

**RENEWABLES AND DOE ADMINISTRATIVE
IMPROVEMENT ACT**

HEARING
BEFORE THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
ONE HUNDRED TWELFTH CONGRESS
FIRST SESSION

TO

RECEIVE TESTIMONY ON: S. 1160, THE DEPARTMENT OF ENERGY AD-
MINISTRATIVE IMPROVEMENT ACT OF 2011; S. 1108, THE 10 MILLION
SOLAR ROOFS ACT OF 2011; AND S. 1142, THE GEOTHERMAL EXPLO-
RATION AND TECHNOLOGY ACT OF 2011

JULY 12, 2011



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

U.S. GOVERNMENT PRINTING OFFICE

72-694 PDF

WASHINGTON : 2012

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512-1800; DC area (202) 512-1800
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

COMMITTEE ON ENERGY AND NATURAL RESOURCES

JEFF BINGAMAN, New Mexico, *Chairman*

RON WYDEN, Oregon	LISA MURKOWSKI, Alaska
TIM JOHNSON, South Dakota	JOHN BARRASSO, Wyoming
MARY L. LANDRIEU, Louisiana	JAMES E. RISCH, Idaho
MARIA CANTWELL, Washington	MIKE LEE, Utah
BERNARD SANDERS, Vermont	RAND PAUL, Kentucky
DEBBIE STABENOW, Michigan	DANIEL COATS, Indiana
MARK UDALL, Colorado	ROB PORTMAN, Ohio
JEANNE SHAHEEN, New Hampshire	JOHN HOEVEN, North Dakota
AL FRANKEN, Minnesota	DEAN HELLER, Nevada
JOE MANCHIN, III, West Virginia	BOB CORKER, Tennessee
CHRISTOPHER A. COONS, Delaware	

ROBERT M. SIMON, *Staff Director*

SAM E. FOWLER, *Chief Counsel*

MCKIE CAMPBELL, *Republican Staff Director*

KAREN K. BILLUPS, *Republican Chief Counsel*

CONTENTS

STATEMENTS

	Page
Bingaman, Hon. Jeff, U.S. Senator From New Mexico	1
Chalk, Steven G., Deputy Assistant Secretary for Renewable Energy, Office of Energy Efficiency and Renewable Energy, Department of Energy	3
Dougherty, Douglas A., President and CEO, The Geothermal Exchange Orga- nization	13
Gordon, Holly, Vice President, Legislative & Regulatory Affairs, SunRun, Inc.	16
Sanders, Hon. Bernard, U.S. Senator From Vermont	1

APPENDIXES

APPENDIX I

Responses to additional questions	29
---	----

APPENDIX II

Additional material submitted for the record	37
--	----

RENEWABLES AND DOE ADMINISTRATIVE IMPROVEMENT ACT

TUESDAY, JULY 12, 2011

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 10 a.m. in room SD-366, Dirksen Senate Office Building, Hon. Jeff Bingaman, chairman, presiding.

OPENING STATEMENT OF HON. JEFF BINGAMAN, U.S. SENATOR FROM NEW MEXICO

The CHAIRMAN. OK, why don't we go ahead and get started. I'm told that Senator Murkowski is on her way, but asks us to proceed in her absence. So we will do that.

The purpose of our hearing today is to receive testimony on 3 bills: S. 1108, the 10 Million Solar Roofs Act of 2011, introduced by Senator Sanders. I will call on him to make any statement he would like here in just a moment. I have co-sponsored this bill, and Senator Boozman has as well.

The second bill is S. 1142, the Geothermal Exploration and Technology Act of 2011. This was introduced by Senator Tester with Senator Murkowski and Senator Reed as co-sponsors.

The third is S. 1160, the Department of Energy Administrative Improvement Act of 2011. This was introduced by myself and Senator Murkowski. S. 1060 was part of the larger energy bill that we reported out of our committee in the last Congress.

There are 2 panels. First we will hear from the Department of Energy with regard to their viewpoint on all 3 bills; and second we will hear from 2 experts who will be testifying on S. 1108 and S. 1142, respectively. So we look forward to the hearing, look forward to the witnesses' testimony.

Senator Sanders, did you wish to make any opening comments before we call on the witnesses?

STATEMENT OF HON. BERNARD SANDERS, U.S. SENATOR FROM VERMONT

Senator SANDERS. I did, and thank you very much, Mr. Chairman, for the opportunity, for including the 10 Million Solar Roofs Act in today's hearing. I was proud to introduce this legislation with Senator Boozman and very much appreciate the chairman's support as an original co-sponsor.

This bipartisan bill will lower the cost of solar energy for families and businesses and set strong goals for American solar energy pro-

duction. There is no question but that we have made dramatic progress in cutting the cost of manufacturing solar panels by 72 percent since 1985, and that is one of the reasons why solar, the solar industry, is exploding in this country. They saw as I understand it, Mr. Chairman, something like a 64 percent increase in their sales just last year alone.

On the other hand, we have not made the same kind of progress on so-called “soft” costs of installing solar. It’s one thing to lower the costs in producing and manufacturing solar, another thing in terms of installing, and that includes permitting and inspection fees. These fees account for up to 20 percent of the price of solar and are equivalent to a \$1 billion tax on solar over the next 5 years.

We can do better. In Germany, solar energy is 40 percent cheaper, thanks in part to a simpler permitting process. In Vermont, I’m happy to say we have just passed legislation this year to streamline solar permitting and eliminate fees. I think it’s going to lower the cost in Vermont and we’d like to see that all over America.

Secretary Chu’s Sunshot Initiative sets a goal of reducing permitting-related costs by up to 88 percent to make solar cost-competitive with fossil fuels without any subsidies—that is the long-term goal—by 2020. That’s an ambitious goal that I believe we can reach. Our bill will help achieve that goal by providing modest competitive grants to local governments who commit to cut unnecessary red tape and reduce permitting costs. Communities that succeed will be eligible for DOE certification as solar-friendly cities and towns, helping them attract solar business.

The grants, which are fully offset, help streamline the permitting process by: simplifying and standardizing permit forms and creating online permit applications; funding training for inspectors to help make the process more efficient; and providing modest funds for community solar projects to pilot new permitting processes.

Our bill also sets a goal, of 10 million solar rooftops by the end of the decade. We need this ambitious vision to compete for solar energy jobs. Germany installed solar in 1 million homes in the past 2 years alone. China has doubled its solar energy target to 50 gigawatts by 2020, the equivalent of 50 nuclear plants.

The bipartisan 10 Million Solar Roofs Act, supported by the Solar Energy Industries Association and the National League of Cities, will help us lower the cost of solar and create jobs, and I look forward to working with my colleagues to achieve broad support for this bill in committee.

Mr. Chairman, thank you very much.

Senator MENENDEZ. Thank you very much.

Our first panel is Mr. Steven Chalk, who is the Deputy Assistant Secretary in the Office of Energy Efficiency and Renewable Energy at the Department of Energy. He is a frequent testifier to our committee. We welcome him back.

Mr. Chalk, who don’t you go right ahead and give us the views of the Department of Energy on these 3 bills.

STATEMENT OF STEVEN G. CHALK, DEPUTY ASSISTANT SECRETARY FOR RENEWABLE ENERGY, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Mr. CHALK. OK, thank you, Senator Bingaman and other members of the committee. Thanks for the opportunity to discuss the Department of Energy's solar and geothermal energy programs. Today I'm also pleased to discuss the Department's perspective and answer questions on the Department of Energy Administrative Improvement Act, S. 1160, as well as the 10 Million Solar Roofs Act of 2011, S. 1108, and the Geothermal Exploration and Technology Act of 2011, S. 1142.

Now, the Administration is still reviewing these bills, so we don't have a formal position on any of them at this time. On solar technology, we thank the committee and the sponsors of this legislation for your strong leadership on solar technologies over the years. The Department has set an ambitious goal for solar energy with the Sunshot Initiative that Senator Sanders mentioned. Our goal is to reduce the cost of solar energy systems by 75 percent, so they're cost-competitive with other forms of energy without subsidies before the end of the decade. Under Sunshot, the Department will support research across the development pipeline from basic photovoltaics—or PV—cell technologies, to manufacturing scale-up, to total system development.

Reducing the total installed cost of utility-scale solar electricity to roughly 6 cents per kilowatt hour without subsidies will result in rapid, large-scale adoption of solar electricity across the United States. Reaching this goal will help reestablish American technological leadership, improve the Nation's energy security, and strengthen U.S. economic competitiveness in the global clean energy race.

Sunshot takes a unique approach to developing solar energy. Historically, our investments have been on achieving incremental efficiency improvements to modules, solar arrays, and so forth. Sunshot also focuses on reducing the installed cost of the entire system as a whole. For instance, in addition to investing in improvements in cell technology and manufacturing, Sunshot also focuses on the steps to reduce balance of system hardware costs, installation labor and permitting costs, which all account for about 40 percent of the total installed system price of solar electricity today. This includes efforts to streamline and digitize local permitting processes and to develop codes and standards that ensure high performance over the approximately 20- to 30-year lifetime of residential solar products.

The proposed legislation, S. 1108, employs a bottom-up approach so that local teams can identify approaches that are best suited for them. The bottom-up approach, coupled with a preference for applicants that have partnered on a regional basis with States, public utility commissions, other stakeholders, could allow not just for local, but also for regional variability, while increasing the speed and scale of installation across a large geographic area. This approach could also allow States to expand existing State programs that have been effective in promoting rooftop solar installations.

On geothermal technology, the Department is committed to developing and deploying a portfolio of innovative technologies for clean domestic geothermal generation. Geothermal energy is a renewable baseload energy resource with a small environmental footprint and emits little or no greenhouse gas emissions.

Despite geothermal's enormous potential, in 2010 only 15 megawatts of new geothermal power generation was added to the grid in the United States. There are 2 principal barriers facing the geothermal industry: the high cost and risk of exploration, and that most of the identified hydrothermal resources have already been developed.

Currently, drilling costs represent approximately 40 percent of the geothermal project development costs. The financing costs for the drilling phase are significantly higher than the financing costs for plant construction. We look forward to working with the committee to identify the opportunities to bring down these costs and risks and better utilize our domestic geothermal resources.

Finally, on S. 1160, the Department of Energy Administrative Improvement Act proposes a variety of changes intended to improve the administration of the Department of Energy. These changes address five key areas: multi-year budget submissions, modification of the department's other transaction authority; expanded direct hire and critical pay authority; protection and disclosure of transaction information; and reemployment of civilian retirees.

While the department does not have a position on S. 1160 at this time, we're happy to work with the committee to identify opportunities to enhance the administration of the Department's activities.

I thank the committee for its continued support for the Department of Energy and I'm happy to answer any questions the committee may have related to the 3 bills under discussion today.

[The prepared statement of Mr. Chalk follows:]

PREPARED STATEMENT OF STEVEN G. CHALK, DEPUTY ASSISTANT SECRETARY FOR RENEWABLE ENERGY, OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, DEPARTMENT OF ENERGY

Chairman Bingaman, Ranking Member Murkowski and Members of the Committee, thank you for the opportunity to discuss the Department of Energy's (DOE's) solar and geothermal energy programs. Today, I am pleased to discuss the Department's perspective and answer questions related to the Department of Energy Administrative Improvement Act (S. 1160), the 10 Million Solar Roofs Act of 2011 (S. 1108) and the Geothermal Exploration and Technology Act of 2011 (S. 1142). However, the Administration is still reviewing these bills and we do not have a position on any of them at this time.

SOLAR TECHNOLOGY

We thank the committee and the sponsors of this legislation for your strong leadership on solar technologies over the years. The Department has set an ambitious goal for solar energy with the SunShot Initiative (SunShot)—to reduce the total costs of solar energy systems by about 75 percent so that they are cost competitive with other forms of energy without subsidies before the end of the decade. In 2012, under SunShot, the Department will support solar research across the development pipeline, from basic photovoltaic (PV) cell technologies to manufacturing scale-up to total system development.

Reducing the total installed cost for utility-scale solar electricity to roughly 6 cents per kilowatt hour without subsidies will result in rapid, large-scale adoption of solar electricity across the United States. Reaching this goal will help re-establish American technological leadership, improve the nation's energy security, and strengthen U.S. economic competitiveness in the global clean energy race.

SunShot takes a unique approach to developing solar energy. Historically, solar investments focused on achieving incremental efficiency improvements to solar cells and arrays. SunShot focuses on reducing the installed cost of the system as a whole, including non-technical barriers. In addition to investing in improvements in cell technologies and manufacturing, the SunShot Initiative also focuses on steps to reduce installation and permitting costs, which account for 40 percent of the total installed system price of solar electricity.¹ This includes efforts to streamline and digitize local permitting processes and to develop codes and standards that ensure high performance over the approximately 20-year lifetime of residential solar products. Decreasing the installed cost of solar is one of the key goals of SunShot.

As the United States is the world's largest consumer of electricity and, at the same time, has the largest solar resource of any industrialized country, SunShot is well-positioned to help the Nation realize the significant benefits from the wide-scale use of solar energy. SunShot underscores solar energy's benefits to the United States and will have multiple positive impacts for the country, including:

- Achieving solar energy cost parity with baseload energy rates. Attaining a total installed system cost of utility solar equivalent to the wholesale cost of electricity from fossil fuels (\$0.06 per kWh) would likely result in rapid and large-scale adoption of solar electricity across the United States
- Increasing solar photovoltaic market share. As recently as 1995, the United States manufactured 43 percent of the world's PV materials, whereas today our manufacturers are only responsible for 6 percent.² Expanding the use of solar will help boost the U.S. solar manufacturing industry while driving innovation and providing long lasting, domestic jobs to support global PV demand that will represent a multibillion dollar industry
- Reducing greenhouse gas emissions—Solar technologies have the potential to significantly reduce the amount of conventional fossil-based electricity generation necessary, which in turn would reduce the amount of greenhouse gases emitted into the atmosphere.

Recently, as part of ongoing Market Transformation activities, DOE announced a Funding Opportunity Announcement (FOA) which we are calling the "Race to the Rooftop" to help standardize, streamline and digitize the permitting process, while improving interconnection and net metering standards, increasing access to financing, and updating planning and zoning codes. This national competition engaging teams of local and state governments along with utilities, installers, and nongovernment organizations, will help standardize processes, cut upfront fees and paperwork, and reduce the overall costs associated with permitting and installation, making it easier and cheaper for homeowners, businesses, and their local communities to deploy solar energy. The standardization and uniformity of local permitting efforts under the "Race to the Rooftop" are similar to the challenge grant provision in the 10 Million Solar Roofs Act, which calls for applicants to develop best practices for solar permitting.

The proposed legislation, S. 1108, employs a bottom-up approach so that local teams can identify approaches best-suited for them. A bottom-up approach, coupled with a preference for applicants that have partnered with states, public utility commissions, or other stakeholders, could allow for local and regional variability while still increasing the speed and scale of installation across large geographic areas. This approach could also allow states to expand existing state programs that have been effective in promoting rooftop solar installations.

GEOTHERMAL TECHNOLOGY

The Department is committed to developing and deploying a portfolio of innovative technologies for clean, domestic geothermal power generation. Geothermal energy is a baseload energy resource with a small environmental footprint and emits little to no greenhouse gases.

Despite geothermal's enormous potential, in 2010, only 15 MW of new geothermal power generation was added to the grid in the United States. There are two principal barriers facing the geothermal industry: the high cost and risk of exploration and most of the identified hydrothermal resources have already been developed.

Drilling costs represent approximately 42 percent of geothermal project development costs, and financing costs are significantly higher for exploratory drilling than

¹ http://www1.eere.energy.gov/solar/sunshot/pdfs/dpw_white_paper.pdf

² PV News (2/1993, 3/2001, 3/2006) and Navigant Consulting (2/2011)

for plant construction.³ Removing the obstacles to exploratory drilling is vitally important to increasing our geothermal power generation capacity. In many cases, geothermal resources have no surface expression, leaving our nation's hydrothermal potential—estimated at 30 GWe by the U.S. Geological Survey—untapped and inaccessible. Exploratory drilling could also identify resources for enhanced geothermal systems (EGS), which have the potential to produce 16,000 GWe of power in a wide range of geographic areas throughout the U.S.⁴

Under the American Recovery and Reinvestment Act of 2009 (Recovery Act), DOE invested \$97.3 million in 24 hydrothermal exploration projects, at which 34 exploration wells are planned. It is expected that from these wells, 400 MW of new resources will be confirmed by 2014.

DOE is also funding seven EGS demonstrations. At Desert Peak, Nevada, the initial stages of reservoir stimulation were successfully completed—a critical milestone in creating an enhanced geothermal reservoir.

DOE supports projects in low temperature geothermal resources as well. For example, DOE is working with industry to develop and field test a variable phase turbine which has the potential to generate 30 percent more power from low temperature geothermal resources than current power conversion technologies, at a lower cost.

DOE's National Geothermal Data System (NGDS) effort is a distributed information system for data sharing in its second year of development, which will enable the availability of comprehensive and accurate data to facilitate geothermal development. The NGDS is scheduled to be fully operational in August 2014, at which time it will make geothermal data from major geothermal centers, DOE-funded geothermal projects and state geological surveys or universities publicly available.⁵

Geothermal heat pumps (GHPs) for building applications also face barriers impeding greater marketplace adoption: high initial cost associated with the installation of the ground loop heat-exchanger, lack of consumer knowledge in GHP benefits, and limitations in GHP design and business planning infrastructure. DOE is developing a roadmap that will serve to strategically direct activities in geothermal heat pumps.

Through the Recovery Act, DOE currently funds 26 projects deploying geothermal heat pumps. \$24M of the \$58M Recovery Act funds allocated to GHPs have been spent in 15 states in both new and retrofit applications. Two projects are completed and several more are already providing data for performance analysis. The Recovery Act projects incorporate innovative business and financial strategies and/or GHP technologies and applications designed to overcome the initial cost premium that has prevented GHPs from being directly cost-competitive with other HVAC technologies, and from gaining wider marketplace acceptance.

DOE currently has projects in many of the areas identified for further RD&D and commercial application in S. 1142, including district heating and cooling at large institutions, use of hot water in shaft mines, combined GHP-solar PV and desiccant projects, and use of carbon dioxide as a refrigerant fluid for heat exchange.

The Department is also addressing other obstacles to geothermal development such as delays in the siting and permitting process which increase overall project costs and could further strain economics. Currently, it takes approximately seven years for a new geothermal project to move from exploration to power generation.

While the Administration is still reviewing the bill, there are serious technical concerns that would need to be addressed. Any new program should be consistent with applicable laws, and structured to mitigate risks and costs to the taxpayer.

S.1160—DEPARTMENT OF ENERGY ADMINISTRATIVE IMPROVEMENT ACT

S.1160 proposes a variety of changes intended to improve the administration of the Department of Energy. The Department is still reviewing this bill and does not have a position on it at this time. However, I will address Sections 4, 6, and 7 as they relate to the Department's current authority.

³ http://www.nrel.gov/applying_technologies/pdfs/46022.pdf

⁴ Augustine, Young, and Anderson, Updated U.S. Geothermal Supply Curve, National Renewable Energy Laboratory and US Department of Energy, February, 2010, <http://www.nrel.gov/docs/fy10osti/47458.pdf>

⁵ NGDS data sources include: DOE Geothermal Data Repository (Boise State University); Energy & Geoscience Institute (University of Utah); Geo-Heat Center (Oregon Institute of Technology); Stanford Geothermal Program (Stanford University); Great Basin Science Sample and Records Library (University of Nevada, Reno); SMU Geothermal Laboratory (Southern Methodist University); and state geological surveys represented by Arizona Geological Survey and the American Association of State Geologists (AASG).

Section 4

Section 4 of S.1160 concerns the administration of the Department's "Other Transactions" (OT) Authority. Section 4 is similar in many respects to DOE's current OT Authority, which is codified at Section 646(g) of the DOE Organization Act (42 U.S.C. 7256(g)). However, there are some important differences.

Currently, the Department has two kinds of OT Authority: Research OT Authority and Prototype OT Authority. Research OT Authority is used to carry out a public purpose of support or stimulation (e.g., RD&D projects). By contrast, Prototype OT Authority is used for the preacquisition development of technology prototypes. Such prototypes are used to evaluate the technical or manufacturing feasibility or utility to DOE's mission of a particular technology, process, concept, end item, or system.

Section 4 provides DOE with permanent and independent OT Authority similar to the authority Congress provided the Defense Department in 1991. However, the precise scope of DOE's OT Authority is left undefined in S.1160.

Additionally, Section 4 of S.1160 requires the Secretary to determine that "the use of a standard contract, grant, or cooperative agreement for the project is not feasible or appropriate" before the Department's OT Authority can be used. Section 4 restricts the delegation of this authority to officials "appointed by the President and confirmed by the Senate."

Section 6 and 7

Section 6 of S.1160 provides the Secretary with direct hire authority for "highly qualified scientists, engineers, or critical technical personnel" for two years following the enactment of the Act. Similarly, Section 7 provides the Secretary with special hiring and pay authority for persons with "expertise in an extremely high level in a scientific or technical field." The Secretary's authority under Section 7 is permanent, but not more than 40 persons may be hired under this authority at any time.

Sections 6 and 7 are analogous to Sections 621(b) and (d) of the DOE Organization Act (42 U.S.C. § 7231(b)-(d)). Section 621(b), which expired after four years, allowed the Secretary to appoint 311 scientific, engineering, and administrative personnel without regard to civil service laws and to fix their compensation at "super grades" (formerly GS-18, now Executive Level IV). Section 621(d), which is still in effect, authorizes the Secretary to appoint 200 scientific, engineering, professional, and administrative staff without regard to civil service laws, but subject to a GS-18 pay cap (now Executive Level IV).

Additionally, Congress granted the Department's ARPA-E program special hiring authority. The Director of ARPA-E has the authority to make appointments of scientific, engineering, and professional personnel "without regard to the civil service laws," "fix the basic pay of such personnel" up to Level II of the Executive Schedule, and provide "additional payments" up to a certain cap.

CONCLUSION

In conclusion, I would like to again thank this Committee for its leadership in supporting both solar and geothermal energy technologies.

It is important to tap valuable assets like solar and geothermal energy to continue growing our economy to expand the Nation's clean energy portfolio and energy security.

I would be pleased to address any questions the Committee might have.

The CHAIRMAN. Let me start with some questions. I guess the first question would be on this Sunshot Initiative that you've talked about and the idea that you have or the main purpose of it as I understand from your testimony is to standardize and bring uniformity to permitting for the installation of solar panels. How do you see that relating to the bill that we're talking about today, that Senator Sanders has introduced? What concrete steps are you planning to take to bring about that standardization and uniformity in the way that these solar installations are permitted?

Mr. CHALK. The steps that we plan to take are very, very consistent with the bill as written. Let me explain a little bit about the problems we're trying to solve here. These soft costs as SunRun will testify later today—amount to approximately 33 percent of the costs of a solar installation. So it's not just the hardware, the module, and the installation, but going through the local jurisdiction for

permitting—and in the United States, there are 18,000 local jurisdictions. They have land use laws, zoning ordinances. There are over 5,000 utilities with different interconnection and net metering standards.

So we're trying to harmonize local standards as much as possible. Rather than having a top-down approach where the Federal Government sets these standards, we want to set them on a regional basis. So we now have out a solicitation to do just that, covering permitting and interconnection. We're looking for transparency, consistency, and most above all expediency in permitting solar installations. The solicitation also covers net metering standards. We actually have a third party that's going to grade the regions on how well they do net metering and how well they have standardized processes for interconnection.

Financing options are another soft cost, because other than self-financing there are other ways to finance solar energy through third parties, but they have legal issues associated with them. Then finally, planning and zoning are also soft costs. So through this solicitation—

The CHAIRMAN. Let me ask, on the solicitation, who are you soliciting and what are you soliciting them to do?

Mr. CHALK. We're soliciting local governments to team with public utility commissions, State governments, perhaps utilities, all to work together in various regions to come up with streamlined digitized web-based processes for siting and permitting and interconnection, so we can speed that up and reduce the cost, which approximately 33 percent today, given some references, to under the Sunshot Initiative, those costs would fall to about 10 percent of the total cost.

The CHAIRMAN. But that's not in any way insisting that anyone standardize their planning process or make it uniform with anyone else's planning process, the way I'm understanding you.

Mr. CHALK. Not initially. In the first phase we're asking each region to develop best practices. When we get to phase 2, we'll start sharing those best practices and perhaps we'll have some harmony nationally. Perhaps it will be specific examples that are going to drive different standards. But we hope to have large metropolitan areas harmonized, so that the solar developers in that area know with certainty what's expected of them when they're trying to site and install a solar installation, so they're not having to deal, as I said, with thousands of different jurisdictions.

The CHAIRMAN. Let me switch and ask a question on this geothermal heat pump issue. One of the concerns I have had is that whenever we have a hearing related to geothermal it's always about how much, how many megawatts of energy we're able to produce from geothermal sources, and it's all focused on power generation from geothermal sources.

As I understand, in many countries geothermal heat pumps have been used as a way to essentially lower the amount of natural gas having to be used for regular building heating and cooling, and that to me seems like a much greater potential or opportunity for us with geothermal heat pumps than constantly focusing on how we can generate more power with large geothermal projects.

So I don't know—to what extent are you folks in the Department of Energy focused on expanding the use of geothermal heat pumps in residences and commercial facilities?

Mr. CHALK. Under the Recovery Act, we were fortunate to invest about \$62 million in geothermal heat pumps. We have approximately 35 demonstrations going on right now, most of which are for very large buildings: universities, prisons, local governments. We are now collecting data which we hope to use to increase consumer awareness, because geothermal heat pumps can achieve about 50 to 60 percent energy savings. So it's a way of saving natural gas. It's also very cost effective for propane or fuel oil, which you tend to get in remote areas.

Our program looks at it as building technology, so we're weighing various options. Ground source heat pumps are one option. We're also looking at improving air source heat pumps, which can be very cost competitive. With ground source heat pumps, the challenge is, like many efficiency and renewable technologies, their up-front costs which sometimes can be 3 times those of an air source heat pump that's more readily available.

One of the challenges with geothermal is retrofitting the building to make it compatible. If a person's heat pump breaks down or they need heating or cooling though, they want it in a matter of days or sometimes hours. But geothermal heat pumps are a very good application for large commercial buildings, like universities, or new construction.

First cost and the cost of drilling equipment is really a challenge with ground source heat pumps. So we need to do additional research to lower that cost.

The CHAIRMAN. Senator Sanders.

Senator SANDERS. Mr. Chairman, thank you.

Mr. Chalk, thank you for the work you're doing, and please convey my appreciation to Secretary Chu for the outstanding work that you guys are doing in this whole area.

Mr. Chairman, I wanted to mention just something to you. Yesterday, yesterday we did an event in Burlington, Vermont, and we highlighted five energy programs around the State. Let me give you an example of what's happening and what the potential is. A low-income school in Burlington, Vermont, called the Bond School, as a result of energy efficiency and geothermal—and soon they're going to add solar—they have cut their fuel bills by 75 percent, 75 percent in a cold weather State. That is not insignificant.

A few blocks away on the other side of town, we have a college called Champlain College which has invested heavily in geothermal. It is a huge success story, significant reduction in their fuel bills.

In terms of solar, in the southern part of our State we have a company called Ivek, a manufacturing company, Mr. Chairman, a manufacturer, 60 employees. As a result of the installation of PV, they are producing 90 percent of the electricity they require in a manufacturing facility.

So we are seeing in Vermont—and I suspect that same story is being told all over the country, about major, major breakthroughs in sustainable energy. I applaud the Department of Energy very much for the work that they are doing.

Mr. Chalk, I was very impressed by your remark that you thought within a reasonably short period of time, if we get legislation passed like this 10 Million Solar Roofs, which will cut back on the cost of permitting, that you think we can get solar down to 6 cents a kilowatt? Is that what you were saying?

Mr. CHALK. The levelized cost of energy of a dollar a watt, which is our goal, is equivalent to 6 cents per kilowatt hour, which is really competitive with conventional baseload energy generation from coal.

Senator SANDERS. Just out of curiosity, if I wanted to build a new nuclear power plant, which I don't, but if I did, how much would that cost me, do you think, comparatively speaking?

Mr. CHALK. That's outside of my expertise, but we feel we need to compete with conventional alternatives that are there now.

Senator SANDERS. Let me just say for the record, I believe that's about half. We think the new nuclear might be 10 or 12 cents and we're talking about 6 cents. So the potential here is enormous.

Let me just ask you, Mr. Chalk. I understand that the DOE is currently under the Sunshot Initiative aiming to pilot some best practices on solar permitting through the Rooftop Solar Challenge. In your view, would the authorization provided in 10 Million Solar Rooftops Act for competitive grants help scale up local government adoption of these best practices on permitting?

Mr. CHALK. Absolutely it does. Again, our solicitation is very, very consistent with this legislation. We believe that if we don't address local government permitting practices, we will not achieve the Sunshot goals. It's more about the module and the power electronics. It's also about what we call soft costs. So we have to address this. It has not really been addressed in the DOE program to date.

Senator SANDERS. I know this is something Secretary Chu has often talked about, is that correct?

Mr. CHALK. Yes.

Senator SANDERS. Mr. Chalk, as you know, this legislation incorporates the goals of the Sunshot Initiative to reduce solar energy costs. Can you speak to how we get from where we are today with solar installation costs ranging from what I understand is about \$4 per watt for commercial systems to 5.50 or \$6 per watt for residential to the Secretary's goal of a dollar per watt by 2020 and how permitting reforms can play a role in that process?

Mr. CHALK. Yes. Overall, no matter what application we're talking about, whether it's utility, which costs a dollar a watt because it's on a large scale of 20 or 40 megawatts, or commercial or residential, we need to decrease the cost by 75 percent. So we've developed a road map that divides up what we're going to do in the module area, in the power electronics area, and in the balance of system.

The balance of system is not just the soft costs of permitting and siting and so forth, it's also the mounting, it's developing a method to install solar technologies at scale to really reduce costs. The scale is really what's going to allow you to get to our goals.

We have a road map in each of these 3 key areas and we have solicitations out now asking folks from industry and academia for proposals to address each of these areas. Each of these areas has

very concrete metrics to measure progress, milestones. Everything is in a metric of a dollar per watt, even some of these soft costs, where we have goals for what goes on in siting and permitting. When we ask for proposals from these regions, they're going to have to give us a score sheet of where they are now in terms of dollar per watt and then where they think they can be in 2 or 3 years.

So all of this is very, very hard driven toward this dollar a watt goal for utility systems.

Senator SANDERS. Mr. Chairman, thank you very much.

Mr. Chalk, thank you.

The CHAIRMAN. Thank you.

Senator Franken.

Senator FRANKEN. Thank you, Mr. Chairman.

A couple of questions that I was going to ask, really the chairman at least broached, on trying to get solar information-sharing so that municipal authorities don't have to sort of reinvent the wheel every time. I understand that DOE plans to do this through the Sunshot Initiative. I can go into more detail on that.

Is there going to be a national common application for—developed to streamline all of this?

Mr. CHALK. That would be ideal, but recognizing that each jurisdiction or region may be different, it may be best for 90 percent of it to be standard. There's a balance between asking the regions to request the information that they need to make their decisions and the Federal Government as making top-down decisions.

So we'll hopefully have something nationwide that's automated and web-based, so that we're not filling out forms and things like that.

Senator FRANKEN. The streamlining of the process.

Mr. CHALK. Right, streamlining. But it'll be up to the jurisdictions to decide how much they want to adopt best practices from other regions.

Senator FRANKEN. Following up also on the chairman's question about geothermal pumps, in Minnesota we don't have geothermal resources for these large-scale geothermal projects that the chairman was referring to, that you guys were talking about. But we use geothermal in the ways that you then start talking about, which is like for residential and for larger facilities. I think you mentioned prisons and other, manufacturing or schools and stuff.

There's a company called ECONAR in Minnesota that's been at it for years and I visited them a while ago and they're doing very good business in residential. It made me think about something that I saw in southern Minnesota. There's a company called McQuay and they make air conditioners and they're one of the biggest air conditioner companies in the world. They're doing the air conditioners for the World Trade Center. This is in Faribault, Minnesota.

You brought up the up-front costs on geothermal as a problem. But you said that it saves an incredible amount on the use of propane or whatever is used, so that there's a savings once the up-front costs are paid. What McQuay does is they make these incredibly efficient air conditioner units and, because they're such a big and creditworthy company, they borrow money from banks, they

lend the money to the commercial buildings that they're selling to or whatever they are. Then that company uses the loan to buy the unit from McQuay, put people to work installing the thing, building the thing. It's like jobs. These units pay for themselves in 3 to 5 years.

So the company pays back the loan it took and pays it off in 3 to 5 years and the rest is gravy, and it's gravy, gravy, gravy. It's win-win-win.

Now, what I'm wondering is is there a model like this, with \$2 trillion sitting on the sidelines that we hear about all the time, is there a model to be right now making sure that we are investing in things like geothermal and investing in these things that we have a proven, have a proven return on investment, where we can not spend Federal money, but we can leverage private money to have companies make their buildings, their commercial factories, their institutions, more energy efficient, get people working making these systems, installing these systems, pay for it with the energy savings, have a win-win-win situation?

Has there been any effort to try to find a model, not like this McQuay model, so that we are making America more efficient and we are getting people working and it's paying for itself?

Mr. CHALK. I mentioned the high up-front costs. What I wasn't very clear about was—and you made this point—over a life cycle, these things pay for themselves in 5 years, 8 years. Sometimes it may be up to 20 depending on the climate. It's very climate-sensitive in this case with ground-source heat pumps and it's very sensitive to the price that you're paying for electricity.

But they do pay for themselves, if you look at a life cycle cost basis. There are government instruments like loan guarantees that people could utilize if they could show they had the orders. They could also go to a bank and get that financing.

What we're doing in our building efficiency sector right now—not specifically for geothermal heat pumps, but we're looking to find those private models for activities like weatherization where we're trying to increase home efficiency. If you aggregate enough orders—weatherizing a whole neighborhood for example—it will help you get to the necessary scale. We're experimenting right now with those models in the building efficiency area, which could include ground source heat pumps, but they're not exclusively geared toward ground source heat pumps. They would be geared toward insulation, higher efficiency HVAC equipment across the board, hot water systems and so forth.

But we're doing that in our buildings program right now, and I expect over the next 12 months that we're going to have a lot of data to share with people. Most of these programs are very, very highly leveraged with the private sector, so we're trying to do the pilot so the industry can stand up itself.

Senator FRANKEN. My time is up. But I guess what I'm saying is, in this budget climate, if we can find ways to duplicate the model I'm talking about, in which there's absolutely no Federal money being spent, none, zero, zip, and yet people being put to work and energy being saved, that would be wonderful.

The CHAIRMAN. All right. Mr. Chalk, thank you very much. We appreciate your testimony and we will go on to the second panel.

Mr. CHALK. OK, thank you.

The CHAIRMAN. The second panel is made up of 2 witnesses: Mr. Douglas Dougherty, who is the President and CEO of the Geothermal Exchange Organization in Springfield, Illinois; and Ms. Holly Gordon, who is Vice President of Legislative and Regulatory Affairs with SunRun Inc. in San Francisco. We very much appreciate both of them being here.

Mr. Dougherty, why don't you go ahead and give us the main points that you think we should understand. We will include your full statement in the record as if read, but give us your views, and then we'll call on Ms. Gordon.

**STATEMENT OF DOUGLAS A. DOUGHERTY, PRESIDENT AND
CEO, THE GEOTHERMAL EXCHANGE ORGANIZATION**

Mr. DOUGHERTY. Good morning. I am Doug Dougherty, President and CEO of the Geothermal Exchange Organization, a nonprofit trade association representing the U.S. geothermal heat pump industry. On behalf of GEO and our more than 200 members, I would like to thank Chairman Bingaman, Ranking Member Murkowski, and the other distinguished members of the committee for the opportunity to share our views on S. 1142, the Geothermal Exploration and Technology Act.

GEO strongly supports S. 1142 and its many provisions to expand the use of geothermal energy. We are especially interested in those that deal with geothermal heating and cooling technologies. A geothermal heat pump is a 50-State clean, renewable energy technology that uses solar energy stored just below the Earth's surface to heat and cool residential and commercial buildings and to provide hot water.

Let me briefly describe how the technology works. Unlike conventional systems that use the outside air to take and release heat, geothermal heat pumps transfer heat from and to the ground. They do that through closed loops of fluid-filled plastic pipes buried either horizontally or vertically in the ground below the frost line, where the temperature is consistently between 40 to 75 degrees year-round.

While a conventional air source heat pump struggles to scavenge heat from freezing winter air or dump it into the summer swelter, the ground source heat pump utilizes the constant temperature for fluid circulating through its loop in the ground. Once installed, the ground loop lasts indefinitely and the inside unit has a life span of greater than 20 years.

Geothermal heat pumps use 20 to 50 percent less electricity than conventional heating or cooling systems and, according to the Environmental Protection Agency, they can reduce energy consumption and corresponding emissions by 44 to 72 percent compared to traditional heating and cooling equipment.

Geothermal heat pumps are a fully scaleable technology. They are effective in residential homes and commercial buildings. The largest project in the country is currently under way at Ball State University in Indiana, where more than 4,000 bore holes will host ground loops to heat and cool 45 buildings for an annual energy savings of \$2 million per year.

Despite the well documented energy efficiency, our industry is still relatively nascent, with less than 5 percent market penetration for new construction. GEO agrees with Senators Tester and Murkowski that geothermal heat pumps can make a significant contribution to the use of renewable energy, but are under-represented in research, development, demonstration, and commercialization.

The primary barriers to expanding the industry include: a lack of consumer awareness; high initial cost, primarily due to the installation of the underground loop; a need for more qualified design and installation professionals; a need for builders, developers, realtors, lenders, and appraisers to value energy savings; and a lack of a home at DOE.

GEO is pleased that the geothermal heat pump effort specified in S. 1142 will focus on cost, a key barrier to wider geothermal heat pump installations, and we agree that the research should be directed at improving ground loop efficiency through more efficient heat transfer fluids and thermal grouts, better loop design, and improved variable pumping rates, reducing ground loop installation costs through improved drilling techniques and equipment, exploring innovative uses of wastewater and mine water for geothermal systems, demonstrating the viability of large-scale commercial and residential neighborhood projects, and integrating geothermal with solar systems to balance loads and to store energy.

The Geothermal Exploration and Technology Act will help drive down the cost of installing geothermal heat pumps. It will also fuel a U.S.-based industry that generates thousands of jobs. The installation of ground loops create well-paid jobs not found in the conventional heating, ventilation, and air conditioning industry. We estimate that expanding our industry by ten times to create one million installations per year by 2017 would create more than 100,000 new well-paying jobs.

S. 1142 will help us reach this goal by making geothermal heat pumps more affordable and further demonstrating the efficiency of the technology in large-scale projects. GEO strongly urges the committee to support this legislation.

We also hope to work with the committee to address the other barriers that have limited the growth of our industry, particularly the lack of a home for our industry at the Department of Energy. Over the years we have been moved from one program to another within the Office of Energy Efficiency and Renewable Energy. We believe that it's important for the Department to have a dedicated staff to promote geothermal heat pumps and to provide technical assistance to other agencies such as the Environmental Protection Agency, the Department of Defense, the Department of Education, the National Park Service, and the General Services Administration that are all considering geothermal heat pump projects.

Thank you for the opportunity to testify this morning, Mr. Chairman.

[The prepared statement of Dougherty follows:]

PREPARED STATEMENT OF DOUGLAS A. DOUGHERTY, PRESIDENT AND CEO, THE
GEOHERMAL EXCHANGE ORGANIZATION

Good morning. I am Doug Dougherty, President and CEO of the Geothermal Exchange Organization, a non-profit trade association representing the U.S. geothermal heat pump industry.

On behalf of GEO and our more than 200 members, I would like to thank Chairman Bingaman, Ranking Member Murkowski, and the other distinguished members of the Committee for the opportunity to share our views on S. 1142, the Geothermal Exploration and Technology Act.

GEO strongly supports S. 1142 and its many provisions to expand the use of geothermal energy. We are especially interested in those that deal with geothermal heating and cooling technologies.

A geothermal heat pump is a 50-State, clean, renewable energy technology that uses solar energy stored just below the earth's surface to heat and cool residential and commercial buildings and to provide hot water.

Let me briefly describe how the technology works. Unlike conventional systems that use the outside air to take and release heat, geothermal heat pumps transfer heat from and to the ground. They do that through closed loops of fluid filled, plastic pipes buried either horizontally or vertically in the ground below the frost line where the temperature is consistently between 40 to 75 degrees year round. While a conventional air source heat pump struggles to scavenge heat from freezing winter air or dump it into the summer swelter, the ground source heat pump utilizes that constant temperature for fluid circulating through its loop in the ground. Once installed, the ground loop lasts indefinitely and the inside unit has a lifespan of greater than 20 years.

Geothermal heat pumps use 25 to 50 percent less electricity than conventional heating or cooling systems, and according to the Environmental Protection Agency, they can reduce energy consumption—and corresponding emissions—by 44 to 72 percent compared to traditional heating and cooling equipment.

Geothermal heat pumps are a fully scalable technology. They are effective in residential homes and commercial buildings. The largest project in the country is currently underway at Ball State University in Indiana, where more than 4,000 boreholes will host ground loops to heat and cool 45 buildings, for annual energy savings of \$2 million per year.

Despite the well-documented energy efficiency, our industry is still relatively nascent, with less than a five-percent market penetration for new construction. GEO agrees with Senators Tester and Murkowski that geothermal heat pumps can make a significant contribution to the use of renewable energy but are underrepresented in research, development, demonstration, and commercialization.

The primary barriers to expanding the industry include: lack of consumer awareness; high initial cost, primarily due to the installation of the underground loop; need for more qualified design and installation professionals; need for builders, developers, realtors, lenders, and appraisers to value energy savings; and lack of a "home" at DOE.

GEO is pleased that the geothermal heat pump efforts specified in S. 1142 will focus on cost, a key barrier to wider geothermal heat pump installations. We agree that research should be directed at:

- Improving ground loop efficiency through more efficient heat transfer fluids and thermal grouts, better loop design, and improved variable pumping rates;
- Reducing ground loop installation cost through improved drilling techniques and equipment;
- Exploring innovative uses of wastewater and mine water for geothermal systems;
- Demonstrating the viability of large-scale commercial and residential neighborhood projects; and,
- Integrating geothermal with solar systems to balance loads and to store energy.

The Geothermal Exploration and Technology Act will help drive down the cost of installing geothermal heat pumps. It will also fuel a U.S.-based industry that generates thousands of jobs. The installation of the ground loop creates well-paid jobs not found in the conventional heating, ventilation, and air conditioning industry. We estimate that expanding our industry 10 times—to a million installations per year—by 2017 would create more than 100,000 jobs.

S. 1142 will help us reach this goal by making geothermal heat pumps more affordable and further demonstrating the efficiency of the technology in large scale projects. GEO strongly urges the Committee to support this legislation.

We also hope to work with the Committee to address the other barriers that have limited the growth of our industry, particularly the lack of a home for our industry at the Department of Energy. Over the years, we have been moved from one program to another within the Office of Energy Efficiency and Renewable Energy. We believe it is important for the Department to have dedicated staff to promote geothermal heat pumps and to provide technical assistance to other agencies such as the Environmental Protection Agency, Department of Defense, Department of Education, National Park Service, and the General Services Administration that are considering geothermal heat pump projects.

Thank you again for the opportunity to testify this morning.

The CHAIRMAN. Thank you very much.
Ms. Gordon, please go ahead.

**STATEMENT OF HOLLY GORDON, VICE PRESIDENT,
LEGISLATIVE & REGULATORY AFFAIRS, SUNRUN, INC.**

Ms. GORDON. Chairman Bingaman, Ranking Member Murkowski, and members of the committee: I appreciate the opportunity to testify on behalf of SunRun in support of the 10 Million Solar Roofs Act of 2011, also known as S. 1108. As the fastest growing company in the United States residential solar industry, SunRun applauds the bill's aims to reduce installation costs of residential solar systems by reducing soft costs associated with wide variations in local permitting processes.

A recent study authored by SunRun and other solar industry leaders shows permitting costs at the local level are equivalent to a \$1 billion tax on the solar industry over the next 5 years. SunRun believes that the bill's provisions represent the most efficient way to mitigate unnecessary costs, cut through the red tape, and give solar the ability to fairly compete with other energy technologies on the open market.

SunRun is the largest owner of residential solar in the United States, with over 11,000 customers and operations in 9 States as of today. This morning we announced our launch in the Maryland market. We're very excited to be in the D.C. Metro area and we are actively looking at a number of additional States.

SunRun offers a solar power service, typically referred to as a lease or power purchase agreement, known as a PPA, which allows homeowners to get solar energy without a big up-front investment and pay for the energy as it is produced. SunRun monitors, maintains, and insures the solar system for no additional cost to the homeowner. We currently invest a million dollars a day in solar energy systems and install 3 megawatts per month.

However, SunRun's ability to enter new markets, increase investment dollars, and offer competitive long-term rates for clean solar energy is dependent on reducing the cost of solar installations. While a number of factors have dramatically reduced the cost of solar projects, there are still many costs associated with purchasing and installing residential solar systems.

The cost of residential solar systems can range from \$15,000 to upwards of \$60,000. This includes fees for panels, construction, interconnection, and permitting, which vary widely among States and municipalities. SunRun has found that, while panel prices have come down significantly over the last 5 years, permitting costs have stayed high.

Germany, France, and Japan have all eliminated permitting fees for residential solar installs and have costs up to 40 percent lower

than the United States. If we could reduce these permitting costs, the price homeowners would have to pay for solar products like SunRun's would correspondingly drop and the size of the addressable market for such products would proportionately increase.

SunRun commissioned AECOM, an independent third party, to analyze the fiscal impacts on State and local governments and the economic impacts on State and regional economies that a streamlined permitting regime would provide. While the study is not yet complete, preliminary numbers show that in California alone a streamlined planning regime would add over 130,000 residential solar systems, equal to approximately 730 megawatts, resulting in 4,000 new jobs between 2012 and 2020.

The bulk of these permitting costs come from local processes and variations in local processes, not from the electrical code itself. Inefficient local processes waste time and money and local variation forces installers to spend time and money customizing plans for each jurisdiction. According to the Solar American Board for Codes and Standards, or Solar ABCs, standardizing this process makes sense because most installations share many similarities of design that allow for a nationally standardized, expedited permit process.

However, jurisdictions often design cumbersome processes to account for the minority of complicated installations that require more in-depth review. A streamlined, consistent process for basic installations, like the common application for college admissions, eliminate waste and variability across jurisdictions.

The Department of Energy is funding development of these standards through the Solar ABCs to allow jurisdictions to streamline permitting for most installations while following code and maintaining safety. This simplified process, combined with process improvements such as imposing fair fees, allowing for email submission, and providing faster turnaround and less inspection waiting time, will help reduce unnecessary costs and delays.

The Department of Energy has also taken a first step in addressing local regulatory barriers. The Sunshot Initiative's Rooftop Solar Challenge will gather examples of best practices for local permitting.

S. 1108 enables the critical second phase of establishing industry best practices by authorizing a scaleable program to focus on streamlining and standardizing local permitting processes across more communities.

In closing if our goal is to increase the deployment of solar installations by decreasing costs and eventually achieving grid parity, we believe that reducing unnecessary red tape and costs associated with local permitting represents the lowest hanging fruit in our efforts to get there.

Germany currently holds a 40 percent cost advantage over the U.S. for solar installations and it's clear that the U.S. permitting costs are the major driver of that difference. In discussions with experts on the permitting process, there does not seem to be a specific technical or policy reason why jurisdictions cannot agree to the same procedures. Permitting costs are immune from price reduction activities that the solar industry is driving, such as making technology advances and installation practice improvements, and therefore should be a top priority for our government.

Thank you for the opportunity to discuss this bill with the committee today and I look forward to answering any questions you may have.

[The prepared statement of Ms. Gordon follows:]

PREPARED STATEMENT OF HOLLY GORDON, VICE PRESIDENT, LEGISLATIVE & REGULATORY AFFAIRS, SUNRUN, INC.

Chairman Bingaman, Ranking Member Murkowski, and Members of the Committee, I appreciate the opportunity to testify before the Committee on behalf of SunRun, Inc., in support of the 10 Million Solar Roofs Act of 2011, S. 1108. As the fastest growing company in the residential solar industry in the United States, SunRun would first like to applaud the bill's aim to reduce installation costs of residential solar systems by reducing "soft costs" associated with wide variations in local permitting processes. As documented in a study authored by SunRun and other leaders in the solar industry, and covered by major media outlets around the country, permitting costs at the local level are equivalent to a \$1 billion tax on the solar industry over the next five years. (The report and several articles about the report are attached at the end of this testimony).^{*} SunRun believes that the provisions included in this bill represent the most efficient way to mitigate these unnecessary costs, cut through the red tape, and give solar the ability to fairly compete with other energy technologies on the open market.

SunRun is the largest owner of residential solar in the United States with over 11,000 customers and operations in Arizona, California, Colorado, Hawaii, Massachusetts, New Jersey, Oregon, and Pennsylvania. We are actively considering launching operations in a number of other states. SunRun offers a solar power service typically referred to as a lease or Power Purchase Agreement (PPA), which allows homeowners to get solar energy without a big upfront investment, and pay for the energy as it is produced. SunRun monitors, maintains and insures the solar system for no additional cost to the homeowner. SunRun currently invests \$1 million per day in solar energy systems and installs 3 MW per month. However, SunRun's ability to enter new markets, increase the investment dollars, and offer competitive long-term rates for clean solar energy is dependent on reducing the cost of solar installations.

While decreasing panel prices, efficiencies in the installation process, and creative financing structures like SunRun's have already dramatically reduced the cost of solar projects, purchasing and installing solar systems on residential roofs still requires high upfront costs. Even with existing federal and state incentive programs, the cost for residential solar systems can range from \$15,000 to upwards of \$60,000. These costs are attributed to the cost of panels and other hardware components, construction costs, interconnection fees, and permitting fees, which vary widely from state-to-state and municipality-to-municipality, as well as marketing costs. In the study referenced above, and released earlier this year, SunRun found that while panel prices have come down significantly over the last 5 years, permitting costs have stagnated. In 2007, local permitting and inspection added 13% to what a homeowner would spend on panels, today they add 33% and within a few years, they will add 50%. Other countries like Germany, France, and Japan have eliminated permitting fees for residential solar installs and have installation costs up to 40% lower than the United States.

The average "turnkey price" per watt to install residential solar is the baseline metric SunRun uses to assess the financial impact of permitting. The higher the turnkey price, the greater the electricity rate (measured in kilowatt hours (kwhs)) PPA providers, such as SunRun, must charge its customers. High turnkey prices limit the size of the solar market because solar companies are best able to sell to homeowners when the price for clean energy is at or below their current utility rate. The residential solar industry's addressable market grows or shrinks based on the relationship between the turnkey prices, as expressed in a cents-per-kwh rate, and the cost of traditional utility electricity. A reduction in the permitting cost component of the turnkey price will increase the number of economically viable solar homeowners and the amount of savings each homeowner will realize from investing in a solar system.

As a growing solar company, SunRun cannot understate the positive economic impact of this increase in the number of economically viable solar homeowners and savings achieved by the homeowner through investment in solar. SunRun commis-

^{*}Documents have been retained in committee files.

sioned AECOM,¹ an independent third party, to analyze the fiscal impacts on state and local governments and the economic impacts on state and regional economies that a streamlined permitting regime would provide. While the study is not yet complete,² AECOM provided a draft indicating that in California alone, a streamlined permitting regime would add over 130,000 residential solar systems (approximately 730 MW), resulting in 4,000 new jobs between 2012-2020. In addition, the study will analyze fiscal impacts such as additional sales, property, and payroll tax revenue to state and local governments as well as other direct, indirect, and induced economic effects.

The bulk of these permitting costs come from local processes and variation in local processes, not from the electrical code itself. Inefficient local processes waste time and money, and local variation forces installers to spend time and money customizing plans for each jurisdiction. According to the Solar America Board for Codes and Standards (Solar ABCs), an organization funded by the Department of Energy (DOE), standardizing this process makes sense because most installations are relatively similar and “share many similarities of design... that allow for a nationally standardized expedited permit process.” However, jurisdictions often design cumbersome processes to account for the minority of complicated installations that require more in-depth review.

A streamlined, consistent process for basic installations, like the “Common Application” for college admissions, will eliminate waste and variability across jurisdictions. DOE has already funded development of these standards through the Solar ABCs to allow jurisdictions to streamline permitting for most installations while following code and maintaining safety. Jurisdictions can use this process to simplify the structural and electrical review of a small PV system project and minimize the need for detailed engineering studies and unnecessary delays. In addition, jurisdictions can make process improvements, such as imposing fair fees, allowing for email submission, and providing faster turnaround and less time waiting on site for inspections, to reduce unnecessary cost and delay.

In addition, DOE has taken a first step to gather examples of best practices for local permitting through the DOE SunShot Initiative’s Rooftop Solar Challenge. The Rooftop Solar Challenge will be collecting examples of best practices from over 25 local and regional entities in order to give the industry a better understanding of the permitting landscape. This effort represents DOE’s first phase in addressing local regulatory barriers, and the “Ten Million Solar Roofs Act of 2011” enables the critical second phase of establishing industry best practices by authorizing a scalable program to focus on streamlining and standardizing local permitting processes for solar installations across many more communities.

In closing, if our goal is to increase the deployment of solar installations by decreasing costs and eventually achieving grid parity, we believe that reducing the unnecessary red tape and costs associated with local permitting represents the lowest hanging fruit in our effort to get there. Germany currently holds a 40% cost advantage to the U.S. for solar installation costs, and it is clear that permitting costs in the U.S. are a major driver of that difference. In discussions with experts on the permitting process, there does not seem to be a specific technical or policy reason why jurisdictions cannot agree to the same procedures. Permitting costs are immune from price reduction activities that the solar industry is driving (such as making technology advances and installation practice improvements), and therefore should be a top priority for our government.

Thank you for the opportunity to discuss this bill with the Committee today, and I look forward to answering any questions you may have.

The CHAIRMAN. Thank you very much.

Mr. Dougherty, let me ask you first, and this demonstrates my ignorance of what I’m asking about here. But you point out in your testimony that the Department of Energy ought to do more to provide technical assistance to other agencies, such as the Energy Protection Agency, Department of Defense, Department of Education, National Park Service, GSA, that are considering geothermal heat pump projects.

One of the successes, I think, that we’ve been able to legislate over the last decade or so is the provisions for energy-saving per-

¹www.aecom.com

²We anticipate the study to be complete before the end of July, 2011 and will submit it as part of the record for S. 1108.

formance contracts. A lot of government agencies enter into those energy-saving performance contracts in a way that works for the taxpayer, works for the agency, works for the private sector that does the installation.

Are you using energy-saving performance contracts? Are developers coming in, members of your association, and doing this kind of geothermal heat pump installation through energy-saving performance contracts for Federal agencies?

Mr. DOUGHERTY. Mr. Chairman, I don't know specifically the answer to that question. I'd be happy to research it with my members. I do know I have several members that have done Department of Defense retrofits of existing facilities with geothermal heat pumps, but I don't know if it was under that contract that you referred to. But I'd be happy to research that and get back to staff.

The CHAIRMAN. How extensive is the use of this technology by the Department of Defense, for example, or by the National Park Service, for example?

Mr. DOUGHERTY. It's growing. I would like to use the example of the educational institutions that Senator Sanders referred to. We have hundreds of examples of schools that have retrofitted with geothermal heat pumps, and we're currently working with the Department of Energy and the Environmental Protection Agency on a new initiative called a Green Ribbon School Initiative, recognizing those schools that put in energy efficiency equipment and technologies and, furthermore, put the teaching of energy efficiency and renewables into the curriculum within that school. We support that. We're working with them on a national webinar that will be broadcast in the fall to all school administrators across the country highlighting the benefits of retrofitting a school with geothermal heat pumps.

The other example is many schools that were built in the 1950s and 1960s do not have air conditioning, and we've got examples of schools that retrofitted a school and now they can heat and cool their building for summer school, all year round classes, less than what it was just to heat the building. So as those are adopted school by school, we're seeing a real initiative by the Department of Education to promote retrofitting schools with geothermal heat pumps.

The CHAIRMAN. OK. Now, does the Department of Education have a specific program with dedicated funding to do this promotion, or is this just having press conferences and urging people to do it?

Mr. DOUGHERTY. No, I think it's a credible program. I don't believe there's any money involved, but what it is, it's an awareness program for school administrators that are looking to save money, because if you can reduce the energy cost of the school building, the thermal load of that building, that's extra dollars to be put into the education of those children through computers and teacher salaries and hiring new people.

So I think it's very important for school administrators to understand the newer technologies. My point would be that if the Department of Education were to contact the Department of Energy, I don't know that the Department of Energy actually has the resources and the references and the documentation that can prove

what we're saying in terms of the data that we have internally within the industry. I don't know that the Department of Energy has that dedicated staff to be able to articulate the benefits of installing that technology in a school building.

The CHAIRMAN. Ms. Gordon, let me ask you a question. I guess I'm concerned, after hearing Mr. Chalk's testimony, that we're encouraging local entities to develop these permitting processes and get up to speed and find ways to streamline, and then the second stage is going to be focusing on standardizing that. It seems to me that we might have the stages backward, that it would make more sense to put in place some standardization before we get everybody too far down the road developing their systems in this area.

Am I missing something there? It just strikes me we're likely to have a lot of ownership on the part of all of these entities and governmental entities around the country that have developed their permitting processes, and then we're coming in during the second stage and saying: OK, now we want you to do it in a standardized way that we've determined makes more sense.

What's your reaction to that?

Ms. GORDON. First I think there actually is a program in place already to standardize these systems. The Solar America Board for Codes and Standards, the Solar ABCs that I mentioned in my testimony, has already put together a pretty robust document to streamline permitting for small systems. So that is really in place and we applaud the Department of Energy for working with the Solar ABCs on that.

So that is actually already in place, and what we're suggesting is that local jurisdictions look to that document and build off of that. The funding opportunity that the Department of Energy has put out I view as a pilot program that has seed money to start the process of adopting the Solar ABCs, and that S. 1108 would scale that process.

I think standardizing how permit applications are done and how permitting is done is just one piece of the process. So there are many things that are troubling about the permitting process right now. The first problem is that you have inspection windows that potentially are 8 hours during the day.

So I should back up just a moment. While the reason why SunRun got involved in this permitting issue is because we went to our local installers—we have 30 installers across our nine States. Last year, we asked them, what is the one thing that we can help you do on a high-level policy issue to help you bring down the installation costs?

SunRun finances solar energy systems. We own those systems and the homeowner pays for the electricity per kilowatt hour per month. So we're solving the up-front cost. In fact, what Senator Franken was asking about earlier from the geothermal industry's perspective, the solar industry is actually doing that right now. Private industry is investing dollars in business models that allow for a low up-front down, where the homeowner doesn't have to have 30 or \$40,000 to buy a solar system. They can put a low amount down, pay per kilowatt hour per month. That's what SunRun's business model and our competitors' offer.

So in order to compete with traditional utility rates, we need to be able to offer a kilowatt hour rate that is at least equal to or lower than that kilowatt hour rate, and there are many markets in the country where we won't be able to do that unless we're able to reduce those soft costs.

So when we asked our installers, how can we reduce that kilowatt hour rate, they said, please work on permitting. Universally, everyone answered that question, please work on permitting. So that's why we put this report together and how we learned that this is not something the industry can take on on its own. It really is a local jurisdiction issue.

In talking with some of our installers, some of the stories that they told me were pretty surprising. Verango, which is one of our largest solar installers in southern California, has 24 employees out of their 400, so well over 5 percent of their employee base, works on permitting and inspection by themselves. That's all they do. They have 4 what they call "permit runners." Those people drive from place to place every day dropping off and picking up permit applications. They have 20 inspection sitters. Those people drive every day to one homeowner's house and sit outside of that house because the homeowner's at work and wait for an inspector to show up. They can't inspect more than one system in a day.

So I think, aside from standardizing the permitting process, you could also streamline by having shorter inspection windows, 2 hours at a time. The inspection only takes 15 minutes right now. You could have on-line permitting applications that wouldn't require these permit runners to drive all over their local jurisdictions to pick them up.

So there are a number of different things that can happen to streamline the process.

The CHAIRMAN. Thank you very much.

Senator Murkowski, why don't you go ahead with any opening statement you'd like to make and also any questions, and then we'll go to Senator Sanders and Senator Franken.

Senator MURKOWSKI. Thank you, Mr. Chairman. I do have an opening statement, but in the interest of time and deference to our witnesses I'll just ask that it be submitted as part of the record.

I've been attending an Arctic energy conference this morning and I apologize for not being here for the full hearing. But at that conference, obviously, one of the issues of great interest when you're talking about Arctic energy is geothermal. Iceland generates about 80 percent of their energy as a Nation from geothermal. I was told this morning that \$35 a month is what a typical home in Iceland is paying for their heating costs with geothermal. If we could only get to a place like that, it would give us so much more hope as an Arctic nation. We are an Arctic Nation, even though it's 100 degrees out there this morning. But thanks to my State, we are one and we're going to figure out how we can capitalize on some of our energy options, geothermal, solar, certainly.

[The prepared statement of Senator Murkowski follows:]

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

Mr. Chairman: Thank you for scheduling this hearing. Let me talk first about a bill that Sen. Tester introduced, a former member of this panel, and that I have co-sponsored, the Geothermal Exploration and Technology Act of 2011.

In both 2005 and 2007, this panel took steps to aid research to expand geothermal energy production nationwide. We provided aid for research, encouraged work on low-temperature technology and provided tax incentives. In 2007, we pushed to encourage the Department to further enhance geothermal system technology—a step that should make geothermal energy economic and accessible for large portions of the nation.

We also set up a high-cost geothermal grant program under Sec. 625 of EISA, that unfortunately DOE has yet to really implement. But that is an issue for another day.

This bill closes most of the remaining gaps the nation's strategy for helping geothermal energy expand from the roughly 2.2 gigawatts that it produces today, to the up to 100 gigawatts of electricity that M-I-T has suggested could be possible in coming decades.

The bill sets up a revolving loan program to help overcome the costs of high-risk geothermal exploration wells—the biggest cost and risk in geothermal development. It's a sliding scale cost-share formula that should incentivize developers while protecting U.S. taxpayers from long-term losses, as developers will have to put significant "skin" in all such projects.

The bill of special interest in Alaska and other hydrocarbon-producing states will allow for co-leasing of geothermal production at the time that permits are issued for drilling of oil and gas wells. That will make it easier for companies to generate the estimated 11,000 megawatts of power that could come from tapping the hot water co-produced in oil production through the use of generally low-temperature geothermal technology. An Alaska developer, a pioneer in low-temperature development at Chena, Alaska, Bernie Karl, proved the efficiency of such systems just last year as a result of a DOE grant.

And this bill provides substantial aid to spur investment in geothermal heat pumps and the direct use of geothermal energy to heat and cool buildings in large-scale applications. That provision is really the piece that has been less emphasized so far by DOE in its geothermal development program and will be helped most by this bill.

This bill at likely little additional cost should help geothermal energy continue to expand its market share and help the U.S.—the world leader in geothermal energy production—continue in the lead in development of geothermal technology. I thank Sen. Tester and his staff for developing the bill and I suspect we will hear testimony supporting its passage today.

We are also considering today S. 1108, the 10 Million Solar Roofs Act of 2011. A bill by the same name was considered by this Committee last Congress, but I understand this bill is substantially different as it mainly addresses permitting barriers, which add a considerable amount to the cost for a homeowner to install solar energy. I'm interested to hear what our witnesses have to say about the proposals contained within the bill.

I am also pleased to join with the Chairman in introducing S. 1160, the Department of Energy Administrative Improvement Act of 2011. This bill would provide the Department with greater flexibility in its hiring and transactions authorities in order to ensure the government has the ability to bring on board the best and brightest talent available. It also would require a five-year budgetary outlook from the Department of Energy to give Congress greater insight into the purpose and progress of Departmental programs. I am hopeful these provisions will help make the Department of Energy more effective in its missions and will get the most mileage out of the taxpayers' dollar.

I thank all of our witnesses for taking the time to prepare testimony and appear today.

Senator MURKOWSKI. Mr. Dougherty, I wanted to ask you a question about geothermal heat pumps and the costs associated with them. In your written testimony, you talk about the importance of funding research to help cut the costs that are associated with the thermal pump and the installation, and the need to improve the drilling techniques and improve the efficiency of the heat transfer.

Can you speak about any promising areas that we can be looking to that can help to reduce some of these costs, and are we close to solutions in how we can advance the research to see some of these breakthroughs?

Mr. DOUGHERTY. Yes, I thank you, Ranking Member Murkowski. In my testimony I talked about what DOE is doing pursuant to the bill in terms of looking at greater efficiencies on the up-front costs from a drilling perspective, better heat transfers in fluids, better loop design, better drilling techniques, better drilling equipment. There is a lot of research to be done, I believe, in lowering that up-front cost.

So we applaud S. 1142 for asking the DOE to spend more resources on that research in terms of lowering that up-front cost, due in large part to the installation of the loop.

Senator MURKOWSKI. So we just need more research? We're not on the verge of breaking into something new here?

Mr. DOUGHERTY. No. Unfortunately, the technology, it's incremental improvements, and there's no real, we don't believe, anything on the horizon that's going to transform the way this technology works.

Senator MURKOWSKI. Let me ask you about Alaska and the possibility, the physics of using geothermal heat pumps in colder climate locations. Just last week there was an article from the University of Alaska that said that geothermal heat pumps could be economic for use even in northern Alaska, even in areas where they have incidence of permafrost.

Can you speak to that application?

Mr. DOUGHERTY. Yes. I'll answer it this way. I believe the market is very nascent in Alaska in terms of geothermal heat pump installations. But we do have statistics for Canada installations, Canadian installations, and it's pretty prevalent in Canada. I think a lot of their geology and a lot of their temperatures are the same as Alaska.

I think if you use vertical drill bore holes and you can get below the frost line, the technology does work. The paybacks may be a little longer on a new home or a retrofit, but the technology is proven to work in very cold temperature climates. Sweden is one of the leading installers of geothermal heat pumps for buildings. We're at 5 percent market penetration for geothermal heat pumps. Sweden is at 90 percent market penetration. So it is a proven technology in cold climates.

Senator MURKOWSKI. Mr. Chairman, I have a series of questions that I had for the first panel that I'll also be submitting for the record, if they can take them at that time.

Thank you to the witnesses.

The CHAIRMAN. Thank you.

Senator SANDERS.

Senator SANDERS. Thank you very much, Mr. Chairman.

It's just very exciting to hear from both Ms. Gordon and Mr. Dougherty about the potential of transforming our energy system in a cost-effective way.

Let me start off with Ms. Gordon, if I might. You touched on this issue, but I'll maybe get into it at a little bit deeper level. You do business now, your company does business, in nine States, but no doubt you have some familiarity with what's going on in the other 41 States. On a day to day basis, what is the permitting process like for a company like yours, that wants to help, say, homeowners install solar? What is it like?

Ms. GORDON. Yes, I did talk about that a little bit, but I can go into some further detail. Some of the examples that Verengo Solar gave to us were, they have these inspector sitters and permit runners that are a large part of their employee base, and it really impacts the customer experience. So when you have an inspection that's supposed to occur and the inspector doesn't show up, or they're supposed to come in the morning and they don't come until the afternoon, it's—

Senator SANDERS. Let me just ask you this. I want solar in my rooftop. I go to work, right? Can't be home. This is already a major impediment, is it not?

Ms. GORDON. It shouldn't be, but in some places it is. The solar installer should be able to go to your home, wait for the inspector to show up, ideally within a 2-hour window, and have the inspection done within 15 minutes. However, for example, in southern California right now some cities are coming out to do a solar inspection and wanting to know if there's a smoke detector in the home. If the homeowner isn't home when that inspection occurs, they can't—the installer can't get into the home to determine whether there's a smoke detector there are not, which is really unrelated to whether or not you have a solar system on your home.

Senator SANDERS. Your company's report on solar permitting, which was endorsed by a number of solar energy companies, including groSolar in Vermont, indicates that countries like Germany can install solar energy at prices 40 percent lower than we do here in the U.S., thanks in part to simpler and less expensive permitting processes. If we achieve solar permit reforms as this legislation attempts to do, what will that mean for the average homeowner who wants to install solar panels in terms of lower costs and less hassle?

Ms. GORDON. Certainly. So the dollars per watt in Germany is about \$3.50 per watt and it's about \$5.50 on average in the United States. Streamlining permitting could reduce that dollars per watt by about 38 cents, just streamlining permitting inspection, and that will unlock other parts of the soft costs that go into that installation. For example, customer acquisition, marketing, sales, telling your neighbors that you had a good experience so that your neighbors will get solar. If you're frustrated, you're not going to tell your neighbor that they should do this. You want it to be a good experience for that customer, and that's going to help us unlock those soft costs, those stubborn soft costs that have been hard to bring down.

Senator SANDERS. Thank you.

Let me ask, Mr. Dougherty, a question. As I mentioned earlier, even in my State, a cold weather State, we are beginning, beginning, to see an increased utilization of geothermal with, as I understand it, some good success. What is the potential? If we got our act together, people—and we had a conference, you may know, just over a year ago for precisely the purpose of educating people and builders about the potential of geothermal. We had a couple of hundred people out to that conference.

But if we got our act together as a Nation, what do you see the potential of geothermal for residential and business buildings?

Mr. DOUGHERTY. I think 2 things would happen. In my testimony I talked about growing our industry from 100,000 residential units to a million by 2017, and we estimate that that would create 100,000 new jobs, both at the manufacturing plants of the geothermal heat pumps, at the component manufacturers that are mostly domestic in terms of pumps and fans and coils that go into the machine, but also that job-creating aspect that we have that no other part of the HVAC industry has, which is the installation of the loop. So you have the manufacturers of the pipe, the manufacturers of the grout, the manufacturers of the drilling equipment.

So we estimate that just by going from a tenfold increase to a million units a year of the 6 to 7 million that are done on an annual basis now, and we only have 100,000—if we can get to a million, we'll create 100,000 new jobs by 2017.

Senator SANDERS. What about reductions in greenhouse gas emissions?

Mr. DOUGHERTY. We would have a tremendous impact on lowering the carbon footprint of those homes and nationally as a Nation in terms of carbon footprint. The other thing is it's lowering the demand for additional generation. Because we significantly reduce the amount of kilowatt energy used in the summer, we are deferring the need for new construction of power plants. So we estimate that if we can put in a million geothermal heat pumps, we will shave the need—shave peak and reduce the need for additional capacity significantly, and reducing the strain on the transmission grid.

Senator SANDERS. Let me ask you this. Ms. Gordon, in terms of solar, referred to the permitting processes as a major obstacle for us to lower costs. What are the obstacles—I think if the average person heard what you have to say they'd see this as a win-win-win situation. What would you say are the major obstacles right now in terms of going forward in a very aggressive way with geothermal?

Mr. DOUGHERTY. I think consumer awareness is No. 1.

Senator SANDERS. People just don't know about it?

Mr. DOUGHERTY. People just don't know. There also is this I think misimpression of the up-front cost. I think Mr. Chalk mentioned 3 times. That is debatable. I in fact am retrofitting my home as we speak with a geothermal heat pump—

Senator SANDERS. If I'm building an average size home in Vermont right now, in English how much is it going to cost me to put in geothermal?

Mr. DOUGHERTY. Probably double. So if you were looking at a \$10,000 conventional system, high efficiency gas furnace, a high efficiency air conditioning unit, probably \$10,000 for an average home. This would probably cost you 18 to \$20,000.

Senator SANDERS. What are my savings over a 10-year period?

Mr. DOUGHERTY. But if you put that, you put the extra cost, that \$10,000, into your 30-year mortgage, your energy savings are greater than your debt service, so the day you walk into your new home it's positive cash-flow.

Senator SANDERS. Is one of the impediments, getting back to Senator Franken's point, helping people come up with that additional \$10,000?

Mr. DOUGHERTY. Correct. We're working with the electric utility industry. We believe they're the players that can really help in terms of deferring the up-front costs with something called on-bill financing. If you can lend money to the homeowner and have that debt service put on your electric bill, your energy savings are greater than that debt service added to your electric bill.

We think it's a no-brainer for electric utilities to—

Senator SANDERS. It's true for geothermal. It's true for solar. It's true for wind. This is I think one of the great impediments that we face, getting that up-front money and paying it back with reduced fuel costs.

Mr. DOUGHERTY. Absolutely, Senator.

Senator SANDERS. Thank you very much, Mr. Chairman.

The CHAIRMAN. Senator Franken.

Senator FRANKEN. I like this on-bill financing. I take note of this about the need for—or getting rid of the need for excess, for building new utilities. That's an important thing. For lower carbon footprint.

We had a hearing in here the other day about the forest fires in the Southwest and it was very clear the expense of that. The testimony was that climate change was adding to the intensity of these fires and the costs. So when we're really talking about cost savings, we've got to talk about the whole picture here.

First of all, I just want to applaud the chair and the ranking member for focusing on streamlining the administration of the department in S. 1160. I want to thank you both for doing that.

Also, I want to applaud Ms. Gordon and SunRun for finding a way to finance this and for owning this and finding a way of creating more solar energy in this country in a way where you find a financing model where it doesn't cost the government money, but private industry is doing it. That's what I'm looking for here. So I really like this electric utility on-bill financing. I think that's brilliant and I want to pursue that.

\$35 a month for heating in Iceland. Now, Iceland I believe is a cold climate country, judging by the name. I'm not great with geography, but "Iceland."

I think I want to tell a little bit of a story, and I hope—so I go to this place ECONAR. This is like a couple years ago. It was while I'm running. I'm going on a green jobs tour. I talk to the guy who started the company. It's a geothermal company and they do the coils and the pumps. They do the heat pumps. They do the whole system.

He told me that he had just believed in geothermal for years and years and years. You've talked about getting the message out to folks and people not knowing about this. It just wasn't going anywhere, and he was making these heat pumps in Appleton, Minnesota, and he just had been doing this for years. Finally it's starting to take off a little bit, and he gets this offer from this company in Indiana to buy him out. This is like his payday. Finally, after years and years of doing this, it's his payday.

So he's going to sell it to this company in Indiana, but the guy in Indiana wants to take the business in Appleton, Minnesota, and take it to Indiana. So he's driving out to Appleton to tell the people

who work in the factory there, I'm sorry, I'm selling it to this business in Indiana.

On the way—he's telling me this story in his office in Elk River. On the way he just says: No, I'm not going to do this, I'm not going to do it. So he goes there and he tells them: I'm not selling the company.

So he's telling me this story and he said: So I kept the company. So while he's telling me this story, every once in a while this bell goes off. I'm sitting there and this bell goes off. Finally, I just go: What are those bells? He says: Oh, that's every time I sell a system a bell goes off. He's doing fabulously, and he made the right decision.

This is the right decision for our country. I want to thank you guys for being in the business that you're in and finding ways that we can be saving electricity, saving greenhouse gas production, and finding ways to finance these that aren't—it isn't about the government spending money. It's about, if anything, us facilitating how the private sector can be financing us with these \$2 trillion sitting on the bench famously. We're always talking about this money sitting on the bench.

The utilities, you're so right—and, Mr. Chairman, I think that if we can find a way when we finally get to a clean energy standard or a renewable energy standard that we can reward utilities for lending money for all kinds of things, for solar, for geothermal, for more efficient units, air conditioning units, etcetera, that you reward the utilities, that the efficiency that they're creating through their own financing can be represented in this energy standard and rewarded, so that the financing is coming from the private sector, that we will be doing a great thing for the country and for future generations.

So I want to just thank you both, and I want to thank the chair and the ranking member, who I'll thank her personally, for the bill, for 1160 on increasing the efficiency of the administration of the Department.

Thank you.

The CHAIRMAN. Thank you very much.

Thank you both for your excellent testimony. I think it's been useful and we hope we can move ahead with these various bills.

Mr. DOUGHERTY. Thank you, Mr. Chairman.

The CHAIRMAN. So that will conclude our hearing.

[Whereupon, at 11:11 a.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSES OF STEVEN G. CHALK TO QUESTIONS FROM SENATOR BINGAMAN

Question 1. The Advanced Research Projects Agency—Energy or ARPA-E was given exempt hiring authority similar to that in S. 1160 to quickly hire scientific and technical personnel similar to DARPA, has the Department found this authority useful to date?

Answer. While ARPA-E has only existed for three years, to date, this hiring authority has been very useful within ARPA-E. ARPA-E has a unique R&D model within DOE and was set up to be a lean and agile organization. ARPA-E has used its hiring authority to quickly hire scientific, engineering, and professional personnel pursuant to its statute, including people to serve limited terms as Program Directors and Fellows. The hiring authority helps quickly recruit some of the best technical/professional talent in multiple energy research fields. Further, limited terms also lead to a sense of urgency and efficiency to effectively execute new programs.

Question 2. The Nuclear Regulatory Commission has authority to rehire retired personnel who are receiving their retirement annuity—can you please explain how the Department would use the re-hire authority as described in S. 1160 for retirees?

Answer. The Nuclear Regulatory Commission was granted the authority to rehire retirees in situations where there is exceptional difficulty in recruiting or retaining qualified employees or when a temporary emergency hiring need exists. Under S. 1160, and as required therein, the Department of Energy would limit the rehiring of retired personnel to only those positions that are necessary to carry out a critical function of the Department and for which it has encountered exceptional difficulty in recruiting suitably qualified candidates. In addition, the appointments would be limited to a maximum of four years.

Currently, the Department has been delegated the authority to rehire reemployed annuitants for a limited period of time (not exceed 1040 hours over one year).

As its technical and scientific workforce ages and retires, the Department is losing valuable experience and knowledge. The recent budget restrictions and the impact on Federal salaries, awards, and benefits are already beginning to decrease retention of experienced, senior-level employees. Individuals, who in the past may have continued their Federal employment, are finding it more advantageous to retire and are leaving at a faster rate than anticipated. This is resulting in gaps in locating highly qualified individuals to assume the most specialized positions in science, nuclear engineering and safety, energy efficiency, renewable energy, environmental management, and other critical mission areas of the Department. Recruitment efforts for these positions can frequently take longer than six months as the positions are sufficiently specialized that longer announcement periods and more proactive recruitment efforts are needed. Recently, one position in the Office of Energy Efficiency and Renewable Energy's Geothermal Technologies office was advertised three times over one year before suitably qualified candidates were found. It is not unusual for positions in the Office of Science to be routinely advertised for three months or more to locate fusion, genomic science research, high energy physics, or other scarce scientific applicants.

Question 3. The Department currently has Other Transactions Authority based on that used by the Department of Defense in title 10 of the U.S. Code. Can you please explain how the modifications proposed in S. 1160 would be helpful to the Department?

Answer. [No response received at the time the hearing went to press.]

Question 4. S. 1160 proposes a section titled “Critical Pay Authority” based upon similar authority used by NASA to hire highly qualified scientific and technical personnel for up to 4 years. Can you please explain how the Department would use this authority?

Answer. Many potential candidates from academia and private industry have salaries that are significantly greater than the current cap of \$179,700 for Senior Executive Service position. It is not unusual for candidates with salaries of \$250K to \$450K who also enjoy stock options and large bonuses to apply for the Department’s positions. Most decline our offer when they learn that the top salary and relocation bonuses may only equate to half of their salary.

To ensure that their programs are attracting candidates with cutting edge technical knowledge and expertise, some managers are utilizing offers of Intergovernmental Personnel Assignments (IPA) to individuals from academia. The IPA authority permits a much higher pay rate—usually equivalent to their current salary—which makes the assignments more attractive to the highly qualified candidates. However, IPAs are very temporary in nature. Individuals who accept IPAs come to the Department through a short-term leave of absence from their employer. As result, they usually return to their employer within 1 or 2 years. This can create volatile skills gaps in critical mission areas.

RESPONSES OF STEVEN G. CHALK TO QUESTIONS FROM SENATOR MURKOWSKI

S. 1160

Question 1. Could you provide some examples of how greater flexibility in hiring and transactions authority, such as S. 1160 provides, would benefit the Department of Energy?

Answer. The Department needs greater flexibility to attract and recruit a highly skilled and technical workforce in the science, nuclear engineering and safety, energy efficiency, renewable energy, and other critical mission areas of the Department. Under current requirements of Title 5, United States Code, recruitment actions must follow very specific competitive procedures. Although we have cut our time to hire in half, this process can still take up to three months and in critical specialties it can take longer. The direct hire flexibility would allow the Department to quickly extend job offers to these highly skilled individuals who often have competing or more lucrative job offers, yet have a strong desire to work for the Department. Under the American Recovery and Reinvestment Act, the Department was authorized with direct hire authority for positions supporting electricity delivery and energy reliability. This was very useful in quickly obtaining the critical skills necessary for the Department to execute its responsibility under the Act.

Question 2. Section 3 of 1160 requires the Department of Energy to implement a 5-year estimate of program content as part of the annual budget request. Does the Department of energy already prepare future year’s estimates in preparing for the budget request, and if so, how many years out?

Answer. For internal planning purposes only, the Department does prepare estimates for five years into the future as part of developing the current year budget request.

Question 3. Section 5 of S. 1160 allows the government to protect against the public release of results from cooperative research and development agreements for five years. Given that some portion of the research and development programs are funded by U.S. taxpayer dollars, what is the justification for not publicly releasing the results when they are available?

Answer. Section 5 of S. 1160 provides the Secretary with the ability to protect certain data generated under transactions with DOE—including grants, contracts and cooperative agreements—from public disclosure. The data subject to protection would be protected from disclosure under the Freedom of Information Act as if it had been developed using private funds. The period of protection for such data is not to exceed five years. This provision would more broadly apply the data protection authority already provided in statutes such as the Energy Policy Act of 1992 (EPAct 1992) and the Stevenson-Wydler Technology Innovation Act of 1980 (Stevenson-Wydler), which are both limited to certain programs and applications. The limited period of data protection strikes a balance between two of the Department’s missions. First, the Department is generally required by statute to disseminate the results of research it funds, subject to applicable law. Second, the Department seeks to facilitate commercialization of those research results. Commercialization, when successful, can increase the U.S. domestic manufacturing capacity, provide jobs to

American workers, and advance the state of the art in economically critical energy technologies.

Data developed under Department-funded research often provides companies with some of the most commercially valuable assets arising from those efforts. To commercialize these results effectively, those who enter into transactions with the Department may need a limited period of exclusivity during which they can pursue those endeavors. The need for such a limited period was recognized and codified in Stevenson-Wydler. Section 12(c)(7) of Stevenson-Wydler (15 U.S.C. 3710a (c)(7)) states that data generated under a cooperative research and development agreement (CRADA) may be protected against dissemination for a period of up to five years.

Congress recognized that providing a limited period for data protection would also benefit the Department's R&D financial assistance recipients, such as grantees, and applied the same data protections found in Stevenson-Wydler to those recipients in EPOA 1992, in Section 3001(d). However, even when data is protected from disclosure for a limited period, DOE typically requires some level of data (e.g. performance data) to be available for immediate dissemination.

The statutes allow for protection for up to five years, or, as in the case of S. 1160, for a period "not to exceed 5 years." These provisions provide the Secretary with the discretion to limit data protection even further, to a shorter time limit, or even requiring all data to be disseminated immediately. They are flexible so that the Department may consider individual programs and even individual financial assistance awards on a case-by-case basis to determine how the needs for wide dissemination versus protection to enhance commercialization may best be balanced.

ON S. 1108

Question 4. This committee has been focusing on the issue of overlap and duplication amongst federal authorities. How is S. 1108 different from The Rooftop Solar Challenge that just started at DOE? Would it make more sense to amend the Solar Technologies Program if we want it done differently, or to make sure that funds are appropriated for this purpose, instead of passing a new law?

Answer. Phase 1 of the Rooftop Solar Challenge is an initiative launched by DOE in June 2011 to make PV more accessible and affordable for residents and businesses by emphasizing streamlined and standardized permitting processes. With this first phase, DOE has committed up to \$12.5 million total for up to 25 teams from across the country. DOE has required that teams represent minimum populations of 500,000, so the Challenge can reasonably be expected to impact at least 12.5 million residents. The funding opportunity is currently open, with applications due August 31, 2011.

Phase 1 of the Rooftop Solar Challenge represents a first step in streamlining and standardizing permitting processes to drive down the non-hardware Balance of Systems costs for installed rooftop PV. S. 1108 describes a more widespread effort.

Reaching an ambitious 10 million solar rooftops target, such as that set out in S. 1108, would likely require jurisdictions across the country to draw upon lessons learned in Phase 1 of the Challenge and significantly scale them. It would also likely require jurisdictions to go further than they will in Phase 1.

Question 5. When do you expect we will get some significant feedback from localities as a result of the Rooftop Solar Challenge? How will the Department use the information gained from various localities?

Answer. Awardees under the Rooftop Solar Challenge will complete a market assessment at the beginning of their project, and then again a year later at the completion of their period of performance. This market assessment will identify the status of the region/locality with regard to PV permitting and interconnection processes, net metering and interconnection standards, PV financing options, and planning and zoning restrictions. DOE will use the initial market assessments to identify the range of existing policies and practices and refine our estimates of the cost reductions and increase in solar deployment that can be achieved through improving and standardizing practices.

DOE expects to make awards under this Challenge by the end of calendar year 2011, and expects to have qualitative and quantitative evidence of the progress of each of the awardees by the end of their period of performance 12 months later, at the end of calendar year 2012. DOE will use the information from this second round of market assessments to evaluate the impact this Challenge has had on PV market development in the first year, and determine how best to allocate funding in future years to achieve additional reductions in PV system costs and increases in market penetration.

Throughout the Challenge, DOE will share the best practices developed by each team with the other participating teams, and with thousands more local jurisdictions through a national outreach effort. This will enable local and state governments to leapfrog the complexity common in immature solar markets and move directly to implementation of more efficient, low-cost permitting practices.

Question 6. Have there been any statewide initiatives to streamline solar permitting processes? If so, how have these fared?

Answer. Several states have made efforts to simplify solar permitting processes for small-scale systems. Three examples of states that took very different approaches are:

1) In October 2010, Oregon adopted a statewide Solar Installation Specialty Code, which specifies the building and electrical standards with which PV installations in the state must comply. The code eliminates the requirement for structural engineering for most PV systems, significantly reducing the time and complexity of the permitting process. It also provides a standard permitting fee calculation methodology. This standard statewide code reduces the inter-jurisdiction variability in permitting processes, which reduces PV system costs by simplifying business processes for solar installers.

2) In May 2011, Vermont adopted a statewide PV system registration process under which customers complete a system registration form and submit it to the state Public Service Board. The Board and any relevant parties have 10 days to express concerns with the installation. If the customer does not hear from the Board within 10 days, the customer is granted the right to proceed with the installation and interconnection of the system. This is perhaps the simplest PV permitting process enacted in any state, and is scheduled to take effect in January 2012. Vermont has several unusual characteristics that enable Vermont to implement such a unique permitting process. Characteristics such as:

—No local inspections: With the exception of Burlington, local jurisdictions do not have electrical inspectors and do not conduct inspections of electrical projects on private properties.

—Centralized interconnection approvals: Unlike most states, the state utility regulatory authority (VT Public Service Board) is responsible for approving all interconnections of generating facilities, whether a 2 kW residential system or a nuclear reactor. This authority supersedes both utility and local jurisdiction approval (except for the Burlington electrical inspector).

—Low registration volumes: In a small state like Vermont, where the population is 620,000, and only 623 PV installations are currently installed, the PSB is equipped to process the relatively low volume of registrations.

3) In June 2011, Colorado enacted the Fair Permit Act, which caps permit fees and clarifies that local and state agencies must clearly identify all solar-related fees and taxes for customers. Prior to this Act, a study showed that permit fees in Colorado were as high as \$2,000 for a residential system. The Act capped fees at \$500 for residential systems and \$1,000 for commercial systems under 2 MW. This Act has the potential to be easily replicated in other states.

DOE's Rooftop Solar Challenge is designed to build on the best practices developed by states and localities and accelerate the further development and implementation of these practices across the U.S. By coordinating efforts at the national level, DOE can help states and local jurisdictions learn from each other while still ensuring that the policies implemented are locally appropriate.

S. 1142

Question 7. Issues from testimony: In the key comment from your testimony, you say the Administration is still reviewing the bill (S. 1142), but that there are "serious technical concerns that would need to be addressed." Could you please discuss those technical problems? It would also be helpful if you would suggest any potential fixes if there are any. What are you specifically saying are the problems with the bill?

Answer. There are aspects to the proposal that are inconsistent with the requirements of the Federal Credit Reform Act of 1990 (FCRA). While the Administration is still reviewing this proposal, any new program should be designed consistent with Federal credit policies, to ensure efficient and effective use of Federal support, and to protect taxpayers from undue cost and risk.

Question 8. Loan guarantee program: Could you address the Department's view of the direct loan program for high-risk geothermal exploration wells called for in the bill? Do you have any estimates internally for how many high-risk wells might

be drilled in a year, if the program is implemented, how much aid the Department on average might be asked to provide, and how much federal loan funds might be outstanding before repayments begin and the program's revolving loan fund process is fully implemented? What, in the Department's view, is the definition for high-risk well? Your testimony largely ignored the loan program; can you talk about the Department's willingness to see a new program set up?

Answer. The Administration is still reviewing this proposal, and its implications for furthering geothermal exploration, including potential costs to the Government. Any new legislation should be designed consistent with the Federal Credit Reform Act and Federal credit policies, to ensure efficient and effective use of Federal support, and to protect taxpayers from undue cost and risk. Revolving fund credit programs are inconsistent with the FCRA, and can lead to inefficient funding mechanisms, where the available support is more reliant on the performance of initial awards than on the form and amount of assistance needed to meet the policy goal.

Past DOE-sponsored programs, such as the Geothermal Resource Exploration and Definition project (GRED), have helped confirm new resources. Under the program, drilling was supported at 26 different sites and seven of those sites now support geothermal power plants. It is possible that the data developed under GRED can still be used to support power plant development (either conventional or EGS), so the benefits of this work may continue well into the future.

In DOE's view, all exploratory geothermal drilling is "high risk" because success rates for the initial wells range from 25% to 50%. The success rate will be lower for undiscovered hydrothermal or "greenfield" development and on the higher end for sites where some preliminary drilling has already occurred. The number of exploratory geothermal wells drilled in a year is likely to be limited by the following additional factors: 1) the small size of the industry (less than 10 developers); 2) limited availability of drill rigs; 3) the fact that most of the currently identified resources have already been developed; and 4) the time needed for permitting requirements.

Question 9. Co-Energy production from oil and gas wells: This bill includes a provision to allow for co-leasing of geothermal production with approved applications to drill and gas wells. I know this is probably not a purely DOE area and in some respects more a question for the BLM that handles petroleum leasing on shore, but can you say how much time and money should be saved for applicants by co-leasing and is this a useful policy change to increase geothermal electricity production from the waste water produced in oil and gas extraction?

Answer. Co-leasing could save time and reduce costs associated with leasing. As BLM handles geothermal leasing and would implement those provisions of the bill, BLM is in the best position to estimate time and money savings from a non-competitive geothermal leasing process.

Question 10. Geothermal Heat Pumps: Can you talk a bit more than your prepared testimony about how the geothermal heat pump provisions in the bill mesh with current Department efforts to promote geothermal heat pump technology? Does this bill that directs the Secretary to establish a program to improve heat pump applications and direct use of geothermal, especially in large-scale applications, tie into the Department's existing research and development plans for geothermal? Does it dovetail well? If not, is there anything that should be changed in the bill?

Answer. The Department is in the process of determining the role of geothermal heat pumps in its research and development plans. Under the American Recovery and Reinvestment Act of 2009 (Recovery Act), the Department invested more than \$60 million in geothermal heat pump demonstration and deployment projects. These projects incorporate strategies to overcome the first-cost premium that has prevented geothermal heat pumps from gaining wider marketplace acceptance. The Department expects that information and lessons learned from those projects will encourage wider market acceptance of geothermal heat pumps for residential and industrial buildings. The information will also be used to determine the role of geothermal heat pumps in the Building Technologies Program's roadmap. It may also be used to help define a geothermal heat pump roadmap establishing a set of high-priority research and development (R&D) activities.

Direct use geothermal is not a major focus in the Department's research and development portfolio. Under the Recovery Act, the Department invested in three direct use geothermal projects—a greenhouse operation and fish farm in Canby, California; a tilapia business in Paisley, Oregon; and district heating in Klamath Falls, Oregon. However, the Department can have the most impact on the role of geothermal energy in our nation's clean energy supply by reducing the cost of baseload geothermal energy so that it is competitive with other energy sources. Therefore, the emphasis of our Geothermal Technologies Program is on overcoming the technical

challenges associated with supplying geothermal energy to the grid rather than on highly localized, distributed generation geothermal technologies.

Question 11. General Cost Question: Obviously S. 1142 hasn't been scored yet by CBO. I have my guesses what it will cost to adequately implement the provisions in the bill, but I would be interested in hearing if the Department has come up with any estimates for what this bill would cost to implement initially? How would it affect the existing geothermal office budget, which I know is getting for \$38 million for FY11, about \$6 million cut from last year?

Answer. The proposal is still under review by the Administration. The Department can have the most impact on the role of geothermal energy in our nation's clean energy supply by reducing the cost of baseload geothermal energy so that it is competitive with other energy sources. Therefore, the emphasis of the Department's Geothermal Technologies Program is on research and development of technologies that improve performance and lower cost.

RESPONSE OF DOUGLAS A. DOUGHERTY TO QUESTION FROM SENATOR MURKOWSKI

MINE WATER

Question 1. In your testimony you talk about exploring innovative uses of wastewater and mine water to fuel geothermal systems. Coming from Alaska where we do have underground mines, that point interested me. Could you talk more about how geothermal heat pump technology can work with processed mine water and what are its future potentials?

Answer. To best answer the question, I will refer you to a presentation done by the National Energy Technology Laboratory (NETL) of DOE in 2007. The presentation explains how mine water can be used as the heat exchange for geothermal heat pump technology. Using mine water can significantly reduce the upfront cost of installing a geothermal heat pump by decreasing the need for an extended loop. The NETL refers to the exploitation of geothermal energy from underground mine pools as an "unconventional application" and in need of further research. Specifically NETL identifies several areas of the application in need of further research: water quality and the effects of corrosion and scaling; use of a secondary heat exchanger; legal issues involving mine water ownership and the return of water back into the mine; lowering the costs of wells and improving pumping costs; and most importantly, the need to demonstrate the technology. To GEO's knowledge, DOE has not undertaken any of these research items relating to the use of mine water for geothermal heat pump technology and it is why I testified in support of S.1142 on this particular issue. The link to the NETL report can be found at: http://www.netl.doe.gov/energy-analyses/pubs/EUEC_07_Ackman.pdf

Thank you for the opportunity to testify in support of S.1142 and to provide additional clarity on why GEO believes it important for the DOE to spend greater resources on the research and development of geothermal heat pump technology.

RESPONSES OF HOLLY GORDON TO QUESTIONS FROM SENATOR MURKOWSKI

Question 1. This committee has been focusing on the issue of overlap and duplication amongst federal authorities. How is S. 1108 different from The Rooftop Solar Challenge that recently started at DOE? Would it make more sense to amend the Solar Energy Technologies Program if we want it done differently, or to make sure that funds are appropriated for this purpose, instead of passing a new law?

Answer. As I indicated in my testimony, there is no second phase funding identified in the Rooftop Solar Challenge. S. 1108 would provide the necessary funding to take the best practices identified in phase 1 of the Rooftop Solar Challenge and implement these best practices in phase 2 to spread those improvements to other jurisdictions in the region. DOE is limiting the regional coalitions to 25 groups to undertake phase 1 of the Challenge and split the \$12.5 million in funding. The majority of jurisdictions will be watching closely to gauge whether the federal initiative is real or symbolic and whether they too will have to improve. Putting the phase 2 funding into legislation in the form proposed in S. 1108 solidifies the federal commitment to reducing soft costs by incentivizing local bureaucratic reform related to soft cost reduction. This message will sharply reduce inertia related to participating in the initial phase of the Challenge and get all cities prepared to embrace the phase 2 reform. Leaving phase 2 funding ambiguous and uncertain will taint and slow phase 1 efforts.

To put this in business terms, the Challenge is a research and development project aimed at ways to reduce soft costs. The funding from S. 1108 will go toward bringing what's developed in the Challenge to the mainstream market.

The economic benefit of this effort is substantial and the reason we asked AECOM to assess the California market. Just using the direct savings of \$.38 per watt from streamlined permitting will result in an 18% growth of economic output over 9 years, and an additional 4,000 jobs in California alone. The reason permitting reform accelerates the economic impact is because the pricing reduction it generates grows the market by lowering costs for customers where solar simply wasn't economically viable and creating greater savings for those customers for which solar already made sense. As I explain in response to question 2 below, the cost reduction from permitting is just the tip of the potential soft cost savings which will result from permitting reform. For these reasons, the AECOM numbers are understated. Lastly while the AECOM report assessment was limited to California, each state will get a similar economic boost. The specific benefit will vary by state and be based on its particular tax treatment for equipment sales, corporate and personal income tax, property tax rules and rates, and taxation generated by increased customer spending from utility savings.

Question 2. In your testimony you mention that while solar panel prices have come down significantly over the last 5 years, permitting costs have stagnated. In 2007, local permitting and inspection added 13% to the installation, today they add 33% and within a few years, you are predicting that they will add 50%. Is this rising percentage a result of the proliferation of residential solar use? That is, are these increased costs a result of successful growth in the industry?

Answer. The increases in the percentages of permitting as compared to the total cost shows that permitting costs will become an increasingly larger part of the total costs as the hard costs are reduced. The permitting costs are stubborn and are unlikely to go down as they are impervious to the market forces that are currently causing hard costs reductions. Permitting effectively bars installers from reducing other soft costs and getting even greater reductions through efficiencies of scale. That is to say, if we can solve the permitting issues, installers can attack other inefficiencies related to operational deployment, costs to convert sales, capital expenses, etc... Without permitting reform, permitting costs will continue to grow as a percentage of total costs, as will activities that make up the remaining soft costs.

Question 3. Have there been any statewide initiatives to streamline solar permitting processes? If so, how have these fared?

Answer. There are a few states that have statewide initiatives related to permitting, such as Oregon, Vermont and Colorado. While Vermont's process is low cost and significantly streamlined it is unlikely to be replicable in other states. Vermont's permitting structure is very different from other states in that there are limited permitting activities performed locally. This makes it relatively easy to reform the process through legislation impacting the state agencies involved in permitting. Colorado undertook legislation that capped fees, which is a good step, but does not impact consistency, complexity, or submittal, review and timing of approval of applications—components that impact installer's operational costs. In Oregon, they have some consistency in state level codes and processes, which is a good start. Unfortunately, Oregon has not experienced significant enough volume to test these processes to see if they make a significant operational difference under load. Most states in which we operate believe code implementation is inherently local and the state must incentivize, instead of legislate, the solution. We believe the Rooftop Solar Challenge will result in taking the best examples of what works well and generating reasons why deploying these practices is appropriate. S. 1108 would fund that deployment.

Finally, replicating the German cost structure, which has little to no soft costs, should be the policy objective and we applaud DOE for recognizing this goal in the SunShot Initiative. German soft costs are only a fraction of those in the U.S., while the hard costs are generally equivalent. Once widespread permitting reform is implemented the market can independently attack the other soft costs significantly lowering the cost barrier to residential solar deployment.

APPENDIX II

Additional Material Submitted for the Record

GEOTHERMAL ENERGY ASSOCIATION,
Washington, DC, July 5, 2011.

Hon. JOHN TESTER,
U.S. Senate, Washington, DC.

DEAR SENATOR TESTER,

Thank you for introducing S 1142, the Geothermal Exploration and Technology Act of 2011 along with Senators Reid and Murkowski. This is important legislation for the future of geothermal energy.

Geothermal electrical generation is base load renewable power that uses the heat of the earth to create electricity. The U.S. Geological Survey has estimated that the geothermal industry has the potential to produce as much as 89,000 Megawatts of electricity in the United State using readily available conventional geothermal technology. This represents nearly a 30-fold increase from today's geothermal generation levels. But this tremendous potential for additional clean, baseload renewable energy is not being realized because today's economics do not support exploratory geothermal drilling to discover and unlock the potential of new geothermal areas. Exploratory drilling includes drilling to identify, prove and develop an untapped geothermal resource in order to construct a geothermal generation facility.

Geothermal exploration is simply too risky for conventional financing sources. A geothermal exploratory well typically costs \$5 to \$8 million to drill, and may not be usable if it does not encounter proper conditions. There are no sources of debt capital available for this type of exploratory drilling; therefore this drilling has to be done with limited equity capital. Even once a resource has been identified, it is not unusual for development wells to prove unproductive.

Senate bill S. 1142 proposes a new federal loan program to promote exploratory geothermal drilling and promote mapping and development of the nation's substantial untapped geothermal potential. GEA is strongly supportive of S. 1142, and applauds the sponsors for taking the initiative to introduce this legislation. The economic obstacles to geothermal exploration are substantial and an effective program to promote exploratory drilling is critical to the long-term growth of geothermal energy in the United States. A successful national geothermal exploration initiative could unlock tens of thousands of megawatts of undeveloped power potential.

Again, thank you for introducing S 1142, and we look forward to it receiving further consideration by Congress.

Sincerely,

KARL GAWELL,
Executive Director.

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS,
CLIMATE, ENERGY AND ENVIRONMENT POLICY COMMITTEE,
Washington, DC, July 27, 2011.

Hon. JEFF BINGAMAN,
Chairman, Committee on Energy and Natural Resources, U.S. Senate, 204 Dirksen Senate Building, Washington, DC.

RE: Support Amended S 1108 10 Million Solar Roofs Act of 2011

DEAR SENATOR BINGAMAN:

On behalf of the Climate, Energy and Environment Policy Committee of the Metropolitan Washington Council of Governments (COG), I am writing to urge you to support S 1108 10 Million Solar Roofs Act of 2011, with an extension of the technologies that the program considers for permitting and regulation streamlining to

include other clean energy technologies. This bill and its established competitive grant program would remove numerous barriers to adoption of domestic energy options and create incentives for market development that will reduce the cost of domestic clean energy.

COG is dedicated to increasing the adoption of solar and other clean energy technology solutions. COG's Climate and Energy Action Workplan has a goal of 10,000 solar roofs in the region by the end of 2012. At the end of 2010 there were over 1,000 solar roofs installed in the Washington region for a capacity just under 10 megawatts (MW). COG members Arlington and Loudoun Counties have community energy plans that call for over 260 MW of solar installations by 2040. The region is working with EPA's Green Power Partnership to conduct a cooperative solar procurement which could develop 30-40 MW of solar generation. The COG region is committed to solar power as a solution to reducing the region's dependence on foreign energy sources.

COG's Integrated Community Energy Taskforce is considering the use of other clean energy technologies such as district energy, combined heat and power and microgrids, in addition to solar power. These technologies face similar zoning, permitting and regulatory hurdles that will slow adoption. We believe this proposed grant program could be used to reduce the hurdles to adopting a variety of solutions that will work together to increase the production and reliability of domestic clean energy.

Local governments are an integral piece in the adoption of these technologies because of their control of permitting and zoning requirements, as well as influence over groups such as homeowners associations. A grant program that would encourage streamlining the regulatory and permitting processes for clean energy technologies across regions, states and the nation would help achieve market certainty and catalyze market growth, just as the Energy Efficiency and Conservation Block Grant Program helped to stimulate the widespread adoption of energy efficiency and renewable energy technologies.

We urge you to support an amended S 1108 10 Million Solar Roofs Act of 2011 and lessen the burden of regulatory and permitting barriers to implementing and developing the market for a variety of clean energy solutions that will increase our nation's energy independence.

Thank you for giving this your consideration.

Sincerely,

JAY FISETTE,
Chair.

ORMAT TECHNOLOGIES, INC.,
Reno, NV.

Hon. JOHN TESTER,
U.S. Senate, Washington, DC.

DEAR SENATOR TESTER,

On behalf of Ormat Technologies, Inc., I thank you for your interest in our views on S 1142, the Geothermal Exploration and Technology Act of 2011.

Ormat Technologies is a world leader in the geothermal power plant sector. The company has four decades of experience and is responsible for the development of over 1,000 MW of geothermal generation throughout the world and over 400 MW of generation in the United States. Important to this bill is that Ormat is engaged in the largest effort undertaken by a single company, within the last 20 years, to categorize, map, sample and drill Greenfield prospects in the US making it quite knowledgeable on the issues facing exploratory drilling risks.

Geothermal electrical generation is a base load renewable power that uses the heat of the earth to create electricity. The U.S. Geological Survey has estimated that the geothermal industry has the potential to produce as much as 89,000 Megawatts of electricity in the United State using readily available conventional geothermal technology. This represents nearly a 30-fold increase from today's geothermal generation levels. But this tremendous potential for additional clean, baseload renewable energy is not being realized in part because today's economics do not support exploratory geothermal drilling to discover and unlock the potential of new geothermal areas.

Exploratory drilling includes drilling to identify, prove, and develop untapped geothermal resources in order to construct a geothermal generation facility. Geothermal exploration is simply too risky for conventional financing sources. A geothermal exploratory well typically costs \$5 to \$8 million to drill, and may not be usable if it does not encounter proper conditions. In addition, even if it did encounter the com-

mercially viable resource, it will take many years before it can generate revenues that will service a loan. There are no sources of debt capital available for this type of exploratory drilling; therefore this drilling has to be done with limited equity capital.

Senate bill S. 1142 proposes a new federal loan program to promote exploratory geothermal drilling and promote mapping and development of the nation's substantial untapped geothermal potential. Ormat is supportive of S. 1142, and applauds the sponsors for taking the initiative to introduce this legislation. The economic obstacles to geothermal exploration are substantial and an effective program to promote exploratory drilling is critical to the long-term growth of the geothermal sector in the United States. A successful national geothermal exploration initiative will be the first and necessary step in unlocking tens of thousands of megawatts of undeveloped power potential.

Thank you for your attention to this important legislative effort.

Best Regards,

PAUL A. THOMSEN,
Director.

TERRA-GEN POWER, LLC,
Bethesda, MD, July 19, 2011.

Hon. JEFF BINGAMAN,
Chairman, U.S. Senate, Committee on Energy and Natural Resources, 304 Dirksen Senate Office Building, Washington, DC.

DEAR CHAIRMAN BINGAMAN,

I am writing on behalf of Terra Gen Power, one the nation's leading renewable energy companies, to convey our strong support for S.1142, the Geothermal Exploration and Technology Act of 2011. I respectfully request that this letter be included in the record of the Energy Committee's hearing on this important bill.

As you know, geothermal electrical generation is base load renewable power that uses the heat of the earth to create electricity. The U.S. Geological Survey has estimated that the geothermal industry has the potential to produce as much as 89,000 Megawatts of electricity in the United State using readily available conventional geothermal technology. This represents nearly a 30-fold increase from today's geothermal generation levels. But this tremendous potential for additional clean, base-load renewable energy is not being realized because today's economics do not support exploratory geothermal drilling to discover and unlock the potential of new geothermal areas. Exploratory drilling includes drilling to identify, prove and develop an untapped geothermal resource in order to construct a geothermal generation facility.

Senate bill S. 1142 proposes a new federal loan program to promote exploratory geothermal drilling along with the mapping and development of the nation's substantial untapped geothermal potential. Terra Gen Power is strongly supportive of S. 1142, and applauds the bill's sponsors for taking the initiative to introduce this legislation. The economic obstacles to geothermal exploration are substantial and an effective program to promote exploratory drilling is critical to the long-term growth of geothermal energy in the United States. A successful national geothermal exploration initiative could unlock tens of thousands of megawatts of undeveloped power potential.

S 1142 provides a helpful framework for reducing the risks and costs associated with mapping and developing the nation's geothermal resources. However there are two important areas where the measure can be improved.

- First, if the program is to be successful in promoting geothermal exploration, developers will need certainty in advance of the level of cost and risk share that DOE will assume under the program. Such certainty is essential in order to secure the needed financing to develop a project, particularly with regard to the terms for repayment if a well proves to be unproductive. Where possible, loans should be forgiven when a well cannot be commercially developed.
- Second, the program should be designed and implemented to maximize the development of the nation's geothermal resources and the number of new geothermal megawatts added to the grid. Most specifically, this means that the "preference" provision in section 2(d)(2) should be rewritten to include a preference for "projects likely to lead to successful new geothermal development" instead of the current preference for "previously unexplored, underexplored, or unproven geothermal resources in a variety of geological and geographic settings." Improving the success rate to fully develop and prove a geothermal field

will help ensure that program funds are able to bring more renewable megawatts to the grid, be fully repaid, and go further to support more projects.

Also, while authorization of this new initiative is an important step, it is of course essential that sufficient funds are appropriated for this program to be effective.

Thank you for your attention to this important legislative effort. Please feel free to have your staff contact me for any additional information. I can be reached at 202?486?1103 or via email at gwetstone@tgpnyc.com.

Sincerely,

GREGORY S. WETSTONE,
Vice President for Governmental Affairs.

GEO,
Washington, DC, June 6, 2011.

Hon. JON TESTER,
U.S. Senator, 724 Hart Senate Office Building, Washington, DC.

DEAR SENATOR TESTER:

On behalf of the Geothermal Exchange Organization, a non-profit trade association representing the interest of the geothermal heat pump industry, I am writing to thank you for your leadership on energy efficiency issues.

We strongly support the legislation you recently introduced with Senators Murkowski and Reid that, among other things, authorizes a new program to help develop innovative technologies to enhance the use of geothermal heat pumps in commercial applications. Your legislation will help address some of the key barriers in our industry, including reducing the cost of installing the geothermal ground loop and integrating geothermal heat pumps with other building systems.

Thank you again for your leadership. We also want to express our gratitude to your staff, particularly Stephenne Harding. We look forward to continuing to work with you to promote this legislation as well as other initiatives to improve the efficiency of residential and commercial buildings.

Sincerely,

DOUGLAS DOUGHERTY,
President and CEO.

SOUTHERN METHODIST UNIVERSITY,
GEO THERMAL LABORATORY,
HUFFINGTON DEPARTMENT OF EARTH SCIENCES,
Dallas, TX, July 1, 2011.

Hon. JON TESTER,
U.S. Senate, 724 Hart Senate Office Building, Washington, DC.

DEAR SENATOR TESTER,

The SMU Geothermal Laboratory is pleased to write this letter in support of Senate Bill S 1142, the Geothermal Exploration and Technology Act of 2011 you recently introduced with co-sponsors Harry Reid and Lisa Murkowski amending the Energy Independence and Security Act of 2007. In particular, Section 4 of the bill, which addresses the Facilitation of Coproduction of Geothermal Energy on Oil and Gas Leases, will be very helpful towards removing one of the key barriers to entry for this clean, renewable energy source.

In Texas, we have several hundred thousand oil and gas wells, many of which are no longer producing hydrocarbons at an economically viable rate. Every year more wells are 'plugged and abandoned' to be never used again. Our country's environment benefits from using even a small percentage of oil and gas wells as a source for geothermal electricity generation and your support of this bill will help make that possible.

Geothermal energy is one of the few renewable energy sources that are always available, independent of the weather conditions. To develop this resource requires an understanding of both the business model and the geologic structures involved. The existing infrastructure of the oil and gas industry affords us the opportunity to leverage that investment and combine geothermal energy production with hydrocarbon and waste heat production. It presents an opportunity for the oil and gas industry to be part of a clean energy solution, rather than a source of pollution. The interest from the business community is evidenced by the successful SMU conferences 'Geothermal Energy Associated with Oil & Gas Development,' which draw enthusiastic support. Even with the low price of natural gas, the number of oil &

gas industry attendees increased from prior conferences. Additional information on our most recent conference in June 2011, including copies of the presentations, is available at: <http://smu.edu/geothermal/Oil&Gas/GeothermalEnergyUtilization.htm>

CONCLUSION

The next five years will be crucial to gain enough momentum to establish a geothermal industry. There are currently over 200,000 active wells in Texas alone, representing 200,000 potential sources of cost-competitive, renewable, base-load, and clean energy in just our one state. We have a window of opportunity to leverage our country's investment in the oil and gas industry while the economic forces, political pressures, and available technology are aligned towards a common goal of renewable energy. Additional resources of time and dollars would be well spent on exploiting America's geothermal energy potential. We encourage the full Senate to vote in support of S 1142.

Sincerely,

DAVID D. BLACKWELL, PHD,
W. B. Hamilton Professor of Geophysics.
 MARIA RICHARDS,
SMU Geothermal Laboratory Coordinator.

NATIONAL GROUND WATER ASSOCIATION®,
 Westerville, OH, June 28, 2011.

Hon. JON TESTER,
U.S. Senate, 724 Hart Senate Office Building, Washington DC.

DEAR SENATOR TESTER:

The National Ground Water Association (NGWA) thanks you for your leadership on energy issues as evidenced by the introduction of S. 1142. NGWA strongly supports the bill and geothermal heat pump technology as a step toward energy Independence, reduced costs for consumers, and jobs for American manufacturers and installers.

We appreciate your efforts and those of Senators Murkowski and Reid to ensure the United States maintains a leadership position in geothermal heat pump technology. The bill's focus on enhancing research, development, demonstration and commercial application of geothermal heat pumps and the direct use of geothermal energy while maintaining environmental protections will help address the nation's energy needs in a sustainable manner.

NGWA is a nonprofit professional society and trade association. Our 12,000 members from all 50 states include some of the country's leading public and private sector groundwater scientists, engineers, drilling contractors, manufacturers, and suppliers of groundwater related products and services. The groundwater industry has multiple roles in assisting in energy production—from drilling to water resource assessment and water management. Thank you again for your leadership.

Sincerely yours,

KEVIN B. MCCRAY, CAE,
Executive Director.

Web site link to access the "Economic and Fiscal Impact Analysis of Solar Permitting Reform" and "Economic and Fiscal Impact Analysis of Solar Permitting Reform—Executive Summary" reports: http://www.sunrunhome.com/uploads/media_items/aecom-executive-summary.original.pdf