

**HEARING TO EXAMINE S. 383, THE UTILIZING
SIGNIFICANT EMISSIONS WITH INNOVATIVE
TECHNOLOGIES ACT, AND THE STATE OF CUR-
RENT TECHNOLOGIES THAT REDUCE, CAPTURE,
AND USE CARBON DIOXIDE**

HEARING
BEFORE THE
COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE
ONE HUNDRED SIXTEENTH CONGRESS
FIRST SESSION

FEBRUARY 27, 2019

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COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

ONE HUNDRED SIXTEENTH CONGRESS
FIRST SESSION

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WEDNESDAY, FEBRUARY 27, 2019

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

The committee met, pursuant to notice, at 10:05 a.m. in room 406, Dirksen Senate Building, Hon. John Barrasso (chairman of the committee) presiding.

Present: Senators Barrasso, Carper, Inhofe, Capito, Braun, Rounds, Sullivan, Ernst, Cardin, Whitehouse, Merkley, Gillibrand, Booker, Markey, Duckworth, Van Hollen.

**OPENING STATEMENT OF HON. JOHN BARRASSO,
U.S. SENATOR FROM THE STATE OF WYOMING**

Senator BARRASSO. Good morning. The committee will come to order.

Today we are here to discuss Utilizing Significant Emissions with Innovative Technologies Act, or simply, the USEIT Act. The USEIT Act would encourage the commercial use of man-made carbon dioxide emissions.

The bill supports the use of carbon capture technology, including direct air capture. The legislation also expedites permitting for carbon dioxide pipelines in order to move the carbon dioxide from where it is captured to where it is stored or used.

For those of you who are not familiar with the USEIT Act, it is a practical, common-sense piece of legislation to turn carbon dioxide emissions into valuable products. We can use carbon dioxide to extra oil from wells that wouldn't otherwise be profitable through a process called enhanced oil recovery. We can capture carbon dioxide and use it to make building materials and carbon fiber. Captured carbon even can be used for medical purposes.

Today we are going to hear testimony about other new and exciting developments in the area of carbon capture technologies. When we introduced the USEIT Act last year, we had a group of four Senators in support, including members of this committee, Senators Whitehouse and Senators Capito. And I would like to introduce into the record an article published in the National Journal last week entitled The Senate's Quite Climate Policy Deal Maker. You look great in that picture, Sheldon.

[Laughter.]

Senator BARRASSO. The article praises Senator Whitehouse for “finding incremental successes working with Republican colleagues.” And I hope there is no objection to introducing this.

Senator WHITEHOUSE. I don’t know. Does Senator Cardin have any objection?

[Laughter.]

Senator WHITEHOUSE. Well, thank you, Chairman, that is kind of you.

Senator BARRASSO. The praise is well-deserved.

This Congress, I want to again thank Senator Whitehouse and Senator Capito for their continued partnership as we work to get the USEIT Act to the President’s desk. Support for the USEIT Act has now grown from an initial bipartisan group of four Senators to a larger group of 12 Senators, including seven of my colleagues on this committee. Along with Senators Whitehouse and Capito, I am pleased, this Congress, to have Ranking Member Carper, Senator Cramer, Senator Duckworth, Senator Rounds and Senator Inhofe as cosponsors of the USEIT Act.

In addition, a bipartisan companion bill has been introduced in the House of Representatives.

When we had a hearing on the USEIT Act last year, we heard testimony about the many ways carbon dioxide can be transformed from a useless by-product into a valuable commercial good. Interest in the USEIT Act has continued to grow since last year. This is in large part due to the bipartisan success we had with the FUTURE Act, which was signed into law a year ago. Senators Whitehouse, Capito and I led that legislative effort as well. The FUTURE Act extended and expanded the tax credit for using and storing carbon dioxide.

The Clean Air Task Force called the FUTURE Act one of the most important bills for reducing global warming pollution in the last two decades. The extension and expansion of the so-called 45Q tax credit to the FUTURE Act has expended public interest about how we capture and use carbon dioxide.

This Congress, I have continued to focus on ways to expedite and expand the use of carbon capture. That begins with the USEIT Act. Last Congress, we unanimously supported the legislation out of committee by a voice vote. This Congress, we want it signed into law. America should reduce emissions through innovation, not punishing government regulations. The USEIT Act advances that goal.

This is also the approach we took with the bipartisan Nuclear Energy Innovation and Modernization Act. The bill will make sure America remains a leader in nuclear energy innovation. Nuclear power creates jobs and is critical if we are going to reduce our carbon dioxide emissions. President Trump signed the legislation into law earlier this year.

Passage of the Nuclear Energy Innovation and Modernization Act was an important step forward. I look forward to continuing to work with members of this committee on both sides of the aisle to make additional progress in promoting nuclear energy technology, including exploring solutions to nuclear waste disposal issues.

This committee has and should continue to lead on bipartisan and on common-sense solutions. Such solutions do not include, in

my opinion, the Green New Deal, which I believe is unworkable and according to Doug Holtz-Eakin, the former director of the Congressional Budget Office, would cost between \$51 trillion and \$93 trillion dollars.

My ideas do include the USEIT Act, as Axios recently reported, although the USEIT Act is not as high-profile or sweeping as the Green New Deal resolution, also unveiled on the same day. The bill takes a more direct, concrete aim at the root of climate change, emissions themselves. So when we work together, we have shown we can promote American leadership, grow our economy and lower our emissions.

I would now like to recognize Ranking Member Carper, a cosponsor of the USEIT Act, for his opening statement.

**OPENING STATEMENT OF HON. THOMAS R. CARPER,
U.S. SENATOR FROM THE STATE OF DELAWARE**

Senator CARPER. Thanks, Mr. Chairman.

Sheldon, I just note, that looking over your shoulder, in this article, that the headline says, the Senate's Quiet Climate Policy deal maker, Bernie, is looking over your shoulder. So for what it's worth.

[Laughter.]

Senator CARPER. Mr. Chairman, thank you for convening this hearing today and for your leadership as we begin to examine one of the many ways we can work together to find solutions that we need to, and then craft legislation to support what I call win-win policies that address climate change while addressing job creation and fostering economic growth.

In today's hearing, we are going to be focusing on technologies that reduce, capture, and use carbon dioxide as well as bipartisan legislation that supports them. Utilizing these significant innovations with innovative technology or USEIT is sponsored, as we know, by the Chairman, cosponsored by a bunch of us, including me. And let's start with the primary reason I believe we need to act, and that is, to address carbon dioxide emissions and climate change.

The science behind climate change is settled, from our warming oceans to heat traps in our atmosphere. Climate change is real. It is happening, and human activities, such as burning fossil fuels, are greatly contributing to the problem. Scientists have also found direct links between climate change and recent extreme weather events such as the rash of devastating category 5 hurricanes that our Country has experienced, wildfires in the west, they are as big as my State of Delaware. Again, the science is clear from these extreme weather events, they are only going to get worse if we do nothing.

It doesn't matter if you are from a coastal State or from a landlocked State. I have lived in both. If you care about public health or the environment, if you care about our economy and our national security, the reality of climate change is that every person living in our Country will eventually see or experience it. Most are already affected by it today. God knows that we are in Delaware.

As I see it, we have a couple of options. We can take up this fight and get serious about addressing and adopting and adapting to cli-

mate change, or we can stick our heads in the sand and do nothing. Doing so I think threatens the future of our children and our grandchildren. I say we fight and we fight together, not with one another. Senator Barrasso's colleague, his wing man from Wyoming is Mike Enzi, who is a great guy. He is the author of the 80-20 rule that I oftentimes cite. I used to explain why Mike Enzi, a very conservative Republican, got so much accomplished by working with Ted Kennedy, the most liberal Democrat we had at the time. And Mike said that, "Ted and I work on the 80-20 rule." I said, what is that, and he said, "We agree on 80 percent of the stuff, we disagree on 20 percent of the stuff, we focus on the 80 percent where we agree, and we'll turn to the other 20 percent some other time." I think the USEIT Act is just a great example of the 80-20 rule. So we appreciate his wisdom.

The fight, however, can also do some real good, can unleash American innovation and job opportunities, while putting the U.S. in the driver's seat of a global clean energy economy that would include this kind of technology. That won't be easy. We still need a comprehensive approach, every tool in our tool box to address this issue.

To make that major shift toward a cleaner energy economy, R&D and our other Federal investments, tax incentives from our regulations and all our other policies that harness market forces are going to be on the table, too. Fortunately, we are not starting this fight from square one. Smart investments and regulations made by the Obama administration, and we can go back even as far as the George Herbert Walker Bush administration, results in dramatic increases in the deployment of energy efficiency, clean energy technology at a cheaper cost.

As a result of these smart policies, more than 3 million people went to work today in clean energy energy jobs, while consumers pay less, not more, in energy costs now than they did a decade ago. Which proves yet again we can have a cleaner environment, better climate, and stronger economy.

Despite these successes, much more is needed to stem the tide of climate change. We are going to hear today from our witnesses that major investments in carbon capture utilization and sequestration technologies are in demand. The USEIT Act helps make these investments through R&D and by lowering other barriers preventing the widespread development and deployment of CCUS. I am especially pleased to see that this year's version of the bill makes additional investments in direct air capture of carbon pollution. With the changes we have made, and again, I am happy to join our Chairman and colleagues and Sheldon in cosponsoring this USEIT Act.

We want to assure the broad deployment of CCUS and other clean energy technologies. However, the U.S. must make bolder, bigger actions than the USEIT Act. And we must embrace broad climate policies, such as a price on carbon eventually to really move the needle on our climate change policies.

With that said, this hearing is not the end. It is just the beginning. I look forward to working with the Chairman and all of our colleagues here to make sure that our Country is more secure, both economically and with respect to the threat of climate change. My

hope is that we can do so in this Congress. This is a good place to start. Thanks so much.

Senator BARRASSO. Thank you, Senator Carper.

I would like to give my two colleagues who have supported the USEIT Act since its initial introduction last year an opportunity to provide some remarks. Senator Whitehouse, would you like to say a few words?

**OPENING OF HON. SHELDON WHITEHOUSE,
U.S. SENATOR FROM THE STATE OF RHODE ISLAND**

Senator WHITEHOUSE. I would be delighted to, Chairman. Thank you very much for your kind words and for your leadership on this.

If we can get this bill passed, it will build on the success of the FUTURE Act, the 45Q Act, which we successfully got into the 2018 budget deal. And I want to thank our chairman, Senator Barrasso, and Senator Capito, for their leadership on the FUTURE Act. Pulling everybody together was a broad and unlikely coalition, but it worked, and the bill is in place.

It will help solve the market failure of there being no revenue proposition for captured carbon. We gave it a revenue proposition, and the market has responded. Occidental Energy and Hoyt Energy have announced that they will pursue a project to capture CO₂ from two ethanol plants supported by the 45Q Rule. Net Power, a novel natural gas electricity-generation technology that inherently captures all its CO₂ emissions, has said it will use the credit to build its first commercial scale plant.

So things are already moving. But nobody likes highways and roads more than Senator Inhofe, and this USEIT Act will basically allow for highways and roads for the CO₂ to get from the place where it is captured to the place where it can be either used or sequestered. At the moment, you can do things like they are doing up in Saskatchewan and you can capture carbon from the plants emissions and run it to, as the Chairman pointed out, enhanced oil recovery sites. But that limits the reach of this technology. And we need to expand it. The USEIT Act will help expand it.

I want to thank Chairman Barrasso for his leadership on both of these bills. I appreciate it very much. I want to thank our ranking member, Senator Carper, for his very helpful contributions to this bill and his support of it. Senator Capito is again a key, lead player in this, and I appreciate and thank her. Senators Duckworth, Rounds and Cramer were in my notes to thank. But Chairman Barrasso mentioned that Senator Inhofe is a cosponsor as well. So I want to express my appreciation to him.

We have had very good luck when we work with Senator Inhofe on pieces of legislation. We have a plastics bill that passed by unanimous consent with Senator Inhofe's support. We have the TSCA bill that passed Congress and has been a very strong, bipartisan environmental achievement, with not just Senator Inhofe's support, but his leadership. And Senator Inhofe is very often very active in making sure that infrastructure bills get done. We have had a few occasions where we have worked together to break various logjams in the Senate to keep infrastructure bills moving.

I think that our colleagues look at a bill that has both Senator Whitehouse and Senator Inhofe cosponsoring it and think, well, there is probably room for me in that bill.

[Laughter.]

Senator WHITEHOUSE. And that, combined with Senator Inhofe's immense legislative skills at getting things done, I think I would give him a particular welcome to this bill.

So we have a big opportunity here. I do think that we have shown that pricing carbon works, that the market does need to accept that there is a real difference between carbon-intensive power and carbon-free power. And the quicker we can reflect that, the better we will respond to the climate crisis that is looming over us.

So it is great to have this bipartisan opportunity. I have companies like AgCorp and BioProcessH2O and my home State of Rhode Island that are excited by these prospects.

I will close by saying that some years ago, I won the very prestigious award of being the algae advocate of the year. I know you are all deeply jealous of that accomplishment by me. But one of the reasons I was the algae advocate of the year was because algae actually can get into the exhaust stream once CO₂ gets captured, and it can be turned into a variety of products, from feed to makeup to human food products and so forth. So when we added carbon capture utilization and sequestration, a kind word to the algae folks.

Thank you very much, Mr. Chairman.

Senator BARRASSO. Thank you, Senator Whitehouse.

Senator Capito, over to you.

**OPENING STATEMENT OF HON. SHELLEY MOORE CAPITO,
U.S. SENATOR FROM THE STATE OF WEST VIRGINIA**

Senator CAPITO. Thank you, Mr. Chairman. That is going to be a hard act to follow Captain Algae over there.

[Laughter.]

Senator CAPITO. But I am going to try. I do appreciate, certainly, Senator Whitehouse's leadership on this, when we introduced it last year, when we did 45Q, the FUTURE Act. It was amazing to see the different stakeholders in the room. And I want to thank the chairman and the ranking member for being here, and Senator Inhofe for joining on to our second try here.

I want to thank the chairman, too, for prioritizing this bill early in our session. I really appreciate this. We did learn some things last year when we tried to move the bill forward. And this year, I am happy to say that one of my counterparts from West Virginia, David McKinley, has already introduced a counterpart for this in the House.

So I think timely enactment of the USEIT Act is of essence. Because last year we did pass the FUTURE Act, as Senator Whitehouse said. The FUTURE Act expanded and improved the 45Q tax credit for the utilization, carbon capture and storage. I think it was a very substantive step.

But we have had some headwinds with that that prevent that bipartisan achievement from having its full effect. First of all, the IRS has yet to provide revised guidance, helping us to utilize the credit. And just recently, Senators Whitehouse and Barrasso and I

sent a letter earlier to the IRS leadership requesting that they expedite that guidance.

The January 1, 2024, deadline for projects to begin construction is looming ever larger. And we know, and you all know certainly, and I know our panel will tell us, these are not inexpensive projects as you are moving forward. You are making enormous capital commitments along with a longevity. Predictability is absolutely critical.

Second, there remains the lack of regulatory certainty from our Federal permitting agencies. That is where we know that this bill comes in, providing a clear playbook for securing the necessary permits. Senator Whitehouse talked about sort of the belts and suspenders aspect of this bill, and the associated infrastructure, like CO₂ pipelines, will help sponsors know what they are getting into. And it will provide assurance that as they seek private investment that a project won't get lost in approval purgatory.

This committee has heard substantive testimony about the cost overruns and delays that can result when project sponsors in any arena, and even the agencies themselves, don't know what the approval process actually looks like. So that is why timely enactment of the USEIT Act is so vital for making broad-based deployment of carbon capture utilization and storage technologies reality.

As I am sure we will hear from our witnesses today, if the United States and the world are to bend the curve on atmospheric carbon dioxide, CCUS has to be a part of a policy and technological win and mix. CCUS will also serve to preserve employment in industries like coal and construction and manufacturing, and in the process, it will prevent major market disruptions that could kill jobs and significantly raise costs for energy and goods across our Nation.

So I look forward to hearing from the panel. Again, thank you for bringing this bill up so quickly. It is an important policy and it has a lot of good, bipartisan cosponsors and interests. Thank you.

Senator BARRASSO. Thank you, Senator Capito. Senator Carper.

Senator CARPER. I was counting the number of times I heard the word bipartisan. I stopped counting at 20. And normally, you would hear a lot about fighting, how we don't get along, we don't work on anything together. And normally, at this part of our hearings, we stop and we join hands and sing Kum By Yah.

[Laughter.]

Senator CARPER. And this might be one of those moments, if not right away, then maybe at the end of the hearing. But we are glad you are here to add to the spirit. Thank you.

Senator BARRASSO. Thank you, Senator Carper.

I am pleased now to introduce our three witnesses, Paul Sukut, who is CEO and General Manager of Basin Electric Power Cooperative. Basin provides power to residents of nine States, including my home State of Wyoming. We are happy for your willingness to testify.

We also have with us Mr. Steve Oldham, who is the CEO of Carbon Engineering, and Mr. Kurt Waltzer, who is the Managing Director of the Clean Air Task Force.

So welcome. I invite all of you to testify. I want to remind the witnesses that your full written testimony will be included and

made part of the official hearing record today. We ask that you try to keep your statement to within 5 minutes, so we will have some time for questions. I look forward to hearing from each of you. Would you like to begin, Mr. Sukut?

**STATEMENT OF PAUL SUKUT, GENERAL MANAGER AND
CEO, BASIN ELECTRIC POWER COOPERATIVE**

Mr. SUKUT. Thank you, and good morning, Chairman Barrasso, Ranking Member Carper and members of the committee.

As the Senator said, my name is Paul Sukut. I am the CEO and General Manager of Basin Electric Power Cooperative. We are headquartered in Bismarck, North Dakota. I have worked in the energy industry about 40 years, about 36 with Basin Electric, and really, I have served as CEO since 2014.

I would like to thank you for the invitation to speak this morning about innovation in the utility industry and other efforts to reduce emissions, particularly carbon. Basin Electric is a generation and transmission cooperative that provides wholesale electricity to 141 rural electric cooperatives that serve 3 million customers across 9 States.

We have a diverse generation portfolio, consisting of over 6,000 megawatts of coal, natural gas, wind, recovered energy, nuclear and market purchase agreements. Our generation resources participate both in the MISO and SPP regional transmission organizations.

Basin electric and its members have invested billions of dollars in capital in recent years to secure its fossil-based generation. I would refer the committee to my written testimony for additional details on our facilities. Basin Electric is actively engaged in assuring that these assets can continue to operate in a carbon-constrained future, and we strongly support common-sense carbon management regulation that recognizes improvements already made to existing plants, and sets a standard that is achievable with cost-effective technologies that can be applied to the facility itself and allows flexibility.

As utilities make decades-long planning decisions, it is imperative to have certainty with respect to how regulations impact our facilities, and the associated costs just to run them. Looking further into the future, Basin Electric remains interested in developing solutions to innovate with respect to cost-effective clean coal technologies that capture, utilize and sequester CO₂.

Basin Electric is the host site for the Integrated Test Center located at our Dry Fork Station near Gillette, Wyoming. This test facility will provide space for researchers to turn CO₂ into a marketable commodity.

In addition to the Integrated Test Center, Basin has been involved with exploring the potential for near-zero emission Allam Cycle technology as an option for future power generation. Again, I would refer the committee members to my written testimony for details on this technology, our partners and its status.

I would like to highlight for the committee a subsidiary of Basin Electric, the Dakota Gasification Company, which operates the Great Plains Synfuels Plant near Beulah, North Dakota. This one of a kind facility produces synthetic natural gas from lignite coal,

and several fertilizer and chemical coal products. Notably, the facility is also one of the largest CO₂ sequestration projects in the world, utilizing CO₂ separated during the coal gasification process for enhanced oil recovery in Saskatchewan, Canada.

I believe that the plant and the development of its products continue to demonstrate what a resource we have in our coal reserves, and what can happen with smart innovation. I hope this is the kind of progress that we will continue to see from the ITC and through other initiatives for value-added coal use and CO₂ capture at the Federal and State levels.

Finally, a lot of discussion on carbon capture tends to focus on the technological challenges of economically capturing CO₂. But the other side of this equation is what you do with CO₂ once it is captured. Recently, Basin Electric has participated with the Plains CO₂ Reduction Partnership in the Department of Energy's CarbonSAFE program, to investigate the geology in both North Dakota and Wyoming and ultimately develop a large-scale injection test well for CO₂ sequestration. Developing a solution for captured CO₂ will inevitably require additional build-out of pipeline infrastructure in order to come to fruition.

For this reason, we support the Utilizing Significant Emissions with Innovative Technologies Act and its provisions to expedite guidance, permitting and construction of CO₂ infrastructure. As a not-for-profit electric cooperative, Basin Electric has a fiduciary responsibility to its members to provide electric generation at the lowest possible cost.

The question of carbon capture is not only one of a technology barrier, but an economic one as well. Many factors impacting the utility industry today make capital investments, such as new coal construction, cost prohibitive if not impossible.

To this end, we appreciate the bipartisan support from the members of this committee for legislation such as the 45Q capture tax credit that was expanded last year, as well as the USEIT Act that provide further assistance to relieve the regulatory and financial barriers to carbon capture utilization and sequestration, as well as other novel technologies.

In closing, Basin Electric has undergone a number of changes as the electric industry has evolved. But I believe we have a good story to tell with respect to CO₂ reduction, and are well-positioned to serve our members now and well into the future.

Again, thank you for the opportunity to share my thoughts. I would be happy to answer any questions that the committee may have.

[The prepared statement of Mr. Sukut follows:]

**Testimony of Paul Sukut, CEO and General Manager, Basin Electric Power Cooperative
Before the Senate Committee on Environment and Public Works
February 27, 2019**

Introduction

Good morning Chairman Barrasso, Ranking Member Carper, and members of the committee. My name is Paul Sukut, I am the CEO and General Manager of Basin Electric Power Cooperative (Basin Electric) headquartered in Bismarck, North Dakota. I have worked in the energy industry for 40 years, including over 35 with Basin Electric. I served as the cooperative's Chief Financial Officer and Deputy General Manager prior to becoming CEO in 2014.

Thank you for the invitation to speak this morning about innovation in the utility industry and our efforts to reduce emissions. Basin Electric is a generation and transmission cooperative that provides wholesale electricity to 141 rural electric cooperatives who serve three million consumers in nine states across a high voltage transmission system of over 2,500 miles (owned and maintained).

Basin Electric has a diverse generation portfolio consisting of approximately 6,700 megawatts of coal, natural gas, wind, recovered energy, oil, nuclear power, and market purchase agreements. Our generation resources participate in both the Midcontinent Independent System Operator and Southwest Power Pool regional transmission organizations.

In North Dakota, Basin Electric operates two separate, two-unit coal-based power plants, the Antelope Valley Station and Leland Olds Station. To meet the demands of the rapid development in the Bakken oil fields in Western North Dakota, Basin Electric recently completed deployment of approximately 500 megawatts of natural gas-fired electric generation and over 200 hundred miles of 345-kV transmission infrastructure. As a result, we now own and operate simple cycle natural gas turbines and reciprocating engine generation at the Pioneer Generation Station, along with simple cycle natural gas turbines at the Lonesome Creek Station.

In Wyoming, Basin Electric is a member of the Missouri Basin Power Project that owns the Laramie River Station in Wheatland and is operated by Basin Electric. We also operate one of the newest additions to the coal-based fleet, the Dry Fork Station outside of Gillette, which commenced operation in 2011. In addition to these coal-based facilities, Basin Electric operates 45 megawatts of distributed generation in Wyoming consisting of nine natural gas-fired combustion turbines. Basin Electric also built and operates a simple cycle natural gas turbine at the Culbertson Station in Montana.

The Deer Creek Station - a 300 megawatt natural gas combined cycle plant near Elkton, South Dakota - went into service in 2012. We also operate a two-unit simple cycle natural gas turbine at the Groton Station, as well as an oil-based peaking station near Vermillion. Finally, Basin Electric has also developed and owns nearly 300 megawatts of wind generation since 2009, and has power purchase agreements for over 1,000 megawatts of additional wind power. By 2021, Basin Electric will contract and own nearly 2,000 megawatts of wind generation.

Carbon-Constrained Future

As I've described, Basin Electric and its members have invested billions in capital in recent years to secure its fossil-based generation. In addition to new facilities, such as Dry Fork and Deer Creek, Basin Electric has and continues to invest in the latest environmental controls for its existing facilities - \$1.6 billion to-date. At the same time, we have sought to diversify our portfolio with renewable generation and low-cost power purchase agreements enabled in part by the renewable Production Tax Credit. By next year, 25 percent of the energy Basin Electric will be delivering to our members will be from renewable sources. This investment and diversification in our generation portfolio has significantly lowered our carbon dioxide (CO₂) emissions per megawatt-hour and we expect to continue that trend.

Going forward, Basin Electric is actively-engaged in ensuring that these assets can continue to operate in a carbon-constrained future. One of the biggest factors driving our long-term planning involves what the Environmental Protection Agency (EPA) ultimately does about CO₂ regulation. The Clean Power Plan would have been devastating to rural electric cooperatives. At the time the CPP was released, we estimated a \$5 billion impact to Basin Electric and our members, in both stranded costs for our existing coal generation, and replacement generation to continue meeting load. We support the EPA in finalizing the proposed Affordable Clean Energy rule. This proposed regulation recognizes the improvements made to existing plants, provides for setting a standard that is achievable with cost-effective technologies that can be applied to the facility itself, and allows for flexibility to achieve a unit-based standard.

Basin Electric continues to support reform of other Clean Air Act programs, such as New Source Review, to ensure that utilities can make cost-effective improvements to their facilities that increase efficiency and reduce emissions. As utilities make decades-long planning decisions, it is imperative to have certainty with respect to how regulations impact our facilities and the associated costs to run them. The absence of regulatory certainty creates the threat of not knowing whether we can continue operating a facility through the duration of its estimated life. Our number one priority as a utility, besides providing low-cost and reliable power, is to ensure that our generating facilities do not become stranded assets for which our members still have to pay for yet receive no benefit from. The Clean Air Act directed the EPA to account for remaining useful life in its regulation of existing facilities to address this concern, and regulations need to uphold this important principle.

Innovation

Looking further into the future, Basin Electric remains interested in developing solutions to help crack the code with respect to cost-effective clean coal technologies that capture, utilize, and sequester CO₂. Basin Electric is a partner - along with Tri-State Generation and Transmission Association, and the National Rural Electric Cooperatives Association - with the Integrated Test Center (ITC) located at our Dry Fork Station. Using flue gas provided by Dry Fork, this test facility will provide space for researchers to explore new and innovative solutions to turn CO₂ into a marketable commodity. The State of Wyoming invested in the design and construction of this facility, and oversees its operation. Five teams from several different countries are preparing to move on-site and will compete for the NRG COSIA Carbon XPRIZE.

In addition to the ITC, Basin has been involved with exploring the potential for Allam Cycle technology as an option for future power generation. The Allam Cycle, developed by NET Power, is a new power cycle that utilizes oxy-fired natural gas to produce supercritical CO₂, which is then used as the working fluid in a turbine to generate power with near-zero emissions. Given Basin Electric's long history with coal gasification at the Great Plains Synfuels Plant, and our interest in continuing to utilize North Dakota's vast lignite reserves, we have looked into whether this technology can be deployed with gasified coal. At this point, Basin Electric, and its partners - ALLETE Clean Energy, the Lignite Energy Council, the North Dakota Industrial Commission, and the Energy and Environmental Research Center, have been conducting research on syngas combustion and feasibility while NET Power completes construction and testing at its demonstration facility near Houston, Texas.

I would also like to highlight for the committee a subsidiary of Basin Electric, the Dakota Gasification Company, which operates the Great Plains Synfuels Plant near Beulah, North Dakota. This one-of-a-kind facility produces synthetic natural gas from lignite coal, and produces approximately 600,000 tons of fertilizer co-products including anhydrous ammonia, ammonium sulfate, and a newly-commissioned urea plant that began operation early last year. In addition to fertilizers, the facility produces several chemical co-products such as phenol, naphtha, tar oil, krypton and xenon gases, and liquid nitrogen.

Originally designed to solely produce synthetic natural gas following the 1970s energy crisis, the Dakota Gasification Company has diversified its product stream after acquiring the facility from the Department of Energy in 1988. Today, nearly 80 percent of the plant's revenue is derived from products other than synthetic natural gas. In the process, the Dakota Gasification Company returned over \$1 billion of the Federal Government's original investment in the plant through revenue sharing and surrender of tax credits. Notably, the facility is also one of the largest CO₂ sequestration projects in the world. Approximately three million tons of CO₂ are separated annually during the process of reforming raw gasified coal into pipeline-quality natural gas. Since 2000, more than 35 million tons of CO₂ have been shipped via pipeline to the Weyburn oil field in Saskatchewan and utilized for enhanced oil recovery.

The Great Plains Synfuels Plant has certainly had its challenges throughout the years, but I wanted to highlight that this facility and the development of these products continue to demonstrate what a resource we have in our coal reserves, and what can happen when innovation is unleashed and fostered. I hope this is the kind of progress that we will continue to see from participants at the ITC, and through other initiatives for value-added coal-use and CO₂ capture at the federal and state levels.

Finally, a lot of our discussions on carbon capture tend to focus on the technological challenge of economically capturing CO₂ from electric generation, but the other side of this equation is what you do with CO₂ once it is captured. As I mentioned, Basin Electric, through the Dakota Gasification Company has delivered CO₂ for enhanced oil recovery for nearly two decades. More recently, Basin Electric has participated with the Plains CO₂ Reduction Partnership in the Department of Energy's CarbonSAFE program to investigate geology in both North Dakota and Wyoming, and ultimately develop a large-scale injection test well for CO₂ sequestration. I believe

this program will provide important insight to prove out both geological capacity for permanently storing CO₂, as well as the costs associated with injecting, storing, and monitoring a sequestration well.

Our region is particularly blessed with the geology for CO₂ sequestration and enhanced oil recovery, but either of those options will require additional buildout of pipeline infrastructure to come to fruition. For this reason, we support the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act and its provisions to expedite guidance, permitting, and construction of CO₂ infrastructure.

As a not-for-profit electric cooperative, Basin Electric has a fiduciary responsibility to its members to provide reliable electric generation at the least cost. As I mentioned, we have worked to achieve this goal by diversifying our portfolio with wind and market purchases. Basin Electric has a vested interest in generation sources with long-term fuel certainty, such as coal, that provide affordable power and serve as the backbone of the electric grid. However, in the near-term historically-low natural gas prices continue to drive new generation decisions while regulatory uncertainty makes new coal construction a cost-prohibitive option. Moreover, regional transmission organizations provide no pricing mechanisms to compensate utilities for investment in carbon-free or low-carbon facilities such as nuclear or carbon capture. The markets' failure to recognize and compensate these attributes effectively prevents market participants from spending considerable capital on these technologies.

To this end, we appreciate members of this committee and others for their bipartisan support of policies that allow the Federal Government to be a partner with states and the private sector to prove out technologies, mitigate the risk of uncertainty, and eventually allow for commercial deployment of new electric generation by Basin Electric and other utilities. Legislation such as the 45Q carbon capture tax credit that was expanded last year, as well as the USE IT Act, provide further assistance to relieve the regulatory and financial barriers to carbon capture, utilization, and sequestration, as well as other novel technologies. I thank members of this committee for their support of these legislative efforts.

Conclusion

In closing, there is no shortage of challenges as we seek solutions that balance the need for affordable and reliable energy with the challenge of reducing CO₂ emissions. However, the cooperative model was established specifically in response to a challenge, to extend electric service at the time to those areas no one else would, and continues to serve us well as the electric industry evolves. Basin Electric has undergone a number of changes in recent years, we have a good story to tell with respect to CO₂ reduction, and are well-positioned to serve our members at the end of the line now and well into the future.

Thank you for the opportunity to discuss our thoughts on innovation and technology development in the electric sector, and for your support of these efforts. I would be happy to answer any questions you might have.

Senate Committee on Environment and Public Works
Hearing entitled, "Hearing to Examine S. 383, the Utilizing Significant Emissions with Innovative Technologies Act, and the State of Current Technologies that Reduce, Capture, and Use Carbon Dioxide"
February 27, 2019
Questions for the Record for Mr. Sukut

Chairman Barrasso:

1. In your testimony, you mentioned a project that was held up by the New Source Review program. Although the project would have reduced emissions and the amount of coal burned, it did not go forward. In your experience, is the current New Source Review program a common impediment to projects that would reduce emissions?

I would say that those types of capital projects are not terribly common, but when they do come up, NSR is certainly a consideration and can be an impediment. However, NSR evaluations are a frequent routine that require considerable staff time and expense to determine whether routine maintenance or modifications will trigger NSR. Case in point, the first step when we plan a maintenance outage for our generating facilities is whether the outage work will trigger NSR. It is a program that would benefit from clarification and streamlining to avoid these issues.

2. In your testimony, you discussed how the National Environmental Policy Act environmental review process limited Basin from securing public financing for a wind farm project. Can you talk more about that project and the environmental review uncertainties Basin encountered?

Starting in the late 2000s, Basin's member systems in Western North Dakota experienced sudden and immense load growth due to the Bakken oil boom. Basin could not build high-voltage transmission fast enough to meet load due to the length of time needed to acquire easements, right-of-ways, as well as state and federal permitting, including NEPA analysis and potential mitigation requirements.

As such, our only option was to pursue construction of generation located in Western North Dakota near the distribution network. A condition of pursuing funding from the Rural Utilities Service was having to perform environmental analysis under NEPA. However, we had to have the generation in-place and operating before an Environmental Impact Statement would have been completed, therefore we had to seek outside sources of funds to build generation and keep the lights on in the Bakken region. Had we been forced to rely on RUS, the NEPA process would have been a significant threat to our ability to provide reliable power during this period.

At the same time, Basin sought to utilize section 1603 grants provided by the American Recovery and Reinvestment Act in order to build the PrairieWinds 1 wind project. While we did seek RUS funding for this project, the NEPA process was not complete until years after the project had been placed into operation. In the meantime, Basin had to expose

itself to considerable risk by utilizing short-term capital and general operating funds to construct the project and meet the timing requirements of section 1603.

3. Can federal permitting uncertainty slow, or worse altogether prevent, environmentally beneficial projects that would reduce emissions from moving forward? If so, do these impediments affect development of both baseload power resources as well as more intermittent power resources?

Yes. As I've mentioned, NSR has been a barrier to projects that could increase efficiency and reduce emissions. Similarly, the NEPA process has been a barrier to developing wind projects. In addition, NEPA and other federal permitting requirements such as mitigation requirements from the U.S. Fish and Wildlife Service, and the pending Waters of the U.S. definition can greatly impact both renewable energy projects, as well as transmission development needed to transport that energy to load.

Senator Whitehouse:

4. What is the best-case scenario for deployment of CCUS by 2040? What could we expect in terms of quantity of CO2 capture and removal? How do we get there?

The Carbon Utilization Research Council, a group of which Basin serves as a member, has developed a roadmap that identifies technologies that can be available by the 2025-2035 timeframe that can generate electricity while utilizing CCUS. I would encourage you and your staff to review this report and its recommendations for additional detail: <http://www.curc.net/webfiles/Roadmap/FINAL%202018%20CURC-EPRI%20Roadmap.pdf>. A companion study by CURC and ClearPath, called "Making Carbon a Commodity" shows that if the technology recommendations of the roadmap are implemented, there could upwards of 80 gigawatts of carbon capture on both coal and natural gas fired power plants in operation by 2040 that would create 780,000 new jobs and increase our GDP by \$190 billion. This analysis can be reviewed at: <http://curc.net/making-carbon-a-commodity-the-potential-of-carbon-capture-rdd>

Simply put, the best case would be new thermal plants with integrated CO2 capture by 2040 that are able to provide a competitive cost of energy. The broad application of these facilities could be limited by the market for utilization. Again, this is why it is important for the Federal Government to lead with policies like the USE IT Act to help sustainable CO2 markets materialize, similar to how the renewable Production Tax Credit and other incentives have helped the wind industry become a prominent power provider. Finally, as most utilities have become participants in wholesale markets through Regional Transmission Organizations, the need to be able to recover these costs from the RTO market is critical. It is difficult, if not impossible, for utilities to justify these investments otherwise.

5. What are the most exciting technologies and projects on the radar?

As I mentioned during my testimony, there are many advancements being made with post-combustion technologies such as amine CO2 scrubbers and membrane technology. Basin Electric has been working with numerous partners including the State of North Dakota to study the feasibility of utilizing NET Power's Allam Cycle technology with gasified coal to generate electricity with near-zero emissions. So far, these technologies have yet to break the cost barriers in today's wholesale electricity markets, but there is a need to continue proving the technology because we will need options for backup generation to serve load when renewables are not available, i.e., the wind is not blowing and the sun is not shining.

6. How would a price on carbon affect the economics of CCUS and investment in CCUS technologies?

As I mentioned during my testimony, as a cooperative utility we are tasked with providing electricity at the least cost. Any kind of price, tax, or other effort that will increase the cost of utilizing fossil resources will have a negative impact on our membership/the consumer, and will discourage investment in CCUS. A carbon price would further accelerate the current dynamic of coal plant retirements and reliance on natural gas generation, leaving few, if any, facilities at which to test CCUS. A better way to incent the development of these technologies is to continue investment in research and development to lower the cost curve and help utilities deploy CCUS without harming the electric consumer.

Senator BARRASSO. Thank you very much, Mr. Sukut.
Mr. Oldham, welcome to the committee.

STATEMENT OF STEVE OLDHAM, CEO, CARBON ENGINEERING

Mr. OLDHAM. Thank you. Mr. Chairman, Ranking Member Carper, thank you very much for the opportunity to meet, and the other distinguished members of the committee, too. Thank you for your attention to this matter.

Senator CARPER. Mr. Chairman, could we have a translator, please?

[Laughter.]

Mr. OLDHAM. Is it my British accent? I will talk slowly.

[Laughter.]

Mr. OLDHAM. I am CEO of a company called Carbon Engineering. We are actually based in British Columbia, Canada. We are an innovative company. We are privately funded. And we have been focused on developing technologies that will allow the large-scale capture of atmospheric CO₂.

Why atmospheric CO₂? Why do we focus on capturing that? I am a simple guy, I would like to do a simple metaphor to help you and everybody else understand. Think of your kid in the bathtub. Think of the bathtub as the atmosphere, and we fill the bath with water. We all know there is a safe level of water that you can put in there before your kind is under any threat whatsoever.

Now put the taps on, and leave the taps running. So the taps running is the equivalent of CO₂ emissions. We keep building more and more water in that bathtub. Eventually, it becomes a threat for the child and the bathtub. Eventually, it runs over the side of the bathtub and wrecks the whole house.

So what do we do about that? The first and most obvious thing we do is we turn down the tap. And that is CO₂ emission control. It is absolutely essential that we turn down the tap.

But every one of us knows that even if you turn the tap down so it is just dripping, it is just a matter of time before the bathtub fills and it overflows and it wrecks the house. So the other solution is to pull out the plug. And the plug allows you to rapidly drain the bathtub, and you can put the plug back in when it gets back to a safe level.

That is negative emissions. That is direct air capture and that is what we do.

Senator CARPER. Could you explain that to me one more time, please?

[Laughter.]

Senator CARPER. That was a great example. That is terrific.

Mr. OLDHAM. Thank you.

So our focus as a company has been to develop the tools that allow very large-scale capture of CO₂ directly from the atmosphere. We have developed and demonstrated that technology, it has been working in British Columbia since 2015.

We are now moving ahead with a plan to bring that technology into the United States with a variety of different partners. We have had inquiries from 38 U.S. States that would like to set up a facility within their State. And of course, we have recently received investment from some significant companies here in the United

States, Occidental Petroleum and Chevron have become both shareholders and partners with Carbon Engineering in bringing our technology to market.

The process is extremely safe. This is an example of a part of our process. When we capture the CO₂ from the atmosphere, we make calcium carbonate. Calcium carbonate is what you guys would know as seashells. So just as our kids play safely on beaches with seashells all around them, this calcium carbonate here, which is made out of atmospheric CO₂, this is negative emissions right here in my hand, is part of our process.

Moving forward, our company is now ready to start building commercial-scale activities. It is critical that we have large scale here. The CO₂ problem in the atmosphere is significant, and it has to be addressed at scale. So the interest of Occidental, the interest of Chevron, why are they interested? They like negative emissions, they want to focus on de-carbonization. The use of CO₂ enhanced oil recovery is a very valuable opportunity. If you capture CO₂ from the atmosphere and you put that CO₂ underground in the process of EOR, you are putting more carbon underground than is contained in the crude that comes back up.

So now you have a win-win. We have a continued source of jobs and prosperity associated with that crude. But you also have a negative emission.

Third, what if you take that CO₂ from the atmosphere, you combine it with hydrogen and you make a synthetic fuel? Now that synthetic fuel uses the CO₂ that was burned in the atmosphere already, you put it in your car, your vehicle, you drive that vehicle, the CO₂ is put back into the atmosphere, we collect it again and we make more fuel. So the opportunity to create a sustainable, low-carbon fuel which is compatible with every vehicle, every truck, every plane that exists today, is enabled by large-scale capture of atmospheric CO₂.

That is the reason why our friends at Chevron are interested in our business. They would like to de-carbonize their fuel by blending our fuel with their fossil fuel. It makes the fossil fuel more sustainable while achieving de-carbonization at the same time.

Moving ahead as a company, the building of our plants is a critical activity, as the Senator pointed out earlier on. These are large capital projects, and investors in those projects look at the market, they look at the legislation that is on the books right now. 45Q has been an essential part of the economics of our plants, so thank you for your work and your leadership in bringing that in.

The USEIT Act is also important. When we have the IPCC, we have the National Academy, we have the Royal Academy, the United Nations, all saying that negative emissions, capturing atmospheric CO₂ is essential, it scares me that there are less than 200 people in the world today working on direct air capture. We need more people. We need more brilliant minds onto this. And the USEIT Act will enable that by providing funding for R&D.

Here at Carbon Engineer, we need more competitors. We need more partners, we need more innovation. We hope your Act brings more people to the table, and we thank you for your leadership. Thank you.

[The prepared statement of Mr. Oldham follows:]



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Written Testimony of Steve Oldham CEO, Carbon Engineering Before the Senate Environment and Public Works Committee February 27, 2019

Introduction and Executive Summary

Mr. Chairman, Senator Carper, and the other members of the Committee, thank you for the opportunity to participate in this hearing and to submit written testimony. My name is Steve Oldham and I'm the CEO of Carbon Engineering, where we have developed a direct air capture technology that removes carbon dioxide from the atmosphere, creating a valuable product that can be used or stored.

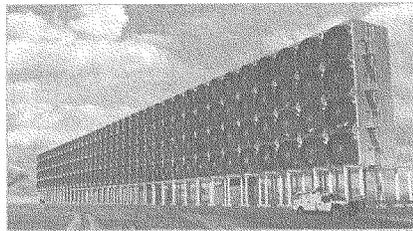


Figure 1: Commercial-Scale Direct Air Capture (DAC) Unit.

To understand where our technology fits, imagine that the atmosphere is simply a bathtub that holds all gases including carbon dioxide (CO₂). The world is measuring a higher and higher fill level on the amount of CO₂ in the bathtub, so in our attempts to decarbonize, we are trying to turn down the CO₂ tap.

But the other way to deal with too much CO₂ in the atmospheric bathtub is to open up the drain. While there are natural carbon removal techniques like afforestation, never before have we been able to open up the bathtub drain at large scale through technical means.

Our technology, which is demonstrated and commercially viable, enables CO₂ to be pulled out of the atmosphere at large scale and then permanently sequestered underground or used to manufacture transportation fuels and other industrial products. Our technology is similar to carbon capture on industrial flue stacks, but distinct and complementary in that we capture directly from the more dilute CO₂ in the atmospheric air.

Within my written testimony I will cover:

1. Carbon Engineering's successful efforts over the last ten years to solve the DAC technical challenges and capture atmospheric carbon for as little as \$100 per ton.
2. Our new partnerships including those with world-class industrial companies like Occidental Petroleum, Chevron, and BHP.
3. Our commercialization plans and the potential for significant economic development in the US through production of CO₂ and liquid transportation fuels.
4. The positive impact of the USE IT Act.



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Background on Carbon Engineering

Since our founding in 2009, we have designed and engineered our technology to be deployed at large industrial scales. Our commercial direct air capture plants are designed to capture 1,000,000 metric tons of carbon dioxide per year. At that scale, one facility is processing a quantity of CO₂ equivalent to the emissions from 250,000 average cars. We designed our technology for these large scales because these are the capacities at which oilfield operations, geological injection of CO₂, and large fuel refineries operate. As an example, the energy industry utilizes 50 million tons (megatons) of CO₂ each year to inject underground to help produce oil in the Permian Basin through a technique called enhanced oil recovery. In part due to positive measures such as 45Q, some estimates show that this amount could triple in coming years to a demand of 150 megatons of CO₂. Existing supplies of CO₂ – primarily from geologic sources -- are not enough. We are ready to meet that demand with atmospheric CO₂. Since our only feedstocks are air, water, and energy, our plants can be located adjacent to existing pipelines and oilfields to deliver CO₂ at point of demand, and our costings show that this can be economical today.

What Carbon Engineering has achieved over more than a decade of research and development – the ability to remove carbon dioxide from the atmosphere for as little as \$100 per ton – is significant. Carbon Engineering's technology represents a tremendous economic opportunity for the United States to lead on innovation around CO₂ capture and utilization. Our CO₂ capture plants will help established fossil energy companies to decarbonize their portfolios, while enhancing domestic energy security and creating entirely new domestic manufacturing industries that will utilize captured CO₂ for the production of fuels, chemicals and industrial products. Carbon Engineering's technology provides a market-based solution for simultaneously meeting the demands of existing industries and decarbonizing the economy.

I assumed the leadership of Carbon Engineering a little over a year ago, after building and running a number of businesses in the satellite and high-tech sectors, to help commercialize what I recognized then, and continue to believe now, to be an important game-changing technology. Carbon Engineering had been founded in 2009 by Professor David Keith, who is now at the Harvard University School for Engineering and Applied Sciences and the Kennedy School for Government. He raised seed capital from a small group of investors, including Bill Gates, to create and commercialize this important technology.

David and his investors saw the potential in direct air capture and founded the company with the mission to develop and engineer a system that could be brought to market affordably and at industrial scale, and which could play a mainstream role in cutting emissions and producing clean energy. Since 2009, the team at Carbon Engineering – now over 50 individuals -- has been able to do just that. Our technology is proven, the leading commercial markets are ready, and we've formed core strategic partnerships with some of the world's largest energy companies. Our mission now is to be the preferred solution for the capture and utilization of atmospheric CO₂, by providing technology that is economic, accessible, and effective.

And that's happening -- we're getting major buy-in and validation from private industry. We recently received investments from Occidental Petroleum, Chevron and BHP (Formerly BHP Billiton), each of whom see our technology as a strategic asset in delivering affordable – and increasingly clean – energy to consumers. This strategic interest will be key as we continue to develop project opportunities in locations such as Texas, Wyoming, Oklahoma, the Dakotas, New Mexico, Colorado, Nevada, and California – where



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carbon dioxide is used in oilfield operations, where renewable energy is available, and where markets are demanding increasing quantities of domestic, low-carbon fuels.

Direct Air Capture Technology Description

"Direct air capture" is the term used to describe the process of capturing carbon dioxide directly out of atmospheric air with an engineered, mechanical system. DAC, as it is known, pulls in atmospheric air and through various chemical reactions, extracts the carbon dioxide within it, and returns the rest of the air to the environment. This is what plants and trees do every day as they photo-synthesize, except DAC technology does it much, much faster, and delivers the carbon dioxide in a pure, compressed form which can then be stored underground or used to manufacture products like clean transportation fuels. DAC is a similar, and complementary, technology to "carbon capture and storage" which removes carbon dioxide from industrial flue gas instead of the atmosphere.

Over our ten years of work at Carbon Engineering, we have developed and now demonstrated a direct air capture technology that is cost effective, ready for market, and which can be deployed at large industrial scale. We've done this by borrowing already commercial and widely used equipment and modules from other industries, and then innovating and integrating around them to create a fully-integrated DAC system.

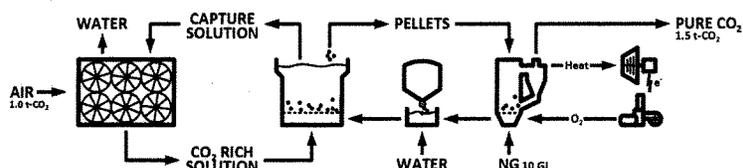


Figure 2: Schematic of CE's DAC Technology. Inputs are air, water, and energy. Output is pure, compressed, CO₂ ready for injection or use.

Fundamentally, our technology has four main steps (See Figure 2):

1. Our "air contactor" – built with design philosophy from the industrial cooling industry – pulls air in and reacts it with an alkaline liquid solution known as potassium hydroxide. It is non-toxic, non-volatile, and reacts with atmospheric carbon dioxide to form a salt known as a carbonate. As air is passed through our device, carbon dioxide is removed, until once discharged from the outlet back into the environment, the air has only one quarter of its original CO₂; the rest having been absorbed into our liquid. This means air goes in with 400 parts per million (ppm) of CO₂, and comes out with only 100 ppm CO₂, and then the discharged air quickly mixes with the rest of the atmosphere.
2. A second step takes the carbon dioxide we have absorbed and reacted to form carbonate and causes this to precipitate out of solution in solid form. This module uses technology from the wastewater treatment industry. This is very similar to a glass of salt water that evaporates, and



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- leaves behind a precipitated ring of salt. In our case, we don't evaporate, we use a chemical reaction to cause precipitation. What we have after this step is a solid carbonate, containing the CO₂ we have captured from air, that we can further process.
3. In the last major step of our process, we heat this carbon dioxide-carrying carbonate to high temperature, which causes it to release pure CO₂. We do this in a closed vessel – adapted from mineral and ore processing – so we can capture and compress the CO₂ that is released and deliver it for use or storage.
 4. Finally, to complete our process, we take the solids that are left behind from the high-temperature CO₂ release, and we mix them with water to return to our system. This mixture actually re-creates the original capture chemical used in the air contactor to absorb CO₂, and the cycle begins again.

These four steps, all taken together, mean that we have a “closed loop” chemical process that captures and purifies atmospheric carbon dioxide. Closed loop means that we don't require a constant supply of chemicals to operate; rather, we simply need water and energy. The energy for our system can come in two main forms. We either operate with clean, low-carbon electricity, or we can operate by using natural gas as our energy source. In this latter case, we are able to take advantage of cheap and abundant natural gas to power our system, and we capture all of the carbon dioxide created by the gas, so that both the CO₂ from the air and from the natural gas are purified and compressed for further use. This is important because it keeps us from releasing CO₂ and counter-acting the CO₂ that we have absorbed.

Uses of Direct Air Capture

We have developed our Direct Air Capture technology with a few key uses in mind, which now form the project opportunities that we are developing along with our strategic investors. First, our technology allows atmospheric carbon dioxide to be collected and purified at any location. Our system works just as well in West Texas as it would near a busy highway or big city and we are cultivating opportunities to capture and deliver carbon dioxide to where it is demanded for both geological sequestration and enhanced oil recovery. Enhanced oil recovery has been in practice since the 1970's, and American energy companies inject over fifty million tons of CO₂ per year and need more. Current supplies are mostly CO₂ produced from geologic wells, but these are limited, and direct air capture offers the opportunity to produce CO₂ at point of demand and also to leave atmospheric CO₂ underground permanently during oil production. One of our largest investors, Occidental Petroleum, sees significant value in applying our technology to their oilfield operations in the Texas Permian Basin where they use it to manage reservoir production, and can manage their reservoir engineering to permanently store the carbon dioxide underground. We see additional value in deploying our technology in locations that have injectable geology but limited carbon dioxide pipeline capacity, such as areas of Wyoming, the Dakotas, the Gulf coast, and California.

Another commercial opportunity to utilize our CO₂ is to supply atmospheric carbon dioxide that can create valuable industrial products. Some are starting to call this broad concept “electrons to molecules”. We have in fact developed a process that we call Air to Fuels™, which pairs our air capture system with renewable hydrogen, in order to provide both carbon dioxide and hydrogen as feedstocks for direct refining of liquid fuels (See Figure 3). Our Air to Fuels™ process allows us to harness low-carbon or



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renewable electricity, such as that produced by wind turbines or solar panels – which is often intermittent – and to split water to make hydrogen. Instead of trying to sell the renewable electricity or the hydrogen, we instead combine the hydrogen with captured atmospheric carbon dioxide and directly refine it into a liquid fuel such as diesel or Jet-A. This has several benefits, including increasing the demand for renewable energy, as well as producing a hydrocarbon drop-in fuel that is compatible with existing refineries and engines. As with the case of using atmospheric CO₂ for underground injection, we are now seeing significant interest in our Air to Fuels™ technology to deliver the increasing volumes of low carbon fuels demanded in leading markets like California, Oregon, British Columbia, and Europe.

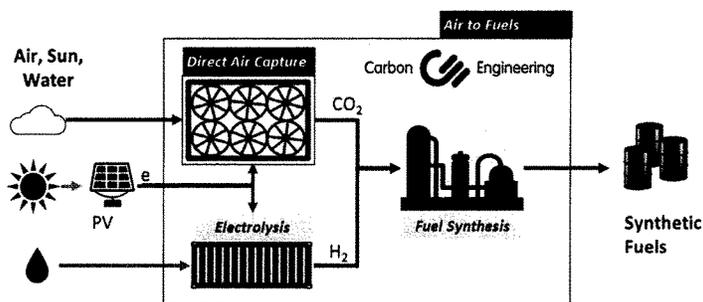


Figure 3: Schematic of CE's Air to Fuels™ Technology. Air to Fuels builds on direct air capture, and clean electricity, to directly produce liquid fuels like gasoline, diesel, and jet.

As an additional note, direct air capture, when coupled with geological sequestration, allows us to achieve what is known as “carbon dioxide removal” or “negative emissions.” As companies and nations tackle commitments to reduce environmental footprints and cut emissions, many are starting to recognize that in certain sectors, cutting emissions at their source is too costly or challenging to be practical. In certain industrial or agricultural sectors, emissions-reducing fixes are difficult to imagine. So rather than stopping or limiting activity in such sectors, direct air capture with permanent sequestration could be used to capture and store an equivalent quantity of emissions, thus offsetting the impact of the facility or practice in question. Further, in far future scenarios, if and when carbon emissions have largely been eliminated, negative emissions provided by direct air capture can allow us to achieve “global net negative” scenarios and to begin reducing the concentration of CO₂ in the atmosphere.

Status and Trajectory

To date we have been almost entirely supported by private capital, coupled with early-stage R&D support from government sources. Our early private equity financing rounds allowed us to develop, engineer, and demonstrate the technology. We secured funding – largely from competitive, performance-based government funding solicitations – to augment our private capital, and we have been proud recipients of a



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grant from the US Department of Energy to help us operate our direct air capture pilot facility and continue to advance the technology. This early work allowed us to demonstrate both our Direct Air Capture and our Air to Fuels™ technologies at pilot plant scale. Our direct air capture pilot was commissioned in 2015 and can capture a ton of carbon dioxide from the atmosphere each day, and our full air to fuels pilot made first fuels from atmospheric carbon in late 2017 (See Figure 4).

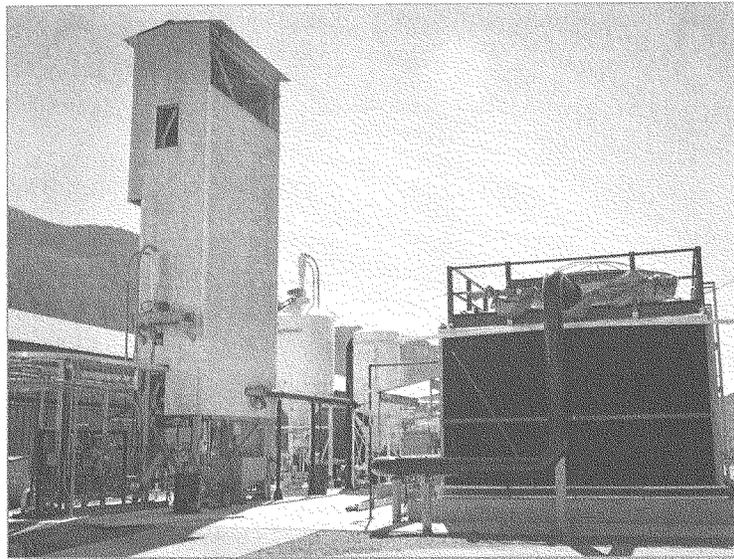


Figure 4: CE's DAC Pilot Facility. Commissioned 2015, capture capacity 1 ton- CO₂/day.

Having demonstrated these technologies, we are now poised to close a \$60 million USD financing round that will see us continue our disciplined scale up strategy and will allow us to start work on first commercial projects. We have secured funding from Occidental Petroleum, BHP, and Chevron as investors in this round, and we anticipate announcing additional major investors in March 2019.

This funding round will enable us to deploy a larger, fully-integrated system - roughly 5-10-times greater capacity than what has been done to date. We'll deploy this equipment at our existing facility, and its engineering, fabrication, commission, and operation life-cycle will take us roughly two years. The data and experience from these scale-up efforts will be used to validate our commercial scale designs, and to adhere to best-practice disciplined engineering scale up. Overall, this continues the hardware-driven



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approach we've used as a company since day one, and allows our engineers to deploy early commercial facilities with high confidence and low risk.

At the same time, we are already starting to develop our first commercial facilities, with several of our leading candidate sites being here in the United States. We're working with our lead investors, and other potential partners, to develop first commercial facilities. There are a number of candidate locations, but for example, one project would see us deploy a direct air capture facility capable of delivering 100,000-500,000 metric tons of CO₂, via an existing pipeline for use in oilfield operations in Texas. The facility would cost in the range of \$300-600M USD, would create several hundred construction jobs and over a hundred permanent jobs, and would pay back a positive internal rate of return (IRR) to investors (even for this first project) from the value generated by CO₂ delivery and by generation of California Low Carbon Fuel Standard credits and 45Q tax credits for permanent capture and storage of CO₂.

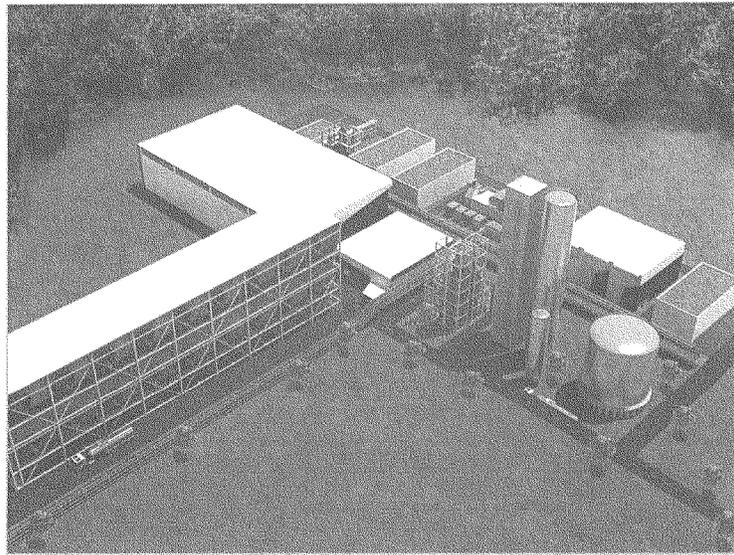


Figure 5: Depiction of a Commercial CE Air to Fuels™ Plant.

We are also pursuing opportunities to acquire electricity from renewable power developers – which at some locations can be difficult to sell due to its intermittency – to drive full Air to Fuels™ facilities (see Figure 5). Again, we see leading candidate sites in Texas, but potential for deployment in Colorado, New



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Mexico, Nevada, and other locations, as well. Such an early facility would likely produce 500 barrels per day of a product known as “Fischer-Tropsch Synthetic Crude” which could be processed in existing refineries into the usual slate of gasoline, diesel, and jet fuels (See Figure 6).



Figure 6: Fuel production at CE's facility.

Five hundred barrels per day is small by refining standards, but in both the stand-alone direct air capture, and the Air to Fuels configurations, our expectation is that energy industry and finance sector players need to see these early plants executed well before they'll allow us to finance bigger installations. These early commercial projects will be challenging. We have demonstrated technology, and market demand, but first projects often require extra help, and we see the mutual benefit of an active Government role here, on which we would welcome further discussion.

Once through early projects, we anticipate deploying growing numbers of both stand-alone direct air capture and air to fuels facilities at increasingly larger scales. With the full economics of scale shown by our engineering work to-date, we anticipate that these facilities are financeable from competitive capital markets, and can be a self-sustaining, self-perpetuating industry based on the value of CO₂ and fuels produced, and credits generated under California's Low Carbon Fuel Standard. Eventually, with improved optimization and economics, we see the same technologies having significant export potential, and being applied in multiple regions of the world.



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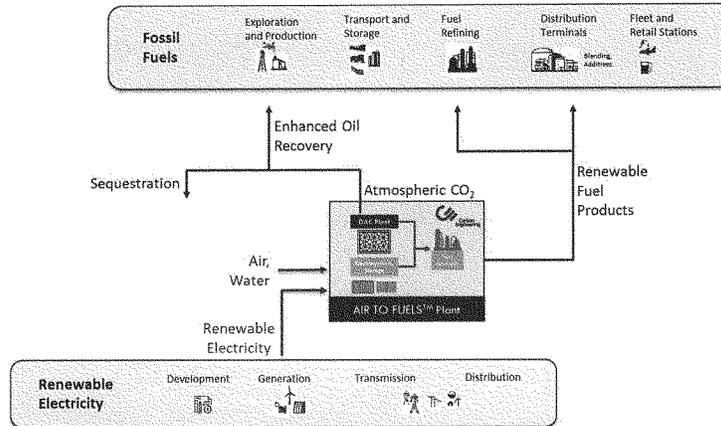


Figure 7: Industry impacts: CE's DAC and Air to Fuels™ technologies play a key role in "electrons to molecules".

Supportive Public Policies

Mr. Chairman, we appreciate your role – and the role of Senator Whitehouse and others – in developing and reintroducing the USE IT Act. We are confident that Carbon Engineering's technology will be economic and competitive at commercial scale. We are grateful for the support that the Department of Energy has provided for necessary research and development work. We also acknowledge the support that the 45Q tax credit has provided to help secure investment from the petroleum sector. And we recognize that California's Low Carbon Fuel Standard provides long-term market opportunity by incentivizing the permanent sequestration of carbon dioxide, regardless of location, and the production of low carbon fuels for the transportation sector.

But we hope you will recognize that there are significant challenges to developing the first-of-its-kind version of any new technology, and our technology is no exception. We believe the USE IT Act proposal, to the extent that it increases focus on direct air capture of carbon dioxide, will be an added incentive to potential investors in our sector. There are multiple measures that, as we understand them, will help both carbon capture and storage projects, as well as direct air capture projects. We especially agree that outcome-based investment, such as the "technology prize" mentioned in the USE IT Act proposal, is a viable approach for the Congress to encourage because it requires the government to take less risk, even if ultimate investments would be higher. We would note, however, that Carbon Engineering's critical path to market – now that our technology is demonstrated and that we have industry demand – is to raise financing for a first-of-a-kind commercial scale Direct Air Capture plant, for which a prize may not be the

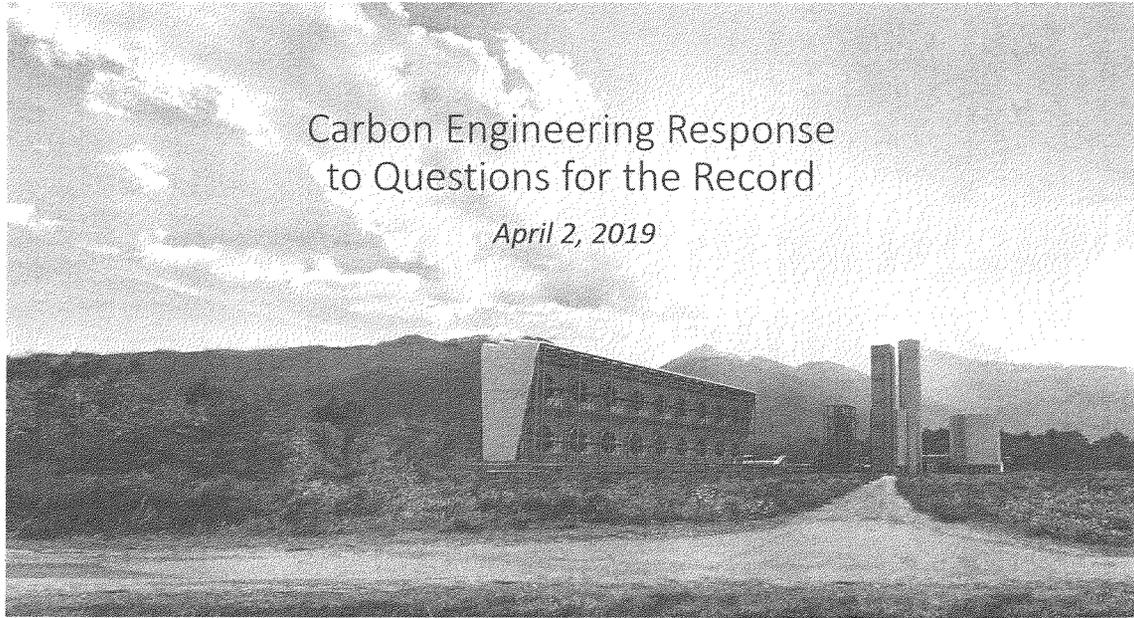


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right mechanism. Nonetheless, we support and endorse the “technology prize” described in USE IT, in the context that it will encourage more actors, more research projects, and more focus on the direct air capture space. We would encourage continued discussion with leaders in our field to determine how to provide the right support to anchor development of this new technology in the United States.

I would like to take this opportunity to point out that there is one other way that the federal government could help Carbon Engineering and companies like it to manage the risks associated with bringing new technologies to market. I have mentioned Carbon Engineering’s Air to Fuels technology, which can directly synthesize liquid fuels from captured atmospheric CO₂ and clean electricity. At present time, our feedstock – ambient air – is not among those feedstocks which are approved in the Renewable Fuels Standard to generate RIN credits. It simply was not anticipated when the legislation was written. If fuels generated by the Air to Fuels process were eligible to generate RINs, the economics of the process would be greatly enhanced and would allow us to finance such facilities from competitive capital markets. Increased deployment of Air to Fuels facilities would help parties obligated under the RFS, would create clean burning fuels for American consumers, and would unlock increased business activity in the wind and solar electricity sectors.

Mr. Chairman, again, I appreciate very much the opportunity to discuss Carbon Engineering’s new technologies and how they may be affected by the language of the newly re-proposed USE IT Act. We look forward to continuing to work with you on this and related matters.



Carbon Engineering Response to Questions for the Record

April 2, 2019

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From the Senate Committee on Environment and Public Works Hearing entitled, *"Hearing to Examine S. 383, the Utilizing Significant Emissions with Innovative Technologies Act, and the State of Current Technologies that Reduce, Capture, and Use Carbon Dioxide"*, February 27, 2019



Questions for the Record for Mr. Oldham

Senator Markey:

1. The USE IT Act would provide for the 45Q production tax credit to be available for 12 years for qualifying projects constructed before 2024.
 - a) What is the average scale of commercial direct air capture facilities you expect to deploy, in terms of CO₂ ton drawdown per day or per year?
 - b) How much energy is required to draw down a ton of carbon dioxide currently using your technology at this scale?
 - c) How much CO₂ do you expect an average commercial scale facility will be able to draw down from the atmosphere with the investment credit as proposed over that 12 year time period?
 - d) What amount, in dollars, would that tax credit amount to over that 12 year time period?
2. What locations within the United States are you expecting to target for deployment? Please name at least one state, and indicate if you are working with that state as part of any implementation planning for emissions reductions.

30

Senator Whitehouse:

3. What is the best-case scenario for deployment of CCUS by 2040? What could we expect in terms of quantity of CO₂ capture and removal? How do we get there?
4. What are the most exciting technologies and projects on the radar?
5. How would a price on carbon affect the economics of CCUS and investment in CCUS technologies?

Question 1

The USE IT Act would provide for the 45Q production tax credit to be available for 12 years for qualifying projects constructed before 2024.

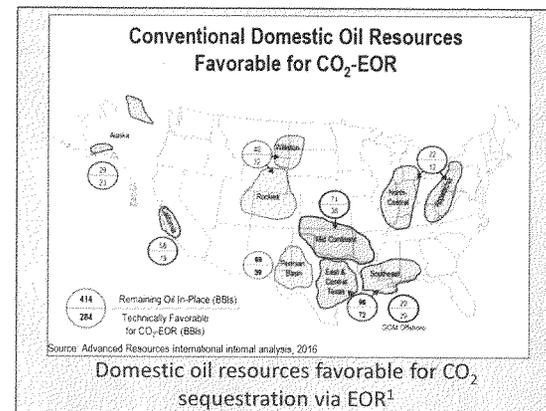
- a) What is the average scale of commercial direct air capture facilities you expect to deploy, in terms of CO₂ ton drawdown per day or per year?
 - b) How much energy is required to draw down a ton of carbon dioxide currently using your technology at this scale?
 - c) How much CO₂ do you expect an average commercial scale facility will be able to draw down from the atmosphere with the investment credit as proposed over that 12 year time period?
 - d) What amount, in dollars, would that tax credit amount to over that 12 year time period?
-
- a) A standard commercial Direct Air Capture (DAC) plant will draw down one million tons (1 Mt) of atmospheric CO₂ per year and uses ~1/30th the land footprint of bio-based methods
 - b) CE published a peer-reviewed energy balance in Joule¹
 - Power for the plant can be supplied from renewable and other zero-carbon energy sources
 - c) Over a 12-year period, an average commercial-scale facility will draw down 12 Mt
 - d) With 12 years of operations the DAC plant would create over 2,000 person years of direct employment and enable significant additional economic development benefits and tax revenues. The plant would earn the following tax credits, depending on its configuration:
 - \$420M for utilization, or
 - \$600M for sequestration



Question 2

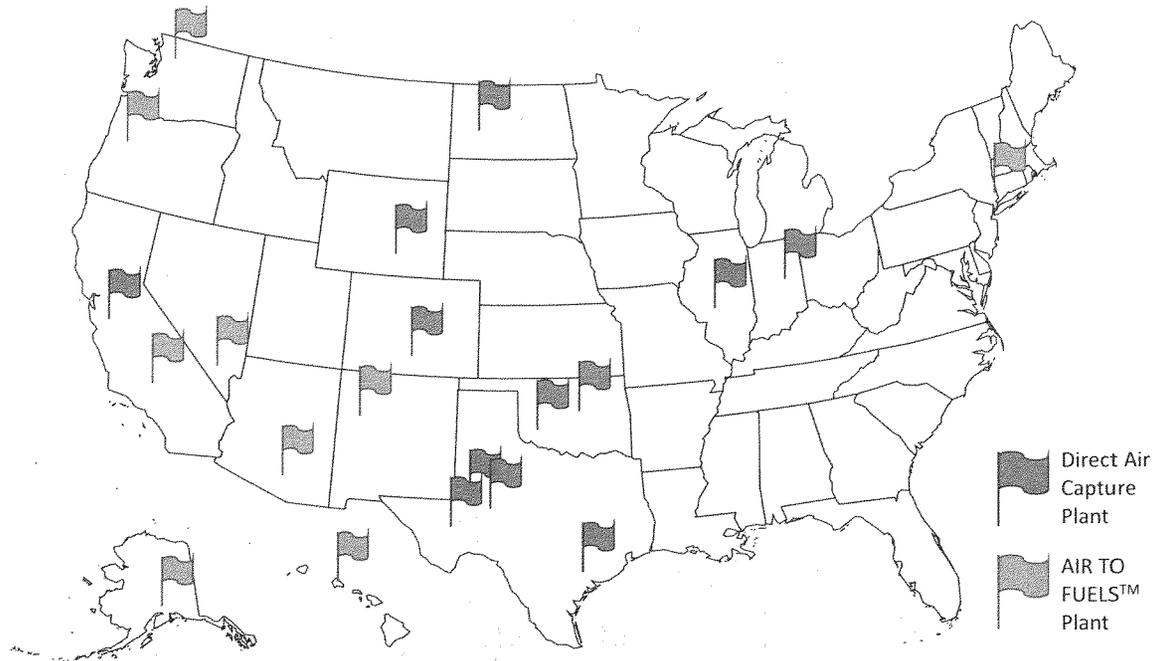
What locations within the United States are you expecting to target for deployment? Please name at least one state, and indicate if you are working with that state as part of any implementation planning for emissions reductions.

- We are engaged in discussions with dozens of states and continue to investigate project opportunities in locations such as TX, WY, OK, IL, WA, ND, NM, CO, NV, AK, AZ, HI, and CA – where carbon dioxide is used in oilfield operations, where natural gas and renewable energy are available, where there are sequestration opportunities, and/or where markets are demanding increasing quantities of domestic, low-carbon fuels.



- A number of states have included low-carbon fuels (such as CE's F-T fuels) in their low-carbon fuel standards. California has also included permanent sequestration from Direct Air Capture projects in their Low Carbon Fuel Standard.

Conceptual Early Plant Rollout (aligned with market demand)

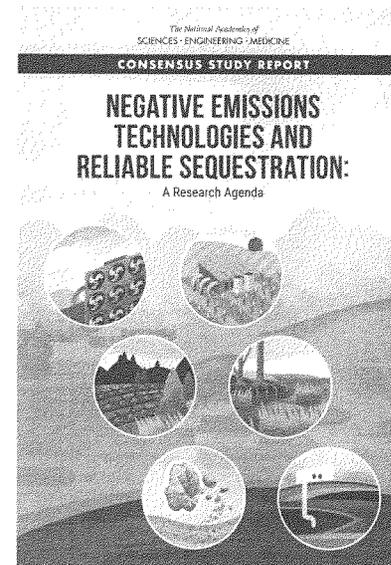


Question 3

What is the best-case scenario for deployment of CCUS by 2040?

What could we expect in terms of quantity of CO₂ capture and removal?
How do we get there?

- In their 2018 report on Negative Emissions Technologies and Reliable Sequestration¹, the National Academy of Sciences found that “Direct air capture flux and capacity potential has **no fundamental physical limit**, making its primary limitation financial”
- Therefore, by 2040, the best-case scenario is determined by market
 - ✓ With current policies and market conditions, CE can deploy dozens of direct air capture and air to fuels facilities.
 - ✓ Increased policy measures – such as participation in the EPA’s RFS, or adoption of LCFS in additional state – could allow CE to deploy hundreds of facilities to meet industry demand for CO₂ and clean fuels.
 - ✓ Globally, CE has studied deployment scenarios reaching into the 1000’s of plants, and finds no barriers if favorable policy conditions are created.

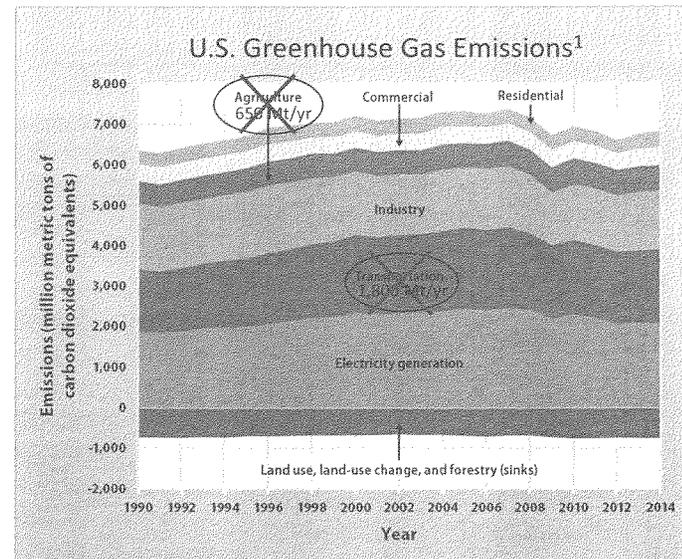


Question 3

What is the best-case scenario for deployment of CCUS by 2040?

What could we expect in terms of quantity of CO₂ capture and removal?
How do we get there?

- CE has done a detailed feasibility analysis supporting plant rollout at a rate of 130 plants per year
 - This would lead to 2,600 plants by 2040 and **2,600 Mt/yr** being sequestered
- This is equivalent to decarbonizing all of the 1,800 Mt/yr in the hard-to-decarbonize transportation sector – **equivalent to taking all of the U.S. cars and trucks and airplanes “off the road”** – and leaving another 800 Mt/yr of negative emissions to offset other sectors e.g., agriculture



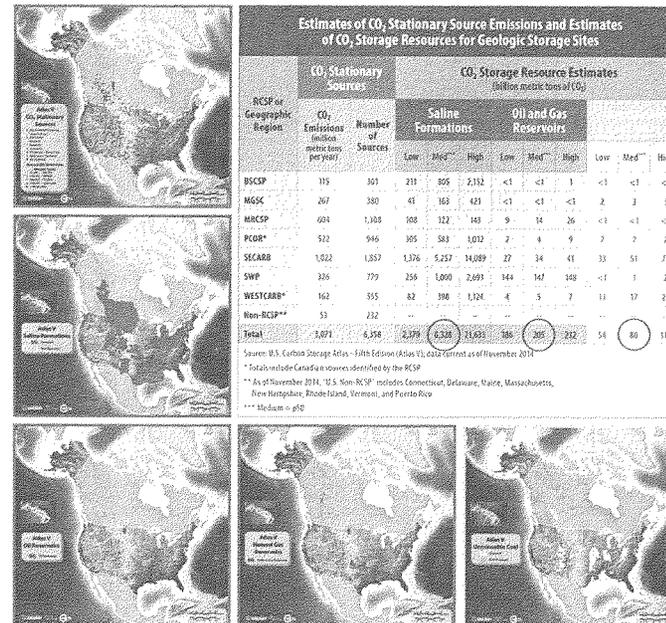
Question 3

What is the best-case scenario for deployment of CCUS by 2040?

What could we expect in terms of quantity of CO₂ capture and removal?

How do we get there?

- Is there really room for all of that CO₂ underground?
 - ✓ In the U.S. Department of Energy (DOE) 2015 version of the Carbon Storage Atlas¹, the DOE estimates that the U.S. has the median potential to store 8.6 trillion tons of CO₂ underground
 - ✓ This means that the U.S. could *offset its own emissions for >500 years with known underground storage*



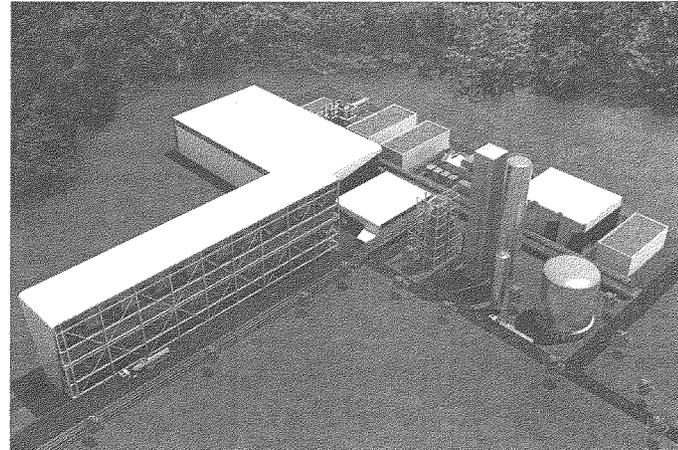
Question 3

What is the best-case scenario for deployment of CCUS by 2040?
What could we expect in terms of quantity of CO₂ capture and removal?
How do we get there?

- How do we get there?

Two simple steps:

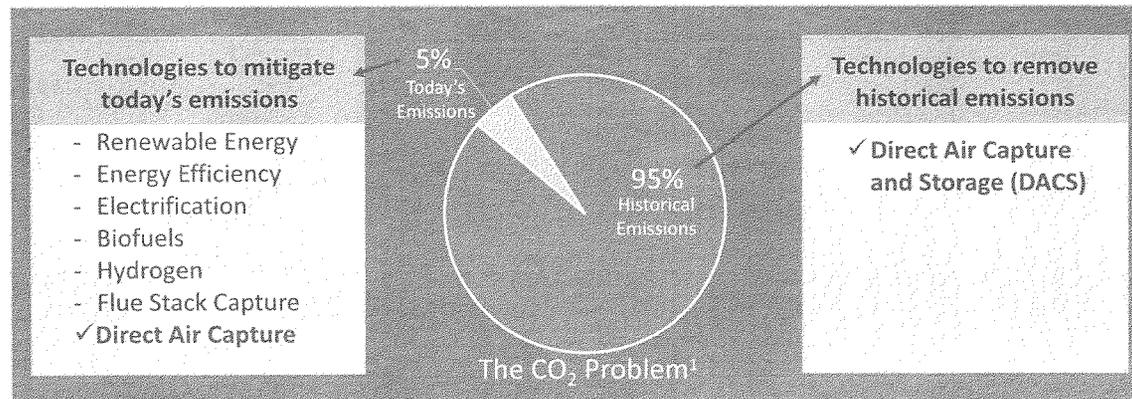
1. Support commercialization and scale-up of the first plants where economics are strongest and demand is highest (e.g., TX)
2. Support U.S. and global policies that, in combination with the value of the product (e.g., CO₂, fuels), value utilization and storage of atmospheric carbon



Question 4

What are the most exciting technologies and projects on the radar?

- *Direct Air Capture*
- 95% of the CO₂ problem is the CO₂ that's already in the atmosphere
- With Direct Air Capture and Storage, we finally have a tool to address the historical emissions as well as offsetting today's emissions



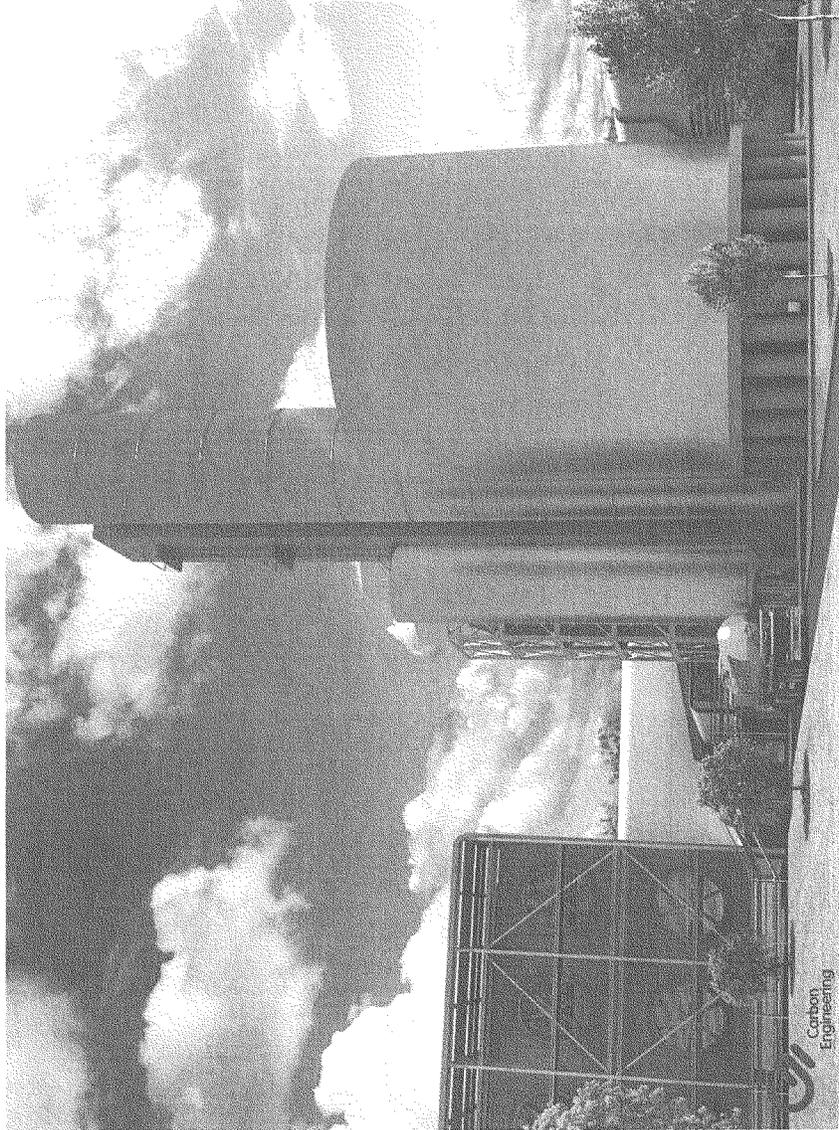
¹ Over two trillion tons of CO₂ have been added to the atmosphere since the industrial revolution, growing from 280 ppm to >400 ppm today. 350 ppm is considered a safe level, which would require removal of 800 Gt of legacy CO₂. The world emits over 40 Gt/yr. 40/800 = 5%, making today's emissions 5% of the CO₂ problem.

With DAC, we finally have the potential to meaningfully and permanently remove legacy carbon from the atmosphere as well as offsetting today's emissions

Question 5

How would a price on carbon affect the economics of CCUS and investment in CCUS technologies?

- For CCUS technologies to succeed in mainstream commercial markets, either the emissions reductions they achieve or the products they make must generate additional financial value over and above the status quo.
 - There are many ways to achieve this including tax credits, carbon pricing, flexible performance-based regulations, or renewable and low carbon fuel standards.
 - Several of these can be revenue neutral from a government perspective, and several are now tried and tested with proven track records of success in various jurisdictions. But fundamentally, CO₂ must be priced as an externality in our society.
- Implementing reliable, market-based systems that allow CCUS technologies to generate financial value for the emissions reductions they achieve creates predictable revenue, which in turn generates investment from competitive capital markets.
- In short, private investment and capital markets can drive widespread deployment of CCUS technologies, but reliable carbon pricing is required.



Senator BARRASSO. Thank you very much for your testimony. Very, very interesting.
Mr. Waltzer, please.

**STATEMENT OF KURT WALTZER, MANAGING
DIRECTOR, CLEAN AIR TASK FORCE**

Mr. WALTZER. Senator Barrasso, Ranking Member Carper, members of the committee, I am here on behalf of Clean Air Task Force to express our support for the USEIT Act and urge its prompt enactment.

The kinds of solutions proposed in this legislation is urgent. Supporting innovation and infrastructure development for carbon capture utilization and direct air capture as well as other types of technologies and policies is crucial, given the enormous challenges we are facing in addressing climate change. To address this Herculean challenge will require nothing less than fully de-carbonizing a \$25 trillion global energy system at the same time that we expect a 40 percent increase in the world's energy demand.

To accomplish this task, we need a portfolio of low-carbon technologies that are widely commercially available. Solar and wind will certainly play an important role in de-carbonization, but relying wholly on those technologies would be risky. In part, this is because generating 100 percent of electricity from just those sources will be significantly more expensive than a more balanced portfolio of low-carbon solutions, including nuclear and CCUS.

But more broadly, our complex energy system has some sectors that are really not easily addressed or electrified. These include aircraft, other certain types of industrial processes. So in short, we really need multiple technology shots on goal.

This is underscored in the de-carbonization scenarios studied by the Intergovernmental Panel on Climate Change where the vast majority of those scenarios included a substantial amount of CCUS, as well as direct air capture. We are also going to need a portfolio of policies, which includes policies that provide certainty to investors and investors by setting clear targets through technology portfolio standards or emission limits.

At the same time we need to also drive forward technology innovation policies, including research and development, support for commercial demonstrations, deployment incentives and support for infrastructure. We need all these tools in the tool kit if we are going to address this massive challenge.

For CCUS and direct air capture, the 45Q incentive was an important bipartisan success supported by a broad range of stakeholders from environmental organizations, labor unions and industry. The USEIT Act is an important successor bill to that effort.

If adopted, it will provide important, targeted support for early stage R&D for demonstrations in CO₂ pipeline infrastructure development. The proposed direct air capture prize is an important addition to our current RD&D tool kit, and is based on a proven approach for leveraging private capital in service to technology problems.

Supporting R&D for new products that utilize and efficiently store carbon will provide an important catalyst to an area that is already attracting early stage private investment and early com-

mercialization in niche markets. Clarifying the eligibility of CO₂ pipelines under the FAST Act, and developing regional task forces to promote local, State and Federal coordination will help move projects while preserving environmental protections needed to ensure responsible development.

Again, these policies by themselves are not going to be sufficient to get us where we need to be. But they are necessary.

We appreciate your leadership, Mr. Chairman, as well as that of the bill's cosponsors on championing these policies and on the bipartisan approach you have all taken in introducing this legislation as well as your commitment to maintaining that approach and addressing any future amendments. I appreciate the opportunity to testify and look forward to answering your questions.

[The prepared statement of Mr. Waltzer follows:]

**BEFORE THE SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC
WORKS**

**HEARING TO EXAMINE S. 383, THE UTILIZING SIGNIFICANT EMISSIONS
WITH INNOVATIVE TECHNOLOGIES ACT, AND THE STATE OF CURRENT
TECHNOLOGIES THAT REDUCE, CAPTURE, AND USE CARBON DIOXIDE**

**TESTIMONY OF KURT WALTZER
ON BEHALF OF THE CLEAN AIR TASK FORCE
FEBRUARY 27TH, 2019**

Chairman Barrasso and ranking member Carper, thank you for the opportunity to testify today. My name is Kurt Waltzer and I am the Managing Director of the Clean Air Task Force. The Clean Air Task Force is an environmental non-profit dedicated to catalyzing the development and global deployment of low-carbon energy technologies, and other climate protective technologies, through research, public advocacy leadership, and partnerships with the private sector.

I am here today to voice CATF's support of the USE IT Act. The development and deployment of technologies such as carbon capture utilization and storage and direct air capture carbon is critical to avoiding the worst impacts of climate change. If enacted, the USE IT Act will support innovation in the areas of direct air capture and CO₂ utilization, while also helping to facilitate infrastructure development that would benefit all forms of carbon capture. Policies such as these are urgently needed to develop the robust technology tool kit that we need to address climate change.

The Scale and Urgency of the Climate and Technology Challenge

The size of the climate challenge is staggering. Global energy and industrial production releases over 37 billion tonnes per year of CO₂. These emissions come from diverse sources in the power, industrial, transportation, commercial, and residential sectors. Increasingly, the emissions come from developing countries as well as developed ones.

To prevent the worst impacts of climate change, not only must these emissions be eliminated by late this century, but there must also be actions that result in negative emissions (i.e., more greenhouse gases sequestered than are emitted).ⁱ Based on current projections, average temperature growth is estimated to reach between 4.1 degrees and 4.9 degrees Celsius above pre-industrial conditions, unless action is taken to reduce emissions. Humanity has never existed in a world where the estimated global temperature is above 2 degrees more than pre-industrial conditions. In order to achieve less than 2 degrees C of global warming, worldwide manmade CO₂ emissions must be at least 50–80% lower in 2050 relative to 2010.ⁱⁱ In order to achieve less than 1.5 degrees C of warming, at least a 65–90% reduction in CO₂ is needed from 2010 levels by 2050ⁱⁱⁱ. Moreover, we know these emission reductions are going to have to occur in a global economy where total energy demand is projected to increase 40% between 2010 and 2040.^{iv}

Unfortunately, global emissions are in fact going in the wrong direction. Since nations first agreed to establish the U.N. Framework Convention on Climate Change, in 1992, global CO₂ emissions have increased 66%.^v Whether this trajectory can be altered depends on policy, investment and innovation. The world's need for economic development, energy and mobility cannot be denied. But the climate challenge demands this need be met through energy sources with much lower carbon emissions than conventional technologies.

Currently, coal, oil and gas energy sources, that are unbated for CO₂ emissions, dominate the world's primary energy production – providing over 81%. In terms of low-carbon sources, nuclear energy provides roughly 4% of the world's energy, with wind and solar providing less than 1% of global energy production. Carbon capture, utilization and storage has only been recently applied to energy production with fossil sources through a few commercial demonstration projects.

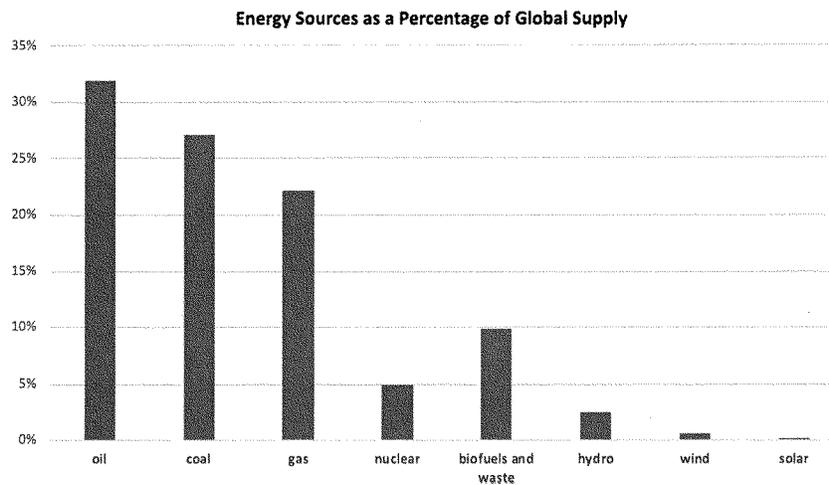


Figure 1 Source: International Energy Agency, Key Energy Statistics, 2018 (2016 data)

Moreover, the current global energy system represents \$25 trillion of investment, with an annual energy investment on the order of \$1.8 trillion per year, and that rate is expected to grow as demand increases. Existing energy capital stock has a turnover rate of 2% to 4% per year.

Given the scale and urgency of this challenge, replacing or modifying the system will require global markets to prefer zero-carbon technology over carbon-intensive alternatives for both new and replacement infrastructure. Meeting this challenge may be possible, but only if we ensure there are widely commercially available low-carbon technologies that global energy markets will deploy in the system.

The Need for a Low-Carbon Technology Portfolio

To maximize our chance of meeting this challenge within our limited window of time, we need a broad tool kit of technologies and policies. Our technology tool kit will require the continued development and deployment of technologies such as advanced renewable energy, nuclear

fission and fusion, CCUS, low-carbon fuels, and electrification, where possible, in the transportation and industrial sectors.

Given the substantial, rapid emission reductions needed, as well as the challenges of energy asset turnover and capital availability, it is clear that the need for action is urgent. In order to minimize the risk of failing to prevent climate change, most decarbonization modeling suggests we need to develop multiple zero-carbon technology options. This is the case for two reasons:

(1) *Having a portfolio reduces risk of any one technology failing.* Technology innovation and market behavior are unpredictable, so relying on any single technology or a narrow group of technologies risks failure. A simple thought experiment based on portfolio theory supports a diversified approach; if 10 different technologies each have a 50% chance of failure, there is only a 0.1% chance they will all fail, as shown in Figure 3. While this is an oversimplification, the reality is we cannot predict the final level at which any potential option will be taken up in our future energy system – at least with enough accuracy to be confident we are adequately addressing the decarbonization challenge. All options will have inherent limits, and a diversity of solutions increases the likelihood of success.

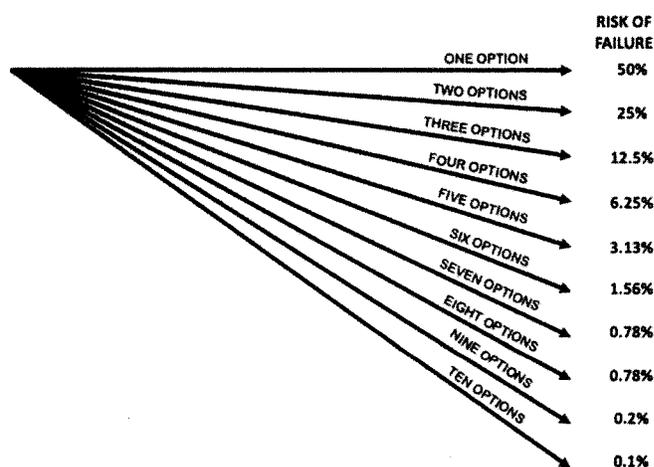


Figure 2 Source: Clean Air Task Force

(2) *Greenhouse gas emissions come from a wide range of activities, so we need a range of low-carbon solutions.* In the transportation sector, for example, we need solutions for many different purposes (personal, public and freight transportation) and modes (e.g., planes, trains, buses and automobiles). In the power sector, because supply and demand options vary over

space and time, we need a mix of resources to accommodate a range of temporal, geographic, and climatic conditions. We also need innovation at the power system level to integrate a mix of supply and demand technologies into a resilient whole.

Some of these activity areas are particularly challenging. These include industrial sources for which CO₂ emissions are an inherent part of the process (such as steel and cement), and types of transportation that are not easily electrified (such as shipping, long-haul trucking, and aircraft).

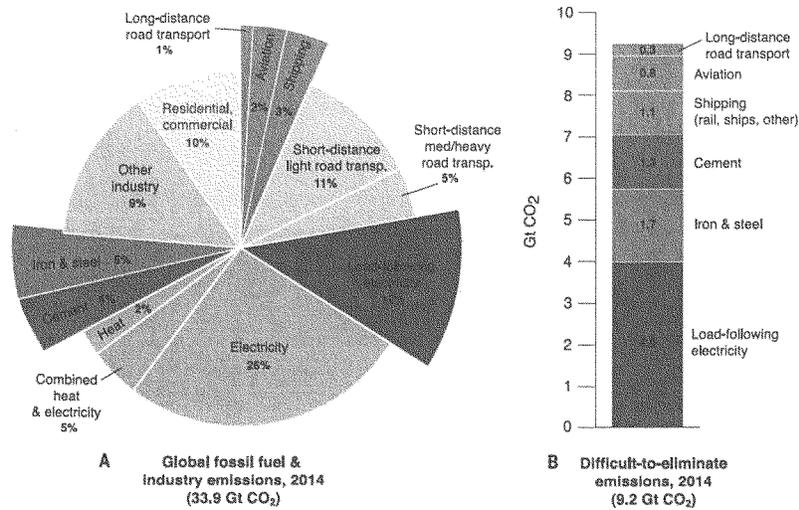


Figure 3 Source: Davis et al., Science 360, 1419 (2018) 29 June 2018

Load-following electricity is also a significant challenge. Low carbon variable energy sources, such as wind and solar, are likely to play an important role in decarbonizing power grids. However, relying *only* on these resources can be substantially more expensive due to the need to overbuild generation and energy storage facilities in order to meet full demand load. One recent study looking at Texas and New England power markets found such systems could be as much as 105% (Texas) and 163% (New England) more expensive than a system using a more

balanced portfolio that also included nuclear, gas with carbon capture and storage and bioenergy^{vi}.

The Importance of Carbon Capture in the Technology Portfolio

Carbon capture utilization and storage can play an important role across many of the “hard to reach” areas of our energy sector. CCUS has been best understood as a source of potential dispatchable or load-following electricity, including the notable demonstration projects of NRG’s Petra Nova and Sask Power’s Boundary Dam, as well as the technology pilot project of NETPower. In addition, CCUS is an important technology for emissions reduction from industrial sources. While it can be applied across a range of industries, it will be particularly important for industrial sources with CO₂ process emissions, such as steel and cement production^{vii}. CCUS can also be applied to the production of zero-carbon fuels such as hydrogen or ammonia. This approach is currently under development in the Netherlands and Japan^{viii}.

More broadly, carbon capture, utilization and storage, and direct air capture will play a crucial role in decarbonizing our global energy system. In the Intergovernmental Panel on Climate Change’s (IPCC’s) 4th assessment report, the vast majority of decarbonization scenarios that limited global temperature growth to 2 degrees C from pre-industrial conditions include the use of CCUS (Figure 3)^{ix}.

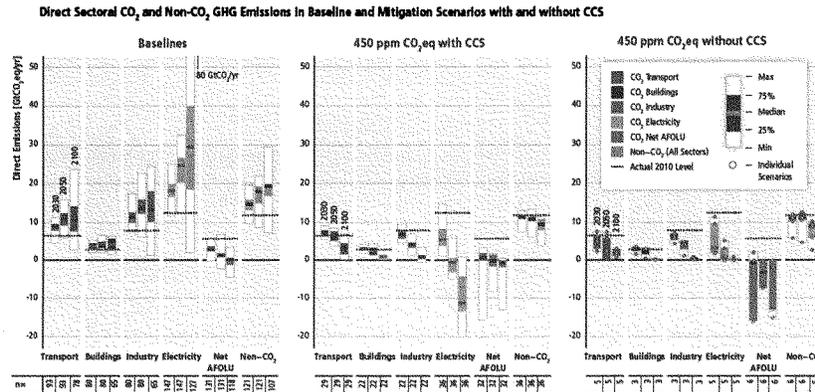


Figure 4 Direct emissions of CO₂ by sector and total non-CO₂ GHGs (Kyoto gases) across sectors in baseline (left panel) and mitigation scenarios that reach around 450 (430 – 480) ppm CO₂e/yr with CCUS (middle panel) and without CCUS (right panel). The numbers at the bottom of the graphs refer to the number of scenarios included in the range which differs across sectors and time due to different sectoral resolution and time horizon of models. Note that many models cannot reach about 450 ppm CO₂e/yr concentration by 2100 in the absence of CCUS, resulting in a low number of scenarios for the right panel.

Source: IPCC, 2014: Summary for Policymakers. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*

In the IPCC's recent report on limiting temperature growth to 1.5 degrees C, three different scenarios projected a need of between 348 billion tonnes to 1,218 billion tonnes of CO₂ to be captured and stored by the year 2100. The share of carbon removal ranged from 43% to 97%, depending on the level of energy growth through the century. The only scenario where carbon capture and sequestration technologies were not included at significant levels, included a dramatic *reduction* in global energy demand of 32% between 2010 and 2050^x. Relying on such a demand reduction to address climate is highly risky, given the history of demand growth to date and the likely growth, particularly in developing economies, which is projected to be 40% between the years 2010 and 2040^{xi}.

The Need for Comprehensive Policy

Given the scale and scope of change that is required, we must use all the policy tools available to us to accelerate change. Our tool kit must include policies that promote R&D, and leverage private sector investment in demonstration, deployment and infrastructure development. In addition, we need to provide a clear signal to inventors and investors that our energy system of the future will be zero-carbon through either emissions requirements, technology requirements or carbon prices.

There are important examples of how innovation and requirements can work in combination to reduce technology costs and drive technology deployment.

One of the most arguably successful public health benefits in terms of air quality improvement has been the deployment of pollution controls on coal-fired power plants. The health impacts from fine particle pollution from coal-fired power plants have dropped substantially, with estimated premature mortality dropping 90% between the years 2000 and 2014^{xii}. In large part this is due to the deployment of pollution controls such as sulfur dioxide scrubbers – with most coal-fired generation in the US coming from units that have installed sulfur dioxide scrubbers^{xiii}. This result was driven by a combination of initial R&D investment paired with requirements through the Clean Air Act, which helped catalyze a technology cost reduction of scrubbers by nearly 50% from 1972 and 1996^{xiv}, and paved the way for broad scale deployment through subsequent rules and regulations.

Another example can be seen through deployment of photovoltaic solar technology. Historically, early R&D investment combined with deployment incentives (such as the investment tax credit) and requirements (such as state portfolio standards), have helped drive technology deployment and cost reduction. The combination of the R&D, deployment incentives, and market requirements have helped drop technology costs from \$104/W in 1976 to \$0.67/W in 2014^{xv}.

It should be noted, however, in both cases most of the cost reduction came through incremental, not transformative technology innovation. Absent continued support for

technology advancement, deployment incentives and requirements can lead to technology lock-in^{vi}, where cost reductions are driven more by learning than transformational innovation.

Given the scale of the climate and technology challenge we are facing, we will need a robust approach to innovation that drives transformational technologies that are cost competitive with carbon-intensive alternatives, can deploy rapidly, can easily access the low-cost equity and debt from financial markets, and can either adapt to or facilitate change of infrastructure and regulatory frameworks. Catalyzing the development of multiple low-carbon technology options will require policy tools that drive:

- investment in transformative R&D
- development of commercial demonstration projects from first of a kind (FOAK) projects to Nth of a kind project (NOAK)
- initial deployment in energy market
- development of supporting infrastructure and regulations

The USE IT Act is an important component to the set of tools needed to help carbon capture and storage, and direct air capture meet reach wide scale availability.

The Importance of the USE IT Act

As technologies, carbon capture and storage and direct air capture are both old and new. Carbon dioxide capture and its injection into geologic strata have been in commercial use for decades, and direct air capture technologies are a direct result of the US military's decades-long interest in developing novel fuel source alternatives. Both technologies are now being repurposed to address our climate crisis. Both technologies will need access to secure geologic storage sites and both will benefit from the development of a robust CO₂ pipeline network. Both will also benefit from further developing markets that utilize CO₂ in products, including enhanced oil recovery, but also other end uses, such as aggregates for construction material, specialty chemicals, plastics and other items.

One key difference is that while carbon capture for industrial and power sources is seeing continuing investment into next generation technology, direct air capture is undergoing first generation innovation. That makes it even more important to support direct air capture at this point in the process, including with the types of policies that are included in the USE IT Act.

This bill is an important follow-up to the recent enactment by Congress of the FUTURE Act, that extended and expanded the 45Q tax incentive for carbon capture and storage and direct air capture. 45Q has the potential to catalyze a broader market for these technologies. CATF recently released a study on the potential impact of the 45Q provision, *Carbon Capture & Storage in the US Power Sector: The Impact of 45Q Financial Tax Credits*^{vii}. The study found that the provision has the economic potential to drive 49 million tonnes of emissions reduction per year in the power sector by 2030 – the equivalent of taking 7 million cars off the road. It is important to note that this is only an economic potential, and to ensure it can be met, other factors will need to be addressed - including the development of CO₂ pipeline infrastructure.

It's also important to recognize as well, that like the FUTURE Act, this bill represents a bi-partisan commitment to support innovation. CATF greatly appreciates this broad support for such policies and in particular the approach stated by Senator Barrasso to approach any future amendments to this bill on a consensus basis with all of the bill's co-sponsors.

As noted above, while not sufficient by themselves, policies that promote innovation and infrastructure development are important for decarbonizing our energy system. The USE IT Act addresses the need for innovation and infrastructure by promoting direct air capture and utilization technologies, while also helping to facilitate the development of CO₂ projects and pipelines.

Establishing a prize competition for direct air capture is an innovative method for drawing technologies into the next stage of development. Such prizes have had powerful impacts, such as the Orteig prize that prompted Charles Lindberg's crossing of the Atlantic. As with the early stages of air travel, private companies are investing in this area to develop initial commercial technologies, and as while the development of intercontinental air travel took substantially more policy and investment, the prize played an important catalytic role. At least three commercial companies have developed direct air capture technologies and rewarding them for meeting a performance target would provide important support at this time.

Carbon dioxide utilization, aside from enhanced oil recovery (EOR), is also in the early stages of development. Like direct air capture, it is an area attracting new investment. Accelerating the development of new end uses that ensure carbon dioxide is removed from the atmosphere with a robust R&D program will provide important support for this emerging industry. And while the market for other products may not be as large as for EOR, they can play an important catalytic role in moving carbon capture technology forward. As an example, Carbon Clean Solutions developed its first carbon capture project in India, producing baking soda from CO₂ capture at a coal-fired power plant. The company is building on that experience by developing its next generation of solvents to further lower carbon capture costs – which would benefit all forms of CCUS.

In terms of infrastructure development, the US has an important foundation for development in that we have 4,500 miles of CO₂ pipelines in place. However, for carbon capture and storage and direct air capture to be deployed at scale, we will need a pipeline network several times that size. A 2009 study by the Interstate Natural Gas Association of America (INGAA) Foundation estimated a substantial use of carbon capture technology would require up to 66,000 miles of CO₂ pipelines^{xviii}. The current CO₂ pipeline network is primarily point-to-point delivery, whereas we will need larger interstate trunk pipelines as well as pipeline spurs that helps make the buying and selling of CO₂ less financially risky through a more robust commodities market, in much the way that the natural gas delivery market functions today. By clarifying that CO₂ pipelines are eligible under the FAST Act and creating regional task forces focused on facilitating better and more efficient coordination on the permitting of interstate CO₂ pipelines, the USE IT Act would provide an important step in building this needed network,

while maintaining the environmental protections that are needed to ensure responsible development.

In summary, the enactment of the USE IT Act would be an important step on carbon capture utilization and storage and direct air capture innovation and infrastructure development and is another important example of pragmatic bipartisan policy. I appreciate the opportunity to testify this morning and look forward to answering your questions.

ⁱ The Intergovernmental Panel on Climate Change (IPCC) concludes that greenhouse gas emissions must be reduced by 40 to 70% by 2050 and must be zero or below in 2100. Cuts from the electricity sector must be even deeper. The IPCC concludes that electricity sector emissions must reach zero by 2050 and be negative by 2100. (See pages 20 and 28 of the Synthesis Report Summary for Policymakers, available at: https://www.ipcc.ch/pdf/assessment-report/ars5/syr/AR5_SYR_FINAL_SPM.pdf) The International Energy Agency (IEA) reaches a similar conclusion: a 50% reduction in CO₂ emissions from the whole energy sector is needed by 2050, while "the power sector becomes virtually decarbonized." (See page 107 of Energy Technology Perspectives, available at: <https://www.iea.org/publications/freepublications/publication/eto2010.pdf>).

ⁱⁱ IPCC, 2014: Summary for Policymakers. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

ⁱⁱⁱ IPCC, 2018: Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. P. rtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. P. an, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

^{iv} International Energy Agency. World Energy Outlook, 2018

^v Source: Boden, T.A., Marland, G., and Andres, R.J. (2017). *Global, Regional, and National Fossil-Fuel CO₂Emissions*. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334/CDIAC/00001_V2017

^{vi} Sepulveda, Jenkins, de Sisternes, and Lester, "The Role of Firm Low-Carbon Electricity Resources in Deep Decarbonization of Power Generation" Joule 2, 2403–2420, November 21, 2018

^{vii} IEA (2017), *Energy Technology Perspectives 2017: Catalysing Energy Technology Transformations*, IEA, Paris, https://doi.org/10.1787/energy_tech-2017-en.

^{viii} <https://www.equinor.com/en/news/evaluating-conversion-natural-gas-hydrogen.html> ; <https://hydrogenenergysupplychain.com>

^{ix} IPCC, 2014: Summary for Policymakers. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

^x IPCC, 2018: Summary for Policymakers. In: *Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [V. Masson-Delmotte, P. Zhai, H. O. P. rtner, D. Roberts, J. Skea, P. R. Shukla, A. Pirani, W. Moufouma-Okia, C. P. an, R. Pidcock, S. Connors, J. B. R. Matthews, Y. Chen, X. Zhou, M. I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland, 32 pp.

^{xi} International Energy Agency. World Energy Outlook, 2018

^{xii} <https://www.catf.us/educational/coal-plant-pollution/>

^{xiii} <https://www.catf.us/educational/coal-plant-pollution/>

^{xiv} Taylor, Rubin, and Houndshell, "Regulation as the Mother of Innovation: The Case of SO₂ Control", LAW & POLICY, Vol. 27, No. 2, April 2005; Yubin, Yeh and Houndshell, "Experience curves for power plant emission control technologies.", Int. J. Energy Technology and Policy, Vol. 2, Nos. 1/2, 2004

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- ^{xv} Trancik, J.E., Brown, P.R., Jean, J., Kavlak, G., Klemun, M.M., Edwards, M.R., McNerney, J., Miotti, M., Mueller, J.M., Needell, Z.A., 2015. Technology Improvement and Emissions Reductions as Mutually Reinforcing Efforts: Observations from the Global Development of Solar and Wind Energy. Technical Report. Institute for Data, Systems, and Society, MIT. <http://energy.mit.edu/publication/technology-improvement-and-emissions-reductions-as-mutually-reinforcing-efforts/>
- ^{xvi} J. Hoppmann et al. "The two faces of market support—How deployment policies affect technological exploration and exploitation in the solar photovoltaic industry", Research Policy 42 (2013) 989– 1003
- ^{xvii} <https://www.catf.us/2019/02/ccs-reduce-49-million-tonnes-co2-emissions/>
- ^{xviii} <https://www.ingaa.org/File.aspx?id=8228&v=4903b99e>

Senate Committee on Environment and Public Works
Hearing entitled, "Hearing to Examine S. 383, the Utilizing Significant Emissions with Innovative Technologies Act, and the State of Current Technologies that Reduce, Capture, and Use Carbon Dioxide"
February 27, 2019
Questions for the Record for Mr. Waltzer

Senator Whitehouse:

1. What is the best-case scenario for deployment of CCUS by 2040? What could we expect in terms of quantity of CO₂ capture and removal? How do we get there?

It is difficult to determine the best-case scenario for CCUS deployment by 2040, based on current modeling and analysis. But we can consider CCUS targets under various decarbonization pathways. As Figure 1 below shows, The international Energy Agency's (IEA's) 2-degree Celsius scenario (2DS) projects that the US should be reducing CO₂ emissions by roughly 350 million tons annually in 2040 to stay on track with the scenario's 2DS target.

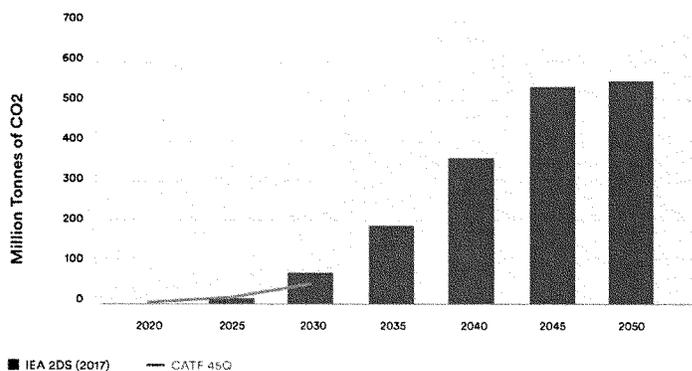


Figure 1

Based on modeling commissioned by CATF¹, the 45Q incentive has the potential to help the US come near the IEA 2DS 2030 target level. However, to meet the exponential growth required to meet the 2040 target level, other considerations will need to be addressed:

- **Extending 45Q:** Currently 45Q will not give any project construction after the year 2023, due the commence construction window closing that year. This will likely result in

¹ <https://www.catf.us/resource/45q-ccs-analysis/>

the growth of additional projects tapering off beginning in the late 2020s and early 2030s. It should be noted that even in the near term, the development of CCUS projects have been hampered by lack of clear rules from the US Treasury, thereby reducing the emissions reduction potential indicated in Figure 1.

- **Reduction in technology cost:** CATF's modeling results assumed no significant changes in technology costs through learning or innovation. However, if advanced technology developers are successful, this could significantly improve project economics and drive many more projects for the same incentive levels. Examples of this are provided in the answer to question 2, below.
- **Additional incremental incentives to unlock large use of saline storage:** Initial unpublished results from our modeling indicate incremental additional incentives, possibly in the range of \$10/ton, could help unlock significantly more saline storage project development. Such an incremental difference could be provided by a modest increase in the incentive level, allowing CCUS projects access to lower cost financing, such as through private activity bonds and Master Limited Partnerships, or reductions in technology costs.
- **Development of additional utilization options:** CATF modeling did not include storage through utilization. Developing utilization options, particularly those that may reach a meaningful scale, such as aggregates, could help reach target levels.
- **Development of CO₂ pipeline infrastructure:** It is unlikely that CCUS will be able to scale to the target levels indicated by the IEA study without further significant development of the US CO₂ pipeline system.

2. What are the most exciting technologies and projects on the radar?

The most important issues to address in developing transformative carbon capture technology are the following:

- **Thermodynamics:** reducing energetic requirements
- **Kinetics:** developing faster, more selective chemical/physical separation pathways that allow for the use of smaller, lower-cost, more efficient reactors
- **Reducing capital cost:** reducing total required equipment and costs
- **Improving durability:** developing capture media (solvents, sorbents, and membranes) with rugged long-term performance and slow degradation rates
- **Improving scalability:** providing economic viability at all relevant process scales

Potential transformative carbon capture technology approaches include oxy combustion, cryogenic capture, advanced solvents and sorbents, and membranes. In addition, advanced design and construction techniques such as modular construction, 3D fabrication of components, 3D design modeling, and inclusion of open architecture designs also help address these cost issues.

As noted in my testimony, two examples of potentially transformative technology developers include NETPower and Clean Carbon Solutions. The NETPower technology being pilot tested in

LaPorte, Texas is attempting to address all five of the cost issues by combining oxy-combustion with turbines that use CO₂ as a working fluid in the process. Carbon Clean Solutions, being pilot tested in Tamil Nadu, India is developing advanced solvents to address kinetics, durability and capital costs.

An interesting alternative model for CCUS is being studied by the Swedish Utility Vattenfall and the Norwegian state oil company Equinor². Under this approach, CCUS would be centralized in that gas produced in the North Sea would be reformed on site into hydrogen or ammonia, and the CO₂ geologically stored in nearby saline formations under the ocean floor. The zero-carbon fuel would then be shipped to an existing combustion turbine in the Netherlands and used for zero-carbon electricity production. While none of technologies are new, the approach may have significant cost and infrastructure advantages.

3. How would a price on carbon affect the economics of CCUS and investment in CCUS technologies?

Having a price on carbon would provide important certainty to investors and help further drive technology innovation and reduce costs. As noted in my testimony, innovation policy, combined with the certainty of emissions reductions (whether through carbon prices, emission limits or energy standards) are the most powerful combinations for accelerating technology development and deployment. The combination of investment and production tax incentives for solar and wind, combined with renewable portfolio standards, helped drive deployment and significantly reduce the cost of renewable energy – contributing to a drop in technology costs from \$104/W in 1976 to \$0.67/W in 2014³. Similarly, the combination of R&D investment, combined with Clean Air Act regulatory requirements, significantly reduce the costs of sulfur dioxide scrubbers – driving a cost reduction of nearly 50% from 1972 and 1996⁴.

² <https://bellona.org/news/ccs/2017-07-23661>

³ Trancik, J.E., Brown, P.R., Jean, J., Kavlak, G., Klemun, M.M., Edwards, M.R., McNeerney, J., Miotti, M., Mueller, J.M., Needell, Z.A., 2015. Technology Improvement and Emissions Reductions as Mutually Reinforcing Efforts: Observations from the Global Development of Solar and Wind Energy. Technical Report. Institute for Data, Systems, and Society, MIT. <http://energy.mit.edu/publication/technology-improvement-and-emissions-reductions-as-mutually-reinforcing-efforts/>

⁴ Taylor, Rubin, and Houndshell, "Regulation as the Mother of Innovation: The Case of SO₂ Control", LAW & POLICY, Vol. 27, No. 2, April 2005; Yubin, Yeh and Houndshell, "Experience curves for power plant emission control technologies.", Int. J. Energy Technology and Policy, Vol. 2, Nos. 1/2, 2004

Senator BARRASSO. Thank you very much. We are going to proceed to a series of questions. I will start, Mr. Sukut, I would like to start with you.

Basin Electric's leadership in carbon capture and utilization and sequestration is impressive. I think you are really to be commended for what you have been doing. Through initiatives like the Integrated Test Center in Gillette and Basin's Dry Fork Station, we are really proud to see Wyoming has already established itself as an innovation hub. Can you discuss why Wyoming and surrounding States are ideal, like yours, are ideal places to do carbon capture utilization and sequestration work?

Mr. SUKUT. I think we should point out the first thing is States like Wyoming, and of course North Dakota, have abundant oil, gas and coal resources, natural resources. And these resources are going to be a part of the energy future for this Country for a long time.

But I think the most important thing to point out, and the most relevant thing this morning to talk a little bit about is actually the geology. Through the CarbonSAFE program, we have got some wells drilled, one of them only less than a quarter mile from Dry Fork Station. The geology looks very promising to infuse carbon. We have two sites in North Dakota that are virtually under some of our resources, our coal-based resources.

So from that standpoint, I think we have an opportunity here, a great opportunity here to infuse and demonstrate that once we capture the carbon, we will be able to infuse it and store it in the ground. But I think one of the most important things, and I am so encouraged by sitting in front of you all for all the leadership that you have taken in trying to get us the legislation. I thank you for all that. Because the leadership really does make a difference for us.

Senator BARRASSO. Mr. Oldham, you can followup on that. But I really have been interested for a long time in direct air capture. I am pleased to see that public interest is now coming into the fore. This is something I read about years ago in *The Economist*, talking about the ways that they can be doing it and trying to make it more cost-effective. Clearly, the technology is there.

Why do you think we are seeing an increased interest in direct air capture? Do you think the USEIT Act can actually help drive public sector interest in direct air capture?

Mr. OLDHAM. Thank you. I see we even made a Dilbert cartoon in the last couple of weeks. So I guess direct air capture is really public domain now.

[Laughter.]

Mr. OLDHAM. So that is very good.

I will answer the question two ways. First, I think in public conscience, the recent reports from the various scientific committees worldwide have raised awareness of the issue. So there is increasing recognition of need and equally, at the same time, the recognition that there are solutions out there like ours. We are not the only one. Having a need and a solution really drives interest.

Economically, for sure, 45Q has made a big difference. It sent a very clear signal from this house that there is a desire to see inno-

vation in this area. It helped close the economics for business cases that didn't close otherwise.

For businesses like ours, the challenge is always the first couple of projects. There, the cost is higher, the schedule is longer, the perceived risk is higher. So having some support for those initial projects is just essential.

So to my mind, that is a large part of it, helping us over the hump at the first few projects.

Senator BARRASSO. Good. And Mr. Waltzer, in terms of this 45Q, and I am so pleased to see the Clean Air Task Force's recent report about the real impact that the 45Q tax credit could have on reducing emissions. We have worked hard to extend and expand that tax credit to support carbon capture efforts. So we want to make sure that that tax credit is used.

If carbon capture projects are developed on a scale that you predict, is there a real need for supporting infrastructure, and how can the Federal Government support and expedite the development of that infrastructure that you talk of?

Mr. WALTZER. Mr. Chairman, in short, the answer is yes, that is needed. What our study really showed was the economic potential of 45Q. But 45Q by itself perhaps will not get us there. In fact, we think more is needed.

We think that just because of the way commercial contracts are set up today for developing pipelines, you can set up a contract between point A and point B with the amount of CO₂ that is going to flow through, but you are not going to necessarily set up the interstate pipelines that are necessary to connect all the little sources together to get them to where the markets are. Right now, the most developed market is enhanced oil recovery activity.

So we are going to need the sort of support to develop that infrastructure and develop our national CO₂ pipelines. But we are also going to need the kind of solutions that are proposed in the USEIT Act that make the process of setting those pipelines efficient and effective, while maintaining our current environmental protection standards.

Senator BARRASSO. Thanks so very much. Senator Carper?

Senator CARPER. Thank you all for your testimony. I was especially interested in your example of the infant in the tub. I thought that was a great example. I wrote it down. I will use it often, never attribute it to you.

[Laughter.]

Senator CARPER. Oh, I will, I will. Thank you, that was great.

I have a couple of questions for the whole panel.

Senator BARRASSO. We don't need to start the clock. So we had a former member of this committee, Senator Joe Lieberman.

Senator CARPER. I remember, he just had his birthday last week.

Senator BARRASSO. And he said, well, here is something really smart. The first time he repeats it, he says, and I have heard Mr. Oldham say, dah, dah, dah, dah, dah. The next time he would say, I heard a wise man once say, dah, dah, dah, dah.

[Laughter.]

Senator BARRASSO. And then the third time, he says, As I have said time and time again.

[Laughter.]

Senator CARPER. We do this all the time.

[Laughter.]

Senator CARPER. I am surprised there are not more cameras here.

This is one for Mr. Waltzer. Again, thank you all for your testimony. Like you, Mr. Waltzer, I want to ensure that this legislation doesn't lead to other efforts to weaken the Clean Air Act. I also appreciate the Chairman's commitment about not using this bill as a vehicle to weaken the Clean Air Act, and want to thank him for accepting a number of changes that we recommended to last year's legislation, which we think makes this version better.

My question, if I could, Mr. Waltzer, in your opinion is the Clean Air Act inhibiting progress in CCUS technology development or deployment?

Mr. WALTZER. Mr. Chairman, Senator Carper, I want to make sure I understand your question. You are asking if the Clean Air Act is, can play a role in moving CCUS technology forward?

Senator CARPER. I will repeat the question. In your opinion, is the Clean Air Act inhibiting progress in its current form in CCUS technology development or deployment? Is it impeding work in this area?

Mr. WALTZER. We have looked at this question from a legal and technical perspective, and in our view, we don't see any impediment. By the way, programs such as New Source Review would be applied when carbon capture equipment is installed on the power sector. So from our assessment, no, we don't see an impediment.

Senator CARPER. All right, good. As a followup, in 2009, Congress was debating a climate bill that amended the Clean Air Act. In the Senate climate bill, I worked with the late Senator Robert Byrd and other coal-State Senators to provide incentives for the deployment of CCUS. At the time, there were several CCUS projects in the works nationwide. Once the climate bill died, so did most of those projects.

My question is, could the Clean Air Act and broader climate regulatory actions be helpful, maybe even critical, for the success of CCUS?

Mr. WALTZER. Mr. Chairman, Senator Carper, in our view, having that kind of long-term certainty associated with planning horizons is absolutely crucial for power companies, for example, to plan to include and develop carbon capture and storage in their portfolios.

As many of us have witnessed, more and more power companies are making commitments or laying out plans for de-carbonizing their systems. We don't see those plans coming to fruition unless there is a strong signal that is sent to allow that kind of investment to occur. What we will see in the interim is more investment in incremental resources that may reduce emissions. But we are not going to see the kind of large-scale energy system change that we think is needed, absent that kind of direction.

Senator CARPER. My next question, and I am going to ask it initially of Mr. Waltzer, then I will ask our other panelists to respond as well. That question is, would you take a couple of moments to talk further about why the development of today's carbon capture and sequestration technology is critical to help us meet our climate

goals and also help us get closer to having direct air capture become a reality?

Mr. WALTZER. Senator, I think today's legislation, as I noted, is an important component. We need all of the tools in the tool kit. We need the kind of innovative prize tools that are being proposed in this legislation to bring new commercial pilot scale projects to market. We need to be developing utilization technologies that create new uses.

While those markets may not necessarily be large by themselves, they can have important catalytic effects. We have seen one company develop its first pilot project in India making baking soda, and based on that, they are developing their next generation of solvents for carbon capture. We think that moving this kind of legislation forward on a bipartisan basis also more broadly sends an important signal that technology innovation is increasingly being taken seriously, and that does have, as soft as it is, that has an actual impact on driving more interest in investment.

Senator CARPER. Good. Thanks for that. Mr. Oldham, any brief comments, please?

Mr. OLDHAM. Yes. I think a recognition of the problem of increased carbon levels is critical. This house's recognition of that problem is critical. The funding that you put aside will, as I said earlier on, bring more brilliant minds into this business. I think that is essential.

For me, it is about developing the tools. If we have the tools that allow us the flexibility to make choices, we now are able to make choices to address decarbonization. So any innovation that drives that, any funding mechanisms that drive an innovation will make a big difference.

Senator CARPER. Thanks. Mr. Sukut?

Mr. SUKUT. I basically agree with both the other two panelists, maybe in a different way. When I look at our facilities and how we get there. When we put iron in the ground, we put it in for 30 or 40 years. My sense is that sol, the USEIT Act gives us sort of the road map to get there, 45Q gives us the financial incentives to get there. That is so important.

I mean, we recognize we are past the science now. We recognize the fact that we are in a carbon-constrained world, and how do we get there. So we need time, and we need some flexibility. I think Kurt mentioned the time element of this. From our perspective, those are kind of the two aspects of how we look at it, as I would look at it as a CEO of a utility.

Senator CARPER. Thank you all. Thanks.

Senator BARRASSO. Senator Inhofe.

Senator INHOFE. Thank you, Mr. Chairman.

None of the three of you will appreciate this statement, but it is so refreshing to me that we can talk about climate without the normal, hysterical Hollywood references that are being made, that the world is coming to an end and such as that. Our world is not coming to an end, and climate has always changed and always will change. I don't think anyone will disagree with that.

All right. Let me just mention a couple of things. First of all, the comments that were made by Senator Whitehouse. That is significant, because those three pieces of legislation that he mentioned,

with the exception of the Defense Authorization Act, were the three biggest, most significant things passed that year. And it was a great partnership that did it, and it surprised a lot of people.

Quite frankly, I didn't get on this bill until today, because I didn't want my appearance on this bill to chase off any of the others that were on this thing.

[Laughter.]

Senator INHOFE. So that is where I am. Now, I am the first to admit, my State of Oklahoma is an oil State. We have 150,000 jobs with an average salary of \$104,000. We contribute \$24 billion to the gross State product. It is nearly a quarter of the State's budget, that is spent in the oil and gas industry.

Now, you think that is the reason I would be supportive of this. It is not. Those are good things. But when you look at the fact that, I have 20 kids and grandkids, and they are going to be around here a lot longer than I am. And we have to run this machine called America. And you can't do it without the use of fossil fuels. I think we now, this is kind of a recognition that that is a fact.

Let me ask a question of you first, Mr. Oldham. In your testimony, you talk about the existing supply of CO₂ are primarily from geological sources and they are not enough. I would like to have you speak on the demand side of this.

Mr. OLDHAM. Yes, sure. So today, I believe the figure is about 18 megatons of CO₂ are used globally around the planet, of which my understanding is about 50 megatons are used for enhanced oil recovery. So enhanced oil recovery is actually the largest use of CO₂ around the world today.

Speculation and the market reports estimate that increasing the amount of CO₂ up to even as high as 140 megatons per year is justified and can be used for EOR. So this is part of the reason why we have had some energy companies invest into our company and start working in partnership with us.

Remember also, when you capture CO₂ directly from the air, you have split the dependence on location. So we can build our plant just about anywhere. We no longer have to build a CO₂ collection plant where the ethanol plant has to be, and then move the CO₂ through a pipeline. By being able to do it by pulling CO₂ directly from the air, you can do EOR and capture your CO₂ locally, and then use that CO₂ for EOR and get negative emissions at the same time.

Senator INHOFE. That is great. That offsets so many of the people who are trying to use this issue for political purposes, and they say you just have to do away with fossil fuels altogether. You do that, you can't do that we are talking about doing.

I want to have one short question there to Mr. Sukut. I know this is addressed in the opening statement by our chairman. But in your testimony, you mentioned that your cooperative supports reform to other parts of the Clean Air Act, specifically the New Source Review. I would like to have you elaborate a little bit more, if you have more to say about that, the fact that we are looking at it.

Mr. SUKUT. I would be happy to, Senator. We, I think, more than anything, encourage the enactment or, it isn't that we don't, are not compliant with the New Source Review. I think the biggest

problem that we have had in the past, we have had situations where, and I will use, actually I will give you a real-life situation, where we had one of our coal plants in North Dakota was going to put in some equipment to actually make it more efficient. And then at the same time, it would have generated 22 megawatts more of electricity. But we were impacted and not able to do it because of the NSR rules.

Actually, if you had thought about it, it was going to reduce the amount of coal burned, we were going to increase the amount of electricity. But the rules were written such that we couldn't get that done. I think we just need more clarity, Senator, in terms of with the NSR rules. We need more clarity in terms of what we can and can't do.

If we get a road map, we are going to be compliant and we are going to do it. But we just need clarity, because it really stopped us from, a, we could have generated more electricity, two, we could have burned less coal and we would have had less emissions. So it is kind of a double-edged sword. But if you will, that is sort of my comment in terms of the NSR rules.

Senator INHOFE. That is good. I appreciate that.

Mr. Waltzer, I do have a question for you, but it will have to be in the record, because I will not have time to get to it now. But I do want to ask Mr. Oldham, you heard me describe my State of Oklahoma, the number of jobs, the reliance we have, how important the fossil fuels are to our State of Oklahoma. I would like to ask you, what specifically, for a State like Oklahoma, what does carbon capture utilization sequester, CCUS, mean for my State of Oklahoma and how do these technologies help?

Mr. OLDHAM. Sure. So that is probably a several-point answer, but I will try and be brief. I think the first thing is the ability to do further enhanced oil recovery, but in an environmentally safe way. Negative emissions and EOR combined is really a win-win. So that is No. 1. And of course, Wyoming has a good amount of EOR already.

Second, I think it offers an opportunity for new industry. There are many, the Department of Energy publishes an atlas of sequestration sites across the United States. Wyoming has a lot of potential sequestration sites, saline aquifers, geological formations. So the opportunity to store CO₂ underground in a State like Wyoming and many other States is a very real opportunity.

The third thing is the synthetic fuel. So by reducing the carbon intensity of fuel through blending, which of course the biofuel industry, the ethanol industry does today, it is a great way of helping de-carbonize the fossil fuels while continuing to enable the economy that is so essential. So I think those are the three main areas where I think we can benefit. What I have said to you here, sir, is also applicable for many other States across the United States.

Senator INHOFE. OK. I appreciate that very much, appreciate the testimony very much. Thank you.

Senator BARRASSO. Thank you, Senator Inhofe. Senator Whitehouse.

Senator WHITEHOUSE. Thank you, Chairman. Let me just take a minute to ask unanimous consent that letters of support from The Nature Conservancy, the Audubon Society, a list of our many,

many, many USEIT Act supporters, running from the AFL-CIO to the Wyoming Outdoor Council, alphabetically, and a series of statements from some of our supporters be put into the record.

Senator BARRASSO. What was the first one?

Senator WHITEHOUSE. AFL-CIO. A to W.

Senator BARRASSO. OK. I was looking where the Algae Association would fit in there.

[The referenced information follows:]



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Suite 100
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Jason Albritton
Director of Climate and Energy Policy
703-841-5300
Jason.Albritton@tnc.org

February 26, 2019

The Honorable John Barrasso
Chairman
Committee on Environment and Public Works
U.S. Senate
Washington, DC 20510

The Honorable Thomas Carper
Ranking Member
Committee on Environment and Public Works
U.S. Senate
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper:

On behalf of The Nature Conservancy, I write to express our support for S. 383, the USE IT Act, and applaud your leadership in introducing this bill. We also appreciate Sen. Whitehouse's tireless efforts to advance this legislation and are thankful to the many other members on both sides of the aisle who are cosponsors.

As a conservation organization whose mission is to protect the land and waters on which all life depends, we are committed to finding common sense solutions to some of nature's greatest challenges, including climate change. The Conservancy recognizes that carbon capture, utilization, and sequestration can play a role in meeting the long-term greenhouse gas reduction targets that science indicates will be necessary to avoid the worst impacts of climate change. We support efforts to ensure carbon capture is available as an effective tool for reducing greenhouse gas emissions while maintaining environmental safeguards.

TNC supports the passage of the USE IT Act and its efforts to advance carbon capture. By investing in research and development for carbon capture, and assessing its benefits and risks, the USE IT Act will play a critical role in helping these technologies come to market in an effective and responsible way.

We appreciate the bipartisan leadership on this issue and urge the Environment and Public Works Committee to support the legislation. We also look forward to working with other members of the Senate and the House of Representatives to move the USE IT Act forward so that it can be signed into law this Congress.

Thank you for your consideration of our views.

Sincerely,

Jason Albritton
Director of Climate and Energy Policy
The Nature Conservancy

cc: Senator Sheldon Whitehouse



National Audubon Society
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New York, NY 10014

212.979.3196
www.audubon.org

February 27, 2019

Senator John Barrasso
Chairman
Senate Committee on Environment
and Public Works
Washington, DC 20510

Senator Thomas R. Carper
Ranking Member
Senate Committee on Environment
and Public Works
Washington, DC 20510

Dear Chairman Barrasso and Ranking Member Carper,

On behalf of Audubon's one million plus members, we would like to express our support for S. 383, the Utilizing Significant Emissions with Innovative Technologies Act (USE IT Act). This bipartisan legislation aims to facilitate additional research and development of carbon capture and storage technologies that reduce emissions.

The USE IT Act builds on the successful reform and extension of the federal 45Q tax credit by establishing a prize program for early-stage direct-air capture research and demonstration to spur investment and innovation in this technology. Removing CO₂ directly from the atmosphere and developing viable mechanisms for permanent storage will be critical to achieving meaningful emissions reductions now and in the future.

Just like people, birds are facing a cascade of threats because of the changing climate. Rising seas and temperatures are shrinking and shifting the landscapes that sustain them. In 2014, Audubon published its Birds and Climate Change Report. The study shows that more than half of the bird species in North America could lose at least fifty percent of their current ranges by 2080 due to rising temperatures. These species include the Bald Eagle, the American Kestrel, and the Northern Harrier.

Audubon believes we need to pursue an array of common-sense, bipartisan approaches that reduce carbon emissions, and that carbon capture, utilization and storage is one of those elements. According to the Intergovernmental Panel on Climate Change, carbon capture and storage is vital to meeting mid-century goals for reducing carbon emissions.

Audubon appreciates the bipartisan leadership of Senators Barrasso and Whitehouse on S. 383 and we call on the U.S. Senate and House of Representatives to support a full range of policy solutions at the speed and scale necessary to address the threat of climate change. We look forward to working with you and members of the Senate Committee on Environment and Public Works to protect human health, as well as birds and the places they need, now and into the future.

Sincerely,

Jesse Walls
Senior Director of Government Affairs
National Audubon Society

Cc: Senator Sheldon Whitehouse

116th USE IT Act Supporters

- AFL-CIO
- Air Liquide
- Air Products
- American Carbon Registry
- ArcelorMittal
- Arch Coal
- Archer Daniels Midland Co.
- National Audubon Society
- Baker Hughes, a GE Company
- Bipartisan Policy Center
- Carbon180
- Carbon Wrangler LLC
- Clean Air Task Force
- ClearPath Foundation
- Cloud Peak Energy
- Conestoga Energy Partners
- Core Energy LLC
- EBR Development LLC
- EnergyBlue Project
- Energy Innovation Reform Project
- Glenrock Petroleum
- Great River Energy
- Greene Street Capital
- Impact Natural Resources LLC
- ION Engineering LLC
- International Brotherhood of Boilermakers
- International Brotherhood of Electrical Workers
- Jackson Hole Center for Global Affairs
- Jupiter Oxygen Corporation
- Lake Charles Methanol
- LanzaTech
- Linde LLC
- Mitsubishi Heavy Industries America, Inc.
- National Audubon Society
- National Farmers Union
- NET Power
- New Steel International, Inc.
- NRG Energy
- Occidental Petroleum Corporation
- Peabody Energy
- Prairie State Generating Company
- Praxair, Inc.
- Renewable Fuels Association
- Shell
- SMART Transportation Division (of the Sheet Metal, Air, Rail and Transportation Workers)
- Summit Power Group
- Tenaska Energy
- The Nature Conservancy
- Third Way
- Thunderbolt Clean Energy LLC
- United Mine Workers of America
- United Steel Workers
- Utility Workers Union of America
- White Energy
- Wyoming Outdoor Council

Senator WHITEHOUSE. After AFL–CIO.

[Laughter.]

Senator BARRASSO. Do you have the Algae Association?

Senator WHITEHOUSE. No, I have got to get them on that.

[Laughter.]

Senator WHITEHOUSE. First of all, very basic question. Do any of you doubt that climate change is a serious matter requiring urgent attention by Congress?

Mr. WALTZER. No.

Mr. SUKUT. No. I mean, I think we are past the science. I think we are to a point as a utility that we want to find ways to capture and sequester carbon.

Mr. OLDHAM. No.

Senator WHITEHOUSE. And how important do you feel carbon pricing is as one of the solutions to the problem? In the top ten, in the top two, top one?

Mr. SUKUT. So maybe I will start with a comment and then you can followup with a question based on my comment. I think as a utility, we are really challenged or pressed to operate at the lowest possible cost that we can. I think technologically there are probably some solutions that might be a little bit, if you are referring to a carbon tax in its essence is maybe something a little bit cheaper than a carbon tax as far as being onerous to our end consumers.

So I would encourage, as a utility, I would encourage the technological advances that we can make to capture carbon, because I think there are ways we can even do it cheaper there than through the carbon tax.

Senator WHITEHOUSE. Mr. Oldham.

Mr. OLDHAM. Let me first apologize to Senator Inhofe. I got your State wrong. Please chalk that down to an ignorant foreigner.

[Laughter.]

Senator BARRASSO. The Chairman loved your answers.

[Laughter.]

Mr. OLDHAM. Again, my apologies. So I think the question is, how do you incentivize the public to recognize a better product, and a better product in terms of de-carbonization is a product that has a lower carbon footprint.

Often the way that works is a combination of public sentiment, but also government direction and regulation. So the mechanism of government direction I am not the expert on. I can't speak as to whether a carbon tax is the right answer or tax credits or positive incentive or a negative incentive. It is just not my area of expertise. But I think the signal is essential.

Senator WHITEHOUSE. The signal is essential.

Mr. OLDHAM. Yes.

Senator WHITEHOUSE. Mr. Waltzer.

Mr. WALTZER. I think there is ample evidence that a combination of a pull policy, something that has a clear signal that companies know they need to invest in order to meet a technology goal, an emissions reduction goal, or a carbon price, combined with innovation, has been a winning combination. We have seen that with deployment of sulfur dioxide scrubbers, there was a lot of R&D that went into that.

And obviously a lot of tools in the Clean Air Act that pulled that technology forward. We have seen that with solar, for example, significant price drop between the early 1980's to say, 2010, almost 95 percent, driven by a combination of R&D, the kind of deployment incentives that we have now with 45Q and the renewable portfolio standards. These policies, given how short our timeframe is, given the need to develop technologies that are here, not just here but globally, we have to have both of those options on the table and move forward with them quickly.

Senator WHITEHOUSE. Let me ask a question specific to this technology. And it would be, what do you think the best case scenario is for the carbon capture industry, say by 2040? What could we expect in terms of potential carbon removal? And what in the way of getting there, to you, are the most exciting technical or other opportunities? What do you see as the great things that might open up? Let's go the other way this time, we will start with Waltzer, Oldham and Sukut.

Mr. WALTZER. So by 2040, what we hope to see and what we think is possible is significant deployment of carbon capture utilization storage, not just in the U.S., but around the world. We think, as we have seen with technologies like Net Power, there can be substantial cost reductions on CO₂, carbon capture at industrial facilities and power facilities. They are targeting \$10 a ton if that happens, if you have a natural gas plant, if they can capture \$10 a ton, that is a game changer.

We also are really interested in the concept of zero carbon fuels, and carbon capture and storage can play an important role there. Hydrogen and ammonia, basically taking natural gas or forming it, sequestering it.

Senator WHITEHOUSE. I am down to 30 seconds and I have two more witnesses. So let me jump to Mr. Oldham. Sorry, Mr. Waltzer.

Mr. WALTZER. No problem.

Mr. OLDHAM. I would like to see a combination of successes. The first would be the continued prevalence of emission control through the types of activities that you have heard discussed here. The second would be a recognition that there are some industries that it is extremely challenging to de-carbonize, and instead, you set up a carbon offset program by doing something like direct air capture to reduce CO₂.

Senator WHITEHOUSE. How big could this be?

Mr. OLDHAM. How big?

Senator WHITEHOUSE. Yes. There are only 200 people working in this area right now. Could that be 200,000? Could that be 20,000?

Mr. OLDHAM. So each of our plants does about a megaton of CO₂ capture per year. So a large number of plants is required to make a dent in this problem. I believe there is no reason why you can't roll out these plants worldwide. Our business model is to license our technology to any partner who is interested. So we would like to see literally hundreds of our plants put worldwide, because this is a global problem, it is everybody's problem.

Senator WHITEHOUSE. Well, my time is expired, so let me just leave a question for the record. Because I have truncated your answer and we ran out of time before you could have a chance, Mr.

Sukut. So if you could, again, what are the coolest things that you think are out there in this industry? And what do you think the prospects are, and how can we help you achieve those best case prospects?

Senator BARRASSO. You would like written response to that?

Senator WHITEHOUSE. Yes. I think response to the record makes sense. We can go on with other colleagues who are waiting.

Senator BARRASSO. All right. Before heading to Senator Capito, I have a list of letters supporting this as well in alphabetical order, from the Carbon Utilization Research Council to the Western Governors Association. And without objection, we will submit these as well.

[The referenced information follows:]

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February 26, 2019

The Honorable Senator John Barrasso
 307 Dirksen Senate Office Building
 Washington, DC 20510

The Honorable Senator Sheldon Whitehouse
 530 Hart Senate Office Building
 Washington, DC 20510

Dear Senators Barrasso and Whitehouse:

The Carbon Utilization Research Council (CURC) is pleased to support the "Utilizing Significant Emissions with Innovative Technologies" Act (USE IT Act). The introduction of the legislation is emblematic of a growing bipartisan leadership effort to advance carbon capture, utilization, and sequestration (CCUS) technologies that will improve our nation's economic and energy security objectives, while also mitigating emissions of CO₂ from the use of fossil fuels.

The USE IT Act builds on the recently-enacted FUTURE Act and the Carbon Capture Modernization Act by improving the permitting of carbon capture, utilization, and sequestration projects and CO₂ pipelines. It would also provide necessary certainty to power generators and other industrial sources and will incentivize the build-out of CCUS projects.

Implementation of the USE IT Act will ultimately lead to solutions that will help bring down the costs of commercial-scale CCUS projects integrated with power generation. These efforts will complement and enhance work already being done through public-private partnerships such as the Wyoming Integrated Test Center and the National Carbon Capture Center.

We thank you for your leadership and look forward to supporting your efforts to advance this important legislation.

Sincerely,

Shannon Angielski
 Executive Director, CURC

Co-Chairs

Melissa Horton
 Southern
 Company
 Holly Krutka
 Peabody

Vice Chairs

Dale Niezwaag
 Basin Electric Power
 Cooperative

Treasurer

Zak Baig
 ClearPath Action

Secretary

Ruth Demeter
 Peabody

Executive

Director
 Shannon
 Angielski



DAVID IGE
GOVERNOR OF HAWAII
CHAIR

DOUG BURGUM
GOVERNOR OF NORTH DAKOTA
VICE CHAIR

JAMES D. OGSBURY
EXECUTIVE DIRECTOR

February 21, 2019

The Honorable John Barrasso
Chairman
Committee on Environment & Public Works
United States Senate
410 Dirksen Senate Office Building
Washington, D.C. 20510

The Honorable Thomas R. Carper
Ranking Member
Committee on Environment & Public Works
United States Senate
456 Dirksen Senate Office Building
Washington, D.C. 20510

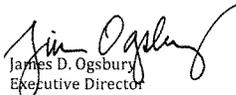
Dear Chairman Barrasso and Ranking Member Carper:

The United States has the opportunity to continue global leadership in carbon capture, utilization, and storage (CCUS) research and technology development. Western Governors support federal policies that promote the development and deployment of CCUS. Thank you for examining this important topic at your February 27 Hearing to Examine S. 383, the Utilizing Significant Emissions with Innovative Technologies Act, and the State of Current Technologies that Reduce, Capture, and Use Carbon Dioxide. To inform the Committee's consideration of this subject, I request that you include the following attachments in the permanent record of the hearing:

- WGA Policy Resolution [2018-07, Enhanced Oil Recovery](#);
- WGA Policy Resolution [2018-04, Energy in the West](#), and the Governors' [Energy Vision for the West](#); and
- The Governors' [April 24, 2018 letter](#) to the Committee in support of S. 2602, the Utilizing Significant Emissions with Innovative Technologies Act.

Thank you for your consideration of this request.

Respectfully,


James D. Ogsbury
Executive Director

Attachments



Policy Resolution 2018-07

Enhanced Oil Recovery

A. BACKGROUND

1. Enhanced oil recovery (EOR), using carbon dioxide (CO₂), when performed appropriately and responsibly offers a safe and commercially proven method of domestic oil production. The U.S. oil and gas industry, which pioneered the CO₂ EOR process in West Texas in 1972, is the world leader. For decades, the EOR industry has captured, transported, and injected large volumes of CO₂ for oil recovery with no major accidents, serious injuries or fatalities reported.
2. The CO₂ EOR process typically works by injecting CO₂ obtained from natural and anthropogenic sources into existing oil fields – often referred to as “brownfields” – to produce additional crude trapped in rock formations. This CO₂ “flooding” can result in recovery of about twenty percent of the original oil in place.¹ CO₂ flooding utilizes existing assets to recover significant additional resources stimulating the economy and minimizing surface disturbance that new exploration and development projects necessarily entail. In addition, many areas favorable for CO₂ application exist where new or continued significant drilling activity is unlikely to occur at a meaningful scale for years, if ever.
3. As of 2013, EOR using CO₂ produced approximately 280,000 barrels of domestic oil per day, or four percent of U.S. crude oil production.²
4. America has an estimated 21.4 billion barrels of oil, requiring 8.9 billion metric tons of CO₂, which could be economically recovered with today's EOR technologies. With advances in technology, 63.3 billion barrels of oil, requiring 16.2 billion metric tons of CO₂, could be economically recovered, which is roughly double current U.S. proven reserves.³
5. EOR enhances our nation's energy and fiscal security by reducing dependence on foreign oil, often imported from unstable and hostile foreign sources. It allows reduction of our trade deficit by keeping dollars now spent on oil imports here at home and at work in the U.S. economy.
6. Coal, oil, and other industrial processes are a vital component of many western states' economies. EOR provides a long-term path for continued low-carbon production and use of our nation's coal and oil resources, while industrial sources can provide CO₂ at lower capture costs. EOR presents an opportunity for state and local governments to stimulate economic activity and realize additional revenue by transforming their CO₂ emissions into a valuable commodity.

¹ National Energy Technology Laboratory – Untapped Domestic Energy Supply and Long Term Carbon Storage.

² Energy Information Administration – Annual Energy Outlook 2015.

³ U.S. Department of Energy, National Energy Technology Laboratory.

7. CO₂ is currently limited in availability from sources needed for EOR – natural sources will not close a supply gap projected to grow. Further, CO₂ capture and pipeline transport capacity to oil fields is not sufficient.
8. CO₂ capture equipment, installed on a broad range of industrial processes, has the potential to supply significant volumes of CO₂ to the EOR industry enabling the U.S. to achieve significant net carbon reductions through the permanent storage of CO₂.⁴
9. The U.S. has the opportunity to continue global leadership in carbon capture and storage (CCUS) research and technology development, while further deploying CCUS technologies that provide financial benefits to our nation's entire value chain.

B. GOVERNORS' POLICY STATEMENT

1. In recognition of the environmental and economic benefits of EOR, Western Governors will work collaboratively to promote broad scale development of infrastructure for carbon capture, CO₂ pipelines, EOR, and other forms of geologic storage.
2. Western Governors support efforts to increase the awareness of the many benefits of CO₂ EOR.
3. In order to expand deployment of CO₂ capture at power plants and other industrial sources, the President and Congress should continue to enact federal incentives to increase CO₂ supply available for the oil industry to purchase and use in EOR. Federal incentives have the potential to leverage private and state investment, harness the ingenuity of entrepreneurs and capitalize on billions of dollars' worth of DOE-sponsored research and development to enable new commercial carbon capture and pipeline projects.
4. Federal policies aimed to limit CO₂ emissions should promote, and not impede, development and deployment of CO₂ capture and commoditization. Federal regulations should allow states to create programs tailored to individual state needs, industries and economies and recognize permanent CO₂ storage that results from EOR in meeting federal regulatory objectives. As such, EPA should abide by principles already established by the Agency in its regulations promulgated to ensure the permanent storage of CO₂ in different geologic formations.
5. Recognizing that lack of pipeline infrastructure is a critical challenge to deployment of CCUS technology, Western Governors support proactively identifying, analyzing and evaluating opportunities for pipeline corridors to transport industrial and power plant CO₂ for beneficial use and permanent storage.

⁴ As of 2014, approximately 13.6 million metric tons of CO₂ was captured that would otherwise be released into the atmosphere has been permanently stored as a result of EOR (U.S. Department of Energy – Quadrennial Energy Review). Over the life of a project, for every 2.5 barrels of oil produced, it is estimated that a typical commercial EOR project can safely prevent one metric ton of CO₂ from entering the atmosphere (Kuuskraa, Godec, Dipietro – Energy Procedia). Further, the volume that could be captured and permanently stored from industrial facilities and power plants to support economically recoverable EOR reserves could be 8.9 to 16.2 billion metric tons of CO₂. This is equal to the total U.S. CO₂ production from fossil fuel electricity generation for approximately 4 to 8 years (EPA 2015 Green House Gas Inventory).

C. **GOVERNORS' MANAGEMENT DIRECTIVE**

1. The Governors direct WGA staff to work with Congressional committees of jurisdiction, the Executive Branch, and other entities, where appropriate, to achieve the objectives of this resolution.
2. Furthermore, the Governors direct WGA staff to consult with the Staff Advisory Council regarding its efforts to realize the objectives of this resolution and to keep the Governors apprised of its progress in this regard.

Western Governors enact new policy resolutions and amend existing resolutions on a bi-annual basis. Please consult www.westgov.org/policies for the most current copy of a resolution and a list of all current WGA policy resolutions.



**Western Governors' Association
Policy Resolution 2018-04**

Energy in the West

A. BACKGROUND

1. Energy policy and the development of sustainable energy resources are major priorities for every Western Governor.
2. Western Governors recognize that approaches to energy use and development vary among our states, territories, and flag islands. However, the Governors remain committed to the development of policies and utilization of state energy endowments that result in the maximum benefit for their citizens, the region, and the nation.
3. Western energy production is indispensable to meeting national energy demands. The West is the energy breadbasket of the United States:
 - a. Western states have all high-yield geothermal energy capacity in the continental United States.
 - b. Western states supply the majority of non-federal United States petroleum.
 - c. Western states are at the forefront of unconventional natural gas production.
 - d. The Pacific Northwest produces the largest output of hydropower in the nation.
 - e. Western states have the largest contiguous areas of wind power resources in the nation.
 - f. The Southwest has some of the highest-identified solar energy resource areas in the United States.
 - g. Western states produce the largest portion of coal in the United States, which is the fuel that constitutes the largest share of the national electricity generation mix.
 - h. The West has the largest contiguous areas of high-yield biomass energy resource potential in the nation.
 - i. Western states have nuclear power generation facilities and produce all domestic uranium.
4. Western states, Pacific territories, and flag islands have the resources to drive job creation and economic development through broad growth in the energy industry.

5. The Merchant Marine Act of 1920 has prevented certain noncontiguous states, territories, and flag islands from being supplied with domestically produced energy commodities.

B. GOVERNORS' POLICY STATEMENT

1. Western Governors recognize the following as energy policy priorities for the West:
 - a. Secure the United States' energy supply and systems, and safeguard against risks to cybersecurity and physical security.
 - b. Ensure energy is clean, affordable, and reliable by providing a balanced portfolio of renewable, non-traditional, and traditional resources.
 - c. Increase energy efficiency associated with electricity, natural gas, and other energy sources and uses to enhance energy affordability and to effectively meet environmental goals.
 - d. Advance efficient environmental review, siting, and permitting processes that facilitate energy development and the improvement and construction of necessary electric grid (transmission and distribution) and pipeline infrastructure, while ensuring environmental and natural resource protection.
 - e. Improve the United States' electric grid's reliability and resiliency.
 - f. Protect western wildlife, natural resources, and the environment, including clean air and clean water, and strive to reduce greenhouse gas emissions.
 - g. Make the West a leader in energy education, technology development, research, and innovation.
 - h. Utilize an all-of-the-above approach to energy development and use in the West, while protecting the environment, wildlife, and natural resources.
2. Western Governors support increasing the development and use of energy storage, alternative transportation fuels, and alternative vehicles.
3. Western Governors call on the federal government to lift a barrier to domestic free trade between the contiguous United States and the noncontiguous states, territories and U.S. flag islands by the Merchant Marine Act of 1920 by allowing those jurisdictions to receive energy commodities produced in the mainland but transported by foreign vessels, should those jurisdictions, and the jurisdictions whose ports are being used to ship these materials, desire it.
4. Redundant federal regulation of energy development, transport, and use is not required where sufficient state, territorial, or flag island regulations exist. Existing state authority should not be replaced or impeded by Congress or federal agencies.

C. GOVERNORS' MANAGEMENT DIRECTIVE

1. The Governors direct WGA staff to work with Congressional committees of jurisdiction, the Executive Branch, and other entities, where appropriate, to achieve the objectives of this resolution.
2. The Governors also direct WGA staff to consult with the Western Interstate Energy Board to recommend updates to the 10-Year Energy Vision that provide detail on the Governors' energy policy objectives outlined in this resolution.
3. Furthermore, the Governors direct WGA staff to consult with the Staff Advisory Council regarding its efforts to realize the objectives of this resolution and to keep the Governors apprised of its progress in this regard.

Western Governors enact new policy resolutions and amend existing resolutions on a biannual basis. Please consult www.westgov.org/policies for the most current copy of a resolution and a list of all current WGA policy resolutions.



Energy Vision for the West

Introduction

The resource-rich West supplies a majority of the country's energy resources and electric power. The United States is currently projected to become a net energy exporter within five years. The increase in natural gas developed in the West, coupled with increased investment in renewable and alternative energy sources, have positioned the region and its Governors to play a central role in the nation's economy and energy policy.

The West's vast energy resources and the Governors' role in the development of energy policy underscores the value of a regional energy policy, the *Energy Vision for the West*. This policy does not impede states or territories from approaching energy choice and industry growth based on their own resource endowments and policies. It illustrates that Western Governors have coalesced around common issues and specific goals, despite diverse geography, resources, and politics. The *Energy Vision for the West* elaborates on the Governors' objectives set forth in WGA Policy Resolution 2018-04, Energy in the West.

Western Governors support a comprehensive energy portfolio for the West to ensure that energy is clean, affordable, and reliable. They are also committed to energy policies that promote economic growth and protect the environment. This approach facilitates a strong economy and jobs across a variety of professions, skill sets, and educations.

This approach also recognizes that there are challenges and opportunities associated with every type of energy resource and use, the costs and benefits of which must be considered in policymaking. One such opportunity – and challenge – is creating an effective state-federal partnership in energy development, lands management, and environmental protection. This regional policy is a guide for realizing opportunities to advance the West as the nation's principal energy provider and a leader in energy innovation and effective policy.

Goal 1: Secure the United States' energy supply and systems, and safeguard against risks to cybersecurity and physical security.

Addressing threats to the nation's energy systems and resources is a high priority of Western Governors. Coordination between states, the federal government, and the private sector on energy emergency planning and response is vital to addressing physical and cybersecurity impacts on the West's energy systems and resources. To this end, the Governors establish the following objectives:

- Work with the Department of Defense to meet its national security mission by ensuring safe and secure onsite and off-site electricity generation for key defense installations.
- Continue to reduce reliance on non-North American oil imports from unstable foreign sources through individualized state-by-state solutions, such as increasing North American production, improving fuel efficiency, and developing renewable and alternative fuels.

- Ensure there is sufficient domestic energy supply, including domestic renewable electric generation, to meet existing and new market demand.
- Identify security and other vulnerabilities of energy infrastructure and create programs and standards to defend infrastructure from cyber and physical attacks, as well as natural disasters.
- Encourage effective relationships between state agencies, federal agencies, public utilities, and the private sector to prevent and prepare for risks to the region's energy supply and systems, as well as to respond to and recover from disruptions.
- Partner with the federal government to ensure the provision of adequate funding and access to resources for state emergency planning, response, and recovery.
- Expand, upgrade, and secure transmission and pipeline infrastructure, as well as ensure that all federal pipeline safety measures are efficiently implemented.

Goal 2: Ensure energy is clean, affordable and reliable by providing a balanced portfolio of renewable, non-traditional and traditional resources.

Western Governors believe that a balanced energy portfolio should consist of energy sources that are clean, affordable and reliable, that maintain system reliability, and limit rapid rate increases. These resources also require the maintenance and expansion of transmission and distribution infrastructure. To this end, the Governors establish the following objectives:

- Recognize the importance of western renewable (wind, solar, biomass, biofuels, geothermal, hydropower), nuclear, coal and natural gas resources, and the generation facilities that utilize those resources.
- Adapt utility regulation to changing markets, technologies, and resources.
- Encourage the addition of renewable, low-carbon, and clean generation, including utility-scale and distributed generation.
- Promote, advance and fund the evolution of new technologies, including carbon capture and advancements in renewable energy.
- Maintain the Rural Energy for America (REAP) program, which has benefited farmers, ranchers and rural businesses that are often underserved by other federal energy efforts.

Goal 3: Increase energy efficiency associated with electricity, natural gas, and other energy sources and use to enhance energy affordability and to effectively meet environmental goals.

Eliminating waste and using resources wisely are cornerstones of a sound energy strategy. State and local governments, utilities, households, and businesses are currently realizing the economic and other benefits of energy efficiency, but there are still substantial gains to be made. To this end, the Governors establish the following objectives:

- Prioritize energy efficiency associated with electricity, natural gas, and vehicle transportation.

- Enhance utility rate designs, including time-varying rates, and cost-effective utility energy efficiency programs that deliver electricity and natural gas savings to consumers.
- Support energy efficiency programs that provide incentives and rebates to lower the incremental up-front costs of energy efficiency technologies; Energy Service Company (ESCO) programs; and where successful, utility ratepayer-funded energy efficiency programs, including the use of rate decoupling.
- Encourage the retrofit of residential and commercial buildings and improve the energy efficiency of new buildings, such as through building energy codes and programs that stimulate energy efficient construction.
- Decrease energy intensity using tools such as combined heat and power and waste heat to power systems.
- Incorporate systems strategies to improve efficiency throughout the building lifecycle and to improve grid connectivity, including energy systems that enable two-way, automated utility-to-customer communications to facilitate demand response programs.
- Maintain funding and support long-term authorization for the State Energy Program (SEP), Weatherization Assistance Program (WAP), and Low-Income Home Energy Assistance Program (LIHEAP).

Goal 4: Advance efficient environmental review, siting and permitting processes that facilitate energy development and the improvement and construction of necessary electric grid (transmission and distribution) and pipeline infrastructure, while ensuring environmental and natural resource protection.

Responsible energy development and a robust, well maintained energy delivery system are vital to the economy and quality of life in the West. To this end, the Governors establish the following objectives:

- Encourage responsible leasing and development of energy resources and infrastructure.
- Create a clear and transparent process for regulation and permitting, coordinated among well-trained and adequately funded federal, state and local agencies.
- Streamline project-permitting reviews to minimize timelines, without compromising environmental and natural resource protection or states' roles in those processes.
- Maintain state and local decision-making authority over transmission line siting and permitting.
- Encourage regional transmission planning organizations to conduct interconnection-wide planning with the full participation of the states and with consideration of state energy policies.
- Create functional partnerships among states, federal agencies, tribal governments and local jurisdictions to solve conflicts that hinder energy infrastructure and resource development.

- Increase cooperation on interstate projects through interstate compacts and other tools.
- In the West-wide energy corridor process, ask federal agencies to guarantee: ongoing, substantive, and meaningful state consultation; consideration of state plans, processes, priorities, and policies; and integration of other streamlining efforts.

Goal 5: Improve the United States electric grid's reliability and resiliency.

Changes in energy generation, distribution, and management are transforming the nation's electric grid. But these advancements also highlight the need for grid level investment, along with associated updates for electricity regulation and policy. To this end, the Governors establish the following objectives:

- Protect state authority to determine the type and amount of new generation facilities and the programs used to procure new generation, recognizing that each state has their own priorities and portfolios.
- Protect state authority to encourage continued operation of existing generation facilities through long-term contracts, retail utility contracting, or other incentives.
- Encourage regional reliability organizations, utilities, state agencies and public utility commissions to assess the provision of essential reliability services under future scenarios that include a changing resource mix in the West.
- Support grid operator situational awareness of distributed energy resources by promoting coordination between utilities and distributed energy resource developers.
- Preserve areas of exclusive state authority regarding distributed energy resources, including storage, and improve utility distribution systems planning for distributed energy resources to enhance grid reliability and resilience.
- Improve understanding of grid resources and services and the need for new power production facilities and transmission/distribution infrastructure through data, analysis, and coordination.
- Prepare for potential disruptions to the grid from wildfires, flooding, earthquakes, tornadoes, cyberattacks and other disturbances and emergencies, as well as increase the grid's ability to withstand and reduce the magnitude of such events.
- Enable utilities to take necessary actions to enhance grid reliability and reduce the threat of wildfires to and from electric transmission and distribution rights-of-way.

Goal 6: Protect western wildlife, natural resources and the environment, including clean air and clean water, and strive to reduce greenhouse gas emissions.

Western states have long assumed a stewardship role for the natural environment and have worked across state lines to protect air, land, wildlife and water. Western Governors are committed to ensuring that energy development is done in an environmentally responsible manner. To this end, the Governors establish the following objectives:

- Promote energy technologies and sources that lower emissions.
- Continue advancing air and water quality improvements and plans in each state and across state lines.
- Foster environmental cooperation that: protects the state-federal partnership; provides for sustainable environmental protection; is nimble and flexible; and ensures that state governments play a key role in regulation.
- Acknowledge that a productive economy and responsible development can support environmental protection by providing additional funding and opportunities for public-private partnership.
- Encourage technologies that reduce water consumption, prioritize water consumption for traditional activities (drinking water, agriculture, habitat conservation/restoration), and contribute to the responsible development of new energy resources.
- Achieve a balance between the responsible development of energy projects and wildlife conservation.
- Urge the federal government to identify and approve solutions for the long-term storage and permanent disposal of spent nuclear fuel and nuclear waste.
- Encourage the development and deployment of a full range of technologies that offer the potential for cost-effective reductions in greenhouse gas emissions from energy production and use, including carbon capture and storage, energy efficiency, zero emissions generation sources, and other emerging options.

Goal 7: Make the West a leader in energy education, technology development, research, and innovation.

Effective energy policy is facilitated by an understanding of a common set of impartial facts and scientific evidence. Furthermore, the advancement of technology will play a critical role in realizing a clean energy future. To this end, the Governors establish the following objectives:

- Leverage the vast expertise in the West's industry, academic institutions, and national laboratories to make the region an international hub for new energy technology research and development, as well as energy education.
- Encourage Congress and the Department of Energy to support and fund research, development, demonstration, and deployment of advanced energy technologies.
- Create public-private research and development partnerships among industry, academia, the national labs, and federal agencies to identify promising new technologies, including energy efficiency technologies that advance clean energy with reduced environmental impacts.
- Encourage market operators, reliability organizations, and utilities to appropriately share electric system operational data with researchers, educators, and entrepreneurs to promote

electric system innovation and technology development, while still safeguarding against risks to cybersecurity and physical security.

- Encourage training and education in energy-related fields and ensure there is an adequate workforce operating under the highest safety standards.
- Facilitate the creation of employment opportunities for displaced energy sector workers.
- Educate the public regarding: the role of energy in maintaining a high standard of living and quality of life; trade-offs and externalities associated with all types of energy development and consumption; the coexistence of a healthy environment and a thriving economy; and how federal policy on public lands impacts energy and infrastructure development.

Goal 8: Utilize an all-of-the-above approach to energy development and use in the West, while protecting the environment, wildlife and natural resources.

A diverse energy portfolio is essential to the provision of clean, affordable, secure, and reliable energy. Western Governors support a comprehensive energy portfolio, including: oil, gas, coal, nuclear, biomass, geothermal, hydropower, solar, wind, and conservation and energy efficiency. To this end, the Governors establish the following objectives:

- Reduce costs and risks for the environmentally sound development of all energy resources.
- Ensure competition in the market for all resources.
- Recognize the growing importance of consumer choice in driving energy policy.
- Support consumer choice of distributed energy resources to achieve affordability, environmental, and other objectives.
- Increase the development and use of alternative transportation fuels and vehicles, including the necessary infrastructure for those vehicles.
- Encourage innovation and application of energy storage, including pumped hydro storage, battery storage, and compressed air energy storage where cost-effective.
- Support the responsible and efficient development and use of traditional and renewable resources.
- Increase the amount of electricity generated from new, retrofitted, or relicensed hydroelectric facilities, including small, irrigation, and flood control hydropower projects.
- Restore financing for the geothermal exploration program financed by the Department of Energy.
- Accelerate the introduction of small modular reactors into the marketplace.

April 24, 2018

Honorable John Barrasso
Chairman
Committee on Environment and Public Works
United States Senate
410 Dirksen Senate Office Building
Washington, D.C. 20510

Honorable Thomas R. Carper
Ranking Member
Committee on Environment and Public Works
United States Senate
456 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Chairman Barrasso and Ranking Member Carper:

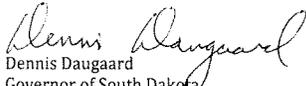
The U.S. is the global leader in carbon dioxide (CO₂) capture, utilization and sequestration (CCUS) research, development and deployment. Given the appropriate resources and regulatory environment, we will advance our technologies so that we can continue to use our abundant resources while minimizing our carbon footprint. Western Governors support the bipartisan Utilizing Significant Emissions with Innovative Technologies (USE IT) Act ([S. 2602](#)), which will facilitate development and deployment of CCUS infrastructure.

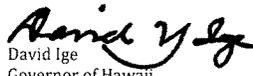
Western Governors have long supported advancement of carbon capture technology due to its environmental and economic benefits. S. 2602 directs the Environmental Protection Agency to support research on direct air capture and CO₂ utilization, with a focus on technologies that transform CO₂ into a product or product input with commercial value. The bill also clarifies that carbon capture and utilization projects and pipelines are eligible for the streamlined permitting process under the Fixing America's Surface Transportation (FAST) Act and directs the Council on Environmental Quality to develop guidance on reviews of CCUS projects and CO₂ pipelines.

Furthermore, WGA Policy Resolution [2017-01, Building a Stronger State-Federal Relationship](#), advocates for greater state representation on committees and panels advising federal agencies on scientific, technological, social, and economic issues. We are pleased that this bill requires the task force to include states (at their request) and to provide models for, and technical assistance to, states for CCUS projects and CO₂ pipeline regulation.

Thank you for your leadership in this area of crucial importance to our nation's economy, energy, and environment, as well as for your recognition that states have a critical role in promoting the development and utilization of carbon capture technologies. Please do not hesitate to contact us if we can be of further assistance.

Sincerely,


Dennis Daugaard
Governor of South Dakota
Chair, WGA


David Ige
Governor of Hawaii
Vice Chair, WGA

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Senator BARRASSO. Senator Capito.

Senator CAPITO. Thank you, Mr. Chairman.

Mr. Sukut, you mentioned in your statements about research and development. We have talked about enhanced oil recovery as a use. Mr. Oldham talked about a new synthetic fuel that could be used with the recycling of the carbon. Is it your intention or is the intention—how advanced would you say the research is in this area in terms of other kinds of uses of carbon, and where do you see this in the next 10 to 15 years?

Mr. SUKUT. So just let me start by saying, I think we are probably, in the technology curve, we are probably back here a little bit. But let me say this. In taking a look at the Integrated Test Center in Wyoming that we have, we have the six participants now. I see a lot of excitement in some of the things they think they can do to extract and turn it into useable product, like a cement enhancer, ethanol. I think it could be limitless, especially with the timeframe that we have here in terms of years, saying to 2035 or 2040.

Look what this Country did with sulfur. Thirty-five year ago, we were struggling with removing SO₂ from the air. Today it is not tough at all to get to over 99 percent. All of our plants are able to do it, and they do it very routinely. So I think with a timeline like that, this Country has been able to do it before, and I think we can do it again with CO₂.

So I think it is limitless. I know I am not giving you as direct an answer as you want, but I really feel that.

Senator CAPITO. Mr. Oldham, do you have any comments on that?

Mr. OLDHAM. I think this technology is at different phases of implementation. Our technology is ready to go to market now.

Senator CAPITO. Is this for the synthetic fuel?

Mr. OLDHAM. No, well, for both. We have done it to capture CO₂, and then you can make the synthetic fuel.

Senator CAPITO. Right.

Mr. OLDHAM. So it is ready to go to market now, because we use pieces of equipment from things like the clean power industry, the water treatment industry, the I&R industry. So in our case, we think, well, we know we are ready to go to market now, and the large energy companies that are working with us agree.

But you can always improve the process. The sulfur example is a great example. It is an iterative process to make it better and better. But it is a spectrum. There are some technologies that are absolutely fully ready for implementation now.

Senator CAPITO. So let me ask Mr. Sukut again, on the regulatory thing, do you agree that interState CO₂ pipelines would be more challenging than international pipelines? Apparently, we have had some issues in Wyoming and other places where we can't do interState carbon pipelines.

Mr. SUKUT. I think there are some challenges. We have seen some challenges with pipelines via some of the landowners and some of the other things that have happened in this Country. I think all you have to do is look at the natural gas market and see, there are pockets there where natural gas can go to eight bucks where Nymex is trading at two, just because of its infrastructure. There is a lot of natural gas out there.

Senator CAPITO. Right.

Mr. SUKUT. So yes, I think that there are some issues. I think we could use some help with it. I think the USEIT Act is a huge step in that direction, I really do, and I applaud you, all of you, for taking that step, to be honest with you.

Senator CAPITO. There has been a lot of pushback on pipelines. We are experiencing that in West Virginia right now, with the natural gas pipelines.

In terms of, this is a little offshoot question, but in terms of the general public's perception of a carbon CO₂ pipeline, does that present any other inherent dangers, besides a regular ethane, methane pipeline?

Mr. SUKUT. No, it doesn't at all. In fact, we have a CO₂ pipeline in service. We have had it in service for 20 years.

Senator CAPITO. Right.

Mr. SUKUT. We send CO₂ every day to the Canadian oil fields. We add a sort of an odor, it is called mercaptan, it is added to natural gas.

Senator CAPITO. To protect it. Yes.

Mr. SUKUT. Absolutely not, doesn't pose any kind of greater threat.

Senator CAPITO. So I also have a large coal industry, as you all probably know, being from West Virginia. My interest here is obviously on the economic front, but on the environmental front as well. Globally, we know that a lot more countries are using coal in other areas to pull people out of poverty and bring up the economic viabilities.

Are you finding globally that this technology is something that is—you mentioned you wanted to have plants all over the world. For the heavy coal-intense areas now, where are you seeing this acceptability?

Mr. OLDHAM. It is a great question. So why people are interested in our technology is because we can offset the hard to de-carbonize industries that are essential for economy or essential for any other reasons, for jobs and so on. So our technology, because it sounds independent and does negative emissions in parallel with other industries, airline industry is another great example, really hard to de-carbonize, the coal industry, hard to de-carbonize.

So by doing things like a negative emissions plant which can be located at any location, you can put them anywhere, you have another industry, but you allow that first industry to keep going, but you are still de-carbonizing it.

Senator CAPITO. Thank you.

Senator BARRASSO. Thank you, Senator Capito. Senator Cardin? Oh, Senator Whitehouse, yes.

Senator WHITEHOUSE. When I gave my thank-yous to my cosponsors on this bill, Senator Duckworth was not in the room. She is now in the room, so I just want to add my gratitude personally to her for her support. Thank you.

Senator BARRASSO. Senator Cardin.

Senator CARDIN. Thank you, Mr. Chairman. I want to thank you and I want to thank Senator Whitehouse for working together to deal with a practical, bipartisan way to reduce carbon through carbon capture. To me, this is how we should be working to try to

make progress wherever we can make progress. I thank you. It is science-driven decisionmaking.

In my State of Maryland, the geological survey has been working on carbon capture and sequestration for many, many years. They are targeting entities such as unused gas wells, geologic rift zones and deep saline aquifers. So we are very much engaged in this process, because we think there is a major return.

But I would also point out there is no one answer to dealing with the carbon issue. Senator Van Hollen and Senator Carper and I, and also Senator Gillibrand, represent the Chesapeake Bay watershed. So we understand, and Senator Capito who was here, is also part of that region.

We recognize the challenge that we have in the Chesapeake Bay. So we look at carbon capture as one way of helping deal with the issue. We also look at our energy policy as an important point on dealing with carbon emissions. We look at farming practices, we look at shoreline development and dealing with storm runoff issues. All these are important.

One area where we have been able to get bipartisan support is to restore wetlands. Wetlands are a natural way of capturing carbon. So as we lose wetlands, and we lose wetlands every year, we are making the carbon issue more severe in this Country.

So when we got to the nutria eradication issue, which was a bipartisan effort, this committee was very much engaged in it, we were able, effectively, to eliminate the nutria population on the eastern shore, which has saved, literally, a large portion of Blackwater National Wildlife Refuge, it is saved today with wetlands because we got rid of the nutria population. That is helping on our carbon emissions.

So my question to Mr. Waltzer is, do you agree that carbon capture is important, but we need to have a coordinated effort on so many different directions if we are going to make a consequential difference on the carbon emissions that are occurring today? What would your priorities be?

Mr. WALTZER. Senator Cardin, I think there is no question that we have to have a broad set of technology tools available to us to de-carbonize our planet. Our priorities are pretty simple. We need to have a set of policies that drive innovation across renewables, carbon capture and nuclear.

We need to make sure that those technologies get to the point where they are widely commercially available, to be not just used here in the U.S., but around the world. And that tool kit is going to be a combination of certainty that comes from technology portfolio standards or emission limits or carbon pricing combined with a robust set of innovation policies, like we are talking about today with the USEIT Act.

It seems like a pretty simple formula. But it is a profound formula, and one that we need to move on on all fronts quickly if we are going to address this in a timeframe that matters.

Senator CARDIN. Another area that we were able to work in a bipartisan manner dealt with certain tax incentives for renewable energy sources. That also has a dramatic impact on reducing carbon emissions. I just mention the different areas that we need to work on in a coordinated way to deal with the realities of carbon

pollution and what it is doing to our atmosphere and what it is doing to our environment.

So on a scale of where we need to put our attention, where should we be placing our attentions?

Mr. WALTZER. I think our priorities need to be focused on insuring that renewable energy continues to develop as a solution. Right now it is only providing less than 1 percent of the world's primary energy production. That is not enough. We can do much more. But we are currently getting over 80 percent of our primary energy production from fossil fuels. That is not likely to go away by mid-century. So we are going to need a robust application of carbon capture utilization and storage.

And we get about 5 percent globally from nuclear power. We are beginning to see some evidence that that can get back to a place where it can play an important role in providing those solutions. And we need all of those tools in the tool kit. So I think we have to be ambitious and move forward on all fronts.

Senator CARDIN. Thank you. Thank you, Mr. Chairman.

Senator BARRASSO. Thank you so much. Senator Braun?

Senator BRAUN. Thank you. Indiana is a State among others that is disproportionately dependent on coal, and most of our fossil fuel reserves are in coal. My opinion is, in the long run, the cleanest, least expensive fuel is going to win out in the marketplace. We are slowly transitioning.

I want to direct these questions at Mr. Sukut, if you could start off. Is there anything on the horizon that can take coal and have it emit more cleanly? I would also like a comment about recapture on fossil fuels once you burn them. Is that basically the same? And does one have an advantage over the other?

But we are closing coal plants down, probably starting out any new regeneration with natural gas. But just curious if there is anything on the horizon for a State like Indiana that is so dependent on coal, to fix it in the short run and then maybe lengthen the life of these plants in a clean way.

Mr. SUKUT. Thank you for the question, Senator. Yes, I think there is. I think there are some promising technologies out there that work. For example, Amine, and I am not a scientist, I am a finance CPA, so don't ask me any scientific questions here, because I can't answer them.

But I do know this: the Amine process works, it does. I think the most important thing is, we really do kind of need an all of the above energy resources, inclusive of coal. If we can clean coal up, if we can take the CO₂ out, we already know we can take sulfur, mercury, NOX out, it would operate a lot just like wind. You would have a clean source.

Now, as time goes along, for example, in North Dakota, wind works very well for us. In fact, this year over 25 percent of the energy produced at Basin Electric is going to come from wind. Because wind works up in North Dakota, it really does. And as time goes along, new coal, as you know, Senator, has not come online for about 10 years. Dry Fork Station is one of the last ones that came on, and that was 2010.

So if you think about it, the older coal plants, they will retire, and as they retire, you are going to see less and less coal. But I

think what we do need to do is the newer plants continue to work on, for example, the Amine technology is one I can think of right off hand, to capture carbon and infuse it. Because we know we have ways to do that, and we have caverns that we know we can store it at.

So from that standpoint, I would encourage that we continue to re-use that natural resource to the extent we can utilize those kinds of technologies.

Senator BRAUN. Anything other than Amine that you can think of?

Mr. SUKUT. The science guys would be better at talking about this than I would.

Senator BRAUN. Go ahead.

Mr. WALTZER. I think it is important to note a couple of things with coal and CCUS. The first commercial demonstration of applying CCUS was done on a coal plant, the Petra Nova project, outside Houston. It is worth to note that project came in on time and on budget. It is very well managed, operating very well.

More broadly, when we step back, we think about this issue as global. And we see a thousand gigawatts of coal plants in China, most are new and are going to be emitting for the next 50 years. It is absolutely crucial to develop this technology so it can be applied, not just in the U.S., but around the world.

The third point is, we have talked with power companies that have expressed an interest in using 45Q to move forward on projects. I think as Senator Capito alluded to, we are waiting for the starting gun to happen, when the Treasury will put out its guidance, and that can't happen too soon. We have that short window of commenced construction, which can be a challenge for power plants. But we do think that utilizing CCUS with coal plants is an important tool.

Senator BRAUN. Thank you. Mr. Oldham?

Mr. OLDHAM. Yes, thank you. One of the beauties of the technology that we have developed is the fact that it allows you to do purely negative emissions. Capture CO₂ from the atmosphere, bury it under the ground permanently, at a location that makes sense. And there are many, many locations across the United States.

What that allows you to do is make a choice. You can continue to operate a coal plant and it can continue to have emissions. But at the same time you build one of our plants or a similar technology, to completely offset those emissions. So you have immediately gone carbon-neutral. But you haven't affected the economics of that plant and the industries that depend on it.

So in my view, that is one of the critical reasons why direct air capture technology should be increased in funding. It gives you choices. You can continue with the airline industry, you can continue with the coal industry, but doing so in a carbon-neutral or even carbon-negative way.

Mr. SUKUT. One last technology that we have participated with, Allete, it is a Minnesota-based investor-owned, is the Allam cycle. And I referred to it in my written testimony. Actually, that is a coal-based, but is zero-emissions. The byproduct of that, it uses compressed CO₂ to run a turbine. And really, the byproduct of that is water, so it is completely clean. But yet another technology that

is on the horizon, and it is down the road a little way. We are trying to get to the demonstration stage with it.

Senator BRAUN. Thank you.

Senator BARRASSO. Thank you, Senator Braun. Appreciate it.

Senator Duckworth?

Senator DUCKWORTH. Thank you, Mr. Chairman. Gentlemen, welcome, and Mr. Sukut, a special welcome to you. Your daughter is one of my wonderful staff members, and I exploit her labor on a daily basis. She is quite wonderful, I am glad to have her on staff.

Mr. SUKUT. Thank you, Senator. We are very proud and thank you to, for employing her gainfully. We appreciate that.

[Laughter.]

Senator DUCKWORTH. You are most welcome.

Across Illinois and our Country, we are already experiencing the harmful effects of climate change. Growing seasons are changing, heat waves are increasing, extreme floods are becoming more frequent and severe. This all that we are talking about today.

Simply put, climate change is no longer a threat. It is here, the climate has changed. I believe that we must seek solutions to cutting carbon pollution that strengthen our economy and advance new industries and create quality American jobs. The bipartisan USEIT Act, combined with the action Congress took last year that extended and reformed the 45Q tax credit, will help to make sure we accomplish these goals. Senator Whitehouse mentioned this. I look forward to working with my colleagues on this committee to advance and further improve this promising legislation.

Mr. Waltzer, Illinois has some of the best saline storage locations in the Country. Last Congress, Chairman Barrasso and Senator Whitehouse worked with me on adding language to the USEIT Act that requires the Department of Energy to author a report to make recommendations to project developers on how best to use saline formation for carbon sequestration. Can you share why this report would be important to the future of permanent carbon sequestration?

Mr. WALTZER. Absolutely, Senator Duckworth, for three reasons. First, given the scale of what we need to do in terms of eliminating carbon emissions on the planet, saline is going to be our biggest target. There is really no substitute. We need to move forward on enhanced oil recovery and utilization. But if we are really going to make the cuts we need to make, that is where we are going to store the carbon.

Second, there are innovations that are occurring, for example, being able to produce water, particularly in arid areas. So it is not just a storage space, it is potentially a place where we can also develop useful products.

And third, it is the resource that is most abundant. That is why ADM is doing that project in Illinois in saline, because there is some EOR potential, but it is completely dwarfed by the availability of saline resources. We have more saline resources in North America than we have EOR or any other target. So if we are not developing this resource and we are not being thoughtful, then we are putting ourselves at a significant disadvantage.

Senator DUCKWORTH. Thank you. So you mentioned ADM. They are one of the world's largest food processors, and this is a one of a kind project in Decatur, Illinois. It captures carbon dioxide, which is created as a by-product at a corn processing facility, and stores it safely almost a mile and a half underground in the Mount Simon Sandstone. A lot of attention is spent discussing on how CCUS can be applied to the power sector. I believe the USEIT Act will help spur industrial capture projects like the one in my back yard.

Mr. Waltzer, you mentioned ADM's project. Can you talk a little bit about how decarbonizing projects like ADM can teach us lessons about how we can decarbonize the industrial sector?

Mr. WALTZER. Absolutely. It is a very important project. It is a first of a kind. Industry is one of those hard to reach places in terms of decarbonizing. CCUS is almost certainly going to be necessary to decarbonize the industrial sector.

Fortunately, there are plants like the ADM plant that are ready-made, in a sense. They have a low-cost CO₂ supply, they have pure CO₂ streams, and there are many of these types of facilities, from ethanol, from hydrogen or ammonia production, other sources that we can quickly move forward on. And we expect 45Q to really move first in those areas.

So we think it is both absolutely necessary and an area that we expect to see a fair amount of activity on in terms of utilizing incentives like 45Q and the USEIT Act.

Senator DUCKWORTH. Thank you.

Mr. Sukut, I know you said that you are a finance guy and not a scientist, but I would think that a report that would come out of something like the USEIT Act, that would make recommendations to project developers on how best to use information for carbon sequestration would be something useful. Can you talk a little bit to that? In Illinois, for example, wind power has created 100,000 jobs in 10 years. I see that there is potential on the economic front for some great benefits here as well.

Mr. SUKUT. Absolutely, Senator. I think when we put iron in the ground, we put it in, as I said, for 30 or 40 years. To the extent that we can get more information and we can use it in terms of making sure that it is critical and can be used, and the fact that it gives us the information that we can go forward with, that is one of the most critical things in the utility industry, quite frankly.

So I would think it is absolutely critical that we have information like this in the USEIT Act. So I would very strongly encourage it to be part of the Act.

Senator DUCKWORTH. Thank you. Mr. Oldham, I just have a minute left. Did you want to add anything to the discussion so far?

Mr. OLDHAM. I think one of the things, you are absolutely correct, that renewable energy and the driver, that is a critical part of developing jobs. One of the key things to remember is the importance of not just reducing emissions but also reducing the CO₂ already in the atmosphere. Senator Carper has an excellent bathtub analogy that I think he uses.

[Laughter.]

Senator CARPER. I have been using it for years.

Mr. OLDHAM. Continued focus on CO₂ removal, and you are quite correct, saline aquifers are a fantastic place to store CO₂, and Illinois a great place to do so.

Senator DUCKWORTH. Thank you. I yield back, Mr. Chairman.

Senator BARRASSO. Thank you so much. Senator Sullivan?

Senator SULLIVAN. Thank you, Mr. Chairman. You learn a lot in these hearings. I am not sure I was expecting to hear the exploitation of labor happening—I am just kidding.

[Laughter.]

Senator SULLIVAN. That is just a joke.

But let me ask really all of you gentlemen, one of the issues, when we are all looking at the issue of bringing on new technologies in the energy space is our regulatory and permitting processes at the Federal level. One of the things that I have been very concerned about is the time it takes to deploy just basic infrastructure in our Country, whether it is roads or bridges or pipelines. And as all of you know, it takes forever, about 8 years on average, to permit a bridge in America, if you can believe that. Same with a pipeline. Highways, it is well over a decade.

This is a problem that I say cuts across partisan issues. I had a bill last year we are going to reintroduce called the Rebuild America Now Act, which is looking at reforming the NEPA process, not to cut corners. But I don't think anyone thinks nine to 10 years to permit a pipeline is a good idea for our Country.

What are the big areas of permitting roadblocks that you have seen in your experience, and how can we address it here in the Congress? I will open that up to any and all.

Mr. SUKUT. I can start, because this is sort of one of my things, too, quite frankly. So in some of the things with NEPA, one of the areas that we see a lot of roadblocks is the EA, or the environmental assessment or the EIA. Those things take months and months and months.

Really, if we had some more certainty when we headed into them, and the rules that we could get over the hump. Because a lot of times, the actual work doesn't really take that long. But there is just so many regulations. And really, we are not trying to bypass the environmental assessment at all.

Senator SULLIVAN. No.

Mr. SUKUT. That is not what we are trying to do. Please don't get that impression. But it takes so much time to get some of this done.

So I will give you one example. We are not an RUS borrower any more. We used to be. We were putting in a 200-megawatt wind farm. We had to go through an environmental assessment. We finally went to outside financing, just because we couldn't get all of the work done because we had to do an EIS instead of an EA. It took us so long to get it done, I think the thing was fully depreciated by the time we got the go-ahead from RUS.

Senator SULLIVAN. How many years did it take?

Mr. SUKUT. Well, we ran two and a half years. The wind farm was completed and we had run it two and a half years before we finally got the go-ahead, oh, you can go get the RUS money now. Well, too late, we had to do conventional financing.

So yes, Senator, absolutely.

Senator SULLIVAN. We want to work with all of you on this. Because again, the original idea NEPA and EIS was to make sure there was public input with the EISs. Well, the irony is now, the EISs now are in the thousands of pages. They cost millions of dollars. They stop development. And nobody reads them, because they are too big. So the idea of public input has been turned on its head. Usually an EIS comes out, it is several thousand pages and nobody has any idea what is in it and nobody reads it. I think we can do better as a Country.

Mr. SUKUT. That and it costs money.

Senator SULLIVAN. It costs a lot of money and it stalls projects and jobs.

Let me just ask one kind of final question. I think there is this really, really exciting area in the world of energy and technology, that relates to some of our traditional resources that we have and the marriage of technology.

Let me just give you an example, natural gas. So our Country is now the largest producer of natural gas in the world. I happen to think that is a really good thing. We actually are the largest producer of oil in the world. I actually think that is a really good thing. We are actually the largest producer of renewables in the world. That is also a good thing. All of the above, energy.

But in terms of gas, because it is low carbon, and when you burn it really high, you can actually almost zero out any emissions, the marriage of technology and a hundred to two hundred years of supply of natural gas in America creates enormous opportunities. Some of you might be familiar, I was out in the Silicon Valley area not too long ago. Bloom Energy is doing all kinds of really exciting work with natural gas and fuel cell opportunities.

What do you see as some of the opportunities that relates to integrating some of our current, abundant resources, in particular I want to ask about natural gas, and technology, or renewables, for example. There is a lot of experiments going on with wind power and solar power. It is intermittent, and when you don't have the wind, you find up natural gas turbines that can create power generation. I think it is a very exciting area and I would love any of your views on that.

Mr. OLDHAM. Just a quick comment. Our direct capture plants use natural gas. They can be powered by natural gas or renewable electricity or both. And the reasons are exactly what you say, it is a prevalent resource, it is effective.

Senator SULLIVAN. Low carbon when you burn it high.

Mr. OLDHAM. We also capture all of the CO₂ emissions from using natural gas and it becomes part of our product at the end of the day. So yes, I agree, natural gas is a tremendous resource.

Senator SULLIVAN. So becoming the world's largest producer of natural gas in terms of jobs, energy security, national security, but also in terms of the environment in the future is pretty exciting, wouldn't you say?

Mr. OLDHAM. Certainly when you combine it with a technology like ours, absolutely, yes.

Mr. WALTZER. I would say that there is enormous potential to use low-cost gas to actually drive forward low carbon technologies. There is also a caution that we have to do that by managing things

like upstream methane emissions and insuring the coal life cycle chain of the gas is truly low carbon.

But a couple of areas on the technology side that are most interesting to us, anyway, we have talked before about the Net Power technology that is potentially a breakthrough technology to supply zero carbon power, fueled by natural gas, at very low cost. The other area that we think is particularly interesting is generation of hydrogen or ammonia from zero carbon gas. You can even repurpose conventional gas turbines to burn hydrogen or ammonia. They are looking at that in the Netherlands right now. But that can also apply to the industrial sector and the transportation sector.

It does have enormous potential, but it also is going to require some diligence on all the elements that are necessary to insure it is truly low carbon.

Senator SULLIVAN. Thank you. Thank you, Mr. Chairman.

Senator BARRASSO. Thank you very much. Senator Van Hollen.

Senator Van Hollen. Thank you, Mr. Chairman, and thank all of you for being here today.

I like this legislation, because it seems to be a bipartisan acknowledgment that we have to make public investments in order to reduce carbon pollution emissions, in order to address the risks of climate change. Do all of you gentlemen agree with that statement? Is that a yes? I see all of you nodding.

Mr. SUKUT. Yes.

Mr. OLDHAM. Absolutely.

Mr. WALTZER. Yes.

Senator Van Hollen. All right. Now, as you have all testified, there are a number of ways to do that. We have tax credits in the area of solar, we have had tax credits in the area of wind. A number of us have bills that would put a price on carbon.

I would like all of you, if you could, to respond to an article that was written in Forbes just a few years ago. It was by Jeffrey Rissman and Robbie Orvis. One of them is the Energy Innovations head of modeling and energy policy. The other is the Energy Innovations policy design projects manager. Here is what they said. "While many technologies can reduce power sector emissions, carbon capture and storage has gained support in Congress. But it is the most expensive option available."

They go on to say, "Our analysis shows coal plants equipped with CCS are nearly three times more expensive than on-shore wind power and more than twice as expensive as solar photovoltaics. Although these costs will decline with research and development, the potential for cost improvement is limited. Coal with CCS will always need significant subsidies to compete economically with wind and solar."

Now, the reason I support this legislation is I think that we are at a dangerous point and that we need to put all hands on deck. We need to turn off the faucets, as you said, Mr. Oldham, and pull out the plug. So I support this.

But could you just discuss briefly the cost comparisons with respect to public subsidy, with respect to technologies, both today and what you see going forward?

Mr. OLDHAM. Yes, I think that is a really challenging question, because it is a multi-faceted one.

I think the way to look at it is to baseline what we think the cost of a ton of carbon is. And the cost of a ton of carbon has an impact in a variety of different ways. A large amount of carbon has a very significant cost.

So for us, the way that we look at our business is to drive our cost per ton of carbon down as low as we can. We do so by using technology that exists today, measurable performance. And we have driven it down to around about \$100 per ton.

So the question then becomes, is that a reasonable cost per ton of carbon. Now, the carbon that I am talking about is atmospheric carbon. It is not emitted carbon. So emitted carbon is easier to capture, because it is more prevalent in the source. CO₂ in the atmosphere, 400 parts per million. So my carbon is more expensive to capture, but it is also essential per the bathtub analogy we discussed earlier on.

So for us, about \$100 per ton of CO₂. A few years ago, the National Academy of Scientists published a report that said the cost of a ton of carbon from the atmosphere would be about \$600. We are now at \$100. So your point about innovation driving down the cost point, it is already happening and it will continue.

Mr. WALTZER. So in a limited way I agree with that statement. Reducing current generation technology through incremental improvements on the kind of technologies we are applying to coal plants today, I don't think they are going to get radically lower. But there are next generation technologies and carbon capture and storage that can take us to that golden zone of trying to be cost competitive with carbon-intensive alternatives.

And so I think it is important to move forward to try and obtain that goal. The risk is if we don't do that, then we are relying on fewer technologies. We support significant deployment, additional significant deployment of renewables, but they are variable source technologies, and there is a point at which you have to over-build the system in order to pay for it, even if on an incremental basis they are cost effective.

Senator Van Hollen. I am sorry to interrupt. Do you envision that you are going to require a significant public subsidy for the foreseeable future to address, to provide for carbon capture technology?

Mr. WALTZER. I would say the kind of support that is needed to move the technology forward isn't that different than the kind of support that was needed to move wind and solar technologies down the cost curve. I don't think we really want any technology to be on a perpetual subsidy. We want them all to become as affordable as possible as soon as possible.

Senator Van Hollen. Absolutely.

But if I could, Mr. Sukut, you mentioned, I think in response to Senator Whitehouse, that the cost of doing this relative to a carbon fee, you saw this technology being a lower cost, if I understood your answer.

Mr. SUKUT. And I do, Senator. In fact, I would offer this up, I actually, again, I go back to our integrated test facility in Wyoming. One or two of those test guys are actually offering up that it would be less than \$40 a ton, because I think it is, and I abso-

lutely agree with it, it is cheaper to extract from the existing flue than it is from the air, it really is.

So less than \$40, in terms of our Dry Fork Station, I don't mean to be overly practical here, but that is such a new plant that it runs way cheaper and more efficiently also. So we have a lot more cost groom there in order to be able to still compete in the market. And the technology will improve a little bit. So I think they will come together some.

But I think we have room to run those facilities, and if we can capture it in a way that is more economic, I think we have a good, good chance here to do this.

Senator Van Hollen. I appreciate that. I see my time is out. It is that last part, if it is economical, right. That is the focus.

Senator BARRASSO. Senator Whitehouse.

Senator WHITEHOUSE. Mr. Chairman, if I could just interject one point on it. The way I see this is that, let's say hypothetically there were a \$50 per ton carbon price. That puts a huge economic incentive into the hands of every entity that is paying that \$50 per ton carbon price to instead pay \$49 per ton to have the carbon removed, or \$48 or \$10, depending on whatever the price is.

And the fact that we have this artificial failure to price carbon emissions in our marketplace I think is discouraging to this industry. If we went to a proper market system in which the externalities are in the price of the product, then anything cheaper than that becomes something that becomes quickly marketable. I don't consider that a subsidy. I consider the subsidy as not having that in the market system.

So I just wanted to add that point, and I appreciate Senator Van Hollen's concern.

Senator BARRASSO. Senator Van Hollen.

Senator Van Hollen. If I could just, I agree with Senator Whitehouse. Look, a price on carbon in my view is the most economic way to do this. Subsidies, or the flip side of it, right. Because on one hand, a price on carbon, you are letting the market set the price by requiring people to be more efficient. The other side is you provide subsidies for different kinds of technologies.

I would prefer the market approach, because I think that allows all players to compete on a more even playing field. There are some different pieces of legislation to do that.

But in the meantime, I support efforts like this. Thank you.

Senator BARRASSO. Well, thank you, Senator Van Hollen. Just to interject, Senators Whitehouse, Carper and Duckworth are all co-sponsoring the legislation. If you would like to, that would make it four Republicans and four Democrats from this committee.

Senator Van Hollen. I would be happy to do that.

Senator BARRASSO. Thank you so much. Senator Merkley.

Senator MERKLEY. Thank you very much. I appreciate this conversation. I have felt that so much coal and gas is being burned around the world, that if we can find a way to extract carbon dioxide efficiently, economically, that it can make a big difference. We have to move quickly.

I am struck by the fact that in the industrialized era, we have increased the amount of carbon dioxide in the atmosphere by 50 percent. And most of that has happened in my lifetime. And we are

on an upward accelerating, an upward curve. So I think we have to explore every possible option.

Meanwhile, though, I remain somewhat skeptical. Worth investing and exploring, but somewhat skeptical. And here is why I am skeptical. I think about Xcel Energy doing their request for proposals where they came back with proposals at two cents per kilowatt hour for wind, three cents for solar, both of which were below the cost of burning coal at an already depreciated coal plant.

Now, the cost, whatever the cost, there is at least some cost, whether it is \$100 or it can be driven down to \$50 or \$40. And a number of the technologies require a significant amount of extra energy inputs and extra water. I used to have, somewhere in my office, I think I could find it, a hockey puck made out of carbon dioxide that was captured by some technology some 10 years.

Give me a sense of why I should be a little more optimistic, at least in power generation, that burning fossil fuels with carbon capture can compete when it is at cost to an industry that is already falling above the line, if you will, of where solar and wind are now, and they will continue to drop over the next 10 years as a still-evolving technology. Just a brief comment.

Mr. WALTZER. Sure. Again, solar and wind are important technologies and we need them to be deployed globally. The reason why we need carbon capture and storage and a broader assortment of low-carbon technologies options is first. There is at some point a level where because of the variability and because we don't have seasonal storage, the levelized costs of electricity of those technologies really don't reflect the full system costs. They can get substantially larger if we are approaching 80 to 100 percent. So we need load-following technologies, in addition to those technologies.

In addition, there are technologies that are in pilot development that are really rethinking the way of doing carbon capture. Net Power is one that is often cited, but it is part of a broader class of technologies that use CO₂ as a fluid within the turbine. It is thermodynamically very different. They are targeting \$10 a ton as the objective of that cost.

Mr. MERKLEY. So I am going to have you stop there, simply because my time is so short. But this is exactly the way I look at it. It is worth exploring these future technologies. I again remain skeptical. The cost of battery storage is coming down. Demand response systems can help address the supply and demand.

But there is another issue that I am concerned about. That is, we have extensive leakage in our gas pipeline system. A number of the stretches of the system have a 4 percent or more factor, at which point you have methane, which unburned, is far more potent as a heat trapping gas than is carbon dioxide. Over a period of 20 years, 80 times more heat trapped per pound.

So I wrestle with whether it makes, even if you can get the carbon dioxide out of the smokestack where you are burning gas, are you sustaining a system in which leaky methane is doing a lot of damage? And that is a much harder problem, well, I won't say it is a hard problem, it is an additional big part of the picture. So should I not be worried about sustaining a system of pipelines that are leaking methane into the air?

Mr. WALTZER. You should be worried about the fugitive methane emissions that are a significant source of greenhouse gas emissions. And those are controllable. We were strong supporters of the earlier Administration's rule to reduce methane emissions from both new sources, and we think it should have gone further to look at existing sources. We are working with, we worked with the government of Mexico and are working with Argentina and Colombia on developing exactly those kinds of rules and regulations to reduce methane emissions.

But that is something we need to do irrespective of whether or not we use gas and the way that we are talking about for a low carbon source. That is just something that has to happen. If we do expand its use into those areas, we need to double ensure that those upstream methane emissions are managed. But it is not really an either-or, it is an and, in our view.

Senator MERKLEY. My time is expiring. Thank you. Those are a couple of my concerns. I am also concerned that we need to look at every strategy to remove carbon. If, for example, the best dollar effect is in supporting modified agricultural practices that maybe produce improved crop yields and store carbon in the soil, let's look at that. If we are looking at forest practices that reduce the amount of forest fires and allow trees to grow and store more carbon, let's look at that. Let's look at this from every angle.

Thank you all.

Senator BARRASSO. Senator Carper.

Senator CARPER. Thanks, Mr. Chairman. Before we close, I just want to mention one other thing. First of all, just thanks a lot for coming. Jim and I love music, and every now and then I like to work some lyrics into our hearings. One of those sets of lyrics is "Hope in a Hopeless World." Great song, if you have never heard it. It is a great song.

It actually kind of reminds me of this hearing, the hope. A lot of people don't see much hope for our world, but there is some hope. And you have given us some reasons to be hopeful.

I hope we have given you some reasons to be hopeful, given the kind of bipartisan cooperation we have, led by our chairman, Sheldon and others on the committee.

The other lyric I was reminded of today was, you have heard of doing a one hit wonder, there was this guy named Thomas Dolby who was a one hit wonder. But he had a great hit, the song was "Blinded by Science." Maybe we can have a remake of the song, at least for our purposes, it could be "Guided by Science," not blinded, but guided by science.

What you are giving us is some areas where we can agree and provide some hope, and also be guided by science in a way that can do good things for our planet and create economic opportunity. That is the goal, the holy grail, that is the holy grail for me and I think it is for our Chairman and others.

So we thank you. I would like to ask unanimous consent, Mr. Chairman, if I could, to submit for the record letters and documents related to the USEIT Act and the technologies we discussed today.

Senator BARRASSO. They will be accepted in alphabetical order, without objection.

[The referenced information follows:]

Carbon Capture Coalition
Supportive Quotes from Participants on the USE IT Act
February 2019

“BPC Action commends Sens. John Barrasso (R-WY) and Sheldon Whitehouse (D-RI) for introducing the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act. This bill is needed to build on recently enacted investments in carbon capture to continue important innovation in this space, reduce emissions and maintain America’s energy leadership. Carbon utilization and direct air capture are at the forefront of American innovation and critical to not only addressing carbon pollution, but also expanding opportunities for American businesses in emerging technology sectors. Importantly, the USE IT Act supports the buildout of enabling carbon dioxide pipeline infrastructure critical to deploying these technologies to a point where American businesses can seize the economic opportunities afforded by them. As the global appetite for clean technologies grows, the United States has an opportunity to reassert its competitive edge by pioneering the technologies of tomorrow, and the USE IT Act helps us get there.” – **Michele Stockwell, Executive Director, BPC Action**

“The USE IT Act represents the first ever serious federal investment in carbon removal. Today, there are already a number of direct air capture and carbontech entrepreneurs working to transform waste carbon into a valuable resource, and federal support will be critical to spurring on these new industries, unlocking a trillion dollar market opportunity, and ultimately building an economy that removes more carbon than we emit.” – **Noah Deich, Executive Director, Carbon180**

“Over and over, experts conclude that carbon capture and storage is essential for both rapid climate mitigation and economic growth. The USE IT Act provides some welcome support to CCS deployment in the US, including support for pipeline permitting and an expansive innovation agenda on carbon management. If the US wants to maintain its leadership and commercial edge, the USE IT act is cornerstone legislation.” – **Julio Friedmann, CEO, Carbon Wrangler**

“Just like people, birds are facing a cascade of threats because of the changing climate. Rising seas and temperatures are shrinking and shifting the landscapes that sustain them,” said Jesse Walls, Director of Government Affairs for the National Audubon Society. *“Audubon believes we need to pursue an array of common-sense, bipartisan approaches that reduce carbon emissions, and that carbon capture and sequestration is one of the essential elements. This legislation has the potential to get us to smart solutions faster, by supporting research and spurring investment in the most promising technologies. This is the kind of bipartisanship we need to see more of, and we applaud Senators Whitehouse and Barrasso for their leadership.”*
 – **Jesse Walls, Director of Government Affairs for the National Audubon Society**

“We need both carbon capture on smokestacks and carbon removal from the atmosphere if we are going to prevent the worst impacts of climate change. Adoption by Congress of the USE IT Act would encourage early stage innovation for carbon removal and help develop needed

infrastructure for both technologies. We urge its enactment as soon as possible.” - Armond Cohen, Executive Director, Clean Air Task Force

“The bipartisan USE IT Act is a common-sense approach to supporting carbon capture technologies, including necessary pipelines and other infrastructure, enhanced public-private partnerships, innovative R&D and permitting improvements. It is a strong and necessary step in enabling market-driven carbon capture and realizing its benefits for American consumers.” - ClearPath Action Executive Director Rich Powell

“We applaud the bipartisan leadership of Senators Barrasso and Whitehouse for their introduction of S. [bill #], the USE IT Act. As a science-based organization whose mission it is to protect the land and waters on which all life depends, The Nature Conservancy is committed to finding solutions to some of nature’s greatest challenges, including climate change. The technologies supported by this bill -- carbon utilization and direct air capture – can play an important role in reducing carbon emissions and can be part of the comprehensive array of approaches needed to address climate change. The USE IT Act invests in research and development that will help expedite the commercial deployment of these critical technologies. We hope other members of the Senate will support this common-sense, bipartisan legislation.” - Jason Albritton, Director of US Climate and Energy Policy, The Nature Conservancy

“Avoiding the worst impacts of climate change will require us to get to zero emissions by 2050—something that leading climate authorities say is unlikely without carbon capture. The USE IT Act is a smart way to encourage innovative capture methods, profitable uses for captured carbon, and new infrastructure that will help scale-up this important climate solution.” - Josh Freed, Senior Vice President for Clean Energy, Third Way

“The USE IT Act is another step forward in advancing technology-based solutions to environmental challenges in a manner designed to maximize the economic potential of our energy and manufacturing sectors. In seeking new ways to power our nation and energize our industrial base, this bill recognizes the value of retaining and creating high-quality, family supporting jobs, and their importance to the working families and communities that depend on them for their way of life.” - Mike Langford, National President, Utility Workers Union of America

“While carbon capture is playing an important role in many states’ environmental and economic development planning, Congress can and should continue to consider policies that can make viable carbon capture projects of all types and sizes. The USE IT Act is aimed at accelerating both the development of breakthrough technologies like Direct Air Capture and the deployment of CO2 infrastructure that could foster a boom in new projects. Senators Barrasso and Whitehouse are true leaders in building the consensus for effective climate policies like the USE IT Act that can and should be enacted with bipartisan support this year.” - Jeff Bobeck, co-director of the Carbon Capture Coalition and Center for Climate and Energy Solutions Director of Energy Policy Engagement

"The Carbon Capture Coalition is pleased to endorse the USE IT Act and thanks Senators Barrasso, Whitehouse and all of the sponsors for continuing their bipartisan leadership on carbon capture. Last year's passage of landmark legislation to reform the Section 45Q tax credit showed that support for carbon capture spans the political spectrum. Early action by the new Congress to pass the USE IT Act will build on that bipartisan effort to reduce carbon emissions, strengthen American energy independence, and protect and create high-wage jobs." – **Brad Crabtree, co-director of the Carbon Capture Coalition and Great Plains Institute Vice President for Carbon Management**



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LONNIE R. STEPHENSON
International President

KENNETH W. COOPER
International
Secretary-Treasurer

February 27, 2019

VIA EMAIL

The Honorable John Barrasso
Chairman
U.S. Senate Committee on Environment
and Public Works
410 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Tom Carper
Ranking Member
U.S. Senate Committee on
Environment and Public Works
456 Dirksen Senate Office Building
Washington, DC 20510

**Re: Utilizing Significant Emissions with Innovative Technologies
(USE IT) Act**

Dear Chairman Barrasso and Ranking Member Carper:

On behalf of the approximately 775,000 active members and retirees of the International Brotherhood of Electrical Workers (IBEW), I am writing to express my support for federal legislation to facilitate the research and development of carbon capture, utilization and storage (CCUS) and S. 383, the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act.

The IBEW represents hundreds of thousands of members who work in the generation, transmission and distribution of electricity in all 50 states. Our members are committed to ensuring communities in the United States can rely on a safe and resilient source of electricity while protecting our communities and natural resources from environmental degradation and climate change. IBEW members have worked countless hours installing and maintaining pollution control equipment in coal-fired powerhouses, steel mills, automobile manufacturing facilities, oil refineries, and other industrial facilities.

There is consensus among energy and climate experts, including the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA), that CCUS technology is an essential tool in the effort to reduce carbon emissions, which is necessary to avoid the worst effects of climate change, while supporting energy security, protecting the existing energy infrastructure, and retaining and creating high-quality, family-supporting jobs that are critical to working families and communities.

The IBEW supports many of the policies proposed in the USE IT Act, including the creation of financial incentives for innovators to develop direct air capture technology, as well as clarification that CCUS projects and carbon dioxide pipelines are eligible for expedited permitting review established under the FAST Act. These policies, if enacted, will accelerate the development and deployment of CCUS technology and position the United States as a leader in this important field.

IBEW commends the leadership of Chairman Barrasso, Ranking Member Carper, and the other co-sponsors of the USE IT Act for coming together in





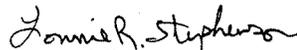
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Mr. John Barrasso and Mr. Tom Carper
February 27, 2019
Page 2

bipartisan manner to introduce this legislation, which we hope will build on the success of the FUTURE Act and help retain and create thousands of jobs.

The IBEW looks forward to working with the United States Senate and the EPW Committee in finding solutions that will best balance our nation's economic, environmental and security needs.

Sincerely yours,


Lonnie R. Stephenson
International President

LRS:slv

Copy to All Members of the US Senate Committee on Environment and Public Works

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CHAMBER OF COMMERCE
OF THE
UNITED STATES OF AMERICA

JACK HOWARD
SENIOR VICE PRESIDENT
CONGRESSIONAL AND PUBLIC AFFAIRS

1615 H STREET, NW
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February 27, 2019

TO THE MEMBERS OF THE UNITED STATES CONGRESS:

Earlier this year, the U.S. Chamber of Commerce announced a revision to our legislative scorecard. Beginning with this Congress, lawmakers will receive credit for cosponsoring Chamber-endorsed bills or refraining from cosponsoring bills the Chamber endorses against.

Our intent is to use this process to build momentum for the pro-business position on individual bills.

How you vote on legislation where the Chamber has communicated a position will continue to make up 80% of your score. The Chamber will continue to issue support and opposition letters, including key vote letters, on legislation important to the business community and our members.

The action you take by choosing to cosponsor, or not, the legislation the Chamber identifies will make up a 10% "Legislative Leadership" component of your overall grade.

The remaining 10% of your score will be assessed by the degree to which you cosponsor bipartisan legislation which is not anti-business.

Attached is an initial list of bills the Chamber is endorsing for or against as part of the "Legislative Leadership" score. Over the course of the Congress, the Chamber will update this list, disseminate it to you, and maintain it on our website at USChamber.com/scorecard.

Sincerely,



Jack Howard

The Chamber encourages you to cosponsor:

Senate:

1. S. 146 – Move America Act
2. S. 287 – Bicameral Congressional Trade Authority Act
3. S. 365 – Trade Security Act
4. S. 383 – Utilizing Significant Emissions with Innovative Technologies Act
5. S. 172 – Health Insurance Tax Relief Act
6. S. 471 – Litigation Funding Transparency Act

House:

1. H.R. 940 – Bicameral Congressional Trade Authority Act
2. H.R. 1008 – Trade Security Act
3. H.R. 748 – Middle Class Health Benefits Tax Repeal Act of 2019
4. H.R. 1166 – Utilizing Significant Emissions with Innovative Technologies Act
5. H.R. 1007 – Retirement Enhancement and Savings Act

The Chamber encourages you to refrain from cosponsoring:

Senate:

1. S.Res.59 - A resolution recognizing the duty of the Federal Government to create a Green New Deal
2. Medicare Drug Price Negotiation Bills (S. 62 and S. 99)
3. Medicare for All / Medicare Buy-In (S. 470)

House:

1. H.Res.109 - Recognizing the duty of the Federal Government to create a Green New Deal
2. H.R. 764 - United States Reciprocal Trade Act
3. Medicare Drug Price Negotiation Bills (H.R. 275 and H.R. 448)
4. H.R. 1346 - Medicare for All / Medicare Buy-In

In addition to the bills above, examples of some of the bills we anticipate endorsing for cosponsorship upon their reintroduction in this Congress include:

Senate:

1. *S. 488 (115th) – JOBS ACT 3.0*
2. *S. 2392 (115th) – Cyber SAFETY Act*
3. *S. 1121 (115th) – College Transparency Act*
4. *S. 108 (115th) – Medical Device Access and Innovation Protection Act*
5. *S. 584 (115th) – Small Business Regulatory Flexibility Improvements Act*
6. *S. 2526 (115th) – Retirement Enhancement and Savings Act*
7. *S. 540 (115th) – Mobile Workforce State Income Tax Simplification Act*
8. *S. 1885 (115th) – AV START Act*

House:

1. *H.R. 2434 (115th) – College Transparency Act*
2. *H.R. 5963 (115th) – Health Insurance Tax Relief Act*
3. *H.R. 184 (115th) – Protect Medical Innovation Act*
4. *H.R. 3945 (115th) – CASE Act*
5. *H.R. 33 (115th) – Small Business Regulatory Flexibility Improvements Act*
6. *H.R. 1393 (115th) – Mobile Workforce State Income Tax Simplification Act*
7. *H.R. 4015 (115th) – Corporate Governance Reform and Transparency Act*

Barrasso USA Today Op-Ed: Green New Deal is Unworkable and Unaffordable

March 5, 2019

By: U.S. Senator John Barrasso

March 5, 2019

USA Today

The Green New Deal would drive a stake through the heart of our nation's strong, healthy and growing economy.

Since passing tax reform, the economy has added 3 million new jobs.

Americans' paychecks are growing, and there are a record 7.3 million available jobs across the country. But the Green New Deal would slam the brakes on our momentum.

The cost is staggering. An analysis found that if fully implemented, the proposal would cost up to \$93 trillion over the next decade. That's more than 90 percent of the combined wealth of all American households.

It would cost every American family as much as \$65,000 per year — more than the average household makes in a year.

One of the key tenets of this proposal is a mandate to move to 100 percent renewable energy. Doing so would eliminate abundant, affordable and reliable energy that currently powers three out of five U.S. homes.

Even if it were possible — and it isn't — the massive costs would be passed directly to consumers in the form of higher electricity and heating bills. One estimate concludes that households could see their energy bills spike by as much as \$3,800 a year.

Eliminating American production of coal, natural gas and oil would be a big mistake. We'd still need these sources of energy, meaning we would become dependent on the rest of the world.

Solar and wind power provide 8 percent of our electricity. We should continue to increase use of renewables, but there are times the wind doesn't blow and the sun doesn't shine.

The Green New Deal would be a gift to Russian President Vladimir Putin, weakening our economy and making us dependent on foreign energy.

Instead, we should support more American innovation.

The earth's climate is changing and it requires a global solution.

In 2017, America generated just 13 percent of global carbon emissions. China and India produced 34 percent.

We must continue to develop and deploy innovative and reliable clean energy solutions around the world.

In the Senate, Republicans and Democrats are working together on meaningful legislation to reduce carbon dioxide emissions.

In the past year, Congress passed laws to support advanced nuclear power and carbon-capture technologies.

Clean, reliable nuclear power currently provides 63 percent of America's emission-free energy.

Carbon capture is a cutting-edge technology that can even remove carbon directly from the air, while developing construction and medical uses for it.

American innovation holds the key to reducing emissions, not unworkable and unaffordable proposals like the Green New Deal.

Sen. John Barrasso, R-Wyo., is chairman of the Senate Committee on Environment and Public Works.



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[NEWS AND BLOG](#)

Carbon Capture Coalition Endorses Bipartisan Carbon Capture Legislation Introduced in the U.S. Senate Today

February 7, 2019 | News

Washington, D.C. – Senate Environment and Public Works (EPW) Committee Chairman John Barrasso (R-WY) and a bipartisan group of Senators today introduced the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act, legislation to boost carbon capture development and deployment nationwide. Cosponsors of the bill include EPW Committee members Sheldon Whitehouse (D-RI), Shelley Moore Capito (R-WV), Tammy Duckworth (D-IL), Kevin Cramer (R-ND) and Tom Carper (D-DE) along with Mike Enzi (R-WY), Tina Smith (D-MN) and Joe Manchin (D-WV). This year's bill closely matches legislation introduced by Senators Barrasso and Whitehouse last year that passed the Senate Environment and Public Works Committee unanimously. Companion bipartisan legislation is expected to be introduced in the U.S. House this month.

"The Carbon Capture Coalition is pleased to endorse the USE IT Act and thanks Senators Barrasso, Whitehouse and all of the sponsors for continuing their bipartisan leadership on carbon capture," declared Brad Crabtree, co-director of the Carbon Capture Coalition and Great Plains Institute Vice President for Carbon Management. "Last year's passage of landmark legislation to reform the Section 45Q tax credit showed that support for carbon capture spans the political spectrum. Early action by the

new Congress to pass the USE IT Act will build on that bipartisan effort to reduce carbon emissions, strengthen American energy independence, and protect and create high-wage jobs.”

The USE IT Act would establish initial federal efforts to help advance carbon utilization and direct air capture technologies. It would also support collaboration between federal, state, tribal and non-governmental interests to facilitate the planning and construction of pipeline systems to transport CO₂ captured from industrial facilities and power plants for ultimate storage or use.

“While carbon capture is playing an important role in many states’ environmental and economic development planning, Congress can and should continue to consider policies that can make viable carbon capture projects of all types and sizes,” said Jeff Bobeck, co-director of the Carbon Capture Coalition and Center for Climate and Energy Solutions Director of Energy Policy Engagement. “The USE IT Act is aimed at accelerating both the development of breakthrough technologies like Direct Air Capture and the deployment of CO₂ infrastructure that could foster a boom in new projects. Senators Barrasso and Whitehouse are true leaders in building the consensus for effective climate policies like the USE IT Act that can and should be enacted with bipartisan support this year.”

The USE IT Act would provide much needed funding for carbon capture and utilization technology development, including \$50 million in federal funding for research and development of new uses of captured carbon that reduce emissions, such as producing low-carbon fuels, chemicals, materials and products, as well as a \$25 million prize program for early stage research and demonstration of direct air capture technologies that remove CO₂ directly from the atmosphere. Currently, only minimal federal funding exists to support emerging direct air capture and utilization technologies.

The Carbon Capture Coalition has supported the USE IT Act since introduction in 2018 and hosted invitation-only media breakfast briefings on the bill with Senator Barrasso in June 2018 and with Senator Whitehouse in September 2018. Introduction of the USE IT Act again this year comes just days after the one year anniversary of passage of the FUTURE Act, legislation to reform Section 45Q of the U.S. Tax Code to boost carbon capture deployment.

###

CARBON CAPTURE COALITION PARTICIPANT QUOTES IN SUPPORT OF THE USE IT ACT

“BPC Action commends Sens. John Barrasso (R-WY) and Sheldon Whitehouse (D-RI) for introducing the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act. This bill is needed to build on recently enacted investments in carbon capture to continue important innovation in this space, reduce emissions and maintain America’s energy leadership. Carbon utilization and direct air capture are at the forefront of American innovation and critical to not only addressing carbon pollution, but also expanding

3/15/2019 Carbon Capture Coalition Endorses Bipartisan Carbon Capture Legislation Introduced in the U.S. Senate Today | Carbon Capture Coalition

opportunities for American businesses in emerging technology sectors. Importantly, the USE IT Act supports the buildout of enabling carbon dioxide pipeline infrastructure critical to deploying these technologies to a point where American businesses can seize the economic opportunities afforded by them. As the global appetite for clean technologies grows, the United States has an opportunity to reassert its competitive edge by pioneering the technologies of tomorrow, and the USE IT Act helps us get there.” – **Michele Stockwell, Executive Director, BPC Action**

“The USE IT Act represents the first ever serious federal investment in carbon removal. Today, there are already a number of direct air capture and carbontech entrepreneurs working to transform waste carbon into a valuable resource, and federal support will be critical to spurring on these new industries, unlocking a trillion dollar market opportunity, and ultimately building an economy that removes more carbon than we emit.” – **Noah Deich, Executive Director, Carbon180**

“Over and over, experts conclude that carbon capture and storage is essential for both rapid climate mitigation and economic growth. The USE IT Act provides some welcome support to CCS deployment in the US, including support for pipeline permitting and an expansive innovation agenda on carbon management. If the US wants to maintain its leadership and commercial edge, the USE IT act is cornerstone legislation.” – **Julio Friedmann, CEO, Carbon Wrangler**

“We need both carbon capture on smokestacks and carbon removal from the atmosphere if we are going to prevent the worst impacts of climate change. Adoption by Congress of the USE IT Act would encourage early stage innovation for carbon removal and help develop needed infrastructure for both technologies. We urge its enactment as soon as possible.” – **Armond Cohen, Executive Director, Clean Air Task Force**

“The bipartisan USE IT Act is a common-sense approach to supporting carbon capture technologies, including necessary pipelines and other infrastructure, enhanced public-private partnerships, innovative R&D and permitting improvements. It is a strong and necessary step in enabling market-driven carbon capture and realizing its benefits for American consumers.” – **ClearPath Action Executive Director Rich Powell**

“Building upon the bipartisan reform of 45Q, the USE IT Act will foster continued development and deployment of carbon capture by furthering research for carbon utilization and direct air capture technologies and facilitate planning and deployment of pipelines to transport CO₂ for ultimate storage or beneficial use. The bipartisan sponsorship of the bill demonstrates that promotion of innovative technology to reduce GHG emissions while creating new business opportunities is an approach with far reaching support.” – **Vicki Hollub, President and CEO, Occidental Petroleum Corporation**

“We applaud the bipartisan leadership of Senators Barrasso and Whitehouse for their introduction of S. [bill #], the USE IT Act. As a science-based organization whose mission it is to protect the land and waters

<http://carboncapturecoalition.org/carbon-capture-coalition-endorses-bipartisan-carbon-capture-legislation-introduced-in-the-u-s-senate-today/>

3/15/2019 Carbon Capture Coalition Endorses Bipartisan Carbon Capture Legislation Introduced in the U.S. Senate Today | Carbon Capture Coalition

on which all life depends, The Nature Conservancy is committed to finding solutions to some of nature's greatest challenges, including climate change. The technologies supported by this bill — carbon utilization and direct air capture — can play an important role in reducing carbon emissions and can be part of the comprehensive array of approaches needed to address climate change. The USE IT Act invests in research and development that will help expedite the commercial deployment of these critical technologies. We hope other members of the Senate will support this common-sense, bipartisan legislation.” – **Jason Albritton, Director of US Climate and Energy Policy, The Nature Conservancy**

“Avoiding the worst impacts of climate change will require us to get to zero emissions by 2050— something that leading climate authorities say is unlikely without carbon capture. The USE IT Act is a smart way to encourage innovative capture methods, profitable uses for captured carbon, and new infrastructure that will help scale-up this important climate solution.” – **Josh Freed, Senior Vice President for Clean Energy, Third Way**

“The USE IT Act is another step forward in advancing technology-based solutions to environmental challenges in a manner designed to maximize the economic potential of our energy and manufacturing sectors. In seeking new ways to power our nation and energize our industrial base, this bill recognizes the value of retaining and creating high-quality, family supporting jobs, and their importance to the working families and communities that depend on them for their way of life.” – **Mike Langford, National President, Utility Workers Union of America**

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April 11, 2018

Coalition Supports Utilizing Significant Emissions with Innovative Technologies (USE IT) Act

<http://carboncapturecoalition.org/carbon-capture-coalition-endorses-bipartisan-carbon-capture-legislation-introduced-in-the-u-s-senate-today/>

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October 23, 2018
Carbon Capture Coalition Wins the Inaugural Cleanie Award for Best Public Affairs Campaign of the Year

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Momentum for Carbon Capture Grows with Introduction of Bipartisan Tax Incentive Legislation Co-Sponsored by One-Fourth of the U.S. Senate

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GET IN TOUCH

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CARBON CAPTURE

Research funding legislation returns

Dylan Brown, E&E News reporter
Published: Thursday, February 7, 2019



(Left to right) Senate Environment and Public Works Chairman John Barrasso (R-Wyo.) and panel member Sen. Sheldon Whitehouse (D-R.I.). Gage Skidmore/Flickr (Barrasso); Center for American Progress/Flickr (Whitehouse)

Senators today revived two bipartisan bills bent on boosting carbon capture and sequestration (CCS) in the United States.

Senate Environment and Public Works Chairman John Barrasso (R-Wyo.) introduced the latest "Utilizing Significant Emissions With Innovative Technologies Act," [S. 383](#).

Sen. John Hoeven (R-N.D.) put forward the "[Carbon Capture Modernization Act](#)"

"Congress needs to help make American energy as clean as we can, as fast as we can, without raising costs on consumers," Barrasso said in a statement. "This bill supports groundbreaking innovation to address climate change. Carbon capture and utilization technologies hold the key to major emissions reductions."

The bill would direct EPA to conduct CCS research through an amendment to the Clean Air Act. It would also make CCS and carbon dioxide pipeline projects eligible for streamlined permitting under the 2015 Fixing America's Surface Transportation Act, the last national infrastructure package passed by Congress.

The bill would task the White House Council on Environmental Quality with creating guidance to help project developers.

The legislation also looks to extend and expand the Section 45Q tax credit for CCS projects. Under a 2018 law, projects that qualify for the tax credit must start construction by 2023.

Hoeven's bill would modify another coal tax credit, Section 46A, to encourage more CCS use.

Former Sen. Heidi Heitkamp (D-N.D.) was a key champion of both bills, as well as the [Furthering Carbon Capture, Utilization, Technology, Underground Storage and Reduced Emissions Act](#) that passed last year ([E&E Daily](#), Nov. 6,

2018). Her Republican replacement, Sen. Kevin Cramer, is a co-sponsor of both bills introduced today.

"We've proven we can pass sensible bills like this with broad bipartisan support," said Sen. Sheldon Whitehouse (D-R.I.). "Now let's do it again."

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CATF Releases Modeling Study That Shows 45Q Carbon Capture & Storage Federal Tax Credit Can Have A Major Impact On CO2 Emissions Reductions Through 2030

DEEPIKA NAGABHUSHAN
STUART ROSS
February 12, 2019

Clean Air Task Force (CATF) today released a comprehensive report on the near-term implications of the federal tax credit (45Q) for carbon capture and storage (CCS) projects. The study found that, as a result of tax credit legislation known as 45Q, which was extended and expanded in early 2018, nearly 49 million metric tonnes of CO₂ could be captured and stored annually by 2030 through CCS on U.S. coal- and gas-fired power plants, equivalent to taking seven million cars off the road.

CATF's modeling takes into account the passage and signing one year ago of the Bipartisan Budget Act that included the expansion and extension of the 45Q corporate income tax credits. These credits are expected to enable additional deployment of CCS projects in the U.S. and as a result will help reduce carbon emissions while meeting energy needs and supporting domestic jobs. The study covers the impact of 45Q on the power sector only, although 45Q tax credits will likely spur CCS projects on industrial facilities as well.

CATF retained Charles River Associates, a leading economic consulting firm that developed the North American Energy and Environment Model (NEEM), for the modeling underlying the report. NEEM is widely used by power utilities in the U.S for making strategic capacity and rate decisions.

"Our study projects that the CCS tax incentive could result in nearly 49 million metric tonnes of CO₂ captured and stored annually by 2030 through CCS on U.S. coal- and gas-fired power plants. That amount of CO₂ reduction is equivalent to taking seven million cars off the road, a number greater than the number of new cars sold in the US in 2017," said Deepika Nagabhushan, Energy Policy Associate for CATF and lead author of the study.

"Our study also projects that by 2030, 45Q could help the U.S. achieve more than two-thirds of the share of carbon capture that is needed on our power sector in order to limit global warming to 2-degrees, based on assessments by the International Energy Agency (IEA)" she said.

“So far, we’ve seen a few companies that have expressed strong interest in capitalizing on the tax breaks from 45Q,” said Nagabhushan. “As a next step, the U.S. Treasury must issue updated guidance on the requirements for claiming 45Q tax credits. After that, we can expect carbon capture projects to ramp up in the near term towards the levels modeled in our study.

“However, to achieve much wider deployment of CCS in the longer term as seen in IEA’s 2-degree modeling scenario, a suite of strategic policies would need to be implemented targeting all parts of the capture, transport and storage industries, and further extension of 45Q tax credits may be a part of that strategy.”

More findings of the study

Importantly, the modeling results show that the 45Q-induced power sector CO₂ reductions are additive to those achieved through renewable sources of electricity generation.

The modeling results from the analysis also show that 45 units of coal and natural gas power plants could be retrofitted with CCS, resulting in a total of 10.8 GW of generating capacity with carbon controls. Currently one coal-fired power plant in Texas – Petra Nova – and one in Saskatchewan – Boundary Dam – are capturing CO₂ and sequestering it through EOR, so the prognosis for rapid expansion of the technology under 45Q is very encouraging.

The results indicated that CO₂ is stored in oil fields within three regions. California would store 6.4 million tonnes per year, East & Central Texas 19 million tonnes and the Mid-Continent region 23.5 million tonnes. To assess the growth level projected by the modeling, the study compared the results to historic U.S. EOR regional growth rates, which ranged from 3.6 to 19 million tonnes per year. This suggests that the modeled regional growth rates are not out of line with previous growth periods. Furthermore, the largest rates of past growth were spurred by tax policy.

Here’s the link to our 45Q modeling study: <https://www.catf.us/resource/45q-ccs-analysis/>

In shadow of Green New Deal, bipartisan bill takes direct aim at emissions

Axios

Amy Harder

February 8, 2019

A small bipartisan group of lawmakers introduced legislation Thursday that would support the buildout of technology capturing carbon dioxide emissions.

Why it matters: Although it's not nearly as high-profile or sweeping as the Green New Deal resolution, also unveiled Thursday, the bill takes a more direct, concrete aim at the root of climate change: emissions themselves.

Details: Senate Environment and Public Works Committee chairman John Barrasso (R.-Wyo.) and the panel's top Democrat, Sen. Tom Carper (D-Del.), led the group introducing the bill, which supports the technology by ensuring coordination among federal agencies to develop pipelines to move the captured CO2 emissions, among other things.

- Barrasso likes the bill because it helps ensure use of U.S. fossil fuels in a world addressing climate change, while Carper said the technology is essential to cutting emissions.
- **The bottom line:** They're both right. The world remains heavily dependent on fossil fuels, so making them cleaner is key to addressing climate change. That's why this technology is both essential and a rare bipartisan policy.

Flashback: The bill passed the same committee last year, but didn't make it through the Senate before session ended.

Between the lines: The Green New Deal is agnostic on whether it supports carbon capture technology, despite scientists saying it's essential. An earlier version backed by Rep. Alexandria Ocasio-Cortez (D-N.Y.) appeared to endorse it, but that language is now gone. It's an indication of the internal disagreements between factions of the left over this tech, given that it supports fossil fuels.

The New York Times

Cut Carbon Through Innovation, Not Regulation

People across the world are rejecting the idea that carbon taxes are the answer to lowering emissions.

By John Barrasso

Senator Barrasso, a Republican of Wyoming, is chairman of the Environment and Public Works Committee.

Dec. 18, 2018

Leaders from nearly 200 countries met in Katowice, Poland, last week and agreed to rules to carry out the Paris climate accord. Now that the 22,000 delegates have returned home, there are three truths they need to recognize to make actual progress in the hard work of lowering carbon dioxide emissions across the globe.

The first is, the climate is changing and we, collectively, have a responsibility to do something about it. Second, the United States and the world will continue to rely on affordable and abundant fossil fuels, including coal, to power our economies for decades to come. And third, innovation, not new taxes or punishing global agreements, is the ultimate solution.

People across the world are rejecting the idea that carbon taxes and raising the cost of energy is the answer to lowering emissions. In France, the government just suspended a planned fuel tax increase after some of its citizens took to the streets in protest. And in the United States, the results of November elections showed that these plans and other government interventions are just as unpopular.

Voters in Washington State rejected the creation of an expensive tax on carbon emissions. In Colorado, a ballot measure to severely restrict drilling was defeated. And in Arizona, voters rejected a mandate to make the state's utilities much more dependent on renewable energy by 2030 — regardless of the cost to consumers. All three of these states elected liberal Democrats to Congress on election night.

The United States is currently on track to reduce emissions to 17 percent below 2005 levels by 2025, according to one recent analysis. That's roughly two-thirds of the way to the original United States target under the Paris climate agreement.

The nation is leading the way not because of punishing regulations, restrictive laws or carbon taxes but because of innovation and advanced technology, especially in the energy sector.

<https://www.nytimes.com/2018/12/18/opinion/climate-carbon-tax-innovation.html>

1/7/2019

Opinion | Cut Carbon Through Innovation, Not Regulation - The New York Times

Over the past decade, American energy-related carbon dioxide emissions have been falling. Technology breakthroughs have led to an American energy renaissance and a growing economy. As our economy has strengthened, we have lowered emissions.

While the United States cut its emissions in 2017, global emissions moved in the opposite direction. Emission levels increased in China and India, and even rose in the European Union in 2017.

Making energy as clean as we can, as fast as we can, without raising costs to consumers will be accomplished through investment, invention and innovation.

As chairman of the Senate Environment and Public Works Committee, I am working across party lines to support the development of new technologies that will further decrease America's carbon emissions.

Nuclear energy is produced with zero carbon emissions. It has been a source of clean, affordable and reliable power for decades. Nuclear energy provides more than twice the global electricity of wind power and more than five times the amount of solar energy.

Washington needs to make it simpler for innovators who are building state-of-the-art nuclear reactors. These advancements in nuclear energy will create jobs, lower costs and contribute to America's energy security without additional carbon emissions.

Groundbreaking new research in the area of carbon utilization to turn emissions into productive commodities, and even direct air capture of carbon dioxide from the atmosphere, also hold keys to major emission reductions. We have made meaningful progress on bipartisan legislation to help researchers engaged in cutting-edge carbon capture and utilization technologies.

The legislation supports efforts to find profitable uses for the captured carbon dioxide. The legislation will also simplify the process for building carbon dioxide pipelines, so that we can safely move the gas to where it is needed.

A leading commercial use of captured carbon dioxide is a process called enhanced oil recovery. By injecting carbon dioxide into an otherwise unproductive well, oil can be economically extracted. This is good for the environment and the economy — producing more American energy and sequestering carbon dioxide underground.

In addition to being used for enhanced oil recovery, carbon has the potential to be repurposed in building materials, medical supplies and manufactured goods.

Citizens around the world will continue to reject climate policies that cost them personally, either by direct taxation or by undermining the competitiveness of their own economies. The sooner the world's leaders accept this reality, the sooner we will be able to put new and lasting solutions in place.

1/7/2019

Opinion | Cut Carbon Through Innovation, Not Regulation - The New York Times

Senator John Barrasso was an orthopedic surgeon before joining the Senate in 2007. In addition to heading the Environment and Public Works Committee, he is a member of the Energy and Natural Resources Committee.

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PRESS RELEASES

Senators Reintroduce USE IT Act to Promote Carbon Capture Research and Development

February 7, 2019

WASHINGTON, D.C. — Today, U.S. Senator John Barrasso (R-WY), chairman of the Senate Committee on Environment and Public Works (EPW), joined with Sen. Sheldon Whitehouse (D-RI) to reintroduce S. 383, the Utilizing Significant Emissions with Innovative Technologies (USE IT) Act. The legislation is cosponsored by Sens. Shelley Moore Capito (R-WV), EPW Committee Ranking Member Tom Carper (D-DE), Tammy Duckworth (D-IL), Kevin Cramer (R-ND), Tina Smith (D-MN), Joe Manchin (D-WV), and Mike Enzi (R-WY).

The USE IT Act would support carbon utilization and direct air capture research. The bill would also support federal, state, and non-governmental collaboration in the construction and development of carbon capture, utilization, and sequestration (CCUS) facilities and carbon dioxide (CO₂) pipelines.

"Congress needs to help make American energy as clean as we can, as fast as we can, without raising costs on consumers," **said Barrasso**. "The USE IT Act will promote the long term use of Wyoming's natural resources and help make America more energy dominant. This bill supports groundbreaking innovation to address climate change. Carbon capture and utilization technologies hold the key to major emissions reductions. The bipartisan legislation supports efforts to find profitable uses for captured carbon dioxide and simplifies the process for building carbon dioxide pipelines."

"The science from the world's top experts, including our own National Academies, shows that we ought to be reversing the carbon pollution driving climate change. If we don't, it will be nearly impossible to avoid the worst of climate change," **said**

Whitehouse. “That’s why I’ve been working across the aisle on ways to boost promising new technologies like direct air capture. We’ve proven we can pass sensible bills like this with broad bipartisan support. Now let’s do it again.”

“This bipartisan legislation is part of a smart all-of-the-above energy plan,” **Capito said.** “By providing incentives for the deployment of carbon capture technologies and regulatory certainty for those trying to reduce their emissions by using their carbon, we’re building on America’s energy leadership and investing in innovative ways to use our energy resources.”

“Carbon capture, utilization and sequestration, or CCUS, technologies are critical in our fight against climate change,” **said Ranking Member Carper.** “The USE IT Act helps lower the current barriers that are preventing the wide-spread development and deployment of CCUS. I am especially pleased to see that this year’s version of the bill makes a more significant investment in direct air capture of carbon pollution, which recent studies show will be needed – along with emissions reductions – to mitigate the dangerous effects of climate change. With the changes we’ve made, I’m happy to join Chairman Barrasso and my other colleagues on the USE IT Act. Especially on the heels of reports saying that 2018 was one of the hottest years on record, we need all effective tools like CCUS in our arsenal to rapidly drive down carbon emissions. I hope that we can continue to work on solutions like this that will reduce carbon emissions and spur good-paying American jobs in engineering, manufacturing and installation of these crucially needed technologies.”

The USE IT Act would:

- Narrowly amend the Clean Air Act to direct the Environmental Protection Agency (EPA) to use its existing authority to support carbon utilization and direct air capture research;
- Clarify that CCUS projects and CO2 pipelines are eligible for the permitting review process established by the FAST Act;
- Direct the Council on Environmental Quality (CEQ) to establish guidance to assist project developers and operators of CCUS facilities and CO2 pipelines;
- Establish task forces to hear input from affected stakeholders for updating and improving guidance over time; and
- Build on the FUTURE Act, bipartisan legislation – now signed into law – introduced by Barrasso, Whitehouse, and Capito to extend and expand the 45Q tax credit to provide certainty to utilities and other industrial sources and incentivize the build-out of CCUS projects.

Read the text of the USE IT Act here.

Background Information:

On March 22, 2018, Barrasso, Whitehouse, Capito, and Sen. Heidi Heitkamp (D-ND)

introduced the USE IT Act during the 115th Congress.

On May 22, 2018, the EPW Committee unanimously passed the USE IT Act.

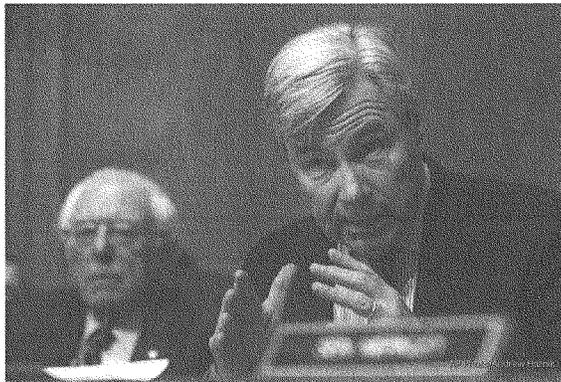
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Permalink: <https://www.epw.senate.gov/public/index.cfm/2019/2/senators-reintroduce-use-it-act-to-promote-carbon-capture-research-and-development>

NationalJournal

The Senate's Quiet Climate-Policy Dealmaker

As the Green New Deal hits a polarized Congress, Democratic Sen. Sheldon Whitehouse is finding incremental success working with Republican colleagues.



Sen. Sheldon Whitehouse (right) accompanied by Sen. Bernie Sanders, questions Andrew Wheeler at a Senate Environment and Public Works Committee hearing, Jan. 16.

Zach C. Cohen

© Feb. 19, 2019, 8 p.m.

As rank-and-file Democrats propose sweeping new regulations to combat climate change, one of their colleagues in the Senate is quietly pushing through more incremental environmental laws all the way to President Trump's desk.

Sen. Sheldon Whitehouse, a Rhode Island Democrat and frequent advocate for environmental causes, has found success working behind the scenes to pass legislation to limit the release of greenhouse gasses and clean up pollution. And while he has yet to endorse the Green New Deal pushed by House Democrats, he said he believes a debate over national climate policy ahead of the 2020 election in the Republican-controlled Senate could prompt significant work to stem the effects of global warming.

"The things that I'm doing ... I believe create at least a pilot light for potential Republican support on larger measures," Whitehouse said in an interview Thursday. "But nobody should make the mistake of believing that all of these things dialed up to their maximum effect will make a significant difference against the hazard that is coming at us. ... [E]very step that I can make in the direction of solving the problem I think is worth taking."

<https://www.nationaljournal.com/s/676759/the-senates-quiet-climate-policy-dealmaker>

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Whitehouse, who delivers a weekly "Time to Wake Up" speech on the Senate floor about the existential threat posed by climate change, has cosponsored [89 bills](https://www.congress.gov/members/sheldon-whitehouse/W000802?searchResultViewType=expanded&q=%3B%22search%22%3A%3B%22%3C%22sheldon+whitehouse%3C%22%24%5D%2C%2Acongress%22%3A%22all%22%3C%2Astatus%22%3A%22law%22%7D) since coming to the Senate in 2007 that became law. Some of those successful legislative efforts just in the last year promoted nuclear energy and carbon-capture technology in the hopes of reducing carbon emissions, both which [continue to be pushed by members of both parties on committees governing energy policy](https://www.nationaljournal.com/s/676622/lawmakers-pitch-nuclear-energy-carbon-capture-to-scale-down-emissions).

"I'm looking for common ground with people that want to actually solve a problem and not just have an issue, and I think he's very serious about wanting to solve this problem," said Senate Environment and Public Works Chairman John Barrasso.

Whitehouse said former Sen. Heidi Heitkamp, a North Dakota Democrat, recruited him to last year's carbon-capture bill because it required a "climate hawk" to broaden appeal for the technology, which Whitehouse said was no longer an "industry talking point to discourage and proper and full solution" but a way to reduce the harmful effects of fossil fuel production.

"By pushing carbon capture and sequestration and utilization and being able to get a tax advantage from that really has a huge environmental plus," said Sen. Shelley Moore Capito, a West Virginia Republican who sponsored the legislation. "And so there were a lot of stakeholders that joined both from the environmental side and then from the energy side."

Nuclear power has similarly served as a bridge between environmentalists and most Republican lawmakers because, in Whitehouse's words, it "brought the Senate over the hurdle of denying that there is a value to carbon-free power." The Democrat is also increasingly optimistic about methods that could convert nuclear waste into energy.

"It was a very natural fit to work with him on trying to expand and increase the availability of nuclear power," said Republican Sen. Mike Crapo of Idaho, who signed onto enacted legislation with Whitehouse that promotes research into spent nuclear fuel.

Whitehouse said the key to recruiting bipartisan partners is finding "safe political space" to address evident problems by courting Republican senators representing states particularly impacted by environmental hazards. For example, he approached Sen. John Kennedy to sponsor funding to protect communities from sea-level rise "because few states are more coastal than Louisiana."

Republican Sen. Dan Sullivan, at a joint appearance with Whitehouse at an Alliance to End Plastic Waste panel this month, said Whitehouse approached him four years ago. The former Alaska Department of Natural Resources commissioner had arrived in Washington along with a new Republican Senate majority, and Whitehouse urged him to tackle marine debris along his state's and the country's vast shores.

"We saw very broad support across our very often divided committee for this," Whitehouse said of the Environmental and Public Works Committee at the Alliance event, "and that I think was a strong signal for both of us that this was good to go."

The resulting Save Our Seas Act directed federal funding to clean up marine debris. It passed both chambers unanimously last fall before Trump signed it.

"Literally every stakeholder is pulling on the same oar on this solvable issue," Sullivan said. "And that doesn't happen a lot here, especially on big environmental issues."

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Whitehouse met Trump for the first time at the bill's Oval Office signing (<https://www.c-span.org/video/?454877-17/president-trump-blames-federal-reserve-stock-market-drop>), at which Trump thanked Whitehouse and Sullivan for "spearheading" the "very important" legislation to tackle the "vast, tremendous, unthinkable amount of garbage ... floating right into our coast."

It was a meeting even Trump found surprising. "Can you imagine Trump and Whitehouse in the same area?" the president asked before reaching out to shake the Democrat's hand.

Trump at the signing said that, at Whitehouse and Sullivan's behest, the new trade deal with Canada and Mexico will "include commitments by the parties to cooperate to address land- and sea-based pollution and improve waste management."

The two coastal senators are also working on an update to that law, dubbed SOS 2.0, that could include incentivize private-sector waste reduction innovation, dispatch aid overseas to cleanup projects, and research methods for physically catching upstream trash before it feeds into the ocean. Whitehouse gave the bill "a pretty good prognosis" as it's presented to the bipartisan Senate Oceans Caucus, which includes Jim Inhofe of landlocked Oklahoma, before it comes to the floor.

"Everybody can look at it and go, 'Oh my God,'" Whitehouse told industry stakeholders this month. "Inhofe and Whitehouse, same bill? I guess there's room for me in there."

Whitehouse, who won his primary and general campaigns last year by double digits, said he has received "surprisingly little blowback" from the Left for his support for carbon capture and nuclear technology.

But his bipartisan outreach is not without controversy. Lukas Ross, a senior policy analyst at the environmental advocacy organization Friends of the Earth, said Whitehouse's record on sequestration was "long and problematic."

"The evidence certainly points towards the simple reality that this is not a viable solution to the climate crisis on the necessary timeline," Ross said. "Therefore, it's unclear who the audience is for this kind of legislation."

Whitehouse is effusive toward his Republican colleagues, who control two of the three bodies necessary to pass a bill. Whitehouse at the Alliance event praised Sullivan's "spectacular leadership" and for "pushing so hard on those open doors" at the Trump administration.

But Whitehouse's bipartisan relationships haven't stopped the third-term senator from lambasting Republicans' general reluctance to join efforts to curb the effects of climate change. In an interview, he accused the GOP of backing "climate-denying" executive nominees and on the floor has railed against the party's inaction on rising global temperatures.

Atop the environmental agenda after this week's congressional recess is the Green New Deal, an ambitious proposal from newly elected Rep. Alexandria Ocasio-Cortez and Sen. Ed Markey, the dean of Senate's climate-change caucus. Senate Majority Leader Mitch McConnell said last week he'll bring the measure up for a vote, which lacks backing from senators who have signed on to Whitehouse's more-piecemeal environmental initiatives.

Whitehouse for his part has yet to join Democratic presidential hopefuls in cosponsoring the resolution in the hopes of remaining a "facilitator in the climate debate," according to an aide.

But the Democrat thinks McConnell's tactic to hold a vote in order to divide Democrats will instead "rap the beehive" and show that Republicans are "heading into 2020 with nothing but industry talking points and denial on climate change.

"So I think actually we could very well smoke out the probably dozen Republicans who would very much like to, I think, start working on this if they were bipartisan prospects if they weren't to be punished too badly by the Republican donor community," Whitehouse added.

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Senator CARPER. Thank you so much. Thank you all.

Senator BARRASSO. No further questions. Thanks so much for being here. Some of the other members of the committee may actually put some written questions to you, so I hope that you will submit answers quickly. The committee hearing will be open for 2 weeks.

I just really want to thank you for your testimony. It was very helpful. Senator Van Hollen, thank you for cosponsoring this wonderful, bipartisan piece of legislation. The hearing is adjourned.

[Whereupon, at 1:48 p.m., the committee was adjourned.]

