4	3.54	Percent Alaska Native/American Indian (2010) 80.9%
Median Household Income	N/A	\$ 47,232.00	Low and Moderate Income (LMI) Percent (2014) 69.5%
Electric Utility	Generation Sources	Interties	PCE?
Alaska Village Electric Cooperative - AVEC	Diesel		Yes
Landfill	Class	3	Permitted? No Location Togiak
Water/Wastewater System	City of Togiak	Homes Served	System Volume
Water	Piped	213	N/A
Sewer	Piped	Energy Audit?	
Notes	5 miles of lines need replacement. City has design, but no funding.	Yes	
Access			
Road	No		
Air Access	State owned; gravel	Runway	410'x59'
Dock/Port	Yes	Barge Access?	Yes Ferry Service? No
Notes			

Energy Profile: Togiak

Diesel Power System

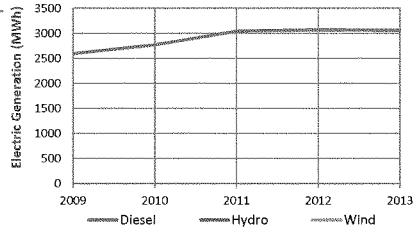
Utility	AVEC		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	Cummins	Fair/28,931	499
Unit 2	Caterpillar	Fair/27,865	350
Unit 3	Cummins	Fair/36,041	824
Unit 4			
Line Loss	3.7%		
Heat Recovery?	Yes; AVEC Tool Shack, Bunk House		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	In Progress		
RPSU Distribution	In Progress		
Outage History/Known Issues	Two outages due to fishing plant going online.		
Operators	No. of Operators	Training/Certifications	
	9	BFO, Itin BFO	

Maintenance Planning (RPSU)	Excellent		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	228	1,289,757	5,657
Community	20	282,630	14,132
Commercial	68	1,275,523	18,758
Utility Use	39,731		



Power Production

Diesel (kWh/yr)	2,997,095	Avg. Load (kW)	348
Wind (kWh/yr)		Peak Load (kW)	596
Hydro (kWh/yr)		Efficiency (kWh/gal)	13
Total (kWh/yr)	2,997,095	Diesel Used (gals/yr)	228,112

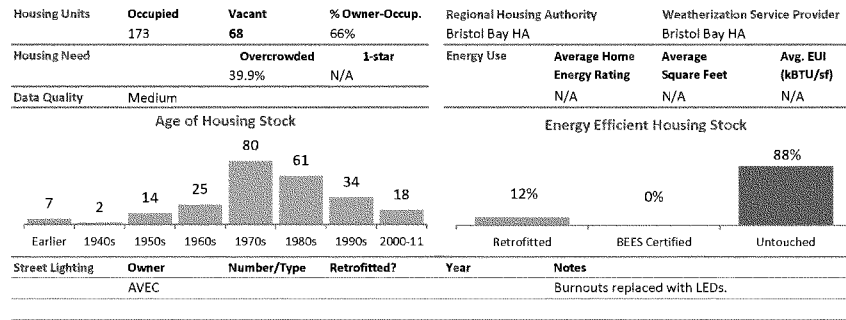


Electric Rates (\$/kWh)	Cost per kWh Sold (\$/kWh)		
Rate with PCE	\$0.20	Fuel Cost	\$0.35
Residential Rate	\$0.63	Non-fuel Cost	\$0.23
Commercial Rate		Total Cost	\$0.58
Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.45	\$6.42	6-13; 8-14
Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100#)			
Wood (1 cord)	N/A		
Pellets			
Discounts?	None		

Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Medium		
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	High	Togiak Waste Heat Recovery Project	Construction
Energy Efficiency	High	EECBG; VEEP	Both Complete
Bulk Fuel		Purchasing	Deliveries/Year
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
City	stove oil; gas	45,000	
AVEC		135,700	
SWR Schools		59,400	
Village Council		1,000	
AK Comm. Co.		2,000	
Misc. Other		6,600	
Bulk Fuel Upgrade	Priority	Project	Status

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	2+		Delta, Crowley, Vitus
By Air			
Cooperative Purchasing Agreements			
None			
Notes			

Energy Profile: Togiak



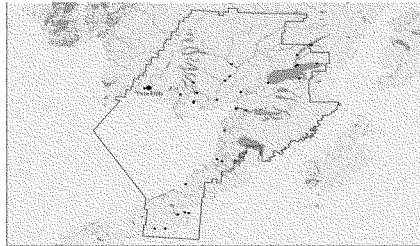
Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
AC Store					No
Assembly Of God Church					No
AVEC Elec. Plant					No
AVEC Tank Farm					No
BBHA rentals					No
Beacon Tower					No
Boys & Girls Club		3,046			No
City Duplex		1,169			No
City Garage					No
City Maint. Bldg					No
City Office		1,682			No
City Old School		17,061			No
City Police & Fire Station					No
City Quarters					No
City Shop		1,200			No
City Water & Sewer Bldg					No
Clinic		1,000			No
Coupchiak Bldg 1					No
Coupchiak Bldg 2					No
Double Wide Trailer					No
Family Resource Center		6,548			No
GCI Station					No
Moravian Church					No
New School	2004	70,205			No
New School Gym					No
Police & Fire Bldg		2,287			No
Senior Center/Clinic					No
Senior Housing					No
Seventh Day Ad. Church					No
SWRSD housing					No
TNL Garage					No
TNL Office					No
Togiak Head Start					No

Energy Profile: Togiak

Non-residential Building Inventory (continued)					
Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Togiak Water Tank					No
Trading Store					No
USPS					No
UUI Station					No
Yellow Bldg					No

Community Profile: Twin Hills



Alaska Native Name (definition)

Ingricuar

Historical Setting / Cultural Resources

The village was established in 1965 by families who moved from Togiak to avoid the recurrent flooding there. Some residents migrated from Quinhagak on Kuskokwim Bay. The people have strong cultural ties to the Yukon-Kuskokwim region, because many of their ancestors migrated to Togiak following the 1918-19 influenza epidemic. Twin Hills is a traditional Yup'ik Eskimo village with a fishing and subsistence lifestyle.

Energy Priorities and Projects

Install heat recovery system; New low-maintenance generators needed; Add solar arrays to homes and community buildings; Alternative method for fuel delivery due to lower river level; Upkeep of road pads built on tundra and moss; need more homes and community buildings

Local Contacts	Email	Phone	Fax
Twin Hills Village	william15@starband.net	907-525-4821	907-525-4822
Twin Hills Native Corporation		907-525-4327	907-525-4820
Bristol Bay Native Corporation		907-278-3602	907-276-3924
Demographics	2000	2010	2013
Population	69	74 (80)	63.6%
Median Age	39	41.5	Denali Commission Distressed Community
Avg. Household Size	3	2.55	Yes
Median Household Income	N/A	\$ 29,000.00	Percent Alaska Native/American Indian (2010)
Electric Utility	Generation Sources	Interties	Low and Moderate Income (LMI) Percent (2014)
Twin Hills Village	Diesel		N/A
Landfill	Class	3	Permitted?
Water/Wastewater System	Class	3	Permitted?
Water	Piped		No
Sewer	Piped, gravity sewer		No
Notes	Broken pipes in need of replacement.		Yes
Access			
Road	No		
Air Access	State owned; gravel	Runway	3000'x60'
Dock/Port	No	Barge Access?	No
		Ferry Service?	No
Notes			

Incorporation Unincorporated

Location

Twin Hills is located near the mouth of the Twin Hills River, a tributary of the Togiak River, 386 miles southwest of Anchorage.

Longitude -160.275 Latitude 59.0792

ANCSA Region Bristol Bay Native Corporation

Borough/CA Dillingham Census Area

School District Southwest Region School District

AEA Region Bristol Bay

Taxes Type (rate) Per-Capita Revenue

None

Economy

Local government, education/health services, and manufacturing are the main employers. There are 8 fishing permit holders and 3 business licenses.

Climate Avg. Temp. N/A Climate Zone 7 Heating Deg. Days N/A

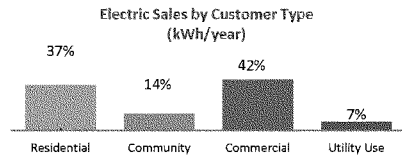
Natural Hazard Plan Year

Energy Profile: Twin Hills

Diesel Power System

Utility	Twin Hills Village Council		
Engine	Make/Model	Condition/Hrs	Gen Capacity
Unit 1	John Deere	Fair/Unknown	128
Unit 2	John Deere	Fair/1,488	92
Unit 3			
Unit 4			
Line Loss	Not Reported		
Heat Recovery?	No		
Upgrades	Priority	Projects	Status
RPSU Powerhouse	In Progress		
RPSU Distribution	In Progress		
Outage History/Known Issues			
1-2 outs/year from old power lines. 1 from snapped cond. line.			
Operators	No. of Operators	Training/Certifications	
	2	Basic PPO	

Maintenance Planning (RPSU)	Acceptable		
Electric Sales	No. of Customers	kWh/year	kWh/Customer
Residential	29	103,044	3,553
Community	6	37,701	6,284
Commercial	9	115,388	12,821
Utility Use		20,042	

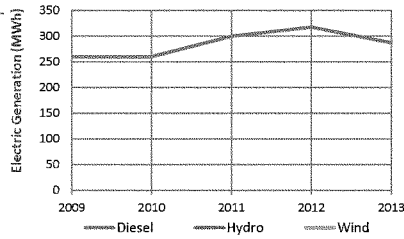


Alternative Energy	Potential	Projects	Status
Hydroelectric	Low		
Wind Diesel	Low		
Biomass	Low		
Solar	Pending		
Geothermal	Low		
Oil and Gas	Low		
Coal	Low		
Emerging Tech	Not Rated		
Heat Recovery	Low		
Energy Efficiency	High	1)ANTHC Water EE Audit 2)Upgrades & Training	1) Complete 2) Complete 2015

Bulk Fuel			
Tank Owner	Fuel Type(s)	Capacity	Age/Condition
Village	Heating Oil	52,000	Good
Village	Gasoline	6,000	Good
School	Heating Oil	20,000	Unknown
Bulk Fuel Upgrade	Priority	Project	Status

Power Production

Diesel (kWh/yr)	143,605	Avg. Load (kW)	18
Wind (kWh/yr)	0	Peak Load (kW)	41
Hydro (kWh/yr)	0	Efficiency (kWh/g)	5
Total (kWh/yr)	143,605	Diesel Used (gals)	29,180



Electric Rates (\$/kWh)		Cost per kWh Sold (\$/kWh)	
Rate with PCE	\$0.64	Fuel Cost	\$0.48
Residential Rate	\$1.00	Non-fuel Cost	\$0.07
Commercial Rate	\$1.00	Total Cost	\$0.54

Fuel Prices (\$)	Utility/Wholesale	Retail	Month/Year
Diesel (1 gal)	\$4.60	\$8.00	6-13; 8-14

Other Fuel? (1 gal)			
Gasoline (1 gal)			
Propane (100lb)		\$252.14	8-14
Wood (1 cord)			
Pellets			
Discounts?	None		

Purchasing	Deliveries/Year	Gallons/Delivery	Vendor(s)
By Barge	1		Delta West.
By Air			

Cooperative Purchasing Agreements

None.

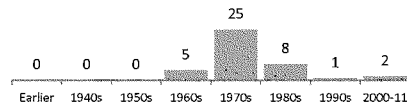
Notes

Barge delivery in late Aug. or Sept. Comp. bid (fixed price)

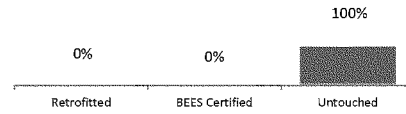
Energy Profile: Twin Hills

Housing Units	Occupied 20	Vacant 21	% Owner-Occup. 55%	Regional Housing Authority Bristol Bay HA	Weatherization Service Provider Bristol Bay HA
Housing Need		Overcrowded 5.0%	1-star N/A	Energy Use	Average Home Energy Rating
Data Quality	Low				Average Square Feet
					Avg. EUI (kBtu/sf)
				N/A	N/A

Age of Housing Stock



Energy Efficient Housing Stock



Street Lighting	Owner	Number/Type 9	Retrofitted? No	Year	Notes Half operational. No upgrade plans.
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Non-residential Building Inventory

Building Name or Location	Year Built	Square Feet	Audited?	Retrofits Done?	In ARIS?
Airport & State Storage Bldg	2000	1,104			No
Church	2005				No
Clinic	2008	1,604			No
Community Hall	1970	560			No
Native Corp.					No
Propane Farm (shed)					No
School Fuel Storage					No
School Generator					No
SRE Bldg		1,104			Yes
Tank Farm					No
Twin Hills K-12	1976	6,499	Yes		Yes
UUI					No
Village Council Offices	2002	2,400			No
Village Garage	1977	768			No
Village Generator Building	1984	384			No
Water Storage Tank					No
Water Treatment Plant					No

A | COMMUNITY AND UTILITY INTERVIEWS

Community and utility interviews were conducted over the phone from January to March 2015. Interviews were conducted by BBNA, SWAMC, and Information Insights staff.

Community	Interviewed	Utility	Interviewed
Aleknagik	Kay Andrews, City Administrator	Nushagak Electric Cooperative	Mike Megli, CEO & Michael Favors, Telecom Ops Manager, Nushagak Electric Cooperative
Chignik	Becky Boettcher, City Clerk		
Chignik Lagoon	Delissa McCormick, Tribal Administrator & Michelle Anderson, Grants Manager		
Chignik Lake	Shirley Kalmakoff, Tribal Administrator		
Clark's Point			
Dillingham	Alice Ruby, Mayor		
Egegik	Don Strand, City Administrator		
Ekwok	Crystal Clark, City Administrator		
Igiugig	AlexAnna Salmon, President and Administrator, Village Council		
Iliamna	Martha Anelon & Gerold Anelon, Tribal Administrator	INN Electric Coop, Inc	George Hornberger, General Manager, INNEC
King Salmon			
Kokhanok	Peducia Andrew, Tribal Administrator & Elijah Eknaty		
Koliganek	Herman Nelson, Sr., President, New Koliganek Village Council		
Levelock	Alexander Talleepalek, President, Levelock Village Council		
Manokotak	Michael Alakayuk, Manokotak Power Co		
Naknek	Lucy Goode, General Manager, Paul-Vik Inc. Ltd.	Naknek Electric Association	Donna Vukich, General Manager, NEA
New Stuyahok	William (Chuck) Peterson, City Administrator		
Newhalen	Greg Anelon, City Administrator		
Nondalton			
Pedro Bay	Keith Jenson, President, Pedro Bay Village		
Perryville	Gerald Kosbruk, President, Native Village of Perryville		

Appendix A

Pilot Point	Steven Kramer, Mayor
Port Alsworth	Mark Lang , Co-op Manager, Tanalian Electric Coop
Port Heiden	
South Naknek	
Togiak	Darryl Thompson, City Administrator
Twin Hills	William Ilutsik, Vice President, Twin Hills Village Council

B | ENERGY MEETING PARTICIPANTS

Iliamna Subregional Meeting | March 23, 2015

Natalia Marttila	Nondalton Tribal
Will Evanoff	Nondalton Tribal
Peducia Andrew	Kokhanok Village Council
Elijah Eknaty	Kokhanok Village Council
Nathan Hill	Lake & Pen Borough
Larry J. Hill	Iliamna Village Council
George Hornberger	INN Electric Cooperative
Greg Anelon	City of Newhalen
Ben Foss	Pedro Bay
Jon Burrows	Port Alsworth
Shannon J. Nanalook	Self
Senafont Shugak Jr.	Pedro Bay Council

Chignik Lagoon Subregional Meeting | March 24, 2015

John Christensen Jr.	Port Heiden
Frank Simpson	Port Heiden Utilities
Steve Kramer	City of Pilot Point
Becky Boettcher	City of Chignik
Debbie Carlson	Chignik Bay Tribal Council
Clinton Boskofsky	Chignik Lake Village Council
Terrence Kosbruk	Native Village of Perryville
Austin Shangin	Native Village of Perryville
Willard Lind Jr.	Chignik Lake
Don Bumpus	Chignik Lagoon
Michelle L. Anderson	Chignik Lagoon Village Council
Delissa McCormick	Chignik Lagoon Village Council
Clem Grunert	Chignik Lagoon Village Council President

King Salmon Subregional Meeting | March 25, 2015

David Hostetter	Igiugig
Betsy Hostetter	Igiugig
James Kallenberg	Levelock Village Council
Henry Olsen	Egegik
Don Strand	City of Egegik
Roland Briggs	Ugashik

William Weatherby	WM Manufactory
Eddie Clark	Naknek
Dale Peters	Naknek Electric Association
Becky Savo	Bristol Bay Borough
Suzanne Lamson	Naknek Electric Association
Thomas Deck	Naknek Electric Association
Alexander Tallekpalek	Levelock Village Council
Adelheid Herrmann	SAVEC
Laura Zimin	Bristol Bay Borough/SAVEC
Paul Hansen	Naknek Native Village
Stephen Jones	Naknek Electric Association

Dillingham Subregional Meeting | March 26, 2015

Jennie Apokedak	New Koliganek Village Council - IGAP
Gwen Larson	BBNA - Community Development
Kenny Jensen	Ekwoke Village Council
Diane Folsom	Ekuk Village Council
Bruse Ilutsik	Aleknagik Traditional Council
Allen Ilutsik	Aleknagik Traditional Council
Roy Hiratsuka	Ekuk Village Council
Rose Loera	City of Dillingham
Billy Maines	Curyung Tribal Council
Betty Gardiner	Clark's Point Village Council
Arthur Sharp	Twin Hills Native Corp
Joseph Wassily	Clark's Point Village Council
Mariano Floresta	Clark's Point Village Council
Dennis Andrew	New Stuyahok Limited
Peter Christopher Sr.	New Stuyahok Traditional Council
Luki Akelkok Sr.	Ekwoke
Melvin P. Andrew	City of Manokotak
Kenneth Nukwak Sr.	Manokotak Natives Ltd.
Joseph Kazimirowicz	City of Ekwoke
Moses Toyukak Sr.	City of Manokotak
Peter Lockuk Sr.	Togiak Traditional Council
Mark Scotford	Bristol Bay Area Health Corporation
Julianne Baltar	Bristol Bay Native Association
Jody Saiz	City of Dillingham
Eric Hanssen	ANTHC
Brice Eningowuk	City of Togiak
Tom Matsik	UAF Bristol Bay Campus
Tina Tinker	Aleknagik Traditional Council

Delores Larson	New Koliganek Village Council
Kay Andrews	City of Aleknagik
Alice Ruby	City of Dillingham
Melody Nibeck	DCRA

Energy Summit Representatives | Dillingham, May 4, 2015

Amber McDonough	Siemens
Annie Fritze	BBNA
Arthur Sharp	Twin Hills Native Corp.
Becky Savo	Bristol Bay Borough
Bill Hill	BBSD/Paug-Vik Inc. Ltd.
Brenda Kerr	BBNA/Dept. of Transportation
Cameron Poindexter	BBNC
Chris Napoli	BBEDC
Clinton Boskofsky	Chignik Lake
Connie Fredenberg	Marsh Creek
Diane Folsom	Ekuk Village Council
Elijah Eknaty	Kokhanok Village Council
Emil Larson	BBHA
Eric Hanssen	ANTHC
Francisca Demoski	BBNC
Fred (Ted) Angasan	South Naknek
Greg Anelon	City of Newhalen
Greg Calvert	BBAHC
Gusty Akelhok	BBNA
James Kallenberg	Levelock Village Council
Jaylon Kosbruk	Perryville
Jed Drolet	AEA
Jennie Apokedak	New Koliganek Village Council - IGAP
John Christensen Jr.	Port Heiden
John Wanamaker	BBDF/Alaska Venture Partners, LLC
Joseph Wassily	Clark's Pt. Village Council
Josh Craft	AEA
Lucy Goode	Paug-Vik Inc., Ltd.
Mark Scotford	BBAHC
Mischa Ellanna	BBNC
Moses Toyukak Sr.	City of Manokotak
Nick Smeaton	BBHA
Nikki Shanigan	City of Pilot Point
Pete Andrew	Nush. Electric Coop.
Peter Angasan Sr.	King Salmon Tribal

Peter Christopher Sr.	New Stuyahok Traditional Council
Peter Lockuk Sr.	Togiak Traditional Council
Rebecca Garrett	AEA
Rose Loera	City of Dillingham
Senafont Shugak Jr.	Pedro Bay Council
Steven Gilbert	AVEC
Tim McDermott	Lake and Pen School District
Tom Marsik	UAF Bristol Bay campus

C | BRISTOL BAY INDUSTRY SURVEY

Contact Information

Please verify the following information:

*First Name:

*Last Name:

*Email Address:

Work Phone:

All fields with an asterisk () are required.*

1. Name of company:

2. Location of facilities in Bristol Bay region:

3. What is your current annual energy use?

Electricity (kWh/year):	
Fuel/Heating Oil (gallons/year):	
Other (gallons/year):	

4. If your company's energy demand is seasonal, in what month(s) is your demand for energy highest?

5. What rate does your business pay for electricity?

 \$/ kWh

6. Please enter the most recent date on which this rate was charged (month and year).

7. What price does your business pay for fuel? Please enter prices for any of the fuels your business purchases.

Diesel (\$/gallon):	
Heating Oil (\$/gallon):	
Propane (\$/100 lb tank):	
Gasoline (\$/gallon):	

8. Please enter the most recent dates on which this price was paid.

*9. To increase the quality of our load projections, would you be willing to share the last 2 years of electricity and/or fuel purchase data with our data analysts? (Your data will be kept strictly confidential.)(*Required)

Select one.

☐	Yes	(Answer question number 9.1.)
☐	No	(Go to question number 10.)
☐	Maybe	(Answer question number 9.1.)

9a. Who should we contact to request your data?

Name:	
Phone or email:	
Notes:	

10. Does your company self-generate any electricity?

Select one.

☐	Yes	(Answer question number 10.1.)
☐	No	(Go to question number 11.)

10a. Please check all that apply.

Select all that apply.

☐	Diesel generator
☐	Solar P/V
☐	Wind turbine
☐	Waste-to-energy
☐	Other:

11. Does your company have plans to self-generate electricity in the next 5 years? Explain.

12. What does your company use for space heating? (check all that apply):

Select all that apply.

☐	Fuel Oil
☐	Electricity
☐	Natural Gas
☐	Propane
☐	Wood
☐	Coal
☐	Biodiesel (fish oil, other)
☐	Other:

13. How many buildings does your company currently heat?

Number:	
Total Square Footage:	

14. Have any of your company's buildings had a professional energy audit in the past 10 years?

Select one.

☐	Yes	(Answer question number 14.1.)
☐	No	(Go to question number 15.)

14a. Please enter information on the audited facility(s).

What is the name and address?:	
What energy efficiency and conservation measures were implemented following the audit?:	

15. Has your company conducted audits on overall energy use (machinery/process flow/energy conversion)?

Select one.

☐	Yes
☐	No

16. Have energy efficiency and conservation measures been implemented in any of your facilities - whether audited or not?

Select one.

☐	Yes	(Answer question number 16.1.)
☐	No	(Go to question number 18.)

16a. Check all energy efficiency retrofits that apply:

Select all that apply.

- ☐ All implemented measures reported in Question 10
- ☐ Conservation measures / changes in energy behaviors (e.g. manually setting back thermostats, turning off computers)
- ☐ Installed energy efficient indoor lighting
- ☐ Installed energy efficient outdoor lighting
- ☐ Installed energy efficient refrigeration or other appliances
- ☐ Tightened up building envelope (e.g. insulation, roof, windows)
- ☐ Installed building sensors or programmable controls (e.g. occupancy sensors or programmable thermostats)
- ☐ Machinery/Equipment upgrades
- ☐ Other:

17. Would you be interested in receiving a confidential energy audit if it were free and sponsored by a government entity?

Select one.

☐	Yes
☐	No

18. Looking ahead 5 years, how do you think your company's electricity use will change?

Select one.

☐	Increase significantly
☐	Increase modestly
☐	Stay the same
☐	Decrease modestly
☐	Decrease significantly

19. Looking ahead 5 years, how do you think your company's energy use for heating will change?

Select one.

☐	Increase significantly
☐	Increase modestly
☐	Stay the same
☐	Decrease modestly
☐	Decrease significantly

20. What do you think will drive these changes in energy use? (check all that apply):

Select all that apply.

☐	Changes in size of business operations
☐	Changes in technology
☐	Energy efficiency or conservation measures
☐	Other:

21. List any energy projects or priorities your business has for reducing or stabilizing the cost of energy for heating, electricity or transportation.

22. Which of the following energy goals would help your business the most?

Select one.

☐	Reducing the cost of electricity
☐	Reducing the cost of space heating
☐	Reducing the cost of transportation
☐	Stabilizing the overall cost of energy
☐	Stabilizing the supply of energy
☐	Other: <table border="1" style="display: inline-table; width: 400px; height: 15px;"></table>

23. Have you seen the Draft Bristol Bay Regional Energy Plan?

Select one.

☐	Yes	(Answer question number 23.2.)
☐	No	(Answer question number 23.1.)

Please take a look at <http://bristolbayenergy.org/documents/>.

Thank you for reviewing the report.

D | AUDIENCE POLLING RESULTS

Table 27: May 4 Energy Summit audience polling results

Demographics					
<i>Who are you representing today?</i>					
Community	Tribal Organization	Regional Organization	State Organization	Business	Utility
34%	31%	11%	11%	9%	3%
<i>Who supplies your electricity?</i>					
Community Utility	Nushagak Electric Coop.	Naknek Electric Assoc.	AVEC	INNEC	
39%	26%	16%	16%	3%	
<i>Did you attend a subregional meeting?</i>					
No	Dillingham	Iliamna	Chignik Lagoon	King Salmon	
57%	23%	9%	6%	6%	
Regional Priorities					
For the following strategies, when should work start – immediately, medium-term (2 to 5 years), long-term (5+ years), or is it not a priority at all?					
<i>Improve existing power infrastructure and systems</i>					
Immediate	Medium-term	Long-term	Not a priority		
56%	25%	19%	0%		
<i>Address rural utility issues through regional and subregional coordination</i>					
Immediate	Medium-term	Long-term	Not a priority		
61%	27%	9%	3%		
<i>Investigate and develop renewable energy generation opportunities</i>					
Immediate	Medium-term	Long-term	Not a priority		
79%	21%	0%	0%		
<i>Monitor emerging technologies</i>					
Immediate	Medium-term	Long-term	Not a priority		
47%	26%	21%	6%		

Initiate additional energy efficiency projects for homes, businesses, and public facilities

Immediate	Medium-term	Long-term	Not a priority
85%	12%	3%	0%

As a region, we should prioritize energy efficiency initiatives at which level...

Homes	Businesses	Public/Community Buildings	Public Infrastructure
41%	9%	36%	14%

Implement transportation projects to improve access

Immediate	Medium-term	Long-term	Not a priority
64%	18%	12%	6%

Support for Energy Priorities

In what ways would you support an energy project that benefits your community?

Staff Time	Financial Support	Both	Neither
38%	3%	59%	0%

Interest in Energy Working Groups

Are you interested in participating in an energy working group?

Yes	No	Not Sure
55%	12%	33%

Table 28: December 2013 Village Leadership Workshop

Demographics					
<i>Who is in the room today?</i>					
Lakes Subregion	Kvichak Bay Subregion	Nushagak Bay Subregion	Nushagak River Subregion	Peninsula Subregion	Togiak Bay Subregion
6	16	18	5	22	15
<i>What is the main hat you are wearing today?</i>					
Village Corp	BB Regional Org.	Tribal Gov't	City/Municipal Gov't	Other	
51%	21%	16%	1%	10%	

Energy Priorities & Concerns

What do you think has the greatest potential to lower your energy costs?

Wind	Energy Efficiency	Biomass	Geothm'l	Solar	Natr'l Gas	Diesel Eff.	Hydro	Trans. Lines
20%	14%	14%	12%	12%	11%	6%	5%	5%

Thinking about household energy costs, what is the biggest burden on your family's finances?

Electricity	Space Heating	Transportation
37%	35%	28%

Do you think your community would be interested in participating in a regional or subregional bulk fuel purchasing group to try to save costs on heating oil and other bulk fuels?

Yes	No	Don't know
85%	8%	7%

What do you think the biggest barrier is to more participation in residential EE&C programs in your community?

Hard to find auditors	Lack of info	Lack of interest	Other
41%	43%	2%	14%

Would you be in favor of coordinating the development of Wind Projects in the region to increase financing options?

Every community should develop own projects	Bundle projects within region to attract investors	Bundle projects with other regions if needed to attract more investors	Other / No opinion
41%	43%	15%	2%

If the result is cheaper power in your community, how comfortable would you be with someone else owning the power and selling it to the local utility?

Very Comfortable	Comfortable	Neutral	Uncomfortable	Very Uncomfortable
23%	16%	16%	26%	18%

Would you be interested in new subregional interties?

Yes - If it would stabilize energy rates	Yes - Only if it would reduce energy rates	No	Don't Know/ No opinion
16%	70%	8%	6%

What is the biggest barrier other than financing to advancing energy projects in your community?

Leadership/champion	Technical know how	Administrative capacity
36%	38%	25%

What is most important to your community in terms of energy planning?

Saving money	Saving energy	More reliable energy	More price stability	Community sustainability
19%	2%	21%	19%	40%

Should our Regional Energy Plan include goals for energy efficiency?

Yes	No	Don't know
97%	0%	3%

Should strategies to encourage local food production be included as part of an energy plan?

Yes	No	Don't know
68%	23%	8%

While previous road and transmission studies have not been encouraging, should we pursue updated technical and feasibility studies as part of a regional energy plan?

Yes	No	Don't know
84%	9%	6%

Who is the best group to continue the momentum for energy planning in Bristol Bay?

New group of energy stakeholders (including small and large utilities, industrial users, and local/tribal energy champion)	Bristol Bay Partnership or other existing regional group	Other/No opinion
36%	58%	6%

E | ANALYSIS OF RESOURCE POTENTIAL

The data in the following tables has been compiled from multiple sources including the Alaska Energy Data Gateway (4), the Renewable Energy Atlas of Alaska (19), the Alaska Energy Efficiency Map (15), the Division of Geological & Geophysical Services report, Summary of Fossil Fuel and Geothermal Resource Potential in the Bristol Bay region (20), NREL's PVWatts (21), personal communication with Alaska Energy Authority program managers for Biomass Energy, Heat Recovery, Hydroelectric Power, and Wind Energy, and data shared by the region's electric utilities.

Note that each table estimates the savings potential from new, community- or utility-scale energy projects. The analysis does not reflect the value of infrastructure or programs already in place. It does not look at opportunity from residential projects; it does look at potential for building scale projects for biomass, energy efficiency, and solar.

The rating criteria for individual resources of biomass, heat recovery, hydroelectric, and wind were developed in collaboration with AEA program managers. See Table 38 for an explanation of the criteria used in the analysis.

Table 29: Wood biomass resource potential

	20-Year Average Diesel Fuel Price (\$)	Potential	Productive Forest	Project in Operation	Rough B/C Ratio	Existing Study (R,F) or Development (D,C)	Certainty
Aleknagik	4.16	L	M	N	1.10	R	M
Chignik	4.22	L	L	N	0.00		L
Chignik Lagoon	5.12	L	L	N	0.00		L
Chignik Lake	5.12	L	L	N	0.00		L
Clark's Point	4.16	H	L	N	0.00	R	M
Dillingham	4.16	M	M	N	1.10		L
Egegik	5.26	L	L	N	0.00		L
Ekwok	5.43	H	M	N	1.64		L
Igiugig	6.88	H	L	N	0.00	R	M
Iliamna	5.51	H	M	N	1.67	R	M
King Salmon	4.22	L	L	N	0.00		L
Kokhanok	6.39	H	M	Y	2.05	C	M
Koliganek	5.97	H	M	N	1.87		L
Levelock	6.43	L	L	N	0.00		L
Manokotak	3.52	L	L	N	0.00		L
Naknek	4.22	L	L	N	0.00		L
New Stuyahok	4.97	H	M	N	1.44	R	M
Newhalen	5.51	H	M	N	1.67	R	M
Nondalton	5.51	H	M	N	1.67	R	M
Pedro Bay	6.45	H	M	N	2.07	R	M
Perryville	5.97	L	L	N	0.00		L
Pilot Point	5.76	L	L	N	0.00		L
Port Alsworth	6.38	L	M	N	2.04	R	M
Port Heiden	5.38	L	L	N	0.00		L
South Naknek	4.22	L	L	N	0.00		L
Togiak	4.69	L	L	N	0.00		L
Twin Hills	6.26	L	L	N	0.00		L

See D-1 for data sources and notes.

Table 30: Geothermal resource potential

	Potential	Identified Resource within 20 miles (Y,N)	Identified Significant Resource within 20 miles (Y,N)	No resource identified w/ 20 miles	Certainty
Aleknagik	L	N	N	N	L
Chignik	L	N	N	N	L
Chignik Lagoon	L	N	N	N	L
Chignik Lake	L	N	N	N	L
Clark's Point	L	N	N	N	L
Dillingham	L	N	N	N	L
Egegik	L	N	N	N	L
Ekwok	L	N	N	N	L
Igiugig	L	N	N	N	L
Iliamna	L	N	N	N	L
King Salmon	L	N	N	N	L
Kokhanok	L	N	N	N	L
Koliganek	L	N	N	N	L
Levelock	L	N	N	N	L
Manokotak	L	N	N	N	L
Naknek	L	N	N	N	L
New Stuyahok	L	N	N	N	L
Newhalen	L	N	N	N	L
Nondalton	L	N	N	N	L
Pedro Bay	L	N	N	N	L
Perryville	L	N	N	N	L
Pilot Point	L	N	N	N	L
Port Alsworth	L	N	N	N	L
Port Heiden	L	N	N	N	L
South Naknek	L	N	N	N	L
Togiak	L	N	N	N	L
Twin Hills	L	N	N	N	L

Table 31: Hydropower resource potential

	Potential	Projects in Operation	Hydro Resource	Identified in Pathway	Existing Study (R,F) or Development (D,C)	Viable Hydro based on Visual Assessment	Certainty
Aleknagik	L		Y		F	M	H
Chignik	H	Y	Y		D	H	H
Chignik Lagoon	H		Y		C	M	H
Chignik Lake	M		Y			M	M
Clark's Point	L		N			L	M
Dillingham	L		Y		F	L	H
Egegik	L		N			L	M
Ekwok	L		Y			L	M
Igiugig	L		Y			L	M
Iliamna	H	Y	Y		R	L	H
King Salmon	L		Y			L	M
Kokhanok	M		Y			M	M
Koliganek	L		Y			L	M
Levelock	L		N			L	M
Manokotak	L		Y			L	M
Naknek	L		N			L	M
New Stuyahok	L		Y			L	M
Newhalen	H	Y	Y			L	H
Nondalton	H	Y	Y			M	H
Pedro Bay	M		Y		F	M	H
Perryville	M		Y			M	M
Pilot Point	L		N			L	M
Port Alsworth	M		Y		R	M	M
Port Heiden	M		Y			M	M
South Naknek	L		N			L	M
Togiak	L		Y			L	M
Twin Hills	L		Y			L	M

Table 32: Wind energy resource potential

	Wind Potential	Wind-Resource	Wind Developability	Site Accessible	Permittability	Site Availability	Load	Certainty
Aleknagik	M	H	M	N	Y	Y	Y	M
Chignik	L	H	L	N	Y	X	Y	H
Chignik Lagoon	L	L	L	Y	Y	Y	X	H
Chignik Lake	L	L	L	Y	Y	Y	X	M
Clark's Point	L	M	L	Y	Y	Y	X	M
Dillingham	M	M	H	Y	Y	Y	Y	H
Egegik	L	M	L	Y	Y	Y	X	M
Ekwok	L	L	L	N	Y	N	X	M
Igiugig	L	L	L	Y	Y	Y	X	H
Iliamna	M	L	H	Y	Y	Y	Y	L
King Salmon	M	M	H	Y	Y	Y	Y	H
Kokhanok	H	H	H				H	H
Koliganek	M	M	H	Y	Y	Y	Y	H
Levelock	L	L	L	Y	Y	Y	X	L
Manokotak	M	M	H	Y	Y	Y	Y	H
Naknek	M	M	H	Y	Y	Y	Y	H
New Stuyahok	M	M	M	Y	Y	Y	Y	H
Newhalen	M	M	H	Y	Y	Y	Y	L
Nondalton	M	L	L	N	Y	N	Y	M
Pedro Bay	L	M	L	Y	Y	Y	X	L
Perryville	M	H	M	Y	Y	Y	X	H
Pilot Point	M	M	M	Y	Y	Y	X	H
Port Alsworth	L	L	L	Y	Y	Y	X	H
Port Heiden	L	M	L	Y	Y	Y	X	H
South Naknek	M	M	H	Y	Y	Y	Y	H
Togiak	M	M	M	Y	Y	N	Y	H
Twin Hills	L	L	L	Y	Y	Y	X	M

Table 33: Coal resource potential

	Potential	Identified Deposits	Quality/High subsurface volume	Long Distance to Load	Project Planned or in Development	Certainty
Aleknagik	L	N	N	N	N	L
Chignik	M	Y	Y	Y	N	L
Chignik Lagoon	M	Y	Y	Y	N	L
Chignik Lake	M	Y	Y	Y	N	L
Clark's Point	L	N	N	N	N	L
Dillingham	L	N	N	N	N	L
Egegik	M	Y	Y	Y	N	L
Ekwok	L	N	N	N	N	L
Igiugig	L	N	N	N	N	L
Iliamna	L	N	N	N	N	L
King Salmon	L	N	N	N	N	L
Kokhanok	L	N	N	N	N	L
Koliganek	L	N	N	N	N	L
Levelock	L	N	N	N	N	L
Manokotak	L	N	N	N	N	L
Naknek	L	N	N	N	N	L
New Stuyahok	L	N	N	N	N	L
Newhalen	L	N	N	N	N	L
Nondalton	L	N	N	N	N	L
Pedro Bay	L	N	N	N	N	L
Perryville	M	Y	Y	Y	N	L
Pilot Point	M	Y	Y	Y	N	L
Port Alsworth	L	N	N	N	N	L
Port Heiden	M	Y	Y	Y	N	L
South Naknek	L	N	N	N	N	L
Togiak	L	N	N	N	N	L
Twin Hills	L	N	N	N	N	L

Table 34: Oil and gas resource potential

	Potential	Source Rock, Traps and Reservoirs Present	Wells Drilled & Resource Identified	Certainty
Aleknagik	L	N	N	L
Chignik	L	N	N	L
Chignik Lagoon	L	N	N	L
Chignik Lake	L	N	N	L
Clark's Point	L	N	N	L
Dillingham	L	N	N	L
Egegik	L	N	N	L
Ekwok	L	N	N	L
Igiugig	L	N	N	L
Iliamna	L	N	N	L
King Salmon	L	N	N	L
Kokhanok	L	N	N	L
Koliganek	L	N	N	L
Levelock	L	N	N	L
Manokotak	L	N	N	L
Naknek	L	N	N	L
New Stuyahok	L	N	N	L
Newhalen	L	N	N	L
Nondalton	L	N	N	L
Pedro Bay	L	N	N	L
Perryville	L	N	N	L
Pilot Point	L	N	N	L
Port Alsworth	L	N	N	L
Port Heiden	L	Y	N	L
South Naknek	L	N	N	L
Togiak	L	N	N	L
Twin Hills	L	N	N	L

Table 35: Heat recovery (HR) resource potential

	Potential	HR Equipment at Powerhouse	HR In Operation	Recoverable Heat Available	Thermal Loads Nearby	Certainty
Aleknagik	L	N	N	N		H
Chignik	L	Y	Y	N	N	L
Chignik Lagoon	L	Y	Y	N		M
Chignik Lake	H	Y	Y	Y		M
Clark's Point	L	N	N	N		L
Dillingham	H	Y	Y	Y		M
Egegik	L	Y	Y	N		H
Ekwok	L	N	N	N		M
Igiugig	L	Y	Y	N		M
Iliamna	H	Y	Y	N		M
King Salmon	L	N	N	N		H
Kokhanok	H	Y	Y	N		M
Koliganek	H	Y	Y	Y		M
Levelock	M	N	N	Y		L
Manokotak	L	Y	N	N		L
Naknek	H	Y	Y	Y		H
New Stuyahok	L	Y	N	Y		H
Newhalen	H	Y	Y	N		M
Nondalton	H	Y	Y	N		M
Pedro Bay	L	Y	Y	N		H
Perryville	H	Y	Y	Y		M
Pilot Point	H	Y	Y	Y		M
Port Alsworth	H	Y	N	Y		H
Port Heiden	H	Y	N	Y		H
South Naknek	L	N	N	N		H
Togiak	L	Y	Y	Y		H
Twin Hills	L	Y	Y	N		M

Table 36: Energy Efficiency savings potential

Table 37: Solar resource potential
Pending AEA Review

Table 38: Criteria used in resource potential analysis

Resource		Potential			Certainty		
Resource	What it includes	Low	Medium	High	Low	Medium	High
Alternative Power Generation							
Coal	Resource development* and power generation	Local, quality resource absent.	Quality resource identified; further study needed	High quality, local resource identified; project in development	No information documented.	Based on documented opinion of credible source or recon level study.	Based on feasibility or higher level study.
Geothermal	Resource development and power generation	No documented resource within 20 miles.	Significant resource within 20 miles.	Significant resource within economic distance.	"	"	"
Hydro	Resource development and power generation	No hydro resource present or, if present, economic viability is nil to highly unlikely based on visual inspection.	Economic viability is unlikely to possible based on visual inspection.	Hydro project is present or under construction. Or, economic viability is possible to highly likely based on visual inspection.	No information documented.	Based on documented opinion of credible source or recon level study, including hydro database.	Based on feasibility or higher level study.
Hydrokinetic	Resource development and power generation	Not Rated (See notes on emerging technologies following table.)					
Oil & Natural Gas	Resource development and power generation	No source rock, traps or reservoirs present.	Source rock, traps or reservoirs present. Needs investigation.	Wells drilled and economic resource identified.	"	"	"
Solar	Photovoltaic	PVWatts estimated levelized cost of energy* > residential electric rate; no net metering available.	PVWatts estimated levelized cost of energy* is > residential electric rate; net metering available.	PVWatts estimated levelized cost of energy* is < residential electric rate	No information documented.	No information documented.	Electric rates and PVWatts weather data available.
Wind	Resource development and power generation	Wind resource or developability low***.	"	Project in operation, or wind resource and developability high***.	"	Based on recon level study.	Resource based on 12+ months onsite resource assessment, hourly load data, feasibility or higher level study.
Other	Nuclear, emerging energy technology	Low (See notes on emerging technologies following table.)					

Bristol Bay Regional Energy Plan

Phase II: Stakeholder Engagement and Public Input | E-10

Resource		Potential			Certainty		
Resource	What it includes	Low	Medium	High	Low	Medium	High
Heat							
Biomass	Resource development and heat generation	Low productivity of nearby forest. And, if B/C ratio between 1.0 and 1.5, based on either rough analysis*** or existing study.	Medium or higher productivity of nearby forest; and, B/C ratio between 1.0 and 1.5, based on either rough analysis*** or existing study.	Medium or higher productivity of nearby forest; and B/C ratio greater than 1.5, based on either rough analysis*** or existing study.	No information documented.	Based on documented opinion of credible source or recent level study.	Based on feasibility or higher level study.
Heat Pumps	Ground, sea water, and air source heat pumps	Economic criteria are more important than resource data. Projects should be evaluated on a case-by-case basis. See notes following table on heat pumps in communities with diesel electric generation.					
Diesel Heat Recovery	CHP from diesel, other	Thermal loads remote from powerhouse, minimal recoverable heat remains.	<-->	HR equipment installed at powerhouse, thermal loads nearby, much recoverable heat remains.	No information documented.	Based on documented opinion of credible source or recent level study (e.g. power system inventory).	Based on feasibility or higher level study (e.g. RPSU CDR).
End User							
Efficiency - Based on residential & public/commercial ratings^	Residential	> 30% of homes have NOT received recent EE upgrades	30 - 55% of homes have NOT received recent EE upgrades.	< 60% of homes have NOT received recent EE upgrades	Little to no information available on buildings or recent EE upgrades.^		Little to no information available on buildings or recent EE upgrades.
	Public & Commercial	See Note ^^	Completed all: Water/Sewer system audit, school audit, streetlight replacements, EECBG, AHFC Commercial or VEEP	Completed 3 to 0 of the infrastructure audits/upgrades/programs	Little to no information available on buildings or recent EE upgrades.^		Little to no information available on buildings or recent EE upgrades.
Notes							
* Resource development: Activities that include energy resource assessment, infrastructure development, transportation, fuel storage and handling.							
** Visual assessment by AEA hydro PM indication L=None to Highly Unlikely, M=Unlikely to Maybe, H=Maybe to Highly Likely							
*** Wind potential defined by two factors:							
1. Wind resource: L=class 2 or lower, M=class 3-4, H=class 5 or higher.							
2. Developability, indicated by four factors (Y=yes, N=likely no, X=fundamental problem that indicates low wind potential)							

Resource	What it Includes	Low	Medium	High	Low	Medium	Certainty																												
	a. Access in place: Is there a road, power transmission, or other suitable access to a viable wind site? b. Permitability: Can habitat, FAA, or other factors be resolved without significant difficulty? c. Site availability: Is there suitable land that is available for siting wind turbines? d. Load: Is there sufficient load such that wind can be integrated economically with the existing diesel system (X: less than 50 kW average load)?																																		
**** Rough analysis of biomass project benefit/cost estimated based on these assumptions:	1. Fuel price estimated as simple 20-year average of BSEE projections of power-sector fuel price plus an adder of \$0.50 per gallon for heating fuel (http://www.aidea.org/REFund/Round%20Documents/EvaluationModel.xlsm) 2. Fuelwood with an energy content of 20 MMBtu/cord and price of \$250/cord 3. Wood and oil combustion efficiency equal 4. Installed cost of system estimated at \$35/gallons per year of displaced fuel 5. O&M cost of 1% installed cost																																		
Energy Efficiency Rating ^A	The rating is conservative in giving a high potential for communities with any high rating whether in residential or public/commercial. Medium ratings are used for communities with two mediums or a low and a high. No community is rated as low for overall energy efficiency potential.																																		
Energy Efficiency Low ^{AA}	Low is not used as a resource potential for public and commercial building energy efficiency because even if all programs and audits are completed there is substantial work left to be done on implementing retrofits. Where information on audits especially for public and commercial buildings is sufficient, information on whether retrofits have been implemented is often lacking. To reflect that these criteria are not the full story of energy efficiency in commercial and public infrastructure, this low potential rating is not used.																																		
Energy Efficiency Certainty ^{AAA}	The assumption is audits and streetlights that have been completed are recorded by AHEC and EE programs are recorded in multiple locations - REAP, AK Energy Efficiency, and AEA. Therefore, these ratings are based on collected data and have a high level of certainty.																																		
Solar Potential Rating ⁺	This ratings is based on the PVWatts (http://pvwatts.nrel.gov/pvwatts.php) calculation of the Cost of Electricity Generated by System, or levelized cost of energy. The system specifications used for the calculation for all communities is as follows:	<table><tr><th colspan="2">System Specifications</th><th colspan="2">Initial Economic Assumptions</th></tr><tr><td>DC System Size (kW)</td><td>4</td><td>System Type</td><td>Residential or Commercial</td></tr><tr><td>Module Type</td><td>Standard</td><td>Average Cost of Electricity Purchased from Utility (\$/kWh)</td><td>2014 Residential Rate for each community</td></tr><tr><td>Array Type</td><td>Fixed (open rack)</td><td>Initial Cost (\$/Wdc)*</td><td>\$5 / Wdc</td></tr><tr><td>System Losses (%)</td><td>14</td><td colspan="2">*The Initial cost is an average of the installed cost of systems in Galena, Fort Yukon, and Manley Hot Springs. No tax credits were used in the calculation.</td></tr><tr><td>Tilt (deg)</td><td>70</td><td colspan="2"></td></tr><tr><td>Azimuth (deg)</td><td>180</td><td colspan="2"></td></tr></table>						System Specifications		Initial Economic Assumptions		DC System Size (kW)	4	System Type	Residential or Commercial	Module Type	Standard	Average Cost of Electricity Purchased from Utility (\$/kWh)	2014 Residential Rate for each community	Array Type	Fixed (open rack)	Initial Cost (\$/Wdc)*	\$5 / Wdc	System Losses (%)	14	*The Initial cost is an average of the installed cost of systems in Galena, Fort Yukon, and Manley Hot Springs. No tax credits were used in the calculation.		Tilt (deg)	70			Azimuth (deg)	180		
System Specifications		Initial Economic Assumptions																																	
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Tilt (deg)	70																																		
Azimuth (deg)	180																																		
	PVWatts Assumptions for Levelized Cost of Energy calculation:																																		
	Debt Amount	100% of installed cost																																	
	Loan Term	25 years																																	
	Loan Interest Rate	7.5%																																	

Description	2014		2013		2012		2011		2010		2009		2008		2007		2006		2005		2004		2003		2002		2001		2000		1999		1998		1997		1996		1995		1994		1993		1992		1991		1990		1989		1988		1987		1986		1985		1984		1983		1982		1981		1980		1979		1978		1977		1976		1975		1974		1973		1972		1971		1970		1969		1968		1967		1966		1965		1964		1963		1962		1961		1960		1959		1958		1957		1956		1955		1954		1953		1952		1951		1950		1949		1948		1947		1946		1945		1944		1943		1942		1941		1940		1939		1938		1937		1936		1935		1934		1933		1932		1931		1930		1929		1928		1927		1926		1925		1924		1923		1922		1921		1920		1919		1918		1917		1916		1915		1914		1913		1912		1911		1910		1909		1908		1907		1906		1905		1904		1903		1902		1901		1900		1899		1898		1897		1896		1895		1894		1893		1892		1891		1890		1889		1888		1887		1886		1885		1884		1883		1882		1881		1880		1879		1878		1877		1876		1875		1874		1873		1872		1871		1870		1869		1868		1867		1866		1865		1864		1863		1862		1861		1860		1859		1858		1857		1856		1855		1854		1853		1852		1851		1850		1849		1848		1847		1846		1845		1844		1843		1842		1841		1840		1839		1838		1837		1836		1835		1834		1833		1832		1831		1830		1829		1828		1827		1826		1825		1824		1823		1822		1821		1820		1819		1818		1817		1816		1815		1814		1813		1812		1811		1810		1809		1808		1807		1806		1805		1804		1803		1802		1801		1800		1799		1798		1797		1796		1795		1794		1793		1792		1791		1790		1789		1788		1787		1786		1785		1784		1783		1782		1781		1780		1779		1778		1777		1776		1775		1774		1773		1772		1771		1770		1769		1768		1767		1766		1765		1764		1763		1762		1761		1760		1759		1758		1757		1756		1755		1754		1753		1752		1751		1750		1749		1748		1747		1746		1745		1744		1743		1742		1741		1740		1739		1738		1737		1736		1735		1734		1733		1732		1731		1730		1729		1728		1727		1726		1725		1724		1723		1722		1721		1720		1719		1718		1717		1716		1715		1714		1713		1712		1711		1710		1709		1708		1707		1706		1705		1704		1703		1702		1701		1700		1699		1698		1697		1696		1695		1694		1693		1692		1691		1690		1689		1688		1687		1686		1685		1684		1683		1682		1681		1680		1679		1678		1677		1676		1675		1674		1673		1672		1671		1670		1669		1668		1667		1666		1665		1664		1663		1662		1661		1660		1659		1658		1657		1656		1655		1654		1653		1652		1651		1650		1649		1648		1647		1646		1645		1644		1643		1642		1641		1640		1639		1638		1637		1636		1635		1634		1633		1632		1631		1630		1629		1628		1627		1626		1625		1624		1623		1622		1621		1620		1619		1618		1617		1616		1615		1614		1613		1612		1611		1610		1609		1608		1607		1606		1605		1604		1603		1602		1601		1600		1599		1598		1597		1596		1595		1594		1593		1592		1591		1590		1589		1588		1587		1586		1585		1584		1583		1582		1581		1580		1579		1578		1577		1576		1575		1574		1573		1572		1571		1570		1569		1568		1567		1566		1565		1564		1563		1562		1561		1560		1559		1558		1557		1556		1555		1554		1553		1552		1551		1550		1549		1548		1547		1546		1545		1544		1543		1542		1541		1540		1539		1538		1537		1536		1535		1534		1533		1532		1531		1530		1529		1528		1527		1526		1525		1524		1523		1522		1521		1520		1519		1518		1517		1516		1515		1514		1513		1512		1511		1510		1509		1508		1507		1506		1505		1504		1503		1502		1501		1500		1499		1498		1497		1496		1495		1494		1493		1492		1491		1490		1489		1488		1487		1486		1485		1484		1483		1482		1481		1480		1479		1478		1477		1476		1475		1474		1473		1472		1471		1470		1469		1468		1467		1466		1465		1464		1463		1462		1461		1460		1459		1458		1457		1456		1455		1454		1453		1452		1451		1450		1449		1448		1447		1446		1445		1444		1443		1442		1441		1440		1439		1438		1437		1436		1435		1434		1433		1432		1431		1430		1429		1428		1427		1426		1425		1424		1423		1422		1421		1420		1419		1418		1417		1416		1415		1414		1413		1412		1411		1410		1409		1408		1407		1406		1405		1404		1403		1402		1401		1400		1399		1398		1397		1396		1395		1394		1393		1392		1391		1390		1389		1388		1387		1386		1385		1384		1383		1382		1381		1380		1379		1378		1377		1376		1375		1374		1373		1372		1371		1370		1369		1368		1367		1366		1365		1364		1363		1362		1361		1360		1359		1358		1357		1356		1355		1354		1353		1352		1351		1350		1349		1348		1347		1346		1345		1344		1343		1342		1341		1340		1339		1338		1337		1336		1335		1334		1333		1332		1331		1330		1329		1328		1327		1326		1325		1324		1323		1322		1321		1320		1319		1318		1317		1316		1315		1314		1313		1312		1311		1310		1309		1308		1307		1306		1305		1304		1303		1302		1301		1300		1299		1298		1297		1296		1295		1294		1293		1292		1291		1290		1289		1288		1287		1286		1285		1284		1283		1282		1281		1280		1279		1278		1277		1276		1275		1274		1273		1272		1271		1270		1269		1268		1267		1266		1265		1264		1263		1262		1261		1260		1259		1258		1257		1256		1255		1254		1253		1252		1251		1250		1249		1248		1247		1246		1245		1244		1243		1242		1241		1240		1239		1238		1237		1236		1235		1234		1233		1232		1231		1230		1229		1228		1227		1226		1225		1224		1223		1222		1221		1220		1219		1218		1217		1216		1215		1214		1213		1212		1211		1210		1209		1208		1207		1206		1205		1204		1203		1202		1201		1200		1199		1198		1197		1196		1195		1194		1193		1192		1191		1190		1189		1188		1187		1186		1185		1184		11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Notes on Specific Technologies

HEAT PUMPS IN COMMUNITIES WITH DIESEL ELECTRICAL GENERATION

Given the high installation costs and efficiency limitations of current technology, heat pumps do not appear economically competitive with fuel oil heaters in rural communities that rely on diesel for electrical generation.

Heat pumps use a working fluid in a refrigeration cycle to move heat from a lower temperature source to a higher temperature load, consuming electricity in the process. Heat sources can include the ground (via glycol filled loops in vertical boreholes or horizontal trenches), air, ground water, lakes, and seawater. Heat pump performance is expressed as a ratio of thermal energy delivered to electrical energy consumed which is referred to as the Coefficient of Performance (COP).

Unit oil fuel heaters typical of rural Alaska operate at approximately 90% efficiency. Diesel genset conversion efficiencies typical of rural Alaska communities are in the range of 30-35% (in other words, 30-35% of the energy available in diesel fuel is converted to electricity). Based on these assumptions, a heat pump would need to operate with a minimum average COP greater than of 2.5 in order to supply the same amount of heat from electricity generated from 1 gallon of diesel fuel as would be supplied by burning 1 gallon of diesel fuel. While this level of performance may be attainable in many areas of the state, the cost of installation—which Cold Climate Housing Research Center has estimated to range from \$25,000 to \$35,000 for ground source heat pump systems—almost certainly precludes the economic viability of heat pumps in communities reliant on diesel generation. Additional factors to take into account:

- Powerhouse heat recovery adds significant additional value to each gallon of diesel consumed for electricity generation.
- Transmission losses reduce the amount of electrical energy actually available per gallon of diesel.
- Maintenance requiring specially trained technicians and equipment further increase operational costs.

EMERGING TECHNOLOGIES

River and marine hydrokinetics, including tidal and wave power, are emerging technologies with no commercial projects currently in operation in the United States. Considerable resources are being invested in advancement of the technologies at the state and federal level although at this point they are considered pre-commercial.

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G | Data Sources

Table 39: Data sources for community profiles

		Source	Date			Source	Date
Alaska Native Name		NAF	2014	Location		DCRA	2015
Historical Setting		DCRA	2015	Climate	Avg. Temp	ACRC weatherbase.com	2015
Cultural Resources		DCRA	2015		Climate Zone	CCMAC	2014
Energy Priorities		Input	2015		HDD	CCMAC	2014
Contacts	City	DCRA Input	2015	Taxes		Alaska Taxable	2015
	Tribal	DCRA Input	2015	Economy		DCRA	2015
	Village Corp	DCRA Input	2015	Natural Hazards Plan		DCRA	2014
				Community Plans		DCRA	2015
Demographics				Demographics (cont.)			
2000	Population	DCRA	2000	HH Income		DCRA	2010
	Median Age	DCRA	2000	% Employed		DCRA	2015
	HH Size	DCRA	2000	LMI%		HIO	2014
	% Native	DCRA	2000	Distressed		Denali Commission	2015
2010	Population	DCRA	2010				
	Median Age	DCRA	2010				
	HH Size	DCRA	2010				
	% Native	DCRA	2010				
Landfill	Class	DCRA	2015	Landfill	Location	DCRA	2015
	Permitted	DCRA	2015		Condition/Life	DCRA	2015
W/W System	Water	DCRA Input	2015	W/W Sys.	Audited?	AKTHC Input	2015
	Sewer	DCRA Input	2015		Homes Served	Input	2015
	Condition	DCRA Input	2015		Gallons		
Road Access		DCRA	2015	Electric Utility		DCRA	2015
Air Access	Owner	DCRA	2015		Gen. Sources	AEDS	2015
	Runway (lxw)	FAA	2015		Interties	DCRA	2015
Dock/Port Facilities					PCE	DCRA	2015
	Ferry Service	DCRA	2015	Notes		Phase II Input	2015
	Barge Access	DCRA	2015				

Note: See page 6 for a list of acronyms.

Table 40: Data sources for energy profiles

Field	Source	Date	Field	Source	Date
Utility	DCRA	2015	Power Production		
Power House			Diesel	AK EE Maps	2015
Engine Make	AK EE Maps	2015	Wind	AK EE Maps	2015
Line Loss	PCE	2015	Hydro	AK EE Maps	2015
Heat Recovery	AK EE Maps	2015	Avg Load	AK EE Maps	2015
Upgrades	AK EE Maps	2015	Peak Load	AK EE Maps	2015
Outages/Issues	AK EE Maps	2015	Diesel Eff.	AK EE Maps	2015
Operators			Diesel Use	AK EE Maps	2015
Number	AK EE Maps	2015	5-yr Trend	AK EE Maps	2015
Training/Certs	AK EE Maps	2015	Electric Rates Residential	PCE	2015
Maint. Planning	AK EE Maps	2015	Commercial	PCE	2015
Electric Sales			Cost per kWh All	PCE	2015
Customers	PCE	2014	Fuel Prices		
kWh sold	PCE	2014	Utility	AK EE Maps	2015
Resources			Retail	AK EE Maps	2015
All	See Appendix F	2015	Discounts	AK EE Maps	2015
Bulk Fuel			Other sources		
Tanks	AK EE Maps	2015	Regional Housing Authority	AHFC	2014
Purchasing	AK EE Maps	2015	Wx Service Provider	AHFC	2014
Coop Purchase	AK EE Maps	2015	Energy Use		
Other			Avg Star Rating	CCHRC	2014
Housing Units			Avg Sq Feet	CCHRC	2014
Occupied	CCHRC	2014	Avg. EUI	CCHRC	2014
Vacant	CCHRC	2014	EE Housing Stock		
Housing Need			Retrofitted	AK EE Maps	2015
Overcrowded	CCHRC	2014	Retrofitted	AK EE Maps	2015
Owners/Occup	CCHRC	2014	Retrofitted	AK EE Maps	2015
Data Quality			BEES Certified	CCHRC	2014
1-star	CCHRC	2014	Lighting		
Housing Age			All	AK EE Maps, VEEP reports, input	2015
By Decade	CCHRC	2014			
Non-residential Bldg Inventory	ARIS (2014), DCRA maps (2008), AK EE Maps (2015), Energy audits (variable)				

Note: See page 6 for a list of acronyms.

The CHAIRMAN. Thank you for your comments. Thank you for being here.

Michael Black, welcome.

STATEMENT OF MICHAEL BLACK, DIRECTOR OF RURAL UTILITY MANAGEMENT SERVICES, DIVISION OF ENVIRONMENTAL HEALTH AND ENGINEERING, ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

Mr. BLACK. First of all, thank you very much for the opportunity, Madam Chair, Senator Cantwell, fellow members of the Committee.

I represent the Alaska Native Tribal Health Consortium. My name is Michael Black. I am the Director for Rural Utility Management Services.

And you might wonder why is a health organization appearing for a group to talk about energy but let me show all the reasons.

First of all, the Alaska Native Tribal Health Consortium is the largest consortium of tribes in the United States and it delivers health care throughout the state with our regional partners. We run a native hospital in Anchorage as well as many other research efforts into native health issues as well as nutritional issues and so forth. We also have a very large group of community health aides that provide primary health care in rural Alaska and to over 200 communities and villages.

We also are very concerned about, of course, infectious diseases and so we have assumed the responsibility of the Indian Health Service for the provision of water and sewer in many communities throughout the state. We do this in cooperation with the State of Alaska through their village/state water program.

But as such, we are very interested in being able to provide proper sanitation to households. In this region one out of every three infants is hospitalized each year for lower respiratory disease, and that's because of the lack of adequate water and proper sanitation.

So as you can see, our vision as an organization is that Alaska natives are the healthiest people in the world. That cannot be achieved if sanitation is not provided.

So what does this have to do with energy? In the United States four percent of the total energy of the United States is used for water and sewer. In Alaska it's considerably higher, as you might imagine. Just from your examination of the environment we're in, water and waste water is prone to freeze. So therefore we require energy both to move it from one place to another as well as to keep it from becoming a sauna.

We have estimated that approximately, in villages, that approximately 30 percent of the total energy use is for water and sewer in the form of heat, primarily. Although electricity to drive pumps and to make mechanical devices work that are necessary for water plants, that's certainly an important aspect of the energy use. But most of the energy you see is actually to heat the water and in some cases even waste water so that it will be able to be disposed of properly and, of course, delivered to homes.

In our examination of the budgets of these small tribes and cities that are operating water and sewer services, we see that the total

costs of operating sanitation services, about 40 percent of that is related to the cost of energy itself.

In 2009, well actually in 2010, we began a program called the Rural Energy Initiative because of our recognition of this issue. Actually that program began with ARRA funding from the U.S. Government, and it was used to do and conduct a number of energy audits. In fact, today we have audited 50 communities, 50 small community systems in various parts of the state, primarily in the colder environments.

What we mean by an audit is we mean a team of mechanical and electrical engineers combined with operational maintenance specialist visiting facilities throughout the state and examining this energy use and where energy efficiencies can be derived as well as where we can take advantage of renewable energy opportunities. And from that effort we've been able to put together a plan, if you will, for 52 communities to that.

Of those 52 we see a large number of them could benefit from energy efficiency work. And so therefore we've begun using funding from various sources including USDA, the EPA, but primarily from USDA's RAVG program, Rural Alaska Village Grant program. And that has provided a great deal of resources and benefit to communities.

When we go in we identify those inefficiencies and we're able to address the changing out of antiquated or inefficient components of those clients, also and very importantly, the training of operatives. I think there is no doubt in anybody's mind that's examined the energy efficiency issue is that if you just change out plan components you will not achieve efficiencies. You have to actually train and change behavior of the operators themselves or those that are actually making decisions daily as to how energy is used. So we've seen a substantial benefit from that effort.

We've also seen a substantial benefit from working with our partners such as AVEC and others on renewable energy solutions.

Heat recovery alone provides a huge benefit and heat recovery for those that are not familiar with how villages actually generate power, it's mainly through the diesel generator and that generator gives off heat. That heat is lost to the environment, oftentimes, if it's not captured through a heat recovery system.

We take every bit of that heat that we can get and we can put it into the water system and avoid having to fire our boilers and to try to keep that water from freezing. So that has been a very, very important part.

Now where did we get the funding for that? Primarily from the State of Alaska through the Renewable Energy Program. And I must say it is disheartening to realize that the State of Alaska will not be able to put that much resources into renewable energy under its current fiscal situation. We certainly have had major benefits from it.

We've also used waste heat from wind turbines that would have otherwise been blowing the energy being produced at night or in a low demand period into the atmosphere as well. So we can purchase that as we've agreed to with AVEC at a discounted rate. We can put that electric energy into resistive heat and put it into the water and waste water systems as well.

We have used biomass where timber is available. You may have seen that at the waterfront. There was actually timber available here in Bethel. It comes from up river. Anyplace where we have standing timber we can use a local resource instead of imported fuel. And that certainly does help things. It certainly reduces the cost but more importantly it creates local jobs. And that helps the economies themselves.

I would like to now touch on the phylum aspect of rural energy initiative and that is remote monitoring. That's extremely important for these plants whether they've been actually addressed through energy efficiency efforts or even the use of renewable energy like waste heat. If you're not monitoring their success or their faults, it's very often that they will lose the efficiencies that you've actually tried to put into them.

So we use a system of remote monitoring. Currently we're monitoring about 25 remote plants around the state. We're using radio technology instead of costly satellite bandwidth, and we use the cell phone system that actually the Federal Government had an important part in trying to get established here in rural Alaska.

What that allows us to do is for about \$15,000 instead of \$100,000, we can put remote monitoring into rural plants and keep track of whether the waste heat is working, whether the temperature of the water is approaching 32 degrees which should set an alarm off. So we can do a number of things.

I believe that the Committee and the Affordable Energy Act is, it speaks, or Modernization Act is extremely important. It has a number of components that we find interesting. The nexus of the energy and water for sustainability, the smart energy and water efficiency pilot programs, these are things that have we're very interested in.

The one thing we would want to see is if we could be explicitly allowed to be part of that program through the inclusion of Tribal Consortium or tribes in eligibility for any of those programs.

So with that I think I've probably exceeded my five minutes. Thank you.

[The prepared statement of Mr. Black follows:]

MICHAEL BLACK, DIRECTOR OF RURAL UTILITY MANAGEMENT SERVICES
DIVISION OF ENVIRONMENTAL HEALTH AND ENGINEERING
ALASKA NATIVE TRIBAL HEALTH CONSORTIUM

SENATE ENERGY AND NATURAL RESOURCES COMMITTEE
OVERSIGHT FIELD HEARING ON ENERGY TECHNOLOGY INNOVATION AND DEPLOYMENT
Opportunities for Alaska's Energy Future

February 10, 2016

Thank you for the opportunity to describe the activities of the Alaska Native Tribal Health Consortium (ANTHC) in regards to addressing the energy needs and demands of rural community-owned water and sewer infrastructure and the innovative methods employed to minimize the use of fossil fuel for those needs. My name is Michael Black. I am the Director of the Department of Rural Utilities Management Services for the Division of Environmental Health and Engineering within ANTHC.

Formed in 1997, ANTHC is dedicated to the vision that Alaska Native people are the healthiest people in the world. As the largest tribal health organization in the United States, the Consortium's well over 2,000 employees deliver world-class medical, community, and environmental health services to the more than 150,000 Alaska Native and American Indian people residing in Alaska. ANTHC provides comprehensive specialty medical services at the Alaska Native Medical Center; wellness and prevention programs; disease research and prevention; rural health provider training; telehealth services; and essential operational, technical, and logistical support for our tribal health partners in Alaska.

In addition, ANTHC's Division of Environmental Health and Engineering provides planning, design, construction, and operations support of public health infrastructure—including safe water, sanitary waste disposal, and energy efficiency upgrades—throughout Alaska. Providing vital public health facilities that provide clean water and sanitary sewer systems for remote communities with no road access and harsh climates makes for unique engineering challenges, including extremely high energy usage and high energy costs.

Sanitation facilities play a critical role in the health of rural communities. Infants in communities without adequate sanitation are eleven times more likely to be hospitalized for respiratory infections and five times more likely to be hospitalized for skin infections. In communities with very limited water service, one in three infants requires hospitalization each year for lower respiratory tract infections.

Rural Energy Initiative

The high cost of energy coupled with the intensive energy needs of sanitation systems across rural Alaska directly threaten the important health benefits provided by clean water and sanitary sewer service. Unlike most systems in the United States, Arctic and sub-Arctic sanitation systems common to Alaska require the constant addition of heat from oil-fired boilers and electricity for pumps that maintain circulation of water in order to keep water and sewer systems running in regions that can see temperatures colder than minus fifty degrees. Energy costs make up, on average, 40 percent of the total cost of operating public sanitation in rural Alaska, where heating fuel costs over \$10 per gallon in some locations. The high price of fuel results in water and sewer bills in rural Alaska that range from \$80 to \$250 per month per household; that's five times the national average and well above the Environmental Protection Agency's (EPA) recommended median household income threshold for customer affordability. While some operating costs for rural sanitation systems, such as labor, regulatory compliance and replacement parts, remain relatively fixed; reducing the cost of energy represents the most significant opportunity to make water and sewer services more affordable and, therefore, more sustainable for rural communities in Alaska.

Recognizing the essential role affordable and sustainable energy plays in rural communities, ANTHC has developed the Rural Energy Initiative—a program focused on reducing operational costs of rural water and sewer systems through energy efficiency and renewable energy solutions. To date, ANTHC has completed energy projects in 45 rural Alaskan communities. Funding for these efforts has been provided by three primary sources: the Denali Commission, United States Department of Agriculture (USDA) Rural Development's Rural Alaska Village Grant Program 2% set-aside for technical assistance and training, and the State of Alaska. However, current funding levels will leave over 100 communities across rural Alaska with unfulfilled energy-saving potential, placing the health and the future of residents and their community in jeopardy.

The Rural Energy Initiative reduces water and sewer costs through a holistic, four-phased approach:

1. Conducting energy audits to model energy use and identify opportunities for savings
2. Implementing appropriate energy efficiency improvements and operator training
3. Reducing operating costs when possible using available renewable energy opportunities
4. Tracking performance and impacts of changes in the plant, operator behavior, and renewable energy approaches

The following sections outline each step of this process, which began in 2011, after audits funded by the Department of Energy found that energy comprises 40 percent of rural sanitation costs, making the long-term viability of these systems unsustainable.

1. *Step One: Identify energy use and potential energy projects by conducting energy audits.* ANTHC has conducted energy audits of 59 rural sanitation systems as well as completed detailed engineering analyses for renewable energy systems in 43 communities. These efforts both identify energy efficiency opportunities and develop specific renewable energy solutions to reduce dependence on fossil fuels and lower sanitation system operating costs. Using sanitation engineering and operation and maintenance expertise developed by ANTHC personnel familiar with the unique nature of Arctic water/sewer plants, distribution, and collection systems; ANTHC has provided a roadmap for needed energy upgrades in 59 communities in Alaska. Expanding that effort to the remaining 127 rural Alaskan communities is our goal. To continue assisting rural communities through energy auditing and feasibility analysis of renewable solutions over the next four years will require \$800,000. We intend to pursue that goal through private and public funding sources.
2. *Step Two: Implement energy efficiency retrofits and provide operator training.* Using the results of our completed energy audits, ANTHC has worked directly with rural communities across Alaska to acquire funding primarily from the EPA, the USDA, the Denali Commission, and the State of Alaska to implement energy efficiency improvements and provide training for rural water plant operators. The training of operators is critical to maintain energy efficiency benefits because human behavior and local capacity are central to maintaining long - term efficiency. The savings to rural sanitation systems from energy efficiency improvements completed by ANTHC to date in 34 communities is estimated at \$800,000 annually.

It is our goal to continue the implementation of energy efficiency improvements and operator training in 80 additional communities over the next four years. Between energy efficiency upgrades of equipment and proper training of operators, an additional \$7.3 million in funding will need to be identified. The savings to rural communities from these improvements are estimated at \$1.45 million annually.

3. *Step Three: Implement renewable energy solutions.* Integration of renewable energy as part of the solution often leads to more affordable and sustainable residential water and sewer service. A variety of approaches can be employed. ANTHC has found that using recovered heat from the commonly used diesel fired electric generators, capturing excess energy from wind turbine generators and converting it to heat, using ground source heat pumps, using micro-hydro energy when available, and using biomass boilers when standing or drift wood timber is available makes sense if these systems are maintained and operated correctly.

ANTHC works directly with Alaska's rural communities to identify, design, and construct renewable energy solutions to reduce the high cost of operating sanitation systems. The implementation of renewable energy has steadily increased each year as new opportunities are identified and innovative approaches are developed. ANTHC tailors its renewable solutions to meet the dramatic environmental diversity, location-specific renewable resource availability, and unique energy needs of the facilities served.

ANTHC has completed 24 renewable energy projects for rural Alaska sanitation systems since 2011 with funding provided by the U.S. Department of Energy, the EPA, and the State of Alaska's Renewable Energy Fund. This initial deployment of renewable energy systems has resulted in an estimated annual energy savings of \$1.25 million in 2015.

The most substantial contributor of resources has been the State of Alaska through the Renewable Energy Fund. This funding was designed to help Alaska become more reliant upon renewable energy. It uses a competitive award of funding that requires feasibility studies and favorable cost/benefit ratios. Unfortunately, the State's ability to continue funding renewable energy solutions has become highly questionable. The Renewable Energy Fund resources have dwindled from a high of \$100 million to its current level of \$5 million annually.

ANTHC has identified renewable energy solutions and completed feasibility analyses for several additional communities across Alaska, with many of these projects currently designed and shovel ready. To complete the identified renewable energy projects in 34 communities over the next four years, \$15 million will be needed. These projects are projected to save rural communities \$2.15 million in annual operating costs.

4. *Step Four: Monitor results and track effectiveness.* Monitoring the results of energy upgrades and ensuring that energy savings are realized and maintained is an important element of the Rural Energy Initiative's approach.

ANTHC is installing durable, off-the-shelf equipment to remotely monitor sanitation systems and maintain information on energy use via a web-based interface. These systems can be installed and maintained at a fraction of the cost of the previously used remote monitoring systems relying upon satellite bandwidth.

To date, this program has provided monitoring service to 20 communities, with 28 total communities expected to be served by the end of 2016 with existing funding. In addition to tracking energy performance, remote monitoring enables maintenance expertise outside the community to assist with identifying potential catastrophic failures, such as freeze-ups, and avert expensive and damaging emergencies. Many examples have occurred in the last four years where relatively inexpensive monitoring has saved millions of dollars in plant infrastructure and equipment that would have needed to be replaced if failure had occurred.

The benefits of remote monitoring can be easily extended to many more rural communities across Alaska. To install remote monitoring equipment for 80 additional rural sanitation systems during the next four years will require funding of \$1.45 million.

Additional Benefits

The energy efficiency and renewable energy solutions carried out by ANTHC have many additional benefits that go beyond reducing sanitation system operating costs. Energy-focused improvements enable communities to reduce water and sewer service fees for homeowners, improve the sustainability of critical public infrastructure, reduce environmental impacts through reduction of fuel usage and carbon dioxide emissions, improve workplace safety in rural water plants, and increase overall access to the public health benefits of rural sanitation. In addition, use of local renewable energy sources such as wind power and locally harvested wood for heating acts to reduce community reliance on imported diesel fuel and keep money in the local economy. Finally, including operator training and education as part of the solution not only allows efficiency improvements to last, but also build local technical capacity as well as pride in ownership of public sanitation infrastructure.

Continuation of ANTHC’s Rural Energy Initiative planned improvements over the next four years will require \$24.8 million in funding and result in a projected annual energy savings to rural Alaskan communities of \$3.6 million.

We appreciate the Committee’s work to refine our nation’s energy priorities through the proposed “Energy Policy Modernization Act.” Most notably, we appreciate the legislation’s recognition of the important interconnection between energy and water through proposed programs like the “Nexus of Energy and Water for Sustainability” (Sec 4101), and the “Smart Energy and Water Efficiency Pilot Program” (Sec 4102). We also see progress for Alaska’s tribes and rural communities stemming from sections focused on energy efficiency for public and non-profit facilities (Sec 1004), and those focused on energy solutions for remote micro-grid communities like those seen across rural Alaska (Sec 2304). In addition, proposed programs focusing on capacity building through energy training and education (Secs 1007, 1008, and 3602) hold promise for rural communities where programs like the Rural Energy Initiative have proven the importance of including local capacity training as part of the solution.

As this legislation moves forward, we would ask that tribes and tribal consortia be specifically mentioned as eligible to participate in each proposed program. We also ask the committee to increase the legislation’s focus on assistance to communities like those across rural Alaska, where remoteness, high energy costs and intensive energy requirements act as barriers to implementation of already-identified energy saving solutions. Also, while research, planning and piloting of new ideas are important to paving our nation’s energy path forward, that path also demands direct support through programs that provide resources to enable our nation’s underserved areas to fulfill energy improvements that are ready to implement today.

Finally, we ask the Committee to consider Alaska’s present fiscal challenges and the devastating impacts that reduced resources pose to Alaska’s rural communities. By offering matching funds to state programs like Alaska’s Renewable Energy Fund, the federal government has an

opportunity to bolster a program that has been refined over the years and now offers an established mechanism for objectively prioritizing renewable opportunities. ANTHC has worked on behalf of dozens of rural communities over the past six years with funding from Alaska's Renewable Energy Fund to deliver renewable systems that are now producing real savings. We hope to continue serving our rural customer-owners by delivering future energy improvements, many of which are shovel ready, through added federal program support.

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The CHAIRMAN. Thank you, Michael.
Mr. Steve Gilbert, thank you for being here.

STATEMENT OF STEVEN GILBERT, MANAGER, PROJECTS DEVELOPMENT AND KEY ACCOUNTS, ALASKA VILLAGE ELECTRIC COOPERATIVE, INC.

Mr. GILBERT. Thanks, Senator Murkowski, and thank you for the opportunity to come and testify.

I work, as mentioned, at Alaska Village Electric Cooperative and I serve as Manager of Projects where I lead a team of dedicated professionals who focus on reducing the costs of energy in Alaska. And I find that very exciting, very compelling opportunity and in my career I guess I just had more fun than anybody should be allowed to have, worked on R-Shield power generation, large scale coal and large scale nuclear facilities.

The last 20 years I've actually spent quite a bit of time focusing on renewables, currently chair one of the largest wind O and M User Groups plus the largest in the United States, obviously among the largest in the world of 60 thousand megawatts. So we've got an Alaskan chairing a very large wind O and M User Group. So we extended lessons learned from Alaska to the lower 48 and routinely called and asked about well how do you do this, how do you do that.

And so it's been exciting to be a part of that. So, thank you for the opportunity to come and talk a little bit about what we're doing at AVEC.

We aptly serve 56 rural communities with—the residents of whom are among the lowest income families in the United States. But we've heard that over and over here today, with unfortunately some of the highest cost energy. It's principally diesel fuel.

We do generate six percent of our total power with wind power. We operate more wind turbines than any other company in the State of Alaska. We have 34 wind turbines serving—located at 11 communities and serving 15.

So the way we do that works is with electric interties. We have 48 power plants serving those 56 communities. Again, those interties give us the ability to then gain what we would otherwise cannot have access to and that is economies of scale.

And when and where ever possible we try to build interties from one community to another. We will serve them on two communities, on three communities from a single power plant and then convert the other power plants, that have shut down, to stand by duty. We save on operating costs and we also enhance efficiency through those mechanisms.

We're doing that now and we want to do more of that. And so the Federal Government and especially has helped us through the high energy cost grant programs and the like.

I was going to mention a couple things.

Technical support for our company, I mentioned that we have 56 communities that we serve. Our technical support, i.e., utility engineering, administrative services. There's billing, that sort of thing. That's where we're making our buck. It's a utility after all so we send a bill to everybody once a month and hopefully they send us a check back. And so that all comes out of our Anchorage office.

I'm going to put my cheaters on, my \$5 cheaters. I thought I would tell everybody that I'm a cheap utility engineer and my boss likes to remind me that Steve, no, you should say frugal utility engineer.

The villages that we serve do reflect not only economic poverty but energy poverty. And I'll try to underscore that. Our first witness mentioned this. The national average is somewhere around 600, 650 kilowatt hours a month. AVEC's customers are around 350 to 400 kilowatt hours a month. So people are working diligently to control their costs but their costs are substantial, driven principally by diesel when boats are transporting diesel and economies of scale which are difficult for us to access.

In Alaska, if you think broadly about Alaska there's roughly 325 communities, 100 or so of those are rail well communities. And that leaves 200 plus as rural communities and those are all supplied with stand-alone. This is an important key, important differentiation or stand-alone microgrids.

I know that DOE along with some of the colleagues that I work with, we talk about microgrids, but those are effectively grids within a grid. That definition is an important difference to understand that definition because that can sometimes serve as a hindrance to funding opportunities because our grids are stand-alone. We don't always have the ability to tie in to other grids. We try to tie communities together but then we've created a single grid. It's not—it's a mountain still. It wouldn't qualify, I think, as a microgrid from a size perspective.

Again, putting things into perspective for Alaska, state wide, all the utilities together generate about 6,300 gigawatt hours of sales. That's about 50 percent of the city of Sacramento. So again, we struggle with economies of scale.

Seventy-seven percent of that energy was sold to the rail well, that's our urban communities. 13 percent to Southeast, Juneau and four communities there. And then about 10 percent to rural communities. So where we are today. Anchorage, Fairbanks, Juneau, the average is roughly 15.8 cents per kilowatt hour.

Capital investment, there's another start differentiation, you know, in the utility business. We look at our capital costs, operating costs, and they're our two big, main categories. So capital costs to serve rural communities per customer is about \$17,000 per village customer. So think about it. Seventeen thousand dollars. That's the infrastructure that happens, power lines, power plants and the like. Compare that to the lower 48, where it's about \$2,500 per kilowatt so it gives you a sense of the hurdle that we face.

Diesel generation. And so if you want to install a new power, diesel power plant, it's about \$3,000 per kW installed, the kilowatt, installed. And it's a quick reference that we use in our industry.

Wind generation, I already said, came out of I'm a big advocate of renewables. It's a flat price power. But wind generates about \$10,000 per kW installed.

Compare that to a diesel plant. Diesel plant works you've got to buy fuel for and your maintenance costs per kilowatt hour are higher than they would be for a wind power plant but your upfront capital cost is much, much higher. So it creates a hurdle force.

The way we run our power plants and this is true of all utilities, we have the costs or the price of power but people are very interested in reliability. So we back up our wind. In other words, when we're leaning on wind or we're using a wind power, we're using a diesel power system on, sort of, a stand by effect. We call that spinning reserve.

Currently we're basically forced to carry out 100 percent of that passage for balancing purposes. There are mechanisms. They're off the shelf. They're called grid bridging which would give us the ability to use a much smaller engine in parallel with our wind power. So that will substantially increase our penetration of wind.

I mentioned that we have 11 locations where we have wind turbines now. Six percent of our total system is generated by wind. But if you go to those villages where we have the wind installed that's where we're seeing, in some cases, 25 percent of the total power for that community generated from wind. We believe we can exceed that with things like grid bridging. It's a concept but it's based on off-the-shelf technology. We put that together. It's actually being used in other segments of industry, as I mentioned I'm a cheap utility engineer so I'm always looking for opportunities that already exist.

So a point I guess we've already made but sustainable communities must have jobs and essential services, the underpinning of which is low cost energy.

Federal help needed through the NAV Commission has been a fantastic partner with AVEC has been able to partner with and serve as a mechanism where Federal policy has a lot to bear to help us lower the cost of energy in rural Alaska. I mentioned earlier the high energy cost program. That has actually funded several of our interties. And we have one, actually, in process right now where I understand the funding for that program is in peril or perhaps already largely detailed but we would advise some consideration to channeling funding through that program again.

Transmission funding to enhance microgrid, stand-alone microgrid efficiency, grants and loan programs to develop renewables and alternatives. We see that as a huge benefit and opportunity for us to lower our costs of energy in rural Alaska.

And then energy independence. We've heard that talked about, a little bit, maybe a lot of it. And it has to do with globally-grown, if you will, globally-produced energy and that's what the renewables do for you. And maybe it's a little higher cost up front, but it's a lower cost over time. And so that's the direction we would like to go. It's the direction we'd like to transition to.

So specifically speaking, interties between communities to enhance economies of scale and mechanisms for helping us fund those.

Grid Bridging to increase renewable penetration.

Thermal storage. Mr. Black alluded to that. That's where we recover heat from our engines and use that to deliver heat to community facilities. That allows the community to avoid burning fuel in their boilers.

And the wind and heat. This is very exciting. We actually have enough of, well four of our existing installations, where we're actually having to shed the wind. In the wind business we call that cur-

tailment if you actually let the wind go by your place because it's more wind than you can use at that moment in time.

Well we've come up with a way where we can turn on and off electric boilers in water plants and it allows these communities to avoid thousands of gallons of fuel a year. Some of them are around 8,000, some of them are over 10,000 gallons a year. So working closely with ANTHC we've got four of those in place now. There's more opportunities like that.

Training of personnel. We know we're going to transition to a model which is actually more complicated. So training of personnel, I mentioned our participation in the actual O and M Users Group. Our subject at the spring meeting is training and what does it take to train people. What skill sets do people need?

And so finally I was going to just mention we are very interested and I think you're going to hear about that from Ms. Holdmann, and this is the Alaska Energy Network of Innovation Hub.

[The prepared statement of Mr. Gilbert follows:]

**Written Testimony
Submitted to the
United States Senate
Committee on Energy and Natural Resources**

On

**Energy Technology Innovation and Deployment
Opportunities for Alaska's Energy Future
February 15, 2016**

**Respectfully Submitted By Steven Gilbert
Manager, Projects Development and Key Accounts
Alaska Village Electric Cooperative, Inc.**

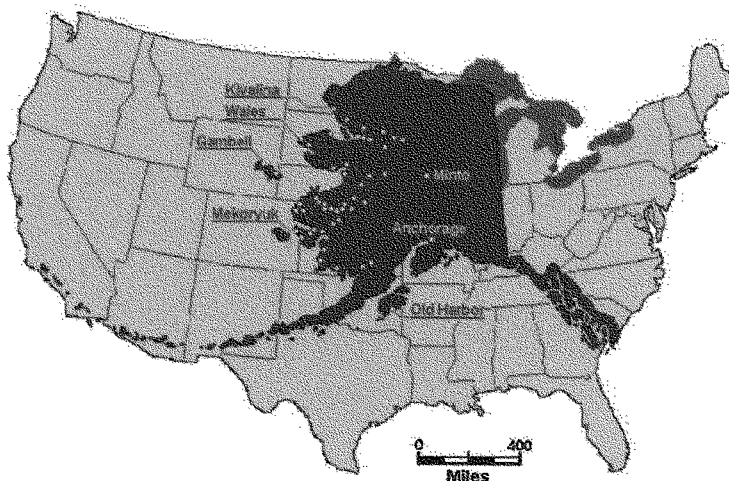
Testimony of Steven Gilbert
 Manager, Projects and Key Accounts, Alaska Village Electric Cooperative, Inc.
 February 15, 2016

Senator Murkowski, thank you for the opportunity to testify in Alaska.

My name is Steve Gilbert. I serve as department manager of Projects and Key Accounts of Alaska Village Electric Cooperative (AVEC). I have worked in the electric power industry for more than 35 years and during my career have become familiar with most conventional and renewable energy generation sources.

AVEC was established in 1967 as the culmination of an effort of the then-Governor of Alaska to find a way to deliver central station electricity to the small villages that housed Alaska's rural, mostly indigenous population. The task was daunting, given the distances, geography, absence of infrastructure of any kind and extreme climactic conditions of our great state.

Working with USDA REA (Rural Electrification Administration, now Rural Utilities Service) a unique electric cooperative was established -- one that would serve communities whose physical boundaries did not coincide with those of other member villages. This patchwork of electric grids began with three communities that were electrified in late 1968. Old Harbor, Nulato and Hooper Bay are an average of 400 air miles from Anchorage, AVEC's base of operations and an average of 470 miles from each other.



AVEC served communities are largely clustered in western Alaska, (Anchorage is included for geographic reference only)

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AVEC today serves 56 communities in Alaska and does so with 48 separate diesel fueled power plants. Several of our communities have populations of less than 100 while our largest, Bethel, has a population of more than 6,200.

Discounting Bethel, which is more than five times the population of our second largest community, the average village population is 450 – likely less than the occupants of a single apartment building in most cities.

AVEC is, in effect, operating a series of 48 stand-alone micro-grids. As small stand-alone grids we cannot benefit from interconnection with other grids to optimize reliability and share costs as is the case with virtually all communities in the Lower-48. Instead we must provide redundancy within our power systems to allow for planned and unplanned generation maintenance. Extended outages in a community equate to life, health and safety crises almost immediately. During the winter, houses freeze up and human life is at risk. During the short summers, extended loss of refrigeration could mean the loss of an entire season of subsistence food.

AVEC systems typically consist of a stand-alone power plant with three or four generators. Sizing is carefully done so as to operate the most efficient generator to meet the needs of the day and the season. Redundancy is determined based upon having adequate capacity when the largest generator is down for maintenance and another fails unexpectedly. As a result, AVEC owns 80 megawatts of generation to supply an average load of 13 megawatts.

In addition to AVEC's 48 power plants, we maintain diesel tank farms in each community. Because fuel is delivered by barge during the short "open water" season, we must be able to store fuel for an entire year at a minimum. Since weather can delay the arrival of the first barge, we will generally ensure that we have up to 14 months of fuel on hand by the end of the delivery season.

In this day of the drive to distance ourselves from fossil fuels, rural Alaska's dependence on diesel is surprising to an outside observer. Alaska is one of the nation's leading energy states with vast reserves of natural gas. It would seem self-evident that Alaskans' energy needs would be met with inexpensive, low-emission sources such as that natural gas. That is not possible however, because Alaska lacks the basic infrastructure that is ubiquitous in other states.

Alaska lacks roads, railways, adequate port and dock facilities, paved runways, transmission grids, communication grids and other elements deemed necessary for modern American society. As a result, we have had to develop micro-systems to meet the needs of the people who have been resident in these areas for many hundreds of years. However, these micro-systems come at very high cost per capita.

As an example, AVEC's investment in utility plant to serve our villages is more than \$17,000 per service or meter. That is 4-5 times the investment typical in the Lower-48

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states and reflects the very large redundancy built into our generation plants as well as the value of the fuel storage systems that go with it.

Despite these staggering costs, AVEC has nonetheless been a leader in deploying wind generation in communities with a robust wind regime. We typically install wind turbines that, at peak output, exceed the connected electrical load at the time. We install diversion systems that shunt excess wind generation to passive loads such as electric boilers in water treatment plants and other public buildings and reduce the use of diesel fuel in those facilities. While use of excess wind does not displace AVEC's fuel it does help communities reduce fuel they need for water treatment. To accomplish this AVEC is using off the shelf equipment in an innovative way which keeps up front costs lower. Depending on location, these wind to heat systems save communities between 8,000 and 10,000 gallons a year using excess wind.

AVEC has been engaged in developing wind generation since 2003 and owns and operates the largest fleet of wind turbines in Alaska – 34 machines are located in 11 communities and serve another four through modest transmission connections. In 2015, 6% of the electricity we sold came from wind. That is significantly better than the US total of 4.4%. In communities with optimal wind regimes we are able to meet 25%+ of their electrical needs from wind.

Where practical, AVEC offers recovered heat to communities where engine heat is captured in the cooling loop. The heat that would otherwise be rejected to the atmosphere in a radiator is recovered and used by communities to heat buildings and/or community water treatment plants. There are modest costs to operate a heat recovery system. The heat is provided to the community at a cost well below the cost of the equivalent fuel the heat replaces and saves thousands of dollars each year.

AVEC also has a full time training supervisor who travels between villages. The supervisor provides ongoing training for power plant operators. There is an on-going need for people with the requisite skills necessary to maintain the systems and troubleshoot problems when they arise. AVEC works with local technical colleges to identify skills that schools need to teach students to prepare them for field work.

Renewables are intermittent, with output goes dependent on wind speed. AVEC has developed the basic design for what we call a "grid bridging" system. The intent is to allow AVEC to operate diesel engines at the lowest possible rating, without causing damage or significant efficiency reduction. The power plant will rely on the grid bridging system to carry the community as the wind trails off and the diesel unit comes up to carry the load. As the wind picks up, the diesel will reduce its output and fuel consumption is reduced. This function is called spinning reserve and is currently supplied by a diesel engine. The grid bridging system will provide the reserve energy and significantly reduce fuel consumption. The grid bridging system has application potential in the lower 48 states as larger utilities also grapple with integration of intermittent resources.

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AVEC has also branched out into the tug and barge business. With diesel fuel playing a critical role in meeting the energy needs of rural Alaska, AVEC decided to enter this arena in order to deliver lower cost fuel to its constituents. Through an innovative business arrangement with professional barge operators, AVEC has been a catalyst for competition which has led to consistently lower cost fuel transportation across the entire western Alaska market.

Alaskans do not wish to be tied to the yoke of fossil fuels. Fuel spills occur routinely because the fuel is stored and handled so frequently, although rarely are they of such magnitude as to command national attention. Nonetheless, spills and combustion emissions are a continuing threat to human health and extremely expensive to respond to. That is why AVEC is committed to reducing our dependence on diesel fuel, which can only be achieved by improving efficiencies and by installing alternative sources of generation.

Generation efficiencies are achieved through optimizing generator output and running the most practical sized engine at any given time. AVEC's customer/members have realized savings through our use of electrical interties between villages. The interties allow us to serve 56 communities with 48 power plants, reducing operating costs. Interconnection of nearby communities helps AVEC optimize power generation efficiency and spread the benefits of wind.

The cost of operating a power plant accounts for ten cents per kWh. That is the average cost of a kWh delivered to a home in the Lower-48 today – but is only one fifth of the cost of a kWh across the AVEC system.

Because of the very poor economies of scale in rural Alaska, costs are very high. While all technical, administrative and support services are provided from our Anchorage headquarters; each stand-alone generation and distribution system accounts for 1.5 full time equivalent employees and two local part time employees to operate the plant.

To put the very small scale of these utility operations into perspective, a village's entire annual power consumption is the equivalent of half the consumption of a typical grocery store in Anchorage. All 56 of our communities together represent a population of almost 32,000, about the same as Fairbanks, but the combined electrical usage is less than 10% of Fairbanks.

Electricity is the underpinning of modern society. Without abundant, affordable, reliable electricity, modern society cannot function efficiently. That is palpable in rural Alaska and, to a lesser extent, in urban Alaska as well, where the cost of electricity is 150% that of the US average.

Testimony of Steven Gilbert
Manager, Projects and Key Accounts, Alaska Village Electric Cooperative, Inc.
February 15, 2016

As we address the delivery of electricity, AVEC is keenly attuned to the interlinked needs of sustainability for our communities. Space heat is typically provided by diesel fuel or wood, where that is available. Again, cost-effective alternatives are simply not available or practical. Transportation infrastructure in and to our communities is almost non-existent. Economic development is stymied absent these underlying basic needs and the social fabric of the community is strained by the day-to-day struggle of existence.

The State of Alaska has been a major player in the effort to overcome the shortfall in infrastructure to serve Alaska – a role that in the Lower-48 was largely met by the federal government. The Denali Commission has been a significant contributor when funding was available in past years. Unfortunately, their role has perforce diminished as funding sources have dwindled.

In the energy sector, the State has established the Power Cost Equalization program to make a lifeline amount of electricity affordable for individual Alaskans, while non-residential users pay often unsustainable electric and heat bills to operate their modest businesses. The State has established a Renewable Energy funding program that has been better capitalized than any other state. Millions of gallon of diesel are being displaced annually by projects funded through this program. Unfortunately the State has had to significantly reduce funding of this program. The State funds research opportunities for emerging energy technologies. The State also established low cost financing options for energy infrastructure for larger utilities.

But the State cannot carry all of the necessary infrastructure development with its limited resources. The Federal government through DOE and other agencies supporting the Energy Policy Modernization Act should consider leveraging lessons learned in Alaska. It should be looking at deploying innovative commercially viable technologies, such as what we are trying to do on a small scale.

The federal government has passed legislation to help with these costs. The Department of Agriculture runs the High Energy Cost Grant program through the Rural Utility Service (RUS) that does make grants, plus loans, available to fund the installation of renewable electricity systems, but funding for the program has been cut repeatedly over the past decade. And Congress in 2007 approved in the Energy Independence and Security Act the creation of two matching grant programs to provide grants for up to 50% of the cost of installing proven renewable energy systems in high-cost regions.

Unfortunately those grant programs have never been implemented by the Department of Energy nor actually been funded by the executive and legislative branches. Providing additional funding for these programs, plus for additional transmission aid, also currently available through RUS, would dramatically improve the likelihood that islanded grids could afford to install renewable energy systems and not only reduce consumer power

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costs over time, but also reduce the consumption of fossil fuels with their associated emissions.

AVEC has also expressed its strong support for the establishment of an Alaska Energy Network Innovation Hub. This audacious project encapsulates an Alaskan vision of 100% self-sufficient micro-grid systems. This effort coupled with our drive to interconnect communities could catalyze a fundamental leap in delivering energy to remote and Arctic communities and could establish Alaska as an energy innovator second to none.

Specifically, AVEC requests the federal government to support:

- More electrical interties between communities which increases economies of scale, reduces operating costs and allows for the benefits of renewable energy sources such as wind to be distributed to more villages.
- Grid bridging, uses off the shelf equipment but allows for the integration of more wind generation than would otherwise be possible. 30 – 60 seconds of storage.
- Thermal energy using both recovered heat and excess renewable energy. By intentionally sizing the renewable energy system to exceed, periodically the electric systems ability to absorb all the power, the renewable energy can be sized to meet more of the villages energy needs both electrically and for heat.
- Training of personnel to maintain existing systems and adapt to ever increasing renewable energy on the systems.
- Funding of an Alaska Energy Network Innovation Hub to create duplicable solutions for remote and islanded communities.

It is time for a renewed, holistic approach to meeting the basic infrastructure needs of rural Alaska. With the US chairmanship of the Arctic Council, a spotlight is being shone on the only arctic state in the US – Alaska. This is where the impacts of climate change are being most sharply felt. This is where economic and living conditions most closely resemble those of developing countries. This is where the vast resources of the Arctic Ocean nurture the land and the people and whose shores will witness the evolution of new transportation, tourism and mineral extraction activities.

It is time for the federal government to partner with the State of Alaska and those of us that exist to serve Alaskans to continue and enhance the infrastructure development that is critical for our future.

We should be expanding our vision of micro-grids to include sustainable clusters of communities that are not connected to a grid but that collectively can be served by robust technologies that represent reliable, affordable, clean abundant energy.

Thank you for the opportunity to testify.

The CHAIRMAN. Thank you, Steve, we appreciate it.
Jack Hébert, with the Cold Climate Housing Center, welcome.

**STATEMENT OF JACK HÉBERT, FOUNDER AND CEO, COLD
CLIMATE HOUSING RESEARCH CENTER**

Mr. HÉBERT. Welcome and thank you so much. This is quite an honor to be here. And it was, as well, a real wonderful experience to share our work in Oscarville with you today.

I did and have submitted written testimony, and I'm summarizing a bit of it here. But I'll begin talking about problems in Alaska. I think, from what I've heard, you've got a pretty good idea of our challenges.

The Cold Climate Housing Research Center is a 501(c)(3). We're 16 years old now. We're on the campus of the University of Alaska in the center of the state, but we are state and privately-funded and federally-supported.

We're not part of the University of Alaska. We are really part of all Alaska. We've worked everywhere in the state to a great deal of success with our partners and our collaborators. And that's due to a real embedded, deep respect for people that live in the regions of Alaska and their understanding.

I'm going to talk a little bit about some of our work because Senator Cantwell was curious about it.

We, our home, is the farthest north, LEED platinum building in the world. It's 25,000 square feet in Fairbanks. It has over 2,000 sensors embedded in it. It's on degrading permafrost so the foundation itself is adjustable. It has advanced mechanical systems. In fact, SIEMENS awarded us runner up for the smartest building in America for the systems that we put in this building. I would love to show it to you. And Senator Murkowski, bless her, comes by and sees us a great deal. But it is a fascinating building.

And our research is very, very broad. Everything from public policy to the housing needs assessment for the state which very clearly shows a great need in rural Alaska, but elsewhere, to improve the quality of housing. Ten thousand homes in rural Alaska are on the verge of catastrophic structural failure, and these are in communities with no economy.

Now as a lifelong home builder and involved in that industry, I understand what an economy that can be built on housing itself. It is essentially, in many communities, the only economic engine we have. We have to use local resources, we have to listen to the local people, we need to design for that place in an appropriate way, and we need to keep the money there. And we've had remarkable success with that kind of collaboration which were expanded into the holistic approach that you saw in Oscarville.

By dramatic success I'm talking about reducing the cost of construction of rural housing by 50 percent. The energy use in rural housing by 89 percent. And in fact, we have net zero homes that we've designed and built with partners in the Fairbanks area with 15,000 heating degree days, a net zero building.

Our research center, right now, is not using for space heating a 25,000 square feet, anything but renewables today as we speak. And that began two weeks ago at minus 20 Fahrenheit in Fairbanks, just the sun. We have created photovoltaics with ground

source heat pumps of which we have done in frozen ground, probably the most amount of research on heat pumps in frozen ground of anyone in the, certainly for the world and have collaborators everywhere.

We also have worked with air source heat pumps using the air itself to extract heat.

We've done refrigeration studies using cold air in the wintertime to refrigerate subsistence foods rather than using electricity. And then when the sun comes back, refrigerate with the sun.

We've done countless studies that I would encourage you to go on our website and see. And I implore you, really implore you, that we need a national lab here in Alaska. We have the talent here in Alaska.

We do find that people, like myself, who are in love with the tools and like to build and do things, it's very frustrating when we see others come here with the solutions, when we're seeing the solutions being applied every day by Alaskans in Alaska. So I really would love to discuss that with you. And I really do feel and EPA feels that in the center of the state, at the Housing Research Center, is the perfect place for that lab whether it's part of a lab, your nationwide labs or a stand-alone, that it be part of that strength and that research strength.

And we can mentor the other labs and introduce them to what's going on. But many times we feel like, a little bit like the Who. We are here. We are here. Horton hears a Who.

[Laughter.]

And we're not shouting loud enough. We're too busy swinging hammers and banging nails and trying to get things done. So please remember that.

I was very encouraged with Secretary Moniz and what is going on with the energy bill and what you're doing with DOE in Alaska. We've got a lone captain here. He's got a long beard, but he's not that wise.

[Laughter.]

All it's all of my own stuff.

And he needs, as part of his team, others helping him and well, others need to be rooted to this land. We need Native Alaskans involved in that. We need the voice of rural Alaska as part of DOE's policy.

And we'll all win. And we'll all work together. And this holistic approach doesn't mean we've got all the answers. It means we're working on them and we want to work on them with you, with all of you in your states.

I love these Western states. I was a big climber years ago, and I climbed in Montana in the Tetons. And I know that you understand the essence of the land.

And then when you come up here your eyes were like mine when I came up here 45 years ago. They were this big around looking at the greatness of this land and the greatness of the people. We're a resource to you. Use us, use that talent.

So those are my written, or not, statements, but thank you so much.

[The prepared statement of Mr. Hébert follows:]

Full Presentation before the Senate Subcommittee on Energy
Solutions to Reduce Energy Costs in Rural Alaska

Presented by Jack Hébert, Founder and CEO
Cold Climate Housing Research Center
Fairbanks, Alaska
February 15, 2016

Introduction

Among the fifty U.S. states, Alaska is perhaps the most unique with respect to energy costs, housing, water and sewer infrastructure, transportation issues, and its role in climate change response issues.

Alaskans pay almost twice the national average annually on energy costs¹. Rural Alaskans confront an even larger problem, with areas of Western and Interior Alaska estimated to spend approximately \$8,000 a year on heat and electricity¹. The cost of electricity in rural Alaskan communities is the highest in the nation, ranging up to \$1.00 per kWh². Low-income residents are the most affected by these high costs, as they pay a much higher percentage of their disposable income on keeping their house warm and the lights on than residents in higher income brackets. These communities were the most impacted when the cost of diesel spiked over the last decade. The cost of operating and maintaining energy and power systems shows the critical need to improve the efficiency of the housing stock in rural Alaska. Cost to distribute power in rural Alaska is estimated at \$200,000-\$1,500,000 per mile³. This factor alone creates a major barrier in furthering the distribution of power generation in those communities.

The dramatic rise of energy costs in Alaska has created a growing interest in affordable, energy efficient commercial building construction and residential housing. A review of the occupied housing in the state indicates that of the 10% of housing is classified as *one-star*, the lowest possible energy rating, and half of these housing units are in rural areas of the state not served by road, rail, or the marine highway. One-star housing units use approximately five times as much energy as newly constructed housing in the state. Furthermore, approximately half of the nearly 250,000 housing units in Alaska were built in the 1970s or 1980s and are approaching the end of their useful life². To compound the housing issues, there is significant overcrowding in rural Alaska, exceeding both the national average of 3.1% and the statewide average of 6%².

Aging and poorly designed water and sewer infrastructure has become a great burden on rural Alaska. Water and sanitation challenges have provided a variety of solutions, which include honeybucket haul systems, drilled water well house distribution points, piped systems, and haul systems for safe water.

¹ 2014 Alaska Housing Assessment. Alaska Housing Finance Corporation and Cold Climate Housing Research Center. Available at: <https://www.ahfc.us/efficiency/research-information-center/housing-assessment/>

² Fay, G., & Meléndez, A. V. (2012). *All-Alaska Rate Electric Power Pricing Structure*. University of Alaska Anchorage, Institute of Social and Economic Research, Anchorage.

³ NANA Pacific. (2008). *Distributing Alaska's Power: A technical and policy review of electric transmission in Alaska*. Anchorage: Denali Commission.

Rural communities are faced with some of the highest rates of unemployment in the nation. Census “Quick Facts” figures indicate that poverty rates in rural villages averaged 19.4% in 2010.⁴ According to the Denali Commission 2014 Annual Report, unemployment rates in many rural Alaskan communities exceed 50%.⁵

Transportation of materials, food, clothing, and essential necessities are shipped by either air or barge to all rural communities in Alaska. The logistics of transporting to these communities provides a unique challenge when addressing energy, housing, and infrastructure issues. Due to the short summer barge season, the cost of materials can easily double once transportation costs are factored in. Communities with shallow river systems and lower tides due to climatic changes have additional lightering costs to transport materials from the barge to the dock or landing, resulting in increased costs throughout the state. Regardless of the global price for oil, rural Alaska faces extreme energy costs and pays a fixed price for oil delivery once a year. This unique challenge becomes compounded when combined with funding guidelines for procurement and deadlines.

Alaska is warming at twice the rate of the rest of the United States. The impacts of climate change are highly visible in Alaska, as evidenced by coastal erosion, increased storm patterns, sea ice retreat, melting glaciers, and thawing permafrost (which covers 85% of the state). Adaptation and resiliency measures are essential to protect the people and infrastructure of Alaska. Roads, airports, and housing built on permafrost are highly vulnerable to warming, leading to increased maintenance costs and more frequent disruption in services. Addressing climate change with site-specific foundations, building science ingenuity, and adaptable and/or movable structures has proven to be the most effective approach.

Solutions for Alaska

Supporting projects in Alaska by any organization can be complicated by the very same issues that encumber rural Alaskan communities: high materials costs, limited resources and skilled labor pool, transportation costs and logistics, and complex interagency relationships and cultural values of each community. Projects in these areas are most effectively executed by those who have experience working in these communities and who have experience with overcoming these limitations and challenges. Experience has shown that when a top-down, single-agency approach has occurred for projects in these remote locations, the benefit to and the buy-in from the local communities have been limited at best; additionally, these projects tend to be the most costly.

Rural Alaskan projects are best executed when collaborative efforts between agencies and stakeholders are promoted; when community members are engaged to apply their knowledge, skills, and resources to expand community development; and when entrepreneurship and capacity building endeavors are promoted throughout rural Alaska to promote self-reliance and decrease community dependence on agency support. Established organizations in Alaska such as CCHRC, DOE's Office of Indian Energy, and Alaska Native Tribal Health Consortium, to name a few, have a long history of working with rural communities, leveraging existing resources, overcoming logistical constraints, and successfully seeing their projects to completion.

⁴ <http://quickfacts.census.gov/qfd/states/020001k.html>

⁵ Denali Commission. (2011). *Annual Report 2011*. Anchorage.

Cold Climate Housing Research Center

Cold Climate Housing Research Center (CCHRC) is a 501(c)(3) Fairbanks-based nonprofit that was established in 1999 to research, test, and develop the materials and technologies to provide healthy, durable, and economically sound housing for the people of Alaska. Over the past 15 years, CCHRC's mission has evolved from a relatively narrow research mission to one of a comprehensive community development agency providing a wide variety of business innovation and development services to communities and private-sector partners through a program initiative called the Sustainable Northern Communities (SNC). To accommodate CCHRC's expanding menu of innovation and development services, the U.S. Economic Development Administration (EDA) provided funding (\$1,900,000) in 2011 to construct additional facility space (7,500 sf) to support the SNC Program Initiative.

Through the SNC Program, CCHRC has been working to improve the efficiency and effectiveness of community development efforts in rural Alaska through promoting more collaborative efforts between agencies and stakeholders; engaging community members to apply their knowledge, skills, and resources to bolster community development; and promoting entrepreneurship and capacity-building throughout rural Alaska to promote self-reliance.

These projects engage the community from the design stage through the construction phase, including community design meetings, workforce training, and consulting and quality control throughout the construction and occupancy of the home. CCHRC has developed regional prototype homes that are tailored to geographic and climate conditions, helping communities construct demonstration homes that can then be reproduced by local labor. For example CCHRC partnered with the Association of Village Council Presidents (AVCP) in Bethel to design and oversee construction of two "integrated truss" duplexes for the local aviation school in 2014. The "integrated truss" design reduces construction time and cost, and provides an energy efficient, airtight envelope that can withstand the wet, arctic climate of the region. CCHRC is now working with AVCP to develop a truss plant to local timber harvest operation in Bethel that would create local capacity and reduce the cost of building materials.

Since 2008, CCHRC has worked with more than a dozen communities around Alaska to design energy efficient, healthy, affordable housing that is appropriate for the climate and culture of the residents. These homes have reduced energy use by 80% on average, through innovative approaches to design, building science, and transportation. A high-performance, low cost prototype home built in Atmautluak in 2013, for example, used less than 200 gallons of heating oil during the first year of occupancy, compared to 1,200 gallons for the average house in Bethel region. The project also reduced square construction costs by using local labor and a simple, innovative design.

CCHRC's Fairbanks-based facility provides space to bring together experts in the fields of sustainability and resiliency, cultural vitality, building science and design, renewable energy, local workforce training, health, and regional economic development, through a holistic community development approach that starts with the people.

Recommendations

The Department of Energy's (DOE) Alaska office has created a draft action plan that would meet the U.S. government's strategic priorities outlined for the Arctic in the National Strategy for the Arctic Region, we ask that you consider specific language from that plan in the Energy Bill to codify and fund the following recommendations:

1. Expand Alaska Office of DOE

With Alaska as the strategic energy center of the US, an appropriately sized DOE presence and staff in Alaska is essential to orchestrate and sustain activities outlined in the National Strategy for the Arctic Region (NSAR) as well as all other DOE efforts in the state. Investments should be made to properly fund and staff the DOE Office of Indian Energy to help meet the needs of communities in rural Alaska. One federal employee for DOE is not sufficient to manage national and regional Arctic issues for which this office is responsible. While the Office of Indian Energy has established strong interagency relationships across the state, the office needs more personnel to be effective.

2. Create a National Arctic Energy Laboratory in Alaska

The federal government, through the U.S. Economic Development Administration, invested in CCHRC's Sustainable Northern Communities addition (completed in 2013) specifically for this purpose. The addition has appropriate space for research and collaboration and demonstrates the most energy efficient building science and mechanical systems in the Arctic today. The Research and Testing Facility (the farthest north building earning the highest LEED designation), resides in the heart of Alaska, an ideal climate for research, testing, and development of new emerging technologies for the Arctic.

CCHRC is an established research center whose work has resulted in energy-efficient building systems being implemented and applied throughout Alaska to help homeowners and communities save money and resources. Researchers study the performance and economics of various building techniques and products in the lab and in the field. Specific research focus areas include thermal performance and moisture control in the building envelope, thermal interactions between foundations and frozen ground, energy-efficiency and efficacy of heating and ventilation systems for cold climate structures, and the testing of renewable energy system performance in the Arctic. CCHRC's Building Science Research program is staffed with engineers and scientists that collectively have broad backgrounds in heat and mass transfer, arctic engineering, data acquisition and management, material science, research design, programming, and project management.

Additionally, CCHRC's Policy Research program supports the CCHRC mission through research, consulting, advocacy, and information systems development. Policy projects are closely engaged with key agencies policy makers in an effort to inform energy efficiency and housing policy with sound building science. CCHRC's Policy Research program has resulted in improvement to the home energy rating standards used by builders, energy rates and lenders, guided the development of statewide energy efficiency policies, informed policymakers and housing authorities at local, state and federal levels about the state of housing in Alaska, and developed data collection capabilities for answering vital, long-term building science, energy, economic, and policy questions.

CCHRC has two decades of statewide innovation and experience entirely focused on holistic, sustainable, cost-effective construction that meets the needs of Arctic communities. We have the capacity and talent to expand our activities to become the Arctic Energy Laboratory for the Nation. Furthermore, as the Department of Defense and the U.S. Coast Guard build critical national and homeland security infrastructure, villages relocate, and communities upgrade energy supply chains and infrastructure, the costly mistakes of the past can be prevented by integrating proven Alaska-pioneered solutions, as CCHRC has done since inception.

3. Fund Existing State Energy and Weatherization Programs that Work

Co-fund with the state of Alaska, existing state energy and weatherization programs that are successful such as the Renewable Energy Fund and the Emerging Energy Technology Fund. For over 10 years, these programs have demonstrated significant improvements in energy efficiency from both the energy production and energy consumption sectors and they continue to push the envelope for new solutions that work for Alaskans.

While direct subsidies provide needed emergency assistance, the Weatherization Assistance Program provides long-term reductions in energy costs for Alaskans. Statewide, the average home participating in this program reduces its energy use by 28% and saves an estimated \$1,300 in energy costs per year, though the savings vary by region, with some areas on average saving more than \$3,500 a year after being retrofitted⁶. With more than 16,500 homes having participated in the Weatherization Assistance Program between 2008 and the end of March 2015⁷, low-income Alaskans throughout the state are estimated to be saving approximately \$22.1 million each year in energy costs.

Saving energy also has the capacity to produce more jobs. By reducing the need to purchase imported heating fuel, more money is available to be used in the local economy in rural areas. In areas using natural gas, this limited resource can be conserved for future generations and the savings are available to be spent locally, helping to create jobs. It is estimated that the spending from this additional available income creates 11 jobs for each million dollars of energy saved annually⁸; annual savings from the Weatherization Program are \$22.1 million, equivalent to 242 permanent jobs. In addition, jobs are created to perform the actual retrofit of the buildings, with an estimated 7 direct jobs and 5 indirect jobs created for every million dollars of public spending⁹. The Weatherization program has expended \$307 million between 2008 and March 2015¹⁰, creating an estimated 3,684 jobs over the history of the program. Nationally, for every \$1 invested, weatherization returns \$2.51 in energy and non-energy-related benefits¹¹.

Look to Alaska for Solutions

As you look to solidify national support and understanding about the strategic importance of the Arctic, know that behind you stand a broad, highly engaged team of leaders across Alaska working on the many challenges and turning them into opportunities for our state as well as our nation. Solutions for the north will not come from the "Outside" but from the people that live on this ground and breathe this air.

⁶ CCHRC estimates using Alaska Retrofit Information System data

⁷ Ord, Jimmy. "Alaska Housing Finance Corporation Weatherization and Home Energy Rebate Program Updates." 6/1/2015

⁸ Goldsmith, S., Pathan, S., Wiltse, N. "Snapshot: The Home Energy Rebate Program." Institute of Social and Economic Research and Cold Climate Housing Research Center. May, 2012. Available at:

http://www.cchrc.org/sites/default/files/docs/HERP_snapshot.pdf

⁹ Ibid

¹⁰ Ord, Jimmy. "Alaska Housing Finance Corporation Weatherization and Home Energy Rebate Program Updates." 6/1/2015

¹¹ US DOE. Weatherization and Intergovernmental Program. Available at: http://www1.eere.energy.gov/library/pdfs/48098_weatherization_assisprog_fsr4.pdf

The CHAIRMAN. Jack, thank you.

I think that you know that every time I have an opportunity to bring an out of townner by the Cold Climate Housing facility to showcase what you have built and demonstrate what we are putting into practice, we certainly do. So thank you. We really appreciate it.

Mr. HÉBERT. Well I would love to, I actually wouldn't love to, but we're, if we had the resources and I could go around the world and go around the nation, telling everybody about ourselves. God help me I'd probably have to do it. But we're busy trying to get things done here. And I appreciate everybody focusing on what we can do.

The CHAIRMAN. Thank you.

Mike Hoffman, good to be in your town.

**STATEMENT OF MICHAEL HOFFMAN, EXECUTIVE VICE
PRESIDENT, ASSOCIATION OF VILLAGE COUNCIL PRESIDENTS**

Mr. HOFFMAN. Thank you, Senator.

Before I get started I feel a little guilty, but not too guilty. To the panel, I apologize. We strategically maneuvered me to be the driver of 6 percent of the Senate today.

[Laughter.]

Stopped on the river. And I want to thank you for all the funding you promised me.

[Laughter.]

Welcome Madam Chair, Secretary Moniz and the members of the Committee.

Thank you very much for inviting AVCP to address you regarding tribal issues and solutions we face related to energy in our region. My name is Mike Hoffman. I'm the Executive Vice President for the Association of Village Council Presidents. We are a consortium of 56 tribes.

My Yup'ik name is Assivigan. I was born here in Bethel and I was raised in this region. In a region that we have the lowest per capita income, one of the highest rate of unemployment and the highest rate of suicide in the nation.

We live in a region where we don't have tourism, oil, gas, forestry and our fishing is depleted. But we have a very rich cultural way of life where 61 percent of our population still speaks our native language and practices our subsistence way of life and not our lifestyle, but our way of life.

It's perplexing to us the cost of energy and transportation that has risen so dramatically in our region when the price of fuel is decreasing across the nation. You've heard it said a number of times today, what everyone is paying in America but what we're paying here.

In our region that's the size of Oregon but has no roads connecting any of our villages, the price of oil today is less than \$30 a barrel. It costs us over \$300 to fly to Hooper Bay which is about 154 miles to the West of Bethel versus 11 years ago in 2005 when the cost of oil was 50 percent more at \$58 a barrel and the cost to Hooper Bay was \$145.

In ten years the cost of transportation has increased while the cost of oil has decreased. Our region would like to know who is reg-

ulating the energy that comes to rural Alaska and how can we honestly justify this.

This continues to leave our families to make a very tough decision every day in our region. Fuel or food. You've heard it a number of times. I've seen it first-hand in our villages for families every night whether they need to get five gallons of stove oil or food for their children in the morning. Our people here cannot improve the quality of life without allowing access to the basic needs at affordable costs. Water, health, safety are basic needs that all people in villages, not only in Alaska, but across the nation need to need help with. As you see today in Oscarville that issue still exists.

The staff at AVCP work very hard to improve the quality of life in this region. Working on reducing energy costs or innovative ideas, we've been working on long term solutions and short term solutions.

Senator Capito, I know when you asked the question to the Governor on the gas line coming down into the interior how were you going to distribute it to the rest of the state? Well, we have an answer here.

One of our long term solutions our tribes and partners are developing is a freight energy corridor connecting the Yukon and Kuskokwim Rivers together at its closest point. These will be two lifelines that run through our region.

We're preparing our region to be ready for when the State of Alaska connects the gas line from the North Slope to the interior of Alaska. From there we'll be able to access the natural gas and bring it down river, down the Yukon River to the corridor across to the Kuskokwim River. It's about 40 miles across. The goal is to improve commerce, reduce energy and freight costs and position the region, this region, for Alaska's natural gas economy.

We've completed one third of the design and study of this freight energy corridor with funds from the State of Alaska, the Denali Commission and our tribes. We, and our partners, are inviting the Federal Government to join our efforts to complete the design/study phase of this project.

Our short term fix, and as my friend, Jack, here always says, is conserving energy. And he does it very well. We're learning down here in our region.

Our region is partnering with Cold Climate Research to build six-star energy rated homes through an integrated trust design. Homes that will burn 80 percent less fuel than a conventional home. In a region where the price of fuel is well over \$6 a gallon for the cost, savings could be put toward fuel, food, mortgages or other necessities other cities enjoy.

But what we're really excited about is the opportunities for economic development. In reopening a sawmill up the river on the Kuskokwim where the white spruce grows abundantly, we'll be able to produce one million board feet a year and bring it down the river to Bethel. Our staging area will be an old fish pond converted into a truss plant located strategically on the river that we'll build the trusses with limited transportation, with limited transportation costs.

We've heard all day today, transportation costs here in our region exceed 60 percent. And we'll be bringing commodities here

into our region. The integrated truss plant is an opportunity to reduce, to as low as three percent, the total cost to build a home in our region. This is something we're excited about. The project will produce \$212 million of economic development and additional sales to the region during the first 11 years and at least \$27 million per year thereafter.

Secretary Moniz, I'm really thankful for Chris and Givey. We see them, I see them, sometimes more than my own family since they've been in our state, especially Chris. I said to you today that you're in the state all the time, do you ever go to any other states? We're thankful. He is a blessing to our tribes and our state.

There's an opportunity for the Federal Government to shine through the Department of Energy. Currently their budget has only been \$15 million a year to work with and seven staff working with all 567 tribes in the nation. They need help.

Through the Office of Energy, Indian Energy, we'd like to see even more intertribal technical assistance agencies and funding for the development of energy infrastructure and efficiency. We need to plan for the future where our homes, facilities and energy infrastructure is robust. And we need to eliminate our need for energy subsidies and assistance.

In our region our definition of energy is more than the price of gas at the pump, more than the price of a barrel of oil. When we think of energy as we think of food we need to gather to eat so that we have the day to day energy to take care of our families. Our Yup'ik word, Uqur, which as translated is oil. Seal and whale oil for many years was used to provide nourishment for our people, light and heat for our homes.

And with the thoughts and the ideas that we've heard today and in Oscarville, hopefully we can increase the income, reduce the unemployment and reduce the suicide in a region that wants and needs this change.

Quyana.

[The prepared statement of Mr. Hoffman follows:]

Henry Hunter, Chairperson
Myron P. Manning Sr., President
Phone: (907) 549-7200
Fax: (907) 549-9869

AVCP
Association of Village Council Presidents
Administration
Pouch 218, Bethel, AK 99559



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Nunapitchuk
Obogmut
Oscarville
Paimut
Pilot Station
Pika's Point
Platinum
Quinagak
Red Devil
Russian Mission
Scammon Bay
Steenmut
St. Mary's
Stony River
Tulakak
Tutututuk
Tunuk
Unkumut

Michael J. Hoffman
Executive Vice President
Association of Village Council Presidents
February 15, 2016

United State Senate Committee on Energy and Natural Resources
Field Hearing Testimony
Yup'it Piciryarit Cultural Center
Bethel, Alaska

Mr. Chairman, members of the committee:

My name is Michael J. Hoffman, Executive Vice President for the Association of Village Council Presidents (AVCP) in Bethel, Alaska. My Yup'ik name is Assivigan. I was born and raised in Bethel. AVCP is the regional Tribal non-profit organization that represents 10% of Tribes in the United States. There are fifty-six Tribes in the AVCP region located along the Yukon River and Kuskokwim River and Bering Sea Coast in Western Alaska. The AVCP region suffers from persistent unemployment amongst its working age adults. We face the lowest per capita income, highest rate of unemployment and the highest rate of suicide.

Thank you for inviting AVCP to address you regarding the Tribal issues we face related to energy in our region.

The cost to live in Rural Alaska is extreme. The cost of living in the most rural communities are usually the highest where fresh foods, if available, cost five times higher when delivered by air and often arrive in poor condition.

It is perplexing that the costs of energy and transportation have risen so exponentially when the price of fuel has decreased across the nation. Who is responsible for regulating these costs?

In a region the size of Oregon that has no roads connecting its 48 villages, and the price of oil today is less than \$30 per barrel, it costs \$321 to fly to Hooper bay which is only 154 miles away versus in 2005, when the cost of oil was 50% more at \$58 per barrel. Back then, the cost was \$145 one way to Hooper Bay. In 10 years, the cost of transportation has increased while the cost of oil has decreased. We would like to know as first people of our region, who is regulating the energy that comes to rural Alaska? Can you please tell me how we can justify this?

This is money that can be used to feed families that depend largely on public assistance and subsistence for their well-being. Families often spend half of their disposable income on energy.

This leaves families to make the tough decision, food or fuel.

The only hospital in the region is in Bethel. With the tremendous transportation cost, entire paychecks can be used to obtain medical care.

Allowing families to save money that would go to groceries, mortgage and improving the quality of life is essential.

We cannot improve the quality of life without allowing access to basic needs at an affordable cost. Water, Health and Safety are basic things all villages should have.

There are many villages in our region that do not have running water, or access to basic needs. As you have seen in Oscarville, which is only 6 miles downriver from Bethel, they lack safe drinking water, access to a clinic, and a Village Public Safety Officer. They are not the only village in the region that lacks these basic needs.

AVCP submitted a grant proposal on behalf of Oscarville for home weatherization. If this proposal is funded, the energy audit completed by Alaska Housing Finance Corporation (AHFC) will be utilized to weatherize homes decreasing energy costs by 42%.

Truss Plant/Partnership with CCHRC

AVCP currently has a partnership through MOU with the Cold Climate Housing Research Center (CCHRC) working towards a truss plant that can provide lumber with a limited transportation cost. This integrated truss plant is an opportunity; an investment that is innovative to create 6 star homes that burn 80% less fuel than a conventional home. Shipping would be as low as 3% of the total cost to build a home vs. 60%.

60% of the cost of lumber is the shipping cost from Seattle. This number drops substantially to 3% if it was manufactured at the integrated truss plant.

The project will produce \$212 million in economic output or additional sales to the region during eleven years of operation and at least \$26.8 million per year thereafter.

Ask: Utilize the opportunity to create a tribal economic development model in the Arctic addressing the high cost of transportation and energy. This would include taking the AVCP Truss Plant proposal for economic development worth 212 Million over a 10 year period and incorporating it into the proposed Energy legislation.

Yukon Kuskokwim Freight Energy Corridor

AVCP is developing a freight energy corridor between the Yukon River and Kuskokwim Rivers. The goal is to improve commerce; reduce fuel and freight costs; and position the region for an Alaska natural gas economy.

Ask: AVCP has completed 1/3 of the design of the Yukon Kuskokwim Freight Energy Corridor with funds from the State of Alaska, Denali Commission and our Tribes. We request the remaining 2/3 funding to complete the design and study phase of this project. This is a request for 10 Million dollars.

State of Alaska PCE/Indian Energy

Communities without Power Cost Equalization (PCE) would pay from .56 to .86 per/kWh. The State of Alaska subsidizes approximately .32/per kWh per month per resident.

More funding is needed in rural Alaska to mitigate the crisis that may affect PCE.

The average annual energy cost is \$6,240 which is approximately 2.9 times the national average according to a 2014 CCHRC study.

Alaska Energy Authority is with the State of Alaska who is currently facing a budget crisis. This is an opportunity for the federal government to shine through the Department of Indian Energy. Currently there are \$15 million dollars to work with and seven staff working with the 567 Tribes in the nation.

We support the growth of the Office of Indian Energy. We also want to see more inter-tribal technical assistance agencies. AVCP is currently partnering with DOE to provide technical assistance outreach through a cooperative agreement. We are currently assisting three tribes facilitating community energy plans. We need actual funding to outreach for, and help Tribes apply for grants and loans related to energy.

Ask: AVCP requests supporting the growth of the Office of Indian Energy to serve the 567 Tribes in the Nation, and specifically the 56 Tribes in the Yukon Kuskokwim Delta by adequately staffing the Office of Indian Energy with full funding.

Ask: Utilize and fund the AVCP Resource Center as a Tribal Model to address community energy development with the 56 Tribes to confront the high cost of energy. AVCP requests a ten year demonstration project at 2.5 Million per year, to work with Yukon Kuskokwim Delta Tribes to plan, implement and manage energy projects for our Tribes.

Tribal Energy Revenue Sharing

We live in a region where we don't have tourism, oil, gas, and forestry. We have a very rich cultural way of life where 61% of the population still speaks our native language and practices our subsistence way of life. But, our region continues to have needs.

We applaud Alaska Senate Bill 138 to ensure the gasoline helps lower energy costs for all Alaskans. Our region should continue to be considered in the revenue sharing formula for all energy-related projects. For instance, the Northwest Passage where ships from other nations sail along Alaska's 6,640 miles of coast line.

Ask: Our final ask is that all Tribes should receive revenue sharing from all major energy-related projects.

Thank you.


Michael J. Hoffman
Executive Vice President

The CHAIRMAN. Quyana. Thank you.
Gwen Holdmann, it is good to have you and your expertise with us.

STATEMENT OF GWEN HOLDMANN, DIRECTOR, ALASKA CENTER FOR ENERGY AND POWER, UNIVERSITY OF ALASKA FAIRBANKS

Ms. HOLDMANN. Good afternoon, Senator Murkowski and members of the Committee. Thank you for giving me a chance to speak. And it seems like we're going a bit late. I guess the lady gets to wrap up the panel today.

So, I'm really glad that so much of the conversation today really focused on the kinds of innovation that are happening in Alaska. Obviously we have challenges. You've seen that and heard about that in terms of lack of infrastructure, in terms of the costs of energy here, especially in remote parts of the state, rural parts of the state, like here in the Bethel region.

But I think that this issue about innovation and creativity in Alaska and this is something that really stands, you know, back to the days of the first Alaskans, kind of, where the spirit of innovation is necessary to survive and thrive in this kind of environment. I think that that's something that carries through to our energy industry today.

We currently pour into Navigant research here in Alaska about 12 percent of the world's hybrid microgrid energy systems. We're considered a global leader in this particular area, and this is something that I'd like to talk a little bit more about because of course there's innovation everywhere.

Every one of your states has innovative things going on. Senator Cantwell, I've been very impressed with what Washington State has been doing in this area. We really want to expand the partnerships with some of the kind of companies in Washington. Of course there's some fabulous things going on there.

But for Alaska I gave some examples in my written testimony. I think I'll use a more personal story here.

Secretary Moniz mentioned that Chena Hot Springs geothermal power plant which, I believe, may have received the only R and D 100 project of worth from a project in the State of Alaska. I was actually the lead engineer developing that particular project. And I worked in the private sector for a long time developing projects like that one.

And this is the perfect example, just to, kind of, give an example, of where Alaska ingenuity and Alaska expertise comes in. We worked with the Fortune 500 company, national labs. This was funded through the Department of Energy. So we're very appreciative of that, the Geothermal Technologies Programs and very, very good in Alaska and you've done a very good job.

We wanted to put out the Chena geothermal power plant at very low temperatures. And so we were able to do that working, again like I mentioned, with a Fortune 500 company with very smart people. I was the only Alaska onsite person working on this project. By the end the day we were able to get that geothermal power plant to run, and that was a really wonderful and innovative opportunity for me as a young engineer to be involved in that.

But we weren't able, the people that we were working with that were from other parts of the country, never figured out how you could economically—in that system and be able to turn off the diesel and run off 100 percent of renewable energy. That's tricky. That's challenging.

Secretary Moniz understands that this is not a simple thing. Just think, it will turn—renewables doesn't mean that you can isolate your grid and run it off of local energy sources. It's trickier than that.

And this is, kind of, where Alaska expertise actually comes in. We have utilities here in Alaska that are pushing the envelope in ways that is really uncommon in the United States. There's communities that are running, typically, on utilities like AVEC above 50 percent penetration of wind energy, variable resources like that.

And if that would make a utility manager in the lower 48 quite nervous. You know, people like, I think Dennis Meiners is here in the audience and he has been pioneering the Chaninik Wind Group here in this region. Strategists are getting to 100 percent diesel off, where you turn off the diesel engine, run off 100 percent variable resources.

I go through, you know, managed loads or through batteries. These are very innovative things that can help companies like, for example, UET and others, to really access a larger market base. They're important strategies for the United States, but they're important strategies to get Alaska products and non-Alaska products and U.S. products with Alaska ingenuity into global energy markets. And that's really where we see this opportunity to provide partnerships.

And I really did want to mention a couple other parts of the Department of Energy that have really got it right when it comes to this partnership between states and local entities and the Federal Government. I think Jack alluded to this a little bit. A lot of times we feel like, here in Alaska, we're saying hey, we actually know something where we don't always need you to come in and solve our problems. Sometimes we have some solutions for ourselves and now also, actually, narrowing that might actually be helpful to other regions.

And I think that the chief programs that I wanted to highlight today is first of all, Senator Barrasso, you mentioned DOE—score. I couldn't say more about what this program has meant for the University of Alaska in terms of building a center of expertise in this particular area. There's nothing more valuable for us than that. We don't have a current award. That's been the most important Department of Energy funding we've ever gotten, and it's small amounts of money that make a humongous difference. So I'd really like to highlight that.

And then I'd like to also mention the Office of Electricity which didn't directly come up today. But for example, Dan Tons, one of the program managers there. He has listened to what Alaska has asked for and he's actually partnering with the State of Alaska and the Alaska Energy Authority putting money into our emerging energy technology fund.

Now it's only \$250,000. We could use quite a lot more, Federal partnership and that. But this is what we want to see. They don't

want to see that the Federal Government is developing new programs for Alaska. We want to see how we can leverage these existing programs we already have because we actually do have a pretty good idea on how to solve a lot of our issues here in Alaska. The question is just we need a hand up, not necessarily just somebody else to come up with other ideas.

I think another, small example is also with the Office of Electricity working with the Clean Energy State's Alliance partnering with states to figure out what kinds of projects and what kind of partnerships we can do and then pulling in the national labs where we need their expertise because they have a real role to play. But Alaskans are kind of defining what their needs are and the states are defining that. So I really appreciate what the Office of Electricity is doing in that regard and we're lucky that they have it right in that way.

RACEE, I'll just give like a very tiny example. I fully agree that energy efficiency is a really important first step. But as Steve Gilbert mentioned earlier, our communities are very conservative when it comes to electric energy use. And a lot of times I think I would love to see these communities double for energy use because that meant that there was an industry and some businesses going on because these energy prices are just crippling our ability to have meaningful business and industry. If they doubled their energy use I think that'd be a great thing if that meant a fish processor came in or something was happening there.

So I think—we need to be looking at displacing diesel fuel not reducing our energy use. If everybody leaves the community they'll cut their energy use. But is that really the goal? That's not what we're trying to accomplish.

I think, really, thinking about how we want to define our program goals is pretty important in that respect.

So I think what I did want to mention, in particular, is that I put a lot of thoughts in a proactive person into what we could actually do to develop a new kind of partnership with the Department of Energy and with the Federal Government that's taking advantage of Alaska's expertise.

And we, together with utilities representing 88 communities in this state, the mayors of our largest municipalities of Anchorage and Fairbanks and also smaller communities, tribal entities, native corporations, we've all signed this request or this partnership opportunity for Alaska to entertain the nation hubs, the Governor mentioned this earlier, as a way that we can really be taking advantage of what Alaska has to offer to create national partnerships around some of these opportunities. And particularly for our communities to serve as living laboratories for the rest of this country in terms of testing innovative technologies and innovative strategies around what we envision as that energy system of the future.

So that's something that I'll be sharing with Secretary Moniz.

I do think that the timing right now is very critical because, it's been mentioned before, we obviously have budget challenges in the State of Alaska. Almost all the innovation that's been done in Alaska so far, that renewable energy fund, emerging energy technologies. These are state programs. A lot of this has been state-funded.

And we need to continue the momentum. And the state needs to take a little bit of a step back right now. It would be a wonderful opportunity for the Federal Government to step forward and, kind of, continue the momentum in what we're doing here in the State of Alaska.

One other small example, as I mentioned and we've heard before, that Alaska is, kind of, considered a global leader in these areas. Well we recently have formed a program that the U.S. is leading under the Arctic Council. It's called Arctic Renewable Energy Networks Academy. It's a training program for people that are interested in developing renewable energy systems on small, isolated communities in the Arctic.

This particular project was proposed by Alaskans. It was actually part of a bill that Representative Herron and Senator McGuire sponsored to the U.S. through the Alaska legislature. And this program has co-leads in Iceland, in Canada. It has Finland on board as a co-lead and several permanent participants of the Arctic Council.

And all of them are putting in resources to sponsor this program which will be here in Alaska and we're planning on coming here to Bethel, to this region, to highlight Alaska, what Alaska is doing in this particular space. And the only organization that's a sponsor to this program that's not funding it right now is the U.S. Government, the lead organization. And this is one program that's been put forward by the U.S. Government under the sustainable development working group and there's no funding. The State of Alaska has put funding in, but not the lead sponsor.

So these are the kinds of examples of where we look for what the states need but what we're putting forward and find partnerships in that area.

So thank you very much.

[The prepared statement of Ms. Holdmann follows:]

Gwen Holdmann
Director
Alaska Center for Energy and Power
University of Alaska Fairbanks
Written Testimony before the
United States Senate Committee on Energy and Natural Resources
February 15th, 2016

Madam Chair, thank you for the opportunity to testify before you today. My name is Gwen Holdmann, I am the Deputy Director for the Alaska Center for Energy and Power. Our mission is to develop and disseminate practical, cost-effective, and innovative energy solutions for Alaska and beyond. The Alaska Center for Energy and Power is a statewide, university-led, applied research program based at the University of Alaska Fairbanks. We make every effort at being responsive to immediate and long term needs of residents, industries and agencies; and we focus on research related to community and industry-scale power generation that has the potential for providing reliable and affordable energy, especially in instance of microgrids.

Of our roughly 150 communities in rural Alaska, there are about 70 projects that incorporate grid-scale renewables on community microgrids. Many are pushing penetration levels of variable renewables on a regular basis that would make most utility managers quite nervous. These are not demonstration projects. These are not pilot projects. Are they innovative? Yes. Do they work with local operators? Yes. Are they economically viable? Well, that might be a more complicated question to answer but the point is that these are examples of strategies Alaskans have adopted to provide reliable energy services in remote and harsh environments.

Just to our Southwest, the Chaninik Wind Group communities of Kongiganak, Kwigillingok, and Tuntutuliak have been working together with an Alaska developer Intelligent Energy Solutions to turn off the diesel engines and run off 100% wind energy when the resource is available, and use thermal loads in individual residences to balance the grid.

400 miles SW in the Pribilof Islands you will find the community of St Paul. The airport complex at St Paul has been operated by a subsidiary of the village native corporation in diesel off mode when there is adequate wind for 15 years with no battery system. They now have a holistic goal to meet 80% of all the energy needs of the community – heat and transportation included, from renewable resources by 2020, and has received support from DOE to help them meet this goal.

400 miles to the SE is Kodiak Island, where a combination of hydropower, wind, and storage technologies including a battery and small flywheels support a grid that is almost 100% renewables on a year-round basis for a community of about 10,000 residents.

500 miles to the NE is Fairbanks is one of the largest battery systems in the world, a 27MW supporting the Golden Valley Electric Association grid and the northern portion of an intertie between Fairbanks and Anchorage. Even our main grid, connecting Anchorage and Fairbanks and extending a bit beyond that, is essentially a series of overlapping microgrids that can operate independently and are not connected to Canada or the rest of the US.

Point 1: I would like to take to this opportunity to acknowledge the long and important history the Department of Energy has had in working with Alaskans to develop energy solutions for our communities. DOE has had an important role in dozens of projects spanning a wide range of technologies, including some of the projects I mentioned earlier. However, I would like to call out three programs specifically. First of all, I would like to acknowledge the Office of Indian Energy who has significantly increased their efforts in Alaska in recent years. Secondly, I would like to mention the DOE EPSCoR program, which has been the single greatest factor in building a research based center of excellence in microgrid technologies in Alaska. Finally, I would like to mention the Office of Electricity, and program managers Imre Gyuk and Dan Ton. OE has been absolutely wonderful in terms of understanding the need to partner directly with states, and to listen to local organization and partners and ultimately to build on those efforts that are already underway and have local support. To give them a push to give them some momentum and direction, but leaving it to local people to set the agenda and define the needs. They perfectly exemplify the hand up, rather than hand out attitude, and understand that being effective is deeply rooted in meaningful partnerships, and serving as a connector and a catalyst, rather than the knight in shining armor coming it to rescue the poor peasants in the hinterlands of Alaska.

Point 2: I would also like to applaud Senator Murkowski and her colleagues for the ambitious effort represented by the Energy Policy Modernization Act. In preparation for this hearing, I made the mistake of hitting 'print' on the bill and then realized it was 423 pages. I mean, does anyone actually read these bills from cover to cover? We resorted to a key word search and I will be submitting specific comments on the bill as an addition to my written testimony. But I did thought there was one point I would make today. I've been using the word 'microgrids' to describe Alaska's community energy grids, but actually they don't qualify as microgrids by DOE's definition, or at least is open to some interpretation. DOE's definition of microgrids is: "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in grid-connected or island-mode." Because Alaska's grids are never connected to a larger grid, we fail the second part of that definition, but we are not alone. So do the hundreds of other small community grids in the Pacific region, and the developing world.

Perhaps the Energy Policy Modernization Act is an opportunity to also update the definition of microgrids to recognize that Alaska systems are also a form of microgrid. Or perhaps DOE can take the initiative internally to make this change. From my perspective, this is more than an issue of semantics, it both creates challenges in our ability to respond to national funding opportunities, and also I think creates a bit of a divide that insinuates that the systems we have in Alaska bare little resemblance to the microgrids in the rest of the country, and thus what happens here or is developed here is largely irrelevant to the rest of the country.

Point 3: It is the final point I would like to take some time to expand upon. According to Navigant Research (and I would welcome a joint effort to refine this number), Alaska has about 12% of the microgrids in the world. Not islanded or remote systems, but microgrids in the broader sense of the definition. These have in very large part been funded by the State of Alaska, through programs like the Renewable Energy Fund and the Emerging Energy Technology Fund. Over the course of the past 2 decades, we have built up a substantial body of knowledge related to the design, construction, and operation of these systems. I have a real vision for the future of Alaska, and how we can engage with

and participate in the development of energy systems of the future. I have a white paper here that has been signed by 49 leaders in the energy industry in Alaska, that proposes a new DOE Innovation Hub here in Alaska. It proposes an Alaska role for transformational change of the electric power market, with commonplace 100% renewable energy operation for microgrids - whether in U.S. markets or the developing world – using strategies that are cost effective from a holistic community perspective, addressing all energy requirements for the customers served, not only those that are electric. Alaska's Energy Network Innovation Hub would include as partners Alaskan utilities, Native Corporation and Tribes, developers, non-profits, and the University of Alaska. Alaska's microgrid-centric electric grid, high cost of energy, supportive community leadership, specialized expertise, and friendly utility industry makes Alaska the natural proving ground for the energy systems of the future. We envision this natural testing ground to serve as a living laboratory central to a different sort of Innovation Hub, where technology developers have tested and demonstrated new technologies across the energy technology spectrum, from generation technologies (wind, biomass, geothermal, solar, fuel cells) to advanced storage systems, multi-nodal small scale HVDC, highly advanced demand-side management strategies, intuitive human-machine interface approaches, and paradigms enabling acceptance of a supply-driven energy system. We wish to build on these natural synergies to enhance U.S. leadership in these critical energy technology areas, both domestically and abroad. Alaskan communities live and breathe change while living in some of the most adverse conditions in the nation. This enterprising spirit establishes Alaskans as with finely honed early adopter skills, that coupled with the widespread experience in dealing with constrained resources and challenging operational conditions, can provide an excellent venue for hardening U.S. technologies prior to deployment in emerging markets. We propose pulling together a diverse group of partners, including National Labs, Manufacturers, Developers, the Utility Industry, Academia, and Native Alaskan organizations (technology end-users) to work together to develop the *Energy Systems of the Future*, based around microgrids and holistic 'energy networks', inclusive of technology advances, and improved understanding of the human dimension of implementing change.

Point 4: Alaska's leadership in hybrid microgrid technologies is exemplified by a new project sponsored under the US Chairmanship of the Arctic Council. It is called ARENA – the Arctic Renewable Energy Network Academy (ARENA). We are using the word 'energy network' rather than 'microgrid' because we want to be sure to include all of the ways energy we use energy – specifically, not just a focus on electric power but also heat, and we hope, transportation as well. Our plan is to first create a series of widely accessible video documentaries about specific projects and technologies throughout the Arctic to increase awareness of what is being done that is successful, and provide an avenue for disseminating best practices to as wide of an audience as possible. Secondly, we are planning to bring together a small but very selective group of practitioners, including energy professionals and community leaders, in Alaska this summer. Our goal is to promote knowledge sharing among people that are in the best position to influence the future trajectory of project development in their home countries and regions. We are planning to use Alaska as a living classroom to support ARENA, with our fellows touring projects relevant to their interests and interacting directly with utilities, developers, and the communities in which these projects are based to gather knowledge that can help them make good decisions about future energy development that can displace reliance on imported diesel fuel. ARENA is a formal project under the Arctic Council co-led by Canada, Iceland, Finland, and the U.S., and supported by a number of both permanent participants and other organizations based in all 8 Arctic nations. To date, our co-leads Canada, Iceland, and Finland have committed resources to this initiative. The State of Alaska and

University of Alaska have both made cash contributions to this initiative despite our challenging budget situation. The only partner who has not contributed any resources to ARENA is the lead sponsor of it – the US Government. While this is a bit embarrassing, it also does put the entire initiative at risk in terms of whether we can make the Alaska portion of the program happen, and whether we can actually include any US participants since most of the international participants are sponsored by their home nations.

In closing, I would very much like to commend you Senator Murkowski for your strong leadership for Alaska, and for the nation. I am extremely appreciative of your willingness to role up your sleeves and really understand these very challenging issues, and then drag your colleagues up to the Alaska hinterlands so they can better understand both the challenges, and the opportunities that exist here in the 49th state.

The CHAIRMAN. Thank you, Gwen, and thank you to all of you. I think we noticed that some people are leaving, and it is because Alaska Airlines is leaving. Some of our witnesses, Mr. Andersen, had to leave and some others will as well.

So we have about 15 minutes which is not near enough time to query you all after this good presentation. I am going to start with a lightning round because we have had an opportunity to expose these five Senators and Secretary Moniz to a little glimpse of what is out here in the region with Oscarville and kind of this holistic concept that Jack led some of the discussion on when we were at the school.

I am going to keep bringing more colleagues to Alaska to see how we are pioneering and innovating, not only to help Alaska but to help other parts around the country and the globe.

If you get one project, one community, one initiative that you want to have a group of Congressional members to see, what would it be?

I know that Ralph would suggest that we need to go out to Igiugig and we need to see the turbine that is in the river there which is phenomenal what they are doing with that community.

Mike, where would you have us go?

Mr. BLACK. Kivalina.

The CHAIRMAN. Where?

Mr. BLACK. Kivalina.

The CHAIRMAN. Kivalina.

Mr. BLACK. To look at our new—we were working with Cold Climate on a new in-house system that can actually be moved with the home for sanitation purposes and rain water catch mitt. But I would suggest that everyone could benefit from looking and seeing how well that's accepted, but also what kind of public benefit from a health standpoint could be derived.

The CHAIRMAN. It is pretty cool.

Steve, where can we take people?

Mr. GILBERT. Well there's a lot of opportunities.

The CHAIRMAN. No, you only get one.

[Laughter.]

And quickly.

Mr. GILBERT. Well I would love to showcase our wind to heat and demonstrate how we'd like to do more of that.

The CHAIRMAN. Wind to heat.

Jack?

Mr. HÉBERT. North Arctic for the moving of Noatak by the people. Great people making a difference finding their village in place.

The CHAIRMAN. What a sight.

Mike?

Mr. HOFFMAN. The fact that you're here is already helping me. Noatak would—but I would like to bring them out to see what we're doing with the freight energy corridor.

The CHAIRMAN. Gwen?

Ms. HOLDMANN. I think I'd have to pick Kodiak Island where they've been able to get to 100 percent renewables year round using a combination of wind, hydro, batteries and flywheels.

The CHAIRMAN. I had an opportunity to go to Kwig and we were, well it was a day, it was the first day that we were entirely off of diesel and everyone was loving the fact that it was so quiet.

Colleagues, questions?

Secretary, do you want to lead off?

Senator CANTWELL. You do not usually get to ask them the questions——

The CHAIRMAN. Senator Cantwell?

Senator CANTWELL. Well thank you, Madam Chair.

I really applaud this panel because I think this is the future of Alaska. The solutions that you are talking about, the empowerment of people within the communities, the jobs for the future, the solutions that you are providing and on top of some circumstances.

So I almost feel like it is unfortunate that it is now 6:30 and that we could not have had this earlier so that people could have made sure that this was part of the story that was being told today. Because as I think the Senator just said, these are examples that we could come back on many, many different trips and see the level of innovation that is happening here and then strategize more about the solutions.

Mr. Hébert. your numbers are just shocking when you talk about the amount of energy that can be reduced from businesses being 50 percent. You want to talk about cost? That is some of my analysis of notes was something that, when we were talking about 40 or 50 percent of your business cost being energy and you could reduce that by 50 percent.

You are talking about making people more and more competitive but the number on homes being 80 to 90 percent is just, we are talking about people's quality of life.

Mr. Hoffman, you mentioned 10,000 homes as having immediate impact.

So these are things that can be done now and I don't know that we should be thinking about, as our last witness said, how we can help you now in coordination of this effort and move forward on it.

So I guess the question I would have is, Ms. Holdmann, you mentioned ways in which we could work together. When it comes to DOE's current grid program, are there ways that we can make that apply a little better here in Alaska because it is——

Ms. HOLDMANN. Yes.

Senator CANTWELL. Problematic for using the resources.

Ms. HOLDMANN. Absolutely. I think that this is something that Mr. Gilbert touched on earlier.

This is sort of an issue where right now this is something that probably that the Senate Energy and Resources Committee can look at. The definition of microgrids technically excludes all of Alaska communities, okay? Because it says that a grid must be able to connect and disconnect from a larger grid, and we don't do that. So just dropping that second sentence out of the definition would make a really big difference because partially it's a disenfranchisement/franchising kind of issue, not just for Alaska but for the Pacific Islands and the developing world.

But secondly, it does, kind of, provide some limitations on what kind of funding we had access to because we have to sit around and wait until there's funding opportunities for the remote or island

systems. And we view the kinds of things that we're doing here in Alaska is completely applicable to what's going on in terms of modernizing our electric grid in the United States. We don't want to be a unique case, okay? We want to see how what we're doing and making leverage to modernize the grid nationally. And that's really something that we'd like to help follow up.

We ask all of you for help in getting people to understand that we're not just this little sub set. But what we're doing is wholly relevant to the rest of the country, and how can we, kind of, bring that together.

Senator CANTWELL. Thank you for that explanation. I think that is so important because obviously you are—on microgrids and just because of the nature you are not connecting to one. So it doesn't mean that you are not having applicable information and demonstration.

Ms. HOLDMANN. No, right.

Senator CANTWELL. Mr. Hébert, I am a big fan of this regional clean energy partnership, the commitment that we have made. You mentioned having a national lab partnership here.

If we had the regional investments, what would you do? What kind of partnership? What will you focus on?

Mr. HÉBERT. Well I think the kind, sorry.

Pick one, you know, if we're talking about energy efficient envelopes and their behavior in cold climates and the dynamics of vapor drive related to that rather than initiate a study in Colorado to investigate that or come up here to try to find out.

Just get a hold of us and see what we're doing or if you have a question or the national labs have a question related to the operation of photovoltaics. That was good example today. We have studied photovoltaics in the far north, and we have data on how they perform. That will blow your socks off how efficient they are, and we've already done that.

Now I hear that a national lab is also doing that study in cold climates on photovoltaics. So what I'm saying is know we're here. If we could set a formal relationship so that we are your go to people here, we are a great bang for the buck.

Senator CANTWELL. Well I am a very big fan of the regions playing the regional role because they are experts and they have to deploy. So rural hybrid states—plus percent hydro, so we want to diversify as well, not that we don't love two to four cent kilowatt power, but we know that we are going to be impacted by climate. You talk about no snow pack, that is going to affect us.

We want to diversify too. We are moving probably faster on intermittent power and storage, and you are going to move faster on these cold climate issues, what you know is relevant.

So I think empowering the regions from a strategic research perspective is very important because we are at the stage of innovation. While the innovation is there, it is about the applications. It is about implementation that is going to help us find the answers to what is really applicable. So I hope that we can move forward on. Thank you.

The CHAIRMAN. I think I saw Senator Daines and Senator King who wanted to ask a question.

Senator Daines?

Senator DAINES. One question.

It was probably for Mr. Andersen, his tests on hydropower, but I will throw it out to the great panel here. Thank you for the love and passion, the competence displayed here in this room.

By the way, one of the advantages or successes of this energy bill that we are going to pass in the Senate here soon is the fact that it actually officially classifies hydropower as a renewable resource. Only in Washington, DC would hydro not be classified as renewable. So, kind of, Sesame Street in front of the guy and it will be classified as renewable in the energy bill. So that is good news.

But we source about 30 percent of our electrical supply from hydro. Senator Cantwell is about 70 percent in Washington. Any thoughts around small hydro developments of the potential here in Alaska and barriers to accomplishing such?

Mr. GILBERT. I could address that if you like, Senator.

We actually are pursuing a small hydro, 750 kW. It would supply a community out on the island of Kodiak. We actually served one community on the southern tip of the island of Kodiak, and we've been working on that for quite a few years.

The whole licensing process for small hydro is just like that of a large hydro and it creates an enormous hurdle. You really have to set back and take a good look at what are the potential environmental impacts of the small hydro and ask yourself why do you have to go through the same hoops, so to speak, they would have to go through for a multi-megawatt, 10,000 megawatt, hydro.

It's just not the same potential impact, and yet we've spent well over a million dollars studying to get it to where we could apply for our FERC license for 750 kilowatt hydro. It's still, we see it as a substantial benefit for the communities, flat-priced power, the price of water doesn't change over time. But that NEPA/FERC process, if you will, isn't going—it's a small hydro.

The CHAIRMAN. Senator King?

Senator KING. Just a quick question.

Mike Hoffman, the corridor you talked about for natural gas is that a pipeline or that compressed natural gas? How do you move the gas?

Mr. HOFFMAN. Right now with the study it's a—we're looking at a crate line.

Senator KING. So it would be a pipeline corridor. It would be a spur off the thing.

Mr. HOFFMAN. Well when we, we're looking at a corridor. When we say corridor there are three aspects to it. The reason we use corridor was because of Secretary LaHood when he was transportation he was pushing freight and energy corridors through the United States. So we used that. But what it is is a road, transmission lines and the pipelines.

Senator KING. Mr. Gilbert, we can talk all fine about this but I was surprised at your figures on wind. I used to be in the wind development business, and we would develop a major project at about \$2,500 a kilowatt.

I guess you are talking about small scale, sort of, home size? Because I can't—you said \$10,000. That seemed awfully high to me.

Mr. GILBERT. These are typically 100 kW wind turbines that, you know, where the key issue, of course, is transportation and the size——

Senator KING. Transportation of the equipment itself?

Mr. GILBERT. Of the device itself, the system itself. We have to bring a crane in to erect it, the turbine. There's an example right here in Bethel. It's 100 Kw turbine. And so we have 30 of that same model turbine distributed through 11 different communities. The cost of putting those in, putting foundations in. If you had a chance, I wish you could go look at the foundation on that turbine. It's set on——

Senator KING. Because of the permafrost subsoil.

Mr. GILBERT. Right. So the piling foundations and then we had to put thermal siphons next to those pilings in order to ensure the permafrost doesn't develop——

Senator KING. Special challenges in transportation and construction.

Mr. GILBERT. Correct.

Senator KING. Mr. Hébert is that Hébear?

Mr. HÉBERT. Well it's like a Hébear, pronounced teddy bear.

Senator KING. In Maine it is also pronounced teddy bear.

I think you answered this question. Photovoltaics will work in Alaska, yes or no?

Mr. HÉBERT. Very well.

Senator KING. Okay.

So, as the price comes down dramatically, that is going to become more economic.

Mr. HÉBERT. And solar hydronic as well works very well.

Senator KING. So storage becomes a big issue?

Mr. HÉBERT. Storage is the issue.

Senator KING. Finally I shamelessly promote a small company in Maine that fits exactly with what all of you are doing called Tyba Energy that makes super sophisticated electronic. But the electronics that connect, for example, solar or wind to a battery or to the grid. It is the secret sauce for connecting these kinds of developments that, I think, you all would find very interesting or could you hand those out? I have got some material. I think it would be very interesting to you because——

[Laughter.]

Hey, I am from Maine. I also have L.L. Bean boots on if you were going to ask.

[Laughter.]

Thank you, Madam Chair.

Mr. BLACK. Senator King, if I could add to some of the old storage areas, the storage issue. That's one thing that we've been able to use the water tank that's often found at these villages that are called fill and draw systems where once a year you make enough water to be used by the entire village for that year. Adding a few BTUs to that water tank is a great battery, if you will, for solar as well as wind. So that's been one of our answers.

Senator KING. I think that is the big, one of the biggest things. I know Secretary Moniz is working on this storage that will unlock enormous potential of solar and wind once we can deal with the intermittency.

Mr. HÉBERT. We think we can get through the heating load when we don't have the sun next year with the thermal storage tank that we've got. We just want to get it up to just under boiling.

But we're working with another company that's looking at phase change materials. And they are actually, and Gwen may know more about this than I do, but they have a hydronic system that uses phase change material that they can heat up to about a thousand degrees. For an efficient building we need, even in our heating degree, minus 50 design temperature, we can heat the building with 90-degree water. So that's a huge cup of tea.

Now we can heat our 25,000-gallon tank, it's a buried railroad tanker, super insulated. We can heat it to about 200 degrees. And we think we'll be able to squeak by with that for thermal storage in mid-winter.

Senator KING. I love the idea of a buried railroad tanker. That is Alaska ingenuity. [Laughter.]

Mr. HÉBERT. Bernie Karl gave it to us. [Laughter.]

The CHAIRMAN. Any further questions from colleagues?

Secretary Moniz, did you have anything that you would ask the panel?

Secretary MONIZ. Got it.

I think I might ask questions. There is a lot to think about and talk about and I did have some suggestions for, opportunities for DOE to invest in.

But I want to go back, actually, to just reinforce that again, our interactions here in Alaska have been, I think, terrific. We see the innovation and this, we are committed to adding some more staff here. And that's going to be an opportunity for tripling of the opportunities for immediate discussion here in Alaska.

And we'd like to keep it two ways that again, because I agree with what's been said. I said it earlier that it's a lot of innovation that we can work from for our country, but also as we face the global challenges around energy and environment and security—these can be quite welcome. So we're all in.

The CHAIRMAN. Well thank you all. I think if we were given a little bit more time perhaps the rest of the evening we could cover you with questions all over the board. But I think what you have shared with us is that even given challenges that we have heard about all day long, that we have seen in our walkabout over in Oscarville and here in Bethel, even with the challenges, Alaskans are pioneering in ways that are capturing the attention of others and rightly so.

We do need to be working on that, and you can use us as that resource. I think what you have established today is that clearly the expertise is available, the innovation is available and the willingness to share it with others is available as well.

With that, we will conclude the hearing, again, with my thanks to colleagues who have come from the farthest ends of the country to be here in Bethel, Alaska to see and learn and understand. Thank you for your willingness to be here. Thank you for your willingness to listen to us and not only our concerns, but what we have to contribute to the rest of the nation.

And with that, we stand adjourned.

[Whereupon, at 6:49 p.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED



Department of Energy

Washington, DC 20585

March 8, 2016

The Honorable Lisa Murkowski
Chairman
Committee on Energy and Natural Resources
United States Senate
Washington, DC 20510

Dear Madam Chairman:

On February 15, 2016, Secretary Ernest Moniz testified regarding *Energy Technology and Development-Opportunities for Alaska's Energy Future*.

Enclosed is the answer to a question submitted by Senator Angus King for the hearing record.

If you need any additional information or further assistance, please contact me or Fahiyeh Yusuf, Office of Congressional and Intergovernmental Affairs at (202) 586-5450.

Sincerely,

A handwritten signature in black ink, appearing to read "J. Shimek", is written over a faint, circular official stamp.

Jaime Shimek
Deputy Assistant Secretary for Senate Affairs
Congressional and Intergovernmental Affairs

Enclosure

cc: The Honorable Maria Cantwell
Ranking Member



Printed with soy ink on recycled paper

QUESTION FROM SENATOR ANGUS KING

- Q1. Because the Department of Energy recognizes the importance of energy planning for remote “off the grid” areas and especially highlighted this recognition during the field hearing, I wanted to bring your attention to a specific program that’s helping communities in both Alaska and in Maine. The DOE’s WindExchange program has established the Islanded Grid Resource Center that has allowed joint collaboration, cooperation and problem solving in communities that never would have been able to work together. However I understand that the program’s funding may not be prioritized by the agency. After hearing of your commitment to these islanded communities, will you commit to supporting full funding for the WindExchange program so that the Islanded Grid Resource Center can continue it’s important support for remote communities?
- A1. The Department has been and continues to be very supportive of the Islanded Grid Resource Center and the other five Regional Wind Resource Centers. The Regional Resource Centers, which are supported by the Wind and Water Power Technologies Office’s WINDEXchange program, provide accurate and unbiased information about wind energy to regional stakeholders and decision-makers, including information on supply chains, workforce, wind resources, geography, wildlife, electricity infrastructure, and project costs. Regional Resource Centers provide information about various sizes of wind energy systems, such as utility-scale, distributed wind, and offshore wind, based on various factors within a region of the United States, such as wind resource, energy options, electricity costs, and other considerations.

As indicated in the original 2013 Request for Proposals and agreed to by subcontractors, Regional Resource Centers are partially funded by competitive awards from the Department and partially by participant cost share. In addition, the Request for Proposals also indicated that awards would run an anticipated 36 months at maximum, and subcontractor cost share would increase annually over that time.

Because fiscal year (FY) 2016 enacted funding for the DOE Wind Program was lower than both the President’s FY 2016 Budget Request and the FY 2015 enacted level, the Program is currently in the process of evaluating options that would allow for continued support for the Regional Resource Centers. The Program is committed to exploring every possibility that will allow for all of the Regional Resource Centers to be funded

through the end of their final contract year, which ends during FY 2017. After that time, the Department's focus would shift from implementation to evaluation of Regional Resource Center performance to measure the success of the three-year effort and inform the future direction of the program's education and outreach. We look forward to working with Congress regarding the direction of the program moving forward.

**U.S. Senate Committee on Energy and Natural Resources
Field Hearing on February 15, 2016: Energy Technology Innovation and
Deployment Opportunities for Alaska's Energy Future
Questions for the Record Submitted to Mr. Ralph Andersen**

Questions from Chairman Lisa Murkowski

Question 1: River-Powered Electrical Generators

Mr. Andersen, in your written testimony you mentioned one of the energy innovation projects that has been installed in Igiugig: the river-powered electrical generators. And you're right, they do look like giant underwater wheat threshers. You also mentioned that the Ocean Renewable Power led project had a \$5 million upfront cost, but that the next versions of these units will only run around \$500,000 each. Could you please share with us:

The impact of these units in Igiugig. Do we have any sharable data yet on what kind of savings these generators are resulting in?

Where and when are these next-gen units slated to go next?

ANSWER 1:

The system at Igiugig is a "test" system and operates only during ice-free periods in the Kvichak River. The impacts on creating local jobs is minimal since it is a "self-contained" system. The only labor involved is with installing and removing the system from the river, for system modifications and adjustments, and, when in operation, for minimal monitoring. The generator is usually installed in the river in the spring (after break-up) and is removed in the fall (before freeze-up) – roughly a 4-month period from June to September. Considering this system is still in "test" phase, was first installed in 2014, operates only during the ice-free months (for a total operating period of about 8 months since 2014), and cost factors such as installation, monitoring, equipment adjustments/modifications/improvements, etc., are yet to be totally calculated, there is no hard data yet on the exact total cost savings. Ocean Renewable Power posts on its website that when in operation the system provides up to one-third of the power for the community, but this does not consider any of the cost factors. Village contacts at Igiugig generally verify this information.

I don't know where and when Ocean Renewable plans to install these units next.

Question 2: Energy Clearinghouses

Mr. Andersen, in your written testimony you reference a couple of times the concept of an "energy clearinghouse." You referenced it as a part of a potential solution -- a plan to address the energy challenges in Bristol Bay. Can you please share some additional details on how that concept would look, and how it would work?

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ANSWER 2:

One of the biggest problems we face in Bristol Bay is a central location for information regarding energy grant or loan opportunities, informational sessions, applications and application information, and available programs. There is little information to villages, local utilities, businesses, and individuals for new systems, upgrades, or maintenance/repairs, etc. There is very little information provided in the mail, through news outlets, or in any other way to village and rural residents. For information distributed on the internet, many remote villages do not have reliable internet access or affordable broadband. Also, many federal agencies (USDA, DOE, DOI) operate separate tribal and/or rural energy programs with, from my view, little or no coordination between them and provide minimal outreach and technical assistance to tribes and rural residents and businesses.

Many Bristol Bay residents don't apply for energy loans or grants simply because they don't know what opportunities are available or where to get and submit applications. BBNA, businesses, organizations, and village councils simply don't have the financial means to train and dedicate staff to gather and disseminate information for federal agencies about energy opportunities and conservation or other programs that are available, nor can we afford to train and dedicate staff to provide technical assistance and information for federal programs. I suggest a rural energy clearinghouses be established throughout rural Alaska through contracts with the regional Tribal Consortia (such as BBNA) with funds from or costs shared by all of the federal agencies that have Tribal Energy programs.

Question 3: DOE & Federal Interaction

Can any of you share some real-life examples – both good and bad – of experiences that you have had collaborating with the federal government in working to plan, upgrade, revamp, or build energy projects in Alaska?

ANSWER 3:

I don't have any examples regarding energy projects. BBNA's involvements in village energy projects is normally at the request of tribes and by coordinating with tribes and state and federal agencies on general policy matters, such as ensuring tribal involvement, coordination in application processes, etc. BBNA does not build or install energy systems but provides technical assistance and coordination as requested by tribes. The tribes, local utilities, and the funding agencies typically take the lead roles.

Question 4: Top-Down Approach

I am sure you all have anecdotes about cases in Alaska where a well-meaning individual, agency, or company tried to install an energy project or upgrade in a village, but encountered some level of failure. In my experience, this often results from a top-down

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approach, which is problematic anywhere, but especially in Alaska and even more so in rural parts of our state. Would any of you care to explain some of the reasons why that's the case? And, from your experiences, what kind of approach *will* work and has worked in rural Alaska? For example, how do we increase the changes that an energy project in a remote village will enjoy sustained, long-term success?

ANSWER 4:

There are many reasons this is the case. They range from an attitude that the person, agency, or company think they know what's best for the village. The decision to move ahead is made unilaterally. Another reason includes receiving no feedback on a proposal from a village and misinterpreting it as being agreement. Silence does not mean agreement. It indicates a need to find out why there is silence. Other reasons include poor or rushed planning, inaccurate cost and other estimates, no communication between parties, no permits or authorizations, etc. These "top-down" situations are becoming less frequent, especially in recent years, with more efforts for local or tribal consultation.

There are several ways to best ensure an energy project in a remote village will enjoy success, with the real key being with the funding source. The most obvious is to stop individuals, agencies and organizations from doing what they think is best for a village. Funding sources need to ensure village consultation occurs first before moving any project forward. Another way, perhaps the most essential, is to involve or provide opportunities for involvement of the village in every phase of a project – from planning to implementation – and getting consensus on a project before moving it forward. Another is to provide for villages to develop strategic plans for energy. This process will identify priorities and will reflect a village consensus. In most cases, however, tribes simply lack the funds and capacity to develop their own energy plans, and must rely on others to develop or for inclusion in one. Regional or local energy plans must be honored.

There isn't a single action or way to ensure success of a project. Village collaboration, communication, planning, consultation, and other mechanisms that allow wide involvement are key components of successful projects.

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 FIELD HEARING ON FEBRUARY 15, 2016: ENERGY TECHNOLOGY INNOVATION AND
 DEPLOYMENT OPPORTUNITIES FOR ALASKA'S ENERGY FUTURE
 RESPONSES TO QUESTIONS FOR THE RECORD SUBMITTED TO MR. MICHAEL BLACK

Question 1: *Workforce & Maintenance*

Mr. Black, when ANTHC implements new energy, water, sewer, and other types of technologies or projects in the villages, how do you go about training local workers to perform maintenance as-needed on the equipment and systems you install?

Response 1:

A robust and proactive maintenance and local operator training program is essential to better protect the public health and maximize the return on investment of constructed facilities

ANTHC has long recognized that engineering a solution to sanitation does not begin and end on the drawing board or in the successful installation and construction of systems. Training of the local operators and the governing body that owns the systems is equally as important as the innovations designed by our Engineering Services Department.

Our training of local operators has a multiple staged approach:

- Operators trained as part of the local construction crew
- Operators trained during the "commissioning" process
- Operators offered on-site training periodically
- Operators offered classroom and lab training at a regional or central training facility.

Training begins at the construction stage where local labor is employed through Force Account methods to build the system and learn using a "from the ground up" familiarity with the components and overall system construction. The use of the local operators as part of the construction team is essential to their understanding of how the system works and is maintained.

Training of local workers continues through 'commissioning' of the construction project. Commissioning is when ANTHC engineers, construction personnel and local operators calibrate all parts of the project, including the electrical, mechanical and heating systems, to work together as designed. Calibration and operation of these rural sanitation systems are much more demanding than systems elsewhere, because of the challenges associated with remote communities in Arctic climates. The commissioning challenges include learning complex treatment methods driven by the unique source water conditions in many parts of Alaska (treating hardness and color staining through mineralization, arsenic and lead removal, treating organics in tundra water, and high sedimentation loads in surface waters).

The level of training provided to local rural Alaskan operators must be much higher than in road-accessible communities. Many problems in road-accessible communities can be solved by

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calling a specialist company in to complete plumbing, electrical, mechanical, or electrical controls repairs. Most rural Alaskan communities do not have these companies, so repair help is thousands of dollars and days of travel away. Therefore, rural Alaskan operators have to be trained to troubleshoot and repair issues that many urban operators would not even attempt to fix themselves.

Training is usually adequately funded during the construction, the commissioning and the follow up of a project; the dollars being included as a part of the project's budget. The biggest challenges for operator training occur a year or more after construction is complete. Turnover of local operators is high, and small communities typically cannot afford to employ a full time backup operator. Therefore, the backup operator is usually not already trained if the primary operator quits. Often a newly hired operator knows little about the system or lacks the knowledge needed to troubleshoot and fix complicated problems. New operators require weeks of on-site training, over a period of months, to become fully trained.

The ANTHC Tribal Utility Support group (TUS) takes the lead with operator training during commissioning and following construction. Before the Rural Energy Initiative, Rural operator training has traditionally been provided following the project-funded commissioning process on either a request from a local operator or on an emergency call out. TUS engineers or specialists would travel to provide on-site training to operators when time and money were available. Due to limited funding, most of this assistance was reactive instead of proactive.

With the establishment of our Rural Energy Initiative, ANTHC has begun shifting its approach to training, in order to more effectively address the need for local capacity to maintain existing infrastructure that is often inefficient and in need of replacement. ANTHC now incorporates both local hands-on training and offsite classroom training into the energy efficiency improvements plan for each community it serves. This energy efficiency operator training funded by the US Department of Agriculture, Rural Alaska Village Grant Program (RAVG) allows for energy audits to be completed for community water and sewer systems, and enables ANTHC to provide on-site, hands-on training to operators based upon the findings of the plant's energy audit while energy efficiency retrofits are being carried out. This training has demonstrated positive results. Proactive training of operators is based upon a comprehensive look at a community's sanitation system; its mechanical, electrical systems and the operational procedures where energy is being used throughout the system, as well as the recommended physical and operational improvements that can reduce energy usage and system expenses. This approach is more likely to result in operating cost savings, improved efficiency, and prolonged life of rural water and sewer systems.

With the Rural Energy Initiative, ANTHC has developed a partnership with the Alaska Vocational and Technical Center (AVTEC) in Seward. ANTHC and AVTEC developed a curriculum that combines the cost-effectiveness of classroom training with laboratory exercises involving hands-on training critical to developing operator skills. These two-week classes leverage the existing hands-on training facilities and skilled instructors at AVTEC with the water and sewer system expertise of ANTHC. They also help develop, through acquainting operators with their neighboring community counterparts, a support network of rural operators for obtaining advice on the similar issues and problems they face.

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ANTHC believes that improved operator training, especially on-site training, is critical to maintaining the benefits of energy improvements, and to prolonging the life of existing water and sewer systems. We also view rural operator training as a highly effective, low cost investment to protect the billions of dollars in public health infrastructure from premature failure. Currently we rely upon continuing resources from USDA-RAVG and the Denali Commission to provide an average of 15 rural operators with on-site and classroom training per year. Additional, targeted resources will be needed to improve our training program and make it available to more rural operators on an annual basis.

Question 2: *Remote Monitoring*

Mr. Black, in your written testimony you discuss a key component within ANTHC's Rural Energy Initiative: remote monitoring. There has been some real innovation in that space with strides in technology, cost-reduction, and effectiveness. Would you please explain the impact that a relatively simple, "off-the-shelf" as you put it, piece of equipment can have in rural villages all over Alaska?

Response 2:

Remote monitoring provides an inexpensive and effective safety net for system operations that improves service and can prevent catastrophic failure of facilities

Remote monitoring in Alaska was revolutionized with the expansion of cell phone service across rural communities. Before, remote monitoring relied upon satellite technology that was expensive to install and expensive to maintain. With the expansion of microwave towers and the development of cell phone service for rural Alaska, things have changed. Inexpensive local networks of monitoring devices can, using radio technology, "talk" to a router and rely upon a dedicated cell phone device to report the results to anywhere in the world.

The remote nature of rural Alaska villages, the small population size, and the limited local resources for technical operations can create a variety of problems that remote monitoring can help to address. First, many of the technical advisors that rural villages rely upon for support are located in hub communities such as Bethel or Anchorage that require a flight to reach, resulting in high travel costs and delayed response times. Second, one of the largest concerns in an Arctic water system, and the primary driver of high energy consumption in these systems, is the need to prevent distributed water and collected wastewater from freezing. It is important that efficiency not put water and sewer services at risk of a "freeze-up". Access to safe water is lost when freeze-ups occur, compromising public health and resulting in expensive repairs beyond the means of the local community, sometimes exceeding hundreds of thousands of dollars.

The Environmental Protection Agency (EPA) has been an ardent supporter of remote monitoring of rural sanitation systems because of the agency's recognition of the importance of avoiding loss of substantial investments in water and wastewater infrastructure. Safe Drinking Water Act (SDWA) funding from the EPA during the last three years has allowed ANTHC to develop,

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demonstrate, and build a remote monitoring program using “low tech,” off the shelf components that can be installed at a minimal cost. To date, our program has proven highly successful at protecting rural sanitation infrastructure, preventing two potentially catastrophic and expensive freeze-ups in the last three years.

Additionally, through remote monitoring, ANTHC and our partners in the regional tribal health organizations have identified numerous energy efficiency saving opportunities through more efficient management of distributed water temperatures and optimization of diesel power plant heat recovery systems. These benefits to the village are very direct: water/sewer service continues unabated, and energy savings are realized. Beyond the very real savings of avoided freeze-ups, and energy efficiency opportunities; remote monitoring has also produced savings for technical assistance providers by avoiding the need for technical support staff to fly out to assist communities. There are multiple cases every year when staff from the State of Alaska’s Remote Maintenance Worker program and ANTHC staff troubleshoot problems over the phone with assistance of real time data from remote monitoring, thus avoiding the need to fly to the community. An added benefit has been the extensive data collection in identifying Arctic water and sewer operations “best practices”; such as comparing the energy performance of two types of vacuum sewer pumps, or providing real time results on implemented projects. Data collection in rural villages has always been a challenge; remote monitoring is helping to eliminate some of the barriers and provide improved tools for better service from our organization to rural villages.

In summary, rural sanitation remote monitoring systems are being installed in Alaskan communities as resources allow. This remote monitoring is proving to increase energy efficiency and reduce costly emergencies. It enables the sharing of sanitation system data between multiple stakeholders, such as water managers, Remote Maintenance Workers, and utility engineers, allowing many problems to be identified and corrected before they become emergencies. It also allows inefficient use of electricity and heating fuel to be quickly identified and corrected, where in the past, sources of inefficiency would go undiscovered for months or even years. Though remote monitoring has proven inexpensive and effective, the limited funding available for these installations from the EPA SDWA challenges ANTHC’s ability to serve additional Alaskan communities that could benefit greatly from them.

Some prime examples of ANTHC remote monitoring efforts are:

Kiana - One week after installation of remote monitoring, the system identified one lift station pump that was not running properly, which contributed to sewer force main freeze-ups in the past. Once this problem was identified, ANTHC staff and a local operator were able to correct the problem by installing improved electrical controls. **With remote monitoring, operators can continue to track pump cycle times, sewer temperatures and downtime to minimize the chance of future freeze-ups.**

Selawik - In 2014, the recently installed remote monitoring system helped avert a water system freeze-up similar to one the community experienced in 2012 that left over one hundred homes to without water for a month and more than fifty homes without water for over two months. With the remote monitoring system, ANTHC staff in Kotzebue were able to identify water pump failure and obtain help from a nearby community operator skilled in pump repair before the

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system failed. Being able to track water flow and tank levels let us know the severity of the situation. **Remote monitoring was the difference between the \$300,000 freeze-up two years ago and less than ten thousand dollars in labor and repairs this year.”**

Chevak – Remote monitoring installed in 2013 quickly identified a non-functioning pressure transducer that was leading to a well pump turning off and on every few minutes. This inefficiency dramatically shortens the life of pumps, leading to higher repair bills. **Upon receiving the monitoring data, ANTHC staff was able to repair the problem at very low cost, reducing the cost of electricity and future pump repairs.**

Question 3: *Renewables Beyond Wind & Solar*

Too often, we see people try to define the term “renewables” to narrowly cover just wind and solar. But ANTHC’s sanitation projects, for example, utilize a much wider variety of renewable resources than that. Would you please run through some of those renewable options and talk us through how they factor into ANTHC’s Rural Energy Initiative?

Response 3:

The ANTHC Rural Energy Initiative develops and implements expanded “renewable” options that reduce fossil fuel consumption, have short payback periods and strengthen utility system sustainability

ANTHC’s Rural Energy Initiative looks at both reducing operating cost as well as the appropriateness of technology when bringing renewable solutions to Alaska’s rural communities. ANTHC and the rural communities where we are working have benefited greatly from a broad definition of renewable energy. Renewable energy systems being employed by ANTHC include: heating water systems with recovered heat from community power plants, biomass heating using local wood resources when available, ground source heat pumps, small hydro-electricity, and use of excess wind turbine energy to heat sanitation systems.

ANTHC has completed 24 renewable energy projects for rural Alaska sanitation systems since 2011. Funding for these projects in the amount of \$8.2 million has been provided by DOE, EPA and the State of Alaska’s Renewable Energy Fund. The majority of the funding (56%) has been received through the State of Alaska’s Renewable Energy Fund. The initial deployment of renewable energy systems has resulted in an estimated annual energy savings of \$1.25 million in 2015.

Our Rural Energy Initiative envisions solutions for every community in Alaska based upon a careful examination of the use of energy in the existing infrastructure and the available local energy resources. One size does not fit all. There must be a knowledgeable evaluation of the conditions in each community, involvement of the community and the operators and a clear idea understanding of the capacity of local resources in order to deliver appropriate and sustainable energy solutions to rural Alaskan communities.

Examples of our use of renewable energy are explained below:

Heat Recovery:

At the onset of our program, excess heat from the generator cooling systems of existing community power plants represented an enormous untapped energy resource for dozens of rural communities. While not a true renewable energy source, heat recovery has fortunately been an eligible solution under the State of Alaska's Renewable Energy Fund, due to its ability to drastically reduce the burning of fossil fuels for heating. Recovered heat, measured and metered in British Thermal Units (BTUs), is sold by the power utility to the community at a fraction of the cost of BTUs otherwise produced by fuel oil, creating huge savings for water and wastewater system customers while adding a revenue stream for the electric utility. By partnering with the Alaska Village Electric Cooperative (AVEC) which produces power for 52 rural communities, ANTHC has designed and constructed heat recovery systems that lower the cost of heating rural washeterias (combined laundromats, water treatment plants and shower facilities), water treatment plants, and other public facilities in 26 communities across the state.

Through collaboration with AVEC and with funding from Alaska's Renewable Energy Fund, ANTHC brought a new heat recovery system online for the community of Quinhagak in December 2015. This system captures excess heat from the existing AVEC power plant and uses it to heat Quinhagak's washeteria and combined utility building. With the system now operational, **it is expected that the community will reduce their annual heating fuel usage by 14,200 gallons, for a fuel savings of almost \$64,000 per year. Net savings to the water utility after paying the electric utility for the captured heat is expected to be \$45,000 per year.**

Biomass:

ANTHC's biomass heating projects tap the traditional renewable energy resource of cordwood, combined with modern wood boiler technology to reduce dependency on imported fossil fuels and lower rural sanitation operating costs. Using locally harvested wood in the heating system, instead of fuel oil, keeps energy dollars in the local economy, promotes energy sustainability and provides the added benefit of creating new jobs for local wood cutters in rural communities, where employment is hard to come by.

Located north of the Arctic Circle, the village of Kobuk, Alaska was heating its community water system with heating fuel, which has to be flown in to the community at a cost of \$11.00 per gallon. With funding from the State of Alaska's Renewable Energy Fund, ANTHC worked with Kobuk to design and construct a biomass boiler to heat the community's water plant and water distribution system. Through the coordinated efforts of ANTHC's Rural Energy Initiative, NANA Regional Corporation, the City of Kobuk and the Kobuk Traditional Council, **Kobuk's biomass project is now helping the community save \$24,000 in avoided heating fuel costs and provides a new income opportunity to local wood cutters for supplying locally harvested cordwood.**

Wind-to-Heat:

Development of the “wind to heat” system was conceived by ANTHC’s Rural Energy Initiative in 2011. This innovation, the first in Alaska and perhaps in the country for public water systems, was developed by ANTHC in partnership with Alaska Village Electric Cooperative (AVEC). AVEC has agreed to sell extra power generated by wind turbines under “interruptible power agreements” at substantial discounts to the community sanitation utilities. Wind energy is transferred through use of electric boilers in the water treatment plant and displaces fuel otherwise needed to heat the water. Another elegant feature of this approach is that it solves the long standing problem with wind turbines of how to store excess energy. Battery technology today has not been proven reliable in cold climates. However, taking available and excess energy that would be wasted and putting it into a large water tank is simple.

An example of “wind to heat” savings is demonstrated by the system ANTHC completed for the community of Mekoryuk in 2014. **The excess wind electricity is purchased at \$0.05 per kilowatt hour, which is equivalent to buying fuel oil at \$1.46 per gallon in this remote island community. The savings to the community amounts to \$40,000 annually.**

Micro Hydroelectric:

Water systems often share infrastructure with hydroelectric facilities. Often, a dam and penstock are shared between the hydroelectric producer and the water system owner. The dam backs up water needed for year-round drinking water as well as providing water for steady hydroelectric operations. The penstock, or pipeline, is needed to transport water to both the generator and water plants. Combining public water and power facilities reduces capital costs associated for both sanitation and power infrastructure, with compounded benefits for the community.

Micro hydroelectric systems have potential in many locations in Alaska. To make these projects economically feasible, the developer will need the cooperation of many agencies, land owners and regulators. The potential for long term, affordable cheap power along with the development of a reliable water source for a relatively small capital investment makes these projects attractive.

Where hydroelectric facilities are possible, ANTHC has helped communities identify that potential and assemble technical analysis to assist with grant funding. For example, ANTHC submitted a grant application and received design funding from the Alaska Energy Authority for the communities of Scammon Bay and Ouzinkie. Later construction funding was received through the Alaska Legislature for Ouzinkie. The Ouzinkie project was completed last year and currently provides a reliable water source while also providing a large portion of the electrical energy needed for this small community. The \$ 2.5 million project took less than a year to complete from start to finish. **Construction on this project allowed the community to continue producing 30 percent of its electricity from hydroelectric power, or 300,000 kWh/year, with a diesel offset of 24,584 gallons of diesel or \$148,240 per year.**

The Scammon Bay project remains unfunded. However, ANTHC’s investigation of the hydroelectric resources in the community of Scammon Bay has **identified the potential for**

hydroelectric generation of 755,790 kWh, a diesel offset of 39,252 gallons of fuel or \$157,007 a year.

Ground Source Heat Pumps:

This year, ANTHC is also commencing design and construction of our first ground source heat pump (GSHP) system in partnership with the Metlakatla Indian Community. GSHP systems harness the relatively constant temperature of the subsurface earth as an essentially unlimited renewable energy resource. The proposed GSHP system for Metlakatla's Lepquinum Wellness Center will extract heat from a geothermal loopfield on the facility's property and transfer it to the building hydronic heating system via a water-to-water heat pump.

Once complete, **Metlakatla's GSHP system is estimated to reduce the overall energy costs for the Wellness Center by 73%, displacing 47,200 gallons of heating oil per year, and lowering the overall annual energy and operational costs by \$203,000.** Through the savings created by this project, dollars normally spent on heating oil can stay in the local economy and enable support of other important public programs and services in Metlakatla.

Question 4: ANTHC's Timeline for Energy Efficiency Upgrades

Mr. Black, do you anticipate ANTHC being able to achieve its goal of installing another 80 energy efficiency systems – including the operator training component – over the next four years? What are the main challenges ANTHC encounters as you go about trying to implement these systems in our state's rural locations? And does ANTHC have a timeline for completing the energy audits and analyses of the remaining 127 communities that haven't been audited yet?

Response 4:

ANTHC has the technical capacity to achieve its rural energy initiative 4-year implementation plan, provided stable funding of \$6.2m/year is made available.

ANTHC absolutely has the in-house capacity to implement renewable energy solutions, energy efficiency improvements and provide energy efficiency training for the remaining rural communities across Alaska. The nature of these projects is relatively small in scope on a village by village basis; one or two staff members can spend a month or two in total per community to identify and implement efficiency improvements alongside needed training. The issue is of course identifying funding for these efforts.

Accomplishing the goal will require strategic decision making. With previously collected data we are able to project the energy use and potential savings of unaudited sanitation systems; using a model based upon sanitation system type, the number of households served, and the climate zone. From this information we are able to prioritize future energy efficiency efforts in order to derive the greatest benefits as soon as possible and prioritize the communities where greatest benefits can be derived.

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That said, only a field assessment can identify specific efficiency measures and only a full energy audit will forecast costs and savings accurately. It will be necessary for us to intelligently deploy the resources to make the greatest beneficial impact for the time and resources available.

If funding allows, ANTHC can conduct energy audits at the rate of two per month in perpetuity. Significant funding could allow for an expanded rate of delivery of energy audits on rural sanitation systems. We think it is important that complex Arctic sanitation systems are evaluated by experienced staff members who understand the unique nature of water and sewer in rural Alaska as well as energy efficiency potential. The unique combination of those skills is somewhat rare but a key focus of our internal technical staff development. It is important to have these staff members involved in producing a quality efficiency product that addresses the crucial and sensitive operational concerns of rural sanitation systems.

The implementation of our four year plan for the Rural Energy Initiative is not without its challenges, most notably, stable funding to execute energy audits and efficiency retrofits. While there is stable capital funding for water and sewer projects to address the sanitation services in rural Alaska, energy efficiency is often viewed by funding agencies as “maintenance,” and therefore ineligible for most capital funding. In addition, much of the funding available for energy projects does not recognize the essential need for local operator training to ensure the long-term benefits of energy improvements. If the operator does not understand the solutions that have been installed, they will not be maintained. Our experience indicates that local operators will sometimes actively defeat the energy conservation measures if they do not understand how they operate. Energy improvements will quickly revert back to a state of inefficiency, if training and education of local operators are not part of the solution.

ANTHC has worked across a variety of funding partners to cobble together the funds to create an energy efficiency “program”. Little of this funding is stable or dedicated to addresses the full spectrum of sanitation energy efficiency activities. Additionally, funding for needed training is not readily provided for energy efficiency or for efficient operation of sanitation systems if it is not associated with a major capital project. Regular and updated training is necessary for rural sanitation systems, especially as new operators come on board, years after the initial construction of the facility.

Other challenges are the timing of implementing projects in the challenging Alaskan climate. It is best to identify energy efficiency improvements through our energy audits in the winter months, when the majority of the sanitation system energy consumption is occurring. In contrast, installing major efficiency improvements is best accomplished during summer months followed by minor efficiency improvements occurring during cold weather to allow for observation and tweaking of the heating system. This can be challenging as it requires extensive logistical coordination because of the remote nature of most communities.

An additional challenge is the wide range of technical capacity identified in local communities. Some communities have very experienced operators who are very skilled and experienced; these operators receive training focused on learning new technologies and more efficient operations. More often we come across operators with little experience and training; training for these operators is more focused on basic skills and preventative maintenance practices. Both methods

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result in energy savings, but the approach is very different. The result is that training resources need to be tailored and available at multiple levels. Training is critical but often overlooked and usually underfunded.

Our goal is to serve every rural Alaskan community sanitation system, prioritizing systems with the highest energy savings potential first. Additionally, by the nature of efficiency, we anticipate that 7 to 10 years down the road; new technologies, aging infrastructure and turnover in the population of sanitation system operators will necessitate new audits of communities that have previously been audited. While this may seem like a long term program, the significant savings and short term payback justifies repeated examination of systems every 7 to 10 years

Question 5: *DOE & Federal Interaction*

Can any of you share some real-life examples – both good and bad – of experiences that you have had collaborating with the federal government in working to plan, upgrade, revamp, or build energy projects in Alaska?

Response 5:

While federal support has been essential to ANTHC's delivery of energy solutions across Alaska, federal resources represent less than 30% of our rural energy initiative's funding to date—a reality that is likely the greatest risk to our program's future success.

The energy improvements brought to Alaska's rural communities by ANTHC's Rural Energy Initiative would not be possible without support received to date from our federal partners. As mentioned in responses to previous questions, federal funding for various program elements has come from the EPA, USDA, DOE, and the Denali Commission. In particular, we would like to thank Senator Murkowski for making possible the 2% set-aside through USDA's Rural Alaska Village Grant Program (RAVG), which has enabled ANTHC to serve dozens of rural communities with energy audits, technical assistance and energy-focused operator training. While federal partnerships have been crucial, our Rural Energy Initiative has been heavily reliant on State of Alaska support (over 60% of funding to date), which has seen significant declines in recent years and is at risk of going away entirely given the state's current fiscal situation. Thus, continued and strengthened federal support of our rural energy program is more important now than ever.

We see particular potential for support of energy improvements across rural Alaska in funding opportunities recently announced by DOE's Office of Indian Energy. Specifically, the program

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entitled “Establishment of an Inter-Tribal Technical Assistance Energy Providers Network” speaks precisely to the technical expertise and types of service ANTHC has worked to grow and provide to the communities we serve through our Rural Energy Initiative. Our hope now is that this new DOE program will focus federal resources on existing, proven, Alaska-based technical assistance providers like ANTHC, to improve the delivery of practical solutions and tangible benefits to Alaska’s rural communities.

While we recognize the role of past DOE support in the establishment of ANTHC’s Rural Energy Initiative, the agency’s support to rural Alaska has been largely ineffective over the past several years. Our program’s initial energy auditing effort across rural Alaska was made possible by funding through the DOE’s Energy Efficiency and Conservation Block Grant (EECBG) under the 2009 American Recovery and Reinvestment Act (ARRA). This one-time funding support enabled ANTHC to conduct initial energy audits and gather baseline data on 40 rural sanitation systems and other public facilities across the state. With this baseline data, we were able to shed light on, for the first time, the energy use and opportunities for savings in Arctic and sub-Arctic sanitation systems. These initial audits allowed us to build a prioritized energy roadmap for 40 communities and formulate the Rural Energy Initiative’s systematic approach bringing energy solutions to rural Alaska.

Since 2009, we have been disappointed in the resources and services made available to Alaska’s tribes from the DOE, and particularly from DOE’s Office of Indian Energy (OIE). With a single Alaska-based staffer and a lack of funding for actual physical improvements, DOE’s OIE is extremely limited in its ability to provide the level of service they claim to offer to Alaska’s 229 tribes. This resource limitation also leads to a dependence on outside resources to provide the technical assistance (TA) their office offers to tribes. DOE’s approach has been to provide tribes with energy-related TA from “experts” outside Alaska, such as the National Renewable Energy Laboratory (NREL) and other lower-48 DOE entities. These resources have high travel costs and minimal familiarity with the specific concerns of rural Alaskan communities. There are large learning curves and the results of this TA are difficult to justify for the costs. The benefits of the TA provided by DOE’s OIE across Alaska to date is difficult to distinguish in any of the communities ANTHC serves.

Over the past three years, DOE has attempted to address energy concerns in rural Alaska through its Strategic Technical Assistance Response Team Program (START). In addition to reliance on lower-48 technical resources, START is restricted to evaluating tribally owned facilities. We all realize that strict eligibility criteria in rural Alaskan communities severely limit the application of resources and the benefits to be derived for dollars spent. When resources are strictly limited to one category of ownership it discourages a truly “strategic” approach to community energy solutions. Our observation is that the limited DOE resources available to rural Alaska have resulted in a myriad of meetings, site visits from NREL staff, and planning documents with minimal to no tangible improvements.

Alaska’s rural communities present such unique energy challenges, that technical assistance by federal agencies must be based within the state. Most federal agencies have few resources within Alaska and little understanding of life in remote Arctic areas. Federal funding resources

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partnered with existing Alaska-based technical assistance providers, such as ANTHC's Rural Energy Initiative, represents the best path to real energy solutions for rural Alaska in the future.

Question 6: *Top-Down Approach*

I am sure you all have anecdotes about cases in Alaska where a well-meaning individual, agency, or company tried to install an energy project or upgrade in a village, but encountered some level of failure. In my experience, this often results from a top-down approach, which is problematic anywhere, but especially in Alaska and even more so in rural parts of our state. Would any of you care to explain some of the reasons why that's the case? And, from your experiences, what kind of approach will work and has worked in rural Alaska? For example, how do we increase the changes that an energy project in a remote village will enjoy sustained, long-term success?

Response 6:

Success is best achieved through in-state organizations that can establish long term relationships with communities and build partnerships that enable/empower community participation and ownership of provided improvements

A top-down approach without direct involvement of community members and local operators from the onset is not a sustainable solution. To ensure sustained savings from energy efficiency improvements over the long-term, the "one size fits all" approach is not appropriate. Familiarity with the community, the governance style, the plant, the operator and the system's unique characteristics, including the households, is critical. We have in the past seen an engineered solution simply not deliver the reliability and essential affordability that was promised. Many examples exist of energy efficiency solutions that worked for only a short time, or not at all, because the designers simply misunderstood the problems or underestimated the complexities of the system and the community. Local operators struggle with studio developed solutions and yet their need to understand the newly introduced technologies and to receive operational instructions is often not fully addressed.

It is very easy to think you have the answer to a problem that you only partially understand. Agencies often sell a solution to rural Alaskan communities that they have developed in their conference rooms and offices without taking a good, long look at the situation, or more importantly, without full engagement of local community stakeholders. Recently a western Alaskan community was subjected to such an approach by well-meaning agencies that swooped in to do a comprehensive energy efficiency upgrade of the entire community. They employed numerous specialist and local laborers in retrofitting homes, commercial buildings and local government offices with the idea of getting everything done once and for all. The result of such a breakneck speed solution was poor workmanship, wasteful speed overcoming efficient and deliberate improvements, homeowner confusion, resentment from the local leadership and no sustainable improvement.

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The reality is that very few organizations and experts have any long term experience with rural Alaska and even less with the realities of operating engineered systems in the environment unique to remote cold weather communities. Individuals with the ability to both communicate with local operators, managers and households as well as the design engineers and construction personnel are critical to appropriate improvements to the community's infrastructure. Few people or organizations have the "muddy boots" experience to develop realistic solutions.

A thorough examination of the nature of energy efficiency and how it relates to reliable and sustained operations requires personnel very familiar with the realities on the ground. This is the first and possibly the most important component of a sustainable solution.

Next, solutions need to be simplified and not rely upon the latest untested technology. Limited technical support normally exists in remote communities and the idea of factory warranties in this setting is a mirage. Exotic hardware is often inappropriate and unsustainable, and until thoroughly tested and proven it should be resisted. The critical aspect of engineered solutions is simplicity and operational support.

Organizations and funding agencies need to recognize the need for resources at all stages of project development. Funding of knowledgeable technical review at the conceptual stage of project's design, the quality control of the construction, sufficient commissioning and the warranty of projects, initial and subsequent periodic operator training, monitoring of performance and ultimately follow-up and adjustments are all needed for the best engineering to succeed. Projects must have the full support and understanding of not only the community but also the existing organizations that have a long-term connection with and provide technical assistance to the community. Typically these organizations are Tribal consortia, regional health corporations, the State Remote Maintenance Worker and Rural Utility Business Advisor programs, and regional boroughs. These organizations are critical to maintaining the institutional knowledge of how a system works, so new community operators or managers can be trained when local turnover occurs. Rural Alaska is full of examples of projects which soon failed because they were installed by organizations that did not have long-term connections with communities. Some of these projects were well engineered and constructed, but failed because of lack of local understanding, long term training, or turnover of staff. Similarly, technical assistance organizations without long term connections to communities can often do more damage than good in their well-meaning attempts to assist communities.

The heat recovery system in Deering is a great example of both of these. This system was installed with grant funding by a contractor to use otherwise wasted heat from the power plant to heat the community's washeteria. The contractor left Deering immediately after construction finished. Local operators were not adequately trained on the system, and so would occasionally turn up the washeteria boiler heat so clothes dryers would work faster. When the boiler heat was turned up, the recovered heat system flow reversed, which wasted fuel by moving heat from the washeteria boilers to the power plant. Then, an electric fan and radio blew this heat out of the building. During times when the boiler temperatures were turned down, the recovered heat system worked as designed and saved fuel however, a short time later, a separate short-term contractor was hired with grant money to perform an energy audit inside the Deering washeteria. This contractor arrived on a day the boiler temperatures were turned up, recognized the

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recovered heat system was working in reverse, completely disconnected the system, and then immediately left Deering. The system, constructed by one contractor with grant money, and disconnected by another contractor paid with grant money, now provided zero benefit to Deering. Two years later, **ANTHC discovered the issue, remodeled the system and did some other low cost energy improvements, reducing winter energy costs in Deering by over \$150 per household per month.** Had either contractor had a long-term connection with the local operators, these savings would have occurred years earlier.

Another example of well-intended but poorly delivered energy improvements occurred in Toksook Bay. Toksook Bay's power plant received grant money to install a recovered heat system some years ago. The contractor provided minimal operator training on the system, who had no idea how much fuel should be saved. Several years later, after **ANTHC reviewed the system controls, it was discovered that one of the pumps was never connected. Once connected to controls (a ½ hour job), the recovered heat system began working as designed and saved an additional \$18,000 in fuel per year.** Again, a contractor with a long-term connection with local operators would have soon discovered this error and saved tens of thousands of dollars in fuel.

In summary, successful energy projects in remote villages require design, construction and training by an organization that embraces a long term connection with the operators in that community. Projects will soon fail if they are built by contractors that come to the community, complete their work, then leave. Operational problems will inevitably arise, and if not supported with operator training and call-back support from someone trusted, the project will soon become ineffective.

If consistently funded and done in a systematic way, adequate operator training could also lead to opening specialized repair businesses in rural villages. If specialized skills and certifications were developed in local workers, they could become the go-to resource for the entire community. For example, a certified boiler maintenance worker could perform boiler maintenance at the water plant, health clinic, school, tribal office and airport equipment building. This would not only develop local skills and businesses, but also save agencies many thousands of dollars in travel costs currently used to transport specialized repair contractors to rural villages.

**U.S. Senate Committee on Energy and Natural Resources
Field Hearing on February 15, 2016: Energy Technology Innovation and
Deployment Opportunities for Alaska's Energy Future
Questions for the Record Submitted to Mr. Steve Gilbert**

Questions from Chairman Lisa Murkowski

Question 1: DOE & Federal Interaction

Can any of you share some real-life examples – both good and bad – of experiences that you have had collaborating with the federal government in working to plan, upgrade, revamp, or build energy projects in Alaska?

Following are examples of good and perhaps not so good experiences. The Denali Commission has been a good experience for AVEC. With the Denali Commission as a funding vehicle, AVEC has been able to upgrade roughly 1/3 of its tank farms and power plants with code compliant facilities. As a partner with the Commission AVEC has in many cases upgraded community fuel storage facilities at the same time. This unique collaboration leverages the Commissions funding to assure maximum benefit to remote rural communities.

On the less than favorable side, AVEC is currently seeking to license a small hydro power project on the southern tip of Kodiak Island at the community of Old Harbor. The license application process has been extremely long. It would seem unnecessarily long and expensive for such a tiny project. Additionally FERC is not adhering to its own schedule for issuing the license. The delay in issuing the license hampers AVEC's ability to seek funding for the next step which is construction ready design. Finally, FERC has signaled that it intends to license the project with one turbine instead of the two in the application even though no agency has objected. This will increase the cost in the future when AVEC seeks to add the second turbine.

Question 2: Top-Down Approach

I am sure you all have anecdotes about cases in Alaska where a well-meaning individual, agency, or company tried to install an energy project or upgrade in a village, but encountered some level of failure. In my experience, this often results from a top-down approach, which is problematic anywhere, but especially in Alaska and even more so in rural parts of our state. Would any of you care to explain some of the reasons why that's the case? And, from your experiences, what kind of approach *will* work and has worked in rural Alaska? For example, how do we increase the changes that an energy project in a remote village will enjoy sustained, long-term success?

There are examples where federal energy experts from outside of Alaska have attempted to either help from afar or who have come saying they have the answers (without taking the time to understand the challenges). Often agency representative come to rural communities only once with a preverbal "silver bullet" In those cases the subsequent projects have failed to produce the projected energy savings, proven to be unsustainable or both.

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In order to be successful the outside help has to become educated as to the challenges, ie: lack of infrastructure, lack of economies of scale, cost of transportation, cost of construction and long term maintenance of facilities. To overcome this lack knowledge, federal help needs to partner with Alaskan business with a history of building and operating in arctic and subarctic regions. The experience of those currently providing service to remote communities is essential to the success of projects.

AVEC's experience includes not only providing electric and recovered heat energy in the communities we serve; but also working with communities to develop business plans that call for the community to adopt and adhere to basic business practices in the operation and maintenance of facilities. The business plans are officially adopted by the communities, cities and corporations, and requires setting up of O&M, R&R and SRF accounts so that continued operation is self-funded at the community level.

**U.S. Senate Committee on Energy and Natural Resources
Field Hearing on February 15, 2016: Energy Technology Innovation
and Deployment Opportunities for Alaska's Energy Future
Questions for the Record Submitted to Mr. Jack Hébert**

Questions from Chairman Lisa Murkowski

As per your request the following (in blue) are my responses to Senator Murkowski's questions. I am deeply honored to be in the discussion and hope that I can continue contribute to a brighter future for the people of Alaska.

Quyana, Jack Hébert

Question 1: *Truss Plant and Partnership with CCHRC*

Mr. Hoffman and Mr. Hébert, I understand you have been working on a partnership to create a "truss plant" that could provide lumber to the Bethel region with a greatly reduced transportation cost. As you have pointed out, Mr. Hoffman, 60 percent of the cost of lumber in Bethel is the shipping cost from Seattle, and that cost could be closer to 3 percent if the lumber were manufactured locally. Can you tell me more about the status of this project, the partnership, and what's next? Mr. Hébert, I would appreciate your perspective as well.

Response:

As leadership at AVCP has communicated with you, CCHRC has been partnering with them to develop a truss manufacturing facility in Bethel. The facility is proposed to be located in a former fish processing building that has not been used for a number of years. CCHRC did an initial concept and estimate on what would be needed to improve the existing structure so that a productive truss operation could be commissioned. This business could be run by either AVCP or subcontracted to others. A pre-feasibility study for an Integrated Truss Plant and Sawmill Business Plan prepared by the University of Alaska Center for Economic Development led to the conclusion that a viable operation could indeed be established in Bethel. The economic benefits to the region will be significant. In addition, the facility could be expanded to create other value-added manufacturing for regional building needs. This could include a number of products with high demand given the critical need for more homes in the region, such as trim, doors and cabinetry. The potential for year-round employment of a local workforce is significant.

Since 2008, CCHRC has worked in more than a dozen communities around Alaska to design energy efficient, healthy, affordable housing that is appropriate for the climate and culture of the residents. These projects engage the community from design through the construction stage, including community design meetings, workforce training, and consulting and quality control throughout the construction and occupancy of the home. CCHRC has developed regional "prototype" homes that are tailored to geographic and climate conditions, helping communities construct demonstration homes that can be reproduced by local labor. For example, in 2014 CCHRC partnered with the Association of Village Council Presidents in Bethel to design and oversee construction of two "integrated truss" duplexes for the local aviation school. The "integrated truss" design reduces construction time and cost, and provides an energy efficient, airtight envelope that can withstand the wet, arctic climate of the region. As mentioned, CCHRC is now working with AVCP to develop a truss plant and local timber harvest operation in Bethel that would create local capacity and reduce the cost of building materials.

Ask:

A conceptual design and estimated renovation cost has been completed by CCHRC, which indicates a budget of **\$2.0 million** is required. The truss plant will utilize the abundant white

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spruce in the mid-upper Kuskokwim River for home construction in the Bethel and Kusilvak Census Areas. A commercial sawmill in Chuathbaluk will mill the logs utilized in this manufacturing process. This sawmill will require equipment modifications in the amount of \$250,000 in order to increase lumber production to supply the anticipated demand. This project will serve as an important source of economic development for the local community, Yukon-Kuskokwim villages, and Alaska overall with a potential economic output by year eleven of \$212 million dollars. Not only would the project create jobs and new income for the region, it would also allow production of integrated trusses to assemble high-quality homes specifically designed for an Arctic Climate.

Question 2: *DOE & Federal Interaction*

Can any of you share some real-life examples – both good and bad – of experiences that you have had collaborating with the federal government in working to plan, upgrade, revamp, or build energy projects in Alaska?

Response:

We agree with Association of Village Council Presidents that the recent creation of the Alaska DOE Office of Indian Energy (OIE) has been a positive step. The OIE, under the leadership of Chris Deschene, has been proactive in Alaska in creating a number of Community Energy Plans and Technical Assistance opportunities – such as the Holistic Approach to Sustainable Northern Communities being implemented in Oscarville. In particular, the effort of the lone OIE staff (Givey Kochanowski) has been remarkably productive. In rural Alaska in particular the development of collaborative relationships are essential for success. We strongly support the expansion of the Office of Indian Energy to assume a broader DOE mission in Alaska. This cannot be done without the addition of key staff to the Alaska Office. It is essential that these staff have established relationships with Rural Communities and their cultures. This depth of understanding cannot be acquired in a few years if residency. Preferably, any serious candidate to fill new positions should have deep roots in the Native Community. CCHRC's mission and that of DOE in Alaska complement each other. We look forward to many years of productive collaborations. Progress and success in addressing the daunting challenges facing Alaska will only be realized by a holistic approach, beginning at the community level, expanding through multi-agency stakeholder involvement, and embracing a shared deep commitment to the future of our people and the generations to follow. I cannot stress enough the importance that residents of Alaska lead these efforts.

Ask:

Hold the Secretary of Energy to his expressed pledge to increase the OIE staff in Alaska immediately. The need and opportunity are now. Alaskans must fill these positions with a direct connection to the Native and Rural Villages of the state. There is little time for a learning curve. This is also true of research that could be done in Alaska by existing institutions such as the Cold

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Climate Hosing Research Center, the Alaska Center for Energy and Power, or Renewable Energy Alaska Project.

Question 3: *Top-Down Approach*

I am sure you all have anecdotes about cases in Alaska where a well-meaning individual, agency, or company tried to install an energy project or upgrade in a village, but encountered some level of failure. In my experience, this often results from a top-down approach, which is problematic anywhere, but especially in Alaska and even more so in rural parts of our state. Would any of you care to explain some of the reasons why that's the case? And, from your experiences, what kind of approach will work and has worked in rural Alaska? For example, how do we increase the chances that an energy project in a remote village will enjoy sustained, long-term success?

Response:

In rural Alaska life is about connecting to one another – being engaged with community events and embracing change. When agencies develop projects in small communities around our state they usually come in, complete the job, and leave. They typically host one community meeting, hand out door prizes, and expect folks to grasp the upcoming project in a one-hour event. Most folks show up for the prizes, not the purpose or process. They may or may not learn anything in that one hour and often don't ask questions, especially if there are no locals involved. This is not the fault of an agency, but a cultural barrier. Rural Alaskans like to communicate with rural Alaskans – their culture has created a sense of security and trust in one another. The top-down approach simply does not create a personal, safe environment for folks to engage.

A more personal approach

Taking a more personal approach and valuing the community outreach component of project development is the only way to change how people receive and engage with agencies and contractors. Hiring a local or regional rural Alaskan to help with community meetings and education is vital to the sustainability of project development in rural communities. An education component is also vital to the sense of ownership of any energy project. By engaging with the local school, an agency or contractor can utilize younger generations to carry the message home to elders, siblings and other adults not wishing to engage at a community meeting. These young voices echo loudly and are truly underutilized. Engaging first with local leadership councils to create the environment for a community meeting also drives the success of a project. If the community feels like they are not part of the process, they most likely will not become "owners" of the project.

Sustainable energy projects in rural Alaska

Energy projects are very visual – solar panels, wind turbines, efficiency upgrades, etc. – They can be seen and sometimes felt. They affect the human factor and behavior of the people who interact with a energy project. If they do not understand the project, they most likely will fear it. With a thorough understanding of the cause/effect of an implemented project, a person is more likely to embrace it, learn more about it and protect it – creating the desired results. **A great example is the regional energy planning community outreach meetings. These meetings engaged local leadership to reach out to community members and encourage them to get involved. The schools allowed energy experts to engage and educate youth with presentations and skits on renewable energy technologies. The result was community feedback that became quantifiable data to the

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energy plan and community members who felt they had contributed to the process. The energy plan became a vital tool for future project prioritization and implementation. In the end, the sustainability of a project lies in the hands of the community members who live there. It is vital that their voices and ideas be part of the process.

Holistic Approach to sustainable Northern Communities

There are decades of examples where types of infrastructure and buildings funded by agencies have not performed well or passed the test of time. While well meaning, there is a historical disconnect from between agency priorities and a village's priorities. This lack of community engagement often begins during the planning stage, is present during the construction phase and continues in the operation and maintenance years. Efforts to create enduring and effective strategies and responses will only be successful if local involvement plays a lead role. Mentoring of village and regional leadership from the local and culturally connected population has been shown to be successful. An example is the Chenega Wind Group and its projects in the YK Delta. Building on successes is a positive way forward. This has proven true in housing as well. The engagement of the community in initial planning, design, and construction has created a sense of ownership, local economic contribution, outstanding energy performance, and lower cost. This video link (<https://www.youtube.com/watch?v=ztFHxpKtYGY>) illustrates one success story. As demonstrated in your recent visit to the community of Oscarville, community improvement projects are best executed by collaborative efforts between federal and state agencies and community stakeholders. Engaging local residents not only empowers the community but also diminishes the dependency on agency support. The "Holistic Approach to Sustainable Northern Communities" begins at the community level and involves all stakeholders in an inclusive, creative effort to find effective solutions to multiple challenges.

Ask:

Create a Sustainable Northern Communities Holistic Coordination Center. Funding this initiative will enable the Cold Climate Housing Research Center (CCHRC) and its partners to expand its proof-of-concept initiative to improve the efficiency and effectiveness of community development efforts in rural Alaska through: promoting more collaborative efforts between agencies and stakeholders; further engaging community members to apply their knowledge, skills, and resources to expand community development; and promoting entrepreneurship and capacity-building endeavors throughout rural Alaska to promote self-reliance and decrease community dependence on agency support. CCHRC's Fairbanks-based facility provides space to bring together experts in the fields of sustainability and resiliency, cultural vitality, building science and design, renewable energy, local workforce training, health, and regional economic development. The objectives of the Sustainable Northern Communities Holistic Coordination Initiative (the Project) will be met through the following activities:

- Work with communities to assess local resources and assets including alternative energy resources, economic resources, material resources, human capacity, and indigenous wisdom.
- Identify specific climatic, soil and logistic elements in the development of responsive design of the built environment including buildings, infrastructure, transportation, and waste management.

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- Identify critical elements of human and environmental health including air quality, water and sanitation, mental health, and cultural identities.
- Use resource, assets, and environmental assessments to develop a matrix that communities can use to define goals from environmental, economic, logistical, cultural, and educational perspectives.
- Stimulate local capacity in the population through entrepreneurship, workforce development, consumer education, and school curriculum development.
- Strategize to connect each field to create a holistic response to the challenges and barriers that rural Alaskan communities face.

CCHRC, in a recent application for an EDA i6 grant, estimated yearly costs for the Coordination Center to be \$375,000 per year. We were not successful but plan to resubmit in the next round.

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Questions from Chairman Lisa Murkowski

Question 1: Truss Plant and Partnership with CCHRC

Mr. Hoffman and Mr. Hebert, I understand you have been working on a partnership to create a “truss plant” that could provide lumber to the Bethel region with a greatly reduced transportation cost. As you have pointed out, Mr. Hoffman, 60 percent of the cost of lumber in Bethel is the shipping cost from Seattle, and that cost could be closer to 3 percent if the lumber were manufactured locally. Can you tell me more about the status of this project, the partnership, and what’s next? Mr. Hebert, I would appreciate your perspective as well.

Response to Question 1:

In reference to the attached 2009 Alaska Housing Assessment as prepared on behalf of the Alaska Housing Finance Corporation it was reported that in the AVCP region 40% of the homes are classified as “overcrowded” or “severely overcrowded.” In some communities, as high as 44% of homes are “1-star” energy rated, meaning that these home use at least 4 times as much energy than houses built to AHFC’s 2012 standards. A CCHRC study in Quinhagak, AK found 1/3 of the housing in their community was beyond the point of being salvageable with significant mold and subsidence issues.

Based upon this 2009 Alaska Housing Assessment, CCHRC prepared a Pre-feasibility Analysis for Developing and Operating a Truss Plant in Bethel, Alaska, that was funded by the Alaska Department of Commerce, Community & Economic Development.

In turn, this Pre-feasibility study lead to the attached Integrated Truss Plant and Sawmill Business Plan as prepared by the University of Alaska Center for Economic Development. These multiple feasibility studies have concluded that a proposed truss plant to be located in a vacant warehouse in Bethel is achievable.

A conceptual design and estimated renovation cost has been completed by CCHRC which indicates a budget of **\$2.0 million** is required. The truss plant will utilize the abundant white spruce in the mid-upper Kuskokwim River for home construction in the Bethel and Kusilvak Census Areas. A commercial sawmill in Chuathbaluk will mill the logs utilized in this manufacturing process. This sawmill will require equipment modifications in the amount of **\$250,000** in order to increase lumber production to supply the anticipated demand.

This project will serve as an important source of economic development for the local community, Yukon-Kuskokwim villages, and Alaska overall with a potential economic output by year eleven of \$212 million dollars. Not only would the project create jobs and new income for the region, it would also allow production of integrated trusses to

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assemble high-quality homes that were developed specifically to be affordable and energy efficient in an Arctic Climate.

Total Ask: \$2,250,000

Question 2: DOE & Federal Interaction

Can any of you share some real-life examples – both good and bad – of experiences that you have had collaborating with the federal government in working to plan, upgrade, revamp, or build energy projects in Alaska?

Response to Question 2:

While working with the tribes in collaboration with the federal government to plan, upgrade, revamp, or build energy projects in Alaska we've recognized that technical assistance is appreciated and very much a need, but another recognized need is for more retrofit and construction grants with a larger and more open eligibility criteria. This request is asked with consideration to the level of poverty, unemployment and cost of living in our tribal communities. The federally recognized tribes of our region have approximately 25% of our residents living in poverty versus the 2014 official poverty rate in the United States of approximately 15 %. (U.S. Census Bureau, 2014.) The unemployment rate for our region is approximately 18% versus the 5.5 % United States unemployment rate according to the Bureau of Labor Statistics.

Office of Indian Energy

The recent creation of the Alaska DOE Office of Indian Energy (OIE) has been a positive step. The OIE, under the leadership of Chris Dechene, has been proactive in Alaska where a number of Community Energy Plans were created and Technical Assistance provided – such as in the Holistic Approach to Sustainable Northern Communities being implemented in Oscarville. We support the expansion of the Office of Indian Energy in expanding its human capacity in the Alaska Office. This will assist the Tribes in energy planning efforts and provide technical assistance in implementing energy projects.

The OIE is presently underfunded at \$15.0 million and understaffed. In order to execute its mission in Indian Country of providing tribal technical assistance and funding energy projects in Alaska and the nation via a blend of grants and loans a fully funded budget in the amount of \$200 million is needed.

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Yukon Kuskokwim Freight Energy Corridor

On behalf of a request from the tribe of Kalskag, AVCP is developing the design of a freight energy corridor between the Yukon River and Kuskokwim Rivers. The goal is to improve commerce; reduce fuel and freight costs; and position the region for an Alaska natural gas economy. We are proud to note that our design study recently received an Engineering Excellence Honor Award in the Studies category during the recent annual convention of professional engineers in Alaska.

Ask: AVCP has completed 1/3 of the design of the Yukon Kuskokwim Freight Energy Corridor with funds from the State of Alaska, Denali Commission and our Tribes. We request the remaining 2/3 funding to complete the design and study phase of this project.

This is a request for \$10 Million.

Total Ask: \$210 million

Question 3: Top-Down Approach

I am sure you all have anecdotes about cases in Alaska where a well-meaning individual, agency, or company tried to install an energy project or upgrade in a village, but encountered some level of failure. In my experience, this often results from a top-down approach, which is problematic anywhere, but especially in Alaska and even more so in rural parts of our state. Would any of you care to explain some of the reasons why that's the case? And, from your experiences, what kind of approach *will* work and has worked in rural Alaska? For example, how do we increase the chances that an energy project in a remote village will enjoy sustained, long-term success?

Response to Question 3:

In AVCP's experience, an approach that does not work is one where an outside agency comes in and tells the community what needs to be done. A good example is the Tulusak power generation issues whereby lack of workforce development and lack of input from the community for solutions has resulted in several electrical power outages necessitating emergency responses from various agencies as well as the procurement of electrical generators as a short-term solution.

Another example of a Top/Down effort is the State of Alaska's "Roads to Resources" proposed 220 mile road/rail line in the Ambler Mining District in Northwest Alaska. To date over \$26.0 million has been appropriated to the project by the State of Alaska, which has received strong support from the mining companies but has met considerable resistance from tribes living in the area who maintain a subsistence lifestyle – collecting

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berries in the summer, fish for salmon and other freshwater species, and hunt caribou, moose and bears for food. Industrialization of this sensitive area could have adverse impacts to water resources, wildlife habitat and subsistence resources.

As demonstrated in your recent visit to the community of Oscarville, community improvement projects are best executed when collaborative efforts between federal and state agencies and community stakeholders are incorporated. When community members are engaged to apply their knowledge, skills, and resources to improve their quality of life self-reliance and self-determination are promoted thereby diminishing the dependency on agency support.

Established organizations in Alaska such as the Association of Village Council Presidents (AVCP), Cold Climate Housing Research Center (CCHRC), DOE's Office of Indian Energy, and the Alaska Native Tribal Health Consortium (ANTHC), have a long history of leveraging limited resources, while overcoming logistical constraints to successfully complete projects.

Ask: What will work and has worked is the Holistic Approach to Sustainable Northern Communities. This is a pilot coordination effort in Oscarville, Alaska, that brings together the community, as well as State and federal agencies to create connections regarding the resolution of the needs of the community. Collaboration on housing, energy, infrastructure, water/sewer, health and economic development lead to a sustainable healthy community.

The Holistic Approach to Sustainable Northern Communities is successful and is a statewide model for sustainable community development. AVCP in partnership with the Cold Climate Housing Research Center (CCHRC) has facilitated the development of this model through the leveraging of its partners to provide financial assistance to provide community outreach. In order to continue the success of this model AVCP in partnership with CCHRC requests annual funding in the amount of \$275,000 for 5 years to continue our efforts to help create a template that will assist our communities to reduce energy consumption as well as improve the quality of life in the AVCP Region.

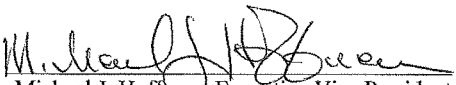
Ask: \$1,375,000.

The AVCP Tribal Community Resource Center presently provides limited technical assistance to the AVCP tribes regarding the completion of grant applications as well as community planning and initial project management regarding energy sector projects. In order to accomplish our goal of continued information sharing, education and capacity building to the tribes, additional staff are needed as well as administrative support funds.

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The staffing needs are as follows: Assistant Director along with a Community Specialist in the Lower Yukon River area, the Lower Kuskokwim River area and the Interior Rivers area. Annual funding of \$450 k for 5 years is requested.

Ask: \$2,250,000

Submitted by: 
Michael J. Hoffman, Executive Vice President
Association of Village Council Presidents
POB 219
Bethel, AK 99559

Date: 3-3-16

Alaska Housing Finance Corporation 2009 Alaska Housing Assessment

DECEMBER 2009 | PART I



Prepared for

COLD CLIMATE HOUSING RESEARCH CENTER
& ALASKA HOUSING FINANCE CORPORATION

 **Information Insights**
Fairbanks + Anchorage

**Alaska Housing Finance Corporation
2009 Alaska Housing Assessment**

DECEMBER 2009 | PART I

We express grateful appreciation to all the Alaskans who agreed to complete the statewide housing survey.

Prepared for

Cold Climate Housing Research Center
1000 Fairbanks Street
P.O. Box 82489
Fairbanks, AK 99708

Alaska Housing Finance Corporation
P.O. Box 101020
Anchorage, AK 99510

Prepared by

Information Insights, Inc.

Project Lead: Cady Lister
Research Analyst: Indra Arriaga
Survey Lead: Sylvan Robb
Publication Design & Editing: Jana Peirce
Data Cleaning & Entry: Nancy Lowe

Corporate Office

212 Front Street, Suite 100
Fairbanks, Alaska 99701

Anchorage Office

429 L Street
Anchorage, Alaska 99501

www.infoinsights.com
info@infoinsights.com



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Executive Summary

A NOTE FROM THE AUTHORS ON LIMITATIONS

The purpose of the 2009 Housing Assessment is to paint a picture of the condition and energy use of the current housing stock in Alaska. The study focus is on the condition of the housing unit and energy consumption and pays only cursory attention to the inhabitants of those units. One important exception is an estimate of conditions of overcrowding, a long standing issue in Alaska housing.

Our estimates of need for new housing units are based solely on alleviating overcrowded conditions and replacing severely substandard housing. The project team recognizes that there are many variables, social, economic, climatic, that play a role in an individual and/or a family's ability to access and maintain safe and affordable housing. It was not within the scope of this report to consider all of these variables.

The estimates of need are not comprehensive and should not be interpreted as such. They do, however provide some valuable direction in solving issue of overcrowding, severely substandard housing and providing estimates of homes that could benefit from weatherization services.

This 2009 Alaska Housing Assessment provides an overview of housing stock in Alaska. The purpose of the study is to assist in determining the condition of that stock so that policy makers and builders can make informed decisions about where the need is greatest. This study follows two similar studies, one in 1990 and another in 2005.

The primary difference between this study and the one conducted in 2005 is the shift in focus from the resident of the housing unit to the housing unit itself. The winter of 2008/2009 taught all of Alaska just how vulnerable we are to heating fuel price fluctuations that are beyond our control. High fuel prices sparked a renewed interest in reducing energy used for space heating, thus lowering bills and creating environmental benefit.

The information presented in this study derives from a variety of sources. Major sources include but are by no means limited to the list below:

Executive Summary

- 2000 U.S. Census
- 1990 U.S. Census
- 1980 U.S. Census
- Weatherization data provided by Alaska Housing Finance Corporation (AHFC)
- Alaska Home Energy Rebate program data provided by AHFC
- Data from 11 of the Alaska Native Regional Housing Authorities (RHA)
- Telephone survey of nearly 1,700 households statewide, conducted by Information Insights
- Department of Labor and Workforce Development Research Section
- Alaska Housing Market Indicator Reports, 2000 through 2007, published quarterly
- Native American Housing and Self Determination Act Recipient Data provided by the Department of Housing and Urban Development Office of Native American Programs and Alaska Native Regional Housing Authorities

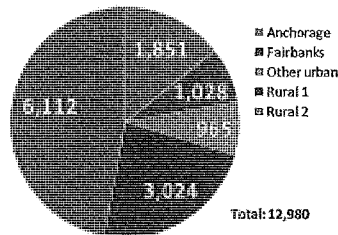
Key Findings

Major findings of the study include an estimate of the need for new housing in the state based on current overcrowding and the condition of existing housing units. Data gathered from nearly 1,700 households statewide on residential heating fuel use and energy costs also provided the basis for estimating energy consumption for home heating for different types of community and regions of the state.

TOTAL NEED FOR NEW UNITS

The 2009 Housing Assessment estimates a need for 12,980 new housing units to meet demand created by overcrowded conditions and houses that are severely substandard. Almost half (47.1 percent) of new housing is needed in smaller and more remote rural communities (designated as Rural 2 in this study). Almost another quarter (23.3 percent) are in other rural communities, including larger communities off the road system as well as small communities on the road system (designated as Rural 1). The remaining housing units are needed in Anchorage (14.3 percent), Fairbanks (7.9 percent) and other Urban areas (7.4 percent).

Figure 1: Need for new housing by community level



OVERCROWDING

Calling a household overcrowded is somewhat subjective; we provide high, medium and low estimates in the bulleted lists below. Estimates of overcrowded conditions are defined as high (150 square feet per resident), medium (200 square feet per resident) and low (300 square feet per resident). Final estimates of need are based on the medium definition of overcrowding.

The 2009 estimates of overcrowding are roughly half that found in the 2005 housing assessment. The significant decrease is attributable to a more sophisticated methodology used in this study. The 1991 and 2005 housing assessment studies estimated of overcrowding by applying a single percentage to the state or Native region housing stock number to arrive at an estimate of overcrowded units. The total number of housing units estimated to be overcrowded in these two studies hovered around 20,000 units. If we apply this same methodology to the 2009 housing assessment we arrive at a number just under 20,000 units (18,428 to be exact).

However, the project team believes this number to be inflated by oversampling in rural areas and then applying the resulting percentage (of overcrowded units) to the state as a whole or to Alaska Native region housing stock even though the majority of housing units are located in urban communities - where overcrowding is far less common. The 2009 estimates of overcrowded housing units in primarily rural areas did not see as significant a change from 2005 estimates as the change we see in areas that include urban communities.

In estimating overcrowding for the 2009 housing assessment, we looked at the percentage of overcrowded units by community level (Urban, Rural 1, Rural 2, etc.) and applied those percentages to the estimated housing stock based on the proportion in each community level within a region. It is a subtle change in methodology that created a significant change in output. We believe that the number of overcrowded units derived from the new methodology (9,946) is more accurate, and it has been used as the basis to determine housing need based on overcrowding in this report.

High overcrowding (Less than 150 square feet per person = overcrowded)

- 1.6 percent of households in Alaska have fewer than 150 square feet per resident
- There are roughly 4,500 homes in Alaska with fewer than 150 square feet per resident and 74.9 percent of them are located in Rural 2 communities. These are the smallest and most isolated villages in Alaska.
- The remainder of these homes are relatively evenly split between Rural 1 and Urban communities.

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Medium overcrowding (Less than 200 square feet per person = overcrowded)

- 3.5 percent of households in Alaska have fewer than 200 square feet per resident.
- There are nearly 10,000 households statewide with fewer than 200 square feet per resident and 48.9 percent of them are located in Rural 2 communities.
- More than 20 percent – or one out of five – of all homes in Rural 2 communities report overcrowded conditions, representing nearly half of all homes in the state with fewer than 200 square feet per resident.
- The remainder of overcrowded homes are relatively evenly split between Rural 1 and Urban communities; about a quarter of the remaining overcrowded homes in Urban and a quarter in Rural 1 communities.

Low overcrowding (Less than 300 square feet per resident = overcrowded)

- 10.5 percent of households in Alaska statewide have fewer than 300 square feet per resident; this represents nearly 30,000 housing units.
- A little less than half – 14,188 units – of these homes are in Urban Alaska. The remainder of overcrowded homes by this definition are split between Rural 1 – 7,135 units – and Rural 2 – 8,402 units – communities with 24 percent and 28 percent respectively.

What is clear from these findings (and is consistent with earlier housing assessments) is that very remote, small communities that are not on the highway system (either road or marine) have much higher levels of overcrowding than larger, connected and urban communities. It is worth noting that while there is the least amount (in terms of a percentage of total) of overcrowding in Urban areas, Rural 1 communities report only a slightly higher proportion of overcrowding overall.

An estimated 9.4 percent of overcrowded housing units are ALSO falling apart; duplicates are removed from estimate of total need for new housing units.

UNSALVAGEABLE CONDITION

The other primary driver used in estimating housing need is the determination that a housing unit is so substandard that it is unsalvageable. Survey results on condition of home indicate that 1.4 percent, or just under 4,000 housing units are unsalvageable statewide. This is a little more than 500 units lower than the 2005 survey results that estimated need due to condition at 4,500 units statewide.

This apparent drop is directly attributable to the new focus on the housing unit and away from the resident living within. The 2005 survey included questions about whether the home had repairs that the owner was unable to make. If this was the case the home was determined to be substandard and in need of replacement. In truth, much of the time when a home has repairs that the homeowner is unable to make, the unit is unsalvageable for economic reasons not reasons associated with the condition of the home.

- 1.4 percent (or 3,972) of homes statewide are estimated to be “falling apart”
- Sixty-three percent of homes that are “falling apart” are in rural Alaska, most of them in the most remote Rural 2 communities.

HOUSING SIZE AND AGE

- **Very small houses:** Rural 2 communities have a high proportion of small houses – 12.5 percent of homes are less than 500 square feet. Less than one percent of the housing stock in Anchorage falls into this size category.
- **Small houses:** The largest proportion of houses that are 501 to 1,000 sq ft are located in Rural 2 communities where nearly 37 percent of all units fall into this range. All other types of communities have housing stock that is comprised of between 12 and 17 percent of housing units in this size range.
- **Medium houses:** Roughly half of all housing units in Anchorage, Fairbanks, other Urban and Rural 1 communities are between 1,001 and 2,000 square feet. Just under 40 percent of housing units in Rural 2 communities are also this size.
- **Large houses:** The largest proportion of large (greater than 2,000 sq ft) houses in the state are in Anchorage (40.9 percent) followed by other Urban communities (37.4 percent) and Fairbanks (33.6 percent.) Only 10.8 percent of homes in Rural 2 communities are larger than 2,000 square feet.

Survey respondents reported a good proportion of new homes (zero to ten years) in all communities with the exception of Anchorage. The real numbers of new housing units is largest in Anchorage but as a percentage of total housing stock these units represent only about eight percent. Anchorage has the largest proportion of housing that is 21 years and older, with 80 percent of housing stock within the municipality of Anchorage falling into this category.

HOUSING CONDITIONS

Most housing units in Alaska are in relatively good shape. Survey respondents reported their homes to be like new, in good shape, or in need of minor repair the majority of the time, even in Rural 2 communities.

- The largest proportion of housing units determined to be “falling apart” are in Rural 2 communities (7.2 percent of all housing within the Rural 2 classification.)
- Falling apart housing units in Rural 2 communities represent 43 percent of all units estimated to be falling apart statewide – a disproportionately high number compared to the proportion of total housing stock located in these communities.
- An additional 25 percent of homes in Rural 2 communities are in need of major repair (5,976 actual units.)
- There are an estimated 23,475 housing units in need of major repair in statewide

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- All of the Urban communities and the Rural 1 communities reported at least 89.6 percent of their housing stock was like new, in good shape or in need of minor repair. Rural 1 communities had a slightly higher rate (9.1 percent) of housing in need of major repair than Urban communities.

FINDINGS BY NATIVE REGION

Statistically significant findings are used to estimate need for Calista, Cook Inlet, Doyon and Sealaska regions. These regions encompass nearly 90 percent of total housing stock statewide. Estimates based on statistically significant findings by level of community are used to estimate need in the remaining Alaska Native regions.

The Native region with the greatest level of need is the Calista region in western Alaska. This region includes some of the poorest communities in Alaska and has long stood out an area in need of, amongst other things, adequate housing.

- 31 percent of housing units in Calista region are overcrowded (200 square feet or fewer per person)
- Nine percent of housing units in Calista region are perceived by their inhabitants to be falling apart.
- The greatest need by sheer numbers exists in the Cook Inlet region where there is need for an estimated 4,161 new units.

ENERGY USE

Energy consumption for space heating accounts for about 45 percent¹ of all energy used to run a home in Alaska. How much energy is consumed depends on several factors: climate, condition and size of the home and the behavior of the homeowner. The table below shows the heating degree days for four Alaska locations and two lower 48 locations for comparative purposes. The numbers displayed are not surprising, Barrow has more than twice as many heating degree days as Juneau and all Alaska locations are higher than the lower 48 locations.

Table 1: Heating degree days by location

Location	Heating degree days
Barrow	20,226
Fairbanks	13,940
Anchorage	10,570
Juneau	8,897
New England	6,752
Seattle	4,908

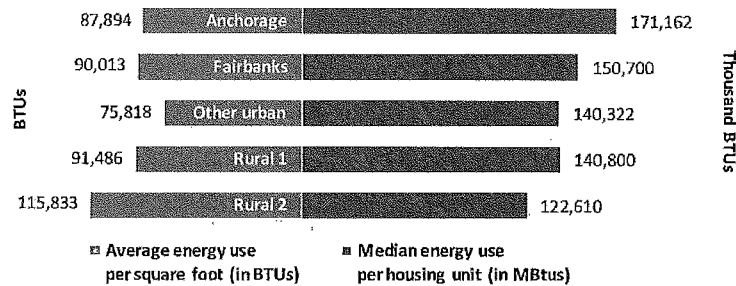
The statewide survey conducted as part of this project asked residents to talk about their energy consumption for space heat, including both primary and secondary fuel sources where applicable. Survey respondents had varying levels of knowledge

¹ This figure is derived from analysis of the Alaska Retrofit Information System

about their household energy consumption, but respondents who were unable to provide energy consumption in units of fuel were most often able to report dollars spent. This information was then translated into British thermal units (BTUs) for purposes of comparison.

Residents of communities in rural Alaska consume the highest average number of BTUs per square foot (BTU/ft²) for space heating. The “Other urban” community classification has the lowest. Keep in mind that most housing units in this classification are in Southeast and Southcentral Alaska where the climate is more temperate. The amount of energy used for space heating for each community type is shown in Figure 2. Looking only at BTUs per square foot (the blue bars), it would appear that households in Alaska’s smallest and most remote communities are the largest energy consumers.

Figure 2: Energy use for space heating by community level



Notes: Most of the housing units in “Other urban” communities are in Southeast and Southcentral Alaska, where the climate is more temperate. Energy use per square foot is given in BTUs. Energy use per housing unit is provided in thousand BTUs.

However, the picture changes when we look at energy consumption per housing unit (the red bars). The average Anchorage household uses more energy for space heating than any other part of the state, while units in Rural 2 communities use the least. These seemingly incongruent figures are explained entirely by the fact that, on average, homes are largest in Anchorage and smallest in Rural 2 communities. The median size of a home in Anchorage is more than 900 square feet larger than the median-size home in a Rural 2 community; 900 square feet is a significant amount of additional space to heat.

Not surprisingly Alaska homes utilize more energy for space heat than their lower-48 counterparts. The average home in New England uses only 85.4 MBtu (million BTUs) for space heating, compared to 150.7 MBtu in Fairbanks.

The median cost of fuel reported by survey respondents is in keeping with these findings and with what we know about the cost of different heating fuels. The typical natural gas user has bills that are slightly less than half the annual cost of the

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average heating oil user. Electricity, coal and wood are also more cost effective than heating oil, but more costly than natural gas.

It is worth noting that the most expensive heating fuel to use is also the most geographically widespread in Alaska. Heating oil is available in all parts of the state and is used as the primary heat source in the majority of rural communities as well as in Fairbanks and Southeast Alaska. Natural gas is widely available to a large portion of the state population since it is the common space heating fuel for Anchorage, the Mat-Su core area, and the Kenai Peninsula Borough.

WEATHERIZATION

There are more than 27,700² housing units estimated statewide to be in need of weatherization services because residents are unable to maintain a comfortable indoor temperature during the coldest parts of winter. The ability to maintain temperature is a function of both housing condition and socioeconomic status of its inhabitants. Study findings related to weatherization include:

- One in five homes in Rural 2 communities report being unable to maintain a comfortable room temperature during winter.
- An estimated 7.1 percent, or nearly 8,000 homes, in Anchorage are unable to maintain room temperature during winter.
- More than 115, 000 housing units statewide are believed to be “drafty” (defined here as wind coming through the windows, door or floor).

ALASKA HOME ENERGY REBATE

It is difficult to provide an estimate of the number of housing units that could benefit from the home energy rebate program because it is likely that nearly every house in Alaska could see some benefit from participating in the program. We can say with some confidence that at least the estimated 115,000 homes that are believed to be drafty would see substantial benefit from participation in the program.

The project team analyzed the records of 368 housing units that have completed the program – that is: they have had their initial (as-is) rating, they have done the improvements suggested by their energy rater, and they have had their post improvement rating to measure the how much more efficiently their home is using energy. Findings from this analysis of homes completing the rebate program include:

- The average home moved from a 2.7 star home to a 3.8 star home.
- The average reduction in energy costs is 30 percent.
- Homes saw an average reduction of 45 percent in the energy used to run their space-heating appliances (e.g. furnace, stove, etc.)

² Not all of these housing units are occupied by residents who qualify for the weatherization program. The number of homes estimated to be both in need of services *and* financially eligible for the program is presented in the weatherization section within the body of the report.

Introduction

The purpose of the 2009 Housing Assessment is to provide a snapshot of housing stock, condition and energy use in Alaska. This 2009 Alaska Housing Assessment updates the 2005 assessment with some important differences. The 2005 study focused on the inhabitants of the housing units whereas this study aims to focus more attention on the unit itself. For this reason there were more questions on the survey related to energy consumption, taking the place of questions about resident satisfaction with housing, rental/owner status, etc.

Data Sources

The project team gathered information on housing variables including condition, energy consumption, and limited demographics of residents through a survey of nearly 1,700 households. The study uses updated housing unit data from the 2000 U.S. census³, the Alaska Housing Market Indicators report, and information provided by regional housing authorities to create a baseline estimate of housing stock.

Information on housing construction in rural Alaska has been derived primarily from data provided by Alaska Native Regional Housing Authorities that are recipients of Native American Housing Assistance and Self Determination Act (NAHASDA) funds. Congress passed NAHASDA in 1996, empowering Tribes by giving them direct access to money intended to improve housing for Alaska Native/American Indian people. Since that time recipients of NAHASDA funds have built the majority of new housing in rural Alaska.

New unit construction reported for rural areas by regional housing authorities was compared to information on new housing units gathered by the State of Alaska. Where there was disparity it was generally the case that the state had no record of anything being built and the housing authority had record of building units. In these cases the housing authority numbers were used.

Report Organization

This report is organized in two parts. Part I of the report contains:

³ Note that the 2000 census housing stock numbers have been updated by community through the appeal process. Many communities in Alaska (particularly in rural areas) successfully appeal the findings of the census. The most recent numbers available are the ones used in this report, this means that our regional numbers do not always exactly match the regional numbers published in the 2000 census.

Introduction

- An executive summary of results
- A detailed description of the methodology utilized to perform household surveys and assess need
- Highlights of salient findings and a general overview in narrative form
- Population dynamics
- Cost of construction around the state
- Details of income by population and housing variables
- Analysis of weatherization activity
- Analysis of Alaska Home Energy Rebate program activity
- Estimates of housing stock and condition detailed by community classification and Alaska Native region

Part II of the report includes three appendices:

- Explanation of levels of community used in public health and a list by community of the classifications used in this study
- Completed survey counts
- Frequency tables from the survey

Definitions

Estimating housing need is based on survey findings that indicate conditions of overcrowding and severely substandard housing.

- **Overcrowding** is defined as a household with 200 square feet or fewer per resident.
- **Substandard housing** is broken into two categories, that which is salvageable and that which is not. The units that are determined to be beyond repair prompt a new housing unit. Substandard housing units that are determined to be salvageable prompt need for repair and renovation.
- **Weatherization** – An estimate of need for weatherization services is provided and is based on survey respondents indicating that they were unable to maintain a comfortable room temperature during the coldest days of winter.

Estimates of housing stock and housing need are broken out by community type. Alaska communities were first divided into three classifications by remoteness and size: Urban, Rural 1, and Rural 2. The Urban community type was further broken down into Anchorage, Fairbanks, and Other. These five community types or levels are described below:

- **Anchorage** includes the Municipality of Anchorage
- **Fairbanks** includes the Fairbanks North Star Borough
- **Other urban** includes highway-connected large towns, small cities and urban centers
- **Rural 1** includes highway-connected villages and off-road regional hubs
- **Rural 2** includes the smallest and most isolated communities in Alaska, all of which are off the road system

These community classifications stratify the state according to the variables that most impact access to quality housing: transportation, access to skilled labor, a viable housing market, and economic activity. Anchorage and Fairbanks are broken out of the Urban category because they represent such a large percentage of the state population and thus skew findings for other urban areas. A detailed description of the methodology behind the community classifications can be found in the methodology section and a complete listing of communities and their classifications is included in the appendices.

Estimates of housing stock and need are also outlined for each of the Alaska Native regions. Statistically significant survey data was collected for the largest regions and was used to estimate need. For the smaller regions, findings from the appropriate community classification were applied to the regional housing stock (i.e. if a regions' housing stock is 58 percent in Rural 1 communities and 42 percent in Rural 2 communities then findings relevant to those community classifications are applied to the appropriate housing stock numbers in the region.)

We do not try to estimate the gross cost associated with new units, or repair and renovation. Past studies have used Anchorage as a baseline for determining costs and made adjustments to cost by region depending on how much more or less transportation costs are in relation to Anchorage. This method is problematic at best, even within regions there is vast variability in costs mostly associated with transportation and access to skilled labor. The report does include a section on construction and transportation costs which outline costs in select locations around the state.

Methodology

The 2009 Alaska Housing Assessment provides a synthesis of existing housing data and new data resulting from a statewide telephone survey. The final report describes the housing situation in Alaska in a variety of ways, striving to be accessible and understandable. It represents the culmination of a range of tasks performed by the project team:

- Gathering, organizing and analyzing existing data and other useful information.
- Analysis of information provided by Alaska Native Housing Authorities.
- Redesigning the household survey tool to glean more information on the housing unit.
- Conducting nearly 1,700 household surveys in rural and urban Alaska.
- Analyzing the survey data.
- Analyzing AHFC Weatherization and AK Rebate data.
- Producing estimates of current housing stock.
- Producing estimates of housing stock condition.
- Producing estimates of need.

Sample Selection and Community Classification

The telephone survey included selected communities around that state. First, all communities were designated as Urban, Rural 1 or Rural 2. To achieve this classification we started with the five levels of community designations used by Alaska public health that were then collapsed into three community types. Given that this survey was focused on housing issues and much of the cost of housing is related to the difficulty and expense of transporting building materials to the communities, the primary variables driving classification are population and accessibility. A table explaining the public health levels of community is included in the appendices, along with tables listing each Alaska community and its associated classification.

Urban communities include Level 3 communities on the road system and all Level 4 and 5 communities in the public health categories. All Urban communities must be on the highway system (either road or marine), including:

- Highway sub-regional communities
- Large town or regional centers
- Small cities

- Urban centers

Rural 1 communities include Level 1 and Level 2 communities on the highway and Level 3 communities off the highway of the public health categories. These communities may be on or off the highway system. This includes:

- Highway villages
- Off-road regional hubs
- Isolated sub-regional communities

Rural 2 communities include Level 1 and 2 communities off the highway from the public health categories. No communities on the road system could be Rural 2 for our purposes. Rural 2 includes:

- Isolated villages

Because we wanted to be able to analyze the data for the Anchorage and Fairbanks urban areas, all communities in the Municipality of Anchorage (Eagle River and Girdwood) and all those in the Fairbanks North Star Borough (Chatanika, Ester, Fox, and Salcha) were categorized as Urban. Additionally, the status of communities that are on the road system for a portion of the year were determined on an individual basis. Communities that are accessible only by ice roads in the winter such as Evansville or Bettles were not considered to be road-system communities. However Eagle, which has road access in the summer, was treated as an on-road community.

The goal of the sample was to provide a statistically representative sample for each of the community levels (Urban, Rural 1 and Rural 2) as well as surveying enough households in the Municipality of Anchorage and the Fairbanks North Star Borough to ensure those areas had a representative sample. We used the 12 Native Corporation regions to ensure that within each community level we had as much statewide representation as possible.

The methodology described below was applied to each community level for the survey sample (e.g. Urban, Rural 1 and Rural 2). The first step was to sort all communities in the state into the Urban, Rural 1 and Rural 2 categories. The communities in each of those categories were then sorted by Native Corporation region. The total population for each community level (Urban, Rural 1 and Rural 2) was calculated. We then calculated the percentage of the population in each community level in each Native corporation region (e.g. the total population of Rural 1 communities statewide was 140,591 and communities in the Doyon region accounted for 7 percent of that population). Thus since we needed 383 completed surveys from Rural 1, we wanted 7 percent of those, or 26 surveys, to be from Doyon Rural 1 communities.

Within each Native corporation region the communities were ordered according to population. Then six communities were selected from the list; the number six was based on nothing but what felt like a reasonable compromise between representation and convenience. Obviously, for those Native Corporation regions

Methodology

with six or fewer communities at that level, all communities were selected. For those Native corporation regions with more than six communities, every n^{th} community was selected to reach six. (We tried to keep the selections even—for example, in those regions with 8 communities to choose from we selected the first and second communities on the list, skipped the third, selected the fourth and fifth, skipped the sixth, and selected the seventh and eighth).

In order to decide how many numbers to pull from each community selected, we tallied the population for the six selected communities. We then calculated the percentage of the selected communities' total population represented by each selected community. (E.g. Fort Yukon's population equals 60 percent of the total population from the six selected Doyon communities.) We then calculated the number of needed phone numbers that represented (e.g. if Doyon needed 1,000 phone numbers total, I figured out that we needed 600 numbers from Fort Yukon.) We agreed that for any selected community for which we could not obtain a telephone book, we would just drop to the next community on the list and take the same number of phone numbers from that community instead. We did not select any communities with a population of zero.

Statewide Survey Methodology

Telephone calls were made to call lists of randomly selected residents in the selected communities. Telephone numbers for the urban areas of Anchorage, Fairbanks and Juneau were obtained from the Polk Directory for the area that is updated every three months. Telephone numbers for other areas were selected from the some recent edition of the telephone book for each area. Calls took place from October 6th to November 3rd from 6:30 to 9:00 p.m. Approximately 7,365 calls were made resulting in 1,698 completed surveys. A total of 16 of our trained survey callers made calls.

DEVELOPMENT OF SURVEY QUESTIONS

The survey tool was designed to obtain information on:

- The demographics of household members
- Household size and conditions
- Costs associated with maintaining space heat in the household

Information Insights developed the survey tool with input from the Cold Climate Housing Research Center and the Alaska Housing Finance Corporation.

SURVEY IMPLEMENTATION AND LIMITATIONS

Number of Calls Made: Approximately 7,365 calls were made over the four-week period. Of these, there were 1,136 (15 percent) invalid numbers or numbers without an eligible participant, 2,573 (34 percent) numbers where no one answered, 1,881 (25 percent) individuals who answered but chose not to participate in the survey, 332 (4 percent) people who asked to be called back at a

different time but didn't complete the survey, and 1,698 (22 percent) completed surveys.

- Number completed: **1,698**
- Response rate: **22 percent**

The Alaska Department of Commerce, Community, and Economic Development (DCCED) 2007 certified populations were used for all communities. While landline phones are typically allocated by household not by person, the sample was developed based on population. DCCED does not provide numbers of households; the U.S. Census Bureau does not provide estimates of households only the actual count conducted every decade. Thus we used population figures since they were the most current even though that might have led to slightly over sampling. Per DCCED the population for the state is 629,163. The population in Urban communities was 438,227. We gathered 384 completed surveys. The population in the Rural 1 communities was 140,591. We gathered 383 completed surveys. The population in the Rural 2 communities was 50,345. We gathered 381 completed surveys. The population of the Municipality of Anchorage was 283,938. We gathered 384 completed surveys. The population of the Fairbanks North Star Borough was 96,888. We gathered 383 completed surveys. The sample sizes for each of these areas provides a confidence interval of plus or minus 5.0 with a confidence level of 95 percent.

The survey information is limited to application in estimating overall housing condition by the classifications of Rural 1, Rural 2, Urban, Anchorage and Fairbanks North Star Borough. This method of classifying communities in the state makes sense for housing as the variables considered are that that impact cost of construction and access to skilled labor. There is also a strong correlation across the state between communities within each classification in terms of other economic indicators such as income and education.

ANALYSIS OF SURVEY DATA

Information Insights staff provided analysis of survey data in narrative, picture and spreadsheet formats.

Analysis of Energy Rating and Alaska Rebate data

Information Insights staff uploaded 1997 and 1998 energy rating data into the new AHFC database, the Alaska Retrofit Information System; 2007 and 2008 data were already in the system. The 1997 and 1998 data record count was reflected in the total number of ratings in the system; however, needed programming changes in order to integrate decade-old data into the database were not completed in time for this report, rendering the 1997 and 1998 records "null" and therefore unusable for this analysis.

AHFC is in the process of integrating all energy rating data into the new database, at which time it will be possible to perform analysis on the entire dataset. The project

Methodology

team highly recommends performing this analysis as it will include tens of thousands of records and allow policy makers and planners to dissect the data in multiple ways and refine their understanding of the variables that effect household energy consumption in Alaska.

The initial data for the four years was first cleansed of “true” duplicates, that is, duplicate records that matched on every variable. The remaining data was then separated by year and summaries were compiled, 1997 and 1998 data were excluded from the summary analysis as the variable fields were null.

2007 and 2008 data were parsed out by the respective year. Records that showed all data as ‘null’ were excluded from analysis. Records that were partially ‘null’ were left in the dataset but only included where relevant. The decades were further analyzed for duplicates. While the first duplicate check matched data on all fields, the second duplicate check matched on First Name, Last Name, Address, Home City, Rating Type and Rating date. The data was then manually checked for duplicates a third time looking at address, first name and last name. Where the address field contained “na” or “wrong address” and there were no other indications that could differentiate reliably between these, these data were also excluded for analysis. Where the same record existed more than once and differed by rating date, the later date was kept and the earlier dates excluded.

Housing units were grouped by decade range in which they were built and then totaled. Average square footage was then derived by decade. In some cases, the “year built” was in the future of the rating date, given the illogical data, these were excluded from analysis.

Regional Native Corporation boundary information was added to each of the records in the 2007 and 2008 dataset and the data presented by these regions. In this particular dataset, there are no records matching the Arctic Slope region. That is not to say that there were no ratings in the region for 2007 and 2008, but rather that in a dataset that excludes incomplete, illogical or null data, no records for the Arctic Slope made it through the process. Another limitation of the dataset is that the frequency of ratings is not equally distributed across the state, making data analysis of the rural areas less reliable; in cases where only a couple of records by fuel type exist, making comparisons is inadvisable.

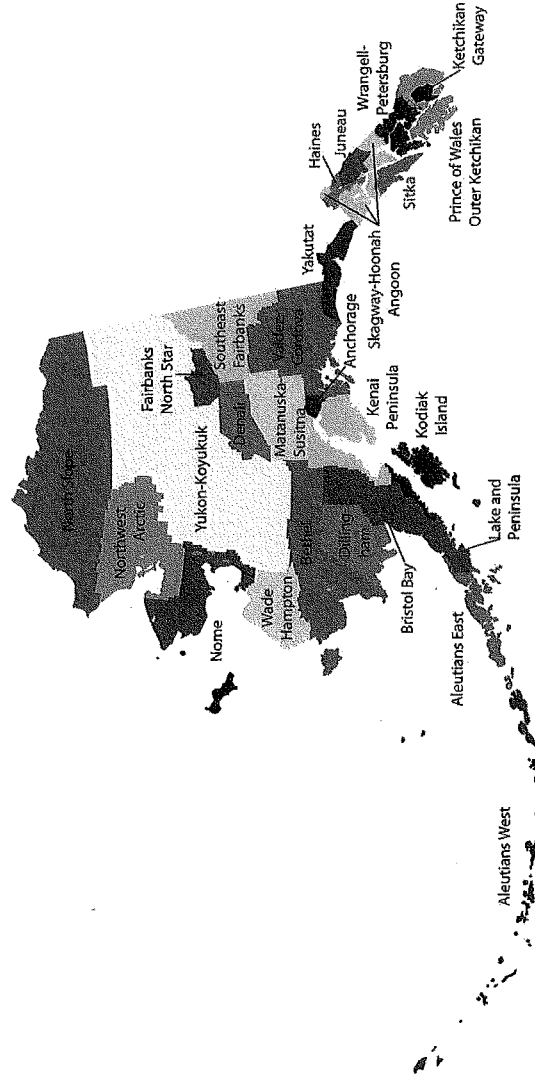


Figure 3: Map of Alaska Boroughs and Census Areas

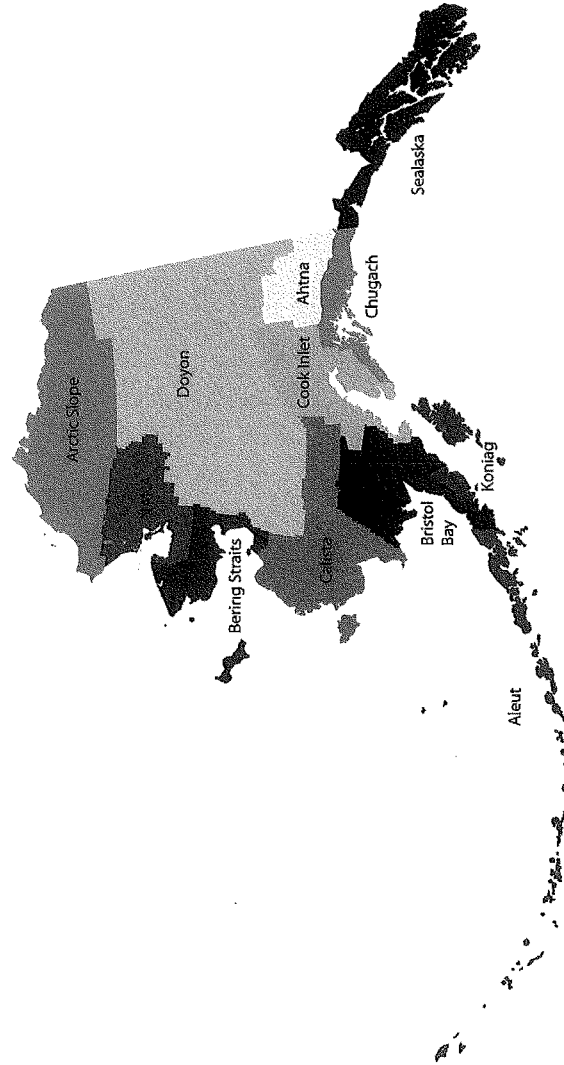


Figure 4: Map of Alaska Native Corporation regions

Estimating Housing Stock

In non-census years, the U.S. Census Bureau publishes estimates of new housing units by census area. These estimates rely primarily on permitting offices for their information. Information Insights contacted permitting offices throughout the state and received the same information. However, much of Alaska lies in unorganized boroughs where permitting is not required. Even within organized areas not all activity is reported all of the time.

A more accurate indicator of activity is the number of new housing units reported in the Housing Market Indicators Report, researched by the Alaska Department of Labor research section and published quarterly.

New units reported in the Market Indicators Report is supplemented in this report by information on new units (built 2005-2007) provided by Alaska Native Regional Housing Authorities (RHA.)

In cases where the Market Indicators Report did not report any new units in a community but the housing authority reported having constructed units; the project team inserted housing authority data. The resulting number does not consider housing units currently under construction or units demolished since 2000 as there is no reliable source for comprehensive demolition information.

Getting a solid housing count is difficult even in organized boroughs and urban parts of the state. Many boroughs encompass several distinct communities and do not gather building information in a central location - sometimes their member cities do not collect new housing data at all. We highly recommend a quick update to the report when 2010 census housing data becomes available.

The project team also reviewed electric utility information from Power Cost Equalization (PCE) covering nearly 200 communities around the state. Since communities have to submit documentation to be included in the PCE program, it is not uncommon for the list of PCE communities to vary from year to year. This information was used to check the accuracy of numbers reported in the Alaska Housing Market Indicators Report and U.S. Census estimates of new housing stock. Electric utility information provided a useful check on accuracy of housing stock estimates in areas of the state with no permitting practices. There were no communities in which estimates varied dramatically from residential electric utility customers.

Table 2 shows estimates of new housing units by census area and type of unit.

Estimating Housing Stock

Table 2. Estimate of new housing units, 2001-2007

Census area	Single family	Multi family	Mobile	All units	% of new units
Aleutians East Borough	9	13	0	22	0.09%
Aleutians West CA	28	18	0	48	0.19%
Anchorage, Municipality	5,218	6,537	0	11,755	46.76%
Bethel CA	230	34	0	264	1.05%
Bristol Bay Borough	14	4	0	18	0.07%
Denali Borough	4	0	1	5	0.02%
Dillingham CA	41	44	0	85	0.34%
Fairbanks North Star Borough	1,803	747	4	2,554	10.16%
Haines Borough	76	2	0	78	0.31%
Juneau Borough	542	240	25	864	3.44%
Kenai Peninsula Borough	656	169	5	830	3.30%
Ketchikan Gateway Borough	192	70	1	263	1.05%
Kodiak Island Borough	273	94	28	395	1.57%
Lake & Peninsula Borough	2	0	0	2	0.01%
Mat-Su Borough	4,968	1,369	36	6,373	25.35%
Nome CA	83	31	1	115	0.46%
North Slope Borough	54	2	0	56	0.22%
Northwest Arctic Borough	108	130	0	240	0.95%
Prince of Wales Outer Ketchikan	58	33	20	111	0.44%
Sitka Borough	233	186	11	430	1.71%
Skagway Hoonah Angoon	53	33	5	91	0.36%
Southeast Fairbanks CA	4	0	0	4	0.02%
Valdez Cordova CA	152	27	7	186	0.74%
Wade Hampton CA	111	7	0	130	0.52%
Wrangell Petersburg Census	97	33	7	137	0.55%
Yakutat Borough	4	1	0	6	0.02%
Yukon Koyukuk CA	71	0	4	75	0.30%
Statewide	15,084	9,824	157	25,137	

Note: More than 72 percent of new housing units occurred in Anchorage and Mat-Su borough.

The three tables on the following pages show the estimated 2008 housing units by Alaska Native region, Census area, and finally by the community level categorizations created for this report. The last table, housing estimates by community level, provides the basis for estimating housing need and is used throughout the report.

Table 3 provides the estimated total number of housing units for 2008 by Alaska Native Region. A large majority of the state's housing stock, as well as its' population, resides in the four largest Native regions: Calista, Cook Inlet, Doyon and Sealaska.

Table 3: Estimated housing stock by Alaska Native region

ANCSA region	No. of households 2008 (est.)	ANCSA region	No. of households 2008 (est.)
Ahtna	2,128	Cook Inlet	167,658
Aleut	3,030	Doyon	44,005
Arctic Slope	2,577	Koniag	5,521
Bering Straits	3,777	NANA	2,753
Bristol Bay	4,511	Sealaska	34,278
Calista	7,667		
Chugach	5,592	Statewide	283,497

Table 4: Growth in the number of households, 2000-08

Census Area	No. of households 2000 U.S. census	No. of households 2008 (est.)	% Change 2000-2008
Aleutians East	724	747	3.2%
Aleutians West	2,234	2,283	2.2%
Municipality of Anchorage	100,368	112,269	11.9%
Bethel Census Area	5,188	5,503	6.1%
Bristol Bay Borough	979	979	4.7%
Denali Borough	1,351	1,355	0.3%
Dillingham	2,332	2,409	3.3%
FNSB	33,291	35,652	7.1%
Haines	1,419	1,486	4.7%
Juneau	12,282	13,115	6.8%
Kenai Peninsula Borough	24,871	25,690	3.3%
Ketchikan Gateway Borough	6,218	6,331	1.8%
Kodiak Island Borough	5,159	5,521	7.0%
Lake & Peninsula Borough	1,191	1,193	0.2%
Mat-Su Borough	27,329	31,816	16.4%
Nome	3,649	3,777	3.5%
North Slope Borough	2,538	2,577	1.5%
Northwest Arctic Borough	2,540	2,753	8.4%
Prince of Wales Island	3,055	3,144	2.9%
Sitka	3,650	4,061	11.3%
Skagway-Hoonah-Angoon	2,108	2,243	6.4%
Southeast Fairbanks Census Area	3,225	3,228	0.1%
Valdez-Cordova	5,148	5,320	3.3%
Wade Hampton	2,063	2,164	4.9%
Wrangell-Petersburg	3,284	3,393	3.3%
Yakutat City & Borough	499	505	1.2%
Yukon-Koyukuk	3,917	3,983	1.7%
Total	260,568	283,497	8.8%

Table 4 provides the estimated total number of households in 2008 by census area. Total number of households increased around 12 percent between the 1990 and 2000 census; the estimated increase of 8.8 percent between 2000 and the beginning

Estimating Housing Stock

of 2008 shows a similar growth rate. In contrast, the U.S. Census counted a nearly 41 percent growth in the number of households in Alaska between the 1980 and 1990 census with more than 100 percent growth in the Mat-Su Borough and more than 80 percent growth in the North Slope Borough and Prince of Wales Island. The largest growth rates in housing stock occurred in the Mat-Su borough and Municipality of Anchorage; the least amount of growth occurring in the Southeast Fairbanks census area and the Lake and Peninsula borough.

Table 5 provides the estimated total number of housing units for 2008 by community level classification – Anchorage, Fairbanks, Other Urban, Rural 1 and Rural 2. These estimates form the basis for this report.

Table 5: Number of Alaska households by community level, 2000-08

Community level	No. of households 2000 U.S. census	No. of households 2008 (est.)	% Change 2000-2008
Anchorage	100,368	112,269	11.9%
Fairbanks	33,291	35,652	7.1%
Other urban	42,424	49,656	17.0%
Rural 1	61,614	62,268	1.1%
Rural 2	22,915	23,652	3.2%
Total	260,612	283,497	8.8%

Most of the housing stock in Alaska – 87.5 percent – is wood frame construction. The second most common type of construction is log at just under seven percent of the total, followed by mobile homes which make up four percent of total housing stock. The remaining two percent of homes fall under the category of “other” type of construction and reflect Alaska ingenuity with examples of homes made from concrete, plastic panels, foam blocks, etc.

Energy Use

Household Energy Consumption

Household energy consumption has been at the front of minds of policy makers and home owners alike since fuel prices peaked in the spring and summer 2008. When Alaska's capitol city was threatened with a fivefold increase in electricity costs in the spring of 2008 it was another reminder of how vulnerable we are to both natural disasters like avalanches and commodity prices set on world markets. There is compelling evidence from across the world, as well as here in Alaska, that low cost energy leads to increased energy consumption. Urban communities that enjoy low energy costs – Juneau with cheap electricity and Anchorage with cheap natural gas – have consumption rates far higher than rural communities where energy is more expensive.

Overall, Alaska ranks number one in energy consumption per capita in the United States, but much of this energy use is associated with industrial activity and transportation. Alaska's residential end-use energy consumption represents 0.3 percent of total U.S. end-use energy consumption, slightly over the 0.2 percent of the total U.S. population that lives in Alaska. Residential end-use energy consumption in Alaska was 61,658 billion BTU in 2006.⁴ Space heating accounts for around 45 percent of the total energy used to run a home. What this tells us is that Alaska's residential energy consumption is close to being in line with the rest of the country, especially when the high number of heating degree days in Alaska are taken into account.⁵ Where we by far outpace other states is in per capita transportation and industry energy consumption.⁶

A primary focus of this study has been household energy consumption for space heating. The building community in Alaska has long understood the costs associated with failing to build and design for cold climates. Recent increases in energy cost has brought that awareness to homeowners as well.

⁴ This is the most recent full-year data from the national Energy Information Administration. Complete 2007 data will be released by the EIA in August 2009.

⁵ Alaska ranks first in the nation in average Heating Degree Days (HDD.) HDD is a climate statistic published by the U.S. Department of Commerce National Climatic Data Center (NCDC) to compare the severity and length of the heating season in different locations. It equals the sum for the year of the average hourly temperature difference between the outside air temperature and 65°F (when outside air temperature is less than 65°F.) Source: <http://apps1.eere.energy.gov>

⁶ Energy Information Authority State Energy Data System <http://www.eia.doe.gov/>

Energy Use

A WORD ABOUT BRITISH THERMAL UNITS

British thermal units or BTUs are a useful equalizer when talking about energy use. A British thermal unit is the amount of heat energy needed to raise the temperature of one pound of liquid water by one degree Fahrenheit at one atmosphere pressure. This is the standard measurement used to express the amount of energy a fuel has, as well as the amount of output of any heat-generating device.

Converting energy consumption into BTUs allows us to compare apples to apples; it can be cumbersome to think about how 50 gallons of heating oil stacks up next to 10 cords of wood but both fuel types can be easily converted to BTUs. The table below shows the BTU values used to convert survey data on home energy consumption into BTUs.

Table 6: BTU conversion values by fuel type⁷

Fuel type	BTUs		Natural unit
Heating oil	139,000 BTUs	per	Gallon
Natural gas	102,800 BTUs	per	100 cubic feet (CCF)
Electricity	3,412 BTUs	per	kilowatt hour (kWh)
Propane	91,000 BTUs	per	Gallon
Wood (1)	20,300,000 BTUs	per	Cord
Coal	20,034,000 BTUs	per	short ton (2,000 lbs.)
Kerosene	135,000 BTUs	per	Gallon

Note: (1) The BTU value for white spruce was used for all wood conversions because it was not clear what type of wood was being used in many households; white spruce is a median value wood for Alaska.

All information on energy use in this report is presented in BTUs rather than dollars. With wide variation in the cost of fuel in different parts of the state and significant fluctuations in world fuel prices over time, it is less useful to try to figure out how many dollars were spent, or might be spent, on home heating than to focus on how MUCH energy is being consumed. Easy methods for converting BTUs to natural units for each fuel type (gallons, cords, etc.) and for estimating fuel cost will be provided in the appendices with examples included in the body of the report.

The average urban household in Alaska's largest city used just shy of 90,000 BTU/ft² for space heating in 2008, while the average household in the most remote parts of the state used nearly 116,000 BTU/ft². Keep in mind, however, that the average household in the smallest and most remote (Rural 2) communities uses fewer total BTUs than the average household in urban Alaska. This finding is consistent with other studies that have found rural households use less energy than their urban counterparts in large part because houses tend to be smaller.

⁷ Btu conversion values for fuel used in this report are provided by the Energy Information Administration <http://www.eia.doe.gov/>

Table 7: Energy use for space heating by community level

Community level	Average BTUs/ft ²	Median housing unit size (ft ²)	Median annual energy use per household (000s Btus)
Anchorage	87,894	1,960	171,162
Fairbanks	90,013	1,700	150,700
Other urban (1)	75,818	1,800	140,322
Rural 1	91,486	1,554	140,800
Rural 2	115,833	1,056	122,610

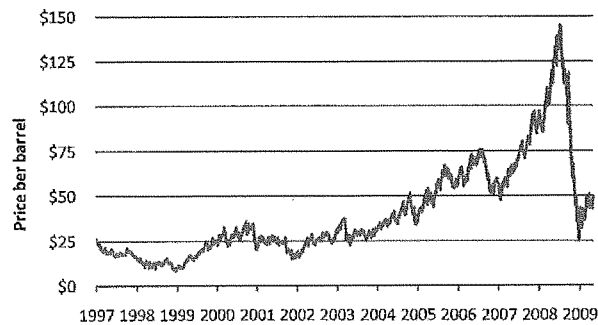
Note: (1) Most "Other urban" communities are in Southeast Alaska, where the climate is more temperate.

Table 7 shows the median size of a housing unit for each community type as well as the median amount of energy used for space heating. The median Btu per household is not simply the size of median housing unit multiplied by the average BTUs per square foot. Each housing unit is impacted by several variables that determine energy consumption including, but not limited to, home size.

Fuel Costs

The cost of fuel varies dramatically across the state. The last two years have seen fuel costs for home heating, electrical generation and transportation that have crippled communities and prompted the state government to send out supplemental cash payments to every Alaskan to assist with household energy costs.

Figure 5: Price history for ANS Crude oil, 1997-2009



The cost of fuel in rural communities has been high for a long time and is based on a number of factors including transportation costs, volume, and financial risk profiles associated with each community. There is no single place, or organization, where fuel prices are collected for all Alaska communities. However, recent efforts have lead to coordination in the collection of fuel price data so that now, more uniform methodologies are employed, and the same questions are being asked in fuel surveys conducted by multiple entities.

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The organization with the most data is the Alaska Housing Finance Corporation, which collected fuel price information from nearly 200 communities in June 2008. The price of fuel, like the price of building materials and everything else that must be shipped to remote communities, is impacted most heavily by transportation costs. Rural 2 communities pay the highest prices for regular heating oil, which averaged \$5.70 per gallon (excluding the North Slope) in June 2008. The next highest prices were in Rural 1 communities with average per gallon costs just under \$5. The least expensive heating oil was found in Urban communities coming in at just under \$4.50 per gallon (not including Urban communities that depend on natural gas).

The project team obtained fuel prices directly from local and regional sources for communities included in the 2008 housing survey for which AHFC lacked fuel price data. Prices for less commonly used fuels such as wood and coal were also obtained from local vendors and regional studies when appropriate. The resulting fuel price dataset was used to estimate actual fuel consumption for survey respondents who knew how much they paid for heating fuel but not how much fuel they used. Prices for heating oil in June 2008 ranged from a high of \$9.10 per gallon in Kokhanok to a heavily subsidized low of \$1.00 per gallon in Barrow.

With this data it is possible to determine that a survey participant who reported paying \$100 every two months in Barrow for heating oil uses approximately 50 gallons per month or 600 gallons per year for space heating. This was then converted into BTUs for comparison purposes.

BTU CONVERSION

The great majority of respondents use regular heating fuel or natural gas for space heat in their homes. Table 8 displays the primary type of fuel used for space heat for different urban and rural classifications.

Table 8: Primary fuel type for space heating by community level, 2008

	Anchorage	Fairbanks	Other urban	Rural 1	Rural 2
Heating Oil	1.5%	86.1%	53.1%	39.2%	81.5%
Natural Gas	93.2%	1.3%	30.8%	46.5%	0.5%
Electricity	3.8%	1.3%	5.6%	3.4%	0.3%
Wood	0.8%	9.5%	7.7%	8.6%	17.2%
Other	0.8%	1.8%	2.8%	2.3%	0.5%

Natural gas is the clear choice in areas of the state where it is available. The rest of the state is still reliant on heating oil. The use of wood as a primary space heating fuel is only significant in the smallest remote communities (Rural 2) and in Fairbanks. The category of "other" fuels includes coal, propane, kerosene and other bottled gas, and wood pellets.

To estimate the average cost of home heating for a community or region we can simply convert the average BTUs per square foot into the fuel used in the area and

then multiply it by the cost of fuel at any point in time. For example, in Fairbanks the average home uses 90,013 BTUs/ft² for space heat. We know that more than 86 percent of these homes use heating oil for space heat. We also know that the average home size is 1,882 square feet, and that heating oil has a value of 139,000 BTU per gallon. The following equation is applied:

BTUs per square foot	×	Avg. size of housing unit	=	Avg. BTU per housing unit
90,013	×	1,882 square feet	=	169,404,466 BTU
Avg. BTU per housing unit	÷	BTU per gallon of heating oil	=	Avg. gallons per housing unit
169,404,466	÷	139,000	=	1,219 gallons
Avg. gallons per housing unit	×	Fuel cost per gallon	=	Avg. home heating cost
1,219	×	\$4.55	=	\$5,546

Using the formulas above we can estimate the average home heating cost at any time since the BTUs per square foot will remain the same regardless of fluctuations in the price of fuel.

Analysis of Alaska Retrofit Information System (ARIS) Data

The Alaska Housing Finance Corporation maintains a database (called ARIS) that holds all of the energy ratings performed for its weatherization program, Building Energy Efficiency Standard (BEES) certification, and the Home Energy Rebate program (AKRebate). The database holds tens of thousands of records for individual housing units and multiplexes including estimated energy consumption and recommended improvements for each unit. ARIS is an important source of information about household energy consumption in Alaska. The project team analyzed data entered into ARIS in 2007 and 2008.

Table 9: Household energy use by fuel type, ARIS 2007-08

Fuel type	No. of records 2007-08 (1)	Average annual energy use (000s BTUs)
Birch	207	168,759
Coal	10	174,020
Gas	3,126	196,887
Oil1	986	132,041
Oil2	1,996	227,665
Propane	90	119,522
Spruce	440	92,972
Total	6,855	

Note: (1) ARIS data reveals a marked increase in ratings in 2008 following the State's increase in weatherization funding.

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Table 9 lists the number of ARIS records that include space heating data by fuel type and the average Btus for each fuel type. The Btu estimate for each record is generated by AKWarm software used by raters at the time of the energy rating. These numbers are slightly higher, but consistent with, estimates derived for this study from household survey data (shown in Table 7).

The tables that follow provide additional information for Alaska housing units that received energy ratings in 2007 and 2008. The majority of housing units rated in 2007 and 2008 were stand-alone single family houses. This is in keeping with survey findings and census data about housing in Alaska.

Table 10: Housing type, ARIS 2007-08

Housing type	No. of records 2007	% of total 2007	No. of records 2008	% of total 2008
Single Family	1016	81.5%	4,751	90.5%
Multi Family (Whole building)	30	2.4%	101	1.9%
Multi Family (One unit)	201	16.1%	358	0.7%
Mobile Home (1)	--	--	39	6.8%

(1) Mobile homes were added as a field for housing type in 2008.

Table 11 shows average square footage and annual energy cost estimates for homes rated in 2007 to 2008. The data does not show a significant variation in average home size across several decades (although like Btu per house the numbers are slightly higher), nor does it show substantial differences in energy costs. The notable exception being new homes, built 2000 to 2008, which appear to be at least twice as cheap to heat – presumably because they have been built to higher energy standards and with newer materials.

Table 11: Energy cost and home size by age of housing unit, ARIS 2007-08

Construction date	No. of records	Average home size (ft ²)	Average annual energy cost
1930-1939	34	2,055	\$7,864
1940-1949	67	1,882	\$5,968
1950-1959	297	1,850	\$6,206
1960-1969	514	2,098	\$6,109
1970-1979	1,472	2,196	\$6,271
1980-1989	1,640	2,116	\$5,867
1990-1999	408	2,319	\$6,202
2000-2008	1,886	1,993	\$2,847

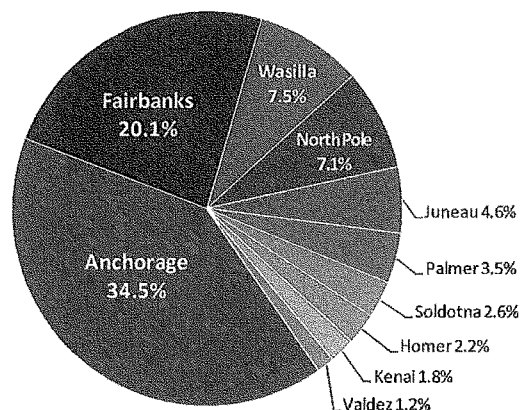
Note: Differing total records are due to blank fields in the database where a record existed but the square footage variable was blank. There were also more than 100 records for homes constructed prior to 1930. However, these records have minimal representation and the dates cannot be verified so they were excluded from analysis.

HOME ENERGY REBATE PROGRAM PARTICIPATION

Although the ARIS data include housing in all parts of the state, energy-rated homes that have completed the Alaska Home Energy Rebate program are clustered by

geography in 2007 and 2008, with urban areas having a higher level of participation, Anchorage, Fairbanks and Wasilla combined accounted for over 60 percent of ratings done in the state in 2007-2008. Figure 6 shows participation rates the top ten communities in 2007-08.

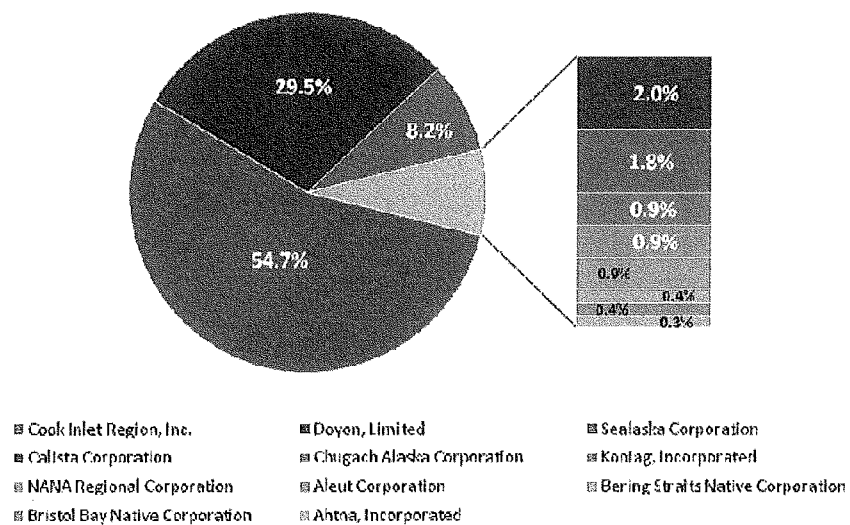
Figure 6: Energy rating participation rates by community: Top 10 communities represented, 2007-08



The project team also analyzed data by Alaska Native regional corporation boundaries. Native corporation regions are used as inclusive geographies in this report; therefore non-shareholder households are included in totals for each region. Looking at Figure 7, it is not surprising to note that regional Native corporation boundaries encompassing larger populations also have higher participation rates.

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Figure 7: Energy rating participation by Native corporation region, 2007-08



The 2007-08 ARIS data provides average household energy consumption for space heating by fuel type (see Table 12.) The data also includes square footage and electric cost by household, as shown in Table 13, please note that the database is small and thus vulnerable to being pulled significantly by outliers and that the houses are more heavily weighted toward rural communities.

Table 12: Average household energy use in MMbtu (million Btu) for space heating, ARIS 2007-08

Native corporation region	Birch	Coal	Electric	Gas	Oil 1	Oil 2	Propane	Spruce
Cook Inlet	168.8	na	4.0	170.1	133.2	140.6	98.2	154.0
Doyon	121.8	155.5	3.0	149.7	110.3	207.7	68.1	107.7
Sealaska	65.3	na	16.5	31.9	113.7	177.9	89.3	87.4
Cellista	53.4	na	1.2	na	56.0	109.2	na	27.0
Chugach	64.3	na	4.3	na	170.9	145.2	126.8	98.2
Koniag	na	na	1.8	na	60.4	146.4	na	71.7
NANA	38.1	na	1.6	na	59.6	147.3	na	44.4
Aleut	na	na	1.1	15.8	31.1	71.3	5.5	Na
Bering Straits	na	na	1.5	na	113.8	16.5	na	Na
Bristol Bay	107.3	na	1.6	na	80.9	na	na	42.1
Ahtna	246.8	na	3.1	na	166.6	110.0	24.0	125.7

Note: Not all fuel types are available in all regions. There are no records matching the Arctic Slope region in the ARIS dataset for 2007-08. Because the frequency of ratings is not equally distributed across the state, analysis of energy use data for the rural areas is less reliable, especially where there are only a couple records for a specific fuel type.

Table 13: Annual house size and electric cost per household by Native corporation region, ARIS 2007-08

Native Regional Corporation Boundary	Average housing unit size (ft ²)	Average annual electric cost
Cook Inlet Region, Inc.	2,143	\$3,405
Doyon, Limited	2,218	\$7,925
Sealaska Corporation	1,902	\$6,072
Cellista Corporation	826	\$4,451
Chugach Alaska Corporation	2,099	\$8,222
Koniag, Incorporated	1,894	\$6,186
NANA Regional Corporation	1,193	\$7,283
Aleut Corporation	1,342	\$4,565
Bering Straits Native Corporation	1,621	\$5,950
Bristol Bay Native Corporation	1,279	\$6,573
Ahtna, Incorporated	2,170	\$7,247

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AHFC Weatherization Program

The Alaska Housing Finance Corporation administers a grant program for the purpose of improving the energy efficiency of low-income homes statewide. Funds for weatherization come from the U.S. Department of Energy and from AHFC. Grants are given by AHFC to nonprofit weatherization service providers. Over the past 30 years there have been five primary recipients of this funding who administer weatherization programs in the following areas:

Alaska Community Development Corporation

- Mat-Su Borough, Kenai-Peninsula Borough
- Copper River Valley (Tok to Cordova)
- Southeast Alaska (except Juneau)
- Kodiak (road connected communities only)
- Bristol Bay
- Prince William Sound
- Aleutians

Interior Weatherization

- Fairbanks/NSB
- Road System: South to Cantwell and East to Delta Junction
- Tanana Chiefs Conference

Municipality of Anchorage

- Municipality of Anchorage

Rural Alaska Community Action Program (Rural CAP)

- Western Alaska
- Northern Alaska
- Juneau

Annual state funding for the weatherization program has been around \$4 million to \$6 million for many years. In 2008 the Alaska legislature appropriated \$200 million to AHFC for weatherization programs. This unprecedented level of funding was a direct result of the high fuel prices that were crippling Alaska households – especially lower income households and those in rural communities. The legislature increased the program's income threshold from 60 percent to 100 percent of median household income.

In response to increased funding, weatherization programs have been established within the Alaska Native regional housing authorities to build capacity and expedite service delivery. Low income, elderly and disabled individuals are still given priority on the weatherization waitlist.

We asked survey respondents if their homes had been improved through AHFC's weatherization program in the last 10 years. The highest percentage of homes that

received weatherization services was in Rural 2 communities (8.5 percent), followed by Urban and Rural 1 communities (around four percent each). Among urban communities, there was a significant difference between the state's two largest communities, with Anchorage reporting 3.1 percent of homes having received weatherization services in the past 10 years and Fairbanks reporting nearly twice that many (6.1 percent). Historically, weatherization programs provide services to around 600 homes per year. The amount spent to improve each housing unit varies depending on the condition and location of the home.

According to Oak Ridge National Laboratories, weatherization can decrease energy bills an average of 23 percent. In Alaska, savings are also seen in the costs of running village generators and reducing requirements for state Power Cost Equalization funding – a savings enjoyed by state government. In addition to increasing energy efficiency, weatherization can address mildew and mold problems that plague many households in Alaska causing serious health concerns particularly for children and the elderly.

Home Energy Rebate Program

In 2008, the Alaska legislature appropriated \$100 million (and later an additional \$60 million) to help Alaska homeowners, regardless of income, decrease fuel consumption by increasing the energy efficiency of their homes through a rebate program. This program is different than weatherization in a few of important ways; participants must own their home, there are no income guidelines, and all improvements must be paid for up front by the homeowner. The Alaska Home Energy Rebate Program (AKRebate) provides a potential benefit to every home in the state that is not already a five star home. It is difficult to estimate the number of five star homes in Alaska because houses built without AHFC underwriting are not required to meet BEES. As a result, they will not appear in the ARIS database unless they become part of either the AHFC weatherization or home energy rebate programs (which is unlikely if they are already five star homes).

With no income guidelines, the home energy rebate program opened the door for assistance to homeowners who do not qualify for the low-income weatherization program. Program guidelines stipulate that to qualify a participant needs to own and occupy the housing unit that will be rated. Each participant is eligible for a rebate of up to \$10,000 of the money they spend on energy improvements to their home. The actual rebate amount is based on how much the home's energy efficiency is estimated to have improved after implementing any of the energy improvements recommended by the energy rater. This is determined by looking at the difference between the initial or "as-is" rating and the "post" rating which is done after energy improvements are complete. Ratings are performed by certified home energy raters.

The home energy rebate program offers a unique opportunity by providing the state with a large dataset that includes both pre- and post-improvement measurements of

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housing unit energy use. Other programs have relied on norms and estimates generated by software to determine the energy saved by implementing efficiency measures. These estimates are likely based on valid assumptions and produce reasonably sound predictions of energy savings. However, the Alaska Home Energy Rebate Program offers real world data and can be used to ground truth the software used to estimate energy savings in the weatherization program.

The Alaska Home Energy Rebate Program, which started in May 2008, has given the Alaska Housing Finance Corporation for the first time in its history the ability to measure the impact of weatherization efforts at a household level. While the data processing systems are still being refined, the data collection systems are in place, allowing analysis of the matched As-Is and Post-improvement data. At the time of this report only 368 matched sets of data were available. The analysis that follows examines matched records and provides a glimpse of the program's overall potential.

Comparisons of As-Is data matched with the respective Post data indicate that weatherization efforts are successful in improving the energy performance of homes. On average, homes that participate in the program improve by 15.3 percent in rating points, star ratings increase by almost 29 percent, while CO₂ levels drop by almost 35 percent. In addition, homes in the program reduced their energy cost by approximately 30 percent. While individual home findings may vary, the overall picture is an early indicator that the rebate program is effective in improving living conditions in Alaska.

Table 14: Average change per home in the AKRebate program

Factor	As-Is rating	Post rating	Change	% Change
Rating Points	64.2	75.9	11.6	18.1%
Rating Stars	2.7	3.8	1.1	40.0%
CO ₂	41,195.1	30,630.3	-10,564.8	-25.6%
DHW Energy Factor	-17.1	-17.5	-0.3	1.8%
Energy Cost	5,605.3	4,306.7	-1,298.6	-23.2%
Air Loss	668.8	550.3	-118.6	-17.7%
Appliance Loss	1,313.6	1,216.4	-97.2	-7.4%
Ceiling Loss	285.6	202.7	-82.9	-29.0%
DHW Loss	573.0	551.2	-21.8	-3.8%
Floor Loss	448.3	394.1	-54.2	-12.1%
Heating System Loss	1,380.2	574.5	-805.7	-58.4%
Wall/Door Loss	760.1	694.9	-65.2	-8.6%
Window Loss	271.0	215.4	-55.6	-20.5%
Appliance Use	1,313.6	1,216.4	-97.2	-7.4%
DHW Use	573.0	551.2	-21.8	-3.8%
Space Use	3,805.9	2,624.4	-1,181.4	-31.0%

Table 14 gives further information detailing the average increase in rating stars and points and reductions in other factors, with the biggest drop in Heating System Loss.

Table 15 shows the average energy savings per home for the 368 housing units for which matched data was available at the time of this analysis. After recommended energy improvements were made by the homeowner, average energy savings equaled 600 kWh electricity or nearly one and a half cords of birch or over 600 gallons of number 2 heating oil.

Table 15: Energy savings per home converted to natural units

Average savings per home	Natural unit	Fuel type
747.6	CCF	Gas
256.9	Gallon	Oil1
633.5	Gallon	Oil2
600.0	Kwh	Electricity
145.1	Gallon	Propane
1.45	Cord	Birch
1.2	Cord	Spruce
--	Ton	Coal

Energy Efficiency Indicators in the 2009 Housing Assessment

ABILITY TO MAINTAIN TEMPERATURE

In 1990 it was estimated that 20,824 homes statewide were unable to maintain a comfortable indoor temperature on the coldest days of winter. The 2005 housing assessment found 24,445 homes fit this category, and the 2008 survey produced more than 27,000 homes.

The surprising 13.5 percent increase from 2005 to 2008 in the estimate of housing units unable to maintain a comfortable room temperature is larger than the overall increase in housing stock, which was 8.8 percent for the period. This disparity may be partially explained by the unprecedented high energy prices that plagued the state last winter; survey respondents' difficulty in keeping houses at 70 degrees Fahrenheit may be more reflective of their ability to pay for fuel than of a precipitous deterioration in the condition of Alaska's housing stock. Table 16 reports the findings of the 2008 survey by community classification.⁸

Conventional wisdom about housing stock in Alaska tells us that the more remote a community is the worse the condition of the housing will generally be. Survey findings confirm this. The percentage of homes unable to maintain temperature

⁸ It is important to note that the ability to maintain a comfortable temperature during the coldest days of winter is both a function of the condition of the home and the residents' income. We talked to people who said "Yes, we can keep our house warm. It just costs a lot." These responses are not included in the number or percent of households unable to maintain a comfortable temperature.

Energy Use

increases from urban to large rural communities (Rural 1) and then increases again between large rural and small or very remote rural communities (Rural 2).

Table 16: Households unable to maintain temperature by community level, 2008

Community level	Total no. of households, 2008 (est.)	Households unable to maintain 70° F on the coldest days of winter	
		No.	%
Anchorage	112,269	7,958	7.1%
Fairbanks	35,652	2,408	6.8%
Other urban	49,656	5,214	10.5%
Rural 1	62,268	7,009	11.3%
Rural 2	23,652	5,150	21.8%
Total	283,497	27,739	9.8%

WINDOWS AND FLOORS

The table below presents data on the type of windows installed in Alaska homes. Survey participants were asked what the majority of windows in their homes are (single pane, double pane, triple pane). In all parts of the state and at all community levels, double-pane windows are by far the most common. Only in Fairbanks do nearly one third of all housing units have triple-pane windows. At no community level did more than an eighth of homes have a majority of single-pane windows.

Table 17: Window type by community level, 2008

Community level	Single pane		Double pane		Triple pane	
	No.	%	No.	%	No.	%
Anchorage	13,677	12.2%	92,323	82.2%	5,414	4.8%
Fairbanks	2,679	7.5%	21,151	59.3%	11,822	33.2%
Other urban	5,214	10.5%	41,661	83.9%	2,781	5.6%
Rural 1	7,393	11.9%	50,932	81.8%	3,450	5.5%
Rural 2	2,941	12.4%	19,210	81.2%	1,251	5.3%

Note: Response to the question, "Are the majority of windows in your house single-, double-, or triple-paned?"

The survey asked several other questions that are good indicators of the construction quality and energy efficiency of a home. Table 18 shows survey participants' responses to the question, "During the winter is the floor of your house cold, chilly, comfortable, or warm?" for each community classification. Comfortable floors are most prevalent in all but Rural 2 communities where nearly 40 percent of respondents reported cold floors and 30 percent said floors were chilly.

Table 18: Winter floor temperature by community level, 2008

Response (1)	Anchorage	Fairbanks	Other urban	Rural 1	Rural 2
Cold	5.5%	11.3%	7.6%	13.6%	39.3%
Chilly	17.6%	20.1%	26.4%	22.3%	29.6%
Comfortable	62.0%	49.6%	50.7%	47.1%	24.0%
Warm	14.9%	19.0%	15.3%	17.0%	7.1%

Note: (1) Response to the question, "During the winter is the floor of your house...?"

OTHER INDICATORS

The table below shows the estimated number and percent of Alaska homes that can be considered "drafty." We asked survey participants the question, "When the wind blows, does it come through your windows, doors, or floor?" Not surprisingly, residents of Rural 2 communities answered yes to that question much more often than Rural 1 and Urban residents.

Table 19: Draftiness of homes by community level, 2008

Community level	No. of housing units, 2008	Drafty homes (1)	
		No.	%
Anchorage	112,269	40,417	36.0%
Fairbanks	35,652	10,090	28.3%
Other urban	49,656	17,231	34.7%
Rural 1	62,268	29,675	47.7%
Rural 2	23,652	17,661	74.7%
Total	283,497	115,073	40.6%

Note: (1) Draftiness homes defined as "When the wind blows, does it come through your windows, doors, or floor?"

We also asked people if ice builds up anywhere in their homes in the winter. Fewer respondents reported ice buildup than draftiness; respondents said yes in just over half of Rural 2 homes (52.6 percent), less than a third of Rural 1 homes (29.9 percent), and less than a quarter of all Urban homes (23.4 percent). What is telling is that whether the question is draftiness or ice buildup or mold/mildew (see Table 21), the relative proportions remain fairly consistent, with a much higher percentage of poor housing condition and energy efficiency indicators in small, isolated, rural communities than in larger or highway-connected rural communities or urban areas.

Table 20: Ice buildup inside home by community level, 2008

Response (1)	Anchorage	Fairbanks	Other urban	Rural 1	Rural 2
Yes (%)	15.3%	34.4%	15.9%	29.9%	52.6%
Yes (No.)	17,207	12,250	7,895	18,631	12,452

Note: (1) Response to the question: "Do you get ice build up anywhere on the inside of your house?"

Energy Use

Table 21: Mold or mildew around windows by community level, 2008

Response (1)	Anchorage	Fairbanks	Other urban	Rural 1	Rural 2
Yes (%)	10.8%	16.7%	17.2%	20.9%	37.4%
Yes (No.)	12,160	5,942	8,541	13,006	8,838

Note: (1) Response to the question, "Is there any mold or mildew around your windows?"

Household Variables

This section presents more detailed information on the characteristics of the 1,700 Alaska households surveyed for the 2009 housing assessment.

Eighty-five percent of the households surveyed live in single-family homes; just under five percent live in duplex units; 6.5 percent live in multi-family units; 3.5 percent live in mobile homes, and just one-tenth of one percent fall into the “other” category. These housing units ranged in age from brand new to 111 years old.

Just over seventy percent of survey respondents reported their race as Caucasian, and 19.5 gave their race as Alaska Native or American Indian. The remaining 7.3 percent of respondents reported their primary race as African American, Hispanic, Asian or Pacific Islander, or other.

One in four respondents reported a household income of less than \$35,000 per year, while more than half reported incomes between \$35,000 and \$100,000 per year. A little over one-third of all respondents said they have had a friend or family member stay with them because the person did not have a home. The majority of these stays were reported to be less than one year.

The housing variables covered in this section include:

- Size of home
- Age of home
- Condition of home

House Size

Table 22 displays square footage of homes by community classification. The largest share of homes at all community levels is in the 1,001 to 2,000 ft² range, however in Rural 2 communities that share (39.7 percent) is only slightly bigger than housing units that fall into the 501 sq ft to 1,000 ft² range (36.9 percent). Anchorage has the highest percentage of homes larger than 1,000 ft² (87.1 percent), while Rural 2 communities have the highest percentage of homes falling at or below 1,000 ft² (49.4 percent.)

Household Variables

Table 22: House size by community level, 2008

House size (ft ²)	Anchorage	Fairbanks	Other Urban	Rural 1	Rural 2
Less than 500	0.8%	3.0%	0.0%	2.0%	12.5%
501 to 1,000	12.0%	15.2%	16.8%	16.2%	36.9%
1,001 to 2,000	46.2%	48.2%	45.8%	54.0%	39.7%
More than 2,000	40.9%	33.6%	37.4%	27.7%	10.8%
Mean	2,074	1,882	1,975	1,730	1,226
Median	1,960	1,700	1,800	1,554	1,056

Table 23 gives mean and median home size per person in households around the state. Households in small rural communities have less than half the square footage per person as households in urban areas. This is a function of both smaller houses and more people per household.

Table 23: Mean and median house size per person, 2008

Community level	Mean no. of people per house	Mean ft ² per person	Median no. of people per house	Median ft ² per person
Anchorage	2.60	798	2.00	980
Fairbanks	2.67	706	2.00	850
Other urban	2.79	708	2.00	900
Rural 1	2.82	613	2.00	777
Rural 2	3.69	332	3.00	352

The average square footage per resident has increased since the 2005, when the estimated living space per person was 452 ft² statewide – ranging from a high of 641 ft² in Southcentral Alaska to a low of 212 ft² in remote western Alaska communities. While the mean and median house size has increased slightly, the real change is due to a decrease in the number of people per household.

There are parts of rural Alaska where overcrowding is worse than in others. Remote communities in western and northwestern Alaska have among the highest rates of overcrowding in the country. It is also clear there are communities within the same region that have dramatically different rates of overcrowding. With a large enough sample size we can make statistically significant statements about conditions and crowding. It is important for policy makers to consider higher level housing data when making decisions about how to target funds.

Age of Housing Stock

Age plays an important role in the condition of housing stock. As housing units age they, like everything else, begin to deteriorate. Unless the owner has the financial means or the skills necessary to provide maintenance the housing unit may fall into disrepair. In Alaska the age of housing stock has additional meaning for energy use. Much of the housing stock built in Alaska prior to the implementation of the Built Energy Efficiency Standards (BEES) by AHFC in 1992 was substandard from an

energy use perspective. BEES helped promote an understanding of improved cold climate construction methods that had been largely lacking beforehand.

The largest percentage of housing stock older than two decades is in the Municipality of Anchorage, according to 2008 survey data. Rural 1 communities have the largest percentage of new housing stock, accounting for over a quarter of all housing units. Survey responses on housing age ranged from brand new to more than 100 years old.

Table 24: Age of housing stock, 2008

Community level	0 to 10 years		11 to 20 years		21+ years	
	%	No.	%	No.	%	No.
Anchorage	7.7%	8,681	11.9%	13,310	80.4%	90,278
Fairbanks	19.2%	6,831	15.7%	5,614	65.1%	23,207
Other urban	23.2%	11,514	15.2%	7,556	61.6%	30,585
Rural 1	29.0%	18,148	17.0%	10,489	54.0%	33,631
Rural 2	20.7%	4,898	21.5%	5,091	58.0%	13,663

Condition of Housing Stock

Table 25 displays survey results on the condition of housing units as perceived by the homeowner. The majority of homes at all community levels are believed to be in adequate condition. We have combined responses for “like new”, “in good shape” and “in need of minor repair,” because these conditions do not require any action at the policy level. Housing units reported to be “in need of major repair” range from a low of 5.1 percent of the housing stock in Anchorage to a high of 25.3 percent (one in four homes) in Rural 2 communities. If repairs are not performed, these units are at risk of becoming unsalvageable at which point they would need to be replaced. Seven percent of homes in Rural 2 communities are said to be “falling apart” and need to be replaced.

Table 25: Condition of housing stock by community level, 2008

Community level	like new/ in good shape/ needs minor repair		In need of major repair		Falling apart	
	No.	%	No.	%	No.	%
Anchorage	106,032	94.4%	5,670	5.1%	567	.5%
Fairbanks	32,068	89.9%	3,032	8.5%	551	1.5%
Other urban	46,207	93.1%	3,103	6.3%	345	0.7%
Rural 2	15,978	67.6%	5,976	25.3%	1,698	7.2%
Rural 1	55,782	89.6%	5,675	9.1%	811	1.3%

Estimated Housing Need

Housing need is estimated using the criteria of overcrowding and a condition of “falling apart.” A house is considered overcrowded if there is fewer than 200 square feet per person. There is some duplication between these two categories of housing. Approximately 9.4 percent of homes that are overcrowded are also falling apart. Duplicates are removed to arrive at a final total number of needed housing units.

The project team also estimates the number of homes that would benefit from weatherization services. A house is considered to be in need of weatherization services if the resident reports that they are unable to maintain a comfortable room temperature during the coldest days of winter. The State weatherization program serves households up to 100 percent of median income so a conservative estimate of eligibility is half of estimated housing units in need.

Need created by overcrowded conditions

Using the definition of overcrowding of 200 or fewer square feet per resident we estimate a statewide need for nearly 10,000 additional housing units to alleviate overcrowding. Clearly there are other measures that can be taken to alleviate overcrowding such as expanding on existing housing units. Just under 10 percent of survey respondents who live in overcrowded conditions also report having homes with are falling apart but for the remaining 90 percent who live in homes that are on decent condition but are just too small adding on is a viable and sometimes more cost effective solution.

Table 26: Households with fewer than 200 square feet per resident, 2008

Community level	% of total units	No. of units
Rural 2	20.5%	4,855
Rural 1	3.9%	2,432
Anchorage	1.3%	1,418
Fairbanks	1.5%	551
Other Urban	1.4%	690
Total		9,946

As noted in the executive summary, the 2008 estimate of overcrowded housing units is significantly lower than the 2005 estimates or the 1991 estimates. The 2008 estimates of overcrowding are roughly half of the 2005 housing assessment findings. The significant decrease is attributable to a more sophisticated methodology. The 1991 and 2005 housing assessment studies and the Department

Estimated Housing Need

of Housing and Urban Development estimates of overcrowding all apply a single percentage to the state housing stock number to arrive at an estimate of overcrowded units. This total number has then been distributed throughout the state based on housing stock in different regions. The total number of housing units estimated to be overcrowded has hovered around 20,000 units. If we apply this same methodology to the 2009 housing assessment we will arrive at a number that is just under 20,000 (18,428 to be exact.)

Using a more refined methodology developed in part because we recognized that applying a single number to a statewide figure would not produce defensible results we arrived at a significantly lower but, we believe, more accurate number.

It is worth noting that even using the old methodology we arrive at a number lower than the 2005 estimate by nearly 3,000 units. The 1991 study did not include any data collection from urban Alaska and appears to have overstated the number of housing units statewide that are overcrowded. When we examine statistically significant findings from the four largest Alaska Native corporations (which represent %% of the total state housing stock) they confirm that the lower estimated number of housing units is the correct one.

Need created by poor housing condition

There are an estimated nearly 4,000 homes in Alaska that are in need of replacement because they are in such poor condition – 43 percent of these housing units are located in the smallest and most remote rural communities.

Table 27: Housing units described as “falling apart,” 2008

Community level	% of units falling apart	No. of units falling apart
Anchorage	0.5%	567
Fairbanks	1.5%	551
Other Urban	0.7%	345
Rural 1	1.3%	811
Rural 2	7.2%	1,698
Total		3,972

It is worth noting that Rural 1 communities have roughly the same rate of unsalvageable housing stock as urban areas and significantly lower than rural two communities. Creation of new housing stock is most difficult in the most remote parts of the state but perhaps more importantly access and ability to maintain a home once it is in place are also most difficult in very remote communities where both supplies and skilled labor are less available.

Need for major repair

There are more than 23,000 homes in the state that are estimated to be in need of major repair. About half of these homes are in rural Alaska with the other half in urban communities.

Table 28: Housing units in need of major repair, 2008

Community level	% in need of major repair	No. in need of major repair
Anchorage	5.1%	5,670
Fairbanks	8.5%	3,032
Other Urban	6.3%	3,103
Rural 1	9.1%	5,675
Rural 2	25.3%	5,976
Total		23,456

The need for major repair is important to pay attention to because it is an indication that a housing unit is on its way to "falling apart" and becoming unsalvageable.

Need for weatherization

We estimate a need for weatherization services for more than 27,000 homes throughout the state. Just under 44 percent of these housing units are located in rural Alaska with the remaining 56 percent in urban locations.

We estimate that of the 27,000 plus homes that are in need of weatherization services, just under 14,000 of them are *also* financially eligible for the program. It is important to note that this estimate of households that are both in need and eligible for weatherization services is extremely conservative. It is very likely that the actual number is higher than this estimate.

Table 29: Households that cannot maintain 70 degrees Fahrenheit, 2008

Community level	No. of households, 2008 (est.)	Households that cannot maintain 70 deg F, 2008	No. of HH low estimated at 100 percent of median income ⁹
Anchorage	112,269	7,958	3,979
Fairbanks	35,652	2,408	1,204
Other urban	49,656	5,214	2,607
Rural 1	62,268	7,009	3,505
Rural 2	23,652	5,150	2,575
Total		27,739	13,870

⁹ The estimated number of houses that are both eligible AND in need of weatherization services is a low end estimate operating on the assumption that 50 percent of households fall at or under median income. It is unknown how many households have income equal to median and would therefore be eligible as well.

Estimated Housing Need

Providing weatherization services to the 13,870 housing units estimated to be both eligible and in need of services would be a monumental undertaking that. If we estimate a cost of \$11,000 to weatherize all urban housing units in need and \$30,000 to weatherize all rural housing units in need the project would require funding of 268,623,200. These costs do not consider the cost of administering the program and again, this is a very conservative estimate of need.

Household Income as Housing Variable

Income is a significant variable when examining any quality of life measure – such as housing – and is an important component for policy makers who are prioritizing distribution of public funds. This section examines housing unit data by income levels. Table 30 shows the distribution of income of survey respondents by the type of community in which they live.

Table 30: Household income by community level

Community level	Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
Anchorage	11.2%	12.4%	22.2%	27.7%	28.3%	31.5%	31.4%
Fairbanks	8.2%	23.0%	21.8%	27.0%	27.6%	26.0%	23.8%
Other urban	5.5%	14.5%	11.0%	20.0%	13.8%	9.7%	9.7%
Rural 1	20.0%	15.3%	24.4%	22.3%	26.1%	24.9%	22.9%
Rural 2	55.9%	39.2%	24.4%	13.2%	11.0%	9.9%	8.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The majority of people in the state – more than 80 percent surveyed – live in single family units. Not surprisingly the largest percentage of people living in mobile homes (7.6 percent) are also those with household income less than \$20,000 per year.

Table 31 shows housing unit size by income. Average housing unit size increases as income increases. The median size of a housing unit with residents who earn more than \$150,000 per year is 2,400 ft². At the other end of the income spectrum, the median size of a housing unit with residents who earn under \$20,000 per year is 960 square feet.

Table 31: House size by household income, 2008

House size	Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
Mean (ft ²)	1,095	1,214	1,667	1,760	1,979	1,996	2,523
Median (ft ²)	960	1,100	1,500	1,600	1,800	1,868	2,400
Minimum (ft ²)	150	252	150	300	216	600	400
Maximum (ft ²)	4,000	4,000	6,000	7,200	7,500	5,000	6,000

According to our survey results there is not a strong relationship between income and the average number of people living in each household. The statewide mean

Household Income as Housing Variable

bounced between two and three people per household but not in a way that was related to household income.

Likewise, there does not appear to be a strong relationship between household income and the age of the home. Lower income households are residing in housing units that are on average about five years older than upper income households, and about 2.5 years older than middle income households.

Table 32 shows survey results for the resident's perception of the condition of their home. As would be expected, the income level with the highest percentage of those reported "falling apart" and those "in need of major repair" is the lowest income, less than \$20,000 per year.

Table 32: Condition of home by household income, 2008

	Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
Like new	7.6%	7.2%	11.1%	16.6%	16.0%	20.4%	26.7%
In good shape with normal wear and tear	16.5%	27.8%	32.0%	39.7%	44.3%	42.0%	44.8%
In need of minor repairs	38.2%	39.7%	44.9%	34.6%	32.6%	30.4%	25.7%
In need of major repairs	29.4%	20.6%	9.8%	8.1%	6.4%	5.0%	2.9%
Falling apart	8.2%	4.8%	2.2%	1.0%	0.7%	2.2%	0.0%

Table 33 shows the survey results to three questions related to housing quality and weatherization: (1) When the wind blows does it come through your windows, doors or floors?; (2) Do you get ice build up anywhere on the inside of your house?; and (3) Is there any mold or mildew around the windows of your house? There is a clear correlation between income and these three housing condition variables. The lower the household income the more likely the housing unit is to be insufficiently sealed, leading to drafts, ice buildup, condensation and mold and mildew.

Table 33: Housing quality variables by household income, 2008

	Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
Draftiness (1)	76.2%	58.9%	49.8%	37.5%	37.8%	38.7%	27.6%
Ice buildup inside house (2)	50.0%	45.7%	31.9%	31.3%	22.7%	29.3%	9.5%
Mold/mildew around windows (3)	38.2%	26.8%	18.6%	18.9%	15.9%	21.0%	8.6%

Similarly the highest percentage of homes with only single-pane windows are those that earn less than \$20,000 per year. However, the large majority (more than 70 percent even for the lowest income homes) of housing units statewide and across income lines have double pane windows.

Household Income as Housing Variable

Table 34: Floor temperature by household income, 2008

In winter, floor is...	Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
Cold	45.0%	26.8%	15.1%	11.5%	11.1%	7.2%	3.8%
Chilly	23.7%	27.8%	25.8%	21.3%	23.2%	22.1%	11.4%
Comfortable	19.5%	33.0%	47.1%	53.0%	51.1%	53.6%	61.0%
Warm	11.8%	12.4%	12.0%	14.2%	14.6%	17.1%	23.8%

Table 35 shows the results of the survey question: "Can you maintain a comfortable temperature in your home during the coldest days in winter?" Most respondents indicated they were able to keep their homes at a comfortable temperature, but again, we can see a clear connection between income and housing condition with nearly a quarter of the lowest income respondents reporting that they were unable to maintain temperature and only 5.8 percent at the other end of the income spectrum. Ability to maintain temperature is as much a function of the condition of the home as it is the income of the resident since if a household has unlimited amounts of money to spend on space heating they can simply keep turning up the heat source without regard to how much is being used.

Table 35: Households that cannot maintain temperature, by income, 2008

Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
24.2%	20.2%	11.2%	9.2%	7.9%	5.6%	5.8%

Low income households are more than twice as likely (9.9 percent) as middle and upper income households to have had their homes weatherized in the last ten years. This makes sense because the program has historically only served households that were at 60 percent of median household income. Presumably those households that do not appear to be eligible for the AHFC weatherization program but report having been served are households that have seen increases in their household income in the last ten years.

There is some variation in primary fuel for space heat by income. However, this is a function of the location of the respondent, how wealth is distributed around the state, and what types of fuels are available in those regions. For example more than 49 percent of households earning \$150,000 or more use natural gas for their primary space-heat and only 16 percent of homes with income of less than \$20,000 per year use natural gas as their primary heat source. In contrast 65 percent of homes reporting income less than \$20,000 per year reported using heating oil as their primary space heating fuel.

Household Income as Housing Variable

Table 36: Primary heating fuel by household income, 2008

Main heating fuel	Under \$20,000	\$20,000 to \$34,999	\$35,000 to \$49,999	\$50,000 to \$69,999	\$70,000 to \$99,999	\$100,000 to \$149,999	\$150,000 or more
Heating oil	65.1%	65.2%	51.8%	48.5%	47.0%	45.9%	45.7%
Natural gas	16.0%	20.3%	34.4%	39.7%	40.3%	44.2%	49.5%
Electricity	2.4%	2.9%	2.2%	1.7%	3.2%	4.4%	1.9%
Wood	16.0%	9.2%	10.7%	9.2%	7.1%	3.9%	1.9%
Other	0.6%	2.4%	0.9%	1.0%	2.5%	1.7%	1.0%

Cost of Construction

Cost of construction, like the price of fuel, can vary wildly from location to location and from year to year, even within the same geographic region of the state. This section of the report provides a picture of the costs to build a house during the last building season and outlines some of the issues that impact residential construction in Alaska. In particular we examine the impact of transportation costs and the impact of regulations that govern the operations of regional housing authorities.

The prohibitively high cost of construction coupled with limited economic opportunity create substantial barriers to residential housing development in many rural communities in Alaska. In many of these communities there is little or no activity in what would be viewed as a traditional housing market. Shipping costs make home construction significantly more expensive in rural communities, particularly those that are off the road and marine highway systems.

One consistent measure of the transportation costs associated with construction materials is the AHFC Construction Cost survey produced by the Alaska Department of Labor and Workforce development annually for 16 years. The survey collects prices for a market basket of goods used to build a home from area contractors; these goods represent roughly 30 percent of the total cost associated with the materials used to build a new home. There is some variation in the types of goods in a local market basket to reflect the different types of housing in different parts of the state. For example no foundation materials would be included in an area where homes are built on pilings and metal roofs are used widely in rural Alaska but almost never in Anchorage.

The Construction Cost survey samples 11 communities. The sample includes urban communities, those on the road system and/or the marine highway system and rural hub villages from around the state but does not include any small rural communities for whom transportation costs are even more significant.

Using information provided in the cost of construction survey it is possible to create a transportation index. By setting Anchorage to one we can estimate the expense associated with shipping materials to various parts of the state. One added cost that this methodology does not consider is the additional costs associated with skilled labor in communities where none exists. Flying a plumber in to a remote site to plumb a housing unit is far more expensive than calling a local plumber to do the job.

Cost of Construction

Table 37 shows the transportation costs associated with purchasing a market basket of residential housing construction materials from Seattle to the listed destinations. An index is created from this information with Anchorage set to 1.0. To estimate cost of construction in any of these communities outside Anchorage the average cost to build a home in Anchorage is multiplied by the index value for the chosen community.

New construction permits for the Municipality of Anchorage in 2008 give the following average cost of construction for new residential units.

- \$345,437 per single family unit
- \$203,708 per multiple family unit

Table 37: Costs to ship construction materials from Seattle for sample Alaska destinations

Destination	Census area	Cost to ship from Seattle	Index (Anchorage = 1.0)
Ketchikan	Ketchikan Gateway	\$2,549	0.38
Juneau	Juneau Borough	\$3,944	0.58
Sitka	Sitka Borough	\$6,472	0.95
Anchorage	Anchorage Municipality	\$6,782	1.00
Wasilla	Mat-Su Borough	\$7,441	1.10
Kenai	Kenai Peninsula Borough	\$8,626	1.27
Fairbanks	Fairbanks North Star Borough	\$8,793	1.30
Kodiak	Kodiak Island Borough	\$9,609	1.42
Bethel	Bethel CA	\$12,047	1.78
Nome	Nome CA	\$14,927	2.20
Barrow	North Slope Borough	\$20,289	2.99

It is important to note that the sample in the table above does not include any small rural communities where transportation costs are often even higher than rural hub communities like Bethel, Nome and Barrow. In many very small remote communities the only builder of new housing units is the area's regional housing authority.

The project team gathered actual cost of construction information from Alaska regional housing authorities for years 2005 through 2008. Housing authorities built new housing in all parts of the state, including urban and rural communities. Housing authorities reported building primarily single family homes during this time with a healthy number of multiple family units and purchasing minimal mobile homes. For rural areas in Alaska the regional housing authorities build (or contract out to build) the vast majority of new housing units and so their costs are a good measure of average costs for the area.

Regional housing authorities receive federal funds to provide housing and/or access to home loans for low income Alaska Native people. Alaska's regional housing authorities have been so successful in leveraging the federal money they receive with other revenue streams that several of them are also able to provide services to low income non-Native people in many parts of the state, most notably in

Anchorage. Regional housing authorities construct housing units in some of the most challenging conditions in the country, operating in extreme weather, with limited infrastructure and a heavy administrative burden associated with regulatory requirements that come with state and federal government funds.

Many of the unique challenges that regional housing authorities face are related to the locations in which they are building. The high cost of any project development in rural Alaska is well established. There are however, other requirements that impact both urban and rural development, some of these requirements are listed below.

- The Native American Housing and Self Determination Act (NAHASDA) which governs federal funds received by housing authorities requires that they pay Davis Bacon wage rates for all projects. Davis Bacon wages are often considerably higher than a private sector contractor would have to pay for similar work. NAHASDA also required extensive environmental site review.
- The Alaska Housing Finance Corporation (AHFC) supplemental grant fund which provides energy efficiency dollars to supplement housing authority projects requires that all homes meet the Built Energy Efficiency Standard (BEES). While most regional housing authorities are already building energy efficient homes and would continue to do so, there are additional costs associated with inspections that are required for BEES certification. There is currently no statewide building energy code so private builders do not have to comply with BEES or any other building energy standard.
- HUD Section 3 requirement that projects *“to the greatest extent possible, provide job training, employment, and contract opportunities for low- or very-low income residents in connection with projects and activities in their neighborhoods.”* Many housing authorities use force account labor to increase the level of resident hire on projects.

The result of these requirements, and others, is higher administrative and labor costs and more energy efficient (but also more expensive) housing units.

Table 38 provides examples of the actual costs associated with building new single family housing units in remote rural communities. Each of the examples below represents real projects completed in the past two years. Note that there are no costs associated with land, which is usually donated, or with construction financing; two significant costs in traditional home building. Other cost categories appear much larger for housing authorities including infrastructure, freight and developer fees. In one of the examples below infrastructure costs account for 23 percent of total project cost and freight costs range from 10 to nearly 17 percent of total project cost.

Cost of Construction

Table 38: RHA single family construction costs, selected projects

Location	Chefnak	Marshall	Nelson Lagoon ¹⁰	Shaktoolik	Alatna
Building Type	Single Family	Single Family	Single Family	Single Family	Single Family
Total Units	1	1	1	4	1
Total Bedrooms	2	3	3	13	3
Cost Information					
Land	\$0	\$0	\$0	\$0	\$0
Infrastructure ¹¹	\$2,793	\$93,250	\$5,199	\$100,000	\$10,000
Freight	\$30,652	\$34,710	\$51,941	\$126,205	\$70,000
Construction Permits	\$0	\$0	\$0	\$1,000	\$0
Hard Costs ¹²	\$172,817	\$180,039	\$439,867	\$872,686	\$324,000
Soft Costs ¹³	\$5,150	\$5,150	\$28,126	\$50,000	\$10,000
Construction Financing	\$0	\$0	\$0	\$0	\$0
Permanent Financing	\$0	\$0	\$0	\$0	\$0
Developer Fees/Costs ¹⁴	\$63,599	\$90,397	\$20,967	\$20,000	20%
Total Cost of Project	\$275,011	\$403,546	\$546,100	\$1,169,891	\$414,000

Notes:

¹⁰ Note that this home was built with State Davis Bacon wage requirements, substantially increasing labor costs (found in hard costs), also note that freight costs were shared with another housing unit built at the same time, lowering per unit freight costs.

¹¹ Infrastructure includes, water, sewer, extending utility connection, roads, etc.

¹² Hard costs include labor, materials, etc.

¹³ Soft costs include design, inspections, surveys, soils/environmental reports

¹⁴ Developer fees include Housing Authority admin

Table 39 on provides further analysis of the projects described in Table 38 to table above. It is important to remember that most housing units built in rural Alaska are much smaller than homes built in urban areas. The housing units described in these tables range in size from 624 to 1,500 square feet. Other differences appear from region to region include type of building materials used and complexity of design. For example, in the Calista region where transportation costs are extremely high and ability to quickly address building maintenance issues is limited, most homes have internal siding instead of drywall and a single monitor heater instead of more complex heating systems that are typical in urban homes.

Table 39: RHA single family selected project cost analysis

Location of project	Chefnak	Marshall	Nelson	Shaktoolik	Alatna
Total cost of project	\$275,011	\$403,546	\$546,100	\$1,169,891	\$414,000
Cost per bedroom	\$137,506	\$134,515	\$182,033	\$89,992	\$138,000
Cost per square foot	\$441	\$360	\$442	\$245	\$316
Cost Per unit	\$275,011	\$403,546	\$546,100	\$292,473	\$414,000

Figure 8 shows the cost per square foot for several different single family homes built throughout the state. Some communities have multiple examples represented, e.g. Marshall, while others have only one example represented. The homes below range in size from 624 square feet in Chefnak to 1,504 in Nelson Lagoon. Cost of construction per square foot ranges from \$189 in Sitka to \$501 in Shageluk.

Figure 8: Single-family house construction cost per square foot

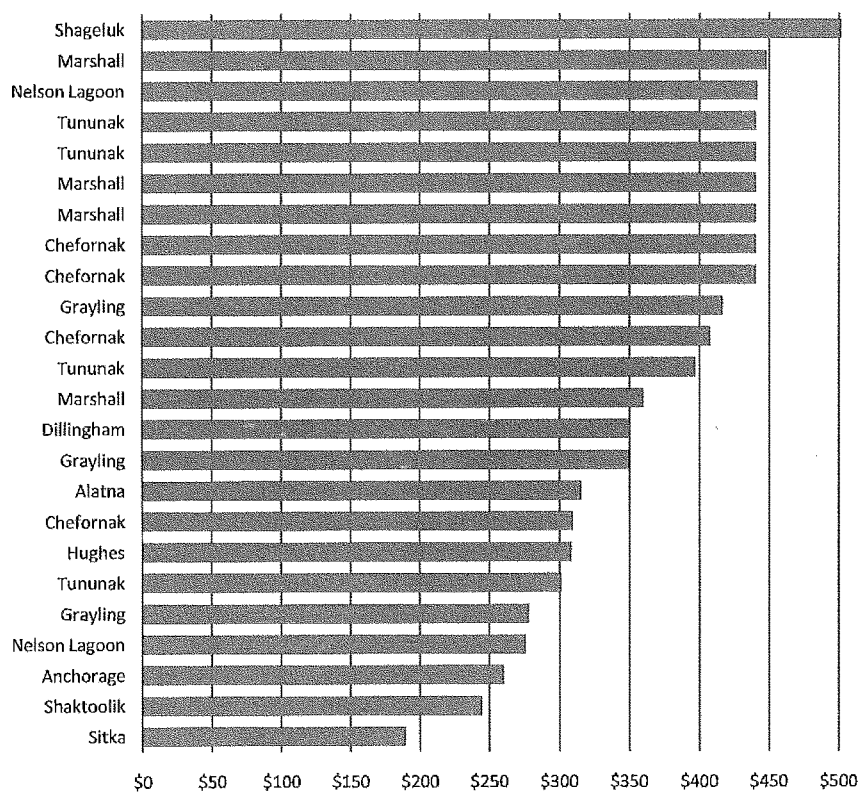


Table 40 shows the costs associated with two multi-family projects; one in Hooper Bay and one in Anchorage. The project in Hooper Bay was built for families and includes 2, 3, 4, and 5 bedroom units. The Anchorage project is senior housing. These two projects, while different, provide examples of the types of costs incurred by housing authorities building multi-family housing projects.

Cost of Construction

Table 40: RHA multi-family housing project construction costs, Two examples

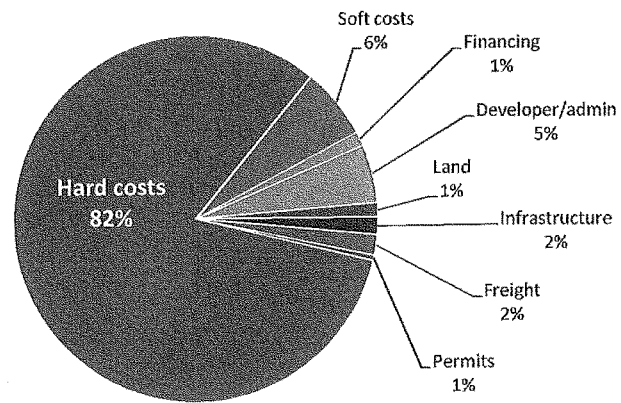
Location	Hooper Bay	Anchorage
Building type	Multi-Family	Multi-Family
Total units	19	59
Total bedrooms	65	72
Total living area all units: sq ft	27,070	91,693
Average living area per unit sq ft	1,425	1,554
Cost Information		
Land	\$0	\$0
Infrastructure	\$0	\$46,956
Freight	\$1,200,000	\$0
Location	Hooper Bay	Anchorage
Construction Permits	\$5,470	\$128,265
Hard Costs	\$8,851,661	\$19,769,648
Soft Costs	\$1,373,589	\$1,490,086
Construction Financing	\$0	\$308,480
Permanent Financing	\$3,276	\$94,534
Total Cost of Project	\$12,126,758	\$22,837,969
Total Cost Per Square Foot	\$448	\$249
Total Cost Per Unit	\$638,250	\$387,084

Figure 9 on page 63 shows the percentage of total cost associated with a variety of construction variables for several rural and urban housing projects completed by regional housing authorities over the last two years. The number of units is not large enough to be a representative sample of regional housing authority construction but it does provide a picture of how construction costs are allocated.

The costs associated with building in Alaska are explored in this section because they are so varied and are an important variable in the housing equation. However, estimating a total cost of replacing all substandard housing units and building to alleviate overcrowded conditions is an unnecessary and misleading effort. It is not possible that all of the housing needed to alleviate overcrowding and substandard housing will occur in one building season or even in ten. Even if the funding were available to build all of the needed units, it would take considerable time to get the job done. For this reason an estimate of gross cost is not terribly meaningful.

Cost of Construction

Figure 9: Regional housing authority construction cost allocation



Population Dynamics

Alaska's Population: 2000-2008

Alaska has a population of 686,300, ranking it 47th among the nation's 50 states.¹⁰ The state's population has been growing at about 1.0 percent a year since 2000, due primarily to natural increase (births minus deaths) rather than migration.¹¹ The state has grown at almost the same rate as the United States population as a whole, which experienced an eight percent increase from 2000 to 2008.

Alaska's population is concentrated in its urban road/railbelt areas, especially in the Municipality of Anchorage (41 percent) and Matanuska-Susitna Borough (12 percent). Currently over half (53 percent) of Alaskans live in the greater Anchorage/Mat-Su region. That proportion has been growing. In 2000, the region accounted for 51 percent of the state's population.

Other predominantly urban boroughs account for another quarter of Alaska's population: Fairbanks North Star Borough (14 percent), Kenai Peninsula Borough (8 percent) and the city and borough of Juneau (4 percent). In all 458,000 (67 percent) Alaskans live in the communities designated as Urban in this study.

WHERE THE GROWTH IS

The fastest growing area of the state continues to be the Mat-Su Borough, which has grown at an average rate of four percent per year since 2000, continuing the rapid pace of growth the borough saw throughout the 1990s. Three-quarters of the growth in Mat-Su has been from migration. Mat-Su is one of only 10 of Alaska's 29 boroughs and census areas that gained population since the 2000 U.S. census: Municipality of Anchorage (+24,700 people), Mat-Su Borough (+23,200), Fairbanks

¹⁰ The U.S. Census Bureau estimates Alaska's 2008 population at 686,293. The Alaska Department of Labor and Workforce Development (DOLWD) uses a lower estimate of 679,720. The difference is due primarily to differing estimates for the population of the Fairbanks North Star Borough. The FNSB population was revised upward by the Census Bureau following the borough's successful 2007 challenge to the state's municipal population estimate. On June 1, 2009, the Alaska Department of Commerce, Community and Economic Development (DCCED) certified FNSB population at 97,970; however Alaska DOLWD still uses a lower estimate of 89,896 in calculations of Alaska economic and demographic statistics and trends.

¹¹ About 90,000 people migrate to or from Alaska each year, but in- and out- migration have been nearly equal in recent years. Between 2007 and 2008 approximately 2,500 more people left than entered the state. Since 2000, the state has lost a total of 6,000 residents through net migration, while gaining nearly 60,000 through natural increase.

Population Dynamics

North Star Borough (+15,150), Kenai Peninsula Borough (+3,300), Bethel Census Area (+900), Southeast Fairbanks Census Area (+850), and Wade Hampton Census Area (+650).¹²

Figure 10: Alaska population by borough and census area, 2008 estimate

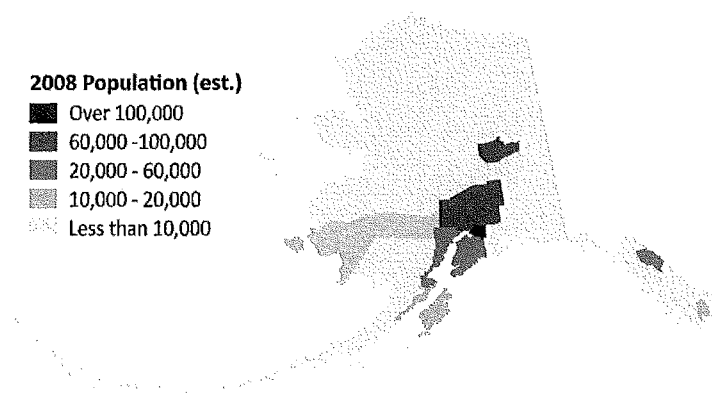
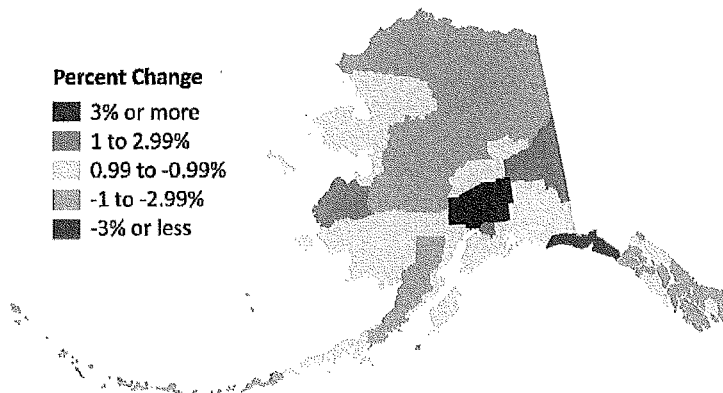


Figure 11: Average annual change in regional population, 2000-2008



Data source: Alaska DOLWD, Research and Analysis Section, Demographics Unit.

¹² Except for the Fairbanks North Star Borough, all figures represent the difference between the 2000 U.S. Census and the 2008 Alaska DOLWD population estimate. Fairbanks' growth is calculated using the 2008 U.S. Census estimate for the borough. Numbers have been rounded.

DECLINING POPULATIONS

Southeast Alaska has seen its population decline faster than other regions of the state, and this trend is projected to continue, according to DOLWD.¹³ Overall the Southeast region lost 8,000 people to net out-migration between 2000 and 2008; with an aging population, these losses were only partially offset by new births. The population of the region as a whole declined by 3,880 people (+5.3 percent) since 2000, and no community saw long-term population growth over this period. Nearly a third of the region's decline was in the Ketchikan Gateway Borough, which saw its population drop by 1,066 (+7.6 percent) during the period.

In the Southwest, while Bethel and the Wade Hampton Census Areas gained population, the Aleutians West Census Area saw its population decline by over 1,000 (-30.1 percent). Sharp declines were also experienced in Bristol Bay Borough (229 people, -28.6 percent) and the Lake and Peninsula Borough (271 people, +21.2 percent). The Dillingham Census Area lost 151 residents (-3.3 percent) since 2000. Population was flat for Aleutians East Borough (+0.1 percent) and the region as a whole (-0.4 percent).

In the Gulf Coast region, the Kodiak Island Borough's population declined by 540 people (-3.9 percent), and Valdez/Cordova Census Area lost more than 650 residents (-6.7 percent) between 2000 and 2008. The 6.6 percent growth in the Kenai Peninsula Borough was due primarily to new births. Net migration accounted for less than 600 (17.6%) of the borough's new residents.

In the Northern region, the North Slope Borough lost nearly 700 residents (-9.2 percent) from 2000 to 2008, while Nome and the Northwest Arctic Borough saw modest overall population gains (+3.3 percent and +2.8 percent respectively) from natural increase outpacing out-migration.¹⁴

In Interior Alaska, population in the Yukon-Koyukuk Census Area declined by over 800 people (-14.8 percent) as out-migration exceeded gains from natural increase. Population in the Denali Borough has held nearly steady since 2000 with a net loss of just 45 people (-2.4 percent).

¹³ Alaska population estimates and projections published by the department's Research and Analysis Section form the basis for much of the information in this chapter, especially the May 2009 issue of *Alaska Economic Trends*, ("Alaska's 2008 Population," 13), and the October 2007 issue ("Population Projections: 2007-2030," 4).

¹⁴ The Mat-Su Borough, Kenai Peninsula Borough and Southeast Fairbanks Census Areas were the only areas of the state with more in-migration than out-migration between 2000 and 2008. All other boroughs and census areas in the state lost more people than they gained through net migration, according to Alaska DOLWD. Other areas of the state which gained population since 2000 did so by having natural increases (births minus deaths) that more than offset their out-migration.

Population Dynamics

Table 41: Alaska population by economic region, borough and census area, 2000-08

Region or Area	2000 Census (Apr 1, 2000)	2008 Estimate (July 1, 2008)	Natural Increase (Births- Deaths) 4/1/00- 06/30/08	Net Migration (In-Out) 4/1/00- 06/30/08	Rate of Change Total Change 2000- 2008	Annual Average 2000- 2008
Alaska (1)	626,931	679,720	59,828	-7,039	8.4%	1.0
Anchorage/Mat-Su	319,605	367,509	31,139	16,765	15.0%	1.7
Anchorage, Municipality of	260,283	284,994	25,578	-867	9.5%	1.1
Matanuska-Susitna Borough	59,322	82,515	5,561	17,632	39.1%	4.0
Gulf Coast Region	73,799	75,876	4,656	-2,579	2.8%	0.3
Kenai Peninsula Borough	49,691	52,990	2,717	582	6.6%	0.8
Kodiak Island Borough	13,913	13,373	1,314	-1,854	-3.9%	-0.5
Valdez-Cordova Census Area	10,195	9,513	625	-1,307	-6.7%	-0.8
Interior Region	97,417	104,421	11,204	-4,200	6.7%	0.8
Denali Borough	1,893	1,848	127	-172	-2.4%	-0.3
Fairbanks North Star Borough (2)	82,840	97,970	—	—	18.3%	—
Southeast Fairbanks Census Area	6,174	7,008	527	307	11.9%	1.5
Yukon-Koyukuk Census Area	6,510	5,669	305	-1,146	-14.8%	-1.7
Northern Region	23,789	23,612	3,508	-3,685	-0.7%	-0.1
Nome Census Area	9,196	9,499	1,285	-982	3.3%	0.4
North Slope Borough	7,385	6,706	1,098	-1,777	-9.2%	-1.2
Northwest Arctic Borough	7,208	7,407	1,125	-926	2.8%	0.3
Southeast Region	73,082	69,202	4,099	-7,979	-5.3%	-0.7
Haines Borough	2,392	2,310	34	-116	-3.4%	-0.4
Juneau City and Borough	30,711	30,427	2,070	-2,354	-0.9%	-0.1
Ketchikan Gateway Borough (3)	14,059	12,993	778	-1,844	-7.6%	-1.0
Prince of Wales-Outer Ketchikan C.A. (4)	6,157	5,360	338	-1,135	-12.9%	-1.7
Sitka City and Borough	8,835	8,615	556	-776	-2.5%	-0.3
Skagway-Hoonah-Angoon C.A.	3,436	2,946	129	-619	-14.3%	-1.9
Hoonah-Angoon Census Area	2,574	2,100	—	—	-18.4%	-2.5
Skagway Municipality	862	846	—	—	-1.9%	-0.2
Wrangell-Petersburg Census Area	—	—	166	-891	—	-1.4
Petersburg Census Area	4,260	3,847	—	—	-9.7%	-1.2
Wrangell City and Borough (5)	2,448	2,112	—	—	-13.7%	-1.8
Yakutat City and Borough	808	592	28	-244	-26.7%	-3.7
Southwest Region	38,961	39,100	5,222	-5,361	-0.4%	0.0
Aleutians East Borough	2,701	2,699	102	-100	0.1%	0.0
Aleutians West Census Area	3,413	4,439	216	-1,242	-30.1%	-2.5
Bethel Census Area	17,834	16,940	2,766	-1,872	5.0%	0.7
Bristol Bay Borough	800	1,029	61	-290	-28.6%	-2.4
Dillingham Census Area	4,620	4,771	522	-673	-3.3%	-0.4
Lake and Peninsula Borough	1,281	1,552	93	-364	-21.2%	-1.9
Wade Hampton Census Area	8,312	7,670	1,462	-820	7.7%	1.1

Sources: US Census 2000, 1990; Alaska DOLWD, Research and Analysis Section, Demographics Unit.

Notes: (1) The U.S. Census Bureau estimates Alaska's 2008 population at 686,293. (2) The 2008 estimate for the Fairbanks North Star Borough comes from the U.S. Census Bureau. (3) 2000 population for the Ketchikan Gateway Borough does not include annexed population of Outer Ketchikan. (4) Renamed Prince of Wales-Hyder Census Area in 2008. (5) 2000 population reflects the incorporated area, which is greater than the 2000 Census Area Population.

Table 42: Population change in Alaska places with more than 2,000 people, 2000-2008

	2008 estimate (Jul 1, 2008)	2000 census (Apr 1, 2000)	Population Change	Average Annual Change
Knik-Fairview CDP	12,989	7,049	5,940	7.2%
Fishhook CDP	3,230	2,030	1,200	5.5%
Meadow Lakes CDP	7,106	4,819	2,287	4.7%
Tanaina CDP	7,218	4,993	2,225	4.4%
Deltana CDP	2,233	1,570	663	4.2%
Homer city	5,390	3,946	1,444	3.8%
Gateway CDP	3,996	2,952	1,044	3.6%
North Pole city	2,099	1,570	529	3.5%
Wasilla city	7,176	5,469	1,707	3.3%
Willow CDP	2,142	1,658	484	3.1%
Butte CDP	3,262	2,561	701	2.9%
Kalifornsky CDP	7,312	5,846	1,466	2.7%
Lakes CDP	8,249	6,706	1,543	2.5%
Palmer city	5,559	4,533	1,026	2.5%
Big Lake CDP	3,191	2,635	556	2.3%
Anchorage municipality	284,994	260,283	24,711	1.1%
College CDP	12,456	11,402	1,054	1.1%
Sterling CDP	5,134	4,705	429	1.1%
Soldotna city	4,061	3,759	302	0.9%
Bethel city*	5,665	5,471	194	0.4%
Kenai city	7,134	6,942	192	0.3%
Nikiski CDP	4,406	4,327	79	0.2%
Nome city	3,570	3,505	65	0.2%
Kotzebue city*	3,126	3,082	44	0.2%
Fairbanks city	30,367	30,224	143	0.1%
Juneau city and borough	30,427	30,711	-284	-0.1%
Sitka city and borough	8,615	8,835	-220	-0.3%
Dillingham city*	2,347	2,466	-119	-0.6%
Ketchikan city	7,508	7,922	-414	-0.7%
Kodiak city	5,974	6,334	-360	-0.7%
Petersburg city	3,009	3,224	-215	-0.8%
Seward city	2,619	2,830	-211	-0.9%
Valdez city	3,635	4,036	-401	-1.3%
Barrow city*	4,054	4,581	-527	-1.5%
Cordova city	2,161	2,454	-293	-1.5%
Wrangell city and borough	2,112	2,448	-336	-1.8%
Unalaska city*	3,551	4,283	-732	-2.3%

* Alaska Native Statistical Area

Sources: US Census 2000; Alaska DOLWD Research and Analysis Section, Demographics Unit.

Notes: (1) CDP is an abbreviation for Census Designated Place. (2) The July 1, 2008, estimates represent the annual average population for the year, not the population on July 1. Seasonal populations may be higher than the average annual population shown. (3) Homer, Ketchikan, Palmer, Wasilla, and Wrangell gained population through annexation between 2000 and 2008.

Population Dynamics

CHANGES AT THE COMMUNITY-LEVEL

Not surprisingly, 11 of the 15 fastest-growing places in Alaska are in Mat-Su, according to DOLWD. The Knik-Fairview Census Designated Place (CDP), which has grown at an average of 7.2 percent per year since 2000, would become the state's fourth-largest city if it incorporated. Other especially fast-growing Mat-Su communities include: Fishhook CDP (+5.5 percent), Meadow Lakes (+4.7 percent), Tanaina (+4.4 percent), Wasilla (+3.3 percent), Willow (+3.1 percent), and Butte (+2.9 percent). Numbers in parentheses are the communities' average annual growth rates from April 1, 2000, to June 20, 2008. The community's overall population change for the period will be approximately eight times the annual average.

Only four communities in other parts of the state have been gaining population at rates over two percent per year. In the Interior, Deltana grew at 4.2 percent per year between 2000 and 2008, while the City of North Pole grew at 3.5 percent. On the Kenai Peninsula, Homer's population grew at 3.8 percent per year since 2000, and Kalifornsky has experienced average annual growth of 2.7 percent.

The majority of Alaska communities (56 percent) have had flat or declining populations in recent years. This includes Unalaska (City, -2.3 percent), Wrangell (City and Borough, -1.8 percent), Cordova (City including Eyak, -1.5 percent), Barrow (City, -1.5 percent), Valdez (City, -1.3 percent), Ketchikan (City, -0.7 percent), Sitka (City and Borough, -0.3 percent), and Juneau (City and Borough, -0.1 percent). Table 42 shows recent population changes for all census designated places in Alaska with populations greater than 2,000.

Population Projections, 2010-2030

Alaska's population is projected to grow 25 percent from 670,000 in 2006 to over 838,000 in 2030. This growth model is based on a relatively stable level of net migration to and from Alaska, consistent with the state's experience over the last two decades. Alaska DOLWD projected future population growth in 2007 through the year 2030 for the state as a whole, for each economic region, borough and census area, and for Alaska's Native American population. (Alaska DOLWD, 2007)¹⁵

State demographers caution that there is a great deal of uncertainty about what actual rates of growth will be. The greatest uncertainty comes from trying to predict migration trends. Alaska's history is marked by transforming events like the gold rush, the construction of the Trans-Alaska Pipeline System (TAPS), and the oil boom

¹⁵ To arrive at their projections, researchers used a "cohort component" method to project population changes for each sex by age group and then applied a large number of differing assumptions to each group to model the probable impacts of migration and fertility on the population. Their methodology and conclusions are published in Alaska DOLWD, *Alaska Population Projections: 2007-2030*. (Juneau, July 2007), which is the basis for much of the information in this section. Accessed online at <http://laborstats.alaska.gov/?PAGEID=67&SUBID=163>.

which followed it, which dramatically increased migration to Alaska. In recent years, however, out-migration has exceeded in-migration.

It is considered unlikely that any events over the next 20 to 25 years will produce large-scale population changes in Alaska due to net migration, but state demographers do not rule them out. The population shocks from construction of a natural gas pipeline are not expected to be on the scale Alaska experienced with TAPS.¹⁶ In real dollar terms, the Alaska portion of a gas pipeline project will be considerably smaller than TAPS, and Alaska is better equipped to provide the labor, expertise and public infrastructure a large pipeline project will require than it was in 1974. While Alaska's population has grown, the state's economy and workforce have become larger and more diversified. State demographers believe that as Alaska develops, both in- and out-migration levels will become less prone to dramatic shifts.

The state could still see greater population influxes than predicted if several large infrastructure projects occur simultaneously, increasing the demand for specialized labor. Even without such a "perfect storm," speculative migration may increase if a mega project fuels robust economic growth in Alaska at the same time that other areas of the country are in recession, as was the case during TAPS construction.

AGING OF ALASKA'S POPULATION

Alaska's senior population has historically been small, but with the aging of the "baby boom" generation Alaska's population age 65 and over will grow substantially over the next 20 years, mirroring the trend in the rest of the country. The state's population projections anticipate the number of older Alaskans will nearly triple in size from 45,500 in 2006 to 134,400 by 2030. Alaskans in this age group are expected to increase from seven percent of the population to 16 percent, which will increase demand for the whole range of senior housing options. Projected growth for other age groups is shown in Table 43.

Table 43: Population projections by age, 2010-2030

Age group	2006 estimate	2030 projection	2006 % of Pop.	2030 % of pop.	% Change 2006-2030
0 - 4 (1)	53,456	64,425	8.0%	7.7%	21%
5 - 13	95,048	118,624	14.2%	14.1%	25%
14 - 17	46,243	51,320	6.9%	6.1%	11%
18 - 64	429,817	469,916	64.1%	56.0%	9%
65+	45,489	134,391	6.8%	16.0%	195%

Source: Alaska DOLWD Research and Analysis Section, Demographics Unit.

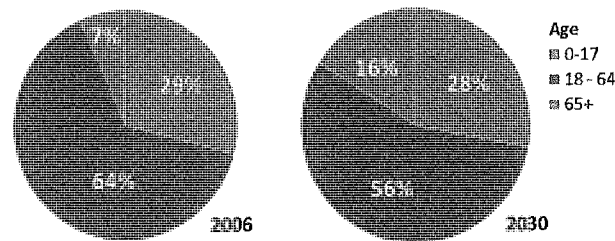
Notes: (1) There is a high degree of uncertainty in projections for younger age group, especially those not yet born.

¹⁶ Information Insights, *Stranded Gas Development Act Municipal Impact Analysis*. (Fairbanks, November 2004), 25.

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Because of these changing age demographics, the burden on Alaska's working-age population to support the growing number of elderly Alaskans will increase. Whereas every 100 Alaskans of working age (ages 18 to 64) supported 10.6 persons over the age of 64 in 2006, by 2030 the same number of Alaskans may need to support up to 27.9 people over age 64.

Figure 12: Alaska population aged 18-64 compared with youth and elderly, 2006 and 2030.



ALASKA NATIVE POPULATION PROJECTIONS

Alaska Natives and other Native Americans living in the state are projected to grow slightly as a share of the state's population, from 17.7 percent in 2006 to 19.4 percent by 2030. The proportion of Alaska Natives aged 65 or over will also grow from six percent to 12 percent of the overall Native population.

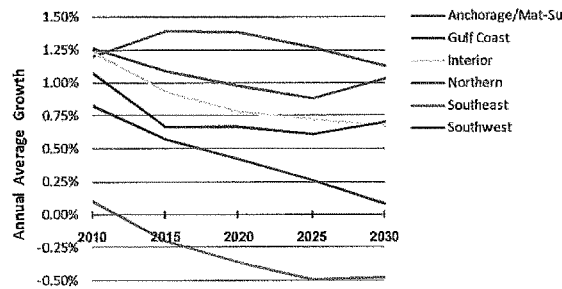
As the Alaska Native population ages and as more Alaska Natives move into urban areas, the fertility rate among Alaska Natives (the average number of children per woman), which is one of the highest in the country, is expected to decline somewhat (from 3.2 to 3.0), resulting in slightly smaller family sizes.

Total fertility rates in Alaska vary greatly from region to region, from a high of 4.73 in the Wade Hampton Census Area in Western Alaska to a low of 1.74 in Haines Borough. Fertility (and thus household size) is generally lower in urban Alaska. Birth rates are lowest in the Aleutians, where large numbers of people involved in fishing and fish processing live in group quarters.

REGIONAL POPULATION CHANGES

Looking forward, population growth in the Anchorage/Mat-Su region is expected to continue to outpace growth in other regions of the state, while the only region expected to lose population is Southeast Alaska. Figure 13 shows the projected rate of population growth or decline for different areas of the state over the next 20 years.

Figure 13: Projected Alaska population growth rate by region, 2010-2030



Data source: Alaska Department of Labor and Workforce Development, Research and Analysis Section

Demographers warn that there is a great deal of uncertainty regarding population changes for specific regions, especially regions with small populations. Inter-regional migration is subject to highly specific economic factors, historic events and policy initiatives which can dramatically influence population movement. DOLWD population projections for Alaska's boroughs and census areas, shown on page 75 should not be regarded as inevitable.

FACTORS BEHIND RURAL OUT-MIGRATION

There is concern among many in Alaska that the dramatic increase in energy costs over the past two years may be greatly accelerating the state's historical trend of rural to urban migration.

A May 2008 study by the Institute of Social and Economic Research (ISER) at the University of Alaska Anchorage found that net out-migration from rural areas of the state had more than doubled to 2,700 people annually for 2006-2007 compared with 1,200 annually in the three previous years. (Martin, Killorin, & Colt, May 2008). The authors conclude that it is too soon to tell whether this represents a statistical "blip" or a significant acceleration in outmigration, especially since many Alaska Natives move back and forth several times over their lifetimes.

Surveys show that in many cases people looking for more job opportunities initially move to hub communities such as Nome, Bethel or Barrow within their own cultural region, before moving to an urban area such as Anchorage, Fairbanks, or Juneau. The U.S. Census does not publish statistics on migration within regions (e.g. moving from a village to a regional hub) so this first step in rural out-migration is not included in statistics on net migration.

A 2003 ISER survey of Alaska Natives in the North Slope, Northwest Arctic, and Bering Straits regions found that people in middle income groups are most likely to leave their communities, since people with the lowest incomes cannot afford to move and there is less incentive for people with high incomes to move. For this

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reason, the people hardest hit by high fuel costs may be the least able to afford to move.¹⁷

This may be one reason that, as of 2007, fuel prices did not seem to be the driving force behind decisions to move out of rural communities, though the high cost of living in villages was considered a problem by village residents. There is not sufficient data to show whether the increases in fuel prices since 2007 have been a primary factor behind more recent increases in migration.

There does not appear to be a single, simple reason behind out-migration. Even in the North Slope Borough, which has fuel subsidies and high paying jobs that allow for subsistence activities, the rate of out-migration has been high.

Lack of housing may affect migration. A 1986 study by ISER found that people are more likely to leave communities with overcrowded housing and are not likely to return if they don't believe they can find a decent place to live.

Previous studies have found that more Alaska Native women are leaving villages than men. Since relatively high birth rates have been responsible for much of Alaska's rural population growth – offsetting losses from migration – the fact that more women are moving has implications for the future viability of small rural communities. For 18 of Alaska's smallest communities (those with populations under 100) there were zero women aged 20-29 at the time of the 2000 census. Another 23 communities reported only one woman in that age group.

Communities under 100 have historically been the most vulnerable to decline. Even in regions where population is declining, some larger communities continue to grow. Men who prefer to stay in rural Alaska cite hunting and fishing as major reasons. Women are more likely to stay for family reasons.

¹⁷ Martin, S., Killorin, M., & Colt, S. (May 2008). *Fuel Costs, Migration, and Community Viability*. Anchorage: Institute of Social and Economic Research.

Table 44: Projected Alaska population by region, 2010-2030

	2006	2010	2015	2020	2025	2030
Anchorage/Mat-Su Region	359,987	377,651	404,745	433,588	462,005	488,553
Municipality of Anchorage	282,813	293,323	306,902	322,087	337,706	350,871
Matanuska-Susitna Borough	77,174	84,328	97,843	111,501	124,299	137,682
Gulf Coast Region	74,611	77,107	79,279	80,920	81,951	82,286
Kenai Peninsula Borough	51,350	53,607	55,951	57,883	59,339	60,268
Kodiak Island Borough	13,506	13,477	13,298	13,058	12,740	12,255
Valdez-Cordova Census Area	9,755	10,023	10,030	9,979	9,872	9,763
Interior Region	102,276	107,416	112,525	117,026	121,291	125,422
Denali Borough	1,795	1,786	1,739	1,676	1,601	1,536
Fairbanks North Star Borough	87,849	92,868	97,706	101,973	106,106	110,131
Southeast Fairbanks Census Area	6,772	6,863	7,314	7,782	8,222	8,644
Yukon-Koyukuk Census Area	5,860	5,899	5,766	5,595	5,362	5,111
Northern Region	23,676	24,904	26,299	27,607	28,854	30,372
Nome Census Area	9,535	9,902	10,412	10,908	11,405	12,024
North Slope Borough	6,807	7,291	7,722	8,095	8,433	8,867
Northwest Arctic Borough	7,334	7,711	8,165	8,604	9,016	9,481
Southeast Region	70,053	70,315	69,593	68,335	66,661	65,073
Haines Borough	2,241	2,095	1,978	1,854	1,712	1,571
Juneau Borough	30,650	31,691	32,078	32,252	32,227	32,260
Ketchikan Gateway Borough	13,174	12,836	12,507	12,088	11,587	11,095
Prince of Wales-Outer Ketchikan C.A.	5,477	5,261	4,996	4,658	4,274	3,894
Sitka Borough	8,833	8,964	8,948	8,864	8,740	8,658
Skagway-Hoonah-Angoon C.A.	3,020	2,862	2,657	2,415	2,180	1,945
Wrangell-Petersburg Census Area	6,024	5,960	5,785	5,580	5,340	5,076
Yakutat Borough	634	646	644	624	601	574
Southwest Region	39,450	41,180	42,558	43,989	45,351	46,970
Aleutians East Borough	2,643	2,675	2,688	2,676	2,645	2,632
Aleutians West Census Area	4,810	5,169	5,068	4,944	4,795	4,665
Bethel Census Area	17,031	17,774	18,590	19,457	20,333	21,354
Bristol Bay Borough	1,060	1,169	1,153	1,152	1,133	1,120
Dillingham Census Area	4,796	4,897	5,044	5,181	5,293	5,408
Lake & Peninsula Borough	1,557	1,586	1,560	1,510	1,443	1,364
Wade Hampton Census Area	7,553	7,910	8,455	9,069	9,709	10,427
State of Alaska	670,053	698,573	734,999	771,465	806,113	838,676

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section, Demographics Unit.

Alaska Native Corporation Regions

Alaska Native corporation regions are relevant in the state housing conversation because Regional Housing Authorities (RHA) follow regional Native corporation boundaries. RHAs are recipients of federal funds under the Native American Housing and Self Determination Act.

Most very remote communities in Alaska do not have a functioning housing market capable of meeting demand/need for housing. Housing construction costs are so high in most rural locations so as to make building a new home financially inaccessible to most residents. It is for this, amongst other, reasons that RHAs build the majority of new units constructed in rural Alaska.

The pages that follow provide a description of the housing situation in each of the Native corporation regions. In order to stay within a defensible level of statistical reliability the only Native corporation regions for which 2008 regional survey results have been used to estimate need are Calista, Cook Inlet, Doyon and Sealaska. These four regions are home to 89.5 percent of the housing stock in the state and include all levels of community from very small and remote to urban Anchorage. For the remaining regions we rely on community classification (Urban, Rural 1, Rural 2) to estimate need.

Table 45: Growth in housing stock by Native corporation regions, 2000-08

Region	2008 housing units (est.)	% of total stock 2008	2000 housing units (census)	% Change 2000-08
Ahtna	2,128	0.75%	2,093	1.66%
Aleut	3,030	1.07%	2,958	2.43%
Arctic Slope	2,577	0.91%	2,538	1.54%
Bering Strait	3,777	1.33%	3,649	3.51%
Bristol Bay	4,511	1.59%	4,432	1.78%
Calista	7,667	2.70%	7,251	5.74%
Chugach	5,592	1.97%	5,305	5.41%
Cook Inlet	167,658	59.14%	150,566	11.35%
Doyon	44,005	15.52%	41,606	5.77%
Koniag	5,521	1.95%	5,159	7.02%
Nana	2,753	0.97%	2,540	8.39%
Sealaska	34,278	12.09%	32,515	5.42%
Total	283,497	100.00%	260,612	8.78%

Cook Inlet, Doyon and Sealaska are significantly larger than Calista and are home to a majority of the state population. The survey team broke Calista out because it is

Alaska Native Corporation Regions

the next largest region in the state and also because of its status as the poorest part of the state with the highest level of need. The remaining eight regions encompass 10.5 percent of the total estimated housing stock in Alaska. For these regions estimates of need created by overcrowded conditions and poor condition are based on survey findings by community classification. Survey findings are applied to appropriate communities within a given region. For example, in Ahtna region there are only communities classified as Rural 1. We can apply survey findings for housing variables in Rural 1 communities to the estimates of housing stock in that region to arrive at an estimate of need.

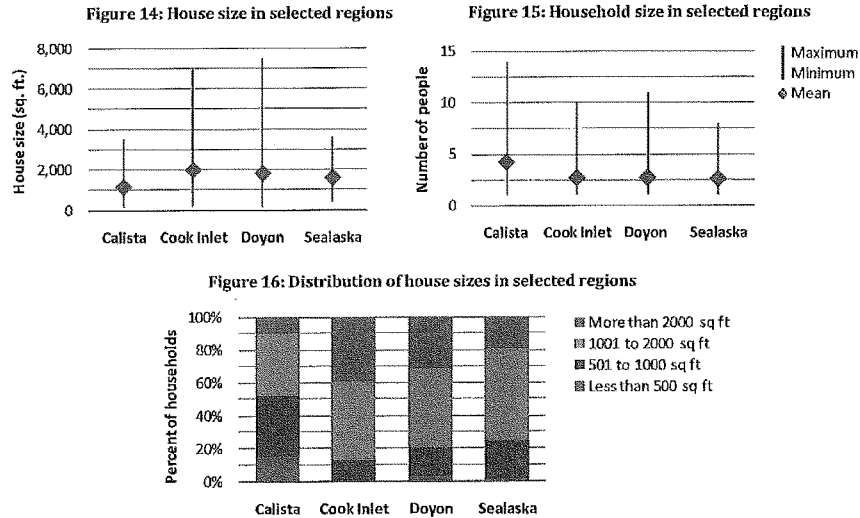
**Evidence of Overcrowding**

We asked survey respondents how large their homes are and how many people live with them. The Calista region had both the smallest home sizes and the greatest number of residents per house. These findings are in keeping with what we know of the economic and housing conditions in the region. Ninety percent of the homes in the Calista region of Southwestern Alaska are 2,000 ft² or less, while the average household size is over four people (compared with an average of less than three people per household in other ANCSA regions for which we have sufficient data).

As a result, the amount of living space per person in Calista is one-third or less than that in Cook Inlet, Doyon, and Sealaska regions. The median square footage per resident in the Calista region is 250 ft². By contrast, Cook Inlet has 925 square feet per resident; Doyon, 825 ft² per resident; and Sealaska, 750 ft² per resident. In the Sealaska region, nearly 32 percent of respondents have had a family member or friend stay with them because the person did not have a home.

The top two figures below show mean house and household size by region as well as the maximum and minimum values reported by survey participants in that region. Figure 16 illustrates the overall distribution of sizes in the housing stock for each region. In Cook Inlet, 87 percent of housing units are over 1,000 square feet, compared with 79 percent in Doyon, 75 percent in Sealaska, and 48 percent in Calista.

Alaska Native Corporation Regions

**Weatherization and Energy Efficiency**

The statewide survey asked several questions to help make a determination about the construction quality and energy efficiency of respondent's homes. The following figures show aggregate responses for residents of the four largest ANCSA regions.

Construction quality and weatherization are adequate to maintaining a comfortable indoor environment in over ninety percent of homes in the Cook Inlet and Doyon regions, and over 85 percent of homes in Sealaska. The picture is reversed in Calista, where 87 percent of respondents said they cannot keep their homes warm enough on the coldest days of winter.

In the Cook Inlet and Calista regions, over 90 percent of homes are wood frame. Fewer than 80 percent of homes in the Doyon region are wood frame; there is a much higher percentage of log homes (17 percent) in this region than in any other area of the state. Roughly 84 percent of homes in the Sealaska region are wood-frame construction. The region reported the highest percentage of mobile homes in its housing stock (16 percent) of any region in the state.

Alaska Native Corporation Regions

Figure 17: Can you maintain a comfortable temperature in your home during the coldest days in winter?

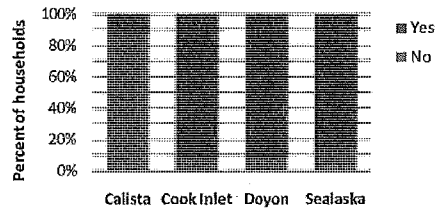


Figure 18: During the winter is the floor of your house...?

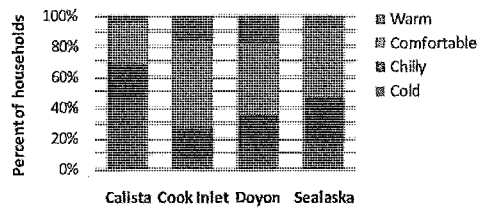
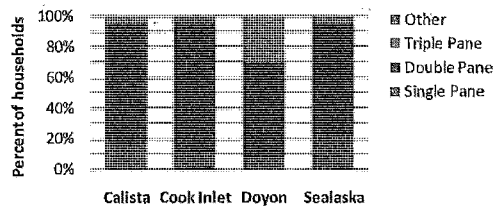


Figure 19: Are the windows of your home mostly...(layers of glass)?



Double-pane windows are the norm across the state, accounting for somewhere around three-quarters of the windows in these four regions. Only in the Doyon region, which has the coldest climate of the group, do a significant number of houses (30 percent) have triple-pane windows. None of the other regions reported having triple-pane windows in more than five percent of housing units.

While houses may be better insulated in the Doyon region, the fact that a greater proportion of homeowners report interior ice buildup than in Sealaska or Cook Inlet is most likely attributable to the colder Interior winters. (See Figure 20 through Figure 22.) Once again, the responses of Calista residents reveal serious construction quality issues and weatherization gaps.

Figure 20: When the wind blows, does it come through your windows, doors, or floor?

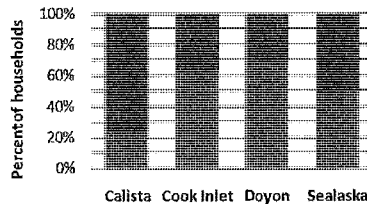


Figure 21: Do you get ice build up anywhere on the inside of your house?

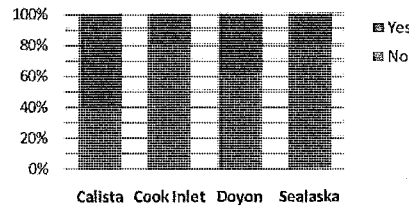
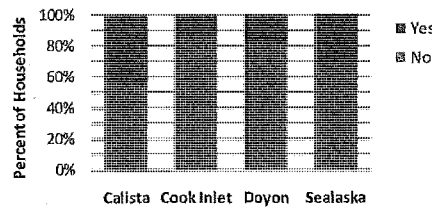


Figure 22: Is there any mold or mildew around the windows?



Heating Fuel

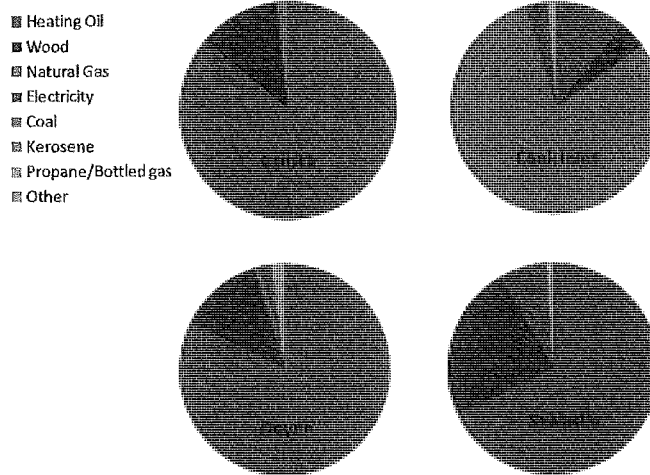
Heating oil is by far the most common primary heating source for homes in Calista, Doyon and Sealaska, responsible for heating 86 percent, 82 percent, and 68 percent of homes in these regions respectively. Wood is the next most common primary heating source in these regions, heating almost one-quarter (24 percent) of homes in the Sealaska region and one-eighth of the homes in Calista and Doyon regions.

In the Sealaska region, 48 percent of respondents reported using a secondary heat source. Of these respondents, almost even numbers reported using heating oil, electricity and wood as their secondary heat source.

The heating picture looks very different in Cook Inlet, due to the available of natural gas. Natural gas is the primary heating source in 80 percent of all homes, while heating oil heats 11 percent of the region's homes.

Alaska Native Corporation Regions

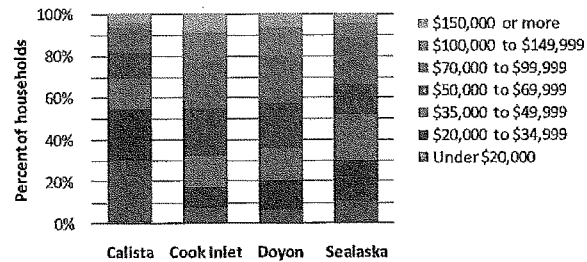
Figure 23: Primary heating fuel for selected regions



Household Income

In the Calista region, more than half (55 percent) of all survey respondents reported having household incomes under \$35,000 per year while 30 percent have annual household incomes under \$20,000. In other regions, 31 percent of Sealaska respondents reported household incomes under \$35,000 per year, as did 21 percent of Doyon households, and 18 percent of Cook Inlet households.

Figure 24: Distribution of household income groups for selected regions



AHTNA

Ahtna region, located in southcentral Alaska includes the Copper River Basin and the Wrangell Mountains. The region's economy boomed during the building of the Trans-Alaska Pipeline, but has had little substantial economic activity since the decline of oil prices in the mid 1980s. The regional housing authority in the AHTNA Region is Copper River Basin Regional Housing Authority.

In 2006, the population of the Ahtna region was 3,888 people, a 5.8 percent increase from 2000. ADOLWD estimates that 25 percent of the population is all or part Native American (of which Alaska Natives makes up the majority), up from 17 percent in 2000.

Table 46: Ahtna population: 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
3,888	3,674	214	5.8%	25%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 47: Ahtna housing units

No. of units, 2008 (est.)	No. of units, 2000	Difference 2000-2008	% change 2000-2008
2,128	2,093	35	1.6%

The 2009 Housing Assessment estimates 2008 housing stock at 2,128 units, an increase of 35 units since the 2000 census. All of the housing units are in communities designated as Rural 1. For the purposes of this study we looked at the individual communities that are in the Ahtna region and the areas undesignated areas in between. Our estimates of housing units are lower than the 2000 U.S. census figures for the region but are true to the counts in the communities within the region.

Forty-one percent of households in the Ahtna region had annual incomes below \$30,000 in 2000 (the last year for which data is available). This figure was 1.5 times the statewide average. The Ahtna region also had a high rate of homes without running water (17 percent) compared with 10 percent statewide, as reported in the 2005 housing assessment. (We did not have a large enough sample size for the region to update these findings for 2008.)

Alaska Native Corporation Regions

Table 48: Ahtna households with 200 sq. ft. or less per resident

	2008	2005
Total number of housing units, estimated	2,128	2,093
No. of housing units with 200 sq. ft. or less per resident	83	157
% of housing units with 200 sq. ft. or less per resident	3.9%	7.5%

Households with 200 square feet or less per resident have decreased as a percentage of total households from 7.5 in 2005 to 3.9 percent in 2008. There are 28 housing units described as “falling apart” by respondents in the 2008 survey. (Eight of these were housing units with less than 200 square feet per resident.)

Table 49: Condition of Ahtna housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2,128	1,906	89.6%	194	9.1%	28	1.3%

We estimate a need for 103 new housing units in the Ahtna region to address overcrowding and replace severely substandard housing. This estimate includes 83 units with 200 square feet or less per resident and the 28 units in need of replacement due to the condition of the home, and subtracting duplicates. In addition to the new units, there is a need for major repair in 194 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

ALEUT

The Aleut region is composed of southwest Alaska, including the Alaska Peninsula, Aleutian Islands, Pribilof Islands, and Shumagin Islands. Major industries include commercial fishing and service and tourism-based industries. The regional housing authority in the Aleut Region is the Aleutian Housing Authority.

In 2006, the population of the Aleut region was 7,453 people, an 8.7 percent decline from 2000. ADOLWD estimates that 25 percent of the population was all or part Native American (of which Alaska Natives make up the majority), down from 27 percent in 2000.

Table 50: Aleut population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
7,453	8,162	709	8.7%	25%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 51: Aleut housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
3,030	2,958	2,742	72	288	2.4%	10.5%

The 2009 Housing Assessment estimates 2008 housing stock at 3,030 units, an increase of 72 units since the 2000 census. The Aleut Corporation has no Urban communities within its boundaries and the housing units are relatively evenly split between Rural 1 (57.6 percent) and Rural 2 (42.5 percent) communities.

The proportion of households with low annual incomes (less than \$30,000) has been somewhat smaller in the region than in the state as a whole. Nineteen percent of households in the Aleut region had incomes below \$30,000 per year at the time of the 2000 census, compared with 27 percent of households statewide. The Aleut region also has a substantially lower portion of households with no running water (3.6 percent) in 2005, compared with 10 percent for the state. (We did not have a large enough sample size for the region to update these findings for this study.)

Table 52: Aleut households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	3,030	2,992	4,399
No. of housing units with 200 sq. ft. or less per resident	333	278	615
% of housing units with 200 sq. ft. or less per resident	11.0%	9%	14%

Households with 200 square feet or less per resident decreased as a percentage of total households from 14 percent in 1991 to 9 percent in 2005 and then increased

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slightly to 11.0 percent in 2008. There are 115 housing units described as “falling apart” by respondents in the 2008 survey, an estimated thirty-on of these units are also overcrowded.

Table 53: Condition of Aleut housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2008	2,430	80.2%	484	16%	115	3.8%

We estimate a need for 417 new housing units in the Aleut region to address overcrowding and replace severely substandard housing. This estimate includes 333 units with 200 square feet or less per resident, and 115 units in need of replacement due to the condition of the home, minus 31 duplicates. In addition to the new units, there is a need for major repair on 484 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

ARCTIC SLOPE

The Arctic Slope Regional Corporation lands lie north of the Brooks Range to the Arctic Ocean, with headquarters in Barrow. The primary industry within the Arctic Slope Region is oil exploration and development. The primary employer in the Arctic Slope Regional Corporation is the North Slope Borough. The regional housing authority in the Arctic Slope Region is Tagiugmiullu Nunamiullu (TNHA).

In 2006, the population of the Arctic Slope region was 6,807 people, a 7.8 percent decline from 2000. ADOLWD estimates that 73 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 69 percent in 2000.

Table 54: Arctic Slope population, 2000-2006

2006(ADOLWD estimate)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
6,807	7,385	578	-7.8%	73%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 55: Arctic Slope housing units

Number of HH units – 2008 (est.)	Number of HH units – 2000	Number of HH units - 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
2,577	2,538	2,154	39	423	1.54%	19.6%

The 2009 Housing Assessment estimates current housing stock at 2,577 units, an increase of 39 units since the 2000 census. None of the housing units are in Urban communities; 1,700 (66.0 percent) are in communities designated as Rural 1, and 877 (34.0 percent) are in Rural 2 communities.

At the time of the 2000 census, one in five households (20 percent) in the Arctic Slope region earned less than \$30,000 per year, compared with 27 percent for the state as a whole.

In the 2005 housing assessment, a high proportion of households (58.6 percent) reported that their homes were drafty, while only 22 percent said they had difficulty maintaining a comfortable temperature in their homes. These seemingly inconsistent findings may be explained by the somewhat higher than average household incomes in the region and the availability of natural gas for home heating. The combination may make maintaining a comfortable temperature in drafty homes more affordable. (We did not have a large enough sample size for the region to update these findings for this study.)

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Table 56: Arctic Slope households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	2,577	2,578	1,433
No. of housing units with 200 sq. ft. or less per resident	246	420	544
% of housing units with 200 sq. ft. or less per resident	9.6%	16%	38%

Households with 200 square feet or less per resident decreased as a percentage of total households from 38 percent in 1991 to 16 percent in 2005 to 9.6 percent in 2008. Eighty-five (3.3 percent) of the 2,577 housing units were described as “falling apart” by respondents in the 2008 survey. (Twenty-three of these were housing units with less than 200 square feet per resident.)

Table 57: Condition of Arctic Slope housing, 2008

2008 housing units (est.)	Like new/ In good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2008						
2,577	2,115	82.1%	377	14.6%	85	3.3%

We estimate a need for 308 new housing units in the Arctic Slope region to alleviate overcrowding and replace severely substandard housing. This estimate includes 246 units with 200 square feet or less per resident, and 80 units in need of replacement due to the condition of the home (we subtracted 23 units that were duplicates.) In addition to the new units, there is a need for major repair on 377 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

BERING STRAITS

The Bering Straits Native Corporation region lies on the west coast of Alaska, encompassing the Seward Peninsula and the eastern part of Norton Sound. There is little in terms of industry in the Bering Straits region, and full time, year round jobs are scarce; the economy is based on subsistence. The regional housing authority for the Bering Straits Region is the Bering Straits Regional Housing Authority.

In 2006, the population of the Bering Straits region was 9,535 people, a 3.9 percent decline from 2000. ADOLWD estimates that 77 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 74 percent in 2000.

Table 58: Bering Straits population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
9,535	9,196	339	-3.9%	77%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 59: Bering Straits housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
3,777	3,649	3,684	128	93	3.5%	2.5%

The 2009 Housing Assessment estimates current housing stock at 3,777 units, an increase of 128 units since the 2000 census. None of the housing units are in Urban communities; 1,709 (45.2 percent) are in communities designated as Rural 1, and 2,068 (54.8 percent) are in Rural 2 communities.

Well over a third of households in the Bering Straits region (37 percent) had annual incomes below \$30,000 at the time of the 2000 census; this was significantly higher than the state average of 27 percent. The 2005 housing assessment found the share of homes with no running water was more than double the state average. In addition, a significantly higher proportion of survey respondents reported drafty homes. (We did not have a large enough sample size for the region to update these estimates for this study.)

Table 60: Bering Straits households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	3,777	3,719	1,790
No. of housing units with 200 sq. ft. or less per resident	491	979	1,199
% of housing units with 200 sq. ft. or less per resident	13.01%	26%	67%

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Households with 200 square feet or less per resident decreased as a percentage of total households from 67 percent in 1991 to 26 percent in 2005 to 13.0 percent in 2008. One hundred seventy-one (4.5 percent) of the 3,777 housing units were described as “falling apart” by respondents in the 2008 survey. (Forty-six of these were housing units with less than 200 square feet per resident.)

Table 61: Condition of Bering Straits housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
3,777	2,928	77.8%	678	17.95%	171	4.5%

We estimate a need for 616 new housing units in the Bering Straits region to alleviate overcrowding and replace severely substandard housing. This estimate includes 491 households that have 200 square feet or less per resident and 171 units that are in need of replacement due to the condition of the home minus the 46 duplicates. In addition to the new units, there is a need for major repair on 678 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

BRISTOL BAY

The Bristol Bay Native Corporation is located 150 miles southwest of Anchorage and east of the Aleut region. Commercial fishing is the main industry in the area; government and transportation services also help comprise the economy. The regional housing authority for the Bristol Bay Region is the Bristol Bay Housing Authority.

In 2006, the population of the Bristol Bay region was 7,293 people, a 1.8 percent increase from 2000. ADOLWD estimates that 70 percent of the population is all or part Native American (of which Alaska Natives make up the majority), down from 70 percent in 2000.

Table 62: Bristol Bay population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
7,293	7,875	-582	-1.8%	67%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 25: Bristol Bay housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
4,511	4,716	3,204	79	1,307	1.6%	41%

The 2009 Housing Assessment estimates current housing stock at 4,511 units, an increase of 79 units since the 2000 census. None of the housing units are in Urban communities; 1,300 (28.8%) are in communities designated as Rural 1, and 3,211 (71.2%) are in Rural 2 communities.

Household income in the region has been significantly lower than the state average, with over one third of households (36 percent) making less than \$30,000 per year in 2000, compared with 27 percent of households statewide.

The percentage of households with no running water was 5.5 percent in 2005, lower than the statewide average of 10 percent. Households also reported being better able to maintain a comfortable temperature, with just under 18 percent reporting difficulty in 2005, compared to the statewide average of 26 percent. (We did not have a large enough sample size for the region to update these responses for this study.)

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Table 63: Bristol Bay households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	4,511	4,738	2,146
No. of housing units with 200 sq. ft. or less per resident	710	711	836
% of housing units with 200 sq. ft. or less per resident	15.7%	15%	39%

Households with 200 square feet or less per resident roughly the same as a percentage of total households from 2005 to 2008, that percentage is down from 39 percent estimated in 1991. (Sixty-seven of these were housing units with less than 200 square feet per resident.)

Table 64: Condition of Bristol Bay housing, 2008

2008 housing units (est.)	Like new/ In good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2008						
4,511	3,334	73.9%	930	20.6%	248	5.5%

We estimate the need for 891 new housing units in the Bristol Bay region to alleviate overcrowding and replace severely substandard housing units. This estimate includes 710 units with 200 square feet or less per resident, and 248 units in need of replacement due to the condition of the home, and then subtracting the 67 duplicates. In addition, there is need for major repair on 930 units. Without major repair, many of these units will fall into the category of needing replacement.

CALISTA

The Calista Corporation also lies in southwest Alaska, encompassing the Yukon-Kuskokwim River Delta and the Kuskokwim Mountains. The main industry in Calista is commercial fishing. Many people rely on subsistence, and there are a limited number of year round, full time positions in government and transportation services. The regional housing authority for the Calista Region is the AVCP Housing Authority.

In 2006, the population of the Calista region was 24,584, a 76.3% increase from 2000. ADOLWD estimates that 86 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 85 percent in 2000.

Table 65: Calista population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-2006	% Population change 2000-06	% Native American (Alone or in combination)
24,584	13,943	10,641	76.3%	86%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 66: Calista housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
7,667	7,251	6,228	416	1,439	5.7%	23.1%

The 2009 Housing Assessment estimates current housing stock at 7,667 units, an increase of 416 units since the 2000 census. None of the housing units are in Urban communities; 2,299 (30 percent) are in communities designated as Rural 1, and 5,368 (70 percent) are in Rural 2 communities.

The Calista region had both the smallest home sizes and the greatest number of residents per house. As a result, the amount of living space per person in the region is one-third or less than that in Cook Inlet, Doyon, and Sealaska regions (the other regions for which there is sufficient data). The median home size is just 1,000 square feet or 250 square feet per resident, according to data from the 2009 housing assessment. The average age of homes in the region is 23 years, slightly less than in the three largest ANCSA regions.

A large majority of survey respondents (87 percent) reported difficulty keeping their homes warm enough on the coldest days of winter. Calista was the only region where a majority reported having cold or chilly floors (68.2 percent), ice buildup around windows (60.5 percent), and drafts coming through doors, windows or floors (75.9 percent).

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The Calista region had the highest percent of households in the state (43 percent) making less than \$30,000 per year in 2000, which was 1.6 times the statewide average of 27 percent of all households. The 2005 housing assessment found that the share of homes lacking running water in the region was three times greater than the statewide average.

Table 67: Calista households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	7,667	7,536	4,186
No. of housing units with 200 sq. ft. or less per resident	2,378	3,230	2,846
% of housing units with 200 sq. ft. or less per resident	31.0%	43%	68%

Households with 200 square feet or less per resident decreased as a percentage of total households from 68 percent in 1991 to 43 percent in 2005 to 31 percent in 2008. Of the 7,667 housing units in the region, 693 (9.0 percent) were described as "falling apart" by respondents in the 2008 survey. (290 of these are housing units with less than 200 square feet per resident.)

Table 68: Condition of Calista housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
7,667	4,996	65.2%	1,979	25.8%	693	9%

We estimate a need for 2,780 new housing units in the Calista region to alleviate overcrowding and replace severely substandard housing. This estimate includes 2,378 units with 200 square feet or less per resident and 402 units in need of replacement due to the condition of the home. In addition to the new units, there is a need for major repair on 1,979 units (25.8 percent). Without intervention and major repair, many of these units will fall into the category of needing replacement.

CHUGACH

The Chugach Alaska Corporation region also lies in South-central Alaska, with Prince William Sound at its center. Industry in the area includes oil, transportation, fishing and government. The regional housing authority in the Chugach Region is the North Pacific Rim Housing Authority.

In 2006, the population of the Chugach region was 11,940 people, a 1.6 percent decline from 2000. ADOLWD estimates that 12 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 14 percent in 2000.

Table 69: Chugach population, 2000-2008

2006 (ADOLWD estimate)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
11,940	12,134	194	-1.6	19%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 70: Chugach housing units

No. of units, 2008 (est.)	No. of units, 2000.	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
5,592	5,293	4,860	287	732	5.4%	15.1%

The 2009 Housing Assessment estimates current housing stock at 5,592 units, an increase of 287 units since the 2000 census. There are 3,044 (54.4%) housing units in Urban communities, 1,606 (28.7%) in communities designated as Rural 1, and 942 (16.8%) are in Rural 2 communities.

The percentage of households making less than \$30,000 was the same in 2000 as for the state as a whole (27 percent). In the 2005 housing assessment, the Chugach region had the largest mean house size in the state at 1,771 square feet. A lower than average percent of 2005 survey respondents reported having difficulty maintaining a comfortable indoor temperature, and only a small percent reported a lack of running water. (We did not have a large enough sample size for the region to update these findings for this study.)

Table 71: Chugach households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	5,592	5,369	3,373
No. of housing units with 200 sq. ft. or less per resident	298	131	67
% of housing units with 200 sq. ft. or less per resident	5.3%	2%	2%

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The estimated number of households with 200 square feet or less per resident increased slightly as a percentage of total households from 2 percent in 2005 to 5.3 percent in 2008. There are 118 (2.1%) of the 5,592 housing units described as “falling apart” by respondents in the 2008 survey. (Twenty-eight of these were housing units with less than 200 square feet per resident.)

Table 72: Condition of Chugach housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2008						
5,592	4,886	87.4%	588	10.5%	118	2.1%

We estimate a need for 388 new housing units in the Chugach region to alleviate overcrowding and replace severely substandard housing units. This estimate includes 298 units with 200 square feet or less per resident, 118 units in need of replacement because of the condition of the home, and subtracting the 28 duplicates. In addition to the new units, there is a need for major repair on 588 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

COOK INLET

The Cook Inlet Region is in South-central Alaska, with its southern boundaries near Iliamna Lake and Seldovia, extending north past Anchorage. Industry in the Cook Inlet region is diverse, ranging from the state's commerce center in Anchorage to commercial fishing, tourism, mining and oil activity. The regional housing authority in the Cook Inlet Region is the Cook Inlet Housing Authority.

In 2006, the population of the Cook Inlet region was 405,750 people, an 11.4 percent increase from 2000. ADOLWD estimates that 12 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from seven percent in 2000.

Table 73: Cook Inlet population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
405,750	364,225	41,525	11.4%	12%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 74: Cook Inlet housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
167,658	150,566	132,266	17,092	35,392	11.35%	26.8%

The 2009 Housing Assessment estimates current housing stock at 167,657.8 units, an increase of 17,092 since the 2000 census. There are 128,388 (75 percent) of the housing units in Urban communities; 38,228 (22.8 percent) are in communities designated as Rural 1, and 1,042 (.62 percent) are in Rural 2 communities.

Cook Inlet region boasts larger than average size homes with a median size of 1850 square feet or 925 square feet per resident in the 2008 housing survey. The average age of homes is 27 years.

Over 90 percent of respondents reported having no trouble maintaining a comfortable indoor temperature. At the same time, nearly 27 percent complained of cold or chilly floors and 38 percent said wind comes through the doors, windows or floor. Nearly 11 percent have primarily single-pane windows, and 20 percent reported ice buildup inside the house.

Looking at income, one in four households made less than \$30,000 per year in 2000, slightly less than the statewide average of 27 percent. In 2005, there was a low incidence of households with no running water (2.5 percent), compared with 10 percent statewide.

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Table 75: Cook Inlet households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	167,658	164,158	132,266
No. of housing units with 200 sq. ft. or less per resident	3,002	7,817	6,613
% of housing units with 200 sq. ft. or less per resident	1.8%	5%	5%

Households with 200 square feet or less per resident maintained the same percentage of total households from 5 percent in 1991 to 5 percent in 2005 and decreased to less than 2 percent in 2008. Of the nearly 168,000 housing units, 1,389 (0.8 percent) were described as “falling apart” by respondents in the 2008 survey (231 of these were among the housing units with less than 200 square feet per resident).

Table 76: Condition of Cook Inlet housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
2008	No.	%	No.	%	No.	%
167,658	155,848	93%	10,421	6.2%	1,389	0.8%

We estimate a need for 4,161 new housing units in the Cook Inlet region to alleviate overcrowding and to replace severely substandard housing units. This estimate includes 3,002 units with 200 square feet or less per resident, and 1,158 more units in need of replacement due to the condition of the home. In addition to the new units, there is a need for major repair on 10,421 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

DOYON

Doyon, Limited is the largest private landowner in Alaska and one of the largest in the United States. The Doyon region stretches from the Brooks Range to the Alaska Range and from the Alaska/Canada border to Norton Sound on Alaska's west coast, with headquarters in Fairbanks. Major industries in this region include tourism and mining. The regional housing authority in Doyon Region is the Interior Regional Housing Authority.

In 2006, the population of the Doyon region was 101,935 people, a 5.8 percent increase from 2000. ADOLWD estimates that 15 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 11 percent in 2000.

Table 77: Doyon population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
101,935	97,169	4,766	4.9%	15%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 78: Doyon housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
44,005	41,606	39,783	2,399	4,222	5.8%	10.6%

The 2009 Housing Assessment estimates current housing stock at 44,005 units, an increase of 2,399 since the 2000 census. There are 35,652 (81 percent) units in Urban communities; 5,046 (11.5 percent) units are in communities designated as Rural 1, and 3,307 (7.5 percent) are in Rural 2 communities.

Homes in the Doyon region are larger than average, with a median size of 1650 square feet or 825 square feet per resident. The average age of homes is 26 years. Over 90 percent of respondents reported no trouble in maintaining a comfortable indoor temperature during the coldest days in winter. However, significant numbers still reported ice buildup indoors (36.7 percent), cold or chilly floors (35.0 percent), wind coming through doors, windows or floors (31.4 percent), and mold or mildew around windows (17.5 percent). The region has the highest percent of homes with triple pane windows (30.4 percent), compared with the other large ANCSA regions.

The percent of low income households in the Doyon region is close to the state average. In 2000, 30 percent had annual incomes below \$30,000, compared with 27 percent statewide. The 2005 housing assessment found that houses in the Doyon

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region were almost twice as likely to lack running water as housing in other parts of the state.

Table 79: Doyon households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	44,005	43,009	19,064
No. of housing units with 200 sq. ft. or less per resident	1,249	5,794	9,722
% of housing units with 200 sq. ft. or less per resident	2.8%	13%	51%

Households with 200 square feet or less per resident decreased as a percentage of total households from 51 percent in 1991 to 13 percent in 2005 to 2.8 percent in 2008. Doyon is one of the regions with a large urban population, the project team believes that past estimates of overcrowding for the region have been inflated due to oversampling in rural communities. There were 869 housing units described as “falling apart” by respondents in the 2008 survey. (192 of these are housing units with less than 200 square feet per resident.)

Table 80: Condition of Doyon housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
2008	No.	%	No.	%	No.	%
44,005	39,180	89%	3,957	9%	869	2%

We estimate a need for 1,925 new housing units in the Doyon region to alleviate overcrowding and replace severely substandard housing units. This estimate includes 1,249 units with 200 square feet or less per resident, 869 units in need of replacement due to the condition of the home and subtracting the 192 duplicates. In addition to the new units, there is a need for major repair in 3,957 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

KONIAG

The Koniag, Inc. Native region is composed of Kodiak Island and a small portion of land on the eastern coast of the Alaska Peninsula. The main industry in the area is commercial fishing. The regional housing authority in the Koniag Region is the Kodiak Island Housing Authority.

In 2006, the population of the Koniag region was 13,506 people, a 2.9 decrease from 2000. ADOLWD estimates that 18 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 14 percent in 2000.

Table 81: Koniag population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 200-06	% Population change 2000-06	% Native American (Alone or in combination)
13,506	13,913	407	-2.9	18%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 82: Koniag housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
5,521	5,159	4,890	362	631	7%	12.9%

The 2009 Housing Assessment estimates current housing stock at 5,521 units, an increase of 362 units since the 2000 census. There are 4,233 (76.7 percent) in Urban communities; 917 (16.6 percent) are in communities designated as Rural 1, and 371 (6.7 percent) are in Rural 2 communities.

Nearly one in four households (24 percent) had incomes below \$30,000 per year in 2000, somewhat less than the statewide average of 27 percent. In 2005, Koniag region had too few respondents indicating a lack of running water to make reliable estimates. That year's housing assessment found that mean house size was higher than the state average, but most other housing characteristics and demographic household data was in keeping with state averages. (We did not have a large enough sample size for the region to update these findings for this study.)

Table 83: Koniag households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	5,521	5,436	3903
No. of housing units with 200 sq. ft. or less per resident	171	431	1,327
% of housing units with 200 sq. ft. or less per resident	3.1%	8%	34%

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Households with 200 square feet or less per resident decreased as a percentage of total households from 34 percent in 1991 to 8 percent in 2005 to 3.1 percent in 2008. Koniag region is one of the regions that may have seen overestimates of crowding in the past as much of the region's housing stock is located in Kodiak, an urban community by our definition. Eighty (1.4 percent) of the 5,521 units were described as "falling apart:" by respondents in the 2008 survey. (Sixteen of these were housing units with less than 200 square feet per resident.)

Table 84: Condition of Koniag housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2008						
5,521	4,981	90.2%	460	8.3%	80	1.4%

We estimate a need for 234 new housing units in the Koniag region to alleviate overcrowding and to replace severely substandard housing units. This estimate includes 171 units with 200 square feet or less per resident, and 80 units in need of replacement due to the condition of the home and subtracting the sixteen duplicates. In addition to the new units, there is a need for major repair on 460 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

NANA

The NANA region is located in northwest Alaska, just west of the Kotzebue Sound. Most of the land is above the Arctic Circle. Government and natural resource development are both important industries in the NANA region. The regional housing authority in the NANA Region is the Northwest Inupiat Housing Authority.

In 2006, the population of the NANA region was 7,334 people, a 1.7 percent increase from 2000. ADOLWD estimates that 82 percent of the population is all or part Native American (of which Alaska Natives make up the majority), which is the same percentage as in 2000.

Table 85: NANA population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
7,334	7,208	126	1.7%	82%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 86: NANA housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
2,753	2,540	1,998	213	755	8.4%	37.8%

The 2009 Housing Assessment estimates current housing stock at 2,753 units, an increase of 213 since the 2000 census. None of the housing units are in Urban communities; 1,373 (49.9 percent) are in communities designated as Rural 1, and 1,380 (50.1 percent) are in Rural 2 communities.

Thirty-two percent of households within the NANA region have earnings below \$30,000 per year in 2000, somewhat more than the statewide average of 27 percent. The 2005 housing assessment found that houses in the region are significantly smaller than average; this was also true for the average square feet per resident. More than half of survey respondents (58 percent), reported having drafty homes, and overall households in the region were 1.5 times more likely to report difficulty maintaining a comfortable temperature than in the state as a whole. (We did not have a large enough sample size for the region to update these findings for this study.)

Table 87: NANA households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	2,753	2,713	1,197
No. of housing units with 200 sq. ft. or less per resident	337	826	898
% of housing units with 200 sq. ft. or less per resident	12.2%	30%	75%

Alaska Native Corporation Regions

Households with 200 square feet or less per resident decreased as a percentage of total households from 75 percent in 1991 to 30 percent in 2005 to 12.2 percent in 2008. There are 117 housing units described as “falling apart” by respondents in the 2008 survey. (Thirty-two of these were housing units with less than 200 square feet per resident.)

Table 88: Condition of NANA housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
	No.	%	No.	%	No.	%
2,753	2,162	78.5%	474	17.2%	117	4.2%

We estimate a need for 422 new housing units in the NANA region to alleviate overcrowding and replace severely substandard housing units. This estimate includes 337 units with 200 square feet or less per resident, and 117 units in need of replacement due to the condition of the home and subtracting the 32 duplicates. In addition to the new units, there is a need for major repair on 474 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

SEALASKA

The Sealaska Corporation encompasses the southeast portion of Alaska including the urban areas of Juneau and Sitka. The main industries in Sealaska are tourism, government and fishing. The regional housing authority in Sealaska Region is the Tlingit-Haida Housing Authority.

In 2006, the population of the Sealaska region was 68,651 people, a four percent decline from 2000. ADOLWD estimates that 21 percent of the population is all or part Native American (of which Alaska Natives make up the majority), up from 16 percent in 2000.

Table 89: Sealaska population, 2000-2006

2006 (ADOLWD est.)	2000 U.S. Census	Population change 2000-06	% Population change 2000-06	% Native American (Alone or in combination)
68,651	71,510	2,859	4%	21%

Sources: U.S. Census Bureau and Alaska Department of Labor and Workforce Development

Table 90: Sealaska housing units

No. of units, 2008 (est.)	No. of units, 2000	No. of units, 1990	Difference 2000-2008	Difference 1990-2008	% change 2000-2008	% change 1990-2008
34,278	32,515	27,556	1,763	6,722	5.4%	24.4%

The 2009 Housing Assessment estimates current housing stock at 34,278 units, an increase of 1,763 units since the 2000 census. There are 26,260 (76.6 percent) units in Urban communities; 4,077 (11.9 percent) in communities designated as Rural 1, and 3,941 (11.5 percent) in Rural 2 communities.

There is evidence of a housing shortage in the region, with nearly 32 percent of respondents in the 2008 survey saying they have had a family member or friend stay with them because that person does not have a home. The region has the highest percentage of mobile homes in the state with 16 percent of survey respondents living in mobile homes. The existing housing stock is older than the other large ANCSA regions, with an average housing unit age of 32 years.

The median housing unit size in the Sealaska region is 1,500 square feet, or 750 square feet per resident. Over 85 percent of respondents reported no trouble in maintaining a comfortable indoor temperature during the coldest days in winter. However, 50 percent still reported wind coming through doors, windows or floors, and significant numbers of survey respondents reported cold or chilly floors (46.2 percent), mold or mildew around windows (30.2 percent), and indoor ice buildup (19.8 percent). Indoor air quality is an important housing and health concern in the

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Sealaska region where the very wet climate creates prime opportunities for mold and mildew.

One in four households (25 percent) had incomes below \$30,000 per year in 2000, slightly less than the statewide average of 27 percent. In 2005, there was a very low percent of homes without running water, less than two percent regionally, compared to 10 percent statewide.

Table 91: Sealaska households with 200 sq. ft. or less per resident

	2008	2005	1991
Total number of housing units, estimated	34,278	33,099	6,464
No. of housing units with 200 sq. ft. or less per resident	970	1,568	1,707
% of housing units with 200 sq. ft. or less per resident	2.6%	5%	26%

Households with 200 square feet or less per resident decreased as a percentage of total households from 26 percent in 1991 to 5 percent in 2005 to 2.6 percent in 2008. There were 979 housing units described as “falling apart” by respondents in the 2008 survey. (None were housing units with less than 200 square feet per resident.)

Table 92: Condition of Sealaska housing, 2008

2008 housing units (est.)	Like new/ in good shape, normal wear and tear/ in need of minor repair (est.)		In need of major repair (est.)		Falling apart (est.)	
2008	No.	%	No.	%	No.	%
34,278	34,278	86.67%	3,591	10.5%	979	2.86%

We estimate a need for 1,949 new housing units in the Sealaska region to alleviate overcrowding and replace severely substandard housing units. This estimate includes 970 units with 200 square feet or less per resident and 979 units in need of replacement due to the condition of the home. In addition to the new units, there is a need for major repair on 3,591 units. Without intervention and major repair, many of these units will fall in to the category of needing replacement.

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Questions for the Record Submitted to Ms. Gwen Holdmann**

Questions from Chairman Lisa Murkowski

Question 1: Microgrids

Ms. Holdmann, how big of a role do you view microgrids having in Alaska's energy future? With the 200-plus permanently islanded microgrids that already exist in the state, how do we improve them? How do we make sure that microgrid energy systems continue to become more affordable, reliable, and beneficial to Alaska's remote communities?

Microgrids will continue to play a crucial role in Alaska in the future. Our load centers (communities) are too small to warrant an extensive statewide transmission network in most places, and thus locally - or regionally - generated power will continue to be the preeminent paradigm in the state. In addition, microgrids are not limited to rural Alaska. Alaska is electrically organized as a patchwork of microgrids across the state. For example, the Railbelt regional grid grew out of a number of independent local grids that were eventually interconnected. Many of our military bases, the University of Alaska Fairbanks campus, and the entire GVEA service area are grid-connected microgrids. I don't know if there is any place in the world that has more examples of the various sorts of iterations of microgrids – both islanded and connected – than Alaska does.

Affordability for our rural Alaska microgrids is a major challenge, and this is closely tied to the need to import fuel (often from outside the US) to operate them. It appears that due to climate change, fuel delivery is becoming more challenging in some areas, where water levels in rivers are fluctuating to the degree that fuel barges can no longer reliably service some communities. When this occurs, flying in fuel becomes the only alternative, and the cost burden for the community increases substantially, and sometimes unpredictably.

In the near term, subsidy programs at the state (PCE) and federal level (such as LIHEAP) are critical. However, it is important to make sure that subsidies do not distort the energy market in ways that disincentive the development of long-term solutions based on local energy sources (renewable or non-renewable) that reduce the reliance on imported fuel. For example, the lowest energy costs in the state for residential consumers is in the North Slope Borough Communities (about 15 cents/kWh). This is because rates are highly subsidized, and while 2 communities in the region rely on locally produced gas, the North Slope is the only region in Alaska that has not developed any renewable energy systems.

In the long term, Alaska can very much serve as a living laboratory for the types of technologies that will make microgrids more economic and reliable everywhere. In this way, Alaska could serve as a real asset nationally as we transform our energy infrastructure.

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Question 2: Hybrid Renewable Energy Systems in Rural Alaska

Ms. Holdmann, microgrids are crucial to Alaska and to the vision you have shared for our state's – and the world's – energy future. Such opportunities are often accompanied by challenges, however. Can you expand on the discussion in your written testimony of just how complicated it is to incorporate larger-scale renewable projects into the energy supply via microgrids? And what do you see as the most promising ways to overcome these challenges?

Microgrids – along with distributed generation, energy storage, and smart grid technologies – will be the future of the US grid. Our grid is aging. Its fundamental design is based on a 100-year-old architecture, and significant portions of the physical components that make up the system were built and installed over 50 years ago. Moreover, many of the ways we use electric power today were not even dreamed of when the system was developed. Reinventing the grid to take into account new challenges, such as making sure it is resilient enough to withstand major storms or a terrorist attack, as well as rethinking how we produce and deliver power (including greater use of distributed small scale renewable generation) will be necessary in the coming decades. Microgrids will be a key component in that evolution.

Delivering energy reliably through distributed generation and microgrids is more complicated than traditional, centralized power systems. It requires advances in controls, and energy storage that can smooth out demand and generation – especially from variable renewable resources. It is important to understand that many devices that are designed for the types of consistent power quality common in the lower 48, can experience real challenges (and failures) when connected to grids with fluctuating power quality, frequent transient events, unbalanced phases, and poor power factor. Just because something works when connected to the grid at a manufacturing facility or lab in the lower 48, does not mean it can survive the typical range of conditions in Alaska (or the developing world). For this reason, we need a deployment strategy, that includes a 'pit stop' for new technologies in a laboratory like the one ACEP has, that can fully emulate the real-world conditions found in many islanded microgrids. Ensuring equipment is robust and can recover from unexpected events is crucial to providing value to end users, and also in helping provide technology developers with adequate information to make appropriate changes to their technology prior to real-world deployment. This laboratory capability extends not just to the physical infrastructure, but making sure the people who run tests understand the operational envelopes – and hence can develop appropriate testing protocols – for islanded microgrids.

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Question 3: DOE & Federal Interaction

Can any of you share some real-life examples – both good and bad – of experiences that you have had collaborating with the federal government in working to plan, upgrade, revamp, or build energy projects in Alaska?

Generally speaking, I believe that when the federal government is investing in the states, it is important to try to work through partnerships and build local capacity as much as possible in order to create long-term value – and the ability to replicate success beyond the end of federally available funding – at the state/local level. There are many good examples of this, and frequently, long-term mutually beneficial relationships have been developed between program managers within federal agencies, and individual stakeholder groups in Alaska. For example, the Office of Naval Research has worked hard to understand the specific gaps in funding in Alaska, while at the same time recognizing Alaska could be a real asset to testing and hardening the types of technologies needed for their next generation ship-board and land-based systems. In actively seeking research partnerships in Alaska, they listened closely to the needs of key stakeholders, and as a result invested in: 1) technology testing through the ACEP lab; 2) energy business incubator support through Launch Alaska; and 3) STEM education coordination through support for the Alaska Network of Energy Educators (led by Renewable Energy Alaska Project). Each of these investments targeted a specific funding need identified by Alaskans, and were designed to build capacity in the state that will help Alaskans contribute meaningfully to solving national and international problems.

One of the more challenging federal relationships is the competition between national laboratories and state/local groups. National laboratories are repositories of an amazing breath and depth of knowledge. These assets should be used to compliment and build on local resources, but not compete with or replace them. However, federal agencies find it easier to contract with labs than with state-based organizations, and indeed often have a mandate to fund them. As a result, there is a constant influx of researchers from national labs, who do not have any background related to Alaska, who are sent to work with or advise communities directly. They are often not well prepared to understand the unique circumstances in Alaska, or the complex stakeholder relationships in even smallest communities. The result is poor advice that often requires intervention by unfunded local groups (such as ACEP or the Alaska Energy Authority), and wasted federal funding. In fact, very little funding that is routed through labs for Alaska ever actually makes it to Alaska. The vast majority is spent at the lab level. This does not build local capacity, and instead creates a revolving door of people that come and go when money is available – not based on a real long-term commitment to the people of Alaska.

As a recent example, a national lab was funded to provide technical assistance to a tribe in Alaska. The tribe told them there was a 'geothermal resource' nearby they were interested in exploring. Since the lab had no local knowledge of the area, they did not

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recognize that the 'geothermal resource' was actually an underground shale oil fire. (This was immediately apparent to Alaskans with knowledge of geothermal energy) The lab researchers spent time working up economic projections and getting the tribe excited about developing this resource. Even when provided with information that showed this site was in no way geothermal in origin, the lab continued to try to pursue funding to develop the site as an 'enhanced geothermal' project. While this site could be construed as an interesting research project, it was not the near-term energy solution the community was looking for. Nonetheless, the lab directed money to researchers outside Alaska to investigate the site further, and continued to lead the community to believe it could be a viable option that they should seek funding to explore further (by the lab). State-based organizations ultimately had to mobilize in order to provide a more accurate assessment to the community, which required time and resources there was no funding for.

In these sorts of cases, it would be better if DOE worked through local providers of technical expertise, bringing in national labs as needed to supplement and support the existing technical expertise and local know-how, rather than competing against or superseding it. The more we can build up local and state capacity, the less need there will be for long-term federal funding, and the less reliant the state will be on this sort of funding (which could always be pulled back based on shifting federal priorities).

Question 4: Top-Down Approach

I am sure you all have anecdotes about cases in Alaska where a well-meaning individual, agency, or company tried to install an energy project or upgrade in a village, but encountered some level of failure. In my experience, this often results from a top-down approach, which is problematic anywhere, but especially in Alaska and even more so in rural parts of our state. Would any of you care to explain some of the reasons why that's the case? And, from your experiences, what kind of approach will work and has worked in rural Alaska? For example, how do we increase the chances that an energy project in a remote village will enjoy sustained, long-term success?

The kinds of energy systems and climatic conditions we have in Alaska are very unusual for the U.S., although globally, there are many places with similar challenges. We estimate that there are 500 million people globally that are served by the sorts of diesel-based remote microgrids that are common in Alaska. In the vast majority of these places, human capacity is a significant challenge, but because high energy prices are ubiquitous – especially relative to cash income – there is a real opportunity to transition to renewable forms of energy, using technology that might not yet be economic in larger and lower cost energy markets. Hence, there is a tremendous interest from developers and manufacturers to build pilot projects to demonstrate their technology in places like Alaska. Similarly, and agencies often have a mandate to develop projects that can reduce the cost of energy in high energy cost communities. There are a large number of

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challenges when outside entities try to engage in the Alaska market using a top-down approach. Many of these are exacerbated by a lack of understanding of rural energy markets and complex network of stakeholders, but the root challenge is a lack of technical and business expertise at the local level to actively manage opportunities and relationships. Hence, communities and utilities are often relegated to a reactive, rather than proactive, role in project development and are not in a position to take advantage of real opportunities when they do arise.

We have been working to develop an alternative mechanism for project development, where the community defines a project or need based on their own best interests, and proactively seeks the partnerships they need to move that project forward. We have explored this model with Nome (geothermal), Cordova (energy storage), and Yakutat (wave energy), with very positive feedback to date – especially for projects that have the potential to attract private funding. Essentially, the process involves a trusted, neutral 3rd party that has no direct financial interest in the project outcome (in this case ACEP) assisting communities and utilities in defining their project need and developing a Request for Proposal (RFPs) to clearly describe the technology and/or project-specific specifications. This goes significantly beyond identifying resources or developing a general community energy plan or strategy – instead, it is very targeted and focused on realizing a specific project or need. This process also decreases transaction costs and makes it easier for private developers to respond to opportunities that already have the support of local stakeholders. It creates a win-win scenario for everyone. An example specific to the Cordova project is included as a separate attachment.

The challenges with this model are: 1) that the group providing the technical expertise must have a deep understanding of the specific needs and challenges associated with the rural Alaska energy market, and, 2) while effective and cost saving for all parties, it has been difficult to find funding to support this upfront project identification/specification work, since communities often do not have adequate financial resources to invest in pre-project planning. (This would be an excellent use of DOE technical support for communities).

Project Specifications Case Study: Cordova Electric Cooperative

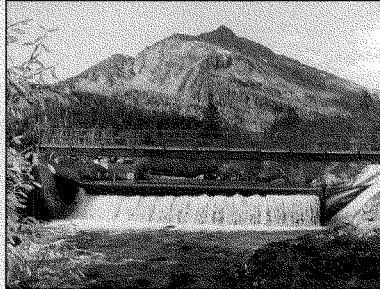
To facilitate private investment opportunities in Alaska, existing expertise within the state could be used to help rural communities and utilities develop requests for proposals (RFPs) for economically viable projects. Outlining a project's technical specification upfront allows a vendor to decide whether the project is an attractive investment opportunity and reduces project risk, since the early stage work of resource assessment and project design are already complete.

Cordova Electric Cooperative (CEC) is partnering with the Alaska Center for Energy and Power (ACEP), Sandia National Laboratories (SNL), and the Clean Energy States Alliance (CESA) to study the impact an energy storage system could have on increasing the contribution of hydropower in the energy mix for the remote microgrid in Cordova. CEC uses both run-of-the-river hydropower and diesel to generate electricity. The utility currently does not have any means of storing hydropower. During off-peak times, water is diverted away from the turbines. An energy storage system would allow the utility to store the hydroelectric energy generated at off-peak times. This stored hydroelectric energy could be supplied back to the grid during the day instead of switching on the diesel generators when the load exceeds the capacity of hydroelectric generation.

The ACEP/SNL/CESA study²² is designed to determine the availability of excess hydropower and the demand of supplemental generation to optimally size an energy storage system. CEC will use the output from the study to determine whether a viable business case for energy storage in its grid exists, and if so, develop an RFP, asking energy storage vendors to make offers for providing an energy storage system. This model can be applied to energy storage projects in other hybrid-diesel grids in Alaska, and provide a mechanism for utilities to generate detailed RFP documentation to attract investment. If the terms are attractive to vendors, the RFP will attract bidders.

These types of assessments may attract private investment and help stabilize the cost of power in small communities, with minimal risk to the community. The state could fund technical support to outline project specifications and generate requests for proposals from third-party vendors. This will reduce transaction costs and risk for potential investors since the project specifications are predetermined. The investor will be able to assess the project based on the specifications outlined in the RFP to determine if the investment is worthwhile.

With this model, risk is transferred from the utility to the vendor. The utility specifies the price at which it is willing to purchase power and enters into a power purchase agreement. The utility does not take on additional debt. The vendor owns, operates, and maintains the system. Any cost overruns are borne by the vendor. There is very little risk to the community other than the risk of the price of diesel falling low enough to make diesel-fired power cheaper than the negotiated price of power purchased from the energy storage vendor.



Power Creek is one of Cordova's run-of-the-river hydro projects.
Photo courtesy of Clay Koplin, CEC.

²² This project is funded by the U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability Storage Program



**The Senate Energy and Natural Resources Committee Oversight Field Hearing on Energy
Technology Innovation and Deployment – Opportunities for Alaska's Energy Future
Bethel, Alaska
February 15, 2016**

Written Comments by Sara Fisher-Goad, executive director, Alaska Energy Authority

Chairwoman Murkowski, Ranking Member Cantwell, and member of the committee, thank you for travelling to Alaska to hold a field hearing on energy technology innovation and deployment, and for taking the time to visit some of our remote communities. Alaska is a special place and we share Senator Murkowski's pride in our state and feel fortunate to call Alaska home.

Alaska's energy costs are high; Alaskans pay more than twice the national average on energy costs and remote Alaska villages can pay even more. Electrical rates can vary from less than 10 cents per kilowatt hour in more urban communities with access to mature hydropower, to more than one dollar/kWh in communities that rely on flying-in diesel fuel. Investments in basic infrastructure like ports, roads, airports, power and water systems have spurred growth and economic development across the Lower 48 states, including rural areas of the country. However, rural Alaska has not had the same level of investment in basic infrastructure and it has a direct impact on not only a community's ability to grow and thrive, but the success of new energy projects.

Remote Alaska community populations vary from fewer than 50 to 6,000 people; some villages are served by a single diesel generator while others have a full power house with renewable integration capabilities. Just as unique as our challenges, Alaskans continue to be on the forefront of creative solutions and innovative technologies. The Alaska Legislature has set the targets of 50 percent renewable power by 2025 and to improve energy efficiency by 15 percent by 2020 (from the 2010 baseline). We know that our state energy programs are working and with continued support, we can meet these ambitious targets.

I was honored to be able to not only attend the hearing, but also to travel to Oscarville. Oscarville is unique because it is connected to Bethel by a transmission line. There are roughly 200 remote, islanded communities across Alaska. These communities are not connected by a road system or a larger electrical grid, are largely dependent on diesel-generated power systems and aging infrastructure. Many Alaska communities have the potential to harness renewable energy to offset diesel use. However the small size of these microgrids makes the integration of renewables challenging.

The Alaska Energy Authority is an independent corporation of the State of Alaska whose mission is to reduce the cost of energy. This year we celebrate our 40th year and actively work to diversify Alaska's energy portfolio, provide technical and community assistance, lead strategic energy planning and construct energy systems. As state grant dollars decline, the Alaska Energy

akenergyauthority.org

813 West Northern Lights Boulevard Anchorage, Alaska 99503 T 907.771.3000 Toll Free (Alaska Only) 888.300.8334 F 907.771.3044

Authority has been working to assist communities to develop potentially financeable projects. We are uniquely positioned to provide synergy between energy planning, projects and funding sources.

We also own two pieces of energy infrastructure along the Railbelt, the most populated region of the state that stretches from Fairbanks in the north to Homer in the south. AEA owns the Bradley Lake Hydroelectric Project that provides 10 to 11 percent of the Railbelt's annual power and the Alaska Intertie, the 138kv transmission line from Healy to Willow, Alaska.

Through efforts like the Alaska Energy Authority's Renewable Energy Grant Fund and Emerging Energy Technology Fund, Alaska is leading the way on integrating alternative energy into small diesel microgrids. The Renewable Energy Grant Fund has resulted in more than 54 operational renewable projects across the state, including hydroelectric, wind, biomass and solar. These 54 operational projects are displacing more than 22 million gallons of diesel and equivalent annually and that figure is expected to grow to above 30 million this year. The State of Alaska has invested \$257 million in the program since 2008 which has funded 287 grants, some for reconnaissance studies, energy resource monitoring, feasibility studies and final design and construction.

In many ways Alaska is a poster child for successful hydropower development and we have proven that it is possible to balance the need for affordable power with environmental concerns. The Bradley Lake Hydroelectric project continues to provide some of the lowest-cost power in the Railbelt, hydro projects in Southeast Alaska have been providing power for a century and more, and through the combination of Terror Lake Hydro and Pillar Mountain Wind, the city of Kodiak is running on 99.7 percent renewable power. Packers Creek Hydro allows the community of Chignik Lagoon to not to use its diesel generators during summer/late fall. After the project was commissioned and the community was running on 100 percent hydropower, Chignik Lagoon 10th grader Isabelle Erickson wrote that "I can finally hear the birds, they're singing in the sky. The noise, that noise is gone. Oh, I can already smell a change, the air is fresh and clean, the clouds, those black clouds are gone." The Renewable Energy Grant Fund continues to advance the potential of hydropower in Arctic and sub-Arctic regions.

The Alaska Energy Authority appreciates the bipartisan efforts of Senators Murkowski and Cantwell on the *Energy Policy Modernization Act of 2015* and the effort to officially designate hydropower as a renewable resource for purposes of all federal programs.

The advancements of renewable energy and a community's ability to reduce its diesel use is directly impacted by the lack of sound infrastructure in some rural communities. For example, staff members at the Alaska Energy Authority have seen renewable projects stalled by a community's inability to transport equipment for installation; a wind project that would serve the communities of Ambler, Shungnak and Kobuk could not progress because the community lacked a viable airport and port to receive the turbine and crane for installation.

Reducing diesel use in rural communities has positive economic and environmental impacts. As more communities are looking to integrate renewables and move toward the ultimate goal of a "diesels off" environment, the Alaska Energy Authority, Alaska Center for Energy and Power

and Alaska Village Electrical Cooperative have identified the development of a Grid Bridging System as a critical component to allow for effective integration of variable renewable power above 30 percent on an annual basis. This Grid Bridging System will be both a control system and integrated equipment that will allow for greater use of renewables, less diesel use when both the renewables and diesel are running, and improved power quality. The addition of this system with a small amount of energy storage will allow smaller diesel gensets to operate, and potentially for variable renewable energy sources such as wind to be used with diesels turned off during sustained wind energy availability. As we continue to integrate variable power into the small systems a power bridge is necessary to immediately absorb errors in the power quality and adjust the sources of power as needed.

Recognizing the need, the Alaska Energy Authority is looking to use the Emerging Energy Technology Fund (EETF) to push for a breakthrough in effectively deploying microgrid systems that can exceed the current technical and economic barrier of about 40 percent renewable energy from variable sources such as wind. Established in 2010, EETF is a program designed to provide an additional influx of capital for new energy and energy efficiency technologies, or existing technologies that have not yet been deployed in Alaska, that are within five years of commercialization. This program is a successful demonstration of the collaboration between the State of Alaska, through the Alaska Energy Authority and data collection provided by Alaska Center for Energy and Power, the Denali Commission and U.S. Department of Energy.

In total, \$11.85 million has been committed and 19 demonstration projects have been funded; these projects include energy storage, wind-diesel integration and space-heating technologies. Notable is the advancement of hydrokinetic projects. Three EETF hydrokinetic devices were deployed in the field during the summer of 2015 and all three successfully generated electricity. We were pleased to see the recent award by the U.S. Department of Energy to further advance one of these projects, Ocean Renewable Power Company's RivGen Power System on the Kvichak River in Igiugig. These types of partnerships further the development of technologies that could reduce the cost of energy for rural communities.

The integrated and community-based approach has proven to be successful. In 2009, AEA spearheaded the Whole Village Retrofit in Nightmute, Alaska, a community of 200 located near Toksook Bay, west of Bethel and Oscarville. It is a young community, more than 60 percent of households have children younger than age 18. At the beginning of the project, the cost of heating fuel in Nightmute was \$7.90 per gallon and the electrical rate was \$0.53 per kWh.

Multiple partners and agencies completed energy efficiency lighting and weatherization upgrades in 13 community buildings and four teacher housing units. After the upgrades, nine buildings were upgraded from two to four star ratings. The Alaska Energy Authority organized the original team of energy partners, and new team members like the Cold Climate Housing Research Center, to return to Nightmute in 2015 to evaluate the implemented energy efficiency measures. After nearly six years, the collaborative model proved successful. The average house and community building cut energy use in half and the village store alone was saving nearly \$11,000 a year in fuel costs. Community buildings that were once near abandonment now serve

as functioning and comfortable community gathering places. We are pleased to see a similar approach in Oscarville and will continue to participate in and support that effort.

The State of Alaska faces challenging fiscal times and the declining price of oil has impacted the state and our agency's ability to maintain the same level of service, especially to rural Alaska. We appreciate the positive working relationship that the Alaska Energy Authority shares with the U.S. Department of Energy and with the U.S. Department of Energy Office of Indian Energy. The Alaska Energy Authority and Office of Indian Energy have successfully partnered on energy planning efforts, rural utility training programs and collaborations to support rural Alaska communities and tribes. I was pleased to hear Secretary Moniz's pledge to expand the Office of Indian Energy's Alaska program staff.

In addition, the Alaska Energy Authority has been named the technical assistance provider for the U.S. Department of Energy's Remote Alaskan Community Energy Efficiency Competition. Energy efficiency is the most effective way of reducing energy costs, especially in high-cost rural Alaska communities. The collaboration between the Alaska Energy Authority and the U.S. Department of Energy allows us to use our experience in working with rural Alaska communities to provide reliable, affordable and efficient power to Alaskans. Having a healthy local U.S. Department of Energy presence in Alaska is important to supporting and growing this essential partnership.

I appreciate the opportunity to share my comments and highlight some of the challenges and opportunities in Alaska, particularly in our rural communities. We have a successful foundation to build upon and I hope we can continue to advance the cause to bring energy parity to much of Alaska.

Sincerely,



Sara Fisher-Goad
Executive Director

United States Senate
Senate Energy
and
Natural Resources Committee
Oversight Field Hearing
on
Energy Technology Innovation
and
Deployment Opportunities
for
Alaska's Energy Future

Testimony By:
Ron Hoffman
President/CEO
February 15, 2016

Association of Village Council Presidents
Regional Housing Authority
PO Box 767, Bethel, AK 99559
(907) 543-3121

Good afternoon, my name is Ron Hoffman, President and CEO of the Association of Village Council Presidents Regional Housing Authority. AVCP RHA is the tribally designated housing entity for 51 federally recognized tribes providing affordable housing opportunities and programs. The Yukon-Kuskokwim region is home to 56 federally recognized tribes.

I want to congratulate Senator Murkowski for becoming the Chairman of the Senate Energy and Natural Resources Committee as well as her assignments to the Appropriations, Indian Affairs and the Health, Education and the Labor and Pensions (HELP) committees. The assignments are very important to the people of the Yukon-Kuskokwim region and to the state of Alaska.

Welcome to Bethel and thank you for taking the opportunity to hear the highlights of innovative work in Alaska and to examine the daily challenges to access affordable energy by developing ways to use renewable energy to meet that challenge.

The information, the experiences, and the innovative advancements you hear at this hearing demonstrate our commitment to see that every region, every community and every family has access to affordable energy. We have challenges but come to the table to work to meet those challenges. We don't let a little snow stop us, right Senator Murkowski? We do need to use this hearing to formulate new legislation and amend current statutes to provide immediate relief to our families and communities as well as develop solutions for long term relief.

INNOVATIVE WORK

ALASKA VILLAGE ELECTRIC COOPERATIVE.

AVEC provides electricity to many rural Alaska villages. They have taken steps to provide energy at the lowest price possible including delivering their own fuel and by using wind power to reduce the use of fossil fuel and to lower the cost of electricity in rural communities. In the YK region there are wind farms in Toksook Bay, Hooper Bay, Chevak and Kasigluk. AVEC also provided intertie in Toksook Bay to serve Tununak (I believe they are working to connect Nightmute). In Kasigluk they have connected Nunapitchuk. This has replaced thousands of gallons of fossil fuel that would otherwise have been necessary.

CHANINIK GROUP

The Chaninik group serving Tuntutuliak, Kongiganak, and Kwigillingok has constructed wind farms to use wind power to supplement other modes of generating electricity.

NUVISTA LIGHT AND ELECTRIC COOPERATIVE, INC.

Nuvista is a non-profit electric cooperative seeking ways to reduce energy costs and provide renewable sources of energy to the people of western Alaska. Founded and led by non-profit, tribal, energy organizations, and Alaska Native stakeholders. Nuvista is working to improve the energy economics by creating energy generation and transmission infrastructure to serve, connect and enable the region to attain affordable, long term energy sustainability and self-sufficiency.

Organizations supporting Nuvista include Calista Corporation, AVCP RHA, AVCP, YKHC, AVEC, LKSD and Chaninik

HIGH ENERGY COSTS

High energy costs affect every person and community in the United States. This is more critically evident in rural Alaska. The cost of energy drives up the cost of necessary goods and services throughout the YK region as it is only accessible by air year round and by water on a seasonal basis.

Our communities utilize air transportation to get their goods (groceries, medicine, other perishable and non-perishable). And marine transportation is used to get bulk materials and goods (fuel, lumber, and similar types) to the villages. This marine transportation is usually available only from June to October.

In terms of fuel, the price of fuel from June till October is set by the cost of crude oil in June and in September. If the price of crude oil drops in October or later, the YK region and other rural parts of Alaska receive no benefit from the drop. The years 2015 and 2016 are good examples. The price of oil has been at the lowest it has been in years but today in Bethel we are paying the price of crude oil set in September, 2015.

According to the January 2016 Alaska Fuel Price Report published by the Alaska Department of Commerce, Community and Economic Development, Alaska communities in western Alaska have the highest fuel retail prices.

Price of Gasoline YK Region

Bethel	\$5.75 per gallon	Pilot Station	\$5.25 per gallon
Atmautluak	\$6.39 per gallon	Nunapitchuk	\$6.52 per gallon

Average fuel price: \$5.66 per gallon

Price of Gasoline Road System

Anchorage	\$2.20 per gallon
Glennallen	\$2.83 per gallon
Homer	\$2.56 per gallon

Comparison of Price of Heating Fuel Anchorage to YK Villages

Diesel prices are \$1.85/gallon in Anchorage, and \$2.79 in Cordova.

Below is a cost comparison between Anchorage vs. Bethel and several villages:

City	Diesel	Difference
Anchorage	1.85	
Atmaultluak	6.73	+4.88
Bethel	5.67	+3.82
Hooper Bay	6.45	+4.60
Kalskag	6.25	+4.40
Pilot Station	7.32	+5.47
Toksook Bay	6.00	+4.15

Affecting Ability to Get and Keep Basic Energy Services

The Institute of Social and Economic Research of University of Alaska Anchorage May 2008 issue reported that high fuel costs are distressing and are affecting the residents of rural Alaska's ability to get and keep basic energy services. The impact to a family is when it gets cold and a family has to decide between feeding their children or purchasing heating fuel.

Affecting Cost of Doing Business

Rising energy costs affect the cost of doing business in rural Alaska. The rise in these energy costs are paid by the residents of Alaska. Costs of air fare, costs of groceries and costs of electricity have increased geometrically.

That high energy costs affect the social and economic well beings of all Alaskan residents and especially rural Alaska residents is beyond doubt. The high energy costs affect business, local and regional services providers such as housing, local governments, school districts and health corporations. We are all in the same boat and it will sink if we cannot meet the renewable, sustainable energy challenge.

AVCP RHA has had to pay up to 50% of the material and supply contracts simply for transporting and shipping materials and supplies from Washington to village construction sites.

In 2013, AVEC paid \$22,380,420 and \$31,751,985.00 in 2015 to purchase fuel to operate its generators to provide electricity. That is an increase of \$9.3 million.

High energy costs effect the ability of employers to attract, recruit, hire, and/or retain employees for jobs in rural Alaska. Salaries in rural Alaska cannot compete with salaries in urban Alaska. LKSD for example has had difficulty in recruiting and retaining teachers to teach our children.

UNEMPLOYMENT AND POVERTY

Bethel and Kusilvak Census Districts

The Bethel Census and the Kusilvak (formerly Wade-Hampton) Census Districts have the highest unemployment and poverty rates in the State of Alaska and most probably in the nation. The unemployment rates are 13.5% and 20.6% respectively (State of Alaska, January 22, 2016) with poverty rates of 23.7% and 33% respectively.

The people of our region have the highest unemployment and poverty rates and yet also face the highest cost of energy in the entire country. We need your help to address these high cost of energy which, when reduced, can bring jobs that will improve the lives of adult and children and which will get them out poverty.

AUTONOMY

Earlier I stated Nuvista is working to address energy issues and seek solutions. This is an organization with local board members who understand and know the area and are working to identify solutions. The same can be said for housing. NAHASDA has made local autonomy key in planning and implementing housing. Health care has also improved when local autonomy is implemented.

Local organizations need to be deemed eligible recipients for national grants and loans. One example might be for Indian housing authorities to be eligible to receive and implement national weatherization services.

FUNDING

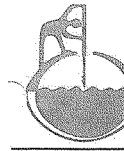
Appropriations are necessary to provide unemployment training in areas of high employment and poverty rates. Jobs available in aviation, education, health, and construction fields that need a trained and skilled labor force which cannot be had without sustainable, renewable and accessible energy.

Some of the areas to look at are:

- Funding to develop infrastructure to produce and refine Alaska-based resources in Alaska for use by Alaskans. Today, the majority of Alaska crude oil is sent to refineries outside the state of Alaska. This increases the cost of fuel our regions.
- Relaxing or waiving excise taxes on fuel.
- Reviewing current statutes and regulations which drive up the cost of energy.
- Providing subsidy prices for energy in rural Alaska.
- Providing subsidy for transportation costs of energy supplies.
- Developing central bulk fuel storage areas such as the Adak Naval Base.
- Supporting and funding the development of alternative of energy sources.
- Looking for ways to reduce the dependency on foreign countries for crude oil such as exploring and opening the Arctic National Wildlife Refuge.

Addressing the challenge of high energy costs is crucial to the well-being to the State of Alaska and to the survival and the preservation of a lifestyle and culture in rural Alaska.

Thank you for the opportunity to testify.



Institute of Social and Economic Research

RESEARCH SUMMARY

R.S. No. 68

University of Alaska Anchorage • May 2008

DOLLARS OF DIFFERENCE: WHAT AFFECTS FUEL PRICES AROUND ALASKA?

By Meghan Wilson, Ben Saylor, Nick Szymanski, Steve Goltz, and Ginny Fay

The spike in oil prices has hit rural Alaskans especially hard, because they rely mostly on fuel oil for heating. But some rural residents are paying much more than others—at times 100% more.

The Alaska Energy Authority asked ISER to analyze what determines the prices rural households pay for fuel oil and gasoline. The agency hopes this research can help identify possible ways of holding down fuel prices in the future. In this summary we report only fuel oil prices, but the full report (see back page) also includes gasoline prices.

We studied 10 communities that reflect, as much as possible, the forces driving fuel prices. We collected information in November 2007, and fuel prices have gone up a lot since then. Crude oil sold for \$120 a barrel in mid-May, up from about \$80 in fall 2007.

But the factors that influence fuel prices haven't changed—and it's those factors that are most important, rather than prices at a specific time.

The map tells a big part of the story. The 10 study communities are scattered across Alaska. They include places that get fuel by truck, barge, and air. Some are much closer to refineries and distribution hubs than others. Some can get fuel through fairly simple transportation routes, and others get fuel only after it has been loaded and unloaded several times.

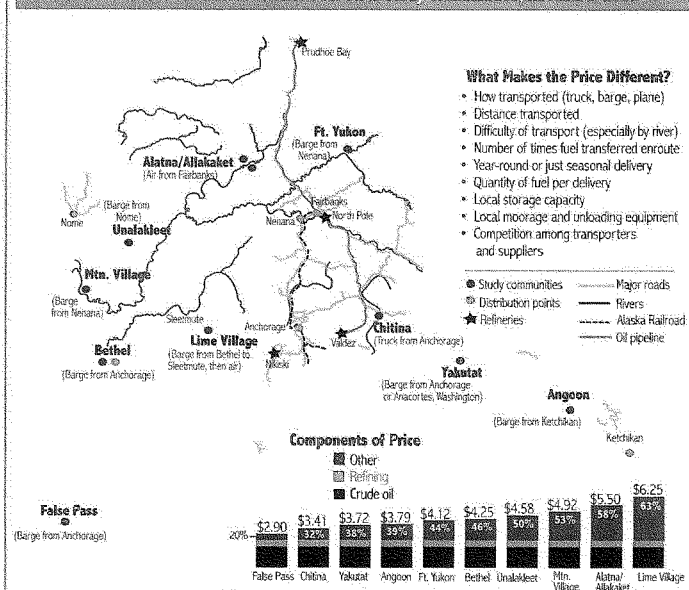
All those things influence prices. But so do some obvious factors, like the condition of local docks and fuel-handling equipment,

the amount of competition among both suppliers and transportation companies, and community storage capacity. Sometimes small remote communities can take advantage of economies of scale, if commercial operators maintain large local storage tanks.

At the base of fuel prices are the costs of buying and refining crude oil (the blue and green bars in the map). In November 2007 those costs together accounted for an estimated \$2.31 of the price Alaska households paid for a gallon of fuel oil. Transportation and other costs added 59 cents to \$3.94 to the price in various study communities—making up from 20% to 63% of the final price for a gallon of fuel oil.

Inside we discuss all the factors that make fuel prices so different around Alaska—and the possibilities for influencing those prices.

\$2.90 to \$6.25 Per Gallon: Price of Fuel Oil in Study Communities, November 2007



WHAT AFFECTS THE PRICE OF FUEL OIL?

Fuel oil (also often called diesel) is one of several products distilled from crude oil and used for heating fuel or engine fuel. Fuel used for home heating is exempt from federal and state taxes, but not from local sales taxes.¹ Many but not all rural communities have sales taxes.

When we refer to fuel oil prices, we specifically mean the price households pay. Most rural Alaskans rely on fuel oil for heating houses and other buildings and generating electricity. Anchorage and a few nearby towns—and Barrow on the North Slope—have access to natural gas. Some places in southeast Alaska have hydro-powered electricity.

All communities have special characteristics that influence prices, but there are a few common contributing factors:

• **Crude oil and refining costs.** For this analysis, we assumed these costs were the same for fuel sold in all communities. In reality they vary, depending on when the fuel was purchased and other factors. But we couldn't get enough data to assign crude-oil costs to fuel in each community. Instead we based our estimates on costs the Energy Information Administration reported for September 2007.

• **Cost of transporting, storing, and distributing fuel.** These costs make up most of the difference in price among communities, but they are very difficult to segregate.

• **Other factors,** like the effects of competition (or lack of competition) are hard to quantify but also affect prices.

World Price of Crude Oil

Crude oil is processed into fuel oil, gasoline, jet fuel, and other fuels. Petroleum is also used in hundreds of other products, including tires, medicines, and plastics. The price of crude oil is driven by worldwide demand for petroleum products, but it's also influenced by political events and natural disasters that disrupt or threaten oil flows.

Oil from the North Slope has made Alaska a top U.S. oil producer since the late 1970s, and some oil is also still produced in Cook Inlet, where it was first discovered in the 1950s.

Refining Crude Oil into Fuel Oil

Fuel oil for most of Alaska is produced in Alaska. The big exception is southeast Alaska, where communities are strategically located to

take advantage of the best prices available from either Alaska or West Coast refineries. Alaska's refineries are at North Pole in the Interior, Nikiski on the Kenai Peninsula, and Valdez, the terminal of the oil pipeline (see map, page 1). Oil companies also operate two refineries on the North Slope—but their production is only for North Slope operations, and we don't include it in this discussion.

Much of the oil for Alaska refineries comes from the North Slope, some from Cook Inlet, and some from other countries. Alaska refineries currently produce something in the range of 127,000 barrels (or 5.3 million gallons) of petroleum products daily. Production varies during the year, with demand for jet fuel and gasoline higher in the summer and demand for fuel oil higher in the winter.

As the figure at the bottom of the page shows, fuel for home heating and for vehicles makes up on average about 11% of the production at Alaska refineries. Even though winters are long and cold, the state population is small, at about 675,000. Also, the city of Anchorage (where 40% of Alaskans live) and nearby communities have access to natural gas for home heating.

Gasoline, the main product of many U.S. refineries, makes up only about 15% of Alaska's refinery production. Again, that's because the in-state market is small. Jet fuel is the main product of state refineries, making up about 60% of total production but 70% or more at individual refineries during the summer season. Anchorage's international airport creates much of the demand for jet fuel, but the Fairbanks airport and Air Force bases in the state also buy jet fuel.

Refineries in Alaska can compete with other U.S. refineries because transporting fuel the long distance to Alaska usually eliminates whatever price advantage the

Outside refineries might have. From 2000 to 2007, average wholesale prices (adjusted for inflation) for a gallon of fuel oil in Alaska were comparable to those in the West Coast and Rocky Mountain regions and somewhat higher than the U.S. average.

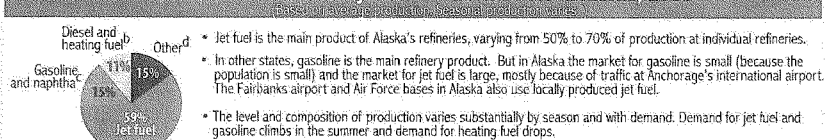
Average U.S. Wholesale Prices: Gallon of Fuel Oil, 2000-2007
(in 2007 dollars)

Gulf Coast	\$1.30
U.S. average	\$1.34
Midwest	\$1.36
Alaska	\$1.42
West Coast	\$1.43
Rocky Mountain	\$1.45

*#2 fuel oil

Source: U.S. Energy Information Administration

Estimated Production by Petroleum Refineries in Alaska, 2008^a



^aThis estimate is based on information available from Alaska refineries, which have different mixes of products and report their production at different levels of detail. It includes production at the Flint Hills refinery at North Pole, the Tesoro refinery at Nikiski, and the Petro Star refineries at Valdez and North Pole. It does not include production at the two refineries on the North Slope, operated by BP Alaska and Conoco Phillips, which produce about 2,700 to 3,800 barrels per day of Arctic heating fuel for industry needs on the North Slope.

^bIncludes various products distilled from oil that can be used as a fuel for heating homes and other buildings or for vehicles, boats, generators, and other machinery.

^cNaphtha is a byproduct of gasoline production and is used as a feedstock for the manufacture of chemicals and other products. Most naphtha produced in Alaska is exported. A small amount of light naphtha produced in Alaska is used to power generators.

^dIncludes asphalt, propane, and various other products; some of which are reported. Also includes the share of production the Flint Hills refinery uses to fuel its own needs.

Sources: Alaska Division of Oil and Gas; Flint Hills Resources; Tesoro Refineries; and Petro Star Inc.

Getting Fuel to Communities

Fuel buyers typically have contracts with transportation companies, specifying fuel delivery charges. We weren't able to learn current contract delivery prices, because companies keep that information confidential. Instead, we looked at all the factors that contribute to the costs of getting fuel to communities.

Sometimes fuel oil goes directly to Alaska communities from the refinery. But most often, fuel is first transported by rail, pipeline, truck, or barge to distribution hubs and then on to small rural communities.

Almost all rural Alaska communities are along the coast or on rivers or lakes. Some, mostly in southcentral and interior Alaska, are on the road system. So most rural places get fuel by barge and perhaps a couple of dozen by truck. A very small number—typically on rivers too shallow for fuel barges to navigate—routinely get fuel by air.

Trucking fuel is generally cheapest. Road communities are usually closer to distribution hubs, can get more frequent deliveries, and have lower storage and inventory costs. But so many factors affect fuel prices—for example, the timing of a fuel purchase—that even road communities don't always have the lowest prices.

Flying fuel is the most expensive, and communities will only get fuel by air if they have to because of their location or if they face a fuel shortage at a time when barges can't deliver.

Barging fuel is complex and risky, and in many places barges can only deliver during a short ice-free season. So while barging is cheaper than flying, it's still expensive, for many reasons. Those include:

• *Distance from the refinery.* The further away the community, the higher the cost. Also, communities closer to more than one refinery can choose among sources and take advantage of any lower prices.

• *Quantity of fuel purchased.* Communities can save money by buying fuel in larger quantities, because the fixed delivery costs are spread over more gallons of fuel. But to buy more fuel, communities must have the money not only to buy the fuel but also to increase their storage capacity.

• *Short seasons.* Ice prevents deliveries in many western and northwestern communities during the winter—so fuel transporters have to recover their capital costs during the short shipping season.

• *Fuel transfers.* Fuel for some small communities has to be transferred several times on its way from the refinery. Loading and unloading the fuel, storing it at hub communities, and incurring other transfer costs all add to the price at the final destination.

• *Navigational hazards.* Many stretches of Alaska rivers are risky, increasing running time and insurance and crew costs. Also, navigating rivers requires a lot of local knowledge—making it hard for inexperienced firms to compete.

• *Custom-built barges.* Barges operating in Alaska's western rivers must be custom-built to draw no more than 3.5 feet of water.

• *Small and shallow ports.* In many communities, fuel from has to be lightered ashore in smaller vessels, increasing the handling costs.

• *Inadequate moorage and fuel-pumping equipment*—making it more difficult, time consuming, and risky to unload fuel in some locations.

Storing and Distributing Fuel

Communities across Alaska also face the costs of storing fuel once it arrives. Fuel tanks are expensive to buy and maintain and have to meet government environmental regulations. And finally, distributing fuel to individual customers also adds to the price. A few communities allow customers to pick up the fuel themselves.

STUDY COMMUNITIES

The maps on this page and the next show transportation routes to the 10 study communities and community fuel oil prices (in order from the lowest to the highest) as of November 2007.

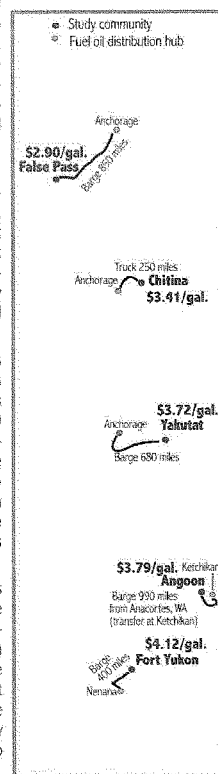
• *False Pass* (population 54) is in the Aleutians. Fuel is barged 850 miles from Anchorage (or Dutch Harbor) once a year—which can have price benefits, depending on the timing of the fuel purchase. A seafood processor maintains 330,000-gallon storage tanks there; local residents can also buy that fuel. Local sales tax on fuel is 3%.

• *Chitina* (population 110) benefits from being on the road, 250 miles from Anchorage. But storage is limited, and frequent fuel purchases mean the community is quickly affected by rising prices. There is no local sales tax on fuel.

• *Yakutat* (population 620) is on the Gulf of Alaska and has an ice-free, deep harbor. Fuel is barged from Anchorage (680 miles) or Anacortes, Washington (1,300 miles). Very large storage tanks (6.5 million-gallon) owned by a transportation company and a major airline benefit residents. Local sales tax on fuel is 4%.

• *Angoon* (population 500) is on Admiralty Island. Fuel can be barged year-round from Anacortes (or Anchorage), which helps reduce prices. But the fuel has to be transferred at Ketchikan and lightered ashore at Angoon. Also, the community has little storage. There is no local tax on fuel.

• *Ft. Yukon* (population 570) is on the upper Yukon River. Fuel has to be barged 400 miles upriver from Nenana and lightered ashore. Ice prevents winter deliveries. But there is relatively large (660,000-gallon) storage capacity. The local tax on fuel sales is 3%.



• *Bethel* (population 5,800) is a fuel distribution hub on the Kuskokwim River in southwest Alaska. It benefits from a large (14.8 million-gallon) storage tanks. A transportation company owns them. But fuel is barged 1,800 miles from Anchorage; ice prevents winter deliveries, and fuel has to be lightered ashore. There is no local tax on fuel.

• *Fuel for Unalakleet* (population 710) on Norton Sound is first barged nearly 1,900 miles from Anchorage to the Nome fuel hub. Ice prevents winter deliveries, and fuel is lightered ashore. Local sales tax on fuel is 3%.

• *Fuel for Mountain Village* (population 790) on the lower Yukon River is usually barged nearly 1,200 miles downriver from Nenana. Fuel can be delivered only during a short season, in a shallow-draft barge. The community has limited storage capacity. Local sales tax is 3%.

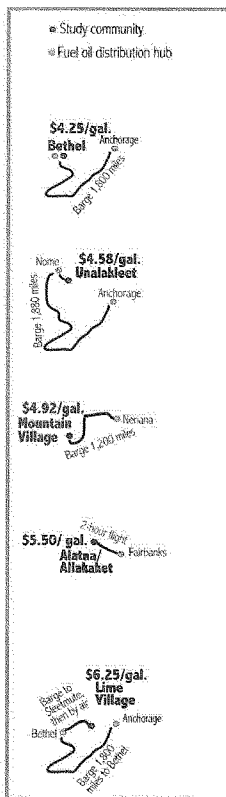
• *Allakaket and Alaina* (population about 125) are neighboring villages on the upper Koyukuk River, where barges can't navigate. They get fuel by air from Fairbanks. They also have small (16,000-gallon) storage tanks. There is no local sales tax.

• *Lime Village* (population 25) is on the Stony River in the Kuskowim Delta. Barges can't reach the community. Fuel comes 1,800 miles by barge from Anchorage to Bethel, where it is transferred and shipped up the Kuskowim River to Sleetmute, then flown to Lime Village. The storage tank holds only 1,800 gallons. There is no local sales tax.

CONCLUSIONS

We weren't able to break out all the factors driving fuel prices, because we couldn't distinguish some distribution costs from profits. Also, some of the study communities are so small and hard to reach that typically just one or two companies compete for their business. It's impossible to specify the price effects of that limited competition.

Still, we learned a lot about what drives fuel prices and have thought about what the state might do to help hold down prices. It's important to point out that the state has already created or expanded programs



to help communities buy fuel or pay fuel companies and to help low-income households having trouble paying their energy bills.

The Alaska Energy Authority and the Denali Commission are also working together to improve fuel-storage capacity in many rural communities. Being able to store more fuel should help reduce community fuel prices. Other potential policies include:

• Consider selling state royalty oil to Alaska refineries at below-market prices, since the price of crude oil has a big effect on fuel prices. But the state wouldn't be able to control the downstream costs, and it's not clear how much benefit households would see after the fuel had passed through the entire distribution chain.

• Investigating the extent of cooperative buying in communities among utilities, schools, the state (which buys fuel for state facilities), and others would be worthwhile. Our research didn't include that assessment, but we heard anecdotally that deliveries may not be well-coordinated. Taking advantage of economies of scale could have price benefits.

• Having non-profit brokers to coordinate and fund collective fuel purchases could help reduce prices. We know that lack of cash frequently limits how much fuel small communities can buy at one time.

• Investigating possibilities for improving barge landings in small communities. Delivering fuel in places with inadequate infrastructure is harder and more expensive. But building barge landings is expensive for small communities, and there are also potential liability issues in the event of fuel spills. If there were a way to improve barge landings and resolve liability questions, both the delivery costs and the risk of fuel spills might be reduced.

Fuel will always cost more in small, remote places than in bigger, more accessible places. Public policies can't change that. But there are a number of points along the chain of fuel distribution where policymakers might find ways to help alleviate high fuel oil prices.

And in the long run, rural Alaskans may have other energy choices. The North Slope has one of the largest accumulations of natural gas in the U.S., and the state and oil companies are considering options for building a pipeline to carry that gas to market. The Alaska Natural Gas Development Authority is also examining ways to make the gas available in-state. The Alaska Legislature has appropriated money for a variety of renewable energy projects and studies. But it's still uncertain when rural Alaskans might have access to natural gas or other less-expensive energy sources.

Note

1. Although fuel oil is not subject to state or federal taxes, diesel for motor fuel—a virtually identical product—is taxed. In other states, fuel oil is dyed to distinguish it from the taxable motor fuel. But because Alaska markets are so small, Alaska is not required to dye fuel oil, and the two products can be shipped together. Because the taxable and non-taxable fuels are typically mixed for shipment, it is possible that at times households may in fact pay taxes on fuel oil—because the taxes have been levied at some earlier point. In that case, households can apply for refunds on those taxes. But our research indicates that in most cases households do not pay federal and state taxes on fuel oil. Instead, wholesale or retail sellers (depending on the circumstances of the sale) determine which sales are exempt from federal and state taxes, and apply for refunds of any such taxes they paid on fuel ultimately sold for home heating.

This summary is based on the report, *Components of Delivered Fuel Prices in Alaska*, by the same authors. That full report will be available in summer 2008 and will be posted on ISER's Web site: www.iser.uaa.alaska.edu

Editor: Linda Leask • Graphics: Clemencia Merrill

LETTER TO THE MEMBERSHIP

April 9, 2014

To our AVEC membership:

2014 was a banner year for AVEC, with Bethel becoming a part of the membership in May. As a result, we sold almost 98 million kWh, 33% more than in 2013. The average monthly residential consumption dropped from 415 kWh to 405 kWh, reflecting continued conservation efforts in the home. The cost of fuel purchased in 2014 was almost exactly the same as 2013 at \$4.20. Wind turbines again contributed six percent of overall generation and have saved \$7,000,000 in fuel since 2006.

The addition of Bethel has resulted in significant changes to the financial statements that make it very difficult to compare 2014 to 2013. 2015 will be similarly complicated because it will include a full year of Bethel operations as compared with eight months in 2014.

Total revenue in 2014 was \$53,815,854. Expenses totaled \$50,720,863, resulting in an operating margin or profit of \$3,094,991. An insurance claim settlement resulted in a reduction to fuel handling costs of about \$550,000, which contributed to these higher margins. Operating margins will be allocated to the membership during 2015. Earnings on our cash investments as well as patronage capital from affiliated organizations resulted in total margins of \$4,707,633 for the year. Our improved cash position resulted in the Board of Directors approving a refund of \$500,000 of patronage capital to the membership, which was distributed in December 2014.

Our two tug and barge sets continue to perform admirably, delivering most of AVEC's fuel to our non-Bethel communities. The operator, Vitus Marine, also delivered fuel to other buyers in AVEC and non-AVEC communities in addition to a large amount of equipment and other deck cargo. AVEC's fuel was purchased and delivered before world oil prices started to plummet in September, so we will not see the benefit of those lower prices until after the 2015 delivery season. Using our own vessels and Vitus Marine for delivery of our fuel continues to result in cost savings of well over \$500,000 each year. Those savings are reflected in lower fuel cost charges on the electric bill.

Approximately \$18.4 million was added to total utility plant, while \$4.4 million was retired from service. An additional \$12.6 million was spent on grant-funded plant and we received about \$10 million in new grant funds from the Denali Commission, Rural Utilities Service and the State of Alaska. \$28 million in grant funds from these granting agencies remain available to be invested in approved energy projects.

PCE has been fully funded for the current fiscal year and is included in the operating budget for full funding in the next fiscal year. PCE funding is designated to come out of the PCE Endowment Fund, so it has not been subject to the widespread budget-cutting that is currently underway in Juneau.

Another milestone achieved in 2014 was receipt of acknowledgement in September that up to \$8 million is available from FEMA disaster recovery funds to address the timeline between Brevig Mission and Teller that was destroyed in the 100-year storm that devastated western Alaska in 2011. We are researching options to develop lower cost electricity for Teller and hope to begin preliminary work on this important project during 2015.

A top priority for AVEC for the last few years has been the pursuit of feasibility funding for the All Alaska Energy Project, also known as the Alaska Grid. This project incorporates very large-scale gas-fired generation located at the North Slope, with a High Voltage Direct Current (HVDC) transmission system delivering that power across the state of Alaska. We continue to pursue this project.

We continue to seek funding from the Legislature for a comprehensive statewide contaminated site assessment and clean-up program, but the severe downturn in the Alaskan economy as a result of low oil prices has dampened our expectations for funding at any level.

Information on major projects underway is provided on Page 6 of this report and on page 7 we highlight our communities and member events.



Robert Beans, Chairman of the Board



Meera Kohler, President and CEO

REPORT TO THE MEMBERSHIP

SCHOLARSHIPS

AVEC's Board of Directors awarded scholarships totaling \$11,500. Colynn Isaacson received the Ted Stevens Memorial Scholarship in the amount of \$5,000. Shanelle Afcan and Caroline Hoover received scholarships worth \$1,000 and Ashley Brankovic, Charlie Robert, Dallas Chayalkun, Ellis Tomaganuk, Kaylena Charlie, Stefan Weingarh, Victoria Hooper, Zachary Lestenkof-Andrew and Ivan Luther were each awarded \$500.

CAPITAL CREDITS

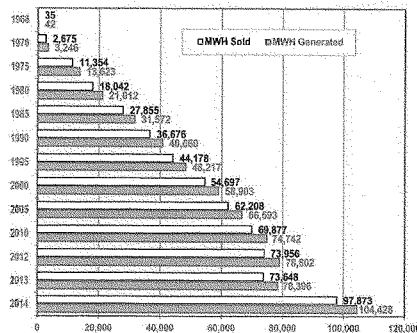
During 2014, the Board of Directors approved disbursement of \$500,000 to retire the oldest capital credits in the system. With this disbursement, AVEC has returned \$18 million of a total of \$40 million in allocated capital credits. As the cooperative's financial condition permits, the AVEC Board will continue to authorize periodic disbursements of capital credits.

TUGS AND BARGES

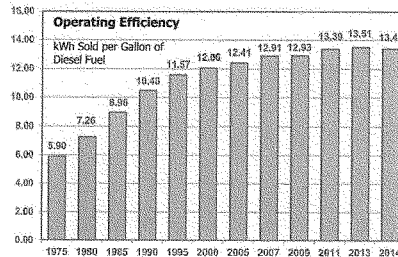
AVEC's tug-and-barge sets, chartered and operated by Vitus Marine, completed their third full season, delivering 4 million gallons of fuel to a majority of AVEC's communities. Vitus Marine's entry into the market has provided downward price pressure on fuel prices in Western Alaska, providing cost saving benefits to residents and businesses in this region.

TOTAL MEGAWATT HOURS GENERATED AND SOLD

In 2014 AVEC generated a total of 104,428 MWH and sold 97,873 MWH, a 33% increase over 2013 due to bringing in Bethel as a new member.



AVEC Annual Report 2014



SAVINGS FROM HEAT RECOVERY

AVEC has been making an increased effort to partner with the Alaska Native Tribal Health Consortium and local authorities to make heat from our diesel engines available for water plants and public buildings. This makes better use of every gallon of diesel burned, benefitting the communities with lower-cost heat and providing additional revenue for the cooperative. AVEC has also been working with ANTHC to install "wind to heat" services in Chevak, Mekoryuk, Gambell and Shaktoolik.

SAVINGS FROM RENEWABLE ENERGY

Thanks to funding received from the Denali Commission, Rural Utilities Service and the State of Alaska, AVEC has installed 34 wind turbines in eleven communities with interties to three other communities. In 2014, wind turbines generated 4,268,565 kWh (net) and displaced an estimated 327,748 gallons of diesel fuel, saving \$1,311,215 dollars in diesel generating costs. The average fuel cost was \$4.00. Combined with fuel savings realized in 2007 through 2014, AVEC's consumers saved \$7,028,608 in fuel costs over the past seven years.

TOP 10 PLANT OPERATORS OF THE YEAR

Each year AVEC selects the Top 10 Plant Operators of the Year in order to reward the operators with the best performance for the past year based on a set list of criteria. Allowing the daytank to run dry automatically removes the operator from the list. The winners receive a heavy-duty jacket along with a cash bonus. Congratulations to the 2014 Top 10 Plant Operators of the Year: **Evan Newman** of Holy Cross, **Megan Esmailka** of Kaltag, **Abner Hawley** of Kivalina, **Mickey Ashby** of Noatak, **Tuck Cleveland** of Noorvik, **Eric Mountain** of Nulato, **Stuart Kingeekuk** of Savoonga, **Daniel Tunutmoak Jr.** of Scammon Bay, **Pauli Bekoalok** of Shaktoolik, **Peter Lincoln** of Toksook Bay.

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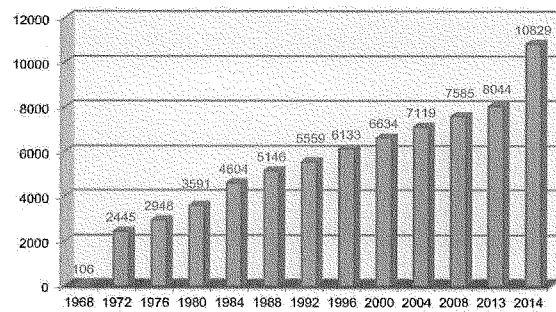
CONSUMERS

As of December 31, 2014

The system overall showed an increase of 2,785 new consumers for the year. The big increase is due to adding Bethel as a member. Thirty-three villages showed an increase in consumers, 19 villages had slight decreases in consumers and four villages remained the same. The total number of meters connected is a record high at 10,829.

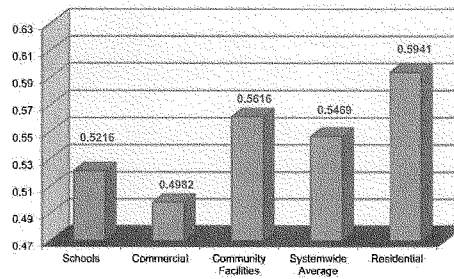
Alakanuk	198	Grayling	86	Marshall	145
Ambler	116	Holy Cross	103	Mekoryuk	124
Anvik	73	Hooper Bay	337	Minto	101
Bethel	2715	Huslia	139	Mountain Village	249
Brevig Mission	119	Kaltag	105	New Stuyahok	155
Chevak	259	Kasigluk	163	Nightmute	88
Eek	139	Kiana	162	Noatak	156
Ekwok	75	Kivalina	110	Noorvik	184
Elim	130	Kobuk	56	Nulato	139
Emmonak	288	Kotlik	176	Nunapitchuk	170
Gambell	222	Koyuk	130	Old Harbor	127
Goodnews Bay	103	Lower Kalskag	102	Pilot Station	166
				Pitkas Point	42
				Quinhagak	229
				Russian Mission	101
				St. Mary's/Andreafsky	254
				St. Michael	139
				Savoonga	209
				Scammon Bay	171
				Selawik	247
				Shageluk	53
				Shaktolik	100
				Shishmaref	196
				Shungnak	92
				Stebbins	184
				Teller	112
				Togiak	320
				Toksook Bay	180
				Tununak	119
				Upper Kalskag	94
				Wales	77

CONSUMERS SERVED AT YEAR'S END



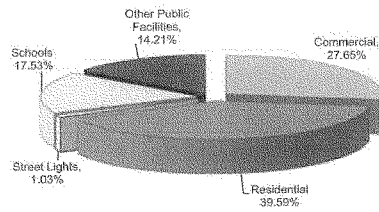
Every year a Lee's Sea Air plane flies overhead and drops money during Kiana's annual 4th of July celebrations.

AVERAGE REVENUE PER KWH BY CONSUMER CLASS

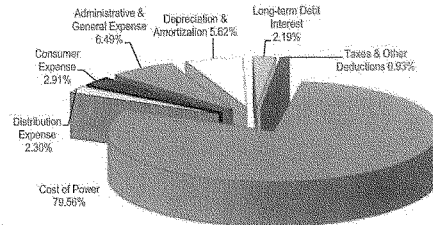


BALANCE SHEET

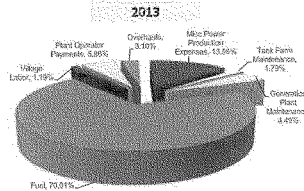
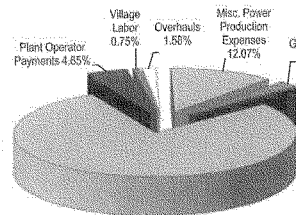
SOURCE OF ELECTRIC REVENUE



TOTAL COST OF SERVICE BY ITEM



POWER PRODUCTION EXPENSES
2014 vs 2013



ASSETS	12/31/14	12/31/13
Total Utility Plant	\$144,527,035	\$132,352,737
Accumulated Provision for Depreciation	<u>80,100,794</u>	<u>73,018,890</u>
Net Utility Plant	\$64,426,241	\$59,333,847
Other Property & Investments	7,652,871	7,643,787
Current & Accrued Assets	54,375,598	46,630,941
Deferred Debits	<u>363,108</u>	<u>876,832</u>
TOTAL ASSETS	\$126,817,818	\$114,485,407

LIABILITIES

Equities	\$47,545,590	\$43,286,742
Long Term Debt	53,858,518	53,715,582
Current & Accrued Liabilities	24,034,600	16,451,501
Deferred Credits	<u>1,379,110</u>	<u>1,031,582</u>
TOTAL LIABILITIES	\$126,817,818	\$114,485,407
Equities As Percent Of Assets	37.49%	37.81%

STATEMENT OF OPERATIONS

	12/31/14	12/31/13
Operating Revenue	\$53,815,854	\$42,206,045
Cost of Power	40,354,492	31,926,420
Distribution Expense	1,164,608	1,251,252
Consumer Expense	1,690,780	1,610,242
Administrative & General Expense	3,078,979	2,899,721
Depreciation & Amortization Expense	2,852,349	2,498,115
Interest Expense	1,116,099	1,107,595
Taxes & Other Deductions	<u>463,555</u>	<u>410,688</u>
Total Cost of Electric Service	\$50,720,863	\$41,704,032
Operating Margin	\$3,094,991	\$502,013
Interest Income	674,207	1,307,814
Other Non-Operating Income	<u>938,436</u>	<u>742,450</u>
TOTAL MARGIN	\$4,707,633	\$2,552,276

PROJECTS/FACILITY UPGRADES

New Member

AVEC took over the assets of the Bethel Utilities Corporation with full integration of the Bethel operations into AVEC's operations on May 7, 2014.

Tugs and Barges

AVEC's tugs and barges, chartered and operated by Vitus Marine, completed their third full season, delivering 4 million gallons of fuel to AVEC communities for an average price of \$4.07 per gallon. In three short years, Vitus Marine's entry into the market has provided downward price pressure on fuel prices in Western Alaska.

Denali Commission

AVEC has traditionally received capital project funding through the Denali Commission, Rural Utilities Service and the State's Renewable Energy Fund. Capital projects may be new or refurbished tank farms, power plants, engines, wind turbines or electrical interties between villages. They may replace existing equipment or extend the useful life of equipment in place. Connecting villages with interties allows AVEC to reduce operating costs. Going forward, reduced funding compared with the previous decade is the new reality. AVEC is working closely with the funding agencies to assure the most is made of available funding. Where possible we will engage in life extension projects to stretch the useful life of existing equipment.

Interties

Brevig Mission – Teller: The intertie completed in 2011 was damaged by a fall storm in 2011 and again in 2013. The barrier land form that the tieline was buried in has been repeatedly eroded. AVEC has been working with FEMA to acquire disaster assistance funding to repair the line. Because of the repeated damage along the route and expense of re-routing the line AVEC is considering an alternative project that would improve the power plant and tank farm facilities in Teller and abandon the effort to rebuild the tieline. FEMA disaster assistance allows for the use of funds to build such an alternate project, but approval and funding have not yet been awarded.

Stebbins – St. Michael: AVEC and the community of Stebbins worked together to secure the final funding needed to construct the electrical intertie between St. Michaels and Stebbins. The intertie will allow AVEC to save operating costs by operating a single power plant to serve both communities. The intertie will also enable both communities to benefit from wind power in the future.

Ekwok to New Stuyahok: In the middle of 2014 AVEC was granted the environmental release required for funding this intertie. Similar to the Stebbins – St. Michael intertie project, AVEC has most of the needed funding. During 2015 we will search for a partner to complete the funding so the project can move ahead.

Generation Projects

New Engine Installations

Selawik: A replacement Cummins K38 generator was installed.

Togiak: A 12V2000 MTU module was completed and put in service.

St. Michael: A new standby module was commissioned to serve St. Michael when the intertie from Stebbins is completed and needs

maintenance or is not operational. The intertie is currently under construction and will be completed this summer.

Stebbins: A new power plant was commissioned and is designed to also serve the St. Michael service area. The retired power plant and tank farm were demolished and work is being accomplished to turn the property over to DOT.

Heat Recovery Projects

AVEC worked with CE2 to assist in the installation of a heat recovery system to the water treatment plant in Hooper Bay.

Cooling system upgrades were completed in New Stuyahok and a marine manifold was installed on the CAT 3456 to provide recovery heat to the school. The heat recovery system should be completed in the 2015 season.

AVEC has worked with ANTHC on installation of a heat recovery system in Savoonga.

AVEC has assisted ANTHC in design of future heat recovery projects in many communities.

Excess Wind Energy Projects

AVEC has been working with ANTHC to provide low cost electricity from excess wind energy to water plants in four communities.

- Mekoryuk is completed and operational.
- Shaktoolik is 95% complete.
- Chevak and Gambell are scheduled for mid-year completion.

Tank Farm Projects

Goodnews Bay's tank farm was renovated, tanks were painted and new decking was installed in the tank farm and at the plant facilities. Emmonak received a new tank farm, which has capacity to also serve Alakanuk.

The Wales tank farm was painted.

Distribution

Schools: Ambler and St. Mary's.

Schools – various living quarters: Seven projects.

Streetlights converted to LED: 249 streetlights in 11 communities were converted to LED. 48 new LED streetlights were installed in 9 communities including Minto, which hasn't had any streetlights before. Two streetlights were relocated in Holy Cross.

Retired and replaced poles: Pilot Station and Toksook Bay.

Three-phase upgrades or new services: Selawik and Togiak.

Single-phase services: 96 permanent and temporary services installed in 32 communities.

Three-phase services: Selawik and Togiak.

Transformers: Alakanuk, Kiana, Marshall, St. Mary's, St. Michael and Shishmaref.

Repeater meters installed: Mekoryuk, Chevak, Anvik.

Modify distribution for road raising - Emmonak; reroute distribution for house raising project – Kotlik.

Verify power line right-of-way for BIA: Emmonak.

Convert underground to overhead: Mekoryuk and Ambler schools.

AVEC MEMBERS AND EVENTS

Some of the plant operators who received training



L to R: Brothers Paul and Edward Bekoalok of Shaktolik.



Ivan Lee and Leslie Sheldon of Shungnak.



Daniel Atoruk of Kiana.



Emil Henry of Kiana.



Darin Douglas of Koyuk.



Brian Douglas of Koyuk.



Stuart Kingeekuk of Savoonga.



Gilbert Tocktoo and Carl Rock of Brevig Mission.

Local Hire

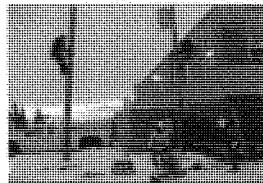


Ruth Bright of Goodnews Bay.



Residents of Emmonak helped build the new bulk fuel tank farm.

Linemen Training



Every year AVEC's linemen demonstrate pole work proficiency and pole top rescue skills.



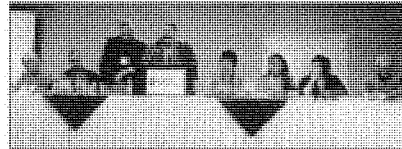
Cody Cadman performs a pole top rescue.

AVEC Annual Report 2014

2014 Annual Meeting

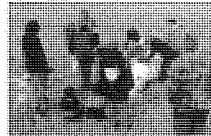


Group photo of delegates and board members.



L to R: AVEC board members Walter Sampson, Fred Sagoonick, Charlie Curtis, Robert Beans, President/CEO Meera Kohler, Helena Jones, Phyllis Clough and Peter Demoski.

Community Events



A Gambell whaling crew cuts up a minke whale they landed.



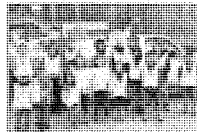
One of the decorated vehicles in Kiana's 4th of July parade.



Grayling's clean up crew.



Toksook Bay's clean up crew.



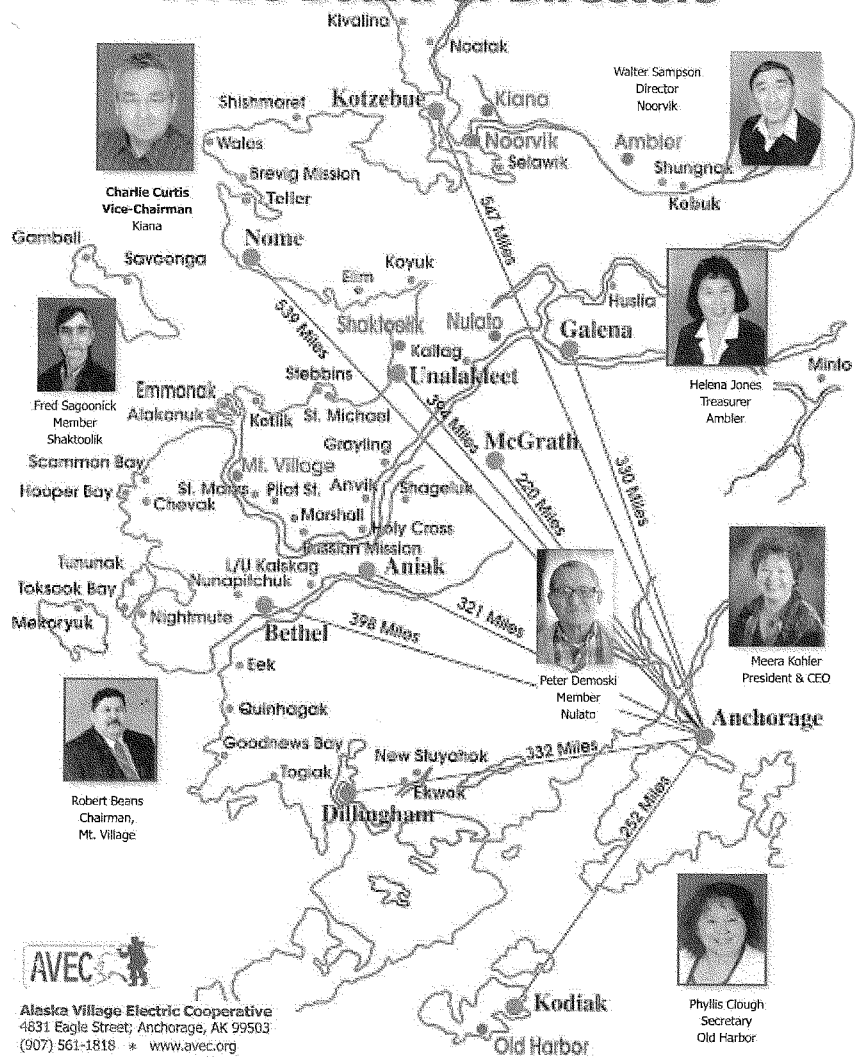
Anvik's clean up crew.



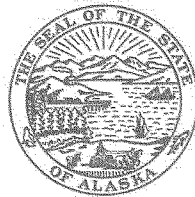
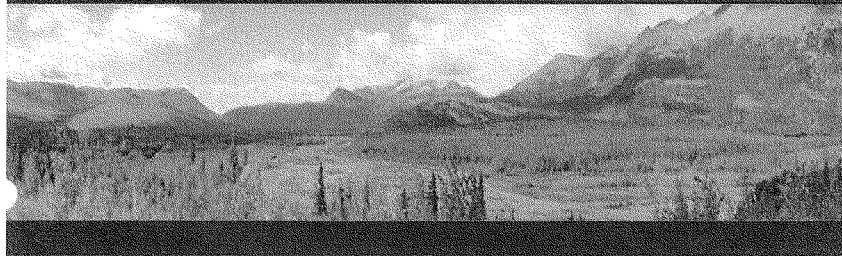
Kalskag's clean up crew.

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AVEC Board of Directors



Alaska Fuel Price Report:
Current Community Conditions
January 2016



Bill Walker, Governor

Department of Commerce, Community, and Economic Development
Chris Hladick, Commissioner

Division of Community and Regional Affairs
Katherine Eldemar, Division Director

Cover page photo credit:

Department of Commerce, Community, and Economic Development; Division of Community and Regional Affairs

Find previous editions of *Alaska Fuel Price Report* on DCRA's website:

<https://www.commerce.alaska.gov/web/dcra/>

The State of Alaska, Department of Commerce, Community, and Economic Development (DCCED), complies with Title II of the Americans with Disabilities Act of 1990. This publication is available in alternative communication formats upon request. Please contact dcra.publications@alaska.gov. The number for the DCCED Telephonic Device for the Deaf (TDD) is 1-907-465-5437.

INTRODUCTION AND METHODOLOGY

The Alaska Fuel Price Report contains a bi-annual collection of fuel prices quoted for residential use in 100 communities during the months of January and July. It illustrates current changes in fuel prices across Alaska, and also provides a historical perspective. The report highlights the price differences among Alaska communities and sheds light on the influence of transportation costs on the fuel prices in various locations. The effect of high transportation costs on the price of fuel, in part, explains the high costs of living in Alaska's remote locations.

To complement the fuel price information recorded from the survey, analysts at the Division of Community and Regional Affairs (DCRA) include monthly Alaska North Slope (ANS) crude price information and the national average prices of gasoline and heating fuel. The nationwide heating fuel prices are tracked only during the heating season that starts in October and stretches into March of the following year.

In 2005, the collection of fuel prices started out as a collaborative project between DCRA, Institute of Social and Economic Research (ISER) and Alaska Housing Finance Corporation (AHFC). The three agencies identified 270 communities to be surveyed and the questions to be included on the survey form. To accurately and consistently track longitudinal changes in fuel prices, the 2005 survey format and community sample were continually used through January, 2016. Therefore, the communities and core questionnaire items have remained the same.

DCRA surveys 100 communities, many of which were rural communities that had been recipients of DCRA's bulk fuel project assistance. These communities lie in the various regions of the state, as shown in Appendix A-1. AHFC surveys the remaining communities. DCRA publishes the fuel price report on the 100 communities it surveys every period. The information collected for all communities is recorded into the Community Database Online¹ and the Alaska Energy Data Gateway².

The current report contains monthly ANS crude price averages from March 2005 to December 2015, national heating fuel prices from March 2005 to January 2016, and national gasoline prices from March 2005 to January 2016, in addition to the statewide price quotations from the survey conducted between January 1 and 11, 2016. Local fuel retailers in the selected communities were contacted via telephone and asked to provide current per-gallon prices on residential heating fuel and gasoline (Appendix A-2) on the date of the survey. All fuel price quotes reflect prices at the vendors' pump stations or delivered price for heating fuel, depending on how fuel is distributed in the community. Therefore, survey results are one-time measurements and are representative of retail fuel prices on the particular day of contact. Heating fuel and gasoline prices may have changed between the time of contact and the publication of this report.

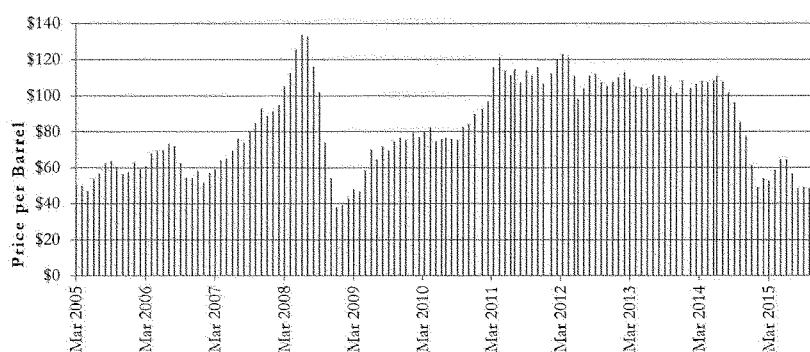
¹ Click on the following link to connect to the CDO: <https://www.commerce.alaska.gov/dcra/DCRAExternal>.

² Click on the following link to connect to the AEDG: <https://akenergygateway.alaska.edu/>.

ALASKA NORTH SLOPE CRUDE AND NATIONAL FUEL PRICES

The shift of fuel prices in Alaska's communities over a given time period generally follow the ANS crude price trend. However, changes in transportation modes of fuel delivery and the cost of a community's existing inventory, held in bulk, also exert strong influences on current local fuel price levels.

Figure 1. Alaska North Slope Crude: March 2005 to December 2015



The Alaska Department of Revenue's Tax Division records the price of ANS West Coast crude oil³ which has been tracked in this report from March 2005 to December 2015 (Figure 1). During this period, the price was highest in June 2008, at \$133.78 per barrel, dropping quickly to \$37.70 in December of the same year. Since the unstable period in 2008, crude oil prices steadily increased until mid 2011. From then on, average annual prices were at least \$107.60 or higher for three consecutive years, peaking at \$122.68 in March of 2012, the highest price recorded since 2008. Since June 2014, the price of crude has dropped dramatically. In December 2015, it hit its lowest price in over ten years, dropping to \$37.14 per barrel.

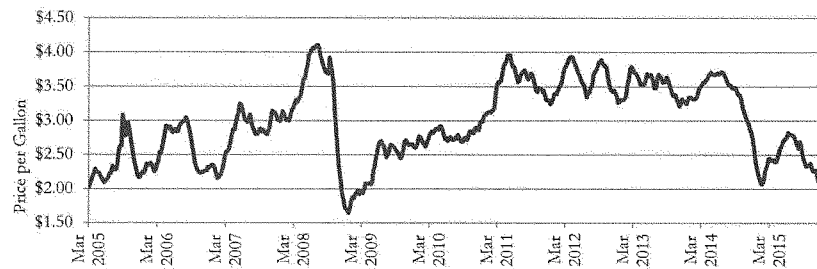
The Energy Information Administration (EIA) has been tracking the national average price of gasoline⁴ since 1990, but this report includes information since March 2005, consistent with the time period included in this report for the ANS West Coast crude oil dataset. As seen in Figure 2, gasoline prices (all grades – conventional retail) did not follow a predictable pattern until 2011. Between March 2011 and June 2014, the difference between the minimum and maximum price was \$0.75 per gallon, with prices fluctuating between \$3.21 and \$3.96 per gallon. Average prices did not climb to peak levels or fall exceptionally until they began to drop in July 2014. The rate of decline

³ Source: Alaska Department of Revenue, Tax Division. Retrieved on January 10, 2016, from: <http://www.tax.alaska.gov/programs/oil/prevaling/ans.aspx>

⁴ Source: U.S. Energy Information Administration. Retrieved on January 10, 2016, from: http://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm

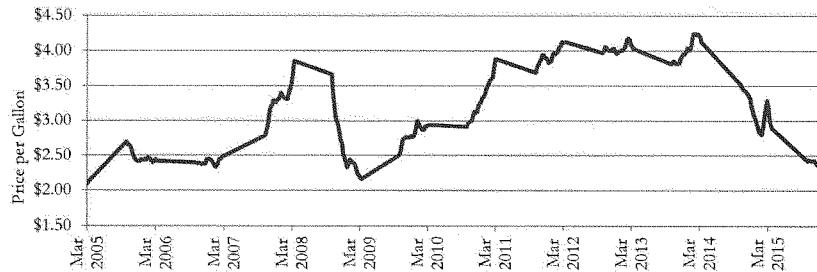
was steady until January 26, 2015, when average gas prices hit a low of \$2.07 per gallon. This was the lowest average price since April 27, 2009, when gas prices were also at \$2.07. The lowest recorded gasoline price since March 2005 was \$1.64 on December 29, 2009. The most recent average price of \$2.03 per gallon was recorded on January 4, 2016. This is a decrease of \$0.20 from the same date in 2015, and the lowest national average gasoline price since March 2009.

Figure 2. Weekly National Average Gasoline Price: March 2005 to January 2016



EIA also reports average residential heating prices, more specifically, heating fuel #2, since it is the most common fuel type used nationwide. Although heating fuel #2 is used in some Alaska communities, the more expensive heating fuel #1 is more common in Alaska communities since it is better suited for cold temperatures. It should be noted that price quotes are only representative of the type of heating fuel most commonly used in the respective locations.

Figure 3. Weekly National Average Heating Fuel: March 2005 to January 2016



As shown in Figure 3, national average heating fuel #2 prices followed the pattern of national average gasoline prices. In February 2014, heating fuel prices hit a record high of \$4.25. From then until January 2016, the national average price of heating fuel has dropped steadily, falling to \$2.18 by January 4, 2016 – the lowest average heating fuel price seen since March 2009, when it briefly dropped as low as \$2.16.

CURRENT FUEL PRICES ACROSS ALASKA

The prices of heating fuel and gasoline in 100 communities across seven regions of Alaska vary based on their location within Alaska and their proximity to the road system. Fuel price quotes in this report reflect prices as charged for residential consumption at the vendors' pump stations or the delivered price for heating fuel, depending on how fuel is distributed in the community, and include local sales tax where applicable.

Table 1. January 2016: Retail Heating Fuel Prices per Gallon across Alaska

	Gulf Coast	Interior	Northern	Northwest	Southeast	Southwest	Western
High	\$6.05	\$12.00	\$2.50	\$7.21	\$4.65	\$7.36	\$7.32
Low	\$2.35	\$2.32	\$1.40	\$3.16	\$2.85	\$2.75	\$4.12
Average	\$3.44	\$5.05	\$1.79	\$5.23	\$3.43	\$4.98	\$5.66

As shown in Table 1, Alaska communities in the Western Region reported the highest average heating fuel retail price at \$5.66 per gallon, while Northern communities reported the lowest average retail price at \$1.79 per gallon. The North Slope Borough subsidizes residential heating fuel costs, and one of the seven communities surveyed, Barrow, uses natural gas for heating. Excluding the Northern Region, Southeast communities experienced the lowest average heating fuel price. The relatively short distance to fuel distribution centers and year-round marine access contribute to the lowest Alaska heating fuel prices at an average of \$3.43 per gallon. This also holds true for the Gulf Coast Region, which has the next-lowest average price of \$3.44 per gallon. Although the Southwest Region has year-round marine access, the greater distance to distribution centers results in higher prices, with a current average of \$4.98. For a more detailed breakdown of heating fuel prices, see Appendix A-2 (page 11).

Many Alaska communities are located off the road system and have limited and, at times, impaired (mostly due to weather) waterway access. Such isolation contributes to higher fuel costs. In the Northern, Northwest, and Western regions in particular, most communities depend on a few bulk deliveries by barge per year, but only if weather and water levels allow the service. Sometimes, fuel must be flown into the community, further increasing the cost for consumers. This also means that when fuel prices drop elsewhere, these remote communities are still locked into a higher price until they receive their next shipment.

Table 2. January 2016: Northern Region Heating Fuel and Gasoline Retail Prices

Community	Community Retailer	Heating Fuel Retail Price		Gasoline Retail Price
		Residential	Commercial	
Anaktuvuk Pass	Nunamiut Corporation	\$1.55	\$8.35	\$8.85
Atkasuk	Atkasuk Corporation	\$1.40	\$4.10	\$4.10
Barrow	BUEC, Inc	Natural Gas	Natural Gas	\$6.50
Kaktovik	Kaktovik Inupiat Corporation	\$2.50	\$6.00	\$6.00
Nuiqsut	Kuukpik Corporation	\$2.05	\$6.51	\$5.00
Point Hope	Tigara Corporation	\$1.74	\$7.99	\$5.76
Wainwright	Olgoonik Corporation	\$1.50	\$7.30	\$6.87

Of noteworthy importance, the North Slope Borough has village corporations that distribute fuel to residents throughout the Northern Region and, within the community, charge only a delivery fee on a per-gallon basis. The North Slope Borough does not subsidize heating fuel for commercial use. Consequently, the retail price of heating fuel for commercial entities is significantly higher than for residences, as shown in Table 2. The Northern Region community of Barrow heats primarily with natural gas.

To summarize statewide heating fuel prices, it is appropriate to exclude Northern Region communities because of the North Slope Borough subsidy for residential-use heating fuel and natural gas connections. On average, excluding the seven Northern communities, heating fuel retailed at \$4.71 per gallon across the remaining surveyed Alaska communities. This is a decrease of \$1.00 from the average heating fuel price in January 2015. Arctic Village (Interior Region) reported the highest heating fuel retail price at \$12.00 per gallon (see Appendix A-2). In contrast, Fairbanks (also Interior Region) reported the lowest heating fuel price at \$2.32 per gallon.

As Table 3 illustrates, average gasoline prices per gallon also varied across Alaska by region. Communities in the Northern Region reported the highest average retail price for gasoline, at \$6.15 per gallon, and Southeast Region communities reported the lowest average retail price at \$3.56 per gallon. Statewide retail gasoline prices vary widely. Arctic Village (Interior Region) reported the highest gasoline price at \$10.00 per gallon. Healy (Interior Region) reported the lowest gasoline retail price at \$2.29 per gallon. On average, gasoline retailed for \$5.23 per gallon across the 100 surveyed Alaska communities. This is a \$0.81 per gallon decrease from the prior year's statewide average.

Table 3. January 2016: Retail Gasoline Prices per Gallon across Alaska

	Gulf Coast	Interior	Northern	Northwest	Southeast	Southwest	Western
High	\$7.34	\$10.00	\$8.85	\$8.24	\$4.85	\$7.81	\$6.52
Low	\$2.56	\$2.29	\$4.10	\$4.59	\$2.77	\$3.41	\$5.00
Average	\$4.09	\$5.37	\$6.15	\$5.86	\$3.56	\$5.34	\$5.81

In the Gulf Coast and Interior regions, some communities are on the road system, and others are not. Because of the lack of accessibility in off-road system communities, heating fuel prices tend to be higher than in communities on the road system (Table 4). This contrast is stronger in the Interior, where the average prices for heating oil and gasoline for communities off the road system were \$3.54 and \$3.38 higher, respectively, than the average prices for communities on the road system. In the Gulf Coast Region, where many of the communities can be served year-round by barge, the average price was \$1.42 higher for heating fuel and \$1.97 higher for gasoline for communities off the road system than the average price for communities on the road system.

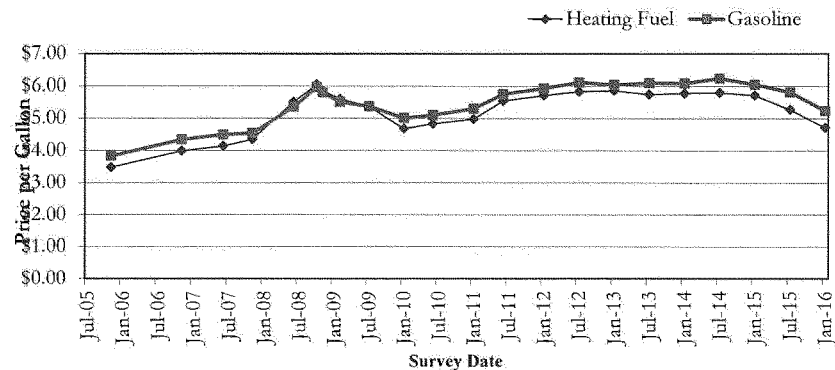
**Table 4. January 2016 On the Road System and Off the Road System:
Prices in the Gulf Coast and Interior Regions**

Gulf Coast	On Road System	Off Road System	Interior	On Road System	Off Road System
Heating Fuel:			Heating Fuel:		
High	\$2.70	\$6.05	High	\$4.25	\$12.00
Low	\$2.35	\$2.72	Low	\$2.32	\$3.70
Average	\$2.49	\$3.91	Average	\$2.86	\$6.39
Gasoline:			Gasoline:		
High	\$3.01	\$7.34	High	\$5.00	\$10.00
Low	\$2.56	\$2.85	Low	\$2.29	\$5.40
Average	\$2.84	\$4.80	Average	\$3.27	\$6.65

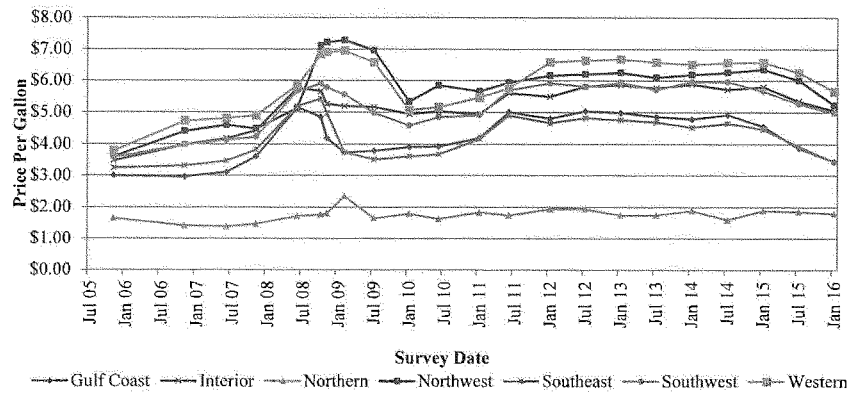
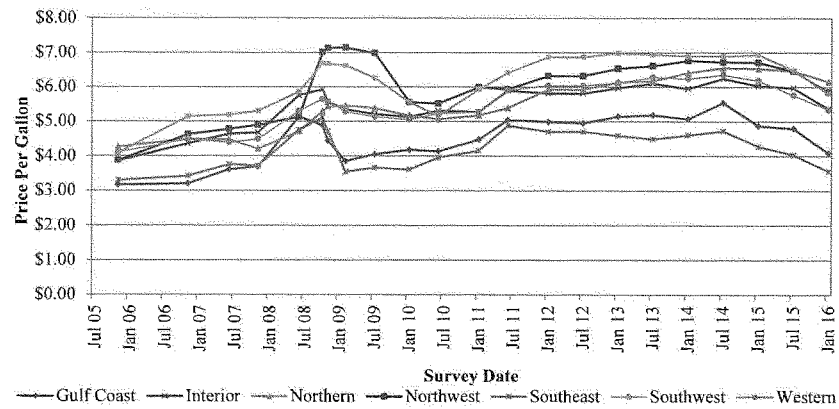
CHANGE IN FUEL PRICES ACROSS ALASKA

Since January 2015, the average heating fuel price for the 100 surveyed communities has decreased by 18%. Excluding the Northern Region communities, the average per gallon heating fuel price was \$5.71 in January 2015, decreasing to \$4.71 by January 2016 (Figure 4). Regional prices reflected that decrease as shown (Figure 5): Gulf Coast (-24%), Interior (-13%), Northwest (-18%), Southeast (-23%), Southwest (-12%), and Western (-14%). The Northern region also had a 5% decrease in average price since January 2015.

Figure 4. Trend in Average Alaska Fuel Price



The average gasoline price of the surveyed communities fell by 13% from January 2015 to January 2016, from \$6.04 to \$5.23 per gallon (Figure 4). Every individual region also experienced an average decrease in price, as shown in figure 6: Gulf Coast -16%, Interior -11%, Northern -6%, Northwest -13%, Southeast -17%, Southwest -14%, and Western -16%.

Figure 5. Heating Fuel Retail Prices by Region**Figure 6. Gasoline Retail Prices by Region**

SUMMARY

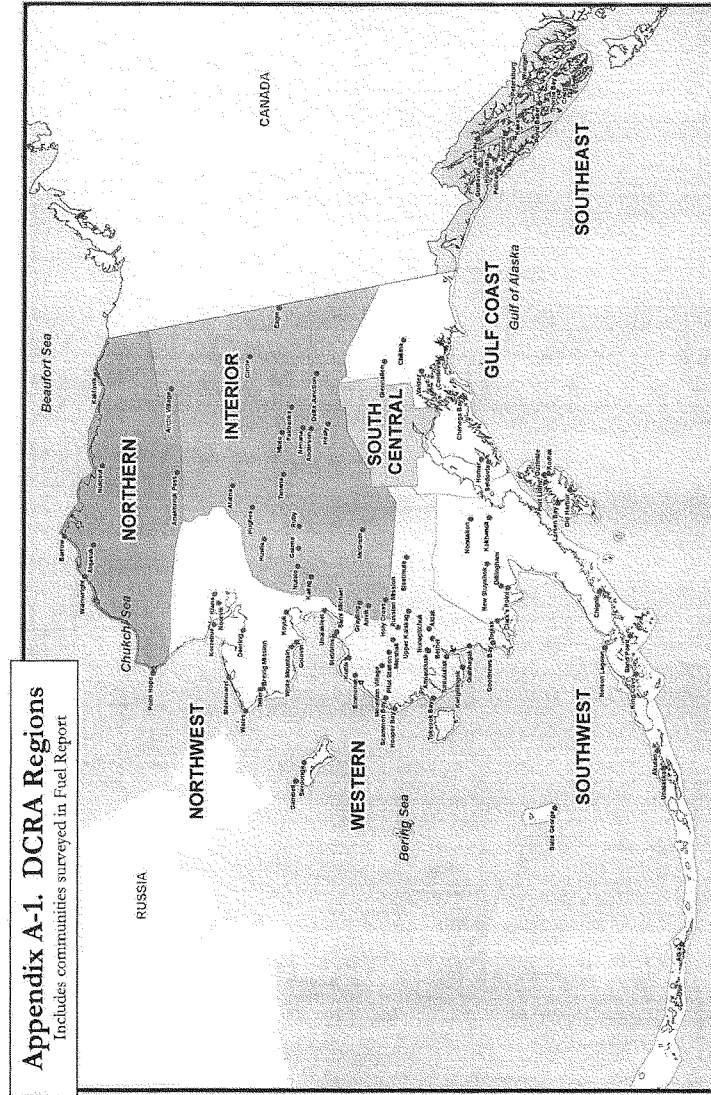
During January 2016, current retail heating fuel and gasoline prices were collected from 100 select communities across Alaska. Overall, the average heating fuel price across the surveyed communities (excluding the Northern Region) was \$4.71; whereas, the most recent national average was \$2.18 on January 4, 2016. The average price of gasoline across survey communities was \$5.23 per gallon, while the national average gasoline price was \$2.13 on January 4, 2016.

Since 2005, the highest recorded average statewide price for heating fuel in Alaska was \$6.05 and the lowest was \$3.48, a difference of 64 percent. Between January 2014 and January 2015 the statewide average heating fuel cost only dropped by 1.1 percent, as opposed to the national average decrease during that period of 26 percent. However, from January 2015 to January 2016, Alaska's average heating fuel cost has dropped by 18 percent. The national average decreased by 27 percent during the same period. Prices in Alaska did not begin to fall dramatically until nearly a year after the rest of the country began to see the change. This could be attributed to the infrequency with which fuel is delivered to some remote locations. Many communities receive one fuel shipment in the spring, so the price those communities reported in January 2015 would have been the same price they had paid in July 2014, before the price of ANS crude began to drop significantly and before the rest of the country began seeing lower fuel prices. However, a year later most communities surveyed reported lower heating fuel and gasoline prices.

Since 2005, the highest recorded average statewide price for gasoline in Alaska was \$6.04 and the lowest recorded was \$3.83, a difference of 58 percent. While the national price of gasoline decreased 33% from January 2014 to January 2015, the average gasoline price for Alaska only dropped by 0.6 percent during that same period. However, from January 2015 to January 2016, the average price of gasoline in Alaska decreased by 13 percent.

Alaska's rural communities, outside of the Southeast and Gulf Coast regions, typically receive large shipments of fuel delivered by barge once or twice per year, and are locked into a given price until the next fuel delivery arrives. These remote communities have higher shipping costs, resulting in fuel prices that are significantly higher than the statewide average. However, since most communities receive at least one fuel delivery per year, they are now benefitting from the lowering costs of fuel that affected the rest of the country starting in late 2014. Of the 100 surveyed communities, 85 recorded lower heating fuel prices and 80 had reduced gasoline prices compared to the prior year. Three communities recorded higher heating fuel prices and seven had higher gasoline prices.

In the past year, the sharp fall in crude oil prices has had a dramatic impact on national heating fuel and gasoline. Alaska's prices lag behind national prices, especially in communities where shipping is infrequent. However, over the past year this survey has shown that Alaska's fuel prices are catching up. Because shipping costs to remote Alaska communities are high, prices are still far above national averages, but heating fuel and gasoline prices throughout the state are at their lowest since early in 2009, and almost all surveyed communities have seen significant declines.



Appendix A-2: Community Heating Fuel and Gasoline January 2016

Community	Region	Community Retailer: (entity selling fuel)	Heating Fuel #1 01/2016 Retail: (selling price per gallon)	Percent +/- Statewide (excl. NBS) Heating Fuel Average: (4.71%)	Percent +/- 01/2015 HF Retail Price	Gasoline 01/2016 Retail Price: (selling price per gallon)	Percent +/- Statewide Gasoline Average: (\$5.23)	Percent +/- 01/2015 Gasoline Retail Price
Chenega Bay†	Gulf Coast	Chenega Bay Utility	\$6.05	28%	-13%	\$6.70	28%	-10%
ChitinaΔ	Gulf Coast	Chitina Services	\$2.45	-48%	-28%	\$2.95	-44%	-18%
Cordova	Gulf Coast	Hovers Mover	\$2.79	-41%	-26%	\$3.15	-40%	-24%
GlennallenΔ	Gulf Coast	Crowley	\$2.45	-48%	-21%	\$2.83	-46%	-13%
HomerΔ	Gulf Coast	Home Run Oil	\$2.35	-50%	-27%	\$2.56	-51%	-22%
Ikroavik	Gulf Coast	Petro Marine	\$2.72	-42%	-30%	\$2.85	-46%	-31%
Larsen Bay†	Gulf Coast	City of Larsen Bay	\$5.26	12%	-9%	\$5.86	12%	-10%
Old Harbor	Gulf Coast	City of Old Harbor	\$4.07	-14%	-21%	\$7.34	40%	0%
Ouzinkie	Gulf Coast	Ouzinkie Native Corporation	\$2.94	-38%	-37%	N/A	N/A	N/A
Port Lions	Gulf Coast	Kizhuyak Oil Sales	\$3.45	-27%	-32%	\$3.75	-28%	-23%
Seldovia	Gulf Coast	Seldovia Fuel and Lube	\$4.00	-15%	-32%	\$3.98	-24%	-30%
ValdezΔ	Gulf Coast	North Pacific	\$2.70	-43%	-27%	\$3.01	-42%	-10%
Alatna	Interior	Alatna Village	\$7.00	49%	0%	\$7.50	43%	0%
AndersonΔ	Interior	Nenana Heating	\$2.59	-45%	-37%	\$3.13	-40%	-13%
Anvik	Interior	Deloyges, Inc.	\$6.00	27%	0%	\$6.00	15%	-8%

Note: Survey prices for Alatna and Circle are from the respective communities of Allakaket and Central. Residents travel to obtain gasoline or heating fuel in those communities.

N/A: Not Available

* Heating fuel average does not include Northern communities, whose residential fuel is subsidized by the North Slope Borough.

Δ Community is on the road system; this only applies to communities in the Gulf Coast and Interior regions.

† Vendors in these communities sell primarily #2 heating fuel.

ALASKA FUEL PRICE REPORT: CURRENT COMMUNITY CONDITIONS, JANUARY 2016
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Community	Region	Community Retailer: (entity selling fuel)	Heating Fuel #1 01/2016 Retail: (selling price per gallon)	Percent +/- Statewide (excl. NBS) Heating Fuel Average: (4.71*)	Percent +/- 01/2015 HF Retail Price	Gasoline 01/2016 Retail Price: (selling price per gallon)	Percent +/- Statewide Gasoline Average: (\$5.23)	Percent +/- 01/2015 Gasoline Retail Price
Arctic Village	Interior	Arctic Village	\$12.00	155%	9%	\$10.00	91%	0%
CircleΔ	Interior	Central Corner (HF); Village of Circle (Gas)	\$2.45	-48%	-34%	\$3.70	-29%	-22%
Delta JunctionΔ	Interior	Delta Fuel	\$2.35	-50%	-32%	\$2.69	-48%	-35%
EagleΔ	Interior	Telegraph Hill Services	\$4.25	-10%	-15%	\$5.00	-4%	0%
FairbanksΔ†	Interior	Alaska Petroleum	\$2.32	-51%	-24%	\$2.67	-49%	-13%
Galena	Interior	Crowley Marine Services	\$6.21	32%	-6%	\$6.81	30%	-10%
Grayling	Interior	HYL Grayling Fuel Company	\$5.50	17%	-4%	\$5.75	10%	-12%
HealyΔ	Interior	Fisher Fuel	\$2.65	-44%	-15%	\$2.29	-56%	-19%
Holy Cross	Interior	Holy Cross Oil Company	\$5.55	18%	-22%	\$6.00	15%	-18%
Hughes	Interior	City of Hughes	\$9.00	91%	0%	\$9.50	82%	3%
Huslia	Interior	Huslia Gas & Oil	\$6.50	38%	-7%	\$5.75	10%	-4%
Kaltag	Interior	Kaltag Cooperative	\$4.50	-4%	-22%	\$5.50	5%	-8%
McGrath	Interior	Crowley	\$7.45	58%	-2%	\$7.49	43%	-2%
MintoΔ	Interior	North Fork Store	\$3.55	-25%	-30%	\$4.00	-24%	-27%
NenanaΔ	Interior	Nenana Heating	\$2.69	-43%	-34%	\$2.69	-49%	-25%
Nulato	Interior	City of Nulato	\$4.45	-6%	-20%	\$5.40	3%	-11%
Ruby	Interior	Dineega Fuel Company	\$3.70	-21%	-38%	\$5.40	3%	-23%

Note: Survey prices for Alutna and Circle are from the respective communities of Allakaket and Central. Residents travel to obtain gasoline or heating fuel in those communities.

N/A: Not Available

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ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT
DIVISION OF COMMUNITY AND REGIONAL AFFAIRS

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Community	Region	Community Retailer: (entity selling fuel)	Heating Fuel #1 01/2016 Retail: (selling price per gallon)	Percent +/- Statewide (excl. NBS) Heating Fuel Average: (4.71*)	Percent +/- 01/2015 HF Retail Price	Gasoline 01/2016 Retail Price: (selling price per gallon)	Percent +/- Statewide Gasoline Average: (\$5.23)	Percent +/- 01/2015 Gasoline Retail Price
Tanana	Interior	Tanana Tribal Council	\$5.25	11%	-9%	\$5.41	3%	-18%
Anaktuvuk Pass	Northern	Nunamiut Corporation	\$1.55	-67%	0%	\$8.85	69%	-7%
Atkasuk	Northern	North Slope Borough	\$1.40	-70%	0%	\$4.10	-22%	0%
Barrow	Northern	Eskimos Inc.	Natural Gas	Natural Gas	Natural Gas	\$6.50	24%	-7%
Kaktovik†	Northern	Kaktovik Inupiat Corporation	\$2.50	-47%	-17%	\$6.00	15%	-20%
Nuiqsut	Northern	Kuukpik Corporation	\$2.05	-56%	N/A	\$5.00	-4%	0%
Point Hope	Northern	Tigara Corporation	\$1.74	-63%	-13%	\$5.76	10%	0%
Wainwright	Northern	Olgoonik Corporation	\$1.50	-68%	0%	\$6.87	31%	0%
Brevig Mission†	Northwest	Brevig Mission Native Store	\$5.80	23%	0%	\$6.41	22%	1%
Deering	Northwest	Deering IRA	\$4.89	4%	-30%	\$5.15	-2%	-26%
Gambell	Northwest	ANICA (Gambell Native Store)	\$5.25	11%	-15%	\$5.65	8%	-16%
Golovin	Northwest	Golovin Public Utilities	\$5.00	6%	-17%	\$5.00	-4%	-17%
Kiana	Northwest	City of Kiana	\$5.67	20%	-8%	\$6.18	18%	-8%
Kotzebue	Northwest	Crowley	\$3.16	-33%	-52%	\$6.09	16%	-8%
Koyuk†	Northwest	Koyuk Native Corporation	\$4.80	2%	-30%	\$5.27	1%	-28%
Noorvik	Northwest	Morris Trading Post	\$6.56	39%	0%	\$7.87	51%	0%
Saint Michael	Northwest	Saint Michael Fuel Company	\$5.88	25%	-13%	\$5.98	14%	-1%

Note: Survey prices for Alaska and Circle are from the respective communities of Allakaket and Central. Residents travel to obtain gasoline or heating fuel in those communities.

N/A: Not Available

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Δ Community is on the road system; this only applies to communities in the Gulf Coast and Interior regions.

† Vendors in these communities sell primarily #2 heating fuel.

ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT
DIVISION OF COMMUNITY AND REGIONAL AFFAIRS

ALASKA FUEL PRICE REPORT: CURRENT COMMUNITY CONDITIONS, JANUARY 2016
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Community	Region	Community Retailer: (entity selling fuel)	Heating Fuel #1 01/2016 Retail: (selling price per gallon)	Percent +/- Statewide (excl. NBS) Heating Fuel Average: (4.71*)	Percent +/- 01/2015 HF Retail Price	Gasoline 01/2016 Retail Price: (selling price per gallon)	Percent +/- Statewide Gasoline Average: (\$5.23)	Percent +/- 01/2015 Gasoline Retail Price
Savoonga	Northwest	ANICA (Savoonga Native Store)	\$5.25	11%	-13%	\$5.65	8%	-13%
Shishmaref	Northwest	Shishmaref Native Store	\$4.08	-13%	-31%	\$4.59	-12%	-31%
Stebbins	Northwest	Tapraq Fuel Company	\$5.69	21%	-21%	\$6.05	16%	-19%
Teller	Northwest	Teller Native Fuel Business	\$5.46	16%	-13%	\$6.16	18%	-6%
Unalakleet	Northwest	Unalakleet Native Corporation	\$4.57	-3%	-35%	\$4.65	-11%	-30%
Wales	Northwest	Wales Native Store	\$7.21	53%	11%	\$8.24	58%	6%
White Mountain	Northwest	White Mountain Native Store	\$4.35	-8%	-11%	\$4.75	-9%	-10%
Angoon	Southeast	Angoon Oil and Gas	\$3.55	-25%	-30%	\$3.55	-32%	-29%
Ulag	Southeast	Petro Marine	\$2.94	-38%	-26%	\$3.32	-37%	-3%
Gustavus	Southeast	Gustavus Dray - Gustavus Propane	\$3.58	-24%	-17%	\$3.51	-33%	-20%
Hoonah†	Southeast	Hoonah Trading	\$2.85	-40%	-23%	\$3.39	-35%	-15%
Juneau	Southeast	Delta West, (HF) Fred Meyer (Gas)	\$3.15	-33%	-22%	\$3.20	-39%	-18%
Kake	Southeast	Kake Tribal Fuel	\$3.68	-22%	-35%	\$3.78	-28%	-32%
Pelican	Southeast	Pelican Fuel	\$3.43	-27%	-33%	\$3.46	-34%	-31%
Petersburg	Southeast	Petro Marine	\$2.97	-37%	-26%	\$3.62	-31%	14%
Point Baker	Southeast	Point Baker Trading Post	\$4.65	-1%	-15%	\$4.85	-7%	-12%
Thorne Bay	Southeast	Petro Marine (HF) The Port (Gas)	\$3.07	-35%	-18%	\$2.77	-47%	-31%

Note: Survey prices for Alaina and Circle are from the respective communities of Allakaket and Central. Residents travel to obtain gasoline or heating fuel in those communities.

N/A: Not Available

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† Vendors in these communities sell primarily #2 heating fuel.

ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT
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ALASKA FUEL PRICE REPORT: CURRENT COMMUNITY CONDITIONS, JANUARY 2016
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Community	Region	Community Retailer: (entity selling fuel)	Heating Fuel #1 01/2016 Retail: (selling price per gallon)	Percent +/- Statewide (excl. NBS) Heating Fuel Average: (4.71*)	Percent +/- 01/2015 HF Retail Price	Gasoline 01/2016 Retail Price: (selling price per gallon)	Percent +/- Statewide Gasoline Average: (\$5.23)	Percent +/- 01/2015 Gasoline Retail Price
Wrangell	Southwest	Wrangell Oil	\$3.85	-18%	-1%	\$3.66	-30%	18%
Akutan†	Southwest	City of Akutan	\$2.75	-42%	-31%	\$4.05	-23%	-16%
Atka	Southwest	Atka Native Store	\$6.85	45%	27%	\$7.65	46%	0%
Chignik	Southwest	City of Chignik (HF); Trident (Gas)	\$3.25	-31%	-26%	\$4.38	-16%	-16%
Clark's Point	Southwest	City of Clark's Point	N/A	N/A	N/A	\$6.00	15%	N/A
Dillingham	Southwest	Delta Western	\$3.57	-24%	-36%	\$4.75	-9%	-29%
King Cove	Southwest	Peter Pan Seafood	\$3.37	-28%	-8%	\$4.51	-14%	6%
Kokhanok	Southwest	Kokhanok Tribal Council	\$7.00	49%	-15%	\$7.00	34%	-13%
Nelson Lagoon	Southwest	Nelson Lagoon Enterprises	\$6.18	31%	-1%	\$3.41	-35%	-47%
New Stuyahok	Southwest	New Stuyahok Village Corp.	\$6.52	38%	-1%	\$6.32	21%	-7%
Nondalton	Southwest	City of Nondalton	\$5.24	11%	-11%	\$5.96	14%	2%
Saint George†	Southwest	Delta Fuel Company	\$7.36	56%	-2%	\$7.81	49%	-2%
Sand Point	Southwest	TDX Svcs (HF); Trident (gas)	\$4.48	-5%	-19%	\$4.26	-18%	-20%
Togiak	Southwest	Togiak Natives Limited	\$4.62	-2%	-22%	\$4.71	-10%	-29%
Unalaska	Southwest	Delta Western	\$3.54	-25%	-24%	\$3.90	-25%	-19%
Akiak	Western	Kokarmiut Corporation	\$6.24	32%	-9%	\$5.60	7%	-19%
Atmautluak	Western	Atmautluak Limited	\$6.73	43%	0%	\$6.39	22%	-11%

Note: Survey prices for Akutan and Circle are from the respective communities of Allakaket and Central. Residents travel to obtain gasoline or heating fuel in those communities.

N/A: Not Available

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Δ Community is on the road system; this only applies to communities in the Gulf Coast and Interior regions.

† Vendors in these communities sell primarily #2 heating fuel.

ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT
DIVISION OF COMMUNITY AND REGIONAL AFFAIRS

ALASKA FUEL PRICE REPORT: CURRENT COMMUNITY CONDITIONS, JANUARY 2016
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Community	Region	Community Retailer: (entity selling fuel)	Heating Fuel #1 01/2016 Retail: (selling price per gallon)	Percent +/- Statewide (excl. NBS) Heating Fuel Average: (4.71*)	Percent +/- 01/2015 HF Retail Price	Gasoline 01/2016 Retail Price: (selling price per gallon)	Percent +/- Statewide Gasoline Average: (\$5.23)	Percent +/- 01/2015 Gasoline Retail Price
Bethel	Western	Crowley	\$5.67	20%	-15%	\$5.75	10%	-14%
Emmonak	Western	Emmonak Corp. Tank Farm	\$5.15	9%	-17%	\$5.00	-4%	-22%
Goodnews Bay	Western	Mumtram Pikkai Village Corp.	\$4.12	-13%	-23%	\$5.36	2%	-17%
Hooper Bay	Western	Crowley Marine	\$6.45	37%	-5%	\$6.25	20%	-10%
Kotlik	Western	Kotlik Yupik Enterprises	\$5.30	13%	-9%	\$5.92	13%	-8%
Kwigillingok	Western	KWIK Marina Inc.	\$4.65	-1%	-26%	\$5.13	-2%	-26%
Marshall	Western	Maserculig Inc.	\$5.41	15%	-18%	\$5.41	3%	-22%
Mountain Range	Western	Azachorak Fuel	\$4.98	6%	-24%	\$5.69	9%	-22%
Nunapitchuk	Western	Nunapitchuk LTD.	\$6.49	38%	-11%	\$6.52	25%	-14%
Pilot Station†	Western	Pilot Station Native Corporation	\$7.32	55%	0%	\$5.25	0%	-30%
Quinhagak	Western	Qanirtuuq Corporation	\$5.00	6%	-25%	\$5.65	8%	-19%
Russian Mission	Western	Russian Mission Corporation	\$4.80	2%	-17%	\$6.08	16%	-6%
Scammon Bay	Western	Askinuk Corporation	\$6.33	34%	-14%	\$6.33	21%	-14%
Sleetmute	Western	Henry Hill Store	\$5.70	21%	-16%	\$6.50	24%	-13%
Toksook Bay	Western	Nunakuiak Yupik Corporation	\$6.00	27%	-16%	\$6.00	15%	-18%
Tuntutuliak	Western	Qinarmiut Corporation	\$4.88	4%	-23%	\$5.35	2%	-19%
Upper Kalskag	Western	City of Upper Kalskag	\$6.25	33%	0%	\$6.25	20%	0%

Note: Survey prices for Matna and Circle are from the respective communities of Allakaket and Central. Residents travel to obtain gasoline or heating fuel in those communities.

N/A: Not Available

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ALASKA DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT
DIVISION OF COMMUNITY AND REGIONAL AFFAIRS

Private Homebuyer	Annual <i>Income</i>	Annual <i>Heating Fuel</i>	Annual <i>Electricity</i>	Total costs	Difference
<i>Village</i>					
Pilot Station	\$ 15,000	\$ 5,235	\$ 1,800	\$ 7,035	\$ 7,965
Toksook Bay	\$ 12,000	\$ 2,400	\$ 3,200	\$ 5,600	\$ 6,400
Upper Kalskag	\$ 8,784	\$ 2,400	\$ 1,250	\$ 3,650	\$ 5,134
Quinhagak	\$ 95,000	\$ 2,000	\$ 1,800	\$ 3,800	\$ 91,200

AVCP RHA Homebuyer	Annual <i>Income</i>	Annual cost <i>Heating Fuel</i>	Annual cost <i>Electricity</i>	Total costs	Difference
<i>Village</i>					
Atmautluak	\$ 21,978	\$ 3,136	\$ 2,666	\$ 5,802	\$ 16,176
Toksook Bay	\$ 12,000	\$ 1,500	\$ 3,500	\$ 5,000	\$ 7,000
Kalskag	\$ 60,000	\$ 1,656	\$ 1,420	\$ 3,076	\$ 56,924



ASSOCIATION OF VILLAGE COUNCIL PRESIDENTS
P.O. BOX 219
BETHEL, ALASKA 99559

ASSOCIATION OF VILLAGE COUNCIL PRESIDENTS
EXECUTIVE BOARD OF DIRECTORS

RESOLUTION 16-02-01

TITLE: RESOLUTION CITING THE CORRELATION BETWEEN THE PRICE WE PAY AT THE PUMP IN OUR ASSOCIATION OF VILLAGE COUNCIL PRESIDENTS REGION FOR GASOLINE AND HEATING FUEL VS. THE PRICE PER BARREL OF OIL.

WHEREAS The Association of Village Council Presidents (AVCP) is the recognized tribal organization and non-profit Alaska Native regional corporation for the fifty-six member indigenous Native villages within Western Alaska and supports the endeavors of its member villages; and

WHEREAS AVCP finds according to the U.S. Energy Information Administration (EIA), Alaska ranks 3rd at 826 (million Btu) total energy consumed per capita behind Wyoming and Louisiana; and

WHEREAS AVCP finds the average temperature in Alaska is 30.1 degrees Fahrenheit and ranks 49th according to the U.S. EIA (2014), and the (American Heritage) Dictionary identifies room temperature as around 68 to 72 degrees Fahrenheit.

WHEREAS The AVCP region suffers from persistent unemployment among its working age adults. The combined average unemployment rate of 18.3% in the Kusilvak and Bethel Census areas combined and represents only the residents who are actively seeking employment; and

WHEREAS According to the QuickFacts from the U.S. Census Bureau, the AVCP Region has a 27.1% of its residents living below poverty level, the lowest per capita income, highest rate of unemployment, and the highest rate of suicide; and

WHEREAS The cost of living where store bought products costs in the most rural communities are usually the highest where fresh foods, if offered, are five-times higher in price delivered by air (weather permitted) and in most cases in poor condition. For example, a single apple in the Village of Eek costs \$1.59 each. There are no seasonal adjustments for the prices of goods in the AVCP Region. In the Bethel area alone, prices average seventy percent (70%) higher than prices in urban areas of the State; and

WHEREAS According to the Alaska Fuel Price Report: Current Community Conditions July 2015 (State of Alaska) "Alaska's rural communities, outside of the Southeast and Gulf Coast regions, typically receive large shipments of fuel delivered by barge once or twice per year, and are locked into a given price until the next fuel delivery arrives. These remote communities have higher shipping costs, result in fuel prices that are significantly higher than the statewide average"; and

WHEREAS A university study has found, low-income rural families spent about half of their disposable income on energy; and

WHEREAS according to the EIA, the retail price of gasoline includes four main components.

1. The cost of crude oil
2. Refining costs and profits
3. Distribution and marketing costs and profits
4. Taxes; and

WHEREAS our regional fuel distributor has been found to cite fuel charges depends on a variety of factors, and the largest one being the wholesale price paid to the refineries. That expense accounts for about two-thirds of the delivery price. Other expenses cited to recover are by marking up the delivery price include the logistics and tank farm storage costs; and

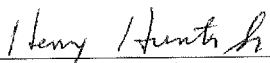
WHEREAS Due to the lack of competition on the U.S. West Coast including Alaska our petroleum prices will continue to stay high even when the price of crude goes down; and

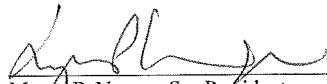
NOW THEREFORE BE IT RESOLVED THAT AVCP requests power cost equalization for fuel similar to the Alaska Energy Authority's (AEA) Power Cost Equalization program where economic assistance is provided to customer in rural areas for electricity where the kilowatt-hour charge for electricity can be three to five times higher than in the more urban areas of the state. Power cost equalization would be for gasoline where a gallon of gasoline in a more urban area of the state can be around \$2.20 a gallon and in our rural communities can range between \$4.90 a gallon and upwards of \$7.15 a gallon for the same gasoline. Economic assistance would be provided for those paying two to three times higher prices for this same gasoline.

BE IT FURTHER RESOLVED THAT a petition for the investigation into the storage and shipping costs of gasoline and heating fuel to ensure the prices are fair as there is no competition for the storage and shipping costs for the fuel.

ADOPTED by the Association of Village Council Presidents on this 10th day of February 2016, by the AVCP Executive Board by a vote of 10 yeas; ___ nays; 1 abstentions; 1 absences.

CERTIFIED:


Henry Hunter Sr., Chairman


Myron P. Naneng Sr., President



ASSOCIATION OF VILLAGE COUNCIL PRESIDENTS
P.O. BOX 219
BETHEL, ALASKA 99559

ASSOCIATION OF VILLAGE COUNCIL PRESIDENTS
EXECUTIVE BOARD OF DIRECTORS

EXECUTIVE BOARD
BETHEL, ALASKA JANUARY 21 & 22, 2016

RESOLUTION 16-01-04

TITLE: A RESOLUTION SUPPORTING THE GROWTH OF THE DEPARTMENT OF ENERGY OFFICE OF INDIAN ENERGY POLICY AND PROGRAMS (DOE OIE)

WHEREAS The Association of Village Council Presidents (AVCP) is the recognized tribal organization and non-profit Alaska Native regional corporation for its fifty-six member indigenous Native villages within Western Alaska; and

WHEREAS AVCP fully supports its member villages in economic and energy development activities; and

WHEREAS The U.S. Department of Energy Office of Indian Energy is charged by Congress to direct, foster, coordinate, and implement energy planning, education, management, and programs that assist tribes with energy development, capacity building, energy infrastructure, energy costs, and electrification of Indian lands, Alaska Native Villages, and homes; and

WHEREAS 85% of the population in the AVCP region is Alaska Native and the region suffers from high cost of energy which inhibits economic growth; and

WHEREAS the DOE OIE is underfunded and understaffed at \$15,000,000 and 7 staff to serve the 566 Tribes in the United States and the 56 Tribes in the AVCP region; and

NOW THEREFORE BE IT RESOLVED THAT, The AVCP Executive Board supports the growth of the Department of Energy Office of Indian Energy to effectively serve the 566 Tribes in the United States by increasing DOE OIE staff to at least 25 and establishing a Tribal Energy Grant and Loan Program for Alaska Native Villages and Indian Reservations; and

ADOPTED by the Association of Village Council Presidents during its Executive Board Meeting held in Bethel, Alaska, 22nd day of January, 2016 with a duly constituted quorum of board members.

CERTIFIED:


James Paul, Vice Chairman


Myron Naneng, President



Enriching Our Native Way of Life

February 26, 2016

Senator Lisa Murkowski, Chairman
 Senator Maria Cantwell, Ranking Member
 Senate Energy and Natural Resources Committee
 304 Dirksen Senate Building
 Washington, DC 20510

Re: Written Testimony to Energy and Natural Resource Committee following Field
 Hearing to Examine Opportunities for Alaska's Energy Future February 15, 2016

Dear Senators Murkowski and Cantwell

Bristol Bay Native Corporation (BBNC) would like to extend its sincere thanks to members of the Energy and Natural Resource Committee for taking the time to travel to Bethel and Oscarville, Alaska, on February 15, 2016. Logistically, travel to any area in our state of Alaska is challenging and the time needed significant. The visit of six Senators and the Secretary of the Energy to Bethel and Oscarville was historic, welcomed, and, frankly, badly needed. The challenges, opportunities, accomplishments and risks facing both the citizens living in the remote areas of Alaska and to the nation itself are not well understood. The risks range from ignorance about the geographical remoteness of areas of our nation, climate change impacts, and international security issues. The Arctic is now the focus of the international community. Alaska is strategically located, with several longstanding military bases, a strong coast guard presence and a resident population acclimated to an extreme climate. It is difficult, if not impossible to understand the challenges faced by the individuals living in arctic conditions without seeing it first-hand. Very few policy makers make the effort, you and your committee members have and we thank you very much for your presence.

BBNC is an Alaska Native owned for-profit corporation created by Congress in 1971. Alaska Native Corporations (ANC's) are dedicated to enriching the lives of their shareholders through economic development, employment, educational and cultural opportunities as well as responsible resource development and management. ANC's are unique, they are hybrid entities, for-profit corporations with a strong social service mandate. BBNC is committed to the Bristol Bay region, its people, descendants, culture, resources, wildlife and fisheries.

This written testimony focuses on areas related to energy, resource development and regulations that impact our ability to meet our goals of improving the lives of the people of Bristol Bay. You heard oral testimony from Ralph Anderson, President and CEO of Bristol Bay Native Association (BBNA), a sister organization, detailing specific projects, such as the Bristol Bay Energy Plan, and efforts to weatherize area residences.

Energy

Providing an affordable source of energy in rural Alaska has been a long-standing challenge and is at the top of the priority list for village and regional corporations, non-profit organizations, and government representatives. Progress is frustratingly slow, especially for our elders, who have seen decades come and go and are still paying \$6 a gallon for fuel to heat their homes and \$8 a gallon for gasoline to fill up their snow machines and ATVs necessary for hunting and for travel and hauling supplies in a region without roads.

Challenges to forward progress include a lack of funding for energy-related feasibility studies and implementation. And, while aggressively working toward innovative and "clean" energies such as hydroelectric, geothermal, wind, and solar, we cannot neglect necessary electrical inter-ties between communities and building revitalization improvements. Additionally, we are actively looking towards ways to utilize the region's own energy resources, such as onshore natural gas, to generate power for our communities.

We support the Department of Energy (DOE), Office of Indian Energy (OIE) and its mission. Congress charged OIE with four specific tasks:

- (1) promote Indian tribal energy development, efficiency, and use;
- (2) reduce or stabilize energy costs;
- (3) enhance and strengthen Indian tribal energy and economic infrastructure relating to natural resource development and electrification; and
- (4) bring electrical power and service to Indian land and the homes of tribal members located on Indian lands or acquired, constructed, or improved (in whole or in part) with Federal funds. See 42 U.S.C. § 7144e.

These tasks are critical for rural Alaska but our communities have few resources to make them happen. In other words, OIE fills an important need. Unfortunately, OIE is underfunded and understaffed. It currently has only a twenty million dollar budget and a staff of seven to serve 567 federally-recognized tribes and more than two hundred Alaska Native corporations. OIE should be made a permanent office within the Department of Energy and have a dedicated budget. At a minimum, it should have a hundred million dollar line budget, access to an adequately funded loan guarantee program and twenty-five full-time positions across the country. Finally, the Alaska office should be staffed by no less than three people¹ including a Senior Advisor who is responsible for Arctic and Alaska Native Affairs and who reports directly both to the Deputy Secretary of Energy and the Director of Indian Energy. Such a position would improve Department of Energy's capability to plan, collaborate and engage across Alaska with partner organizations.

We support the Secretary of Energy's move to hire three new positions dedicated to Alaska issues and we strongly recommend that those positions be located within the state of Alaska. Any positions dedicated to Alaska issues must be filled in Alaska and should include Alaska Natives. Anyone charged with the responsibility of overcoming Alaska's rural energy challenges has to be living and working in Alaska and understand our geography, cultures and people.

¹ The Department of Commerce, Economic Development Administration and the OIE each only have one employee in Alaska. These offices fill critical needs for rural Alaska and neither has sufficient staff.

Finally, the Department of Energy should have a dedicated Alaska office modelled on the office maintained by the Department of Interior and staffed by a Special Assistant for Alaska Affairs. Such an office is necessary to align and coordinate DOE's Alaska programs with other federal agencies, Alaska state agencies, local governments, tribal councils, Alaska Native corporations and the Denali Commission.

Donlin Gold Project

BBNC understands the benefits of responsible resource development and supports the Donlin Gold Project located in Western Alaska. Donlin Gold is a successful example of private industry working with local public input to develop a project that is both economically beneficial and responsive to local concerns. Developers have nurtured a collaborative relationship with stakeholders, as well as with the EPA and other federal and state partners.

Donlin Gold will provide a large boost to the economy of the region, and its impact will also be felt statewide through revenue sharing. Through ANCSA Sections 7(i) and 7(j), twelve Alaska Native Corporations will be strengthened by receiving a portion of the revenues associated with the project.

Fulfillment of ANCSA commitments

When ANCSA passed in 1971, it provided for the conveyance of federal lands to native corporations. However, hundreds of parcels were transferred to our corporations with contamination that occurred while the lands were in federal ownership and are now a health and financial liability to our people and shareholders.

In Bristol Bay alone, communities such as Port Heiden have struggled with this issue for decades. Subsistence activities are still very much a part of our lifestyle, and these contaminants present direct environmental, health and economic impacts to residents.

In 1998, the U.S. Department of the Interior developed recommendations to clean up the land and reported those recommendations to Congress. Those recommendations were never implemented. In 2015, Congress enacted the Consolidated and Further Continuing Appropriations Act in which it further directed the Department of the Interior to report back within 180 days on the status of the sites identified and the recommendations made in the 1998 Report and to provide a detailed plan on how the Department intends to complete cleanup of the contaminated sites. Once again, little progress has been made towards achieving these congressional directives.

A federal mechanism and legally enforceable process to clean-up and remediate these sites is needed. Moreover, clean-up and remediation efforts will bring significant employment to rural Alaska and a better quality of life to our communities.

Federal contracting under Section 8(a)

The Small Business Administration Business Development Program (8(a) Program) has proved to be a highly successful mechanism for building business capacity in ANC's and

tribes. BBNC has utilized the 8(a) Program to generate sustainable and predicable dividends for our shareholders, much needed in cash poor regions such as rural Alaska. In addition, BBNC has been able to provide scholarships, educational benefits, internships and pathways out of poverty. The 8(a) Program is one of the most powerful tools that Congress has provided to Alaska Natives to assist us in building our economies. We appreciate very much the commitment the Secretary of Energy has made to this program. We sincerely hope that the members of the Energy and Natural Resource Committee, after a visit to one of our regions, realize the need for economic development and empowerment mechanisms such as the 8(a) Program in rural Alaska. We ask that you continue to support our participation in the 8(a) Program, it is making a profound difference in our people's lives.

Conclusion

Rural Alaska faces many challenges, yet, our communities also offer a great testing ground for new technologies and innovation. The common denominator, regardless of the program or challenge, is that committed leadership from Washington DC is needed to bring the improvements and a better quality of life to rural Alaska. We are looking to your Committee for that leadership.

BBNC appreciates that several Energy and Natural Resource Committee members took the time to travel to rural Alaska and to see all that our communities have to face and can offer. We also appreciate the opportunity that we now have to submit written comments. We sincerely thank you.

Quyana,



April S. Ferguson
Sr. V.P. and General Counsel



CALISTA CORPORATION
www.calistacorp.com

**US Senate Committee on Energy and Natural Resources
Field Hearing on Alaska's Leadership, Opportunities in Energy Innovation**

US Senator Lisa Murkowski, *Chair*

Bethel, AK 99559

February 15, 2016

Secretary Dr. Ernest Moniz, Senator Maria Cantwell, Senator Lisa Murkowski, Senator John Barrasso, Senator Angus King, Senator Shelly Capito, Senator Steve Daines, thank you for visiting us to examine opportunities for energy innovation & technology deployment in high-cost areas such as the Calista region of Alaska. Your visit has big implications for our people, our communities, our region, and our country. We are grateful for the leadership of Senators Murkowski and Cantwell in the US Senate Committee on Energy and Natural Resources to shepherd the Energy Policy Modernization Act of 2015 through Congress; this bi-partisan leadership is how it looks when Congress collaborates.

High Energy costs in rural Alaska preclude Alaska Native corporations from meaningfully creating jobs and sustaining business operations in regional hubs and remote villages. Regional corporations maintain headquarters in Anchorage where business opportunity is facilitated by low-cost energy, world-class inter-modal transportation infrastructure, quality education and population. Alaska Native Village Corporation growth is limited by the very high cost of energy, even as profit-margins in local fuel and retail store operations are reduced or eliminated by high overhead related to the exorbitant cost of energy. Often, ANCSA Section 7(j)¹ distributions are the only revenue preventing village corporations from annual net operating losses. The high cost of energy defeats the Alaska Native Claims Settlement Act mandate to create jobs and business in rural Alaska.

¹ ...70% of all revenues received by each Regional Corporation from the timber resources and subsurface estate patented to it pursuant to this Act shall be divided annually by the Regional Corporation among all twelve Regional Corporations...Each Regional Corporation distributes 50% of 7(i) distributions to its Village Corporations and to its at-large shareholders, pursuant to ANCSA §7(j).



CALISTA CORPORATION
www.calistacorp.com

Calista is addressing its goal to promote in-region business development, in part, by pursuing federal funding to implement clean-energy micro-grids at the village and regional level. Implementing innovative energy solutions to improve resiliency of critical infrastructure will benefit not just our isolated communities, but also all places in our country which desire to implement proven technologies of clean energy.

Calista advocates for a standard of displacing 70% of diesel fuel used for community heating and power generation by implementing a \$10 Million renewable energy infrastructure project—for one of our tribes—combining wind and solar power production with energy storage, smart grid controls, and energy efficiency measures. Focusing resources on advancing the performance of at least one village to a 70% renewable level leverages existing experience and investments, and rapidly advance our knowledge of comprehensive smart, micro-grids. Subsequently, this village-level clean energy infrastructure would be integrated into an approximately \$33 Million regional inter-tie based around Bethel and surrounding villages.

Our modeling studies indicate that a renewable-based micro-grid system, laid in the application of larger, more productive wind turbines, combined with both electrical and thermal energy storage can feasibly and cost-effectively power all critical infrastructure in smaller communities. The wind provides the power backbone, the energy storage allows us to capture and use that wind. The smart metering system and controls allows effective use, and the energy efficiency improvements improve its value. Our studies show that this is the future of clean energy in rural Alaska. We anticipate the successful bi-partisan passage of the Energy Policy Modernization Act of 2015 through Congress will help us promote in-region business development by displacing 70% of expensive diesel energy consumption with cheap, renewable clean energy. We already know how to get there, and know this solution is broadly applicable to similar situations in Alaska, across the Arctic and communities worldwide.

We are blessed to have Senator Lisa Murkowski for her leadership on the US Senate Energy and Natural Resources Committee, for inviting Energy Secretary Dr. Ernest Moniz and US Senators from across the United States to hear our energy issues today. Thank you for the opportunity to submit our testimony.

1013 Wainwright Blvd., Suite 2000 Anchorage, AK 99501
907.562.3000 • 800.727.2729

2/15/16

SENATE ENERGY + NATURAL RESOURCES COMMITTEE

FIELD HEARING - OPPORTUNITIES - ENERGY INNOVATION + TECHNOLOGY.

DEPLOYMENT IN HIGH COST AREAS IN ALASKA.

MY NAME IS GEORGE GUY, GEN. MGR. KWETHLWK, INC.

I THANK YOU FOR THE OPPORTUNITY TO TESTIFY ON ENERGY.

FIRST OF ALL - MAJORITY OF RURAL ALASKA DEPENDS ON DIESEL

FUEL - BOTH FOR HOME HEATING AND GENERATORS, AS WE ALL

KNOW THE OPEC PRICES ARE AT A RECORD LOW - ANTICIPATED

TO REACH 2017, WHILE THE USA PETROLEUM PRICES ARE FLUCTUATING

THE RURAL AREAS ARE LOCKED IN WITH STILL HIGH PRICE OF

FUEL TO KEEP HOMES HEATED, FACILITIES ETC., GENERATORS RUNNING

SINCE WE RECEIVE OUR FUEL - MAJORITY BY OIL BARRELS

DURING SUMMER AND FALL SEASONS, HOW CAN THE FEDERAL GOV.

LOOK INTO THE FUEL INDUSTRY TO ~~SEE~~ EXAMINE THE COMMODITY PRICESTO MAKE SURE RURAL ALASKA ISN'T BEING ^{MONOPOLIZED} ~~MONOPOLIZED~~ - ONE

MAIN CHALLENGE TO ENSURE THAT RURAL ALASKANS HAVE ACCESS

TO AFFORDABLE ENERGY. SECONDLY ON ALTERNATIVE ENERGY

MAJORITY OF THE YUKON-KUSKOKWIM DELTA UTILITIES HAVE ALTERNATIVE

ENERGY - MAINLY WIND - FOR US LEFT OUT OF ALTERNATIVE ENERGY

RESOURCES MORE NEEDS TO BE DONE TO ACCESS OTHER RESOURCES

THAT DON'T MEET THE WIND STANDARDS, THE ONLY COMMUNITIES

THAT HAVE WIND SOURCES ARE THE ONES BENEFITTING FROM

ALTERNATIVE ENERGY. THE FOCUS NEEDS TO SHIFT GEARS TO

HELP US - RURAL ALASKA NATIVE COMMUNITIES GET UP TO PAR

WITH THE REST OF UNITED STATES - IN ALL ASPECTS OF OUR

LIVING STANDARDS. AND TO SECURE THE NEEDS FOR THE NEXT

GENERATIONS WITH ANALYTICAL TOOLS NEEDED TO DEVELOP

SUSTAINABLE ENERGY STRATEGIES AND TO IMPLEMENT

VIABLE SOLUTIONS. THANK-YOU.



February 29, 2016

The Honorable Senator Lisa Murkowski, Chair
 The Honorable Senator Maria Cantwell, Ranking Member
 U.S. Senate Committee on Energy and Natural Resources
 304 Dirksen Senate Building
 Washington, DC 20510

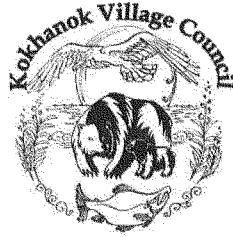
Dear members of the U.S. Senate Committee on Energy and Natural Resources and Energy Secretary Ernest Moniz:

As a community dealing with extremely high energy prices, we thank you for your genuine interest in Rural Alaska's energy plight as evidenced by your willingness to travel all the way to Bethel. Although no one from Kokhanok was able to be there and witness the historic event, we did see some great press coverage and would like to comment.

We echo the words of Gwen Holdmann, Executive Director of the Alaska Center for Energy and Power, in her speech from that day. She is absolutely right that Alaskans in remote communities are resourceful, creative and motivated to solve our own energy problems. We get it that importing our main energy fuel source will never be a long term solution – locally produced energy is where it's at. For Kokhanok, located on the South shore of Lake Iliamna in the Bristol Bay Region, that would be wind and biomass. And if our home grown micro-grid engineering solutions put Alaskan companies at the leading edge for developing the growing demand for micro-grids world-wide, well Hallelujah! Let's usher in this new energy age.

Rural Alaska has several hybrid micro-grids across the state outperforming expectations, but the state is also peppered with hybrid micro-grid generation plants stuck in various stages of success. Funding opportunities to fine tune integration components and controllers is difficult to find – and particularly hard for the smaller communities to access.

Kokhanok is a perfect example of an energy project in limbo. We installed two refurbished Vestas V-17 90 kW wind turbines at the end of 2010. A battery bank and a top-of-the-line one-of-a-kind inverter and Supervisory Controller were expected to complete the innovative high penetration integration by the end of 2011. Funding from USDA/RUS was supplemented with



monies from the Lake and Peninsula Borough, the Alaska Energy Authority and Kokhanok's Village Council. The hybrid power system worked nearly as expected for a couple of years when cascading errors within the Supervisory Controller caused the wind farm to be put on permanent stop until the controller could be fixed or replaced. It is now 2016 and our wind farm has yet to operate since mid-2013.

We eagerly applied to a recent RFP from the USDOE Tribal Energy Program in hopes of replacing the original controller and inverter with off-the-shelf technology from an internationally known company. Our wind farm was inspected and maintenance done in June of 2015. The two wind turbines are in excellent condition and ready to spin – but can't for want of a solution to this integration control problem. We can't begin to express the disappointment felt by our whole team when we got the news that because our particular piece of equipment did not actually produce renewable kWhs, it was not eligible for funding under the RFP. But we do not consider our efforts wasted. We have all the information necessary in a neat proposal now.

Our Council and Community recognize the need for planning and technical assistance. We commend the Office of Indian Energy for providing these services. We respectfully ask that some attention also be directed at what will surely be labeled "grant scat" without a round of funding to improve upon integration controls – so that the renewable technologies in place can properly function.

Sincerely,



Peducia Andrew, President, Kokhanok Village Council



February 17, 2016

The Honorable Senator Lisa Murkowski, Chair
 The Honorable Senator Maria Cantwell, Ranking Member
 U.S. Senate Committee on Energy and Natural Resources
 304 Dirksen Senate Building
 Washington, DC 20510

Dear members of the U.S. Senate Committee on Energy and Natural Resources and Energy Secretary Ernest Moniz:

Thank you for traveling to Bethel, Alaska to see firsthand the challenges and opportunities for energy technology innovation and deployment for Alaska's energy future. NANA Regional Corporation (NANA) is a for profit business with a social responsibility to improve the social and economic well-being of our shareholders. Created in 1971 pursuant to the Alaska Native Claims Settlement Act, NANA is the Alaska Native regional corporation whose shareholders who are the descendants of the Inupiat people from Northwest Alaska. Today, NANA has over 13,900 shareholders, half who reside in the NANA region. The NANA region overlaps with the Northwest Arctic Borough boundaries and is about 38,000 square miles or the size of Indiana. The NANA region includes 11 communities. NANA is the largest private landowner with 2.28 million acres of land or 9.4 percent of the 24.3 million acres that make up the Borough. Approximately 80 percent of lands in the Borough are State and Federal lands. This is important in the context of economic development and energy security in the Arctic.

The NANA region is a road-less region. Similar to Southwest Alaska—though our average temperatures are lower in the Arctic—electricity and home heating require diesel fuel. In our region, diesel fuel is delivered by barge to 7 communities and 4 receive it by air because the river system has become too shallow for barges. For these four communities, Noatak, Ambler, Kobuk, and Shungnak, air deliveries cause the price of fuel to range from about \$9.00 to \$11.00 per gallon. The cost of electricity without Power Cost Equalization, a state residential subsidy for diesel fuel, ranges from about 50 to 90 cents per kWh in our region.

These extreme fuel and electricity prices are of concern to NANA for two reasons:

- 1) The impact to our shareholders; and
- 2) The impact to business and related economic development.

Fuel brought into communities, both diesel and gasoline, are very expensive. As mentioned, diesel is used for the generation of power and for home heating. Gasoline, equally as important, is used to participate in traditional subsistence activities and gather wood to supplement home heating. The cost of living in the hub community of Kotzebue is 61% higher than urban Alaska and is even higher in the

more remote villages. Households in the region have an average household size of 3.72 with about 57 percent having children younger than 18 years old and 19 percent with someone ages 65 or older residing in them. What this boils down to is that many households are choosing between heating their homes and feeding their families from store bought food or food from the land.

As a business, NANA is the landowner of the second largest lead and zinc mine in the world. The Red Dog Mine relies on diesel fuel to power the mine and the port site. Annually, the Red Dog Mine uses about 19.7 million gallons of fuel for its operations. The cost of fuel can make or break the economics of small and large scale business opportunities in the Arctic whether it is resource development or other business ventures. NANA is interested in bringing these costs down to pursue future responsible resource development and other business opportunities.

Because of the business implications and the impact to our shareholders, NANA is partnering with public and private entities to implement solutions to reduce dependence on diesel fuel and reduce the cost of power generation. NANA brings lands as a resource, staff resources from our team of companies, expertise in community consultation, and our commitment to our social responsibility to improve the economic well-being of our shareholders to these partnerships. Our partners who include the Northwest Arctic Borough, local communities, the Alaska Native Tribal Health Consortium, Kotzebue Electric Association, and other power producers bring their expertise, access to federal and state resources, and technical capability in deploying renewable technologies on NANA lands.

Northwest Alaska is also home to Alaska's first regional energy plan in response to the beginning of the energy crisis that hit the communities in 2008. This plan identifies potential energy efficiency and renewable energy opportunities through consultation with villages, residents, and regional organizations. The plan was developed in collaboration with NANA, the Borough, Maniilaq Association, the School District, and the communities in the region. Today the Alaska Energy Authority uses the Northwest Arctic Energy Plan and process as a model for the rest of Alaska. Since 2008, individual tribes, cities, local power companies, the Borough, NANA, and other regional organizations have worked together to complete feasibility studies, increase technical knowledge, test solar panels in the Arctic, implement energy efficiency measures, and deploy wind in our communities. Based on these efforts, we now understand the resources we have, the potential they have to reduce diesel dependence and energy costs, the value of these solutions in supporting the United States' National Strategy for the Arctic Region, and barriers to deployment. The following are solutions to some of the barriers we are experiencing.

Funding and Deploying Infrastructure to Support Renewables

Rural Alaska has very limited or outdated basic infrastructure that does not meet current demand to integrate renewables. Communities need upgrades to generators, switchgear, communication, and controls; better bulk fuel storage; interties and improved distribution systems; and

dispatchable loads and energy storage to properly integrate renewables. With inadequate funding, technical support, and lack of coordination among various government agencies, remote communities such as ours must compete for scarce resources and are often left short when deploying whole-system solutions engineered for the Arctic.

For greater deployment of necessary infrastructure to integrate more renewables into rural Alaskan communities, we recommend increased funding for DOE's Office of Tribal and Indian Energy Programs and the Office of Electricity as well as promotion of interagency coordination with agencies such as the Denali Commission and U.S. Department of Agriculture Rural Utilities Service. Specific funding to deploy remote and isolated grids and integrating hybrid systems that target high energy cost, diesel dependence, and community involvement and training to rural Alaska would be highly valuable. Such an effort could be based on existing successes such as the Kotzebue wind farm—which recently added Lithium-ion energy storage and is pursuing the largest solar PV array in the state of Alaska—as well as developing new solutions with replication potential and ultimately, export value to other developing regions of the world.

Improve Opportunities to Leverage State and Federal Funding

While DOE has unrivaled technical expertise other federal agencies, such as the Denali Commission, the U.S. Department of Agriculture, and the Economic Development Administration, all bring valuable resources to bear on our energy challenges and solutions. However, the cost and effort devoted to preparing complex federal applications is substantial and ever-increasing. Simplification of procedures to apply for technical assistance and funding for deployment would be significant. Many communities are currently hindered or prevented from engaging because of the initial hurdle presented by complex federal applications. Utilizing interagency coordination to meet all the infrastructure requirements for integration of renewables and reducing dependence on diesel will ensure a holistic approach for energy solutions in rural Alaska.

We also recommend streamlining granting procedures, such as reduced cost-share requirements, allowing use of land and existing infrastructure for matching funds, and providing up-front funding instead of reimbursement of expenses once grants are awarded. Many communities are cash-strapped and recognizing the value of non-cash assets contributed to projects as matching funds can increase the number of communities that access DOE and other sources of funding. The Denali Commission in particular is well suited to provide a coordinated approach that addresses the unique challenges our communities are facing to achieve deployment of these systems.

Additionally, the Denali Commission originally funded and directed the Emerging Energy Technology Fund. This fund is used to test pre-commercial technology in a setting where it has not been used before, such as the Arctic. Eventually, a state-federal partnership emerged in which both the Denali

Commission and the Alaska Energy Authority contributed to the Fund. Currently, the State and the Denali Commission have very limited funding but matching funds and expertise from DOE could boost the impact of this highly valuable initiative and strengthen the state-federal partnership that is necessary to help rural Alaska. In particular we see an opportunity for residential air source heat pumps to be tested for Alaska through this fund.

Funding for Natural Gas and other Fossil Fuels

Due to the remote nature of rural Alaska, traditional non-renewable fuels are still needed for generation of electricity and for home heating. Development of renewables will continue to include hybrid systems designed to reduce diesel consumption and increase use of renewables. Many DOE programs only focus on renewables; a coordinated approach to allow non-renewable resource development will be needed to acknowledge the unique situation of rural Alaska to make projects successful. Northwest Alaska has coal resources and natural gas deposits. In addition, more efficient fuel, such as liquefied natural gas (LNG), could support maritime transportation in the Arctic, U.S. Coast Guard activities, Department of Defense activities and responsible natural resource development. The United States, especially in the Arctic region, needs to continue an "all of the above" energy approach for rural communities and to support the implementation of the U.S. National Strategy for the Arctic Region.

Technical Support for Tribes

We commend the Department of Energy for the recent announcements adding staff to the Alaska Office as well as making funding available for technical assistance to tribes. In Alaska, tribes are small and have very limited funding. This means many tribes interested in evaluating renewable energy options for their communities often need technical assistance just to apply for DOE funding and have to enter into unique partnerships to access lands, other technical expertise, and capital. In the Lower 48, tribes with significant resources and capacity tend to be more competitive and successful in obtaining DOE funding. To support tribes looking to evaluate and use their energy resources, we recommend that DOE strengthen the Alaska Office by adding technical staff and capitalize on existing staff in the National Laboratories. For example, the Alaska Office can work with communities to assess and model costs and return on investment for solar projects.

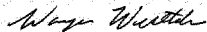
Communities in rural Alaska are also interested in building the technical capability and capacity locally through workforce training, community energy education, and other investments in human capital. Increased technical staff within the DOE Alaska office and other workforce development support can help communities develop plans and capacity to train the local workforce to manage the deployed technology. Funding Tribal Energy Specialists in each community, similar to the Environmental Protection Agency's Indian General Assistance Program, would greatly help with workforce development and improving local energy education and efficiency.

Finally, we are encouraged by Senator Murkowski's placing Alaska tribal and Alaska Native Corporation hydroelectric projects on equal footing with municipalities and states. In Northwest Alaska we have a significant opportunity to provide low environmental impact hydro power to three communities in the Upper Kobuk through the Cosmos Hills Hydro project.

In conclusion, Northwest Alaska is ready and willing to deploy the technologies needed to reduce dependence on diesel fuel, reduce residential heating costs, as well as explore opportunities to provide the energy needed for stewardship, Homeland Security and Defense in the Arctic. Though our region faces many challenges, we are already demonstrating the power of Public Private Partnerships to deploy these projects in rural communities, and we see many opportunities for DOE to work with us and other agencies to strengthen Alaska's energy future and deploy new and innovative solutions.

Thank you for your time and consideration, we look forward to working with you, our partners, and our communities to strengthen Alaska's energy future.

Sincerely,



Wayne Westlake
President/CEO

Enclosure: Map of Northwest Alaska's Renewable Energy Potential

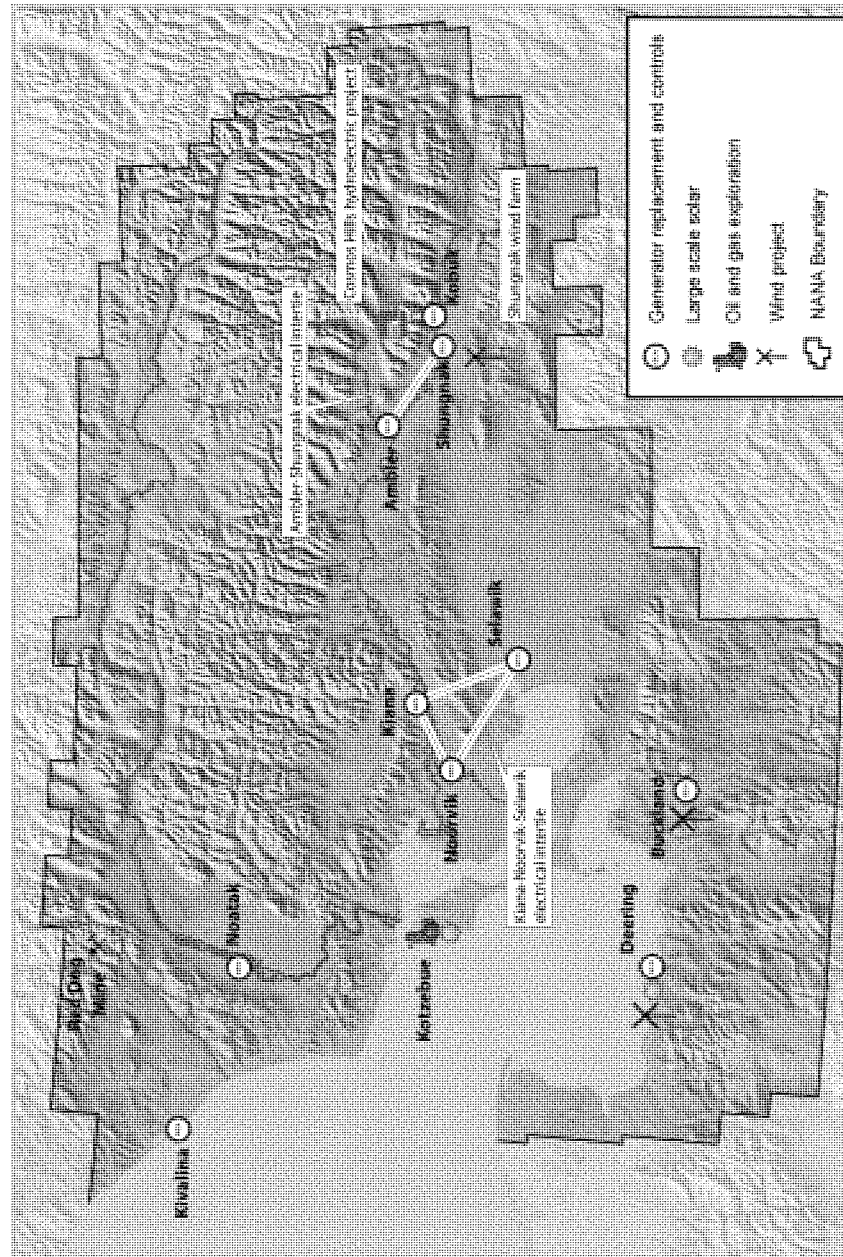
CC:

The Honorable Bill Walker

Energy Secretary Ernest Moniz

Joel Neimeyer, Federal Co-Chair, Denali Commission

The Honorable Byron Mallott, State Co-Chair, Denali Commission



Written Testimony of
John G. Lyons
President & General Manager
TDX Power Inc.
Microgrid Technology
Before the
United States Senate
Committee on Energy and Natural Resources

Madam Chairman and Honorable Members of the Committee, thank you for this opportunity to provide written testimony on the innovation of microgrid technologies. My name is John Lyons, and I am the President and General Manager of TDX Power, Inc. I've had the pleasure of working in Alaska's energy industry for nearly 40 years.

TDX Power is excited to provide the Committee with our insights, experiences and vision regarding how remote Alaskan communities can increase their energy independence, lower and stabilize their energy costs and in general, make these communities more sustainable and more livable through the application of microgrid and renewable energy technology.

Alaskan residents are continuously confronted by high and unsustainable energy costs, with an estimated 20% of their after-tax income going toward the cost of energy (American Coalition for Clean Coal Energy, 2013). Opportunities are needed to continually address the underlying structural, social and regulatory impacts for residents of Alaska.

TDX Power Inc., (TDX) incorporated in 1999, is a wholly-owned subsidiary of Tanadgusix Corporation ("TDX"), a federally recognized Alaska Native Village Corporation established in 1973 under the federal Alaska Native Claims Settlement Act for the benefit of the Aleut people of St. Paul Island. With revenues exceeding \$21 million in 2015, TDX Power is supported by a professional staff of approximately 35 personnel.

TDX Power has established a goal to dramatically reduce fossil fuel dependence, significantly decrease greenhouse gas (GHG) emissions, increase energy efficiency, and implement high penetration renewable integration at two island communities where TDX Power has a significant presence.

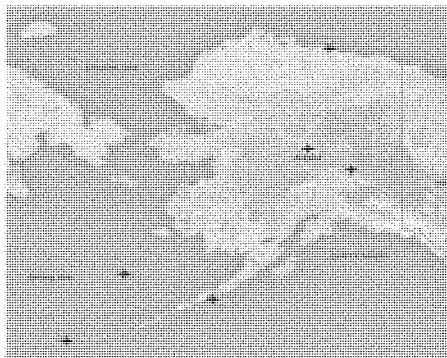
On St. Paul Island, Alaska, TDX Power's corporate parent, TDX, invested its own funds to design and construct the first commercial scale high penetration wind power, microgrid system in Alaska. TDX Power operates and maintains a 675 kW wind farm and a 300 kW diesel power plant with microgrid technology to provide 60% of all electricity, heat, and ground transportation (electric vehicles) to the industrial business park and hotel located next to the airport. In addition this wind farm exports wholesale electricity to the City-owned electric utility, providing approximately 20% of the community's electric power requirements. TDX Power's goal is to expand its application of microgrid technology to provide 80% of the community's future energy from renewable resources by 2020; that is, 80% of the energy required for electricity, heat and ground transportation.

TDX Power has already taken the first steps towards this goal. A detailed plan of action has been prepared and approved by TDX management and its Board. As part of its vision, TDX sees a need to grow internal technical capacity, document the business case, source financing, and strengthen community understanding and support. Also to be successful, State and Federal agencies need to work collaboratively because "energy" use and costs permeates across multiple agencies' boundaries. Sustainable energy solutions need coordinated support from Energy, Housing, Transportation, and Health and Community Development. Finally TDX Power understands and continues to explore emerging technical options such as flywheel storage, new smart metering and switching technology, and energy storage technologies that might be economically viable in all rural or high energy cost communities with cost effective renewable resources.

TDX Power was developed as a result of our effort on St. Paul to provide a strong presence in the power generation field. It has provided project management, construction management, and

regulated utility management since its incorporation, beginning with the integration of wind turbines to the existing TDX corporate facilities and power plants on St. Paul and Sand Point. TDX Power provided the first high-penetration wind-diesel hybrid system of its kind in the state. TDX Power then purchased and incorporated as subsidiaries the regulated electric utility in Sand Point in 2002, the regulated electric utility in Deadhorse in 2003, and in 2008 both the Adak and Manley Hot Springs electric utilities were established. In 2011, Aleutian Wind Energy, a regulated wholesale wind energy utility, was formed providing wind-generated electrons to Sand Point electric utility, and St. Paul Wind Energy was also granted a state Certificate of Public Convenience and Necessity as a wholesale provider of wind-generated energy to the City of St. Paul.

Through that time, TDX Power worked with the U.S. Government and the State of Alaska to provide various construction and project management services for power plant and wind-hybrid systems throughout the state. Because of its core business experience of power generation operations and maintenance, TDX Power was approached by Raytheon to provide remote power generation services in support of the government contracts it operated around the world. The addition of six remote international sites beginning in 2009 provided a significant increase to the depth and breadth of TDX Power's already widely varied resume of power generation support services.



TDX Power has over fifteen years of experience in running operations, maintenance and power plant management in some of the most austere and protected environments of Alaska, including Prudhoe Bay, St. Paul, Adak, Sand Point, and Manley Hot Springs. TDX Power has also been providing remote power generation support to the U.S. Government at multiple remote international locations since 2009.

TDX Power provides operations, maintenance, upgrades, and total engineering solutions both for its regulated utility assets, as well as assets we install (and often operate) for our clients. The following highlights our experience:

- Fossil Fuel Generation - We develop, own, and operate power plants of all sizes using both liquid and gaseous fuels, and have experience with all major vendors of this type of generation technology.
- Renewable Energy - We own and operate one of the only Alaskan high-penetration wind-diesel hybrid plants which is located on Saint Paul Island and a 1MW medium penetration wind-diesel hybrid plant at Sand Point, Alaska.
- Hybrid Technologies - We are the industry leader in integrating renewable technologies with base-load fossil-fuel generation for stand-alone, high reliability critical systems.
- Microgrid and smart switching technology - We integrate diesel generating assets, wind, flywheel and thermal energy storage technologies.

The high cost of energy for heat, power and transportation represent a barrier to the improved quality of life, economic viability, and long-term sustainability for most rural Alaskan communities. Microgrids with smart switching technology providing for high penetration alternative energy will be one of the best ways to ensure long term sustainability of communities in Rural Alaska and other off-grid rural communities around the world.

TDX Power has set a corporate goal to reduce community dependency on fossil fuel by 80% before 2020, create local jobs utilizing local renewable resources, and position the community for continued economic growth and sustainability. TDX Power proposes to use renewable wind energy to supply lower cost electric power to the local electric utility (City of St Paul) and use excess wind energy on a dispatchable, intermittent load basis to displace heating fuel across the entire community.

A community that is energy self-sufficient is a community that is able to supply its own needs without external assistance. How many truly self-sufficient communities are there?

By 2020, the island community of St. Paul, Alaska intends to be the example of how this can be done. The use of microgrid technology and reliable wind turbines, a Class 7 wind resource, and highly qualified and competent management at TDX Power position St. Paul for success.

TDX Power continues to aggressively pursue its “80% by 2020, St. Paul Sustainable Energy Plan”. Implementation of the Plan requires actions on several levels; the design and deployment of multiple technologies with components funded by various private, state, and federal sources.

TDX Power believes that there is sufficient wind energy at St. Paul that eventually 80% of the total energy consumption for electricity, heating, and ground transportation on the island will be sourced from renewable energy resources. Given the fifteen years of continuous wind power experience and recent improvements in controls, electrical storage and heat utilization, TDX Power is committed to reaching our goal of 80% Renewable by 2020. Although the first steps have been taken, there are a number of important steps that need to be completed to fully develop and implement this vision.

The table following summarizes TDX Power’s success implementing the high penetration renewable industrial business park and hotel located next to the St Paul Island airport:

St. Paul - Wind Energy - Annual Power Production Summary					
Gross Total kWh Generated	100%	100%	100%	100%	100%
kWh Generated Diesel	45%	42%	44%	49%	46%
kWh Generated Wind	55%	58%	56%	51%	54%
Diesel Efficiency kWh/gal	14.13	12.03	13.52	13.14	13.40
System Efficiency W/D kWh/gal	34.95	30.59	30.44	26.62	29.33
kWh Thermal Tank Usage	44%	39%	34%	31%	35%
kWh Facility Usage	46%	51%	58%	61%	57%
% Parasitic Losses	10.0%	10.0%	8.7%	8.2%	7.3%
Diesels Off hours	2,734	2,137	1,168	1,886	2,115
Diesels Off (% of year)	31%	24%	13%	22%	24%

Our next project along with the St. Paul effort is in Sand Point, Alaska. TDX Power's goal is to provide 70% of the community's future energy requirements from renewable resources by 2023. TDX Power and related subsidiaries own and operate the regulated electric utility, a fuel supply company, and a 1 MW wind farm. From this solid foundation, TDX Power is demonstrating how dispatchable thermal loads that utilize excess renewable energy can be used to displace fossil fuel heating at the Sand Point School. TDX Power has been working closely with the Shumagin Corporation (major land owner and local Alaska Native Village Corporation) and the city to embrace the expansion of the renewable contribution to all the island energy supply needs. Currently, renewables provide ~30% of the island electrical power and less than 1% of the thermal energy. TDX Power has a long term plan to expand renewable power on the island to meet our 70% goal for electricity and thermal energy. That plan includes advanced variable speed diesel gensets, small amounts of electrical storage, and a significant expansion of the wind farm and deployment of both commercial and residential heat pumps and other dispatchable loads (heating).

For both of these communities, to help execute on our promises, a solid and detailed "Community Energy Baseline" needs to be established. The Community Energy Baseline (CEB) establishes "as is" energy use for electricity, heating, and ground transportation, along with an assessment of building envelope integrity, insulation levels, lighting, and appliance efficiency. On the ground transportation side, miles driven, trip length, road conditions, temperatures, and serviceability of equipment are also evaluated. The CEB will provide the economic metrics to cost justify energy efficiency improvements within the community, and allow "right sizing" of renewable generation assets.

Information and data collected for government and public buildings along with private facilities/homes that opt-in to this Energy Baseline assessment will be made accessible via a web-based GIS relational database that interfaces with the Alaska Department of Commerce, Community and Regional Affairs Community Database Online, or via the Alaska Energy Authority.

These necessary and important first steps will define the energy sources and energy resources, and energy use on the island for electricity, heat and transportation, and provide a solid baseline of current needs. This information will feed into the next big step to create a roadmap to define specific approaches to both the reduction of energy consumption as well as the design of the renewable energy delivery system and required auxiliary components.

Recent grant awards to TDX Power from the Alaska Energy Authority Emerging Energy Technology Fund (flywheel project) and the Department of Energy have enabled TDX to develop and implement its cutting edge engineering projects. In 2015, TDX Power was awarded a \$1.2 million grant through the Department of Energy (DOE) to develop a “microgrid system” on St. Paul to demonstrate its function and performance under real life conditions.

The project now underway will be to develop a fully functional and cost effective microgrid controller with smart switching capacity that will have widespread acceptance by the utility industry. Building on commercially available energy system control products, a microgrid controller with complimentary component libraries will be developed and demonstrated. This product will provide a flexible vehicle to integrate a diverse range of energy resources and control those resources in both grid-connected and islanded modes.

Another important feature of this microgrid system will be the design, using existing distributed generation (DG) assets within the distribution network on St. Paul Island. The proposed microgrid and microgrid controller functions will be modelled and simulated, and a baseline for performance comparison will be established. The microgrid controller and any grid upgrades needed for microgrid operation will be installed and commissioned with comprehensive field testing to verify intended operation, performance, and emissions on the microgrid.

Conclusion

TDX Power envisions a program of expanding a microgrid system with renewable energy supply at the utility level, demonstrating the cost effectiveness of dispatchable distributed loads (heat and load regulation), and the positive symbiotic relationship between renewables and electric ground transportation.

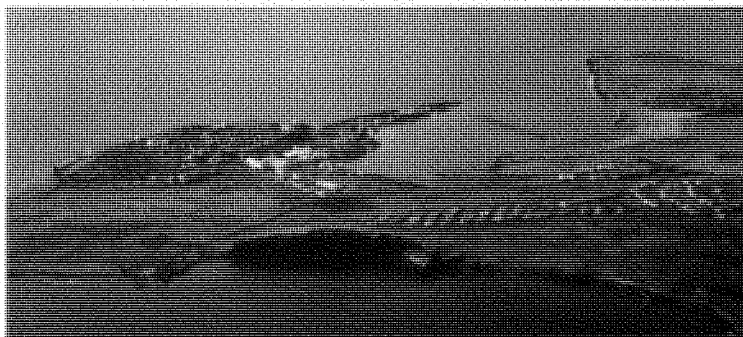
Renewable energy generation must be sustainable and microgrid provide the opportunity to meet this goal. Yes, we need continued study to expand pilot and demonstration projects and ultimately for more common deployment.

The advancement of microgrid technology with Wind Combined Heat and Power (WCHP) systems serves to enhance energy stability, increases the net production of a renewable resource and ultimately to the sustainability of off-grid rural communities.

For the communities of Sand Point and St. Paul, TDX Power's ability to execute our vision will require regulatory approvals at the State level. The community- wide impact of creating a new energy paradigm on these islands is a daunting task. The support, guidance and technical participation of DOE will make a significant difference. This level of change will not be easy, but it's worth the effort. In the end, a microgrid system with energy conservation combined with high penetration renewables is the right solution to reduce the high cost of energy faced by most remote Alaskan Communities.

Thank you for the opportunity to share TDX Power's story with you, and the attention you are devoting to renewable energy and microgrid technology development.

Microgrid Project is an important
stepping stone toward
80% by 2020





United States Arctic Research Commission

February 8, 2016

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The Honorable Lisa Murkowski
United States Senate
709 Hart Senate Office Building
Washington, D.C. 20510-0203

Dear Senator Murkowski:

I hope that this letter finds you well. I write to commend you on your recent activities as Chair of the Energy Committee and inform you of some of the exciting developments that have been happening at the US Arctic Research Commission (USARC) in the area of renewable energy and energy efficiency.

In September of 2015, the USARC held the first meeting of its newly formed Arctic Renewable Energy Working Group (AREWG). This group is made up of energy experts from a range of organizations and its mission is focused on *benefitting Arctic communities by identifying and addressing critical renewable energy and energy efficiency research needs*. In late January, we held a workshop that was focused on developing a heat-related research plan for rural Alaska focused on reducing heating oil consumption via increased energy efficiency and the increased use of renewables. I would be happy to discuss this further with you or your staff in person, but have attached a draft one-pager on the group for your review. USARC will provide a final version and a link to the working group's website in the near future.

We are looking forward to the upcoming energy hearing in Bethel. We understand that there is a very full agenda, but hope we will be able to submit written testimony related to the heat information discussed above.

Finally, I wish you the best of success in negotiating a balanced energy bill. Alaskans recognize the work you are doing and appreciate your willingness to "reach across the aisle" to get things done.

Best regards,

Fran Ulmer
Chair, US Arctic Research Commission

Washington DC office: 4350 N. Fairfax Drive, #510, Arlington, VA 22203 703.525.0111 Ph. -0114 Fax
Anchorage office: 420 L Street, #315, Anchorage, AK 99501 907.271.4577 Ph. -4578 Fax
www.arctic.gov info@arctic.gov



Residential Heating in Remote Arctic Villages: Research Needs

WORKSHOP SERIES REPORT 1



A Report from the Arctic Renewable Energy Working Group
January 20, 2016 – Anchorage, Alaska

Introduction

A 2008 publication by the Institute of Social and Economic Research (ISER) at the University of Alaska Anchorage, reports that 79% of households in rural Alaska depend on diesel fuel to heat their homes, with the other 21% using wood, natural gas, propane, coal, or solar power.¹ The same report indicated that rural residents in the lowest income bracket spend 47% (median value) of their annual earnings on home heat compared to 8.7% for the same income groups in Anchorage, Alaska's largest city.¹

Although the global price of oil has fallen in 2016, heating and electrical costs for remote Alaskan villages remain high due to the nominal rigidity of the market/industry, fixed expenses of transporting fuel to the villages (by air or barge), the infrequency of fuel delivery, the cost of bulk fuel storage, and the high cost of operating and maintaining isolated and remote systems. These factors also lead to wide variation in the cost of fuel in Alaskan communities. For example, the January 2016 Alaska Fuel Price Report² indicated that communities in the western region of Alaska pay an average of \$5.66 per gallon for heating fuel, as compared to under \$4.00 per gallon in rural Alaskan communities in the Northern, Southeast, and Gulf Coast regions (Table 1). Even within regions, prices vary greatly, with communities in Interior Alaska paying prices ranging from \$2.32 to \$12.00 per gallon.²

The Regulatory Commission of Alaska (RCA) regulates the price of many home utilities—phone, water and wastewater, natural gas, refuse, and electricity. However, the cost of home heating fuel oil is unregulated.³

While this lack of regulation may play a part in the price variation of heating fuel, a more significant factor is the remote and isolated nature of many Alaskan communities, most of which are located off the road system and are accessible only by waterways (when not blocked by ice) or by air. This remoteness significantly increases the cost of fuel, as the expense of delivering fuel to the community is passed on to the customer. When accounting for distribution costs, a 2010 study by ISER⁴ found no evidence of excessive charges by fuel distributors in the western region of Alaska, where fuel prices are highest. Rather, most of the variation in fuel prices appears to be due to discrepancies in the retail price-setting practices at the community level.⁴ Suggested reasons for this include differences in the cost of debt for bulk fuel loans; collection approaches for operations and maintenance costs; the level of implementation of safety and environmental compliance; fuel sales operation hours; and the level of local mark-up practices to collect revenues.

In addition to the high and unstable cost of heating fuel, Alaskan villages are often challenged by limited access to a stable and trained workforce to operate and maintain the utility and heating systems on which the village depends. A stable governance to administer heating programs can also pose challenges.

In Arctic communities, where temperatures can plummet far below freezing, home heating is a critical utility that can be difficult and expensive to maintain.

TABLE 1. RETAIL HEATING FUEL PRICES PER GALLON ACROSS REGIONS OF ALASKA²

	Gulf Coast	Interior	Northern	Northwest	Southeast	Southwest	Western
High	\$6.05	\$12.00	\$2.50	\$7.21	\$4.65	\$7.36	\$7.32
Low	\$2.35	\$2.32	\$1.40	\$3.16	\$2.85	\$2.75	\$4.12
Average	\$3.44	\$5.05	\$1.79	\$5.23	\$3.43	\$4.98	\$5.66

¹ Saylor, B., S. Haley, and N. Szymoniak. 2008. Estimated Household Costs for Home Energy Use. Institute of Social and Economic Research, University of Alaska Anchorage, Note 1, 10 pp., <http://www/iser.uaa.alaska.edu/Publications/webnote/LI.Fuelcostupdatefinal.pdf>.

² Alaska Fuel Price Report: Current Community Conditions, January 2016, https://www.commerce.alaska.gov/web/Portals/4/pub/Fuel_Price_Report_Jan.2016.pdf.

³ The RCA regulates the oil and gas pipeline carriers that operate within the state.

⁴ Szymoniak, N. G. Fay, A. Villalobos-Melendez, J. Charon, and M. Smith. 2010. Components of Alaska Fuel Costs: An Analysis of the Market Factors and Characteristics that Influence Rural Fuel Prices. University of Alaska Anchorage, Institute of Social and Economic Research. Prepared for the Alaska State Legislature, Senate Finance Committee, 77 pp.

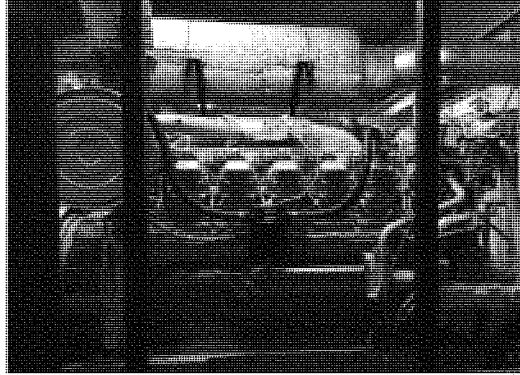


FIGURE 1. Village heating infrastructure, Anaktuvuk Pass, Alaska. Photo by USARC

The Arctic Renewable Energy Working Group (AREWG), coordinated by the US Arctic Research Commission (USARC), promotes research on renewable and efficient energy systems in remote Arctic communities. Formed in 2015, this working group benefits Arctic communities by identifying and addressing critical research needs in renewable energy and energy efficiency. Further information on this working group can be found at <https://arctic.gov/arewg/index.html>.

AREWG's initial efforts have focused on the home heating needs of remote Alaskan villages. To begin addressing this issue, the first of three heat-specific workshops was held on January 20, 2016. The aim of this initial workshop was to identify data gaps and research needs related to how heat is used in villages in order to better understand how renewable energy systems, energy efficiencies, and education and/or policy level efforts might best address heating needs for remote communities. Future workshops will focus on implementation of research recommendations (November 2016) and evaluation of efforts (2017).

Participants in the workshop included representatives from the Alaska Energy Authority (AEA), Alaska Center for Energy and Power (ACEP), Alaska Housing Finance Corporation (AHFC), Alaska Native Tribal Health Consortium (ANTHC), Alaska Village Electric Cooperative (AVEC), Renewable Energy Alaska Project (REAP), ISER, and USARC.

Several workshop participants noted that this was the first meeting focused solely on heat solutions for remote communities, and many felt this was highly responsive to the needs of rural residents.

Workshop Attendees

David Lockard (AEA)
 Devany Plentovich (AEA)
 Neil McMahon (AEA)
 Scott Waterman (AHFC)
 Eric Hanssen (ANTHC)
 Tashina Duttie (ANTHC)
 Meera Kohler (AVEC)
 Steve Gilbert (AVEC)
 Rob Bensin (BSNC)
 Brian Hirsch (Deer Stone Consulting)
 Steve Colt (ISER)
 Gwen Holdmann (UAF/ACEP)
 Marc Mueller-Stoffels (UAF/ACEP)
 Cheryl Rosa (USARC)
 Carrie Eischens (USARC)

Residential Heating Needs

Residential Heating in Remote Communities: Data Gaps

The meeting began with a review of the status quo with respect to heating in remote Alaskan villages (with a focus on the Arctic as defined by the Arctic Research and Policy Act: <https://arctic.gov/maps.html>). Little data are available on home heating in rural Alaska. The attendees determined that there is a fundamental need to know the amount of fuel that is being used for home heating in the villages. Researchers and energy specialists do not have the quantitative "top-down" information required to fully understand heating fuel delivery to service sites, how the utility is administered, or the efficiency of heating fuel use.

The amount of fuel delivered to villages by suppliers (for heat and other uses) is not publicly disclosed, and most suppliers are unwilling to share this information. Total fuel delivery can be estimated but is subject to speculation and may not accurately reflect actual use. While this level of data may be obtained with permission of, for example, village councils/communities, the effort would likely group commercial and residential fuel supplies as one, not solving the data gap for fuel used for home heating.

Community-wide fuel usage can sometimes be determined from the bulk fuel tanks, specifically in communities participating in the state's Power Cost Equalization program.⁵ Again, these data sets are not residentially specific and do not provide the *household* heat energy usage information needed by researchers (averages and outliers). Meeting participants also emphasized that until the dimensions of the problem (i.e., amount of fuel/energy for home heating that is needed) are known, it is difficult to generate feasible and economic solutions to reduce fossil fuel usage for home heating. To accurately model the cost savings and efficiency generated by any potential improvements from new technology, renewable energy sources, or energy efficiency implementations, reliable baseline data at the household scale are needed along with the temporal/seasonal scale of heating needs.

⁵ The Alaska Energy Authority's Power Cost Equalization program provides economic assistance to communities and residents of rural electric utilities where the cost of electricity can be three to five times higher than for customers in more urban areas of the state. For more information on this program go to <http://www.akenergyauthority.org/Programs/PCE>.

In some communities, basic information such as the number of buildings and their size, use/function, and occupancy is not easily accessible given the logistics of reaching remote Alaskan villages.

Additional barriers to data collection discussed at the workshop include the practice of fuel tank sharing among public (non-residential) buildings, making it difficult to judge the efficiency of individual buildings on fuel usage alone. Additionally, few heating fuel meters are currently in use in rural communities. Without these "microdata", neighbor-to-neighbor comparisons of heating fuel usage are impossible, making difficult rough estimates of comparative home efficiency.

The AHFC has done a large amount of efficiency and weatherization work in the villages, but needs still exist. The Cold Climate Housing Research Center (CCHRC; www.cchrc.org) has worked with tribes and housing authorities to design and build new cost-effective and energy efficient homes across the state. Additionally, CCHRC has performed extensive research and demonstration of weatherization and building envelope retrofit strategies that have been effective in reducing energy use. While new home construction has been inspired by CCHRC's work, there continues to be a lack of cost-effective energy efficient housing in rural Alaska.

The Challenges

SHORT-TERM: Collect heat-related data to inform users and utility operators on heat use and efficiency (e.g., low cost/no cost behavioral changes that reduce fuel use, program effectiveness measures).

MID-TERM: Retrofit outdated energy infrastructure, learn which factors affect energy usage other than behavior, provide sufficient maintenance of infrastructure, etc.

LONG-TERM: Develop new building designs and construction methods that are energy efficient on a life-cycle basis and that incorporate renewable energy sources.

Another barrier to village-level energy efficiency and use of renewables is the lack of traditional project financing and poor understanding of energy project financing intricacies. Communities are often unaware of loans programs that may allow them to develop and implement infrastructure improvements to reduce their dependence on diesel fuel for heat. This may also involve a lack of awareness surrounding the loan process, loan qualification, credit history requirements, and steps they could take to improve loan eligibility.

Difficulties with project financing are not restricted to Alaska's remote villages, but they are exacerbated in poor communities in Alaska and elsewhere. In Alaska, technical assistance funds are provided to assist communities with this problem, but options are limited. Assistance is often available only to rare small businesses or agricultural projects, and even then often covers only approximately 25% of the project cost. Improving technical assistance for financing energy projects aimed at small municipal and tribal governments, local native corporations, and residents would dramatically increase the ability of these communities to make economically sound choices for their future energy use.

Heat-Related Needs by Stakeholder Group

Workshop participants created a list of heat-related needs for specific user groups in Alaska.

RURAL RESIDENT NEEDS

- The ability to heat ones' home at reasonable cost⁶
- Energy pricing/cost stability
- Fuel source available year round
- Homeowner options to monitor usage of heating fuel
- Systems that are simple and easily maintained, preferably by the homeowner or village-level maintenance worker
- Access to skilled repair/maintenance services at the village level
- Training and understanding of heating systems by local residents/home owners (resulting in a sense of ownership and improved functionality of system)
- Information on available energy efficiency upgrades programs/behaviors
- Minimize pollution from heat production so that air and water quality are not compromised
- Jobs and economic improvements: jobs and local money kept in the community leading to increased economic independence
- Education about holistic house functionality
- Local/regional energy champion(s) and a network of energy educators (remote villages can share knowledge)
- Creation of a path to augment "economies of scale"
- Long-term vision of where the State of Alaska is going with respect to building design and energy code (will this vision accommodate district heating system options?)

OPERATOR NEEDS (power utilities)

- Cost effective and efficient energy storage systems
- Trained and accountable operations and maintenance workforce (consider incentive systems)
- Information on available energy efficiency upgrades/ programs/behaviors
- Heat utility availability – reimagining heat as a service
- Energy and maintenance management services
- Simple and straightforward systems
- Network of educated/well-trained operators
- Heat recovery systems services provider (possible overlap with water and sanitation service providers)

AGENCY/REGULATORY/GOVERNING BODY NEEDS (state/federal/local)

- Policies that influence behavior (carbon tax?)
- Information needed to develop "forward looking" (strategic, future) policies
- Policy alignment (of new and existing policies)
- Funding opportunities for solutions

INVESTOR NEEDS

- Minimize risk
- Return on investment (long and short term)
- Debt minimization
- Regionalized service (or larger) cooperative model approaches—economies of scale
- Maximize profit

INDUSTRY NEEDS

- Dependable consumer base/schedule
- Customers with the ability to pay
- Incentives to share data
- Regulation of distribution monopoly

⁶ Reasonable cost was estimated at this workshop as <10% of median home income.

Research Needs and Priorities

General Priorities/Data Collection Needs

- Compile and collect basic data at the individual residential home level—how much of what kind of fuel is being used to heat homes where? (important to include metered vs. unmetered homes in this analysis)
- Fuel metering data on homes (and potentially commercial buildings)
- Data on use of home heating appliances
- Basic data on rural infrastructure and buildings: a well organized, centralized data set of basic community information, would help in heat-use modeling. Ideally, this would include community name, the number of buildings in the community, owner of the building (resident, city, tribal, corporations, business), and their size, spacing and use/function, and current heating method. This information will inform cost estimates.
- Data review of “heat technology” research trials

General Priorities/Research Questions

- How would a reduction in energy subsidies impact communities?
- At what point do small, off the road system communities become non-viable under this scenario?
- Is the “district heating” model feasible in Alaska (Figure 2)? How can a centralized district heating distribution system be implemented?
- Would increased use of multi-family housing increase the viability of district heating systems? Is this something that would be socially acceptable in communities?
- How have other countries (especially Arctic) approached this model?
- What are the challenges to local implementation of energy efficiency projects in rural Alaska?
- What are the barriers to behavior changes to implement efficiencies?
- What organizational/capacity barriers exist?
- What opportunities are there for sewage, food waste, fish processing waste to be used as heat through small scale anaerobic digestion in rural communities? Is it feasible in rural Alaska, especially in Arctic and sub-Arctic locales?
- What is the potential for methane as a fuel in Alaska?
- How can we best leverage existing situations (i.e., with electrical distribution system infrastructure) to become more “energy secure”?
- What new technology provides the best options for energy storage in remote Alaska given our knowledge of conditions under which they would be used?
- How can we minimize risk to private investors in order to augment the installation of renewables in remote Alaska?
- What makes a “secure investment” and is it possible to move towards this in remote Alaska?
- How do we best reach and take advantage of an “economies of scale” approach to renewables in small, remote Alaskan villages?

Policy Priorities/Research Questions

- What is the role of policy on heating in rural communities?
- What are other international Arctic communities doing with respect to energy and renewables policy? Could alternative approaches used elsewhere work in rural Alaska?
- What is the best approach to prioritization and strategic planning in order to better inform renewable energy policy?
- Which policies influence behavior with respect to energy efficiency?

Coordination Priorities/Research Questions

- How do other international Arctic communities approach the administration of energy systems (both renewable and non-renewable)? Could alternative approaches used elsewhere work in rural Alaska?
- How can we increase opportunities to enhance public-private partnerships? (In which the community and private enterprise are in a win-win situation)?
- How do we provide more accurate information on energy efficiency upgrades/programs/behaviors to both villages and consumers so better choices can be made?
- What is Alaska's long term vision on renewable energy and energy efficiency? (especially with respect to building design and energy code). Some Alaskan communities and regions have implemented their own building standards, are these working? How far advanced are the building standards from state standards?
- What new approaches to energy and maintenance management services might be effective in remote communities (especially given the State of Alaska's fiscal situation in 2016)?
- How could a "network of energy educators" be created to:
 - > Provide information on whole house functionality?
 - > Provide information on what is working in other local villages/information sharing?

What is District Heating?

"District heating" refers to a heat distribution system that generates heat in a centralized location for residential and/or commercial heating requirements such as space or water heating. After generation, the heat is distributed to the customer via a network of insulated pipes through which pressurized hot water or steam is transported. Usually the pipes are installed underground but there are also systems with over-ground pipes. While earlier district heating systems were powered by fossil fuels, these systems are increasingly using renewable energy sources such as geothermal, biomass, solar and wind as their source of power generation.

District heating fueled by renewable resources has long been used in Europe to provide heating to small isolated communities as well as urban areas. In Iceland, 90% of households are connected to a district heating system fueled by geothermal resources.⁷ In contrast, renewable energy district heating has only recently begun to be implemented in North America. Drake Landing in Alberta, Canada, provides an example of a small (52 homes) community using solar energy to supply space and water heating throughout the year via a district heating system.⁸ Seasonal and short-term thermal storage allow solar energy to be collected and stored during the summer that is then used for space heating during the winter months.

In Alaska, several renewable energy district heating projects are being considered. Currently, a feasibility study is underway for a geothermal district heating system in Akutan, and a biomass fueled district heating system is being constructed in Galena. A small biomass fueled district heating loop is already operating in Gulkana and numerous diesel heat recovery loops are operating throughout rural Alaska where cooling water from the diesel generators is captured and routed to surrounding buildings.

⁷ Mims, C. 2008. One hot island: Iceland's renewable geothermal power. *Scientific American*, <http://www.scientificamerican.com/article/iceland-geothermal-power>

⁸ <http://www.dlsc.ca/index.htm>

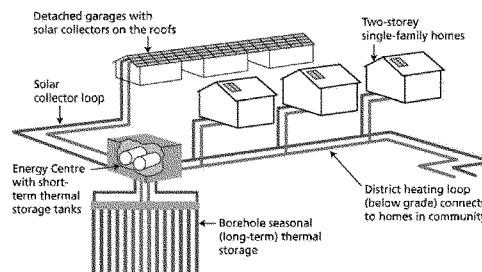


FIGURE 2. Solar seasonal storage and district loop.
Image from <http://www.dlsc.ca/how.htm>

Conclusion and Next Steps

How Do We Address These Needs and Research Questions?

The US Arctic Research Commission coordinates the Arctic Renewable Energy Working Group to promote research on renewable and efficient energy systems in remote Arctic communities. Initial working group efforts are being concentrated on the heating needs of isolated Alaskan villages with the development of a heat-related research plan for rural Alaska, focused on reducing heating oil consumption, increasing energy efficiency, and the integration of renewable energy.

Given the State of Alaska's 2016 fiscal climate and the lack of funding to the Renewable Energy Fund in the most recent state budget, identification and prioritization of data gaps and energy research needs is paramount.

At an initial workshop held in January 2016, our aim was to identify data gaps related to how heat is used in villages in order to better understand how renewable energy systems, energy efficiencies, as well as education and policy level efforts might best address heating needs for remote communities.

Throughout our discussions, the need for capacity-building as it relates to the operation of energy efficient and heating utilities in remote, rural villages was a reoccurring theme. Within a community, capacity is needed to envision, fund, organize, and execute projects such as a renewable energy project or utility. In Alaska, village-level capacity is highly variable and depends on strong community leadership and the experience and training of skilled individuals.

Human Capacity

Efficient management and operation of a community utility requires a trained and stable workforce. In small, remote villages that depend on a subsistence economy, such a workforce may be more difficult to secure and sustain than in more populated urban areas. While training opportunities may be available to educate new employees, turnover rates for operator positions are high as families leave villages for more lucrative positions, or employees take extended



FIGURE 3. The CCHRC demonstration home in Anaktuvuk Pass, Alaska. Photo by USARC

Capacity-Building Assistance Opportunities

Within the state of Alaska, there are several programs that provide assistance with the human and financial capacity issues facing utility management in rural communities. A few examples that may be applied to heat-related utilities follow:

The state of Alaska's Department of Commerce, Community, and Economic Development runs the Rural Utilities Business Advisor (RUBA) program with the aim of increasing the managerial and financial capacity of rural water and wastewater providers. This program offers capacity-building assistance and provides management training classes to rural utility operators throughout the state. This training may also be useful in operating renewable energy systems/utilities.

The Alaska Rural Utility Collaborative (ARUC), coordinated by the Alaska Native Tribal Health Consortium, assists communities with customer billing and with hiring and training local operators (and backup operators) that work towards professional certification. The ARUC is a statewide program that partners with communities to manage, operate, and maintain their water/sewer systems. This type of model could perhaps be expanded and applied to renewable energy and heating utilities.

leave in order to take part in traditional subsistence activities. As a result, village utilities generally require "backup operators" who understand the technical aspects of the utility and can step in when the lead operator is absent. In some small communities, finding two individuals with the desire and aptitude for these positions is challenging.

Financial Capacity

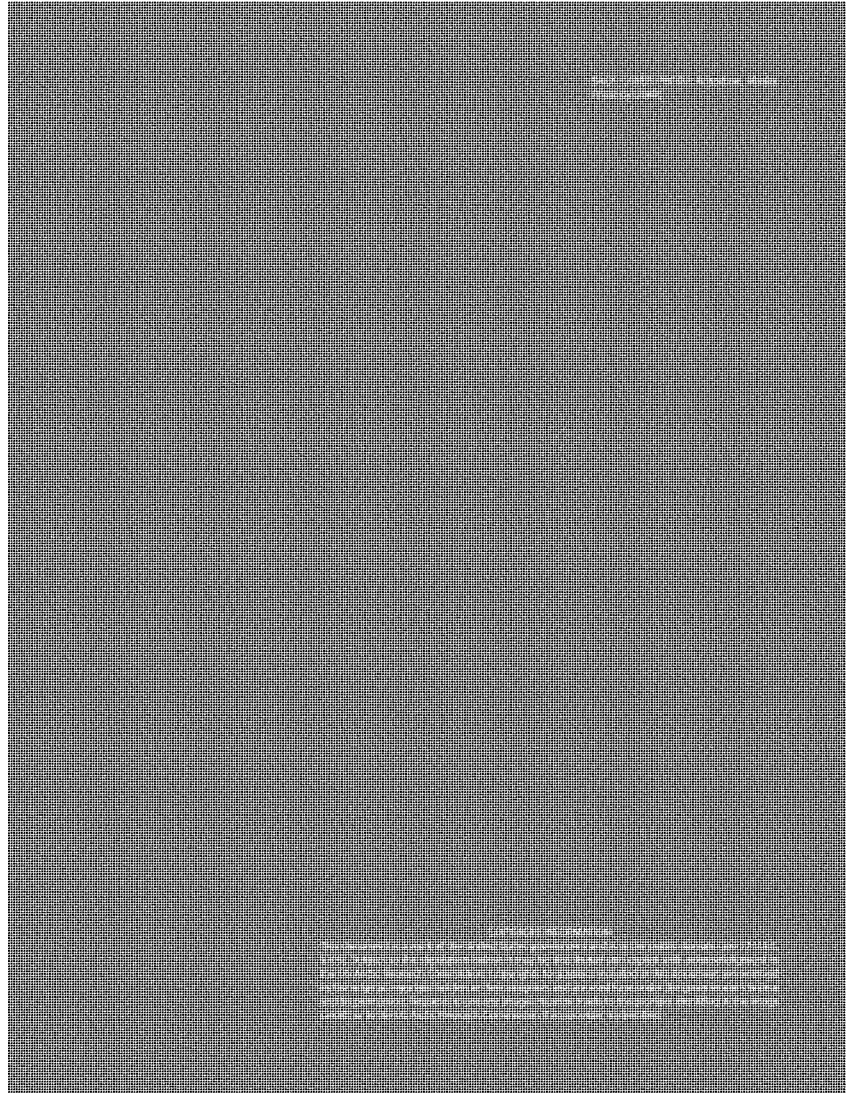
Infrastructure for renewable energy projects and utility operations in remote villages require a significant initial capital investment, followed by ongoing investment to maintain operations and management. Utility customer billing (user fees) is one source of income that ideally would cover the operations, maintenance, and management portion of the cost, but rarely do remote villages have the ability to cover the full costs of administering and maintaining a local utility. Nor do remote villages generally have the significant start-up funds needed to purchase the initial infrastructure, such as wind turbines or solar panels. As a result, communities must apply for grants or loans to cover these types of expenses. To be eligible for these type of financial assistance programs, communities must show they are credit-worthy in a cash economy paradigm. This poses a significant challenge given that many villages in remote Alaska are based on a subsistence economy which residents consider to be central to their way of life and important to their health and well-being. Rural and tribal communities would benefit from a clear path, and proper assistance, to secure funding opportunities for renewable energy projects and utility operations.

The Arctic Renewable Energy Working Group is focusing on finding solutions for remote Arctic communities with respect to:

- New options for home heating and electricity aimed at increasing energy efficiency/use of renewable energy and reducing heating oil consumption
- Promote data standardization and sharing of renewable energy metrics
- Storage of energy produced by renewables, with particular focus on improved battery technology
- Indirect community benefits of renewable and efficient energy use that do not get figured into typical renewable energy cost/benefit analyses
- Increasing potential for industry investment in remote renewable energy projects (decreasing uncertainty by identifying and mitigating risk)

Most of these topics are related to heat. The Arctic Renewable Energy Working Group will use its expertise, the information generated by the workshop, and subsequent follow up workshops, to move forward on these objectives to develop a heat-related research plan. Future efforts in this workshop series will address the issue of village-level capacity and determine implementation, funding, and evaluation strategies for heat-related research needs.

Additional information on the Arctic Renewable Energy Working Group (AREWG) can be found at <https://arctic.gov/arewg/index.html>





www.arctic.gov

AREWG

Arctic Renewable Energy Working Group

The group's mission is to benefit Arctic communities by identifying and addressing critical renewable energy and energy efficiency research needs.

The US Arctic Research Commission coordinates the Arctic Renewable Energy Working Group (AREWG) to promote research on renewable and efficient energy systems in remote Arctic communities. Integration of renewable resources and supporting technologies into a community's current power generation capacity has the potential to increase local employment and decrease air pollution, carbon footprint and, ideally, cost to consumers. Pushing the boundaries of energy efficiency and conservation are critical components of this effort. The AREWG is composed of Alaska-based energy experts familiar with the energy challenges facing remote villages. Many members have spent years working directly with rural communities. While the initial focus of this group is on remote Alaskan communities, the group intends to expand its scope to include circumpolar remote Arctic communities in the future.

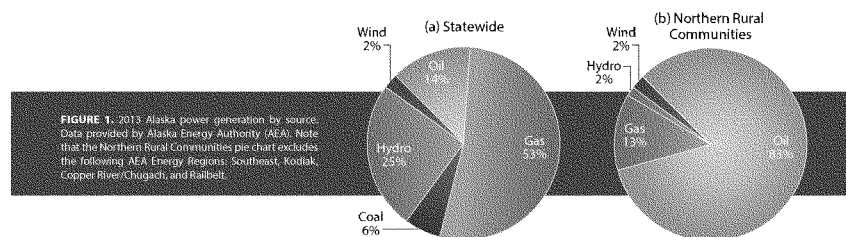
Fossil fuels are by far the most common means of providing energy for heating, electricity, and transportation in remote Alaskan communities that are disconnected from a centralized power grid (Figure 1). In these communities, fuel cost burden is often voiced as the priority concern for rural residents. Indeed, a 2008 study showed that the estimated median share of income spent on rural home energy is 12% and 47% for mid- and low-range income families, respectively, compared to 3.6% and 8.7% for the same income groups in Anchorage, Alaska's largest city¹. The challenges of transporting fossil fuels to these remote communities, the high cost of fuel storage, the adverse effects of fossil fuel combustion on the environment and human health, and the price volatility of oil have resulted in the need to develop and advance renewable energy options and energy-efficient technologies and behaviors.

The impacts of climate change (e.g., thawing permafrost, erosion and flooding, ecosystem changes, threats to subsistence practices and resources) are disparately felt in communities throughout the Arctic. The continued burning of fossil fuels, though minor at the village scale as compared to industrialized areas, will amplify these impacts, and provides additional incentive to reduce the dependence of remote Alaskan communities on oil as a primary power generation source (Figure 1b).

FOCUS AREAS

The working group will focus on the following topics with respect to remote Arctic communities:

- New options for home heating and electricity aimed at increasing efficiency/use of renewable energy and reducing heating oil consumption
- Storage of energy produced by renewables, with particular focus on improved battery technology
- Indirect community benefits of renewable and efficient energy use that do not get figured into typical renewable energy cost/benefit analyses
- Increasing potential for industry investment in remote renewable energy projects (decreasing uncertainty by identifying and mitigating risk)



¹ Saylor, R., S. Haley, and N. Szymoniak, Estimated Household Costs For Home Energy Use (ISER, May 2008), 10 pp., <http://www/iser.uaa.alaska.edu/Publications/webnote/11Fuelcostupdatefinal.pdf>

Did you know?

In rural Alaskan communities, almost 90% of total residential energy use is for home heating.²

Energy efficiency and well-maintained diesel power generation are essential to stable heat and electric energy use on isolated grids in remote communities. However, dependence on fossil fuels can be minimized through both efficiency and conservation practices and integration of renewable resources (e.g., biomass, geothermal, hydro, solar, wave/tidal, wind) with well-maintained diesel systems.

Currently, the remoteness and limited accessibility of these isolated communities pose a significant financial challenge to the goal of integrating renewable energy sources into their energy source portfolio. However, when viewed over the long term, considering the potential for advances in and reduced costs of technology, renewable resources may play a "key role in providing a local, clean, and inexhaustible energy"² source. Microgrid advances and fuel switching technologies (between fossil fuels and renewable sources), such as enhanced battery storage capacity, are considered important steps toward expanding the use of renewable energy sources in rural Alaska.

Initial working group efforts will be concentrated on the heating needs of isolated Alaskan villages. To move forward with this effort, a heat-focused workshop was held in January 2016. Based on workshop discussions, a heat-related research plan will be developed for rural Alaska that focuses on reducing heating oil consumption, increasing energy efficiency, and integrating renewable energy. For more information on this working group and the heat-related research plan, see the working group Web page at <https://www.arctic.gov>.

AREWG MEMBERSHIP

R. Andersen
Alaska Federation of Natives

R. Bensin
Bering Strait Development Company

F. Burton
Alaska Village Electrical Cooperative

M. Davis
US Arctic Executive Steering Committee

T. Duttie
Alaska Native Tribal Health Consortium

C. Eischen
US Arctic Research Commission

J. Farmwald
Denali Commission

B. Grunau
Cold Climate Housing Research Center

E. Hanssen
Alaska Native Tribal Health Consortium

B. Hirsch
Deer Stone Consulting

G. Hoidmann
Alaska Center for Energy and Power

J. Huff
US Department of Agriculture – Rural Development

D. Lockard
Alaska Energy Authority

D. MacCoert
US Department of Energy

M. Mueller-Stoffas
Alaska Center for Energy and Power

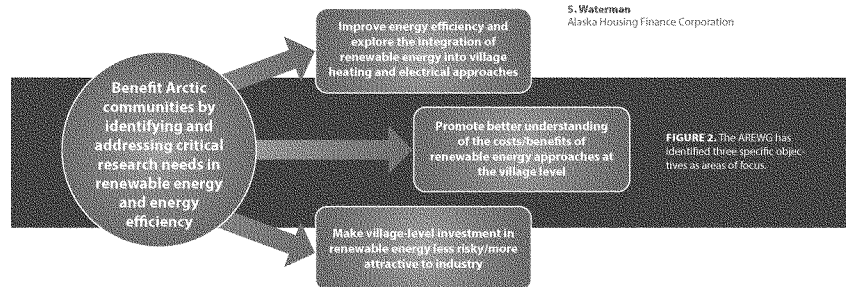
D. Pelonis-Messler
Tanana Chiefs Conference

C. Reed
US Department of Housing and Urban Development

C. Rosa
US Arctic Research Commission

C. Rose
Renewable Energy Alaska Project

S. Waterman
Alaska Housing Finance Corporation



² Renewable Energy Atlas of Alaska: A Guide to Alaska's Clean, Local and Inexhaustible Energy Resources (2013), Alaska Energy Authority & Renewable Energy Alaska Project.

¹ Alaska Energy Authority End Use Study, 2012. Produced by WHPacific with Brian Saylor and Associates, CTG Energetics and Cradun Research Group, April 2012. 151 pp. <http://www.akenergyauthority.org/Content/Efficiency/EndUse/Documents/AlaskaEndUseStudy2012.pdf>

Utility Management Assistance / UMA

P.O. Box 3513
Palmer, AK 99645

February 29, 2016

The Honorable Senator Lisa Murkowski, Chair
The Honorable Senator Maria Cantwell, Ranking Member
U.S. Senate Committee on Energy and Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

Dear members of the U.S. Senate Committee on Energy and Natural Resources and Energy Secretary Ernest Moniz:

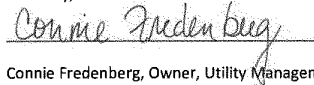
As small business owners that work exclusively with rural Alaskan communities struggling with extremely high energy prices, we greatly appreciate your genuine interest in Rural Alaska's energy plight as evidenced by your willingness to travel all the way to Bethel, Alaska. Although neither of us was able to be there for the historic event, we did see some great press coverage and would like to comment.

We share the sentiments of Gwen Holdmann, Executive Director of the Alaska Center for Energy and Power, in her speech from that day. She is absolutely right that Alaskans in remote communities are resourceful, creative and motivated to solve their own energy problems. Everyone gets it that importing one's main energy fuel source will never be a long term solution – locally produced energy is the answer. And not only to our problems. We believe perfecting this technology, so integral to the sustainability of Alaska's villages as modern communities, will set Alaskans up to lead the world in hybrid renewable micro-grid system development.

Rural Alaska has several micro-grids across the state outperforming expectations, but hybrid generation plants stuck in various stages of success also mar the landscape. Funding opportunities to fine tune integration components and controllers is difficult to find – and particularly hard for the smaller communities to access.

While we recognize the need for planning and technical assistance – and commend the Office of Indian Energy for providing these services - we respectfully ask that some attention and funding also be directed at a few projects that will surely join the sad ranks of "grant scat" without a mechanism to fund either adding to or replacing failed integration controls. The small communities with these projects in limbo have invested heavily of their own money and time.

Sincerely,



Connie Fredenberg, Owner, Utility Management Assistance a.k.a. UMA

Connie Fredenberg (907)444-6220 * Grace Oomittuk (907)631-2867 * FAX: 866-420-2532