S. HRG. 116–327

PENDING LEGISLATION

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDRED SIXTEENTH CONGRESS

FIRST SESSION

ON

S. 143
S. 983
S. 1064
S. 1183
S. 1593
S. 1602
S. 1685
S. 1741
S. 1857
S. 2048
H.R. 1138

JULY 9, 2019

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

Available via the World Wide Web: http://www.govinfo.gov

U.S. GOVERNMENT PUBLISHING OFFICE

37–809 WASHINGTON : 2021

COMMITTEE ON ENERGY AND NATURAL RESOURCES

LISA MURKOWSKI, Alaska, *Chairman*

JOHN BARRASSO, Wyoming
JAMES E. RISCH, Idaho
MIKE LEE, Utah
STEVE DAINES, Montana
BILL CASSIDY, Louisiana
CORY GARDNER, Colorado
CINDY HYDE-SMITH, Mississippi
MARTHA MCSALLY, Arizona
LAMAR ALEXANDER, Tennessee
JOHN HOEVEN, North Dakota
JOE MANCHIN III, West Virginia
RON WYDEN, Oregon
MARIA CANTWELL, Washington
BERNARD SANDERS, Vermont
DEBBIE STABENOW, Michigan
MARTIN HEINRICH, New Mexico
MAZIE K. HIRONO, Hawaii
ANGUS S. KING, JR., Maine
CATHERINE CORTEZ MASTO, Nevada

SUBCOMMITTEE ON ENERGY

BILL CASSIDY, *Chairman*

JAMES E. RISCH
MIKE LEE
STEVE DAINES
CORY GARDNER
CINDY HYDE-SMITH
MARTHA MCSALLY
LAMAR ALEXANDER
JOHN HOEVEN
MARTIN HEINRICH
RON WYDEN
MARIA CANTWELL
BERNARD SANDERS
DEBBIE STABENOW
MAZIE K. HIRONO
ANGUS S. KING, JR.
CATHERINE CORTEZ MASTO

BRIAN HUGHES, *Staff Director*
KELLIE DONNELLY, *Chief Counsel*
BRIANNE MILLER, *Senior Professional Staff Member and Energy Policy Advisor*
SARAH VENUTO, *Democratic Staff Director*
SAM E. FOWLER, *Democratic Chief Counsel*
RENAE BLACK, *Democratic General Counsel*

CONTENTS

OPENING STATEMENTS

WITNESSES

ALPHABETICAL LISTING AND APPENDIX MATERIAL SUBMITTED

The text for each of the bills which were addressed in this hearing can be found on the committee's website at: https://www.energy.senate.gov/hearings/2019/7/subcommittee-on-energy-legislative-hearing.

PENDING LEGISLATION

TUESDAY, JULY 9, 2019

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

The Subcommittee met, pursuant to notice, at 10:00 a.m. in Room SD–366, Dirksen Senate Office Building, Hon. Bill Cassidy, presiding.

OPENING STATEMENT OF HON. BILL CASSIDY, U.S. SENATOR FROM LOUISIANA

Senator CASSIDY [presiding]. The hearing shall come to order.

Good morning. Today the Committee comes together for a legislative hearing on several bills. I appreciate the opportunity to work with Senator Heinrich, the Subcommittee Ranking Member, to address key issues in our energy portfolio.

This hearing will allow us to receive testimony and ask questions from the Assistant Secretary for the Office of Electricity, Mr. Bruce Walker, and the Deputy Assistant Secretary for Oil and Gas from the Office of Fossil Fuel, Mr. Shawn Bennett.

The Department of Energy (DOE) will play a critical role in helping the U.S. and the world lower emissions which is, of course, a global problem. If we want to be leaders, we need to provide a model that others can follow and part of that model is showing the world that, through innovation, we can lower emissions and maintain a modern economy.

Through technological breakthroughs, such as carbon capture and energy storage, we have the opportunity to show such a model. However, if we are to reach these breakthroughs, we must ensure that right policies are in place to set up success. There has been promising breakthroughs in each area, and I hope we can continue to build.

One of the bills on the docket I have been working on with my colleague, Senator Cornyn, is S. 1685, the Launching Energy Advancement and Development through Innovations for Natural Gas Act, or the LEADING Act. This bill requires the U.S. Department of Energy to establish a research, development and demonstration program for carbon capture technologies for use by natural gas generating power facilities.

I want to acknowledge the hard work that DOE is already doing to develop such technology for both coal and natural gas, but as we continue to increase natural gas consumption, new challenges arise and we must keep natural gas competitive.

The U.S. is leading the world in lowering emissions by increasing its use of natural gas and other innovative resources. Natural gas is now the main source of energy in the U.S., generating 35.1 percent of our electricity in 2018, and the U.S. Energy Information Administration expects this number to continue to rise for the foreseeable future as more gas comes online.

Natural gas emits 50 to 60 percent less carbon dioxide when combusted in natural gas power plants compared with other sources. It also supports the deployment of renewable energy. Gas power plants can quickly and safely ramp up and down to combat the volatility of renewables.

According to the National Bureau of Economic Research, a one percent increase in the share of fast reacting power source is associated with almost a 0.9 percent long-term increase in renewable generation. Investment in gas is able and necessary to support increased use of renewables.

Developing cost-effective carbon capture technology for natural gas plants will help the U.S. continue to lower emissions while creating jobs and supporting domestic energy production and security.

Other bills on today's docket include several energy storage bills that would each authorize funding to encourage energy storage, research development and demonstration.

S. 143, the Department of Energy's Veterans' Health Initiative Act, introduced by Senator Ernst, authorizes DOE to conduct collaborative research with the Department of Veterans Affairs to improve health care services for veterans in the U.S.

S. 983, the Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act of 2019, introduced by Senator Coons, reauthorizes and modernizes the DOE's Weatherization Assistance Program.

S. 1857, the Federal Energy and Water Management Performance Act of 2019, introduced by Chairman Murkowski, improves federal energy and water performance requirements and formally authorizes the Federal Energy Management Program.

S. 1064, the Appalachian Energy for National Security Act, introduced by Ranking Member Manchin, requires DOE, in consultation with the Departments of Defense and Treasury, to conduct a study and issue a report on the national security benefits of the proposed ethane storage and distribution hub located in Appalachia.

Lastly, H.R. 1138, introduced by Representative Reed, would reauthorize the West Valley Demonstration Project in West Valley, New York.

Now I will turn to my colleague, Ranking Member Heinrich.

Senator HEINRICH. Actually, Chairman, while we have our colleague from Maine, why don't we let her give her testimony and then I will come back and give my opening statement so that she can move on, if she would like?

Senator CASSIDY. I was halfway through my opening statement thinking what in the heck? Why didn't I allow Senator Collins to go first? So, I apologize.

Please, Senator Collins, and thank you.

STATEMENT OF HON. SUSAN COLLINS,
U.S. SENATOR FROM MAINE

Senator COLLINS. Thank you very much. That's very gracious of both of you.

Good morning, Chairman Cassidy and Ranking Member Heinrich. I want to begin by thanking you for holding this hearing to examine new energy proposals that have been referred to your Subcommittee.

I appreciate the opportunity to testify on the Better Energy Storage Technology Act, or BEST Act, that I've sponsored with the distinguished Subcommittee Ranking Member, Senator Heinrich. I would also like to thank Senators Gardner, Smith, McSally, Coons and King, who have joined us as original co-sponsors.

Energy storage systems provide a wide range of benefits, including improving the reliability of our grid, decreasing energy costs and allowing the increased use of our renewable resources. Developing these new technologies is critical.

Our bipartisan legislation will support the next generation of energy storage technologies at the Department of Energy. Energy storage technology holds such great promise in the fight against climate change. Advancing next generation energy storage technology will allow us to integrate more renewables such as wind and solar which, in turn, will help to reduce emissions. Solutions to the challenges posed by energy storage are, in fact, key to expanding our reliance on renewable sources of energy.

Specifically, our bill would support energy storage research on highly flexible, longer duration and seasonal storage systems. Those are the three areas that the bill specifically concentrates on. Second, it would authorize up to five demonstration projects. Third, it would direct the Department of Energy to establish a strategic plan and allow the Department to develop cost targets. We've seen what the Department can do working with the private sector. For example, the great success the Department had in working with the private sector in lowering the cost of solar technology. Another provision of the bill would support coordination of research across government—so the left hand knows what the right is doing. And finally, the bill would authorize $60 million annually for five years. The BEST Act would help advance energy storage technologies to improve the efficiency of the nation's electricity grid while helping to promote wider use of clean, renewable energy.

I want to thank you again for holding this hearing. Let me just end by saying that I think the energy storage bills are so important and exciting. They really represent the new frontier.

I hope that this Subcommittee will favorably report the BEST Act.

Thank you very much, Mr. Chairman, Ranking Member, my colleagues.

Senator CASSIDY. Thank you, Senator Collins.

Senator COLLINS. Thank you.

Senator CASSIDY. Senator Heinrich.

STATEMENT OF HON. MARTIN HEINRICH, U.S. SENATOR FROM NEW MEXICO

Senator HEINRICH. First, I want to thank Chairman Cassidy for calling this hearing today, our first hearing together as Chairman and Ranking Member of the Energy Subcommittee. And I certainly want to thank our witnesses today.

The Energy and Natural Resources Committee really hit the ground running this Congress with an excellent package of public lands legislation. I was very pleased to see that legislation get to the President's desk in March, but it left a number of really good energy bills behind. And today we begin consideration of important energy legislation with 11 bills, almost all of which are bipartisan. The list of bills on today's agenda could have been, literally, twice as long, so I hope the Subcommittee will continue to process legislation with additional hearings and a markup in the full Committee.

We should be able to assemble, fairly quickly, one or even more packages of energy legislation that can be marked up in the Committee with bipartisan support. I certainly look forward to working with the Chairman, Ranking Member Manchin and our colleagues on the full Committee to pass important energy legislation.

Today's hearing will address several important energy issues including energy efficiency, energy storage, artificial intelligence, and carbon capture.

Energy technologies are one of the critical tools we need to address climate change and what many of us believe has become a climate crisis. We need to get additional low-carbon energy technologies ready for commercialization, and then we need to get them deployed.

Energy storage is clearly a major topic of interest for members judging by the five bills before us today. I am pleased to be a cosponsor on several of these bills.

Expanded use of energy storage, especially long-term storage, is the key to modernizing the grid and the near-term transition to a clean energy economy. There is widespread support in Congress for a robust R&D program on energy storage, including long-term storage, and I look forward to working with my colleagues to move legislation forward.

Although the President's FY 2020 overall request for energy R&D is wholly inadequate, the Administration has acknowledged energy storage as an important area for investment. And I want to hear more about the Department of Energy's plans today.

Again, I want to thank the Chairman for calling today's hearing and I look forward to hearing from our witnesses and working to pass a number of these bills.

Before I give up the mic, I just want to ask unanimous consent to add a number of letters articulating support for a number of the bills on the docket today to be added to the record.

Senator CASSIDY. Without objection.

[Letters of support follow:]

July 8, 2019

The Honorable Lisa Murkowski
Chairwoman
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

The Honorable Joe Manchin
Ranking Member
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Re: Support for S. 1857, the Federal Energy and Water Management Performance Act of 2019

Dear Chairman Murkowski and Ranking Member Manchin:

We the undersigned represent a coalition of business and energy and water efficiency leaders who work together to improve U.S. energy productivity to achieve economic growth, a cleaner environment, and greater energy security, affordability, and reliability. We write today in support of **S. 1857, the Federal Energy and Water Management Performance Act of 2019**. This bipartisan legislation would authorize the Federal Energy Management Program (FEMP) and re-establish federal leadership by setting forward-looking targets to reduce the energy and water wasted within the federal government.

The federal government is the largest energy consumer in the nation, spending $6 billion annually to power its buildings alone.[1] With more than 350,000 buildings in the federal portfolio, the U.S. has an unparalleled opportunity to cut costs, reduce energy and water wastage, and decrease the greenhouse gas emissions resulting from inefficient energy and water use in outdated buildings. The Department of Energy (DOE) has identified energy conservation measures within these buildings that could trim nearly $800 million from its utility bill, by saving more than 34 trillion British thermal units (BTUs) of energy, 10 billion gallons of water, and 7.1 million tons of carbon dioxide equivalent each year.[2] The energy savings alone represent greater than 10% of the total energy consumption of federal buildings, which consumed 347 trillion BTUs in Fiscal Year (FY) 2017.[3]

FEMP has made significant contributions to reducing the energy footprint of nearly every federal agency, through assistance with energy benchmarking and tracking programs, procurement of energy-efficient appliances and equipment, sharing best practices, providing technical assistance, and enhancing cross-agency collaboration. FEMP also assists agencies entering into performance contracts, which provide a critical funding mechanism through public-private partnerships that install modern equipment and guarantee performance and energy savings at no upfront costs to the U.S. taxpayer. Since 1975, the federal government has nearly halved the energy intensity of its buildings, and energy management targets and the programs within FEMP played no small role in this achievement.[4] But the U.S. can do more, and the federal government must continue to lead by example.

---

[1] Department of Energy (DOE). Annual Report to Congress, Fiscal Year 2015. November 30, 2017. Available at: https://www.energy.gov/sites/prod/files/2018/01/f46/fy15_annual_report.pdf
[2] DOE. FEMP EISA 432 Compliance Tracking System. Data as of June 18, 2019. Available at: https://ctsedwweb.ee.doe.gov/CTSDataAnalysis/Reports/PublicAgencyReport_ComprehensiveEvaluationFindings.aspx
[3] DOE. Comprehensive Annual Energy Data and Sustainability Performance. Federal Government Energy and Water Use in 2017. Available at: https://ctsedwweb.ee.doe.gov/Annual/Report/Report.aspx
[4] DOE. Office of Energy Efficiency and Renewable Energy (EERE). About the Federal Energy Management Program. Available at: https://www.energy.gov/eere/femp/about-federal-energy-management-program

Letter of Support for S. 1857, the Federal Energy and Water Management Performance Act of 2019
July 8, 2019

Buildings are where people and commerce meet, creating a demand for 40% of the energy – including 75% of the electricity -- consumed in the United States. Existing buildings are responsible for up to 80% of peak demand, and therefore are vital to achieving any decarbonization strategy, yet the Energy Information Administration predicts that demand will grow.[5,6] Formally authorizing FEMP is critical to DOE's continued success at assisting agencies with their missions while also enabling progress toward energy security, reliability, resilience, and affordability goals. By modernizing our nation's federal buildings, grid operators can bridge the meter to gain real-time demand-side resources to provide ancillary support and avoid costly generation and transmission.

S. 1857 also gives critical recognition to the inextricable link between the water we use and energy consumption—i.e., the energy-water nexus. Significant amounts of energy are used daily to pump, treat, and distribute that water across a vast network of aging, leaking underground infrastructure, but there is an enormous information gap that constrains efforts to address the inefficiencies in this area. Setting forward-looking water and energy use intensity targets and understanding how we manage both at the federal level will create synergistic gains that simply are not achievable by addressing either in isolation. S. 1857 would encourage federal agencies to develop and share best practices and case studies among other partners, to better inform energy managers, utilities, energy service companies, and governmental entities to find even greater successes.

As innovative solutions emerge from DOE research, development, demonstration, and deployment programs, such as those within the Office of Energy Efficiency and Renewable Energy's (EERE's) Building Technologies Office, FEMP can help agencies achieve even greater gains.[7] FEMP can further assist with breaking down silos that currently exist by facilitating comprehensive systems-level planning practices that would enable greater opportunity for efficiency improvements.[8] For instance, collaboration across a range of public and private stakeholders, including architects, engineers, designers, developers, and building operators, would leverage greater resilience and energy and water savings opportunities across building systems while increasing occupant comfort and productivity.

We look forward to working with you and your colleagues to provide more assistance to identify specific information and research gaps that may warrant further Congressional direction and guidance. And we are ready to assist you and your staff by identifying further legislative measures, including ways to further strengthen the bill, that would improve the nation's energy productivity by maximizing opportunities within this critical energy-water nexus. Thank you for your continued support for energy efficiency and commitment to federal leadership in energy and water conservation. We know that through federal leadership, we can achieve the necessary policies to maximize energy efficiency in both the water and power sectors.

Thank you for your consideration,

Acuity Brands
Air-Conditioning, Heating, & Refrigeration Institute (AHRI)

---

[5] DOE. Office of Energy Efficiency and Renewable Energy (EERE). *Grid-interactive Efficient Buildings: Overview*. April 2019. Available at: https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf
[6] Energy Information Administration. Annual Energy Outlook 2019. January 24, 2019. Available at: https://www.eia.gov/outlooks/aeo/pdf/aeo2019.pdf
[7] DOE. Request for Information (RFI). DE-FOA-0002070: Efficient and Flexible Building Loads. January 28, 2019. Available at: https://eere-exchange.energy.gov/FileContent.aspx?FileID=efb3f9f5-dfa5-4772-954f-419e73504bc1
[8] Alliance to Save Energy. *Going Beyond Zero: A Systems Efficiency Blueprint for Building Energy Optimization and Resilience*. May 2017. Available at: https://ase.org/sites/ase.org/files/ase-sei_going_beyond_zero-digital-vf050317.pdf

Letter of Support for S. 1857, the Federal Energy and Water Management Performance Act of 2019
July 8, 2019

Alliance to Save Energy
American Institute of Architects (AIA)
ASHRAE
Copper Development Association
Covestro, LLC
Danfoss
DuPont de Nemours, Inc.
Ingersoll Rand
Intel
Illuminating Engineering Society
Johnson Controls
Knauf Insulation
Legrand
Natural Resources Defense Council (NRDC)
National Electrical Manufacturers Association
Signify
Siemens

Cc: The Honorable Bill Cassidy
The Honorable Martin Heinrich
The Honorable Rob Portman
The Honorable Jeanne Shaheen
The Honorable Cory Gardner
The Honorable Mazie Hirono

May 22, 2019

The Honorable Lisa Murkowski
Chair
Committee on Energy & Natural Resources
304 Dirksen Senate Office Building
Washington, D.C. 20510

The Honorable Joe Manchin
Ranking Member
Committee on Energy & Natural Resources
304 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Chairman Murkowski and Ranking Member Manchin,

Our organizations endorse the bipartisan Promoting Grid Storage Act, which was introduced today by Senators Tina Smith and Susan Collins and is co-sponsored by a bipartisan group of senators. Energy storage is a powerful tool for grid operators to enhance electric system resilience, lower energy costs, manage load, and adapt to a changing power supply mix. Nonetheless, the unique attributes of energy storage technologies present a learning curve for grid operators, with technical and financial hurdles that can serve as a barrier to their optimal use.

The Promoting Grid Storage Act would address these challenges by authorizing the Department of Energy to support states, investor-owned electric utilities, public power utilities, and electric cooperatives to incorporate storage into long-term planning and grid operations. By prioritizing assistance to electric utilities who have yet to deploy energy storage technologies, this bill will target particularly smaller utilities that need the most assistance. Moreover, greater collaboration between federal, state, and local energy officials will help ensure we have flexible and resilient grid operations suited to meeting 21st century demands.

As your committees consider legislation to enhance U.S. energy infrastructure, we respectfully request that you include the Promoting Grid Storage Act in your discussions and support its passage into law.

Sincerely,

American Public Power Association (APPA)
Energy Storage Association (ESA)
National Rural Electric Cooperative Association (NRECA)

NRECA
America's Electric Cooperatives

April 26, 2019

The Honorable Amy Klobuchar
425 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Jerry Moran
521 Dirksen Senate Office Building
Washington, DC 20510

Dear Senators Klobuchar and Moran:

I write in support of S. 1183, the Expanding Access to Sustainable Energy Act of 2019 (the EASE Act). Thank you for introducing this important legislation to spur development of energy storage projects in rural America.

The EASE Act builds upon the success of the SUNDA project, a collaboration between the U.S. Department of Energy, the National Rural Electric Cooperative Association, and 17 co-ops, which dramatically accelerated solar deployment in rural America. In fact, co-op solar increased ten-fold from 2013 to 2018.

Under the EASE Act, rural electric cooperatives will be eligible to receive grants to identify, evaluate and design energy storage (and microgrid) projects. These grants may fund feasibility studies, detailed engineering of projects, and integration planning. Co-ops will also receive technical assistance from DOE and experts in the field. In exchange, participating co-ops will spread the message to other co-ops, showcasing how these projects were implemented, how barriers were overcome and what potential cost savings were achieved.

While many electric cooperatives have deployed some energy storage, there are still financial, technical and logistical hurdles to its expansion. These grants will help co-ops experiment with the technologies and create workable business models.

Energy storage can help overcome difficult technical problems caused by fast fluctuation of energy delivered to the grid from renewable sources. It is particularly useful in rural America as remote communities sometimes have difficulty receiving power through an overloaded transmission system. Successfully implementing these technologies may allow co-ops to purchase power at non-peak times at a considerable reduction in cost and have the power available for their communities

at peak time. Thank you both for spearheading this effort and I strongly urge the U.S. Senate to pass the EASE Act swiftly.

Sincerely,

Jim Matheson
Chief Executive Officer
National Rural Electric Cooperative Association

cc: The Honorable Lisa Murkowski
The Honorable Joe Manchin

NASCSP | NATIONAL ASSOCIATION FOR STATE COMMUNITY SERVICES PROGRAMS

Office of Senator Chris Coons
218 Russell Senate Office Building
Washington, DC 20510

Dear Senator Chris Coons,

We write to express our support for S.983, the Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act. This legislation would reauthorize the Weatherization Assistance Program (WAP) through 2024.

NASCSP is the member organization representing the weatherization grantees in all 50 States, DC, and the US Territories on issues related to the WAP. Since the program's inception just over 40 years ago, WAP grantees have weatherized over 7.4 million homes, lowering energy bills and allowing families to afford other essentials like food, education, and healthcare. WAP not only makes our nation's housing stock more energy efficient, but it also supports thousands of jobs and small businesses in our local communities.

S.983 makes several adjustments to strengthen and modernize the WAP, ensuring that low-income Americans have access to the latest energy savings techniques and technologies. NASCSP supports passage of S.983 and its House counterpart H.R. 2041; these bills reauthorize a program with a proven record of saving families money on energy, while making homes healthier, safer, and more comfortable. We thank the Senate Energy committee for its support of WAP over the years and for its careful consideration of this bill. We are happy to respond to any questions.

Sincerely,

Jenae Bjelland
Executive Director
National Association for State Community Services Programs (NASCSP)

NASEO
National Association of State Energy Officials

1300 North 17th Street
Suite 1275
Arlington, Virginia 22209
Telephone: 703.299.8800
www.naseo.org

July 8, 2019

The Honorable Chris Coons
218 Russell Senate Office Building
Washington, D.C. 20510

Re: S. 983 – Weatherization Assistance Program Reauthorization

Dear Senator Coons:

On behalf of the National Association of State Energy Officials (NASEO), we are writing to you in strong support of S. 983 reauthorizing and strengthening the U.S. Weatherization Assistance Program (WAP).

NASEO represents the state energy directors in the 56 states, territories and the District of Columbia. We have worked with your staff for eight years on this important, bipartisan legislation. Coupled with the reauthorization of the U.S. State Energy Program (SEP), S. 983 can advance our national energy policy and dramatically improve the lives of all Americans, especially low-income Americans, veterans, and those living on fixed incomes.

You have worked tirelessly to advance S. 983, and we are pleased that it has been introduced on a bipartisan basis. It will modernize a successful program and help even more Americans, while including a new innovation program.

NASEO strongly supports the early passage of S. 983 and the House counterpart introduced by Representative Tonko.

We are happy to respond to any questions.

Best regards,

David Terry
NASEO Executive Director

cc: State and Territory Energy Directors

National Community Action Foundation
Connecting Communities to Washington Since 1981

July 8, 2019

RE: Support for S. 983 regarding Low-Income Weatherization Assistance

Dear Chairman Murkowski and Ranking Member Manchin,

The National Community Action Foundation (NCAF) represents the local nonprofit organizations that deliver the weatherization services in low-income homes and create partnerships with utility and local energy efficiency programs. Collectively, they have attracted more than $300 million annually that is not from federal sources to combine with WAP.

Eighty percent of these skilled local organizations are Community Action agencies and the rest are their community -based partners.

We are pleased to support S. 983 which reauthorizes the weatherization Assistance Program and contains several changes that are necessary to ensure the program continues to be effective in the context of twenty-first century technology and energy markets.

On behalf of NCAF, I look forward to working with the Committee as this legislation advances. Thank you for acting on this important and effective program that makes energy more affordable.

Sincerely,

David Bradley

CEO

CC Hon Chris Coons

Attn: Leah Rubin Shen

National Community Action Foundation

400 N. Capitol Street G80 Washington, D.C. 20001

Phone: (202) 842-2092 Fax: (202) 842-2095 Email: info@ncaf.org

Senator CASSIDY. Senator Klobuchar.

STATEMENT OF HON. AMY KLOBUCHAR,
U.S. SENATOR FROM MINNESOTA

Senator KLOBUCHAR. Thank you very much.

Thank you, Chairman Cassidy and Ranking Member Heinrich and all the members of this Committee. It's an honor to be here. And thank you for holding this important hearing to examine legislation relating to energy storage, grid improvements and energy production.

We all know the important moment we are at in history. And what I have seen in the rural areas of my State and across the country is that there is more and more interest in how we move forward to cleaner energy and to a clean energy grid. Some of this is, of course, obvious with the flooding we're seeing in the Heartland, and the wildfires. Some of it is simply homeowners insurance going up, but people are starting to say to themselves, let's see what we can do to be part of this.

And I appreciate this opportunity to discuss a bill that I've introduced with Senator Moran, the Expanding Access to Sustainable Energy Act.

What our bill would do is help rural communities and rural electric co-ops overcome barriers to renewable energy storage and grid improvements by providing access to needed resources and expertise.

We all know from so many of you from states that have significant rural areas that it is not one-size-fits-all when it comes to electric companies. And I've spent a lot of time out at the electric co-ops in my State, including going up in a bucket and doing other various interesting things. One of the things that I've learned is they want to be a part of this and they want to figure out how they financially can be a part of it.

One of my favorite examples was the Steele-Waseca Electric Co-op in Minnesota. Once some incentives were put in place for solar, they actually wanted to figure out how to get their customers to buy a solar panel, not for their own homes, but for an area right outside their co-op. So they came up with an idea that they would give a free large capacity water heater, which aren't that expensive, which have been found to actually be smart for large farmhouses.

And it was a bill actually Senator Hoeven and I had worked on when they were going to be phased out. So they ended up doing that, and it was astounding the hundreds of people in their small co-op that bought these solar panels because they were able to price it out for them. And in exchange they got a free large capacity water heater for their basement. So when I saw that, I thought, well, we have to do more to incentivize these small co-ops.

This bill is co-sponsored by our colleagues, Senator Gardner and Senator King, both members of this Committee, and it empowers rural communities and electric co-ops to develop their own energy storage and grid improvement projects. By providing technical assistance and grant support, the bill provides opportunities for these communities to invest in improvement. The bill builds upon the success of the Department of Energy's Sunday program, which led

to a dramatic increase in adoption of solar energy by rural electric co-ops, such as the one I just mentioned, from 2013 to 2018.

The recognized need to improve energy grid capacity and resiliency, as well as the unpredictability of a day with solar and wind power has fueled interest, of course, in energy storage as a way to meet electricity demand during peak times.

While tax incentives have helped spur development of renewable energy projects, these incentives do not address the most significant barriers to exploration and establishment of new renewable energy projects, including storage projects in rural communities where help is needed in planning, implementing, and maintaining these projects. Our bill would address these barriers head-on.

I believe that extending expertise and support to rural communities and rural electric co-ops will improve rural community energy resiliency and autonomy, spur economic activity, and improve environmental and public health.

So thank you so much for allowing me to testify in support of this bill. It is my hope that you will all support our bipartisan effort.

Thank you very much.

Senator CASSIDY. Thank you, Senator Klobuchar.

And now, could we have Mr. Walker and Mr. Bennett move to the witness table?

[Witnesses come up and take their seats.]

Senator CASSIDY. Mr. Walker, whenever you are ready.

STATEMENT OF HON. BRUCE J. WALKER, ASSISTANT SECRETARY, OFFICE OF ELECTRICITY, U.S. DEPARTMENT OF ENERGY

Mr. WALKER. Thank you, Chairman.

Chairman Cassidy, Ranking Member Heinrich and members of the Subcommittee, thank you for the opportunity to testify regarding these important pieces of legislation.

First, I would like to thank the members of the Senate Energy and Natural Resources Committee for your advocacy resulting in the confirmation of Mr. Genatowski, our Director of ARPA-E.

Today's hearing addresses many areas including advancing utilizing artificial intelligence (AI) and relational computational capabilities for complex problems including our veterans' health, optimizing the way we utilize fossil fuels, especially natural gas given its importance in electric generation, providing federal leadership in energy and water conservation and ensuring energy efficiency, health and safety investments for low income citizens, and finally grid-scale electric energy storage. Each of these are, indeed, crucial factors in advancing energy resilience and our economic and national security.

The Department is grateful for the Committee's attention to these critical issues in the energy sector. We believe that our research and development capabilities consistently demonstrated by our national labs is unrivaled and provide unique opportunities to address key challenges working with industry and academia.

Specifically, the bills associated with electric energy storage technology are timely impression. Grid-scale electric energy storage is disruptive and has the opportunity to revolutionize the energy in-

dustry. Having spent my career in the electric industry managing grid operations, I know this firsthand.

By comparison, the significant changes that have been realized in the energy industry over the last two years will pale in comparison to the remarkable changes and improvements that will be realized through ubiquitous grid-scale electric energy storage and the related smaller storage technologies that will evolve as a result.

Similar to the computer industry where we witnessed the transition from centralized mainframes to highly capable networked personal computers, here too, with grid-scale electric energy storage, we shall witness the transition from a consolidated grid to a disaggregated, more secure, more robust and more flexible energy grid.

The Department, specifically, the Office of Electricity, is focused on advancing grid-scale electric energy storage to address resilience on the bulk power system, including our defense critical electric infrastructure.

Keenly aware of the threats posed by physical and cyberattacks, as well as natural disaster, the Office of Electricity is working with other DOE Departments developing new tools and technologies to accelerate electric energy storage developments through the Grid Modernization Initiative, the Advanced Energy Storage Initiative and the Grid Storage Launchpad.

The Office of Electricity proposed Grid Storage Launchpad at Pacific Northwest National Lab will focus on expanding or extending U.S. R&D grid-scale electric energy storage leadership by validating new technologies and earlier readiness levels and by accelerating new technologies in partnership with industry and academia. The $5 million requested in FY20 will fund that design and lead to the construction in subsequent years.

Finally, it is important to highlight that without this Committee's insistence, advancing critical technologies such as AI, advanced data analytics, grid-scale electric energy storage, and carbon capture, utilization and sequestration, would simply not be possible.

And before I close, the Secretary specifically asked me to convey his thoughts regarding Senate bill 143, DOE's Veterans' Health Initiative Act. "The health of our nation's veterans is one of utmost importance to the Trump Administration, especially the U.S. Department of Energy. Using the power of the world's fastest supercomputers housed at our national laboratories, DOE is uniquely positioned to improve the diagnosis of and treatment for the most perplexing diseases our war fighters disproportionately suffer from. DOE fueled advancements in artificial intelligence and machine learning are helping researchers identify and neurologists treat traumatic brain injuries and other mental health conditions paving the way for better outcomes and a better future for our nation's war fighters.

"Specifically, the DOE's Veterans' Health Initiative Act authorizes DOE, in partnership and coordination with the Department of Veterans Affairs, to analyze the world's richest medical dataset with the world's most powerful computers to transform data into knowledge. This bill is strongly aligned with the Administration's stated research and development budget priorities that include the

American leadership in artificial intelligence, maximizing interagency coordination and a workforce for the 21st century economy.

"All Americans have an obligation to do everything in our power to ensure that those who have worn the uniform get the best care our country has to offer. It is my highest priority to apply DOE's world leading computational capabilities to research and the development of new ways to improve and positively impact their lives." Secretary Rick Perry.

Thank you and I look forward to the discussion today.

[The prepared statement of Mr. Walker follows:]

Testimony of the Honorable Bruce J. Walker
Assistant Secretary, Office of Electricity
U.S. Department of Energy
Before the
U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy

July 9, 2019

INTRODUCTION

Chairman Cassidy, Ranking Member Heinrich, and Members of the Subcommittee, it is an honor and a privilege to serve at the Department of Energy (DOE or the Department), as Assistant Secretary for the Office of Electricity. DOE is charged with, among other important responsibilities, providing our Nation with premier energy research and development (R&D) activities. The work being conducted by DOE is setting the course for various advancements in the energy field and beyond. Issues like energy storage, improving energy efficiency, creating breakthroughs in how we extract and utilize our Nation's fossil fuels, and Artificial Intelligence are just some of the important areas of DOE research. These are also the topics being covered at today's hearing.

Thank you for the opportunity to testify today on behalf of the Department regarding these various pieces of legislation. The Administration continues to review all eleven of these bills. Below are some highlights and perspectives regarding the legislation being discussed today.

ENERGY STORAGE

DOE applauds Congress in recognizing that energy storage is a technology of national interest and the backbone of a future resilient energy system. With benefits extending to transportation, the power grid, and throughout the economy, DOE has been proactive in developing new tools and technologies to accelerate energy storage development, such as through the Grid Modernization Initiative (GMI), the Advanced Energy Storage Initiative (AESI), and the Grid Storage Launchpad (GSL).

In May of this year, DOE issued its most recent Grid Modernization Lab Call, with Energy Storage and System Flexibility as one of the major topic areas. The lab call placed a particular emphasis on developing the storage functions that enhance system resilience and flexibility.

The proposed GSL will extend U.S. R&D leadership in energy storage through validation, collaboration, and acceleration. By validating new technologies at earlier maturity stages, the GSL will lower the time and expense of storage chemistry innovations. Through collaboration with universities and the commercial sector, the GSL will augment the industry with enhanced testing protocols and in-operando characterization capabilities. Finally the GSL will accelerate and de-risk new technologies by propagating rigorous grid performance requirements to all stages of storage development, from benchtop to systems.

DOE established the Mission Need for the GSL at Critical Decision 0 (CD-0) in November of 2018. We anticipate finalizing the preferred alternative facility and cost range as part of CD-1 this summer. The FY 2020 Budget requested funds for design and construction planning of the GSL.

The FY 2020 Budget also proposes an AESI led by DOE's Offices of Electricity (OE) and Energy Efficiency and Renewable Energy (EERE), in conjunction with the Offices of Fossil Energy (FE) and Nuclear Energy (NE). AESI will provide a platform to coordinate R&D activities across these programs—and existing energy storage efforts in the Office of Science (SC) and the Advanced Research Projects Agency (ARPA-E)—to establish aggressive, achievable, and measurable goals for cost-competitive energy storage technologies, services, and applications. In FY 2020, AESI will establish application-specific cost and performance metrics to align research objectives and to coordinate the development of new energy storage and flexibility technologies.

Finally, OE's Energy Storage Program continues to conduct research and development to expand storage capabilities and shared industry knowledge. From performance breakthroughs in batteries based on earth-abundant materials to evaluation tools and workshops for state regulators, OE is at the forefront in helping communities realize the benefits of energy storage.

Last month, Chairman Murkowski visited one of our most recent projects, a megawatt-scale battery designed for load following and frequency regulation, located at Cordova Electricity Co-operative in Alaska. In FY 2020 and beyond, OE will continue work that lowers cell and system costs; reduces critical element usage; increases performance; and elevates safety of grid-connected energy storage systems. In general, all of these bills would build on the successes underway with energy storage technologies at DOE.

To focus any new program's efforts on the highest-impact breakthrough technologies, we recommend replacing the term "energy storage system" with the term "electrical energy storage system" to refer to bidirectional electrical energy storage systems that have capability to both absorb electric energy and inject the stored energy back into the grid and introducing the term "flexible energy resource" for other technologies that can shift energy demand in time and provide other services to the grid.

S. 1741 – Reducing the Cost of Energy Storage Act of 2019

This bill requires the Secretary of Energy (Secretary) to "establish a cross-cutting national program within the Department of Energy to advance energy storage deployment."

The goals of the new program will include considerations of lifecycle management, cost-competitiveness, innovation, use cases, market barrier reductions, safety, deployment pathways, analytical assistance, manufacturing leadership, and supply chain risks.

The program would also establish technology cost targets differentiated by technology class, such as electrochemical, pumped hydro, mechanical, or thermal.

DOE agrees with the bill in recognizing that energy storage is a cross-cutting activity.

The program should have the flexibility to establish cost targets by application (*i.e.*, seasonal storage or peak shifting) rather than by technology. An application-centric approach would help stakeholders evaluate storage benefits and accelerate the path toward commercialization.

S. 1602 – Better Energy Storage Technology (BEST) Act

This bill requires the Secretary to establish a "research, development, and demonstration program of grid-scale energy storage systems" within OE.

The new R&D activities would be focused on cost-effective energy storage systems with specific performance characteristics that would be applicable to daily, weekly, or seasonal cycling.

The bill would also direct the Secretary to establish technology-neutral cost targets, taking into account electricity market prices and the goal of being cost-competitive in specific markets for electric grid products and services.

Finally, the bill would direct the Secretary to "accelerate the standardized testing and validation of grid-scale energy storage systems" in collaboration with our National Laboratories.

DOE agrees with the bill in recognizing that energy storage is a cross-cutting activity. Many of these activities, such as establishing market-aware, cost-competitive, and technology-neutral cost targets, are currently underway as part of the AESI, which includes activities in OE and across multiple programs in EERE. The Office of Science also supports extensive battery R&D efforts specifically through the Joint Center for Energy Storage Research. Providing resources and a formal structure for these activities will help the Department accelerate storage technology development and commercialization.

S. 1593 – Promoting Grid Storage Act of 2019

This bill requires the Secretary to establish a "cross-cutting national program…for the research of energy storage systems, components, and materials." The bill would also require a "technical assistance and grant program" to provide technical assistance and grants to facilitate energy storage adoption.

DOE agrees with and recognizes the need to provide analytical technical assistance, especially for state, local, and other relevant stakeholders as they seek to understand the benefits of energy storage systems.

S. 1183 – Expanding Access to Sustainable Energy Act of 2019

DOE has provided support for state and local governments to integrate renewable energy and utilize new applications such as cybersecurity and smart grid technologies. The Expanding Access to Sustainable Energy Act would establish an energy storage and microgrid grant and technical assistance program within the Department, focusing on rural electric cooperatives.

The Department continues to review the legislation and looks forward to working with Congress as the legislative process moves forward.

S. 2048 Joint Long Term Storage Act of 2019

The purposes of this legislation are to facilitate the development of long-duration energy storage technologies, increase commercial viability of long-duration energy storage technologies, and increase the energy resilience, energy security, and national security of the United States through the use of long-duration energy storage technologies.

This legislation establishes a demonstration initiative to pilot the potential benefits of long-duration energy storage, increase commercial viability, recognize the range of grid services, quantify the value of those services, identify a range of technology types, and improve integration of energy storage and the grid.

The bill requires ARPA-E and the Department of Defense's Environmental Security Technology Certification Program to establish a joint program to carry out demonstration projects at scale and help technologies become commercially viable with priority given to demonstration projects that will be carried out in the field.

DOE appreciates Congress's attention to energy storage issues, and continues to evaluate this legislation.

ENERGY EFFICIENCY

EERE is, among other strategic goals, aiming to improve the energy efficiency of our nation's homes, buildings, and industries. EERE has set milestones for providing energy savings of 25 percent – 50 percent by 2020–2030. By developing new materials, technologies, and processes for American homes, buildings, and industry, EERE will implement threshold energy performance standards, improve building energy codes, and support home weatherization.

S. 983 – Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act of 2019

The Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act of 2019 updates and reauthorizes the DOE Weatherization Assistance Program (WAP) through 2024. The President's Budget requests no funding for the WAP. DOE recognizes that the Department of Health and Human Services and state entities allow for the transfer of LIHEAP funds to the state weatherization agency or may provide separate funding to the state weatherization agency. DOE also understands Congressional interests in the program, and continues to manage them consistent with statute.

S.1857 – Federal Energy and Water Management Performance Act of 2019

The Federal Energy and Water Management Performance Act of 2019 is structured into two key areas: establishing energy and water performance requirements for Federal buildings, with an increased emphasis on water management activities; and codifying the Federal Energy Management Program (FEMP) and its activities and authorities which are currently directed to the Secretary by statute and delegated to FEMP by the Secretary. Given its complexity, the Department continues to review this bill and believes that the Secretary should retain authority over the program.

FOSSIL ENERGY

FE is responsible for Federal research, development, and demonstration efforts on advanced power generation; power plant efficiency; water management; and carbon capture, utilization, and storage (CCUS) technologies. Additionally, FE is responsible for the development of technological solutions for the prudent and sustainable development of our unconventional oil and gas domestic resources.

S. 1685 - Launching Energy Advancement and Development through Innovations for Natural Gas Act of 2019

The Department is advancing an important part of FE's R&D portfolio — the commercial deployment of CCUS technologies. With ongoing support, the Department is backing up its commitment to CCUS with R&D necessary to advance these technologies, improve our environmental footprint, and advance U.S. world leadership in this critical area.

This bill directs DOE to establish a program for the capture of carbon dioxide produced during the generation of natural gas-generated power.

Specifically, DOE must:

- identify opportunities to accelerate the development of commercially viable carbon capture technologies to reduce carbon dioxide emissions;
- enter into cooperative agreements with certain entities to license, permit, construct, and operate at least three facilities to capture carbon dioxide from natural gas- fueled power generating facilities; and
- identify any barriers to the commercial development of carbon capture technologies.

The Department is reviewing the proposed language and we look forward to working with the Committee.

S. 1064 – Appalachian Energy for National Security Act

The United States is now the top producer of oil and natural gas in the world, with an additional benefit in the form of increased natural gas liquids (NGL), including ethane. Ethane is particularly useful as a feedstock for petrochemical manufacturing.

The Appalachian region has experienced near-exponential growth in natural gas production, and that production is expected to increase for decades to come. According to the Energy Information Administration, through April of this year, natural gas production in the Appalachian Basin has represented 35 percent of total U.S. natural gas production, and that

number is expected to increase.[1] In addition, NGL processing and fractionating capacity in Appalachia has grown quickly to match this increase in natural gas production.

S. 1064 requires a report to Congress on the "national and economic security" impacts of petrochemical infrastructure near the Marcellus, Utica, and Rogersville shale plays. Under the bill, DOE has the lead for preparation of the report, in consultation with the Departments of Defense and Treasury (and other agencies and stakeholders).

DOE appreciates Congress' attention to the vast energy resources in Appalachia. This legislation builds upon current efforts by the Administration. In December of 2018, DOE issued a report to Congress entitled *Ethane Storage and Distribution Hub in the United States*. The report highlights the potential in Appalachia for the development of a new ethane hub based on the resource from the Marcellus and Utica shales, and the accompanying security and reliability benefits derived from geographic diversity in the nation's petrochemicals manufacturing base.

This past April, the President issued Executive Order 13868 ("Promoting Energy Infrastructure and Economic Growth"), part of which requires DOE to issue a report on economic development in Appalachia in the petrochemical industry. The Department is currently working on this report, and will share the results with Congress and other interested parties.

WEST VALLEY DEMONSTRATION PROJECT REAUTHORIZATION

The West Valley Demonstration Project came into being through the West Valley Demonstration Project Act of 1980. The Act makes DOE responsible for solidifying the high-level waste, disposing of waste created by the solidification, and decommissioning the facilities used in the process.

H.R. 1138 – West Valley Demonstration Project Reauthorization

This bill reauthorizes the West Valley Demonstration Project located in West Valley, New York, through FY 2026.

The FY 2020 Budget request $78 million for the site, which provides for completion of deactivation activities at the Main Plant Process Building to reduce risk. The proposed legislation would not impact DOE's legal obligations.

VETERAN'S HEALTH INITIATIVE

The Department is eager to assist in promoting the physical and economic health of our veterans, who have given so much in service in the nation.

S.143 – DOE Veteran's Health Initiative Act

---

[1] Sum of YTD Appalachian production from Drilling Productivity Report divided by total U.S. dry production https://www.eia.gov/petroleum/drilling/ (production by region tab) and https://www.eia.gov/naturalgas/monthly/pdf/table_01.pdf https://www.eia.gov/todayinenergy/detail.php?id=38652

The DOE Veteran's Health Initiative Act authorizes DOE to establish and carry out a research program in artificial intelligence and high performance computing, focused on the development of tools and technology to solve big data and large scale analytics challenges in partnership and coordination with the Department of Veterans Affairs. The bill also requires DOE to carry out a pilot program to develop tools for big data analytics in order to advance artificial intelligence technologies to solve complex big data challenges.

This bill is strongly aligned with the Administration's stated R&D budget priorities including: American Leadership in Artificial Intelligence, Maximizing Interagency Coordination, and a Workforce for the 21st Century Economy. The Administration continues to review the bill.

CONCLUSION

Thank you again for the opportunity to testify today on behalf of DOE. The Department appreciates the ongoing bipartisan efforts to address our nation's energy challenges, and looks forward to working with the Committee on the legislation on today's agenda and any future legislation.

I would be happy to answer your questions.

Senator CASSIDY. Mr. Bennett, it is my understanding that you do not have an opening statement, correct?

Mr. BENNETT. That is correct.

Senator CASSIDY. Okay. Well then, let's start with questions.

I will defer to Senator Gardner.

Senator GARDNER. Thank you, Mr. Chairman.

Mr. Bennett, I appreciate your statement, thank you.

[Laughter.]

Just kidding. Efficiency of the Committee under the new leadership, thank you, Chairman Cassidy.

I want to thank you for holding this very important hearing and to both of the witnesses today, Mr. Walker and Mr. Bennett, for being here.

I want to, first of all, start by thanking you, Mr. Walker, for your support of the bill that you concluded with, the Veterans' Health Initiative. I think this is an incredible opportunity for us to capture a couple things that the U.S. is leading on, of course, artificial intelligence, our computer capabilities, our supercomputers within the Department of Energy and the lab system, particularly Oak Ridge and others that we can harness the information we have through the Veterans Administration. Working with our veterans to improve health care through advanced cutting-edge technologies and applications really is something that could be seen as one of the great accomplishments of this Congress.

We all agree that the Department of Energy's brain trust to their ability to harness computational capabilities is incredible and have solved many difficult problems in the past and can also, now, be applied to help our veterans.

When it comes to the storage bills that we have talked about today, Senator Collins testified about, it appears the Department is supportive of the Better Energy Storage Technology Act and the Promoting Grid Storage Act, both of which I am proud to be a part of. Thank you for that.

And as the Department completes its analysis of the Expanding Access to Sustainable Energy Act, I hope it will see the benefit of supporting rural electrical cooperatives to explore electrical energy storage opportunities in rural America as well.

You and I have talked at length about the defense critical electric infrastructure in the past, and I am committed to giving the Department of Energy the authorities that it requires to fulfill its role as the sector specific agency for energy.

We have a lot more work to do in this area, and I think the two bills today will be a step in the right direction.

Do you think that the joint long-term storage acts focus on demonstrating long duration, electrical energy storage in collaboration with the Department of Defense will be a helpful tool in protecting defense critical electrical infrastructure?

Mr. WALKER. Thank you, Senator, for that question.

Indeed, I do. The work we've been doing through the initiatives regarding the defense critical electric infrastructure which was, you know, astutely placed in the FAST Act, have allowed us to work very closely with the Department of Defense, our own National Nuclear Security Administration, NNSA, within DOE, as well as DHS

to prioritize and work through identifying the most critical infrastructure throughout the United States.

In fact, we are working and have been working for over a year with the Department of Defense with regards to opportunities to utilize storage technologies as well as other microgrid technologies, to better secure and improve the resilience capabilities for those sites, clearly on a prioritized basis. And I thank you for your support and the discussions we've had with regard to that, Senator.

Senator GARDNER. Yes, thank you, Mr. Walker.

And the Federal Energy and Water Management Performance Act would increase FMP's focus on the Federal Government's energy resiliency. Do you think that is also something that could be useful in conversations, collaborations, with the Department of Defense (DoD)?

Mr. WALKER. Absolutely.

One of the things that we've realized through our work with DoD, specific to the defense critical electric infrastructure, is that there are many capabilities of renewable technologies that are on or nearby those sites. And we believe that there are opportunities for us to leverage those renewable capabilities working with the base to maximize and look at energy utilization as well as water utilization. So, yes, sir.

Senator GARDNER. Thank you.

One of the great things about Colorado, of course, is we are home to NREL and the opportunities we have there to utilize a vast number of experts in renewable energy and clean energy but also home to some of the largest defense installation communities in the country. Colorado Springs, you know, Denver, are all home to very significant and important national security operations and mission sets.

I hope that we can be of assistance going forward as we look at both renewable energy defense resiliency and, you know, when you are flying our GPS Constellation out of Schriever Air Force Base, we need to make sure that for our national security, resiliency is there, but also for our economy that relies on the timing and synchronization that we have all of the resiliencies in place, resiliency efforts and policies in place to make sure that we protect both the security and economy of this country.

So thank you, Mr. Walker.

Thank you, Mr. Bennett.

Thanks, Mr. Chairman.

Senator CASSIDY. Senator Heinrich.

Senator HEINRICH. Mr. Walker, I am pleased to be a co-sponsor on a number of these bills, but I want to ask you about how a lot of the work that is being done in storage is being done across a number of different departments. There is R&D work that is being done, there is work to bring down costs—those are split up between the Office of Science, ARPA-E, and the DOE labs.

What is the Department doing to make sure that all of this disparate work gets shared across those departments so that we are not balkanizing this and we are really taking advantage of moving those costs down quickly and moving performance up quickly in energy storage?

Mr. WALKER. Thank you for that question, Senator.

That's a fantastic point, one that was recognized by the Secretary a couple years ago and has mobilized us to place into the FY20 budget an initiative called the Advanced Energy Storage Initiative (AESI) which cuts across all of the organizations within DOE that you referenced, ARPA-E, Department of Science, EERE and Office of Electricity as well as FE and the NE space. The intent of that is to coordinate all of the cross-cutting efforts under one umbrella that was proposed in the budget in an effort to really drive down, significantly, the price of storage and, I think, more importantly, it also focuses on the different applications.

So similar to the bills that you noted, there's components that deal with transportation. There's components that deal with buildings, in front of the meter, behind the meter, as well as bulk storage things like electro-chemical things that we're working on within the Office of Electricity.

So through that AESI we have been coordinating across all those departments to better understand what each one of the aspects each department has been working on and then leveraging those through the efforts collaboratively, pooling the money together to really make sure that we're addressing storage from a 360-degree view. So we're well on our way with regard to that initiative that's proposed in the FY20 budget, and we've outlined a number of those things.

One of the key components that I would highlight is the metrics for driving down the price which has been mentioned, I think——

Senator HEINRICH. Sure.

Mr. WALKER. ——very appropriately in the bills.

Senator HEINRICH. Yes, that is one of the key things about storage at this point because lithium-ion has become so dominant, there is a tendency to think of that as storage. But as we move toward seasonal storage, you know, the kind of metrics that are important for transportation, like driving down weight, will not be an issue where you have long-term storage that never moves. So I want to make sure that we are tackling that from all sides.

I want to ask you about something that is related to all of this, which is artificial intelligence, which came up today as well. I am curious where you see the near-term opportunities for using both AI and machine learning in terms of optimizing our grid operations and really optimizing the amount of clean electrons we can get on the grid at any given moment?

Mr. WALKER. Excellent. That's a key focus of mine, particularly as we move forward with the development of the North American Energy Resilience Model which is a model that integrates all the bulk power energy infrastructure throughout the United States. And that is important today because of the interdependencies across the different infrastructure, energy infrastructure and, most notably, one of the key areas is megawatt-scale renewable technology.

So the utilization we've already been working with our AI Department within the Department of Energy to analyze the information that is included in that North American Energy Resilience Model to be able to optimize the utilization of all of the energy sector capabilities, integration of renewable technologies to support the resilience of the grid as well as being able to incorporate dif-

ferent capabilities and technologies like automated restructuring of relay protection to avoid outages, particularly for the most critical infrastructure in the United States.

So AI is playing a key component in this. There are a number of projects underway particularly as it relates to that North American Energy Resilience Model which has a huge component developed focusing on grid storage.

Senator HEINRICH. I am glad to hear that.

When my dad was a lineman, he had to check those relays manually. It is a big difference.

Talk to me a little bit about direct air capture. I think it is something we have not adequately resourced from an R&D standpoint yet. What is the current thinking at DOE on direct air capture?

Mr. WALKER. I'm sorry, I'm having trouble hearing the first word.

Senator HEINRICH. Direct air capture.

Mr. WALKER. Direct air capture for——

Senator HEINRICH. For CO_2.

Mr. WALKER. Do you want to go with that, Shawn?

Senator HEINRICH. Mr. Bennett?

Mr. BENNETT. Ranking Member Heinrich, yes, I'll be pleased to take that question.

In 2018 the Office of Fossil Energy actually worked with the National Academies of Science on a report of negative emissions technologies and reliable sequestration which is direct air capture. Really the report concluded that direct air capture in its current form is too expensive and immature to have a wide range of, you know, wide range of scale deployment.

Senator HEINRICH. But you could say that about carbon capture and sequestration too.

Mr. BENNETT. Yes, well, you can say that for that, and we can get to that here in a bit.

Now what we are doing in that space and we continue to work diligently in that space.

On July 24th we are hosting a forum with 40 scientists and engineers for their input on key areas that we need to address to bring down the cost of direct air capture and learn more about that to be able to utilize this more on a commercially viable technology.

So, you know, what we gleaned from the 2018 study was the fact that we needed to meet the scientists and engineers to bring down or get more input from the stakeholders to be able to implement a more robust R&D technology focus for the Office of Fossil Energy.

Senator CASSIDY. Senator Hirono.

Senator HIRONO. Thank you, Mr. Chairman.

This is for Mr. Walker.

In April I visited the Lawai Solar and Storage Facility on Kauai Island. It is the largest combined solar and battery storage facility in the world, and it generates 11 percent of Kauai's power and can serve as much as 40 percent of the evening peak power demand on the Island of Kauai for the Kauai Island Utility Co-op.

Hawaiian Electric is also pursuing six new combined solar and storage projects on other islands, enough to serve 105,000 homes.

Hawaii is on the leading edge of energy storage and finding ways to cut pollution and use high amounts of renewable power. Kauai

is already at 50 percent renewable power, and we are at 27 percent statewide.

I think we need a similar focus nationwide, which is why I am pleased to be a co-sponsor of one of the bills we are considering today, S. 1593, the Promoting Grid Storage Act of 2019, introduced by Senator Smith. It will provide over $1 billion over five years to accelerate the research, development and demonstration of energy storage technologies while helping organizations or communities design and develop energy storage systems to meet their needs.

On page 3 of your testimony you say that the DOE agrees with and recognizes—and this is regarding S. 1593, which is the bill I am talking about—the need to provide analytical and technical assistance, especially for state, local, other relevant stakeholders. So you recognize the need. My question is, does the Office of Electricity have the expertise to carry out a nationwide program to accelerate energy storage research, development, and deployment along the lines of S. 1593 if Congress directs it to do so?

Mr. WALKER. Thank you for the opportunity to answer that question.

In fact, we do. We do have that capability and as part of the FY20 budget we proposed a Grid Storage Launchpad. There's $5 million in FY20 proposed to build out the capabilities based on our analysis thus far at the Pacific Northwest National Lab (PNNL).

We are in our alternative analysis component of that. We're working with PNNL. And what that does is it enables us to leverage the different areas, similar to my response to Senator Heinrich, with regard to the advanced energy storage initiative. So the Grid Storage Launchpad will bring together all the capabilities of our national labs in one place.

Senator HIRONO. This bill calls for $1 billion over five years, and you are telling me you have the capability with $5 million. Is that what you are saying?

Mr. WALKER. No, the $5 million, Senator, is to do the design engineering analysis for the building of one facility that brings together all the capabilities that we have within our national labs at one of our national labs and that becomes the focal point to deal with industry and academia, where in fact, we would be bringing together the expertise at 23 labs.

Senator HIRONO. So you would use the $5 million to do the kinds of things that the bill, S. 1593, will——

Mr. WALKER. No, ma'am.

The $5 million is simply to do the engineering to actually be able to construct the building over the next several years with appropriation.

Senator HIRONO. So can you say then that you do have the capability now to perform the requirements of S. 1593?

Mr. WALKER. We are, you know, working on what is suggested through many of the bills here today, not at the, obviously, with the amount of funding resources that are being offered.

You know, the work that we do, predominately, at PNNL and Sandia, Argonne, is work that is being done to push all of the different components that are highlighted in these bills, but we don't have anywhere near a billion dollars over the period of time.

Senator HIRONO. Yes.

Would you say that this Administration has a major commitment toward R&D for energy storage? Would you say that there's a major commitment?

Mr. WALKER. I would say there is and, in fact, in FY20 with the advent of the Advanced Energy Storage Initiative and the Grid Storage Launchpad, those are the initiating points from which to jump from in order for us to move forward in a much bigger way.

Senator HIRONO. I am very hopeful that that is actually what is going to happen.

Let me say, as I run out of time, I was glad to join Chair Murkowski and Ranking Member Manchin and Senators Gardner, Shaheen and Portman in co-sponsoring the Federal Energy and Water Management Performance Act. This bill would codify the Federal Energy Management Program (FEMP) and update federal energy and water performance requirements for federal buildings. So this is a bill that simply codifies an existing program, is it not?

Mr. WALKER. That's correct.

Senator HIRONO. And yet, in page 4 of your testimony you say that because of complexity you are reviewing this bill. Why do you have to review a bill if it is simply codifying an existing program?

Mr. WALKER. The—I'm not sure of the distinction you're making, Senator, with regard to codifying the FEMP. It was what has been utilized since 1976 with great success——

Senator HIRONO. So you would have no problem with this bill actually codifying what you are already doing?

Mr. WALKER. We do not.

Senator HIRONO. Okay.

So then would you be able to detail—could I just ask one little follow-up question? Can you detail how much energy and taxpayer money the Federal Energy Management Program has saved to date from this existing program and explain the savings in energy, water, and money that would come from raising the water and energy efficiency standards for federal buildings as laid out in the bill? This may require a more thorough answer. So if you could submit your answer to this question for the record, that would be fine.

Mr. WALKER. Yes, very broadly, we've reduced energy costs by 50 percent since the inception of this, resulting in about $50 billion of savings.

There are seven key metrics that there is detailed information that I'd be happy to provide on a QFR back with regard to those seven metrics that are at, have and continue to be measured.

Senator HIRONO. Thank you very much.

Senator CASSIDY. Thank you.

Chairman Murkowski.

The CHAIRMAN. Thank you, Mr. Chairman, and to your Ranking Member. Thank you for having this Subcommittee hearing this morning.

Following on Senator Hirono's comments, I am pleased to be able to be working on this Federal Energy Water Management Performance Act measure, moving it forward. I appreciate the endorsement.

I think when we look to different ways that we can lead by example when it comes to long-term energy efficiency, water usage

reduction goals, this is pretty much a no brainer here, in my view, and certainly an area where we can work to reduce costs to taxpayers over time.

So I appreciate that that is on the agenda, but I think the real main attractions this morning are the energy storage bills. I think we have done some good work here in the Committee in focusing on the role that energy storage will play in our clean energy future. I think not only do we have broad bipartisan support in this space, but we have colleagues over on the House side that are working on it as well.

Back in June we had an oversight hearing on grid-scale energy storage, and it was pretty clear then that expanded deployment really does offer us an opportunity to make the grid just that much more resilient, that much more clean and certainly more affordable.

I had an opportunity, and I have shared with my colleagues here, the opportunity to go to Cordova just a month ago to cut the ribbon on an energy storage facility there in Cordova. They continue to lead and innovate. And I know that you, Assistant Secretary Walker, have had an opportunity to see for yourself all the good things that come out of that little town.

But we now have a new battery system that is paired with existing run-of-river hydropower. We are reducing the reliance on diesel fuel. We are managing demand fluctuations. We are lowering the energy costs for the city's residents. It is just all good.

I think the next step for us as a Committee is to really work to develop these storage technologies more broadly. The five bills that we have before the Subcommittee this morning, again, indicate the level of interest and it is encouraging that it is not only bipartisan, it is in more remote and rural areas and urban and clearly very bicameral. These are exactly the types of initiatives that I think we can advance at a time when everyone says that the Congress cannot get anything done. So I encourage the work of the Subcommittee this morning.

I am not going to be staying for the duration of the hearing here, but I am looking forward to the discussion and better understanding of what DOE is doing in the space of energy storage, what further support we can provide, the direction that you would like from this Committee and from those of us here in the Senate.

So we have some good things going on, and I am hopeful that this will, again, be one of those initiatives that can really break what we are seeing with the legislative log jam because of good cooperation.

My goal, recognizing that we have five different bills out there, is to really evaluate where we are with them, synthesize the various bills and the concepts, take in the best provisions that we have in each of them, combining them into, perhaps, a larger, more comprehensive energy storage package that we will be able to report out of the Committee.

I hope that we would be able to do that, possibly as early as the end of this month or more likely in September. But again, I am optimistic about this space and what it is that we can do.

I appreciate your leadership and that of many of the members on this Committee and outside the Committee that have weighed in on this very important matter.

I am not going to ask questions of our witnesses this morning but just thank you for the work that you are doing to help us here at the Committee level.

Thank you, Mr. Chairman.

Senator CASSIDY. Thank you, Madam Chair.

Senator Manchin.

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

I want to thank both of you for holding this Subcommittee hearing because it is extremely important to our energy package. Hopefully we will have an energy bill this year, and it would be a great part of that.

But let me just say that West Virginia is an all-in energy supplier, if you will. We are heavily, as you know, coal industry. We have an ocean of natural gas under us with wet properties and propane, ethane, and butane. We have been blessed, but also, we have an awful lot of wind, which we are taking advantage of, and solar is coming on. So we are a little bit on all sides. We are for everything.

We think innovation is the way to go. Elimination is not going to work because the rest of the world will not follow elimination. But if we can innovate, we can do much better.

In 1920 in the Kanawha Valley in West Virginia, we built one of the first petrochemical crackers. And now, with all the wet properties we have with the gas boom, shale gas boom, in our neighboring states, Ohio and Pennsylvania, West Virginia is in the epicenter of this whole center of newfound energy.

I have also talked to Secretary Perry and he said, "Joe, I've seen the model of the Class 5 hurricane coming up the Houston Channel and what it does to cripple the energy of our country and the dependency that we have." So we are looking for a backup in West Virginia, in that area there, Ohio, Pennsylvania, West Virginia, with all the energy it has stored there—the protection of the mountains and everything else, is a natural hub.

We are talking about a storage hub, petrochemical storage hub, for all of our wet properties that can be used for a renaissance, if you will, in the chemical industry as far as making products—manufacturing again—but also the backup energy needs of this country as far as the stabilization.

Can you provide any type of an update regarding the President's Executive Order directive to examine the Appalachian region as a candidate for economic development in the nation's petrochemical sector?

Mr. BENNETT. Yes, Ranking Member Manchin, and I appreciate those comments. Not many people know where Kanawha, West Virginia, is and the Kanawha Valley and I'm from Ohio and, you know, back in April——

Senator MANCHIN. You are not far from us then.

Mr. BENNETT. Oh, 45 minutes away from the Ohio River and, you know, within six months in 1859, 1860, we started——

Senator MANCHIN. Well, when you think about it, nylon was invented in Charleston, all the things that we did for the war, all the

things that our little state has done because of the energy. We have been blessed with energy. Now people want to curse us a little bit, but we are doing it better and we want to continue to improve.

Mr. BENNETT. That is correct.

Senator MANCHIN. An all-in policy.

Mr. BENNETT. I've seen you at the Polymer Corridor coming right up through Parkersburg.

Senator MANCHIN. Yes.

Mr. BENNETT. And you know, we understand the importance of the petrochemical industry within——

Senator MANCHIN. How does it play within the President's——

Mr. BENNETT. You know, and Secretary Perry has been very fond of talking about creating an Appalachian petrochemical complex storage hub in the region because he recognizes the importance from an economic security standpoint.

You know, he has said many times, you know, that one of the things that kept him awake at night was a hurricane coming up the Houston ship channel and with that you need to have a diversity of your petrochemical manufacturing.

So we are definitely looking at that and through that came the President's Executive Order and Section 9 of that, so we are hard at work on supplying that Executive Order. I believe it will be due here then, what, August? Yeah, in August, that we will have that report complete. But again, in that report we do recognize the importance of Appalachia and the diversity of your economic security for, you know, polymer and petrochemical manufacturing.

Senator MANCHIN. Let me just say something that I don't know, and I am sure that Secretary Perry and I have talked about this, but there is no CFIUS review of propane, ethane, and butane which are the building blocks.

China is trying to buy every drop of propane, butane, and ethane in that new shale industry. If they do, they will suck out every opportunity that we have for revitalization of manufacturing as far as energy protection we need for our country.

I hope that you all are aware of this. I hope that you are aware of what they are trying to do, because we are trying to stop it. They came into the little State of West Virginia and offered an $83 billion deal with a "B." Now you throw $83 billion at any State, especially a little State like West Virginia, and it seems to be very attractive for people that don't know what their end game is. I want to go on record saying that we will do everything we can to stop them from taking this product without the review of how it is needed for the security of our nation, our country, and our states.

I don't know if you all have been aware of that? I would like to put you on record to understand that we have a concern there, and I hope you look into it.

Mr. BENNETT. Yes, and thank you for that concern. And again, we definitely share in wanting to have the petrochemical manufacturing industry stay in Appalachia. Again, where you're seeing the growth in natural gas as well as natural gas liquids is coming, really, out of West Virginia, Pennsylvania and Ohio.

Senator MANCHIN. Right.

Mr. BENNETT. If you take that, if you took those three states and put them as a country, we'd be the third largest natural gas producer in the world.

Senator MANCHIN. Alright.

Mr. BENNETT. And that's just fascinating to me.

Senator MANCHIN. And then the petrochemical industry we have, it is a footprint of what it used to be. I mean, we are about 50 percent.

So we can expand without any additional infrastructure because it is already there waiting to take off again.

Mr. BENNETT. Yes, and currently where you're seeing the ethane move to is the Gulf Coast and a lot of that is being used——

Senator MANCHIN. It is moving by pipeline, yeah.

Mr. BENNETT. Within the petrochemical complexes on the Gulf Coast and then ultimately gets shipped back up to our region of the United States and up to Chicago and so——

Senator MANCHIN. I am glad you all know about that. I hope you can help us with that, but I think it would be great for our country and great for the security of our nation.

Thank you very much.

Mr. BENNETT. Yup.

Senator CASSIDY. Senator King.

Senator KING. Thank you, Mr. Chair.

I think there has been a little discussion of this but I want to inject another point into this discussion. Senator McSally and I are both members also, and Senator Heinrich, of the Armed Services Committee and energy, particularly the transportation of energy, is more and more important to our military, everything from radios on the backs of soldiers to fuel for tanks.

During one of the Gulf Wars, Secretary Mattis said, "Unleash me from the tether of fuel." It was a real problem. In fact, lack of fuel stopped George Patton in World War II when he was heading across Europe.

So this is not only important for the grid and for the economy, generally, but it is a national security issue. And Senator McSally, Senator Heinrich and I have a bill, and I think Senator Gardner may have mentioned it, to work to develop a joint project between the Department of Defense, which is already doing research in this area, and ARPA-E or the Department of Energy. I hope that you will look with favor on that proposal. I think it makes a lot of sense, because this is an aspect of this issue that does not get all that much discussion.

The Defense Department is the largest single energy user in the United States, and battery storage and storage for them is not only something nice to have, important to have, but it is vital to national security concerns.

I would like your thoughts on that.

Mr. WALKER. Yes, Senator, thank you for the opportunity to speak on this.

This is a critically important issue and one that I am keenly aware of as I lead the Defense Critical Electric Infrastructure Initiative for the Secretary in the Department of Energy. And specifically, with regard to that, the Department of Defense has been a close partner in working with the Department of Energy on the

nexus of the concept of energy on base as well as for any of the ancillary capabilities that they actually require.

So we are working very closely right now with the Department of Defense. We have a number of pilot projects underway, under our existing storage programs, some very specific sites. We're working through different R&D capabilities to, you know, enable utilization of different storage capabilities, utilizing and capitalizing on much of, many of the renewable components and capabilities that were previously put on these sites but tend to be grid-facing and not base-facing.

So I applaud the bill that you're proposing with regard to the partnership with DoD because it significantly expands our capability to leverage the expertise within DOE within our national labs and our partnerships within industry and academia to meet the needs of our most important and critical infrastructure throughout the U.S.

Senator KING. I appreciate that and I look forward to working with you on working out the bill to an extent where the Administration can support it. We can move forward, make it part of this important package that we are talking about here.

Mr. WALKER. Absolutely.

Senator KING. I noted in my background research for this hearing, there are a lot of storage initiatives in the Department of Energy and in various places in the Department of Defense.

Is there a coordination issue? How do you coordinate all these different programs to be sure that they are sharing information, that one knows what the other is doing, that we are not reinventing the wheel in one program that we have already covered in another?

Mr. WALKER. Thank you, Senator.

And that goes back to the heart of Senator Heinrich's question. We have advanced forward development of an Advanced Energy Storage Initiative which is also included in the FY20 budget. That initiative, led by the Secretary, cuts across all of the different departments, ARPA-E, the Department of the Office of Science, all the applied sciences, to aggregate all of the otherwise disparate efforts on storage capability, both from a bidirectional electric storage down to flexible resource storage. So basically running the full gamut, everything that incorporates and is covered in a number of the other bills, things like transportation, battery waste management, coordination with the states, the regulatory components and, most notably, really driving down the cost and safety of long-term storage.

So the DAYS program that was put forward by the ARPA-E Department, in fact, was really meant to be and driven by, and we worked in close partnership with, the ARPA-E Department, to drive things like defense critical installations.

So that $30 million funding opportunity that went out for 10-hour to 100-hour, long-term storage is one of the initiating factors to bring us, throughout the Department of Energy, together to really focus on number one, driving the cost, eliminating any of the duplication, really being able to define things and success by the application of the different types of storage capabilities that there are.

And so, we continue on that effort really challenging ourselves and building off of what the needs are of our most critical infrastructure, as well as those things that are going to further the integration of renewable, you know, capabilities and technologies with the utmost focus on the overall resilience of the bulk power system.

And we're really, we really made some great strides in this arena, particularly as it relates to what the barrier is today which is in the case of the batteries that exist today, which were fundamentally developed for the integration of renewables, is the cost of vanadium and/or lithium and the fact that they're not necessarily owned or abundant in the United States.

We have broken that nexus and now we're focused on other chemistry solutions that break us away completely from any of the supply chain risks and the costs associated that, today, eliminate us driving the cost of vanadium or lithium down.

So through aqueous solution redox equation chemistry innovation, we are driving these costs down significantly while simultaneously breaking that supply chain and reliance on things like vanadium or lithium or things that are otherwise rare earth minerals controlled by other countries that we don't necessarily get along with.

Senator KING. Thank you. That is a wonderful analysis.

Mr. Chairman, can I follow up with one additional question?

Senator CASSIDY. Yes.

Senator KING. Given that—and that was a very erudite response and I appreciate it—and this is not a hostile question.

I am puzzled, given the significance and success of ARPA-E in the past, why it is slated for zeroing out in the Administration's budget? It seems to me it has been one of the most successful of Department of Energy programs, and I just worry that if it goes away there will be a loss of impetus behind the research imperative that we have in this area.

Mr. WALKER. Excellent question.

And so, similar to the Advanced Energy Storage Initiative, one of the things that we are trying to do is cut across what we are doing and I'll give you another example where we've done that, cut across the different siloes that exist through different varying platforms that enable us to join the forces of the different departments.

So similar to that Advanced Energy Storage Initiative that I mentioned earlier, in the Grid Modernization Initiative, which up until last year was simply a partnership between EERE as well as the Office of Electricity, my office, we've now further expanded that platform to include the five applied sciences and many of the function capabilities depending on what the determination/appropriation is for ARPA-E and some of the functions there.

So ARPA-E has been working very closely with each of the applied sciences and the Office of Science, and we believe that there's an opportunity to consolidate the work that they're doing and more cohesively meet the needs of the applied sciences with an ARPA-E type function but using the grid modernization initiative to do that.

Senator KING. But I assume if the Congress appropriates funds for ARPA-E, you will administer it according to the law?

Mr. WALKER. Yes, sir.

Senator KING. Thank you.

Thank you, Mr. Chairman.

Senator CASSIDY. Thank you.

Mr. Bennett, there is a megatrend toward using more natural gas for electricity generation. What percent of your carbon capture research is specific for natural gas as opposed to combined with efforts related to coal?

Mr. BENNETT. Chairman Cassidy, and again we truly appreciate your comments earlier about CCUS and as well as really growing this important topic and really the commitment of this Committee.

And I do not have an exact number for the percent. I can say that we do have 97 active projects working.

Senator CASSIDY. Now if I can interrupt just because we have limited time.

It is my understanding, not my foolproof knowledge, that most of the effort is going toward coal even though whatever we think of the generation of electricity by coal is declining with many more retirements and visage and the amount of generation by natural gas is growing significantly and will continue to grow. It is now, I think, 35 percent of the grid, as I mentioned.

So why would DOE not have more of an effort that is specific, not just for natural gas, but also for the later technology which is the combined cycle natural gas plant?

Mr. BENNETT. Chairman Cassidy, that is a great question.

So when you look at CCUS technology over the past ten years, we have spent approximately $4 billion in CCUS technology. While that has been mainly focused on coal, we currently have about five projects that are working both on flue gas and natural gas as well as coal. And currently——

Senator CASSIDY. Now, let me come back because as well as coal—so you have 95 projects, five of which include natural gas but none of which are specific for natural gas.

Why would you not have one which is specific, not just for natural gas, but also for the combined cycle which is, of course, a different set of technologies which I am told allow gas to be captured at different points along the way, not just in the flue?

Mr. BENNETT. Chairman Cassidy, and we are currently, through the National Carbon Capture Center actually retrofitting a natural gas boiler to test additional technologies for, specifically for natural gas.

Now regarding the technology that goes into carbon capture, the applications remain mainly the same between coal and natural gas.

Senator CASSIDY. Now I am going to disagree with you a little bit and I hesitate to do so because you are the expert, but I am told that if you retrofit a coal plant for gas it is not as efficient, number one. Number two, it won't be combined cycle. And number three, whereas in coal it is in the flue, in combined cycle there are numerous steps along the way.

I go back to if we have an increasing amount of gas and a decrease in amount of coal, but the focus is basically, it sounds like, 99 percent upon coal, with kind of, you know, I don't want to be rude about this, but kind of the stepchild treatment of gas. That seems to be, kind of, ignoring a megatrend. Does that make sense?

Mr. BENNETT. No, Chairman Cassidy, I do understand that and the question.

And again, as you are, as you did mention, natural gas is playing a more predominant role in electric generation. But again, when we look at the carbon capture, we are focusing more toward natural gas. You're starting to see that with the carbon capture. Actually, we had Exxon and Total just join the NCCC, the National Carbon Capture Center, since they are interested in natural gas capture. So that is a focus that the Department of Energy is taking on as well.

Now historically, it has been focused on coal. You are correct there. But it has also had applications within natural gas as well.

And really, you know, I can understand with the flue gas comment there are definitely differences. However, with the, when you look at carbon sequestration and the amount of carbon that comes out of coal-fired power plants versus carbon that comes out of natural gas-fired power plants, obviously it is significantly more.

The success that we do have in coal-fired generation with CCUS is applicable to natural gas because if we are successful there, that can be applied to natural gas and be more commercially and economically viable.

Senator CASSIDY. I am going to interrupt just for the sake of time.

I accept what you are saying as a theoretical, but as an applied we do not know because apparently we are applying it to one and not the other.

Part of this Committee is coming up with initiatives that other countries can follow and other countries are obviously using more and more natural gas. So that would just be the strong encouragement from this member of this Committee.

Mr. Walker, you gave, kind of, a paradoxical statement at the outset. You, on the one hand, said that our grid will be more decentralized and therefore more secure. Then you, in multiple other areas, spoke about wholesale integration using AI to, kind of, take all the bulk power around the country and to integrate. And seasonal transmission which I assume, again, if we are shipping something from the panhandle of Texas to the Northeast in the wintertime, then that is going to be integrated across different grids. So what is it? Are we decentralized or are we more integrated than we ever were? Do you follow what I am saying?

Mr. WALKER. I think so, Senator.

So the statement I was making was that, you know, today and over the last 20 years we've been transitioning from a bulk power system with generation, transmission lines and load without much penetration of renewables. Obviously, over the last 20 years, that transition has significantly increased, as has the fuel sources as the discussion has been ensuing, with regard to the generation sources for each of the degeneration capacity components.

The point I'm making is one, today, what we're pushing is bulk power storage as well as other types of storage. Not the only type of storage, but the long duration storage to be able to work through some of the challenges that we have on our transmission and generation systems today, particularly as we integrate megawatt-scale renewables.

So, today——

Senator CASSIDY. I am still not sure I am getting—you say we are decentralized but if we are going to have bulk power, utility grade storage, then that is not decentralization, that is still resident within a power plant, presumably, and then going through the same transmission lines.

Mr. WALKER. Senator, it depends on how the system is designed.

Today I would argue that our system is fundamentally centralized with a small portion of megawatt-scale renewable penetration of the system. As we add in bulk power storage, it will become less and less centralized because that storage will be able to be utilized in various levels of the system——

Senator CASSIDY. I got it. So it will be two poles.

Mr. WALKER. Right.

Senator CASSIDY. As of right now, it is the power plant, so it would be the power plant plus the bulk storage.

Mr. WALKER. Bulk storage, and bulk storage will also be able to be utilized on the distribution system as well.

Senator CASSIDY. We will have a question for the record.

Mr. WALKER. Sure.

Senator CASSIDY. And several things you have mentioned, they are very promising but we don't have a sense of the time horizon. So we will ask both the time horizon and the projected expense of full deployment as a QFR.

I think my Ranking Member has a follow-up question.

Senator HEINRICH. I think one of the things that the Chairman raised that is very interesting is where the storage goes. One of the interesting things we have seen with regard to utility deployment is that that storage is now being decoupled from generation of any sort, in many cases, and used to replace either transmission or other infrastructure like transformers on the grid which will allow a very different way of optimizing a distributed grid.

I also wanted to say just a bit about the idea of a megatrend with regard to natural gas. Certainly natural gas has been on a tear over the course of the last ten years in terms of electric generation. But it is interesting—I was just reading an article about FERC revising their three-year forecasts through 2022, and they are now predicting a retirement of 17 gigawatts of coal and a retirement of 7 gigawatts of nuclear, which certainly does not help us decarbonize the grid. But an addition of 28 gigawatts of gas with 10 in retirements, so a net increase of 18. But additions in wind at 27 and additions in solar at 16, which adds up to almost 43 gig in renewable additions, is about twice what we are seeing in natural gas. So I think we have another trend that is emerging at the moment.

Mr. Bennett, I want to ask you a question about the next phase of all of this which is, how do we decarbonize some of the high temperature, industrial processes that are going to be the hard stuff in the future? And this is the role of DOE to think about these things, to do the research and then other people come along and commercialize these things. So, steel, cement, those kinds of industrial processes, what are you doing to decarbonize those?

Mr. BENNETT. Ranking Member Heinrich, and again, great question.

This goes back to your earlier question here this morning and that's the fact that the Department of Energy has a very strong record of tackling these very tough questions. That's what we're really posed with doing. And that's, again, with the industrial gases and similar from the coal and natural gas, they do act very similar in nature. So the successes that we have on one, hopefully, we can transfer more to the other.

And in that vein, in just this year and I guess last year, but we are working currently. Secretary Perry requested the National Petroleum Council to do a study on carbon capture and underground sequestration, CCUS, that would look at the business quick case, not just for coal and natural gas, but also industrial gases as well. So really the recommendations that will come from that will help guide us as we look at utilizing industrial sources for carbon capture and sequestration.

Senator HEINRICH. Mr. Walker, I have one last question for you and that is, you know, we were talking about distributed resources and we are seeing utilities, more and more often, use a number of distributed and even non-wires alternatives.

We are seeing advanced demand response where in the old days demand response was someone at the utility, like my dad, calling up a factory and saying can you dial it back for the next three hours because we have a peak here and we cannot meet the demand? Today you have a cell phone connection between someone's water heater that can automatically turn it on and off within certain parameters and that can be aggregated over the course of an entire city or an entire distribution area. That requires a lot of computation, which is something DOE is good at.

What are we doing to get the right tools in the hands of co-ops, utilities, and community choice aggregators so that they can use those advanced and distributed tools to really save ratepayers money and increase the penetration of clean electricity as well?

Mr. WALKER. Thank you, Senator. That's an important point.

With the advent of number one, long-term storage, short-term storage, flexible resources, you introduce a high level of complexity with regard to the dynamics associated with, you know, running a system where load really has to match generation as closely as possible all the time, otherwise we run into things like under frequency, you know, problems and things like that.

So throughout the labs and throughout much of the work that is being done through the Office of Electricity, through the Energy Efficiency Office, we are looking at and developing tool sets for—and promulgating those out through things like NASEO, NGA, the NARUC organizations—for things like flexible building loads, grid services for vehicle charging. I can go on and on. I've got a list literally sitting in front of me of all the different types of things that we're doing, dealing with the dynamics of the load and being able to maximize and optimize the system.

One of the things I think is important as we move forward in that space is recognizing the complexity associated with the addition of all of the different capabilities, and to that end, we are spending a great deal of time working through the labs to build the control algorithms necessary to optimize that, much like the advent and, I think, success of the microgrids. Early microgrid technology

was fairly simple. It has continued to evolve with the complexities associated with integrating more and more components.

We continue to spend a lot of time working on the electronics, the power electronics necessary to be able to optimize the utilization, particularly as it relates to things like storage, some of the wind, some of the renewable technologies in this process.

And through this we work with, I know just within the Office of Electricity, we're working with about 25 different universities on this to develop different tool sets. We work with about 35 to 40 different private industry groups. Once that's done, DOE, we work through our department, OTT, to bring it out for tech transfer capability to get those things licensed, to get them out into industry so that they can be promulgated and utilized by the consumer and by the utility industry.

So we've got a lot of efforts focused—about a third of, maybe actually a sixth, of my program just in the Office of Electricity is focused on working with state regulators in getting information out.

In fact, we have built an entire computer system that enables, or computer program, that enables anybody to go on to it and look at what the regulatory processes are for any particular state, what the standards are, where there are penetrations of different things of storage.

And we have developed over the last few years and continue to work with Sandia and NRECA and EPRI to develop a very, very comprehensive report that comes out of Sandia that's about 350 pages that goes into a lot of the capabilities and tool sets that are available.

Senator HEINRICH. Fantastic, thank you.

Senator CASSIDY. Thank you.

This concludes the hearing. The record will remain open for questions for the record and follow-up comments.

With that, this hearing is adjourned. Thank you.

[Whereupon, at 11:14 a.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

QUESTION FROM RANKING MEMBER JOE MANCHIN III

Q1. My understanding is that the Advanced Energy Storage Initiative builds on previous and ongoing work from the Beyond Batteries Initiative and that the Office of Electricity and the Office of Energy Efficiency and Renewable Energy are co-leading this effort with involvement from both Fossil and Nuclear Energy Offices. It's unclear how Fossil and Nuclear Energy Offices are involved in this joint effort – can you please explain their involvement?

A1. The Advanced Energy Storage Initiative (AESI) includes activities that advance bidirectional energy storage and storage for the transportation sector. AESI also includes activities that advance flexible energy resources – systems that provide incremental flexibility for controllable loads and generation and provide benefits similar to energy storage. The Offices of Fossil Energy (FE) and Nuclear Energy participate in this last category of activities, particularly in advancing systems and technologies that increase the capabilities of generators to meet ramping, load following, frequency management, voltage management, and rapid re-start functions.

While FE has not yet received funding explicitly appropriated for the new AESI (to be initiated in FY 2020), ongoing research and development (R&D) funded by other FE budget lines is already maturing advanced technologies to enable coal-fueled power plants to operate more flexibly and efficiently.

The Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative) R&D initiative is advancing small-scale, modular coal-based power plants of the future to provide secure, stable, and reliable power for the evolving electricity markets. These systems, which will be capable of integration with energy storage, will also be capable of quick start-up, turndown, and ramping to provide steady power and grid stability. The Coal FIRST system concepts proposed by industry are currently being assessed, leading to more detailed preliminary designs as well as R&D to mature the critical components required by these advanced systems.

FE also has more than thirty projects focused on using advanced sensors and diagnostics to enable the current fleet of coal-fueled power plants to ramp more quickly and maintain higher efficiencies while improving reliability. This includes the use of artificial intelligence and machine learning,

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

which are being developed to improve predictive maintenance and interventions to increase plant reliability.

Projects to integrate energy storage with existing power plants are also underway. For example, FE is supporting concepts that find thermal, mechanical, and chemical energy storage synergies with coal-fueled boilers and natural gas-fired turbines to enable power plants to flexibly operate in a dynamic grid.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

QUESTIONS FROM SENATOR BILL CASSIDY

Q1. Many of the bills before the subcommittee today seek to expand DOE's energy storage research and development program, and add new programs for demonstration projects, grants, and technical assistance.

Q1a. As we continue to evaluate these bills, how should we focus any new research and development authorization to ensure that we are giving the Department the tools it needs to deploy more energy storage on the grid?

A1a. Electric energy storage provides a new set of functions that will dramatically enhance the resilience and flexibility of the grid. The Department, through its proposed Advanced Energy Storage Initiative (AESI), seeks to identify how these functions can be provided by a wide set of technologies. The scope of AESI includes electrical energy storage that can be used for grid applications and transportation and other flexible energy resources that can provide benefits similar to energy storage. Framework initiatives like AESI help the Department breakdown institutional silos to efficiently identify and strategically develop solutions to key energy challenges such as energy storage technology capabilities that provide the most benefit to the grid.

The Department has also found that the current ability to develop next-generation energy storage materials for grid applications is a major bottleneck to widespread energy storage deployment. In particular, there is a need for focused research and development (R&D) on energy storage technologies for long-duration applications using locally available, non-critical materials. The proposed Grid Storage Launchpad (GSL) project will unlock this bottleneck and extend U.S. R&D leadership in energy storage through validation, collaboration, and acceleration. By validating new technologies at earlier maturity stages, the GSL will lower the time and expense of storage chemistry innovations. Through collaboration with universities and the commercial sector, the GSL will assist the industry with enhanced testing protocols and materials validation capabilities. Finally, the GSL will accelerate and de-risk new technologies by propagating rigorous grid performance requirements to all stages of storage development, from benchtop to systems.

Q2. During your testimony you spoke about the cross cutting work that is being done on energy storage. Specifically, you mentioned the advanced energy storage initiative that is aimed at driving

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

down the price of storage and looking at energy storage research in the transportation sector, buildings, and bulk storage.

Q2a. Is the Department looking at the projected expense for full scale commercial energy storage deployment? If so, do you have an idea of what that cost would be?

A2a. The Department generally seeks to identify uses of energy storage that provide a net benefit to the end user, the operator, or the system as a whole. The value of such deployments or the cost of not deploying storage should exceed the cost of the storage resource. As both costs and values will vary by location, time, and future technological progress, the Department does not currently have a projected expense for full-scale commercial energy storage deployment.

Q3. I am also interested in your comments about how energy storage has the ability to transform our grid to one that is decentralized. Do you have a projected timeline of when this could happen?

A3. The degree and rate of grid decentralization will vary by region and market conditions. For example, many remote areas already have a very decentralized grid. Highly populated regions may indefinitely retain some degree of centralization. As such, the Department does not have a projected timeline for grid transformation, but continues to accelerate the technology options that allow end users and communities to choose the option that best meets their needs. Additionally, markets generally do not value, from a rate base standpoint, storage for the full suite of grid services it provides, further complicating deployment of grid-scale storage and, therefore, decentralization of the grid.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

QUESTION FROM SENATOR MAZIE K. HIRONO

Q1. Could you detail how much energy and taxpayer money the Federal Energy Management Program has saved to date? Could you also estimate the savings in energy, water, and taxpayer money that would come from raising the water and energy efficiency standards for Federal buildings as laid out in the Federal Energy and Water Management Performance Act (S. 1857)?

A1. The U.S. government currently consumes about 1% of total U.S. energy costing $16.6 billion annually with more than 350,000 energy-utilizing buildings and 600,000 vehicles; the federal government is the Nation's largest energy consumer. Not surprisingly, most of this energy consumption is by the Department of Defense facilities, training, and operations.

Substantial opportunities exist for investment in further energy cost reduction and energy conservation to reduce tax payer burden, including:

- almost $9 billion in potential cost-effective efficiency improvements, referred to as energy conservation measures (ECMs), identified by agencies in their evaluations of their facilities and could be addressed through either performance contracting, where appropriate, or with appropriated dollars, and
- almost $150 billion in deferred maintenance and repairs to bring Government owned property, plant and equipment to an acceptable condition[1].

The Federal Energy Management Program (FEMP) enables federal agencies, through technical assistance, guidance and training, to effectively address their $16.6 billion annual energy bill, meet energy related goals, and provide global energy leadership fostering resilient, efficient, and secure federal operations.

Federal agencies have an opportunity to lead by example in cutting costs and energy waste and ensuring energy dominance that balances environmental protection with energy independence for economic growth to encourage innovation, discovery and prosperity. For example where the

[1] Deferred Maintenance and Repairs. https://www.fiscal.treasury.gov/files/reports-statements/financial-report/2018/deferred-maintenance-repairs.pdf

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

federal government is leading, VA health care facilities, when compared to private sector benchmarks, consume 37% less energy per square foot and GSA high performance office buildings have an energy intensity that is 43% lower than commercial building benchmarks. FEMP helps other agencies support the Administration's goal of energy dominance and implement Executive Order (EO) 13834, Efficient Federal Operations, by providing opportunities for more efficient, cost effective and secure energy usage and management in Government facilities. FEMP's efforts to assist agencies in facility management reduces costs, increases energy and water security, maintains and modernizes infrastructure, and improves the health and safety of Federal employees. Through FEMP's technical resources in auditing, retuning, energy management and fleet operations, agencies can receive the training and hands-on support to optimize facility and fleet operations in order to identify and prioritize low- and no-cost energy efficiency measures and to cost-effectively improve energy performance.

FEMP also provides live and free on-demand training available to anyone to foster and maintain a high-performance workforce that constructs, operates, and maintains energy-efficient and cost-effective federal facilities. FEMP is accredited by the International Association for Continuing Education and Training (IACET) and awards IACET continuing education units (CEUs) upon the successful completion of select courses.

The energy and cost savings most directly attributable to FEMP program efforts are from its Energy Savings Performance Contracting (ESPC) program. Since the inception of U.S. Department of Energy (DOE) indefinite-delivery, indefinite-quantity (IDIQ) ESPCs in 1998, agencies have used the ESPC contracting vehicle to significantly reduce energy and operating costs and make progress toward meeting federal sustainability goals. FEMP's ESPC program continues to support agencies in improving energy efficiency as they implement the E.O. 13834 goal that encourages the use of performance contracting, where appropriate. Since the inception of the DOE ESPC IDIQ in 1998, 407 projects have been awarded across the Federal Government with more than $6.5 billion invested in facility energy and water efficiency and renewable energy improvements. The DOE ESPC IDIQ awarded task orders report provides detailed project data, as

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

reported at the time of award. In terms of the savings during the contract period, these are, for the most part, used to pay for the new energy equipment and associated services. Additional savings are achieved during the contract performance period and historically task orders issued under DOE's IDIQ contracts perform to an average of 105% of the guarantee. Additional savings, not accounted for in the contract, can also accrue to the U.S. government after the contract term (for example, a high efficiency boiler or chiller is likely to have a service life, with associated energy savings, that is greater than the duration of an average ESPC contract term).

Federal agencies have made broader efficiency investments in their facilities from all funding sources, activity which FEMP facilitates and tracks. From Fiscal Years 2007 through 2018, the Government invested $24.2 billion (in current year dollars) in facility efficiency. Specifically, in Fiscal Year 2018, the federal government invested $1.845 billion in energy efficiency projects. These investments have the potential to be paid back by 2020 and result in cumulative cost savings of $53 billion by 2030. Estimated energy savings from this investment in Fiscal Year 2018 alone was 114 trillion Btu, which means facility energy use likely would have been at least 30 percent higher in Fiscal Year 2018 without that investment.

The energy performance requirements of S. 1857 require a reduction in federal facility Btu per gross square foot by an additional 2.5 percent each year beginning in Fiscal Year 2020 relative to Fiscal Year 2018 and culminating in a 27.5 percent reduction in Fiscal Year 2030. In Fiscal Year 2018, the federal government already achieved a 25.5 percent reduction relative to Fiscal Year 2003, with 29% of the 24 principle agencies exceeding a 30 percent reduction by almost 10 percentage points or more. Assuming the Government-wide gross square footage remains the same, the performance requirements of S.1857 (if met) could potentially result in cumulative energy cost savings of 482 trillion Btu and $10 billion over the 11-year period. However, the rate at which efficiency gains are achieved will be determined by the delta in performance between new and existing systems and technologies. As older systems and technologies are replaced and newer technologies approach theoretical energy performance limits, the ability to maintain a linear energy intensity reduction path may become cost prohibitive.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

The water performance requirements of S. 1857 require a reduction of water use per gross square foot by an additional 2 percent each year beginning in Fiscal Year 2020 relative to Fiscal Year 2007 and culminating in a 54 percent reduction in Fiscal Year 2030. In Fiscal Year 2018, the federal government has already achieved a 27.2 percent reduction relative to Fiscal Year 2007. Assuming the Government-wide gross square footage remains the same, the performance requirements (if met) could potentially result in cumulative water savings of 308 billion gallons and $1.8 billion in water cost savings over the 11-year period compared to current levels of consumption. As with energy intensity, as older systems and technologies are replaced by newer technologies, the ability to maintain a linear water intensity reduction path may become cost prohibitive.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

QUESTION FROM SENATOR ANGUS S. KING, JR.

Q1. In your testimony, you referenced pilot projects where the Department of Energy is working with the Department of Defense on existing storage programs.

Q1a. To the extent possible, can you provide a list of these projects, and whether the technology is focused on long duration or long-term battery storage capabilities?

A1a. The Office of Electricity (OE) Energy Storage Program is involved in a variety of efforts supporting the Department of Defense (DoD). Many of these projects aim at making military bases more energy-resilient and self-sufficient by enabling dispatchable storage that can be utilized during outages. Current batteries generally are appropriate for 1–4 hours of discharge at full capacity. The duration can be extended by running the batteries at less than full discharge rate. With the help of renewable generation, mission-critical functions can thus be maintained for extended durations. The program also pursues research on technologies such as flow batteries that inherently provide longer duration. The following are prior and current OE storage program DoD engagements:

Prior:

- **Fort Devens, MA - Base Camp Integration Lab**. OE support to establish an energy storage test capability at Fort Devens. Enabled testing and evaluation of 5 different storage technologies to support forward base resiliency including a 160 kilowatt (kW) / 640 kilowatt-hour vanadium redox flow battery.
- **Marine Corps Air Station Miramar (CA).** 250 kW / 4hr zinc-bromine batteries for mission-critical backup power islanding and peak-shaving capability integrated with 230 kW photovoltaics.

Current/Future:

- **U.S. Army Corps of Engineers - Engineering Research and Development Center and Cold Regions Research and Engineering Laboratory.** Joint program to understand energy storage technologies capabilities in cold, remote regions that cost-effectively meet critical Army installations' electricity needs.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

- **Kirtland AFB/ABQ Airport - Albuquerque, NM**. 4–10 hour energy storage installation to support airport islanding and resilience capabilities incorporating renewables. Sandia National Laboratories are also collaborating in developing and demonstrating a direct current microgrid with photovoltaics and storage in the military housing community at Kirtland Air Force Base.
- **Fort Carson – Colorado Springs, CO.** Flow battery pilot demonstration for renewables integration and base resiliency.
- **Pacific Missile Range Facility.** Sandia is in discussion with the personnel at the Pacific Missile Range Facility to install energy storage for critical mission continuity.
- **Navy Electric Ships Office (CIV USN NAVSEA).** Exploration of OE research on energy storage, power electronics, and smart grids for possible future application to Navy ships.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

QUESTION FROM SENATOR MARTHA MCSALLY

Q1. Many of the raw materials needed in renewable energy generation and energy storage are dependent on risky foreign supply chains. Battery manufactures are almost completely reliant on cobalt from the Democratic Republic of the Congo – which is notorious for its use of child labor and horrific working conditions – and our rare earths supplies are dominated by China who has threatened to restrict their availability. This is unwise from both an economic and national security perspective when we have abundant supplies of these materials domestically. Has the Department of Energy considered hard rock mineral supply chain vulnerabilities in their assessments of electric grid and energy security risks? If energy storage is going to be an increasingly significant component of grid resiliency and security, how important is a domestic supply chain of necessary raw materials in meeting energy security goals?

A1. Early and on-going assessment is required to adapt the Department of Energy's priorities to changing material and energy technology markets. Since 2011, the Department has assessed material criticality across a range of energy technologies based on importance to energy and potential for supply risk. The Department's analysis of supply risk considers basic availability (including production capacity relative to anticipated increases in demand); competing technology demand; political, regulatory, and social factors; codependence on other markets; and producer diversity.

Cobalt and lithium are two key elements used in the manufacturing of lithium-ion batteries for transportation and stationary energy storage that are experiencing a ramp up in demand. Cobalt and lithium are included on the list of critical minerals published by the Department of Interior in 2018[2] and were also found critical in the medium term in the Department of Energy's most recent criticality assessment. Foreign sources of cobalt and lithium are concentrated in just a few countries. For example, 60 percent of the world's cobalt is mined in the Democratic Republic of Congo, and 80 percent of that supply is processed in China.[3] Lithium production is concentrated in Australia, Chile, China and Argentina.[4] This import dependence could be a problem when it puts supply chains and U.S. companies and mineral users at risk. The dependency of the U.S. on foreign sources of critical minerals creates a strategic vulnerability for both our economy and our

[2] Federal Register. https://www.federalregister.gov/documents/2018/05/18/2018-10667/final-list-of-critical-minerals-2018
[3] https://www.energy.gov/eere/femp/downloads/doe-idiq-energy-savings-performance-contract-awarded-projects

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

military with respect to adverse foreign government actions, natural disasters, and other events that could disrupt supply.

The Department's approach to mitigate critical minerals supply risk is in alignment with the President's Executive Order 13817 to ensure secure and reliable supplies of critical minerals. Within the Department, research and development (R&D) investments are coordinated among the program offices agency-wide around three pillars to address supply chain disruption risks: (1) diversifying supply of critical materials – including increasing domestic production, (2) developing substitutes, and (3) driving recycling, reuse, and more efficient use of critical materials. These investments promote adaptability, resilience, and competitiveness across the critical minerals supply chain by drawing upon American ingenuity and entrepreneurship to foster innovation.

The U.S. has limited domestic production and downstream processing and manufacturing capabilities of cobalt and lithium. The U.S. produced 500 metric tons of cobalt as a byproduct from a single nickel-copper mine in Michigan in 2018. This represents less than one percent of estimated global cobalt production. The only domestic production of lithium in 2018 was from brine extraction in Nevada. Production data on lithium in 2018 were withheld to protect company propriety data.[4]

U.S. reserves of lithium are not limited to hard rock minerals and also include brines. To diversify critical materials supplies, the Department's Office of Energy Efficiency and Renewable Energy (EERE) has invested and continues to invest in the recovery of lithium from geothermal brines through the Geothermal Technologies Office and Advanced Manufacturing Office (AMO). U.S. industry is currently developing additional domestic production capacity. A mining project for cobalt in Idaho is in development by eCobalt, but not yet online.[5] Lithium Nevada is developing a

[4] USGS Mineral Commodity Summaries 2019. https://www.usgs.gov/centers/nmic/mineral-commodity-summaries
[5] https://www.ecobalt.com/projects/overview

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

mine in Nevada.[6] Standard Lithium Ltd. is developing a demonstration pilot plant to extract lithium from tail brines in Arkansas.[7]

Domestic downstream processing and manufacturing of cobalt and lithium are heavily dependent on foreign sources. Increasing domestic production without developing the domestic processing and manufacturing capabilities simply moves the source of economic and national security risk further down the supply chain and creates dependence on foreign sources for these capabilities. In 2018, most U.S. cobalt supply was comprised of imports and secondary (scrap) materials. To directly address dependence of lithium-ion batteries on critical materials, EERE's Vehicle Technologies Office (VTO) is funding R&D to reduce cobalt content in the battery cathode to less than 5% by weight.

Albemarle and Livent Corporation are two of the largest lithium producers worldwide and are both based in the United States. Both companies do most processing of raw materials outside of the United States and use a majority of imported raw materials, with Albemarle using some domestically produced materials. Tesla's Gigafactory, located in the United States, produces battery packs for electric vehicles as well as their energy storage products. In mid-2018, battery production at the Gigafactory reached an annualized rate of roughly 20 GWh, making it the highest-volume battery plant in the world. The Office of Electricity is funding efforts to develop non-lithium energy storage technologies for use on the grid. The program supports fundamental research to advance the development of batteries based on earth-abundant materials such as sodium and zinc, with a cell-level cost target below $100/kwh. Specifically, the Office of Electricity (OE) focuses on advancing grid-scale storage to help address long-term, unexpected outages from physical and cyberattacks, as well as natural disasters. The Office of Electricity's proposed Grid Storage Launchpad will serve as a catalyst in this space by validating new technologies at earlier maturity stages and by accelerating new technologies to deployment.

[6] https://www.lithiumamericas.com/thacker-pass/
[7] https://standardlithium.com/lithium-arkansas-smackover/

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

Secondary resources of critical materials, including reuse, remanufacturing and recycling of post-industrial materials and end-of-life products and/or materials, represent an alternative path to diversifying supply and increases environmental stewardship of production and waste management. EERE is funding efforts to address the challenges of recycling lithium-ion batteries, which have more than 15 different cathode chemistries across end-use applications. EERE's VTO has established the ReCell Lithium Battery Recycling R&D Center to develop innovative, efficient recycling technologies for current and future battery chemistries. ReCell funds R&D across four research areas: design for recycling, recovery of other materials, direct recycling or cathode-to-cathode recovery, and reintroduction of recycled materials.

Getting end-of-life lithium-ion batteries to recycling centers is also a challenge to the reuse, recycling and recovery of critical materials. ReCell reports that lithium-ion batteries are currently recycling at a rate of less than 5%. In January 2019, the Department (through EERE's VTO and AMO) announced the launch of a Lithium-Ion Battery Recycling Prize to provide an incentive to American entrepreneurs to create cost-effective, disruptive solutions to collect, sort, store, and transport 90% of spent or discarded lithium-ion batteries for eventual recycling.

The Department and our National Lab researchers and experts are committed to working in partnership with industry, academia, and other federal agencies to mitigate critical minerals supply chain risks. The Department is happy to provide more information on any of these topics.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

QUESTIONS FROM SENATOR JOHN HOEVEN

Q1. S. 1857, the Federal Energy and Water Management Performance Act of 2019, includes certain provisions from my legislation that I reintroduced with Ranking Member Manchin, the All-of-the-Above Federal Building Energy Conservation Act. Our legislation sets targets for energy intensity reduction of 2.5% annually from 2020-2027. Further, it provides more flexibility for the federal government to achieve its energy efficiency goals by replacing the fossil fuel ban in Section 433. Will you speak to the merits of reducing energy intensity in federal buildings?

A1. Establishing goals aligned to an organization's mission helps facilitate and drive federal performance, making it easier to implement projects that target reduction in energy intensity to optimize facilities. Optimizing facility energy use in facilities allows agencies to effectively accomplish their mission, reduce waste, cut costs, and enhance the resilience of federal infrastructure and operations. Agencies are working towards these goals as specified in E.O. 13834, and DOE supports agencies through the Federal Energy Management Program.

Examples include, but are not limited to:

- The Food and Drug Administration (FDA) White Oak Campus in Silver Spring, Maryland achieved 30% energy savings and installed combined heat and power project, micro-grid, back up boilers and thermal storage to provide resilience for FDA's mission of protecting the public health.

- NASA Johnson Space Center (JSC) in Houston, Texas leveraged $1 million in AFFECT (Assisting Federal Facilities with Energy Conservation Technologies 2019) funding from FEMP to support a $47 million investment in a new combined heat and power project (CHP). This ~12MW CHP plant project provided the site with 70% of its base power consumption and allowing the site to operate off the grid during outages. In addition, this project helped JSC meet their energy intensity reduction goal through 2020.

- The U.S. Marine Corps (USMC), Parris Island, South Carolina awarded an $89 million project, via an Energy Savings Performance Contract (ESPC), to replace an existing end-of-life steam plant with a new, fully automated, natural-gas fueled CHP plant. This CHP

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

plant is capable of producing 3.5 MW of electricity and all of the steam required for the entire installation. In addition, the USMC deployed integrated renewable energy solutions, including solar PV, domestic hot water system upgrades, a battery energy storage system (BESS), and a microgrid control system (MCS) capable of fast load shedding. These systems provide Parris Island with the ability to maintain reliable operations in the event of loss of utility services. This project represents the most comprehensive ESPC to date entered into by the Navy, involving 121 buildings (3.1 million square feet total) and 20 energy conservation measures (ECMs) resulting in Parris Island reducing their energy consumption by 79% and water consumption by 27% annually, but it is important to point out all cost savings generated from energy efficiency and renewable energy improvements are being used to pay for the ECMs installed and for resiliency, which cannot be financed as a standalone measure through an ESPC contract.

Q2. How will authorizing the Federal Energy Management Program assist the federal government in meeting its efficiency goals?

A2. S. 1857 will authorize the Federal Energy Management Program's mission to support Federal agencies in meeting Executive Order and statutory energy and water management-related goals and supporting mission assurance through identifying government best practices, providing technical assistance, tracking progress, and helping train both the Federal workforce and other stakeholders.

FEMP enables federal agencies to reduce their $16.6 billion annual energy bill and meet energy and water management goals by providing support, technical assistance, and training for federal agencies. FEMP works with federal agencies to improve infrastructure by addressing the estimated $150 billion of deferred maintenance and repairs related to agency facilities and equipment. In addition, FEMP continues to increase the skills of the multidisciplinary federal workforce by providing training and best practices. FEMP provides technical assistance and guidance for completing energy-savings projects.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

Federal agencies have an opportunity to lead by example in cutting energy waste and advancing America's progress toward energy independence, resiliency, and security. FEMP strives to build agencies' ability and agility to manage their missions by becoming efficient, resilient, and secure. It supplies agencies with the information, tools, and assistance they need to meet and track their energy-related requirements and goals. .

Q3. How can improving efficiency in our federal buildings save American taxpayer dollars?

A3. From Fiscal Years 2007 through 2018, the Government invested $24.2 billion (in current year dollars) in facility efficiency. Specifically, in Fiscal Year 2018, the federal government invested $1.845 billion in energy efficiency projects. This investment is expected to be paid back by 2020 and potentially result in cumulative cost savings of $53 billion by 2030. Estimated energy savings from this investment in Fiscal Year 2018 alone was 114 trillion Btu, which means facility energy use likely would have been at least 30 percent higher in Fiscal Year 2018 without that investment.

The Federal Energy Management Program (FEMP) can assist by developing and disseminating facility-wide project models that include a diversity of options, focus on cutting costs and waste, and emphasizing preparedness through the use of tools like the Technical Resilience Navigator (TRN). The TRN helps agencies identify mission risk, prioritize projects and identify financing options.

Since 1998, 36 federal agencies have utilized the DOE Energy Savings Performance Contract (ESPC) Indefinite Delivery Indefinite Quantity (IDIQ) in all 50 states, Puerto Rico, and the U.S. Virgin Islands. In Fiscal Year 2018, ESPCs awarded by federal agencies using the DOE IDIQ contract will provide $809.6 million of facility infrastructure investment (record year for DOE IDIQ contract) which will result in:

- 2 trillion Btu of ongoing energy savings annually, and
- Equivalent to the annual energy use of 25,000 average US households.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Honorable Bruce Walker

July 9, 2019

DOE has developed the 50001 Ready recognition program for conformance to the ISO 50001 energy management standard, which facilitates a culture of continuous energy improvement. FEMP has been providing the training and technical resources of this no cost program to federal facilities to help cut energy costs, improve resilience, and meet statutory mandates and E.O. 13834 goals. Because it is based on the ISO 50001 energy management system standard, the globally accepted best practice for energy management, implementation of 50001 Ready ensures that federal agencies can use a streamlined and standardized approach to energy management and to identify and implement low and no cost ways to save energy in facility operations. And since it is self-paced and self-attested, there are no external audits or costs associated with implementing 50001 Ready. Successes include Tinker Air Force base which has improved energy performance ~15% over 3 years. Over 10 federal agencies are currently in some stage of 50001 Ready adoption including the U.S. Army, U.S. National Oceanic and Atmospheric Administration, U.S. National Park Service, U.S. Air Force, Architect of the Capitol, Oak Ridge National Laboratory, Lawrence Berkeley National Laboratory, National Renewable Energy Laboratory, General Services Administration and Tennessee Valley Authority, with others beginning later this year.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Mr. Shawn Bennett
July 9, 2019

QUESTIONS FROM SENATOR MAZIE K. HIRONO

Q1. S. 1685, introduced by Sen. Cornyn, would authorize $250 million for a five year program to develop technologies to capture carbon from power plants burning natural gas. Is there any requirement in the bill that the captured carbon would need to be permanently stored, or could it be released back into the atmosphere?

A1. The proposed bill amends the Energy Policy Act of 2005 and one of the goals of the carbon capture facilities demonstration program is, "if necessary, secure agreements for the offtake of the majority of the carbon dioxide emissions captured by qualifying technologies during the project…". Projects that secure an offtake agreement could permanently store the carbon dioxide (CO_2) in deep saline formations, utilize it as a commodity working fluid for enhanced oil recovery which will result in associated storage of CO_2, or use the CO_2 as a valuable product in industrial gas supply markets, which may either consume or release the CO_2 after use.

Q2. Are you aware of any technologies for capturing greenhouse gas emissions from fossil fuels that have zero cost, meaning they are cheaper under current law than not using the technologies? How many fossil-fueled plants does DOE forecast will adopt carbon capture technologies, assuming there continues to be no price on carbon emissions under federal law?

A2. We are not aware of any commercially available technologies that have zero cost. Some technology developers may claim that their technologies have zero cost but these technologies are not yet commercially available. Additionally, under current law, the Section 45Q tax credit provides an incentive through calendar year 2026 of up to $35 per metric ton of carbon dioxide that is utilized and up to $50 per metric ton of CO_2 placed in secure geologic storage, with adjustments for inflation in subsequent years. While the Internal Revenue Service is preparing guidance for these credits, they may offer the potential to offset some or all of the costs of carbon capture, offering a business case for commercial deployment under current law. The Department has asked the National Petroleum Council to evaluate the potential deployment of carbon capture technologies considering the benefits of the current 45Q tax credit for both saline storage and enhanced oil recovery. The NPC study is expected at the end of 2019.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Energy
Pending Legislation
Questions for the Record Submitted to Mr. Shawn Bennett
July 9, 2019

QUESTIONS FROM SENATOR JOHN HOEVEN

Q1. The Allam Cycle technology carries great promise not only for the United States but also for countries abroad. The Net Power natural gas plant in La Porte, Texas is the first facility of its kind in the world and provides the basis for deployment of this technology on similar, larger commercial-scale facilities. What benefits does the Allam Cycle offer to the industry and power consumers in terms of both reliable baseload energy and environmental stewardship?

A1. The Allam cycle, which has not been fully demonstrated with direct fire combustion in the turbine at the La Porte facility in Texas, is well suited for power generation where it's possible to have inherent CO_2generation for storage or direct injection without further processing. The cycle could provide baseload energy with environmental benefits when demonstrated for an extended period for reliability. The carbon dioxide generation feature of this technology leads to a revenue stream which could be used for Enhanced Oil Recovery (EOR) from abandoned oil fields. Utilities are currently hesitant to embrace this technology due to its high cost and a need for a long-duration demonstration of the technology at a larger scale.

Q2. How would S. 1685, the Launching Energy Advancement and Development through Innovations for Natural Gas (LEADING) Act, improve the viability of natural gas technologies such as the Allam Cycle?

A2. The natural gas combined cycle (NGCC) technology, as well as some post combustion capture technologies, are ready for implementation as these technologies have been proven at scale. When fully developed, Allam cycle will compete with these established technologies and can provide inherent carbon dioxide generation for storage or direct injection without further processing. S.1685 could identify opportunities to accelerate the development of commercially viable carbon capture technologies that will reduce carbon dioxide emissions and clearly improve the viability of the natural gas technologies.

TESTIMONY FOR THE RECORD
U.S. Senator Joni Ernst (R-IA)

U.S. Senate Energy and Natural Resources Committee
Subcommittee on Energy
S.143, the Department of Energy Veterans' Health Initiative Act
July 9, 2019

Chairman Cassidy, Ranking Member Heinrich: Thank you for the opportunity to present to the Subcommittee testimony for the record in support of S.143, the *Department of Energy Veterans' Health Initiative Act*. I also want to thank the members of this committee, Senators Heinrich (the co-lead of this bill), Gardner, and King; as well as Senators Hassan, Portman and Rounds for supporting this bill.

As a veteran myself, and as a U.S. Senator representing thousands of veterans across Iowa, finding new and innovative ways to do the job of serving those who have served our nation is always at the forefront of my mind. In May 2017, the Department of Veterans Affairs (VA) and the Department of Energy (DOE) announced a first-of-its-kind partnership to begin using "big data" to identify health care trends among veterans and begin working toward new treatments and prevention strategies. This intersection between technology and helping the communities we serve is exciting, and one that I was pleased to support.

The marquee piece of the initiative is the MVP-CHAMPION program, or the Million Veteran Program, Computational Health Analytics for Medical Precision to Improve Outcomes Now, which allows hundreds of thousands of veterans to voluntarily share information about their health history, including providing DNA samples as well as securely offering their electronic health records for research and analysis.

The partnership also utilizes survey data from questionnaires that specifically ask participating veterans about health care history, lifestyle trends and military experiences to develop algorithms that will more accurately generate personalized risk scores for suicide. These scores will enhance VA providers' ability to identify which patients are at most risk to taking their own life and lead to more effective suicide prevention options.

As a veteran, reducing veteran suicide is a top priority of mine and, unfortunately, I know that each member of this body is affected by this tragic and widespread epidemic crippling our veteran communities. To date, almost six-hundred thousand veterans have volunteered this information to the MVP-CHAMPION program. As you can imagine, with this much information on the health history and outcomes of a key population, the VA will be empowered to make better decisions about care and resourcing.

S.143 would ensure that these breakthrough research efforts continue by authorizing the MPV-CHAMPION program through 2023. It is also our intention for the legislation to unleash the power of artificial intelligence (AI) to solve complex data challenges, which is why we included a pilot program in the proposal. This pilot will promote more effective and secure data sharing between

our National Laboratories and other research entities as well as facilities within the Department of Energy to harness emerging technologies like AI.

Remaining at the cutting edge of technology and science, we can make new strides forward in terms of our security and economy while also boldly promoting policies that will honor those that served and provide them with the world class VA care they have earned. Proposals like the S.143 not only keep people healthy and safe, but lead to more prudent and informed decision making from policy-makers.

I urge the committee to support this bill.

Thank you.

FPCC
FEDERAL PERFORMANCE CONTRACTING COALITION

© FEDERAL PERFORMANCE CONTRACTING COALITION
805 15TH STREET, NW, SUITE 708
WASHINGTON, DC 20005 | 202.554.5828

June 13, 2019

The Honorable Lisa Murkowski
Chairwoman
Committee on Energy and Natural Resources
United States Senate
304 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Joe Manchin
Ranking Member
Committee on Energy and Natural Resources
United States Senate
304 Dirksen Senate Office Building
Washington, DC 20510

Dear Chairwoman Murkowski and Ranking Member Manchin:

I write today on behalf of the Federal Performance Contracting Coalition to support your introduction of the Federal Energy and Water Management Performance Act of 2019. We are excited that the bill will re-assert federal leadership by authorizing new forward-looking energy intensity and water reduction goals that recognize past agency performance. This legislation will make significant contributions to reducing the carbon footprint associated with energy and water waste within federal agencies through common-sense cost-saving measures. We also appreciate that the bill explicitly authorizes the critical Federal Energy Management Program (FEMP) at the Department of Energy (DOE).

As you know, the federal government has had energy intensity reduction goals in statute for more than a decade. The last set of goals, which were set in the Energy Policy Act of 2005 and amended by the Energy Independence and Security Act of 2007, expired in 2015. Most recently, energy use intensity (EUI) targets extended by Executive Order were revoked, causing a void in federal leadership in energy efficiency for the first time since agency energy targets began two decades ago. These goals really do drive agencies to be more efficient. In fact, on average, our federal buildings were 26.7% less energy intensive in 2017 than in 2003. Much of the improvement, particularly in recent years, has been the result of an increased use of performance contracting to achieve energy and water reductions which require no up-front cost to the federal government.

Water reduction goals have also been exceeded by agencies, but much "low hanging fruit" remains to be plucked by setting new goals that reflect that successful performance. Agencies had been required to reduce water consumption intensity by 20% below 2007 levels by 2015, and by 2017 had reduced water intensity by 26.1%. Even more reductions can be achieved, and we recommend utilizing performance-based contracts to meet agency energy and water goals established in this bill.

We are glad to see explicit authorization of FEMP. This small, but impactful program within DOE is tasked with helping all agencies of the federal government use energy related resources more wisely. The trainings, technical assistance, evaluations and oversight it provides is invaluable, regardless of the specific priorities of the day.

FPCC
FEDERAL PERFORMANCE
CONTRACTING COALITION

© FEDERAL PERFORMANCE CONTRACTING COALITION
805 15TH STREET, NW, SUITE 708
WASHINGTON, DC 20005 | 202.554.5828

Finally, thank you for your wonderful and dedicated staffs. They have worked tirelessly to execute your vision for reducing energy and water use and costs while improving federal infrastructure.

Sincerely,

Jennifer Schafer
Executive Director

From: Richard W. Ford
To: fortherecord (Energy)
Subject: S1685 Carbon Capture and Sequestration
Date: Monday, July 8, 2019 2:37:01 PM

Dear Committee Members,

I am opposed to bill S1685 and any government spending on carbon capture and sequestration. CCS has the unintended consequence of increasing the amount of fossil fuel use per net kilowatt of electric output.
A basic law of physics is that every 44 pounds of carbon dioxide (a number of pounds equal to the molecular weight) occupies 359 cubic feet. To reduce that large volume of carbon dioxide gas into a dense liquid
for transport or storage requires some combination of compression and cooling, such as to 146 pounds per square inch and 40 degrees below zero Fahrenheit. The electricity to run the compressors cannot come
from nowhere. Extra fuel needs to be burned to generate the electricity to run the compressors. Drilling more wells and doing more fracking to get that extra fuel releases methane into the atmosphere, which is
a more potent greenhouse gas than the carbon dioxide which CCS was intended to capture.

There are many practical ways of reducing greenhouse gas emissions. CCS would be a case of wasting the resources available on something that is not a practical solution.

Richard W. Ford, CEM
Energy Engineer
OEM Energy Services
7601 Transit Road
East Amherst, NY 14051
716-440-5255
RWFord@roadrunner.com

ITIF | INFORMATION TECHNOLOGY & INNOVATION FOUNDATION

July 19, 2019

Senator Angus King
U.S. Senate
Washington DC 20510

Dear Senator King:

It is my pleasure to share with you ITIF's support for S. 2048, which would require the Departments of Energy and Defense to work together to establish a demonstration initiative focused on the development of long-duration energy storage technologies. The bill advances an important item on the clean energy innovation policy agenda that is well-supported by our evidence-based research.

ITIF's report "Across the Second Valley of Death" (July 2017) identified clean energy demonstration, including energy storage, as a key phase of the innovation process that requires additional federal investment. ITIF's report "An Innovation Agenda for Deep Decarbonization" (November 2018) identified long-duration energy storage as one of the most important gaps in the federal energy research, development, and demonstration portfolio as the nation seeks to create pathways to deep decarbonization.

Most recent and most relevant is ITIF's report "The Clean Energy Dividend: Military Investment in Energy Technology and What It Means for Civilian Energy Innovation" (March 2019), which was co-authored by former senior DOD energy officials Dorothy Robyn and Jeffrey Marqusee. Drs. Robyn and Marqusee concluded in general that "collaboration with DOD would make DOE a stronger innovator" and recommended specifically that "DOE should partner with DOD on its stationary storage programs."

S. 2048 would put this partnership on a solid statutory basis and lay the groundwork for Congressional oversight to ensure that the two departments cooperate in this important area of clean energy technology.

Thank you for your leadership in bringing this bill forward.

Sincerely,

Robert D. Atkinson

Robert D. Atkinson
President and Founder, The Information Technology and Innovation Foundation

INFORMATION TECHNOLOGY AND INNOVATION FOUNDATION | 700 K STREET NW | SUITE 600 | WASHINGTON, DC 20001
MAIL@ITIF.ORG | (202) 449-1351