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"

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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

[1] https://www-cdn.law.stanford.edu/wp-content/uploads/2017/11/stanfordcleanenergyfinanceframingdoc10-31_final.pdf at 3.

the world in 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 Enacted	FY 2017 Annualized CR	FY 2018 Request	FY 2018 vs FY 2016 $	FY 2018 vs FY 2016 %
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

[2] https://www.eenews.net/assets/2017/06/08/document_gw_02.pdf

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 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

[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

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.

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,

[8] http://www.sciencemag.org/news/2017/05/key-republican-lawmakers-urge-trump-not-cut-doe-research

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.

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, 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

[9] https://energy.gov/articles/energy-department-offers-conditional-commitment-first-advanced-fossil-energy-loan-guarantee

[10] http://www4vip.inl.gov/ebr/

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 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:

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[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

[15] https://www.energy.gov/sites/prod/files/2016/10/f33/9-22-16_SEAB%20Nuclear%20Power%20TF%20Report%20and%20transmittal.pdf

> *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 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

[16] http://thebreakthrough.org/archive/shale_gas_fracking_history_and

[17] http://www.alphr.com/features/373546/10-brilliant-darpa-inventions/page/0/1

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 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;

[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

- 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.*

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

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[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.

[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.

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 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

[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

[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

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 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.

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[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.

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 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

[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

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 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

[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.

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.

i.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 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]

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[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.

[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

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.

ii. 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.

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

[45] 82 Fed Reg 56181.

[46] See Lawsuit Update: DOE Inaction Costs Consumers Billions.

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-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

[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

[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

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).

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

[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

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 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

[55] https://www.ferc.gov/whats-new/comm-meet/2016/111716/E-1.pdf

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

[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

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.

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 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 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.

[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

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 national laboratories (especially the NNSA weapons laboratories), the future of nuclear

[60] https://www.energy.gov/seab/secretary-energy-advisory-board

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