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DOE MODERNIZATION: ADVANCING DOE'S MISSION FOR NATIONAL, ECONOMIC, AND ENERGY SECURITY OF THE UNITED STATES

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY

OF THE

COMMITTEE ON ENERGY AND COMMERCE
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTEENTH CONGRESS

SECOND SESSION

JANUARY 9, 2018

Serial No. 115–90

Printed for the use of the Committee on Energy and Commerce
energycommerce.house.gov

U.S. GOVERNMENT PUBLISHING OFFICE
29–537 WASHINGTON : 2018

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DOE MODERNIZATION: ADVANCING DOE'S MISSION FOR NATIONAL, ECONOMIC, AND ENERGY SECURITY OF THE UNITED STATES

TUESDAY, JANUARY 9, 2018

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY,
COMMITTEE ON ENERGY AND COMMERCE,
Washington, DC.

The subcommittee met, pursuant to call, at 10:02 in room 2123, Rayburn House Office Building, Hon. Fred Upton (chairman of the subcommittee) presiding.

Present: Representatives Upton, Olson, Barton, Shimkus, Latta, Harper, McKinley, Kinzinger, Griffith, Johnson, Long, Bucshon, Flores, Mullin, Hudson, Cramer, Walberg, Duncan, Walden (ex officio), Rush, Peters, Doyle, Castor, Sarbanes, Welch, Tonko, Loebsack, Schrader, Kennedy, Butterfield, and Pallone (ex officio).

Staff Present: Ray Baum, Staff Director; Mike Bloomquist, Deputy Staff Director; Samantha Bopp, Staff Assistant; Allie Bury, Legislative Clerk, Energy Environment; Karen Christian, General Counsel; Kelly Collins, Staff Assistant; Wyatt Ellertson, Professional Staff, Energy/Environment; Margaret Tucker Fogarty, Staff Assistant; Adam Fromm, Director of Outreach and Coalitions; Jordan Haverly, Policy Coordinator, Environment; A.T. Johnston, Senior Policy Advisor, Energy; Ben Lieberman, Senior Counsel, Energy; Mary Martin, Chief Counsel, Energy/Environment; Katie McKeogh, Press Assistant; Brandon Mooney, Deputy Chief Counsel, Energy; Mark Ratner, Policy Coordinator; Annelise Rickert, Counsel, Energy; Dan Schneider, Press Secretary; Peter Spencer, Professional Staff Member, Energy; Jason Stanek, Senior Counsel, Energy; Madeline Vey, Policy Coordinator, DCCP; Andy Zach, Senior Professional Staff Member, Environment; Priscilla Barbour, Minority Energy Fellow; Rick Kessler, Minority Senior Advisor and Staff Director, Energy and Environment; John Marshall, Minority Policy Coordinator; Jon Monger, Minority Counsel; Alexander Ratner, Minority Policy Analyst; Tim Robinson, Minority Chief Counsel; Andrew Souvall, Minority Director of Communications, Outreach and Member Services; Tuley Wright, Minority Energy and Environment Policy Advisor; and C.J. Young, Minority Press Secretary.

OPENING STATEMENT OF HON. FRED UPTON, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. UPTON. Good morning. Good morning, everybody. Happy New Year.

Today's hearing begins this subcommittee's work in this session to identify what steps we need to do to make sure that DOE can address the national economic and energy security challenges that are going to be confronting the Nation over the coming number of decades.

Recent years, we have been updating certain agency programs and authorities to shift DOE's mission focus more fully away from the energy scarcity mind-set of its founding back in the 1970s. We have worked to position the agency more appropriately toward the tremendous energy resources now available to our country and the economic and geopolitical benefits of those resources. We have sought to modernize the Department's strategic petroleum reserve and its response capabilities, and we have upgraded DOE's emergency preparedness for energy supply distributions and its authorities to protect critical infrastructure from physical as well as cyber attacks.

But we are reminded almost daily that more needs to be done. Growing nuclear weapons, threats, and tens of billions of dollars needed to maintain the nuclear deterrent underscores the urgency for creating efficient, effective, and durable governance and management of DOE's nuclear security missions.

So increasingly complex interconnections of our modern energy systems propelled by the digital efficiencies of the cyber age present new and growing risks. Getting ahead of these risks requires secretarial leadership and coordinated attention across the agency's many programs and operations. Modernizing the Department of Energy means ensuring it has the appropriate statutory authorities and sound management structures to meet not only the challenges that we know about today, but what may be coming over the horizon. It means ensuring agency leadership can align with the Department's operations and resources to meet those priorities, and it means ensuring the tremendous scientific and technological assets of this agency are effectively focused for the benefit of the long-term security and prosperity of all Americans.

Our two panels today will help look at what is needed to meet current and emerging challenges. We are going to hear from the senior leadership of the Department on the first panel. And with that, who once served this committee very well as its staff director, is the deputy secretary for the Department. He is essentially DOE's CEO. So I look forward to hearing his plans for aligning the Department to meet the administration's priorities and to discuss those priorities.

He is joined by three Department Under Secretaries responsible for the bulk of its missions. Under Secretary of Energy Mark Menezes, also a capable alumnus of this committee, can help us understand what is necessary to enhance the Department's work regarding all of our national energy policy interests, and what more may be needed to enhance DOE's emergency and cyber functions. General Frank Klotz, who heads the Department's nuclear security enterprise, and with several years under his belt at DOE, has im-

portant perspective on what is needed for efficient and effective execution of the Department's vital nuclear and nonproliferation programs and related work across the DOE's enterprise. And finally, Under Secretary of Science Paul Dabbar can help examine how best to deploy and maintain the scientific and technological capabilities at the national laboratory system and its facilities offer to support the Department's missions. He also has new responsibilities for the Office of Environmental Management which oversees complicated environmental cleanup projects that present a host of management challenges.

The second panel offers broader perspectives to help us assess what more is needed to improve execution of the agency's mission and to prepare for future challenges. We will hear from distinguished leaders and scientists on what is necessary to unleash the full benefits of the national lab system. We will hear how to ensure appropriate oversight in management of projects and programs in the national and nuclear security space and across departmental activities. We will hear how better to focus DOE's support of innovation and what our era of the energy abundance means for DOE responsibilities, both here and abroad.

Our testimony today will start a record to inform our modernization efforts and to assist us as we prioritize what program authorizations to tackle in this new session of the Congress.

With that, I yield for an opening statement from my friend and colleague, the ranking member of the energy subcommittee, Mr. Rush, from the good State of Illinois.

[The prepared statement of Mr. Upton follows:]

PREPARED STATEMENT OF HON. FRED UPTON

Today's hearing begins the subcommittee's work this session to identify what steps Congress may take to be sure DOE can address the national, economic, and energy security challenges that will be confronting the Nation over the coming decades.

In recent years, we've been updating certain agency programs and authorities to shift DOE's mission focus more fully away from the energy scarcity mindset of its founding in the 1970s.

We've worked to position the agency more appropriately towards the tremendous energy resources now available to our nation—and the economic and geopolitical benefits of those resources. We've sought to modernize the department's Strategic Petroleum Reserve and its response capabilities. And we've upgraded DOE's emergency preparedness for energy supply disruptions and its authorities to protect critical infrastructure from physical and cyber threats.

But we are reminded almost daily that more needs to be done. Growing nuclear weapons threats and the tens of billions of dollars needed to maintain the nuclear deterrent underscore the urgency for creating efficient, effective, and durable governance and management of DOE's nuclear security missions.

The increasingly complex interconnections of our modern energy systems, propelled by the digital efficiencies of the cyber age, present new and growing risks. Getting ahead of these risks requires Secretarial leadership and coordinated attention across the agency's many programs and operations.

Modernizing the Department of Energy means ensuring it has the appropriate statutory authorities and sound management structure to meet not only the challenges we know about today, but what may be coming over the horizon.

It means ensuring agency leadership can align the department's operations and resources to meet priorities. It means ensuring the tremendous scientific and technological assets of this agency are effectively focused for the benefit of the long-term security and prosperity of Americans.

Our two panels today will help us look at what is needed to meet current and emerging challenges. We will hear from the senior leadership of the Department on the first panel.

Dan Brouillette, who once served this Committee very well as its staff director, is the Deputy Secretary for the Department. He is essentially DOE's chief operating officer, and so I look forward to hearing his plans for aligning the department to meet the Administration's priorities, and to discuss those priorities.

He is joined by the three Department Under Secretaries, responsible for the bulk of its missions. Under Secretary of Energy Mark Menezes, also a capable alumnus of this committee, can help us understand what is necessary to enhance the department's work regarding all our national energy policy interests, and what more may be needed to enhance DOE's emergency and cyber functions.

General Frank Klotz, who heads the Department's nuclear security enterprise and, with several years under his belt at DOE, has important perspective on what is needed for efficient and effective execution of the Department's vital nuclear and nonproliferation programs, and related work across DOE's enterprise.

Finally, Under Secretary for Science Paul Dabbar, can help examine how best to deploy and maintain the scientific and technological capabilities the national laboratory system and its facilities offer to support the Department's missions. He also has new responsibilities for the Office of Environmental Management—which oversees complicated environmental cleanup projects that present a host of management challenges.

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We'll hear from distinguished leaders and scientists on what is necessary to unleash the full benefits of the national laboratory system. We'll hear how to ensure appropriate oversight and management of projects and programs in the national and nuclear security space and across departmental activities.

We'll hear how better to focus DOE's support of innovation and what our era of energy abundance means for DOE responsibilities, here and abroad.

Our testimony today will start a record to inform our modernization efforts and to assist us as we prioritize what program authorizations to tackle in the upcoming session of Congress.

OPENING STATEMENT OF HON. BOBBY L. RUSH, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ILLINOIS

Mr. RUSH. I want to thank you, Mr. Chairman, for holding this important hearing on modernizing the Department of Energy. I also want to welcome all of the witnesses to this hearing.

Mr. Chairman, for constituents, such as those I represent, one of the most pressing issues regarding DOE involves a matter of ensuring that the agency is representative of all communities, and that the needs of all citizens are being addressed through its energy policy and initiatives including the loan and grant programs as well as through engagement at the national labs, and access to contracting and vendor opportunities. Many of my constituents are constantly seeking ways to break into what has essentially become an onerous, good ol' boys network.

As you are aware of, Mr. Chairman, my office worked extensively with former Secretary Moniz to establish the minorities and energy initiative which was designed to help foster increased minority participation in all sections of the energy industry. And this initiative, Mr. Chairman, was successful in beginning the process of raising awareness and engagement between DOE, industry, and minority communities. However, Secretary Perry did not seem to even be aware of the program, and many of the activities that were established by this initiative seemed to have tapered off.

Mr. Chairman, as we go through this process of modernizing the Department, it is imperative that we examine the leadership profile of the agency and work to ensure that there is diversity at the top where most of the decisions and policies are first enacted. We

need more people of color in the top echelons of the Department from the Secretary's office as well as in the Office of Science, which directs billions of research dollars to higher education institutions.

Mr. Chairman, we need more diversity of people, and so, on the review boards, and the boards and counselors which are responsible for making key decisions regarding the national labs, among many other issues. Mr. Chairman, when it comes to these same national labs, we need more women and people of color running these institutions so that decisions regarding increased inclusion and diversity are made inherently, and not simply as an afterthought or as a checklist, or as an empty token act.

Additionally, Mr. Chairman, we need to ensure that the senior executive staff, or SES, who play pivotal roles in running the Department and making important decisions regarding the agency's policies and priorities also include men and women of color.

Mr. Chairman, it is easy to overlook the importance of these issues if you are not among the groups that have been historically excluded. But when we are using taxpayer dollars to fund the labs or to dole out loans and grants to the same schools, the same universities, or to provide millions of dollars to contractors and vendors, then it must be incumbent upon us, the policymakers here in Congress, to ensure that everyone is given the same opportunity to share in the wealth and to share in the resources.

So, Mr. Chairman, that said, I look forward to working with Mr. Martin as well as other members of this subcommittee to restructure the Department in a way that addresses the systemic and institutional discrepancies that exist in the agency today.

With that, I yield back.

Mr. UPTON. Thank you.

The chair will now recognize the chair of the full committee, Mr. Walden, from Oregon.

OPENING STATEMENT OF HON. GREG WALDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF OREGON

Mr. WALDEN. Thank you very much, Mr. Chairman. And I want to welcome our panelists here today. This is a really important hearing for the committee, and it is a goal of this committee to begin the process to modernize the Department of Energy, an agency that was created in an era of scarcity. And we find ourselves in an era of abundance but of new challenges involving the environment and energy. And so we look forward to your testimony today. In October, we heard directly from Secretary Perry on his vision for the Department. Today, we will hear from the top leaders of that Department on how the Secretary's vision can be advanced and the role Congress is being asked to play.

We also have a distinguished second panel. This panel features important perspectives on Department of Energy's various operations concerning the national labs, nuclear oversight, research, and energy security challenges. So I appreciate all of your participation today. It is also always a pleasure to welcome back to the Energy and Commerce Committee alumni, including both Deputy Director Brouillette and Under Secretary Menezes, who served this committee with distinction. Dan was staff director and Mark as the Energy and Environment chief counsel. So we look forward to hav-

ing you back. It is always fun to question former members of the committee who wrote questions for all of us to ask other witnesses in the past.

I also understand that Under Secretary Dabbar visited the Hanford site this last week. Thank you for doing that. Secretary Perry was kind enough both to come out and visit Hanford as well as take a look at McNary Dam, one of our great hydro energy, non-carbon-emitting energy sources in the northwest last year.

Hanford is just up the Columbia River from my home and across from my district. And all of us in the Pacific Northwest are deeply concerned about the cleanup, making sure it says on schedule, on budget, and on time. I also want to recognize Administrator Klotz's long service to our country, sir. General Klotz has served in distinguished positions in both Republican and Democratic administrations throughout his career, including almost 4 years as NNSA administrator. So we are glad for your service and your participation today.

While the domestic international energy posture is substantially different from what it was when Congress established the Department more than 40 years ago, the importance of DOE's role in serving the national and the public interest has only increased. We are reaping the benefits of energy abundance. But legacy challenges remain, such as the cleanup of Cold War sites and permanent disposal of nuclear waste, which my colleague, Mr. Shimkus, has played an incredibly important, strong, and dedicated role toward achieving permanent and interim storage.

New risks have evolved, such as cybersecurity threats, the electric grid, managing and overseeing the modernization of our aging energy infrastructure.

So our responsibility is to ensure that a modernized Department of Energy is fully prepared to meet these 21st century challenges. So as we examine the DOE management and mission priorities today, we should keep in mind the benefits of the interconnected nature of the Department's missions. These missions, national security, energy security, environmental remediation, and mission enabling scientific research across the DOE enterprise, can be difficult and expensive to manage.

I am confident the team of professionals on our first panel today are up to this task. This committee will work through the remainder of this Congress and beyond to ensure the Department's organization and missions are aligned with the energy security challenges of the Nation and that we are nimble enough to meet the challenges of tomorrow. At my direction, the committee has been examining whether DOE resources are focused on its core missions. Going forward, we will review certain DOE authorizations—by the way, many of which expired a decade ago—to ensure proper program alignment.

I believe in collaboration with the Department of Energy. Many bipartisan good government policies can be implemented if we work together. So I look forward to continuing a positive working relationship.

The basic scientific and applied energy research conducted throughout the DOE lab system is the foundation for new technological advances. These advances enable us to remain an inter-

national leader in innovation, security, and scientific know-how. This is the fundamental question before us today: How can we best harness the Department's enormous scientific, technical, and world-class capabilities to enhance America's national, economic, and energy security?

So I look forward to your testimony today and your response to our questions, both this panel and the one that follows.

With that, Mr. Chairman, I yield back the balance of my time. And thank you for your leadership on this issue.

[The prepared statement of Mr. Walden follows:]

PREPARED STATEMENT OF HON. GREG WALDEN

Good morning and welcome to this morning's hearing as we continue our efforts to modernize the Department of Energy. In October, we heard directly from Secretary Perry on his vision for the department and today we will hear from his top lieutenants as to how the secretary's vision will be advanced.

We also have a distinguished second panel, featuring important perspectives on DOE's various operations concerning the national labs, nuclear oversight, research and energy security challenges. I appreciate all of our witnesses joining us today.

It is always a pleasure to welcome Energy and Commerce alumni back to the committee. Both Deputy Secretary Brouillette and Under Secretary Menezes served this committee with distinction—Dan as staff director and Mark as the Energy and Environment Chief Counsel. I appreciate that you know how this committee operates, and look forward to accomplishing much together.

I also understand that Under Secretary Dabbar visited the Hanford site last week, which I appreciate. Hanford is just up the Columbia River from my Oregon district and all of us in the Pacific Northwest have a great interest in seeing the cleanup there completed. I would also like to recognize Administrator Klotz's long service to our country. General Klotz has served in distinguished positions in both Republican and Democrat administrations throughout his career, including almost 4 years as NNSA Administrator.

While the domestic and international energy posture is substantially different from what it was when Congress established the department over 40 years ago, the importance of DOE's role in serving the national and public interest has increased. We are reaping the benefits of energy abundance, but legacy challenges remain, such as cleanup of Cold War sites and permanent disposal of nuclear waste. New risks have evolved, such as cyber security threats to the electric grid and managing and overseeing the modernization of our aging energy infrastructure. Our responsibility is to ensure a modernized DOE is fully prepared to meet these 21st Century challenges.

As we examine the DOE management and mission priorities today, we should keep in mind the benefits of the interconnected nature of the department's missions. These missions—national security, energy security, environmental remediation, and mission-enabling scientific research-across the DOE enterprise can be difficult and expensive to manage. I am confident that the team of professionals on our first panel today are up to this task. This committee will work through the remainder of this Congress, and beyond, to ensure the department's organization and missions are aligned with the energy security challenges of today and are nimble enough to meet the challenges of tomorrow.

At my direction, the committee has been examining whether DOE resources are focused on its core missions. Going forward, we will review certain DOE authorizations—many of which expired over a decade ago—to ensure proper program alignment. I believe, in collaboration with DOE, many bipartisan, good government policies can be implemented. I look forward to a positive working relationship.

The basic scientific and applied energy research conducted throughout the DOE lab system is the foundation for new technological advances. These advances enable us to remain an international leader in innovation, security, and scientific know how. This is the fundamental question before us today: how can we best harness the department's enormous scientific, technical, and world-class capabilities to enhance America's national, economic, and energy security? I look forward to hearing from all the witnesses today.

Mr. UPTON. Thank you.

The chair will now recognize the ranking member of the full committee, Mr. Pallone, from New Jersey, 5 minutes.

OPENING STATEMENT OF HON. FRANK PALLONE, JR., A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. PALLONE. Thank you, Mr. Chairman.

As we start a new year, it is nice to finally have a full panel of agency witnesses before us. Last year, I was repeatedly disappointed by the Trump administration's unwillingness to send agency witnesses before our committee. Today, we have an experienced panel of senior leadership officials from the Department of Energy, including two distinguished former Energy and Commerce staffers, Deputy Secretary Dan Brouillette, and Under Secretary for Energy Mark Menezes. I am pleased they are back with us, and I want to welcome them, as well as the other agency officials.

The purpose of this hearing, according to my Republican colleagues, is to weigh whether DOE is in need of modernization, and what parts of its mission are still necessary. Now, publicly, my colleagues have discussed a full-fledged effort to reauthorize the Department, an effort that has not occurred since the creation of DOE over 40 years ago. However, so far, they have been short on details, and I hope to learn more today about what my Republican colleagues want to achieve in this endeavor. Specifically, we need to know what real problems at the Department we are attempting to solve. If my Republican colleagues want to take a targeted look at DOE programs to see where improvements can be made, then I am open to listening to their proposals. We might be able to find the areas of agreement where we could work together to enact solutions.

However, if the goal is simply to eliminate scores of successful programs and arbitrarily shrink of size of DOE, like the unrealistic and flawed Trump budget proposal last year, then you are going to find opposition on this side of the aisle. Last year, President Trump made his priorities clear by proposing a budget for DOE that gutted or eliminated critical programs that historically had bipartisan support. The President's budget took a hatchet to popular bipartisan programs like energy efficiency, renewable energy, the Loan Programs Office and the Weatherization Assistance Program.

If my Republican colleagues hope to work together on this, they should know in advance that we will not support any reorganization that harms these programs or others which benefit consumers and help combat climate change. And similarly, we will not support any reorganization that attempts to shift some or all of EPA's programs into the Department of Energy. I do believe there are ways that the DOE can improve, and more successfully, fulfill its mission. And I think we can work together to make those improvements. For example, according to the Government Accountability Office, DOE's Office of Environmental Management and the National Nuclear Security Administration have demonstrated limited progress in improving contract management and have struggled to ensure that they have the financial and staffing capacity to mitigate risk. So we can and must develop bipartisan solutions that address these and other critically important issues.

The Department of Energy is a vital part of the executive branch, playing a critical role in incentivizing the development of clean energy technologies, conducting cutting-edge scientific research, and maintaining our Nation's nuclear security. DOE is also home to a number of other agencies that operate independently and are vital to our Nation's energy policy, including the Energy Information Administration and the Federal Energy Regulatory Commission, or FERC. And it is critical that the independence of these agencies be maintained. I was pleased to see that FERC reaffirmed its independence yesterday when the five commissioners unanimously rejected Secretary Perry's proposal to provide preferential rates to coal and nuclear generation.

So we have two knowledgeable panels of witnesses before us today, and I hope, and I look forward to hearing their perspective. And I yield back the balance of my time. I don't think any of my colleagues want the time, so I will yield back, Mr. Chairman.

Mr. UPTON. The gentleman yields back, so we are ready for testimony.

I want to thank you all of you for sending your testimony up in advance. We could look at it half-time between the Alabama and the Georgia game. And we appreciate that. Your testimony will be made part of the record in its entirety, and we will give each of you 5 minutes to summarize that before we do the questions. You know the drill, and we will start with our friend, Dan Brouillette.

Thank you.

You have got to turn that—we have new switches since you were here.

STATEMENTS OF HON. DAN BROUILLETTE, DEPUTY SECRETARY, U.S. DEPARTMENT OF ENERGY; HON. MARK MENEZES, UNDER SECRETARY OF ENERGY, U.S. DEPARTMENT OF ENERGY; HON. PAUL DABBAR, UNDER SECRETARY FOR SCIENCE, U.S. DEPARTMENT OF ENERGY; AND HON. FRANK KLOTZ, UNDER SECRETARY FOR NUCLEAR SECURITY, AND ADMINISTRATOR NATIONAL NUCLEAR SECURITY ADMINISTRATION, U.S. DEPARTMENT OF ENERGY

STATEMENT OF DAN BROUILLETTE

Mr. BROUILLETTE. You guys have gotten a little technology since I have been here. And I am more accustomed to being on that side. The view is a little better from over there.

Chairman Upton and Ranking Member Rush and members of the committee, speaking for myself and my three colleagues, who will also testify today, it is on honor to appear before you on behalf of the administration and the Department of Energy. This is my first opportunity to testify before Congress as the Deputy Secretary of Energy, and I appreciate the opportunity to update you on our progress.

I am proud to work for such an outstanding Department, and especially under Secretary Perry, who is a true leader with exceptional management skills. He has set for us several priorities, and we will walk through this today. But just to run through them really quickly: Promoting America energy security by stressing innovation over regulation; enhancing national security through nuclear

security; addressing the obligation of legacy management and nuclear waste; and the topic of today's hearing, modernizing the Department of Energy. With my full testimony submitted for the record, allow me to briefly discuss these priorities.

Thanks to continued innovation from our national labs, we have ignited a technology revolution which has led to an energy revolution that is advancing our national security and our energy security. Today, we use energy cleaner and more efficiently, we obtain it from a wider diversity of sources, and we produce it more responsibly, affordably, and in greater abundance than previously predicted. We are closing in as a country on full energy independence, and we are on a path to achieving the administration's goal of energy dominance.

For far too long, U.S. energy policy has been hampered by a false choice between two goals: growing our economy or protecting the environment. The result was an overload of regulations that drastically reduced energy production. Our administration and the Department of Energy are working to replace the "or" with an "and." We are reducing unnecessary regulations on American energy, and in so doing, we are allowing our Nation to benefit fully from technological breakthroughs that reduce pollutants while dramatically increasing production.

We are also focused on ensuring the reliable delivery of electrical energy to the American consumer for years to come. America's electrical grid is strong and reliable because it is powered by a diverse mix of energy sources. These sources work together to mitigate disruptions and increase resiliency when periods of extreme temperatures, like the one we just recently faced, affect supply and demand.

As you know, last fall, Secretary Perry proposed that FERC consider establishing new pricing rules that factor in the important contributions of baseload generation to ensure long-term grid resiliency and reliability. FERC responded yesterday with the unanimous decision to direct regional transmission organizations and independent system operators to proactively evaluate the resilience of the bulk power system. We are encouraged by this action, and we look forward to working with FERC and the individual commissioners on this important issue.

But taking steps to ensure the grid's diverse energy supply is but one aspect of DOE's critical mission. Today, the Secretary of Energy is responsible for a broad range of national security, scientific, and environmental activities. A key challenge for any large enterprise with such a broad mission is that it remain agile enough to adapt to tomorrow's challenges. Last month, the Secretary announced his intention to modernize the Department, to return it to its statutory framework, and to enable us to deploy resources more effectively and efficiently.

The modernization plan directs several key changes. First, we have separated the Office of the Under Secretary of Science and Energy into two Under Secretary positions, and we restored of three Under Secretaries that are outlined in statute. The Under Secretary of Energy, the Under Secretary of Science, and the Under Secretary of Nuclear Security and administrator of the

NNSA, all of whom who are here today to address this subcommittee and respond to your questions.

The new Under Secretary of Energy, Mark Menezes, will focus on energy policy, technologies, security, and reliability, and certain departmental management functions. While the new Under Secretary for Science, Paul Dabbar, will focus on innovation, basic research, and environmental cleanup. General Klotz from NNSA, who will soon be retiring, as was mentioned by the chairman, is here today as well. And I would like to also publicly take this opportunity to thank him for his service to our Nation nearly 40 years, where he has served with honor and distinction, both in and out of uniform.

In addition, elements of the former Under Secretary for Management and Performance portfolio will now fall under my responsibility as the Deputy Secretary. These changes are a vital first step to better organizing the Department to carry out its broad mission and to get much needed results for the American people. We will continue to look at ways to maximize our effectiveness, and we look forward to working with Congress and, in particular, this committee. We look forward to consultations with you toward that end.

In conclusion, I would like to thank this subcommittee once again for inviting us to testify today. I believe each of the Under Secretaries has brief opening statements, and then we will all look forward to answering any questions that you may have.

Thank you, Mr. Chairman.

[The prepared statement of Mr. Brouillette follows:]

Testimony of Deputy Secretary Dan Brouillette
U.S. Department of Energy
Before the
U.S. House Committee on Energy and Commerce
Subcommittee on Energy
January 9, 2018

Chairman Upton, Ranking Member Rush, and Members of the Committee, speaking for myself and three of my colleagues who will also testify before you today, it is an honor to appear before you on behalf of the Administration. This is my first opportunity to testify before Congress as the Deputy Secretary of Energy, and I appreciate the opportunity to update you on our progress at the Department of Energy (the "Department" or "DOE").

As you may be aware, this is not my first tour at the Department, and when the Energy Secretary asked me to come back to serve, it was an easy sell. I believe there is no better place to work inside the federal government, and I am proud to be a part of such a great enterprise.

I am also proud to work under the Energy Secretary, a true leader with exceptional management skills. He has set important priorities for the coming years. These priorities include refocusing the Department on its core missions:

- Promoting America's energy security;
- Spurring innovation;
- Reducing regulatory burden;
- Restoring the nuclear security enterprise and enhancing national security through the military application of nuclear science; and
- Addressing the obligation of legacy management and nuclear waste.

I will elaborate momentarily on our progress regarding these priorities.

There remains much to do. As the Energy Secretary stated, Congress has a distinct role in helping us achieve these goals, and I look forward to our ongoing dialogue.

Sunday marked my five-month anniversary as Deputy Secretary, and during my brief tenure, I have visited several DOE sites, including five national laboratories (Los Alamos, Pacific Northwest, Oak Ridge, Sandia, and the National Renewable Energy Laboratory - NREL), Hanford, and the Western Area Power Administration, to name a few, and have attended DOE's 2017 Solar Decathlon in Denver, Colorado. I have interacted with some of the Department's best and brightest individuals and have gained an even greater appreciation of the breadth and critical importance of DOE's mission.

On national security, the Secretary and I have worked extensively with the National Nuclear Security Administration (NNSA) and the National Security Council to strengthen our nuclear deterrent and enhance our nation's security.

Because our work extends beyond our borders, I have traveled abroad to reiterate the President's and the Secretary's message that the U.S. is open for business and is a willing partner to those sharing our vision of making this world safer and more prosperous. I will depart tomorrow for Saudi Arabia and the U.A.E. to share that message with some of our Middle East partners and friends.

Now let me summarize our initiatives to achieve our priorities.

PROMOTING AMERICA'S ENERGY SECURITY

The United States is making remarkable strides toward energy security. Today we use energy more cleanly and more efficiently, obtain it from a wider diversity of sources, and produce it more affordably and in greater abundance than was predicted a few short years ago. As a result, we are closing in on our Nation's long-elusive goal of full energy independence. We are also on a path to achieving the Administration's goal of energy dominance, freeing our people at home and our allies abroad from reliance on other countries for our energy needs.

With our energy supplies increasingly secure, it is time to advance overall energy security further. It is time to ensure its reliable delivery to the American people in the years to come. We are attending to this critical need in a number of ways.

Grid Security

Among the most essential ways to ensure this outcome is by ensuring America has a reliable and resilient electric grid powered by a diverse mix of generation resources that help mitigate disruptions and enable rapid response when disruptions occur.

Last August the Department released the *Staff Report to the Secretary on Electricity Markets and Reliability.*

The report's recommendations included a call for the Federal Energy Regulatory Commission (FERC) to "expedite its efforts" to improve energy price formation in centrally organized wholesale electricity markets. This recommendation, in part, prompted the Secretary to exercise his authority under section 403 of the Department of Energy Organization Act and make a concrete proposal for pricing reform in FERC-approved organized markets.

The Secretary and I are grateful to those who submitted comments and engaged in vital conversation on the proposal. This includes PJM, whose leadership invited me to its headquarters in Valley Forge, Pennsylvania to tour the facility and discuss this issue.

I understand that FERC's decision is forthcoming. We look forward to working with the commissioners – and with you – to ensure tomorrow's grid remains as reliable and resilient as it is today.

Increasing Cybersecurity

In addition to electric grid resilience, our national and economic security also depends on the reliable function of the Nation's overall energy infrastructure in the face of the threat posed by malicious cyber actors. Cybersecurity is one of our top priorities and we are addressing it in a variety of ways.

A 2015 amendment to the Federal Power Act establishes DOE as the sector-specific agency for cybersecurity in the energy sector. DOE is the only statutorily-defined sector-specific agency, making it the lead sector-specific agency for supporting energy infrastructure owners and ensuring cyberattacks do not have a catastrophic impact on the energy sector. DOE is a unique sector-specific agency given that we experience these threats as energy infrastructure owners and bring deep technical expertise from 17 national labs to our work with industry. Private industry owns or operates the vast majority of the Nation's energy-sector assets, so strong partnerships with industry as well as our Federal colleagues are essential.

Accordingly, in coordination with the Department of Homeland Security and other Federal agency partners, we are working with the private sector to prepare, mitigate vulnerabilities, and help reduce impacts from threats. We also seek to enhance visibility and situational awareness. We are working to improve preparedness, planning and response capabilities for cyber incidents and to align them across state, local, tribal, territorial, and Federal jurisdictions. Finally, we are seeking to leverage the cutting-edge power of DOE's national labs to drive cybersecurity innovation across the energy sector.

As we do so, we must respond to the risks to our Department's own science, technology, nuclear security and energy infrastructure.

To that end, we are focused on improving enterprise cybersecurity risk management. We are creating an enterprise-wide threat management capability through our cyber operations center. We are bolstering organizational structures and supporting a culture of cybersecurity. We are investing in our infrastructure to reduce our exposure to threats and manage cybersecurity risks holistically.

DOE Efforts in Puerto Rico

In addition to focusing on grid resilience and cybersecurity throughout the United States, the Department continues to support restoration and long-term resilience planning efforts specifically in Puerto Rico. Last month, we held a workshop at our headquarters with public and private energy experts and stakeholders – including the Puerto Rican government and DOE's national labs – to consider long-term strategies to ensure the resilience of the island's energy infrastructure.

FOCUSING ON INNOVATION

Our Nation's continued progress on energy security – as well as economic prosperity – clearly depends on continued American ingenuity and innovation. The Secretary and I are very proud of the advancements that DOE's research and development have spurred.

DOE-funded R&D is truly inspirational.

Our national labs have put a distinctly American stamp on the last century of science. We support better coordination, communication, and collaboration between the labs and DOE program offices and are confident that they will continue to expand the frontiers of energy research and development.

REDUCING REGULATORY BURDEN

For too long, U.S. energy policy assumed a tradeoff between two great national goals – growing our economy and enhancing our environment. At DOE and throughout the Administration, we recognize that innovation provides the breakthrough technology to achieve them both. The same innovation-driven technology revolution that birthed America's energy revolution has ignited a clean energy revolution.

Accordingly, we support eliminating burdensome regulations that needlessly restrict energy production in the name of this tradeoff, and unleashing the American spirit of innovation.

Shortly after taking office, the President issued an executive order calling for a review of such regulations. The Administration has cut 22 regulations for every one new regulation, the most in the history of our country. In addition, during this Administration, an easement was approved by the Army and the Army Corps of Engineers across Corps managed lands that allowed oil flow through the Dakota Access Pipeline, the Keystone XL pipeline was approved, and the Environmental Protection Agency has proposed to repeal the Clean Power Plan. The President also signed legislation repealing a rule that hindered coal development, and is working to revive nuclear energy. While reducing these regulations will give Americans greater freedom to innovate, the recently enacted tax reform legislation could provide incentives to invest in further innovation.

By reducing government regulation and unleashing American innovation, we are fueling prosperity and strengthening our security.

ENHANCING NATIONAL SECURITY

Beyond securing energy dominance, DOE also has a unique role in our nation's security; the Secretary is a member of the National Security Council and the Department is responsible for managing our nuclear stockpile. We undertake these responsibilities with the utmost gravity.

Under the President's leadership, the Department, through NNSA, will work to deter those who threaten the United States, while convincing allies to put their full trust in our extended deterrence.

ADDRESSING THE OBLIGATIONS OF LEGACY MANAGEMENT AND NUCLEAR WASTE

In addition to maintaining and safeguarding our nuclear stockpile, the Secretary and I are committed to safely advancing the environmental clean-up from the nuclear weapons development and government-sponsored nuclear energy research which helped us win the Second World War and the Cold War.

I am proud of our progress in advancing that mission since I last served at DOE.

At Hanford, all 20 tons of plutonium have been shipped out. We have made significant progress on key sections of the Waste Treatment Plant (WTP). We are treating over two billion gallons of groundwater and removing more than 100,000 pounds of contaminants each year. Work along the Columbia River has so advanced that a portion of land has been transferred by Congress to the community to help boost jobs and the local economy.

But there is more work to be done, and we need your help to complete this cleanup safely and as efficiently and cost-effectively as possible.

In 2018, we will continue to make progress on key facilities and capabilities.

We will continue our progress on those sections of the Hanford WTP necessary for the Direct Feed Low Activity Waste (DFLAW) approach, which is vital to beginning actual tank waste treatment at Hanford. In addition, we will ramp up activities to increase shipments of transuranic waste (TRU) to the Waste Isolation Pilot Plant (WIPP). We also will initiate construction of the Oak Ridge Mercury Treatment Facility, where we broke ground last November. We will keep pressing ahead in dealing with deteriorating excess facilities. We will continue deactivating and decommissioning facilities at Portsmouth. Finally, we will deactivate and initiate demolition of the C-400 Cleaning Building at Paducah.

DOE MODERNIZATION

To further the Department's mission in light of the ever-changing world in which we operate and work, we as a Department must continue to adapt and to adjust our focus.

Accordingly, last month, the Secretary announced his intention to modernize the Department not only to deploy its magnificent resources more effectively and efficiently in order to address present and future challenges, but also to return the Department to its statutory framework.

Under the DOE Organization Act, the Secretary of Energy has the authority to organize the Department in order to meet current needs and advance the Administration's policy priorities. As the President and the Secretary have made clear, the Administration's priorities are: achieving U.S. energy dominance, protecting our energy and national security, and advancing innovation.

The modernization plan announced last month directs several key changes. First, we have now separated the Office of the Under Secretary for Science and Energy (established in 2013 during the previous Secretary's tenure) into two Under Secretary positions, restoring the three Under Secretaries outlined in the statute: the Under Secretary of Energy, the Under Secretary of Science; and the Under Secretary of Nuclear Security and Administrator of NNSA.

You will hear from all three Under Secretaries today.

The new Under Secretary of Energy will focus on energy policy, applied energy technologies, energy security and reliability, and certain DOE-wide management functions, while the new Under Secretary for Science will focus on innovation, basic scientific research, and environmental cleanup.

In addition, elements of the former Under Secretary for Management and Performance's portfolio now fall under the responsibility of the Deputy Secretary.

Finally, we have now called the former Office of Energy Policy and Systems Analysis the Office of Policy, which reports to the Under Secretary of Energy.

These changes are a first step to empowering the Department to carry out its mission with greater efficiency and effectiveness. We look forward to continuing the conversation internally and in consultation with Members of Congress.

ADVANCING ENERGY DOMINANCE THROUGH ENERGY PROGRAMS

The President's America First Energy Plan rightly calls for utilizing all of our energy sources to achieve energy security and economic strength at home and energy dominance through exports to markets abroad. Let me discuss how the Department is working to promote the responsible development of these resources as well as ensure the reliability and resilience of our electrical grid.

Fossil Energy

When it comes to fossil fuels, the United States has become the world's largest combined producer of oil and natural gas, resulting in an abundance of reliable and affordable energy resources available for domestic use and for export. We continue to support expeditious approval of natural gas exports, which provides both economic and strategic benefits to the United States and our allies.

Through the National Energy Technology Laboratory (NETL), we are pursuing early-stage R&D on clean coal technologies to improve the efficiency and reduce emissions on the existing fleet of coal-fired power plants, as well as developing transformational technologies to help build the coal plants of tomorrow. NETL is leading an effort to assess and develop technologies for the recovery of rare earth elements (REEs) from coal and coal by-products. Due to their unique chemical properties, REEs have become essential components of many technologies including electronics, computer and communication systems, transportation, health care, and national defense. NETL's REE Program aims to provide a pathway to improve the economics and reduce the environmental impact of a domestic coal-based REE value chain.

Renewable Energy and Energy Efficiency

When it comes to renewable energy, DOE's early-stage R&D at its National Renewable Energy Laboratory has contributed to significant advances. DOE research has helped reduce the levelized cost of electricity from renewable resources, including wind and solar, resulting in large capacity additions. In 2017, the solar industry met DOE's goal of 6 cents per kWh for utility-scale solar, three years ahead of schedule. This success allows DOE to focus its research priorities on a more significant, long-term challenge: integrating variable renewables into the electric grid. DOE recently funded three projects to study the integration of advanced forecasting technologies with grid planning and operations systems in partnership with the California Independent System Operator, the Midcontinent Independent System Operator, and the Electric Reliability Council of Texas. This research will validate whether or not these technologies can be efficiently integrated into energy management systems and enhance grid operation efficiency, while working to identify any future research needs.

DOE research also has contributed to technological advances in energy efficiency. From 2008 to 2015, total installations of home LED lightbulbs increased from under 100,000 to over 200 million, while LED costs fell by nearly 90%.

Nuclear Energy

When it comes to nuclear energy, the Administration recognizes it as a key source of electricity generation—providing 60% of our nation's emissions-free baseload energy around the clock, 24/7. As the most reliable and resilient source of clean electricity, nuclear energy contributes uniquely to our energy portfolio. Maintaining our commercial nuclear fleet is fundamental to our domestic energy security, economic prosperity, environmental sustainability, and global security objectives.

We are improving the economics and extending the life of the existing nuclear fleet in private-public partnerships that bring together the Department's national laboratories with industry. For example, the Department is working to enable industry to deploy digital, wireless monitoring and control systems and accident tolerant fuels that will improve the economics and extend the life of today's fleet.

We are developing improved ways to integrate nuclear and renewable energy sources so we can better manage the mix of variable and distributed energy sources on the electrical grid through hybrid energy systems. We are investing in the research and development of advanced reactor technologies, including small modular reactors, and opening our national labs to the U.S. nuclear industry in unprecedented ways. The Department recently issued a funding opportunity announcement (FOA) of approximately $30 million to support the development of advanced nuclear energy technology. Through this FOA we are soliciting proposals for cost-shared projects to develop innovative reactor designs and accompanying technologies with high potential to advance nuclear power in the United States.

Advanced nuclear technology development is a process that requires unique facilities and materials. The Department is establishing effective private-public partnerships to leverage technology advancements and focus federal investments on priority research and capability needs so we can accelerate the process of bringing innovative nuclear energy technologies to

market. By leveraging these partnerships and our national laboratory system, we are developing an advanced nuclear infrastructure, encouraging a resilient supply chain, and promoting a strong domestic industry now and for the future.

Electricity Delivery and Energy Reliability

Our economy, national security, and the well-being of our citizens depend on the reliable delivery of electricity. The Department, working with and through our national labs, supports key efforts to improve the resilience and reliability of the nation's electricity system. These include investing in our transmission system to support resource adequacy and generation diversity; developing and deploying cyber security technology for the energy sector; moving forward with new architecture approaches for the transmission and distribution system to enhance security and resilience; and advancing energy storage. Megawatt-scale energy storage is becoming a critical system asset that provides a buffer between generation and consumer demand through services such as frequency response, ramping support and bulk load shifting, allowing for greater asset utilization of generation. Initiatives within our Office of Electricity Delivery & Energy Reliability focus on developing new technologies and processes to provide a more resilient and reliable energy system and protecting critical infrastructure.

This office is also the lead for providing energy-related expertise to the Federal Emergency Management Agency (FEMA), interagency partners, and the Administration as part of DOE's emergency response activities. DOE serves as the lead agency for Emergency Support Function #12 - Energy (ESF-12) under the National Response Framework and as the Sector Specific Agency for Energy under Presidential Policy Directive 21. As the lead for ESF-12, DOE is responsible for providing information and analysis about energy disruptions and for helping to facilitate the restoration of damaged energy infrastructure.

Indian Energy

DOE's Office of Indian Energy (IE) promotes Indian energy development to increase efficiency, reduce costs, and strengthen tribal energy and economic infrastructure and electrification. To achieve this mission, IE offers education, technical assistance, and competitive grants to assist consenting Indian tribes and Alaska Native villages in overcoming the unique regulatory and economic challenges to developing their vast energy resources. In November of 2017, IE published a Notice of Intent to issue a FOA in the coming months for the deployment of energy efficiency, generation, or resilience projects on tribal lands on a fuel-neutral basis, consistent with this Administration's approach to energy policy.

Loan Programs

The Loan Programs Office (LPO) was created by Congress in 2005 to help American innovative energy and advanced auto manufacturing projects overcome hurdles in obtaining loans to help bring new technologies to commercial deployment. LPO manages a portfolio comprising more than $30 billion of loans, loan guarantees, and conditional commitments covering more than 30 projects. Overall, these loans and loan guarantees resulted in more than $50 billion in total project investment. LPO supported the latest generation of nuclear power facilities by

conditionally committing additional loan guarantees to Vogtle Units 3 & 4, the only new nuclear reactors under construction in the United States today.

Environment, Health, Safety and Security (AU)

AU is the Department's environment, health, safety and security office, and is responsible for safety analysis, security programs, and policy development to ensure the protection of DOE workers, the public, the environment and national security assets. This responsibility is accomplished through the maintenance of corporate-level policies and standards and by providing technical assistance for the implementation of those policies. The Office also provides assistance across the complex by sharing operating experiences, lessons learned and best practices and subject matter expert services to successfully manage its operations.

Project Management Oversight and Assessments

The Office of Project Management (PM) supports the Department's goal to increase the focus on efficient and effective management across the enterprise and improve performance in the areas of environmental cleanup, construction project management, and cybersecurity. Project Management is separate from our largest projects and programs - namely Environmental Management, Science, and the National Nuclear Security Administration – and strives to improve objective Departmental project management governance and project execution evaluation resulting in cost savings to be used on other projects.

ENHANCING SCIENTIFIC RESEARCH TO PROMOTE AMERICA'S ENERGY AND ECONOMIC SECURITY

DOE, through programs at all 17 DOE national laboratories but in particular its 10 national laboratories run by the Office of Science (SC), is among the largest federal sponsors of R&D in the physical sciences, covering the major disciplines that underpin DOE missions in science, energy, and national security. DOE is a federal leader in patent applications, patents, inventions disclosed, licenses and income-bearing licenses. The capabilities residing in these laboratories are well-known and highly regarded, from the world-class talent of their researchers to their state-of-the-art scientific tools and supercomputers.

One of the main priorities for SC will be the first U.S. exascale-capable supercomputer, with an intent to accelerate delivery to 2021.

Supercomputing is an area of intense international competition, in which sustained support is essential to our continued leadership in science, our economic competitiveness, and our national security. Computer modeling and simulation have become vital in all three realms, and exascale—computing at a billion-billion calculations a second—represents the future. Supercomputing paces advances in the physical sciences and high-technology areas stewarded by SC. This is just one technology area that is essential to U.S. economic security.

Working with partners Intel and Cray, ASCR has overseen a complete redesign of the planned Aurora machine for Argonne National Laboratory. This redesign tackled one of the biggest

challenges of moving to exascale—combining a major increase in computational capability with reducing power consumption. In addition, DOE is moving forward on developing applications for exascale systems, including ones for additive manufacturing and small modular reactors led by the Oak Ridge National Laboratory.

The Office of Fusion Energy Sciences has made remarkable strides using DOE's supercomputer capability to advance the understanding of how plasmas behave in fusion reactors. Recent massively parallel simulations modeled a key plasma transition for the first time, using a first-principles plasma turbulence simulation code and computing resources. The data for these simulations utilized 90% of the capacity of the Titan supercomputer, and the findings represent a major breakthrough.

The Long Baseline Neutrino Facility and the Deep Underground Neutrino Experiment (LBNF/DUNE) is another important SC priority, this one for the Office of High Energy Physics (HEP). This project is headquartered at Fermilab. Once completed, this international center for the study of neutrinos will pair the world's highest-intensity neutrino beam at Fermilab, with the infrastructure necessary to support massive, cryogenic far detectors installed deep underground at the Sanford Underground Research Facility in South Dakota, 800 miles to the west. Completion of LBNF/DUNE will cement U.S. preeminence in neutrino science, one of the frontiers of high-energy physics.

Additionally, the user facilities at the DOE national labs continue to foster cutting-edge scientific discoveries, supporting more than 30,000 additional researchers from academia, industry, and government spanning all 50 states and the District of Columbia. As an example, the Continuous Electron Beam Accelerator Facility at the Thomas Jefferson National Laboratory was recently upgraded to achieve up to 12 billion electron volts (GeV). This upgrade will allow for better study of the nuclear and particle physics building blocks of the universe.

The Office of Basic Energy Sciences was the first in the world to deploy accelerator-based X-ray lasers for the study of materials and chemical systems when the Linac Coherent Light Source (LCLS) was completed in 2009 at the Stanford Linear Accelerator Center (SLAC) National Accelerator Laboratory. SC leads the world in this important new realm of science through the upgrade of LCLS to become LCLS II. This upgrade will elevate X-ray science, allowing for new studies in ultrafast phenomena.

Upon completion, LCLS II will be the leading instrument of its kind in the world. This powerful x-ray laser will be capable of high-repetition rates of femtosecond observations (one millionth of a billionth of a second). These ultrafast observations provide an unprecedented window into chemical processes at the nanoscale, which will enable major advances in fields ranging from human health to energy production and storage to novel materials with extraordinary properties.

Over the last few years, Quantum Information Science (QIS) has emerged as a transformational area in science and technology, utilizing both advanced quantum theory and information theory. DOE laboratories are exploring QIS applications to physical sciences (detectors and sensors for use in materials, chemical and physics experiments), machine-learning and artificial intelligence. The national laboratories are uniquely qualified for these areas, leveraging decades of expertise

in applied mathematics, computer science, high-performance computing and high energy physics. For example, DOE sponsored a pilot project that seeks to develop fast quantum and classical algorithms for simulating quantum field theories, and quantum computing can potentially be used to identify candidate particles for dark matter.

Ongoing stewardship of the DOE Isotope Program remains critical to producing, managing, and distributing stable and radioactive isotopes for research, commercial, and medical applications for domestic use. Isotopes such as californium-252 are technologically important in oil production; while actinium-227 has improved cancer therapy. The DOE Isotope Program has produced and researched these and a host of others.

ENHANCING TECHNOLOGY TRANSITIONS

The mission of the Office of Technology Transitions (OTT) is to expand the commercial impact of the DOE R&D portfolio, advancing U.S. economic, energy, and national security interests. OTT is helping to ensure access to the cutting edge results of DOE's early stage research across the DOE complex, program offices, and national laboratories. It pursues this mission by facilitating industry and other partnerships. To accelerate these interests, DOE recently authorized national lab contractors to use Agreements for Commercializing Technology (ACT). Adding to the existing available agreements, laboratories will have fewer barriers for potential business partners to access lab expertise and capabilities.

OTT is assuming responsibility for other DOE programs, as well as consulting with NNSA to boost national lab capability in working with industry. For example, the Energy I-Corps Program accelerates lab researchers' understanding of business needs and communicating technological solutions from a market perspective.

The OTT Energy Investor Center directly facilitates national laboratories' engagement with investors and industry. In November, the Pacific Northwest National Laboratory and National Grid announced a new major partnership, resulting from an OTT-facilitated roundtable held earlier in the year.

ENVIRONMENTAL MANAGEMENT

The federal government's nuclear weapons production programs made significant contributions to our nation's defense for decades. But a byproduct of these programs are millions of gallons of liquid radioactive waste, thousands of tons of spent nuclear fuel and special nuclear material, large volumes of transuranic and mixed and low-level waste, huge quantities of contaminated soil and water, and thousands of excess facilities that must be cleaned up by the federal government.

The Office of Environmental Management (EM) has executed this mission for more than 25 years. The Department is leveraging past experiences, applying best practices and lessons learned; identifying, developing, and deploying practical technological solutions derived from scientific research; and looking for innovative and sustainable practices that make cleanup safer and more efficient. We believe the new alignment of SC and EM reporting to the Under

Secretary of Science will create added momentum in environmental cleanup. By leveraging the expertise of the national lab complex, and exploring potential project management and contract approaches used by SC, we will be able to better manage costs and solve EM challenges, while ensuring the highest level of safety for our Federal and contractor employees, the public, and the environment.

STRENGTHENING NUCLEAR SECURITY

NNSA was established by Congress in 2000 as a separately organized agency within the Department of Energy and was charged with three important and enduring missions: maintaining the safety, security, reliability, and effectiveness of the nuclear weapons stockpile; reducing the threat of nuclear proliferation and nuclear terrorism around the world; and providing naval nuclear propulsion to the U.S. Navy's fleet of aircraft carriers and submarines. NNSA continues to fulfill its national security missions, while supporting DOE and other agencies that draw upon its unique capabilities, by investing in its scientific, technical, and engineering intellectual capital and infrastructure. Since 1943, the U.S. nuclear program has relied extensively upon commercial industry and academic institutions to provide crucial technologies and innovations. NNSA is driving continued improvement in project management and the operations conducted by its management and operating (M&O) contractors, such as the establishment of clear lines of authority and accountability, and improved cost and schedule performance measures. As a result, since 2011, NNSA has delivered its $1.4 billion capital construction project portfolio 8% under original budget.

DEPARTMENT-WIDE COLLABORATION

NNSA collaborates closely with other DOE organizations on several fronts to execute its missions. The three national laboratories for which NNSA has responsibility – Sandia National Laboratories, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory – support NNSA's vital nuclear security missions and other DOE programs. Likewise, other national laboratories within the DOE complex provide significant assistance to advance NNSA's nuclear deterrence, nonproliferation, and naval reactors missions. For example, Pacific Northwest National Laboratory delivers science-based solutions to NNSA's global nuclear security mission in the areas of nuclear safeguards and export control, nonproliferation technology, and nuclear forensics. Argonne National Laboratory has played a central role since 1978 to convert research reactors and isotope production facilities all around the globe from the use of highly enriched uranium (HEU) to low enriched uranium, reducing the risk posed by weapons-usable HEU in civilian applications. Another of DOE's leading laboratories, Oak Ridge National Laboratory, covers the full spectrum of nuclear nonproliferation work, from basic research and development, to detection technologies and nuclear forensics.

This collaborative enterprise integrates the core competencies of each of the national laboratories, resulting in the most comprehensive research network of its kind. Together, the national laboratories are greater than the sum of their parts, creating a world-class scientific complex of unparalleled capability.

SUPERCOMPUTERS AND NATIONAL SECURITY

Four of the 10 fastest supercomputers in the world are located at DOE laboratories. The Department is a world leader in computational capability, as high-performance computing (HPC) is a critical component of DOE's national security, energy, and science missions. U.S. computing capabilities have been maintained over the past six decades through continuous research and the development and deployment of new computing systems, improving performance on applications of critical importance to government, industry, and academia. To maximize the benefits of high-performance computing in the coming decades, the United States will require an effective national response to increasing demands on computing power, emerging HPC technological challenges and opportunities, and growing competition with other nations.

The DOE Office of Science and NNSA are jointly responsible for executing the Exascale Computing Project (ECP), an initiative to develop a capable exascale computing program focusing on advanced simulation. The program will emphasize sustained performance on science and national security mission applications, as well as increased convergence between exascale and large-data analytic computing. In addition to underpinning NNSA's missions, the ECP will support DOE's applied energy technology developments. This joint partnership benefits our national security mission and our broader science and energy missions.

CONCLUSION

Mr. Chairman and members of the Subcommittee, I want to thank you again for inviting the Department to share our vision on how we can make America more prosperous and energy secure.

I look forward to working with the Committee and the full Congress to realize the President's vision of advancing our economic and national security by producing more reliable, affordable, and secure energy, fueling the creation of more high-paying jobs for American workers and achieving energy independence and eventual energy dominance for our country.

Thank you very much, and I look forward to answering your questions.

Mr. UPTON. Thank you, Mr. Brouillette.

Mr. Menezes, before you start, I just want to again thank you for your time that you spend with us on a bipartisan delegation trip to look at the terrible circumstances of the hurricane impact in both Puerto Rico and the Virgin Islands. You may want to update us from when we went together down last month. But thank you for appearing before us, and we look forward to your testimony and your responses to our questions as well.

Mr. MENEZES. Thank you. And I look forward to giving you an update on the Puerto Rico situation, should the committee desire.

STATEMENT OF HON. MARK MENEZES

Chairman Upton, Vice Chairman Olson, Ranking Member Rush, Chairmans Walden and Pallone, and members of the subcommittee, thank you for the opportunity to testify before you today, along with my colleagues, on behalf of the administration and the Department on the Department's modernization and realignment efforts.

Support of the administration's goals of energy dominance and economic competitiveness are realized through this realignment effort, which more carefully aligns the resources and efforts of the Department to promote the responsible development of resources, as well as to ensure the reliability and the resiliency of our electrical grid. Returning to this committee room, I am reminded of the work accomplished on behalf of the American people by the members and the staff of this committee, some of whom are here today, and with whom I have had the pleasure to work when I served on the staff. In my 2-month tenure as Under Secretary, I have had the pleasure of meeting with and speaking to a number of former colleagues and friends in endeavor to keep the lines of communication open as we continue to evaluate the progress made with this realignment.

As Chairman Upton mentioned in early December, I was invited to travel with Chairman Walden's codel to Puerto Rico. It was my fourth trip to Puerto Rico and the Virgin Islands, along with eight members of this committee. And we saw the damage firsthand that Hurricanes Irma and Maria brought to these territories. Seeing the devastation to the electricity delivery system as well as to the healthcare and other services, serve as a reminder of the important work that we can do to ensure reliable and resilient electricity delivery which is critical to the lives of so many millions.

The President's America First Energy Plan rightly calls for utilizing all of our energy resources in an all-of-the-above strategy to achieve energy security and economic strength at home and energy dominance through exports to markets abroad.

Let me give a few examples of how the Department is working to promote the responsible development of these resources as well as to ensure the reliability and resilience of our electrical grid. DOE is the lead Federal agency for supporting energy infrastructure owners and addressing cyber threats to the energy sector. We partner with the private sector to prepare for, protect against, and reduce the impact of cyber threats. We are a member of the National Security Council, and bring the deep technical expertise from our 17 national labs to recognize and respond to cyber threats.

The Office of Fossil Energy's national energy technology laboratory rare earth elements program focuses on developing technologies that be help recover rare earth elements from coal and coal by-products. The development of a domestic supply of rare earth elements that is economically competitive will help fuel our Nation's economic growth, secure our energy independence, by reducing our reliance on foreign rare earth element sources and increase our national security. Additionally, the National Renewable Energy Laboratory has conducted research that has delivered 6 cents per kilowatt hour utility scale solar 3 years ahead of the Department's goal. This success allows us to focus our research priorities on a more significant and long-term challenge, integrating variable renewables into our electric grid.

Reliability and affordability paired with grid security enhancements will provide a more resilient energy infrastructure for the Nation. Improved policies for the development of energy infrastructure, including gas pipelines, smart grids, small modular nuclear reactors, energy storage, along with public-private partnerships with our national laboratories, bringing research technology to market, will help us address our Nation's energy challenges.

The Department appreciates the committee's interest in our realignment, and we look forward to continuing to work with you on this and other opportunities to foster and promote responsible energy development and promote energy dominance.

Thank you again for the opportunity to be here today, and I look forward to your questions.

Mr. UPTON. Thank you.

Mr. Dabbar, welcome.

STATEMENT OF HON. PAUL DABBAR

Mr. DABBAR. Thank you, Chairman Upton, Ranking Member Rush, and members of the committee. I am honored to highlight the mission of the Under Secretary of Science, which includes the Office of Science, the Office of Technology Transitions, the Office of Environmental Management, and of Legacy Management. I could say much about our priorities in those areas, but I will instead focus my remarks today on basic research, market-driven innovation, and environmental cleanup.

In the area of basic research, let me highlight two near-term projects and programs. One of the main priorities of the Office of Science is the accelerated deployment of the first U.S. exoscale-capable super computer with the intent to deploy the first of the three machines in 2021, maintaining our global leadership in computing since its inception. Computer modeling and simulations are vital in this era of big data and complex systems. And exoscale computing, which will be at a billion billion calculations a second, that is 10 to the 18th, represents the next step. The evolution of super computing includes advances into physical sciences and high technology areas. This area is of intense international competition, and it is key that this project will maintain our global leadership.

The second project area I would like to highlight is the Long-Baseline Neutrino Facility and the Deep Underground Neutrino Experiment, LBNF DUNE, at Fermilab outside of Chicago. It is another important priority for our Department. Once completed, this

international center for neutrinos will study—will pair the world's highest intensity neutrino beam at Fermilab outside of Chicago with massive cryogenic detectors installed deep in a former mine in south Dakota. Completion of this project will cement U.S. preeminence in neutrino science, one of the frontiers of high energy physics. I can report to you today that America's global leadership in science remains dominant, as it has for the last century. In the area of enhancing technology transitions, the mission of the Office of Technology Transitions is to expand the commercial impact of R&D and the DOE portfolio by facilitating partnerships with industry and investors in close coordination with the DOE programs in the national labs.

Additionally, OTT is responsible for commercialization activities across all the DOE programs. Commercialization is a high priority of mine and the rest of the management team. I look forward to working closely with the Energy Investor Center, as well as with other DOE programs and our national labs to continue facilitating engagement with investors and with industry, and expand the pool of potential investment capital in DOE technologies.

In the area of environmental management, the government's nuclear weapons program has made significant contributions to our Nation's defense. But this legacy includes significant obligations to address liquid radioactive waste, spent nuclear fuel, special nuclear material, transuranic and mixed low level waste, contaminated soil and water, and thousands of access facilities. As a former radiation control worker, I am particularly sensitive to our obligations in the area, as well as the health and safety of those executing on the program.

We look forward to successful completion of key projects around low activity waste vitrification in Hanford, as well as salt waste treatment in Savannah River. This can significantly demonstrate risk reduction and progress in addressing cleanup obligations. The new alignment of the Offices of Science and Environmental Management reporting to the Under Secretary of Science, myself, will create additional momentum in environmental cleanup by further leveraging the experience of the national lab complex, and exploring various potential alternatives for science and environmental management, project management, and contract approaches. And we hope to better manage costs and solve the environmental management challenges while ensuring the highest level of safety for our Federal and contract employees, the public, and the environment.

Thank you, and I look forward to answering your questions.

Mr. UPTON. Thank you.

And Mr. Klotz, welcome.

STATEMENT OF HON. FRANK KLOTZ

Mr. KLOTZ. Thank you. Chairman Upton, Ranking Member Rush, Chairman Walden, and members of the subcommittee, thank you for the opportunity to represent the women and the men of the Department of Energy's National Nuclear Security Administration. We greatly appreciate your interest in and your strong support for NNSA missions, its major programs, its infrastructure modernization projects, and, most importantly, its people.

As America's highest ranking military leaders have repeatedly said, nuclear deterrence is the bedrock of our national security. NNSA was established by the Congress in the year 2000 as a separately organized agency within the Department of Energy to carry out three vitally important and enduring missions that directly relate to nuclear deterrence. The first of these is maintaining the safety, the security, the reliability, and the effectiveness of America's nuclear weapons stockpile. The second is to reduce the threat of nuclear proliferation and nuclear terrorism at home and abroad. And the third is to provide nuclear propulsion to the U.S. Navy's aircraft carriers and submarines.

NNSA relies heavily upon the scientific, technical, and engineering talent and capabilities at its national laboratories and its production plants in fulfilling these national security missions. Secretary Perry has described these unique facilities as our nation's crown jewels. And they have, indeed, done a remarkable job in applying leading-edge science to address the Nation's most urgent security needs.

That said, we continue to face important challenges as an enterprise, and we clearly have work to do. For example, it is absolutely imperative that we repair and modernize NNSA's aging infrastructure, over 50 percent of which is more than 40 years old, and some facilities even date back to the World War II and post-war Manhattan project.

We must also continue to improve project management and conduct of operations by our contractors who manage and operate our sites. Our initiatives, to this end, have been informed to either findings and recommendations of recent congressionally mandated and internal reviews, and include such measures as establishing clear lines of authority and responsibility; adjusting contract incentive structures; holding contractors accountable for safety, security, and performance; and assuring appropriate levels of oversight.

The results, I think, over the last several years, speak for themselves. Since we created an office for project management in NNSA in 2011, the administration has delivered its $1.4 billion capital construction project portfolio, 8 percent under the original budget. And just this year, we delivered the High Explosive Pressing Facility at Pantex in Amarillo, Texas. We delivered the TRU Waste Facility at Los Alamos in New Mexico. The Deputy Secretary and I cut the ribbon at the construction support building at the Y-12 production plant in Oak Ridge, Tennessee. And we are just about to finish the administrative support complex at Pantex, which will house about a third of the Pantex workforce later this year.

Additionally, I am proud to say all of NNSA's weapons life extension programs are on schedule and on budget despite the fact that we are in one of the busiest periods we have been as an enterprise since the end of the Cold War. It is worth emphasizing that NNSA collaborates closely with other DOE organizations on several fronts to execute its missions. The three national laboratories for which NNSA has responsibility, Sandia, Los Alamos, Lawrence Livermore, not only support NNSA's missions, they also support other DOE programs.

Likewise, the other 14 national laboratories within the DOE complex do substantial work in support of NNSA's missions because of

the unique skills and resources they possess. Together, the 17 DOE national laboratories are greater than the sum of their parts creating a world-class scientific complex of unparalleled capability.

One of these areas, as already mentioned by my colleague, is in developing exoscale computing capability. We are doing this jointly with the Office of Science. The project will dramatically advance the Nation's capabilities in science, medicine, applied energy technology, and national security. It will also ensure that America remains a world leader in the highly dynamic and competitive field of computational technologies. For this reason, this exoscale project ranks as one of the Department's highest priorities.

Again, thank you for your very strong support, and I look forward to answering any questions that you may have.

Mr. UPTON. Well, thank you all for participating and being here this morning. And we wish Secretary Perry well for sure.

Mr. Brouillette, as the DOE's chief operating officer, I know this is the budget time. I am a former OMB official a lot of years ago. And the timeframe is a little bit different than it was when I worked for President Reagan in that the budget had already been up by the first week of January, and now since then, Presidents have sent their budgets up a little bit later. Given the huge demand for resources in your important department, I don't know if they have actually done the passback yet from OMB back to DOE, but how is your relationship with those folks down at the old executive office building in terms of their response to the Secretary's budget priorities?

Mr. BROUILLETTE. Well, sir, Mr. Chairman, our relationship——

Mr. UPTON. They are not in the room. They are watching.

Mr. BROUILLETTE. They are watching. Yes, I will be graded on this response, I am certain.

Our relationship with Director Mulvaney has been strong. We are fortunate to have him as an OMB Director. As you well know, he is your former colleague, he comes from the Congress, he understands the budget process very, very well.

With regard to our processes internally, we are in active conversations with the OMB. We have not yet completed the budget process. We do expect to see the final product of their work very, very shortly. And we expect it will be sent to Congress very, very shortly as well.

Mr. UPTON. The Department's role to maintain the Nation's nuclear deterrent is obviously a very important and vital mission. Recent reviews have found that the structure of the NNSA has sometimes isolated DOE's work from the needed cabinet level leadership. Can you commit to us, and certainly Mr. Klotz as well, that you will be working to ensure appropriate secretarial leadership and management support to enhance that vital mission?

Mr. BROUILLETTE. Yes. Absolutely. As you know, Mr. Chairman, this committee was instrumental in 1999, in the general time frame, in the creation of NNSA. So we understand full well what the direction of the U.S. Congress is toward the Department. It has given us the ability to work closely together. The Department and the NNSA collaborate very, very closely on the national security mission, and as well as other missions, which includes environmental cleanup, the cleanup of those sites.

I will defer if General Klotz has any further comments that he might want to make about that collaboration. But I can assure you and this committee that we are working closely together.

Mr. UPTON. General Klotz.

Mr. KLOTZ. Chairman, I would echo everything that the Deputy Secretary said. I think we have a very close working relationship. We had one in the previous administration. We certainly have one in this administration as well.

One of the things that Congress did in creating the NNSA and the position of the administrator of the NNSA is they made that same individual also an Under Secretary within the Department which allows that individual to work very, very closely with the colleagues and throughout.

I might add, one of the points that I really want to foot stomp in my oral statement applies to that part of the DOE complex out in the laboratories, the 17 laboratories. And as I indicated, we work very, very closely together. The non-NNSA laboratory support us significantly in our national security work, and we do an awful lot of basic science research that has relevance to the work they are doing as well. So I think this is a win-win organizational structure which has been created.

Mr. UPTON. My remaining comment, I would like each of you to respond just briefly with regard to the cyber threats, not only on DOE, but obviously the facilities that you oversee. So we know that there had been a number of briefings, public and private, over the years in terms of the increasing cyber threats. We know that literally hundreds of times daily it is the—likely attempts. And what can we do to ensure the safety for all of our citizens?

Mr. Brouillette.

Mr. BROUILLETTE. Yes, Mr. Chairman. Cybersecurity is one of our highest priorities. The Department of Energy is the sector specific agency responsible for cybersecurity within the energy community, or energy industry, I should say. One of the first steps that the Secretary directed me to take as the Deputy and as the chief operating officer was to ensure that our own house is in order. We are obviously going to work with the industry, work closely with what is known as the ESCC, the Electric Sector Coordinating Council, to take input from our industry partners. I am aggressively focused at the moment on our inside-of-the-house activities. So working closely with our own CIO to make sure that our Department, our complex is protected on cyber matters.

Mr. UPTON. And do you have any recommendations for us in terms of trying to make your job easier?

Mr. BROUILLETTE. I will happily come back to the committee and share with you some additional thoughts once I can get my arms around this complex. But, sir, at the moment, I can't think of anything that I would need from this particular committee or the Congress.

Mr. UPTON. I know my time has expired.

Do you have something you would like to add to that response? If not, go ahead, Mark.

Mr. MENEZES. One thing that we are doing, in Office of Electricity, we are actually running a nationwide grid system evaluation, really, if we can continue to supply the national critical assets

with the power and eliminate the potential risk of cyber attack. This has not been done, and so this will be done by our Office of Electricity.

Mr. UPTON. I think there was an exercise that was supposed to take place not too long ago.

My time has expired. Let me——

Mr. MENEZES. Grid X. We did——

Mr. UPTON [continuing]. Yield to the ranking member of the subcommittee, Mr. Rush.

Mr. RUSH. Well, thank you, Mr. Chairman. To all of the witnesses, I want to ask questions. If you don't have answers to the questions in that I only have 5 minutes, I want to allow you to respond in writing. As a matter of fact, that would be good.

Deputy Secretary Brouillette, last week, my office reached out to staff at DOE in preparation for today's hearing inquiring about the percentage of minorities and the senior positions within the agency as well as it is much easier for the agency to consider policies and initiatives that address the needs of minorities when there are minorities at the table when decisions are being made.

Are you prepared today to share some of these figures with the subcommittee? Specifically, can you provide a percentage or number of minorities in leadership position within the Secretary's office, the review boards, the boards and council, and among the SES staff?

Also, can you, or Under Secretary Dabbar, share with us a number of minority directors at the 17 national labs and on the percentage of senior minority staffers in leadership positions at those labs?

Mr. BROUILLETTE. Yes, sir, I would be happy to provide those to you. I am aware of the question. I will respond to you formally in writing and make those numbers available to you.

I would also like to share with you, at least, some of my early experiences at the Department. My first impressions——

Mr. RUSH. Mr. Secretary, I only have a few minutes.

Mr. BROUILLETTE. Yes, sir.

Mr. RUSH. Let me ask Mr. Dabbar.

Mr. Dabbar, can you answer the question? How many minority directors of the 17 national labs, and on the percentage of minority staffers in leadership positions in the labs?

Mr. DABBAR. I apologize. Could you repeat? Someone was coughing.

Mr. RUSH. Can you or Under Secretary share with us the number of minority directors at these 17 national labs and on the percentage of senior minority staffers in leadership positions at those labs?

Mr. DABBAR. Thank you, Congressman Rush.

No. I will be glad to share that information with you. I do not——

Mr. RUSH. OK. Thank you. You don't have them.

All right. Secretary Brouillette, are you familiar with the minorities energy initiatives that were created under former Secretary Moniz?

Mr. BROUILLETTE. Yes, sir, I am.

Mr. RUSH. What are your plans for moving forward with that?

Mr. BROUILLETTE. We are going to continue that important program. I understand its importance to not only Congress, but the communities that are served by that program. We have every intention of continuing it.

Mr. RUSH. Now, then, the Office of Economic Impact and Diversity have been moved to the Deputy Secretary level.

What are the plans for, in this office, moving forward?

Mr. BROUILLETTE. The same answer, sir. We are going to continue that. It is a very important program. It is vital to the communities that it is serves. And we see its continued importance to the Department.

Mr. RUSH. In your response in writing to me——

Mr. BROUILLETTE. Yes, sir.

Mr. RUSH [continuing]. Be very specific. I would like to know what plans and the implementation schedule, what those are?

Mr. BROUILLETTE. Yes, sir.

Mr. RUSH. Secretary Dabbar, your jurisdiction within the Office of Science includes responsibility for doling out taxpayer research dollars in the form of grants to institutions of higher learning.

Can you provide this subcommittee with a list of schools, universities that have received funding over the past 10 years from your Department as well as the amount distributed to each institution? Also, do you know the percentage of funding that is loaned to minorities serving institutions, including historically black colleges and universities, and Hispanic-serving institutions over the past 10 years?

Mr. DABBAR. Congressman Rush, yes. About $3 billion a year is distributed through various FOAs out of the Department. It is a very large portion of the budget. The vast majority of the $3 billion across all our various programs goes to universities, and I would be glad to follow up with the specific information in writing that you are asking for.

Mr. RUSH. And I want to know about black-serving institutions and historically black colleges and universities and Hispanic-serving institutions.

Mr. DABBAR. Yes, sir, we will do that.

Mr. RUSH. Mr. Chairman, I have just one more question for Mr. Dabbar.

You oversee national labs. Can you provide this subcommittee with the approximate dollar amount of contracts that the labs dole out to private companies and vendors? Is their goal to include minority contractors? Have the labs reached that goal? And if not, is there a plan in place to increase minority participation for contracting and vending opportunities within the labs?

Mr. DABBAR. Yes, we will.

Mr. UPTON. Thank you. Thank you all. The gentleman's time has expired.

The chair would recognize the chair of the full committee, Mr. Walden.

Mr. WALDEN. Thank you very much, Mr. Chairman. And, again, thank you all for being here. We look forward to your written responses to Mr. Rush's questions.

The Office of Environment Management oversees the environmental remediation projects at some of our nation's most contami-

nated sites, including the Hanford reservation which I referenced earlier, located just up the Columbia River from where I live.

In 2013, then-energy Secretary Moniz moved the environmental management out of the responsibilities of the NNSA administrator to a newly created Under Secretary for Management and Performance. And DOE's recent realignment shifted the office to now be managed by the Under Secretary for Science. So it seems like it has been moving around a bit on who has the responsibility. Those of us in the northwest care deeply about that and even more deeply about getting it cleaned up and protected, especially given some of the failures that have occurred eventually in some of the tanks and all.

So Deputy Secretary Brouillette and Under Secretary Dabbar, will you please describe the reasoning for this shift, and, for example, what expertise is aligned with the Office of Science that may prove beneficial to similar large project management challenges that are associated with the EM's mission and give us an update on the latest at Hanford and where that waste would go if we ever get Yucca open. So, Mr. Brouillette, maybe you'd like to start out.

Mr. BROUILLETTE. Yes, sir. Thank you, Mr. Chairman.

I will share with you some of the thinking that we had behind that particular move. And it starts with some of the first comments that I heard when I became a young staffer on this committee back in 1989. And that was along the lines of Hanford is very complex. Hanford is very complicated. It is a technical issue and, therefore, we haven't cleaned it up yet.

And Secretary Perry has heard those very same arguments. And the thought process that we went through was how can we figure out how to fix this problem. And we have some of the best, some of the brightest scientists in the world working at the Department of Energy. So we thought that perhaps by combining these programs and forcing some collaboration between the environmental management program and these scientists would allow us to find the technical answers that we need to find to begin the actual cleanup of that site as well as other environmental management sites throughout the country. I will defer to Mr. Dabbar as to what the specific steps that we will take. But that was the initial thought.

From a management standpoint, you should also know, too, that the Office of Science within the Department of Energy stands head and shoulders above many Federal agencies in its ability to conduct proper, efficient, and effective contract management. They do that very, very well. So we want to avail ourselves to those talents as well within the Department of Energy.

Mr. WALDEN. Thank you.

Secretary Dabbar.

Mr. DABBAR. Yes. Chairman Walden, as the Deputy Secretary mentioned, I think there are two major buckets of reasons that—in terms of the specifics why the coordination can help in the execution of the mission of environmental management upon this reorganization. The first is technology. There are a number of different areas within the national lab complex that have linkages to the mission of environmental management. As you know, within the BES area, the Office of Science, we have chemistry. And a large

portion of the issues associated with environmental management are radiochemistry issues. And obviously, between the chemistry functions as well as the nuclear side, nuclear physics side of the Office of Science, there is an awful lot of technology overlap. On top of that, there are other examples such as computer modeling of various disposition of various radionuclides, which we can use our high performance computing for. So it is a great degree of opportunity.

And then the other bucket is project management. As the Deputy Secretary mentioned, the Office of Science is one of the three major areas that deal with project management, and it generally executes on time and on budget. And we think that the project management skills associated with other areas including the Office of Science.

Mr. WALDEN. So you were just out there, right?

Mr. DABBAR. Yes, sir.

Mr. WALDEN. Can you give me, in the 45 seconds left, your update? Are we still on target?

Mr. DABBAR. So there are things that we are moving along with that we are very excited about and we think are very positive. And there are some areas that have challenges. In terms of the positive areas, finally, we are moving down the road of making glass at the plateau. The DF LAW, which is the low activity waste treatment plant, is coming online. And we are going to make some glass, and we are going to clean up some tanks.

We are also looking at closing out our first tank farm, possibly, first time ever. And we are looking to ship some waste off sight, first time ever. So there is some very positive things that we are executing on.

Mr. WALDEN. When and where?

Mr. DABBAR. Well, there are some options around TRU. TRU Waste is the things that we are looking at, and there is a couple different options very specifically that we are looking at. We have not identified exactly which one, but there are specific locations. And for that shipment portion example that we are focused on, we are focused on TRU.

Mr. WALDEN. All right. Thank you very much.

Thank you, Mr. Chairman.

Mr. UPTON. You are recognized, Mr. Pallone, from New Jersey.

Mr. PALLONE. Thank you, Mr. Chairman.

My questions are of Mr. Brouillette.

I was pleased to see FERC yesterday unanimously terminated the grid resiliency rulemaking that Secretary Perry proposed last year. And that flawed proposal would have subsidized certain coal and nuclear plants under the guise of a grid reliability crisis. And this is chiefly a policy matter, in my opinion, that should be left to Congress and to the states.

On October 12 of 2017, I sent a letter to Secretary Perry requesting additional details regarding the development of this proposed rulemaking, including a list of DOE staff who put together the proposal and a list of all meetings where DOE staff or leadership discussed the proposal with outside organizations. And I saw that photos were published recently showing Murray Energy's CEO Robert Murray handing Secretary Perry a so-called action plan last March, a portion of which states, "Immediate action needs to be

taken to require organized power markets to value fuel security, fuel diversity, and ancillary services that only base-load generating assets, especially coal plants, can provide."

And so, these photos made me question how much outside influence went into the preparation of the proposed rulemaking and who those outside parties were.

Now, Mr. Brouillette, I haven't received response to my letter, which was sent nearly 3 months ago, so I wanted to ask first: Do you know the status of DOE's response to this letter?

Mr. BROUILLETTE. No, sir, I don't, but I will happily look into it and make sure that you are responded to.

Mr. PALLONE. I appreciate that. Obviously you are making a commitment to ensure I receive a total response, and you will do that.

Mr. BROUILLETTE. I was just handed a note, sir. It seems that our lawyers, our GC office is responding to your note, preparing a response, but I will ensure that you receive it.

Mr. PALLONE. I appreciate that. Thank you. Now, let me go to the second thing that I want to talk about, and that is this Secretary of Energy Advisory Board panel. I would like to ask about that and its current status. As far as I can tell, the board, which has historically provided advice and recommendations to the Secretary on key DOE issues has not been reconstituted under Secretary Perry; in fact, the DOE website still shows members of the board that served under the Obama administration, including one of the witnesses on our second panel today, Dan Reicher.

Now, Secretary Menezes relied heavily on advice and guidance from this advisory board, which put together several comprehensive reports during his tenure, and it seems to me, my opinion is that Secretary Perry, who had little experience on national energy issues before taking the helm at DOE, and even proposed eliminating the Department all together, when he was a presidential candidate, would benefit from such a group of advisors.

So my question first is, am I correct that the Secretary of Energy Advisory Board has not been reconstituted under Secretary Perry? Is that accurate?

Mr. BROUILLETTE. I think it is accurate to say that it has not been disbanded. The Secretary's advisor board still exists. The Secretary is still in the process of evaluating membership on that board. But at this moment in time, I don't think he has made any decisions with regard to that particular board in terms of its membership. But I can tell you that it is an important component of the advisory function at DOE, and I think he has every intention of maintaining it.

Mr. PALLONE. So from what you said, and I don't want to put words in your mouth, you are saying that he does intend to keep it and appoint some members, it is just that he hasn't gotten around to it.

Mr. BROUILLETTE. I think that is correct.

Mr. PALLONE. I just think it is important that the Secretary have the guidance of a body like that.

Mr. BROUILLETTE. Yes, sir.

Mr. PALLONE. As he makes key decisions.

Mr. BROUILLETTE. Yes, sir.

Mr. PALLONE. And obviously, you agree.

Mr. BROUILLETTE. Yes, sir.

Mr. PALLONE. And hopefully, he is going to move ahead with that.

Mr. BROUILLETTE. Yes, sir, he will.

Mr. PALLONE. OK. Thank you so much. I yield back, Mr. Chairman.

Mr. UPTON. Mr. Barton.

Mr. BARTON. Thank you, Mr. Chairman, and welcome to this subcommittee. Two of you, especially, should be very familiar with this room. You worked with a lot of the portraits that are up on the walls. So it is good to see you all back. I don't know whether to congratulate you on progress or to commiserate with you on regression, but I am glad to see you.

Before I ask my questions, I doubt that too many people—General Klotz was talking about Pantex, and one of the unknown stories in my life is that in 1972, I was offered a job at Pantex as an industrial engineer with a company called Mason & Hanger, which was a contractor. It is the weirdest plant interview I ever did. They said, we can't let you see the plant. We can't tell you what we make. We can't tell you what you are going to do, but we really want you to come to work. And I asked a couple of questions, and they just said, we can't tell you.

So then when I left the office, out in Amarillo, or outside of Amarillo, I saw this big bomb casing, big, big bomb casing. I said, well, that gives me a clue as to what they do here. But not too many members probably know what Pantex—I don't know what they do now, but then they actually made some of our nuclear weapons, and maybe they still do or they just maintain those.

Mr. KLOTZ. Well, two thoughts, sir. One is, your career turned out OK, even though he didn't come work for us. And, two, the Pantex is the one facility where all the various components that make up a nuclear weapon are shipped, and it is the highly skilled workforce of people in the panhandle region that——

Mr. BARTON. Well, I know they are very proud of it. Chairman Thornberry is very proud that that facility is in his district. Well, I have a number of questions in terms of the Department's structure and reauthorization. Chairman Walden has asked that I try to lead an effort to reauthorize the Department on a bipartisan basis. So I just have some kind of general questions I want to ask Deputy Secretary Brouillette.

What is the number of direct personnel that is actually working at the Department right now, not contractors, but full-time Federal employees?

Mr. BROUILLETTE. Sir, it is approximately 13,000. Just north of 13,000.

Mr. BARTON. How many contract employees does the Department have authority over?

Mr. BROUILLETTE. The approximate number is going to be just north of 100,000.

Mr. BARTON. 100,000. OK.

Mr. BROUILLETTE. Yes.

Mr. BARTON. Do you know in terms of the contractors how many of the primary contracts are competitively bid as opposed to no bid contracts, sole source contracts?

Mr. BROUILLETTE. No, sir. In terms of an absolute number, I can't give you that, but I am happy to respond for that on the record. We will do the research and provide that information to your office.

Mr. BARTON. OK. Again, in terms of these contracts, I know some of them are long-term contracts. Do you have any idea what the average length of the prime contracts are?

Mr. BROUILLETTE. It really depends on the work that is being done, but I will defer to the two Under Secretaries who may be able to provide you with a more precise answer. Paul.

Mr. DABBAR. Yes, Chairman Barton. It does depend on which ones, but in a typical science contract, many of them are 5 years with a 5-year extension. That is a typical contract. Obviously, within a lot of our national labs, some have very long-term relationship needs and are linked to universities. Some of them are more engineering and construction jobs, so if you take environmental management or some of the general areas, those are very project specific. So depending on the length of the project, many times they could be 3 or 4 years. And some of the very longer term ones, such as at Hanford, they are a bit longer, given the length of the construction.

Mr. BARTON. Could the Department give the committee a list of these large primary contracts and when they are next scheduled to be up for renewal?

Mr. DABBAR. Yes, sir.

Mr. BARTON. If we are going to do a reauthorization bill, that is some information we would need.

Mr. BROUILLETTE. Yes, sir, we would be happy to provide that to the committee.

Mr. BARTON. One of the things that now Senator, then Congressman, Ed Markey, and I worked on 10 or 15 years ago was the creation of a northeast gasoline reserve in fuel oil reserve. And I notice those have now been established in almost every State in the northeast—has either/and a fuel oil and a gasoline reserve—are these facilities similar to tank farms where you actually store fuel onsite, or is it a contractual arrangement where the private sector has to provide the fuel if it is called on to?

Mr. BROUILLETTE. Sir, with regard to the strategic petroleum reserve, we actually retain the fuel onsite.

Mr. BARTON. So these gasoline reserves and fuel-off centers, like in Massachusetts and New York and New Jersey, they actually have the fuel onsite?

Mr. BROUILLETTE. I will check on the gasoline reserves in the northeast to ensure that this answer is correct. It is my understanding that at least partially those fuels are stored onsite. But with regard to the strategic petroleum reserve——

Mr. BARTON. I know the crude oil is.

Mr. BROUILLETTE. Yes, it is.

Mr. BARTON. My last question is. Is the Department and the Trump administration supportive of a Department of Energy reauthorization bill in this Congress?

Mr. BROUILLETTE. Sir, I am sorry, the question is, do we support a reauthorization bill?

Mr. BARTON. I have had informal contact and discussions with Secretary Perry, but I have never asked for a formal response on the record, so I am now doing so.

Mr. BROUILLETTE. Sure. We would be very enthusiastic about working with Congress to reauthorize the programs. With regard to the actual policy, OMB is going to be a part of this process as well. But as a Department, I can assure you that we stand ready to assist the committee if it proceeds.

Mr. BARTON. I appreciate that. And I yield back, Mr. Chairman.

Mr. UPTON. Thank you. Mr. Peters.

Mr. PETERS. Thank you, Mr. Chairman. Thanks to the witnesses for being here. Mr. Deputy Secretary Brouillette?

Mr. BROUILLETTE. Yes, sir.

Mr. PETERS. You said something that I have said in my campaign speeches for 20 years, 15 years, however long I have been doing this, which is that the choice between a clean environment and a prosperous economy is a false choice. And I wanted to follow up just in terms of the Department's policy with respect to that.

I read through the testimony, I saw some stuff about environmental cleanup, but what I didn't see was reference to some of the more current discussion around greenhouse gases. And I just wanted to ask you, is it a policy in any respect of the United States Department of Energy to limit the emission of greenhouse gases and short-lived climate pollutants, including methane and black carbon?

Mr. BROUILLETTE. Is it the policy of the Department to limit it?

Mr. PETERS. To limit those emissions.

Mr. BROUILLETTE. Well, we are not the regulator, if that is your question. We don't regulate those types of emissions, that falls more to the EPA. But with regard to finding technological solutions, using the scientists in our labs to develop new technologies, that would limit those types or reduce those types of emissions. Absolutely, that is part of the Department's mission.

Mr. PETERS. Would that be a reference to carbon capture specifically, or do you mean——

Mr. BROUILLETTE. Yes, it is. The Secretary has been very gauged on that issue. He just returned, as a matter of fact, from overseas, where he was part of a clean energy ministerial. We have been working with our international partners around the world to see that technology further developed and utilized in other countries around the world.

Mr. PETERS. Beyond that, are there any other technological solutions the Department is pursuing to reduce or limit greenhouse gas emission?

Mr. BROUILLETTE. I might defer to our Under Secretaries as they run those programs.

Mr. MENEZES. Specifically, our Office of Fossil, for example, is developing new technologies on small coal units, for example, where one of the criteria is reduced emissions. So it is actually in the production of electricity is where the technology is focusing on, not just post-combustion where you capture it and store it.

We are developing really, across the broad spectra, we are looking at fuels that can be produced and used at the front end to lower emissions than during the actual combustion process itself to reduce emissions, and then post-combustion capture and sequestration.

Mr. PETERS. Mr. Deputy Secretary, let me just say, is it fair to say that, in developing resiliency and energy security, it is not part of your calculus to determine which energy sources are cleaner than the other, to be abbreviated about it?

Mr. BROUILLETTE. I think the Nation is served by the all-of-the-above strategy. I don't know that we are going to pick and choose the generation sources or the energy sources, that is where the American people—for other policymakers. But if your question is related to our support of an all-of-the-above strategy, the answer to that is clearly, yes, we do support renewables, we support wind, we support solar, we also support nuclear, as well as coal and natural gas.

Mr. PETERS. Do you have a position on the Tax Code's treatment of any particular energy source?

Mr. BROUILLETTE. No, sir.

Mr. PETERS. I guess the other question I have is with respect to energy. First of all, I was struck by what we all do agree on. We talked a lot in this committee about cybersecurity and grid security, we want solid distribution, and basic research. And I pointed out before that the ARPA-E program, I think, since it was created in 2009, has provided $1.5 billion in funding to more than 580 projects that has led to the formation of 56 new companies, 68 projects with other government agencies, including Defense that has attracted more than $1.8 billion in additional private sector investment.

Mr. Dabbar, is that the kind of investment you want to see continued when you talk about basic science research?

Mr. DABBAR. Overall, we are very supportive of the programs that we have at the Department around commercialization. ARPA-E is certainly a portion of it. If you think about the large FOA bucket, which is a grant bucket, we have about $3 billion a year across our various different areas. And ARPA-E is about $300 million of that, so it is about 10 percent.

Mr. PETERS. I was concerned that the President's initial budget zeroed it out. And I spoke to the Secretary about it when he was here. He indicated that maybe he didn't agree with that, I certainly don't. I want to say that I am sympathetic to all the agencies that come testify for us in the wake of this so-called tax reform that added at least $1 trillion to a national debt. And we are looking at $1 trillion deficits going forward. I think it puts a lot of pressure on that. But I do want to highlight that as something that I agree deserves our support as a Congress and hope that we can figure out a way to responsibly fund that.

With that, I yield back.

Mr. UPTON. Yield to Mr. Olson. Thank you.

Mr. OLSON. I thank the chair, and welcome to our four witnesses. A great panel. Two neighbors from Louisiana, Secretary Brouillette and Secretary Menezes. A Naval Academy graduate, a fellow sailor, a submariner, Mr. Dabbar. And Lieutenant General Klotz, who has

the high honor of being a native born Texan, Lubbock, Texas. Welcome.

As a former naval aviator, over 1300 hours of P-3 Orion submarine hunter, I was trained to track, attack, and destroy Russian ballistic missile submarines. And while I can never confirm nor deny that I flew with nuclear weapons, we were qualified to drop what is called a B-57 nuclear death bomb. That bomb was designed to destroy Russian submarines where it created a big wave of air on the break and keel by the weight of the boat. That bomb has since been retired. But as you all know, we still have nuclear weapons as part of our strategic deterrence.

My first question is for you, General Klotz. DOE and NNSA has the task of keeping, as you said, our nuclear weapons safe, reliable, and effective. And you have years of experience administrating the nuclear security programs of the Department. You understand the challenges to this complex mission.

My question is, please discuss the role of the national lab system, not only the weapons labs, but the whole system in maintaining our nuclear deterrent and national security?

Mr. KLOTZ. Thank you, sir. That is a wonderful question. People often ask me what was I most surprised about coming into this particular job 4 years ago, and one of my answers is, I understood how the three national laboratories, which NNSA has responsibility for, contribute to that mission. What I didn't realize, until I went out and visited all of the other 14 laboratories is how much work is being done throughout the entire system. We use the other laboratories because of the special scientific and engineering skills that are resident in those laboratories, some of the unique equipment that they have. But I would say of all 17 laboratories, we have direct funding going to the vast majority of them. And even those laboratories that we do not directly fund, many times they are subcontractors to other laboratories doing work for the NNSA, both in the weapons activity account, and in the defense nuclear non-proliferation account, as well as naval reactors.

Mr. OLSON. Thank you. My next question is for Secretary Brouillette and Secretary Dabbar. Houston, my home town, is the oil and gas capital of the entire world. I am proud of that. As we say in Texas, that ain't changing any time soon. Natural gas is now very abundant, and it has now become the core of electric grids across the country. At the same time, though, the fastest growing jobs in Texas are actually in wind power. We are exploding, number one in America in production of wind power.

We have an important role to play, but some have said that unlocking that source of energy, it is right, will have to have better batteries, better transmission lines, and also the wind is always blowing when we need it and where we need it.

Could you talk about how DOE balances and supports new developments like wind, a crucial source of energy, while moving forward with research to alternative energy?

Mr. BROUILLETTE. Yes, sir, I can. As you know, sir, as a Texan, and as a part-time resident of Texas myself for 12 years. I was down with USAA in San Antonio, Texas. I understand the record of Secretary Perry, I wanted to call him Governor Perry. But as Governor of Texas, he approached this with an all-of-the-above

strategy. Texas is now the largest wind energy producer—one of the largest, I should say, in the United States. It is a very, very important component of our diversity mix for the purposes of generating electricity.

What we are doing at the Department of Energy is trying to find ways to manage the variability of those intermittent sources on the grid, as well as using the science labs to develop the next stage, the next level, if you will, of battery storage, of battery power. And I will let Under Secretary Paul Dabbar speak to the specific activities that he has undertaken as the head of our science labs.

Mr. OLSON. Commander Dabbar.

Mr. DABBAR. Thank you, Congressman. As someone who grew up in Oklahoma and saw the wind come over from Texas, I am very much appreciative of that—we kind of caught the tail end of what wasn't used in Texas.

One particular area of the Office of Science, and this goes back to our previous question around renewables, is in the battery area. One of the big strengths of what the Office of Science does is in the area of battery technology beyond lithium. Actually, at our laboratory in Oregon, they branded the chemistry area for batteries beyond lithium. So there is at least a little bit of marketing in the science organization.

There is a number of different batteries that we are working on: multiple batteries, including magnesium ion, which includes solid state that we are working on at a very early stage; flow batteries, which can be used for grid applications; and next generation lithium ion, using our light sources and other modeling techniques on the computer side to improve upon existing lithium ion.

We think this is a major idea in terms of being able to take applications from technologies in the Office of Science and really move forward and really leverage renewables from an intermittent source to something that can be more 24 by 7.

Mr. OLSON. Thank you, my time has expired. USAA member for life. I yield back.

Mr. UPTON. Mr. Doyle.

Mr. DOYLE. Thank you, Mr. Chairman. And thank you to the witnesses here today. Secretary Brouillette, in your testimony, you highlight the importance of energy security and explain that this energy security, as well as our economic prosperity depends on continued American ingenuity and innovation. And you continue by saying that Secretary Perry and yourself are very proud of the advancements that DOE's research and development has spurred. That DOE-funded R&D is truly inspirational. I want you to know that we all agree with that statement, however, many of my colleagues and myself are greatly concerned by the budget request we received from the Department of Energy earlier this year.

And I just have a few yes-or-no questions about the budget proposals for you. For instance, you emphasized the importance of reliable electricity, but the proposal proposes cutting electricity delivery and energy reliability budget from $206 million to a $120 million, which is a decrease of over 40 percent. Can you tell me just yes or no, do you anticipate revising that cut for this year's budget request?

Mr. BROUILLETTE. It is hard for me to answer yes or no, sir, because we are going through the process that is ongoing.

Mr. DOYLE. Try your best to do that because our time is limited.

Mr. BROUILLETTE. Sure. I think this office is very important. We are going to work with OMB to find an appropriate number.

Mr. DOYLE. OK. Thank you. Also, President Trump's repeated promises on clean coal throughout the campaign and presidency, I want to point out that many members on both sides of the aisle support technological innovations that aim to achieve that goal.

In fact, my colleague on this committee, Representative McKinley and I, lead a letter each year that would boost funding for that research. Last year, we proposed increasing the funding for fossil R&D by over 30 percent to $829 million. However, the Department of Energy's budget request proposed cutting the fossil energy R&D budget by $352 million. That is an over 55 percent cut down to $280 million. And it is Mr. Reicher's testimony that we will hear when the second panel gets here highlights, it actually cuts R&D funding for CCUS specifically by nearly 85 percent.

Do you anticipate increasing the Department's budget request for fossil R&D, and specifically, for CCUS next year?

Mr. BROUILLETTE. I anticipate that the Congress will want to support that at a higher number.

Mr. DOYLE. Yes. Yes, they will.

Mr. BROUILLETTE. That is exactly right. That is exactly right.

Mr. DOYLE. Your testimony also sings the praises of energy and technological innovation. But the budget proposes, as Mr. Peters pointed out, eliminating ARPA-E. This is very perplexing to a lot of us. The nonpartisan National Academy of Sciences, Engineering, and Medicine released a report last year that analyzed ARPA-E, a congressionally-authorized program. And that report says ARPA-E is, in many cases, successfully enhancing the economic and energy security of the United States by funding transformational activities. And it continues to say, importantly at this early stage, the committee has found no signs that ARPA-E is failing to deliver on its mission and goals, or is on a path to failure, or is in need of reform.

Do you plan on revising your budget requests for next year with regards to ARPA-E?

Mr. BROUILLETTE. That is a decision, sir, that is going to be made by OMB. But there are differences of opinion about whether or not the Department should be in that particular business. We have offered a proposal to the Congress, but I will assure you the Congress funds the agency or funds ARPA-E, we will execute to the letter of the law.

Mr. DOYLE. Yes, we will be doing that, too. Thank you. I want to also highlight a DOE study published in 2016 that highlights the importance of CCUS technologies. In it, the authors describe the industrial CCUS as the low-hanging fruit among CCUS projects, because many industrial processes produce relatively pure streams of CO_2.

DOE has previously funded industrial CCUS pilot projects through the American Reinvestment and Recovery Act. And though there have been proposals to delineate natural gas CCUS technology and coal CCUS technologies in the previous administration's

budget request, would you support separate R&D funding source for industrial CCUS?

Mr. BROUILLETTE. I would, sir, but again, that is a final decision that is going to be made by OMB and the Congress itself.

Mr. DOYLE. Thank you. And let me just finish by saying that I am pleased to participate in an energy efficiency and manufacturing roundtable hosted by Scott Energy Innovation Institute at Carnegie Mellon this coming Friday, and Representative McKinley, a leader on this issue, will be joining me, as will many manufacturers and energy companies in my district.

President Trump has placed a special emphasis on the manufacturing sector, and understandably so, as the industry has been suffering for too long. In this proposed reauthorization of DOE, would you want to change the Advanced Manufacturing Office or the Clean Energy Manufacturing Initiative, and if so, what kind of changes would you foresee?

Mr. BROUILLETTE. As a former executive at Ford Motor Company, I understand full well and understand keenly the important work that is done by the advanced manufacture and technology folks at DOE, and I happen to support what they do. With regard to future changes, I would like to work with you and this committee to determine what those might be. I have not given it significant thought before you asked me the question, but I will do so.

Mr. DOYLE. Thank you. We appreciate you being here today, and we look forward to working with you.

Mr. BROUILLETTE. Thanks.

Mr. DOYLE. I yield back.

Mr. UPTON. Thank you. Mr. Shimkus.

Mr. SHIMKUS. Thank you, Mr. Chairman. It is great to have you all here. I am going to try to go quick. I have got four short questions.

First, Dan, Secretary Perry has stated that it is the Federal Government's legal and moral obligation to permanently dispose of spent nuclear fuel and defense waste. If Congress provides the funding, is DOE prepared to reconstitute the Office of Civilian Radioactive Waste Management, which we call OCRWM, and resume its statutorily required regulatory review of the Yucca Mountain license application?

Mr. BROUILLETTE. Yes, sir. If you provide the funds, we will execute to the letter of the law.

Mr. SHIMKUS. Great. Thank you. I have been flipping around. Mr. Dabbar, just because you mentioned it. I understand what making glass means in this whole Hanford debate. Had we not broken the law with the last administration, and had we kept to the timeframe per the Nuclear Waste Policy Act and its amendments, where would that glass go?

Mr. DABBAR. Thank you, Congressman. So the vitrification I was referring to for DF LAW, which is the new vitrification facility which is coming on line, is low activity waste. That can be stored onsite at Hanford. It does not need to go to——

Mr. SHIMKUS. What part of the Hanford waste is designated to go to the final repository? And you can name that for me.

Mr. DABBAR. Yes, sir. That would be the high level waste, which that building is still under construction, but that also is planned

to be vitrified in the future, and that would need to be disposed of offsite.

Mr. SHIMKUS. And if we were on schedule, per the law, where are you and DOE designing the cast and the delivery systems to finally go to? There is an easy answer.

Mr. DABBAR. So, in general, there has been, I think, a lot of debate by this House about whether——

Mr. SHIMKUS. I am not asking about the debate by this House, I am asking about the Department's position and current law.

Mr. DABBAR. Yes. The previous analysis of where it was supposed to go was to go to the Yucca Mountain site.

Mr. SHIMKUS. That is where it is supposed to go per law. And had we not broken the law and not derailed the timeline, that is where it would be going. So, thank you, that was a lot harder than I thought.

Let me go to Mark real quick. Under the Office of Energy Efficiency and Renewable Energy, they are doing a study called Co-Optima. I am not sure if you are aware of that. I would ask you to look into it and report back to me on this. It is basically an energy efficiency in transportation vehicles.

Actually, Secretary Brouillette might know a little bit about it, but it is going to be very, very helpful to us as we try to thread the needle on this RFS debate. And it is really a high-efficiency, high-octane research project that you all are doing. And I need to know when you are going to be done with that, and that will be very, very helpful in this. So could you get back to us?

Mr. MENEZES. We will. We will look into it and we will provide the response.

Mr. SHIMKUS. Dan, do you want to add anything to that since you——

Mr. BROUILLETTE. No, sir. I know that this is an ongoing conversation between you and the administration and others in Congress, and we will get right back to you on the results of that study, or at least the progress of that study.

Mr. SHIMKUS. Yes, because that study I think it is linchpin on how we can thread the needle on this, if it comes out the way I think a lot of us have hopes and expectations. Mark, I want to go back to you—and maybe there will be some other folks that this kind of addresses some of the other agencies here. Secretary Perry signed a—this is on the uranium market, and Secretary Perry, let me see the—I have the Honeywell Conversion Facility in Metropolis, Illinois that is idle because we think—part of the reason is the DOE's activity and the uranium market through the Uranium Bartering Program, Secretary Perry wrote a letter last year in reference to how that should not affect uranium mining, and our individual processing facility, and our ability. We think it is. Can anybody comment on this because of the idling of that?

Mr. DABBAR. I would be glad to take that, sir. I think, as you know, a previous administration had looked at funding part of the Portsmouth D&D through funding of sales of uranium, and that there is a requirement that the Department does an analysis on the impact of those sales. That current program is expected to be completed in 2021. And the Department earlier this year, and the Secretary signed off on a detailed analysis that took down the

amount that we are selling this year to 1200 MTU. And that is the current plan. Once again, the current plan is that it will end by 2021.

Mr. SHIMKUS. I would just say, it is impacting the jobs and the economic activity in my district in this plan. I would hope you all would take that into consideration.

Mr. UPTON. Ms. Castor.

Ms. CASTOR. Thank you, Mr. Chairman. Secretary Menezes, in Puerto Rico, over 40 percent of the electricity customers have been without power now for about 4 months. And I understand that that is well over half a million American citizens. I was surprised that in the emergency aid package, what was proposed by the Trump administration, and passed at the end of the year in the House, it did not include a lot of direction and flexibility for the Department of Energy working with FEMA and the Army Corps of Engineers to build the more resilient grid that we discussed in this committee.

Can you give us an update on what is happening right now and the division of labor to help get the power back on, and do it in a resilient way that protects the American taxpayer in the future?

Mr. MENEZES. Let me use this as an opportunity to just update with the numbers. As of the 6th, we have 80.8 percent of the normal peak load restored, and now we have 60 percent of the customers with power—that is 885,000 homes and businesses. We have 87 percent of the substations that are operating. And we still have 3,000 personnel down there working every day to restore power to the people of Puerto Rico.

With respect to the request for assistance, that is going to be an OMB, I think, agency answer to provide for you. I know we certainly gave them——

Ms. CASTOR. Do you feel like you have the authority, working with the Army Corps and FEMA, to build a more resilient grid, to not just build back what was there that was outdated and it was bankrupt, but to do something to protect taxpayers in the future?

Mr. MENEZES. Yes.

Ms. CASTOR. Or do you need additional authority from the Congress to do that?

Mr. MENEZES. Well, again, I can't speak for the administration, but from my own personal observations of having been involved in the Puerto Rico efforts since I have been sworn in, it is clear that DOE's expectations of what it can do exceeds its authorities and the resources that are provided to it, particularly——

Ms. CASTOR. I think I understand your question that you need greater authority.

Mr. MENEZES. Particularly on the resiliency, though, however, we are leading the interagency effort to model to determine how when we move toward—after restoration toward rebuild——

Ms. CASTOR. I am afraid it might be too late by that point if we are doing the modeling now, because we have the technology. The national labs and industry have all the tools at their disposal. But if we are just going to restore power the way it was, it is not going to work as well.

I want to move on. I heard what you all said, you are committed to innovation, you are committed to diversity of sources, but every-

thing going on at the Department of Energy just belies that fact when you look at the very significant proposed budget cuts by the Trump administration last year. A $2.7 billion decrease, including drastic cuts in clean energy, electric grid operations, next generation energy technologies. That is not a recipe for innovation.

And then, thank goodness, the FERC unanimously rejected Secretary Perry's proposal yesterday to give financial relief to some sources of energy when we need really a competitive wholesale market. And resiliency and reliability doesn't mean you just double-down on what has been our energy sources of the past, but to look at all the energy sources for the future.

Then you add on the Department of Energy's backpedaling on our very popular and cost-effective energy efficiency appliance standards. That is not a recipe for innovation and diversity of sources. I hear what you are saying, that the policy is dominance, but I think that all of this added together is taking America backwards at a time when other countries and businesses across the world are investing. Thank goodness America still remains the leader in research and development, and there is fantastic research going on in the national labs, in our higher education institutions, and with business.

But I think when you backpedal, when you say, we are not going to invest in the science that we have in the past, you are just weakening our ability to compete with companies like China. They want to be the world leader now. And it is no secret.

All of that put together, Secretary Brouillette, how do we keep America's competitive edge in all of these sources of energy, all of the technology, when policies of the Trump administration seem to be going backwards?

Mr. BROUILLETTE. Thank you for your question. I hear your concern, I am not sure I agree with every premise, but I do hear your concern in your argument. Let's just start with the NOPR, with regard to what the Secretary in proposing a rule to the Federal Energy Regulatory Commission, the point of that rule was not to pick winners and losers as it has been described or to subsidize in certain cases certain forms of energy. What it was proposed for and the rationale behind it was to preserve baseload generation, which provides, in many respects, the resiliency and the reliability that we currently enjoy with our grid.

Ms. CASTOR. But weren't you then asking customers across the country to pay for more expensive sources of energy, and that would cost customers billions and billions of dollars? That doesn't seem like a path for innovation and diversity sources.

Mr. BROUILLETTE. Sure. Well, in some respect, it wasn't the Department of Energy asking, it was the people who actually run the grid, the PJM folks, in particular, and others who were asking for changes to their market rules because they, themselves, acknowledge, in certain cases, the providers of this type of electricity are not properly compensated for the services that they provide. So they have sought changes as well to their own market rules, and that is what we were participating in, was that conversation to do exactly that.

So it wasn't an effort to subsidize dirty fuels or to take a step backward, if you will, it was to provide a more appropriate com-

pensation for services that are provided each and every day. So that was the intent behind that rule.

With regard to the budget and the science and the innovation that the Department is currently undertaking, in certain cases, while we may see some reductions in certain areas of the Department, it is the focus of the Secretary and the focus of the administration to have the Department focus on basic science rather than applied science. So to the extent you see some reductions in areas, it may be that you are looking at reductions in applied science, simply because we want the focal point to be basic research, which we feel is a very strong point of the Department of Energy. We feel that they do that very, very well, and we want to encourage those activities.

Mr. UPTON. The gentlelady's time is expired. The gentleman from Ohio, Mr. Latta.

Mr. LATTA. Thank you, Mr. Chairman. And thank you very much for our panel for being here, it is very, very interesting and informative, so I appreciate your time here today.

In recent Congresses, this committee has taken steps to give DOE new authorities that modernize its energy security missions. Response for enacting legislation in the FAST Act to give the agency additional critical infrastructure protection authorities, particularly for the electric grid. We also enhance authorities for emergency preparedness for energy supply disruptions.

And in my district, again, to give you an idea, northwest, west central Ohio, I have got 60,000 manufacturing jobs and a couple—several years ago, not too many years ago, we had a very, very tough winter, and we were fearful that we might have some energy disruptions. When you got 60,000 type manufacturing jobs out there doing everything from float glass to steel and everything else, you just can't shut down lines. So we are heavily dependent on baseload capacity out there to make sure we can keep things running.

It is also interesting in the last year, year and a half, that they have been out, not only talking with all of my folks from my electric co-ops to my municipal electrics and you go on down the line, that not only talking with customers, but also the individuals that work and run the facilities. There is a lot more concern out there about cyber attacks, and what could be happening out there.

And, Mr. Menezes, I understand that you have received the Cyber and Emergency Energy Supply Responses functions in the Department; is that correct?

Mr. MENEZES. With respect to the program in the Office of——

Mr. LATTA. Let me ask you this: In your experience with the emergency responses in recent months, do you believe the Department should have a larger role in energy and cyber emergencies at this time?

Mr. MENEZES. Again, it has been my experience since being with the Department that the expectations do exceed the authorities that we have. We see it in all emergency response across the board. We are looked at to provide answers and expertise, which we have in support of rebuild efforts, protection efforts, et cetera, as I mentioned. We are on the NFC, which gives us insight into certain

classified information that others do not have. And, yet, when you look at our authorities, it is limited.

Mr. LATTA. All right. Let me ask you this then. As you talk about that limited authority that you have, are you committed to work with this committee to identify and enhance your authorities, and really work with us to say, what are the tools out there that you need to have to make sure that you can do your job?

Mr. MENEZES. Yes, sir. We are committed to working with this committee as long as you let us bring our OMB counterparts with us.

Mr. LATTA. OK. General Klotz, again, as from the other members on the committee, thank you very much for your service to our Nation. And with your responsibilities to cover emergency response relating to radiological emergencies. Is that correct?

Mr. KLOTZ. That is correct, Congressman. Although, most of the work in terms of emergency response is a responsibility of state and local responders or National Guard. Our primary function is to support them by, one, training them, and two, being there with the tools that are necessary to measure and characterize any radiological or nuclear release.

Mr. LATTA. Let me follow up with that then. When you are out there training, especially the National Guard and local responders, because that is, again, who I hear from the most because I am out in my district all the time. Do they feel that they are getting the information that they need to have from you all to make sure that they can get the tools that they need for these responses that they might have to deal with?

Mr. KLOTZ. Sir, the feedback I get is very, very positive, that this is a very useful course. In fact, we usually get asked to come back and either expand the number of people we reach in our particular courses, or go through a program of training the trainer so that they can do that themselves.

I might add, one of the other things we do is because this is the season for large sporting events, we are also the organization that goes out and measures the radioactive characteristic picture of a given community before an event. So if there is an event, we can very quickly home in on that. So you may see, from time to time, a helicopter or aircraft flying over areas where that is being done, that is the NNSA out there doing that work.

Mr. LATTA. With my last 17 seconds that I have left, just to follow up real quick. Now, who pays for the local response? Is it through you or——

Mr. KLOTZ. No, I think that that comes through a different funding stream. What we basically do is we fund the training, as I said. We have teams at each of our national laboratories, and I mean the broader DOE complex of national laboratories, which can be deployed with equipment to support state and local or military responders, and so we fund that part of the process.

Mr. LATTA. Well, thank you very much. Mr. Chairman, my time has expired.

Mr. UPTON. Yes. Mr. Tonko.

Mr. TONKO. Thank you, Mr. Chair. First, I thank all of the Secretaries for being here this morning. Secretary Brouillette, thank you for reiterating a point that Secretary Perry made when he testified

before this subcommittee last year. Spurring energy innovation is an essential part of the Department's core mission.

The national labs are often rightly called the crown jewels of America's research infrastructure. They produce major achievements in advancing science, energy innovation, and national security. Much of their work is cross-cutting and promotes all of these goals. I saw this firsthand when I visited Brookhaven last year.

When Secretary Perry appeared at our hearing earlier, he expressed his support for ARPA-E. However, the budget request from the administration, which included the virtual elimination of ARPA-E and 70 percent cut to the Office of Energy Efficiency and Renewable Energy, did not reflect, in my opinion, the importance of innovation in DOE's role in supporting the next generation energy technology.

So, Secretary Brouillette, do you believe a robust R&D budget, as well as a qualified DOE workforce, are critical to maintaining U.S. leadership in science, energy, and security?

Mr. BROUILLETTE. Yes, I do. Do you want me to elaborate?

Mr. TONKO. Just quickly.

Mr. BROUILLETTE. Sure. Yes, sir, I do. Sir, as you and your colleagues begin this budget process, it is going to be a negotiation between you and the White House, and I just want to assure you that at some point, the Congress and the White House will come to an appropriate funding number for those labs, and we will honor those commitments.

Mr. TONKO. I would hope the message from the agency will be forceful——

Mr. BROUILLETTE. Yes, sir.

Mr. TONKO [continuing]. In making certain that progress is the——

Mr. BROUILLETTE. Yes, sir.

Mr. TONKO [continuing]. Is the mission here. As this committee and DOE's leadership consider the future of the Department, can you explain your vision for the R&D portfolio for the next 3 years? What are the goals and what are the priorities?

Mr. BROUILLETTE. Sure. I will also defer to Under Secretary Dabbar, as the new Under Secretary of Science, he has some specific things that he would like to share with you. But I can tell you that we will continue the progress that has already been made by those 17 national laboratories, they are, in fact, crown jewels. I appreciate the fact that you would take the time to visit Brookhaven. I would also like to invite you to attend and to visit the rest of the laboratory system so that you can see firsthand the rest of the work that is being done there.

With that, I will defer to Under Secretary Dabbar.

Mr. DABBAR. I thank you, Congressman Tonko, and I remember following your energy work prior to this particular role throughout New York. Across the whole complex, including New York, the Department is very much focused on innovation. As you know, Brookhaven is one of our premiere laboratories, as well as our other complex that we have through NNSA, SPRU, West Valley through NYSERDA, there is a lot of focus that we have to the state, and of course, to the whole Nation.

The Office of Science is obviously the preeminent position in the world across all the different areas of physical science. The particular areas that we are focused on, as were mentioned earlier, was on exoscale computing, that has the ability for us to really move the ball forward across a number of the areas of physical science. In the areas of particle physics, we are obviously moving forward, and LBNF/DUNE, which is out of Chicago, as well as a number of other high energy particle physics that spread in Michigan from Chairman Upton's area.

So there is a number of areas that we are focused on. I also mentioned batteries with Brookhaven, the chemistry side, which we think has particular potential advantages across a number of energy areas.

Mr. TONKO. Thank you. Thank you very much. I am particularly concerned about the proposed elimination of the Weatherization Assistance Program, which is among the Department's expired authorizations. And I urge this committee to examine reauthorization as part of this effort. We just experienced dangerous winter conditions throughout much of the country. Wind chills were as low as negative 30 degrees for sustained days in my hometown in upstate New York. In the Adirondack to the north of my district, the temperature, in a number of places, never got above zero degrees for several days. People deserve a response from a weatherization program; those especially who live in poverty, who live paycheck to paycheck and still have a difficult time providing for their energy cost.

Not only are the energy efficiency benefits from WAP critical to low income families budgets, but these homes are often unhealthy and unsafe.

Through WAP, DOE provides funding to states, tribes, and U.S. territories. So whether it is the weatherization program or the State Energy Program, do you believe DOE should play a role in supporting state energy offices and the work they do? Senator Brouillette or Senator——

Mr. MENEZES. Well, again, just to echo the comments of the Deputy Secretary, we look forward to working with this committee and the appropriators, to reach an appropriate number. The organization is alive and well now at DOE under the CR, and we look forward to working with a number and then carrying out the intent of Congress on that.

Mr. TONKO. Thank you, Secretary. And last year the House passed the reauthorization of state energy programs. Would the Department welcome Congress taking a look at how to improve the weatherization program?

Mr. BROUILLETTE. Yes, sir.

Mr. TONKO. I believe my time is up, but I yield back, Mr. Chair.

Mr. UPTON. Time is up. Mr. McKinley.

Mr. MCNERNEY. Thank you, Mr. Chairman. I guess probably, Brouillette, it is to you on this. If I could just get this question out, where I really want to go. I have been over to the NETL Laboratory in Morgantown. I know Mike Doyle has got a facility up in the Pittsburgh area, and we have one in Morgantown. There has been a request to do a mission alignment study under DOE. Can you give me an update on where that might stand?

Mr. BROUILLETTE. With regard to the structure of the labs or——

Mr. MCKINLEY. Yes. Over the years, people talk about consolidation.

Mr. BROUILLETTE. Yes, sir.

Mr. MCKINLEY. And I think the uncertainty is still swirling there to give them comfort. Secretary Chu had said there will not be a consolidation at Morgantown with anyone else. Mooney said the same thing. I am just curious——

Mr. BROUILLETTE. And I am unaware of any plan to consolidate those two facilities.

Mr. MCKINLEY. OK.

Mr. BROUILLETTE. We are looking at missions throughout the Department. It could be that we utilize NETL's resources in both locations to attack a singular problem, but I am aware of no plan in terms of a reorganization to combine the two organizations.

Mr. MCKINLEY. Thank you. To the core, last month when we had a hearing with DOE, some folks that we were talking, it opened up a different subject, and that was the importing of energy from Canada, particularly in the northeast. I was unaware of that. I think most of the people here in this group in Congress were unaware of the amount; 76 gigawatts of power coming in from that.

My concern was—76 gigawatts of power, on average, may be 100 power plants that aren't existing in America because of that, bringing in Canadian-subsidized utilities. I want people to understand the impact of that.

Just if you take at NEI's, their own website, with a nuclear, they are talking about, for each nuclear power plant, it generates around $16 million of taxes, local taxes, and to the Federal Government; it is $67 million for each one. We are short about 100 power plants because importing the Canadian-subsidized or government-owned, where they are creating excess electricity.

I am curious, from DOE's perspective, when the negotiations are underway under NAFTA, or when they get taken place, will this be taken into consideration so that we might be able to see some consideration for that where we are supporting Canadian energy producers rather than American?

Mr. MENEZES. Well, regarding——

Mr. MCKINLEY. It shifts over to you then.

Mr. MENEZES. First of all, I definitely agree with your comments on the amount of energy that we actually import from Canada, it is a huge amount, and it is one of our largest trading partners in energy. Most of it is into the tight power pools in the northeast, it doesn't surprise anyone where. Regarding——

Mr. MCKINLEY. My concern is that when we do that, that means we are not—our local tax base is—it is non-existent. There are the things that take care of our schools, our roads, our infrastructure. We are supporting the infrastructure of Canada rather than having 100 power plants in the United States.

Mr. MENEZES. Yes. And our research is aimed toward smaller, like small modular nuclear, for example, as well as I had mentioned before, some of the smaller coal facilities, the low emission, zero emission coal facilities. This would allow you to put smaller units closest to the load pocket. And whereas it is difficult to build interstate transmission lines, as we know, but if you can't increase

the transmission lines, you can at least begin to site clean generation closer to the load pocket. That would minimize our dependency on interstate transmission——

Mr. MCKINLEY. If I could reclaim—I am holding my time here. As long as we are continuing to import something that is government-owned, and it is cheaper when it comes in here, they are competing unfairly with America energy producers.

All I am asking is that when we hit with NAFTA, that we have some discussion about the importing of all of this 76 gigawatts of Canadian power at the expense of American jobs.

Mr. MENEZES. You have our commitment, and we are certainly monitoring the NAFTA situation.

Mr. BROUILLETTE. Congressman, if I could add just real quickly. You do have our commitment on that. The Secretary did initiate a conversation with Minister Carr of Canada and his counterpart in Mexico. Recently, he held a meeting in Houston, Texas, among the three energy ministers, I will commit to you that we will ensure that this issue is discussed in those conversations.

Mr. MCKINLEY. Thank you very much. I yield back.

Mr. FLORES [presiding]. Mr. Loebsack is recognized for 5 minutes.

Mr. LOEBSACK. Thank you, Mr. Chair. I want to thank all of you for being here today, obviously, and I always learn a lot, I don't get to ask questions until the end here, but it is really great for me to listen to my colleagues ask questions and to hear your answers, I do appreciate that very much. But I want to follow up on what Mr. Tonko asked about weatherization.

First, I just have to say for the life of me, I cannot understand why anybody could possibly propose dramatic, drastic slashes in a weatherization program as this administration did, it is completely beyond me. If anybody has ever, as I have, visited any of the local community action programs, for example, that implement weatherization programs and gone to homes of seniors or low income folks or disabled folks who have benefited from weatherization, and it is not just in the winter, it can be in the summer as well in either the midwest or in the southern parts of our country, we can see that there is job creation. They employ local folks to weatherize homes. Sometimes they have even high school kids, for example, who are trying to learn a trade who participate in this kind of a program.

So for the life of me, I just don't understand why there was this proposed cut on the part of the administration. And Mr. Brouillette, sorry, I was not here when you were here or on this committee, I should say. Can you give me some justification or rationale as to why those cuts were proposed in the first place?

Mr. BROUILLETTE. Well, I don't think it is because we disagree with the ultimate goal of those programs. And I can't speak to your specific concern on the specific program or this specific amount that you are proposing—there are better ways, sometimes there are different ways to achieve the same outcomes. And I can commit to you that we at DOE are attempting to do those things.

I was just fortunate enough to attend the solar decathlon out in the western part of the U.S., and I saw many of the kids that you were referencing in your comments. They built homes that were

energy efficient; they built homes that were safe; they built homes that were frankly astounding in their technological advance. We want to continue to support those types of activities.

Mr. LOEBSACK. Can we get your commitment that you will press as hard as you possibly can——

Mr. BROUILLETTE. Yes, sir. Yes, sir.

Mr. LOEBSACK [continuing]. On this front?

I realize it won't be—make the final decision, but——

Mr. BROUILLETTE. It is always a negotiated effort, sir, but you have my commitment.

Mr. LOEBSACK. Because it is important, as it is with so many other programs, that we get that commitment from you folks as part of the administration.

And with respect to the reorganization that is being proposed, how will that play out when it comes to something like this to make sure that the weatherization program—let's assume that we do get adequate funding for it—that it is implemented properly and that it continues as it has been?

Mr. BROUILLETTE. Yes, sir. I don't see any changes. The reorganization does not fundamentally alter or change the direction of these particular programs that were set up by Congress.

Mr. LOEBSACK. That is good to know.

Mr. BROUILLETTE. We are simply changing an organizational chart and providing a different structure by which we manage the agency.

Mr. LOEBSACK. Thank you.

I would like to go back also, if I could, to the question having to do with storage for electricity, if I can, Mr. Dabbar. Is that how you pronounce it?

Mr. DABBAR. Thank you.

Mr. LOEBSACK. Naval Academy grad, you said? Is that correct?

Mr. DABBAR. Yes, sir.

Mr. LOEBSACK. Yes. My stepson and his wife are both Naval Academy grads and Active Duty Marines at the moment. So thank you for your service.

But it is true that Texas does produce the most wind energy of any state. But Iowa produces the largest percentage of its electricity from wind, and it is upwards of 37, 38 percent. Could you give us some kind of a timeframe to follow up on Mr. Olson's question? Because it is great that we are seeing—you mentioned beyond lithium—a lot of R&D, a lot of work going into how we are going to store this electricity so that we can do more with respect to wind energy or with respect to solar energy. But can you give us a timeframe down the road what kind of number of years we are talking about?

Mr. DABBAR. Yes, Congressman. The time is now. It is one of the most exciting areas within the Office of Science, dealing with applied energy in terms of developments of something that can be sent to the grid.

I mentioned a number of technologies in my previous conversation. I won't go through it. But the list of companies that we are working with specifically on those various different types of technologies is vast. We are working with big companies such as United Technologies and Dow and Johnson Controls and General

Motors. We are working with startup companies. The list that is across our various labs that deal with chemistry in the battery area is, give or take, around 80 different companies today.

And so there are various different types of technologies that have different uses in terms of weight-to-power ratio. And some are better for transportation. Some are better for utility scale. And so we intend to push that very hard on the basis of what we have been developing, and so we look forward to doing that promptly.

Mr. LOEBSACK. Thank you so much.

Thank you so much, and I yield back.

Mr. FLORES. Mr. Kinzinger is recognized for 5 minutes.

Mr. KINZINGER. Thank you, Mr. Chairman. Thank you all for being here, again, spending some time with us on these important issues.

I would like to start by commending all of you, led by the Secretary, for your renewed focus on the vital role of the DOE, our science and energy workforce, and our energy resources have to play in national security. It has been an area that I think has been way underdiscussed when it comes to issues of countering Russia, countering our enemies overseas, et cetera. It is something I have often stressed in this committee, and I look forward to continuing to work with all of you on it.

To Mr. Brouillette and Menezes, did you guys get the hardest names possible to come here? I thought Kinzinger was tough.

In the hearing with Secretary Perry a few months ago, I raised concerns that DOE was not always fully represented or engaged on energy matters pursued by the State Department due to the establishment of an energy bureau at State.

Will you discuss the value of DOE engagement internationally. When the U.S. meets with other nations' energy ministers, why is it important for DOE to be at the table? Either one of you can start.

Mr. BROUILLETTE. Sure. Well, sir, as I leave for Saudi Arabia and UAE tomorrow, I can speak firsthand to the importance of those conversations. I did return from several overseas trips. I represented the President and the Secretary in Kazakhstan; Tokyo, Japan; and Santiago, Chile, just recently.

Each one of those conversations brought new ideas. They brought a richness. And, candidly, I know some concerns were raised here about U.S. interests. It gave us an opportunity to articulate and, in some cases, to protect U.S. interests with regard to energy development and security.

We value those conversations very deeply. The Secretary does. I do. We do have a very robust and a very aggressive international affairs department within our organization. It is led by an assistant secretary. He is not yet confirmed or she is not yet confirmed. I don't know who the nominee will be, but it will come forward shortly to the U.S. Senate. But we hope to have that position filled very, very shortly. We are going to continue these conversations around the world.

With regard to our State Department colleagues, we interact with them very closely. I never travel internationally without collaborating with the State Department and, in many cases, integrating our work. So that process——

Mr. KINZINGER. All of us, when we travel, we work with State. But do you send silos? Are there areas we need to break through those silos where there is duplicative action or counter action?

Mr. MENEZES. Well, we work closely with our State Department colleagues, as the deputy said. We are trying to enhance our collaboration so that we can have much fuller communications between the two. Because in the past, there really has been a break, at least with respect to the energy component at the State Department. There appear to be sometimes conflicting missions. And so we are now working, taking positive steps to try to see and understand what they do. We know what we do. And so we hope that we can work together to achieve some efficiencies and really gain an understanding of what they are doing and what they hope to accomplish.

Mr. KINZINGER. Good. Thank you. I am also on this committee, but I am also a member of the Foreign Affairs Committee, so I have traveled a lot in that capacity. And it really does blow me away the number of times. And I get that we have a government but that I see sometimes State countering the message of other parts of government. So I think the more you guys can coordinate and work together, the more beneficial it is not for DOE or State, but for America.

General Klotz, and thank you for your service to the greatest branch of the military. On the nuclear security front, I understand that DOE and the National Nuclear Security Administration have done considerable work to enhance detection of radiological smuggling from former Soviet states, along with almost 60 partner countries. Can you provide an update about the process of the Nuclear Smuggling Detection and Deterrence program and what you are doing to ensure that we can safely transition to a model where countries fully fund the sustainment and maintenance of the equipment we supply? And I want to add on that, that is something that people don't think about much anymore because it is just out of our purview, so——

Mr. KLOTZ. Well, thank you very much for that question. The nuclear detection and smuggling program is one of the most important ways in which we try to work to make sure that special nuclear materials do not get in the hands of bad guys, whether the bad guys are a rogue nation that wants to develop a nuclear weapon or a terrorist that wants to use nuclear radiological materials in an improvised bomb to sow terror and panic.

We have worked, as you said, with a number of different countries. Our business model, basically, is to go in, deploy technology that has been largely developed through our national laboratories, including the non-NNSA national laboratories, train the individuals who operate this, help them for a period of basically 5 years. And over that 5-year period, the objective is to transition the maintenance, the recapitalization, and the training necessary to operate that to the host countries.

We have sent a couple reports, since I have been in the seat on, where we are doing that, when the progress is. And I would be happy to make sure your staff gets the most recent copy of that.

Mr. KINZINGER. Again, thank you all for being here.

And I yield back.

Mr. FLORES. Mr. Schrader, you are recognized for 5 minutes.

Mr. SCHRADER. Thank you, Mr. Chairman.

Mr. Brouillette, the administration last year proposed privatizing transmission assets owned by the Bonneville Power Administration. The proposal to sell off BPA's assets represents about three-quarters of the grid in the Northwest, was supposedly a major savings reform effort offered by the administration in its fiscal year 2018 budget. As you can imagine, those of us in the Pacific Northwest are pretty concerned, Chairman Walden, Mrs. McMorris Rodgers, and myself here on the committee.

Frankly, BPA manages the majority of the transmission in our neck of the woods. It is clean energy. It seems very misguided since Federal hydropower actually makes us money, doesn't cost us money, some upfront money, but with interest it gets paid back. I don't understand the logic of that. We are totally against that idea, very concerned about that, would hope that your agency as well as the administration might commit here and now not to pursue that in this coming budget.

Mr. BROUILLETTE. Thank you, sir, for that question. I am aware of the concerns of the delegation throughout the Northwest. I have met with Chairman Walden as well as several Senators to discuss this issue in my confirmation hearings. And as I said there, and I will say here again publicly, the Congress really does control whether or not we actually sell anything with regard to those assets. So without some statutory change by the Congress, I can assure you that nothing will be sold.

Mr. SCHRADER. All right. I appreciate that. I assume you yourself think it is a wise asset to retain?

Mr. BROUILLETTE. It has provided cheap energy in the Northwest. We enjoy our relationship with the PMAs. We are looking at them very closely, frankly, to learn from them as we address issues like cybersecurity and other matters.

Mr. SCHRADER. Sure.

Mr. BROUILLETTE. DOE is uniquely positioned with both a science agency and a research agency. We are also an asset manager and owner through the BPA, and others, SWPA and WAPA, and whatnot. But we enjoy our relationship. We look forward to working closely with them.

Mr. SCHRADER. That seems to fit into all the above energy strategies using different types of components.

Mr. BROUILLETTE. Yes, sir.

Mr. SCHRADER. Along the same lines, BPA currently reports to you, as I understand it. And given the size of the agency and the importance, as I just outlined, to the 12 million people in the Pacific Northwest, we consider it very important to have the ear of someone higher up in the agency. There was a proposal, as I understand, to change that. Maybe have BPA report another under secretary or something along those lines. Could you commit today to maintaining the current organizational structure with regard to how BPA reports directly to the deputy?

Mr. BROUILLETTE. Well, sir, I would be hesitant to commit to any future plans we might have simply because I want the opportunity to review the entire department. The PMAs have reported to the deputy secretary for some time. There was a time in the past when

they reported actually to an assistant secretary within the Department. So I would like the opportunity to continue reviewing the department and perhaps report to you on my findings and work with you on any future changes that we might make or we may not make.

Mr. SCHRADER. If you could commit maybe to at least consulting the delegation before you made a final decision——

Mr. BROUILLETTE. Yes, sir. Yes, sir.

Mr. SCHRADER [continuing]. We could give a little input. Given the nature of energy security these days, it is more and more important, I think, to make sure we have direct access to people and power that make these——

Mr. BROUILLETTE. I can assure you they will always have direct access. And I will give you a commitment to work closely with you.

Mr. SCHRADER. Thank you.

Mr. Menezes, given the climactic changing events we have had this past year, huge floods, huge hurricanes, the big fires out West all the way from the Canadian border down to California, very concerned about grid reliability and the hardening of the grid. There seems to be diverse opinions about what that hardening the grid means. Some would say it is a lot more renewable energy. Others would say making sure we have the redundancy and the assets we have on the ground, as was alluded to in some earlier questions, or rebuilt to withstand some of these huge events, these devastating nature events that we haven't seen in the past.

Where is the Department going with regard to reliability? Where are we going to put most of our efforts and our funding?

Mr. MENEZES. Well, currently, we had the modern grid consortium, the laboratory consortium, where we have been modeling how to make grids more resilient. We are bringing that to bear in Puerto Rico where we are going to make recommendations when we begin to rebuild and restore in Puerto Rico.

The advent of integrated microgrids, for example, is a key component of that. In New York and other states they have been looking at this. And our labs have been doing modeling. And in Puerto Rico, we are actually going to find three pilot microgrids so that we can bring the actual research that the labs have been doing and put them into action in Puerto Rico. In my response to Representative Castor, we had run out of time. But I wanted to tell the committee that we are actually using the work of the labs to actually model and to build more resilient grid structure.

Mr. SCHRADER. Thank you.

I yield back.

Mr. FLORES. Mr. Johnson, you are recognized for 5 minutes.

Mr. JOHNSON. I thank you, Mr. Chairman. And I thank our panel for being with us today.

The United States is currently positioned well to utilize our vast energy resources, including oil, natural gas, and coal, as a positive geostrategic tool to advance our Nation's interests globally. It is also important that we enable domestic nuclear technologies to compete in the international market to assure we have a seat at the table on critical issues relating to peaceful use of civilian nuclear technologies and nonproliferation.

The Department of Energy plays an important role in that process through what is known as the Part 810 approval process. Recently, Secretary Perry affirmed his commitment to streamline the regulatory review process. NNSA is responsible for overseeing the approval, while consulting the Office of Nuclear Energy and the DOE general counsel in addition to interagency coordination.

So, Deputy Secretary Brouillette and Secretary Menezes and Administrator Klotz, do you recognize the importance of U.S. engagement in the global civil nuclear market? And can you assure me that you will continue to implement greater efficiency in this program?

Mr. BROUILLETTE. Yes, sir, on both accounts. We recognize full well. We are engaged in several conversations around the world, in essence to create opportunities for our civil nuclear programs and our industry partners throughout the U.S.

I will defer to General Klotz, perhaps, for a more detailed discussion on 810 and NNSA's role.

Mr. JOHNSON. OK.

Mr. KLOTZ. Congressman, I think the premise of your question is extraordinarily important, and that is if we want to be leaders in nuclear security, nuclear safety, nuclear safeguards, and nonproliferation, then we need to have a seat at the table. And the only way you get a seat at the table is to be a knowledge leader in this particular industry.

You also touched on—we hear the frustrations from the commercial companies about how long it takes to do 810 processing, and we share that frustration. It is true the DOE and the NNSA are the stewards of this process, but we are not the owners of the process. And the long poles and the tent many times are outside our control. In particular for those countries which require a specific authorization, the State Department has to get assurances from the host government that the requirements will be followed by the host government. Sometimes those take 12, in some cases even 18 months.

So we are working very hard. We continue to work very hard in a process improvement program that you know about for the 810 process. In the areas where we can cut down and make this much more streamline and efficient, we will continue to push on that.

Mr. JOHNSON. OK. Good.

Mr. Menezes, do you have any comments to add to that, or do you concur with what they have said?

Mr. MENEZES. I certainly concur with them. We at the DOE are uniquely positioned to see the importance of maintaining global leadership in this. And that was, frankly, part of our domestic electricity policy. Our 403 letter meant to ensure that our base load nuclear units continued to run economically, because we are losing the leadership certainly on the civilian side. And as we see other countries developing civilian nuclear fleets, we want to be there. We do not want to be on the sidelines.

Mr. JOHNSON. Can any of you identify further policy and process options to assist our domestic nuclear industry to remain competitive in the international market? And we will just go right down the line with the three of you again.

Mr. BROUILLETTE. Sir, I think Under Secretary Dabbar wants to chime in, being a Navy nuke.

Mr. JOHNSON. OK. All right. Go ahead.

Mr. DABBAR. Congressman, one additional point I think addresses that specific question is that the White House has actually convened a cross-agency group, specifically in these particular areas. And we have participated in that. But it also includes Defense, it includes State, and a number of other areas. And there are very specific verticals in the areas that you listed. They are being evaluated by groups. So participation in the fuel chain. Participation and commercialization on an international basis, on security of the fuel chain. And so we are participating and getting very much into the details, along with other members across agencies on this topic.

Mr. JOHNSON. OK. I don't have time to get into my other question, because it is fairly long. Let me just paraphrase it real quickly and get your affirmation.

LNG exports, big, big deal for us, big geopolitical leverage point for the United States. I have got legislation that is designed to help expedite the permitting process. I know the Secretary and I have talked about this. Are you folks committed to working with us to expedite this as well?

Mr. BROUILLETTE. Yes, sir, we are. We have taken some initial steps. We look forward to working with the committee to further refine the permitting processes.

Mr. JOHNSON. OK. Great.

I yield back.

Mr. FLORES. Mr. Long, you are recognized for 5 minutes.

Oh, Mr. Welch. I am sorry. You are recognized for 5 minutes.

Mr. WELCH. Thank you very much, Mr. Chairman.

I wanted to ask Mr. Brouillette and Mr. Menezes a few questions. Energy efficiency, incredibly important, enormous bipartisan support for it on this committee, a lot of leadership on both sides of the aisle. We are going to be hearing, I think from the next panel, about some things like master limited partnerships, like energy saving performance contracts. Mr. Kinzinger has been a big champion of those, along with me. So I will wait for the next panel.

But one of the questions is about efficiency standards. And there is some debate on this because it does involve regulations. And there is general skepticism about regulations in the new administration, and some of it well-founded. But it is standards, like applying standards have been extremely helpful to industry and to consumers in saving money. And there is a number of deadlines that Congress had set for efficiency standards, and some estimates indicate that could be about a $43 billion annual savings by 2035. But the latest regulatory agenda, as I understand it, that has been released by DOE, removed the target completion date for these standards and put them in a, "longterm action section," a category that OMB has said is specifically for rules where no action is really intended. And there have been five deadlines, I think, since 2017.

So my question here is what is your position, and what do you intend to do to comply with the law to complete these rules by the established deadlines?

And again, the premise of my question is that these rules actually are helpful to industry and helpful to consumers. We might

have some debate on it. But if the regulations are well-designed, then I think they achieve the positive goals of energy efficiency. So could you both comment on that?

Mr. MENEZES. I am happy to start. Certainly, when I was here with the committee, energy efficiency and applying standards were a key part on the major legislation that we passed in 2005. And Congress set a lot of the deadlines that the Department had to meet. Some think that they were aggressive or not. But in my 2 months since being there, a lot of things had been piling up and coming across my desk. And a couple of them are on the mandatory reports to Congress that this committee had put in the legislation back then to provide the very reports that you are probably looking at.

I will be honest, I had not seen them before. And we very clearly set forth those deadlines that we had met, those that we still hadn't met. And as you had said, we are not shy about it. We actually admit some of the difficulties that we have had. The goal is to, of course, meet the statutory deadlines and obligations.

I know the other body is looking at some legislation that would give us a little flexibility, I think, to look at this to be able to meet those deadlines. But the Department is committed to following the law to have these standards in place, according to the deadlines that are set in the statute. And I know that you have the same report that I just reviewed probably a few days ago. And I have been in discussions with the general counsel's office on how we can improve this.

Mr. WELCH. I think I am being reassured here. You are telling me that full speed ahead on meeting the standards, not a detour to slow walking the standards or not implementing them altogether.

Mr. MENEZES. You do have our assurance of that. It is quite stark when you see our very own reports that are very clear on when we have met them and when we haven't.

Mr. WELCH. And I am taking from this a full-throated support for efficiency standards and the benefits that they provide in savings to consumers and, of course, incidental reduction in carbon emissions.

Mr. MENEZES. Well, certainly, in meeting our statutory deadlines, you have my full-throated support on that, because the hallmark of this administration is to comply with the laws that are applied in the Department.

Mr. WELCH. OK. Thank you.

I yield back.

Mr. FLORES. The gentleman yields back.

Mr. Long, you are recognized for 5 minutes.

Mr. LONG. Thank you, Mr. Chairman.

And, Mr. Menezes and Mr. Dabbar, you are responsible for some scientific and nuclear office labs that are examining hardening of the grid from a tax such as electromagnetic pulse, EMP, incidents, which is something I have been harping on ever since I arrived in Congress.

What activities are priorities for the Department to ensure the industry can benefit from your research and infrastructure capabilities?

Mr. MENEZES. Well, as we have said in response to other questions on this, our labs are doing quite a bit of research on making the grid more resilient, particularly with respect to the EMPs, and the GMDs for that matter. We have been working with Oak Ridge and EPRI in the industry to identify ways to ensure that we had the sufficient transformers necessary in the event that there be such an event. Our laboratory consortium is also looking at this issue. And that, together with our efforts in cyber, we hope will eventually, you know, provide us the information to make the grid even more resilient.

Mr. LONG. Mr. Dabbar?

Mr. DABBAR. I have nothing more to add on that, sir.

Mr. LONG. OK. EMPs can happen in nature or through malicious acts, correct?

Mr. DABBAR. That is correct.

Mr. LONG. Pardon?

Mr. DABBAR. Yes, sir.

Mr. LONG. OK. And, General Klotz, the broad crosscutting nature of the Department's mission is evident in my home State of Missouri. The National Nuclear Security Administration, or NNSA, maintains the Kansas City National Security Campus, which is responsible for manufacturing and procuring components for the nuclear weapons programs. Additionally, the Department of Energy helps support the University of Missouri's MURR nuclear research reactor. The MURR reactor is seeking approval to produce life-saving medical isotopes in partnership with NNSA and is currently studying a partnership with NNSA to convert the reactor to use low-enriched uranium instead of highly enriched uranium.

Will you please describe NNSA's programs to convert research reactors to this low-enriched uranium?

Mr. KLOTZ. I would be delighted to. But first of all, thanks for mentioning our Kansas City plant, which produces all the non-nuclear components that go into a nuclear weapon, which is about 80, 90 percent of what goes in there. And for members who have not had a chance to visit that, it is an example of the kinds of things that can be achieved by recapitalization of this 40-, 50-year-old enterprise that I talked about earlier.

But specifically for the reactor conversion, as I said earlier, sir, one of our strategies is to prevent terrorists from getting their hands on special nuclear material or rogue nations getting their hands on special nuclear materials from which they could make an explosive device. One of the ways we do that is to help research reactors and other institutions stop using highly enriched uranium, which can be used in a nuclear weapon, for the research purposes to use low-enriched uranium.

We have already worked with, converted, or verified the shutdown of over 100 facilities worldwide in transitioning either no longer using any uranium or using low-enriched uranium. And our current efforts include close cooperation with Missouri University Research Reactor, MURR, to qualify a new high-density, low-enriched uranium fuel that can be used to convert that particular reactor.

Mr. LONG. OK. And what proliferation challenges keep you awake at night?

Mr. KLOTZ. I think—that is a good question, and I think about it a lot. My sense is nuclear terrorism remains among one of the most significant threats to the security of this country, to the security of our allies, and the security of our partners. So making sure that we have done all we can do to lock up, safeguard these materials that are an important part of our civil nuclear industry, both here and abroad, is one of the things I worry the most about.

Mr. LONG. And how does a highly enriched uranium conversion program fit within NNSA's mission relating to nonproliferation?

Mr. KLOTZ. Well, again, it is one of many arrows in the quiver or one of many of a multifaceted strategy to make sure that those special nuclear materials, like highly enriched uranium, their use is minimized and that people convert to using low-enriched uranium or other types of phenomenon to do their research.

Mr. LONG. OK. Thank you all for being here today.

Mr. Chairman, I yield back.

Mr. FLORES. The gentleman yields back.

Dr. Bucshon, you are recognized for 5 minutes.

Mr. BUCSHON. Thank you, Chairman.

Secretary Brouillette, the Department's 17 national laboratories are the boots on the ground, so to speak, that execute the activities that enable DOE to fulfill its missions. Have you engaged with the lab directors to assure the Department's alignment, or alignment readjustment, will be able to fully unleash the potential of the national labs?

Mr. BROUILLETTE. Yes, sir, I have. We have done that both directly and as a collaborative group effort. We have within the Department of Energy known as a lab operations board. And we have a smaller executive council made up of lab directors that both advise me and the Secretary. I have consulted with the lab directors, and I think you will hear from one on another panel about this reorganization plan and perhaps what it should look like. And they have submitted ideas, many of which we have accepted.

Mr. BUCSHON. OK. So then you can probably share some of the recommendations from the lab directors that were provided to you and some of the specifics of that with the committee?

Mr. BROUILLETTE. Sure. Absolutely. Yes, sir, I think I can.

Mr. BUCSHON. Just for the record, as we look to maybe a reauthorization, that is maybe some information on how the labs in the Department——

Mr. BROUILLETTE. Sure. Would you like me to do that formally, sir, in writing? Would you like me to——

Mr. BUCSHON. Yes, that would be great.

Mr. BROUILLETTE. Yes, sir, I will do that. I will follow up with you.

Mr. BUCSHON. Thanks.

This is for a number of people, but a frequent concern raised by DOE labs and contractors relates to the burdens of unnecessary oversight that detracts from effective and cost-effective mission performance on the other hand, sound oversights necessary to ensure safety and security and protect taxpayer interests. The development of mature contractor assurance systems has been identified in congressional reports and in this committee's work as critical to

enabling a more efficient oversight framework that will help unleash the benefits of the labs and other programmatic work.

So I guess, Secretary Brouillette, you can comment first. What can you tell us about what you are doing to ensure more mature contractor assurance system? Basically, effective and efficient oversight versus onerous and top-down oversight.

Mr. BROUILLETTE. Well, we have looked at the design standards within the Department. For instance, I will just give you an example. We just went and visited a facility in Oak Ridge that is a multimillion, billion dollar project. What we are looking for is making sure that our processes internally inside of the Department of Energy don't require certain things of contractors that either slow down the process or make things just exorbitant in terms of cost.

So if we are going to build, for instance, a simple office building, something you have seen a million times in your practice, it is simply there to house reception staff, we probably don't need a 90 percent design build plan in place before we allow the contractor to begin the initial stages of that work. If we are going to talk about a nuclear facility, however, we want to be very, very careful. It is looking at simple things like that and working with the contractors directly that we hope to bring some efficiencies and perhaps some better processes toward the Department's efforts.

Mr. BUCSHON. Anybody else have any comment?

Mr. DABBAR. Yes, sir. I will go ahead and add the reference that the Deputy Secretary made about the lab operations board. And one of the initiatives that the Secretary wanted to take onboard and for us to execute on, and we are now in the second wave of that, is basically a management and an efficiency review at a very specific level along the lines of what he just described. And the lab operations board actually includes lab directors, people from inside DOE headquarters, contractors across all of our various different labs and programs. And what we have been doing is looking at not only general points, but actually very specific points along the lines of what stands in the way of accomplishing the mission.

I will give you an example of one of the things that came up and we have changed. The labs were required to submit 15 different human resources reports a month. And what we decided was do we need all 15 of those or were there some overlap? As you could probably guess, there was some overlap. And we have actually consolidated some of those. And I believe we are down to 10. So it is shorter than 15 a month, and we are now down to 10 a month.

But we are doing that in collaboration, to your particular question, with the lab directors for us to review what is really required in terms of our oversight requirements for, in this case, human resources, but want to make certain that it is not overlapping, that things that had been added over the years were maybe duplicative.

Mr. BUCSHON. Yes. And I would say I know a number of people have talked about budgetary concerns. And from my viewpoint, every Federal agency that does this, that makes themselves more effective and efficient, also utilizes taxpayer resources in a more effective and efficient way. And in that vein may not necessarily need as many resources.

With that, Chairman, I yield back.

Mr. FLORES. The gentleman yields back.

I will recognize myself for 5 minutes.

Secretary Brouillette, one of the questions I want to talk about is budget itemization and micromanagement. The Department has a heavy reliance on outside contractors using M&O contracts to conduct DOE's research and development activities that manage your facilities and perform environmental cleanup projects. Any time you have this government public-private type of relationship, it results in a high degree of transactional activities, both internally within the Department and externally with these outside entities.

Recently, the Commission to Review the Effectiveness of the National Energy Laboratories, or CRENEL for short, identified transactional compliance and budget itemization, as they called it, as a costly burden that inhibits DOE from fully realizing the benefits of the contractor model. According to the CRENEL report, the chief financial officer maintains thousands of control points which, in turn, require management approval and disbursement at the expense of DOE's overall efficiency. This is not something that rose on your watch, but it is something that has crept into the Department over years, if not decades.

So my question is this, Secretary Brouillette: Do you acknowledge that the cost and burdens associated—or do you acknowledge the costs and burdens associated with budget itemization?

Mr. BROUILLETTE. Yes.

Mr. FLORES. OK. Will you work with the CFO and the relevant program offices to reduce this micromanagement policy?

Mr. BROUILLETTE. Yes, sir, I will. And I am familiar with the CRENEL report and its findings. And I look forward to working with the committee and the Congress overall to help implement those.

Mr. FLORES. That was going to be my next point. To the extent that you need additional support from Congress to—if there is something Congress has done that has created that, then let us know and we will try to help fix that.

Mr. BROUILLETTE. Yes, sir, I will point those out.

Mr. FLORES. My next question is for Under Secretary Menezes. This has to do with low-enriched uranium fuel. As you know, the new technology, nuclear reactors may use innovative fuels to improve reactor efficiency and safety. Currently, commercial nuclear fuel that is available is generally enriched below 5 percent. However, these new technology reactors may require fuel that is enriched beyond 5 percent.

Your department maintains a significant stockpile of uranium, and DOE may be able to consider options to provide this enhanced nuclear fuel just as it does with university research reactors. Do you see a role for DOE to steward this type of nuclear fuel to assure that potential fuel access issues will not inhibit technological innovation from our Nation's next generation nuclear engineers?

Mr. MENEZES. Yes, sir, we do. And we look forward to working with you to get your input on how best to accomplish that.

Mr. FLORES. OK. And since we are talking about reauthorization of the Department, I do have sort of a wildcard question as respects energy in this country and as respects reauthorization.

Secretary Brouillette, what keeps you awake at night, and how does it—with respect to energy, and how should we look at that with respect to reauthorization?

Mr. BROUILLETTE. What keeps me up at night, sir, at the moment is cybersecurity and its relation to the distribution of energy throughout the country. We are facing some significant challenges, both from internal sources here in the U.S. We are all familiar with the kid in the basement who plays at night. That is certainly a security concern. It is not the highest security concern. What we are seeing across the world increasingly are state actors who are taking very aggressive steps to infiltrate certain security components of our grid as well as our national pipeline infrastructure. And if I had to point to one thing that keeps me up at night, it would be that.

Mr. FLORES. OK. General Klotz?

Mr. KLOTZ. As I stated to an earlier question, the thing that keeps me up at night is the threat of nuclear terrorism. The devastating economic psychological consequences of a dirty bomb or a nuclear device set off by a rogue nation would be horrendous. And so everything we can do to make sure that we have safeguarded, locked up, secured special nuclear materials, reduced reliance on highly enriched uranium, plutonium, I think is a positive thing.

Mr. FLORES. OK. Secretary Dabbar?

Mr. DABBAR. In my particular area, it is around Radcon conditions with workers at our environmental management sites. We are decontaminating and decommissioning a number of buildings that have plutonium contamination. We have a number of liquid waste tanks, some of which have had challenges over the years that we need to clean up and we need to put away into our permanent location. So obviously, handling the environment in those particular locations and making certain that the health and safety of the workers during those very challenging situations is paramount.

Mr. FLORES. Secretary Menezes, 10 seconds.

Mr. MENEZES. It is cybersecurity, a threat of our secrets and our proprietary information that has given rise to other countries being able to produce more than the very things that we have developed and that we hold the patents to. I find that very disturbing.

Mr. FLORES. Thank each of you for your responses.

Mr. Duncan, you are recognized for 5 minutes.

Mr. DUNCAN. Thank you, Mr. Chairman.

First off, I want to align myself with the comments made by Mr. Shimkus earlier. The vitrified waste coming out through EM activities in the Hanford and Savannah River Site needs a longterm stable storage facility, and that stable storage facility is Yucca Mountain. Speaking of waste and residual, DOE's plutonium disposition plan are relative responsibilities that you have regarding the Nation's nonproliferation agreements.

In 2003, the DOE, in my home State of South Carolina, entered into an agreement that DOE would remove one ton of plutonium from South Carolina within a decade. The deadline was repeatedly extended, and the DOE has yet to date fulfilled its legal obligations. In fact, due to a number of the previous administration's policy, the deadline is further out of reach. The South Carolina DOE agreement included a stipulation that provides for financial pen-

alties to be paid to South Carolina up to $100 million a year. The South Carolina attorney general has had to sue the Department of Energy to receive this payment, and further litigation is expected.

Deputy Secretary Brouillette, are you familiar with this issue? And what is the DOE's plan to keep the commitment to the South Carolinians that are affected?

Mr. BROUILLETTE. Yes, sir, I am familiar with it. I have known General Wilson for many, many years, and he has raised it to my attention. Unfortunately, as it is subject to litigation, I am not allowed to comment in detail, but I am happy to follow up with you and your office as we move through this pending litigation.

Mr. DUNCAN. So talking about waste and talking about plutonium, rather, we spent a lot of money on MOX at Savannah River Site. And there was a report that was issued by the Department transmitted to Congress September 14 of 2016. It was called "An Updated Performance Baseline for the MOX Facility at the Savannah River Site, South Carolina." I say mislabeled because this Department did not file, as we require in the fiscal 2016 NDAA, its own order 413.3B for setting project baselines and updated baselines.

So do you believe, Mr. Deputy Secretary, that a project that is about 70 percent complete today, which the MOX facility in Savannah River Site is about 70 percent complete today since its construction started in 2007, could still take another 30 years to finish?

Wait a minute. We built the first nuclear weapon at the B Reactor at Hanford in a little over a year.

Mr. BROUILLETTE. Sure. We agree with that. And we would like to see that sort of efficiency brought to the MOX facility in South Carolina. It has taken quite a long period of time to get to this point, and I think that has raised the concern of the budgeteers both here in Congress and in the White House. We have met with the contractors. We are in active conversations with contractors on the ground.

There is, to be quite honest, some disagreement about that 70 percent number and whether or not they are, in fact, 70 percent complete. Folks on the ground in DOE have a different opinion of that, and we have expressed it, and we are in, as I said, very candid conversations with the contractor.

I would ask General Klotz or others if they want to opine further on this and perhaps provide you with more information as to where we currently stand.

Mr. DUNCAN. I appreciate the work that DOE does at sites like Savannah River Site. The nuclear laboratory down there is a valuable asset.

Mr. BROUILLETTE. Sure.

Mr. DUNCAN. There is also a component Savannah River Site is a valuable asset that was almost mothballed under the Obama administration. That is H Canyon.

Mr. BROUILLETTE. I'm sorry?

Mr. DUNCAN. The last—H Canyon.

Mr. BROUILLETTE. Yes, sir.

Mr. DUNCAN. The last chemical separation facility in the United States. So please assure me that this administration is not going to even consider mothballing H Canyon.

Mr. DABBAR. Thank you for the question. H Canyon we consider very important, and we want to keep it up and running, we think, to process. We think there are actually options that we could use for continued operations. So it is an important part of the portfolio.

Mr. DUNCAN. Yes, sir.

Mr. KLOTZ. I would like to echo what you said, Congressman, and that is the importance of Savannah River Site to the entire DOE enterprise. It is particularly important in the NNSA side, because that is where we do our tritium operations, tritium extraction, tritium recycling. Tritium being an extraordinarily important component for all of our nuclear weapons.

The laboratory there, again, having visited all the laboratories in DOE, again, I was astounded to find out how much work they are actually doing in the weapon's activity program for us, NNSA, as well as in the nuclear nonproliferation area.

So I have talked a lot with the people down there, and I think one of the things I can say, maybe as leaving government and looking forward to the future, that is one of the things we ought to think very seriously about is what is the longterm future of the laboratory and of the entire Savannah River Site, and what can it contribute and continue to contribute for decades in the national security. I think this is a fruitful area for discussion.

Mr. DUNCAN. Yes, sir. Savannah River Site is a valuable asset, and they are looking for more missions. And I hope we can give it to them.

And I yield back. Thanks.

Mr. FLORES. Mr. Griffith, you are recognized for 5 minutes.

Mr. GRIFFITH. I thank the chairman. I appreciate you all being here very much. It is an important hearing.

Deputy Secretary Menezes, thank you for mentioning rare earth technologies in your opening statement. I do appreciate that. There is a lot of potential for coal in my district in rare earth and combining the two to create a product that is more profitable than it may be at certain times in the past and in the future.

So can you give me an update? Where do we stand on that? When do we think that the technology will actually be ready for prime time?

Mr. MENEZES. Well, I am not sure I can give you a specific timetable, but I am happy to get our program experts on it and give you a briefing so that you can know exactly where we are.

Mr. GRIFFITH. I know there is a lot of research dollars that have gone into Virginia Tech in my district and in other places. But I also know that I saw a map of slag heaps. And one of the things people may not realize is is that a lot of the rare earth elements or minerals actually exist in the coal, but it is closest to the rock. So in the slag heaps, we can clean up slag heaps and reap a benefit for the United States at the same time and create some jobs, at least in the short run. Short run being a decade. My folks would really appreciate that.

Let me——

Mr. MENEZES. The program experts are very excited about the prospect that you can go to, really, the slag heaps, the waste product piles, and be able to extract rare earth elements. And think about it: We would no longer be dependent on China for a large percentage of our rare earth elements.

Mr. GRIFFITH. Yes. And what could be better? We are cleaning up something that ought to be cleaned up anyway as a part of our environment, and we are taking business away from one of our largest international competitors. I think that is great.

Along those same lines, but shifting gears a little bit, I want to talk about research on burning coal more cleanly. When you look at the world as a whole, while coal used for producing power in this country is down, it is still accelerating in the rest of the world. There are lots of places it is going to be used when people talk about the ill effects of the pollutants that come from burning coal or have come from burning coal in the past. Many of the countries that are going to be expanding coal facilities don't have the regulations we have. They are going to continue to use coal. I would like to see us continue to use coal but burning as cleanly as possible.

Can you give me an update on some of the research that is going on? And I am particularly, and always have been, interested in chemical looping. And I understand there has been a little bit of a breakthrough using a different substance as—for lack of a more scientific term—the primer in the chemical reaction.

Can you give me an update on where we stand on that and whether or not DOE is still positive? I know you are on natural gas, and I get that. But also using chemical looping for coal so we can transfer this technology to other parts of the world and burn coal more cleanly, not just here, but worldwide to help the environment.

Mr. MENEZES. Again, yes, sir. Our national energy lab is doing a lot of the research that you have been discussing. And I think that both of us would benefit from a briefing from our program people as to timetables and where we are.

In response to an earlier question, though, I did emphasize that the research is no longer limited to, if you will, carbon capture sequestration technologies. While it is important, we are looking again at the front end, where the fuel that is to be combusted and see if there are technologies that we can make it on the front end less emission, more efficient, and then during the combustion itself.

So we have some exciting opportunities. It has been a very top priority for the Office of Fossil. Others have asked about our full-throated support of certain issues. We have given full-throated support, certainly during the budget process, to get the resources to the Office of Fossil to evaluate, engage in studies along the lines that you have been mentioning today.

Mr. GRIFFITH. And I should say that, along these lines, it is not just this administration. The Department of Energy has always been interested in putting research into these areas. And so even though I disagreed with the previous administration on a lot of things, their DOE was doing some good things in this arena, and I appreciate you all continuing to do that good work.

And with that, Mr. Chairman, I will yield back.

Mr. FLORES. The gentleman yields back.

Mr. Harper is recognized for 5 minutes.

Mr. HARPER. Thank you, Mr. Chairman. And thanks to each of you for taking time to be here with us today.

I would like to talk to you, if I could, for a minute, Deputy Secretary Brouillette. The National Nuclear Security Administration was established as a semiautonomous agency within the DOE in 2000. And as you know, the NNSA administrator reports directly to you as the Deputy Secretary.

However, when Congress established the NNSA, the statute required an NNSA general counsel, legislative affairs office, and public affairs office separate from those respective functions under you and the Secretary at DOE headquarters. And those offices effectively serve the administrator, not the Secretary.

While establishing separate functions may have been well-intended, review by the congressionally chartered Augustine-Mies Panel in testimony of this committee noted the inherent problem of dual offices that limit and can conflict with the Secretary's leadership over the nuclear enterprise.

So would you agree that there could be problems if, say, the NNSA general counsel considers his client the administrator and not the Secretary of Energy, who is ultimately responsible for the mission?

Mr. BROUILLETTE. That is a loaded question. The short answer to your question, sir, is we respect what Congress did in 1999 with the creation of the NNSA. And until Congress changes that law, we will honor it.

If you are asking me for my personal opinion, however, it does make management of the agency somewhat awkward. We work well together. General Klotz and I have a great both personal and professional relationship, and we work diligently to ensure that the agency speaks with one voice. We try to do that as effectively as we can.

However, as a manager, as a chief operating officer, when I look at the enterprise, I am hard-pressed to make the argument for separate offices and separate parts of the building doing essentially the same functions.

Mr. HARPER. All right. Well, let's just talk a little further, then, about that. As we consider those potential reforms to improve DOE's efficiency, give us some observations or your take of what you make regarding the duplicative functional offices in NNSA and DOE, let's say. Can you elaborate a little more?

Mr. BROUILLETTE. Well, I think you just articulated the most obvious examples of the duplicative offices. Those particular functions are, in my own personal opinion, easily served by one office representing the entire Department. I can't speak to any other specific examples.

I can tell you with regard to policy, with regard to execution, particularly with regard to the nuclear weapons programs, the Under Secretary, the Deputy Secretary, and the Secretary decide both the policy and the execution of that policy within the departments, within our authorities, and we execute them with one voice and as one management team. We do so appropriately, as Congress directed us to do. So there are no other folks within the larger DOE complex directing the NNSA. And I think the general would attest

to that. All of the instructions are given through the Secretary and the Deputy Secretary toward the NNSA.

Mr. HARPER. Thank you.

And let's talk about maybe streamlining decision-making for just a moment, if we could. You were at a town hall last month, and you were asked about steps that can be taken throughout the Department to improve efficiency and specifically reduce burdensome paperwork that is associated with what is known as the concurrence process. And you acknowledged the need to improve this process. Would you please elaborate the problems with this process and tell us what you see is the impact of your efforts?

Mr. BROUILLETTE. Yes, sir. I was fortunate and privileged to serve in the Department of Energy as an assistant secretary. I was confirmed in 2001. I was confirmed for this position almost 5 months ago now. I was somewhat dismayed to learn, frankly, when I walked back into the building, that the same green folders that we used to achieve concurrence on certain matters, sometimes letters that you sent to us, are still there. They are literally paper folders, green in color. And we circulate them manually by hand throughout the Department for opinion.

In this day and age, it strikes me as odd that we wouldn't do that electronically. A much more efficient way of doing it and, candidly, a very good way of maintaining accountability. Other members of this committee have expressed some dismay and some concern about the lack of engagement or the timeliness of our engagement with this committee. I would suggest to you that that is perhaps part of the problem, that we still do things very manually within the Department.

Mr. HARPER. A basic thing that can be corrected.

With that, I yield back.

Mr. BROUILLETTE. Yes, sir.

Mr. FLORES. Mr. Cramer, you are recognized for 5 minutes.

Mr. CRAMER. Thank you, Mr. Chairman. And thanks to all of you for—really been a fascinating hearing, in my view. I also a want to express the special recognition that the deputy secretary issued on behalf of General Klotz. Those of us from North Dakota, as you know, the model at Minot is only the best coal north. I am very familiar with your leadership, and we are grateful for it. Thank you. And you, by the way, are in the perfect place at this time in your life, at least for the country. So thank you for that.

The first issue I want to raise may not surprise those of you who know me well, is I want to talk about what I see as a lack of a research bridge, if you will, for large-scale carbon capture sequestration utilization projects. Basic research, very good. It goes to the utilities where regulators, like I used to be, warn them against investing in things like this, that there is sort of an antirisk culture, certainly among utilities, which I think was highlighted in your grid study, Mr. Deputy Secretary.

And so what I am wondering is can we—or am I right, first of all, and how can DOE play a role in the demonstration part of carbon capture sequestration technologies that, like I said, find basic research, not quite enough muscle to get it to the commercialization side. Maybe, Under Secretary Menezes, you could help me with that.

Mr. MENEZES. Well, this committee has been a key player in identifying carbon capture sequestration of the clean coal power initiative, for example, and providing the authorization for appropriate levels of funding. Of course, appropriate levels of funding is a key thing. But over time, when you look at what we have done here, the DOE has, over the years, identified several projects, whether it be coal or natural gas, for example, or other uses, to try to figure out how it is that post combustion you can capture and then sequester or use the carbon dioxide.

What we have today is we had the Petra Nova plant, for example, in Texas. Of course, Kemper is usually pointed to as a DOE investment. We have others. We have yet to really figure out how it is that we can have the technology to scale to perform at the efficiency level that we want and then to be able to do with the carbon dioxide that we would like.

We have not stopped funding programs. We have a pilot project in India, for example, which would look to enhance oil recovery. But each of these projects are unique with respect to the combustion, the fuel combustion. So this is not a one size fits all. It is not a one technology that fits all combustion types. So the fuel use is important. And even within coal, the type of coal. As you know, lignite is certainly different from other coal.

Mr. CRAMER. It certainly is.

Mr. MENEZES. And your state has had the longest active capture program in use.

So we are committed to it. Sometimes it is a question of resources. I think it is a fair question to ask, have we not sufficiently funded the most promising technologies and perhaps funded other technologies that may not have been promising when, in fact, they received the moneys. And I think as we—the knowledge is maturing, and I think we are close to, hopefully figuring out how, in fact, is the most efficient way on a multiple range of fuels to capture and use the carbon.

Mr. CRAMER. Well, I know you will find advocates on this committee, as you pointed out. And we will continue to work with you on providing those resources. And I appreciate the very good answer, very thorough answer.

I just, in my last minute, just raise one other issue that is a bit different than you might expect. But because General Atomics is—that is an important corporate citizen at the Grand Forks Air Force Base in North Dakota, and particularly at the Grand Sky UAV park. I have had the opportunity to go down to San Diego a couple of times. In my most recent visit about a year ago, I visited their ITER project. I don't know how familiar you are with it. But, yes, the International Thermonuclear Experimental Reactor project, which, to me, just seems to present a lot of opportunity with a mega fusion project. And I know it is housed in San Diego. Thirty-five countries are part of this. As I look at the U.S. commitment to it, again, financially, I sometimes think we are coming up a little bit short. And I just want to highlight it, either for comment or for further discussion as we go forward.

Mr. DABBAR. Thank you, Congressman. Yes. Quite a different topic than my family's farm in Hazen where they would mine the coal seam that was surface mined.

Mr. CRAMER. Yes.

Mr. DABBAR. The ITER project is a very interesting project as a part of the Office of Fusion, which is in the Office of Science. The ITER project was negotiated a very long time ago as a large international consortium. For those of you who don't know, building a 500 megawatt peak fusion plant in the south of France. That would be large. That would be a large normal power plant. It is a very large project in terms of dollar amounts and the contribution from all around the world, including us. Fusion is important to us. General Atomics also has a fusion reactor in San Diego that you visited. So the overall is very important.

The challenges around ITER is project management. I think you have heard a lot before about us as a management team having private sector experience around project management. The biggest challenge around ITER is that it is six times overbudget and it is 10 years late in terms of timing. And so I know that on a very bipartisan basis there has been a big debate about funding of that and how that affects overall budget and the performance.

The performance of the ITER project has improved since they changed out the management team there, and so they are getting back on being able to perform. And we look forward to working with the Congress here on the appropriations side should you want to continue funding it.

Mr. CRAMER. Appreciate it. Thank you, and I am well over time, Mr. Chairman.

Mr. FLORES. Yes, you are. The gentleman's time has expired long ago.

I would like to thank this panel for attending. Seeing that there are no other members wishing to ask questions, this panel is excused and we will move to Panel II.

Mr. FLORES. All right. Let's go ahead and get started. We want to thank all our witnesses for being here today and taking the time to testify before the subcommittee. Today's witnesses will have the opportunity to give opening statements, followed by a round of questions from members.

Our second witness panel for today's hearing includes Thomas Zacharia, Director of the Oak Ridge National Laboratory; Donald Levy, who is the Albert A. Michelson Distinguished Service Professor Emeritus, University of Chicago and Co-chair of the Panel to Track and Assess Governance and Management Reforms in the Nuclear Security Enterprise; Sarah Ladislaw is the Director of Energy and National Security Program at the Center for Strategic and International Studies; Steve Wasserman is the Director of Lilly Research Laboratory Collaborative Access Team, Advanced Photon Source of the Argonne National Laboratory, on behalf of the Society for Science at User Research Facilities; Dan Reicher is the Executive Director at Stanford University Steyer-Taylor Center for Energy Policy and Finance and Senior Fellow at the Brookings Institution; lastly but not least, Rich Powell is the Executive Director of the ClearPath Foundation.

We appreciate all of you being here today.

We will begin the panel with Dr. Zacharia, and you are now recognized for 5 minutes to give an opening statement. We would request that each of you adhere to the 5-minute limit. Thank you.

Dr. Zacharia.

STATEMENT OF THOMAS ZACHARIA, DIRECTOR, OAK RIDGE NATIONAL LABORATORY; DONALD LEVY, ALBERT A. MICHELSON DISTINGUISHED SERVICE PROFESSOR EMERITUS, UNIVERSITY OF CHICAGO AND CO-CHAIR, PANEL TO TRACK AND ASSESS GOVERNANCE AND MANAGEMENT REFORMS IN THE NUCLEAR SECURITY ENTERPRISE; SARAH LADISLAW, DIRECTOR, ENERGY AND NATIONAL SECURITY PROGRAM, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES; STEVE WASSERMAN, DIRECTOR, LILLY RESEARCH LABORATORIES COLLABORATIVE ACCESS TEAM, ADVANCED PHOTON SOURCE, ARGONNE NATIONAL LABORATORY, ON BEHALF OF THE SOCIETY FOR SCIENCE AT USER RESEARCH FACILITIES; DAN REICHER, EXECUTIVE DIRECTOR, STANFORD UNIVERSITY STEYER-TAYLOR CENTER FOR ENERGY POLICY AND FINANCE AND SENIOR FELLOW, BROOKINGS INSTITUTION; AND RICH POWELL, EXECUTIVE DIRECTOR, CLEARPATH FOUNDATION

STATEMENT OF THOMAS ZACHARIA

Mr. ZACHARIA. Thank you, Chairman Flores, Ranking Member Rush, and members of the committee. Thank you for inviting me to testify.

My name is Thomas Zacharia, and I am director of the Department of Energy's Oak Ridge National Laboratory. As you heard from the earlier panel, Department of Energy is responsible for the missions of science, energy, national security, and then LANL legacy cleanup.

The role of the national labs is to provide the science and technology capabilities and solutions the Department needs to accomplish these missions. My written testimony provides several examples of how Oak Ridge had leverage capabilities and resources and works with other national labs, industry, and universities to meet DOE's mission needs. In the interest of time, I will speak to only one of these.

The Summit supercomputer, which will begin operating at ORNL later this year, will surpass what is now the world's most powerful computer in China. Summit resulted from CORAL, the Collaboration of Oak Ridge, Argonne, and Livermore, meant to streamline the procurement process and maximize the government buying power. Six labs are partnering with an extensive network of American companies, academia, and laboratories on the Exascale Computing Project to ensure that U.S. researchers will have access, not only to the computing systems with 50 times the power of today's most capable machines, but also to the applications and software that they will need to use these machines effectively.

This partnership shows how the national labs individually and collectively play a pivotal role in developing new tools for science and technology, to include reliable and resilient infrastructure in applying those tools to DOE's mission needs and in sustaining U.S. competitiveness.

Most DOE national labs are GOCO facilities, government-owned/contractor-operated. The relationship between DOE and the contractors who manage and operate the labs is ideally a partnership

in which DOE determines what is to be done and contractors determine how to achieve it.

Many aspects of the GOCO model work very well. However, some reviews have identified problems in program execution and increased costs. In 2015, the Commission to Review the Effectiveness of the National Energy Laboratories made several recommendations for improving lab management, many focused on rebuilding the GOCO partnership. DOE is responding by working to drive fundamental change in its management of the national labs.

First, DOE has adopted a planning process that is improving the strategic alignment of the labs and enabling them to work more effectively to focus on national priorities. In terms of governance, DOE is working with its contractors to streamline contract mechanisms, while ensuring that contractors are held accountable.

DOE's lab appraisal process has become a useful tool for evaluating and incentivizing contractor performance and for informing decisions on whether to extend or compete expiring contracts. Contractor assurance systems are providing new tools for determining the proper level of oversight. For example, ORNL offers a fast-track CRADA program. This program streamlines execution of cooperative research agreement and major technology of transfer mechanism by exploiting robust contract assurance processes. Our partnership with DOE's ORNL site office was a key factor in implementing this new mechanism.

DOE's regulatory reform task force identified regulations governing lab operations as a target of opportunity. The task force embraced several proposals from the National Laboratory Directors' Council that focused on these regulations. Cross-functional teams are implementing some welcome changes, as described in my written testimony.

This process has fostered an alignment in which DOE and its contractors are working together on common goals. Continuing efforts along these lines should produce additional savings and operational improvements.

With regard to policy reform, Secretary Perry is realigning the Department to advance its policy goals consistent with the statutory requirements. At ORNL we look forward to working with our DOE sponsors to support them in the execution of their missions.

Finally, DOE is encouraging the national labs to work with industry to turn early-stage innovations into products. New approaches include the agreements for commercializing technology mechanisms now available to all labs and support for early-career innovators.

The actions that DOE has taken to make the national labs more efficient and effective will enable these institutions to focus on delivering the science and technology needed to ensure our energy security, national security, and global competitiveness in the 21st century.

The M&O contractors are committed to working with DOE to build and maintain a culture of trust and accountability that will ensure the greatest possible return on the Nation's investment in the national labs. Thank you, again.

[The prepared statement of Mr. Zacharia follows:]

Statement of Thomas Zacharia
Director, Oak Ridge National Laboratory

Before the
Committee on Energy and Commerce
Subcommittee on Energy
U.S. House of Representatives
January 9, 2018

Hearing on DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States

Chairman Upton, Ranking Member Rush, and members of the Committee: Thank you for the opportunity to appear before you today. It is an honor to provide this testimony on the U.S. Department of Energy (DOE) and the role of the DOE national laboratories in executing the Department's missions.

INTRODUCTION

My name is Thomas Zacharia, and I am Director of Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee. I am also a member of the National Laboratory Directors Council (NLDC), an organization formed by the directors of the 17 DOE labs. In my previous position as ORNL Deputy for Science and Technology, I was a member of the NLDC Chief Research Officers Working Group, which advises DOE senior leadership and the NLDC on scientific, programmatic, and operational issues at the national laboratories.

While I am speaking today on my own behalf, my participation in these groups has provided me with a perspective on the national laboratories that extends beyond ORNL. That perspective informs my views on the topics that you are considering today.

I will begin with an overview of ORNL and its programs in science, energy, and national security and provide some examples of how the national laboratories support the execution of DOE's missions in these vital areas. I will briefly discuss the governance of the national laboratories, and I will describe actions that DOE is taking in partnership with the contractors who manage and operate these laboratories to implement regulatory and policy reforms that are designed to make the national laboratories as efficient and effective as possible.

OVERVIEW OF ORNL

ORNL is DOE's largest science and energy laboratory, with a research and development (R&D) portfolio that spans the range from fundamental science to demonstration and deployment of breakthrough technologies for clean energy and national security. Our mission explicitly includes both scientific discovery and innovation, so we place a high value on translational R&D—the coordination of our basic research and applied technology programs to accelerate the deployment of solutions to compelling national problems.

In fiscal year (FY) 2017, ORNL's budget was $1.65 billion. Most of our funding comes from various elements of DOE, including the Office of Science (SC), the Office of Energy Efficiency and Renewable Energy (EERE), the Office of Nuclear Energy (NE), and the National Nuclear Security Administration (NNSA). In any given year, however, 15 to 25 percent of our funding

comes from other federal agencies, state and local governments, and private-sector customers. Our major non-DOE sponsors include the U.S. Department of Defense, the U.S. Department of Homeland Security, the Nuclear Regulatory Commission, the National Aeronautics and Space Administration (NASA), and the U.S. Department of Veterans Affairs. Our work for these sponsors both exploits and strengthens our unique core capabilities.

The distribution of our funding across DOE's major mission areas is roughly 60 percent to science programs, 20 percent to clean energy programs (including nuclear), and 20 percent to national security programs, but it is important to recognize that R&D often has impacts on more than one mission area. In addition, our focus on translational R&D means that we place considerable emphasis on the integration of basic and applied research, often drawing on our distinctive research facilities and on our ability to quickly assemble and deploy multidisciplinary teams to focus on compelling problems.

To illustrate this point, I need to give you some background on ORNL's capabilities. We host four SC user facilities: the Spallation Neutron Source (SNS); the High Flux Isotope Reactor; the Center for Nanophase Materials Sciences; and the Oak Ridge Leadership Computing Facility (OLCF). We also host four shared R&D facilities supported by EERE: the Building Technologies Research and Integration Center, the Carbon Fiber Technology Facility, the Manufacturing Demonstration Facility (MDF), and the National Transportation Research Center (NTRC). Access to ORNL's nuclear and radiological facilities is provided through NE's Nuclear Science User Facilities (NSUF) and the NE Gateway for Accelerated Innovation in Nuclear (GAIN) program.

Substantial value results from the co-location of these resources with one another and with R&D programs that both draw on them and drive their development. For example, with support from EERE, researchers at ORNL have worked with researchers at DOE's Ames Laboratory, NNSA's Lawrence Livermore National Laboratory, and a Wisconsin company, Eck Industries, to develop a new high-performance aluminum alloy. The automotive industry is interested in aluminum alloys that can operate at high temperatures because of their potential for use in lightweight engine components, which would increase efficiency and fuel economy. To assess the performance of their new alloy under real-world operating conditions, the research team used the resources of MDF and NTRC to cast a cylinder head made of this alloy, using sand molds created by 3D printing. They retrofitted this component to a gasoline-powered engine designed to operate on the VULCAN instrument at SNS and used neutron diffraction to assess the performance of the running engine. This experiment confirmed that the new alloy outperforms other aluminum alloys under realistic operating conditions. It also demonstrated the benefits of coupling fundamental science with early-stage R&D on new materials and technologies.

Another ORNL-led partnership links DOE national laboratories, universities, and industry in a multiyear effort to confidently predict the performance of existing and next-generation commercial nuclear reactors through comprehensive, science-based modeling and simulation. Founded in 2010, the Consortium for Advanced Simulation of Light Water Reactors (CASL) takes advantage of the OLCF and of ORNL's exceptional strengths in nuclear science and engineering. It also draws on the resources of a formidable set of core partners: three national laboratories (NE's Idaho National Laboratory and NNSA's Los Alamos National Laboratory and Sandia National Laboratories), three research universities with strong nuclear engineering

programs (the Massachusetts Institute of Technology, North Carolina State University, and the University of Michigan), and three partners from the nuclear power industry (the Electric Power Research Institute, the Tennessee Valley Authority, and Westinghouse). CASL has connected fundamental research and technology development to develop VERA, a Virtual Environment for Reactor Applications that can simulate the operation of a nuclear power plant. When the Tennessee Valley Authority started up its Watts Bar Unit 2 reactor in 2016, VERA was used to perform hour-by-hour simulations of the new plant's first six months, with predictions providing important data to support the achievement of full-power operations. Westinghouse has used VERA to simulate the startup of its new AP1000 pressurized water reactor, confirming its engineering calculations.

To give you an example relating to national security: ORNL researchers have exploited the Laboratory's extensive capabilities to develop tools and technologies for protecting the nation's electric grid from cyber and physical threats. These resources range from hardware in the form of monitoring devices to software that can detect malicious code to platforms that can detect the presence of advanced persistent threats. In developing these innovations, we have drawn on a long history of discovery and innovations in power and energy systems and in the development and assessment of technology for protecting critical infrastructure. We have also applied our recently developed expertise in advanced manufacturing to create low-cost, 3D-printed sensors that can identify voltage issues and power failures as soon as they occur, while also fusing performance analysis with weather and climate indicators, thus supporting more efficient and cost-effective grid security, maintenance, and disaster response. We work closely with industry partners, including the Chattanooga Electric Power Board, Dominion, Duke Energy, Southern

Company, and the Tennessee Valley Authority, to test and deploy innovations in grid modernization and security. ORNL is also part of the Grid Modernization Laboratory Consortium (GMLC), a strategic partnership between DOE and 13 national laboratories that is working closely with partners in industry and academia across multiple cities and states. One of our GMLC projects, the Southeast Consortium, is establishing a regional partnership to increase utility clean energy portfolios and improve power system network resiliency, with the goal of ensuring both increased reliability and improved responsiveness under extreme conditions by eliminating outages or enabling faster restoration of power to critical loads. Our partners on this project include DOE's Savannah River National Laboratory and three universities in the region: the University of Tennessee, the University of North Carolina at Charlotte, and Clemson University.

The DOE national laboratories also work together to deliver the tools needed to accomplish the Department's missions. Earlier, I mentioned the OLCF, which is one of two DOE leadership-class computing facilities. The national laboratories have worked with industry for decades to build powerful supercomputers and apply them to DOE mission needs. These HPC systems have delivered nuclear weapons simulation and modeling capabilities that are vital to the NNSA's Science-Based Stockpile Stewardship Program. They have been used by scientists to understand the evolution of stars, to simulate the combustion of alternative fuels in high-performance engines, to accelerate drug design and discovery, and to improve our understanding of the hazards and risks of earthquakes. Researchers from industry have exploited them to design advanced aircraft, high-efficiency gas turbines, and better paper products. Finally, the technologies developed to enable these systems are exploited by industry to bring ever more

powerful devices to the marketplace. (To quote Lewis Platt, CEO of Hewlett-Packard in the 1990s, "Yesterday's supercomputer is today's laptop.")

In the past few years, other nations—notably China—have invested heavily in the development of HPC systems. As of November 2017, China's TaihuLight system was more than five times as powerful as the top-ranked U.S. system, the Cray XK7 Titan at ORNL. The DOE national laboratories are actively engaged in reclaiming U.S. leadership in this vital area. At the OLCF, we are deploying a system that may well be the world's most powerful supercomputer when it begins operating later this year. Summit will be at least five times as powerful as Titan. It will also be an exceptional resource for deep learning, with the potential to address challenging data analytics problems in a number of scientific domains. Summit is among the products of CORAL, the Collaboration of Oak Ridge, Argonne, and Livermore, a partnership that was recognized by *HPCWire* in 2015 with an Editor's Choice award for "Best HPC Collaboration between Government and Industry."

In addition, we are working with the three NNSA laboratories (Livermore, Los Alamos, and Sandia) and with two other SC laboratories (Argonne and Lawrence Berkeley) on the Exascale Computing Project (ECP). Launched by DOE in FY 2017, the ECP is focused on accelerating the delivery of a capable exascale computing ecosystem.[1] China plans to have its first exascale

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[1] In this context, "capable" addresses the need for systems that can deliver high-fidelity solutions in less time and address problems of greater complexity than today's supercomputers, while operating reliably in a power envelope of 20 to 30 megawatts and supporting a broad spectrum of applications and workloads. "Exascale" refers to computing systems at least fifty times as powerful as those in operation today. A "computing ecosystem" includes system software, hardware technologies and architectures, and the scientific applications that will run on advanced systems, as well as development of the workforce needed to operate and exploit these resources.

system in operation by 2020. The ECP is integrating the strengths of the six participating laboratories to ensure that researchers in the United States will have access not only to physical computing systems with the requisite power, but also to the tools that they will need to deliver breakthrough modeling and simulation solutions that address the most critical challenges in scientific discovery, energy assurance, economic competitiveness, and national security. The benefits of the ECP will extend beyond DOE to other federal agencies and to U.S. industry.

GOVERNANCE OF THE NATIONAL LABORATORIES

With the exception of the National Energy Technology Laboratory, the DOE national laboratories are owned by the U.S. government and managed and operated by contractors. This government-owned/contractor-operated (GOCO) approach has been in existence since the Manhattan Project, when it provided the flexibility needed to accomplish the development of the first nuclear weapons. It was formally adopted for the national laboratories in the Atomic Energy Act of 1946, under which Congress authorized "contracts for the operation of Government-owned plants so as to gain the full advantage of the skill and experience of American industry."

These management and operation (M&O) contracts remain the key instrument for implementing the GOCO model. The relationship between DOE and its contractors is ideally a partnership, in which DOE establishes objectives for the laboratories' R&D programs, based on its mission needs, and exercises the controls necessary to assure security, safety, and the prudent use of public funds, while allowing contractors selected for their technical ability and managerial expertise to determine how to carry out day-to-day operations. Simply stated, DOE decides ***what*** is to be done, and the M&O contractors decide ***how*** it is to be done.

Over time, however, the M&O contracting environment has increasingly become one in which contractors are subjected to increasing oversight, duplicative and burdensome regulations, and greater liability, while having less authority and autonomy. Dozens of past investigations, studies, and reviews of DOE and the national laboratories have focused on the need to return to the intent of the original GOCO model as stated in a clause found in some early M&O contracts: that "this agreement shall be carried on in a spirit of partnership and friendly cooperation with a maximum of effort and common sense in achieving their common objectives."

For example, in October 2015 the Commission to Review the Effectiveness of the National Energy Laboratories (CRENEL) made 36 recommendations designed "to ensure that the laboratories are able to operate as efficiently and effectively as possible so that the Nation realizes the maximum benefit from this national asset in the years ahead."[2] Many of these recommendations focused on restoring the partnership between DOE and its laboratories to establish and maintain a culture of trust and accountability.

REALIZING THE POTENTIAL OF THE NATIONAL LABORATORIES

I am happy to report that DOE is working to drive fundamental change in its management of the national laboratories, concentrating in four areas:

- partnering with leadership to leverage the laboratories' capabilities to address national priorities;

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[2] *Securing America's Future: Realizing the Potential of the Department of Energy's National Laboratories—Final Report, of the Commission to Review the Effectiveness of the National Energy Laboratories,* Vol. 1: Executive Report, October 28, 2015.

- reforming DOE governance of national laboratories to recapture the M&O contract model;
- implementing regulatory and policy reforms to alleviate unnecessary burdens placed on the laboratories; and
- closely coupling the work of the national laboratories with the private sector to support technology innovation that advances U.S. global competitiveness and leadership.

Focus on National Priorities

The national laboratories represent a remarkable asset for the nation. Over the past 75 years, they have consistently provided the science and technology needed to address compelling national problems, and they offer an extraordinary set of resources for sustaining and advancing the national, economic, and energy security of the United States in the 21st century.

DOE has adopted a laboratory strategic planning process, modeled on processes developed by SC, that is improving the strategic alignment of the national laboratories and enabling them to work more effectively, both collectively and individually, to meet DOE mission needs and address national priorities. DOE and the laboratories are using this process to produce plans for accomplishing the Department's missions and conducting world-class R&D.[3]

[3] For details, see "DOE Laboratory Strategic Planning," p. 83 in *Annual Report on the State of the DOE National Laboratories,* U.S. Department of Energy, Washington, D.C., January 2017.

Improved Governance of Laboratories

DOE and its contractors are working to streamline and simplify contract mechanisms to improve partnership, reduce transactional oversight, and deliver more R&D for the federal dollars invested at the national laboratories, while ensuring that contractors are held accountable. Contract reform efforts are paying off in better understanding of performance expectations and requirements, reductions in transactional approvals, and better tailoring of oversight and control to potential risks.

I want to highlight the laboratory appraisal process developed by SC, which has been in place for a decade. This process initially established a common structure and scoring system across the ten SC national laboratories. It has now been implemented for all 16 GOCO laboratories. It emphasizes the importance of delivering the science and technology necessary to meet DOE's mission needs; operating the laboratories in a safe, secure, responsible and cost-effective way; and recognizing the leadership, stewardship, and value-added provided by the M&O contractors. Every year, laboratory staff work with DOE to develop a Performance Evaluation and Measurement Plan (PEMP) that establishes the foundation for an annual evaluation of the contractor's scientific, technological, managerial, and operational performance. The final product is an annual "report card" for each laboratory that is posted on the DOE website. DOE uses the results of the process to determine the performance fee that is paid to the M&O contractor. At some laboratories, strong performance can result in an extension of the contract. Performance evaluations also provide DOE with input to its decisions on whether to extend or compete M&O contracts when they expire.

Our experience at ORNL has been that this process has delivered on its goals of improving transparency, raising the level of involvement of DOE leadership, increasing consistency in the way the laboratories are evaluated, and incentivizing contractor performance. The process provides a way of holding the contractor accountable for results, and it helps to build trust by establishing a clear understanding of what is expected.

More recently, the increasing use of contractor assurance systems has allowed contractors to more effectively manage processes, resources, and outcomes. These systems support DOE in determining the necessary level of oversight for activities at the national laboratories. For example, ORNL recently became the first national laboratory to implement a Fast Track CRADA Program. This program will streamline the execution of cooperative R&D agreements (CRADAs), which are a key mechanism for technology transfer, by exploiting ORNL's robust contractor assurance processes to simplify the involvement of DOE's ORNL Site Office. The flexibility provided by the GOCO model and the "spirit of partnership and friendly cooperation" that is a vital element of our relationship with DOE's ORNL Site Office were key factors in our ability to implement this new tool for accelerating the transition of DOE-sponsored innovations to beneficial use.

Regulatory and Policy Reform

In accordance with the policy outlined in Executive Order 13777, "Enforcing the Regulatory Reform Agenda," DOE is placing a high priority on reducing regulatory burdens that impede competitiveness and innovation. The Department's Regulatory Reform Task Force identified

DOE's "inward-facing regulations" on national laboratory operations as an area presenting substantial opportunities for beneficial and cost-saving improvements.

The task force also sought input from outside entities, and the NLDC responded with a set of proposals for improving the management and operations of the national laboratory complex. DOE embraced a number of these proposals and established cross-functional teams from across the Department and the national laboratories to evaluate, enhance, and implement the improvements.

Good progress is being made. One of these teams is working on improving the M&O contract mechanism, with an eye to strengthening partnerships and reducing transactional oversight. Another is taking action to revise the DOE rule governing nuclear safety management (10 CFR 830) to address recognized issues that have resulted in substantial unnecessary costs associated with the operation of nuclear facilities. A team evaluating human resources functions looked at some 25 required reports and determined that 55 percent of them could be eliminated or revised to incorporate efficiencies. Another 25 percent of required reports are expected to be eliminated by the heads of contracting authorities. Other efforts are moving forward.

This process has fostered a collaborative environment in which DOE and national laboratory staff are working toward shared goals and outcomes, with a view to freeing up human capital to focus on mission. In November, the NLDC submitted a second set of proposals to DOE for consideration. I am confident that continuing efforts along these lines will result in additional savings and extend the value of the dollars invested in the national laboratories.

In terms of policy reform, Secretary Perry recently announced a realignment of DOE's organizational structure "to advance its policy goals consistent with its statutory requirements." At ORNL, we look forward to working with our sponsors across the Department to deliver the science and technology that they need to execute their statutory missions.

Collaborating with Industry

DOE is taking steps to ensure that scientific and technical advances can move beyond the national laboratories to increase the economic impact of the intellectual property developed as a result of federally funded R&D. The laboratories are being encouraged to work with the private sector to find and implement new approaches for translating early-stage innovations to viable market options. These efforts leverage traditional funding streams and programs focused on early-stage research with private-sector and foundation support and market knowledge that provide a pathway to create new businesses, product lines, and jobs. DOE's Office of Technology Transitions provides valuable coordination.

In 2011, DOE and the national laboratories worked together to develop the Agreements for Commercializing Technology (ACT) mechanism to provide potential industry partners with an alternative to CRADAs and the traditional Strategic Partnership Projects (SPP, formerly Work for Others) agreements. Following a successful pilot program, Secretary Perry has made the ACT mechanism available at all of the national laboratories. CRADAs and SPP agreements are between the national laboratory and a third-party company, and they must be approved by DOE. Although both have been successfully used to transfer technology to industry, they have often

been criticized as being too complicated and taking too long to implement. They also require industry partners to assume all risk and to make advance payments before work can begin.

ACT agreements are contracts between the M&O contractor and a third-party company. Among their key characteristics are the following:

- They provide a more flexible framework for negotiation of intellectual property rights, as well as a streamlined approval process.
- They allow M&O contractors to negotiate terms that are better aligned with industry practice, attracting more private investment, and to assume contractual and financial risk.
- They provide a way for national laboratories to participate in groups formed to address complex technological challenges that are of mutual interest.

Secretary Perry has also authorized a pilot program that will expand the use of ACT to allow organizations to partner with the national laboratories on federally funded projects. We look forward to the opportunities that will arise through this new program.

Another innovative approach to accelerating the development of early-stage technologies is the Lab-Embedded Entrepreneurship Programs sponsored by EERE: Cyclotron Road at Lawrence Berkeley, Chain Reaction Innovations at Argonne, and Innovation Crossroads at ORNL. Our Innovation Crossroads program matches aspiring entrepreneurs in energy and advanced manufacturing with experts, mentors, and networks in technology-related fields who can assist these early-career innovators in taking their ideas from R&D to the marketplace. Last year, we welcomed our first cohort of innovators. They are working on a novel approach to growing high-

quality carbon nanotubes from carbon dioxide, an active energy storage system that manages different sources of thermal energy to inexpensively store electricity, and an advanced nuclear reactor that offers high efficiency, low cost, and enhanced safety.

Innovation Crossroads participants are paired with students from the Bredesen Center for Interdisciplinary Research and Graduate Education, who provide assistance with market research and customer discovery. The Bredesen Center was created as a partnership of ORNL and the University of Tennessee in 2012. It offers doctoral degrees in energy science and engineering and in data science and engineering, and it enables students not only to conduct multidisciplinary research at ORNL but also to cultivate skills in science and technology policy, entrepreneurship, and outreach. We have extended the Bredesen Center model to more than 25 additional universities across the nation.[4] These activities help to build a robust pipeline of talent in fields of vital importance to DOE and the nation. Many of these students go on to work in industry, and several have launched companies of their own.

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[4] Universities offering doctoral research programs through ORNL's Graduate Opportunities (GO!) Program: Boston University, the Colorado School of Mines, Duke University, Florida State University, Georgia Institute of Technology, Michigan State University, Michigan Technological University, North Carolina State University, Ohio State University, Oregon State University, Purdue University, Rensselaer Polytechnic Institute, Rice University, Texas A&M University, the University of California–Davis, the University of Florida, the University of Illinois at Urbana-Champaign, the University of Missouri, the University of Nebraska–Lincoln, the University of Virginia, the University of Wisconsin–Madison, the University of Nevada–Las Vegas, Virginia Polytechnic Institute and State University, Washington State University and six Tennessee universities: Middle Tennessee State University, Tennessee Technological University, the University of Memphis, the University of Tennessee–Chattanooga, the University of Tennessee–Knoxville, Vanderbilt University,

CLOSING REMARKS

Our nation is facing a formidable set of challenges: ensuring our national security in a changing world; increasing the availability of clean, reliable, and affordable energy while protecting the environment; improving human health; and enhancing U.S. competitiveness in the global economy by fostering scientific leadership and encouraging innovation. The DOE national laboratories are uniquely equipped and positioned to make substantial contributions to overcoming these challenges.

DOE is taking action to make the national laboratories more efficient and effective, which will enable these institutions to focus their distinctive capabilities on delivering the advances in science and technology that are vital to ensuring our energy security, national security, and global competitiveness. The M&O contractor community is committed to working with DOE to build the culture of trust and accountability that will ensure the greatest possible return on the nation's investment in the DOE national laboratories.

Thank you again for the opportunity to testify. I welcome your questions on this important topic.

Mr. UPTON [presiding]. Thank you.

Dr. Levy. You need to hit that button on the——

STATEMENT OF DONALD LEVY

Mr. LEVY. Chairman Upton, Ranking Member Rush, members of the committee, I am Donald Levy, Professor of Chemistry Emeritus at the University of Chicago. The University of Chicago is a management and operating contractor for the Department of Energy, operates two Office of Science Laboratories: Argonne National Lab and Fermi National Accelerator.

Ten years prior to my retirement in 2016, I was vice-president for research and national laboratories at the university and the person responsible for executing our M&O contract.

I am a member of the National Academy of Sciences, and I am here today as co-chair of the joint panel of the National Academy of Sciences and the National Academy of Public Administration, which is charged to monitor the efforts of the National Nuclear Security Administration, NNSA, to address issues raised in several reports concerning NNSA's management and governance of the enterprise. I also wish to acknowledge my NAPA co-chair for the study, Jonathan Breul of Georgetown University. I very much appreciate you giving me the opportunity to discuss insights we have gained so far in the course of our panel's study.

Our study was requested by Congress in the National Defense Authorization Act of fiscal year 2016, being carried out by a very strong panel whose membership has extensive experience and excellent credentials in both nuclear security and public administration. It is supported by the NNSA, which has gone out of its way to provide the panel with full information relevant to its tasks.

The congressional request that formed our panel came about because of the long series of reports that identified serious concerns in the operation of the nuclear security enterprise. By one count there were more than 50 critical reports over two decades. In spite of all those reports, problems persisted. The concerns in these reports are not about the safety and security incidents you may occasionally read in the paper, and certainly not about the quality of the work being done. Rather, they arise from serious and systemic management and governance problems which have persisted for many years and were perceived as an eventual threat to the national security mission of the NNSA.

Our first report was released last March and the second is in preparation. Our work will run through the fall of 2020. The Authorization Act asked in particular that NNSA create a plan to address concerns raised in the most recent critical report, which was produced by a panel co-chaired by Norman Augustine and Admiral Richard Mies.

The Augustine-Mies report identified five serious concerns, which are called, and I quote from the report, "systemic problems in both management practices and culture that exist across the nuclear enterprise." These are: Number one, a lack of sustained national leadership, focus, and priority. Number two, overlapping DOE and NNSA headquarters staffs and blurred ownership and accountability for the nuclear enterprise missions. Number three, lack of proven management practices, including dysfunctional relationship

between the program line managers and mission support staffs. Number four, dysfunctional relationships between the government and its management and operating contractors, which has led to burdensome transactional oversight rather than management focus on mission execution. Number five, insufficient collaboration between NNSA and Department of Defense weapons customers, resulting in misunderstanding, distrust, and frustration.

These concerns are not merely vexations or opportunities for improvement. Rather, they each represent a risk, which if not addressed, would eventually erode the Nation's ability to provide adequate nuclear security. Each of the concerns in the Augustine-Mies report mirror similar findings in many previous reports.

Our studies found, through multiple site visits, numerous meetings and phone calls with NNSA staff members and study of relevant documents, that NNSA has initiated a large number of changes in response to the Augustine-Mies report and others. But as noted in our first report, quoting from that report, "it has not identified success and it lacks qualitative or quantitative metrics to identify and measure change."

Moreover, the changes that have been made seem piecemeal and not as part of a larger strategic plan intended to address longstanding problems. Our panel continues to press for measures, quantitative or qualitative, that can indicate whether progress is being made against the serious and persistent concerns.

In our upcoming report, we will provide a more detailed analysis of some of NNSA's more promising changes. But the panel has also heard first-hand from the laboratory staff that in spite of these changes, problems persist.

More broadly, NNSA is embarking on a large-scale program of change management in order to alter practices and attitudes that have settled in over decades. In its first report, our panel explained that the experience of many organizations have revealed some common steps that are necessary for effective and lasting change to take root. Not all of those steps are in place at NNSA, and our upcoming report will delve into this.

Successful change management, especially this scale, also requires buy-in and leadership from the top. It is important for the next NNSA administrator and DOE leadership to recognize the magnitude and persistence of the problems and take on this challenge.

Thank you again for the opportunity to testify today. I remain at your disposal for questions.

[The prepared statement of Mr. Levy follows:]

Testimony of

Dr. Donald Levy
Albert A. Michelson Distinguished Service Professor Emeritus
University of Chicago

and

Co-Chair
Tracking and Assessing Governance and Management Reform in the Nuclear Security Enterprise

Joint Panel of the
National Academies of Sciences, Engineering, and Medicine and
National Academy of Public Administration

Before the

Subcommittee on Energy
House Energy and Commerce Committee
U.S. House of Representatives

January 9, 2018

Summary of Major Points

- According to dozens of external examinations over at least two decades, governance and management of the nuclear security enterprise raises concerns
- Despite this continuing stream of reports, problems persist
- A panel of the National Academies of Sciences, Engineering, and Medicine and National Academy of Public Administration is operating through 2020 to track and assess NNSA's plans to address these concerns
- That panel has seen promise in some of NNSA's latest reform efforts
- It has also heard from multiple staff members across the enterprise that problems persist
- This large-scale change management requires several elements in order to succeed, one of which is leadership from the top. It is important for the next NNSA Administrator and for DOE leadership to recognize the problems and embrace the challenge.

Chairman Upton, Ranking Member Rush, and members of the committee:

I am Donald Levy, Professor of Chemistry emeritus at the University of Chicago. The University of Chicago is a Management and Operating contractor for the Department of Energy and operates two Office of Science Laboratories, Argonne National Laboratory and Fermi National Accelerator Laboratory. For ten years prior to my retirement in 2016, I was Vice-President for Research and National Laboratories at the university and the person responsible for executing our M&O contracts.

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1. A lack of sustained national leadership, focus, and priority;
2. Overlapping DOE and NNSA headquarters staffs and blurred ownership and accountability for the nuclear enterprise missions;
3. Lack of proven management practices, including a dysfunctional relationship between program line managers and mission-support staffs;

4. Dysfunctional relationships between the government and its Management and Operating contractors, which has led to burdensome transactional oversight rather than management focus on mission execution;

5. Insufficient collaboration between NNSA and DOD weapons customers, resulting in misunderstanding, distrust, and frustration.

These concerns are not merely vexations, or opportunities for improvement. Rather, they each represent a risk which if not addressed, would eventually erode the nation's ability to provide adequate nuclear security. Each of the concerns in the Augustine-Mies report mirror similar findings in many of the previous reports.

Our study has found—through multiple site visits, numerous meetings and phone calls with NNSA staff members, and study of relevant documents—that NNSA has initiated a large number of changes in response to the Augustine-Mies report and others. But, as noted in our first report, it "has not defined success and it lacks qualitative or quantitative metrics to identify and measure change." Moreover, the changes that have been made seem piecemeal and not as part of a larger, strategic plan intended to address longstanding problems. Our panel continues to press for measures—quantitative or qualitative—that can indicate whether progress is being made against the serious and persistent concerns.

In our upcoming report, we will provide a more detailed analysis of some of NNSA's more promising changes. But the panel has also heard first-hand from laboratory staff that, in spite of these changes, problems persist.

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Thank you again for the opportunity to testify today. I remain at your disposal for questions.

Mr. UPTON. Thank you.
Ms. Ladislaw.

STATEMENT OF SARAH LADISLAW

Ms. LADISLAW. Chairman Upton, Ranking Member Rush, and members of the committee, it is a pleasure to be here to speak with you today about DOE modernization.

I run the CSIS Energy and National Security Program. It is one of the country's oldest and most well-known think tank program focusing on energy policy and geopolitics. It was created around the same time as the Department of Energy and for many of the same reasons. The views I express today are my own.

The Department of Energy was created in the late 1970s during an inflection point in America's energy history. Today, the United States faces a new energy inflection point. Unlike the scarcity atmosphere of the 1970s, the United States has been leading the world in a new age of perceived energy abundance and rapid technological change. With it come new challenges and opportunities.

For example, while the United States is now the world's largest producer of oil and gas, we are still vulnerable to energy supply disruptions in a globally integrated market. Electric power systems are becoming more distributed and complex, which brings enormous benefits but also operational and security challenges.

Efforts to create and manufacture new technologies or capture market share in developing economies is leading to stiff competition and creating new trade relationships and geopolitical dynamics. Concerns over air pollution, water resources, and the global climate challenge are fundamentally altering the investment environment for energy companies and the policy decisions taken by governments around the world. The United States is blessed with many advantages in this environment, but the potential for disruptive change is higher than ever.

The Department of Energy has an important role to play in addressing all of these challenges. First, the DOE should take a leadership role in conducting analysis regarding the safety, reliability, and optimization of the Nation's energy infrastructure. As we continue to witness, abundant supply does not in and of itself provide energy security. Transmission, delivery, and distribution infrastructure is critically important to ensuring adequate supplies of energy.

Second, the DOE should continue to maintain emergency preparedness planning and response functions. Most notably, DOE manages the Nation's strategic petroleum reserves, the world's largest government-owned and managed emergency stockpile of crude and home heating oil. The DOE should modernize and Congress should safeguard this important asset.

Third, energy efficiency promotion should remain a core mandate at the Department of Energy. One of the original mandates of the Department of Energy was to enact efficiency standards. The role that the Department plays in setting those standards is often overlooked or criticized, but has paid important economic and security dividends over the years.

Fourth, scientific research and innovation are essential to meeting DOE's mission across the board and should be strengthened.

The role that DOE and the national laboratories play in national research and development ecosystem are critical. Government does not constitute the entirety of the U.S. innovation landscape, but makes important contributions to funding research not undertaken by private interests, feeding into the personnel and intellectual supply chain of the research community, and working collaboratively with the private industry and universities to catalyze important areas of research.

Fifth, energy strategy and analysis are more important than ever, so the DOE should maintain and strengthen its energy policy and analysis function. It is critically important for DOE to have a strong energy policy and analysis function in order to play an active and authoritative role in the interagency policymaking process and to engage with industry and other stakeholders.

Sixth, independent and impartial energy information is essential. For decades, the country has benefited from the data collection, reporting, and analytical function of the Energy Information Administration. EIA provides unbiased, market-relevant research on a regular basis through reports, and provides an important policy neutral voice in the energy policymaking process.

Seventh, DOE should increase its capabilities when it comes to understanding, managing, and engaging in global energy issues. DOE plays an underreported role in managing international affairs in geopolitics as they relate to energy. The International Affairs Office should be strengthened and expanded to have a stronger analytical function designed to inform DOE leadership and thinking about global energy trends and the emerging challenges we face.

The Department of Energy has a long history of supporting the Nation's security, economic, and environmental priorities and objectives. It was born during a time when the Nation's energy outlook was dangerous and uncertain. Today's energy outlook is no less uncertain as the country prepares for more interconnected and interdependent energy systems driven by new consumers, new priorities, and stiff competition. Preparing for this future requires the same amount of dedication and commitment that the DOE has delivered for the last 40 years.

Thank you for the opportunity to provide my thoughts on DOE modernization. I look forward to taking your questions.

[The prepared statement of Ms. Ladislaw follows:]

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Statement Before the
House Committee on Energy and Commerce
Subcommittee on Energy

"DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States"

A Testimony by:

Sarah Ladislaw

Director, Energy and National Security Program,
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January 9, 2018

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Introduction and Main Points

Good morning Chairman Upton, Ranking Member Rush and members of the committee. It is my pleasure to be here today to speak with you about DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States. My name is Sarah Ladislaw and I direct the Energy and National Security Program at the Center for Strategic and International Studies (CSIS). CSIS is a bipartisan, nonprofit organization headquartered in Washington, D.C. The CSIS Energy and National Security Program provides strategic insights and policy solutions related to the dynamic and changing global energy landscape. My remarks and written testimony represent my views and not the views of my colleagues or CSIS as an institution.

The perspectives I will share with you today are related to my role as an energy analyst but also informed by my time working at, and with officials from, the Department of Energy over the course of my career, as well as the mentorship I have received from colleagues who were around during the creation of the department and sought to steward its development over the years.

History and Performance

The Department of Energy was created in the late 1970s during a strategic inflection point in the American energy narrative. Energy demand was outstripping energy supply and our growing dependence on imported energy resources, particularly oil, emerged as a strategic vulnerability in the wake of the Arab oil embargoes and war in the Middle East, and in the face of successive shortages and price spikes related to U.S. regulation and price controls. Also faced with forecasts of further declines in U.S. oil production, in April 1977, the Carter Administration issued the first National Energy Plan, laying out a vision for how to address the nation's energy challenges. It said:

"The diagnosis of the U.S. energy crisis is quite simple: demand for energy is increasing, while supplies of oil and natural gas are diminishing. Unless the U.S. makes a timely adjustment before world oil becomes very scarce and very expensive in the 1980's, the nation's economic security and the American way of life will be gravely endangered. The steps the U.S. must take now are small compared to the drastic measures that will be needed if the U.S. does nothing until it is too late."[1]

Congress, in agreement with the administration's concerns, passed the Department of Energy Organization Act in 1977 which states:

"The Congress of the United States finds that –

(1) The United States faces an increasing shortage of nonrenewable energy resources;
(2) This energy shortage and our increasing dependence on foreign energy supplies present a serious threat to the national security of the United States and to the health, safety and welfare of its citizen;

[1] Carter, Jimmy. "National Energy Plan Message of the President." The American Presidency Project. 29 Apr. 1977, www.presidency.ucsb.edu/ws/index.php?pid=7423.

(3) A strong national energy program is needed to meet the present and future energy needs of the Nation consistent with overall national economic, environmental and social goals;
(4) Responsibility for energy policy, regulation, and research, development and demonstration is fragmented in many departments and agencies and thus does not allow for the comprehensive centralized focus necessary for effective coordination of energy supply and conservation programs; and
(5) Formulation and implementation of a national energy program require the integration of major Federal energy functions into a single department in the executive branch"[2]

To meet these needs, the Department of Energy Organization Act pulled together disparate and important authorities and programs from around the federal government including the Federal Energy Administration (FEA) and the Energy Research and Development Administration (ERDA), among others, to "secure effective management [of those programs]...and coordinated national energy policy."[3] The Department did not absorb all energy-relevant federal authorities – like public lands and offshore minerals leasing or environmental regulation which are now housed in the Department of Interior and the Environmental Protection Agency respectively – but it did bring under one roof the nation's laboratory system and the civilian control of nuclear weapons stockpile stewardship, both of which gave the new agency enormous standing and authority.[4]

Over the years, DOE's most important contributions, in addition to successful nuclear stockpile stewardship and world-class scientific research, have been:

(1) removing energy price controls;
(2) working with Congress to establish some of the major energy policies and regulations that have shaped the U.S. energy landscape over the last 40 years;
(3) establishing the United States as a technological leader across a range of fields including energy, transportation, medicine, and computer science;
(4) protecting against and responding to energy supply disruptions, natural disasters, and critical infrastructure threats (not least of which in the maintenance of the Strategic Petroleum Reserve); and
(5) creating a first-in-its-class statistical organization, the Energy Information Administration or EIA, to provide policymakers and the public with consistent access to unbiased and transparent energy data and analysis.

The Department has proactively shaped the nation's energy landscape and has played an important role in navigating a range of energy crises from oil supply disruptions, major blackouts, environmental disasters, cyber incidents, and addressing nuclear non-proliferation issues. DOE has advanced development of new technologies and helped inform the public about important energy innovations over the years from nuclear power, oil sands development,

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[2] "Department of Energy Organization Act". (91 Stat. 565; 42 U.S.C. § 7101 note). https://www.usbr.gov/power/legislation/doeorg.pdf.
[3] Curtis, Charles B. "Reflections on James Schlesinger -- the Man, His Times, and the Department of Energy." Dept. of Energy Schlesinger Medal Ceremony, 19 Jan. 2017.
[4] Ibid

liquefied natural gas, smart meters, and countless others. DOE has played a major role in creating and maintaining relationship with other countries based on common energy interests and challenges. It has supported global energy institutions and technology partnership and has played an important coordinating role in domestic energy policy formation.

New Energy Inflection Point

Today, the United States faces a new energy inflection point. For the majority of the last forty years, the overarching goal of U.S. energy policy has been to secure affordable and reliable energy supplies within the context of presumed increasing scarcity. Now, the United States is leading the world in a new age of perceived energy abundance. The most recognized face of this abundance is oil and natural gas. Over the last decade, the US resurgence in oil and natural gas production, thanks to onshore tight oil and shale gas resources, has been nothing short of remarkable.[5] In the last 10 years, crude oil production grew by 75 percent and natural gas production by 45 percent, making the United States the largest oil and gas producer in the world. As a result, oil exports from the United States are growing (despite the fact that the United States still imports approximately 8 million barrels a day as well). During the first half of 2017, the United States reached a new record by exporting more than 6 million barrels per day of crude oil and products to nearly 27 countries around the world.[6] In 2017, the United States became a net exporter of natural gas, and going forward exports of gas are expected to increase substantially as new liquefied natural gas export facilities come online. This development of U.S. oil and gas resources provided a significant boost to the U.S. economy and created a large number of jobs in the wake of the 2008 financial crisis and has had an important impact on global oil and natural gas markets.[7]

This abundance narrative extends far beyond oil and gas, however. Over the last decade renewable and advanced energy resources (like batteries, micro-grids, and other smart energy technologies) have become more affordable nearly everywhere in the word. Many of these advancements were aided by U.S. investments in research and development and the supportive policy environment fostered at a federal and state level. The combination of improving economics and performance, along with policy support, means that renewable energy penetration has soared in recent years as consumers no longer question the cost-competitiveness of these resources. According to a 2017 DOE report (graphic depiction by The New York Times below) the renewable energy industry provides a substantial number of jobs in the U.S. economy. By most accounts, demand for renewable energy resources will grow faster (albeit from a smaller base) than any other fuel source over the next several decades.

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[5] In the World Energy Outlook 2017, the International Energy Agency states that the growth in US oil production over the last decade is the largest ramp-up in oil production in history.

[6] French, Matthew, and Joseph Ralbovsky. "Crude Oil and Petroleum Product Exports Reach Record Levels in the First Half of 2017." Today in Energy, U.S. Energy Information Administration, 18 Oct. 2017, www.eia.gov/todayinenergy/detail.php?id=33372.

[7] For more information please see two recent CSIS publications: U.S. Oil in the Global Economy (https://www.csis.org/features/us-oil-global-economy) and U.S. Natural Gas in the Global Economy (https://www.csis.org/features/us-natural-gas-global-economy)

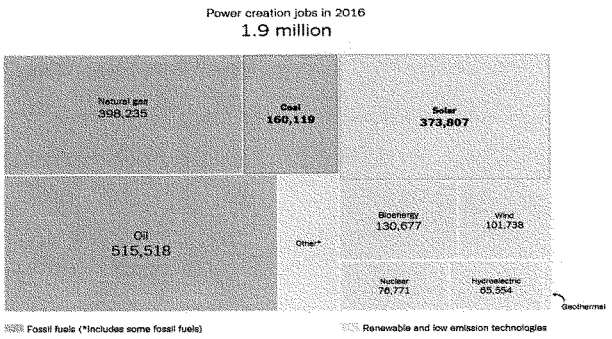

Figure 1: Power Creation Jobs in 2016[8]

This new reality poses many new challenges and opportunities to governments, industry, innovators, and consumers. For example, despite being the largest oil and gas producer in the world, the United States is still vulnerable to energy supply disruptions in a globally integrated market. The United States experienced widespread production and refinery outages in the Gulf Coast of the United States just this past year and a major oil or to a less extent natural gas supply disruption elsewhere in the world would impact the prices and availability or resources upon which we and our allies rely.

Electric power systems are becoming more distributed and sophisticated. This brings enormous benefits but also poses challenges to regulators and system operators, traditional utilities and power providers, as well as new market entrants and innovators. The electricity sector remains deeply interconnected with information systems upon which modern society increasingly relies. The proliferation of smart technologies will increase these interconnections and make them more complex. Industry and government are working hard to maintain system resilience and reliability in the face of cyber threats to our critical infrastructure.

Countries around the world are competing to create new technologies, capture markets, and create economic opportunity for their citizens. Energy plays in important role in this dynamic. Cheap energy is a powerful stimulus to economic growth putting more money in the pockets of industry and consumers. The energy sector provides direct and indirect jobs that underpin local and regional economies and local communities. Energy resource and technology development provide trade and export opportunities that link the United States with larger market opportunities around the world. The competitive environment around energy has become more intense as energy supplies are more readily available. Providers of energy are looking to secure

[8] Popovich, Nadja. "Today's Energy Jobs Are in Solar, Not Coal." The New York Times, 25 Apr. 2017, www.nytimes.com/interactive/2017/04/25/climate/todays-energy-jobs-are-in-solar-not-coal.html.

new relationships in growing energy markets with implications for global energy trade and geopolitics. Governments are devising new strategies to grow the technologies of the future at home and ensure their competitiveness abroad.

Concerns over air pollution, water resources, and the global climate challenge are increasingly shaping the decisions of policymakers, regulators, investors, corporations and citizens. Energy stakeholders that do not consider the very real environmental security risks that must be addressed by society have fewer and fewer places to act unabated. Driven by these priorities countries around the world are enacting new policies and regulation, companies and investors are investing in cleaner energy technologies, and consumers are realizing more choice when it comes to the energy they choices they make. Examples of this include the proliferation of rooftop solar, energy efficient appliances and infrastructure, electric vehicles, and other new forms of technology. The current energy inflection point is one in which the United States has a great many inherent advantages but in which the potential for disruptive changes is higher than ever.

Modernizing the Department of Energy

The Department of Energy has an important role to play in addressing all of these challenges. Other representatives on the panel can speak to needs and capabilities of the department in the areas of stockpile stewardship, non-proliferation, and environmental remediation better than I can. I will just note as others have done that wide range of its mandates and expertise have given the department a schizophrenic identity at times; one that the public and even policymakers do not well understand. Managing the weapons, environmental remediation, scientific research and energy portions of the department of energy has been tricky to navigate over the years and is frequently cited as one of the shortcomings of the department. The last administration sought to separate out the managerial functions of the department into a separate undersecretary, consolidate the environmental stewardship functions, and bring together the various components of the research and development activities under one umbrella. Of course, each administration can exercise its own prerogative to arrange the various programs and offices as it sees fit, to best meet the missions of the department and or match the expertise of officials it chooses to appoint in various positions of leadership. The critical question is what configuration will best enable the department leadership, its employees and its contractors to fulfill those missions.

The areas around which I have specific recommendations have to do with the department's role in preparing the United States for energy challenges of the present and the future.

The DOE should take a leadership role in conducting analysis regarding the safety, reliability, and optimization of the nation's energy infrastructure. As stated earlier, the United States has increasing amounts of nearly all the fuels it consumes. Abundant supply does not, however equal energy security. Transmission, delivery and distribution infrastructure is critically important to ensuring adequate supplies of energy. The department recently sent a notice of proposed rulemaking (NOPR) to the Federal Energy Regulatory Commission (FERC) asking it to take action to ensure reliable supplies of electricity for our nation's energy grid. While I do not agree with the problem as described or solution suggestion by the DOE NOPR, the DOE can and should play an active role in discussions and analysis of the adequacy and reliability of the country's energy infrastructure. The last administration also contributed important insights and

suggestions regarding the nation's transmission, distribution and mid-stream infrastructure as part of the first installment of the Quadrennial Energy Review. The administration before that, working with Congress, established new capacity to transmission congestion and established an office of electricity delivery and reliability. The DOE has a role to play in evaluating and recommending actions that might be taken by other agencies and departments to evaluate and address systemic risks to the nation's vital energy infrastructures.

The DOE should continue to maintain emergency preparedness planning and response functions. Most notably, DOE manages the nation's Strategic Petroleum Reserve, the world's largest government-owned and managed emergency stockpile of crude oil and home heating oil. The SPR plays an important role in ensuring the nation's ability to provide crude oil during time of disruption. While it has its shortcomings, the SPR has been released during times of disruption, most recently during the hurricanes that hit the Gulf Coast in 2017. As I stated in my testimony SPR modernization to the Senate Energy and Natural Resource Committee in 2016 "the SPR is part of a much larger, globally coordinated system of emergency petroleum supplies that have been around since the oil market disruptions in the mid-1970s. These strategic stockpiles are perhaps one of the most visible and enduring examples of shared energy security policies among the world's major energy consumers. The SPR is a fundamental pillar of that system. At the same time, a great deal has changed since the advent of the global strategic stock system and the creation of the U.S. SPR. While the current context of oversupplied markets, low oil prices, and record levels of U.S. production may obscure the dangers of an oil supply disruption, it is important to be clear-eyed about existing threats facing global oil markets and the economic vulnerability associated with a potential disruption. The last forty years have proven time and again that we as analysts, policymakers, and market participants should be humble about our ability forecast future oil market dynamics and take prudent measures to protect against unanticipated supply disruptions."[9] The DOE should maintain (modernize), and Congress should safeguard this important asset but further analysis is warranted about size, composition and location of the reserve given the changing oil crude and product flows and infrastructure required to adequately access the reserve in times of emergency. DOE should also consider how the international strategic stock systems (also created in the 1970s and including the U.S. SPR) is currently positioned and whether it could be configured to better meet the needs of a changing global oil market.

Energy efficiency promotion should remain a core mandate of the DOE. One of the core original mandates of the Department of Energy under the National Energy Plan was to enact efficiency standards and mandates. The efficiency gains of the United States have been our secret weapon to increase the energy productivity of our economy and reduce import reliance. According to the Alliance to Save Energy efficiency gains in the United States has doubled the energy

[9] Ladislaw, Sarah. "Modernization of the Strategic Petroleum Reserve and Related Energy Security Considerations." Statement before the Senate Committee on Energy and Natural Resources. 6 Oct. 2015, csis-prod.s3.amazonaws.com/s3fs-public/legacy_files/files/attachments/ts151006_Ladislaw.pdf.

productivity of the U.S. economy between 1980 and 2014.[10] The energy efficiency sector now employs 2.2 million people and saves hundreds of millions of dollars a year.[11] The role that the Department plays in setting efficiency standards is often overlooked but has paid important economic and security dividends.

Innovation is essential to meeting DOE missions across the board and should be strengthened. As other panelists will also explain, the role that DOE and the national laboratories play in the national research and development ecosystem is critical. At the beginning of this year DOE released a first ever state of the lab report that provided a detailed overview of the performance of the laboratory complex toward meeting their collective missions. It noted, "the extraordinary system of National Labs is unique and, along with America's research universities, underpins our innovation edge for economic productivity and job creation, security and environmental stewardship."[12] Several other key documents produced by the Department like the Quadrennial Technology Review and the crosscut report have been important ways in which the Department can evaluate its progress toward providing the innovations needed to meet the nation's energy challenges.

The proper role of government in research and development is not universally agreed upon with some arguing for a more limited role in either scope (i.e. limit to basic research) or level (i.e. budget cuts requested by the Trump administration). Government does not constitute the entirety of the U.S. innovation landscape but can make important contributions through funding research not undertaken by private interests, feeding into the personnel and intellectual supply chain of the research community, and working collaboratively with private industry and universities to catalyze important areas of research. According to a recent report, since its inception, the Advanced Research Project Agency for Energy or ARPA-E has invested over $1.5 billion in research funding distributed across more than 35 programs and 500 projects, of which 45 projects have received follow-on funding from the private sector totaling $1.8 billion and 36 have resulted in the formation of new companies.[13] While it is just one of the offices engaged in research and development across the department, ARPA-E was born out a bipartisan mandate to provide vehicle for the department to identify and promote revolutionary advancement in fundamental and applied sciences. A recent National Academies review found that it was well on its way to fulfilling that mission.[14]

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[10] Van Wie McGrory, Laura. "Energy Productivity: Communicating the Economic Benefits of Energy Efficiency." Energy Efficiency: The Prosperity Fuel CSIS. Energy Efficiency: The Prosperity Fuel CSIS, 29 June 2017, CSIS.

[11] Ibid

[12] United States Department of Energy, Cohen, Adam, et al. "Annual Report on the State of the DOE National Laboratories January 2017." Jan. 2017. energy.gov/sites/prod/files/2017/02/f34/DOE%20State%20of%20the%20National%20Labs%20Report%2002132017.pdf.

[13] Ladislaw, Sarah. Partnerships for Energy Innovation. CSIS, 27 Feb. 2017, www.csis.org/analysis/partnerships-energy-innovation.

[14] National Academies of Sciences, Engineering, and Medicine. 2017. An Assessment of ARPA-E. Washington, DC: The National Academies Press. Chapter 2. https://doi.org/10.17226/24778.

Finally, climate change is clearly not a challenge around which this administration seems inclined to orient its energy policy. However, innovation will play an important role in in any energy future, including a carbon constrained one that effectively addresses global climate change. DOE has important contributions to make toward meeting this challenge, a great many of them in the area of research, development, and deployment arena. Many of these innovations would have important economic and security co-benefits that the administration does support – like the development of competitive advanced nuclear reactors, cost-effective carbon capture, utilization, and storage strategies, and many others. The DOE should pursue innovation pathways that advance multiple objectives including the reduction of CO2 and other greenhouse gases in the atmosphere.

Energy strategy and analysis are more important than ever so the DOE should maintain and strengthen its energy policy and analysis function. Given the important mandates DOE must fulfill and the strong technical expertise required to fulfill those missions, the Department has often been dismissed as a technical agency rather than one with policy oversight. Despite the clear role as a coordinator of energy policy across the government set out for it in the DOE organization act, the energy policy role has ebbed and flowed over the years depending on focus of a given administration. Over the years the policy office at DOE has been moved, renamed and reorganized a number of times and its staffing and standing within the department have fluctuated. It is critically important for DOE to have a strong energy policy and analysis function. The policy office provides critical input to the Secretary and the offices throughout the agency about energy trends, market developments, and policy options. Having a strong policy and analysis function also enables the department leadership to play a more active and authoritative role within the interagency policymaking process, and provides an excellent resource for industry and other energy stakeholders to engage in important areas of policymaking. One area where the policy office could be particularly helpful at this moment is to develop a deeper understanding of the ways in which the U.S. can harness its energy advantage to increase opportunity and mobility within the economy. The last administration made an investment in the policy analysis function at the department. It is an important investment that this administration should continue.

Independent and impartial energy information is essential to the good policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. The government and the nation have consistently been served by the data collection, reporting and analytical function of the Energy Information Administration (EIA). EIA is a world-class organization that provides important data and analysis to the federal government and the public. EIA has done a remarkable job establishing itself as trusted source of reputable information. It provides market-relevant research on a regular basis, daily, weekly, monthly and annual reports. It responds to requests for information and analysis from Congress and its officials provide an important, policy-neutral voice in the energy policymaking process. Countries from around the world come to EIA to learn about how to replicate its form and function in their own government so they can derive the same benefits from an independent analytical agency within their own government system. Needless to say, EIA should continue to play this role going forward.

DOE should increase its capabilities when it comes to understanding, managing and engaging in global energy issues. DOE plays an underreported role in managing international affairs and geopolitics as they relate to energy. DOE has within its organizational structure an office of International Affairs led by an assistant secretary. The office not only staffs the department leadership on their travel abroad and engagement with foreign counterparts but structures ongoing cooperative initiatives with other countries and serves as the point people for substantive engagement in international energy institutions and consortiums. This office should be strengthened and expanded to have a stronger analytical function designed to inform the secretary and DOE leadership's thinking about global energy trends and challenges. In recent years, the Department of State created an Energy Bureau to elevate the role of energy in foreign policy decision-making. This is an important goal and function at the Department of State that should be supported given the complex relationship between energy and many of our foreign policy objectives, but it should not detract from the need to have strong analytical capabilities at the Department of Energy as the United States must formulate its energy policy based on the expert understanding of a complex global array of policy, technology and commercial trends. Moreover, it is important for DOE to maintain its dominant analytical capabilities on energy because it practically serves as the lead agency on energy relations with other countries not least of which because most other countries around the world see their energy ministers as the top emissaries for energy discussion with other countries. This will only become more important as the United States seeks to forge new and different trade relationships with countries that are accustomed to have an honorary government role, if not direct involvement in (which I do not recommend), energy investment and trade deals. Relatedly, there has been a great deal of discussion about whether and how the Department of Energy should permit or approve exports of natural gas exports. In my view, the DOE played a useful, if not lengthy, role in evaluating the remarkable surge in U.S. natural gas production, its sustainability over time, and the potential impact exports of various amounts would have on natural gas prices and availability. The process for clearing through these approvals is moving much more quickly than when the issue initially arose and while there is room for Congress to hold DOE to a firm schedule for export approvals, I find it implausible that Congress would remove this authority from the department altogether. As we have seen recently in Australia, natural gas shortages can occur in even the most energy abundant countries and when that happens, governments value their ability to manage exports to protect domestic consumers.

Conclusion

The Department of Energy carries an important history of supporting the nation's security, economic, and environmental priorities and objectives. It was born during a time when the nation's energy outlook had shifted and the future looked dangerous and uncertain. Today's energy outlook is no less uncertain as the country prepares for more interconnected and interdependent energy system, driven by new consumers, new priorities, and stiff competition. Preparing for this future requires the same amount of dedication and commitment that the DOE has delivered for the last forty years. Thank you for the opportunity to provide my thoughts on DOE modernization. I look forward to taking your questions.

Mr. UPTON. Thank you.
Dr. Wasserman.

STATEMENT OF STEVE WASSERMAN

Mr. WASSERMAN. Chairman Upton, Ranking Member Rush, and members of the subcommittee, my name is Stephen Wasserman. It is a pleasure to be at this hearing on modernization of the Department of Energy to discuss part of the Department's science mission: the DOE scientific user facilities. DOE's creation and operation of these facilities, an important part of its support of research and energy and the physical sciences, is a major success story of the Department.

This morning, I appear on behalf of the Society for Science at User Research Facilities, SSURF, on whose board of directors I currently serve. SSURF is a new scientific association, founded in 2016. It continues efforts that began 27 years ago to foster cooperation between the large research facilities of the U.S. Government, as well as between the facilities and the scientists who use them.

As we peer into the Department of Energy's future, it is useful to briefly look back at the path that has led to today. In 1945, Dr. Vannevar Bush, the director of the Office of Scientific Research and Development during World War II, issued a report, "Science, the Endless Frontier," in response to a Presidential request a year earlier. In his text, Dr. Bush stated that, "research involving expensive capital facilities beyond the capacity of private institutions should be advanced by active government support." The current DOE user facilities are the result of such support.

The facilities are the Nation's shared toolbox for research and innovation. The individual tools are large, often extremely so. Access to them is merit-based, with each operating an independent review system for proposed experiments.

The DOE Office of Science operates 26 user facilities. Additional ones support the security missions of the National Nuclear Security Administration. No other nation has the number and variety of scientific capabilities that U.S. scientists can avail themselves of here at home.

The user facilities are embedded in our scientific psyche. Over 30,000 scientists from university, industry, and government laboratories currently perform experiments at one or more facilities. These researchers come from all 50 states and from every continent, except Antarctica. Three hundred seventy-five companies use the DOE facilities, including more than 50 members of the Fortune 500. In addition, most Federal agencies which have a scientific component to their mission sponsor or perform research at DOE locations.

Today, I would like to highlight two examples of the impact of the facilities. These represent only a minute sample of the thousands of research projects that are pursued each year within the DOE facility network.

The first example comes from the Oak Ridge Leadership Computing Facility, OLCF. General Electric manufactures large turbines fueled by natural gas for the generation of electrical power. In 2015, GE used the Titan supercomputer at OLCF to simulate two turbine designs: one current, the other then under develop-

ment. The simulations reproduced observations from the current system and predicted successful performance in the new model. Full scale tests of the new turbine later confirmed the simulations. The first of the new turbines, which increased efficiency by 2 percent, a major improvement in the field of power generation, were installed in Texas in mid-2017.

The second example is from the DOE X-ray sources. These sources are vital to research and development in human health. Virtually every major pharmaceutical company in the U.S. uses these sources to probe the structures of proteins implicated in human disease. This area is one in which I have been involved for 20 years, currently at Eli Lilly and Company.

Scientists in the pharmaceutical industry continually investigate how potential new medicinal compounds interact with their biological targets. These efforts have aided the development of drugs to treat cancer, diabetes, hepatitis, and autoimmune diseases, as well as ongoing research to find approaches to the treatment of Alzheimer's.

New medicines whose developments included experiments at one of the DOE synchrotron sources can be found in each year's approvals by the Food and Drug Administration. In a recent example that is for me close to home, in September, the FDA approved abemaciclib, a new treatment for certain forms of breast cancer that was developed by Lilly. I and my co-workers at Lilly performed experiments at the Advanced Photon Source as part of the research that lead to this medicine.

Today, our country is focused on the need to upgrade the Nation's infrastructure. The user facilities are a type of infrastructure that, like transportation and utilities, needs to be maintained and improved. The DOE Office of Science has been an admirable steward of this infrastructure. However, the office has been handicapped by budgets whose buying power has significantly decreased over the last decade.

Current fiscal constraints mean that renewal often occurs at the slower pace than the facility's age and that timelines for upgrades are lengthened or delayed. The current levels of support have already left our Nation behind in the capabilities available at a small subset of the facilities. Continuing this trend risks a gap in innovation and technology between the United States and other nations.

In conclusion, I would like to return to "Science, the Endless Frontier." Near the end of his summary, Dr. Bush observed that responsibilities for scientific research are the proper concern of the government where they vitally affect our health, our jobs, and our national security. We at SSURF and our colleagues in the user facility community could not agree more. The user facilities are a critical part of the greatness of the U.S. scientific endeavor. We need them for our economy, security, and quality of life. Thank you.

[The prepared statement of Mr. Wasserman follows:]

Stephen R. Wasserman

Member of the Board of Directors
Society for Science at User Research Facilities

Senior Research Fellow
Eli Lilly and Company

January 9, 2018

Summary

The Department of Energy's scientific user facilities are the nation's shared toolbox for research and innovation. These tools, too large for any organization other that the government to build, play a vital role in the economic and scientific leadership of the United States.

The DOE Office of Science, through its several program offices, has created and operates 26 user facilities. Additional department facilities support the security mission of the National Nuclear Security Administration. The total suite of facilities offers an extremely diverse set of technical capabilities.

More than 30,000 scientists from university, industry and government laboratories perform experiments at one or more user facilities. These researchers are from all 50 states, as well as from other countries. 375 companies, including more than 50 of the Fortune 500, use the facilities as part of their internal research and development.

The user facilities are essential centers for technical innovation. As part of the critical infrastructure of the United states, they must be strongly supported, maintained and upgraded. Current rates of investment risk the United States falling behind in the international competition in science, technology, and innovation.

Statement of

Dr. Stephen R. Wasserman

Member of the Board of Directors
Society for Science at User Research Facilities

Director, Lilly Research Laboratories Collaborative Access Team
Senior Research Fellow, Discovery Chemistry Research and Technologies
Eli Lilly and Company

Before

The United States House of Representatives
Committee on Energy and Commerce,
Subcommittee on Energy

January 9, 2018

Chairman Upton, Ranking Member Rush and Members of the Subcommittee,

My name is Stephen Wasserman. It is a pleasure to be at this hearing on Modernization of the Department of Energy to discuss the Department's scientific user facilities. DOE's creation and operation of these facilities, an important part of its support of research in energy and the physical sciences, is a major success story of the Department.

This morning I appear on behalf of the Society for Science at User Research Facilities, SSURF, on whose Board of Directors I currently serve. SSURF is a new scientific association, founded in 2016. It continues efforts that began more than 25 years ago to foster cooperation between the large scientific research facilities of the US government, as well as between the facilities and the scientists who use them. Today SSURF links facilities supported by the Department of Energy and the National Science Foundation, of which the majority are operated by DOE. Our society is a community of communities, a place where facility managers, staff and users work together to discover and provide cutting-edge science and capabilities. An important goal of SSURF is to assist the stakeholders of the user facilities, so that impact is as great as possible.

As we peer into the Department of Energy's future, it is useful to briefly look back at the path that has led to today. The genesis of the DOE User Facilities is found more than 70 years ago. In 1945, Dr. Vannevar Bush, the Director of the Office of Scientific Research and Development during World War II, issued a report, *Science, the Endless Frontier*, in response to a Presidential request a year earlier. The report described a new framework for the scientific future of the United States which included government funding of research in universities and national laboratories. In his text Dr. Bush stated that "research involving expensive capital facilities beyond the capacity of private institutions should be advanced by active Government support". The current DOE User Facilities are the result of such

support. The role of the government in providing them, both up to now and in the future, is critical.

The User Facilities are the nation's shared toolbox for research and innovation. The individual tools are large, often extremely so. They are located throughout the country. Access to the facilities is merit-based, with each operating an independent peer review system for proposed experiments. For researchers who will publish their results in the open literature, there are no fees. Organizations that undertake proprietary research reimburse the government for the full-cost to the facility of the experiments undertaken.

The Department of Energy's Office of Science, through its several program offices, operates 26 user facilities, many with multiple capabilities. Additional facilities support the security missions of the National Nuclear Security Administration. The facilities include X-ray sources, neutron sources, high-performance computers and computer networks, and particle accelerators for high energy physics. No other nation has the sheer number and variety of scientific capabilities that US scientists can avail themselves of here at home.

The User Facilities are imbedded in our scientific psyche. Over 30,000 scientists from university, industry and government laboratories currently perform experiments at one or more user facilities.[1] These researchers come from all 50 states and from every continent except Antarctica. 375 companies use the DOE facilities, including more than 50 members of the Fortune 500. An indication of the facilities' effect on innovation can be seen in the fact that over 150 US small businesses make use of the experimental capabilities of the facilities.

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[1] User statistics are from *Office of Science User Facilities Fiscal Year 2015*. https://science.energy.gov/~/media/_/pdf/user-facilities/Reports/DOE-SC-User-Facilities-FY2015-report.pdf

Most Federal agencies, which have a scientific component to their mission, sponsor or perform research at the User Facilities. These include the National Science Foundation, the National Institutes of Health, NASA, the Environmental Protection Agency, the US Geological Survey, the Centers for Disease Control, the National Oceanic and Atmospheric Administration, the Nuclear Regulatory Commission and the Departments of Energy, Defense, Homeland Security, Agriculture, and State.

Like the facilities themselves, the science undertaken is incredibly wide-ranging. Some experiments probe the fundamental characteristics of atoms and nuclear particles. Others yield results that can impact future technologies and products in the relative near term. Smart phones, pharmaceuticals, the strategic nuclear stockpile and environmental quality have all benefited from the existence of these often unique instruments.

Today I would like to provide two examples of the impact of the facilities. These represent only a minute sample of the thousands of research projects, ranging in focus from the fundamental to the applied, that are pursued each year through the resources available at the user facilities.

The first example comes from the Oak Ridge Leadership Computing Facility, OLCF. The General Electric company manufactures large turbines, fueled by natural gas, for the generation of electrical power. In 2014 GE noticed an instability in the combustion flame of their then current turbine design. Although the instability did not affect performance, GE wondered whether a similar instability would occur in the next generation turbine, scheduled to be tested in late 2015. GE, in cooperation with software provider Cascade Technologies, used the Titan supercomputer at OLCF to simulate both turbines. The calculations reproduced the instability found in the old turbine and predicted that such a phenomenon would not alter performance in the new one. Full-scale physical tests of the

new turbine several months later confirmed the simulations. The first of the new turbines, which increase efficiency by 2%, a major improvement in the field of power generation, were installed in Texas in mid-2017. And GE now has an effective predictive modeling tool for future design work, a breakthrough that would not have been reached without Titan.

The DOE X-ray sources are vital to research and development in human health. Virtually every major pharmaceutical company in the US uses these sources to probe the structures, atom by atom, of proteins implicated in human disease. This area is one in which I have been involved for 20 years, currently at Eli Lilly and Company where I am director of the company's facility at the Advanced Photon Source (APS) of Argonne National Laboratory. My colleagues at Lilly and in the pharmaceutical industry continually investigate how potential new medicinal compounds interact with their biological targets to enhance or inhibit their function. These efforts have aided the development of drugs to treat cancer, diabetes, hepatitis, and autoimmune diseases, as well as ongoing research to find approaches to the treatment of Alzheimer's. New medicines whose developments included experiments at one of the DOE synchrotrons can be found in each year's approvals by the Food and Drug Administration. In a recent example that is for me close to home, in September the FDA granted approval for abemaciclib, a new treatment for certain forms of breast cancer that was developed by Lilly. I and my Lilly co-workers performed experiments at the APS as part of the research that led to this medicine.

The type of cooperation between national laboratories and industry in the second example can also be found in cooperative interagency research between the user facilities and the National Science Foundation and the National Institutes of Health. Examples include the joint NSF/DOE partnership in basic plasma science and engineering, which includes use of the DOE user facilities. NIH has agreements with all four of the DOE synchrotron X-ray sources (Advanced Light Source, Advanced Photon Source, Stanford Synchrotron Radiation

Lightsource, National Synchrotron Light Source-II) to support beamlines for studies on biological materials.

An often overlooked facet of the User Facilities is their staffs. The scientific personnel consist of dedicated and talented women and men who work, often at unusual hours, to enhance the capabilities of the facility equipment and the quality of the experiments undertaken by the users. At the same time the administrations of the facilities seek to continually improve the user experience. While most users only interact with the scientists and the user office, the facilities have cadres behind the scenes who ensure that the equipment functions properly, the experiments are as effective as possible and that the users, and those who fund them, obtain the results they need.

Today our country is focused on the need to upgrade the nation's infrastructure. The user facilities are a type of infrastructure that, like transportation and utilities, needs to be maintained and improved. Renewal of the facilities does occur. Examples include the creation of the National Synchrotron Light Source-II to replace the then 30-year old NSLS as well as planned or proposed upgrades to three other DOE X-ray sources and the Spallation Neutron Source. The DOE Office of Science has been an excellent steward of this infrastructure. However, the Office has been handicapped by budgets whose buying power has significantly decreased over the last decade. Current fiscal constraints mean that renewal often occurs at a slower pace than the facilities age and that timelines for upgrades are lengthened or delayed. The latter increases the cost of modernization. Timely funding of these projects offers better value for the American people. The current levels of support have already left our nation behind in the capabilities available at a small subset of the facilities. Continuing this trend risks expanding the gap in innovation and technology between the United States and other nations.

In conclusion, I would like to return to *Science, the Endless Frontier*. The title of Dr. Bush's report indicates that the quest for scientific knowledge and the innovative technologies derived from that knowledge is continual. But this quest and the methodologies employed for it are not static. The User Facilities have evolved with time, ensuring that the tools available remain up to date and relevant.

Near the end of his summary, Dr. Bush observed that "responsibilities (for scientific research) are the proper concern of the Government, for they vitally affect our health, our jobs, and our national security.... The government should foster the opening of new frontiers and ... (science) is the modern way to do it." We at SSURF and our colleagues in the user facility community could not agree more. The user facilities are a critical part of the greatness of the US scientific endeavor. We urge the continued and expanded support of these "crown jewels" of our science and technology ecosystem. We need them for our economy, security and quality of life.

Thank you.

Mr. UPTON. Thank you.

Mr. Reicher, welcome.

STATEMENT OF DAN REICHER

Mr. REICHER. Thank you.

Chairman Upton, Ranking Member Rush, and members of the subcommittee, I am pleased to share my perspective on the DOE's mission.

I have spent more than a decade at the Department under four secretaries and have a deep respect for the agency. So it pains me to say that DOE, under the Trump administration, is heading in a problematic direction when it comes to the innovation, commercialization, and deployment of U.S. clean energy technology.

The administration has sought unprecedented cuts in DOE's budgets for energy efficiency and renewable energy, electricity reliability, fossil energy, and nuclear power. It has proposed to eliminate the Loan Programs Office, ARPA-E, the State Energy Program, and the low-income weatherization program. It has begun putting the brakes on energy efficiency standards and has not reestablished the Secretary of Energy Advisory Board.

Let me be clear, DOE continues to make progress in critical areas, but this progress is slowing as important programs keep personnel, longstanding advisory functions, and related funding are hollowed out. These challenges come at a time when worldwide investment in clean energy is growing, roughly $750 billion annually today, and there is a global race for dominance in this massive market.

The Chinese have a well-organized plan to dominate clean energy. From wind, solar, hydropower, and storage, to nuclear power, advanced vehicles, energy efficiency, carbon capture, and transmission, China is not only leading in manufacturing and deployment, but increasingly in R&D and commercialization, the traditional U.S. strong suits.

This committee should look at the risk posed by these trends and ensure that DOE's applying a full set of resources. We preceded our peril in hobbling the U.S. Government's work with industry to advance our Nation's competitive position in clean energy, a sector where much energy innovation has come from the U.S., often at taxpayer expense.

My testimony addresses several issues. First, Congress should resist the administration's proposed 69 percent cut in funding for energy efficiency and renewable energy or EERE, and urge the administration to propose robust funding in fiscal year 2019. In a June letter, all seven of us who are EERE assistant secretaries, both Republicans and Democrats, emphasized that cuts of this size would do serious harm.

Second, this committee should resist the pending rescission of funds by House appropriators that would effectively end the work of DOE's Loan Programs Office, LPO. LPO, originally authorized by this committee, is carrying out its emissions well, helping to commercialize advanced nuclear fossil and renewable energy as well as transportation technologies, and managing the existing $36 billion investment portfolio.

In a June 4 letter to this committee that I would like to submit for the record, 17 CEOs wrote that the LPO is often the only way to get innovative energy technologies commercially deployed. LPO has $41 billion in remaining loan-making capacity that would be a big down payment on the trillion dollar infrastructure program that Congress may soon take up.

Third, DOE's Appliance Standards Program was one of the most effective approaches to saving energy, and has long enjoyed bipartisan support. Unfortunately, DOE recently put work on most new standards on hold, and could end up violating statutory deadlines. This committee should ensure that DOE does not advocate its important standard setting role.

Fourth, a bipartisan effort over the last several years would open up congressionally authorized investment vehicles, master limited partnerships, private activity bonds, and real estate investment trusts to clean energy technologies, and thereby lower the cost of financing energy projects. The House should adopt the bipartisan MLP Parity Act, sponsored by Representatives Poe and Thompson, as well as Congressman Welch, and the bipartisan Carbon Capture Improvement Act sponsored by Representatives Curbelo and Veasey.

Fifth, the need for electricity storage is growing fast with the significant increase in solar and wind. Congress and the administration should help advance both utility scale and distributed storage through R&D funding, grants, tax credits, loan guarantees, MLPs, and other tools. In this regard, Congress should resist the Trump administration's proposed 61 percent cut in DOE energy storage R&D.

Sixth, carbon capture and storage can cut emissions in both power generation and heavy industry. Over the past 20 years, DOE has relied on a variety of Federal tools—R&D funding grants, Federal tax credits, private activity bonds, and loan guarantees—to advance CCS and made good progress. The House should resist the Trump administration's proposed 85 percent cut in DOE's CCS R&D funding and adopt pending legislation that would improve the current CCS 45Q tax credit and authorize both master limited partnership and private activity bond funding.

Seventh, the U.S. Government is the single largest energy user in the Nation, with an energy bill to taxpayers exceeding $23 billion. The committee should take note of a 2016 task force by a report of the Secretary of Energy Advisory Board that proposes many ways to cut this bill and expand the deployment of clean energy on Federal lands. It should also resist the proposed 63 percent cut to the budget of DOE's Federal Energy Management Program.

Finally, this committee should encourage Secretary Perry to reactivate the Secretary of Energy Advisory Board that has long provided important expert input into the Department's programs and operations. Thank you very much.

[The prepared statement of Mr. Reicher follows:]

Testimony of Dan W. Reicher
Executive Director
of the
Stanford University Steyer-Taylor Center for Energy Policy & Finance
to the
House Committee on Energy and Commerce
Subcommittee on Energy
Hearing on the
"Alignment and Execution of DOE's Missions:
Advancing National and Energy Security in an Era of Energy Abundance"

January 9, 2018

Chairman Upton, Ranking Member Rush, and members of the subcommittees, my name is Dan Reicher and I am pleased to share my perspective on the Department of Energy's mission. I am Executive Director of Stanford University's Steyer-Taylor Center for Energy Policy and Finance, a joint center of Stanford Law School and the Stanford Graduate School of Business, where I teach graduate-level courses and lead a variety of research projects. I am testifying in my individual capacity and my views do not necessarily reflect those of Stanford University.

I am also a senior fellow (non-resident) at the Brookings Institution, have been a member of the Secretary of Energy Advisory Board since 2013, and recently finished a 10-year term on the National Academy of Sciences Board on Energy and Environmental Systems. I also chair the board of directors of the American Council on Renewable Energy and am a board member of the American Council for an Energy Efficient Economy.

I have had substantial experience in both the private and public sectors. Prior to my role at Stanford, I was Director of Climate Change and Energy Initiatives at Google. Prior to this position, I was President and Co-Founder of New Energy Capital, a private equity firm funded by the California State Teachers Retirement System and Vantage Point Venture Partners to invest in clean energy projects. Prior to this position, I was Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy company.

In the Clinton Administration, I served as Assistant Secretary of Energy for Energy Efficiency and Renewable Energy, the Acting Assistant Secretary of Energy for Policy, and Department of Energy Chief of Staff and Deputy Chief of Staff. I also served on President Obama's transition team where I helped develop the stimulus package for clean energy. Early in my career, I was an Assistant Attorney General in Massachusetts, a staff member of President Carter's Commission on the Accident at Three Mile Island, and a legal assistant at the U.S. Department of Justice.

Introduction and Summary

I have been asked to provide my perspective on the "alignment and execution of DOE's mission." There are a number of issues that face the DOE as it pursues its important science, energy, security and environmental responsibilities. I will focus on eight issues reflecting my current work in clean energy innovation, development, and deployment:

1. **Funding for the DOE Office of Energy Efficiency and Renewable Energy**
2. **The DOE Loan Programs Office**
3. **The DOE Appliance Standards Program**
4. **Federal Tax-Advantaged Finance Vehicles**
5. **Federal Support for Electricity Storage**
6. **The Federal Role in Carbon Capture and Storage**
7. **Federal Energy Management**
8. **The Secretary of Energy Advisory Board**

Overall, I believe that the DOE, under the Trump administration, is heading in a problematic direction when it comes to the innovation, commercialization and deployment of U.S. clean energy technology. The Trump administration has sought unprecedented reductions in the budgets for DOE's applied energy offices: energy efficiency and renewable energy; electricity delivery and energy reliability; fossil energy; and nuclear energy. It has proposed to eliminate critical allied functions, like the Loan Programs Office, ARPA-e, the State Energy Program, and the Weatherization Assistance Program. It has begun to put the brakes on energy efficiency standard-setting for appliances and equipment. It has also reduced important input into the Department's programs and operations by, for example, failing to activate key advisory bodies like the Secretary of Energy Advisory Board.

Let me be clear, DOE continues to make progress in critical areas and federal staff capabilities and national laboratory expertise remain strong. But I am concerned that this progress is slowing as important programs, key personnel, long-standing advisory functions, and related funding are hollowed out.

These challenges come at a moment when two fundamental global trends are accelerating. First, world-wide investment in clean energy is growing, measuring roughly $750 billion today and with projected annual needs of more than $2 trillion to meet climate targets, according to the International Energy Agency.[1] Second, an unprecedented global race has broken out for dominance in this massive energy market. Among the competitors, the Chinese have a well-organized and executed plan to dominate the energy technology industry, with all of its associated economic, security and environmental benefits. From wind, solar, hydropower, and storage to nuclear power, advanced vehicles, energy efficiency, carbon capture, and transmission, China is not only leading the world in

[1] https://www-cdn.law.stanford.edu/wp-content/uploads/2017/11/stanfordcleanenergyfinanceframingdoc10-31_final.pdf at 3.

low-cost manufacturing and deployment of clean energy technology but increasingly in energy R&D and commercialization, traditionally the U.S. strong suit.

The U.S. Congress, starting with this committee, should take a serious look at these trends and the risks they pose to the U.S. economy, security and environment. Rather than cutting budgets, dropping programs, laying off workers, and increasingly turning inward, the House and Senate should ensure that DOE is applying a full set of resources — robust federal funding, a strong federal work force, world-class expertise at the DOE labs, and a diverse set of Congressionally-authorized tools — to the opportunities and challenges of clean energy technology. We proceed at our peril in hobbling the U.S. government's work with industry to advance our nation's competitive position in clean energy, a sector where much of the innovation, over multiple decades, has come from the U.S., often at taxpayer expense. This is a moment when we should be strengthening not weakening the successful and long-standing industry-government partnership in clean energy technology so that five years from now we don't look back regretfully at the loss of U.S. leadership in this critical area.

Summarizing my testimony:

1. **Funding for the DOE Office of Energy Efficiency and Renewable Energy:** Congress should resist DOE's proposed 69% cut in FY18 funding for DOE's Office of Energy Efficiency and Renewable Energy (EERE) and should urge the administration to propose robust funding in FY19. In a June 2017 letter from all seven former EERE Assistant Secretaries we emphasized that cuts of this magnitude in the FY18 budget would do serious harm to this office's critical work. Worldwide investment in clean energy now measures about $750 billion annually. Governments across the globe — and companies large and small — want a piece of this massive and growing economic pie, representing tens of trillions of dollars over the next three decades and millions of jobs. China, in particular, has made it a high priority to lead the global clean energy industry and, to this end, is reorganizing its R&D and deployment, and redoubling its efforts, in an array of clean energy technologies, many of them first developed in the U.S. at taxpayer expense. This is the moment for the U.S. government to step up to, not back from, this major opportunity.

2. **The DOE Loan Programs Office:** This committee should resist the pending rescission of funds by House and Senate appropriators that would effectively end the work of DOE's Loan Programs Office (LPO). LPO, originally authorized in the House by this committee, is carrying out its Congressionally-directed missions very capably, both helping to commercialize important energy and transportation technologies and managing the existing $36 billion investment portfolio successfully. In a January 4 letter to this committee, 17 companies wrote that the "LPO represents the best and often only way to cross the barrier from developing innovative technologies to deploying those technologies commercially here in the U.S. and ultimately for export." LPO has $41 billion in remaining loan-making capacity that would be a substantial down payment on the energy portion of the trillion-dollar infrastructure program that Congress may soon take up. This capacity is one of the cheapest and quickest ways for the federal government to build important infrastructure, compared with other options. The LPO has already backed energy and transportation infrastructure projects involving transmission, storage, nuclear technology, battery production, and engine manufacturing. Avoiding a full rescission of LPO funding — i.e. retaining previously

appropriated balances to maintain a range of $100-$200 million to support "self-pay" authority — would give U.S. companies access to a meaningful portion of the $41 billion in LPO capacity.

3. **The DOE Appliance Standards Program:** This DOE program, first created by Congress in the 1970s, is among the nation's most successful and cost-effective approaches to saving energy in homes and businesses. It has long enjoyed strong bipartisan support. Unfortunately, DOE's Fall 2017 Regulatory Agenda puts work on most new standards on hold and, if carried out, will likely put the Department in violation of a series of statutory deadlines. Also, DOE has initiated a process to revamp the standards-setting process. While any process can be improved, the energy efficiency standard-setting process, developed over multiple administrations, works well and generally results in a high level of consensus among industry and advocates and large public benefits. DOE has also left four standards completed in 2016 in regulatory limbo. This committee should ensure that DOE does not abdicate its important standard-setting obligations and any changes to the program should advance, not retard its effectiveness and leave the program flexibility for further evolution.

4. **Federal Tax-Advantaged Finance Vehicles:** There has been a bipartisan effort over the last few years to open up long-standing Congressionally authorized investment vehicles — Master Limited Partnerships (MLPs), Private Activity Bonds (PABs), and Real Estate Investment Trusts (REITs) — to clean energy technologies. These vehicles are attractive because they are tax-advantaged — either eliminating the double taxation of common corporate investment structures or providing a full exemption from federal taxation. As such, they can provide lower-cost financing to clean energy project developers. The House should: adopt the bipartisan "MLP Parity Act" sponsored by Representatives Poe and Thompson; adopt the bipartisan Carbon Capture Improvement Act, focused on PABs, sponsored by Representatives Curbelo and Veasey; and, working with the IRS, should consider options to expand REIT eligibility for clean energy projects.

5. **Federal Support for Electricity Storage:** With the significant growth of solar and wind generation in recent years the need for electricity storage capacity has grown as well. However, large-scale electricity storage, with the exception of pumped hydro, is relatively immature technologically, and the costs of a number of promising options are high. As a result, gas turbines often are needed to fill the gap when solar and wind are not available. Congress and the administration should pursue a well-organized approach to stimulating cost-effective utility-scale and distributed storage, supported by R&D funding, grants, tax credits, loan guarantees, MLPs, and other tools. Unfortunately, the Trump administration has proposed a 61% cut in DOE energy storage-related R&D in its FY18 budget, versus FY17 levels. Congress should ensure adequate R&D funding and advance these other tools.

6. **The Federal Role in Carbon Capture and Storage:** CCS has broad application in cutting carbon emissions — from coal, natural gas, and biomass-fired power plants to industrial operations like oil refineries, ethanol facilities, steel production, cement plants, natural gas processing operations, and fertilizer production. While successfully operating in various industries, CCS has not yet been deployed at the scale or cost required for meaningful climate-related carbon controls. Over the past 20 years, DOE has relied on a variety of federal

support mechanisms and incentives — R&D funding, grants, federal tax credits, private activity bonds and loan guarantees — to advance CCS and made good progress. The House should resist the Trump administration's proposed 85% cut in DOE's FY18 CCS R&D funding. It should also adopt pending legislation that would: improve the current CCS 45Q tax credit; provide access to MLP and PAB financing for carbon capture projects; and protect the DOE loan program from a pending rescission of funds.

7. **Federal Energy Management:** The U.S. government is the single largest energy user in the nation with an energy bill to taxpayers exceeding $23 billion. The federal government owns 350,000 buildings, more than a quarter of all U.S. land, tens of thousands of miles of transmission lines, and 400,000 non-tactical vehicles. There are a number of actions that could cut the federal government's own energy use and expand its deployment of clean energy. They are analyzed in a September 2016 report by a task force of DOE's Secretary of Energy Advisory Board that I co-chaired with former U.S. Representative Ellen Tauscher, with assistance from DOE's Federal Energy Management Program (FEMP). These actions include, for example: increasing and improving the use of Energy Savings Performance Contracts; reducing the federal real estate footprint; improving federal procurement of renewable energy; expanding clean energy development on federal lands; accelerating federal procurement of alternative fuel vehicles; increasing the role of federal Power Marketing Administrations in meeting federal energy goals; supporting DOD and GSA energy technology test beds; and increasing funding for FEMP. Regarding the last action, Congress should resist the Trump administration's proposal to cut FEMP FY18 funding by 63%.

8. **The Secretary of Energy Advisory Board:** The Secretary of Energy Advisory Board (SEAB) has provided valuable advice to multiple secretaries for decades. The SEAB was active under DOE Secretary Moniz, producing reports and advising the Secretary on a range of matters, from technology development for environmental management, next generation high-performance computing, and nuclear non-proliferation to federal energy management, the DOE national laboratories (especially the NNSA weapons laboratories), the future of nuclear power, and methane hydrates. Secretary Perry has not activated the SEAB. This committee should encourage him to do so to improve input into the Department's programs and operations.

My full statement follows:

1. **Funding for the DOE Office of Energy Efficiency and Renewable Energy**

DOE is the single largest funder of clean energy innovation in the U.S., and our nation will be hindered in the global energy market without a strategic and well-funded DOE research portfolio, including basic science, energy efficiency, renewable energy, nuclear energy, fossil energy, and electricity reliability.

In June 2017, the entire group of Senate-confirmed Republican and Democratic Assistant Secretaries of Energy, who led the DOE Office of Energy Efficiency and Renewable Energy (EERE) between 1989

and 2017, wrote to DOE Secretary Perry, OMB Director Mulvaney, and House and Senate leadership.[2] We registered our deep concerns about the Administration's proposal to cut the EERE budget by 69% from FY2017 levels, as detailed in the chart below from DOE's FY18 Budget in Brief. The seven of us noted that while we have not always agreed on the relative emphasis of various elements of EERE funding we are unified that cuts of this magnitude in the FY18 budget would do serious harm to this office's critical work and America's energy future.

ENERGY EFFICIENCY AND RENEWABLE ENERGY

	($K)				
	FY 2016	FY 2017	FY 2018	FY 2018 vs FY 2016	
	Enacted	Annualized CR	Request	$	%
Energy Efficiency and Renewable Energy					
Sustainable Transportation					
Vehicle Technologies	310,000	309,411	82,000	-228,000	-73.5%
Bioenergy Technologies	225,000	224,571	56,600	-168,400	-74.8%
Hydrogen and Fuel Cell Technologies	100,950	100,758	45,000	-55,950	-55.4%
Total, Sustainable Transportation	**635,950**	**634,740**	**183,600**	**-452,350**	**-71.1%**
Renewable Energy					
Solar Energy	241,600	241,141	69,700	-171,900	-71.2%
Wind Energy	95,450	95,269	31,700	-63,750	-66.8%
Water Power	70,000	69,867	20,400	-49,600	-70.9%
Geothermal Technologies	71,000	70,865	12,500	-58,500	-82.4%
Total, Renewable Energy	**478,050**	**477,142**	**134,300**	**-343,750**	**-71.9%**
Energy Efficiency					
Advanced Manufacturing	228,500	228,066	82,000	-146,500	-64.1%
Federal Energy Management Program	27,000	26,949	10,000	-17,000	-63.0%
Building Technologies	200,500	200,119	67,500	-133,000	-66.3%
Weatherization and Intergovernmental Program	265,000	264,496	0	-265,000	-100.0%
Total, Energy Efficiency	**721,000**	**719,630**	**159,500**	**-561,500**	**-77.9%**
Corporate Support					
Program Direction	155,000	154,705	125,849	-29,151	-18.8%
Strategic Programs	21,000	20,960	0	-21,000	-100.0%
Facilities and Infrastructure	62,000	61,882	92,000	+30,000	48.4%
Total, Corporate Support	**238,000**	**237,547**	**217,849**	**-20,151**	**-8.5%**
Subtotal, Energy Efficiency and Renewable Energy	**2,073,000**	**2,069,059**	**695,249**	**-1,377,751**	**-66.5%**
Use of Prior Year Balances*	0	0	-59,100	-59,100	N/A
Rescission of Prior Year Balances	-3,806	0	0	+3,806	100.0%
Total, Energy Efficiency and Renewable Energy	**2,069,194**	**2,069,059**	**636,149**	**-1,433,045**	**-69.3%**

We emphasized that EERE-supported research, development, and demonstration in energy efficiency, renewable energy, transportation, clean energy manufacturing, and electric grid modernization are critical to encouraging U.S. innovation, creating good-paying jobs, cutting pollution, and ensuring American global competitiveness. Other critical EERE programs, with similar benefits, focus on setting efficiency standards for appliances and equipment, helping states deliver energy efficiency improvements, leading the federal government's efforts to reduce its own $23 billion annual energy bill, and cutting energy use in low-income homes.

These programs saw massive proposed cuts in the Trump Administration's proposed FY18 budget versus FY17 levels: solar energy by 71%, wind energy by 66%, and geothermal energy by 82%; vehicle technologies by 74%; and building technologies by 66%. Some programs were proposed to be zeroed

[2] https://www.eenews.net/assets/2017/06/08/document_gw_02.pdf

out, including the Weatherization Assistance Program (WAP) and the State Energy Program (SEP). The Trump administration also proposed a 30% cut in EERE staffing.

Congress has not finalized an FY18 budget and, as a result, EERE has been operating at roughly FY17 levels, while programs proposed for elimination, like the SEP and WAP, are still functioning. Thus, DOE Secretary Perry recently announced $18.5 million in funding for an important new R&D consortium focused on off-shore wind.[3] It is doubtful DOE could have launched this initiative with the proposed 67% cut in wind program funding — from $95 million in FY17 to $32 million in the administration's FY18 proposal. This funding reprieve has definitely been helpful in sustaining important EERE work but there remains significant uncertainty among DOE staff and their outside partners in the public and private sectors about the Department's programs, budgets and staffing. Thus, it is difficult to plan for weatherization of low-income homes around the country when not only funding but the very existence of a key federal program is at issue. This is particularly troubling, first, in a month when we've seen record-breaking cold in large parts of our country and heating fuel costs are rising and, second, in a program that has weatherized more than seven million low-income homes[4] and in 2015 leveraged $4.62 for every dollar invested by DOE.[5]

In our letter, we stressed that this is a particularly inauspicious time to cut the EERE budget. As noted above, worldwide investment in clean energy now measures about $750 billion annually. Governments across the globe — and companies large and small — want a piece of this massive economic pie representing tens of trillions of dollars over the next three decades and millions of jobs. China, in particular, has made it a high priority to lead the globe in the clean energy industry and is reorganizing its energy R&D and deployment efforts in a broad array of clean energy technologies, many of them first developed in the U.S. at taxpayer expense. We analyzed China's commitment in one of these fast-growing industries — solar photovoltaics — in a 2017 Stanford report funded by DOE.[6] China not only dominates global production of photovoltaics but has become the world leader in solar deployment and has made vast strides in solar R&D, a remaining U.S. strength. It is telling that China intends to spend more than $360 billion on renewables through 2020 and create 13 million jobs.[7] We ignore China's resolve — and success to date — at our peril.

In our joint letter, we also emphasized that U.S. energy security, a key focus of Congress and the administration, requires a reliable and resilient electricity system. Fundamental performance characteristics of the grid are changing due to increasing use of variable supplies, electronic converters for motor drives, lights, and other equipment, and grid communications and control with the shift from analog to digital systems. These changes have the potential to improve grid economics and performance, but also require greater agility to optimize operations, reduce response time to system failures, and confront new vulnerabilities such as cybersecurity. R&D to develop the capabilities needed in a modernized grid is critical, yet the electric utility sector invests just 0.2 percent of sales in R&D. R&D by EERE and DOE's Office of Electricity Delivery and Energy Reliability (with a proposed 48% cut in FY2018) is pivotal in meeting these grid modernization challenges.

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[3] https://energy.gov/articles/secretary-energy-rick-perry-announces-185-million-offshore-wind-research
[4] https://energy.gov/eere/articles/celebrating-40-years-america-s-weatherization-assistance-program
[5] https://energy.gov/sites/prod/files/2017/05/f34/wap_factsheet_08.2017.pdf
[6] https://www-cdn.law.stanford.edu/wp-content/uploads/2017/03/2017-03-20-Stanford-China-Report.pdf
[7] Reuters, January 5, 2017 http://www.reuters.com/article/us-china-energy-renewables-idUSKBN14P06P

As six Republican Senators, led by Senator Lamar Alexander (R-TN), wrote in June 2017, referencing EERE and other DOE offices, "We cannot lose the technological advantages we have gained through research and development. Governing is about setting priorities and the federal debt is not about Congress overspending on science and energy research each year."[8]

Our group of former EERE leaders share this view and urged the Administration and Congress to set the FY18 EERE budget at a level that will ensure the continued effectiveness of this critical federal program. I would urge the same as DOE and OMB prepare, and Congress considers, the FY19 budget.

2. DOE Loan Programs Office

A strong adjunct to DOE's applied energy work, the Department's Loan Programs Office (LPO) implements key programs that help innovative U.S. energy and transportation technologies cross the colorfully but accurately named, "valley of death" that sits between the early development of an advanced energy or vehicle technology and its full commercial deployment. By helping to overcome the major capital barrier to market entry, the LPO has increased U.S. private sector investment in advanced energy and vehicle technology deployment, with the attendant economic, environmental, and security benefits.

President George W. Bush signed legislation launching the two key DOE loan programs under discussion today. Title XVII of the 2005 Energy Policy Act, enacted by a Republican-led Congress, directed DOE to issue loan guarantees to support the commercial deployment of energy projects that "employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued" and cut greenhouse gas emissions. The Title XVII program covers a number of eligible technologies including advanced fossil, nuclear, and renewable energy, and energy efficiency.

Congress authorized the Advanced Technology Vehicles Manufacturing (ATVM) program under Section 136 of the Energy Independence and Security Act of 2007. It authorizes the DOE to issue direct loans to auto manufacturers and component suppliers for manufacturing of advanced technology vehicles and associated components in the U.S. In contrast to the Title XVII program, where the applicant pays the "credit subsidy cost" (an estimate of the potential losses), Congress appropriated the funds to cover potential losses for the ATVM program in 2008, also under President Bush.

President Obama signed a third bill in 2009, the American Recovery and Reinvestment Act (the "stimulus bill"), that authorized a new temporary deployment-oriented loan guarantee program to stimulate job creation during the financial crisis and also appropriated funds to cover credit subsidy costs for borrowers. This program, meant to deploy already demonstrated technologies while credit markets were frozen during the financial crisis, built a number of "shovel-ready" energy projects before it expired in 2011.

[8] http://www.sciencemag.org/news/2017/05/key-republican-lawmakers-urge-trump-not-cut-doe-research

In contrast with federal grants, which constitute one-time expenditures to advance particular R&D goals, loans and loan guarantees are the federal financial mechanism that helps take technology advances from the laboratory and turn them into operating projects and companies. Thus, the innovative U.S. auto manufacturer Tesla Motors received a $465 million ATVM loan at a critical moment in its efforts to buy a shuttered former GM-Toyota manufacturing plant in California. The loan was pivotal in Tesla's efforts to not only reopen the factory but rapidly move from a novel concept employing largely contract manufacturing overseas to full-scale manufacturing operations in the U.S., creating more than 3000 full-time jobs in the process. Importantly, in 2013 Tesla repaid the federal government the remaining balance on its loan — nine years early and with interest.

I believe the LPO remains well positioned to carry out its Congressionally-directed mission very capably, both helping to commercialize important energy and transportation technologies and managing the related investment portfolio successfully. Unfortunately, pending budget decisions in both the House and Senate would rescind previous appropriations necessary to fund both staffing of the LPO office and allow that office to exercise its existing $41 billion worth of LPO loan-making capacity. This committee, in conjunction with the Senate Energy and Natural Resources Committee, originally developed the loan programs in 2005 and 2007 bipartisan energy legislation. Subsequent Congresses, also on a strongly bipartisan basis, supported the loan programs by appropriating funds in 2006 and again in 2008 to support over $50 billion worth of loan-making capacity. Today's appropriators are seeking to use these funds for other purposes and I would urge this committee to take a serious look at the dismantling of its good work — that fills a critical financial gap — through this pending rescission.

The $41 billion in remaining LPO loan-making capacity, if not rescinded by the current Congress, would be a substantial down payment on the trillion-dollar infrastructure program that both Republicans and Democrats have talked about on Capitol Hill and that President Trump highlighted in his February 2017 Joint Address to Congress. In that speech, Mr. Trump emphasized the need for both "public and private capital" in advancing this infrastructure spending objective. The $41 billion in existing LPO authority is one of the cheapest and quickest ways for the federal government to build important infrastructure compared with several other options the administration and Congress are considering.

To date, the DOE loan program has backed a variety of innovative energy infrastructure projects, for example: a high voltage transmission line in Nevada with more cost-effective construction; an electricity storage project in New York to address voltage fluctuations in the grid; engine manufacturing in Michigan that has improved, among other things, the fuel economy of the popular Ford F-150 truck; advanced battery manufacturing in Tennessee; and advanced nuclear reactors in Georgia.

Importantly, the more than 30 loans and loan guarantees in the current DOE loan guarantee portfolio have demonstrated impressive financial performance. As of December 2016, there were $36 billion in loans, loan guarantees, and commitments made in the program, with $6.65 billion in loan principal and $1.79 billion in interest already repaid to the U.S. Treasury. Losses in the portfolio, as of December 2016, were barely half of the interest paid so far, or just over 2 percent of the program's commitments to date, and a tiny fraction of the $10 billion set aside by Congress to cover failed loans.

There is also a substantial portfolio of potential new projects. On January 4, executives of 17 companies wrote to the chairs and ranking members of the full Energy and Commerce Committee and this subcommittee in support of the LPO. The companies have either pending loan guarantee applications or are preparing new applications focused on projects to commercialize fossil, nuclear, renewable energy, energy efficiency, energy storage, grid reliability, and advanced transportation technologies. The executives wrote:

> *"The DOE LPO represents the best and often only way to cross the barrier from developing innovative technologies to deploying those technologies commercially here in the U.S. and ultimately for export. The LPO is a win-win-win for taxpayers, American energy innovation, and the communities and states where these investments are being made. The program's real costs are paid by the companies that submit applications, and each federal dollar of loan guarantees leverages approximately $10 in private capital investment, which exceeds the Trump Administration's plans to leverage infrastructure investment at a ratio of 5:1. For these reasons, there are zero savings associated with removing loan authority, only the loss of American jobs and injury to American competitiveness."*

Despite the overall success of the LPO portfolio — and the substantial portfolio of proposed projects — there has been much focus on a handful of losses. Most well-known among them is Solyndra, which was indeed a major loss under the now-expired 1705 program but it has been used for years to impugn the overall program more broadly. Wrapping the entire DOE loan program in the Solyndra blanket is unfortunate because, as described above, the full portfolio is in admirable shape. *A key fact:* LPO has about a 2% loss ratio, less than the loss ratio in the loan portfolios of just about every U.S. money center bank, and these banks are generally not making loans for energy projects deploying advanced technologies — and certainly not in the riskier commercialization stage.

There is a recent compelling example of an energy infrastructure project supported by DOE's loan program. In December, 2016, the Department made a $2 billion conditional loan commitment, that will be matched by $1.9 billion in private investment, for a project in Lake Charles, Louisiana that will convert oil-refining waste ("petcoke") into high-value methanol, a key industrial chemical used in paints, plastics, automotive parts and fuel blending.[9] The carbon dioxide captured in the process will be injected into Texas oil fields to enhance their production, with the CO2 sequestered underground. The project involves more than 1000 construction jobs and 200 permanent jobs in Louisiana and supports about 300 enhanced oil recovery jobs in Texas.

DOE's experienced staff of investment professionals is reviewing more than $50 billion worth of additional proposed new investments across 70 different energy-related projects for approval by Secretary Perry. The Lake Charles project, and new ones in the loan program pipeline, could benefit from a clear and immediate signal from Congress, the White House, OMB, DOE, and the Treasury Department that the federal government supports this existing energy infrastructure finance mechanism and that it will honor current government commitments and project applications.

It would be short-sighted to entirely eliminate funding and lose the benefit of the experienced personnel, lessons learned, and skills developed in LPO to finance advanced energy infrastructure,

[9] https://energy.gov/articles/energy-department-offers-conditional-commitment-first-advanced-fossil-energy-loan-guarantee

just as Congress turns to developing new programs to rebuild our aging infrastructure. This is especially the case when the cost of maintaining the program's loan guarantee and loan-making activities is so minimal. Avoiding a full rescission of LPO funding — i.e. retaining previously appropriated balances to maintain a range of $100-$200 million to support "self-pay" authority — would allow the private sector to continue to access a meaningful portion of the remaining LPO loan guarantee and loan-making capacity, allowing projects to move forward in 2018 and 2019.

a. Why the Reluctance about LPO?

There is an unfortunate view in our country today, mostly inside the D.C. beltway, that the federal government shouldn't play a role in commercializing energy technology. This view flies in the face of many decades of U.S. history — and basic business logic. The U.S. government, as have other governments around the world, has long played a vital and successful role in helping to overcome barriers to commercializing energy technology. It is a role that should continue, especially in light of unprecedented competition from other countries, in particular China. Two brief examples follow, involving commercial nuclear power and hydraulic fracturing, and a third regarding Carbon Capture and Storage (CCS) is discussed in a separate section below.

i. Commercial Nuclear Power

The federal government, in the Truman administration, financed the commercialization of civilian nuclear power, fully funding an Idaho reactor (EBR-I) where usable electricity was first generated from nuclear energy in 1951. The federal government spent approximately $550 million in current dollars on the Idaho project.[10] Further government-funded civilian reactors followed, including six years later the federally-financed Shippingport reactor in Pennsylvania, "the world's first full-scale atomic electric power plant devoted exclusively to peacetime uses."[11] It was not until 1960 that we saw "the first U.S. nuclear power plant built without government funding."[12]

The federal government has stayed in the nuclear power commercialization business helping to finance the scale-up of various technologies, some successful and some not. This includes federal funding of breeder reactors[13] and in recent years significant DOE investment in the development of small modular reactors, involving a number of U.S. companies. Additionally, the LPO has backed the construction of the first new reactors in the U.S. in decades. The Vogtle project in Georgia is using the "next generation of nuclear reactors that incorporate a number of new safety features, including....passive safety systems that are able to respond in an emergency without any human intervention or electrical power."[14] There have undoubtedly been problems with the Vogtle project but that is often the nature of energy projects deploying newer technology.

Looking ahead, a 2016 report by the Secretary of Energy Advisory Board to Secretary of Energy Moniz concluded that the successful development, commercialization and deployment of advanced

[10] http://www4vip.inl.gov/ebr/
[11] https://www.nrc.gov/about-nrc/emerg-preparedness/history.html
[12] Id.
[13] https://en.wikipedia.org/wiki/Clinch_River_Breeder_Reactor_Project
[14] https://www.energy.gov/articles/vogtle-big-results-nuclear-power

reactor technologies in the U.S. at multi-gigawatt scale beginning in 2030 would require significant government investment, measured in the billions of dollars.[15]

The federal government, for decades, has been willing to step up, sometimes completely funding an initial commercial-scale nuclear project or cost-sharing it. From a business standpoint, the government's role makes eminent sense. Back in the 1950s there was no way that an individual company or private investor was going to take the full risk of developing an early nuclear power plant. The technical unknowns and safety concerns were simply too great. Without the major investment that the federal government made in the first generation of civilian reactors – measured in the billions of today's dollars plus the brainpower and facilities provided by federal labs – commercial nuclear power would likely not have developed at the pace and scale that it did.

ii. Hydraulic Fracturing

The federal government played an important role in the commercialization of hydraulic fracturing ("fracking"), the successful, albeit controversial, process by which the U.S. has been able to access substantial deposits of shale gas, tight gas and tight oil. The private sector, particularly pioneers like George Mitchell, were instrumental in the development of fracking but the federal government backed commercialization of this important technology in a variety of ways. These include: shale fracturing and direct drilling technologies developed by the federal government and federal labs; public-private shale drilling demonstration projects in the 1970s; the section 29 production tax credit for unconventional gas in effect from 1980 to 2002; federal funding of cost-shared fracking projects including Mitchell Energy's first horizontal well in 1991; and 3-D micro-seismic imaging developed by DOE's Sandia National Lab. As a 2102 study concluded:

> *These federal investments, coordinated in close concert with gas industry representatives, were predicated upon a single mission: the commercialization of shale gas extraction technology. As a result of these efforts carried out over the course of 30 years, shale gas went from inaccessible deposits locked in unfamiliar geologic formations to the fastest growing contributor to the nation's energy portfolio.*[16]

The partnership between the federal government and the natural gas industry was crucial in the efforts to develop hydraulic fracturing. George Mitchell, often called the "father of fracking," was a bold businessman but he enjoyed strong backing from the federal government in getting his important technology to commercial scale. It is conceivable he and others in the private sector could have succeeded without government help, but it is highly doubtful given modern fracking's dependence on government-born technologies like 3-D seismic imaging from DOE's Sandia National Lab, along with tax credits and early government cost-shared projects.

These and many other examples point to the long-standing role the federal government has played — through Republican and Democratic administrations alike — in commercializing energy technology. Energy project developers and investors often can't or won't shoulder all the risk inherent in the initial commercial scale-up of an energy technology, where a project can cost

[15] https://www.energy.gov/sites/prod/files/2016/10/f33/9-22-16_SEAB%20Nuclear%20Power%20TF%20Report%20and%20transmittal.pdf
[16] http://thebreakthrough.org/archive/shale_gas_fracking_history_and

hundreds of millions or even billions of dollars and there are multiple reasons the first-time project can fail.

Outside of the energy context we don't generally have this debate about whether the federal government should back technology development and deployment. Thus, the government, through DARPA, has had a major hand in the development and application of revolutionary technologies ranging from the Internet and videoconferencing to GPS and the Cloud.[17]

b. China's Energy Dominance

There is another reason why the federal government should continue its efforts in clean energy technology commercialization. As noted in the introduction, the Chinese government and private sector have a well-organized and executed plan to dominate the clean energy technology industry, with all of its attendant economic, security and environmental benefits. From wind, solar, hydropower, and storage, to nuclear power, advanced vehicles, CCS, and transmission, China is not only dominating in low-cost manufacturing and domestic deployment but increasingly in energy technology R&D and commercialization, traditionally the U.S. strong suit.

As noted above, in March 2017, our Stanford center issued a major report, funded by DOE, on the Chinese solar industry. The report spells out just how far the Chinese have come in solar R&D, including recently posting an important world record in solar cell efficiency. The report also analyzes the well-organized approach that Chinese government and industry are taking to solar commercialization and deployment, all focused on dominating the global solar industry.[18] In a related New York Times op-ed,[19] my colleague Jeff Ball and I argued that:

> *[T]he Chinese industry is innovating technologically....contrary to a long-held myth that all China can do is manufacture others' inventions cheaply. It's expanding its manufacturing footprint across the globe. And it's scrambling to import more efficient ways of financing solar power that have been pioneered in the West. The United States needs to take these shifts into account in defining an American solar strategy that minimizes the cost of solar power to the world while maximizing the long-term benefit to the American economy."*

I would add that our country needs to do the same with respect to a broad range of renewable, nuclear, fossil, transportation and grid-related technologies. One of the ways to do that is to maintain the strong energy technology commercialization vehicle put in place by President George W. Bush and a Republican Congress in the form of the DOE loan program.

In the next twenty years, the International Energy Agency projects that the world will spend roughly 48 trillion dollars on energy infrastructure, one of the biggest economic opportunities of the 21st century. China is on a well-organized march to grab the biggest piece of this economic pie. We ignore China's resolve — and impressive success to date — at our peril. And it is this situation that

[17] http://www.alphr.com/features/373546/10-brilliant-darpa-inventions/page/0/1
[18] https://www-cdn.law.stanford.edu/wp-content/uploads/2017/03/2017-03-20-Stanford-China-Report.pdf
[19] https://www.nytimes.com/2017/03/21/opinion/making-solar-big-enough-to-matter.html?_r=0

makes the attacks on federal energy technology commercialization, like the DOE loan guarantee program, so misguided.

I urge you to reexamine the course that has been charted by your colleagues on the Appropriations Committee that would effectively shutter the DOE Loan Programs Office, as a minimal amount of funding can enable this program to remain readily available to support upcoming infrastructure initiatives. If members of this authorizing committee are interested in working to refine the programs to be more effective, I'm confident you will find many willing allies in the industry who can provide good advice. I'm equally confident that if you allow these programs to be shuttered by rescissions of already appropriated dollars in pending funding bills, American energy innovation will suffer in a manner that we cannot quantify until the innovation and job creation opportunities pass us by.

3. DOE Appliance Standards Program

The DOE appliance standards program, first created by Congress in the 1970s, and repeatedly revised and expanded since, sets a floor for efficiency for everyday products bought by consumers and business. It is among the nation's most effective approaches to saving energy. These savings translate into pocketbook savings for consumers and businesses, create jobs, and make our energy systems more resilient and reliable. In sum and as explained below:

- The typical household spends about $500 less per year on utility bills than if these standards had not been adopted;
- In 2014, savings for businesses due to efficiency standards totaled $23 billion;
- Research shows that standards boosted the number of domestic jobs by 340,000 in 2011;
- Because efficiency is distributed in homes and businesses across the country, it is the most reliable and resilient of any energy resource.

Even as standards have eliminated the most inefficient choices from the marketplace, the total range of available consumer choices has increased and product quality improved. Recent research finds that the prices for products affected by standards, contrary to expectations, have generally declined. Standards cause the energy efficiency feature to become incorporated in all products rather than just high-end products and spur innovations that lead to the next level of energy efficiency improvement.

In general, manufacturers prefer national standards to a patchwork of state standards. A well-functioning national standards program also provides manufacturers with regulatory predictability and creates a level competitive field. When the federal standards program stalls out, state activity ramps up to fill the regulatory void, as it is now doing in California and New York.

Standards have long-standing bipartisan support. Legislation signed by Ronald Reagan in 1987 created 13 standards and laws signed by George H.W. Bush and George W. Bush expanded the number of products subject to standards. These laws charge DOE with keeping standards up to date with technological change. In 2017, the Trump administration gave final approval to four standards that DOE developed under the Obama administration: a rare area of regulatory agreement spanning the two administrations. Just last month, Congress approved two narrow bills on unanimous consent to address specific unanticipated problems with specific standards, demonstrating the ongoing bipartisan cooperation that is a hallmark of this program.

However, several areas of concerns are emerging:

- DOE's Fall 2017 Regulatory Agenda puts work on most new standards on hold. This plan, if carried out, will likely put DOE in violation of a series of statutory deadlines;
- DOE has initiated a process to revamp the standards-setting process. While any process can be improved, in general the energy efficiency standard-setting process, developed over multiple administrations, works well and results in a high level of consensus and large public benefits;
- DOE has left four standards completed in 2016 in regulatory limbo: these standards would save consumers $11 billion and provide regulatory certainty for manufacturers. DOE should complete these standards.

a. Background on Energy Efficiency Standards

Saving energy has long been an area of bipartisan agreement. Cost-effective energy-efficiency investments lower utility bills for both households and businesses, boosting the economy, improving U.S. competitiveness and creating jobs. Saving energy also strengthens the reliability and resiliency of our energy systems. For example, more efficient air conditioners mean less strain on our electric grids on hot summer days, reducing the risks of costly power outages. Reducing energy waste also conserves domestic energy resources, strengthening America's position in global markets both today and in an uncertain future.

Working with industry and the national labs, DOE has served a crucial role in fostering improved energy efficiency through early-stage research, technology demonstration and deployment, and a system of minimum efficiency standards for everyday products. These standards provide a floor for efficiency, ensuring purchasers a basic level of energy efficiency performance. The subsections below address key issues in the DOE standards program. [20]

b. The "Little Engine that Could": Saving Energy and Money for Consumers and Businesses

In the letter discussed above from all seven former EERE Assistant Secretaries we wrote:

> *[F]ederal appliance and equipment efficiency standards, set by EERE since 1987, are the little engine that could when it comes to stimulating massive low-cost energy savings. DOE estimates that existing efficiency standards will, on a cumulative basis, save consumers nearly $2 trillion on their utility bills between 1987 and 2030. While not without occasional controversy, the standards have long enjoyed bipartisan support. Standards for many types of residential, commercial, and industrial equipment are required to be regularly updated in order to capture the impact of technology advances and push these advances into the market. Thus, a refrigerator in 1973 used about 1900 kWh of electricity per year but federal R&D and standards have helped drop that electricity use to about 400 kWh per year, saving a typical household roughly $150 per year.*

[20] This section draws on comments filed with DOE in July 2017 by the Appliance Standards Awareness Project, the Alliance to Save Energy and several others.

Altogether, according to a recent study by the American Council for an Energy-Efficient Economy (ACEEE) and the Appliance Standards Awareness Project (ASAP), a typical U.S. household spends about $500 less on their utility bills each year than they would have if no appliance standards had been adopted. These savings work out to about 16% of the typical household's utility bill spending.[21]

Standards also improve efficiency for a suite of the most common products used in commercial buildings and industry, including lighting, HVAC equipment, motors, and refrigeration products. Altogether, businesses saved $23 billion in 2015 due to existing standards.[22] Saving energy boosts employment. When consumers and businesses spend or invest the money saved on utility bills, economic activity increases. An econometric study by ACEEE estimated that savings from standards resulted in 340,000 more jobs in the U.S. economy in 2010 than would have been the case absent any standards.[23] This estimate does not account for more recently adopted standards or for the possibility that the costs to comply with standards have been lower than predicted. Job creation will grow as the economic savings from standards grow.[24]

Similarly, saving energy with improved efficiency standards helps make our energy systems more resilient and reliable. Since efficiency is distributed throughout homes and businesses, it is not subject to the disruptions or price fluctuations that affect power generation and distribution. It is the most resilient and reliable of energy resources. For example, the Northwest Power and Conservation Council found that, in 2014, existing federal standards avoided the need to produce nearly 8,000 gigawatt-hours per year of electricity (an amount equivalent to the output of two to three 300-500 MW power plants). As savings grow in the years ahead, an additional 25,000 gigawatt-hours per year (equivalent to six to nine power plants' production) of costly system expansions in the Northwest will be avoided.[25]

c. Effects on Consumer Choices, Product Performance and Prices

Product manufacturers not only meet efficiency standards, they often exceed them. And they do so while providing consumers with expanded choices, improved product performance, and, perhaps most surprisingly, without raising prices. This finding is counter-intuitive but it turns out that standards that remove the most inefficient choices from the market actually enhance available consumer choices. These results are supported by both casual observation as well as rigorous quantitative research.

A visit to the lighting aisle and appliance department at any Home Depot, Lowe's or other lighting or appliance retailer will readily reveal the dizzying array of innovative choices available for consumers. For example, partly due to lighting standards (both those in effect today and those

[21] "Energy Saving States of America." Appliance Standards Awareness Project and American Council for an Energy-Efficient Economy. 2017. p. 1.
[22] Ibid. p. 6.
[23] Gold, R. and S. Nadel. *Appliance and Equipment Standards Jobs: A Moneymaker and Job Creator in all 50 States.* ACEEE. May 2011.
[24] Energy-sector emissions reductions are another co-benefit of cost-effectively saving energy. DOE has never used emissions reductions to cost-justify an efficiency standard: in effect, the emission savings are a substantial side benefit, achieved while meeting the goals described herein.
[25] 2014 data from https://www.nwcouncil.org/energy/energy-efficiency/home/ 2035 data from "Seventh Northwest Conservation and Electric Power Plan." Document 2016-2, February 2016. p. 12-19. https://www.nwcouncil.org/media/7149926/7thplanfinal_chap12_conservationres.pdf

required to take effect in 2020) and partly due to public- and private-sector investments in research and development, lighting products offer some of the best-case studies on energy efficiency. The U.S. led the light-emitting diode (LED) lighting revolution, and American consumers now have countless choices of bulbs, fixtures, controls, and "smart" features, all while LED prices have decreased by 94% since 2008.[26] Likewise, DOE's clothes washer standards, negotiated over several rounds between industry and efficiency supporters, have spurred manufacturers to develop a wide array of very efficient products (including both top- and front-loading) that not only save energy, but according to Consumer Reports, clean clothes better.[27] From light bulbs, to clothes washers, to refrigerators, to commercial rooftop air conditioners, buyers of products regulated by DOE have more and better choices than ever before.

Research published by Resources for the Future (RFF) found that product performance often improved as new standards took effect. In addition, their research showed that, "product reliability has improved considerably since our case study appliances were first covered under federal (standards)..."[28] Similarly, a 2012 study by ASAP and ACEEE examined ten regulated products before and after standards took effect and found that product performance generally stayed the same or improved and new features became available.[29]

Even as product choices and efficiency have improved, prices have declined. Researchers at the London School of Economics (LSE) reviewed the existing literature finding that, contrary to DOE's predictions, "a number of studies provide empirical evidence showing the correlation between imposing energy efficiency standards and, surprisingly, *declining prices* of durable goods."[30] Their own analysis of price data confirmed that prices declined after standards took effect.[31] The LSE researchers concluded:

> *We find no evidence to suggest that more stringent energy efficiency standards hurt consumers by increasing price or lowering quality. Rather, we find evidence that price declines and quality improvements accelerate with stricter standards, which unambiguously improves consumer welfare, excluding external pollution-related benefits.*[32]

How can improvements in efficiency and quality occur at the same time as price declines? The LSE researchers investigated this question and concluded: "we find evidence supporting policy-induced innovation, wherein firms lower prices of older models as they are forced to introduce new models meeting new, stricter efficiency standards."[33] In other words, as standards take effect, the price of older, but still compliant products comes down and manufacturers introduce new, high-end models

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[26] U.S. DOE. *The Future Arrive for Five Clean Energy Technologies – 2016 Update*. p. 8
[27] Consumer Reports. *The Best Washers for $800 or Less: These workhorses of the laundry room handle loads for less.* Last updated: July 12, 2017 12:30 PM
[28] M. Taylor, C.A. Spurlock, H.C. Yang. Confronting Regulatory Cost and Quality Expectations: An Exploration of Technical Change in Minimum Efficiency Performance Standards. Resources for the Future. October 20115. p. 70.
[29] Mauer et al. *Better Appliances: An Analysis of Performance, Features and Price as Efficiency Has Improved.* ASAP and ACEEE, May 2013.
[30] Brucal and Roberts. p. 3
[31] Brucal and Robert. p. 24
[32] Brucal, A. and M. Roberts. *Do energy efficiency standards hurt consumers? Evidence from household appliance sales.* Grantham Research Institute/London School of Economics. March 2017. p. 2.
[33] Brucal and Roberts. p. 28.

with new features to capture profits from consumers willing to pay premium prices for the latest thing. In addition, manufacturer innovation, sparked by the need to redesign for a new standard, finds new ways of producing the regulated product that not only improves efficiency, but also other aspects of the product and the process for making it.

Of course, for any product category, there will almost always be some poor performing products on the market, whether the product is subject to efficiency standards or not. Anecdotes about a particular clothes washer or dishwasher that performs poorly should not be read as an indictment of all appliances in that category. Poorly performing products, subject to standards or not, will be weeded out by the competitive market. Existing law provides protections against standards that would harm product performance. Thus DOE is not permitted to set a standard at a stringency level which would impair the utility (effectiveness) of the product.

d. Effects on Manufacturers

Although they may not agree with every decision DOE makes, manufacturers that produce products subject to national standards are generally supportive of well-functioning national requirements for three reasons: avoidance of a patchwork of state regulation; regulatory predictability; and, through experience, they have learned that business can thrive even as standards increase.

Absent federal standards, some states choose to develop their own energy efficiency requirements. During periods of federal inactivity, the interest level in many of the states goes up. For example, a dozen states enacted their own standards laws in the 2000s[34] after the federal government had fallen behind on 23 legal deadlines for updating federal standards.[35] Due to federal preemption, states mostly focus on products outside of the scope of federal standards, but some exceptions to federal preemption exist and states sometimes pursue these exceptions. In 2017, state governments began to gear up state regulatory efforts once again to fill what many fear is a developing federal void. California ramped up work, issuing new standards for several products, and, just last week, the governor of New York announced state action to establish energy efficiency standards, in part due to the "abdication" of this function by the federal government.[36]

Second, the existing federal schedule and approach to standards provides regulatory predictability. Manufacturers know when standards for their products will be reviewed, the criteria for increased standards, and that they will be able to participate in an open, public decision-making process. State-level processes are less predictable. In addition, backlogs in DOE regulatory work inevitably result at some point in a push to catch up. For example, in response to more active oversight by Congress and in response to deadline litigation, DOE, in 2006, developed a five-year plan to catch up on its 22 missed legal deadlines. Instead of an even, predictable cadence of review, manufacturers experienced a lull from 2001 to 2005, then heightened regulatory activity starting in 2006. Upon taking office in 2009, President Obama prioritized meeting legal obligations for new standards. The combination of catching up on missed legal deadlines and complying with deadlines for reviewing

[34] See https://appliance-standards.org/sites/default/files/State_status_grid_3.pdf
[35] U.S. Government Accountability Office. "Long-standing Problems with DOE's Program for Setting Efficiency Standards Continue to Result in Forgone Energy Savings" January 2007. This report pegged the cost of DOE delays at $28 billion.
[36] See https://www.governor.ny.gov/news/governor-cuomo-unveils-20th-proposal-2018-state-state-new-yorks-clean-energy-jobs-and-climate

new standards enacted by Congress in 2005 and 2007 resulted in an unprecedented level of revised standards during the Obama presidency.

Third, manufacturers, many of which have now been regulated for three decades or longer, have learned that when they anticipate and plan for improved standards, their companies can thrive as they provide improved products for their customers. Undoubtedly, those companies which fail to plan or improve their products will suffer compared to their competitors, but standards and the associated test procedures and efficiency ratings provide a level playing field for all.

Occasionally, some have asserted that higher efficiency standards have caused manufacturers to move jobs to lower labor cost markets. However, the loss of manufacturing jobs to lower-wage economies has affected all manufacturing, whether a given product must meet efficiency standards or not. Where American jobs have been lost, it is often because factories did not keep up with new technologies and became uncompetitive. In fact, the substantial levels of employment in making many regulated products in the U.S. (e.g. many types of home appliances and commercial equipment) suggests that regulation may bolster domestic employment. Efficiency standards drive innovation and reliance on new technologies which can help keep U.S. plants competitive.

e. Bipartisan Support, Even in 2017

Even as the Trump administration has prioritized rolling back Obama-era regulations, appliance standards have proven to be an area of some agreement. For example, three standards completed by the Obama administration that were eligible for Congressional Review Act (CRA) repeal last year (and which have support from product manufacturers) did not attract CRA resolutions.[37] Even more telling, the Trump administration gave final regulatory approval to four standards developed during the Obama administration: these standards are a rare area of regulatory agreement spanning the change in administrations.[38]

These areas of agreement build on decades of bipartisanship when it comes to standards. Ronald Reagan signed the 1987 law establishing the first national standards, while George H.W. Bush and George W. Bush signed major expansions enacted by strong bipartisan majorities. Just last month, Congress unanimously enacted two narrow appliance standards bills (S. 2030 and H.R. 518): one aligned the dates for two standards affecting ceiling fans and their lights and another exempted certain specialized products from the external power supply standard. These bills demonstrate that when unanticipated problems do emerge with existing standards that DOE is unable to remedy, interested parties can come together to jointly recommend fixes to Congress that gain bipartisan, even universal, support.

f. Emerging Areas of Concern

While there has been tremendous achievements to date with appliance, lighting and equipment standards, including some advanced in 2017, several areas of concern are emerging. Recently, the administration published a plan that appears to put most standards development work on indefinite

[37] The three standards finalized in 2016 which were eligible for CRA repeal concerned dehumidifiers, ceiling fans and devices with rechargeable batteries. A CRA resolution was filed for a test procedure for compressors, but did not come to a vote.
[38] 82 Fed. Reg. 24211, 24214, 24218, and 31808.

hold. In addition, some have called for revamping the process by which standards are developed and the administration has opened an administrative process for considering changes. Finally, several standards completed in 2016 remain in limbo, creating regulatory uncertainty and leaving savings on hold.

i. DOE's new regulatory plan

The DOE's regulatory plan released in December re-categorized twenty standards proceedings and seventeen test methods from active rulemakings to long-term actions. Long-term actions are described as topics on which the agency plans no action in the next 12 months. Many of these proceedings have legal deadlines that have passed or that are coming up. This plan may signal that the Department does not intend to meet statutory deadlines for the review of existing standards and test procedures.[39] Of course, when DOE reviews a standard, it may determine that improvements are not merited. But, in many cases, improvements will make sense. Analysis completed in 2016 found that the next round of updates to national standards due to be completed over the period 2017 to 2025 has the potential to save consumers and business about $43 billion on utility bills annually by 2035. Cumulative savings could reach $1.1 trillion by 2050.[40] In addition, manufacturers have stressed the need to complete test procedure revisions in advance of standards reviews. By delaying test procedure work, a key aspect of the standard-setting process, DOE could have to revise standards before test procedures have been adequately reviewed, a problematic way to proceed.

ii. DOE's new standard-setting process

DOE also recently initiated a process for revising the standards-setting process. The agency is holding a public meeting today on this very topic, soliciting written input, and intends to publish an Advance Notice of Proposed Rulemaking.[41]

The DOE's process for developing and revising efficiency standards has evolved and improved over the decades. The standards-development process in place today dates in part to my tenure at the Department. In 1996, DOE convened a Federal Advisory Committee of interested parties to write guidance on the process for developing new standards. The "Process Rule," published that year, improved the predictability of the regulatory process, increased transparency, and helped reduce the cost and time required for the rulemaking process, among other objectives (10 CFR, Part 430, Appendix A to Subpart C). That process helped us complete a number of important cost-effective energy-saving standards between 1997 and 2001 when I led the EERE office.[42]

During the early years of the George W. Bush administration, progress on new standards lagged despite the reforms included in the Process Rule. Congress intervened, first with the Energy Policy Act of 2005 which directly enacted fifteen new standards and subsequently with the Energy

[39] See press coverage at "The Energy 202: Energy Department pressing pause on rules to make your appliances more efficient, critics charge," Washington Post, Dec. 20, 2017. Oddly, the week after the Regulatory Agenda was published, the Department published two actions that had been identified as long-term actions.
[40] A. deLaski, J. Mauer et al. "Next Generation Standards: How the National Energy Efficiency Standards program Can Continue to Drive Energy, Economic and Environmental Benefits." Appliance Standards Awareness Project and American Council for an Energy-Efficient Economy. August 2016. p vii.
[41] 82 Fed Reg 59992.
[42] Mauer, et al. p. 6.

Independence and Security Act of 2007, which, in addition to directly enacting additional standards, made statutory changes to the standards-setting process. Most notably, the 2007 law provided for regular reviews of all standards and the underlying test procedures on a predictable, statutorily-required schedule. The agency has just begun to implement the regular reviews provision enacted in 2007. None of the three reviews completed to date under this provision have been controversial: one resulted in no change to the standard and the other two changes were broadly supported by manufacturers and others.[43] The revised law also promotes negotiated standards. In response to the legislative changes, DOE published additional guidance in 2010.[44] DOE also created a new Federal Advisory Committee in 2012 to further foster negotiation. The Trump administration recently decided to retain this Federal Advisory Committee.

In sum, the process for developing standards has evolved considerably since 1996 and for the better. The process has worked well in recent years, yielding a high degree of consensus, in part due to an emphasis on negotiation and in part due to DOE's adherence to statutory deadlines. While some DOE decisions have been controversial, these are the exceptions. As this administration looks to revise the process, it should protect the elements that enabled success and avoid adding new steps or unnecessary complexity that will increase costs and hinder progress.

In another recent Federal Register notice, DOE floated the idea of shifting from minimum standards to average standards, similar to those used for automobile and truck efficiency.[45] The minimum standards approach has worked well for appliance standards. Averaging approaches require more data submitted by manufacturers and are administratively more complex. Averaging approaches may also undermine existing state- and utility-based efficiency efforts by allowing manufacturers to offset efficiency gains in some products with greater sales of inefficient products. In general, moving away from a tried and true, successful approach to one that adds complexity and cost and reduces savings does not make sense.

iii. New standards in limbo

DOE issued five final standards in late 2016 that, due to a required additional review period to identify errors, had not been published in the Federal Register by the beginning of the Trump administration. Subsequently, the Trump administration published one of these five standards (concerning walk-in coolers). But the other four remain in regulatory limbo. Several states and advocacy groups have sued, arguing that DOE has a non-discretionary obligation to publish the final rules since no substantive errors were identified. Together, these four standards would save $11 billion according to the DOE analyses for the rulemakings.[46] Most of the standards have considerable manufacturer support. For example, makers of portable air conditioners support DOE publication of that final rule. DOE should at a minimum publish those standards that have consensus support and, preferably, all of them.

[43] These concerned central air conditioners (one of the rules approved by the Trump administration) and dehumidifiers (a rule that was eligible for CRA repeal).
[44] https://energy.gov/gc/articles/doe-announces-changes-energy-conservation-standards-process
[45] 82 Fed Reg 56181.
[46] See Lawsuit Update: DOE Inaction Costs Consumers Billions.

4. Federal Tax-Advantaged Financing Vehicles

Tax-advantaged financing vehicles are another adjunct to DOE's support for clean energy technology through R&D funding, loans, and standards. In the mode of "teaching old dogs new tricks," there has been a bipartisan effort over the last few years to open up long-standing Congressionally authorized investment vehicles to clean energy technologies. These vehicles are attractive because they are tax-advantaged — either eliminating the double taxation of common corporate investment structures or providing a full exemption from federal taxation. As such, they provide lower-cost financing to project developers, particularly as compared with "tax equity" investment using tax credits. There are three tax-advantaged structures currently in the mix.

a. Master Limited Partnerships

The first tax-advantaged structure involves Master Limited Partnerships (MLPs), authorized by Congress in 1981 and used to provide tax-advantaged financing primarily to U.S. oil and gas pipelines and related infrastructure, with more than $500 billion worth of projects financed to date. MLPs are taxed as partnerships, but their ownership interests trade like corporate stock. As a result, they avoid the double taxation of corporate vehicles as the income of the partnership passes through directly to investors. At the same time, they enjoy the advantages of broad public stock issuance, thereby opening up energy investment opportunities for millions of U.S. retail investors.
The MLP structure provides access to large amounts of low-cost capital for energy projects provided by a significant number of investors. However, MLPs, as currently authorized, do not extend to renewables and other clean energy technologies.[47]

Recent bipartisan legislation is pending in both the House and Senate to open up MLPs to investment in a broad range of clean energy technologies including renewables, energy efficiency, CCS, electricity storage, biofuels, cogeneration and more. The Senate bill was introduced by Senators Moran (R-KS) and Coons (D-DE) and the companion House bill by Representatives Poe (R-TX) and Thompson (D-CA).[48] MLPs could provide a true "level playing field" via their tax-advantaged structure, open to the vast majority of energy projects, and providing lower-cost financing than often available today.

b. Private Activity Bonds

The second tax-advantaged vehicle involves Private Activity Bonds (PABs). PABs, issued by or on behalf of a local or state government, were used in the 1970s and 1980s to finance tens of billions of dollars of U.S. projects, deploying an array of then advanced technologies to capture air pollutants like particulates and sulfur dioxide. Like municipal bonds, PABs are exempt from federal tax and support a public benefit, but they are used by private not public entities, (e.g., investor-owned utilities). However, the authority for PAB-financed air pollution control projects ended in tax legislation in 1986. A pending Senate bill introduced by Senators Portman (R-OH) and Bennet (D-

[47] F. Mormann and D. Reicher, "How to Make Renewable Energy Competitive," *New York Times*, June 1, 2012, http://www.nytimes.com/2012/06/02/opinion/how-to-make-renewable-energy-competitive.html?smid=tw-share.
[48] https://www.coons.senate.gov/newsroom/press-releases/sens-coons-moran-reps-poe-thompson-introduce-bipartisan-bicameral-legislation-to-level-the-playing-field-for-clean-energy

CO) would reinstate this authority for CCS projects[49], as would a companion bill in the House introduced by Representatives Curbelo (R-FL) and Veasey (D-TX).[50] The legislation would provide access to this long-term, low-cost fixed-rate debt that has often been unavailable in developing U.S. CCS projects. Interestingly, the independent power producer NRG was able to use PAB financing at a recent Texas CCS project because the plant was located in a hurricane zone where financing authorities that are not generally available are sometimes opened up to encourage rebuilding following a disaster.[51] Developers of other CCS projects, including one focused on cutting emissions from natural gas-fired generation, are interested in access to this financing tool, outside of disaster zones.[52]

c. Real Estate Investment Trusts

The third tax-advantaged structure involves Real Estate Investment Trusts (REITs). REITs, first authorized by Congress in 1960, have cost-effectively raised capital on public markets for commercial real estate, hospitals, hotels, natural gas pipelines, electricity distribution lines, cell towers and billboards. They boast a market capitalization of more than $900 billion. Like MLPs, REITs avoid the double taxation of corporate vehicles and enjoy the advantages of public stock issuance, allowing smaller individual investors to invest in large diversified portfolios of income-producing properties.

In May 2014, the IRS proposed new regulations to clarify the definition of real property for the purposes of REIT eligibility.[53] The proposed rulemaking would expand REIT eligibility to solar and potentially other renewables without the need for Congressional action. Access to the REIT structure could help renewable energy projects reduce their financing costs and help move solar energy and potentially other renewables closer to grid parity and, ultimately, subsidy independence. The IRS finalized the rule in August 2016 but, in sum, extended REITs to renewables in only a limited fashion.[54] It would be worth the IRS taking a second look at REIT-eligible clean energy projects or Congress taking up the issue.

5. Electricity Storage

With the significant growth of solar and wind generation in recent years, the need for electricity storage capacity has grown as well. However, large-scale electricity storage, with the exception of pumped hydro, is relatively immature technologically, and the costs of a number of promising options are high. As a result, gas turbines often fill the gap when solar and wind are not available. It is important to emphasize that storage is needed at both utility scale (e.g., pumped hydro) and at distributed scale (e.g., behind-the-meter battery packs).

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[49] https://www.portman.senate.gov/public/index.cfm/2017/4/portman-bennet-introduce-bill-to-help-finance-carbon-capture-and-storage-projects
[50] https://curbelo.house.gov/news/documentsingle.aspx?DocumentID=1400
[51] https://www.washingtonpost.com/news/powerpost/paloma/the-energy-202/2017/12/04/the-energy-202-hurricanes-could-sweep-in-carbon-capture-projects-in-gulf-coast-but-the-tax-overhaul-could-stop-it/5a24bd6930fb0469e883f9c4/?utm_term=.93a68618c631
[52] Id.
[53] https://www.gpo.gov/fdsys/granule/FR-2014-05-14/2014-11115 See also http://law.stanford.edu/wp-content/uploads/2015/07/ITC-Report-to-DOE-FINAL-Jan-2015.pdf
[54] https://www.mwe.com/en/thought-leadership/publications/2016/09/final-regulations-define-real-property-for-reits

Key federal as well as state policies can stimulate the development and deployment of storage. The Congress and administration need to consider federal policy and finance tools to advance both utility-scale and distributed storage projects. These include R&D funding, grants, tax credits, loan guarantees, MLPs, REITs, Energy Savings Performance Contracts and other tools. Unfortunately, the Trump administration has proposed a 61% cut in DOE energy storage-related research in its FY18 budget versus FY17 levels. A funding cut of this level would affect critical private and public sector work, including path-breaking work at DOE's Argonne National Laboratory and the National Renewable Energy Laboratory. Congress should ensure adequate funding for this R&D. A 2016 bill (H.R. 5640), the Electricity Storage Innovation Act, would have authorized $150 million annually for basic research into advanced batteries. It would, however, have specifically prohibited spending funds for commercialization of storage technologies and it did not authorize research regarding any other storage technology besides batteries.

On another front, the IRS is developing guidance on the extent to which energy storage integrated with a solar project can qualify for the 30 percent federal solar ITC. The IRS ruling will be limited in various respects and, in the face of this, bipartisan legislation — the Energy Storage Tax Incentive and Deployment Act of 2017 — was introduced in the House (H.R. 4649) that would, among other things, extend the ITC to a range of distributed and utility-scale storage technologies. Additionally, as discussed above, bipartisan legislation (S. 2005 and H.R. 4118) is pending in the House and Senate that would open up MLPs to storage projects. Other federal policies include potential availability of R&D tax credits for early-stage storage companies and the Department of Defense and civilian agencies increasing the use of storage in grid resilience efforts.

Beyond these tools, it is important to take account of wholesale rates and their potential impact on the deployment of storage. To this end, in April 2016, FERC initiated Docket No. AD16-20-000 to examine whether barriers exist to the participation of electric storage resources in the capacity, energy and ancillary service markets, potentially leading to unjust and unreasonable wholesale rates, and whether any tariff changes are warranted. FERC followed up with a Notice of Proposed Rulemaking titled "Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators."[55]

Storage is part of a larger package of options — energy efficiency, demand response, grid management, fast-firing gas turbines, broader regional electricity markets, and faster dispatch — to deal with intermittent renewables. The administration and Congress should consider the range of federal policy options, and associated investment vehicles, that can ensure smart and cost-effective integration of these approaches. The states also have a major role to play.

6. Carbon Capture and Storage

As the discussion above indicates, there are an array of tools — R&D funding, federal grants, loans, tax incentives, standards and beyond at the president's disposal — to drive clean energy innovation, commercialization and deployment. While well intentioned, this tool kit was assembled in a haphazard manner — and used today — without enough consideration as to how each tool relates to the others, what new ones are needed, which ones might be phased out, and how they all might be

[55] https://www.ferc.gov/whats-new/comm-meet/2016/111716/E-1.pdf

better integrated. The federal approach to CCS is an example of this complex situation and several bipartisan bills have been introduced that would begin to rationalize and improve the portfolio of tools supporting CCS.

CCS scrubs carbon emissions from power plant and industrial exhausts and then pipes and stores them thousands of feet underground in geologic formations already proven capable of holding saline water or oil and gas for long periods of time. Increasingly, industry is also developing innovative ways to *utilize* captured CO_2 in commercial products, including plastics, cement, chemicals and agricultural products. At the January 2016 World Economic Forum meeting in Davos, Switzerland, the Global CO_2 Initiative was launched to accelerate development of these innovative "CCUS" approaches. As an emission reduction approach, CCS has broad applications across the energy spectrum, from coal, natural gas and biomass-fired power plants to industrial operations like oil refineries, ethanol facilities, steel production, cement plants, natural gas processing operations, and fertilizer production.

The International Energy Agency projects CCS contributing one-sixth of total CO_2 emission reductions required in 2050 from the power sector as well as industrial operations (which themselves produce about one-fifth of global carbon emissions). This is a massive contribution built on the back of various CCS technologies that, while in operation in various industries, have generally not been deployed at the scale or cost required for meaningful climate-related carbon controls. At the same time, with the Trump administration's proposed withdrawal of EPA's Clean Power Plan, there is little in the way of direct federal regulatory control of carbon emissions.

Projects deploying CCS solely for pollution control purposes must therefore take on extra capital costs and operating expenses to capture a pollutant for which there is currently no direct regulatory mandate or market price. The lone exception on the market side is the long-standing use of CO_2 for Enhanced Oil Recovery (EOR). For several decades, CO_2 has been pumped into old oil fields to enhance production. While this creates an economic use for CO_2, its value is tied to the price of oil and, with falling hydrocarbon markets in recent years, CO_2 prices have dropped as well. As a result, in most cases EOR revenues cannot cover the full capital and operating expenses of CCS. The federal government, over the last three administrations, has stepped into this complex situation in order to accelerate the development and deployment of CCS.

a. The Importance of DOE Support for CCS

DOE launched its program to develop and commercialize CCS technology in 1997. Over the past 20 years, it has relied on a variety of federal support mechanisms and incentives — R&D funding, grants, federal tax credits, private activity bonds and loan guarantees — to advance the technology. This array of federal support, measured in the billions of dollars, has helped advance first-time applications of CCS at a number of different types of U.S. facilities. The notable examples of these are a coal-fired power plant in Texas, an ethanol plant in Illinois, a Texas oil refinery and, most recently, a project that is helping to demonstrate CCS technology in natural gas-fired power generation.

The NRG Petra Nova project near Houston, Texas was completed on time and on budget and is America's first commercial-scale retrofit of a coal-fired power plant with post-combustion

technology. Petra Nova captures 90 percent of the CO2 emissions from a 240 MW slipstream at the existing W.A. Parish Plant for use and storage in a nearby oil field. The Archer Daniels Midland Illinois CCS project in Decatur, Illinois captures up to 1.1 million tons of CO2 each year from a major ethanol production facility for storage in a nearby deep saline formation.

DOE support also includes, as discussed above, the LPO's issuance, in late 2016, of a conditional commitment for the first loan guarantee made under the Department's $8 billion Advanced Fossil Energy Project solicitation. The $2 billion loan guarantee would back the world's first methanol production facility to employ carbon capture technology, in Lake Charles, Louisiana. The captured carbon dioxide would be utilized for EOR with geologic storage in Texas.

It is unlikely that utilities or energy companies would have shouldered the cost alone of the initial applications of CCS at U.S. power plants, refineries, chemical production plants, and other industrial facilities. While some of the underlying technologies, for example amine chemistry, have been used in other industries, the technical risks of a new application were too great for an individual company or utility. This is particularly the case given current CCS economics in the U.S. — with no serious price on carbon emissions, no state CCS mandates, and a volatile market for the sale of CO2 (tied to the price of oil) for EOR.

b. Federal Tools in Support of CCS

In sum, CCS is not driven by traditional regulatory requirements for control of CO_2 or a revenue model generally robust enough to pay for CCS. CCS deployment for power and industrial pollution control is instead looking to achieve financial feasibility based upon a mix of current and potential federal incentives and tax-advantaged financing mechanisms, plus the volatile commodity sales market for CO_2 used in EOR. The federal approach to date has been inadequate, with an array of tools on the books or proposed, but no integrated approach that will really drive CCS to a point where major private sector investment can take it to scale in both the power and industrial sectors. These existing and proposed tools include:

- R&D
- Grants
- Investment Tax Credits
- Geologic Storage Tax Credits
- Loan Guarantees
- Master Limited Partnerships
- Private Activity Bonds
- Price Stabilization Contracts

DOE R&D funding has been critical in advancing CCS but, unfortunately, the Trump administration's proposed FY18 budget for DOE would cut CCS R&D by about 85% from FY17 levels. Congress should resist this massive reduction. DOE grants have also helped push some CCS demonstration projects over the finish line, but they were largely creatures of stimulus funding.

There are current federal CCS tax credits designed to stimulate both projects that capture carbon dioxide (IRC Section 48A and 48B) and others that geologically store it (IRC Section 45Q). However, these credits have proven problematic given limitations in terms of amount, scope and duration. A significantly improved approach to the current CO_2 geologic storage tax credit is pending

in bipartisan bills in the House[56] and Senate.[57] These bills would extend and expand the credit by increasing the value of the credit and replacing the soon-to-expire cap on available credits with a time-limited window to commence project construction. In the House, the Carbon Capture Act (H.R. 3761), was introduced by Agriculture Committee Chairman Mike Conaway (R-TX-11) and is currently co-sponsored by 45 representatives from different political backgrounds and many regions of the country. In the Senate, the FUTURE Act, was introduced by Senators Heidi Heitkamp (D-ND), Shelley Moore Capito (R-WV), Sheldon Whitehouse (D-RI), and John Barrasso (R-WY) and is co-sponsored by 25 senators. There is also a broad coalition of outside support for these policies — from industry to labor unions to environmental groups.

As discussed above, CCS is also included in pending bipartisan House and Senate bills to open up Master Limited Partnerships (MLPs) to financing clean energy projects. Also, as discussed above, pending bipartisan House and Senate bills would extend Private Activity Bond (PAB) authority to CCS projects, providing an attractive incentive modeled on pollution control projects financed using this mechanism in the 1970s and 1980s.

There is also discussion of creating a CO_2 sales revenue stabilization mechanism for CO_2 capture projects to address the volatility of CO_2 sales revenue for EOR that results from a contractual linkage to the market price of oil. This approach could authorize DOE to enter into "price stabilization contracts," also known as "Contracts for Differences," that could potentially be designed to be revenue neutral. The U.K. uses this type of contract to stabilize electricity price revenues for renewable energy projects that dispatch into volatile U.K. power markets. A provision directing the U.S. DOE to study such a mechanism was included in the Senate energy bill in the previous Congress.

Finally, with the Trump administration's proposed withdrawal of EPA's Clean Power Plan, greenhouse gas emissions from the power sector, are not federally controlled in the U.S., nor are there significant federal controls on most industrial carbon emissions, with the exception of methane emissions in the oil and gas industry (but not oil refining).

One major question about CCS involves its cost. Some argue that the technology is simply too expensive and cite over-budget projects that have been cancelled. This contention does not reflect several important matters. First, CCS has broad applications across a range of both industrial operations and power technologies. Costs can differ substantially among these applications and for some, especially in the industrial sector, CCS may be the *only* available carbon-control option. Second, cost per ton of carbon abated is generally a better measure of CCS economics than dollars per MWh. CCS projects generally measure up well under the first criterion. The second criterion often obscures the cost of "firming up" variable generation, but some CCS projects measure up well even under that criterion. Third, recent CCS projects, especially those involving "post-combustion" rather than "pre-combustion" CCS technologies, have in fact met their financial goals. Thus, the NRG Petra Nova project in Texas, noted above, was completed on time and on budget and is operating well today.

[56] https://conaway.house.gov/news/documentsingle.aspx?DocumentID=398277
[57] https://www.heitkamp.senate.gov/public/index.cfm/2017/9/heitkamp-capito-whitehouse-barrasso-make-bipartisan-push-for-carbon-capture-technology-during-symposium-in-washington

Overall, Congress and the administration should take a thorough look at CCS: analyzing existing and proposed policy mechanisms as well as current and potential revenue models and the interactions between them and developing an integrated and effective approach to accelerating CCS deployment. This should start with adequate CCS R&D funding and, to this end, Congress should resist DOE's proposed 85% FY18 budget cut. On a different front, CCS tax credits, properly structured, could incentivize equity investment in projects, while PABs could stimulate the availability of low-cost debt, and MLPs could provide a "liquidity event" for the initial equity investors and mitigate the large "exit valuation" risk these projects otherwise face.

Importantly, any consideration of CCS should look at both power and industrial emissions and involve both underground storage and alternative beneficial uses of CO_2 such as cement, chemicals, plastics, fuels, and beyond. Congress and the administration should also consider the international dimensions of CCS. Ten countries, including the U.S. and China, explicitly declared CCS as part of their commitments under the Paris Agreement, and many key countries accept CCS as a compliance mechanism. With the Trump administration's pending withdrawal from the Paris Agreement these international dynamics should be revisited.

7. Federal Energy Management

The U.S. government is the single largest energy user in the nation with an energy bill to taxpayers exceeding more than $23 billion. The federal government owns 350,000 buildings, more than a quarter of all U.S. land, tens of thousands of miles of transmission lines, 400,000 non-tactical vehicles, and in recent years has developed, hosted and procured more renewable energy than any other entity in the United States. There are a number of opportunities that could both green up the federal government's own energy use and accelerate the development and deployment of clean energy more broadly. They are explored in a September 2016 report by a task force of the Secretary of Energy Advisory Board (SEAB) that I co-chaired with former U.S. Representative Ellen Tauscher.[58] This was an important SEAB topic, in part because DOE's Federal Energy Management Program has major responsibilities on this front. More broadly, and as I wrote in a 2017 op-ed, President Trump, as "CEO" of "U.S. Energy Inc." — and with a strong real estate background — could do much to advance these opportunities.[59] Some brief examples:

a. The Federal Government as Technology Test Bed

The DOD and the General Services Administration (GSA) in recent years have used their many buildings and related power infrastructure to demonstrate and evaluate next generation energy technologies important to DOD's defense mission and GSA's function as the nation's largest landlord. With 150 demonstrations completed or underway, these "technology test beds" — GSA's Green Proving Ground and DOD's Installation Energy Test Bed — have helped advance an array of energy technologies including microgrids, new building controls, condensing boilers, and advanced chillers. The administration should build on this success. There are, however, two challenges. First, these programs are not well coordinated with the DOE's energy technology programs, particularly those related to building technologies. The R&D "push" of DOE's work must be better aligned with

[58] https://energy.gov/sites/prod/files/2016/11/f34/9-22-16_Report_of_SEAB_Federal_Energy_Management_TF_w_transmittal.pdf
[59] http://thehill.com/blogs/pundits-blog/the-administration/307719-as-president-trump-will-be-ceo-of-us-energy

the demonstration and validation "pull" of the DOD and GSA test beds. Second, both test beds are oversubscribed and their already modest budgets are declining.

b. Cut the Federal Government's Energy Bill

Congressional legislation and a series of executive orders going back decades have directed the federal government to cut its energy use and, in the process, reduce its $23 billion annual energy bill to taxpayers. The administration and Congress can accelerate progress to date by expanding investment in energy efficiency upgrades in federal buildings through direct appropriations as well as a compelling alternative — Energy Savings Performance Contracts (ESPCs). ESPCs are an arrangement under which a private third-party invests in an energy conservation measure in a federal building and is repaid over time from a portion of the resulting energy savings. ESPCs have become a major tool for federal agencies, are an important alternative to appropriated funds, and enjoy strong bipartisan support. The White House and DOE need to resolve several outstanding issues concerning ESPC scope and implementation, adopt new dollar-denominated ESPC goals, and improve systems to track progress. The federal government can also help accelerate use of ESPCs in energy upgrades of state and local public buildings as well as private facilities.

c. Reduce the Federal Real Estate Footprint

The next administration should consider what may be the most compelling way to reduce the federal government's energy footprint and that is by reducing its real estate footprint. There is an important opportunity to cut energy consumption through a modest decrease in the federal facility footprint — at both DOD and civilian facilities — a reduction that federal agencies themselves favor. Previous federal downsizing has demonstrated the direct and significant connection between cutting square footage and reducing energy use. Thus, the DOD, between 1988 and 2001, cut its real estate footprint by 35 percent, and its facility energy consumption decreased by a corresponding 36 percent, saving billions of dollars in the process. The challenge is the reluctance of Congress to authorize new cuts in federal facility space, especially at the DOD. Congress has turned down a series of administration requests since 2012 for authority to further downsize DOD facilities through the Base Realignment and Closure (BRAC) process. But additional BRAC authority is something the administration and Congress might come to terms on in the interest of greater DOD efficiency and effectiveness — and the civilian side might be addressed at the same time as part of a comprehensive deal. Meanwhile, there are innovative ways to tackle the up-front cost of federal facility downsizing, including a "space-saving performance contract" analogous to an ESPC, as discussed above.

d. Improve Federal Procurement of Renewable Energy

The federal government is a major purchaser of clean energy, but it could be doing a great deal more both to green up its own operations and accelerate cost reductions in clean energy technologies and to improve financing mechanisms more generally. The key mechanism by which federal agencies — and the private sector — procure renewables is a power purchase agreement (PPA), which allows a developer to finance an energy project in exchange for a federal agency's long-term commitment to buy the power at an established price. Despite the benefits of PPAs and PPA-like mechanisms, agencies face major impediments to their use, including statutory limitations and the complexity of the federal procurement process. The DOD and civilian agencies have had a range of challenges

using PPAs that have complicated and slowed federal procurement of renewable energy. For example, under federal law, civilian agencies can typically only enter into PPAs with a maximum duration of 10 years, while power developers typically need commitments of at least 20 years in order to finance a project. The SEAB report to Secretary Moniz, noted above, makes a set of recommendations aimed at removing such impediments to the use of PPAs and expanding the use of alternatives.

e. Increase the Role of the Power Marketing Administrations in Renewable Energy Deployment and Transmission Development

The PMAs — Bonneville Power Administration (BPA), Western Area Power Administration (WAPA), Southwestern Power Administration (SWPA) and Southeastern Power Administration (SEPA) — are an arm of DOE that markets electricity generated at federal hydropower facilities primarily to "preference customers," municipally-owned electric utilities and rural electric cooperatives. There are multiple ways the administration could make greater use of the PMAs in advancing clean energy development while being mindful of the PMAs' core obligations to their preference customers. The PMAs own tens of thousands of miles of transmission lines and have financing and eminent domain authority that could be used to both upgrade existing lines and build new ones — both essential to the large-scale and rapid build-out of U.S. renewables. The PMAs also have authority to purchase non-hydro power to supplement their hydroelectricity resources when necessary. Some of these purchases should come from other renewable resources, particularly as these technologies are increasingly cost competitive. Finally, the PMAs can also take more active roles in operational activities vital to clean energy and transmission: Regional Transmission Organizations, Energy Imbalance Markets, and transmission planning under FERC Order 1000.

f. Address Barriers to Expanding Clean Energy Development on Federal Lands

There is a major potential for renewable energy development on federal lands – making up more than one-quarter of all U.S. territory — but a number of issues, including a complex permitting process and concerns about wildlife impacts, have limited the deployment of wind, solar and other renewables. The administration, led by the Department of the Interior, needs to reduce uncertainty and delay surrounding the assessment of wildlife impacts, formulate a new and improved permitting approach for future energy development on federal lands, and increase research on technology that can improve species conservation. The Obama administration made good progress on this front, but there is more that needs to be done, particularly to ensure increased access to federal property for both utility-scale renewables and transmission development, while being careful about important conservation and wildlife values.

g. Increase Federal Deployment of Alternative Fuel Vehicles

The U.S. government has the single largest vehicle fleet in the nation — currently some 400,000 non-tactical vehicles. Three departments largely control the fleet: the General Services Administration (39 percent), the U.S. Postal Service (33 percent), and the Department of Defense (28 percent). The challenge is that multiple administrations have made little progress in greening up this fleet through the use of alternative fuels — including biofuels, electricity, natural gas and hydrogen — despite specific direction in an array of federal legislation and executive orders. As a

result, although alternative fuel vehicle (AFV) acquisition rates have come close to meeting the requirements of the 1992 Energy Policy Act (which mandates that 75 percent of new acquisitions be AFVs), actual alternative fuel use in federal fleets was only 3.9 percent of total fleet fuel consumption in 2015. Federal fleet access to biofuels for "flex-fuel" vehicles has been one challenge. The other challenge involves plug-in electric cars and trucks where federal procurement has been miniscule because agencies have largely focused on the higher first cost rather than the lower life-cycle costs typical of these vehicles. There are a number of steps the administration and Congress can take to address these problems. Among these are to ensure that the federal government does a better job of accounting for the full life-cycle cost of vehicle acquisitions, that it takes advantage of innovative financing mechanisms to cut the up-front cost of AFVs, and that the U.S. Postal Service use its current need to replace its 180,000 light-duty vehicle fleet to maximize the deployment of AFVs.

h. Increase Funding for DOE's Federal Energy Management Program

DOE's Federal Energy Management Program (FEMP) has played a key role since the 1970s in advancing progress in energy management across all federal agencies. FEMP plays a leadership role with respect to energy goals set out in multiple pieces of federal legislation and executive orders. It is positioned within EERE to coordinate technologies, policies, and expertise from multiple other DOE offices and a range of federal programs. The bipartisan SEAB task force felt strongly that the administration should seek significant increases over time in FEMP's budget. The task force said: "Based on discussions with FEMP officials there are priority funding areas...involving the Federal Energy Efficiency Fund, Technology Demonstration and Validation Efforts, Metering Acceleration, Data Management, Federal Utility Bill Management, and Cybersecurity." There are a number of other areas discussed in the SEAB task force report where additional funding would advance key federal energy management goals.

The FY2016 FEMP budget was $27 million. The Obama administration requested $43 million for FY17; the enacted level was $27 million. The Trump administration unfortunately headed in the opposite direction from the SEAB recommendation, requesting just $10 million in FY18. The administration should increase rather than cut FEMP's budget, given the program's important responsibilities and ability to help mine savings from the federal government's $23 billion taxpayer-funded energy bill and otherwise make the government a leader in the energy arena.

8. The Secretary of Energy Advisory Board

The Secretary of Energy Advisory Board (SEAB) "provides advice and recommendations to the Secretary of Energy on the Department's basic and applied research and development activities, economic and national security policy, educational issues, operational issues and any other activities and operations of the Department of Energy as the Secretary may direct."[60]

The SEAB was active under Secretary Moniz, producing reports and advising the Secretary on a range of matters, from technology development for environmental management, next generation high-performance computing, and nuclear non-proliferation to federal energy management, the DOE

[60] https://www.energy.gov/seab/secretary-energy-advisory-board

national laboratories (especially the NNSA weapons laboratories), the future of nuclear power, and methane hydrates. Each report, after submission, was formally assessed by DOE staff and both documents posted on the DOE SEAB website.[61]

Over the years, SEAB reports have figured prominently in major DOE management decisions, budget requests, research priorities, policy recommendations, and beyond. I have served on the SEAB since 2013 and was also involved with the SEAB under the three Clinton administration energy secretaries for whom I served.

To date, Secretary Perry has not appointed a new SEAB. This is unfortunate given the range of complex and controversial issues DOE currently faces. As John Deutch, recent SEAB chair — whose DOE experience extends back to the Carter administration — said in December: "SEAB has proven useful to most DOE secretaries and senior officers since the agency was founded. It is an independent group of experts that offer constructive advice and carry the Department's message when requested to Congress and to the public." I strongly recommend that a reconstituted SEAB be activated early in 2018.

[61] https://energy.gov/seab/listings/seab-reports

Summary of Testimony – Dan W. Reicher – House E&C – Energy Subcommittee – 1/9/18 Hearing

DOE, under the Trump administration, is heading in a problematic direction when it comes to the Department's mission to advance the innovation, development, and deployment of U.S. clean energy technology. The administration has sought unprecedented reductions in the budgets for DOE's applied energy offices: EERE, fossil, nuclear, and electricity. It has proposed to eliminate critical allied functions, like the Loan Programs Office, ARPA-e, the State Energy Program, and the Weatherization Assistance Program. It has begun to put the brakes on energy efficiency standard-setting for appliances. And it has reduced important input into the Department's programs and operations by, for example, failing to activate the Secretary of Energy Advisory Board. DOE continues to make progress in critical areas and federal staff capabilities and national laboratory expertise remain strong. But I am concerned that this progress is slowing as important programs, key personnel, long-standing advisory functions, and related funding are hollowed out.

These challenges come at a moment when two fundamental global trends are accelerating: first, world-wide investment in clean energy is growing rapidly and, second, an unprecedented global race has broken out for dominance in this massive energy market. Among the competitors, the Chinese have a well-organized plan to dominate the energy technology industry, with all of its associated economic, security and environmental benefits. This is a moment when we should be strengthening not weakening the successful and long-standing industry-government partnership in clean energy technology so that five years from now we don't look back regretfully at the loss of U.S. leadership in this critical area. I will focus on eight issues reflecting my current work:

1. **Funding for the DOE Office of Energy Efficiency and Renewable Energy:** Congress should resist DOE's proposed 69% cut in FY18 funding for DOE's Office of Energy Efficiency and Renewable Energy (EERE) and should urge the administration to propose robust funding in FY19. In a June 2017 letter from all seven former EERE Assistant Secretaries we emphasized that cuts of this magnitude in the FY18 budget would do serious harm to this office's critical work. Worldwide investment in clean energy now measures about $750 billion annually. Governments across the globe — and companies large and small — want a piece of this massive and growing economic pie, representing tens of trillions of dollars over the next three decades and millions of jobs. China, in particular, has made it a high priority to lead the global clean energy industry and, to this end, is reorganizing its R&D and deployment and redoubling its efforts in an array of clean energy technologies, many of them developed in the U.S. at taxpayer expense. This is the moment for the U.S. government to step up to, not back from, from this major opportunity.

2. **The DOE Loan Programs Office:** This committee should resist the pending rescission of funds by House and Senate appropriators that would effectively end the work of DOE's Loan Programs Office (LPO). LPO is carrying out its Congressionally-directed missions very capably, both helping to commercialize important energy and transportation technologies and managing the existing $36 billion investment portfolio successfully. In a January 4 letter to this committee, 17 companies wrote that the "LPO represents the best and often only way to cross the barrier from developing innovative technologies to deploying those technologies commercially here in the U.S. and ultimately for export." LPO has $41 billion in remaining loan-making capacity that would be a substantial down payment on the energy portion of the trillion-dollar infrastructure program that Congress may soon take up. This capacity is one of the cheapest and quickest ways for the federal government to build important infrastructure, compared with other options. The LPO has already backed energy and transportation infrastructure projects involving transmission, storage, nuclear technology, battery production, and engine manufacturing. Avoiding a full rescission of LPO funding — i.e. retaining previously appropriated balances to maintain a range of $100-$200 million to support "self-pay" authority — would give U.S. companies access to a meaningful portion of the $41 billion in LPO capacity.

3. **The DOE Appliance Standards Program:** This DOE program, first created by Congress in the 1970s, is among the nation's most cost-effective approaches to saving energy in homes and businesses. It has long enjoyed strong bipartisan support. Unfortunately, DOE's Fall 2017 Regulatory Agenda puts work on most new standards on hold and, if carried out, will likely put the Department in violation of a series of statutory deadlines. Also, DOE has initiated a process to revamp the standards-setting process. While any process can be improved, the energy efficiency standard-setting process, developed over multiple administrations, works well and generally results in a high level of consensus among industry and advocates and large public benefits. DOE has also left four standards completed in 2016 in regulatory limbo. This committee should ensure that DOE does not abdicate its important standard-setting obligations and any changes to the program should advance, not retard, its effectiveness and leave the program flexibility for further evolution.

4. **Federal Tax-Advantaged Finance Vehicles:** There has been a bipartisan effort over the last few years to open up long-standing Congressionally authorized investment vehicles — Master Limited Partnerships (MLPs), Private Activity Bonds (PABs), and Real Estate Investment Trusts (REITs) — to clean energy technologies. These vehicles are attractive because they are tax-advantaged — either eliminating the double taxation of common corporate investment structures or providing a full exemption from federal taxation. As such, they can provide lower-cost financing to clean energy project developers. The House should: adopt the bipartisan "MLP Parity Act" sponsored by Representatives Poe and Thompson; adopt the bipartisan Carbon Capture Improvement Act, focused on PABs, sponsored by Representatives Curbelo and Veasey; and, working with the IRS, should consider options to expand REIT eligibility for clean energy projects.

5. **Federal Support for Electricity Storage:** With the significant growth of solar and wind generation in recent years the need for electricity storage capacity has grown as well. However, large-scale electricity storage, with the exception of pumped hydro, is relatively immature technologically, and the costs of a number of promising options are high. As a result, gas turbines often are needed to fill the gap when solar and wind are not available. Congress and the administration should pursue a well-organized approach to stimulating cost-effective utility-scale and distributed storage, supported by R&D funding, grants, tax credits, loan guarantees, MLPs, and other tools. Unfortunately, the Trump administration has proposed a 61% cut in DOE energy storage-related R&D in its FY18 budget, versus FY17 levels. Congress should ensure adequate R&D funding and advance these other tools.

6. **The Federal Role in Carbon Capture and Storage:** CCS has broad application in cutting carbon emissions — from coal, natural gas, and biomass-fired power plants to industrial operations like oil refineries, ethanol facilities, steel production, cement plants, natural gas processing operations, and fertilizer production. While successfully operating in various industries, CCS has not yet been deployed at the scale or cost required for meaningful climate-related carbon controls. Over the past 20 years, DOE has relied on a variety of federal support mechanisms and incentives — R&D funding, grants, federal tax credits, private activity bonds and loan guarantees — to advance CCS and has made good progress. The House should resist the Trump administration's proposed 85% cut in DOE's FY18 CCS R&D funding. It should also adopt pending legislation that would: improve the current CCS 45Q tax credit; provide access to MLP and PAB financing for carbon capture projects; and protect the DOE loan program from a pending rescission of funds.

7. **Federal Energy Management:** The U.S. government is the single largest energy user in the nation with an energy bill to taxpayers exceeding $23 billion. The federal government owns 350,000 buildings, more than a quarter of all U.S. land, tens of thousands of miles of transmission lines, and 400,000 non-tactical vehicles. There are a number of actions that could cut the federal government's own energy use and expand its deployment of clean energy. They are analyzed in a September 2016 report by a task force of DOE's Secretary of Energy Advisory Board that I co-chaired with former U.S. Representative Ellen Tauscher, with assistance from DOE's Federal Energy Management Program (FEMP). These actions include, for example: increasing and improving the use of Energy Savings Performance Contracts; reducing the federal real estate footprint; improving federal procurement of renewable energy; expanding clean energy development on federal lands; accelerating federal procurement of alternative fuel vehicles; increasing the role of federal Power Marketing Administrations in meeting federal energy goals; supporting DOD and GSA energy technology test beds; and increasing funding for FEMP. Regarding the last action, Congress should resist the Trump administration's proposal to cut FEMP FY18 funding by 63%.

8. **The Secretary of Energy Advisory Board:** The Secretary of Energy Advisory Board (SEAB) has provided valuable advice to multiple secretaries for decades. The SEAB was active under DOE Secretary Moniz, producing reports and advising the Secretary on a range of matters, from technology development for environmental management, next generation high-performance computing, and nuclear non-proliferation to federal energy management, the DOE national laboratories (especially the NNSA weapons laboratories), the future of nuclear power, and methane hydrates. Secretary Perry has not activated the SEAB. This committee should encourage him to do so to improve input into the Department's programs and operations.

Mr. UPTON. Thank you.
Mr. Powell.

STATEMENT OF RICH POWELL

Mr. POWELL. Good afternoon, Chairman Upton, Ranking Member Rush, and other committee members. My name is Rich Powell, executive director of the ClearPath Foundation.

ClearPath develops conservative policies that accelerate clean energy deployment. We advocate for innovation over regulation, educating policymakers and conducting and supporting independent policy analysis. A note, we receive no funding from industry.

I appreciate the opportunity to address the subcommittee on DOE modernization. Refocusing the Department's key research and development programs is crucial to securing American clean energy dominance internationally and facilitating a cleaner, more reliable, and affordable domestic energy supply.

Our Nation is rapidly approaching a crossroads. Coal makes up a third of American power production, and the average plant will likely retire by 2030. Half of U.S. nuclear plants could close by 2040. Refurbishing or replacing these facilities presents a once in a century opportunity to develop domestic advanced industries.

Meanwhile, global energy demand is projected to grow by 28 percent by 2040. The market in India alone is estimated at $2.7 trillion. A homegrown, U.S. advanced energy economy can seize this opportunity. If our Nation does not rise to that challenge, we run the risk of falling behind. In fact, we already are.

China, in particular, is already outflanking us on next generation technology. It is bringing an advanced nuclear reactor online this year at a time when the U.S. is struggling just to keep its existing fleet afloat and doesn't even have a fast test reactor available for American entrepreneurs to test new designs. China is already the global leader in solar manufacturing and superefficient coal technology and is rapidly advancing in batteries and electric vehicles.

The best way for America to outcompete in future energy markets is to develop increasingly advanced technologies that can best rival offerings, as we did with the fracking revolution for our shale resources. We may not be able to beat China with cranes and concrete, but we can win in high-skilled manufacturing of carbon capturing fuel cells, printable solar panels, and modular advanced reactors.

But these breakthroughs do not happen overnight. Hydraulic fracturing and today's solar and wood technologies took decades and significant investment from both private and public sources before their widespread deployment.

The private sector is often ill-positioned to pioneer new and capital-intensive technologies alone. DOE must remain central to America's clean energy innovation dominance, linking academic research and commercial products. Too often, however, we think of DOE's R&D role in terms of research capabilities or dollars spent, rather than delivering disruptive new technologies to solve particular problems or address market challenges. Spending more with a business-as-usual approach will not win the global energy innovation race.

The Department should reorient itself toward moonshot technology goals that empower industry to tackle the challenges of breakthrough technologies. Clearly articulated, longterm research priorities could insulate critical RD&D efforts from changing political winds. Used appropriately, they would leverage limited Federal resources towards the most important priorities.

Big goals at DOE have worked before. The 2011 SunShot Initiative aligned secretary-level resources to reduce the cost of solar power by 75 percent within 10 years. Last year, DOE reached the goal ahead of schedule. More such goals are needed. For example, an advanced nuclear MoonShot could implement Secretary Perry's call for an increased emphasis on the development of new nuclear technologies.

For ambitious technology development goals to succeed, the Department should implement a few systematic reforms. First, DOE should adopt more private sector management practices. Major Moonshots and interim subgoals could provide yardsticks to evaluate progress. If specific bets don't meet milestones, dollars should be redirected; a practice common today at ARPA-E.

Second, a soup-to-nuts approach to energy research is needed, especially for capital intensive technologies such as carbon capture and advanced nuclear. Striking a balance of supporting demonstration while avoiding market interference is a delicate one, but is necessary to maintain international competitiveness. Prematurely ending private-public research projects raises the risks that our rivals will commercialize them instead.

China has no philosophical objection to funding applied science. They are happy to take American basic research and add applied dollars to demonstrate and commercialize them, reaping the benefits of our creations.

In conclusion, America has an opportunity to lead the global market for clean, reliable, and affordable energy. But without a more focused and nimble government partner, American entrepreneurs are likely to lose the clean energy race. A recommitment to leading global energy innovation would not only improve our geopolitical position, it would reduce emissions and maintain low consumer prices, while seizing a multitrillion dollar opportunity.

ClearPath applauds the committee for taking on this important and overdue task and stands ready to assist its legislative efforts. Thank you again for the opportunity to provide remarks.

[The prepared statement of Mr. Powell follows:]

Testimony of Richard J. Powell
Executive Director, ClearPath Foundation
House Energy and Commerce Subcommittee on Energy
January 9, 2018

Good afternoon Chairman Upton, Ranking Member Rush and other members of the committee. My name is Rich Powell, and I am the Executive Director of the ClearPath Foundation. ClearPath is a 501(c)3 organization focused on conservative policies that accelerate clean energy deployment in the power sector. We support solutions that advance the wide array of baseload clean energy technologies - including next-generation nuclear, hydropower, cleaner fossil fuel technologies and grid-scale storage solutions that improve grid efficiency, including the integration of additional renewable sources such as wind and solar. Our core mission advocates markets over mandates and bolstering technological innovation rather than implementing stifling regulation. ClearPath provides education and analysis to policymakers, collaborates with relevant industry partners to inform our independent research and policy development, and supports mission-aligned grantees. An important note: we receive zero funding from industry.

Staying Ahead of the Curve

I commend Chairman Upton for kicking off the first of a series of hearings focused on Department of Energy (DOE) reforms that ensure the effective execution of its core national, economic and energy security missions. Reauthorizing and modernizing key research, development, and demonstration (RD&D) programs is essential to securing our nation's role as a global technology innovation leader while facilitating a cleaner, more reliable, and affordable domestic electricity supply for the American public.

As Secretary Perry noted to the Subcommittee last October: "America is at the beginning of an energy renaissance." Domestic oil, natural gas and solar energy production are at record highs, while improvements in efficiency allow us to do more with less energy. As a result, North American energy prices are historically low and may stay that way for the foreseeable future. This era of abundance must not make us complacent. Staying ahead of the curve and reinventing energy systems is slower than turning a supertanker, requiring a decade or more of lead time for cutting-edge technologies to mature. Hydraulic fracturing, as well as today's solar and wind technologies, took several decades and significant investment from both private and public sources before widespread commercial deployment. It is essential that our nation capitalize on this era of abundance and invest in the technologies needed to meet the electricity needs of tomorrow.

America is rapidly approaching a crossroads. While coal makes up a third of American power production, the average plant will reach retirement age by 2030. Replacing or refurbishing these

plants presents a once-in-a-century opportunity to deploy advanced energy technologies and build new domestic supply chains.

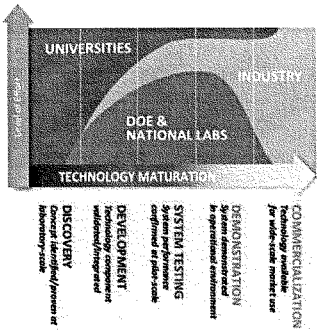
Global energy demand is expected to grow 28% by 2040. This market in India alone is valued at $2.7 trillion by 2040. A homegrown U.S. advanced energy economy can shape and even lead such a market, furthering our energy security, geopolitical influence and economic opportunities abroad. If our nation does not rise to that challenge, we run the risk of falling behind. In fact, we already are.

China is seizing the opportunity and outflanking us. It's attracting advanced nuclear talent, bringing two high temperature gas reactors online early this year, at least half a decade before even our most ambitious plans. China is already the global leader in solar manufacturing, a technology American entrepreneurs invented in partnership with the Department of Energy. China is deploying the most efficient coal plants in the world. And the future bounty under development and early deployment in China is of even greater significance, including ultra-cheap good scale batteries and cutting edge nuclear reactors.

DOE's Critical Role In America's Innovation Engine

The Department of Energy and its 17 national laboratories, partnered with the nation's premiere research universities and facilities, constitute the most comprehensive energy research and development network in the world. As the largest funder of physical sciences research in the United States, it has spurred many technological advances of the modern energy era - engineering, materials science, computing, physics, health sciences and more. The Department, labs and their predecessors pioneered civilian nuclear energy, funded many of the core technologies used in fracking, and produced the first solar cell. The Department is a critical link between university research and commercial products. The private sector alone is often unwilling to assume the risk of pioneering new and capital-intensive technologies, especially in the heavily regulated and risk-averse power sector. Many power companies are regulated and most are structurally discouraged from buying first-of-a-kind technologies.

Figure 2-2: DOE National Laboratories' Relationship to Universities and Industry in the Energy Innovation System



Source: Annual Report on the Status of the National Labs

It is our belief at ClearPath that the Department must modernize if our nation is to export technologies of the future to meet the world's rapidly growing energy appetite. America's specialty is in cutting-edge technology development and manufacturing, not in mass-production of commodity goods.

To that end, the best way for the United States to play a role in meeting future energy demand is to develop increasingly advanced technologies that can outcompete rival nations. We may not be able to beat China with cranes and concrete, but we can in building printable solar panels, modular nuclear plants, carbon capturing fuel cells and other energy tools of tomorrow.

Therefore, a strong commitment to energy innovation and a modern DOE is essential for: (1) improving the nation's geopolitical position as foreign competitors, such as China and Russia, invest in advanced energy research, development and demonstration (RD&D) concepts; (2) enhancing American energy independence with more clean, reliable and affordable generation technologies; and (3) seizing a multi-trillion dollar economic development opportunity that will revitalize domestic manufacturing and create thousands of high-paying jobs.

We can and should aim for clean, reliable and affordable U.S. energy dominance.

But simply spending more taxpayer dollars with a "business as usual" approach will not achieve these goals. While funding is a critical component, collaboration with the private sector must be improved to make innovations more readily transferable to industry and able to thrive in international markets.

The last major overhaul to our national energy strategy was the Energy Policy Act of 2005 and many aspects of power generation have greatly changed since then. Modern market realities such as low-cost natural gas, the declining cost of wind and solar technology and greater competition in clean energy technology from China should prompt a reconsideration of the Department's R&D priorities.

In addition to adapting to the current market environment, DOE can maintain our domestic competitive advantages with long-term research priorities rooted in nonpolitical market and technology projections. Science and research should be nonpartisan enterprises, operating on longer terms than year-to-year appropriation bills or four-year election cycles.

The Need for DOE "MoonShot" Energy Technology Goals

Too often, we think of DOE's role in terms of capabilities, or dollars spent on priority topics. We rarely ask what outcomes DOE is actually working towards. President Kennedy's original MoonShot concept, proven more than half a century ago, has withstood the test of time. DOE has found success at times emulating the MoonShot model, with clearly articulated goals aligning all the management and funding of the Department from the Secretary's desk to the scientists bench. Unfortunately, the concept has only been sparingly used. The last administration provided a noteworthy, but narrowly implemented blueprint with its 2011 SunShot Initiative. It aligned secretary-level, interdisciplinary resources on reducing the cost of solar power by 75% within 10 years. Last year, the Department reached its goal years ahead of schedule. More federal energy innovation goals are needed to maximize the commercial impact of DOE's vast capabilities and resources.

Clearly articulated, long-term research priorities would insulate critical RD&D efforts from changing political whims. Ambitious technology development goals provide a way for the Department to avoid micromanaging the day-to-day operations of national labs and universities while preserving clear guidance. Critical parts of the DOE research portfolio, including nuclear energy and energy storage, lack systematized goals with high level buy in and adequate resources. Establishing more technology-inclusive goals would leverage limited federal dollars and resources to drive down cost and bring breakthrough technologies to the marketplace.

Secretary Perry has recently called for an increased emphasis on the development of advanced reactor technologies, including small modular reactors, stating they should play an important role in the American clean energy portfolio while presenting unique export opportunities. This is just one area that a MoonShot approach could be applied. A public-private advanced nuclear energy research initiative focused on tackling key performance challenges could demonstrate breakthrough reactors and have significant market opportunities.

Co-develop the Goals with Industry
Where applicable, the DOE should work closely with the private sector to meet mutual goals. This includes ensuring no undue regulatory burden on energy technology companies, utilizing funding opportunities for the private sector where appropriate, and partnering with private entities to develop technologies under larger MoonShot goals.

Adopt Private-Sector Management Practices
Relevant funding and management decisions should also be recalibrated around these MoonShot goals. Major "MoonShots" and corresponding subgoals should be used as a yardstick to evaluate the progress within research portfolios. Emulating the private sector, if specific technologies do not realize expected milestones or show progress, support should be reduced or cut and directed to more promising areas. This stands in contrast with the common practice of short-term research initiatives for "flavor of the month" technologies pushed by political appointees, as well as continuing research projects that are not bearing fruit. Additionally, the Department should be empowered to make the necessary human resource decisions for success, such as the ability to offer more competitive wages and terminate employees that do not meet expectations.

Maximize Private-sector Coordination
The DOE should look to prove business models with the private sector. One pragmatic solution is the Innovative Pathways funding program, which optimizes new private-sector financing mechanisms for energy innovation and commercialization. In some cases such as in finance, the private-sector is far better equipped to deliver on the goals of the Department than universities or national labs.

Finally, it is also crucial that the DOE works closely with the private sector to realize the completion of its technology MoonShots. Prematurely ending government support raises the risk that our rivals will commercialize them instead. For example, China has become the global leader in solar and lithium-ion manufacturing, and it is rapidly cementing its leadership role in nuclear plant construction. They have no philosophical objection to funding applied research, and are happy to take the fruits of American basic research and add applied dollars to demonstrate and commercialize them, thus reaping the benefits. A soup-to-nuts approach to energy research is needed - especially for capital intensive projects such as advanced nuclear and carbon capture projects. These sentiments have been echoed by diverse industry stakeholders, including the National Coal Council, the Carbon Utilization Research Council and NuScale Power. Striking a balance of appropriately supporting successful technology demonstration while avoiding market interference is a delicate one, but is necessary to maintain international competitiveness.

Concluding Remarks

The Department needs to be more flexible in operation, without sacrificing accountability. The national laboratories have been prone to 'research drift' without an explicit national energy policy. Goals allow flexibility at the labs while ensuring accountability.

America has an opportunity to lead the global market for clean, safe, affordable and reliable electricity generation. Without a more focused and nimble government partner, American entrepreneurs are likely to lose the clean energy race to other geopolitical powers such as China, squandering an immense economic opportunity. An innovation-centric energy strategy would allow America to cut its own emissions far more cheaply than regulatory hammers, such as the "top down" Obama Administration approach, while creating rather than strangling American entrepreneurs and export opportunities.

Thank you again for the opportunity to provide remarks. ClearPath is eager to assist the Committee in providing ideas for updating the outdated programs and existing authorizations in current law around the new Moonshot energy technology goals outlined above. We applaud the Committee for taking on this important and overdue task to help ensure the Department of Energy has the relevant statutory authorities it needs to modernize and facilitate the research, development, and demonstration of cutting-edge energy technologies.

Mr. UPTON. Well, thank you all for your testimony. I know it has been a long hearing, and you were here promptly when the gavel came down at 10 o'clock. I have a couple of questions, as I know the members do here.

Dr. Wasserman, I was pleased to hear you talking about some very positive things, particularly relating to what Lilly has been doing and the funding to offset some of the buying power for new drugs and devices. As you know, this committee passed, every one of us, passed on a 51 to nothing vote in the last Congress, 21st Century Cures, which accelerates breakthrough drugs to address disease. We worked hard to make sure that there were the appropriate offsets for more funding for the NIH and other resources.

Have you at all looked at what we did as it relates to the advancement of new technologies in the medical side?

Mr. WASSERMAN. Only slightly, Chairman. As we look at new technologies, as a company, we are always looking for ways to improve our goal of getting medicines to the patients who need them as soon as possible. So the things that the government has done to foster that, including our use of the facilities, developing other new technologies, leveraging the things that both that NIH and DOE have created for us to improve our efficiency in the laboratory.

As you know, it is a long slog to get a drug to market. And, for example, the experiments that I mentioned today on breast cancer were done, I think, 7 years ago, and the approval came down. But, again, we know it is difficult to get a drug to market, and every advantage that we can come up with sponsored by the government or with the own initiative within the industry.

Mr. UPTON. We worked very closely with Dr. O'Neese, particularly as it related to the DOE user facilities as part of that legislation. He was a very constructive partner as we worked together.

Dr. Zacharia, you have watched our committee's action and you know that we have been very involved in cybersecurity. And I guess the question that I have for you is, what do you see as we try to avoid unnecessary duplication but still ensure breakthroughs in cyber defenses and response capabilities, in particular, in regard to advanced supercomputing capabilities to address those challenges?

Mr. ZACHARIA. Chairman Upton, thank you very much. So cybersecurity clearly is a challenge for a system like ours or a society like ours because the adversary only has to succeed once, whereas we have to be 100 percent foolproof. And so the approach that we have taken working with the Department is to make sure that the cost of penetrating critical assets is increasingly higher. So just like if your own home, the higher the walls, gates, et cetera, the alarm systems, it forces the people to go look elsewhere. And so cybersecurity, broadly speaking, is focused on new tools and technologies and software solutions, building on the computing capabilities that we have, the supercomputing capabilities that we have. But also within the DOE space, we also focus on the cyber physical systems where you are also not just focused on the penetration of computing and information technology, but really the gateway into grid and energy grid systems, which is a big challenge, as was noted in the previous panel.

And, Mr. Chairman, if I can just add one more comment about the question about the Cures Act, is that, as you—the DOE supercomputer systems are used effectively in working with a joint program between NCI and DOE and working with a private sector, in this particular case, GlaxoSmithKline, in developing a pilot project where the computing capability and the data analytics are being brought forward to look at much more targeted personalized medicine initiatives.

Mr. UPTON. Thank you.

Mr. Rush.

Mr. RUSH. Good morning. Thank you, Mr. Chairman.

Mr. Reicher, I am quite interested in your influent overall proposal—your influent program, but in general, I am interested in your whole thrust here, and I think you have been pretty specific, and that means a lot to this committee in terms of some of your recommendations. But I only have 5 minutes, so I want to zero in on the weatherization program and the EERE recommendations in general.

We are in the midst of extremely cold weather throughout the Nation, and has this weatherization program been effective, and has there been a return on the investment? I mean, what is the cost of the investment, in your opinion, into the weatherization program?

And, secondly, how will low income families be impacted if this program were completely phased out? And what would the effect be on local jobs if this program were to be phased out?

Mr. REICHER. Mr. Rush, the Weatherization Assistance Program has been a very successful program. More than 7 million homes have been weatherized around the United States to date. I think it is every $1 of Federal investment leverages between $4 and $5 of outside investment, so it is a good government leverage in that way. It comes at a moment when it is not only cold out, but we are seeing a pretty big increase in the cost of heating fuels, as oil prices increase, as natural gases prices increase. So it does a lot in that way. I think much of the review of that program, and I know Oak Ridge has done some of it, has been fairly positive about the program, to date.

And there is some great job production in this program. It really puts local people to work going in and, first, measuring what is leaking in a house, and secondly, blowing in insulation and fixing windows. So it has got all the right hallmarks. So I really, really hope that we don't see the elimination of this program. It has been supported for decades. Forty years anniversary, I think, was last year. So I am a big fan.

Mr. RUSH. From your previous work at Argonne, can you speak to some of the innovative works that have taken place in the energy storage field? This is for Dr. Levy, I am sorry.

Dr. Levy, you worked at Argonne. Can you share any insight into some of the most promising potential breakthroughs in the beyond lithium program? What are some of the possibilities that can help move us forward into the future in regards to storing energy and developing a more resilient and efficient 21st century electricity grid?

Mr. LEVY. Thank you, Mr. Rush. First of all, I must confess, I have been away from Argonne for 2 years, and I am a couple of years out of date. And I think in the battery business, that is an important 2 years.

They were having very promising results in improving storage, and of course, that is important for two reasons. It is important in order to use intermittent sources of energy. It is also important for all sorts of other applications. So there is nothing but gain to be had there.

I think the best I can offer you in terms of specifics is to get back to you after talking to some of the people at Argonne.

Mr. RUSH. OK. Mr. Chairman, I yield back.

Mr. UPTON. Mr. Shimkus.

Mr. SHIMKUS. Thank you, Mr. Chairman. And I appreciate you all being here.

What the intent of what I think the administration is trying to do is, and what we are trying to do, is look at the Department of Energy after 40 years, and how do you update it? How do you modernize it? How do you make it efficient? And really how do you tell the story? I think part of the problem is the public really doesn't know the story, and that is part of our challenge too.

I have been to Argonne and I have been to Oak Ridge, but those are special trips that people have to make. And if you are not a member from that area, then you just don't get there. So we have got great scientists, they work real hard.

And then the other part is, you know, Members of Congress easily can go back to why did we create the Department of Energy? And if you go back to the history, remember, it was the energy crisis of the 1970s, which some of us were a lot younger then. And then we get to Congress and we still have an energy crisis.

So the creation of the Department of Energy in the 1970s didn't solve the crisis. And I would argue that it is individual investment. And right now, it is the fracking technology that really has transformed this whole world's view now, not just within the continental United States, but really the international energy markets. I also do a lot in eastern European freedom issues, so the energy extortion by the Russians is real.

So that is kind of the intro into my questions. I want to go to Ms. Ladislaw first in addressing the SPRO. I was a big SPRO supporter when we were importing a lot of crude oil, and we are, but we are also exporting. So we are having that debate, right, $2 million to modernize it, and then what, right? I have been quoted as saying, "I am not even sure why that should be part of our portfolio anymore." I think in your statement you disagree with that, and I would ask why.

Ms. LADISLAW. Thanks very much for the question and for your interest in the Strategic Petroleum Reserve. I find you are right, a lot of people don't know about its existence in addition to all the things that the Department of Energy has done over the years. I was not around the Department's creation. I have worked with——

Mr. SHIMKUS. Let's go to someone else then. No.

Ms. LADISLAW. I have worked with people that were, though. And what I find really interesting is that, as we remember it, the Department was created during a time of crisis, and we thought it

was going to get much worse. And a lot of it had to do with deregulating our domestic environment and making a whole suite of challenges and deciding that we were going to commit to this internationally connected and efficient market for oil and gas and things like that. And we have pursued that for 40 years. And I actually think that the Department and the United States should take a lot of credit for that system that we have created. It is what is going to allow us to sell a lot of the oil and gas resources that we have in a free and open market, and I think that is a huge advantage.

Mr. SHIMKUS. Let me just go ahead, real quick, because I am running out of time.

Ms. LADISLAW. I was just going to say, I think that the reality, though, is that we have, as forecasters, been wrong, time and time again over that 40-year period about near-term market changes, whether we are going to have enough resources or not have enough resources. And a lot of that has to do with situational type of things that we couldn't foresee, like Hurricanes Katrina and Rita and things like that.

Mr. SHIMKUS. Just because I want to be respectful of my colleagues' time. So, we have got the Bakken now and we have got the Pennsylvania shale, we have got, obviously the oil sands, we have got Keystone, and hopefully eventually we will get Keystone XL Pipeline. And we now, after much consternation, export crude oil, which I think has been a huge benefit. It has been a benefit for our identification location recovery, keeping the prices at a place where we still have people looking in the continental United States, and so I think that has been a net plus for the country and for jobs and the economy.

I get from your testimony, and correct me if I am wrong. I think that is true for LNG too. And I would like to hear your comments on that. Do you believe that that would be the same type of response if we were more active in LNG exports?

Ms. LADISLAW. Sure. I think LNG exports are certainly good for the U.S. economy.

Mr. SHIMKUS. OK. Great.

Mr. Chairman, that is all I have. I yield back.

Mr. UPTON. Ms. Castor.

Ms. CASTOR. Thank you, Mr. Chairman. Thank you to all the witnesses for your very interesting testimony.

I have to say, Mr. Reicher, I share your concern that the Trump administration's policies they are putting forth in the beginning of the administration appear to want to hollow out our Department of Energy, and that would be to the detriment of this great country. At this time, it just doesn't seem like the way they are thinking matches the challenges that we face and takes advantage of all of the fantastic technological advances and natural gas revolution, and as Ms. Ladislaw said, the energy abundance that we have at this point.

You, Mr. Reicher, pointed to the drastic cuts in clean energy, the electric grid operations, the next generation energy technology. You pointed to the inexplicable back peddling on energy efficiency standards for household appliances. But you have particular expertise as the former assistant secretary for EERE. Will you explain the consequences of such drastic diminishment of energy efficiency

and renewable energy under what the Trump administration has put forward?

Mr. REICHER. So I think it hurts us in a variety of ways. I think it hurts us in terms of people's pocketbooks, if we really do pull back, if we don't take advantage of the savings that we can achieve, if we don't take advantage of a variety of other things, weatherizing people's homes. So I think it hits there.

It obviously hits from an environmental standpoint. We have made a lot of progress in cutting carbon emissions, both because of the rise of natural gas, but also because of the deployment of a variety of renewables. It definitely hits us in terms of our competitiveness. And I will have to tell you, I am very worried about what we are doing.

We published a major report at Stanford that actually DOE funded, looking at the Chinese solar industry and how it is that it has gotten so very strong. And it has gotten so very strong because there is a highly organized effort in China, industry and government, in each of these major energy technology categories to begin to, essentially, own these energy industries. They now make 70 percent of the world's solar panels. And it is not just cheap manufacturing, it is also now R&D.

The Chinese are getting very good at solar R&D. They are getting very good at nuclear R&D. They are getting very good in carbon capture, in transmission. And I really worry that, from a competitiveness standpoint, we're going to really hurt ourselves. And it is, in fact, this industry government partnership that has been active for the last 40-50 years that has really kept us in the ball game.

And, lastly, I will say, much of what China is moving forward with was technology invented in the United States, and a lot of that at government expense, taxpayer expense. So I really think we need to think from a competitiveness standpoint where we are headed.

Ms. CASTOR. And your point is not lost on me on how much it is costing the rise in carbon pollution because I come from the State of Florida, and I think the insurance industry earlier yesterday or at the end of last week released the totals for the damages from hurricanes. Now, the direct link isn't there, but what the consensus is that these extreme weather events are intensified because of higher carbon levels. We have the best scientists in the world and we have the technological edge, why would we cede that to China?

Ms. Ladislaw, you also highlighted the importance of energy efficiency. You said it is important to the economy and it pays great dividends for security. Could you expand on your concerns about receding in America's leadership on energy efficiency and renewables?

Ms. LADISLAW. Sure. Working for a security organization, I think people think, in particular at this time of abundance, that the way that you are secure is you have more, right? If you just have more, then you are thereby secure.

I think the original sort of mandate for the Department of Energy was to use less and produce more, more in variety and more in quantity, and that use less piece has been huge. The Alliance

to Save Energy has remarkable figures that I included in my testimony about how much the U.S. has saved. And I think that what we are finding now is, around the world, developing countries that don't want to develop along the same lines that the United States did, want to benefit from purchasing those technologies or making those technologies themselves. It is a very competitive marketplace out there for additional energy efficiency.

And we shouldn't forget that part of the reason why the United States has enough oil to export today is not just because we produce it, but it is because we use so much less of it than we thought we were going to. And so I think that energy efficiency just struggles from being one of those untold stories with really big strategic advantages both today and that we can pay forward to the future as well.

Ms. CASTOR. Thank you. I yield back.

Mr. UPTON. Mr. Flores.

Mr. FLORES. Thank you, Mr. Chairman. I also thank the panel for joining us today. It has been enlightening testimony.

Mr. Powell, you and I both agree that as Congress looks to allocate scarce resources, that investment in basic research has great value in terms of translating into the seed corn of future economic opportunity.

In that regard, I was enthused by your talk about setting Moon-Shot approach. Can you expand on how setting technology moonshots can ensure the efficient use of taxpayer dollars versus the status quo?

Mr. POWELL. Sure. Thanks very much for the question. So I think we should remember that the sort of energy miracle of this past decade, the shale gas revolution, was heavily influenced by research conducted at the Department of Energy, on hydraulic fracturing, horizontal drilling, diamond-headed drill bits. It is very possible the shale gas revolution would not have occurred without that research at DOE in partnership with private industry.

And so the question is, how do we produce more of those miracle technologies? In our view, it is very hard to get somewhere if you don't know where you are going. And so one first step is simply to establish the sorts of performance benchmarks that we are looking for, for new sort of miracle technologies. So what does an advanced reactor look like that would actually be right for today's energy market. So smaller, more modular to build, probably a much lower cost point for energy. And then aligning resources at DOE to overcome bottlenecks to achieve a goal like that.

Again, in the SunShot Initiative, they put a very aggressive time-based, cost-based goal out there. They broke down every part of the cost of grid scale solar systems, and they subjected each of those parts of the costs to very rigorous research and analysis and found ways to overcome them, and then helped rapidly bring them down.

So we think that this kind of approach could be applied to advanced carbon capture technologies, grid scale storage, advanced nuclear, certainly in the transportation space, and certainly in the industrial emissions space as well.

Mr. FLORES. That takes me to the second part of my question. You said that ClearPath engages collaboratively with outside organizations, businesses, and think tanks about the future of energy

in this country. And in that regard, can you share with us any insights you have as to examples of moonshots that Congress and the DOE should be considering——

Mr. POWELL. Sure.

Mr. FLORES. When it comes to the energy space?

Mr. POWELL. Well, I think one that is low-hanging fruit is grid scale storage. So we have talked a lot across this hearing about grid scale storage today. The nice thing about grid scale storage is actually you have a lot of dollars, a lot of bang for the buck in expanding. So if we were to set a goal of, say, grid scale storage systems at less than $100 per megawatt hour, that would be a disruptive change. Right? It would greatly improve the ability for grid scale storage to compete with peaker power plants. It would also be very good for the further expansion of solar and wind technologies.

And to accomplish a goal like that might only be incremental 10 of millions of dollars in appropriations in a year. But it is simply having that focus and increasing that level of ambition.

Mr. FLORES. What is another example? You and I have talked about advanced nuclear in the past.

Mr. POWELL. Yes. Certainly, advanced nuclear. So if we were to set a goal, a very ambitious performance-based goal to say, empower the private sector to demonstrate four advanced nuclear reactors within a decade, we are actually on track with a number of our programs already, like the Advanced Reactor Concepts Program, that is working with two advanced reactor developers right now, X-energy and the Southern-TerraPower collaboration on Molten Chloride Fast Reactor.

So we have a new scale power as well that could certainly qualify for something like that. So we have a number of horses already in the race, and this would encourage us to get more advanced reactor developers into collaboration with DOE and hopefully get four of those demonstrated.

Mr. FLORES. Thank you. Ms. Ladislaw, as you discussed in your testimony, and as many of us on this panel know, the change in the U.S. energy profile has really had huge geopolitical impacts. And the State Department's primary mission is diplomacy, but the Department of Energy has a critical role there to play as well, whether it is to authorize exports or provide technical assistance on trade energy flows. In your view, what should Congress do to support the Department of Energy's international affairs mission, in 30 seconds or less?

Ms. LADISLAW. Thanks very much for your question.

I think, first and foremost, it is really important to recognize the work that the Department is doing, both in science and technology and on policy evaluation in an international affairs realm. So the Department of Energy Bureau is a wonderful department, and I fully support that as well. I think that sometimes it leads to an either/or; should it be at the State Department or at the Department of Energy, they should be complements to each other. There is enough to analyze and act on out there that they should be able to be both very robust and complementary offices.

Mr. FLORES. OK. Again, I thank the panel for their testimony.

I yield back the balance of my time.

Mr. UPTON. Mr. Tonko.

Mr. TONKO. Thank you, Mr. Chairman.

Ms. Ladislaw, I really appreciated your written testimony. You highlighted the original congressional intent from the findings of the DOE Organization Act. I think it is clear that Congress intended for DOE's mission to evolve alongside our Nation's energy challenges. We need to face the issues of our time. In the 1970s, it was oil use and reliance on foreign oil. Today, we should be considering our Nation's current and future energy needs.

So, Ms. Ladislaw, in the spirit of DOE Organization Act, is support for renewable energy and energy efficiency R&D consistent with the original goals of the Department?

Ms. LADISLAW. I believe so.

Mr. TONKO. As I mentioned during the first panel, I think DOE's role in supporting innovation is essential. And based on everyone's testimony, it sounds like you would likely agree with that assessment. I think that, obviously, there is great opportunity for job growth with R&D and energy efficiency.

Dr. Zacharia, the Grid Modernization Lab Consortium is a great example of DOE working with public and private stakeholders and making significant R&D investments in order to solve energy challenges and make the U.S. a global leader. Integrating new technologies into our electricity system is one of the challenges to fostering a cleaner and more reliable grid.

Can you explain the role that national labs play in fulfilling DOE's mission, and how grid modernization fits into those priorities?

Mr. ZACHARIA. Thank you very much.

So the national labs clearly sit between academia industry in maturing important technology. In this area, the Grid Modernization Lab Consortium is a consortium of a number of laboratories. We work closely together. And as we deploy a number of intermittent sources, one of the key challenges is really being able to make sure that the grid is resilient and reliable. And the way we have done that is actually both in terms of doing research, but also working in partnership with industry. Let me give you an example.

Oak Ridge National Laboratory has worked very closely with electric power board in Chattanooga, which is a small city scale utility. And we worked very closely in deploying power electronics such that the grid system can be managed very effectively. And today, as a result of that, the citizens of Chattanooga, when a storm comes through, and they only see a blip because the grid is obviously be able to manage and work around that.

One of the challenges in doing that is that, as you make the system much more interconnected, there is also the concern about security. And so we are also working very closely with them to make sure that it is secure.

Mr. TONKO. Thank you.

And as I mentioned, DOE must address the energy issues of our times, along with grid modernization and the seamless integration of more clean energy resources into our energy mix. I believe DOE has a critical role to pay in one of the greatest environmental, economic, and national security challenges of our lifetime, that being climate change.

Does anyone on the panel wish to comment on the responsibility that the Department has in helping to develop climate solutions?

Mr. REICHER. Mr. Tonko, I think the Department has a great opportunity to develop climate solutions. It has been working on them for decades. And I think we are at a moment, though, where I think we have got to keep the pedal to the metal in terms of investment. And I say this with a very broad range of technologies in mind. It is everything from renewables and efficiency to nuclear to carbon capture, energy efficiency technology. We talk a lot about standards, but there is a lot that can be done.

So I think this is both a great opportunity. And I think if we are going to both succeed at addressing climate—but we are always going to profit as a country in addressing the climate problem, we have two very strong reasons we should be moving forward.

Mr. TONKO. Thank you.

And Ms. Ladislaw.

Ms. LADISLAW. I just wanted to second that last point of Dan's. I do think that it is a shortcoming of our political process that on one hand, we discount a bunch of fuels. On the other hand, we discount a bunch of fuels. There is a lot of benefit that can come to the U.S. economic system, to our national security, to all of our strategic objectives from leaning forward into some of the climate challenge issues. And I think that the Department would be well served in doing that.

Mr. TONKO. Thank you.

Mr. Reicher, I was struck by your comments about EERE and weatherization. And I think they do meet both social and economic goals being able to provide for sound-paying jobs and addressing a more energy friendly environment. I know that in upstate New York, a weatherization assistance program is critical. Some of the coldest weather that comes into upstate, and we just saw it, subzero for days in a row. It is some of the toughest, poorest areas of the state with lowest household income. And it is a social economic justice thing that we can advance. So thank you for your comments.

Mr. REICHER. I just want to say, I grew up in upstate New York. I not only know how cold it is, but I also know how snowy it is.

Mr. TONKO. Thank you. It has been both this year. So thank you very much.

And I yield back, Mr. Chair.

Mr. UPTON. Thank you.

Mr. Duncan.

Mr. DUNCAN. Thank you, Mr. Chairman.

I would like to take this opportunity to highlight some of the work the Clemson University is doing with their Duke Energy eGRID. I am proud to represent my alma mater, Clemson University, as it is in my district, and the research work they are doing at facilities all the across the State of South Carolina in partnership with other universities, funding agencies and industry partners is extremely impressive.

At Clemson's Restoration Institute in Charleston, South Carolina at Clemson has what may be considered the world's largest and most capable electric grid emulator called the Duke Energy eGRID. eGRID has the ability to dynamically model electrical power grid

conditions anywhere in the U.S. or the world. With this world class and unparalleled facility, Clemson's technical staff and students are making great advances in grid modernization and grid security through their work at eGRID.

The eGRID is a key enabler of testing half-hour devices that are critical components of the power grid infrastructure, such as extra high voltage transformers. Failure of components such as these transformers will likely cause widespread power outages, which can be very difficult to recover from due to lack of spares, logistics of moving them, and long lead times for their construction. Critical components like these transformers can be damaged from attacks such as EMPs, geomagnetic disturbances from solar activity and cyber attacks. Clemson has acquired one of these high voltage, high power transformers at eGRID further positioning Clemson with the unique capabilities.

Through R&D and testing of these critical components and systems, Clemson University's eGRID facility will be instrumental in modernizing and securing the U.S. grid. And I invite anyone on the committee that would love to go and see that drivetrain facility and eGRID facility in Charleston, it is worth the trip.

So, Mr. Powell, you mentioned in your testimony the importance of the DOE working with private sector to meet mutual goals. The Clemson-Duke Energy eGRID is a prime example of successful collaboration with the private sector to advance innovation by not solely depending on taxpayer dollars. Can you provide other examples of collaboration with the private sector to advance the goal of modernizing the DOE?

Mr. POWELL. Sure.

Well, the one that has been most consequential in the past decade, or the past two decades, was probably Mitchell Energy collaborating with the Office of Fossil Energy to develop shale technologies. That is probably the one that was the most and best known. I think another one that has been very, very successful has been the collaboration between NuScale Energy and the Department of Energy, particularly the Office of Nuclear Energy, in developing a small modular reactor technology. So that collaboration has now resulted in a successful filing for a license with the NRC.

Mr. DUNCAN. Do you see MSRs as a really viable nuclear energy alternative?

Mr. POWELL. Well, in the United States, we see smaller reactors as the only viable nuclear energy alternative——

Mr. DUNCAN. But at any given time, we have got 100 nuclear reactors floating around the seas of the world and the United States Navy without a single mishap. And I believe, and one that believes, that that SMR or type technology is a solution for powering small cities, or even large communities, so——

Mr. POWELL. Absolutely.

Mr. DUNCAN. Do you have other examples?

Mr. POWELL. Just to finish on that. Our power grid today really rewards smaller power plant technologies. And so the smaller that we can make the reactors, the more points that applicability that those will be, that those will be around the country.

I think we have seen very successful development in the wind sector in public-private partnerships, in the Wind Technology Cen-

ter at the National Renewable Lab that has really brought down the price further for very large wind turbine technologies as well as.

Mr. DUNCAN. Right. And speaking of SMRs, which kind of piqued an interest of mine in thorium or molten salt reactors.

Is DOE working the private sector at all on thorium reactors, to your knowledge?

Mr. POWELL. I will have to get back to you on that. I am not sure that there is any current thorium work underway. They are working on molten salt reactors, so that is where the fuel is also the coolant, and it circulates through the reactor. There is currently several active points of research and an active collaboration between DOE and Southern Company and TerraPower, which is the Bill Gates'-backed nuclear development company.

Mr. DUNCAN. Yes. Thank you for that.

Mr. Chairman, I don't have anything further. I yield back.

Mr. UPTON. Thank you.

Mr. Griffith.

Mr. GRIFFITH. Thank you, Mr. Chairman. I appreciate it. I appreciate the testimony of all of our witnesses here today. I particularly liked the testimony of Mr. Powell talking about researching and figuring out new ways to use the fuels that will power the world, not just the United States, in the future.

But with that, I will yield my time to Mr. Shimkus of Illinois.

Mr. SHIMKUS. Thank you, Morgan. I appreciate that. And I really want to make sure I took the time. I appreciate you being here. And also, you are an important panel. Again, as I said earlier, we are trying to figure out should we look at reauthorizing the DOE and what should be its assigned roles. And I do a lot of stuff in the nuclear space, too. And I want to ask a question. It is going to go to Dr. Levy first. And it is really about organization.

So the NNSA, the National Nuclear Security Administration, is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science. But there are some people who question the efficiency of that, since it is semi-autonomous.

In fact, Admiral Richard Mies noted the separation of DOE's support functions from the NNSA created a problem concerning the Secretary's governance over the nuclear security mission. They noted, "What CEO of the successful company would permit one of the largest, most demanding and unforgiving missions to be quarantined from the headquarters' staff. Or to use an operational metaphor, how could the commander of a ship at sea fulfill his or her duty if 40 percent of the crew were, "separately organized'? That would be both inefficient and risky."

Do you agree with that?

Mr. LEVY. I don't think I do, although I am not sure the present implementation of the separation is ideal. I think there is a way to do it. This is an issue that the Augustine-Mies panel took up in great detail. One of the suggestions was that NNSA just be a separate agency. And their conclusion was, for a mission that important, they needed cabinet level support and cabinet level input.

My own personal opinion, and it is my personal opinion, the panel hasn't come to a conclusion on this, is that it is a doable

thing, but it will take a lot of attention at the highest levels of the Department of Energy, primarily the Secretary, the Deputy Secretary and the administrator, the Under Secretary, operating together very well.

Right at the moment, there is a lot of overlap. There is a lot—certainly, the Secretary of Energy—I am not sure one looks at the Secretary of Energy as the commander of the ship, or the chairman of the Joint Chiefs. There has to be somebody responsible for it, and he is responsible to somebody. At the moment, I think there is overlap, which is not a very good situation, and I think that is one of the things that is important to clear up.

Mr. SHIMKUS. I think that is good.

Ms. Ladislaw, have you looked at this from your think tank arena?

Ms. LADISLAW. It is not an area of expertise for me.

Mr. SHIMKUS. OK. And I would raise it to the chairman as something we should look at as we move in this direction.

The last thing I wanted to also address is—I mean, because there is such a different—a broad breadth is this, Dr. Wasserman, on the supercomputing issue, because we—I know that we—we are not Kim Il Jong II, so we don't blow off our nuclear weapons anymore because we supercompute, and we trust it, which is hard for many of us to believe. But we do.

And so in this—but I got confused, and that is why I ask questions, because that is the best way to find out the answers. DOE is moving to an exoskeleton larger supercomputing ability. Is that separate than what the National Science Foundation is doing on it? Doesn't it operate in conjunction with other universities' supercomputing operations?

Mr. WASSERMAN. The exoscale effort, and I am not directly involved in it, but one of my colleagues at Lilly is, actually, as part of a DOE advisory panel. It is a partnership with lots going into it.

Let me pause for a minute. You said it is hard to believe that you can believe the simulation. In the example in GE I gave you, which admittedly is not a national security weapons type of simulation. But in this simulation, they could look at things that they could not measure in the real world. And so they could make a lot of progress in the simulation because you could do that. To build the actual test mock-up and try to do it physically would have not only been cost-prohibitive, but would have required a whole doubling of their infrastructure. So the exoscale is partnership. And as you can tell, if you look at the statistics, the U.S. leapfrogs with other countries. Currently China is ahead. We will catch up. I am sure they will change that in the future.

But the ability to use this to look at things. When I started my scientific career, the type of simulations we look at would have been fantasy. And today, the exquisite nature of not only the computer hardware, but the software developments the people have found to use that hardware as efficiently as possible are exquisite.

Mr. SHIMKUS. I appreciate. I yield back my time.

The University of Illinois has Blue Waters, which is part of the NSF grant, and it is an awesome facility.

And I yield back.

Mr. UPTON. Mr. Welch.

Mr. WELCH. Thank you, Mr. Chairman. And I thank the panel.

I am going to direct my questions to Mr. Reicher, because he has got Vermont roots, and I want to acknowledge the good work everyone has done. But none of you made the wise decision to spend as much time in Vermont as he did. But thank you.

You heard, I think, the first panel, and there was some discussion in that panel about the standard setting process. And I am going to ask you three questions, so I want you to be brief on each one. But can you just address that process and what you think makes sense to do and what the dangers are if we fall behind in what has been, I think, a bipartisan commitment to the standards?

Mr. REICHER. So very quickly, Mr. Welch, there are two things going on. One, there are concerns that DOE is not going to move ahead. They kind of put a hold on issuing standards. The second thing they are doing is reevaluating the standard setting process. We did that back in the 1990s, made a lot of improvements. Improvements have been made since. I am hopeful that they won't go ahead and do more than they need to do at this point, because it is a pretty good process.

Mr. WELCH. All right. Next thing is there is a bipartisan effort to have master limited partnership status apply to clean energy projects. We have got Republican and Democratic sponsors to that, and I am one of the lead sponsors.

Can you just offer your thoughts on the benefits that that would provide to the clean energy sector?

Mr. REICHER. So master limited partnerships have been a very important tool for financing oil and gas infrastructure to the tune of about $500 billion. When the law was passed, though, by Congress in the 1980s, renewables and lots of other things were not included. You, Mr. Poe, others, Mr. Portman, and Mr. Moran in the Senate have introduced legislation that would open up these MLPs to all these other things. CCS, storage renewables efficiency, and it would be a big step because it would cut the cost of financing for these major energy projects. And as we ramp down the tax credits for solar and wind, we should ramp in this master limited partnerships approach.

Mr. WELCH. OK. I hope that is something we can work on, Mr. Chairman. We have got a Ted Poe from Texas and Peter Welch from Vermont, so there is some bipartisan and strange bedfellow situations there, so let's see if we can do something.

On Federal energy management, the Federal Government's energy bill, as you know, is $23 billion a year. And a number of us on this committee, Republicans and Democrats, have been really trying to extend energy saving performance contracts. We have had a knotty problem on the scoring where it is a Byzantine process to try to get there to be resolution between OMB and this CBO.

Can you comment on what the opportunities are if we go very aggressively in pursuit of energy savings performance contracts, which, as my colleagues know, don't cost taxpayers any money. The companies that bid on doing retrofitting of our Federal buildings put the money up to do that, and then they get repaid from the energy savings that benefit them with the payback, and benefit the taxpayers.

Mr. REICHER. Yes. Very quickly. It is a great alternative to appropriating funds to upgrade Federal buildings. There are 350,000 buildings. We could do a lot to cut this $23 billion energy bill. But there are these difficulties in scoring, the disagreements between OMB, CBO, and the Hill. We put out a report, the Secretary of Energy Advisory Board, in 2016, on Federal energy management. We looked at a whole number of issues, a big number of opportunities. And one of them that we explored were ESPCs. And we have suggested some ways that you might fix that process, so I would encourage you to take a look at that report.

Mr. WELCH. All right. Thank you.

I yield back. Thank you all.

Mr. UPTON. Mr. Barton.

Mr. BARTON. Well, thank you, Mr. Chairman.

I appreciate our scientists being here. We have still with us the ranking Democrat on Mr. Upton's subcommittee, the ranking Democrat on Mr. Shimkus' subcommittee—Mr. Shimkus was here until I walked in. He left—myself as vice chairman. And we have all been tasked with the chairman, Mr. Walden, to perhaps do a DOE reauthorization bill, which we have had a number of questions about. Part of that is going to be to look at the role of the national laboratories.

I think it is fair to say that if we were starting from scratch we wouldn't have 17 national laboratories, but we do. Some of those are pretty obvious. Los Alamos, Sandia, some of our weapons laboratories. I think some of them show the need for more robust research. The renewable energy laboratory would fall into that category. I know Mr. Tonko is a big supporter of that. But some of them are not so obvious.

I don't know who to ask this question of, maybe Mr. Reicher. Do we need 17 national laboratories today?

Mr. REICHER. Mr. Barton, I think I am outside of my area of expertise right now.

Mr. BARTON. Well, I just poked at random. If you don't feel qualified——

Mr. REICHER. I will tell you this, that there is just an amazing breadth of strength in those labs. Obviously, you know better than I, the politics of shutting down labs is——

Mr. BARTON. Not good.

Mr. REICHER [continuing]. Not good.

Mr. BARTON. It depends on your point of view. From the point of view of keeping it open, it is very good.

Mr. REICHER. Right. But I guess what I would say is I would take a look at the missions of each and really assess what they are doing, because I think they have all developed areas of expertise. Argonne, for example, is really one of the world leaders in advanced battery technologies, looking at things other than lithium. And you go across the board, there is just so much there. So missions should come first as you do on your analysis.

Mr. BARTON. Well, let me give an example that I know a little bit about. Once upon a time, there was a national laboratory in process called the Superconducting Super Collider. It was going to be in my congressional district. In fact, the main campus would have been about 10 miles from where I live right now. And obvi-

ously, if we would have built it, I would have been a big supporter of it. But we didn't build it. We decided to go a different path. And we are putting quite a bit of money over in Europe at CERN, but we still have the Stanford Linear Accelerator. We still have Fermilab. We still have Brookhaven. Do we need all of those national laboratories studying high energy physics given the fact that we decided to put most of our eggs in the European basket at CERN?

Mr. WASSERMAN. Mr. Barton, if I may. The people at the national labs are incredibly creative. And as the example of the Stanford Linear Accelerator. Its original for which it was built around 1962 when it started, is no longer part of the DOE. It has been repurposed. And instead of a particle accelerator to smash things into each other to look at the fundamental forces of nature, it is now the basis of the Linac Coherent Light Source, which is an x-ray source rather than an atom smasher.

And so this creativity, even though the infrastructure is still there, things that have outlived their life have now found a new use. And, in fact, the linear accelerator there, the LCOS, is an example of interlaboratory cooperation. For example, there is a device called an undulator—we won't go into that today—which is the basis of it. Much of the development work for those undulators were done at Argonne, where they had a lot of expertise at the advanced photon source on this type of device.

So this creativity means that we can repurpose things. It also means that we can take multiple approaches to a difficult problem. As scientists, we wish that innovation were a linear path, but it is not. And often finding the best solution requires looking at several different ways to do it and finding the best one at the end.

Mr. BARTON. Well, my time has expired. I understand the quality of our scientists and our researchers. I don't deny that. I also understand the political reality that DOE has facilities in 30 different states. So that is 60 percent of the states. So any time you try to change something, it is going to be, especially in the Senate, a political difficulty.

But I do think if we are going to reauthorize the Department it is only fair to the taxpayers that we do take a quick look, a serious look at the existing laboratories. Again, I do not deny that they can be repurposed. I don't deny that they do good work. I know for a fact from my experience with the Super Collider, we got a lot of brainpower that came to Texas. And most of it stayed. Not all of it but most of it. And it has benefited our state. So I am good for that. But I just think we owe it, if we are really going to do this reauthorization, that we ought to take a look at the existing structure.

Mr. Powell. And my time's expired, so I am at the mercy of the chairman here.

Mr. POWELL. I will say very, very quickly.

I think the key thing to look at is not whether we need 17 labs, but whether we need 17 labs, all of whom say they can do almost anything, right? I think because the mission of the labs has shifted back and forth, they have gotten themselves—Dr. Zacharia might kill me for saying this—have gotten themselves into a posture where they are ready to go for any administration with any set of

priorities. And I would just build on Mr. Reicher's point that we should be much clearer about what each lab is excellent at and then align those centers of excellence with top-down direction and goals.

Mr. BARTON. I guess my final question. Did we find the top-quark yet? That was the whole purpose of the Super Collider, to find the top-quark.

Did we find it?

Mr. LEVY. Yes.

Mr. BARTON. We did find it.

Well, good.

Mr. ZACHARIA. Mr. Chairman, if you will give me a little bit of time.

The laboratories are really where the integration of the missions occur. And so if you look at Oak Ridge National Laboratory, it is one of the largest science and energy laboratory, about $1.5 billion. It is funded through 1,000 proposals that RPIs have to compete. So in some sense, laboratories bring core capabilities, a combination of people, unique facilities, and programs. And we competed for the best ideas that funded. So in some sense, the labs thrive in a meritocracy. And so what I would say is that if one focuses on the mission of the Department, then the laboratories will self-select based on their capabilities and abilities to support the missions of the Department.

Mr. BARTON. I appreciate the chairman's discretion. Thank you. And I appreciate you all being here.

Mr. UPTON. Yield now to a very patient Mr. Costello.

Mr. COSTELLO. Thank you.

Mr. Powell, the eastern power grid has been experiencing some extreme stress due to what is still now a very cold weather, although today's not so bad. Part of the reason the grid has maintained its reliability has been—and I am getting to the issue of fuel diversity—has been the diversity of fuel sources on the grid. Share with me your perspective on what DOE's role should be to ensure grid reliability. And obviously this comes on the heels of a report and a FERC 5–0 decision yesterday, I think there is a lot of innings left in this game, and I am just curious on your perspective?

Mr. POWELL. So obviously, this has become a pretty contentious topic about whether there is a diversity or a resiliency problem on the grid as it currently stands.

I think the reality, as it stands today, is that we are headed toward a grid dominated by natural gas power generation. And so the question that we have to ask ourselves is, is that a problem? Most of the modeling says it is not a problem. In this cold snap, for example, this winter, the natural gas system has worked well, and there hasn't been a resiliency problem with the grid. But we can imagine events where an attack on a pipeline or especially a major hub could make that a significant issue over reliance on one type of fuel. And we can imagine events where even if there is not a supply disruption, you could have significant price spikes to that fuel source, and that might result in sort of economic pain.

And so I think now the discussion is, is there some other characteristic, diversity or resilience or something like that that we need to find and define and quantify, and should that be worked

into the authority of FERC to ensure that, in addition to reliability and affordability, this resiliency characteristic is there as well.

We do think that there are ways that we can define and value that resiliency characteristic that would not be overly disruptive to the existing order of the wholesale markets. The wholesale markets have delivered a lot of benefits to the country in terms of reliability and affordability. And so we think that it can be defined in a way. An added benefit of defining it would be nuclear generators are a particularly resilient power source, and so, we think that adding that into the power mix would go a long way to helping support our existing nuclear fleet.

Mr. COSTELLO. We have heard some discussion here about China and its role in the energy technology research development and deployment space. What do you believe we need to do as a country? And what is DOE's proper role in order to ensure that we don't play second fiddle to China?

Mr. POWELL. Thanks for that. I was pleased to participate in that event together discussing this more deeply a few weeks back.

So I think the first and most important thing is that we need to signal that we are going to make a deep commitment to some of these technology areas where China is also making a very deep commitment.

Mr. COSTELLO. Is that RPE? Is that somewhere else? Is that purely within DOE? Where else does that come about?

Mr. POWELL. So much of it is in DOE. We discussed a bit today about making sure that our trade standards are correctly putting the right burden on industry so that we are actually able to compete in places like Saudi Arabia to build nuclear reactors there. I think we need to make a clear commitment at DOE through the continuation of RPE and through major mission-oriented goals and commitments to these technologies that we are actually going to put the resources into these technologies so that our innovators don't then need to go over to China to get the commercialization benefits.

If you look at just one company, for example, UET, it is a vanadium flow battery technology that was developed at the Pacific Northwest National Laboratory, spun out of it by some of our best researchers. China identified the technology and its commercial applications, and so now they are sort of funding the commercialization and spin-up. And they are buying, I believe, the largest flow battery in the world which will be deployed in China and not in the United States.

And so finding ways where we can make similar commitments and actually show our innovators that we are serious about that, we will make investors and we will make innovators sort of not flee to China but develop a scale for innovation here at home.

Mr. COSTELLO. Final question for everyone. We have a potential for an infrastructure bill. Let's just say $50 billion is allocated to energy infrastructure.

Where is that best deployed? Anyone?

Mr. ZACHARIA. Well, I will take the $50 billion since no one else will.

So there are a number of areas where there are both science infrastructure, but also infrastructure such as small modular reactor that have been discussed.

In some instances, this discussion becomes academic in terms of whether you are going to have a nuclear Renaissance or not, because if the supply chain goes away, it becomes very, very difficult to reboot the nuclear energy industry. And we are only a few years away, in my view, that, if there is not a procurement of some sort, then that industry will go away. And this is somewhat analogous to the supercomputing industry.

About 10 years ago, the intelligence community was really concerned that the supply chain was going to go away. And the Nation stepped in and basically did the investments in leadership computing and the procurements that ensued that kept the supply chain.

Likewise, with SMR, one of the opportunities that you have is that, for example, in places like Oak Ridge and Idaho where we have a baseload and need between Oak Ridge National Laboratory and Y-12 of about 150 megawatts. That is two units of small modular reactor. One way to incentivize the specific client adoption would be for the government to say is at least explore whether that is a good use of investment in infrastructure to actually buy down the risk of first applying deployment in a small modular reactor. But also there are signs, shovel-ready signs infrastructure, that is again looking for resources. And so those are some of the areas that I would consider for investment.

Mr. REICHER. Mr. Costello, if I could quickly give you an answer.

There is already $41 billion available today in the DOE loan program. It is allocated $12.5 billion for advanced nuclear, $8.5 billion for advanced fossil, $4.5 billion for renewables, and then a big chunk in the transportation side. We are about to see a rescission by appropriators in both the Senate and the House that would prevent major companies from getting access to that $41 billion.

So that is available today. It is going to cost a couple hundred million that already was appropriated by the Congress a number of years ago. And if we could avoid that rescission, that $41 billion across the board would be available. It goes directly to what you just heard, because sitting over at the DOE right now in the loan program office are applications, both part 1 and part 2, for the Vogtle reactor, the NuScale reactor, the Terrestrial reactor, and a couple of more.

So you don't need to find $50 billion. You need to make sure that $200 or $300 million is not rescinded by appropriators that would basically shut down the loan program office at DOE. And I can't say this strongly enough to all of you. Put that $200 million, $300 million back into effect, and you are going to have tens of billions available in the form of loan guarantees for nuclear, for fossil, and for renewables.

Mr. COSTELLO. Very helpful. I waived on, and I am 3 minutes over. So I don't know if I am going to ever get back on this subcommittee again.

Thank you, Mr. Upton.

Mr. UPTON. I want to thank all of you for being here. Seeing no other members wishing to ask questions, we are almost ready to adjourn.

I am going to ask you unanimous consent to submit two letters into the record, a letter on EERE and a letter on the loan program itself.

[The information appears at the conclusion of the hearing.]

Mr. UPTON. And pursuant to committee rules, I will remind all members that they have got 10 business days to submit additional questions for the record. And I would ask that witnesses submit the response, if you can, within 10 business days. Certainly, for the first panel, Mr. Rush had a number of questions we would like the answers back.

Mr. RUSH. No. Mr. Chairman, I just want to ask you a question. Based on Mr. Reicher's passionate request concerning the $41 million loan program, do you have any reaction to——

Mr. UPTON. Well, I wish we were appropriators. That is not a role that we have. Sometimes we can take over. This is the most powerful committee and the oldest, and we don't have that authority. I have supported the loan program, I would say that. I have supported the appropriations.

Mr. RUSH. Mr. Chairman, I think maybe it might be in order for a bipartisan effort on both sides of this committee to make our concerns heard with the Appropriations Committee. And I would be willing to join with you and other members of the committee to have a meeting or send some letters, but I think our voices should be heard.

Mr. UPTON. Well, and I know that we are all anxious to see the administration's budget. We are going to have the opportunity to ask Secretary Perry questions about that as it gets submitted and take action on the floor. So I appreciate the gentleman's interest.

Mr. Welch.

Mr. RUSH. Thank you.

Mr. UPTON. Mr. Welch.

Mr. WELCH. Well, I think we need to do something as a committee. That is a very compelling loss. If we forego these loan guarantees, it is really going to hurt the collective efforts of both sides of this aisle.

And you have done this before, but this committee really needs to speak out, I think.

So thank you.

Mr. UPTON. And if there are no further questions, we stand adjourned.

Thank you all for being here.

[Whereupon, at 2:40 p.m., the subcommittee was adjourned.]

[Material submitted for inclusion in the record follows:]

June 8, 2017

The Honorable Mike Simpson
Chairman, Subcommittee on Energy
and Water Development,
and Related Agencies
U.S. House of Representatives
Committee on Appropriations
2362-B Rayburn House Office Building
Washington, DC 20515

The Honorable Marcy Kaptur
Ranking Member, Subcommittee
on Energy and Water Development,
and Related Agencies
U.S. House of Representatives
Committee on Appropriations
2362-B Rayburn House Office Building
Washington, DC 20515

The Honorable Lamar Alexander
Chairman, Subcommittee on Energy and
Water Development
U.S. Senate Committee on Appropriations
184 Dirksen Senate Office Building
Washington, DC 20510

The Honorable Dianne Feinstein
Ranking Member, Subcommittee on
Energy and Water Development
U.S. Senate Committee on Appropriations
188 Dirksen Senate Office Building
Washington, DC 20510

Re: Fiscal Year 2018 Office of Energy Efficiency and Renewable Energy Budget

Dear Chairman Simpson, Ranking Member Kaptur, Chairman Alexander, and Ranking Member Feinstein:

The U.S. Department of Energy is the single largest funder of clean energy innovation in the United States, and our nation will be hindered in the global energy market without a strategic and well-funded DOE research portfolio, including basic science, energy efficiency, renewable energy, nuclear energy, fossil energy, and electricity reliability.

We are the entire group of Senate-confirmed Republican and Democratic Assistant Secretaries of Energy who led the DOE Office of Energy Efficiency and Renewable Energy (EERE) between 1989 and 2017. We are particularly concerned about the Administration's recent proposal to cut the EERE budget by 69% from FY2017 enacted levels. While we have not always agreed on the relative emphasis of various elements of the EERE budget we are unified that cuts of this magnitude in the proposed FY18 budget will do serious harm to this office's critical work and America's energy future.

EERE-supported research, development, and demonstration in energy efficiency, transportation, renewable energy, clean energy manufacturing and electric grid modernization are critical to encouraging U.S. innovation, creating good-paying jobs,

cutting pollution, and ensuring American global competitiveness. Other important EERE programs, with similar benefits, focus on setting efficiency standards for appliances and equipment, helping states deliver energy efficiency improvements, leading the federal government's efforts to reduce its own $23 billion annual energy bill, and cutting energy use in low-income homes.

This is a particularly inauspicious time to cut the EERE budget. World-wide investment in clean energy now measures in the hundreds of billions of dollars annually. Governments across the globe—and companies large and small—want a piece of this massive economic pie representing tens of trillions of dollars over the next three decades and millions of jobs. China, in particular, has made it a high priority to lead the globe in the clean energy industry and is reorganizing its energy R&D and deployment efforts in a broad array of clean energy technologies, many of them first developed in the U.S. at taxpayer expense. It is telling that China intends to spend more than $360 billion on renewables through 2020 and create 13 million jobs.[1] We ignore China's resolve—and success to date—at our peril.

U.S. energy security, a key focus of Congress and the administration, requires a reliable and resilient electricity system. Fundamental performance characteristics of the grid are changing due to increasing use of variable supplies, electronic converters for motor drives, lights, and other equipment, and grid communications and control with the shift from analog to digital systems. These changes have the potential to improve grid economics and performance, but also require greater agility to optimize operations, reduce response time to system failures, and confront new vulnerabilities such as cybersecurity. R&D to develop the capabilities needed in a modernized grid is critical, yet the electric utility sector invests just 0.2 percent of sales in R&D. R&D by EERE and DOE's Office of Electricity Delivery and Energy Reliability (with a proposed 48% cut) is pivotal in meeting these grid modernization challenges.

Finally, federal appliance and equipment efficiency standards, set by EERE since 1987, are the little engine that could when it comes to stimulating massive low-cost energy savings. DOE estimates that existing efficiency standards will, on a cumulative basis, save consumers nearly $2 trillion on their utility bills between 1987 and 2030. While not without occasional controversy, the standards have long enjoyed bipartisan support. Standards for many types of residential, commercial, and industrial equipment are required to be regularly updated in order to capture the impact of technology advances and push these advances into the market. Thus, a refrigerator in 1973 used about 1900 kWh of electricity per year but federal R&D and standards have helped drop that electricity use to about 400 kWh per year, saving a typical household roughly $150 per year.

As six Republican Senators wrote earlier this month, referencing EERE and other DOE offices, "We cannot lose the technological advantages we have gained through research

[1] Reuters, January 5, 2017 http://www.reuters.com/article/us-china-energy-renewables-idUSKBN14P06P

and development. Governing is about setting priorities and the federal debt is not about Congress overspending on science and energy research each year." We share this view and we urge you to set the FY18 EERE budget at a level that will ensure the continued effectiveness of this critical federal program.

We would be honored to meet with you and share our views on the EERE budget and, more broadly, how to improve the productivity of the entire DOE energy RD&D portfolio in a bipartisan effort to secure America's energy future.

Sincerely,

Dan W. Reicher, EERE, 1997-2001
DOE Chief of Staff, 1996-1997
DOE Assistant Secretary for Policy (Acting) 1995-1996
(President Bill Clinton)

Cathy Zoi, EERE, 2009-2011
DOE Under Secretary (Acting), 2010-2011
(President Barack Obama)

David Garman, EERE, 2001-2005
DOE Under Secretary, 2006-2007
(President George W. Bush)

Mike Davis, EERE, 1989-1992
(President George H.W. Bush)

David Danielson, EERE, 2012-2016
Program Director, ARPA-e, 2009-2012
(President Barack Obama)

Alexander "Andy" Karsner, EERE, 2006-2008
(President George W. Bush)

Christine A. Ervin, EERE, 1993-1997
(President Bill Clinton)

cc:

Chairman and Ranking Member, U.S. House of Representatives Committee on Appropriations
Chairman and Ranking Member, U.S. Senate Committee on Appropriations
U.S. Senate Majority Leader and Democratic Leader
Speaker of the U.S. House of Representatives and Democratic Leader

January 4, 2018

The Honorable Greg Walden
Chairman
Energy and Commerce Committee
U.S. House of Representatives
Washington, DC 20515

The Honorable Frank Pallone
Ranking Member
Energy and Commerce Committee
U.S. House of Representatives
Washington, DC 20515

The Honorable Fred Upton
Chairman
Subcommittee on Energy
U.S. House of Representatives
Washington, DC 20515

The Honorable Bobby Rush
Ranking Member
Subcommittee on Energy
U.S. House of Representatives
Washington, DC 20515

Dear Chairman Walden, Ranking Member Pallone, Subcommittee Chairman Upton, and Subcommittee Ranking Member Rush:

As the Congress considers how to fund the government through fiscal year (FY) 2018 and beyond, we urge you to support the Department of Energy's (DOE) Loan Programs Office (LPO). As executives of 17 companies, we are investing in projects with pending loan guarantee applications or preparing for new applications based on the good faith notion that this DOE program would function as stipulated in law and as Congress intended. We are deeply concerned that proposals to eliminate authority for this critical program, which largely funds itself and mobilizes private capital, will destroy thousands of pending jobs and hinder the growth of critically-needed U.S. domestic energy production. Eliminating it also defeats America's effort to maintain a leadership position with regard to energy innovation and "Dominance."

Our companies represent a wide range of innovative energy and efficient manufacturing technologies including advanced fossil, nuclear, and vehicle technologies, as well as renewable energy technologies such as advanced energy storage and grid management solutions for reliability. The DOE LPO represents the best and often only way to cross the barrier from developing innovative technologies to deploying those technologies commercially here in the U.S. and ultimately for export.

The LPO is a win-win-win for taxpayers, American energy innovation, and the communities and states where these investments are being made. The program's real costs are paid by the companies that submit applications, and each federal dollar of loan guarantees leverages approximately $10 in private capital investment, which exceeds the Trump Administration's plans to leverage infrastructure investment at a ratio of 5:1. For these reasons, there are zero savings associated with removing loan authority, only the loss of American jobs and injury to American competitiveness.

This program has already proven its ability to deliver: It has closed more than $30 billion of loans, loan guarantees, and conditional commitments covering more than 30 projects that represent $50 billion in total project investment in the U.S. economy. These investments

represent 56,000 direct and indirect jobs across 20 states. Projects still in the pipeline for approval that would be killed by the spending bills proposed in the House of Representatives and Senate for FY 18 amount to an additional $40 billion in near-term investments in America's energy infrastructure that would put another 75,000 Americans to work in good, high paying jobs. These are not hypothetical jobs of the future; these are jobs on projects that are ready to begin construction near-term – as soon as their loan guarantees are issued. Further, the current $41 billion of authority in the LPO, with its focus on important energy infrastructure, represents a significant here-and-now down payment on the $1 trillion goal the President has set for U.S. infrastructure spending.

LPO financing for innovative energy projects has proven its ability to de-risk these innovative technologies and to unlock commercial investment in future projects. For instance, before 2009, there were zero utility-scale solar farms located in the U.S. But after the LPO provided project financing to five first-of-a-kind installations, today 50 such solar farms are going forward with commercial financing.

Many of our companies have already spent tens of millions of dollars in connection with our applications to meet the government's stringent requirements for a loan guarantee. Our companies have hired engineers, acquired land, complied with environmental reviews, and negotiated power purchase or other off-take agreements. Eliminating funding at this late stage would literally pull the rug out from underneath our projects, just when we are ready to move forward with the LPO.

Unless appropriation bills for FY 18 and beyond protect authority for the program, our economy could sacrifice a generation of innovations in energy technology. Longer-term, future projects that will seek private sector lending once they have been proven commercial with the help of the LPO would be jeopardized, damaging U.S. competitiveness and domestic job growth. These technologies will eventually be proven, but that proof may be forced offshore. We are in a competitive race with China and other countries for leadership of the multi-trillion dollar global industry in energy innovation, and the LPO is one of the country's best tools to enhance U.S. competitiveness with superior leverage on federal commitments.

We hope you will support the DOE Loan Program, by maintaining its authority and monitoring its progress, and ensure that these private sector investments are made to build and modernize our domestic energy infrastructure.

Respectfully yours,

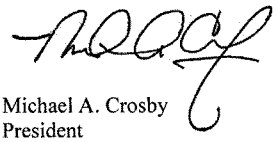
Michael C. Darcy
Chief Executive Officer

Michael Oster
Michael Oster
Chief Executive Office

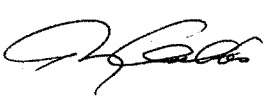
D'Arcinoff Group

Philip L. Smith
Chief Executive Officer
EnRevo Pyro

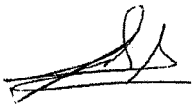
Eos Energy Storage LLC



Michael A. Crosby
President
Green Life US



Ray Crabbs
President & CEO
Chesapeake Integrated BioEnergy Complex, LLC



Alberto Morales
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Steven Estes
Chief Executive Officer
Star Energy Holdings, LLC

Daniel A. Burciaga
President & CEO
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Peter Heinzelman
Chief Financial Officer
Alevo USA Inc.

Fabrice Orecchioni
President
BioAmber Inc.

Simon Irish
Chief Executive Officer
Terrestrial Energy Inc.

Robert D. Trout
President & CEO
Siluria Technologies, Inc.

John W. Schultes
Founder & CEO
New Steel International, Inc.

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Brett Hauser
Chief Executive Officer
Greenots

Double Green Bridge NW INNOVATION WORKS

Simon Zhang
Chief Executive Officer
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Appalachia Development Group, LLC

GREG WALDEN, OREGON
CHAIRMAN

FRANK PALLONE, JR., NEW JERSEY
RANKING MEMBER

ONE HUNDRED FIFTEENTH CONGRESS

Congress of the United States
House of Representatives
COMMITTEE ON ENERGY AND COMMERCE
2125 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–6115
Majority (202) 225–2927
Minority (202) 225–3641

February 8, 2018

The Honorable Dan Brouillette
Deputy Secretary
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear Mr. Brouillette:

Thank you for appearing before the Subcommittee on Energy on January 9, 2018, to testify at the hearing entitled "DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

Also attached are Member requests made during the hearing. The format of your responses to these requests should follow the same format as your responses to the additional questions for the record.

To facilitate the printing of the hearing record, please respond to these questions and requests with a transmittal letter by the close of business on Friday, February 23, 2018. Your responses should be mailed to Kelly Collins, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, DC 20515 and e-mailed in Word format to kelly.collins@mail.house.gov.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

Fred Upton
Chairman
Subcommittee on Energy

cc: The Honorable Bobby L. Rush, Ranking Member, Subcommittee on Energy

Attachment

QUESTIONS FROM CHAIRMAN UPTON

Deputy Secretary of Energy Dan Brouillette

DOE's National Security Mission

Q1. The Department's national security mission and supporting activities plays a critical role in advancing and protecting our nation's national security. The National Nuclear Security Administration (NNSA) maintains our nuclear weapons deterrent, supports key non-proliferation programs, and prepares to respond to national emergencies. Other DOE programs also advance national security programs, and DOE is a member of the Intelligence Community. Much of the focus on DOE's national security activities is centered on NNSA facilities and the three NNSA managed national laboratories; however, the other national labs, such as Idaho, Pacific Northwest, and Oak Ridge National Laboratories also provide key national security services. The recent realignment separated the management of the Science laboratories from the remaining energy laboratories, thus all three Under Secretaries oversee a portion of the national security imperative. How will you assure that certain national security programs are not siloed and this most important DOE mission is fully recognized?

A1. The Department of Energy (DOE), and the National Nuclear Security Administration (NNSA) in particular, is charged with important and enduring missions vital to the national security of the United States. To accomplish these missions, NNSA maintains crosscutting capabilities that enable it to advance world-class science, technology, and engineering. NNSA manages three national security laboratories and five nuclear weapons production facilities, but also draws upon the expertise and core capabilities of the remaining DOE national laboratories.

The Under Secretary for Nuclear Security/NNSA Administrator works closely with the Under Secretaries of Energy and Science to build a stronger, more collaborative and mission-focused culture across DOE and the 17 national laboratories and nuclear weapons production facilities.

NNSA is active in many DOE-led boards and committees. The Laboratory Operations Board (LOB), for example, meets monthly to explore streamlining and collaborative opportunities between DOE, NNSA, and their national laboratories. The LOB supports implementation of energy, science, and national security programs by providing a forum for discussion and developing solutions to complex-wide challenges.

Each DOE laboratory has a unique mix of core capabilities meant to be a resource for the Department's science, energy, and national security needs. NNSA has adopted the DOE's Office of Science's annual lab planning process for its three national security laboratories and tailored it to NNSA's specific mission. NNSA also actively participates in the process that the Office of Science conducts on behalf of its ten national laboratories, as well as the four labs overseen by the Under Secretary for Energy. NNSA reviews the strategic plans from a national security perspective to ensure that the laboratories maintain the capabilities needed to meet national security priorities now and in the future. The annual strategic planning process ensures that DOE and its national laboratories remain aligned on research priorities, infrastructure investments, and stewardship of core capabilities to address the science, energy, and national security missions.

DOE Realignment and Reorganization

Q2. In 2013, then-Secretary Moniz announced as part of a DOE reorganization that he was combining the programs under the Office of Science with the applied energy programs under the newly created Under Secretary of Science and Energy. At the time, he noted this was done partially "to closely integrate and move quickly among basic science, applied research, technology demonstration, and deployment."

Q2a. Your testimony notes the Department's recent realignment was executed to fully implement thisAdministration's agenda. Will you please describe for the Committee the rationale for returning to the former structure and how you will assure that the communication and collaboration between the sciences programs are not siloed from the work funded through the energy offices?

A2a. On December 15, 2017, the Department of Energy (DOE) announced its intent to modernize the agency's organizational structure to advance its policy goals consistent with its statutory requirements.

Under the DOE Organization Act, the Secretary of Energy has the authority to organize the Department to successfully further the Department's mission and support and advance the policy priorities of the new Administration. This Administration's energy priorities include: achieving U.S. energy dominance; protecting our energy and national security; advancing innovation; and improving outcomes in environmental management.

Under the new plan, the Office of Under Secretary for Science and Energy (established in 2013 during the previous Secretary's tenure) has been separated into two Under Secretary positions, restoring the three Under Secretaries outlined in statute: the Under Secretary of Energy; the Under Secretary for Science; and the Under Secretary for Nuclear Security and NNSA Administrator. The Under Secretary of Energy will focus on energy policy, applied energy technologies, energy security and reliability, and certain DOE-wide management functions, while the Under Secretary for Science will focus on supporting innovation, basic scientific research, and environmental cleanup. These measures will enhance DOE's focus on early-stage scientific research and development and energy technology innovation, while improving environmental and legacy management outcomes.

Communication and collaboration between offices within DOE, including our labs, as well as external stakeholders is an important and integral part of daily operations. This coordination will continue between science programs and energy offices under the new structure.

Q2. In 2013, then-Secretary Moniz announced as part of a DOE reorganization that he was combining the programs under the Office of Science with the applied energy programs under the newly created Under Secretary of Science and Energy. At the time, he noted this was done partially "to closely integrate and move quickly among basic science, applied research, technology demonstration, and deployment."

Q2b. What are your views on elevating the Department's cross-cutting energy emergency and cybersecurity incident planning, response, and coordination functions?

A2b. Cybersecurity, energy security, and emergency response are priorities for DOE, and the Department is working closely with stakeholders across Federal agencies, industry, law enforcement, and state governments to ensure resilience is factored into ongoing grid modernization efforts. In coordination with the Department of Homeland Security, DOE works with its energy sector partners, through forums such as the Electricity Subsector Coordinating Council (ESCC) and Oil and National Gas Subsector Coordinating Council (ONG SCC), to prioritize efforts to strengthen cybersecurity preparedness in the energy sector, improve capabilities for cyber incident response and recovery, and accelerate innovative research and development of resilient energy delivery systems. The effects of

Hurricane Maria in Puerto Rico highlight DOE's important mission in natural disaster response for energy supply disruptions.

The Fixing America's Surface Transportation (FAST) Act provides additional authority to the Department for securing defense critical electric infrastructure against physical, cyber, geomagnetic, and electromagnetic disturbances.

To that end, the Secretary of Energy announced in January the establishment of an Office of Cybersecurity, Energy Security, and Emergency Response (CESER). This organizational change will enable the Department to strengthen its role as the sector-specific agency for the energy sector under Presidential Policy Directive 21 (PPD-21): Critical Infrastructure Security and Resilience, support expanded national security responsibilities, and better address natural disasters and emerging threats.

Q3. I understand that DOE is continuing the Grid Modernization Laboratory Consortium, which consists of 13 National Labs coordinating to address major challenges associated with maintaining, protecting, and updating our aging national electricity infrastructure. This model helps ensure subject matter experts throughout the complex utilize unique skills to tackle a big problem.

Q3a. Are there similar big issues which would benefit from such an approach?

A3a. We plan to expand the GMLC to include the Offices of Nuclear Energy and Fossil Energy, and we are evaluating where else this model can be applied across the enterprise.

Q3b. The purpose of the Consortium offers the opportunity to fully capture the contractor system, yet the funding for the projects still is disbursed in minimal increments and therefore limiting the ability to "think big" and pursue game changing ideas. This budget atomization is detrimental to achieving DOE's mission. What options are you considering for improving budgetary management as part of this consortium?

A3b. Grid Management Laboratory Consortium project funding was distributed incrementally primarily due to continuing resolutions until the Department had full-year appropriations. We are hopeful that the recently enacted two-year budget agreement will allow more timely appropriations, which could avert the need to fund activities this way.

DOE Field Offices

Q4. DOE maintains field offices at all of the National Laboratory sites. The field offices serve as DOE's eyes and ears to oversee the M&O contractor that runs the labs; however, high staffing levels combined with excessive micromanagement can inhibit the "GOCO" model, where the contractor runs the day to day operations at the Lab. Do you recognize that bloated field office staffing may lead to greater transactional interactions with the labs and what is your vision for the field office's role?

A4. The Department has a responsibility to provide oversight to each of its national laboratories. DOE utilizes a tailored approach of oversight at our national laboratories based on the complexity, risk, and amount of work at each site. Specific areas of Federal oversight include contract management by warranted DOE contracting officers, project management, and facility and worker safety.

For example, within the Office of Science (SC), the Ames National Laboratory has an annual budget of about $48M per year in funding and no nuclear facilities and has a site office with only 4 Federal FTEs, while Oak Ridge National Laboratory has an annual budget of nearly $1.4 B per year and multiple high risk nuclear facilities and has a site office of 40 Federal staff providing oversight. DOE continuously analyzes the amount and complexity of work at each national laboratory to determine the best balance of Federal presence.

Throughout DOE, Contractor Assurance Systems (CAS) are utilized to enable reduced Federal site presence. Successful CAS programs rely on a "trust but verify" approach to contract oversight. This enables the appropriate amount of oversight without duplicating M&O contractor efforts and leverages the internal assurance systems existing at each of the labs. While CASs are in varied degrees of maturity throughout DOE, SC has seen positive results in the management of its M&O contracts where effective assurance systems are in place.

In August 2016, DOE initiated a pilot project known as the "Revolutionary Working Group" (RWG) contract model at SLAC National Accelerator Facility. This contract modification was designed to increase trust between Federal and laboratory personnel, remove redundant requirements, and move decision making to the lowest possible level,

including delegation from Federal to laboratory personnel where appropriate. This model has enabled DOE to reduce the SLAC Federal site office personnel by nearly 50% and is estimated to generate about $2.8 M per year in cost savings/avoidance at SLAC.
In April 2017, DOE initiated expansion of the RWG model contract to other SC labs, including Lawrence Berkeley National Laboratory, Brookhaven National Laboratory, and Thomas Jefferson National Accelerator Facility. These contract modifications are expected to be approved by the end of FY 2018.

Additionally, all of the other Department Program Offices have been directed to analyze whether these contract modifications would be appropriate to implement at their sites.

Q5. The Advanced Research Projects Agency for Energy was first funded in the 2009 Stimulus legislation and now, over eight years later, a handful of programs have been funded and completed, with the opportunity to evaluate the overall impact of those projects. How is DOE going to review ARPA-E's efficiency and determine the best path forward to assure value for taxpayer funding?

A5. The Advanced Research Projects Agency for Energy (ARPA-E) programs and projects will ultimately be measured by their impact on U.S. energy dominance. The Fiscal Year (FY) 19 Budget proposes to eliminate ARPA-E because the potential for ARPA-E's efforts to overlap with R&D being carried out, or which should be carried out, by the private sector

The program currently reviews various impact indicators to measure progress. The primary metrics are the amount of private sector follow-on funding, the number of new companies and strategic partnerships formed to move products towards deployment, and the number of patents and publications. As of February 2018:: 1) ARPA-E has provided approximately $1.8 billion in early-stage R&D funding across more than 600 projects through 43 focused programs and three open funding solicitations (OPEN 2009, OPEN 2012, and OPEN 2015); 2) since 2009, a group of 136 project teams have attracted more than $2.6 billion in private sector follow-on funding; 3) 71 projects have formed new companies, 109 projects have partnered with other government agencies for further development, and an ever-increasing number of technologies have been incorporated into products sold on the market today; and 4) ARPA-E projects have generated 1,634 peer-

reviewed journal articles, , and 248 patents issued by the U.S. Patent and Trademark Office.

Office of Project Management

Q6. The previous Administration established the Office of Project Management in 2015 to provide additional oversight for large capital projects, some of which have proven troublesome for the Department to appropriately manage. What is your vision for this office and are there other project oversight gaps that you view as opportunities to address?

A6. Our Administration is committed to implementing sound project management principles and proven industry best practices. To address challenges with DOE's most complex projects, DOE is adopting a risk-based approach to project management that focuses resources on projects that require senior-level management attention and oversight. In addition, we are continually improving our policies and practices to reflect lessons learned and to model effective approaches to project management. As part of ongoing strategic reform efforts, DOE has also partnered with our national laboratories to institute common sense reforms that incentivize project management excellence, promote accountability and help ensure that projects are consistently delivered on cost and schedule. The Office of Project Management is playing a critical role in leading these reforms to address deficiencies and unmet needs, improve performance, and promote transparency by continually assessing projects performance. In addition, the Office continues to provide oversight to ensure sound project management planning, especially when validating cost estimates.

QUESTIONS FROM REPRESENTATIVE HUDSON

Deputy Secretary of Energy Dan Brouillette

Q1. With the passage of the FAST Act in 2015, Congress designated the Department of Energy the lead Sector-Specific Agency for cybersecurity for the energy sector. As you know, the nation's energy infrastructure is a highly interdependent network of oil and natural gas pipelines and electric facilities with overlapping jurisdictional boundaries. As the Sector-Specific Agency, DOE is responsible for coordinating multiple federal and state agencies, in addition to infrastructure owners and operators, to keep the system running safely.

Q1a. Would you please describe the coordination conducted with the Department of Homeland Security and other agencies as it relates to cybersecurity for pipelines?

A1a. Pipelines are part of the transportation sector. The Department of Homeland Security (DHS) provides overall cybersecurity leadership across the Government, while DHS and the Department of Transportation (DOT) are the sector-specific agencies (SSA) for the transportation sector. DOE is the SSA for cybersecurity across the energy sector. In addition to the FAST Act designation for cybersecurity for the energy sector, Department of Energy (DOE) also serves as the SSA for energy under Presidential Policy Directive 21 (PPD 21): Critical Infrastructure Security and Resilience and the lead Federal agency for Emergency Support Function (ESF) #12 – Energy under the National Response Framework.

Department of Energy (DOE) has established a productive public-private partnership with government partners and the pipeline industry to secure the transport of oil and natural gas. DOE, through the Office of Electricity Delivery and Energy Reliability (OE), works with the Department of Homeland Security (DHS) National Protection and Programs Directorate (NPPD), Transportation Security Administration, U.S. Coast Guard, and Infrastructure Security Compliance Division, as well as the Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration and the Federal Energy Regulatory Commission to streamline pipeline security and safety initiatives as they relate to resilience and reliability.

DOE OE and DHS NPPD co-chair the Energy Government Coordinating Council (EGCC), which convenes groups listed above, as well as others such as the Federal Bureau of Investigation, Office of the Director of National Intelligence, and Natural Resources Canada, to foster a shared national homeland security strategy as it relates to energy infrastructure.

DOE OE and DHS are the government co-chairs of the Oil and Natural Gas Subsector Coordinating Council (ONG SCC), which is the primary vehicle for coordination with all operational segments of the oil and natural gas industry—drilling, exploration and production, marketing, processing, refining, service and supply, transmission, and distribution on a variety of security and resilience issues, with cybersecurity as a standing agenda item. The ONG SCC meets three times a year with senior cybersecurity and physical security representatives from industry to enable the public and private sectors to coordinate oil and natural gas security strategies, activities, and communication to support the Nation's homeland security mission.

Q1b. Are there actions that Congress should take to clarify authorities or reallocate resources to improve the safety and security of the nation's pipeline system?

A1b. Under PPD-21, DOE is designated as the SSA for the energy sector. DOE coordinates with DHS's Transportation Security Administration and DOT's Pipeline and Hazardous Materials Safety Administration on matters related to the safety and security of the Nation's pipelines, and DOE works closely with interagency partners to fully support the private sector in its protection efforts. As the SSA, DOE also co-chairs the ONGSCC and EGCC, which provide a forum for information sharing between all responsible public and private officials. The ONG SCC also includes a Standing Pipeline Working Group and is an invaluable resource in DOE's emergency response efforts.

Q8: "What are the list of schools and universities that has received funding over the past 10 years from your department, as well as the amounts distributed to each university?"

A8: The following tables list the Department of Energy (DOE) Office of Science (SC) funded institutions of higher education. The fiscal year (FY) funding listed with each Institution of Higher Education is the sum of fiscal year funds obligated to that institution for all active awards at that institution. A "$0" indicates active award(s) forward-funded in a previous fiscal year; a negative (-$) funding amount reflects a deobligation, most likely resulting from a PI leaving the institution and moving to another.

DOE Office of Science Awarded Institutions of Higher Education by Fiscal Year

Prepared in response to the Question for the Record (QFR) by the Honorable Bobby L. Rush, for the House Energy and Commerce Hearing, January 9, 2018.

FY 2017

Institution	FY 2017 Funding
Abilene Christian University	$675,000
Arizona State University	$1,673,132
Auburn University	$2,584,661
Baylor University	$427,397
Boise State University	$0
Boston College	$980,000
Boston University	$2,760,001
Bowie State University	$150,000
Bowling Green State University	$427,335
Brandeis University	$670,000
Brigham Young University	$589,446
Brown University	$3,416,877
Bryn Mawr College	$150,000
California Institute of Technology	$18,781,139
California State University - Dominguez Hills	$0
California State University - Fullerton	$0
California State University - Long Beach	$255,000
California State University - Northridge	$0
Carnegie Mellon University	$3,509,171
Case Western Reserve University	$755,576
Central Michigan University	$1,199,999
Chapman University	$497,450
Clark Atlanta University	$0
Clark University	$0
Clarkson University	$570,000
Clemson University	$881,942
Cleveland State University	$602,178
College of Charleston	$0

Institution	FY 2017 Funding
College of William and Mary	$1,525,759
Colorado School of Mines	$2,098,861
Colorado State University	$3,486,586
Columbia University	$6,895,156
Cornell University	$7,030,280
Creighton University	$669,000
CUNY - Advanced Science Research Center (CUNY-ASRC)	$0
CUNY - Baruch College	$435,000
CUNY - City College	$1,748,189
CUNY - Lehman College	$313,000
CUNY - Queens College	$340,000
Dartmouth College	$0
Drexel University	$250,000
Duke University	$9,427,753
Emory University	$831,439
Florida A&M University	$191,000
Florida Institute of Technology	$290,000
Florida International University	$807,000
Florida State University	$5,811,193
George Mason University	$0
George Washington University	$455,000
Georgetown University	$920,000
Georgia Institute of Technology	$4,226,727
Georgia State University Research Foundation, Inc.	$722,000
Hampton University	$746,408
Harvard Medical School	$3,450,260
Harvard University	$6,511,859
Illinois Institute of Technology	$420,000
Indiana State University	$0
Indiana University	$3,333,999
Iowa State University of Science and Technology	$3,378,802
Jackson State University	$485,969
Johns Hopkins University	$2,586,172
Kansas State University	$3,961,192
Kent State University	$2,193,717
Lehigh University	$1,469,452
Lewis & Clark College	$0
Louisiana State University and A&M College	$3,869,073
Louisiana Tech University	$0
Marquette University	$510,845
Massachusetts Institute of Technology	$42,815,208
Miami University	-$630,000
Michigan State University	$115,503,792

Institution	FY 2017 Funding
Michigan Technological University	$0
Mississippi State University	$1,420,000
Missouri University of Science and Technology	$150,000
Montana State University	$2,396,710
New Jersey Institute of Technology	$5,000
New Mexico State University	$808,000
New York University	$2,608,083
Norfolk State University	$0
North Carolina Central University	$774,004
North Carolina State University	$2,638,000
North Dakota State University	$0
Northeastern University	$1,535,750
Northern Arizona University	$1,294,739
Northern Illinois University	$342,000
Northwestern University	$16,083,141
Ohio State University	$11,117,968
Ohio University	$902,000
Oklahoma State University	$419,000
Old Dominion University	$671,241
Old Dominion University Research Foundation	$853,000
Oregon State University	$1,339,099
Princeton University	$5,541,791
Purdue University	$7,606,922
Rensselaer Polytechnic Institute	$1,680,726
Research Foundation of The City University of New York (CUNY)	$0
Rutgers, State University of New Jersey - New Brunswick	$523,000
Rutgers, State University of New Jersey - Newark	$941,026
Rutgers, State University of New Jersey - Piscataway	$979,059
Saint Michael's College	$0
San Diego State University	$540,427
San Francisco State University	$417,000
San Jose State University	$355,285
Santa Clara College	$0
South Dakota School of Mines & Technology	$436,000
Southern Illinois University - Carbondale	$0
Southern Methodist University	$1,011,000
Stanford University	$8,333,492
SUNY - Binghamton	$3,100,000
SUNY - Stony Brook University	$11,290,812
SUNY - University at Albany	$1,006,797
Swarthmore College	$105,000
Syracuse University	$920,017
Temple University	$4,714,318

Institution	FY 2017 Funding
Tennessee Technological University	$617,490
Texas A&M AgriLife Research	$0
Texas A&M Engineering Experiment Station	$0
Texas A&M University	$6,803,796
Texas A&M University - Commerce	$144,000
Texas A&M University - Galveston	$0
Texas Christian University	$448,579
Texas Tech University	$480,000
Tufts University	$1,770,000
Tulane University	$69,000
University of Alabama	$2,342,094
University of Alabama - Birmingham	$816,980
University of Alaska - Fairbanks	$425,000
University of Arizona	$2,791,915
University of Arkansas	$450,000
University of California - Berkeley	$13,898,705
University of California - Davis	$9,163,765
University of California - Irvine	$8,215,691
University of California - Los Angeles	$16,578,297
University of California - Merced	$823,999
University of California - Riverside	$4,000,000
University of California - San Diego	$14,353,692
University of California - Santa Barbara	$7,904,667
University of California - Santa Cruz	$3,040,975
University of Central Florida	-$146,288
University of Chicago	$3,397,193
University of Cincinnati	$927,000
University of Colorado - Boulder	$9,617,564
University of Colorado - Denver	$555,000
University of Connecticut	$1,567,795
University Of Delaware	$5,161,001
University of Florida	$4,155,825
University of Georgia	$1,550,471
University of Hawaii	$1,974,000
University of Houston	$1,087,000
University of Idaho	$395,312
University of Illinois - Chicago	$1,832,069
University of Illinois - Urbana-Champaign	$14,358,568
University of Iowa	$472,000
University of Kansas	$702,000
University of Kentucky	$2,177,000
University of Maine	$0
University of Maryland - Baltimore County	$402,012

Institution	FY 2017 Funding
University of Maryland - College Park	$8,393,684
University of Massachusetts - Amherst	$3,531,578
University of Massachusetts - Lowell	$1,120,078
University of Miami (Coral Gables & South Campuses)	$0
University of Miami (School of Marine and Atmospheric Science)	$449,546
University of Michigan	$12,830,642
University of Minnesota	$12,477,000
University of Mississippi	$315,000
University of Missouri - Columbia	$2,252,672
University of Montana	$0
University of Nebraska - Lincoln	$4,755,111
University of Nevada - Reno	$0
University of New Hampshire	$192,000
University of New Mexico	$2,075,000
University of North Carolina - Chapel Hill	$6,393,034
University of North Georgia	$0
University of North Texas	$630,000
University of Notre Dame	$7,945,003
University of Oklahoma	$1,195,000
University of Oregon	$1,246,000
University of Pennsylvania	$6,499,878
University of Richmond	$0
University of Rochester	$3,849,988
University of San Diego	$0
University of South Carolina	$2,400,736
University of South Carolina Research Foundation	$587,835
University of South Dakota	$0
University of South Florida	$0
University of Southern California	$3,339,000
University of Tennessee	$10,837,194
University of Texas - Arlington	$1,232,000
University of Texas - Austin	$13,900,619
University of Texas - Dallas	$370,000
University of Texas - El Paso	$0
University of the Pacific	$0
University of Toledo	$0
University of Utah	$2,130,853
University of Vermont and State Agricultural College	$251,032
University of Virginia	$5,385,003
University of Washington	$18,170,368
University of Wisconsin - Eau Claire	$150,000
University of Wisconsin - Madison	$60,527,490

Institution	FY 2017 Funding
University of Wisconsin - Milwaukee	$215,341
University of Wyoming	$1,450,000
Utah State University	$1,462,336
Valparaiso University	$315,000
Vanderbilt University	$2,059,000
Virginia Commonwealth University	$1,084,837
Virginia Polytechnic Institute and State University	$3,304,482
Washington State University	$2,721,488
Washington University in St. Louis	$9,710,327
Wayne State University	$1,416,679
Wellesley College	$8,000
West Virginia University	$1,699,191
Western Michigan University	$0
William Marsh Rice University	$4,072,157
Yale University	$5,577,000

FY 2016

Institution	FY 2016 Funding
Abilene Christian University	$0
Alfred University	$0
Arizona State University	$2,215,659
Auburn University	$2,132,872
Baylor University	$265,000
Boise State University	$510,847
Boston College	$15,000
Boston University	$3,780,285
Bowie State University	$300,000
Bowling Green State University	$50,000
Brandeis University	$2,302,000
Brigham Young University	$988,354
Brown University	$4,158,297
California Institute of Technology	$17,371,858
California State University - Dominguez Hills	$235,000
California State University - Fullerton	$96,000
California State University - Northridge	$345,000
Carnegie Mellon University	$3,143,461
Case Western Reserve University	$1,935,000
Central Michigan University	$1,785,845
Chapman University	$499,715
Clark Atlanta University	$240,000

Institution	FY 2016 Funding
Clark University	$0
Clemson University	$2,049,997
College of William and Mary	-$241,999
Colorado School of Mines	$1,042,776
Colorado State University	$6,467,321
Columbia University	$11,277,991
Cornell University	$6,132,947
Creighton University	$0
CUNY - Baruch College	$0
CUNY - Hunter College	$377,096
CUNY - Lehman College	$0
Dakota State University	$8,477
Dartmouth College	$812,067
Drexel University	$430,000
Duke University	$7,928,000
Emory University	$1,715,137
Florida A&M University	$0
Florida Institute of Technology	$290,000
Florida International University	$1,256,935
Florida State University	$8,809,477
George Mason University	$5,000
George Washington University	$1,891,000
Georgetown University	$340,000
Georgia Institute of Technology	$8,876,313
Georgia State University Research Foundation, Inc.	$1,139,987
Gordon Research Conferences	$188,005
Hampton University	$719,000
Harvard Medical School	$435,000
Harvard School of Public Health	$2,999,999
Harvard University	$5,482,224
Hofstra University	$0
Illinois Institute of Technology	$865,000
Indiana State University	$0
Indiana University	$5,850,877
Iowa State University of Science and Technology	$5,815,856
Johns Hopkins University	$5,272,945
Kansas State University	$4,915,866
Kent State University	$1,017,000
Lehigh University	$2,487,953
Lewis & Clark College	$255,194
Louisiana State University and A&M College	$3,143,986
Louisiana Tech University	$130,000
Massachusetts Institute of Technology	$59,479,500

Institution	FY 2016 Funding
Miami University	$630,000
Michigan State University	$112,685,495
Michigan Technological University	$428,576
Mississippi State University	$403,000
Missouri University of Science and Technology	$150,000
Montana State University	$3,404,404
New Jersey Institute of Technology	$87,146
New Mexico Consortium	$0
New Mexico State University	$465,000
New York University	$3,412,004
Norfolk State University	$0
North Carolina Central University	$0
North Carolina State University	$2,319,000
North Dakota State University	$150,000
Northeastern University	$1,199,725
Northern Arizona University	$1,296,114
Northern Illinois University	$840,000
Northwestern University	$12,556,172
Ohio State University	$10,582,212
Ohio University	$1,324,000
Oklahoma State University	$812,000
Old Dominion University	$0
Old Dominion University Research Foundation	$1,434,000
Oregon State University	$0
Portland State University	$0
Princeton University	$10,692,812
Purdue University	$8,950,735
Rensselaer Polytechnic Institute	$2,133,758
Research Foundation of The City University of New York (CUNY)	$920,500
Rutgers, State University of New Jersey - New Brunswick	$5,056,670
Rutgers, State University of New Jersey - Newark	$0
Saint Michael's College	$0
San Diego State University	$525,000
San Francisco State University	$0
Santa Clara College	$0
South Dakota School of Mines & Technology	$372,000
Southern Illinois University - Carbondale	$371,088
Southern Methodist University	$800,000
Stanford University	$10,166,821
SUNY - Binghamton	$3,193,903
SUNY - University at Albany	$1,172,745
SUNY - University of Buffalo	$539,998

Institution	FY 2016 Funding
Swarthmore College	$0
Syracuse University	$1,219,010
Temple University	$5,225,349
Tennessee Technological University	$115,000
Texas A&M AgriLife Research	$397,298
Texas A&M Research Foundation	$0
Texas A&M University	$6,359,773
Texas A&M University - Commerce	$104,000
Texas A&M University - Galveston	$0
Texas Engineering Experiment Station	$0
Texas Tech University	$820,391
Tufts University	$1,035,000
Tulane University	$0
University of Alabama	$1,245,756
University of Alabama - Birmingham	$569,589
University of Alabama - Huntsville	$0
University of Alaska - Fairbanks	$0
University of Arizona	$3,828,224
University of Arkansas	$3,262,502
University of California - Berkeley	$11,387,941
University of California - Davis	$11,744,910
University of California - Irvine	$8,466,870
University of California - Los Angeles	$17,687,956
University of California - Merced	$649,411
University of California - Riverside	$8,441,146
University of California - San Diego	$13,334,515
University of California - Santa Barbara	$7,388,638
University of California - Santa Cruz	$4,019,587
University of Central Florida	$1,165,000
University of Chicago	$4,734,001
University of Cincinnati	$910,000
University of Colorado - Boulder	$0
University of Colorado - Denver	$11,434,286
University of Connecticut	$3,177,361
University of Delaware	$5,053,825
University of Florida	$4,470,000
University of Georgia	$1,850,625
University of Hawaii	$2,098,000
University of Houston	$2,462,275
University of Idaho	$393,162
University of Illinois - Chicago	$1,298,000
University of Illinois - Urbana-Champaign	$16,028,842
University of Iowa	$2,370,001

Institution	FY 2016 Funding
University of Kansas	$2,161,103
University of Kansas Medical Ctr. Res. Inst., Inc.	$0
University of Kentucky	$2,138,463
University of Maine	$150,000
University of Maryland - Baltimore County	$0
University of Maryland - College Park	$11,007,939
University of Massachusetts - Amherst	$3,541,932
University of Massachusetts - Lowell	$350,000
University of Memphis	-$164,290
University of Miami (Coral Gables & South Campuses)	$0
University of Miami (School of Marine and Atmospheric Science)	$374,867
University of Michigan	$12,378,362
University of Minnesota	$9,645,362
University of Mississippi	$382,000
University of Missouri - Columbia	$1,533,000
University of Montana	$180,000
University of Nebraska - Lincoln	$4,875,126
University of Nevada - Reno	$1,989,976
University of New Hampshire	$1,673,896
University of New Mexico	$1,270,646
University of North Carolina - Chapel Hill	$6,819,952
University of North Texas	$1,012,701
University of Notre Dame	$9,567,811
University of Oklahoma	$1,190,000
University of Oregon	$2,897,000
University of Pennsylvania	$7,287,000
University of Richmond	$0
University of Rochester	$5,249,788
University of San Diego	$0
University of South Carolina	$3,146,254
University of South Carolina Research Foundation	$200,000
University of South Dakota	$120,000
University of South Florida	$1,329,577
University of Southern California	$5,075,894
University of Tennessee	$9,422,057
University of Texas - Arlington	$1,953,000
University of Texas - Austin	$15,388,622
University of Texas - Dallas	$1,172,386
University of Texas - El Paso	$0
University of the Pacific	$0
University of Toledo	$0
University of Tulsa	$0

Institution	FY 2016 Funding
University of Utah	$3,963,221
University of Vermont and State Agricultural College	$586,000
University of Virginia	$5,597,924
University of Washington	$20,423,801
University of Wisconsin - Eau Claire	$150,000
University of Wisconsin - Madison	$46,418,320
University of Wisconsin - Milwaukee	$1,624,444
University of Wyoming	$824,657
Utah State University	$531,000
Valparaiso University	$0
Vanderbilt University	$3,231,000
Virginia Commonwealth University	$300,000
Virginia Polytechnic Institute and State University	$3,958,890
Washington State University	$2,612,332
Washington University in St. Louis	$6,810,674
Wayne State University	$1,632,504
West Virginia University	$798,119
William Marsh Rice University	$2,545,239
Yale University	$7,666,916

FY 2015

Institution	FY 2015 Funding
Abilene Christian University	$420,000
Alfred University	$27,806
Arizona State University	$2,169,922
Auburn University	$1,928,267
Auburn University at Montgomery	$0
Barnard College	$0
Baruch College (CUNY)	$360,000
Baylor University	$279,920
Binghamtom University (SUNY)	$3,300,000
Boston College	-$110,733
Boston University	$3,131,785
Bowling Green State University	$188,000
Brandies University	$1,756,603
Brigham Young University	$0
Brown University	$4,645,395
California Institute of Technology	$17,365,590
California State University - Fullerton	$0
California State University - Northridge	$110,000

Institution	FY 2015 Funding
Carnegie Mellon University	$2,915,319
Case Western Reserve University	$740,000
Central Michigan University	$563,393
Chapman University	$498,618
City College of New York (CUNY)	$749,000
Clark Atlanta University	$80,000
Clark University	$64,871
Clarkson University	$3,718
Clemson University	$2,740,000
Clemson University Research Foundation	$35,000
College of Charleston	$149,933
College of William and Mary	$1,481,296
Colorado School of Mines	$932,609
Colorado State University	$7,573,351
Columbia University	$10,862,666
Cornell University	$8,334,153
Creighton University	$0
Dakota State University	$4,000
Dartmouth College	$571,000
Drexel University	$655,000
Duke University	$8,715,383
Emory University	$685,812
Florida A&M University	$155,542
Florida Institute of Technology	$290,000
Florida International University	$466,000
Florida State University	$5,126,426
George Mason University	$74,360
George Washington University	$612,000
Georgetown University	$170,000
Georgia Institute of Technology	$5,256,509
Georgia State University	$754,244
Hampton University	$1,200,000
Harvard Medical School	$435,000
Harvard School of Public Health	$2,999,998
Hofstra University	$0
Hope College	$374,500
Hunter College (CUNY)	$50,000
Illinois Institute of Technology	$520,000
Indiana State University	$330,000
Indiana University	$5,934,828
Iowa State University of Science and Technology	$3,096,182
Johns Hopkins University	$4,825,659
Kansas State University	$3,395,000

Institution	FY 2015 Funding
Kent State University	$1,261,000
Lehigh University	$3,551,912
Lehman College (CUNY)	$0
Louisiana State University and A&M College	$2,922,999
Louisiana Tech University	$208,000
Marine Biological Laboratory	$350,000
Massachusetts Institute of Technology	$67,286,961
Miami University	$690,000
Michigan State University	$111,091,114
Michigan Technological University	$95,810
Mississippi State University	$826,000
Missouri University of Science and Technology	$708,000
Montana State University	$2,912,085
New Jersey Institute of Technology	$5,000
New Mexico Consortium	$247,966
New Mexico State University	$465,000
New York University	$3,767,273
New York University - Brooklyn	$0
Norfolk State University	$112,000
North Carolina Central University	$0
North Carolina State University	$4,633,006
North Dakota State University	$150,000
Northeastern University	$871,131
Northern Arizona University	$1,251,375
Northern Illinois University	$394,000
Northwestern University	$13,436,565
Ohio State University	$8,783,815
Ohio University	$1,431,458
Oklahoma State University	$365,482
Old Dominion University	$167,000
Old Dominion University Research Foundation	$2,317,000
Oregon State University	$660,634
Portland State University	$210,000
President and Fellows of Harvard College	$8,760,491
Princeton University	$8,750,077
Purdue University	$9,862,507
Queens College (CUNY)	$120,000
Rensselaer Polytechnic Institute	$2,118,000
Research Foundation of The City University of New York (CUNY) - Hunter College	$0
Rutgers, The State University of New Jersey - New Brunswick	$2,015,469
Rutgers, The State University of New Jersey - Newark	$360,000

Institution	FY 2015 Funding
Saint Michael's College	$145,000
San Diego State University	$1,035,000
San Francisco State University	$340,000
Santa Clara College	$71,250
South Dakota School of Mines & Technology	$292,000
Southern Illinois University	$99,999
Southern Methodist University	$1,159,000
Stanford University	$6,585,518
State University of New York (Suny) - Delhi	$0
SUNY Environmental Science and Forestry	$0
Swarthmore College	$148,000
Syracuse University	$774,053
Temple University	$6,442,488
Tennessee Technological University	$240,000
Texas A&M Agrilife Research	$401,498
Texas A&M Research Foundation	$367,000
Texas A&M University	$6,662,884
Texas A&M University - Commerce	$155,000
Texas A&M University - Galveston	$300,000
Texas Engineering Experiment Station	$1,049,757
Texas Tech University	$419,888
Tufts University	$545,000
Tulane University	$449,999
Union College	-$39,557
University at Albany (SUNY)	$340,898
University of Akron	$0
University of Alabama	$997,000
University of Alabama - Huntsville	$0
University of Alaska Fairbanks	$100,000
University of Arizona	$2,408,838
University of Arkansas	$150,000
University of Buffalo (SUNY)	$1,154,940
University of California - Berkeley	$12,340,255
University of California - Davis	$11,303,042
University of California - Irvine	$7,224,854
University of California - La Jolla	$2,219,311
University of California - Los Angeles	$18,056,224
University of California - Merced	$922,707
University of California - Riverside	$7,990,382
University of California - San Diego	$14,043,131
University of California - Santa Barbara	$8,886,342
University of California - Santa Cruz	$2,821,000
University of Central Florida	$977,124

Institution	FY 2015 Funding
University of Chicago	$6,784,013
University of Cincinnati	$818,000
University of Colorado - Boulder	$10,034,212
University of Connecticut	$3,567,562
University of Delaware	$4,955,274
University of Florida	$4,217,678
University of Georgia	$2,857,583
University of Hawaii	$1,802,000
University of Houston	$1,672,000
University of Idaho	$915,000
University of Illinois - Champiagn	$15,332,923
University of Illinois - Chicago	$865,000
University of Iowa	$2,407,000
University of Kansas	$1,532,000
University of Kentucky	$915,000
University of Louisiana - Lafayette	$63,390
University of Louisville	$0
University of Maryland - Baltimore County	$1,346,020
University of Maryland - College Park	$8,901,029
University of Massachusetts - Amherst	$3,618,800
University of Massachusetts - Lowell	$340,000
University of Memphis	$75,000
University of Miami (Coral Gables & South Campuses)	$455,823
University of Miami (School of Marine and Atmospheric Science)	$365,050
University of Michigan	$15,144,515
University of Minnesota	$12,611,402
University of Mississippi	$412,000
University of Missouri	$2,573,171
University of Montana	$0
University of Nebraska	$4,349,088
University of Nevada - Las Vegas	$0
University of Nevada - Reno	$3,315,268
University of New Hampshire	$1,503,000
University of New Mexico	$1,220,993
University of North Carolina - Charlotte	$12,540
University of North Carolina at Chapel Hill	$7,238,033
University of North Dakota	$0
University of North Georgia	$0
University of North Texas	$54,000
University of Notre Dame	$9,260,684
University of Oklahoma	$4,449,034
University of Oregon	$2,528,800

Institution	FY 2015 Funding
University of Pennsylvania	$7,781,000
University of Puerto Rico - Central Administration	$0
University of Richmond	$396,000
University of Rochester	$4,156,580
University of San Diego	$165,000
University of South Carolina	$1,096,955
University of South Carolina Research Foundation	$0
University of South Dakota	$0
University of South Florida	$741,018
University of Southern California	$3,123,693
University of Tennessee	$4,490,365
University of Texas - Arlington	$1,010,000
University of Texas - Austin	$20,454,745
University of Texas - Dallas	$693,000
University of Texas - El Paso	$394,290
University of The Pacific	$334,131
University of Toledo	$0
University of Tulsa	$100,000
University of Utah	$4,825,598
University of Vermont And State Agricultural College	$154,745
University of Virginia	$4,737,000
University of Washington	$17,552,015
University of Wisconsin - Milwaukee	$1,206,486
University of Wisconsin - Eau Claire	$150,000
University of Wisconsin - Madison	$49,798,299
University of Wyoming	$4,158,858
Utah State University	$558,000
Valparaiso University	$210,000
Vanderbilt University	$2,163,000
Virginia Commonwealth University	$347,196
Virginia Polytechnic Institute and State University	$2,526,312
Washington State University	$1,448,300
Washington University in St. Louis	$7,986,509
Wayne State University	$3,840,000
West Virginia University	$380,000
Western Michigan University	$0
William Marsh Rice University	$4,757,672
Xavier University of Louisiana	$0
Yale University	$9,727,000
York College (CUNY)	$95,000
Hebrew University of Jerusalem	$0.00
McGill University	$0.00
Monash University	$583,648.00

Institution	FY 2015 Funding
University of Luxembourg	$199,269.00
University of Reading	$0.00

FY 2014

Institution	FY 2014 Funding
Abilene Christian University	$187,000
Alfred University	$28,551
Arizona State University	$1,531,096
Auburn University	$1,025,000
Baylor University	$233,000
Boise State University	$30,000
Boston College	$1,534,355
Boston University	$5,592,987
Bowling Green State University	$188,000
Brandeis University	$1,456,000
Brigham Young University	$389,999
Brown University	$6,652,832
California Institute of Technology (CalTech)	$24,339,716
California State University Fullerton	$96,000
California State University Northridge	$110,000
California State University, Dominguez Hills	$55,000
Carnegie Mellon University	$3,199,299
Case Western Reserve University	$881,396
Central Michigan University	$592,393
Cheyney University of Pennsylvania	$0
City College of New York (CUNY)	$534,919
City College of New York (CUNY), Baruch College	$490,000
City College of New York (CUNY), Hunter College	$231,249
City College of New York (CUNY), Lehman College	$240,000
City College of New York (CUNY), Queens College	$218,000
Clark Atlanta University	$80,000
Clark University	$63,260
Clemson University	$2,627,421
College of William and Mary	$2,375,419
Colorado School of Mines	$1,698,855
Colorado State University	$5,531,252
Columbia University	$8,137,052
Cornell University	$8,065,399
Creighton University	$669,000

Institution	FY 2014 Funding
Dartmouth College	$444,000
Drexel University	$650,000
Duke University	$8,782,978
Emory University	$1,179,817
Florida A&M University	$334,000
Florida Institute of Technology	$246,000
Florida International University	$923,683
Florida State University	$5,147,782
George Mason University	$784,879
George Washington University	$1,761,000
Georgetown University	$530,000
Georgia Institute of Technology	$7,656,257
Georgia State University	$1,641,292
Hampton University	$690,000
Harvard Medical School	$435,000
Harvard School of Public Health	$3,000,000
Harvard University	$9,613,894
Hope College	$0
Illinois Institute of Technology	$569,000
Indiana State University	$0
Indiana University	$6,516,702
Iowa State University of Science and Technology	$3,249,383
Johns Hopkins University	$5,599,101
Kansas State University	$4,135,950
Kent State University	$882,000
Lehigh University	$1,851,953
Loma Linda University	$0
Louisiana State University and A&M College	$3,393,999
Louisiana Tech University	$208,000
Marine Biological Laboratory	$744,512
Marshall University Research Corporation	$0
Massachusetts Institute of Technology (MIT)	$66,360,027
Miami University	$360,000
Michigan State University	$7,094,686
Michigan Technological University	$2,200,384
Mississippi State University	$884,000
Montana State University	$2,383,679
New Jersey Institute of Technology	$100,000
New Mexico State University	$902,000
New York University	$4,917,764
New York University Langone Medical Center	$0

Institution	FY 2014 Funding
Norfolk State University	$110,000
North Carolina Central University	$697,000
North Carolina State University	$4,261,550
North Dakota State University	$383,000
Northeastern University	$1,106,000
Northern Arizona University	$481,313
Northern Illinois University	$805,000
Northwestern University	$15,191,050
Ohio State University	$10,009,876
Ohio University	$1,068,886
Oklahoma State University	$851,000
Old Dominion University Research Foundation	$1,713,000
Oregon State University	$1,510,382
Portland State University	$210,000
Prairie View A&M University	$272,000
Princeton University	$11,470,892
Purdue University	$12,652,780
Rensselaer Polytechnic Institute	$2,858,090
Rice University	$5,217,409
Rutgers - State University of New Jersey, Newark	$0
Rutgers, The State University of New Jersey	$3,309,315
Salk Institute for Biological Studies	$135,000
San Diego State University Research Foundation	$343,000
San Francisco State University	$100,000
Southern Illinois University	$99,999
Southern Methodist University	$1,063,000
Stanford University	$10,098,656
State University of New York (SUNY) - Albany	$956,335
State University of New York (SUNY) - Binghamton	$3,000,000
State University of New York (SUNY) - Buffalo	$628,968
State University of New York (SUNY) - Delhi	$0
State University of New York (SUNY) - Stony Brook	$8,216,388
State University of New York (SUNY) - Syracuse	$80,000
Swarthmore College	$107,000
Syracuse University	$835,009
Temple University	$4,713,881
Tennessee Technological University	$101,000
Texas A&M University - College Station	$5,391,978
Texas A&M University - Greenville	$3,535,000
Texas Engineering Experiment Station - College Station	$923,520
Texas Tech University	$1,165,000

Institution	FY 2014 Funding
The University of Vermont and State Agricultural College	$150,097
Tufts University	$1,917,478
Tulane Educational Fund	$80,000
Union College	$34,000
University of Akron	$0
University of Alabama	$1,006,600
University of Alabama - Huntsville	$590,000
University of Alaska - Fairbanks	$764,338
University of Arizona	$3,767,312
University of Arkansas	$10,000
University of California - Berkeley	$10,255,051
University of California - Davis	$10,630,393
University of California - Irvine	$10,620,182
University of California - Los Angeles	$20,172,635
University of California - Merced	$1,366,202
University of California - Riverside	$7,363,707
University of California - San Diego	$17,034,333
University of California - San Diego, Scripps Institute of Oceanography (SIO)	$1,649,543
University of California - San Francisco	$124,601
University of California - Santa Barbara	$7,778,021
University of California - Santa Cruz	$2,934,013
University of Central Florida	$759,708
University of Chicago	$5,096,928
University of Cincinnati	$914,000
University of Colorado	$12,431,012
University of Connecticut	$2,129,000
University of Delaware	$5,017,067
University of Florida	$4,850,902
University of Georgia	$3,259,829
University of Hawaii	$2,877,309
University of Houston	$2,527,000
University of Idaho	$95,000
University of Illinois - Chicago	$1,528,392
University of Illinois - Urbana-Champaign	$17,362,725
University of Iowa	$1,062,000
University of Kentucky	$1,313,960
University of Louisiana - Lafayette	$50,367
University of Louisville	$73,000
University of Maine	$30,000
University of Maryland - Baltimore	$443,691

Institution	FY 2014 Funding
University of Maryland - College Park	$9,388,447
University of Massachusetts - Amherst	$4,095,796
University of Massachusetts - Lowell	$731,000
University of Memphis	$75,000
University of Miami	$653,212
University of Michigan	$16,737,338
University of Minnesota	$14,540,972
University of Mississippi	$264,000
University of Missouri - Columbia	$720,878
University of Missouri - Rolla (Mo. Univ of Sci and Tech)	$337,000
University of Montana	$36,000
University of Nebraska	$1,395,589
University of Nevada - Las Vegas	$133,667
University of Nevada - Reno	$1,705,857
University of New Hampshire	$1,074,000
University of New Mexico	$2,586,353
University of North Carolina - Chapel Hill	$6,925,918
University of North Dakota	$126,306
University of North Georgia	$93,000
University of North Texas	$673,999
University of Notre Dame	$9,184,086
University of Oklahoma	$3,800,653
University of Oregon	$4,976,022
University of Pennsylvania	$8,265,672
University of Puerto Rico - Mayaguez	$0
University of Puerto Rico - San Juan	$0
University of Rhode Island	$0
University of Richmond	$56,000
University of Rochester	$3,590,964
University of South Carolina	$1,572,892
University of South Florida	$1,230,714
University of Southern California	$3,326,201
University of Tennessee	$4,898,719
University of Texas - Arlington	$1,070,654
University of Texas - Austin	$15,425,928
University of Texas - Dallas	$866,000
University of Texas - El Paso	$589,820
University of the Pacific	$80,181
University of Toledo	$500,000
University of Tulsa	$0
University of Utah	$5,923,195

Institution	FY 2014 Funding
University of Virginia	$5,668,787
University of Washington	$21,546,876
University of Wisconsin - Eau Claire	$150,000
University of Wisconsin - Madison	$51,049,202
University of Wisconsin - Milwaukee	$1,334,426
University of Wyoming	$2,226,090
Utah State University	$410,000
Vanderbilt University	$2,862,057
Virginia Commonwealth University	$1,527,196
Virginia Polytechnic Institute and State University (Virginia Tech)	$3,856,991
Washington State University	$1,895,347
Washington University	$9,142,507
Wayne State University	$2,485,000
West Virginia University	$952,932
Western Michigan University	$100,000
Worcester Polytechnic Institute	$0
Xavier University of Louisiana	$149,799
Yale University	$8,299,000

FY 2013

Institution	FY 2013 Funding
ABILENE CHRISTIAN UNIVERSITY	$187,000
ALFRED UNIVERSITY	$53,000
ARIZONA STATE UNIVERSITY	$2,380,000
AUBURN UNIVERSITY	$1,310,000
BARNARD COLLEGE	$0
BAYLOR UNIVERSITY	$423,000
BOISE STATE UNIVERSITY	$152,000
BOSTON COLLEGE	$617,000
BOSTON UNIVERSITY	$3,895,000
BOWLING GREEN STATE UNIVERSITY	$188,000
BRANDEIS UNIVERSITY	$1,354,000
BRIGHAM YOUNG UNIVERSITY	$305,000
BROWN UNIVERSITY	$6,171,000
CALIFORNIA INST. OF TECHNOLOGY	$23,118,000
CALIFORNIA STATE U. DOMINGUEZ	$0
CALIFORNIA STATE U. FULLERTON	$96,000
CALIFORNIA STATE U. LONG BEACH	$0
CALIFORNIA STATE UNIV. NORTHRIDGE	$110,000

Institution	FY 2013 Funding
CALIFORNIA STATE. U. SAN MARCOS	$60,000
CARNEGIE MELLON UNIVERSITY	$1,836,000
CASE WESTERN RESERVE UNIV.	$1,053,000
CENTRAL MICHIGAN UNIVERSITY	$350,000
CHEYNEY UNIVERSITY OF PENNSYLVA	$0
CITY U. OF NEW YORK, BARUCH COLLEGE	$0
CITY U. OF NEW YORK, CITY COLLEGE	$545,000
CITY U. OF NEW YORK, HUNTER COLLEGE	$533,000
CITY U. OF NEW YORK, QUEENS COUNTY	$120,000
CITY UNIV. OF NEW YORK, LEHMAN COLLEGE	$80,000
CITY UNIVERSITY OF NEW YORK, YORK COLLEGE	$93,000
CLARK ATLANTA UNIVERSITY	$80,000
CLARK UNIVERSITY	$68,000
CLARKSON UNIVERSITY	$101,000
CLEMSON UNIVERSITY	$764,000
COLLEGE OF WILLIAM AND MARY	$1,293,000
COLORADO SCHOOL OF MINES	$987,000
COLORADO STATE UNIVERSITY	$5,641,000
COLUMBIA UNIVERSITY	$9,899,000
CORNELL UNIVERSITY	$8,790,000
CREIGHTON UNIVERSITY	$215,000
DAKOTA STATE UNIVERSITY	$8,000
DARTMOUTH COLLEGE	$503,000
DREXEL UNIVERSITY	$500,000
DUKE UNIVERSITY	$2,626,000
EMORY UNIVERSITY	$1,182,000
FAIRFIELD UNIVERSITY	$0
FLORIDA A&M UNIVERSITY	$284,000
FLORIDA INSTITUTE OF TECHNOLOGY	$163,000
FLORIDA INTERNATIONAL UNIV.	$675,000
FLORIDA STATE UNIVERSITY	$4,839,000
GEORGE MASON UNIVERSITY	$129,000
GEORGE WASHINGTON UNIVERSITY	$1,370,000
GEORGETOWN UNIVERSITY	$260,000
GEORGIA INSTITUTE OF TECHNOLOGY	$4,001,000
GEORGIA STATE UNIVERSITY	$613,000
HAMPTON UNIVERSITY	$340,000
HARVARD UNIVERSITY	$10,267,000
HOFSTRA UNIVERSITY	$0
IDAHO STATE UNIVERSITY	$0
ILLINOIS INST. OF TECHNOLOGY	$538,000
INDIANA STATE UNIVERSITY	$0
INDIANA UNIVERSITY, BLOOMINGTON	$4,858,000
IOWA STATE UNIVERSITY	$3,263,000
JOHNS HOPKINS UNIVERSITY	$3,900,000
KANSAS STATE UNIVERSITY	$3,580,000
KENT STATE UNIVERSITY	$870,000
LEHIGH UNIVERSITY	$1,501,000

Institution	FY 2013 Funding
LOUISIANA STATE UNIVERSITY	$4,683,000
LOUISIANA TECH UNIVERSITY	$185,000
LUTHERAN UNIVERSITY ASSOCIATION	$154,000
MASSACHUSETTS INST. OF TECHNOLOGY	$52,020,000
MIAMI UNIVERSITY	$333,000
MICHIGAN STATE UNIVERSITY	$31,643,000
MICHIGAN TECH. UNIVERSITY	$672,000
MISSISSIPPI STATE UNIVERSITY	$848,000
Missouri University of Science and Technology	$150,000
MONTANA STATE UNIVERSITY	$754,000
NEW JERSEY INSTITUTE OF TECHNOLOGY	$164,000
NEW MEXICO STATE UNIVERSITY, LAS CRUCES	$708,000
NEW YORK UNIVERSITY	$1,401,000
NEW YORK UNIVERSITY, POLYTECHNIC	$90,000
NORFOLK STATE UNIVERSITY	$105,000
NORTH CAROLINA CENTRAL UNIV.	$100,000
NORTH CAROLINA STATE UNIVERSITY	$3,335,000
NORTH DAKOTA STATE UNIVERSITY	$240,000
NORTH GEORGIA COLLEGE & STATE U.	$93,000
NORTHEASTERN UNIVERSITY	$1,263,000
NORTHERN ARIZONA UNIVERSITY	$1,119,000
NORTHERN ILLINOIS UNIVERSITY	$374,000
NORTHWESTERN UNIVERSITY	$12,160,000
OCCIDENTAL COLLEGE	$0
OHIO STATE UNIVERSITY	$6,510,000
OHIO UNIVERSITY	$1,075,000
OKLAHOMA STATE UNIVERSITY	$888,000
OLD DOMINION UNIVERSITY	$1,701,000
OREGON STATE UNIVERSITY	$810,000
PENNSYLVANIA STATE UNIVERSITY	$6,849,000
PORTLAND STATE UNIVERSITY	$250,000
PRAIRIE VIEW A&M UNIVERSITY	$127,000
PRINCETON UNIVERSITY	$11,615,000
PURDUE UNIVERSITY	$8,898,000
RENSSELAER POLYTECHNIC INST.	$1,888,000
RICE UNIVERSITY	$3,219,000
ROCKEFELLER UNIVERSITY	$180,000
RUTGERS UNIVERSITY, NEW BRUNSWICK	$3,614,000
RUTGERS UNIVERSITY, NEWARK	$181,000
SAINT MICHAELS COLLEGE	$33,000
SAN DIEGO STATE UNIVERSITY	$277,000
SAN FRANCISCO STATE UNIVERSITY	$185,000
SMITHSONIAN ASTROPHYSICAL OBSERVATORY	$475,000
SMITHSONIAN INSTITUTION	$253,000
SOUTH DAKOTA, UNIVERSITY OF	$945,000
SOUTHERN ILLINOIS UNIVERSITY	$99,000
SOUTHERN METHODIST UNIVERSITY	$741,000
STANFORD UNIVERSITY	$11,967,000

Institution	FY 2013 Funding
STATE BOARD OF COMMUNITY COLLEG	$0
STATE U. OF NEW YORK AT ALBANY	$301,000
STATE U. OF NEW YORK AT BUFFALO	$566,000
STATE U. OF NEW YORK AT DELHI	$0
STATE U. OF NEW YORK AT STONY BROOK	$9,104,000
STATE UNIVERSITY OF NEW YORK AT BINGHAMTON	$150,000
SWARTHMORE COLLEGE	$107,000
SYRACUSE UNIVERSITY	$805,000
TEMPLE UNIVERSITY	$1,154,000
TENNESSEE TECH. UNIVERSITY	$94,000
TEXAS A&M UNIVERSITY, COLLEGE STATION	$6,654,000
TEXAS A&M UNIVERSITY, COMMERCE	$94,000
TEXAS TECH UNIVERSITY	$1,047,000
TUFTS UNIVERSITY	$959,000
TULANE UNIVERSITY	$153,000
U. OF CALIFORNIA AT BERKELEY	$7,413,000
U. OF CALIFORNIA AT DAVIS	$10,691,000
U. OF CALIFORNIA AT IRVINE	$6,010,000
U. OF CALIFORNIA AT LOS ANGELES	$18,063,000
U. OF CALIFORNIA AT MERCED	$1,154,000
U. OF CALIFORNIA AT RIVERSIDE	$4,277,000
U. OF CALIFORNIA AT SAN DIEGO	$12,168,000
U. OF CALIFORNIA AT SAN FRANCISCO	$163,000
U. OF CALIFORNIA AT SANTA BARBARA	$6,494,000
U. OF CALIFORNIA AT SANTA CRUZ	$3,496,000
U. OF ILLINOIS AT URBANA-CHAMPAIGN	$14,896,000
U. OF MARYLAND, BALTIMORE COUNTY	$0
U. OF MARYLAND, COLLEGE PARK	$8,809,000
U. OF MASSACHUSETTS, AMHERST	$4,905,000
U. OF MASSACHUSETTS, LOWELL	$322,000
U. OF NORTH CAROLINA, CHAPEL HILL	$2,214,000
UNION COLLEGE	$34,000
UNIVERSITY OF TEXAS, ARLINGTON	$959,000
UNIVERSITY OF AKRON	$122,000
UNIVERSITY OF ALABAMA AT HUNTSVILLE	$437,000
UNIVERSITY OF ALABAMA AT TUSCALOOSA	$1,377,000
UNIVERSITY OF ALASKA, FAIRBANKS	$1,354,000
UNIVERSITY OF ARIZONA	$4,263,000
UNIVERSITY OF ARKANSAS, FAYETVILLE	$400,000
UNIVERSITY OF CENTRAL FLORIDA	$1,008,000
UNIVERSITY OF CHICAGO	$4,417,000
UNIVERSITY OF CINCINNATI	$876,000
UNIVERSITY OF COLORADO AT BOULDER	$10,923,000
UNIVERSITY OF CONNECTICUT	$1,697,000
UNIVERSITY OF DELAWARE	$3,000,000
UNIVERSITY OF FLORIDA	$4,764,000
UNIVERSITY OF GEORGIA	$2,559,000
UNIVERSITY OF HAWAII	$2,560,000

Institution	FY 2013 Funding
UNIVERSITY OF HOUSTON	$1,499,000
UNIVERSITY OF IDAHO	$0
UNIVERSITY OF ILLINOIS AT CHICAGO	$1,121,000
UNIVERSITY OF IOWA	$1,485,000
UNIVERSITY OF KANSAS	$1,029,000
UNIVERSITY OF KENTUCKY	$1,459,000
UNIVERSITY OF LOUISIANA AT LAFAYETTE	$69,000
UNIVERSITY OF LOUISVILLE	$78,000
UNIVERSITY OF MAINE	$649,000
UNIVERSITY OF MEMPHIS	$75,000
UNIVERSITY OF MIAMI	$621,000
UNIVERSITY OF MICHIGAN	$13,950,000
UNIVERSITY OF MINNESOTA, MINNEAPOLIS	$10,305,000
UNIVERSITY OF MISSISSIPPI	$118,000
UNIVERSITY OF MISSOURI	$2,084,000
UNIVERSITY OF MONTANA	$0
UNIVERSITY OF NEBRASKA, LINCOLN	$959,000
UNIVERSITY OF NEBRASKA, OMAHA	$0
UNIVERSITY OF NEVADA, LAS VEGAS	$0
UNIVERSITY OF NEVADA, RENO	$2,948,000
UNIVERSITY OF NEW HAMPSHIRE	$814,000
UNIVERSITY OF NEW MEXICO	$2,628,000
UNIVERSITY OF NORTH DAKOTA	$121,000
UNIVERSITY OF NORTH TEXAS	$606,000
UNIVERSITY OF NOTRE DAME	$6,054,000
UNIVERSITY OF OKLAHOMA	$4,199,000
UNIVERSITY OF OREGON	$3,621,000
UNIVERSITY OF PENNSYLVANIA	$6,578,000
UNIVERSITY OF PITTSBURGH	$2,954,000
UNIVERSITY OF PUERTO RICO, MAYAGUEZ	$0
UNIVERSITY OF PUERTO RICO, SAN JUAN	$69,000
UNIVERSITY OF RHODE ISLAND	$0
UNIVERSITY OF RICHMOND	$98,000
UNIVERSITY OF ROCHESTER	$5,738,000
UNIVERSITY OF SOUTH ALABAMA	$0
UNIVERSITY OF SOUTH CAROLINA	$3,452,000
UNIVERSITY OF SOUTH FLORIDA	$555,000
UNIVERSITY OF SOUTHERN CALIFORNIA	$3,646,000
UNIVERSITY OF TENNESSEE, KNOXVILLE	$6,017,000
UNIVERSITY OF TEXAS, AUSTIN	$15,019,000
UNIVERSITY OF TEXAS, DALLAS	$1,014,000
UNIVERSITY OF TEXAS, EL PASO	$232,000
UNIVERSITY OF TEXAS, HEALTH SC. CTR.	$0
UNIVERSITY OF THE PACIFIC	$81,000
UNIVERSITY OF TULSA	$0
UNIVERSITY OF UTAH	$4,352,000
UNIVERSITY OF VERMONT	$330,000
UNIVERSITY OF VIRGINIA	$2,200,000

Institution	FY 2013 Funding
UNIVERSITY OF WASHINGTON, SEATTLE	$17,349,000
UNIVERSITY OF WISCONSIN, EAU CLAIRE	$0
UNIVERSITY OF WISCONSIN, MADISON	$48,492,000
UNIVERSITY OF WISCONSIN, MILWAUKEE	$1,187,000
UNIVERSITY OF WYOMING	$1,663,000
UTAH STATE UNIVERSITY	$303,000
VANDERBILT UNIVERSITY	$2,225,000
VIRGINIA COMMONWEALTH UNIVERSITY	$741,000
VIRGINIA POLYTECHNIC INSTITUTE	$2,724,000
VIRGINIA, UNIVERSITY OF	$4,221,000
WASHINGTON STATE UNIVERSITY	$1,505,000
WASHINGTON UNIVERSITY	$7,671,000
WAYNE STATE UNIVERSITY	$1,702,000
WEST VIRGINIA UNIVERSITY	$150,000
WESTERN MICHIGAN UNIVERSITY	$485,000
WORCESTER POLYTECHNIC INSTITUTE	$0
WRIGHT STATE UNIVERSITY	$121,000
XAVIER UNIVERSITY OF LOUISIANA	$144,000
YALE UNIVERSITY	$6,371,000

FY 2012

Institution	FY 2012 Funding
ABILENE CHRISTIAN UNIVERSITY	$187,000
ALFRED UNIVERSITY	$75,000
ARIZONA STATE UNIVERSITY	$2,349,000
AUBURN UNIVERSITY	$1,237,000
BAYLOR UNIVERSITY	$270,000
BOISE STATE UNIVERSITY	$75,000
BOSTON COLLEGE	$760,000
BOSTON UNIVERSITY	$4,110,000
BOWLING GREEN STATE UNIVERSITY	$365,000
BRANDEIS UNIVERSITY	$1,172,000
BRIGHAM YOUNG UNIVERSITY	$242,000
BROWN UNIVERSITY	$5,701,000
CALIFORNIA INST. OF TECHNOLOGY	$22,880,000
CALIFORNIA STATE U. DOMINGUEZ	$55,000
CALIFORNIA STATE U. FULLERTON	$96,000
CALIFORNIA STATE U. LONG BEACH	$40,000
CALIFORNIA STATE UNIV. NORTHRIDGE	$110,000
CALIFORNIA STATE UNIVERSITY EAST BAY	$121,000
CALIFORNIA STATE. U. SAN MARCOS	$60,000
CARNEGIE MELLON UNIVERSITY	$3,022,000

Institution	FY 2012 Funding
CASE WESTERN RESERVE UNIV.	$864,000
CENTRAL MICHIGAN UNIVERSITY	$217,000
CITY U. OF NEW YORK, BARUCH COLLEGE	$240,000
CITY U. OF NEW YORK, CITY COLLEGE	$659,000
CITY U. OF NEW YORK, HUNTER COLLEGE	$929,000
CITY U. OF NEW YORK, QUEENS COUNTY	$0
CITY UNIV. OF NEW YORK, LEHMAN COLLEGE	$80,000
CLARK ATLANTA UNIVERSITY	$80,000
CLARK UNIVERSITY	$0
CLARKSON UNIVERSITY	$99,000
CLEMSON UNIVERSITY	$805,000
COLLEGE OFWILLIAM AND MARY	$1,401,000
COLORADO SCHOOL OF MINES	$905,000
COLORADO STATE UNIVERSITY	$4,080,000
COLUMBIA UNIVERSITY	$9,234,000
CORNELL UNIVERSITY	$6,699,000
CREIGHTON UNIVERSITY	$231,000
DARTMOUTH COLLEGE	$220,000
DREXEL UNIVERSITY	$576,000
DUKE UNIVERSITY	$7,653,000
EMORY UNIVERSITY	$1,012,000
FAIRFIELD UNIVERSITY	$31,000
FLORIDA A&M UNIVERSITY	$370,000
FLORIDA INSTITUTE OF TECHNOLOGY	$226,000
FLORIDA INTERNATIONAL UNIV.	$1,009,000
FLORIDA STATE UNIVERSITY	$4,201,000
GEORGE MASON UNIVERSITY	$266,000
GEORGE WASHINGTON UNIVERSITY	$1,014,000
GEORGETOWN UNIVERSITY	$260,000
GEORGIA STATE UNIV. RES. FOUND.	$615,000
GEORGIA TECH RESEARCH CORP	$4,323,000
HAMPTON UNIVERSITY	$550,000
HARVARD UNIVERSITY	$8,918,000
HOPE COLLEGE	$840,000
IDAHO STATE UNIVERSITY	$0
ILLINOIS INST. OF TECHNOLOGY	$510,000
INDIANA STATE UNIVERSITY	$110,000
INDIANA UNIVERSITY, BLOOMINGTON	$5,264,000
IOWA STATE UNIVERSITY	$2,698,000
JOHNS HOPKINS UNIVERSITY	$4,092,000
KANSAS STATE UNIVERSITY	$4,384,000
KENT STATE UNIVERSITY	$1,635,000
LANGSTON UNIVERSITY	$0

Institution	FY 2012 Funding
LEHIGH UNIVERSITY	$944,000
LOMA LINDA UNIVERSITY	$0
LOUISIANA STATE UNIVERSITY	$3,960,000
LOUISIANA TECH UNIVERSITY	$246,000
LUTHERAN UNIVERSITY ASSOCIATION	$154,000
MARINE BIOLOGICAL LABORATORY	$855,000
MASSACHUSETTS INST. OF TECHNOLOGY	$46,422,000
MIAMI UNIVERSITY	$80,000
MICHIGAN STATE UNIVERSITY	$31,263,000
MICHIGAN TECH. UNIVERSITY	$788,000
MIDDLE TENNESSEE STATE UNIV.	$0
MISSISSIPPI STATE UNIVERSITY	$861,000
Missouri University of Science and Technology	$335,000
MONTANA STATE UNIVERSITY	$788,000
NEW JERSEY INSTITUTE OF TECHNOLOGY	$169,000
NEW MEXICO STATE UNIVERSITY, LAS CRUCES	$727,000
NEW YORK UNIVERSITY	$4,383,000
NEW YORK UNIVERSITY, POLYTECHNIC	$449,000
NEW YORK, STATE U. OF BINGHTN	$150,000
NORFOLK STATE UNIVERSITY	$105,000
NORTH CAROLINA CENTRAL UNIV.	$239,000
NORTH CAROLINA STATE UNIVERSITY	$4,255,000
NORTH DAKOTA STATE UNIVERSITY	$240,000
NORTH GEORGIA COLLEGE & STATE U.	$93,000
NORTHEASTERN UNIVERSITY	$817,000
NORTHERN ILLINOIS UNIVERSITY	$153,000
NORTHWESTERN UNIVERSITY	$11,568,000
OHIO STATE UNIVERSITY	$6,803,000
OHIO UNIVERSITY	$1,016,000
OKLAHOMA STATE UNIVERSITY	$691,000
OLD DOMINION UNIVERSITY	$1,528,000
OREGON HEALTH & SCIENCE UNIVERS	$307,000
OREGON STATE UNIVERSITY	$2,111,000
PENNSYLVANIA STATE UNIVERSITY	$6,979,000
PORTLAND STATE UNIVERSITY	$220,000
Prairie View A & M University	$416,000
PRINCETON UNIVERSITY	$12,010,000
PURDUE UNIVERSITY	$9,658,000
RENSSELAER POLYTECHNIC INST.	$3,305,000
RICE UNIVERSITY	$3,377,000
ROCKEFELLER UNIVERSITY	$564,000
RUTGERS UNIVERSITY, NEW BRUNSWICK	$4,434,000
RUTGERS UNIVERSITY, NEWARK	$172,000

Institution	FY 2012 Funding
SAINT MICHAELS COLLEGE	$33,000
SAN DIEGO STATE UNIVERSITY	$473,000
SAN FRANCISCO STATE UNIVERSITY	$200,000
SAN JOSE STATE UNIVERSITY	$0
SETON HALL UNIVERSITY	$7,000
SOUTH DAKOTA SCHOOL OF MINES	$0
SOUTHERN ILLINOIS UNIVERSITY	$200,000
SOUTHERN METHODIST UNIVERSITY	$907,000
STANFORD UNIVERSITY	$14,664,000
STATE BOARD OF COMMUNITY COLLEG	$0
STATE U. OF NEW YORK AT ALBANY	$516,000
STATE U. OF NEW YORK AT BUFFALO	$942,000
STATE U. OF NEW YORK AT DELHI	$0
STATE U. OF NEW YORK AT STONY BROOK	$9,022,000
STATE U. OF NEW YORK AT SYRACUSE	$0
STATE U. OF NEW YORK, PURCHASE COLLEGE	$115,000
SWARTHMORE COLLEGE	$111,000
SYRACUSE UNIVERSITY	$781,000
TEMPLE UNIVERSITY	$1,132,000
TENNESSEE TECH. UNIVERSITY	$101,000
TEXAS A&M UNIVERSITY, COLLEGE STATION	$8,872,000
TEXAS A&M UNIVERSITY, COMMERCE	$57,000
TEXAS TECH UNIVERSITY	$855,000
THE CITADEL	$23,000
TUFTS UNIVERSITY	$1,143,000
TULANE UNIVERSITY	$344,000
U. OF CALIFORNIA AT BERKELEY	$8,514,000
U. OF CALIFORNIA AT DAVIS	$11,562,000
U. OF CALIFORNIA AT IRVINE	$7,318,000
U. OF CALIFORNIA AT LOS ANGELES	$18,999,000
U. OF CALIFORNIA AT MERCED	$615,000
U. OF CALIFORNIA AT RIVERSIDE	$4,174,000
U. OF CALIFORNIA AT SAN DIEGO	$16,785,000
U. OF CALIFORNIA AT SAN FRANCISCO	$568,000
U. OF CALIFORNIA AT SANTA BARBARA	$6,629,000
U. OF CALIFORNIA AT SANTA CRUZ	$2,461,000
U. OF ILLINOIS AT URBANA-CHAMPAIGN	$12,699,000
U. OF MARYLAND, BALTIMORE COUNTY	$128,000
U. OF MARYLAND, COLLEGE PARK	$9,259,000
U. OF MASSACHUSETTS, AMHERST	$4,914,000
U. OF MASSACHUSETTS, DARTMOUTH	$174,000
U. OF MASSACHUSETTS, LOWELL	$350,000
U. OF NORTH CAROLINA, CHAPEL HILL	$3,624,000

Institution	FY 2012 Funding
U. OF NORTH CAROLINA, CHARLOTTE	$0
U. OF TEXAS SOUTHWESTERN MEDICAL CTR	$0
UNION COLLEGE	$33,000
UNIVERSITY OF TEXAS, ARLINGTON	$870,000
UNIVERSITY OF AKRON	$440,000
UNIVERSITY OF ALABAMA AT HUNTSVILLE	$474,000
UNIVERSITY OF ALABAMA AT TUSCALOOSA	$1,140,000
UNIVERSITY OF ALASKA, FAIRBANKS	$221,000
UNIVERSITY OF ARIZONA	$3,517,000
UNIVERSITY OF ARKANSAS, FAYETVILLE	$165,000
UNIVERSITY OF CENTRAL FLORIDA	$1,524,000
UNIVERSITY OF CHICAGO	$4,671,000
UNIVERSITY OF CINCINNATI	$958,000
UNIVERSITY OF COLORADO AT BOULDER	$11,029,000
UNIVERSITY OF CONNECTICUT	$2,157,000
UNIVERSITY OF DELAWARE	$3,306,000
UNIVERSITY OF FLORIDA	$4,333,000
UNIVERSITY OF GEORGIA	$3,926,000
UNIVERSITY OF HAWAII	$2,532,000
UNIVERSITY OF HOUSTON	$2,273,000
UNIVERSITY OF IDAHO	$95,000
UNIVERSITY OF ILLINOIS AT CHICAGO	$1,487,000
UNIVERSITY OF IOWA	$1,596,000
UNIVERSITY OF KANSAS	$1,058,000
UNIVERSITY OF KENTUCKY	$1,541,000
UNIVERSITY OF LOUISVILLE	$0
UNIVERSITY OF MAINE	$620,000
UNIVERSITY OF MEMPHIS	$0
UNIVERSITY OF MIAMI	$1,316,000
UNIVERSITY OF MICHIGAN	$14,255,000
UNIVERSITY OF MINNESOTA, DULUTH	$45,000
UNIVERSITY OF MINNESOTA, MINNEAPOLIS	$9,722,000
UNIVERSITY OF MISSISSIPPI	$349,000
UNIVERSITY OF MISSOURI	$2,753,000
UNIVERSITY OF MONTANA	$65,000
UNIVERSITY OF NEBRASKA, LINCOLN	$1,374,000
UNIVERSITY OF NEBRASKA, OMAHA	$0
UNIVERSITY OF NEVADA, LAS VEGAS	$554,000
UNIVERSITY OF NEVADA, RENO	$3,300,000
UNIVERSITY OF NEW HAMPSHIRE	$1,901,000
UNIVERSITY OF NEW MEXICO	$2,921,000
UNIVERSITY OF NORTH DAKOTA	$116,000
UNIVERSITY OF NORTH TEXAS	$609,000

Institution	FY 2012 Funding
UNIVERSITY OF NORTHERN IOWA	$0
UNIVERSITY OF NOTRE DAME	$5,828,000
UNIVERSITY OF OKLAHOMA	$3,511,000
UNIVERSITY OF OREGON	$3,529,000
UNIVERSITY OF PENNSYLVANIA	$7,617,000
UNIVERSITY OF PITTSBURGH	$5,373,000
UNIVERSITY OF PUERTO RICO, SAN JUAN	$1,551,000
UNIVERSITY OF RHODE ISLAND	$23,000
UNIVERSITY OF RICHMOND	$196,000
UNIVERSITY OF ROCHESTER	$6,746,000
UNIVERSITY OF SOUTH ALABAMA	$70,000
UNIVERSITY OF SOUTH CAROLINA	$3,384,000
UNIVERSITY OF SOUTH DAKOTA	$123,000
UNIVERSITY OF SOUTH FLORIDA	$800,000
UNIVERSITY OF SOUTHERN CALIFORNIA	$2,894,000
UNIVERSITY OF TENNESSEE, KNOXVILLE	$6,808,000
UNIVERSITY OF TEXAS, AUSTIN	$13,939,000
UNIVERSITY OF TEXAS, DALLAS	$786,000
UNIVERSITY OF TEXAS, EL PASO	$60,000
UNIVERSITY OF TEXAS, HEALTH SC. CTR.	$0
UNIVERSITY OF THE PACIFIC	$99,000
UNIVERSITY OF TULSA	$45,000
UNIVERSITY OF UTAH	$5,097,000
UNIVERSITY OF VERMONT	$322,000
UNIVERSITY OF VIRGINIA	$7,009,000
UNIVERSITY OF WASHINGTON, SEATTLE	$17,338,000
UNIVERSITY OF WISCONSIN, MADISON	$51,097,000
UNIVERSITY OF WISCONSIN, MILWAUKEE	$1,433,000
UNIVERSITY OF WYOMING	$982,000
UTAH STATE UNIVERSITY	$397,000
VANDERBILT UNIVERSITY	$2,278,000
VIRGINIA COMMONWEALTH UNIVERSITY	$789,000
VIRGINIA POLYTECHNIC INSTITUTE	$2,507,000
WAKE FOREST UNIVERSITY	$10,000
WASHINGTON STATE UNIVERSITY	$2,504,000
WASHINGTON UNIVERSITY	$9,852,000
WAYNE STATE UNIVERSITY	$1,875,000
WEST VIRGINIA UNIVERSITY	$429,000
WESTERN MICHIGAN UNIVERSITY	$482,000
WORCESTER POLYTECHNIC INSTITUTE	$142,000
WRIGHT STATE UNIVERSITY	$89,000
XAVIER UNIVERSITY OF LOUISIANA	$0
YALE UNIVERSITY	$8,367,000

FY 2011

Institution	FY 2011 Funding
Abilene Christian University, Abilene, TX	$197,000.00
Alfred University, Alfred, NY	$78,836.00
Arizona State University, Tempe, AZ	$2,253,270.00
Auburn University, Auburn University, AL	$1,584,761.00
Barnard College, New York, NY	$150,000.00
Baylor University, Waco, TX	$210,000.00
Board of Regents of the University of Oklahoma, Norman, OK	$2,469,300.00
Board of Regents of the University of Wisconsin, Madison, WI	$39,776,493.00
Board of Regents University of Nebraska Lincoln, Lincoln, NE	$1,510,207.00
Boise State University, Boise, ID	$152,000.00
Bowling Green State University, Bowling Green, OH	$188,000.00
Brandeis University, Waltham, MA	$1,107,000.00
Brigham Young University, Provo, UT	$470,000.00
Brown University, Providence, RI	$6,641,256.00
Bucknell University, Lewisburg, PA	$122,512.00
California Institute of Technology, Pasadena, CA	$23,947,519.00
California State University Dominguez Hills Foundation., Carson, CA	$58,000.00
California State University Fullerton, Fullerton, CA	$96,000.00
California State University Long Beach, Long Beach, CA	$40,000.00
California State University Northridge, Northridge, CA	$110,000.00
California State University San Marcos, San Marcos, CA	$60,000.00
Carnegie Mellon University, Pittsburgh, PA	$4,683,243.00
Case Western Reserve University, Cleveland, OH	$307,310.00
Central Michigan University, Mount Pleasant, MI	$452,136.00
Cheyney University of Pennsylvania, Cheyney, PA	$0.00
Chicago Office of the Board of Education, Chicago, IL	$0.00
City University of New York, City College, New York, NY	$609,608.00
City University of New York, College of Staten Isl, Staten Island, NY	$38,302.00
City University of New York, Hunter College, New York, NY	$810,000.00
City University of New York, Lehman College, Bronx, NY	$80,000.00
Clark Atlanta University, Atlanta, GA	$80,000.00
Clark University, Worcester, MA	$65,452.00
Clemson University, Clemson, SC	$660,144.00
College of William and Mary, Williamsburg, VA	$1,369,060.00
Colorado School of Mines, Golden, CO	$1,256,902.00
Colorado State University, Fort Collins, CO	$3,829,216.00
Columbia University, New York, NY	$10,613,902.00
Connecticut State University, Hartford, CT	$80,000.00
Cornell University, Ithaca, NY	$9,393,221.00
Creighton University, Omaha, NE	$229,000.00
Dartmouth College, Hanover, NH	$484,213.00
DePaul University, Chicago, IL	$0.00
Drexel University, Philadelphia, PA	$474,914.00
Duke University, Durham, NC	$8,395,889.00
Emory University, Atlanta, GA	$1,040,000.00
Fairfield University, Fairfield, CT	$59,933.00

Institution	FY 2011 Funding
Flinders University of South Australia, Adelaide SA 5001, Australia	$421,349.00
Florida A&M University, Tallahassee, FL	$356,999.00
Florida Institute of Technology, Melbourne, FL	$199,000.00
Florida International University, Miami, FL	$1,118,792.00
Florida State University, Tallahassee, FL	$3,363,745.00
George Mason University, Fairfax, VA	$474,876.00
George Washington University, Washington, DC	$1,784,960.00
Georgetown University, Washington, DC	$901,874.00
Georgia State University Research Foundation, Inc., Atlanta, GA	$590,807.00
Georgia Tech Research Corporation, Atlanta, GA	$5,673,679.00
Hampton University, Hampton, VA	$472,500.00
Harvard College, Cambridge, MA	$5,182,571.00
Howard University, Washington, DC	$23,400.00
Idaho State University, Pocatello, ID	$1,488,000.00
Illinois Institute of Technology, Chicago, IL	$688,606.00
Indiana University, Indianapolis, Bloomington, IN	-$232,715.00
Iowa State University of Science and Technology, Ames, IA	$2,999,315.00
Johns Hopkins University, Baltimore, MD	$4,369,776.00
Kansas State University, Manhattan, KS	$3,957,306.00
Kent State University, Kent, OH	$1,445,965.00
Lancaster University, Bailrigg, Lancaster UK, LA1 4Y	$47,759.00
Langston University, Langston, OK	$70,000.00
Lehigh University, Bethlehem, PA	$1,492,794.00
Loma Linda University, Loma Linda, CA	$477,805.00
Louisiana State University and A&M College, Baton Rouge, LA	$3,923,107.00
Louisiana Tech University, Ruston, LA	$248,000.00
Lutheran University Association, Inc., Valparaiso, IN	$211,000.00
Massachusetts Institute of Technology, Cambridge, MA	$60,114,071.00
McGill University, Montreal, Canada	$138,514.00
McMaster University, Hamilton, Ontario, Canada	$200,000.00
Miami University, Oxford, OH	$146,951.00
Michigan State University, East Lansing, MI	$20,332,561.00
Michigan Technological University, Houghton, MI	$1,218,970.00
Middle Tennessee State University, Murfreesboro, TN	$0.00
Mississippi State University, Mississippi State, MS	$1,022,978.00
Missouri University of Science and Technology, Rolla, MO	$175,000.00
Monash University, Clayton, Australia	$349,293.00
Montana State University, Bozeman, MT	$1,073,574.00
Nevada System of Higher Education - Las Vegas, Las Vegas, NV	$180,000.00
Nevada System of Higher Education - Reno, Reno, NV	$61,418.00
New Jersey Institute of Technology, Newark, NJ	$164,774.00
New Mexico State University, Las Cruces, Las Cruces, NM	$775,000.00
New York University, New York, NY	$3,317,149.00
Norfolk State University, Norfolk, VA	$110,000.00
North Carolina Central Univ., Durham, NC	$283,000.00
North Carolina State University, Raleigh, NC	$5,210,233.00
North Dakota State University, Fargo, ND	$90,000.00
North Georgia College and State University, Dahlonega, GA	$133,000.00
Northeastern University, Boston, MA	$2,396,772.00
Northern Arizona University, Flagstaff, AZ	$0.00

Institution	FY 2011 Funding
Northern Illinois University, DeKalb, IL	$538,000.00
Northwestern University, Evanston, IL	$14,778,809.00
NV System of Higher Ed OBO Desert Res Inst-LV, Reno, NV	$370,996.00
NV System of Higher Ed OBO Desert Res Inst-Reno, Reno, NV	$170,714.00
Occidental College, Los Angeles, CA	$65,000.00
Ohio State University, Columbus, OH	$6,821,297.00
Ohio University, Athens, OH	$1,075,511.00
Oklahoma State University, Stillwater, Stillwater, OK	$963,202.00
Old Dominion University Research Foundation, Norfolk, VA	$1,098,000.00
Old Dominion University, Norfolk, VA	$150,000.00
Oregon Health & Science University, Portland, OR	$547,356.00
Oregon State University, Corvallis, OR	$2,097,271.00
Oxford Brookes University, Oxford, United Kingdom	$0.00
Pennsylvania State University, University Park, PA	$6,299,692.00
Polytechnic Institute of New York University, Brooklyn, NY	$720,172.00
Polytechnic Institute of New York University, New York, NY	$100,000.00
Portland State University, Portland, OR	$220,000.00
Prairie View A&M Research Foundation, Prairie View, TX	$473,000.00
Purdue University, West Lafayette, IN	$8,372,439.00
Regents of the University of California, Irvine, Irvine, CA	$8,438,667.00
Regents of the University of Idaho, Moscow, ID	$155,147.00
Regents of the University of Minnesota, Minneapolis, MN	$8,643,403.00
Regents of the University of New Mexico, Albuquerque, NM	$3,685,255.00
Rensselaer Polytechnic Institute, Troy, NY	$3,097,560.00
Research Foundation of CUNY on behalf of Hunter College CUNY, NY	$145,000.00
Research Foundation of The City University of New York	$82,491.00
Research Foundation on behalf of Baruch College CUNY, NY	$176,000.00
Rush University Medical Center, Chicago, IL	$0.00
Rutgers - State University of New Jersey, Newark, Newark, NJ	$538,124.00
Rutgers - The State University of New Jersey, New Brunswick, NJ	$4,382,615.00
Saint Michael's College, Colchester, VT	$33,000.00
San Diego State University Foundation, San Diego, CA	$291,361.00
San Francisco State University, San Francisco, CA	$140,000.00
San Jose State University Foundation, San Jose, CA	$110,955.00
South Dakota School of Mines & Technology, Rapid City, SD	$0.00
Southern Illinois University, Carbondale, Carbondale, IL	$454,812.00
Stanford University, Palo Alto, CA	$11,205,840.00
State University of New York at Albany, Albany, NY	$701,744.00
State University of New York Delhi, Delhi, NY	$0.00
State University of New York, Binghamton, Binghamton, NY	$150,000.00
State University of New York, Buffalo, Amherst, NY	$827,615.00
State University of New York, Stony Brook, Stony Brook, NY	$9,456,396.00
State University of New York, Syracuse, Syracuse, NY	$87,000.00
Swarthmore College, Swarthmore, PA	$114,000.00
Syracuse University, Syracuse, NY	$757,000.00
Temple University, Philadelphia, PA	$814,320.00
Tennessee Technological University, Cookeville, TN	$97,000.00
Texas A&M Research Foundation, College Station, TX	$4,745,803.00
Texas A&M University, College Station, College Station, TX	$3,683,310.00
Texas A&M University, Commerce, Commerce, TX	$121,744.00

Institution	FY 2011 Funding
Texas Engineering Experiment Station, College Station, TX	$663,181.00
Texas Tech University, Lubbock, TX	$1,360,202.00
The Citadel, Charleston, SC	$23,000.00
The Curators of the University of Missouri, Columbia, MO	$2,757,703.00
The Hebrew University of Jerusalem, Jerusalem, Israel	$350,994.00
The President and Fellows of Harvard College, Boston, MA	$2,654,357.00
The Regents of the Univ. of Calif., U.C. San Diego, La Jolla, CA	$13,498,256.00
The Regents of the University of California - UCSD, La Jolla, CA	$0.00
The Regents of the University of California, Davis, Davis, CA	$12,832,796.00
The Regents of the University of California, San D, La Jolla, CA	$2,233,951.00
The Regents of the University of Colorado, Aurora, CO	$5,548,042.00
The Regents of the University of Colorado, Boulder, CO	$3,878,722.00
The Regents of the University of Michigan, Ann Arbor, MI	$11,134,519.00
The Rockefeller University, New York, NY	$534,000.00
The Trustees of Princeton University, Princeton, NJ	$14,131,236.00
The University of North Carolina at Chapel Hill, Chapel Hill, NC	$3,689,045.00
Trustees of Boston College, Chestnut Hill, MA	$1,334,999.00
Trustees of Boston University, Boston, MA	$4,398,020.00
Trustees of Indiana University, Bloomington, Bloomington, IN	$4,596,217.00
Tufts University, Medford, MA	$1,759,340.00
Tulane Educational Fund, New Orleans, LA	$194,113.00
Union College, Schenectady, NY	$33,000.00
University of Akron, Akron, OH	$401,591.00
University of Alabama Huntsville, Huntsville, AL	$537,568.00
University of Alabama Tuscaloosa, Tuscaloosa, AL	$1,941,548.00
University of Alaska Fairbanks, Fairbanks, AK	$2,100,728.00
University of Arizona, Tucson, AZ	$2,811,026.00
University of Arkansas at Little Rock, Little Rock, AR	$0.00
University of Arkansas, Fayetteville, AR	$315,000.00
University of British Columbia, Vancouver, Canada	$169,354.00
University of California, Berkeley, Berkeley, CA	$7,624,879.00
University of California, Los Angeles, Los Angeles, CA	$21,133,120.00
University of California, Merced, Merced, CA	$1,238,931.00
University of California, Riverside, Riverside, CA	$4,413,070.00
University of California, San Francisco, San Francisco, CA	$689,811.00
University of California, Santa Barbara, Santa Barbara, CA	$6,499,770.00
University of California, Santa Cruz, Santa Cruz, CA	$4,649,005.00
University of Central Florida, Orlando, FL	$1,141,334.00
University of Chicago, Chicago, IL	$4,887,147.00
University of Cincinnati, Cincinnati, OH	$930,000.00
University of Colorado at Denver & Health Sc. Ctr., Aurora, CO	$150,000.00
University of Connecticut, Storrs, CT	$2,186,313.00
University of Dayton, Dayton, OH	$486,000.00
University of Delaware, Newark, DE	$4,961,295.00
University of East Anglia, Norwich, United Kingdom	$198,485.00
University of Florida, Gainesville, FL	$5,581,838.00
University of Georgia Research Foundation, Inc., Athens, GA	$3,021,193.00
University of Hawaii, Honolulu, HI	$2,332,666.00
University of Houston, Houston, TX	$2,067,155.00
University of Illinois at Chicago, Chicago, IL	$1,668,031.00

Institution	FY 2011 Funding
University of Illinois at Urbana-Champaign, Champaign, IL	$17,618,063.00
University of Iowa, Iowa City, IA	$2,066,984.00
University of Kansas Center for Research, Inc., Lawrence, KS	$1,027,741.00
University of Kentucky Research Foundation, Lexington, KY	$1,506,000.00
University of Lethbridge, Lethbridge, Canada	$470,994.00
University of Louisville Research Foundation, Inc., Louisville, KY	$105,000.00
University of Maine System, Orono, ME	$620,000.00
University of Maryland Baltimore County, Baltimore, MD	$126,675.00
University of Maryland Biotechnology Inst., Baltimore, MD	$0.00
University of Maryland, Baltimore, Baltimore, MD	$267,504.00
University of Maryland, College Park, College Park, MD	$11,539,380.00
University of Massachusetts at Boston, Boston, MA	$0.00
University of Massachusetts, Amherst, Amherst, MA	$7,171,781.00
University of Massachusetts, Dartmouth, Dartmouth, MA	$175,001.00
University of Massachusetts, Lowell, Lowell, MA	$228,000.00
University of Memphis, Memphis, TN	$142,120.00
University of Miami, Medical Campus, Miami, FL	$741,030.00
University of Minnesota, Duluth, Minneapolis, MN	$45,000.00
University of Mississippi, University, MS	$361,000.00
University of Missouri-Kansas City, Kansas City, MO	$0.00
University of Montana, Missoula, MT	$65,000.00
University of Nebraska Omaha, Omaha, NE	$0.00
University of Nevada, Reno, NV	$1,291,000.00
University of New Hampshire, Durham, NH	$1,438,079.00
University of North Carolina at Charlotte, Charlotte, NC	$0.00
University of North Dakota Research Foundation, Grand Forks, ND	$0.00
University of North Dakota, Grand Forks, ND	$3,566,000.00
University of North Texas, Denton, TX	$793,753.00
University of Notre Dame Du Lac, Notre Dame, IN	$7,227,295.00
University of Oregon, Eugene, OR	$4,529,130.00
University of Oxford, Oxford, United Kingdom	$180,977.00
University of Pennsylvania, Philadelphia, PA	$7,331,094.00
University of Pittsburgh, Pittsburgh, PA	$3,227,300.00
University of Puerto Rico at Mayaguez, Mayaguez, PR	$734,800.00
University of Puerto Rico Central Administration, San Juan, PR	$810,000.00
University of Reading, Reading, United Kingdom	$278,884.00
University of Rhode Island, Kingston, RI	$22,000.00
University of Richmond, Richmond, VA	$184,200.00
University of Rochester, Rochester, NY	$7,587,066.00
University of South Alabama, Mobile, AL	$63,000.00
University of South Carolina Research Foundation, Columbia, SC	$3,454,296.00
University of South Dakota, Vermillion, SD	$1,190,200.00
University of South Florida, Tampa, FL	$625,000.00
University of Southern California, LOS ANGELES, CA	$4,267,371.00
University of Tennessee, Knoxville, Knoxville, TN	$6,436,488.00
University of Texas Arlington, Arlington, TX	$942,101.00
University of Texas at San Antonio, San Antonio, TX	$115,650.00
University of Texas Dallas, Richardson, TX	$858,000.00
University of Texas Health Science Center at Houston, Houston, TX	$0.00
University of Texas Health Science Center at San A, San Antonio, TX	$440,773.00

Institution	FY 2011 Funding
University of Texas Southwestern Medical Center, Dallas, TX	$600,000.00
University of Texas, Austin, TX	$13,907,514.00
University of Texas, El Paso, El Paso, TX	$609,121.00
University of Toronto, Toronto, Canada	$135,000.00
University of Tulsa, Tulsa, OK	$242,000.00
University of Utah, Salt Lake City, UT	$5,328,866.00
University of Vermont, Burlington, VT	$341,593.00
University of Virginia, Charlottesville, VA	$7,236,481.00
University of Washington, Seattle, Seattle, WA	$18,605,004.00
University of Wisconsin - Milwaukee, Milwaukee, WI	$554,349.00
University of Wyoming, Laramie, WY	$972,812.00
Utah State University, Logan, UT	$440,909.00
Vanderbilt University, Nashville, TN	$1,997,626.00
Virginia Commonwealth University, Richmond, VA	$735,027.00
Virginia Polytechnic Institute and State University, Blacksburg, VA	$3,151,104.00
Washington State University, Pullman, WA	$2,803,098.00
Washington University, St Louis, MO	$8,899,333.00
Wayne State University, Detroit, MI	$1,629,000.00
West Virginia University Research Corporation, Morgantown, WV	$426,472.00
Western Michigan University, Kalamazoo, MI	$300,000.00
William Marsh Rice University, Houston, TX	$4,496,000.00
Worcester Polytechnic Institute, Worcester, MA	$138,949.00
Wright State University, Dayton, OH	$448,454.00
Xavier University of Louisiana, New Orleans, LA	$170,290.00
Yale University, New Haven, CT	$8,944,090.00

FY 2010

Institution	FY 2010 Funding
Abilene Christian University, Abilene, TX	$197,000
Alfred University, Alfred, NY	$82,674
Arizona State University, Tempe, AZ	$2,530,334
Auburn University, Auburn University, AL	$1,785,226
Barry University, Inc., Miami, FL	$1,166,400
Baylor University, Waco, TX	$240,523
Bethune-Cookman University Inc., Daytona Beach, FL	$243,000
Board of Regents NSHE obo University of Nevada Las Vegas, Las Vegas, NV	$777,600
Board of Regents of the University of Oklahoma, Norman, OK	$7,633,722
Board of Regents of the University of Wisconsin, Madison, WI	$60,071,638
Board of Regents University of Nebraska Lincoln, Lincoln, NE	$2,850,818
Boise State University, Boise, ID	$143,888
Bowling Green State University, Bowling Green, OH	$365,800
Brandeis University, Waltham, MA	$1,566,000
Brigham Young University, Provo, UT	$313,500
Bronx Community College, CUNY on behalf of, New York, NY	$486,000
Brown University, Providence, RI	$5,153,307
California Institute of Technology, Pasadena, CA	$26,433,074

California State University Dominguez Hills Foundation., Carson, CA	$58,000
California State University East Bay, Hayward, CA	$241,000
California State University Fullerton, Fullerton, CA	$96,000
California State University Long Beach, Long Beach, CA	$113,516
California State University Northridge, Northridge, CA	$176,671
California State University, San Bernardino, CA	$194,400
Carnegie Mellon University, Pittsburgh, PA	$5,188,890
Case Western Reserve University, Cleveland, OH	$487,976
Central Michigan University, Mount Pleasant, MI	$153,753
City University of New York, City College, New York, NY	$745,032
City University of New York, College of Staten Isl, Staten Island, NY	$38,302
City University of New York, Hunter College, New York, NY	$781,906
City University of New York, Lehman College, Bronx, NY	$59,865
Clark Atlanta University, Atlanta, GA	$80,000
Clark University, Worcester, MA	$64,021
Clemson University, Clemson, SC	$1,451,882
College of Saint Elizabeth, Morristown, NJ	$972,000
College of William and Mary, Williamsburg, VA	$1,204,101
Colorado School of Mines, Golden, CO	$1,977,190
Colorado State University, Fort Collins, CO	$5,970,600
Columbia University, New York, NY	$10,741,864
Connecticut State University, Hartford, CT	$649,000
Cornell University, Ithaca, NY	$9,605,138
Creighton University, Omaha, NE	$228,000
Dartmouth College, Hanover, NH	$369,783
Davidson College, Davidson, NC	$51,286
DePaul University, Chicago, IL	$72,000
Dowling College, Oakdale, NY	$0
Drexel University, Philadelphia, PA	$413,500
Duke University, Durham, NC	$9,953,505
Duquesne University, Pittsburgh, PA	$0
Eastern Michigan University, Ypsilanti, MI	$486,000
Emory University, Atlanta, GA	$1,132,113
Florida A&M University, Tallahassee, FL	$913,090
Florida Institute of Technology, Melbourne, FL	$276,500
Florida International University, Miami, FL	$2,057,999
Florida State University, Tallahassee, FL	$4,729,567
George Mason University, Fairfax, VA	$631,467
George Washington University, Washington, DC	$1,454,393
Georgetown University, Washington, DC	$799,216
Georgia State University Research Foundation, Inc., Atlanta, GA	$509,771
Georgia Tech Research Corporation, Atlanta, GA	$5,431,003
Hampton University, Hampton, VA	$1,105,000
Harvard College, Cambridge, MA	$6,090,268
Howard University, Washington, DC	$46,000
Idaho State University, Pocatello, ID	$30,000
Illinois Institute of Technology, Chicago, IL	$673,726
Indiana State University, Terre Haute, IN	$220,000
Indiana University, Indianapolis, Bloomington, IN	$220,000

Iowa State University of Science and Technology, Ames, IA	$3,964,756
Johns Hopkins University, Baltimore, MD	$4,797,029
Kansas State University, Manhattan, KS	$4,302,044
Kent State University, Kent, OH	$1,387,163
Langston University, Langston, OK	$70,000
Lehigh University, Bethlehem, PA	$2,097,000
Loma Linda University, Loma Linda, CA	$377,919
Louisiana State University and A&M College, Baton Rouge, LA	$6,681,871
Louisiana Tech University, Ruston, LA	$584,860
Loyola University of Chicago, Chicago, IL	$486,000
Lutheran University Association, Inc., Valparaiso, IN	$181,000
Marshall University Research Corporation, Huntington, WV	$4,765,715
Massachusetts College of Liberal Arts, North Adams, MA	$0
Massachusetts Institute of Technology, Cambridge, MA	$63,701,095
Miami Dade Community College - Hialeah Campus, Hialeah, FL	$388,800
Miami University, Oxford, OH	$681,649
Michigan State University, East Lansing, MI	$23,858,226
Michigan Technological University, Houghton, MI	$3,035,185
Middle Tennessee State University, Murfreesboro, TN	$889,380
Mississippi State University, Mississippi State, MS	$871,000
Missouri University of Science and Technology, Rolla, MO	$175,000
Montana State University, Bozeman, MT	$823,889
Morris College, Sumter, SC	$1,458,000
Mount Holyoke College, South Hadley, MA	$26,000
Nevada System of Higher Education - Las Vegas, Las Vegas, NV	$1,926,332
New Jersey Institute of Technology, Newark, NJ	$221,743
New Mexico State University, Las Cruces, Las Cruces, NM	$725,000
New York University, New York, NY	$4,194,214
New York, State Univ Research Foundation, Buffalo, Buffalo, NY	$130,000
Norfolk State University, Norfolk, VA	$105,000
North Carolina Central Univ., Durham, NC	$180,000
North Carolina State University, Raleigh, NC	$4,281,078
North Dakota State University, Fargo, ND	$5,189,650
North Georgia College and State University, Dahlonega, GA	$121,000
Northeastern University, Boston, MA	$2,561,924
Northern Arizona University, Flagstaff, AZ	$1,712,851
Northern Illinois University, DeKalb, IL	$1,096,000
Northwestern University, Evanston, IL	$15,054,005
Occidental College, Los Angeles, CA	$60,000
Ohio State University, Columbus, OH	$7,683,252
Ohio University, Athens, OH	$1,100,539
Oklahoma State University, Stillwater, Stillwater, OK	$742,146
Old Dominion University Research Foundation, Norfolk, VA	$2,408,001
Oregon Health & Science University, Portland, OR	$560,620
Oregon State University, Corvallis, OR	$3,218,048
Pennsylvania State University, University Park, PA	$11,419,338
Polytechnic Institute of New York University, New York, NY	$100,000
Portland State University, Portland, OR	$753,098
Prairie View A&M Research Foundation, Prairie View, TX	$659,000

Purdue University, West Lafayette, IN	$11,916,435
Regents of the University of California, Irvine, Irvine, CA	$9,993,532
Regents of the University of Idaho, Moscow, ID	$674,961
Regents of the University of Minnesota, Minneapolis, MN	-$2,922,155
Regents of the University of New Mexico, Albuquerque, NM	$3,938,714
Rensselaer Polytechnic Institute, Troy, NY	$2,446,524
Research Foundation of CUNY on behalf of Hunter College CUNY, NY	$240,000
Research Foundation of The City University of New York Research Foundation CUNY, New York, NY	$82,491
Research Foundation on behalf of Baruch College CUNY, New York, NY	$95,000
Rutgers - State University of New Jersey, Newark, Newark, NJ	$487,565
Rutgers - The State University of New Jersey, New, New Brunswick, NJ	$5,294,120
San Diego State University Foundation, San Diego, CA	$286,379
San Francisco State University, San Francisco, CA	$120,552
San Jose State University Foundation, San Jose, CA	$108,274
South Dakota School of Mines & Technology, Rapid City, SD	$15,000
Southern Illinois University, Carbondale, Carbondale, IL	$333,281
Southern Methodist University, Dallas, TX	$1,573,000
Southern Utah University, Cedar City, UT	$972,000
St. Bonaventure University, Saint Bonaventure, NY	$534,600
Stanford University, Palo Alto, CA	$12,064,974
State University of New York at Albany, Albany, NY	$853,344
State University of New York, Binghamton, Binghamton, NY	$242,645
State University of New York, Buffalo, Amherst, NY	$1,069,783
State University of New York, Geneseo, Geneseo, NY	$486,000
State University of New York, Stony Brook, Stony Brook, NY	$11,880,693
State University of New York, Syracuse, Syracuse, NY	$120,000
Stevens Institute of Technology, Hoboken, NJ	$0
Susquehanna University, Selinsgrove, PA	$972,000
Swarthmore College, Swarthmore, PA	$207,852
Syracuse University, Syracuse, NY	$763,000
Temple University, Philadelphia, PA	$2,077,542
Tennessee Technological University, Cookeville, TN	$95,000
Texas A&M Research Foundation, College Station, TX	$7,737,750
Texas A&M University, College Station, College Station, TX	$3,540,594
Texas A&M University, Commerce, Commerce, TX	$547,240
Texas A&M University, Kingsville, Kingsville, TX	$0
Texas Tech University, Lubbock, TX	$1,707,278
The Citadel, Charleston, SC	$28,000
The Curators of the University of Missouri, Columbia, MO	$2,759,358
The New School, New York, NY	$972,000
The President and Fellows of Harvard College, Boston, MA	$2,588,685
The Regents of the Univ. of Calif., U.C. San Diego, La Jolla, CA	$14,236,976
The Regents of the University of California - UCSD, La Jolla, CA	$80,000
The Regents of the University of California, Davis, Davis, CA	$15,336,410
The Regents of the University of California, San D, La Jolla, CA	$2,403,152
The Regents of the University of Colorado, Aurora, CO	$10,099,469
The Regents of the University of Colorado, Boulder, CO	$2,465,944
The Regents of the University of Michigan, Ann Arbor, MI	$13,317,667

The Rockefeller University, New York, NY	$572,000
The Trustees of Princeton University, Princeton, NJ	$13,804,608
The University of North Carolina at Chapel Hill, Chapel Hill, NC	$5,233,883
The University of Texas Medical Branch at Galveston, Galveston, TX	$0
Transylvania University, Lexington, KY	$631,800
Trustees of Boston College, Chestnut Hill, MA	$3,150,736
Trustees of Boston University, Boston, MA	$4,658,222
Trustees of Indiana University, Bloomington, Bloomington, IN	$5,313,547
Tufts University, Medford, MA	$3,030,177
Tulane Educational Fund, New Orleans, LA	$2,590,358
Union College, Schenectady, NY	$33,000
Univ. of Medicine and Dentistry of NJ-Newark, Newark, NJ	$0
University of Akron, Akron, OH	$417,864
University of Alabama Huntsville, Huntsville, AL	$1,933,600
University of Alabama Tuscaloosa, Tuscaloosa, AL	$1,933,449
University of Alaska Fairbanks, Fairbanks, AK	$2,554,136
University of Arizona, Tucson, AZ	$4,813,408
University of Arkansas at Little Rock, Little Rock, AR	$457,982
University of Arkansas, Fayetteville, AR	$165,000
University of California, Berkeley, Berkeley, CA	$13,736,104
University of California, Los Angeles, Los Angeles, CA	$22,731,396
University of California, Merced, Merced, CA	$1,158,904
University of California, Riverside, Riverside, CA	$4,426,459
University of California, San Francisco, San Francisco, CA	$631,574
University of California, Santa Barbara, Santa Barbara, CA	$8,700,166
University of California, Santa Cruz, Santa Cruz, CA	$4,529,263
University of Central Florida, Orlando, FL	$1,656,589
University of Chicago, Chicago, IL	$5,408,701
University of Cincinnati, Cincinnati, OH	$763,354
University of Connecticut, Storrs, CT	$2,206,246
University of Delaware, Newark, DE	$3,938,873
University of Florida, Gainesville, FL	$7,511,050
University of Georgia Research Foundation, Inc., Athens, GA	$4,644,132
University of Hawaii, Honolulu, HI	$3,394,462
University of Houston, Houston, TX	$1,769,262
University of Illinois at Chicago, Chicago, IL	$2,312,759
University of Illinois at Urbana-Champaign, Champaign, IL	$18,464,570
University of Iowa, Iowa City, IA	$1,677,867
University of Kansas Center for Research, Inc., Lawrence, KS	$1,188,805
University of Kansas Medical Ctr. Res. Inst., Inc., Kansas City, KS	$3,888,000
University of Kentucky Research Foundation, Lexington, KY	$1,521,999
University of Louisville Research Foundation, Inc., Louisville, KY	$447,200
University of Maine System, Orono, ME	$0
University of Maryland Baltimore County, Baltimore, MD	$139,804
University of Maryland Biotechnology Inst., Baltimore, MD	$0
University of Maryland, Baltimore, Baltimore, MD	$187,559
University of Maryland, College Park, College Park, MD	$15,163,718
University of Massachusetts at Boston, Boston, MA	$291,600
University of Massachusetts, Amherst, Amherst, MA	$6,807,755

University of Massachusetts, Dartmouth, Dartmouth, MA	$174,993
University of Massachusetts, Lowell, Lowell, MA	$228,000
University of Massachusetts, Worcester, Worcester, MA	$291,600
University of Miami, Medical Campus, Miami, FL	$1,006,246
University of Minnesota, Duluth, Minneapolis, MN	$61,057
University of Mississippi Medical Center, Jackson, MS	$601,158
University of Mississippi, University, MS	$532,000
University of Missouri-Kansas City, Kansas City, MO	$0
University of Montana, Missoula, MT	$65,000
University of Nebraska Omaha, Omaha, NE	$486,000
University of Nevada, Reno, NV	$1,281,000
University of New Hampshire, Durham, NH	$1,175,000
University of North Carolina at Charlotte, Charlotte, NC	$209,871
University of North Dakota, Grand Forks, ND	$50,000
University of North Texas, Denton, TX	$1,542,065
University of Northern Iowa, Cedar Falls, IA	$923,400
University of Notre Dame Du Lac, Notre Dame, IN	$6,866,388
University of Oregon, Eugene, OR	$4,251,672
University of Pennsylvania, Philadelphia, PA	$7,746,118
University of Pittsburgh, Pittsburgh, PA	$4,020,284
University of Puerto Rico at Mayaguez, Mayaguez, PR	$322,650
University of Puerto Rico Central Administration, San Juan, PR	$490,000
University of Rhode Island, Kingston, RI	$1,274,991
University of Richmond, Richmond, VA	$299,886
University of Rochester, Rochester, NY	$7,608,488
University of South Alabama, Mobile, AL	$81,637
University of South Carolina Research Foundation, Columbia, SC	$3,372,979
University of South Dakota, Vermillion, SD	$2,447,648
University of South Florida, Tampa, FL	$962,909
University of Southern California, LOS ANGELES, CA	$4,434,446
University of Southern Indiana, Evansville, IN	$972,000
University of Tennessee Health Science Center, Memphis, TN	$0
University of Tennessee, Knoxville, Knoxville, TN	$7,407,408
University of Texas Arlington, Arlington, TX	$1,547,264
University of Texas at San Antonio, San Antonio, TX	$125,482
University of Texas Dallas, Richardson, TX	$1,035,000
University of Texas Health Science Center at Houston, Houston, TX	$0
University of Texas Health Science Center at San A, San Antonio, TX	$357,753
University of Texas Southwestern Medical Center, Dallas, TX	$475,000
University of Texas, Austin, TX	$15,717,552
University of Texas, El Paso, El Paso, TX	$424,575
University of Tulsa, Tulsa, OK	$971,000
University of Utah, Salt Lake City, UT	$6,571,954
University of Vermont, Burlington, VT	$1,290,773
University of Virginia, Charlottesville, VA	$7,723,446
University of Washington, Seattle, Seattle, WA	$20,638,632
University of Wisconsin - Milwaukee, Milwaukee, WI	$718,207
University of Wyoming, Laramie, WY	$2,878,379
Utah State University, Logan, UT	$986,732

Vanderbilt University, Nashville, TN	$3,858,970
Virginia Commonwealth University, Richmond, VA	$499,591
Virginia Polytechnic Institute and State University, Blacksburg, VA	$4,376,790
Virginia State University, PETERSBURG, VA	$322,936
Washington State University, Pullman, WA	$4,362,173
Washington University, St Louis, MO	$8,389,110
Wayne State University, Detroit, MI	$1,721,778
West Virginia University Research Corporation, Morgantown, WV	$771,791
Western Michigan University, Kalamazoo, MI	$1,850,358
Westminster College, Salt Lake City, UT	$874,800
Wheaton College, Wheaton, IL	$133,003
Whitworth University, Spokane, WA	$291,600
William Marsh Rice University, Houston, TX	$5,265,149
Wofford College, Spartanburg, SC	$62,324
Worcester Polytechnic Institute, Worcester, MA	$254,843
Wright State University, Dayton, OH	$110,552
Yale University, New Haven, CT	$10,876,755
McGill University, Montreal, Canada	$391,769.00
McMaster University, Hamilton, Ontario, Canada	$295,000.00
University of British Columbia, Vancouver, Canada	$84,677.00
University of Lethbridge, Lethbridge, Canada	$367,358.00
University of Toronto, Toronto, Canada	$270,000.00
Lancaster University, Bailrigg, Lancaster UK, LA1 4Y	$60,965.00
University of Oxford, Oxford, United Kingdom	$130,446.00
Flinders University of South Australia, Adelaide SA 5001, Australia	$385,120.00
Monash University, Clayton, Australia	$242,726.00

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Institution	FY 2009 Funding
Abilene Christian University, Abilene, TX	$321,000
Arizona State University, Tempe, AZ	$15,938,157
Auburn University, Auburn University, AL	$669,340
Baylor University, Waco, TX	$218,000
Board of Regents of the University of Oklahoma, Norman, OK	$3,662,789
Board of Regents of the University of Wisconsin, Madison, WI	$20,137,078
Board of Regents University of Nebraska Lincoln, Lincoln, NE	$2,274,901
Boise State University, Boise, ID	$143,889
Bowling Green State University, Bowling Green, OH	$0
Brandeis University, Waltham, MA	$195,000
Brown University, Providence, RI	$3,533,099
Bucknell University, Lewisburg, PA	$232,887
California Institute of Technology, Pasadena, CA	$8,137,900
California State University Dominguez Hills Foundation., Carson, CA	$58,000
California State University East Bay, Hayward, CA	$110,000
California State University Long Beach, Long Beach, CA	$73,529
California State University Los Angeles, Los Angeles, CA	$0

Institution	FY 2009 Funding
California State University Northridge, Northridge, CA	$88,588
Carnegie Mellon University, Pittsburgh, PA	$2,613,800
Case Western Reserve University, Cleveland, OH	$188,000
Central Michigan University, Mount Pleasant, MI	$154,556
Cheyney University of Pennsylvania, Cheyney, PA	$462,429
Chicago Office of the Board of Education, Chicago, IL	$0
City University of New York, City College, New York, NY	$416,077
City University of New York, College of Staten Isl, Staten Island, NY	$35,894
City University of New York, Hunter College, New York, NY	$400,000
City University of New York, Lehman College, Bronx, NY	$84,967
Clark Atlanta University, Atlanta, GA	$80,000
Clark University, Worcester, MA	$59,999
Clemson University, Clemson, SC	$2,834,192
College of William and Mary, Williamsburg, VA	$791,172
Colorado School of Mines, Golden, CO	$1,008,934
Colorado State University, Fort Collins, CO	$3,514,475
Columbia University, New York, NY	$19,943,497
Cornell University, Ithaca, NY	$23,757,976
Creighton University, Omaha, NE	$200,000
Dartmouth College, Hanover, NH	$630,610
DePaul University, Chicago, IL	$70,000
Dominican University, River Forest, IL	$462,429
Dowling College, Oakdale, NY	$9,713
Drexel University, Philadelphia, PA	$340,000
Duke University, Durham, NC	$5,085,010
Emory University, Atlanta, GA	$1,253,381
Fairfield University, Fairfield, CT	$53,000
Florida A&M University, Tallahassee, FL	$353,999
Florida Atlantic University, Boca Raton, FL	$0
Florida Institute of Technology, Melbourne, FL	$206,000
Florida International University, Miami, FL	$458,603
Florida State University, Tallahassee, FL	$2,539,167
George Mason University, Fairfax, VA	$2,846,097
George Washington University, Washington, DC	$572,696
Georgetown University, Washington, DC	$558,160
Georgia State University Research Foundation, Inc., Atlanta, GA	$351,513
Hampton University, Hampton, VA	$351,000
Harvard College, Cambridge, MA	$3,037,143
Hofstra University, Hempstead, NY	$462,429
Howard University, Washington, DC	$46,000
Idaho State University, Pocatello, ID	$1,899,483
Illinois Institute of Technology, Chicago, IL	$477,897
Indiana State University, Terre Haute, IN	$20,000
Indiana University, Indianapolis, Bloomington, IN	$220,000
Iowa State University of Science and Technology, Ames, IA	$1,339,343
Johns Hopkins University, Baltimore, MD	$2,502,927
Kansas State University, Manhattan, KS	$2,028,014
Kent State University, Kent, OH	$860,102

Institution	FY 2009 Funding
Langston University, Langston, OK	$70,000
Lehigh University, Bethlehem, PA	$1,591,033
Loma Linda University, Loma Linda, CA	$242,935
Louisiana State University and A&M College, Baton Rouge, LA	$3,631,673
Louisiana Tech University, Ruston, LA	$1,672,287
Massachusetts Institute of Technology, Cambridge, MA	$42,599,213
Medical University of South Carolina, Charleston, SC	$0
Miami University, Oxford, OH	$135,299
Michigan State University, East Lansing, MI	$12,414,171
Michigan Technological University, Houghton, MI	$2,043,628
Mississippi State University, Mississippi State, MS	$1,046,000
Missouri University of Science and Technology, Rolla, MO	$175,000
Montana State University, Bozeman, MT	$1,082,603
Nevada System of Higher Education - Las Vegas, Las Vegas, NV	$345,442
New Jersey Institute of Technology, Newark, NJ	$212,603
New Mexico State University, Las Cruces, Las Cruces, NM	$695,000
New York University, New York, NY	$1,682,447
New York, State Univ Research Foundation, Buffalo, Buffalo, NY	$130,000
Norfolk State University, Norfolk, VA	$70,000
North Carolina State University, Raleigh, NC	$2,796,251
North Dakota State University, Fargo, ND	$5,702,148
North Georgia College and State University, Dahlonega, GA	$121,000
Northeastern University, Boston, MA	$1,235,625
Northern Illinois University, DeKalb, IL	$397,000
Northern Virginia Community College, Annandale, VA	$0
Northwestern University, Evanston, IL	$31,354,572
NV System of Higher Ed OBO Desert Res Inst-Reno, Reno, NV	$452,930
Occidental College, Los Angeles, CA	$0
Ohio State University, Columbus, OH	$3,183,843
Ohio University, Athens, OH	$125,000
Oklahoma State University, Stillwater, Stillwater, OK	$1,764,301
Old Dominion University Research Foundation, Norfolk, VA	$991,000
Oregon Health & Science University, Portland, OR	$123,541
Oregon State University, Corvallis, OR	$2,970,367
Pennsylvania State University, University Park, PA	$27,875,934
Portland State University, Portland, OR	$214,618
Purdue University, West Lafayette, IN	$21,649,286
Regents of the University of California, Irvine, Irvine, CA	$4,489,150
Regents of the University of Idaho, Moscow, ID	$479,975
Regents of the University of Minnesota, Minneapolis, MN	$3,849,765
Regents of the University of New Mexico, Albuquerque, NM	$2,418,336
Rensselaer Polytechnic Institute, Troy, NY	$1,452,973
Research Foundation of The City University of New York d/b/a Research Foundation CUNY, New York, NY	$82,491
Research Foundation on behalf of Baruch College CUNY, NY	$85,000
Rosalind Franklin University of Medicine and Science, North Chicago, IL	$462,429
Rush University Medical Center, Chicago, IL	$924,858

Institution	FY 2009 Funding
Rutgers - State University of New Jersey, Newark, Newark, NJ	$240,958
Rutgers - The State University of New Jersey, New Brunswick, NJ	$2,631,098
San Diego State University Foundation, San Diego, CA	$94,925
San Francisco State University, San Francisco, CA	$4,800
South Dakota School of Mines & Technology, Rapid City, SD	$15,000
Southern Illinois University, Carbondale, Carbondale, IL	$1,026,699
Southern Methodist University, Dallas, TX	$211,667
Stanford University, Palo Alto, CA	$9,982,942
State University of New York at Albany, Albany, NY	$509,723
State University of New York Delhi, Delhi, NY	$0
State University of New York, Binghamton, Binghamton, NY	$1,513,287
State University of New York, Buffalo, Amherst, NY	$535,057
State University of New York, Stony Brook, Stony Brook, NY	$6,882,414
State University of New York, Syracuse, Syracuse, NY	$120,000
Stevens Institute of Technology, Hoboken, NJ	$0
Syracuse University, Syracuse, NY	$324,000
Temple University, Philadelphia, PA	$583,231
Tennessee Technological University, Cookeville, TN	$93,000
Texas A&M Research Foundation, College Station, TX	$2,772,723
Texas A&M University, College Station, College Station, TX	$600,000
Texas A&M University, Commerce, Commerce, TX	$369,943
Texas A&M University, Kingsville, Kingsville, TX	$67,167
Texas Tech University, Lubbock, TX	$1,340,915
The Curators of the University of Missouri, Columbia, MO	$2,798,458
The President and Fellows of Harvard College, Boston, MA	$0
The Regents of the Univ. of Calif., U.C. San Diego, La Jolla, CA	$5,331,202
The Regents of the University of California, Davis, Davis, CA	$8,693,552
The Regents of the University of California, San D, La Jolla, CA	$5,013,962
The Regents of the University of Colorado, Aurora, CO	$2,741,137
The Regents of the University of Colorado, Boulder, CO	$1,677,495
The Regents of the University of Michigan, Ann Arbor, MI	$25,410,833
The Rockefeller University, New York, NY	$15,000
The Trustees of Princeton University, Princeton, NJ	$8,579,301
The University of North Carolina at Chapel Hill, Chapel Hill, NC	$20,706,994
Thomas Jefferson University, Philadelphia, PA	-$235,631
Trustees of Boston College, Chestnut Hill, MA	$893,000
Trustees of Boston University, Boston, MA	$2,170,776
Trustees of Indiana University, Bloomington, Bloomington, IN	$3,001,928
Tufts University, Medford, MA	$673,197
Tulane Educational Fund, New Orleans, LA	$665,318
Union College, Schenectady, NY	$33,000
University of Akron, Akron, OH	$122,000
University of Alabama Tuscaloosa, Tuscaloosa, AL	$2,192,432
University of Alaska Fairbanks, Fairbanks, AK	$881,339
University of Arizona, Tucson, AZ	$14,900,634
University of Arkansas, Fayetteville, AR	$459,992
University of California, Berkeley, Berkeley, CA	$7,934,729
University of California, Los Angeles, Los Angeles, CA	$10,106,017

Institution	FY 2009 Funding
University of California, Merced, Merced, CA	$800,597
University of California, Riverside, Riverside, CA	$2,985,620
University of California, San Francisco, San Francisco, CA	$99,941
University of California, Santa Barbara, Santa Barbara, CA	$20,685,500
University of California, Santa Cruz, Santa Cruz, CA	$1,128,408
University of Central Florida, Orlando, FL	$957,034
University of Chicago, Chicago, IL	$3,433,854
University of Cincinnati, Cincinnati, OH	$312,156
University of Connecticut, Storrs, CT	$839,782
University of Delaware, Newark, DE	$21,900,985
University of Florida, Gainesville, FL	$4,562,174
University of Georgia Research Foundation, Inc., Athens, GA	$2,395,193
University of Hawaii, Honolulu, HI	$1,222,766
University of Houston, Houston, TX	$825,000
University of Illinois at Chicago, Chicago, IL	$980,849
University of Illinois at Urbana-Champaign, Champaign, IL	$9,966,964
University of Iowa, Iowa City, IA	$1,656,228
University of Kansas Center for Research, Inc., Lawrence, KS	$536,000
University of Kentucky Research Foundation, Lexington, KY	$1,370,500
University of Louisville Research Foundation, Inc., Louisville, KY	$107,000
University of Maine System, Orono, ME	$867,000
University of Maryland Baltimore County, Baltimore, MD	$0
University of Maryland Biotechnology Inst., Baltimore, MD	$400,000
University of Maryland, Baltimore, Baltimore, MD	$887,172
University of Maryland, College Park, College Park, MD	$7,524,721
University of Massachusetts at Boston, Boston, MA	$462,429
University of Massachusetts, Amherst, Amherst, MA	$18,127,050
University of Massachusetts, Lowell, Lowell, MA	$168,000
University of Memphis, Memphis, TN	$270,778
University of Miami, Medical Campus, Miami, FL	$797,909
University of Minnesota, Duluth, Minneapolis, MN	$43,000
University of Mississippi, University, MS	$550,000
University of Montana, Missoula, MT	$49,996
University of Nevada, Reno, NV	$314,554
University of New Hampshire, Durham, NH	$812,963
University of New Orleans, New Orleans, LA	$0
University of North Carolina at Charlotte, Charlotte, NC	$212,268
University of North Dakota Research Foundation, Grand Forks, ND	$2,543,360
University of North Dakota, Grand Forks, ND	$1,250,000
University of North Texas, Denton, TX	$1,321,907
University of Notre Dame Du Lac, Notre Dame, IN	$17,602,921
University of Oregon, Eugene, OR	$4,095,900
University of Pennsylvania, Philadelphia, PA	$4,345,315
University of Pittsburgh, Pittsburgh, PA	$1,813,285
University of Puerto Rico at Mayaguez, Mayaguez, PR	$230,000
University of Puerto Rico Central Administration, San Juan, PR	$440,000
University of Richmond, Richmond, VA	$176,280
University of Rochester, Rochester, NY	$4,977,977

Institution	FY 2009 Funding
University of South Alabama, Mobile, AL	$70,000
University of South Carolina Research Foundation, Columbia, SC	$4,433,404
University of South Florida, Tampa, FL	$878,908
University of Southern California, LOS ANGELES, CA	$17,082,386
University of Tennessee, Knoxville, Knoxville, TN	$3,536,994
University of Texas Arlington, Arlington, TX	$318,999
University of Texas at San Antonio, San Antonio, TX	$118,869
University of Texas Dallas, Richardson, TX	$905,000
University of Texas Health Science Center at Houston, Houston, TX	$170,000
University of Texas Health Science Center at San A, San Antonio, TX	$233,381
University of Texas Southwestern Medical Center, Dallas, TX	$350,000
University of Texas, Austin, TX	$21,677,341
University of Texas, El Paso, El Paso, TX	$388,903
University of Tulsa, Tulsa, OK	$865,614
University of Utah, Salt Lake City, UT	$3,219,588
University of Vermont, Burlington, VT	$1,407,657
University of Virginia, Charlottesville, VA	$6,215,578
University of Washington, Seattle, Seattle, WA	$9,795,489
University of Wisconsin - Milwaukee, Milwaukee, WI	$1,087,341
University of Wyoming, Laramie, WY	$595,000
Utah State University, Logan, UT	$554,915
Vanderbilt University, Nashville, TN	$2,419,107
Virginia Commonwealth University, Richmond, VA	$372,500
Virginia Polytechnic Institute and State University, Blacksburg, VA	$1,666,308
Washington State University, Pullman, WA	$2,548,981
Washington University, St Louis, MO	$6,863,913
Wayne State University, Detroit, MI	$1,579,500
West Virginia University Research Corporation, Morgantown, WV	$1,679,506
Western Michigan University, Kalamazoo, MI	$4,029,158
Wheaton College, Wheaton, IL	$133,141
William Marsh Rice University, Houston, TX	$4,076,000
Wofford College, Spartanburg, SC	$87,470
Yale University, New Haven, CT	$5,723,465
McGill University, Montreal, Canada	$137,241.00
McMaster University, Hamilton, Ontario, Canada	$545,325.00
University of Lethbridge, Lethbridge, Canada	$243,267.00
Lancaster University, Bailrigg, Lancaster UK, LA1 4Y	$85,887.00
Oxford Brookes University, Oxford, United Kingdom	$0.00
University of East Anglia, Norwich, United Kingdom	$199,680.00
University of Oxford, Oxford, United Kingdom	$84,730.00
Flinders University of South Australia, Adelaide SA 5001, Australia	$247,980.00

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Institution	FY 2008 Funding
Abilene Christian University, Abilene, TX	$191,000
Alabama A&M University Research Institute, Normal, AL	$479,000
Alabama A&M University, Normal, AL	$90,923
Arizona State University, Tempe, AZ	$2,637,770
Auburn University, Auburn University, AL	$2,172,484
Baylor University, Waco, TX	$80,000
Board of Regents of the University of Oklahoma, Norman, OK	$3,201,599
Board of Regents of the University of Wisconsin, Madison, WI	$50,788,097
Board of Regents University of Nebraska Lincoln, Lincoln, NE	$1,907,546
Boise State University, Boise, ID	$143,889
Bowling Green State University, Bowling Green, OH	$160,000
Brandeis University, Waltham, MA	$1,076,000
Brigham Young University, Provo, UT	$547,500
Brown University, Providence, RI	$1,521,807
California Institute of Technology, Pasadena, CA	$13,229,056
California State University Dominguez Hills Foundation., Carson, CA	$58,000
California State University East Bay, Hayward, CA	$110,000
California State University Fullerton, Fullerton, CA	$96,000
California State University Northridge, Northridge, CA	$188,224
Carnegie Mellon University, Pittsburgh, PA	$3,152,729
Case Western Reserve University, Cleveland, OH	$372,000
Chicago Office of the Board of Education, Chicago, IL	$956,000
City University of New York, City College, New York, NY	$581,334
City University of New York, Hunter College, New York, NY	$225,029
City University of New York, Lehman College, Bronx, NY	$49,107
Clark Atlanta University, Atlanta, GA	$80,000
Clark University, Worcester, MA	$54,844
Clemson University, Clemson, SC	$2,276,218
College of William and Mary, Williamsburg, VA	$707,400
Colorado School of Mines, Golden, CO	$1,880,393
Colorado State University, Fort Collins, CO	$5,493,646
Columbia University, New York, NY	$8,372,095
Cornell University, Ithaca, NY	$5,220,032
Creighton University, Omaha, NE	$200,000
Dartmouth College, Hanover, NH	$527,501
Davidson College, Davidson, NC	$69,762
DePaul University, Chicago, IL	$68,000
Dominican University, River Forest, IL	$573,000
Dowling College, Oakdale, NY	$20,795
Drexel University, Philadelphia, PA	$215,000
Duke University, Durham, NC	$9,066,183
Duquesne University, Pittsburgh, PA	$145,609
EARTH University Foundation, Atlanta, GA	-$62,461
Elizabeth City State University, Elizabeth City, NC	$0
Emory University, Atlanta, GA	$1,420,613

Institution	FY 2008 Funding
Fairfield University, Fairfield, CT	$40,000
Florida A&M University, Tallahassee, FL	$355,000
Florida Atlantic University, Boca Raton, FL	$0
Florida Institute of Technology, Melbourne, FL	$164,000
Florida International University, Miami, FL	$977,000
Florida State University, Tallahassee, FL	$4,012,813
George Mason University, Fairfax, VA	$403,093
George Washington University, Washington, DC	$1,027,453
Georgetown University, Washington, DC	$364,000
Georgia State University Research Foundation, Inc., Atlanta, GA	$400,666
Georgia Tech Research Corporation, Atlanta, GA	$3,814,761
Hampton University, Hampton, VA	$387,511
Harvard College, Cambridge, MA	$3,037,821
Hofstra University, Hempstead, NY	$525,000
Howard University, Washington, DC	$40,000
Idaho State University, Pocatello, ID	$602,690
Illinois Institute of Technology, Chicago, IL	$430,000
Indiana State University, Terre Haute, IN	$50,000
Indiana University, Indianapolis, Bloomington, IN	$15,000
Iowa State University of Science and Technology, Ames, IA	$1,449,440
Johns Hopkins University, Baltimore, MD	$3,209,788
Kansas State University, Manhattan, KS	$4,213,468
Kent State University, Kent, OH	$818,548
Langston University, Langston, OK	$67,000
Lehigh University, Bethlehem, PA	$1,390,312
Loma Linda University, Loma Linda, CA	$765,588
Louisiana State University and A&M College, Baton Rouge, LA	$1,943,587
Louisiana Tech University, Ruston, LA	$1,732,960
Lutheran University Association, Inc., Valparaiso, IN	$162,000
Massachusetts College of Liberal Arts, North Adams, MA	$239,000
Massachusetts Institute of Technology, Cambridge, MA	$45,082,502
Medical College of Georgia Research Institute Inc, Augusta, GA	$250,284
Medical University of South Carolina, Charleston, SC	$148,752
Miami University, Oxford, OH	$313,364
Michigan State University, East Lansing, MI	$9,336,827
Michigan Technological University, Houghton, MI	$2,786,828
Middle Tennessee State University, Murfreesboro, TN	$0
Mississippi State University, Mississippi State, MS	$753,502
Missouri University of Science and Technology, Rolla, MO	$175,000
Montana State University, Bozeman, MT	$1,576,269
Mount Holyoke College, South Hadley, MA	$26,000
Nevada System of Higher Education - Las Vegas, Las Vegas, NV	$1,471,000
New Jersey Institute of Technology, Newark, NJ	$160,222
New Mexico State University, Las Cruces, Las Cruces, NM	$675,000
New York Industrial Retention Network, New York, NY	$479,000
New York University, New York, NY	$3,708,001
New York, State Univ Research Foundation, Buffalo, NY	$108,341
Norfolk State University, Norfolk, VA	$157,000

Institution	FY 2008 Funding
North Carolina Central Univ., Durham, NC	$74,000
North Carolina State University, Raleigh, NC	$4,446,450
North Dakota State University, Fargo, ND	$322,000
North Georgia College and State University, Dahlonega, GA	$107,000
Northeastern University, Boston, MA	$1,087,697
Northern Arizona University, Flagstaff, AZ	$1,756,208
Northern Illinois University, DeKalb, IL	$315,916
Northwestern University Chicago Campus, Chicago, IL	$259,943
Northwestern University, Evanston, IL	$8,870,021
Occidental College, Los Angeles, CA	$60,000
Ohio State University, Columbus, OH	$7,253,119
Ohio University, Athens, OH	$1,032,061
Oklahoma State University, Stillwater, Stillwater, OK	$1,582,171
Old Dominion University Research Foundation, Norfolk, VA	$1,035,262
Oregon Health & Science University, Portland, OR	$224,582
Oregon State University, Corvallis, OR	$3,377,319
Pennsylvania State University, University Park, PA	$8,680,947
Portland State University, Portland, OR	$718,869
Prairie View A&M Research Foundation, Prairie View, TX	$201,000
Purdue University, West Lafayette, IN	$8,080,476
Regents of the University of California, Irvine, Irvine, CA	$7,596,446
Regents of the University of Idaho, Moscow, ID	$185,915
Regents of the University of Minnesota, Minneapolis, MN	$1,802,515
Regents of the University of New Mexico, Albuquerque, NM	$4,606,940
Rensselaer Polytechnic Institute, Troy, NY	$1,842,935
Research Foundation of CUNY on behalf of Hunter College CUNY, NY	$145,000
Rollins College, Winter Park, FL	$29,022
Rutgers - State University of New Jersey, Newark, Newark, NJ	$430,188
Rutgers - The State University of New Jersey, New Brunswick, NJ	$1,857,612
San Diego State University Foundation, San Diego, CA	$75,000
San Diego, University of, San Diego, CA	$45,000
San Francisco State University, San Francisco, CA	$118,000
San Jose State University Foundation, San Jose, CA	$101,504
South Dakota School of Mines & Technology, Rapid City, SD	$420,000
Southern Illinois University, Carbondale, Carbondale, IL	$349,554
Southern Methodist University, Dallas, TX	$847,143
Stanford University, Palo Alto, CA	$7,615,641
State University of New York at Albany, Albany, NY	$936,592
State University of New York Delhi, Delhi, NY	$0
State University of New York, Binghamton, Binghamton, NY	$92,645
State University of New York, Buffalo, Amherst, NY	$585,113
State University of New York, Stony Brook, Stony Brook, NY	$8,281,034
Stevens Institute of Technology, Hoboken, NJ	$234,652
Swarthmore College, Swarthmore, PA	$346,000
Syracuse University, Syracuse, NY	$1,263,000
Temple University, Philadelphia, PA	$674,642
Tennessee Technological University, Cookeville, TN	$91,000
Texas A&M Research Foundation, College Station, TX	$3,780,872

Institution	FY 2008 Funding
Texas A&M University, College Station, College Station, TX	$2,505,236
Texas A&M University, Commerce, Commerce, TX	$60,000
Texas A&M University, Kingsville, Kingsville, TX	$82,833
Texas Agrilife Research, College Station, TX	$479,000
Texas Engineering Experiment Station, College Station, TX	$549,916
Texas Tech University, Lubbock, TX	$798,001
The Curators of the University of Missouri, Columbia, MO	$2,119,150
The President and Fellows of Harvard College, Boston, MA	$561,850
The Regents of the Univ. of Calif., U.C. San Diego, La Jolla, CA	$8,704,792
The Regents of the University of California - UCSD, La Jolla, CA	$80,000
The Regents of the University of California, Davis, Davis, CA	$12,364,571
The Regents of the University of California, San D, La Jolla, CA	$2,464,939
The Regents of the University of Colorado, Aurora, CO	$7,120,688
The Regents of the University of Colorado, Boulder, CO	$1,044,890
The Regents of the University of Michigan, Ann Arbor, MI	$6,354,101
The Rockefeller University, New York, NY	$585,000
The Trustees of Princeton University, Princeton, NJ	$2,841,881
The University of North Carolina at Chapel Hill, Chapel Hill, NC	$2,712,672
The University of Texas Medical Branch at Galveston, Galveston, TX	$207,925
Thomas Jefferson University, Philadelphia, PA	$175,447
Trustees of Boston College, Chestnut Hill, MA	$782,551
Trustees of Boston University, Boston, MA	$3,672,211
Trustees of Indiana University, Bloomington, Bloomington, IN	$4,420,482
Tufts University, Medford, MA	$1,320,043
Tulane Educational Fund, New Orleans, LA	$2,189,052
Tuskegee University, Tuskegee, AL	$106,687
Union College, Schenectady, NY	$89,000
Univ. of Medicine and Dentistry of NJ-Newark, Newark, NJ	$241,869
University of Akron, Akron, OH	$122,000
University of Alabama Huntsville, Huntsville, AL	$164,489
University of Alabama Tuscaloosa, Tuscaloosa, AL	$1,380,436
University of Alaska Fairbanks, Fairbanks, AK	$511,476
University of Arizona, Tucson, AZ	$2,410,780
University of Arkansas at Little Rock, Little Rock, AR	$414,220
University of Arkansas, Fayetteville, AR	$149,973
University of California, Berkeley, Berkeley, CA	$5,746,862
University of California, Los Angeles, Los Angeles, CA	$25,056,829
University of California, Merced, Merced, CA	$969,043
University of California, Riverside, Riverside, CA	$4,298,121
University of California, San Francisco, San Francisco, CA	$1,139,909
University of California, Santa Barbara, Santa Barbara, CA	$6,052,312
University of California, Santa Cruz, Santa Cruz, CA	$5,073,287
University of Central Florida, Orlando, FL	$582,381
University of Chicago, Chicago, IL	$3,881,699
University of Cincinnati, Cincinnati, OH	$1,167,666
University of Connecticut, Storrs, CT	$1,218,876
University of Delaware, Newark, DE	$4,195,051
University of Florida, Gainesville, FL	$4,515,976

Institution	FY 2008 Funding
University of Georgia Research Foundation, Inc., Athens, GA	$4,308,789
University of Hawaii, Honolulu, HI	$2,583,021
University of Houston, Houston, TX	$1,035,512
University of Illinois at Chicago, Chicago, IL	$1,137,690
University of Illinois at Urbana-Champaign, Champaign, IL	$11,847,476
University of Iowa, Iowa City, IA	$2,028,241
University of Kansas Center for Research, Inc., Lawrence, KS	$780,000
University of Kentucky Research Foundation, Lexington, KY	$815,000
University of Louisville Research Foundation, Inc., Louisville, KY	$37,305
University of Maine System, Orono, ME	$1,792,073
University of Maryland Baltimore County, Baltimore, MD	$123,624
University of Maryland Biotechnology Inst., Baltimore, MD	$0
University of Maryland, Baltimore, Baltimore, MD	$309,727
University of Maryland, College Park, College Park, MD	$7,622,266
University of Massachusetts at Boston, Boston, MA	$479,000
University of Massachusetts, Amherst, Amherst, MA	$7,787,905
University of Massachusetts, Lowell, Lowell, MA	$153,000
University of Minnesota, Duluth, Minneapolis, MN	$42,000
University of Mississippi Medical Center, Jackson, MS	$573,000
University of Mississippi, University, MS	$448,000
University of Missouri-Kansas City, Kansas City, MO	$160,000
University of Montana, Missoula, MT	$65,000
University of Nebraska Kearney, Kearney, NE	$0
University of Nebraska Omaha, Omaha, NE	$1,913,000
University of Nevada, Reno, NV	$713,186
University of New Hampshire, Durham, NH	$1,068,172
University of North Carolina at Charlotte, Charlotte, NC	$363,032
University of North Dakota Research Foundation, Grand Forks, ND	$2,391,000
University of North Dakota, Grand Forks, ND	$500,000
University of North Texas, Denton, TX	$1,108,000
University of Notre Dame Du Lac, Notre Dame, IN	$5,657,258
University of Oregon, Eugene, OR	$3,801,778
University of Pennsylvania, Philadelphia, PA	$6,820,620
University of Pittsburgh, Pittsburgh, PA	$1,593,308
University of Puerto Rico at Mayaguez, Mayaguez, PR	$205,000
University of Puerto Rico Central Administration, San Juan, PR	$440,000
University of Puerto Rico, Medical Sciences Campus, San Juan, PR	$0
University of Richmond, Richmond, VA	$63,000
University of Rochester, Rochester, NY	$5,207,997
University of South Alabama, Mobile, AL	$34,000
University of South Carolina Research Foundation, Columbia, SC	$1,207,595
University of South Dakota, Vermillion, SD	$1,052,000
University of South Florida, Tampa, FL	$656,330
University of Southern California, LOS ANGELES, CA	$5,971,892
University of Tennessee Health Science Center, Memphis, TN	$440,468
University of Tennessee, Knoxville, Knoxville, TN	$6,735,690
University of Texas Arlington, Arlington, TX	$768,011
University of Texas Dallas, Richardson, TX	$856,104

Institution	FY 2008 Funding
University of Texas Health Science Center at Houston, Houston, TX	$877,000
University of Texas Southwestern Medical Center, Dallas, TX	$404,381
University of Texas, Austin, TX	$5,675,486
University of Tulsa, Tulsa, OK	$229,359
University of Utah, Salt Lake City, UT	$4,310,511
University of Vermont, Burlington, VT	$109,740
University of Virginia, Charlottesville, VA	$4,047,128
University of Washington, Seattle, Seattle, WA	$19,851,211
University of Wisconsin - Milwaukee, Milwaukee, WI	$774,811
University of Wyoming, Laramie, WY	$654,344
Utah State University, Logan, UT	$214,001
Vanderbilt University, Nashville, TN	$1,926,364
Virginia Commonwealth University, Richmond, VA	$182,500
Virginia Polytechnic Institute and State University, Blacksburg, VA	$2,418,722
Wake Forest University Health Sciences, Winston Salem, NC	$956,000
Washington State University, Pullman, WA	$3,517,184
Washington University, St Louis, MO	$5,218,244
Wayne State University, Detroit, MI	$1,066,000
West Virginia University Research Corporation, Morgantown, WV	$1,398,964
Western Michigan University, Kalamazoo, MI	$375,000
Wheaton College, Wheaton, IL	$145,472
William Marsh Rice University, Houston, TX	$3,708,080
Wright State University, Dayton, OH	$105,112
Yale University, New Haven, CT	$10,754,303
McGill University, Montreal, Canada	$130,339.00
McMaster University, Hamilton, Ontario, Canada	$539,325.00
Flinders University of South Australia, Adelaide SA 5001, Australia	$0.00
Monash University, Clayton, Australia	$96,340.00
Oxford Brookes University, Oxford, United Kingdom	$88,853.00
University of East Anglia, Norwich, United Kingdom	$199,682.00
University of Oxford, Oxford, United Kingdom	$91,609.00

QUESTIONS FROM RANKING MEMBER RUSH

Q1. What is the plan for moving forward with the Minorities in Energy (MIE) Initiative, which was designed to increase minority participation within the agency, as well as within the broader energy sector?

Q1a. What are the level of resources devoted to this initiative, including funding and personnel?

A1a. The Office of Economic Impact and Diversity (ED) has allocated $1.3M and five full-time employees to administer the Minorities in Energy Initiative and implement stakeholder engagement and outreach activities.

Q1b. What are the programs currently being funded within the Minorities in Energy Initiative and what are the levels of funding for each of these programs?

A1b. DOE provides financial assistance awards and contracts to Minority Serving Institutions (MSIs) and minority businesses in support of research activities at the Department of Energy (DOE) laboratories; paid internships; scholarships; the formation of strategic public-private partnerships; and stakeholder engagement and outreach initiatives. Based on the FY 2018 Consolidated Appropriations Act, it is estimated that the total funding allocation for MSIs across DOE's complex will range from $32M-$33M. This funding is in addition to the $1.3M invested by ED to conduct stakeholder engagement activities in support of STEM education and minority businesses, technical assistance, and workforce development programs. Specifically, DOE provides opportunities for underserved groups and communities to do the following:

- **Build Capacity** – DOE provides financial assistance awards to enable MSIs to strengthen their STEM capabilities by collaborating with the Department's national laboratories and scientific facilities. Also, MSI grantees are given opportunities to participate in the Visiting FacultyProgram (VFP), which supports 10-week research appointments for faculty to collaborate on a research project with scientists at the DOE national laboratories.
- **Engage in STEM Education and Workforce Development Programs** – The Department provides financial assistance support to enable MSIs and other

underserved groups to obtain scholarships and participate in internship/apprenticeship opportunities hosted by the DOE program offices in collaboration with the DOE national laboratories and/or minority-owned businesses.

- **Obtain Technical Assistance** – DOE provides information, tools and resources to MSIs and minority businesses to enable them to successfully compete for federal grants, contracts, and research opportunities.
- **Participate in Outreach and Engagement Activities** – The Department conducts stakeholder engagement and outreach activities targeted towards MSIs and underserved communities with the dual goal of building awareness of career and business opportunities in DOE and developing pathways for underrepresented groups to connect with the energy sector.

Q1c. What are the objectives of this initiative and how will those objectives be measured?

A1c. The Department is committed to building a more diverse and inclusive workforce pipeline by harnessing the full range of talent that our country has to offer. The new ED Director, James Campos, who was confirmed on April 9, 2018, by the United States Senate will be examining MIE's objectives and metrics to determine how best to leverage the program. Historically, MIE's objectives included: (1) increasing the number of qualified applicants from minority businesses and MSIs who receive research funding opportunities and participate in training programs; (2) building awareness among underserved communities of the career opportunities in DOE and the energy sector; (3) developing pathways for underserved communities to connect with energy sector employers; and (4) establishing a consortium of MSIs and minority businesses to enhance their capabilities and increase their ability to compete for federal and private opportunities on a broader scale. Success, or lack thereof, was measured by whether the objectives were accomplished.

Q1d. What is the timeline for reaching those objectives?

A1d. Going forward, the new ED Director, James Campos will establish appropriate timelines after a comprehensive review of the MIE Initiative is completed.

Q2. What are the plans for the Office of Economic Impact and Diversity moving forward?

Q2a. What are level of resources devoted to this department, including funding and personnel?

A2a. The Office of Economic Impact and Diversity's FY2018 budget is $10.169 million and is comprised of 37 FTEs.

Q2b. Who is leading the OIED department and what is their background working on issues of diversity and inclusion?

A2b. The Office of Economic Impact and Diversity (ED) is led by James E. Campos, who was confirmed by the U.S. Senate on April 9, 2018. Mr. Campos has a distinguished career serving in both the public and private sectors. Prior to his Senate appointment, Mr. Campos served as the Senior Advisor on Economic Development & Strategic Planning/Government Affairs to the College President of Nevada State College (NSC). NSC is a Minority Serving Institution and the only four-year, comprehensive public college in the State of Nevada that places a special emphasis on the advancement of a diverse and largely underserved student populations. Mr. Campos also served a three-year term on the Nevada Equal Rights Commission beginning in 2011, and was the Deputy Administrator for Workforce Solutions for the Department of Employment, Training, and Rehabilitation in the State of Nevada. Mr. Campos' public sector experience also includes an appointment as the Commissioner of Consumer Affairs for the State of Nevada where he established an Ombudsman for Minority Affairs in the Consumer Affairs Division and Nevada Commission of Minority Affairs. He also served as a Member of the Nevada Workforce Investment Board in 2009, and on two of the Workforce Sector Councils from 2014 to 2017. Mr. Campos has been active in a number of community organizations, including (among others) the Latino Coalition Board of Directors. Mr. Campos was recognized in 2011 in the Las Vegas "In Business Magazine's" top five most influential Hispanics in business. He served as an adjunct college professor, teaching courses in organizational operations, international management, marketing, strategy, public relations and human resources. Mr. Campos holds B.A. and M.S. degrees from the University of Maryland, an M.B.A. from the University of Glasgow, Scotland, and an Executive Program Certificate from Georgetown University's McDonough School of Business. Mr. Campos is also a strong advocate for diversity and inclusion, minority education and

community development, minority business and economic development, and workforce initiatives.

Q2c. What are the objectives of this department and how will those objectives be measured?

A2c. Director Campos is conducting an extensive review of all programs under his purview and is still in the process of determining his priorities, including goals, objectives and metrics.

Q2d. What is the timeline for reaching those objectives?

A2d. As noted immediately above, Director Campos needs time to evaluate carefully his priorities before establishing timelines for accomplishing his goals and objectives.

Q3. What is the percentage or number of minorities in decision-making and leadership positions within the Secretary's office?

A3. As of July 7, 2018, there were a total of 21 Federal employees in decision-making and leadership positions within the Office of Secretary. Of those 21 personnel, 1 employee (4.76%) was a minority (African American).

Q4. What is the percentage or number of minorities on the Institutional Review Board?
a. How many members make up the Institutional Review Board in total?
b. How many members of the Institutional Review Board are African American?
c. How many members of the Institutional Review Board are Latino?
d. How many members of the Institutional Review Board are women?

A4. As of July 7, 2018, the Central DOE Institutional Review Board was comprised of four Federal employees, with all four being female and one being African American.

Q5. What is the percentage or number of minorities on the Secretary of Energy Advisory Board?
a. How many members make up the Secretary of Energy Advisory Board in total?
b. How many members of the Secretary of Energy Advisory Board are African American?
c. How many members of the Secretary of Energy Advisory Board are Latino?
d. How many members of the Secretary of Energy Advisory Board are women?

A5. As of July 25, 2018, there were no members serving on the Secretary of Energy Advisory Board (SEAB). The Department of Energy is in the process of standing up the SEAB.

Q6. What is the percentage or number of minorities that make up the Senior Executive Service?

a. How many members of the Senior Executive Service are there in total?
b. How many members of the Senior Executive Service are African American?
c. How many members of the Senior Executive Service are Latino?
d. How many members of the Senior Executive Service are women?

A6. As of July 7, 2018, there were a total of 406 people serving in the Senior Executive Service (SES) within the Department of Energy. Of those 406 personnel, 69 employees (16.9%) were minorities (with 29 being African American and 13 being Latino), and 99 (24.4%) were women.

Q7. How much money, in total dollars, does the Office of Science dole out in the form of research grants, scholarships, and other funding to schools and universities?

A7. The total Office of Science funding to all Institutions of Higher Education by fiscal year is listed in the table below:

Fiscal Year	Total SC Funds To All Institutions of Higher Education
FY 17	$751,350,751
FY 16	$800,855,708
FY 15	$803,587,449
FY 14	$752,309,087
FY 13	$663,395,000
FY 12	$698,760,000
FY 11	$730,917,121
FY 10	$887,127,015
FY 09	$734,782,644
FY 08	$611,477,429

Q8. What are the list of schools and universities that has received funding over the past 10 years from your department, as well as the amounts distributed to each institution?

A8. The list of institutions of higher education awarded funds by the DOE Office of Science over the past 10 fiscal years (FY 2008 – FY 2017) is over 50 pages long and provided in a separate attachment.

Q9. What is the percentage of funding that has gone to Minority Serving Institutions including Historically Black Colleges and Universities and Hispanic Serving Institutions over the past10 years?

A9. The following table provides the funding and percentage of SC funding to Minority Serving Institutions (MSIs).

Fiscal Year	SC Funds to HBCUs*	SC Funds to HSIs*	SC Funds to AANAPISIs*	Total SC Funds to MSIs **	SC Funds To All Institutions of Higher Education	Percent of IHE Funds to MSIs*
FY 17	$2,197,381	$39,528,243	$95,343,748	$117,180,139	$751,350,751	15.60%
FY 16	$959,000	$42,700,328	$92,483,896	$112,196,926	$800,855,708	14.01%
FY 15	$1,547,542	$38,283,698	$86,139,581	$106,949,586	$803,587,449	13.31%
FY 14	$2,332,799	$46,019,174	$95,119,738	$117,616,739	$752,309,087	15.63%
FY 13	$1,180,000	$35,353,000	$81,890,000	$102,358,000	$663,395,000	15.43%
FY 12	$1,760,000	$39,051,000	$87,425,000	$105,468,000	$698,760,000	15.09%
FY 11	$2,039,189	$44,308,367	$80,224,874	$107,681,559	$730,917,121	14.73%
FY 10	$5,182,026	$55,441,492	$111,497,799	$145,566,315	$887,127,015	16.41%
FY 09	$1,433,428	$55,040,157	$60,053,960	$104,553,203	$734,782,644	14.23%
FY 08	$2,038,121	$42,191,949	$81,692,761	$113,113,809	$611,477,429	18.50%

** Historically Black Colleges and Universities (HBCUs); Hispanic Serving Institutions (HSIs); Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs); Institutions of Higher Education (IHE)*
*** Some institutions of higher education meet eligibility criteria and self-report for more than one MSI category thus the sum of first three columns will be greater that this column.*

Q10. How many minority directors are there of the 17 national labs?

A10. There are currently three minority laboratory directors, and 10.4% of all senior leadership positions (laboratory directors, deputy directors, associate laboratory directors) are current held by people that fall in to categories of underrepresented minorities or other people of color. A full summary of demographics at the laboratories can be found here - https://nationallabs.org/staff/diversity/.

Q10a. How many African American directors are there of the 17 national labs?

A10a. There are currently no African American laboratory directors.

Q10b. How many Latino directors are there of the 17 national labs?

A10b. There are currently no Latino laboratory directors.

Q10c. How many women directors are there of the 17 national labs?

A10c. There are currently no women laboratory directors.

Q11. What is the approximate dollar amount of contracts that the 17 national labs dole out to private companies and vendors?

A11. In FY 2016 the 17 national laboratories had over $3.7B available for subcontract awards.

Q12. Is there a goal or objective to include a percentage of minority contractors and vendors for all of the lab contracts?

A12. Federal agencies have specific contracting goals, including specific percentage goals for small business, small disadvantaged business, women-owned small business, service-disable veteran-owned small business, and Historically Underutilized Business Zone (HUBZone) small businesses. These standard goals, as shown below, are used as the subcontracting goals for the national laboratories.

Goal Category	Goal (%)
Small Disadvantaged Business	5%
Women-Owned Small Business	5%
HUBZone Small Business	3%
Service-Disabled Veteran-Owned Small Business	3%

Q13. What percentage of these national lab contracts are given out to minority contractors and vendors?

A13. In FY 2016, the latest year for which reporting has been finalized, the Department met its subcontracting goals for small disadvantaged businesses, women-owned small businesses, and HUBZone small businesses.

Q14. Is there a plan in place to increase minority participation for contracting and vending opportunities with the national labs?

A14. The Department of Energy Office of Small and Disadvantaged Business Utilization (OSDBU) has developed a strategic plan for improving performance in all small business contracting and subcontracting goals, including achieving the Department's goals for small disadvantaged businesses and HUBZone small businesses.

Goal Category	FY 2016 Performance	Goal Achieved
Small Disadvantaged Business	~17%	Yes
Women-Owned Small Business	~15%	Yes
HUBZone Small Business	~3.5%	Yes
Service-Disabled Veteran-Owned Small Business	~2.9%	No

Q14a. Please specify what that plan entails.

A14a. The plan includes strategies for making it easier for small businesses to engage with the U.S. Department of Energy, cultivating more productive and collaborative relationships with internal stakeholders, and improving agency performance in the Small Business Administration's four graded socioeconomic subcategories.

Q14b. What resources, in funding and personnel, will be devoted to carrying out the plan to increase minority participation for contracting and vending opportunities with the national labs?

A14b. In addition to the eleven staff members of OSDBU, each major program has a small business program manager responsible for tracking its program's performance in all of the statutorily mandated small business goals and finding ways to improve their performance. The OSBDU budget in FY 2017 was $2,994,000.

Q14c. What is the timeline for reaching these objectives?

A14c. The national laboratories are meeting their goals for disadvantaged small business, women-owned small businesses, and HUBZone small businesses.

GREG WALDEN, OREGON
CHAIRMAN

FRANK PALLONE, JR., NEW JERSEY
RANKING MEMBER

ONE HUNDRED FIFTEENTH CONGRESS

Congress of the United States
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February 8, 2018

The Honorable Mark Menezes
Under Secretary
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear Mr. Menezes:

Thank you for appearing before the Subcommittee on Energy on January 9, 2018, to testify at the hearing entitled "DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions with a transmittal letter by the close of business on Friday, February 23, 2018. Your responses should be mailed to Kelly Collins, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, DC 20515 and e-mailed in Word format to kelly.collins@mail.house.gov.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

Fred Upton
Chairman
Subcommittee on Energy

cc: The Honorable Bobby L. Rush, Ranking Member, Subcommittee on Energy

Attachment

QUESTIONS FROM REPRESENTATIVE HUDSON

Under Secretary of Energy Mark Menezes

Q1. As you may know, I have worked in a bipartisan matter with my good friend Mr. Rush on legislation to promote a 21st century energy and manufacturing workforce. In that legislation we establish a clearinghouse for information and guidance on job training and other workforce development programs for energy and manufacturing jobs.

Q1a. Are there current programs within the Department of Energy that we can point our constituents to who are looking for jobs, internships, fellowships and the like?

A1a. The Department of Energy (DOE) actively promotes access to careers in energy and recruits for jobs in a variety of occupations in support of DOE's missions. Federal opportunities within DOE can be found on USAJobs at www.usajobs.gov or on the DOE jobs site www.energy.gov/jobs. In addition to federal employment or internship opportunities, there are a variety of other programs available throughout the Department for the public and your constituents looking for jobs, internships, and fellowships, including experiential learning and job training programs available through DOE funded grants. Specifically:

- Grant/contract funded job training programs: Job training programs provide opportunities for specialized training in existing, and emerging, jobs in the energy industry. DOE sponsors these programs through grants and contracts with private companies. Examples of the types of job training programs funded by the Department include:
    - The Power for Vets Program – Smart Grid Workforce Training Program: Training program designed to prepare veterans for careers in the utility and electrical manufacturing industries for Smart Grid related jobs. http://www.incsys.com/power-applications/doe-projects/
    - Advanced Manufacturing Office Traineeship Program: Implements masters-level training programs designed to train a new generation of advanced manufacturing engineers to fill workforce needs across industry, national labs, and universities.

- Round 1: https://energy.gov/eere/articles/energy-department-awards-6-million-universities-tennessee-and-virginia-advance-masters
- Round 2: https://energy.gov/eere/articles/department-energy-selects-georgia-tech-and-uconn-train-next-generation-manufacturing

- **Graduate and Postdoctoral Programs:** DOE sponsors many research training and fellowship programs to provide graduate and post-graduate students opportunities to gain first-hand research experience in particular energy and energy sciences related fields, to provide training in science and engineering critical to the DOE mission and to address workforce needs at the DOE national laboratories and energy industries that will further advance the DOE mission and national energy goals. Examples of the types of opportunities sponsored by the Department include:
  - DOE Computational Sciences Graduate Fellowship Program: Supports, for up to four years, graduate students in fields of study that utilize DOE's high performance computing (HPC) capabilities to solve problems in science and engineering essential to address DOE mission needs. The program, supported by the DOE Office of Science and the National Nuclear Security Administration (NNSA), requires students do a HPC-focused research practicum at a DOE national laboratory as part of their graduate studies. Skilled scientists and engineers in the HPC industry are essential to advancing all aspects of national science and energy innovation in the U.S. https://www.krellinst.org/csgf/
  - The DOE Office of Science Graduate Student Research Program: Supports supplemental research awards to graduates students to conduct part of their graduate thesis research at a DOE National Laboratory for 3 to 12 months, in collaboration with a DOE laboratory scientist or engineer. The program offers access to world-leading capabilities at the DOE labs and exposure to DOE mission critical science and energy challenges. https://science.energy.gov/wdts/scgsr

- **Stipend-based Internship Programs:** Through sponsorship of stipend-based internship programs, DOE provides experiential learning opportunities at the DOE Federal sites and its national laboratories to expose undergraduate students and recent

graduates to national science and energy challenges and prepare them for career opportunities in a broad range of sectors, including the energy industry. Through these programs, students receive a stipend allowance while they gain exposure to jobs related to their academic area of study within the DOE complex. Many graduates of these stipend-based programs go on to accept jobs with DOE, DOE national laboratories, or energy-related jobs in the private sector. Examples of the types of stipend-based internship programs sponsored by the Department include:

- DOE Scholars Program: Provides seasonal or year-round stipend-based student internship opportunities in a variety of disciplines. Students are placed in offices at DOE headquarters and at DOE federal offices across the U.S. https://orise.orau.gov/doescholars/
- Minority Educational Institution Student Partnership Program: Offers seasonal internship opportunities in DOE federal offices that provide practical experience related to a variety of academic majors, including Engineering, Science, Social Sciences, and Business. https://doemeispp.org/
- EERE Robotics Internship Program: Offers seasonal internship opportunities to students of robotics within the private industry or a DOE National laboratory. https://orise.orau.gov/roboticsinternship/about-appointment/index.html
- Mickey Leland Energy Fellowship Program: Offers hands-on research experience with the Office of Fossil Energy for under-represented students in science, technology, engineering, and mathematics. Students in other fields may apply. https://orise.orau.gov/mlef/
- Science Undergraduate Laboratory Internship Program: Places undergraduate students in 10 week or 16 week research intensive internships within the DOE National Laboratories under the mentorship of DOE laboratory scientists and engineers. Research opportunities are available at all 17 DOE national laboratories and include scientific and engineering areas that span the DOE/NNSA missions. https://science.energy.gov/wdts/suli/
- Community College Internships Program: Places community college students in technical training internship opportunities across the DOE national

laboratories. With a more regional focus, community college students are trained in technical areas both unique to the DOE national laboratories and to the industries that support the DOE mission. https://science.energy.gov/wdts/cci/

- DOE Florida International University Science and Technology Workforce Initiative: A partnership between the Office of Environmental Management and Florida International University that offers seasonal fellowships in research and development pertaining to next-generation technology development for environmental cleanup, and robotics and remote sensing. https://fellows.fiu.edu/apply/

Q1b. Can you tell us about programs within the labs complex that work with universities or community colleges to help with this endeavor?

A1b. DOE and its National Laboratories oversee several programs that work with universities or community colleges to promote a 21st century energy and manufacturing workforce. While the list below is not exhaustive, it does provide examples of workforce development programs within the DOE National Laboratory complex:

- The Office of Electricity Delivery and Energy Reliability's Grid School and Conference, supported by Los Alamos National Laboratory (LANL), convenes graduate students and postdocs from across applied mathematics, physics, operations research, computation, complex systems, control theory, and electrical/systems engineering with academic researchers to help nucleate a new interdisciplinary, collaborative, and enduring R&D community on future electrical grid and infrastructure challenges.
- The National Energy Technology Laboratory (NETL) engages in a variety of educational outreach programs to prepare the Nation's students for careers in science and technology. Additionally, NETL, through the Oak Ridge Institute for Sciences and Education (ORISE), offers a range of college and postgraduate internship programs that allow students to work in a laboratory setting.
- LANL's National Security Education Center provides internships and specialized training programs to attract potential full-time employees. The Center includes a

variety of part- to full-time internships, often targeting diverse or under-represented populations in areas related to STEM, including programs for technicians.

- The Berkeley Lab Undergraduate Research (BLUR) program places students from two- and four-year institutions in paid internships in science, engineering, technical areas, and public administration. Participants work with scientists, engineers, technicians, and STEM professionals on projects related to the Lab's research program.
- The Office of Indian Energy Policy and Programs offers a college student internship program for undergraduate and graduate students who are familiar with Native American culture and tribal issues. Interns provide support on Office of Indian Energy-funded projects and assist a cross-disciplinary team to perform specific technical tasks in the field and at DOE's Sandia National Laboratories.
- The Minority Educational Institution Student Partnership Program offers talented high school, undergraduate and graduate students summer internship positions with the DOE and its National Labs. Positions involve scientific research or a focus on policy, business, and government relations.

The Department recently hired a senior advisor that will work with the programs to assess and address the following: 1) future workforce and skills needs of the DOE enterprise; 2) workforce hiring challenges and best practices across the DOE enterprise.

Finally, in 2015, DOE created an online database to track energy and manufacturing workforce training programs: https://energy.gov/eere/education/federal-energy-and-manufacturing-workforce-training-programs.

QUESTION FROM REPRESENTATIVE PETER WELCH

Thank you for your participation and insight as part of our committee's recent DOE Modernization hearing. I was very glad to hear that the Department is committed to meeting statutory deadlines in the appliance and equipment standards program. However, I am concerned that this support is not reflected in the Fall 2017 Unified Agenda of Regulatory and Deregulatory Actions, which moved 20 standards and 17 test procedures to "Long-Term Actions," for which the Department expects no regulatory action over the next twelve months.

As of this month, the Department has missed statutory or court deadlines for nine products, including six that the agency has now moved to the "Long-Term Action" category. The regulatory agenda appears to put the agency on track to miss even more legal deadlines in 2018. Some later deadlines would also seem impossible to meet unless work is started now.

I would like to request more details on how the Department plans to meet these statutory deadlines.

1. What action is the Department taking on, and when do you expect to complete each stage for, each of the standards that is already overdue:

    a. Small electric motors NOPR (due March 2016)
    b. Furnaces final rule (court settlement target of April 2016)

    c. Pool heaters NOPR (April 2016)

    d. Water heaters NOPR (April 2016)

    e. Clothes dryers NOPR (April 2017)

    f. Room air conditioners NOPR (April 2017)

    g. Cooking products final rule (June 2017)

    h. Refrigerators and freezers NOPR (September 2017)

    i. Fluorescent lamp ballasts NOPR (November 2017)

2. What action is the Department taking on, and when do you expect to complete each stage for, each of the standards due in 2018:

    a. Commercial packaged boilers final rule (due March 2018)

    b. Clothes washers NOPR (May 2018)

    c. Commercial water heaters final rule (May 2018)

d. Specialized classes of commercial air conditioners (including computer room, water-cooled, evaporatively-cooled, and variable refrigerant flow air conditioners) (April-May 2018)

3. What action is the Department taking on, and when do you expect to complete each stage for, each of the other standards with statutory deadlines in the coming years:

   a. Metal halide lamp fixtures final rule (due January 2019)

   b. Distribution transformers NOPR (April 2019)

   c. Microwave ovens NOPR (June 2019)

   d. Walk-in coolers and freezers final rule (January 2020)

   e. External power supplies NOPR (February 2020)

   f. Commercial refrigeration equipment final rule (March 2020)

4. The Department is also behind on test procedures. What action is the Department taking on, and when do you expect to complete each stage for, each of the test procedures with statutory deadlines:

   a. Water source heat pump test procedure (due December 2014)

   b. Room air conditioners test procedure (January 2018)

   c. Fluorescent lamp ballasts test procedure (May 2018)

   d. Automatic commercial ice makers test procedure (January 2019)

   e. General service fluorescent lamps, general service incandescent lamps, and incandescent reflector lamps test procedure (January 2019)

   f. Clothes washers test procedure (March 2019)

   g. Commercial air conditioning and heating equipment test procedure (May 2019)

   h. Single-package vertical air conditioners and heat pumps test procedure (May 2019)

   i. Three-phase commercial air conditioners and heat pumps test procedure (May 2019)

   j. Dishwashers test procedure (October 2019)

k. Microwave ovens test procedure (January 2020)

l. Clothes dryers test procedure (August 2020)

m. Plumbing products test procedure (October 2020)

n. Televisions test procedure (October 2020)

ANSWERS TO QUESTIONS 1-4

The Department of Energy's (DOE or The Department) mission is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.

The *Unified Agenda of Federal Regulatory and Deregulatory Actions* (*Agenda*) is a semi-annual, government-wide publication that provides important public notice and transparency about proposed regulatory and deregulatory actions within the Executive Branch. The document highlights agency priorities, promotes planning and coordination and encourages public participation in the regulatory process. The *Agenda* provides a "snapshot" of the various regulatory and deregulatory activities underway at each agency at the time of its publication.

Agencies compile information for their entries in the *Agenda* based on defined rulemaking stages. One of those stages is called "Long-Term Actions." For purposes of the Agenda, Long-Term Actions are those items under development but for which the agency does not expect to have a regulatory action within the 12 months after publication of the particular edition of the *Agenda*. Some of the entries in this section may contain abbreviated information. That an item is listed in the Long-Term Action category does not mean that no work is underway. Often, it is quite the opposite. This is particularly true of rulemakings under the Energy Policy and Conservation Act of 1975 (Pub. L. 94-163, 42 U.S.C. 6291, et seq. "EPCA") (EPCA). These rulemakings are typically multi-year activities that require extensive data gathering and analysis to prepare documents for public review and comment.

As the *Agenda* is prepared on a semi-annual basis, it is continually updated to provide accurate information for the time at which it is released. Information in the Fall 2017 *Agenda* was accurate at the time it was made public. The Department is currently engaged in preparation of the Spring 2018 *Agenda*. When that edition of the *Agenda* is published it will update information about DOE rulemakings accurate for the time of its release. Each subsequent edition of the *Agenda* will likewise be updated to provide information as each DOE rulemaking moves through the various stages of the required process.

Moreover, as noted in question 5 below, and as DOE agrees, it is important that DOE has test procedures in place prior to engaging in rulemaking to revise or establish an energy conservation standard. This is necessary to ensure parties understand the technical parameters that will be assessed in considering whether more stringent standards are justified for a particular product. However, the statutory timelines for completing both test procedure and standards rulemakings do not always coincide with such a step-wise approach. For example, in the questions above there is requested information about both energy conservation standard and test procedure rulemakings for fluorescent lamp ballasts, for which the statutory deadlines arguably prevent completing the test procedure rulemaking before undertaking the standards rulemaking. The same may also be true for microwave ovens. As a result, while DOE is committed to meeting its legal obligations, the Department is also committed to undertaking the necessary steps to ensure that its regulatory actions are well informed and appropriately analyzed. Therefore, as DOE works to complete legally mandated regulatory proceedings it will engage in test procedure actions first. This timing will be reflected in the Department's portion of the Spring 2018 Agenda.

That said, as outlined in the February 2018 "Energy Conservation Standards Activities: Report to Congress," DOE in this Administration has made progress in meeting its legal obligations with respect to the appliance and equipment standards rulemakings. The report is posted at: https://www.energy.gov/sites/prod/files/2018/02/f49/report-to-congress-on-energy-conservation-standards-activities-appliances.pdf.

Please note that some dates could change as the regulatory agenda is updated. DOE is also working hard to meet its upcoming legal obligations.

Q5. Some manufacturers have told this committee that it is important to complete test procedures before rulemakings on standards to enable more informed consideration of proposed standards. Will the delays in any of the test procedure rulemakings listed above delay setting standards for those products?

A5. In the mid-1990s, the Department published a document entitled "Procedures, Interpretations, and Policies for Consideration of New or Revised Energy Conservation Standards for Consumer Products," codified at 10 CFR part 430, subpart C, appendix A. DOE generally has used the procedures in this document to prescribe energy conservation standards and test procedures for both consumer products and commercial equipment pursuant to EPCA. These procedures are commonly referred to as the "Process Rule." DOE's objectives in establishing these procedures include: (1) providing for early input from stakeholders; (2) increasing predictability of the rulemaking timetable; (3) increasing the use of outside technical expertise; (4) eliminating problematic design options early in the process; (5) fully considering non-regulatory approaches; (6) conducting a thorough analysis of impacts; (7) using transparent and robust analytical methods; (8) articulating policies to guide selection of standards; and (9) supporting efforts to build consensus on standards. The Process Rule provides that final, modified test procedures will be issued prior to issuance of a notice of proposed rulemaking on proposed energy conservation standards.

DOE has heard from numerous parties that, consistent with the Process Rule, it should apply the resources needed to gather necessary technical information and develop appropriate test procedures before commencing a rulemaking to consider new or amended energy conservation standards. Interested parties have asserted that it is necessary to finalize the test procedures before beginning work on a standards rulemaking to ensure that the effects of the test procedure on compliance with the standard can be analyzed, and to ensure that commenters can provide effective comments on both proposed test procedures and standards rules.

DOE is committed to following the Process Rule to ensure its rulemaking decisions are well-informed and appropriately vetted before publication, even if that means taking additional time. In DOE's view, engaging stakeholders in the rulemaking process is time well spent. In fact, DOE recently published a Request for Information seeking comments and information from interested parties to assist DOE in identifying potential modifications to its Process Rule, as a way to achieve meaningful burden reduction while continuing to achieve the Department's statutory obligations in the development of energy conservation standards and test procedures. DOE also held a public meeting to receive input from interested parties on potential improvements to the Process Rule. The comment period on the RFI closed recently. DOE is currently reviewing the comments received. To be clear, DOE wants to ensure that it has the process right when it engages in energy conservation standards and test procedure rulemakings. As such, reviewing and updating the Process Rule is DOE's top priority for the Appliance Standards Program at this time.

Q6. The Department has not completed a report to Congress on appliance energy efficiency rulemakings since the 20th report in August 2016, although one is required every six months. When will the Department submit the next report?

Q6. DOE submitted it's most recent "Energy Conservation Standards Activities: Report to Congress" in February, 2018. The report is posted at: https://www.energy.gov/sites/prod/files/2018/02/f49/report-to-congress-on-energy-conservation-standards-activities-appliances.pdf.

Q7. Another five standards were finalized in December 2016 but were subject to an error correction process. According to the Department's procedures (10 CFR 430 and 431), these should have been published in the Federal Register after a 45-day review period, but four of them still have not been published. When will the Department publish the final rules for portable air conditioners, air compressors, uninterruptable power supplies, and commercial packaged boilers, and what has delayed the final publication?

A7. The subject matter of this question is the subject of current litigation. The Department does not comment on issues that are the subject of litigation.

GREG WALDEN, OREGON
CHAIRMAN

FRANK PALLONE, JR., NEW JERSEY
RANKING MEMBER

ONE HUNDRED FIFTEENTH CONGRESS

Congress of the United States
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2125 RAYBURN HOUSE OFFICE BUILDING
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Majority (202) 225–2927
Minority (202) 225–3641

February 8, 2018

The Honorable Paul Dabbar
Under Secretary for Science
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear Mr. Dabbar:

Thank you for appearing before the Subcommittee on Energy on January 9, 2018, to testify at the hearing entitled "DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States."

Pursuant to the Rules of the Committee on Energy and Commerce, the hearing record remains open for ten business days to permit Members to submit additional questions for the record, which are attached. The format of your responses to these questions should be as follows: (1) the name of the Member whose question you are addressing, (2) the complete text of the question you are addressing in bold, and (3) your answer to that question in plain text.

To facilitate the printing of the hearing record, please respond to these questions with a transmittal letter by the close of business on Friday, February 23, 2018. Your responses should be mailed to Kelly Collins, Legislative Clerk, Committee on Energy and Commerce, 2125 Rayburn House Office Building, Washington, DC 20515 and e-mailed in Word format to kelly.collins@mail.house.gov.

Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

Fred Upton
Chairman
Subcommittee on Energy

cc: The Honorable Bobby L. Rush, Ranking Member, Subcommittee on Energy

Attachment

QUESTION FROM REPRESENTATIVE DUNCAN

Under Secretary for Science Paul Dabbar

Q1. The Savannah River Site (SRS) is an integral DOE industrial complex responsible for environmental stewardship, environmental cleanup, and waste management and disposition of nuclear materials. The SRS complex covers 198,344 acres, or 310 square miles, encompassing parts of Aiken, Barnwell, and Allendale counties in South Carolina. Although this is no longer in my district, SRS greatly affects the entire state.

I would like to inquire about the status of DOE's approval of the Advance Manufacturing Collaborative (AMC) project in Aiken, SC.

This project is a public private partnership that combines the unique capabilities of the DOE National Laboratories, industrial enterprises and educational institutions to drive the long-term sustainability of the U.S. manufacturing sector.

The construction of this 60,000 square foot facility on the University of South Carolina Aiken campus would promote the Savannah River National Laboratory's advanced technology partnerships with industry and academia. The AMC project has a highly experienced development team in place and partners representing excellent businesses and universities. The economic impact for South Carolina is huge and the AMC will add to the state's strong manufacturing sector.

It is my understanding that the project has been languishing in the Department for over a year. Can you tell us what is holding up its approval?

A1. The AMC project would alleviate the substandard and inadequate infrastructure of the Savannah River National Laboratory. In addition, the proposed project would benefit the Department's mission by enabling development of advanced technologies and processes that would improve worker safety, reduce costs and shorten the schedule for cleanup of the Savannah River Site. The Department of Energy (DOE) continues to assess how the benefits of this project can be realized in cost-effective manner.

GREG WALDEN, OREGON
CHAIRMAN

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February 8, 2018

The Honorable Frank Klotz
Under Secretary for Nuclear Security
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, DC 20585

Dear General Klotz:

Thank you for appearing before the Subcommittee on Energy on January 9, 2018, to testify at the hearing entitled "DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States."

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Thank you again for your time and effort preparing and delivering testimony before the Subcommittee.

Sincerely,

Fred Upton
Chairman
Subcommittee on Energy

cc: The Honorable Bobby L. Rush, Ranking Member, Subcommittee on Energy

Attachment

QUESTION FROM REPRESENTATIVE HUDSON

Under Secretary for Nuclear Security and Administrator of the National Nuclear Security Administration
General Frank G. Klotz

DOE Modernization: Advancing DOE's Mission for National, Economic, and Energy Security of the United States

Q1. We will hear testimony on the next panel about the need to manage long term change in the nuclear enterprise—and that managing change in an organization like the NNSA is difficult. The testimony indicates that DOE and NNSA have yet to develop a strategic plan to address longstanding accountability and management problems. If these problems are not addressed, they will contribute to the erosion of the nation's ability to maintain our nuclear deterrent.

Q1a. Will you talk about how you're working with the Secretary to make sure there is a strategic plan? And what you are putting in place to measure progress in making reforms?

A1. With the release of the December 2017 National Security Strategy and the February 2018 Nuclear Posture Review, it is imperative that we achieve modern, flexible, and resilient nuclear capabilities that are safe and secure in order to deter 21st century threats and reassure our allies. To meet this critical national security goal, in 2018, National Nuclear Security Administration (NNSA) is taking a holistic approach to strategic planning and is bringing together planning efforts for the nuclear security enterprise, including programmatic offices and the management & operating contractors. NNSA is ensuring that all strategic planning efforts complement one another and cascade from the Department's strategic plan where nuclear security goals and objectives are identified. Looking across the nuclear security enterprise, NNSA is examining the existing strategic and program plans and processes, in addition to laboratory plans, to ensure mission goals, effective management and oversight, and accountability are aligned and achieved.

In addition, a strong and healthy governance and management structure and culture are both critical for NNSA's continuing success in delivering on its national security commitments. Governance is implemented through a collaborative partnership between the Federal and contractor organizations to accomplish a common mission while preserving the Federal independence needed to effectively function in its self-regulatory role. NNSA is taking significant steps in adopting, implementing, and practicing an

improved governance structure, which will lead to an improved mission-focused, performance-based culture. NNSA has embraced three core principles to guide our governance reform efforts: (1) meet all national security mission objectives by enhancing mission awareness and integrating strategic planning and resource management; (2) continuously improve performance by establishing and emphasizing clear lines of authority and accountability and streamlining decision-making; and (3) build enduring and trusted partnerships by enhancing communication and strengthening collaboration. The effectiveness of NNSA measures to improve governance and implement the desired changes in NNSA's culture is already visible. Nevertheless, progress should continuously be assessed and effectiveness of reforms measured with a mind to long-term sustainability and lasting improvements in performance.