U.S. SENATE
COMMITTEE ON ENVIRONMENT
AND PUBLIC WORKS
OVERSIGHT HEARING

ENERGY AND ENVIRONMENTAL INNOVATION:
WYOMING'S LEADERSHIP IN USING AND STORING
CARBON DIOXIDE EMISSIONS

AUGUST 19, 2020
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WYOMING INTEGRATED TEST CENTER
12480 N. HIGHWAY 59
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CHAIRMAN BARRASSO: Good morning. I call this hearing to order and welcome everyone who's here. Please have a seat, make yourself at home, make yourself comfortable.

The Senate Environment and Public Works Committee is honored to convene today in Wyoming for a field hearing at the Wyoming Integrated Test Center.

And I really want to thank Senator Enzi, a Wyoming senior senator, he is the Chairman of the Senate Budget Committee. But most importantly, he is a former Mayor of Gillette, Wyoming. And I want to thank him for joining us here today.

And, Mike, we are normally Wednesday doing Wyoming Wednesdays in Washington with doughnuts and coffee and juice and everyone from Wyoming. And I guess, I wanted to get doughnuts, but they said due to Coronavirus, I couldn't have boxes of doughnuts here today. So we can't quite do Wyoming Wednesday. But it's a pretty good group.

SENATOR ENZI: It is, yes.

CHAIRMAN BARRASSO: Looking at all the folks who are here today.
Well, today we're here to discuss Wyoming's leadership in using and in storing carbon dioxide emissions. Just outside these doors is a world class facility where research is currently underway to study how we can create commercial value from carbon dioxide that would otherwise just go up into the atmosphere, located next to Basin Electric Dry Fork Power Station, and we were both here for the grand opening a dozen years ago.

The Integrated Test Center hosts research that will create new markets and new jobs in Wyoming. The center will research how to transform coal power plant emissions into building materials, like cement as well as alternative fuels.

Through our relationship with NRG Canadian Oil Sands Innovation, XPRIZE, the center will welcome five teams of researchers from around the world.

Last year I met with one of the finalist teams from Aberdeen, Scotland during a trip to their research lab. We had five senators that were on that trip, a bipartisan group, including Lisa Murkowski, the present Chairman of the
Energy Committee; Maria Cantwell, who has served as ranking member of that committee previously; Senator Sheldon Whitehouse from Rhode Island, and Joe Manchin from West Virginia.

It's not surprising that Wyoming can attract such top talent from around the world. Because in Wyoming, we're blessed with tremendous fuel resources, coal, natural gas, oil. And most of that coal comes from right here, Mike, in your home community of Campbell County.

The world-class researchers at this center will study how to transform the carbon dioxide from burning these abundant fuel resources into a host of new and innovative applications.

These new applications can be added to currently viable commercial uses for carbon dioxide, a process that many of us know as enhanced oil recovery. It's already being used in Wyoming. And with Randall Luthi here, it was being used when he was Speaker of the House of the Wyoming Legislature.

This is where carbon dioxide is injected to produce oil from older, more mature -- into older more mature fields. Once this process is complete, the carbon dioxide is then permanently
stored underground.

If we can harness carbon dioxide from power plants and other facilities, Wyoming has the great potential for even broader scale enhanced oil recovery.

Wyoming has abundant, deep saline formations. These formations can store carbon dioxide deep underground instead of being released into the atmosphere. Scientists from the University of Wyoming, many are here today, were conducting geologic testing in a formation just a short distance from this center.

As Chairman of the Environment and Public Works Committee in the United States Senate, carbon capture is one of my top policy priorities.

Two years ago, President Trump signed an extension and expansion of the 45Q tax credit for carbon capture facilities. Now we must make sure that that credit can be deployed and used to build new carbon capture projects.

In order to accomplish this goal, I have pushed the Internal Revenue Service, and specifically and directly the Secretary of the Treasury, to issue the much-needed guidance this
year. Also introduced legislation called the
USE IT Act -- and that stands for Utilizing
Significant Emissions and Innovative
Technologies Act, USE IT Act -- to complement
the 45Q tax credit. This bill ensures that
Washington is a willing partner in the
development of carbon capture projects.

The USE IT Act helps researchers find
commercial uses for captured carbon dioxide
emissions. It supports the use of carbon
capture technology, including direct air
capture.

The USE IT Act also directs the federal
government to work with developers to expedite,
not block, the permitting process. We know all
too well that delayed permitting can kill
important projects.

The USE IT Act also funds research such as
the type of research occurring right here at the
Integrated Test Center for carbon utilization as
well as direct air capture.

The USE IT Act passed the Senate for a
second time this summer after passing the
committee I chair unanimously 21 to nothing.
Last year, House Democrats blocked it from
becoming law. That was in the House, but we have unanimous agreement in the Senate. And I'm working to secure its passage into law this year.

Wyoming continues to be the leading state in the nation with regard to carbon capture research. So I'm so pleased that today's hearing can be held to shine a spotlight on the great work that is happening right here in our state.

I'd like to right now turn this over to Senator Enzi for any opening remarks he would like to make.

SENATOR ENZI: Thank you, John, and thank you for holding this hearing here. This is a very unusual testing center that will make a difference for the country. I thank you for your role in being the Chairman of the Environment and Public Works Committee that's infrastructure as well as environment.

And I know that you're in line to be the Chairman of the Energy Committee as well. That will definitely be a help to this entire process.

Besides that, of course, John is one of the
leaders in the Senate. He's one of the top --
he's in the five people who get to make the
important decisions for what we're going to do
and how we're going to do it. And he does an
outstanding job with that, as well as presenting
the case to the nation. So I'm thankful for you
doing this hearing. I know it will make a
difference.

I want to also welcome everybody to Campbell
County. Chairman of the county commission is
here today, and others. And I used to be the
mayor here. And you'll see the symbol for the
city is the energy capital of the nation. And
that's because in this county, we have more BTUs
of energy than Saudi Arabia has.

And we can utilize it, or we can pass it
over. And a lot of jobs rely on that, and the
jobs are well-paying jobs. Thousands of people.
And the state relies on the revenue, as do all
of the entities of the state, from the energy of
this area.

And they are noticing the lack of oil
production at the moment. For the first time in
over 130 years, there isn't a drilling rig
operating in Wyoming. I think that's going to
affect airplanes at some point because they
still can't run on solar.

But, so pleased that you're holding this. I
want to thank all the witnesses to this
important work to make this facility a success,
and for the insights and experiences that you
can share with us.

It's been great to work with Senator
Barrasso as we try to incentivize growth in this
industry through the 45Q tax credit and his USE
IT Act.

For a long time we've said the people of the
United States are the most innovative people in
the world. And of course I like to think the
people in Wyoming are the most inventive people
anywhere.

And part of it is because of our distances,
and we travel a lot. And when you're traveling,
you think about other things, like what your job
is and how much better it could be. And
consequently, Wyoming per capita has more
patents than any other state. And so, we're
always thinking.

And of course we appreciate the University
of Wyoming and community colleges who are taking
our young people and educating them to think
that -- to increase their thinking ability from
the way that they've grown up having to
innovate. And we know that will make an
important difference for the state.

And it is important, more important than
ever that Wyoming and the federal government
work together with the universities and with the
private sector to invest in technology
innovation in order to create a sustainable
future, particularly for coal, but for all
energy.

And I'll continue to support policies that
help push this innovation forward and ensure
that Wyoming remains the epicenter for these
technologies.

And there are some really amazing things
going on, not only here but at the university
that will make a difference. At the university
they've got one test center that's figuring out
how to get oil out of granite, and I think they
are making progress.

But we need to make sure that oil is still
necessary and as clean as possible. And I have
confidence that the innovation and inventiveness
of the Wyoming people and the people in the United States will make that happen.

Nothing that the federal government does is worth much unless there's talented and capable people on the ground to put the policies into action.

And I'm looking forward to our discussion and learning more about how we can work together to continue advancing these technologies, and the ones that will come out of this.

I'm on the Health, Education, Labor and Pensions Committee, and one of the stunning things that I ran into there is that the average kid that's in junior high right now will have over 15 different occupations based on how technology is moving ahead. And what really stunned me was, 11 of those haven't even been invented yet.

So the world is going to change. We need to make sure we're educating our kids so that they take advantage of that change and make the change. And this is one of the places where that change can be made.

And so, John, I really appreciate you holding the hearing here and bringing to light
some of these opportunities that we have. And that's how we have to look at any problem, as an opportunity. So thank you, John.

CHAIRMAN BARRASSO: Well, thank you, Mike. And you know, you look around the room and talk about your time here as mayor, and my time in the legislature, your time in the legislature and now in the senate.

And I'm going to introduce our friend, Randall Luthi in a few moments as the Chief Energy Advisor to Wyoming Governor Gordon.

You know, you look, there's Jim Anderson, he was probably here in Gillette when you were mayor, and now you got -- and you will -- got reelected last night, you won your primary to the State Senate in Natrona County. So congratulations. I know it was a late night. Although the results on your race were in pretty early. Congratulations.

And you know, it's fun to have Rita Meyer here, former auditor. We have -- talk about leadership at the local level, we have Rusty Bell here from the county commission, and as a graduate of Leadership Wyoming, and all the activity there. And it's nice to have Ed Seidel
here, President of the University of Wyoming.

So we are represented all across the board
with people committed to Wyoming and to the
nation and to energy and the needs that we have
and that we have the availability right here in
Wyoming.

With that, I'd like to introduce, and it's a
great pleasure to introduce, Randall Luthi, who
is the Chief Energy Advisor to Wyoming Governor
Mark Gordon. He's an attorney, a rancher,
former Speaker of the Wyoming House of
Representatives. He brought considerable
insight and experience to the governor's office,
and we're grateful for that.

Prior to joining the governor's office, he
was President of the National Offshore Ocean
Industries Association. So he knows lots about
energy onshore and offshore.

He served in the Department of Interior as
the Director of Minerals Management Service, and
is Deputy Director of the Department's Fish and
Wildlife Service.

Had the pleasure of serving with him in the
Wyoming legislature for many years. Proud to
continue to work with him on behalf of the
people of Wyoming.

And you testified last year at the Senate Environment and Public Works Committee.

Welcome here today, Randall.

MR. LUTHI: Well, thank you very much.

Thanks for those kind words, Chairman Barrasso, Senator Enzi. On behalf of Governor Gordon, welcome home.

And Senator Enzi, this is like double home for you. You know, not only in the state, but as everybody has pointed out, but in Gillette as well.

You know, the work you both do in D.C. is so vital to the people of Wyoming. But it's your dedication to return regularly to the state to find out what is relevant is what keeps you well-grounded. And the Governor appreciates that. The people of Wyoming appreciate that.

Thank you for your efforts, particularly in this last -- this calendar year, as we have faced the oil wars, unwarranted market pressures on coal, and a pandemic. You know, we no longer muse in the governor's office about what else could go wrong, for fear that it actually will.

So on a more personal note, you know, I did
have truly the pleasure and honor to serve with 
both of you in the legislature. I recall you 
represented your districts with honor and 
distinction, and you've continued to clear that 
high bar in the U.S. Senate. 

    Mike, Senator Enzi, today has to be a little 
bit bittersweet for you. As you think about it, 
how long has it been since you haven't had your 
name on a ballot in the primary election? 
However, I'll bet you and Diana are already well 
in to making plans for doing something else for 
your next career. But again, thank you for a 
long, and I describe it as just, put your head 
down and work career of public service. 

    All right. Back to the business at hand. 
You have chosen wisely to hold a field hearing 
at the Integrated Test Center. This center 
represents innovation, cooperation, and hope for 
our future. 

    This center wouldn't be here except for the 
cooperation and the generosity of electric 
utilities, the State of Wyoming, the community 
of Gillette, Campbell County, U.S. Department of 
Energy, and in particularly those willing to 
push the envelope, such as XPRIZE participants.
You know, at a time when so many loud voices -- and I think it's the loud voices of a few, that are calling to remove fossil fuels from our energy portfolio, this center provides an opportunity to focus on the real issue. How do we prevent or remove CO2 from the atmosphere? What are the other uses of coal and CO2 that could benefit our economy and consumers?

This center proves to be essential to our future livelihood and economy. Its work is exciting and has the full support of the Governor.

Although I am not a witness today, the Governor certainly supports measures such as the USE IT Act. Wyoming has enacted key legislation to promote the CO2 capture. And as you all know, the ability to use those 45Q credits is what's going to be make that work.

Our legislature is also looking forward. Their almost two-year process to establish the Wyoming Energy Authority is complete or nearly complete. The Governor is committed to working with the WEA and support all forms of energy.

The ITC is essential in the Governor's energy and economic strategy. We are committed
to ensuring that the strengths of the Wyoming infrastructure authority and the Wyoming pipeline authority remain and are available to assist the stakeholders to those who generously invested in this one-of-a-kind center.

We do know there are challenges today, and there will likely be far more tomorrow. Political winds change directions like a pinball at an arcade. But we must all commit to a steady, sure-footed energy policy that provides stability, reliability, and availability of all energy resources.

So thank you again. And thank you for giving the governor's office a chance to welcome you, because there's -- you are always welcome.

The Governor looks forward to seeing both of you in the future. Thank you very much.

CHAIRMAN BARRASSO: Thanks, Randall. We really appreciate you being here, and all of your help and direction.

Now we are going to turn our panel of witnesses and I would invite the three of them to come up. And Randall mentioned the XPRIZE, and we're very fortunate to have with us the executive director, Dr. Marcius Extavour, who is
here overseeing and the executive director related to the Carbon XPRIZE. We're grateful to have you.

We also have Dr. Holly Krutka, who is the Executive Director of School of Energy Resources at the University of Wyoming, as well as Jason Begger, who is the Deputy Director of the Wyoming Energy Authority and the Managing Director right here at the Wyoming Integrated Test Center.

We're going to start with Jason. And Jason is the current Deputy Director, as I said, here through the Wyoming Energy Authority. Manages the Integrated Test Center. Grew up in eastern Montana, worked in Washington for a couple of members of Congress.

After his time there, he worked for the Petroleum Association for Wyoming, for Rio Tinto and that became Cloud Peak. Graduated with a bachelor's degree from Montana State University; Master's in Business Administration from the University of Denver. You were back in Washington to testify to the Environment and Public Works Committee. We're grateful for that. He and his family live
outside of Cheyenne. It's a pleasure to have you join us today. Please proceed.

We're going to ask all of you to try to keep your remarks to about five minutes so we have time for questioning.

MR. BEGGER: Thank you, Chairman Barrasso, Senator Enzi. I appreciate the opportunity to speak with you today.

As the Chairman said, my name is Jason Begger, and I'm the Managing Director of the Integrated Test Center. A little over three years ago, I had the opportunity to testify before this committee in your hearing room in Washington. So it's a great honor to have you out at our facility today.

The ITC is a private/public partnership between the State of Wyoming, Basin Electric Power Cooperative, Tri-State Transmission and Generation Association, and the National Rural Electric Cooperatives Association, also known as NRECA.

We have also had various in-kind contributions from Black Hills Energy and Rocky Mountain Power. The value of the private sector stakeholders is immeasurable as they have direct
experience with project management, technology review, and strong federal relationships.

This facility was authorized in 2014 by the Wyoming legislature, and what you see today has all occurred within the past six years. Through our coalition, we have constructed a facility, developed a communications plan, established business development strategies as well as all the necessary operational plans.

Through relationships with the Department of Energy's National Carbon Capture Center and the International Carbon Capture Test Center Network, we've been able to learn and share best practices. At the end of the construction, the facility came in 18 percent under budget, which provides additional funding for operations.

The ITC fills a very unique need within the United States. While developers have tested larger projects in the U.S., this is the only dedicated testing site... (Brief pause).

This is the only dedicated testing site that could host larger pilot and demonstration projects.

Currently, many DOE-funded projects must travel to Norway to scale up. The ITC provides
an opportunity to spend those U.S. dollars here at a substantially reduced cost, providing better value to our taxpayers.

We have worked hard to forge a strong relationship with DOE and last summer hosted Assistant Secretary for Fossil Energy, Steve Winberg. Senator Enzi at that time was able to join us for that tour out here.

We recognize that while we have a great facility, we need DOE support to fund the projects we ultimately want to test and host here.

One important lesson we've learned is, scaling up technology takes a long time. It takes years to move through the funding opportunities, the design, the fabrication, and finally testing. In order to see the real fruits, we need long-term commitments from the federal government to support testing.

Our testing partners need to know that they'll have the resources they need to methodically scale up and provide the types of technical assurances utilities need to feel comfortable commercializing the technologies.

The USE IT Act would greatly assist in this
area. Many but not all of our potential tenants are seeking federal funding, and whether or not they receive funding will determine if they can deploy on site.

Currently we have relationships with XPRIZE, which you'll hear about from Dr. Extavour, the Japan Coal Energy Center, also known as JCOAL, Kawasaki Heavy Industries, Columbia University, TDA Research, Membrane Technology and Research, Gas Technology Incorporated, Air Liquide, and the University of Kentucky.

With regards to the research community, we view them as partners not just tenants. One of the great benefits of the ITC is the blank canvas approach we can provide. We have ample physical space to host an array of technologies and add amenities as we grow.

We hope we can partner with our tenants to repurpose equipment that they may no longer need to provide expanded testing capabilities. A great example of this project is one that would grant their steam boiler to the ITC upon the completion of their test. Steam is an integral component of many carbon capture technologies that would be a valuable service to provide.
Lastly, I'd like to touch upon how Wyoming views the ITC as a lynchpin for broader economic technology and development. We have worked closely with Campbell County, the School of Energy Resources, the Enhanced Oil Recovery Institute, the Wyoming Business Council, and many others.

We make sure prospective tenants are aware of the expertise and resources within each of these organizations and how they may be able to best assist to make the Wyoming experience as seamless as possible.

A win/win for Wyoming is first developing these technologies that can be employed to preserve the economic value of the fossil energy industry, and then capturing the manufacturing and technology development that's perfected at the ITC.

I appreciate the opportunity to speak with you today and will gladly answer any questions.

CHAIRMAN BARRASSO: Thanks so much, Jason. We will get back to you with the questions in a few minutes.

But I'd like to turn to Dr. Holly Krutka, who is the Executive Director of the School of
Energy Resources at the University of Wyoming.

Immediately before joining the university, she served as Vice President for Coal Generation and Emissions Technologies at Peabody, the world's largest private sector coal producer.

She's held a variety of roles in the energy industry and has worked specifically on carbon capture during her career. But she's an innovator herself, and actually holds three patents. Holds a bachelor's degree and a Ph.D. from the University of Oklahoma in chemical engineering.

She's a native of Oklahoma, and we're so pleased that she and her family have chosen to make Laramie their home. You may proceed.

DR. KRUTKA: Thank you. Mr. Chairman, Senator Enzi, I appreciate the chance to speak with you today about the opportunities to support energy innovation right here in Wyoming. My name is Dr. Holly Krutka. I am the Executive Director at the University of Wyoming School of Energy Resources, or SER.

SER is focused on energy-driven economic development for the state of Wyoming, which means that we're focused on technologies that
will help support the needs of Wyoming and its energy customers.

If there's one thing you take from my testimony, let it be that Wyoming is an ideal place to drive innovation and deployment of climate-focused technologies, such as carbon capture, use and storage, because the state boasts vast fundamental subsurface knowledge, world-class research programs, the ability to execute large demonstration projects, and the will to drive technology development with the necessary policy support that can ultimately result in commercialization.

The University of the Wyoming boasts a world-class research program in the Center of Innovation for Flow through Porous Media, led by Professor Mohammad Piri. The Center is located at University of Wyoming's High Bay Research Facility, which contains more than 90,000 square feet that make up, to the best of my knowledge, the world's largest experimental research facility focused on flow through porous media and problems associated with applications in hydrocarbon recover, geologic sequestration of greenhouse gases and more.
It's been developed using more than $100 million of investment from the state of Wyoming and corporate sponsors. The Center provides imaging and flow capabilities at the atomic, nan, micro, and macro scales.

In the drive toward commercializing novel technologies, a commercial entity has been spun off and is offering services today.

SER and our project partners are reimagining the use of coal as we develop a thermo-chemical process that produces nonfuel and energy products from Wyoming coal to create products like soil amendments, building materials, asphalt replacements, electro-spun carbon fiber mats that can be used for energy storage and much more.

In addition, SER is developing a dry methane reforming catalyst that uses carbon dioxide and natural to generate syngas, which is carbon monoxide and hydrogen. Our current estimates are that this dry-methane reforming process could create hydrogen at half the cost of current steam methane reforming technologies.

This use for CO2 is an important component of the thermo-chemical process because it allows
all the products I mentioned to be created from Wyoming coal with most of the carbon locked up in the products and near-zero carbon footprint.

SER's Center for Economic Geology Research, or CEGR, is a group of applied geoscientists dedicated to developing opportunities to diversify Wyoming's economy and maintain competitiveness in a low-carbon energy future. It includes internationally recognized experts on the topic of CO2 geologic storage.

Funded by the Department of Energy through the Carbon Storage Assurance Enterprise, or CarbonSAFE Program, CEGR is investigating the commercial feasibility of geologic CO2 storage two million tons per years and a total of at least 50 millions tons of CO2, located right here at Dry Fork Power Plant.

This project, referred to as Wyoming CarbonSAFE, possesses favorable technical, economic, and policy attributes to advancing eventual commercialization of large-scale carbon capture and storage in a modern coal-fired power plant.

Another tool in Wyoming's CCUS tool belt is the Enhanced Oil Recovery Institute, or EORI.
EORI's mission is to facilitate a meaningful and measurable increase in recoverable reserves and production of oil and natural gas in Wyoming. While necessary to help drive state GDP, CO2 enhanced oil recovery, or EOR, is also a commercial-scale climate change mitigation technology.

Historical storage of CO2 with EOR typically sequestered .2 metric tons of CO2 per barrel of oil produced. Today, with the current and next generation technologies being tested and applied in Wyoming, up to 0.5 metric tons of CO2 can be stored per barrel of oil produced, with the possibility of storing even more CO2 per barrel with further research.

These technologies can provide a three-fold increase in the amount of CO2 stored, while producing the same amount of domestic oil.

The final ingredient needed to commercialize CCUS and other environmentally focused technologies is the right policy framework. Wyoming has applied for, and should be the second state to receive Class VI well primacy, allowing the state to implement CCUS projects that are in its interests on a timeline that
works for commercial developers.

In addition, SER's recently launched Center for Energy Regulatory and Policy Analysis, or CERPA, is embarking upon a variety of interdisciplinary energy policy studies to focus on the state of Wyoming's economy.

CERPA is poised to begin an assessment of Wyoming House Bill 200, which established a nation-leading CCUS standard for electricity generation. Among other CCUS-related activities, CERPA is also preparing model CCUS agreements under the Wyoming CarbonSAFE project.

So in summary, while we face many challenges in the global energy sector and with widespread deployment of CCUS, Wyoming stands ready to help and has the necessary tools to make CCUS and other energy technologies a commercial reality.

Thank you.

CHAIRMAN BARRASSO: Well, thank you for your thoughtful testimony. We'll get to them in a moment.

I'm now delighted to welcome Dr. Marcius Extavour here, who is -- has a Ph.D. as well as a master of science in physics from the University of Toronto, where he explored the
quantum mechanics of light and matter near
absolute 0. He also holds a bachelor of science
in engineering science from the University of
Toronto where he built a pancake-making robot.
Pretty good.

Combined nano technology, nanomaterials with
solar cells. You need to meet the president of
the University of Wyoming who has a relativistic
astrophysics Ph.D. on the collision of black
holes. So between the two of you, I -- you
know. Jim Anderson, be careful, you're in
between the two of them.

(Discussion held off the record.)

CHAIRMAN BARRASSO: We are delighted you're
here with us today, and in charge of the XPRIZE
project. Please proceed with your testimony.

DR. EXTAVOUR: Thanks very much.

Mr. Chairman and Senator Enzi, and to the
committee, it's a thrill to be here and a
pleasure to have the opportunity to speak to
transforming what we usually think of as a
liability from the dark side into an asset.

My name is Marcius Extavour. I am the
Executive Director of NRG COSIA Carbon XPRIZE,
which is a $20 million global incentive prize
competition to drive break-through innovation in exactly that, recycle CO2 into something more useful.

A really interesting part of that role is it's allowed me to get a front row seat to not just energy innovation, but carbon management innovation in particular.

If there's one thing you take away from my remarks today is that carbontech, which is the piece of jargon I'm going to use to describe the basket of technologies that we can use to turn CO2 into other materials and the materials themselves.

So that carbontech is a new technology space, it's an emerging space. It's quite young, but can be a really promising tool to decarbonize our existing energy sector to help us fight climate change and to support long-term and sustainable economic growth.

As has been mentioned before, I'm going to echo some of the testimony that my colleagues here, that the State of Wyoming really is extremely well-positioned, not just because of the ITC, to lead in this area and already demonstrating leadership here.
Now carbon dioxide is usually thought of, if we think of it at all, as a colorless, odorless, invisible gas, maybe a greenhouse gas. But we don't usually think about it as a valuable resource. In fact, it is and can be.

The global economy today is fundamentally based on carbon-based materials. You just have to look around the room to recognize that most of the stuff around us is made of carbon-based materials. And the big idea here is that we can make some or maybe even a huge fraction of those materials using abundant extra carbon dioxide. Fertilizers, paints, fuels, building materials, carbon anode fibers is wide range of materials we can pursue.

The science of converting carbon dioxide into any material has been well known and characterized actually for several decades. We know how to do this. The science is pretty well understood. The questions at the cutting edge now are about engineering, scale up, business, finance, and policy.

Yes, we can improve on the science. But there's also -- the field is now maturing and transitioning into broader questions. Not can
we do it, but how do we do it, and how do we do it in a way that makes economic sense, business sense, makes broader policy sense.

Carbontech, as I've mentioned, is a great opportunity to specifically generate revenue by harvesting a low value carbon dioxide feedstock. Carbon dioxide is -- there's basically no cost to emit it. There is a market price, but it's an incredibly low value feedstock.

Now, it's not free to convert it into other materials. It generally takes energy specifically. But whereas we typically focus on the costs of carbon emissions, carbontech is an opportunity to also focus on the value and opportunity that can bring.

As mentioned before, this is an early stage technology area, and how do we unlock this? Innovation. This is where the Carbon XPRIZE enters. The NRG COSIA Carbon XPRIZE was designed exactly to try to catalyze this type of innovation, and to drive the break-throughs in this space that can lead to benefits in this community, in the state, across the nation and the world.

The mission of XPRIZE is to try to help
solve big problems that can impact and benefit
all of humanity. And certainly climate change,
and the need to decarbon and transition and
manage our energy systems and deal with our
excess CO2 falls into that category.

The Prize launched in 2015, and is about to
conclude next spring, spring of 2021, where we
hope to announce some of the winners from some
of the demonstrations we see outside today.

After evaluating and demonstrating -- or,
witnessing demonstrations of dozens of
technologies from around the world, we have now
narrowed the competition down to ten finalist
companies, some of whom have the opportunity to
test at the ITC.

The ITC was chosen specifically as the
testing ground, in fact the XPRIZE was an early
partner in helping it get stood up along with
the leadership of Governor Mead, Governor
Gordon, the legislature of Wyoming, you folks
here on this committee, in fact the broader
Campbell County and Wyoming community, without
which none of this would be possible.

I just cannot stress enough how important
the ITC and an opportunity to test a small
industrial pilot is to the scale-up of innovation. Mr. Begger mentioned this earlier. You don't just come across facilities like this.

Carbontech, carbon recycling is not something you can build up in your garage. It's not two people with a PowerPoint slide. It's an industrial technology that requires safe operating, policy support, business partnership.

And this type of testing facility, which sort of lives between the university labs, research labs, and the commercial market, is a key piece of infrastructure. I really want to underscore that point. Facilities like ITC are unique in this space and absolutely crucial.

Now, I mentioned earlier that materials like concrete, gasoline, plastics, textiles, can all be made out of CO2. Generally speaking, making products out of CO2 can take a couple forms. We can make stuff we are already well familiar with, as I mentioned.

We can make fundamentally new materials that are barely in use today, but could be in broad use in the future, for instance, carbon fiber. Or, we can make better or lower-carbon versions of material we already have.
So I'll give an example. You'll see from the company called CT Concrete -- they will give us a tour a little bit later I know -- they make concrete. Concrete is not their innovation.

Their innovation is to use CO2 to make concrete, and to make that concrete lighter, greener, stronger, stiffer than it otherwise might be. So it's an example of a replacement material, a better version of something we already have. That just happens to be based on carbon.

Senator Enzi, you made a remark about jet fuel and liquid fuels earlier. That's another example. It is possible and people are already making jet fuel out of carbon dioxide. Is it better than existing jet? Jets fly the same, but the carbon intensity is much reduced.

Now we know that making industrial commodities out of CO2 is a great opportunity. It's an economic and business and technology opportunity. But there's something else I'd like to highlight, and that is making consumer products. This is kind of an interesting, emerging niche of this space.

I brought a handful of items to show and
tell which I can speak to you about later. But the interesting thing about consumer products is that it provides an opportunity to have a conversation with everyday people about the opportunity of what CO2 conversion would mean.

It's one thing to say we can make jet fuel or make concrete. The average person isn't really thinking about that in their daily lives, it's not relevant to our sort of our regular culture.

But making items like this hand sanitizer in front of me. How timely. This is actually made of recycled CO2. And this is something I think, especially at this moment, we can all relate to.

The other thing I think is really interesting about consumer products, of course need strong policy support, business support, and innovation of science and engineering. But we also need to support all of that conversation to permeate this conversation, this idea, this vision in the broader public.

And I think the consumer goods are not going to absorb all the emissions coming out of Dry Fork stations, they are not going to solve the problem on their own, far from it. But they are
an interesting entry point into this conversation, for what is a pretty abstract and new technology area, one that I think can be quite powerful to help carbonize our energy sector.

With that, I'd like to conclude. Thank you again for the opportunity to share these remarks. And I look forward to questions and discussion.

CHAIRMAN BARRASSO: Well, thank you to all. Will start with a series of questions. I'm going to pick up on something that you had said, but ask Holly the question, because you talked about Wyoming and what resources we have. And I think, Holly, you started by saying, If you take only one thing away from this hearing, I was going to ask you to go back to that specific sentence.

But it started with, Wyoming is the ideal place, if I got it right. So could you please, again, so that the press, they got the cameras going now, they need to hear this statement coming from you.

DR. KRUTKA: If there's one thing you take from my testimony, let it be that Wyoming is an
ideal place to drive innovation and deployment of climate-focused technologies such as carbon capture use and storage, or CCUS, because the state boasts fast fundamental subsurface knowledge, world-class research programs, the ability to execute large demonstration projects, and the will to drive technology development with the necessary policy support that can ultimately result in commercialization.

CHAIRMAN BARRASSO: That's our marching orders from here, and to us, Wyoming is the ideal place.

DR. KRUTKA: Yes.

CHAIRMAN BARRASSO: Jason, let's start with you. The USE IT Act would fund research such as that's occurring right now. The test center, of the key criteria to receive funding under the USE IT Act, we talked, is having partnership with the group academic, University of Wyoming, commercial development, government.

How important have strong private partnerships, public partnerships been insofar as developing this integrated test center?

MR. BEGGER: Mr. Chairman, I think the partnerships that we pulled together here is an
ideal sort of model for what the USE IT Act
does.

Earlier this year, the ITC, we received
award from the international group, it was a
carbon leadership Award, global award for
innovative partnerships. And the strength in
that is, really comes down to, at the end of the
day, we need partners, we need customers for
these technologies that are going to be
developed.

And so, having Basin Electric and the rural
electric cooperatives and Tri-State and everyone
on board, they can look at something and go,
Actually, that is something we would use, and we
would commercialize and we would take forward.

And so, you know, without somebody who's
going to take it to that next level, all you
have is a really unique science experiment. And
really, there's nothing wrong with those. But
if we do want to commercialize, you need to be
working with the end users. So I think that was
a very important part of the partnership.

The other part is, I mean, you look at the
power plant outside behind us. It was a
$1.4 billion asset. Clearly they are very good
at project management, procurement, you know, everything that it takes together to execute.

And by leveraging their expertise, you know, I mentioned how we were able to come in -- you know, this is a Wyoming thing that we're pretty proud of -- really under budget and ahead of schedule.

And that was -- not saying as the State of Wyoming we need to stand up our own team to do this. We're like, Hey, let's lean on these people that do this every day. And then they executed, you know, as promised.

CHAIRMAN BARRASSO: Dr. Extavour, just a couple things. One, just share -- I got the impression you're very optimistic about what we're doing here. So I was going to ask you to expand on little bit on that, and what commercial break-throughs remain really to be seen here.

And can you discuss the competitive process that was used to select the finalists. I know there are five here, I think there are five also in Canada, and just how that all is working.

A Yes, certainly. I will take the second part first. That way that this -- first thing I'll
say is this. It's important to remember the
purpose of the competition is to try to
accelerate the pace of innovation in this space.

Jason mentioned earlier that, you know, it's
quite complex. It takes something from an idea
through to an industrial technology that can run
at scale safely and effectively for years. Even
shaving a little bit of time off of that, money,
as Jason alluded to earlier, is really helpful
from everyone.

And the next prize is sort of a borderline,
ludicrously extreme version of that. We set an
extremely ambitious goal. Put it out to the
world and say, Who can solve this problem?
We're not sure who, but I bet someone can. And
a cash prize might help drive that.

The call is open to anyone in the world.
We've received dozens of submissions from around
the world. We have an independent panel of
judges, Dr. Krutka would be one of them,
actually.

And they have down-selected by looking at
performance data and evaluating the data that
the team submit down to ten finalists, five as
mentioned testing here, and five at a similar
facility also built around the same time called Alberta Carbon Conversion Technology Center. Key difference being it's fed by a natural gas plant, not a coal plant.

The teams are evaluated in three basic criteria. One, their economics. Does this process look like to become a sustainable business?

Two, environmental sustainability, which really boils down to, are you using more CO2 than you produce? You can make hand sanitizer and produce CO2 in doing it. We're interested in actually reducing CO2 in producing it.

And third, engineering variables. Are you more efficient than your peers or not, which usually boils down to how efficiently, how little energy you can use to execute this process.

My optimism, I would call it data-driven optimism. This is a huge problem, but it's also an opportunity. I will say that there's a market opportunity and also a technology opportunity.

The market opportunity is that, I'll reference a figure here. Independent
not-for-profit called Carbon 180 did a market study. All right. What are all these CO2 materials, what are we talking about, how can we get into these markets.

Just looking at known technologies today and known material markets actually circa 2017, they estimated that the total addressable market is $1 trillion. That's a small number in the context of the global economy. It's a huge number in the context of making stuff out of CO2, which is a still a relatively young industry. So the market is there. I'm optimistic about that.

On the science and technology side, I'm optimistic, like, specifically the ability to produce existing materials in a cheaper and lower-energy way. Lower, lower energy.

And that -- to get into the science, that really has to do with sort of how little energy we can get away with using, but also in producing new materials that aren't quite yet abundant in the marketplace but could be. Things like proteins made of CO2. A bit of a weird concept, but that could be a future.

But also things like carbon fiber, which is
a niche. Expensive material used today, projections show it could be a much broadly cheaper, probably use cheaper material in the future.

The ability to make even a small a fraction of those materials using carbon dioxide emissions is a huge opportunity, which makes me optimistic.

CHAIRMAN BARRASSO: You want to ask more questions?

SENATOR ENZI: Thanks, John. I really appreciate the testimony of all of you again.

One of the things I like about a hearing is usually we can have the opportunity to, even after the hearing is over, we can ask more questions. And I'm an accountant, so I try not to be too technical in my questions. Just put the audience to sleep. I'm not very good at questions anyway.

All right. Jason I'll, start with you.

Because of the pandemic, of course, there's a tremendous constraint on federal government, local government, state government. And one of the things we are discovering, of course, is that if the economy is not there, there's no
money.

But how can we ensure that every dollar that's invested in this carbon capture and research development goes as far as possible?

MR. JASON: Senator, that's a really, really good point. And one of the things that we've really prioritized is these partnerships, you know. You think about the Wyoming Energy Authority coming together. That has members from the School of Energy Resources, the Enhanced Oil Recovery Institute, the business council, those types of things.

You know, what we really want to do is make sure that we're all talking and, you know, sharing. And the worst thing we can do is duplicate what somebody else is working on. So, looking at ways to be as efficient as possible.

And that extends to our relationships, you know, on the national and international level. For example, the organization called the International Carbon Capture Test Center Network. There's 14 facilities globally that are working in this space.

And we share best practices to -- sometimes we share information about, you know, bad actors
that are -- you know, that are trying to, you know, play in the space. And so, you know, no reason to reinvent the wheel if people have already learned those lessons. So there's a huge focus on that.

You know, as an accountant, one of the things that we've been able to do and work with the Department of Energy, is the funding for this facility to build, you know, the bricks and mortar that we have here today, is $15 million from the state of Wyoming, $5 million from Tri-State, and $1 million from NRECA.

Well, that is all non-federal money. So if it's accounted for and applied the right way in the same accounting language that the Department of Energy uses, it can be used as nonfederal cost-share on these projects.

So by tweaking our internal accounting systems, we basically found $21 million to leverage against additional federal opportunities.

So we're really thinking about, okay, this is what we have, given the economic situation federally, you know, in the state and everything else, going back and asking for, you know, $50
million probably isn't in the cards right now. So what can we do to stretch things the best that we can?

And the last area, and along those lines, is I'm kind of a -- it's also kind of a Wyoming thing. You don't need to build a Rolls-Royce when a pickup truck will work. You know, you look at this facility here. It's a modular facility that we were able to procure from, you know, oil services that were kind of moving on. We were able to make it ADA compliant. It meets every standard, but it wasn't a, you know, $20 million, you know, facility that had all the bells and whistles.

Not to say we don't want to get there, but what we want to do is kind of bit by bit, piece by piece, you know. This Company A is leaving behind their steam boiler. Hey, can we for a small fee take it over and just build capacity that way?

So we're really mindful about stretching the dollar the best, the furthest we can.

SENATOR ENZI: Thank you. Dr. Krutka, you mentioned syngas at half the cost. Can you go into a little bit more detail on how that --
what that is, how that works. I'm not a chemist.

DR. KRUTKA: Yeah. Sure. So thank you for the question, Senator Enzi. So syngas, what we -- we can, from coal -- let's see.

We have a thermo-chemical process that is designed to create unique products from coal. Most of the carbon is locked up in the coal, but some of it comes out in the form of CO2.

And so, there's lots of options. So you could do something like what we're talking about, the XPRIZE and use it. Or you could store it. And I want to give a shout out to the head of our CEGR group, Mr. Scott Klonen, over there.

And they are setting -- they the CarbonSAFE project right outside Dry Forks. So you can store it, or we have another potential use for it, which would be combine that CO2 with natural gas. And without getting too into the chemistry, what comes out of that, we have a catalyst that helps facilitate that reaction. And what you get out of that is carbon monoxide and hydrogen.

So it's the hydrogen that would be half the
cost of conventional hydrogen production technologies today. So the way you make them today is with C methane reforming and natural gas.

And so when you get syngas, which again carbon monoxide and hydrogen, you can do all kinds of things. You can make plastics, you can make anything that's made from carbon and hydrogen molecules.

One of the things we could also do is further treat that gas to have -- to separate the hydrogen. Then you have a clean fuel. And again, you can use the CO2, or you can store it, or you can use it for other things. But -- and then you would have hydrogen as a zero-carbon or low-carbon fuel source as well.

SENATOR ENZI: Thank you.

DR. KRUTKA: I'll draw a picture afterwards.

SENATOR ENZI: Ask you more about that then. Recoverable oil there is still in the ground if you want to go after it. Comment on that?

DR. KRUTKA: The amount of oil?

SENATOR ENZI: Yes. The original drilling, as I understand, it gets 20 percent.

DR. KRUTKA: Right. Yes. So, there's a
tremendous amount of work that can be done on
this -- in this area. Even -- you know, you
mentioned that Center of Innovation for Flow
through Porous Media, they are focused on
driving innovation to just squeeze more oil --
understanding the fundamentals, so that they
could squeeze more oil out of conventional and
unconventional reservoirs.

I mean, there's also Enhanced Oil Recovery.
But, there's a number of technologies. But
you're right, they are so -- the vast majority
of oil is left in the ground. And you know, in
a world where there may be less permits coming
out, you really need to -- and less drilling
operations, we need to squeeze every last drop
out of our existing operation.

SENATOR ENZI: Funded without federal
dollars?

DR. KRUTKA: I believe -- I mean they --
yes. The highway research facility was funded
by the State of Wyoming and corporate sponsors.
They do -- I believe they are a Sub ORD on a
federal grant now. But that has nothing to do
with the construction of the facility and the
initial operations.
SENATOR ENZI: Thank you.

Dr. Extavour, I'm glad we're looking at some other uses for carbon. I am reminded of a Dilbert cartoon. Dilbert is given the assignment of eliminating CO2. And he says to the boss: You do know that we won't be able to grow any plants then?

And the boss says: So, we won't eat vegetables.

Well, the next day Dilbert has the machine that will do that. But he warns the boss, he says: Now, the really important part of this is, if you don't turn it off about three days a week, people will die.

And then the next frame you see the janitor going over to this machine saying: Woops, this is unplugged.

So, glad that you're coming up with some valuable resources and encouraging people to come up with innovation. I know that they've challenged people with an XPRIZE to be able to pedal a bicycle across the English Channel. And sure enough, somebody did it. So challenge the American people, is what we need. But I think this XPRIZE competition demonstrates a variety
of applications.

How would you explain to the typical American consumer about the way this research would affect them? The kids in school?

MR. EX: Thank you for that question.

First, I'll say I truly appreciate you bringing Dilbert into the conversation. I prepared for this hearing by reviewing my back catalog of Dilbert cartoons. I think I've actually seen that comic.

It's a funny thing when we talk about energy transition or even using CO2 materials, because in some way, you know, in this place we're privilege to have, for instance, electricity, it's basically on all the time. Sort of surprising if you flip a switch and the light doesn't come on in this part of the world.

When we talk about energy transition, we're sort of talking about replacing the back end without necessarily a lot of disruption for the user.

SENATOR ENZI: I guess what I was going for is more of the products that can be made. We can switch from the polyester that's already out of date to carbon.
DR. EXTAVOUR: Exactly. I think there is huge opportunity here. For some people it will be very inspiring. Just let's say, this polyester shirt was made out of recycled carbon, this one was made out of virgin oil and gas, let's say, that was drilled.

Some people just aren't going to care. They are just, you know, does the shirt fit, does it have the right color, do I like it or not. And that's totally fine.

There are some consumers studies show that will respond well to, Oh, this is a little bit more sustainable, or, Oh, this is made from material right in my home state, or, Oh, I really like that it's made out of CO2 materials. But that's probably a minority of people.

I think the thing that is really going to catch people is what a lot of people that are in the market are trying to do is produce something better. This polyester shirt, to give the example, will last longer, or hold its color better, or be cheaper because it's made of greenstock.

These materials are not really there today. But I think the promise of the opportunity is to
get there. So I think for the average person will be -- or let's say a consumer of a commodity, chemical, cheaper or better or lower CO2 footprint or all three.

SENATOR ENZI: Thank you. I'll turn it back to you.

CHAIRMAN BARRASSO: Holly, you mentioned permits and underground storage of carbon dioxide requires permitting under the federal Safe Drinking Water Act.

Wyoming recently applied for primacy so that we can issue the permits ourselves rather than having to go back to Washington and the U.S. Environmental Protection Agency. With Wyoming's own expertise, the state is expected to process permits I believe in a more efficient way than regulators at the EPA could.

So how important is really timely permitting to the success of some of these underground storage projects?

DR. KRUTKA: Thank you, Mr. Chairman. So while timely permitting is really critical, the priority has to be to ensure that the storage risks are, and the storage projects are conducted safely and securely to minimize
potential risk to human health and the
environment. But we believe that here in
Wyoming we can accomplish both.

It's vital for project developers that
permits are not unduly delayed. Regulators with
the best knowledge of local geology are here.
That means, the Wyoming Department of
Environmental Quality should be able to process
the permits efficiently, while maintaining the
safety and security of CO2 storage, and launch a
widespread CCUS industry.

Time is of the essence for several reasons.
Perhaps most importantly, the clock is running
on the amended section of 45Q tax credits, the
world's first incentive of this type to support
CCUS.

And claiming these credits requires
construction to start before 2024. And we need
rapid deployment of that technology to reduce
the costs associated with the technology and a
phenomenon that's been demonstrated in countless
clean energy technologies before.

So for many, many different reasons,
permitting time is really critical.

CHAIRMAN BARRASSO: Jason, following up with
what she just said about the 45Q tax credits and 
that extension and expansion commercializing 
more carbon projects, how would the USE IT Act 
help complement the 45Q?

MR. BEGGER: Mr. Chairman, you know, in 
order for, I guess, simple economics for any 
project, you need to have a margin. And you 
know, for these early stage technologies, you 
know, that involves two things.

You know, one is, can you increase the 
profitability or bring down the costs? And you 
know, looking at what has happened in the 
renewable sector, you can say that's been a 
great success.

You know, the various tax credits to -- you 
know, to increase the profitability, coupled 
with the research that's been going on, and that 
needs to be -- or, could be replicated here in 
the carbon tax sector where you've got a tax 
credit like 45Q that provides a stable revenue 
stream to get us through these early stages 
where, at the same time, the resources made 
available through the USE IT Act provide some 
research dollars, you know, to try to bring down 
those costs, and hopefully improve the margin.
Can get to the point where, at some point
they are just no longer needed. You know, we've
kicked them out of the nest, so to speak.

CHAIRMAN BARRASSO: Dr. Extavour, the USE IT
Act has a competitive price program, one
spurring more research into direct air capture.

Bill Gates has said he doesn't want to get
to a zero carbon footprint, he wants that
machine, Mike, that you talked about, because he
said he wants to remove from the atmosphere any
carbon dioxide he's put in since Microsoft began
in 1978. I think he's committed, he said he'd
commit $1 billion of his own money to that.

Can you discuss that whole concept and what
you see coming down the line?

DR. EXTAVOUR: Yes, certainly. I think Bill
Gates has it right. Microsoft famously made a
commitment to remove the equivalency of
emissions that company has produced. They are a
software company, so they are not such an
emissions maker.

On the other hand, no other company has made
that commitment, period. And that's just here
in the last few months here.

I think what he's describing is something we
fully agree with at XPRIZE. If you stack up all of our CO2 sources, some of them are easier to curtail than others. And the way this is going to go is, as we curtail emissions is, it's going to -- you know, we should start with the easy stuff. And then it's going to get a little harder, and a little harder, which means a little bit more and more expensive.

At some point we'll cross a threshold where it's cheaper and more effective to keep those sources online, and maybe just build another source that can actually sort of reduce the CO2 emissions.

So, I think what Mr. Gates is thinking about is trying to focus on innovations, specifically the, I'm going to go and get it, and remove past CO2 emissions.

I'll share an analogy, if you don't mind. This is Klaus Lackner's from Arizona State analogy. It's akin to a trash cleanup problem. There's a pile of trash in a public park. Well, first thing you should do is not add more to the pile. That's reducing our existing emissions. Even if you turn your emissions to zero, or greatly reduce them, you still have a trash pile
in the park. Someone is still going to go pick it up. We still have excess CO2 emissions that we're going to want to curtail. We are going to want to reduce what we can today. But going forward, we also may want to actually pull some CO2 emissions back out of the air or the atmosphere.

CHAIRMAN BARRASSO: He points out that the technology that can be developed places like here, could that be used worldwide, India, China, other locations --

DR. EXTAUVOR: Absolutely.

CHAIRMAN BARRASSO: -- that don't have the same commitment that we do here in Wyoming?

DR. EXTAUVOR: There's a tremendous opportunity not just for the State of Wyoming but the broader United States to be the leader in this technology area, and be the nation that can develop it and export it.

We -- we're confident that there will be demand for this technology. We are already seeing some demand expressed by companies like Microsoft and a handful of others.

At XPRIZE we have a competition now for CO2 conversion. Thrilled to be able to have the ITC
as a partner in that. We hope to in the future launch a prize for exactly this, direct air capture and other means of remediating CO2, whether it's from agricultural land management, building a machine that sucks it out of the air, or any other method.

But I think you're exactly on the right track with that, and we support Mr. Gates in that.

CHAIRMAN BARRASSO: Additional questions?

SENATOR ENZI: Well, it's one for Mr. Begger. In your comments you said something about having to go to Norway to scale up. What -- I don't understand that.

MR. JASON: So Senator, right now if you want to test a project of a certain size -- so, in the United States, kind of the typical scale-up -- and I've got a great slide that shows a very small scale of a carbon capture facility in Columbia University. Looks like a pressure cooker.

Then sort of the next scale up is a skid-based system, which you'll see here today. And then the next level, sort of a pilot scale. And then hopefully a commercial scale.
But most utilities need to see something at the 10- to 20-megawatt equivalent to feel comfortable that systems integration and the scale-up actually are a reality.

So when these really small projects, they are a couple kilowatts. And so if you go to the National Carbon Capture Center in Wilsonville, Alabama, which is a DOE-funded facility, about the largest project they can host is about 1.5 megawatts.

So if you’re ready to take that next step to do a 10- or 20-megawatt size project, you either need to do a one-off deal with a power plant -- and that has happened at times, you know. If you're a really well-known developer like, you know, GE or Mitsubishi or somebody like that, you have a lot of institutional reputation where you can call Southern Company or Excel.

But if you're a little developer calling, like, Hey, can I cut a hole in your billion dollar power plant, they are going to tell you to go away.

So, there's a facility in Norway called Mongstad that is -- it's a natural gas facility, but it's -- it's similar to the ITC in ways.
It's a wonderful facility. But it is the only facility of that size globally where you can sort of plug and play those larger technologies.

So we -- over the years, we have had a number of DOE U.S.-based technologies that have had to go to Norway to test simply because they didn't have infrastructure in the U.S.

So we've gotten positive response from Norway -- or, excuse me, from the Department of Energy when they come out here and look at this site, going -- there's someone specifically who has told me, Every time I go to Norway and I'm at -- you know, going out and I have to pay $18 for a cheeseburger, it just boils my blood. Because I know all of these tenants and all of these taxpayer dollars are paying $18 for a cheeseburger. So I can come to Wyoming and, you know, spend $6 for a cheeseburger.

So I think they are really excited to see, you know, how the XPRIZE tenants work. You know, TDA is our first one out here. To sort of see, okay, do these guys have this under control? Are they able to host some of these larger projects with the goal that at some point
they go, Yeah, we're sending all of our DOE stuff to Wyoming and not Norway.

SENATOR ENZI: And Dr. Krutka, I'm happy to see the partnership between the Department of Energy and the University of Wyoming on the CarbonSAFE program, and happy to have a leader in the Chairman Barrasso to the Department of Energy in support of that partnership.

Can you talk about the importance of this kind of research in helping scale-up commercial technology.

DR. KRUTKA: Right. So thank you, Senator Enzi, for that question.

And I think first of all we're very, very proud of the Wyoming CarbonSAFE project. We also have -- we have a great slide showing all the partners in and around the state of Wyoming and beyond that are participating in that project.

Of course, the most important partner is the Department of Energy. Especially for CO2 storage, it is critical that we have these large DOE projects moving forward.

Like I said, there's five around the country. We feel very positive about the
Wyoming CarbonSAFE project for a lot of different reasons. And like I said, one of them is that we have the subsurface knowledge and properties that are going to likely make that successful.

But one of the things that you should know about working with the Department of Energy and doing a true research and development project is that we're able to really study things on a deep level. And we're able to look at a lot of details that need to be understood before we can launch CO2 storage on a large scale, to give the government or regulators the confidence that they can allow this technology before permitting.

The other thing we're trying to do with that project is make a glide path. So as industry picks up that technology and starts to deploy it more commercially, more widespread, you know, we want to make that path easier, especially here in Wyoming where we're focused.

So we're doing things like writing model contracts, right, which you wouldn't do if you were just binding it with a single corporate partner. We're going to be able to support
entities wanting to deploy carbon storage projects in Wyoming in the future as a result of that CarbonSAFE project.

SENATOR ENZI: Thank you. I'm encouraged by hearing. Just add a final comment, I do remember that General Electric was going to do the project in Wyoming several years ago, and they canceled it.

When we got ahold of them to find out why, they said with this de-emphasis, or actually criminalizing coal, who would we ever sell our technology to?

Well, I'm glad that we have this team of people across the United States, across Wyoming, that are trying to de-criminalize coal and show that it is essential to, in a lot of different ways, to our lives. So thank you for your testimony.

CHAIRMAN BARRASSO: Following up, just in terms of ways to store carbon dioxide, research being done with seismic testing that's occurring just a short distance from here, are there specific policies that you would recommend that Congress focus on to advance some large scale carbon storage?
DR. KRUTKA: Yeah. Thank you, Mr. Chairman.

Thank you for all your past support of those policies. So, SER Center for Energy Regulation of Policy Analysis believes that federal policy regarding management of long-term storage and liability of CO2 is vital.

In addition, incentives remain critically important to ensure that CCUS will be widely deployed. From our perspective, R&D funding in commercial deployment incentives go hand in hand to reduce the costs of deploying CCUS now and long into the future.

For example, of course there's the amended 45Q section -- or, section 45Q tax credit. It's vitally important. It's spurred interest so much since it was modified, but it should be extended, especially given the delay with green policing guidance. And again, thank you for your pressure to help get that guidance release.

Fixing other CCUS related incentives, for example, 48A, that would unlock funds that are already authorized by Congress. Of course we've already mentioned the USE IT Act which would help us advance things like direct air capture, but also get CO2 sources to sync. So, from the
producer to the storage location.

    So beyond that, you know, there's a number of policies. I'll say clean energy technologies need more than one incentive to move forward. Fully agree with that, and that's why we're observers of the Carbon Caption Coalition, and members of the Carbon Utilization Research Council. Fully endorse the policies that they've been pushing forward as well.

    CHAIRMAN BARRASSO: Turn to Jason right here. The Dry Fork Station is an example of a site where it's possible to use the storage capture right nearby for carbon dioxide.

    But other sites require pipelines to get from site one to two, to transport it to where it's stored. So how important is a robust carbon dioxide pipeline network in order to really maximize the value of the volume that we can capture and use and store in Wyoming?

    MR. BEGGER: Mr. Chairman, it's going to be critical, you know. In some cases, I've heard people say it's going to be almost equal to the build-out of the existing oil and gas pipeline network.

    You know, maybe the most simple way to think
about it is, we're going to need a new national sort of interstate highway system for CO2 pipelines. You know, it's kind of one of those chicken and egg arguments, where you don't want to build it until you know you have users and producers on one end. But you can't really identify those until somebody has built it.

But, you know, looking at how we're going to build them, what size they should be, where they should be located, are all critically important.

You know, one thing we all recognize in Wyoming, and they are somewhat baffled somewhat that other states don't recognize that, when you look at the land ownership issues in Wyoming, you know, you're not going to throw a baseball across the highway without probably a NEPA analysis.

So what can we do through things like our corridor initiatives, to identify the right places to put these things, the right size that they should be, and where they really need to be going.

So, it's a critical link to all of this that probably isn't discussed nearly enough.

CHAIRMAN BARRASSO: Mike, if you don't have
any other questions, I was just going to ask the
three panelists to see if they had anything
else.

I saw Dr. Extavour making notes and others
have as well. See if there was anything we
didn't ask that they may want to share with us.

DR. EXTAVOUR: Thanks very much for that,
Mr. Chairman. I'll be brief. I just love to
lend my voice of support to the USE IT Act. I
applaud your effort. Thank you very much for
nudging the secretary of the treasury for that
guidance.

To be blunt, it cannot come soon enough. To
give a practical example of I think how 45Q
specifically can impact this space, we are going
to have a look at some sort of early project
developers outside of the ITC.

They are projects that are probably a little
too small to take advantage of the tax credit.
They also probably don't really have a tax
liability to offset. However, what 45Q has done
is entered -- has created a new class of people,
which we need in the sector, which is the
project developers.

They are not necessarily the power stations.
They are not the technology developers. They are the dispassionate people in the middle that say, Okay, I know how to scale up projects. I can combine three technologies and make a large project, and we can do the accounting and that project will benefit from 45Q.

I've got to know some of those folks over the last couple years since 45Q's passage. Unlocking the guidance will unlock their ability to help scale this technology, which is probably a path to scale these types of technologies. Thank you.

DR. KRUTKA: First of all, I just wanted to thank you for having me here today. And it's been an honor to be on a panel with Dr. Extavour and Mr. Boffer. Really appreciate you bringing your attention to the subject.

I guess I'd just follow up on my comment that you had me read again, and just say, you know, we've been very focused on CCUS. It's a critically important technology for Wyoming and beyond.

The thing I'd add is I also think Wyoming has so much potential to be a leader in other energy technologies as well. So, like I
mentioned, coal to products, you know, we have
centuries of reliable, secure coal that is one
of the most affordable, if not the most
affordable, fuel in the world right here. And
we're probably sitting on some right now.

So, I don't want to dismiss that in the
research programs that are trying to find uses
for that, as well as we are working on new types
of power plants. I mean, the sky is the limit.
And I'm just so, so excited to be here.

And I hope that we all continue to see
Wyoming as a leader in research for all
different types of technologies. And thank you
for your time.

MR. BEGGER: Mr. Chairman, again, I really
appreciate the chance to speak with you again in
front of your committee, and would always like
to open the doors to anyone in D.C. and the EPW
to come out here.

I think one of the things that people need
to see is this power plant right behind us,
because this is what a modern new power plant
can look like and does look like.

And at a time when you're seeing rolling
blackouts in California, it's, you know, coal.
There's a role for that. And there's a need for that.

And all the things that we're working on today are ways to ensure that we can still deliver that low-cost reliable power in ways that meet sort of a new societal standard for cleaning -- or, for clean energy.

You know, one of the things as we were building out sort of the, I guess, the business development aspects of the ITC, you know, trying to attract these people in, we started saying, Well, if you're coming in here, you should really talk of SER, tour the power plant and EORI, and all of these things.

One thing we realized after going through all that stuff is that, Wyoming is so perfectly and uniquely suited for a lot of reasons. You know, the world-class facility, the ITC, the only one of its kind in the U.S.

You know, the expertise at the School of Energy Resource, Department of Environmental Quality, you know, the great geology that we have, you know, I mean, that's something that a lot of places can't offer that. You know, a quarter-mile to the south here, we have a
10,000-foot well that looks like it's going to be awesomely suited for long-term geologic storage.

But then also scattered around us are a number of potential fields for enhanced oil recovery or production and those types of things.

But lastly, probably the most important thing, is this license to operate that we have within the state. That means we have political acceptance. You know, we see the folks in the room today in the audience. You know, clearly there's support from our elected officials to make this stuff happen, but also public support.

You know, we've been doing EOR and carbon management for years in the state of Wyoming. So there's that broad public support. And one of the tenants that is hopefully be coming up here, they are from the Bay Area in California.

And he told me, he goes, The one thing that we really like about is, you guys always find a way to get to yes. You know, we couldn't manage trying to permit this in California. We would get a hundred reasons why this won't work, as opposed to you will sit down with you and go,
Okay, here's the Clean Air Act, here's the Safe Water Drinking Act. Here are all the things that we need to do. But here's the glide path to get to yes. If you do these ten things, we can do this right here.

So people are thrilled that, you know, as the state government, we're not throwing up roadblocks. We're trying to help them get there.

So, you know, there's a lot of great things about what's happening in Wyoming. We think we're the perfect place to do that, and just sort of just the tip of the iceberg on what the stuff could look like.

CHAIRMAN BARRASSO: Anything else from your notes?

I'm just so grateful for all of you on the panel and for everyone who's attended. As you know, those that have testified in the past, there may be additional questions, written questions submitted. Been texting with Senator Carper from Delaware, who's the ranking member of the committee, is sorry to not be able to join us today. He had to be in Delaware to help nominate one of his old colleagues from the
Senate last night. So he had to choose.

I said, You missed the boat. You were on national TV, but you could have been in Gillette with us.

He'll come another day to examine and explore and visit and learn. But he's been very interested. And this has been a bipartisan effort, as you know, in the Senate, working together. And these things are coming out of the committee 21 to nothing. And there are conservative members of the committee and we've already seen it.

So there is a unified effort to make this work. We know we need all of the energy, the globe needs all of the energy. We want to make energy as clean as we can, as fast as we can, and new ways that don't raise costs for consumers. And getting back to, Wyoming is the ideal place.

So with that, I want to thank the witnesses, thank everyone else who's joined us, and with that, the hearing is adjourned.

(The proceeding concluded at 11:18 a.m.)
CERTIFICATE

I, Jacqueline K. Weller, Registered Professional Reporter, do hereby assert that said proceedings were taken by me stenographically and thereafter reduced to typewriting under my supervision; that the foregoing transcript is a true and accurate record of the proceeding to the best of my understanding and ability and conditions of the hearing.

Dated this 3rd day of September, 2020.

/s/ Jacqueline K. Weller
Registered Professional Reporter