

CLEAN ENERGY FINANCE

HEARING BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED THIRTEENTH CONGRESS

FIRST SESSION

TO

RECEIVE TESTIMONY ON THE CURRENT STATE OF CLEAN ENERGY FINANCE IN THE UNITED STATES AND OPPORTUNITIES TO FACILITATE GREATER INVESTMENT IN DOMESTIC CLEAN ENERGY TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

JULY 18, 2013



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

U.S. GOVERNMENT PRINTING OFFICE

82-760 PDF

WASHINGTON : 2013

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512-1800; DC area (202) 512-1800
Fax: (202) 512-2104 Mail: Stop IDCC, Washington, DC 20402-0001

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CLEAN ENERGY FINANCE

THURSDAY, JULY 18, 2013

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

The committee met, pursuant to notice, at 9:36 a.m. in room SD-366, Dirksen Senate Office Building, Hon. Ron Wyden, chairman, presiding.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

The CHAIRMAN. The committee will come to order. Today's oversight hearing is on clean energy finance, and it is particularly timely because scientists at the National Oceanic and Atmospheric Administration recently sent a sobering message when they announced that carbon dioxide has now passed 400 parts per million in the atmosphere. The last time that carbon dioxide levels were at 400 parts per million was a few million years ago. Scientists estimate that the Earth has to stabilize at just 450 parts per million to avoid the worst effects of climate change. So it is quite clear that it is going to take significant changes, significant changes, to stay under this goal, and obviously the clock is ticking.

The good news is that, according to a recent study in *Science*, the science publication, by some of the most prominent researchers in the field, there is a path out of this bind. That is a path forged through technology and innovation.

Addressing climate change in my view has got to happen on at least 3 tracks. First, more needs to be done to deploy clean energy technologies that the country already knows about—wind and solar and hydro, geothermal. The list goes on and on.

Second, steps need to be taken, and bold steps, with technologies like energy storage. Energy storage solves the problems of intermittent renewable power and helps the grid operate more smoothly. For example, there is a proposal to build a facility near Boardman, Oregon, that would use compressed air to store energy from wind farms, allowing for even greater use of renewables while offering electricity for sale below the current average electricity rates.

There is bipartisan legislation now before the Senate with respect to promoting energy storage and I'm very pleased that our new Secretary of Energy, Dr. Moniz, after years—and frankly, this has gone on through several administrations, where energy storage got at best short shrift—Dr. Moniz has committed to this committee that he is going to work with us to turn this around and

we will shortly have a comprehensive plan on energy storage from the Department.

The final track involves developing revolutionary technologies that nobody has thought about yet. For example, 5 years ago nobody envisioned that shale oil and the gas boom would allow the United States to become a net exporter of petroleum products for the first time in 50 years.

Let's push for the same kind of focus in the renewable energy field, with breakthrough technologies in a range of areas from hydrogen-powered cars, and in addition to renewables, we ought to look at modular nuclear reactors and fusion energy, because a variety of these fields are equally transformative for our Nation's economy and the environment.

Finally, there's no question it's going to take smart people to design these technologies and skilled labor to deploy the infrastructure to support them. Both of these would promote domestic investment, creating high-skill and high-wage jobs in the country. Addressing climate change by taking on this technology challenge can reduce greenhouse gas emissions at the same time it promotes job growth and a stronger economy.

Now, among the most useful things the government can do to reach that goal is to empower the immense amounts of private capital available to invest more easily in clean energy and let the private sector go to work. One source of low capital that can be difficult for clean energy projects to tap is the bond markets. We have seen, particularly in terms of encouraging new investment, that bonds clearly are an attractive way to bring in the private sector.

For years, for example, there were discussion here in the Senate about bipartisan efforts to bond in terms of transportation. Finally, my friend and colleague Senator Stabenow knows from our service on the Finance Committee, I think there was a bipartisan interest in pursuing bonds finally so that we'd stop talking about it. The projection was for \$3 to \$5 billion of investments through Build America bonds. It's now come in at over \$180 billion.

So my hope is that we can look at ways particularly to tap the bond market, to use the private sector in a creative way for clean energy and efficiency projects. In particular, bonds have been used for big projects—that's often done today—but too often don't get used for smaller projects, like residences or office buildings, because it's too hard to put together so many disparate projects in a pool large enough to float a bond.

So that's leaving a significant demand for clean energy and efficiency going unmet and again causing us to miss a big opportunity to reduce emissions. Industry experts estimate there is \$1 trillion in potential energy savings in buildings alone over the next decade and \$300 billion in potential investment opportunities that could be realized from building efficiency alone.

Another barrier that the committee has been told is hindering investment in clean energy technology is a lack of technical expertise by would-be investors. There are lots of Americans who would like to invest in clean energy, but don't have the ability to evaluate if a technology is meeting its goals and worth investing in. So certainly the Department of Energy could play an expanded role in as-

sessing the technology progress across a broad range of clean energy technologies.

At one point there was a role for government in this area. There was an Office of Technology Assessment, and there was significant bipartisan interest in this. Senator Kennedy, the late Senator Kennedy, and a variety of conservatives were interested in this. So a role for the government in terms of assessing these clean energy technologies I think is also a promising opportunity for us to explore.

The final way is for the government to level the playing field so that clean energy technologies have the same benefits that fossil energy has enjoyed and to make sure that the government itself doesn't stand in the way of clean energy being deployed. One of the big challenges to the Shepherds Flat wind project that's getting built in Oregon—and this is one of the biggest projects, not just in the country; this is one of the biggest projects in the world—was to ensure, and the government really hadn't had to deal with this before—that the wind turbines didn't interfere with nearby defense radar installations. So the Oregon congressional delegation went to work with the the Air Force. We worked this out and now we're able to tap the clean energy benefits of wind power in eastern Oregon, and I think it's pretty obvious that the Department of Defense feels that we have worked through these issues sufficiently so as to be able to proceed and that we're proceeding in a way that's consistent with meeting our national defense needs at a dangerous time.

Simple approaches like those that I've tried to describe here could have a transformative effect on the development of mature technologies, but it's going to take even more revolutionary technology to take America to a truly low carbon future. That's why investments in basic research and development are so important. Programs like the Advanced Research Projects Agency-Energy, which partner with the private sector to jump-start revolutionary technologies, is an important priority.

I think we're going to have a pretty big debate this fall with respect to budget priorities and ARPA-E and I'm very hopeful that there will be bipartisan support for that.

Finally, let me close with a couple of quick comments with respect to the loan guarantee programs. I also want to say that we already miss the late Herb Allison, who recently passed and who did particularly thoughtful work in terms of looking at these loan programs.

Now, the loan programs have clearly produced some results that I think all parties ought to be encouraged by, including that of Tesla Motors, which has repaid its loan guarantee 9 years early, while the Consumer Reports magazine evaluated the Tesla vehicle as the best car ever. As mentioned, Herb Allison has given us a number of instructive recommendations. Senator Murkowski and I think perhaps we're the only 2 Senators who were there when Mr. Allison testified.

But out of those discussions it struck me that a flaw of the existing loan program is that all of the companies considered for loan guarantees in effect get placed in the same risk bucket. So regardless of the risk-reward, they're all clumped together. So you have

a situation where a simple, small entrepreneur who's attracted some funding and has a buyer lined up for the product gets lumped in and treated the same way as a company building a large-scale manufacturing plant for a new technology in a rapidly evolving global market.

So we now have new leadership at the program. Peter Davidson will be heading it. I'm encouraged by the discussions that we've had. He clearly is willing to look at some fresh approaches to incorporate some of the recommendations of these internal reviews. At the end of the day, the urgency behind this hearing—a number of colleagues who've done good work on the climate change have joined us—is to recognize that one of the best paths forward in terms of trying to address climate change in the days ahead is to find these new clean technologies that are going to help us create good-paying jobs while at the same time dealing with that disturbing finding that just came from the government recently that I cited earlier.

Let's level the playing field, unlock private sector investment, and particularly continue investing in innovation.

So I hope once again that the bipartisan cooperation that we've seen on this committee on so many issues is what we'll hear and learn about today. Nobody's done more to make that possible than my friend Senator Murkowski, and I welcome her for any comment.

PREPARED STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Good morning, and welcome to today's oversight hearing on clean energy finance.

Scientists at the National Oceanic and Atmospheric Administration sent a sobering message earlier this year when they announced that carbon dioxide has now passed 400 parts per million in the atmosphere. The last time that carbon dioxide levels were at 400 parts per million was a few million years ago. Scientists estimate that the Earth has to stabilize at just 450 parts per million to avoid the worst effects of climate change, so it's clear that it's going to take big changes to stay under that goal, and there's not a lot of time.

The good news is that, according to a recent study in *Science* by some of the most prominent researchers in the field, there's a clear pathway out of this bind—through technology and innovation.

Addressing climate change has to happen on three tracks:

- First, by deploying more of all the clean energy technologies that we already know about, like wind, solar, hydropower, and efficiency.
- Second, by taking steps forward with technologies like energy storage. Energy storage solves the problem of intermittent renewable power, and helps the whole grid operate more smoothly. For example, there is a proposal to build a facility near Boardman, Oregon that would use compressed air to store energy from wind farms, allowing for even greater use of renewables, while offering electricity for sale below the current average electricity rates. Energy storage offers such great promise overall that I have offered legislation to encourage its deployment.
- The final track involves developing revolutionary technologies that no one has even thought of yet. Five years ago, no one envisioned the shale oil and gas boom or that the US would become a net exporter of petroleum products for the first time in 50 years. In the next five years, breakthrough technologies in any of a range of areas from hydrogen powered cars to modular nuclear reactors or fusion energy could be equally transformative for our nation's economy and environment.
- There's no question that its going to take smart people to design these technologies, and skilled labor deploy the infrastructure to support them. Both of these mean greater domestic investment and American jobs. Addressing climate change by taking on this technology challenge can reduce greenhouse gas emissions at the same time it promotes job growth and a stronger economy.

Among the most powerful things the government can do to reach that goal is to empower the immense amounts of private capital available to invest more easily in clean energy, and let the private sector go to work.

One source of low-cost capital that can be difficult for clean energy projects to tap is the bond market. Bonds are favored by investors looking for a consistent, long-term yield over the potential for a high return, a profile that matches the profile of many types of clean energy and efficiency projects. Bonds are used for big projects today, but don't get often used for smaller projects like residences or office buildings because it's too hard to put together so many disparate projects in a pool big enough to float a bond. That's leaving a huge demand for clean energy and efficiency going unmet, and missing a big opportunity to reduce emissions. Industry experts estimate there is \$1 trillion in potential energy savings in buildings over the next decade and \$300 billion in potential investment opportunities that could be realized from building efficiency alone. If the government were to help set standards for high-quality efficiency or clean energy projects, capital will flow, jobs will be created by local contractors installing domestically made goods, and investors could get a stable investment.

Another barrier that hinders investment in clean energy technology is a simple lack of technical expertise by would-be investors. There are lots of people in the United States that want to invest in clean energy, but don't have the ability to evaluate if a technology is meeting its goals and worth investing in. Think of the investment that would be unleashed if, say, the Department of Energy were to take an expanded role as a trusted and neutral evaluator of technology progress across a broad range of clean energy technologies. Interested companies could submit their technologies on a voluntary basis for testing, and investors would be empowered to choose to invest or not with confidence.

A final way is for the government to level the playing field so that clean energy technologies have the same benefits that fossil energy has enjoyed, and to make sure that the government itself doesn't stand in the way of clean energy getting deployed. I'll note that one of the biggest obstacles to the Shepherd's Flat wind project getting built in Oregon, one of the biggest wind projects in the world, was the Air Force. Once the Air Force backed down, the project and all of the benefits that came with it could proceed.

Simple approaches like I've just described could have a transformative effect on the deployment of mature technologies and energy efficiency, but it's going to take even more revolutionary technology to take America to a truly low-carbon future. This is why it's critical that our investments in basic research and development at the national labs and through our Universities continue, so that they can keep filling the innovation pipeline. Programs like the Advanced Research Projects Agency-Energy, which partner with the private sector to jump-start revolutionary technologies and take them the next step towards deployment are also critical, and must be supported.

The government has sought to address some obstacles to clean energy development through the loan guarantee programs at the Department of Energy. These programs have generated some encouraging success stories, including that of Tesla Motors repaying its loan guarantee 9 years early while also releasing what Consumer Reports has called "the best car ever". The vast majority of the loan guarantees extended are healthy and on track for repayment. Not all of the loan guarantees have fared as well, though, and these programs have been the subjects of a very thoughtful external review by the late Herb Allison, as well as by the Government Accountability Office. The loan programs have also been the subjects of oversight here on the Energy Committee.

As I've considered the loan programs myself, it strikes me that a flaw of the existing program structure is that all of the companies considered for loan guarantees are placed in the same "risk bucket", regardless of the risk/reward profile. For example, a small entrepreneur that has attracted some funding and has a buyer lined up for his product seems to be lumped in and treated the same as a company building a large-scale manufacturing plant for a new technology in a rapidly evolving global market.

The Loan Programs Office at the Department of Energy that oversees these programs now has new leadership in Peter Davidson, and I am very encouraged at his willingness to join us today to discuss the current state of the loan programs, how DOE has adjusted to incorporate the recommendations of these external reviews, and describe how the loan programs will proceed in the future.

There is no question, the challenge to address climate change is immense, and it won't get solved overnight. If our country can level the playing field, unlock private sector investment in clean energy, and continue investing in innovation, this is also a challenge that America can meet.

Let me turn to my colleague and friend Senator Murkowski for her opening comments.

**STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR
FROM ALASKA**

Senator MURKOWSKI. Thank you, Mr. Chairman. I apologize for being a little bit tardy, so I missed the beginning part of your comments, but I appreciated what you have just outlined.

I want to welcome back to the committee our friend Senator Coons. We miss you on the committee already. You've only been gone for a few weeks, but I have appreciated your contributions to this committee and am glad that you're here this morning to speak to us about the Master Limited Partnership Parity Act, something that I support, as you know, and encourage you in all you're doing on this and want to work with you.

I think that this is one of those opportunities where we really do figure out how in perhaps a more creative way we're helping to provide a level of financial incentive out there within the private sector. So I applaud you for that.

Mr. Chairman, I thank you also for noting the passing of Herb Allison. As you mentioned, his testimony before the committee I felt was very instructive. He was—in addition to being a good man, his life of public service was one that I think that we have benefited from particularly here in this committee, particularly as we look at what he look at what he did with the review of the Department's loan program.

This is complicated as we deal with how we move forward on so many of these issues as they relate to whether it's loan programs or how we can bring about some of these changes, move the technologies from that R and D stage actually into implementation, recognizing the costs that are inherent there.

But Herb in particular with his review and analysis left us better prepared to take that on. I'm grateful for that.

Now, as many of you know, I believe that there is a role for the Federal Government to play in facilitating the deployment of new energy technologies, including our loan guarantee program. Even in the aftermath of some high-profile failures, I've never advocated the outright termination of these authorities, though some of my colleagues have understandably taken that position.

But to the contrary, former Chairman Bingaman and I spent a good deal of time looking at different authorities that might make sense to provide a Clean Energy Deployment Administration within DOE. That proposal, like so many other bipartisan energy measures in recent years, languished on the Senate calendar after being reported from this committee back in 2009.

But since 2009 we've seen some events that have caused perhaps us to pump the brakes, to rethink our efforts. All you need to do is mention Solyndra and you know what we're talking about here.

Mr. Chairman, I do think it is vital for our committee to conduct regular and intensive oversight of the programs and agencies under our jurisdiction, particularly when serious or unexpected problems surface. So I want to thank the witnesses that will present today and for their role, not only in helping us understand what has gone wrong in our clean energy programs, but what has gone well, be-

cause we recognize that there have been some successes, and where we might be headed into the future.

For my part, I believe hearings like this are an important first step. Once we have built a record and determined the root causes of the problems that we've encountered, I want to work to fix the programs that we have.

While much of the focus today will be on macroeconomic trends, I remain focused on 3 specific programs. That's section 1703 and section 1705 of the loan guarantee process and the ATVM direct loan program. I think there are some similarities, but there's also some important differences between these 3 programs. I'll just very quickly run through them.

Section 1703, which was created back in 2005, relied heavily on self-paid credit subsidy costs, made any project using new or significantly improved technologies eligible, and has not closed on a single loan guarantee.

Section 1705, on the other hand, created back in 2009, was accompanied by \$6 billion for credit subsidy, limited eligibility to renewable and transmission projects, and closed 27 loan guarantees worth over \$15 billion.

ATVM, of course, was designed to offer direct loans to auto-makers. \$7.5 billion was appropriated to cover credit subsidy costs, but just 5 loans have been issued. The last was in March 2011, and April 2010 before that. Two loan recipients appear to be on the verge of bankruptcy and, according to the GAO, the program has zero active applications.

DOE's loan programs can serve a valuable purpose, but right now we need to know if the loans and the loan guarantees issued so far are as effective as we had hoped. We've got some tough decisions to make. I hope we learn enough this morning to make sure that those decisions are fully informed.

Again, I will thank the witnesses in advance for their contributions and look forward to further discussion and debate.

The CHAIRMAN. Thank you, Senator Murkowski. Again, I appreciate very much how constructive you have been in all of these discussions. I think it's not surprising, once again, we share the same views about Herb Allison, because he really was an extraordinary, extraordinary man who made huge contributions, and we do miss him.

We're not really letting Senator Coons escape from this committee. I realize he had some difficult choices to make for his constituents, but he's been doing awfully good work and bipartisan work with master limited partnerships. Senator, we welcome you. Please make remarks you wish to make this morning. We'll make your prepared statement a part of the record in its entirety, and welcome.

**STATEMENT OF HON. CHRIS COONS, U.S. SENATOR
FROM DELAWARE**

Senator COONS. Thank you, Chairman Wyden, and thank you, Ranking Member Murkowski. Thank you for your welcome. It is great to be back with you here at the Energy and Natural Resources Committee. For those keeping score at home, this is my second time appearing before this committee just in the last month,

which is an accurate reflection of what I view as its central importance and reflects how much I enjoyed my time here and the spirit of cooperation and collaboration that this committee has demonstrated.

So I'm grateful for the chance today to offer brief testimony on what I believe is one of the most fundamental challenges facing the development and deployment of clean energy technology, which is access to reliable long-term financing. This committee has considered this issue before. In 2011 we held an oversight hearing on the concept of a clean energy investment fund and in 2012 another hearing on the role of the Federal Government in spurring American innovation. I was encouraged by the ideas brought forward during those hearings and I am looking forward to the renewed discussions that will take place at this hearing later this morning.

There is little debate about America's potential to lead the world in clean energy development and deployment. We have unparalleled ingenuity. We have some of the most advanced clean energy technologies in the world. However, our innovations and the very real potential energy that they represent are struggling in part in terms of deployment because of the absence of a reliable source of financing. I think they need a catalyst, the catalyst of a clearer, stronger regulatory and statutory structure that allows access efficiently to long-term financing.

Today's energy market broadly is defined by narrow profit margins and established technologies supported by low-cost long-term financing. If clean and renewable sources of energy are to grow and compete in the American energy marketplace and thus also around the world, we have to make sure they're given a level playing field on which to operate.

The Master Limited Partnerships Parity Act of 2013, S. 795, which I reintroduced in April with Senator Murkowski, Senator Stabenow and Senator Moran, would do just that. It is a strikingly simple bipartisan bill that modernizes a section of our tax code to make it consistent with the "all of the above" energy strategy that so many of us have endorsed as the blueprint for energy independence and our energy future.

The Master Limited Partnerships Parity Act would allow clean energy projects to utilize MLP's, a beneficial tax structure that taxes a project like a partnership or a pass-through, but that trades its interests like a corporate stock, a C corp. This prevents double taxation, allows access to the liquidity of equity markets, and leaves more cash available for distribution back to investors.

For the last 30 years MLP's have given the natural gas, oil, and coal industries access to private capital at a lower cost, something other capital-intensive projects badly need. It is a well-developed, well-established financing vehicle. There's roughly 100 MLP's and a market cap of about \$450 billion at the moment.

The extension of access to this financing vehicle to energy efficiency technologies, energy storage, solar power, and a very wide range of other alternative or renewable energy sources has the real potential to bring a significant wave of private capital off the sidelines and into the renewable energy marketplace. It would not only level the playing field, but would also increase access to low-cost capital for all energy sources in our marketplace.

I am so thankful to Senator Murkowski, to Senator Stabenow, and to Senator Moran for their tireless partnership in this effort, for working with me and my staff on this bill, and to Chairman Wyden for his ongoing support support of our efforts and for the opportunity to appear before you this morning.

Companion legislation, bipartisan companion legislation, led by Congressman Ted Poe, by Mike Thompson, by Peter Welch, Cory Gardner, Chris Gibson, which is 3 R's and 2 D's, was reintroduced in the House earlier this year as well.

Access to low-cost financing will define our Nation's energy future. It will determine how, when, and which energy sources emerge as the central players in the American energy marketplace in the long term. I believe it's up to us to ensure that our vast supply of clean renewable power, as well as energy efficiency, are a vital part of that equation.

Thank you.

The CHAIRMAN. Thank you, Senator Coons.

I don't have any questions. I'm going to let colleagues ask questions if they do. But I'd just like to note that I think your work is especially timely right now as we convene, because I think, as Senators know, all Senators have been asked by Senator Baucus and by Senator Hatch to make submissions with respect to tax reform. So that obviously incorporates energy policy.

One area that I feel very strongly about is to try to find ways to, if not secure parity between the various energy sources, let's at least narrow the gap, because there are some energy sources that in effect get subsidy levels up here and are permanent and then there are other energy sources that have this level of subsidy and they're kind of on a year to year roller coaster.

What you seem to be doing in the bipartisan work that you're discussing with MLP's is you're saying here's an opportunity to again try to level the playing field and to bring more people into the debate. I intend to study very closely your legislation. I know my partner Senator Stabenow is on the Finance Committee as well.

I think I just want to let colleagues ask questions. I think Senator Stabenow has one. Shall we have Senator Murkowski go, and then we'll go to Senator Stabenow.

Senator MURKOWSKI. No.

The CHAIRMAN. Senator Stabenow.

Senator STABENOW. Thank you, Mr. Chairman. Actually, not a question, but just a comment and show of support. I think Senator Coons has put forward excellent legislation. I'm very proud to be a co-sponsor of that, as the chair of the Energy Subcommittee of Finance. We certainly are going to be putting forward ideas on tax reform and I think the master limited partnerships approach is one that really makes sense. So I hope we're going to look more positively.

Mr. Chairman, as you said, we have in the areas of energy some areas that have had long-term ability to make decisions because of tax policy and others that limp along with tax extenders year to year at best, and it doesn't seem to really be a level playing field. So I think this is one opportunity to create a level playing field.

So congratulations and I'm pleased to join you.

Senator COONS. Thank you.

The CHAIRMAN. I also want to note that Senator Stabenow has been working to level the playing field in a variety of areas, vehicles being just one of them. So I look forward to working with you on those issues.

Would other colleagues like to either make statements or ask questions of Senator Coons? Senator Murkowski.

Senator MURKOWSKI. No question, but again just to applaud you, Senator, in your efforts on this. You've been relatively dogged, which is what needs to happen around here. As the chairman has noted and Senator Stabenow has noted, I think the timing is good right now to help advance this. So the fact that we've got an opportunity in this committee to again highlight this as an opportunity to bring about parity, to bring about good news, I think, within the energy sector, again you're to be applauded.

The CHAIRMAN. Senator Franken.

Senator FRANKEN. I just want to congratulate Senator Coons on this bipartisan legislation, which I co-sponsored last Congress and I intend to support wholeheartedly this time. Thank you.

The CHAIRMAN. All right.

Senator Heinrich.

Senator HEINRICH. Senator Coons, I've got a list of 1100 questions that I'd like to get started on.

[Laughter.]

Senator COONS. I'll clear my schedule.

The CHAIRMAN. He's lasted for 24 hours.

Senator HEINRICH. This is one of those issues that we really ought to be able to build substantial common ground on. So keep up the good work.

Senator COONS. Thank you, Senator.

Thank you very much, Chairman Wyden. Thank you, Senator Murkowski. I'm particularly grateful for your bipartisan leadership on this. Senator Stabenow, for your tireless advocacy for it both here and in the Finance Committee. I do think this is a simple but potentially very powerful idea that provides access to long-term financing on an "all of the above" basis, that will move our energy economy forward.

Thank you for the opportunity.

The CHAIRMAN. You certainly timed this ideally because, as Senator Stabenow remembers, back in the summer of 2012 in effect what we said in the Finance Committee is we were going to extend a lot of those various programs. Wind was particularly one that people cared about. But we said at the end of that period, which lasts just slightly longer than a year, it was going to be a new day, and in effect you're starting the debate about what the new day ought to look like.

Senator COONS. If I could just be clear on that one point, I'm not personally advocating MLP parity as a replacement or to supplant any of the other sector-specific tax incentives.

The CHAIRMAN. I understand.

Senator COONS. I just think this is one way to take an existing piece of the code and open it up to all energy sources in a way that provides long-term predictability for capital financing.

The CHAIRMAN. All right. Thank you.

Senator COONS. Thank you, Mr. Chairman. Thank you, Senators.

The CHAIRMAN. Good work.

All right. Our panel: Peter Davidson, Executive Director of the Loan Program, Department of Energy; Richard Kauffman, Chairman of Energy and Finance for New York State; Ethan Zindler, Head of Policy Analysis for Bloomberg New Energy Finance; Will Coleman, Partner of OnRamp Capital; and Capital; and Nicolas Loris, Herbert and Joyce Morgan Fellow at The Heritage Foundation.

We welcome all of you. We'll make your prepared statements a part of the hearing record in their entirety. I know that there is almost a biological compulsion to read every word on the piece of paper. We'll make your statements a part of the record, and if you'd just like to take 5 minutes or so and talk to us it'd be great.

We'll start with you, Mr. Davidson.

**STATEMENT OF PETER W. DAVIDSON, EXECUTIVE DIRECTOR,
LOAN PROGRAMS OFFICE, DEPARTMENT OF ENERGY**

Mr. DAVIDSON. Thank you, Chairman Wyden, Ranking Member Murkowski, members of the committee. Thank you for the opportunity to testify before you today and it's a great honor.

My name is Peter Davidson. I recently joined the Department of Energy as the Executive Director of the Loan Programs Office. Prior to the LPO, I served in New York State government, and for 25 years before that I worked as an entrepreneur and a banker.

First, as others have already done, I'd like to share my condolences with the Allison family. He was a great working member of the LPO for a number of months, so we thank him for that.

The Loan Program Office administers Federal loan guarantees authorized under Title 17 of the Energy Policy Act and the direct loan program for advanced technology vehicles manufacturing authorized under the Energy Independence and Security Act. Our mission is to commercialize innovative energy and transportation projects that are not yet able to secure funding from private sector banks, the bond market, or other lenders. As such, LPO support is critical in deploying innovative utility-scale energy and automotive projects that reduce greenhouse gas emissions and promote a stronger and cleaner American economy.

LPO's overall portfolio is one of the largest clean energy and transportation portfolios in the world. As of today, we have committed or closed \$35 billion in direct loan and loan guarantees to over 30 innovative projects with a total project cost counting the equity from the participating partners of greater than \$55 billion.

One of our projects, the Ford Motor Company, has used LPO's \$5.9 billion loan to build out factories to produce more fuel efficient vehicles. Ford has developed the Ecoboost higher efficiency gasoline engine and its hybrid electric and all-electric cars such as the C-Max, Focus, and Fusion with this funding. These new technologies have helped to raise Ford's 2012 average fuel economy rating to nearly 35 miles per gallon, which is the highest among American automobile companies, as well as reduced emissions equal to taking one million cars off the road.

To date, across our portfolio more than \$1 billion in loans have been repaid, including Tesla's complete and early repayment of its \$465 million loan earlier this year, as the chairman mentioned.

Across the portfolio, to date our losses represent approximately 2 percent of the \$35 billion portfolio of closed and committed loans and guarantees, 2 percent. This is less than 10 percent of the roughly \$10 billion in loan loss reserves that Congress set aside for this program.

A significant portion of today's discussion will look at the role of equity in financing clean energy. It's important to remember that the LPO does not provide equity. We provide debt, which has often been the most difficult type of funding to secure for new innovative large-scale projects. As the chairman has noted, private sector lenders have traditionally been adverse to lending to new technologies or new processes no matter how promising they may be. Importantly, debt is often the largest source of money in a transaction, typically representing more than half of a project's total capital.

Simply put, without debt it is extremely difficult to develop next generation innovative projects. For innovative energy and transportation projects, the LPO is one of the few sources of debt available at large scale. As an example, the LPO helped create the utility-scale solar photovoltaic market. In 2009 no utility-scale solar PV projects over 100 megawatts had been built, largely because there was no commercial debt financing available. The LPO helped prove the performance of the PV solar market by funding a total of \$6 billion in 2010 and 2011 over the first 6 utility-scale PV plants in the United States. Since that time, ten new projects over 100 megawatts have been financed by lenders in the private sector without any support from the LPO.

So the LPO demonstrated the commercial viability of these innovative energy projects in 2010 and 2011 and then traditional lenders came into the market in 2012 and 2013.

Yet our program is not limited to a single technology or fuel source. To that end, the President in his climate speech recently announced a new draft loan guarantee solicitation for innovative and advanced fossil energy projects and facilities. As you all know, fossil fuels provide more than 80 percent of our energy today and they are likely to remain the largest source of energy for decades. The new fossil solicitation will help ensure that we adopt cleaner and more efficient technologies as part of a low-carbon future.

I want to address the point raised earlier. As we move forward we are constantly seeking ways to improve the program to ensure we are protecting the interests of the taxpayer. The LPO underwrites and structures its loans and loan guarantees to maximize prospects for full repayment. Before making any loan or loan guarantee, we conduct extensive due diligence on the project, with rigorous financial, technical, legal, and market analysis by the LPO's professional staff, which includes engineers, financial specialists, and a battery of outside expert advisers.

We've benefited from several recommendations for improvement, including those from Congress, the GAO, DOE's inspector general, and independent consultants such as the late Mr. Allison. The LPO has worked to adopt many of these recommendations, including adding staff and management, adding transparency to the approval process of the loans, and streamlining the application process. We continuously look for additional ways of improving our under-

writing and asset monitoring activities to incorporate lessons learned and to ensure best practices to protect taxpayer interests.

In conclusion, securing tomorrow's economic leadership requires the support and deployment of innovative energy and auto technologies today. Developing a robust low-carbon energy sector is crucial to our national interests by advancing our economy, protecting our environment and public health, and helping to ensure our energy independence.

One of the most important tools in building this economy, as our global competitors have learned and are actually doing, is debt financing for large-scale projects on reasonable terms that is wisely targeted and responsibly deployed. That is the role that we in the Loans Program Office fill for the U.S. energy sector.

Thank you very much and I look forward to any questions you may have.

[The prepared statement of Mr. Davidson follows:]

PREPARED STATEMENT OF PETER W. DAVIDSON, EXECUTIVE DIRECTOR, LOAN PROGRAMS OFFICE, DEPARTMENT OF ENERGY

INTRODUCTION

Chairman Wyden, Ranking Member Murkowski, and Members of the Committee, thank you for the opportunity to testify before you today. My name is Peter Davidson, and I am the Executive Director of the Department of Energy's (DOE) Loan Programs Office (LPO). Prior to joining the Loan Programs in May, I was Senior Advisor for Energy and Economic Development at the Port Authority of New York and New Jersey. Prior to that, I served as the Executive Director of New York State's economic development agency, the Empire State Development Corporation, where I oversaw public/private partnerships such as the Moynihan Train Station, Lower Manhattan Development Corporation, Columbia University's Manhattanville expansion, Brooklyn Bridge Park, and the Javits Convention Center.

Prior to my government service, I was an entrepreneur who founded and managed six companies in the newspaper, broadcasting, out-of-home, advertising and marketing research businesses, many of which focused on Hispanic consumers. From 1989-2000, I was the owner and President of El Diario/La Prensa, the leading Spanish language newspaper in New York. Earlier in my career, I was an executive in the investment banking division of Morgan Stanley & Co.

The LPO administers two federal loan guarantee programs-Section 1703 and 1705-for energy technology projects authorized by Title XVII of the Energy Policy Act (EPAAct), as amended. It also administers direct loans for the Advanced Technology Vehicles Manufacturing (ATVM) program as authorized under Section 136 of the Energy Independence and Security Act of 2007 (EISA). DOE's loan programs are a critical component of our nation's commitment to promoting innovative energy technologies, and I welcome the opportunity to discuss them with you.

Overview of the Programs

The Section 1703 program was established to support the commercial deployment of new, innovative technologies that avoid, reduce, or sequester greenhouse gas emissions. The program currently has \$34 billion in loan guarantee authority across several technologies, including nuclear, advanced fossil, transmission, renewable energy, and energy efficiency. The Section 1705 program was created as part of the American Recovery and Reinvestment Act of 2009 (ARRA) to jump-start the country's clean energy sector by supporting various renewable energy projects that had difficulty securing financing in a constricted credit market. The Advanced Technology Vehicles Manufacturing Loan Program (ATVM) was established to expand U.S. business opportunities for advanced automotive technologies that contribute to energy independence and security.

As of today, LPO has closed thirty-one direct loans and loan guarantees that total \$24 billion in investments. These investments are supporting twenty-six energy and five automotive projects.

In addition, the programs have conditionally committed an additional \$10.3 billion to two nuclear projects.

These projects have attracted more than \$21 billion in private sector investment, and completion of the projects will result in total U.S. economic investment of \$55 billion. To date, more than \$1 billion in loans have been repaid, including Tesla's complete and early repayment of its \$465 million loan earlier this year. Our losses to date represent about 2 percent of the \$35 billion portfolio of closed and committed loans and guarantees-and less than 10 percent of the roughly 10 billion in loan loss reserves that Congress set aside for the program.

In 2011, LPO represented the largest single public or private source of debt financing for clean energy projects in the United States as recognized in the Bloomberg New Energy Finance, 2011 Clean Energy & Energy Smart Technology League Tables. LPO's projects include:

- One of the world's largest wind farms;
- The world's largest photovoltaic and concentrating solar power plants currently under construction;
- The first two all-electric vehicle manufacturing facilities in the United States;
- A conditional commitment to the first commercial nuclear power plant to be licensed and built in the United States in three decades; and
- One of the country's first commercial-scale cellulosic ethanol plants.

I would like to highlight four projects to demonstrate how projects funded by the LPO are contributing to a clean energy economy.

- The 290 megawatt Agua Caliente solar generation project, owned by NRG Solar, LLC and MidAmerican Energy Holdings Company, is based in Yuma County, Arizona and will be the world's largest solar photovoltaic installation when fully operational. The project is approximately 96% complete with more than 4.7 million solar panels spanning more than 1,800 acres installed. For the more than 1,300 workers at peak construction, the project means steady employment, marketable skills, and the opportunity to play a critical role in shaping the nation's energy economy. The impact of this project goes well beyond delivering clean, renewable energy to the power grid. Last year, First Solar, the engineering, procurement and construction contractor for Agua Caliente and other projects, spent more than \$1 billion with U.S. suppliers across 38 states. Major domestic suppliers of steel fabrications and electrical equipment for Agua Caliente and other First Solar-supported projects include an Arizona-based division of Omco, Connecticut-based 4 Highway Safety Corp., Texas-based Powerhohm, and SMA Americas of Colorado. In addition, the project is using approximately 39,000 tons of American steel.
- The 392 gross megawatt Ivanpah Solar Generating Complex, which is owned by NRG Energy, Inc., Google and BrightSource Energy, Inc., is located in Baker, California. The Complex is one of the largest infrastructure projects in the nation and the largest solar thermal power plant under construction in the world. There are more than 1,200 workers currently on site, including manual construction workers, engineers, biologists and project managers. This project also has been a catalyst for several supplier businesses, including the project's steel supplier, Gestamp Solar Steel. Gestamp built a new manufacturing facility in Surprise, Arizona just to keep up with orders from Ivanpah. In addition, Michigan-based Guardian Industries started supplying 160,000 of its EcoGuard Solar Boost mirrors in November 2011. The Ivanpah Complex is approximately 93% complete.
- With support from its Advanced Technology Vehicle Manufacturing (ATVM) Program loan, Ford Motors is helping to position the U.S. auto industry as a leader in fuel-efficient vehicles worldwide. Ford's ATVM projects have and will continue to raise the fuel efficiency of more than a dozen popular vehicles, including the C-Max, Focus, Escape, Fusion, and F-150 trucks, representing approximately two million new vehicles annually. Furthermore, the ATVM loan program has assisted Ford in upgrading a number of key manufacturing facilities, enabling Ford to transition approximately 33,000 employees into clean engineering and manufacturing jobs in factories across six states - Illinois, Kentucky, Michigan, Missouri, New York and Ohio.
- Tesla's \$465 million loan enabled it to reopen a shuttered auto manufacturing plant in Fremont, California and to produce battery packs, electric motors, and other powertrain components. Tesla vehicles have won wide acclaim, including the 2013 Car of the Year from both Motor Trend and Automotive Magazine, and Consumer Reports recently rated Tesla's Model S as tied for the best car ever rated. Tesla has created more than 3,000 fulltime jobs in California - far more than the company initially estimated - and is building out a supply chain that supports numerous additional jobs and technologies, and is bringing advanced

manufacturing technology back to America. In May, Tesla repaid the entire remaining balance on its loan nine years earlier than originally required.

The Loan Programs Fill a Critical Role in the Marketplace

While the LPO's portfolio has performed well to date, it is important to understand why the LPO's performance is so critical to a domestic clean energy economy. Development and deployment of technology is severely limited by uncertainty in the availability of debt financing. Lenders and bondholders are often unwilling to finance innovative technologies at scale that do not yet have a history of credit performance, despite realistic projections of a market rate of return. This inhibition particularly hampered commercial technologies during the recent credit crisis.

Project-level debt traditionally provides more than half of the funding for independent energy generation projects. Without debt, there are few-if any-new commercial projects and new innovative technologies that reduce greenhouse gas emissions. The Loan Programs are uniquely positioned to address this market need by bearing some of the risk that traditional debt providers are unwilling or unable to assume. Senior secured loans backed by DOE loan guarantees augment significant project-level equity investments from project sponsors to fund discretionary capital expenditures. Every transaction supported by the LPO is a public-private partnership. Equity invested from private sources represents at least 20% of the total cost of every project, and sometimes more, and DOE will not back a technology unless and until this substantial private equity support is available. This support reflects the commercial reasonableness for each of DOE's financings.

The LPO support has proven and will continue to prove critical in deploying innovative energy projects at scope and scale that reduce greenhouse gas emissions and lead us to a cleaner economy. For example, the Section 1705 Program became available just as solar photovoltaic (PV) projects were being developed at utility scale. Given the lack of capacity in the private debt markets to fund those projects at the time of the financial crisis, DOE supported the first six utility scale PV projects greater than 100MW in the United States. There are now ten additional PV projects in the United States greater than 100MW-none of which benefit from DOE support. Such projects are now more readily financed by private lenders - many of whom began their participation in the sector by acting as lenders in the Section 1705 program. These lending partners include leading financial institutions such as John Hancock, Bank of America, Citigroup, and Banco Santander.

DOE has also enabled debt financing for all concentrating solar power (CSP) projects in the U.S. This technology's high capital costs and long construction periods add to the financing challenges of innovative technology, and the Loan Programs appear to have played a vital role in advancing this technology. In addition, the LPO's support of utility-scale solar projects has indirectly contributed to other important industry developments. With an increased volume of projects, the solar industry has since seen a reduction in costs of constructing projects. In turn, prices for off-take agreements have declined, ultimately making these technologies more cost effective for consumers and more attractive to private lenders.

Advanced Fossil Energy Solicitation

While the Title XVII program has largely supported renewable energy projects to date, the program's mandate is not limited to any specific technology. We endeavor to support a technology only when it is able to support debt financing, but we do not control when a given technology reaches that threshold. Most new, innovative, large-scale technologies will have difficulty accessing debt markets, and DOE will continue to support those technologies that best meet statutory requirements to reduce greenhouse gases and ensure a reasonable prospect of repayment.

This month, LPO released a new draft loan guarantee solicitation for innovative and advanced fossil energy projects and facilities. The Department is in a unique position to evaluate the feasibility of these innovative technologies and assist the private sector as it clears a path to commercialization. Fossil fuels provide more than 80% of our energy today, and they are likely to remain the largest source of energy for decades. This solicitation will help ensure that we adopt the technologies to use them more cleanly and efficiently as part of a low carbon future.

The draft solicitation is open for comments from industry, stakeholders, and the public until early September. The Department will make available up to \$8 billion in loan guarantee authority through this solicitation. This figure may be reduced if DOE is able to close any of the active advanced fossil projects that were submitted under a previous solicitation. When issued, this new solicitation will seek applications for projects and facilities that cover a broader range of technologies than the original solicitation. These technologies could include any fossil technology that is

new or significantly improved, as compared to commercial technologies in service in the U.S. and is described in one or more of the following technology areas:

1. Advanced Resource Development
2. Carbon Capture
3. Low-Carbon Power Systems
4. Efficiency Improvements

Applicants must show that their proposed project avoids, reduces, or sequesters air pollutants or greenhouse gas emissions. In addition to soliciting public comment about the technologies that DOE identifies in the draft solicitation, DOE welcomes comments that identify other technologies within its statutory authority that DOE should consider supporting through this loan guarantee solicitation.

Innovation Equals Risk

Whether solar, wind, advanced fossil or nuclear, financing innovation requires acceptance of a certain level of risk. Once again, it is the private sector that applies for loans and loan guarantees, and each project must have substantial private sector equity commitments before DOE will consider moving forward with a transaction. Even with these commitments, it is difficult to finance risk and minimize losses.

The LPO underwrites and structures its loans and loan guarantees to protect the interests of taxpayers and maximize prospects for full repayment. Before making a loan or loan guarantee, the LPO conducts extensive due diligence on the application, with rigorous financial, technical, legal and market analysis by DOE's professional staff, including qualified engineers, financial experts, and outside advisors. A Government Accountability Office report stated that, "it is noteworthy that the process [the LPO Title XVII loan guarantee program] developed for performing due diligence on loan guarantee applications may equal or exceed those used by private lenders to assess and mitigate project risks."¹

The LPO also has one of the largest, most experienced project finance teams in the world. As designed, LPO has the capabilities and tools to support a number of different project types, all while managing risk appropriately. Transactions are structured to identify and mitigate risk as effectively as possible before proceeding with a guarantee. Once a project closes, the LPO continues to use powerful monitoring tools-including strong covenants in all loan guarantees and strict project milestones-to control the amount of additional risk it assumes. DOE will continue to be an active manager, continuously monitoring projects, their market environments, and other identified risks to seize all opportunities to minimize exposure to loss.

Despite these efforts, and consistent with Congressional intent through the creation of a loan loss reserve, we have experienced some losses and thus constantly strive to improve every aspect of our operations. Given the nature of our work, we have benefited from several recommendations for improvement, including recommendations from Congress, the GAO, DOE's Inspector General, and independent consultants such as Former U.S. Department of Treasury official Herb Allison.

DOE has adopted many of these improvements, including streamlining the application process; adding transparency to the approval process; filling key positions with experienced professionals; clarifying authorities, strengthening internal oversight of the programs; developing a state-of-the-art workflow management system; establishing a robust early warning system; and improving reporting to the public. Furthermore, LPO continuously looks for additional ways of improving its underwriting and asset monitoring activities to incorporate lessons learned and ensure best practices to protect taxpayer interests.

Conclusion

Securing economic leadership in the future requires the support of innovation and deployment today. Developing a robust energy sector that reduces greenhouse gas emissions to the greatest extent possible is crucial to our long-term national interests and will help American companies and workers attain the tools needed to succeed in this competitive space. And one of the most important tools-as our global competitors have learned-is debt financing on reasonable terms, wisely targeted and responsibly deployed.

Other governments have reached the same conclusion. China, Germany, Canada, and Australia, for example, operate government-backed clean energy lending pro-

¹ Government Accountability Office, "DOE Loan Guarantees," March 2012, available at <http://www.gao.gov/products/GAO-12-157>. While the March 2012 GAO report focuses on the underwriting and diligence process for DOE loan guarantees under Title XVII of the Energy Policy Act of 2005, LPO, which manages both the Title XVII loan guarantee program and the ATVM loan program, employs similar underwriting and due diligence processes for both programs.

grams. The UK, the Netherlands and India have announced their intent to do the same. By facilitating credit, these programs allow projects to effectively deploy innovative energy technologies and establish a solid credit history—thereby making them more competitive, useful and attractive to private lenders.

The United States cannot cede the coming technological innovations and related economic development to competitors around the world. Not every company, nor every investment, will succeed, but the United States will be stronger and more competitive with continued support for a thriving energy industry here at home.

The achievements of the Loan Programs to date are remarkable. But they are not enough. We need to do more to compete on the global stage. Starting with our recently issued Advanced Fossil Solicitation, we aim to do just that.

Mr. Chairman, I thank the members of the committee and I look forward to answering your questions.

The CHAIRMAN. We will have some in a moment.

Mr. Kauffman, welcome.

STATEMENT OF RICHARD L. KAUFFMAN, CHAIRMAN OF ENERGY AND FINANCE FOR NEW YORK STATE AND CHAIRMAN OF THE NEW YORK STATE RESEARCH AND DEVELOPMENT AUTHORITY

Mr. KAUFFMAN. Thank you very much, Mr. Chairman, Ranking Member Murkowski, members of the committee. Thank you very much for the opportunity to speak today on clean energy financing.

My name is Richard Kauffman. I'm Chairman of Energy and Finance for New York State and I'm also Chairman of New York State Energy Research and Development Authority. Prior to my appointment in February, I worked as Senior Advisor to Energy Secretary Chu on clean energy finance, and it was my honor also to work with Herb Allison on his report, honor his service, and express condolences to his family.

Clean energy technology costs are rapidly declining in virtually every sector. But the so-called soft costs, things like installation and financing, haven't declined as rapidly. As an example, in a typical solar home installation as little as a third of the costs are the cost of the panels. So two-thirds of the costs are soft costs. Costs are costs, whether we're talking about technology costs or financing costs. Financing costs can be high, particularly for smaller projects.

We will not achieve our climate or economic development development objectives unless we bring clean energy to scale by lowering financing costs. So why are financing costs high? The short answer is that, while the technology is modern, the financing structures that we use in clean energy are old-fashioned. They aren't like other sectors of the economy. We don't generally use stock or bond markets to finance the clean energy sector, in contrast to other industries that easily raise billions in capital markets.

Nor is it easy for developers to get financing from banks. Banks face capital constraints lending to small projects and it's hard for banks to lend to projects because they typically have long lives. A wind or solar project will last 20 years or more. A bank doesn't want a loan outstanding for 20 years.

What this means is not only a lack of availability of capital or high cost of capital; it also means that there aren't the same kind of financing choices that are available to customers as other things we buy. When you want to get a new car, you can pay cash, you can get a loan, or you can lease it. But other than the solar residential lease, which has revolutionized the market, there aren't fi-

nancing products that allow customers to pay as you go, like the way you pay your utility bill. You want a solar hot water heater, a ground source heat pump, combined heat and power combined heat and power unit, chance are you'll need to pay cash or take out a mortgage.

These market gaps justify government intervention, and this committee is aware of these obstacles and in 2009 passed out of the committee on a bipartisan basis a bill creating CEDA, the Clean Energy Deployment Administration. The idea of a government financing mechanism for deployment has been taken up at the State level and in other countries, most notably in the U.K.

Governor Cuomo has taken leadership by calling for the establishment of a billion dollar green bank in New York State. New York's green bank will be like others. It provides capital for clean energy generation, infrastructure, and energy efficiency projects. It will not make loans to manufacturers. It expects to get its money back. Because we're operating in areas where there are market gaps, we will earn a rate of return. The bank is not in the subsidy or grant business.

The bank's goal is to work in partnership with the private sector to carve out new pathways into the clean energy markets for private capital flow past current market failures. The green bank will be successful if it mobilizes and leverages private sector capital, identifies new opportunities for private sector investors, and then steps out of the way.

States can help solve clean energy financing gaps. However, States can address some of the financing gaps. They cannot address all of them, and this is where we need Federal leadership. There are 4 ideas I'm just going to quickly outline as to how the Federal Government might help.

No. 1, States can't create stock market instruments for clean energy projects. Only the Federal Government can do that. Investors can buy shares of stock in assets that seem a lot like clean energy projects, real estate or oil and gas pipelines in the form of REIT's or MLP's. These instruments are not available for clean energy. Expanding REIT's or MLP's could be done on a revenue-neutral basis.

Two, only the Federal Government can solve the overreliance upon tax equity. Most projects don't generate enough taxable income, so third party investors need to be brought in that can use tax benefits. There are only about 20 active players in the market. There simply isn't enough supply of tax equity for the demand. Making tax benefits refundable, transferable, would solve this problem.

Three, help other States set up green banks that want them. New York State has identified its funding and structure, but not all States will be so able. Since green banks will generate assets that will be paid back, the Federal Government could help capitalize green banks and get paid back itself. State green banks would use the money according to certain guidelines, but the Federal Government would not pick specific targets or projects.

Four, States can help create debt markets, but it would be better for the Federal Government to help standardize contracts and collect data needed to establish investment-grade bonds, rather than have 50 different State initiatives. Perhaps the remaining DOE

loan authority could offer a modest credit subsidy in exchange for helping ought set up bond markets. Once bond markets are established, Federal involvement would end.

None of these steps would involve undertaking a major new Federal commitment to subsidies to support the industry. The steps I've outlined involve repurposing existing programs, expanding others on a revenue-neutral basis, or providing financial support for which the government can earn a rate of return. Together with State initiatives, these proposed Federal actions would lower the cost of financing by leveraging private sector capital and by accelerating the transition to using stock and bond markets.

Leaders in the clean energy industry look forward to the end of subsidies and the arrival of cost parity, since at that point the industry faces virtually unlimited demand for its products. The quickest way for the industry to achieve cost parity is through economies of scale. R and D alone is not going to solve the problem. Lowering financing costs is one of the most cost-effective ways to achieve scale.

Thank you very much.

[The prepared statement of Mr. Kauffman follows:]

PREPARED STATEMENT OF RICHARD L. KAUFFMANS, CHAIRMAN OF ENERGY AND FINANCE FOR NEW YORK, CHAIRMAN OF THE NEW YORK STATE RESEARCH AND DEVELOPMENT AUTHORITY

Chairman Wyden, Ranking Member Murkowski, and Members of the Committee, thank you for the opportunity to speak today on clean energy financing. My name is Richard Kauffman and I am the Chairman of Energy and Finance for New York State as well as the Chairman of the New York State Energy Research and Development Authority. Prior to my appointment in New York, I was Senior Advisor to Energy Secretary Chu on clean energy finance. Most of my finance and energy career has been in the private sector.

Clean energy hardware costs have fallen dramatically. As one example, solar panel prices have come down more than 50% in the last three years. Costs of batteries, wind turbines and fuel cells have also declined. Clean energy is the only source of energy that gets cheaper the more of it that is made.

However, as little as a third of the total cost of a residential solar system are the panels themselves. The rest are so-called soft costs-these include installation, permitting, and financing costs. Deployment at scale is the way to reduce soft costs (as well as to continue to reduce hardware costs). Through continued policies to deploy clean energy, costs will decline and the industry will achieve parity with conventional sources of energy. In 2013, solar, without subsidy, is competitive with about 5% of total electricity in the U.S.; in New York State that number is projected to be 50% by 2020. R&D is not enough to reduce clean energy costs-we need deployment to achieve economies of scale.

In spite of nearly record low interest rates, financing costs for the clean energy sector remain high-not for the largest, utility scale projects-but for smaller projects, including small business and residential. Since the ongoing costs of clean energy are very low as wind and sunlight are free, the key to reducing clean energy costs is reducing the upfront costs. And costs are costs-whether they are hardware costs or financing costs.

The key reason of why financing costs are high for clean energy is that the industry is financed in an old-fashioned, anachronistic way. We may be deploying 21st century technology, but the financing structures used are out of date. Discussions about clean energy finance often raise the role of venture capital equity, but by far the biggest source of capital needed for the sector is debt. Clean energy projects are principally financed using debt or debt-like instruments; true risk equity is around 10 percent of the project. In sum, there are three principal market gaps or failures in financing markets:

1. Reliance upon tax equity. Since many projects are financed on a non-recourse project finance basis by entities that do not have large taxable incomes, the industry relies on a small number of tax equity partners that in spite of

the term “equity,” offer debt like financing in exchange for tax benefits. Today, there are fewer than 20 providers of tax equity. Not only does the limited number of providers mean that tax equity can be expensive, but also that it is primarily rationed to the largest projects and developers. The other problem with tax equity is that the deals are typically structured so that the bulk of the cash flow from projects over the first few years goes to repay the tax equity provider. While investors everywhere are looking for current yield investment opportunities of all kinds-after all there’s only the choice between low interest rates and a volatile stock market-the current tax equity structure makes it difficult to tap general investor demand for current yield opportunities since renewable energy projects offer little current yield.

2. Bank capital rules and insurance company regulations. After the financial crisis, it is understandable that banks and insurance companies need to be more prudent. In practice, the amount of capital that banks need to reserve against smaller loans, loans that are barely investment grade or below, or loans that have long tenors mean that smaller renewable energy projects simply cannot get loans from large financial institutions at any cost. This is one of the reasons you seldom see solar installations on all those flat warehouse and factory rooftops when you are landing at airports. To be clear, I am not talking about loans to finance the manufacturing of renewable energy equipment; I am talking about loans to renewable energy generation projects using proven technology.

3. Little use of stock or bond markets. In most sectors of the U.S. economy, companies use stock and bond markets to raise billions of dollars of capital. Stock and bond markets typically offer cheaper and deeper pools of capital than private markets. However, in the clean energy sector, stock and bond markets are scarcely used, except for bonds for the largest of projects. Stock market investors can buy shares in REITs or MLPs that have yield characteristics of renewable energy projects; however MLP or REIT treatment is not available for renewable energy assets. Bonds are a different story. To create renewable energy bonds requires standardization of contracts to aggregate small loans into larger bonds and sufficient data to allow bond ratings.

What do these market failures mean? With limitations on availability of bank debt, little use of stock and bond markets and continued reliance upon tax equity, the clean energy industry relies upon private sources of capital where the U.S. has a competitive disadvantage relative to certain other countries and does not take advantage of the competitive strengths of its capital markets. Simply put, costs of financing remain too high. In addition to financing costs, customer choice is also limited. Consider getting a new car: you can buy it using cash or borrowed money, or you can lease it. The same is true for most large capital expenditures customers make. The solar lease has revolutionized the residential solar market; given that energy is an ongoing operating expense, it is not surprising that customers would want to substitute one operating expense-their electric bill-for another-the lease payment. Unfortunately, in the clean energy space, the solar lease is the exception rather than the rule. You want a solar hot water system, an energy efficiency upgrade or a ground source heat pump? More likely than not, you will need to put a mortgage on your house or pay cash.

All of these market gaps in financing limit economies of scale. Rather than a virtuous cycle where filling financing gaps helps achieve greater scale that in turn reduces costs which increases scale that further lowers costs, we are constraining scale.

These market gaps justify government involvement. This Committee, on a bipartisan basis, voted in 2009 to support a Clean Energy Deployment Administration. Absent federal government action, several states have since set up or announced the formation of state green banks. In his State of the State address in January, Governor Cuomo announced that New York is setting up a \$1 billion green bank to help address some of these failures in clean energy finance. New York’s green bank strategy has several operating principles:

1. New York’s green bank will provide credit support to clean energy generation and energy efficiency projects. Until it can earn a meaningful surplus, it will not offer loans to manufacturers.
2. It will work where government activity can catalyze private market activity. This was DOE’s loan program at its best-where government loans to large solar projects led the way to private sector banks subsequently lending to other projects without government involvement.
3. The bank will find intermediaries in the market-project developers, service companies, or private sector financial institutions who are making progress in the market but where their progress is constrained more by the lack of avail-

ability in financing than cost. While it is easy to give away money for free, a green bank should not fall prey to using artificially low cost financing as the sole means of generating demand. It will use up its money quickly and not engage in market transformation. Market transformation requires partnership with the private sector which means that the bank and its partners must earn a rate of return. What are some examples of activities the green bank intends to support-in conjunction with private sector intermediaries? Loans to smaller clean energy projects such as commercial and industrial solar projects, which could be standardized, aggregated and sold to the capital markets. Or credit enhancement for energy efficiency loans, where data on project energy performance and/or customer credit performance is immature. Through risk sharing, a green bank can help a private bank lend more than it would otherwise feel comfortable doing on its own. The same logic can be applied to partnerships with insurance companies that are considering insurance products to help in financing clean energy projects. Another example is to offer financing to equipment providers that want to offer new clean energy products to customers through a leasing structure or vendor financing. Smaller scale combined heat and power units that use natural gas might be an example.

4. New York's green bank will work in partnership with private sector finance institutions to offer financing not only to leverage private sector capital, but to benefit from the origination and underwriting capabilities of the banks. We do not want to be in the direct lending business ourselves.

5. The bank will facilitate development of bond markets. In exchange for providing financing, the bank intends to help in standardization of contracts and can provide warehouse facilities to act as an aggregator of smaller loans. In addition, the bank can help collect data to help rating agencies with their work. Through credit enhancement, perhaps in conjunction with an insurance company, the green bank could also help clean energy bonds achieve investment grade ratings, thereby further lowering the cost of capital.

6. By focusing on areas where there are gaps in the financing value chain rather than strictly on the costs of financing, the bank will not be in the subsidy business per se. Instead, the bank will operate at the near frontier, where financial institutions aren't quite operating, and use its resources to reduce risk for the private sector. Once the market sees that specific opportunities are attractive, we can step out of the way, leaving the private sector to take over and the green bank to move on to the next frontier.

State green banks can help solve clean energy financing gaps. After all, it makes sense for states to play a role in clean energy finance: projects are local, building codes are local, and a substantial part of utility regulation is also done at the state level. However, while states can address some of the financing gaps, they cannot address them all: we need federal leadership.

You can see the outline of how federal government policy might address the remainder of the market gaps. While state green banks can try to expand the market for tax equity by finding local banks or other tax equity buyers, only the federal government can solve the industry's reliance upon it. Permitting refundability or transferability of tax benefits would reduce the overreliance upon tax equity and remove a barrier to tapping investor demand for current yield instruments. Because the current structure increases financing costs, it actually increases the industry's need for government support. Second, green banks can do little to help create stock market instruments for clean energy projects: only federal policy can do so. Giving MLP or REIT status to renewable energy would level the playing field. And to be clear here, the benefit in the cost of capital is less about the tax benefits of MLPs and REITs and more about the fact that the cost of equity is less in the stock market than in private equity. Expanding eligibility to renewable projects on a revenue neutral basis would barely change the cost of capital for those incumbent industries that currently enjoy MLP or REIT treatment. Third, while state green banks can work to accelerate the creation of debt markets, it would be better for the federal government to help standardize contracts and collect data rather than have 50 states work on the problem. We could imagine using the remaining DOE loan guarantee authority to offer a modest credit subsidy in exchange for standardizing contracts and creating data for bond ratings. Fourth, the federal government could help capitalize state green banks. New York State has identified likely funding sources for its bank, but other states may not have such resources. Since state green banks can focus on areas where there are market gaps and can therefore earn a rate of return, this support could be repaid to the federal government. We also know from Eximbank or OPIC that governments can offer guarantee programs that offer low cost financing and can earn a surplus from guarantee fees.

None of these steps would involve undertaking a major new federal commitment to subsidies to support the industry. The steps involve repurposing existing programs, expanding others on a revenue neutral basis, or providing financial support for which the government can earn a rate of return. Together with state initiatives, these proposed federal actions would lower costs of clean energy financing by leveraging private sector capital and by accelerating the transition to using stock and bond markets. Leaders in the clean energy industry look forward to the end of subsidies and the arrival of cost parity, since at that point the industry faces virtually unlimited demand for its products. The quickest way for the industry to achieve cost parity is through economies of scale, and lowering financing costs is one of the most cost effective ways to achieve scale.

The CHAIRMAN. Very well said, Mr. Kauffman. I remember your Governor, Governor Cuomo, talking to me about these clean energy technologies when I was just sitting pretty much down where Senator Heinrich was and he worked in Washington. So I appreciate the good work you all are doing in New York.

Mr. Zindler, thank you.

**STATEMENT OF ETHAN ZINDLER, HEAD OF POLICY ANALYSIS,
BLOOMBERG NEW ENERGY FINANCE**

Mr. ZINDLER. Good morning and thank you. First I'd like to say thanks to the committee for this opportunity today. This is my first appearance before you, Chairman Wyden. I'm particularly proud to be here today and to try to be of service once again.

I'm here in my role as Head of Policy Analysis for Bloomberg New Energy Finance, a market research firm focused on the clean energy sector. Our clients include major investment banks, wind, solar, and other clean energy equipment makers, venture capitalists and project developers, major energy producers, including utilities and integrated oil companies, as well as government agencies and NGO's.

Before I begin, just a quick disclaimer from the lawyers: My remarks today represent my views alone, not the corporate positions—

The CHAIRMAN. Never a morning without the lawyers.

Mr. ZINDLER [continuing]. Of Bloomberg New Energy Finance. In addition, they do not represent specific investment advice and should not be construed as such.

The topic of today's hearing is clean energy financing. It's a potentially broad subject covering both financing for established cost competitive clean energy technologies such as wind, solar photovoltaics, or geothermal, as well as newer, more cutting edge technologies still in the development phase. I'd just like to highlight that my comments here are going to pertain to the former, that's conventional technologies that are now being deployed at scale. I think we've got some terrific panelists who are going to talk about the other challenges around demonstration-scale stuff.

Bloomberg New Energy Finance has tracked well over \$1.5 trillion in mostly private capital that has been invested in clean energy globally since 2004. In 2011 annual investment hit an all-time high of \$317 billion, then slipped 11 percent to \$281 billion in 2012. This marked the first time in 7 years that we've been tracking the industry that year on year investment actually declined to a notable degree.

Last week our firm released clean energy investment figures for the second quarter of 2013 and they offered a mixed outlook. On the one hand, total funds deployed globally rose to \$53.1 billion in Q2 2013, from \$43 billion or approximately \$44 billion in the first quarter of this year. On the other hand, total investment through the first half of this year was down 18 percent from the same 6 months in 2012.

Why has the rate of capital being deployed apparently slowed in the last 18 months? Two factors are primarily to blame: one, weakening subsidy support from governments in Europe and elsewhere around the world; and 2, rapidly declining equipment costs.

The first of these trends, declining subsidy support, was to a large degree inevitable. In 2008 and 2009 governments globally pledged just under \$200 billion in economic stimulus support to the clean energy sector. The large majority of those funds have now been spent or the programs behind them have expired. By our tally, the U.S. earmarked about \$66 billion in energy-specific stimulus and most of those funds have now been spent. In addition, Nations such as Spain, Italy, and Germany have scaled back support for clean energy after seeing renewable energy installations skyrocket faster than they had anticipated.

The second trend, the dramatic drop in equipment costs, was less predictable, but stands to have a much more profound longer-term impact on the market. Today a photovoltaic module bought at the factory gate in China or the U.S. costs less than a quarter of what it did just 4 years ago. Wind equipment prices are also down. Both technologies are cost competitive in certain markets around the globe, including some in the United States, without the benefit of subsidies.

Technological improvements deserve part of the credit for the cost declines, but a bigger factor has simply been scale. Global photovoltaic manufacturing today stands at some 61 gigawatts in capacity per year. That's twice as high as just 2 years ago, 12 times as high as 3 years ago, and 25 times as high as 6 years ago.

These lower costs are allowing dollars invested in renewables to go further than they would have just a few years ago. While global investment dipped 11 percent from 2011 to 2012, the rate at which new capacity was actually deployed into the field actually accelerated. Annual capacity installations rose from 2011 to 2012 by 12 percent, as nearly 90 gigawatts of new capacity was brought on line last year.

U.S. clean energy investment, which I'll define here as just renewables and biofuels, has followed a similar path. Total capital into the sector hit an all-time high in 2011, then slipped 36 percent in 2012. High investment in 2011 and fears over expiration of the production tax credit resulted in a record approximately 17 or 18 gigawatts of new capacity getting built in 2012. Lower equipment costs also have contributed to this boom.

As I mentioned, through the first 6 months of this year investment is down compared with the first half of 2012. But unlike last year, the U.S. this year will also see less capacity additions, despite what will surely be a record-breaking year for the solar industry.

All this I hope is useful background to ask one fundamental question: Are the capital markets to blame for what appears to be

a deceleration of financing over the last 18 months? In a word, no and yes. Sorry. Energy nerd attempt at humor here. I'm a professional here. I should know better.

Anyway, I would argue that today there is simply no shortage of capital, debt, equity, so-called tax equity, or other, which is available for high-quality clean energy projects, that is projects being developed by reputable companies with relevant permits in hand and, most importantly, firm long-term agreements signed to sell their electricity at a reasonable price to a creditworthy buyer such as a major utility. The financial community will finance such projects.

As an aside, I would note that this has not always been the case. At the height of the financial crisis capital for clean energy projects dried up almost completely. In response, Congress acted quickly to establish the so-called 30 percent cash grant program.

Today, however, there is no such shortage of capital. Instead there's a shortage of projects that meet the criteria I outlined a moment ago. For developers it is now considerably more challenging to sign sufficiently priced power purchase agreements than it was. Demand for new wind energy capacity in particular has weakened. This is partly due to competition from low-priced natural gas, but it's also because the 30-State renewable portfolio standard projects—sorry—the 30-State portfolio standards in many cases are now being met or are going to be soon.

So in the short run, no, I do not believe the lack of capital is to blame for the recent deceleration in investment for conventional technologies. However, looking beyond the immediate term, capital availability and clean energy capacity growth are inextricably linked together. That is, when you cut the cost for one demand for the other—

The CHAIRMAN. Pretty soon we're going to have to break, so I have to break you off here, if you can wrap it up.

Mr. ZINDLER. Yes, I'll wrap up real quick. But I do want to not leave you with the impression that the problem has been solved by any means. My point is basically that in the longer run we have a problem, which is that basically the cost of capital has to come down and the kind of financing that Richard is talking about, the kind of financing that takes place on a larger scale, has to become more present in the market, because that in turn helps allow developers essentially to sell their electricity at a lower lower cost and it makes it more cost competitive.

We are not very bullish on the next couple years in terms of new capacity additions for the wind industry in particular. The cost of capital has to come down for that rate to go back up in terms of actual deployment into the field.

So thank you, Mr. Chairman. I appreciate it.

[The prepared statement of Mr. Zindler follows:]

PREPARED STATEMENT OF ETHAN ZINDLER, HEAD OF POLICY ANALYSIS, BLOOMBERG
NEW ENERGY FINANCE

Good morning. First, I'd like to say thank you to the committee for this opportunity today. This is my first appearance before this panel under Chairman Wyden's leadership and I'm proud to try to be of service.

I come here today in my role as head of policy analysis at Bloomberg New Energy Finance, a market research firm focused on the clean energy sector. Our clients in-

clude major investment banks; wind, solar, and other clean energy equipment makers; venture capitalists and project developers; major energy-producers including utilities and integrated oil companies; as well as government agencies and NGOs. Our group, a market research division of Bloomberg LP, provides timely, accurate, and actionable insights on how the energy sector is being transformed by new technologies.

Before I begin, a disclaimer: my remarks today represent my views alone, not the corporate positions of either Bloomberg LP or Bloomberg New Energy Finance. In addition, they do not represent specific investment advice and should not be construed as such.

The topic of today's hearing is "clean energy financing." It's a potentially broad subject, covering both financing for established, cost-competitive clean energy technologies such as wind, solar photovoltaics, or geothermal as well as newer, more cutting-edge technologies still in the development phase such as marine, tidal and others. In the interests of time, my comments here pertain to the former—the financing of clean energy technologies that are now seeing significant levels of deployment.

Bloomberg New Energy Finance has tracked well over \$1.5 trillion in mostly private capital invested in clean energy globally (defined here as traditional renewables, biofuels, power storage and smart grid). In 2011, annual investment hit an all-time high of \$317bn then slipped 11% to \$281bn in 2012. This marked the first time in the seven years that year-on-year investment actually declined to a notable degree.

Last week, we released our clean energy investment figures for the second quarter of 2013 and they offered a mixed outlook. On the one hand, total funds deployed globally rose to \$53.1bn in Q2 2013 from \$43.6bn in Q1 2013. On the other, total investment through the first half of 2013 was down 18.2% from the same six months in 2012.

Why has the rate of capital being deployed apparently slowed in the past 18 months? Two factors are primarily to blame: (1) weakening subsidy support from governments in Europe and elsewhere; and (2) rapidly declining equipment costs.

The first of these trends—declining subsidy support—was, to a large degree, inevitable. In 2008 and 2009, governments globally pledged \$195bn in economic stimulus support to the clean energy sector. The large majority of those funds have now been spent or the programs behind them have expired. By our tally, the US earmarked \$65.6bn in clean energy-specific stimulus funding and most of that is now gone.

In addition, nations such as Spain, Italy, and Germany have scaled back support for clean energy after seeing renewable energy installations skyrocket faster than they had anticipated.

The second trend—the dramatic drop in equipment costs—was less predictable but stands to have a more profound longer term impact on the market. Today, a photovoltaic module bought at the factory gate costs less than a quarter of what it did just four years ago. Wind equipment prices are also down. Both technologies are now cost competitive in certain markets around the globe—without the benefit of subsidies.

Technological improvements deserve part of the credit for the cost declines, but a bigger factor has simply been scale. Global photovoltaic manufacturing capacity today stands at some 61GW -- twice as high as just two years ago, 12 times as high as three years ago, and 25 times as high six years ago.

These lower costs are allowing dollars invested in renewables to go further than they would have just a few years ago. While global investment dipped 11% from 2011 to 2012, the rate at which new capacity was actually deployed into the field actually accelerated. Annual capacity installations rose from 2011 to 2012 by 12% as nearly 90GW of new capacity was brought on line last year.

US clean energy investment, defined here as renewables and biofuels, has followed a similar path. Total capital into the sector hit an all-time high in 2011 then slipped 36% to \$35.6bn in 2012. High investment in 2011 and fears over expiration of the Production Tax Credit resulted in record 17GW of new capacity getting built in 2012. Lower equipment costs also contributed to the boom.

As I mentioned, through first six months of this year, investment is down compared with the first half of 2012. But unlike last year, the US this year will also see less total capacity additions—despite what will surely be a record-breaking year photovoltaics.

All of this I hope is useful background to ask one fundamental question: are the capital markets to blame for what appears to be a deceleration of financing over the past 18 months? In a word: no and yes.

I would argue that today there simply is no shortage of capital (debt, equity, so-called tax equity, or other) available for high quality clean energy projects—that is, projects being developed by reputable companies, with relevant permits in hand

and, most importantly, firm long-term agreements signed to sell their electricity at a reasonable price to a credit-worthy buyer such as a major utility. The financial community will gladly underwrite such a project.

As an aside, this has not always been the case. At the height of the financial crisis, capital for clean energy projects dried up almost completely. In response, Congress acted quickly to establish the so-called 30% cash-grant program.

Today, however, there is no such shortage of capital. Instead, there is a shortage of projects that meet the criteria I outlined a moment ago. For developers, it is now considerably more challenging to sign sufficiently priced power purchase agreements than it was just a few years ago. Demand for new wind energy capacity in particular has weakened. This is partly due to competition from low-priced natural gas projects and partly because the large majority of 30 state Renewable Portfolio Standard mandates are now either being met or on their way to being so. So, in the short run, no I do not believe a lack of capital is to blame for the recent deceleration in investment.

Looking beyond the immediate term, however, capital availability and clean energy capacity growth are inextricably linked. That is, when you cut the cost for one, demand for the other inevitably rises. Less expensive capital should result in more competitively-priced power and, in turn, greater demand for that power.

Unlike fossil-fuelled plants, clean energy projects have virtually zero marginal costs. Once operating, these plants do not require their owners to spend on buying gas, coal, oil or other fuels to continue operating.

Instead, nearly all the project costs are incurred up-front when the photovoltaic modules, wind turbines, geothermal turbines, or other equipment is put on the roof or in the ground. What this means is that the economics of clean energy are heavily dictated by a project's weighted average cost of capital which gets amortized over much of its operating life. The lower the cost of capital is, the more relaxed a project owner can be about what he defines a "reasonable" return on investment.

Private equity companies, for example, may not be willing to invest in projects with returns on equity lower than mid-teens, and projects with these types of economics are increasingly rare. Utilities, on the other hand, or institutional investors, could be quite happy seeing returns in the high single-digits, and our analysis suggests there are plenty of projects with those types of economics out there.

As I mentioned earlier, our firm has tracked over \$1.5 trillion invested in clean energy since 2004. Very roughly 2/3 of that has come in the form of traditional project financing for large-scale power-generating projects. Typically, these transactions involve a handful of financial institutions collaborating to provide private debt and equity at a cost of capital acceptable to the project's developer.

This system has been adequate to date but it is not how more mature segments of the energy industry raise funds. Builders of large-scale transmission lines or natural gas pipelines for instance typically turn to the public markets to raise nine- or 10-figure sums by issuing bonds or through other financial vehicles such as Master Limited Partnerships.

Greater scale means lower costs. And to continue reducing its costs, the clean energy sector must achieve the same or greater degree of scale in capital raising as it has in manufacturing.

Already, we are seeing signs that this has begun as industry players are finding new and innovative ways to finance or re-finance projects. Most noteworthy have been the bond offerings from MidAmerican Energy Holdings Co., the subsidiary of Warren Buffett's Berkshire Hathaway. Most recently, MidAmerican sold \$1bn in bonds to lower its cost of capital on a \$2.74bn solar project it owns in southern California. Those bonds yield 5.375%. Globally, we have now tracked over \$2.5bn raised this year via bond offerings for clean energy.

There have been other, less high profile examples as well. NRG Energy Inc. recently created a "yield co." to allow investors to take direct ownership in a portfolio of its operating solar, wind and gas-fired generating plants. On Tuesday, NRG raised \$431 million for that business, which now trades on the New York Stock Exchange and offers investors an approximate 6% dividend rate. Other creative efforts in this area have included a real-estate investment trusts and Canadian income trusts trading on the Toronto Stock Exchange.

In all cases, what is being offered to investors is fairly appealing in today's current low interest rate environment: the chance to invest in a relatively low-risk asset and earn a fixed rate of return well above rates offered on 10-year Treasuries. As the committee well knows, there are now efforts afoot in Congress to make another form of "yield co" available to clean energy projects through legislation that would allow clean energy projects to use master limited partnerships as fund-raising vehicles.

What all of these vehicles and potential vehicles have in common is that they seek to open the door to massive pools of institutional investor capital supplied by pension funds, insurance funds, and endowments. To date, that has gone largely untapped for clean energy. But as the successful bond offering from Buffett and others indicate, these investors are ready to invest in clean energy projects—if given the right opportunity.

Finally, I would note that from the policy-making perspective, one question potentially worth considering is how to accelerate the maturing of clean energy project financing to reduce costs. But I would quickly also note that in doing so, policy-makers would be well served not lose sight of the other fundamental challenge I highlighted earlier: the relative weak demand for new renewable energy capacity, particularly wind capacity, today. If fostering strong long-term growth of this sector is a policy goal, then addressing both these challenges is critical.

I would like to again thank the committee for offering me this opportunity. I look forward to your questions.

The CHAIRMAN. Very helpful.
Mr. Coleman.

STATEMENT OF WILL COLEMAN, PARTNER, ONRAMP CAPITAL

Mr. COLEMAN. Thank you, Chairman Wyden, Ranking Member Murkowski, and distinguished members of the committee. I appreciate the opportunity to be here today. My name is Will Coleman. I'm the founder of OnRamp Capital, which is a firm that partners with corporations to help them invest in early stage technologies. I've also spent the last decade working with emerging technologies in the energy space.

So you've heard a little bit about downstream deployment. My focus is really on upstream in terms of new technologies and investing in those new technologies and what it takes.

In my written testimony, I emphasize some things that we've heard a lot about both from myself and others in this committee, which is the need for certainty, the need for a level playing field, and the need to support innovation. I don't really want to repeat myself here today, but I think we can all agree that innovation in energy is important. It's critical to our competitiveness and it's a massive growth opportunity for our economy. It's been shown that 75 percent of the growth since World War II was driven by innovation in our economy.

VC has invested over \$25 billion—venture capital, I should say, has invested over \$25 billion in the energy space over the last decade, largely because we saw an opportunity. We saw an opportunity because there was a growing need in the marketplace and there was momentum in terms of demanding new and diverse energy resources.

This investment drove a boom in technology and attracted a pool of talent, which was critical. That said, venture capital has struggled to scale these technologies. Part of the reason is a structural problem which has to do with financing gaps for unproven technologies. Part of the reason is a little bit more ephemeral, which has to do with policy and momentum.

As a result, as has been highlighted a little bit, venture capital is pulling back from this sector pretty significantly. The risk is not just that capital goes away for some period of time. The risk is that we also lose the knowledge, the experience, and the talent that has been built up, and if we don't address some of these fundamental obstacles the market won't come back any time soon.

Venture capital is a bit of a canary in the coal mine in the sense that it is in a particular stage of the financing ecosystem, but it looks both upstream and downstream in terms of whether or not it has the ability to invest. The problem for us is that when we sit down on a Monday morning and we talk about what companies and what sectors we want to invest in, we have to answer some very basic questions for all of our partners, who are asking whether or not we should consider a sector. The first is: Is there a market need? I think in the energy industry it's pretty obvious that there's a massive market and there is a whole lot—there are a whole lot of pain points that we could solve. But we need certainty and we need a level playing field for new technologies to enter.

The second question is: Is there a pool of knowledge, of technology, and of talent to go out there and actually develop new technologies and compete and execute? This is why it's so important I our mind to continue to support programs like ARPA-E and other early research and development in the labs. We believe that both basic research and applied research is something that is critical, and getting further down the chain in terms of this research is important to compressing the time line associated with commercializing these technologies.

The third question which is critical is: If we invest to develop these technologies, will there be other funding sources to help develop them all the way through to commercialization? This is critical because VC, as I said, is really only one small link in the chain, particularly in energy, where the capital and time that is required is enormous. Our partners sitting around that table on Monday will say: We've seen this before. We don't want to invest in another winning technology that can't get that last \$70 million to scale a manufacturing facility and we end up having to sell it off for pennies to the Chinese or the Swiss or whoever.

The problem is that as venture capitalists we take 2 kinds of risks. We take technology risk and we take talent risk. We take a modicum of market risk where we're opening up new markets, but we don't take funding risk. We don't actually take risk on whether or not a type of funding will materialize in time to support the technologies we've invested in. There's too many other alternatives for us to invest that don't take as much time and capital as the energy industry.

Part of the reason that I started OnRamp Capital was because venture capital was struggling to overcome these issues and because corporates have a slightly different focus. There's an opportunity to help them leverage the ecosystem that has been built up, but they have historically been poor at commercializing early stage technologies. Even for corporates, though, they can't address this fundraising gap, this financing gap for early stage technologies in terms of scale. It's just simply too large.

Which is why as a Nation I think we need an approach to address this single largest gap, this classical valley of of death. We need a provision that is an entity that allows any entity to leverage this approach, whether it's venture capital, whether it's corporates, or whether it's independents. We need to be able to reward the investment in innovation and then get out of the way.

In my written testimony I discuss one such structure that I'm happy to talk more about. It's an innovation credit and it basically supports companies and technologies until they scale and then rolls off. It's technology neutral. It can be applied across the entire landscape, whether it's renewables or conventional. It would be permanent, but it would not create the permanent dependence that most permanent provisions create. The point is to draw capital into the gap and then force them to stand on their own 2 feet, so the market is making the decision where to invest.

If as a Nation—in closing, if as a Nation we want to continue to support continued innovation in energy, we need to solve this problem. It's a structural gap and it's persistent, and we've had this as an ongoing discussion for many years. When we discussed this in 2011, the venture capital industry had invested \$1.1 billion in the first quarter in new technologies. In 2012 when we discussed it again, that number had dropped to \$780 million. Now in the first quarter of 2013, that number has dropped to \$369 million. You can see where the trend is headed.

Private capital does have the capacity, however. But we have alternatives, and we need to address these problems as a Nation if we are going to invest in this area.

So I believe we have a rare opportunity to streamline the tax code in the coming Congress. It's clearly front and center. I also think we have an opportunity to support the next generation technologies. We must continue to support programs like ARPA-E and the national labs and maturation of technologies to maintain the innovation and flow of talent.

Innovation is a really delicate phenomenon, something done very well in America over our history. But we must continue to nurture it in these important sectors that are critical to our economy.

I look forward to working with you on these challenges. Thank you.

[The prepared statement of Mr. Coleman follows:]

PREPARED STATEMENT OF WILL COLEMAN, PARTNER, ONRAMP CAPITAL

Thank you Chairman Wyden, Ranking Member Murkowski, and distinguished members of the Committee. I appreciate the opportunity to be here today. It is an honor and a privilege to speak with you on issues that are so critical to our nation.

I am Will Coleman. I am the founder of OnRamp Capital which partners with corporations to invest in early stage innovations.

As someone focused on investing in and building companies at the earliest stages of the innovation process, and doing so in collaboration with larger corporate partners, I am constantly confronted with the challenge of taking products from early research to full commercialization in the energy industry. I am here today to talk about how innovation in energy continues to be critical to the strength of our economy and to share some perspective on how the overlap between economics and public policy is causing persistent and growing barriers to the kind of innovation that we need to remain competitive. I will also share a few thoughts on where I think the federal government can and should play a role.

America Thrives on a Diversity of Energy Options

America's economic strength over the last century has been fueled in large part by access to affordable and abundant domestic energy resources. Investments in oil, hydro, nuclear, and more recently natural gas have unlocked innovations that have ensured America's relative wealth of resources. We are all well aware of how recent advances in drilling and fracking have unlocked tremendous reserves of natural gas and helped address what has been a worrisome four-decade trend towards dependence on foreign resources.

However, energy is a global commodity, and the unprecedented growth in global demand, a situation that is still in its infancy, has driven continued increases in prices. Thus even as we begin to import less, we are paying more. Even with the boom in gas production and slowing global economies the average price of oil increased to \$112/barrel in 2012 and the U.S. spent \$434 billion on oil imports from foreign countries.¹ That's up from \$337 billion in 2010. In other words, we continue to transfer increasing amounts of America's wealth overseas-dollars that could be reinvested here at home.

Many people argue that with low natural gas prices and a growing abundance of apparent reserves, we don't need alternatives any time soon. However, that ignores the reality of global growth in demand and the complexity of harnessing these resources. It is clear that natural gas will be an important and growing piece of the energy mix going forward, but it does not negate the need for other alternatives. We will continue to rely on coal and oil as well for decades to come, but we need to continue to develop and use these resources with increasing efficiency.

Innovation will be needed to harness all of these resources efficiently, effectively, and safely. The federal government plays an important role in this effort. It's important to remember that the technology that has enabled the shale gas boom actually came from a legacy of federally funded research done in the national labs on horizontal drilling over the last 30 years.² Similarly government research through the DOE, NASA, and DOD over the last 40+ years provided the technological foundation for dramatic improvements in cost and performance in solar, wind, biomass and other technologies.

These technologies would not exist if not for this research funding. At the same time, they would not be commercial without private capital investment. The high cost of gas and oil in the early 2000's and the presumption that governments would need to begin to regulate carbon emissions drove significant new investment in shale gas development and other alternatives. In both cases the investments in commercializing these technologies and then scaling them has led to impressive reductions in cost. Natural gas has dropped from a high of \$7.97/thousand feet³ in 2008 to \$2.66/thousand feet³ in 2012 and production has grown 16% over that time frame³. Wind, solar, biomass and other renewables are also playing increasing roles. Wind deployments grew over 500% from 2007-2012⁴ and solar grew over 1000% over the same time period. The cost of solar modules has dropped over 60% in the last two years alone.⁵ In comparison, most conventional resources which are impacted by global demand have increased in cost. Coal prices have climbed over 200% since 2003⁶ and imported crude oil prices have climbed 350% over the same time period.⁷

Despite the growth of alternatives, many of these technologies are still in their infancy. Wind provides only 2.9% of our electricity and solar just 0.4% as compared to 42% from coal and 25% from natural gas. The reason is not a lack of resource. The U.S. has some of the largest wind, solar, and biomass resources in the world. The US possesses over 231,000 GW⁸ of annual capacity from untapped wind and solar resources alone. This is over 222 times our current total electricity capacity.⁹ Unfortunately, every day that these American resources are not captured they are lost.

Technology transitions have always been good for economic growth, driving both investment and jobs. Even though solar still represents just a small sliver of the energy mix, the solar industry already employs more people in the U.S. (119,000)¹⁰ than the coal mining industry (87,000)¹¹. Solar employment has more than doubled in the last 4 years alone.

The U.S. must continue to leverage its energy assets effectively to embrace the growth potential and to remain economically competitive. Conventional technologies

¹ [http://www.eia.gov/dnav/pet/](http://www.eia.gov/dnav/pet/pet_move_impcus_a2_nus_ep00_im0_mtbl_a.htm)

² http://thebreakthrough.org/archive/shale_gas_fracking_history_and

³ http://www.eia.gov/dnav/ng/ng_sum_lsum_dcu_nus_a.htm

⁴ http://www.awea.org/learnabout/industry_stats/index.cfm

⁵ <http://www.seia.org/research-resources/solar-industry-data>

⁶ http://www.eia.gov/totalenergy/data/annual/pdf/sec7_21.pdf

⁷ <http://www.eia.gov/forecasts/steo/realprices/>

⁸ <http://www.windpoweringamerica.com/http://www.nrel.gov/docs/fy10osti/45889.pdf>
http://votesolar.org/wp-content/uploads/2011/02/NREL_solar_Tools.pdf
http://www.pdfa.gov/pdfs/wind_maps_poster_2010.pdf
<http://www.nrel.gov/docs/fy10osti/45889.pdf>

⁹ <http://www.eia.gov/electricity/annual/pdf/tables1.pdf>

¹⁰ <http://thesolarfoundation.org/sites/thesolarfoundation.org/files/2012%20Census%20Press%20Release%20FINAL.pdf>

¹¹ <http://www.bls.gov/oes/current/naics4-212100.htm>

represent the vast majority of today's production; however, we cannot afford to ignore the growing opportunity that other alternatives represent.

Innovation Drives Long Term Cost Reductions

Shale gas, wind, solar and other alternatives have achieved remarkable reductions in cost over the last decade, but continued innovation is absolutely critical. The cost reductions are the result of a fundamental premise of technology development which is that each technology reduces its costs over time through a combination of technical innovation and scaling the volume of production. The result is that each technology undergoes a "learning curve" that drives costs down.

Different technology solutions—even within the same type of technology - can have different learning curves and development trajectories. For instance, in solar learning curves are specific to individual technology platforms such as Si panels (SunPower, Suntech, etc. . . .) or CdTe panels (First Solar), and even specific to different approaches within these material systems, rather than to solar technology as a whole. Thus the dramatic cost reductions that we have seen over the last decade are really the aggregate result of several different unique platforms reaching commercial scale and driving the whole industry cost curve down.

Continued innovation on variations and wholly new platforms will unlock step-changes in cost reductions even after existing technologies in a category have reached commercial scale.

The main question for any technology investor is not "what is the cost today?", but "can the cost of a technology ultimately get below existing alternatives?" Technology development is one piece of the equation, but scale is critical. Further cost reductions are possible, but only if both research and deployment capital are available.

Again, we can look at solar cost curves to see how this works. Over the past thirty years, solar engineers have reduced cost with every generation of new technology, but it took scaling the volume of production to close the gap with conventional technologies. For example, First Solar's panel production costs have dropped from over \$3.00/watt in 2004 to under \$0.66/watt in 2013, due in large part to a 2,500% increase in production capacity from 2004-2008¹².

Solar is not alone. Almost every technology-driven industry evolves this way, whether it is energy, semiconductors, or steel production. The U.S. has benefitted from leading the innovation cycles in many of these industries, but it always requires significant investments from private capital sources which in turn requires the right market conditions, a robust pipeline of technology, and constructive public policy. Unfortunately, when it comes to energy, the U.S. is faltering in all three of these categories.

The Innovation Gap

We are fortunate to have a strong, diverse natural resource base. However, much of our competitive advantage over the last two centuries has come from our ability to innovate—to develop new, lower-cost or advantaged technologies such as oil, nuclear and now renewables, ahead of our global competitors. According to a report released by the Department of Commerce, "Technological innovation is linked to 75% of the Nation's post-WW II growth rate. Two innovation-linked factors—capital investment and increased efficiency—represent 2.5 percentage points of the 3.4% average annual growth rate achieved since the 1940's."¹³

Unfortunately, the energy industry is extremely slow to adopt new technology. In 2010 the five largest oil companies spent less than 2 percent of profits and less than 0.4 percent of total expenditures on R&D.¹⁴ In the utility sector, the major U.S. utilities employ on average less than 5 people in R&D roles per 1000 employees. This is the lowest level of any industry.¹⁵

Many companies recognize the value of innovation, but are understandably driven by optimizing and protecting existing business lines. This is particularly true when the majority of all federal energy incentives focus on bolstering supply of conventional resources, irrespective of the efficiency or efficacy of the technologies used to access those resources.

¹² <http://www.greentechmedia.com/articles/read/First-Solar-Surprises-With-Big-2013-Guidance-40-Cents-Per-Watt-Cost-by-201>

¹³ U.S. Department of Commerce, Patent Reform: Unleashing Innovation, Promoting Economic Growth & Producing High-Paying Jobs. 2010

¹⁴ Congressional Research Service. Research and Development by Large Energy Production Companies. August, 2011. Calculations are based on total R&D spending of \$3.6bn in 2010.

¹⁵ National Science Foundation, Research and Development in Industry: 2006-07 (Arlington, VA: National Science Foundation, 2011), 130-131. Table 31 and 261. <http://www.nsf.gov/statistics/nsf11301/pdf/nsf11301.pdf>

The net result is an industry that does not natively produce an enormous amount of innovation or adopt novel technologies except in times of acute disruption. This would be fine if energy was not such a strategic imperative for our nation's competitiveness. But given the length of the innovation cycle, we cannot afford to wait until the next disruption or allow other nations to take over the lead on new technology. An opportunity exists and many forward looking companies are looking for ways to get ahead of this trend in the sector, but the bulk of investors in new energy technologies are struggling to overcome these industry dynamics.

State of New Energy Financing

Over the last 10 years, market conditions, technology advancements, and public policy expectations led venture capitalists to deploy \$25.1 billion into energy related technologies¹⁶. Investors relied on the supposition that conditions would persist and other types of investors would participate in the scaling and deployment of the most effective technologies. This investment drove a boom in new technologies and attracted a growing pool of talent to the industry. However, scaling these technologies has proven to be a major stumbling block. Commercializing most energy technologies demands a magnitude of capital and level of collaboration with incumbents that goes beyond the capacity of the venture capital industry.

The challenge for most startups is that without operating track records or large balance sheets, they are unable to secure lower-cost debt capital to get to scale. This means that they typically need to raise higher-cost equity or some combination of equity, mezzanine financing (if available), or higher-cost debt (which often isn't available) to build early commercial plants. More expensive forms of financing impact the profitability of producing any technology and make it harder for investors at each level to realize competitive returns. The result has been a series of financing gaps that exist for scaling larger industrial technologies that need to reach a minimum efficient scale to be competitive.

Venture capital has historically been able to bridge financing gaps in many sectors. Where it works, the results have been transformative. While under 0.2% of GDP is invested in venture capital each year, over 21% of GDP is generated by companies that were originally venture-backed, and 11% of all private sector Americans are employed by these companies. But in energy, the magnitude of capital requires many other investment partners.

Even in the best market conditions, with robust financing options, many promising energy technologies are not able to overcome these gaps. Over the last few years changes in market conditions, instability in financing, and wavering policy commitment have eroded investor confidence in energy technologies. As a result, the financing gaps have grown and venture capital has begun to pull back from investing in new innovations in heavy industrial applications, including energy. Venture investors continue to support existing investments, and family offices and corporate investors have increased investments in the sector. However, we have seen a marked decline in early stage investments in energy technologies. This decline is concerning for the future of energy innovation.

A healthy innovation process, particularly in energy, depends on a stable ecosystem of funding partners including venture capital, private equity, corporates, project finance, and other debt providers. If we as early stage investors don't believe that low-cost capital will be available to scale these technologies, then there is no way we will invest in the early technology development in the first place. Thus, financing gaps at any stage have a rapid domino effect on the rest of the financing ecosystem, and innovation funding begins to dry up at all stages.

As I mentioned, large strategic corporate investors have begun to increase their investments in the sector over the last couple years. Strategics now account for 10.4% of venture type investment in energy technologies.¹⁷ Strategic investment is a critical piece of the equation. However, most strategic investors have historically relied on venture capital for the earliest stages of investment and face legal and structural challenges investing in the earliest stages of the innovation process. OnRamp Capital and other models are emerging to help address this constraint, but the bottom line is that fewer entities are actively investing in the kind of core energy innovation that is needed to continue progressing the industry. If investments

¹⁶ Source: PricewaterhouseCoopers/National Venture Capital Association MoneyTreeT Report, Data: Thomson Reuters

¹⁷ Source: PricewaterhouseCoopers/National Venture Capital Association MoneyTreeT Report, Data: Thomson Reuters 0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100% Share of Equity Invested Share of Equity Invested by Round Type Series C+ Series B Series A Seed knowledge and talent we have developed over the last decade, and it will take a long time to rebuild these innovation ecosystems.

decline so too will the interest from entrepreneurs and scientists. We risk losing the accumulated

The Role of Government

Our premise and our requirement as investors has always been that we invest in technologies and companies that, regardless of political regulation or subsidy, will be able to stand on their own two feet and compete on a level playing field within the lifespan of our investment.

At the same time, we recognize that even in markets that are considered free and open there are often market failures or financing gaps that can prevent new viable technologies from getting to market. In energy, incumbents benefit from decades of investment in infrastructure, legacy government support, fully depreciated plants, economies of scale, and operating track records that make it difficult for any new technology to compete without assistance.

To create a level playing field that encourages continued innovation we must acknowledge past investments that have created the current systems. According to a report from DBL Investors, the average annual inflation adjusted federal spending on oil over the first 15 years of its deployment in the U.S. was 5 times greater than what we have spent on renewables. Spending on nuclear was 10 times greater.¹⁸

I am not suggesting that the federal government needs to spend enormous sums on any specific new technology, but it is important to recognize that the government has played a role in cementing the current energy landscape. If we can agree that continued innovation in energy is critical to our competitiveness as a nation, then the federal government can and should play a role in helping to unlock that innovation.

The Need for Certainty

The primary challenge for Congress is to identify ways to support continued technology development while working with private capital to close the funding gaps around commercializing new technologies. For federal policy to unlock continued innovation, it will need to consider these scaling challenges, work to accommodate the financial constraints of smaller emerging companies, and provide enough certainty to draw private capital into the market.

As investors we are seeking stable, open markets that reward better solutions over a long period of time. Any significant innovation takes years and sometimes decades to develop, deploy, and mature. Even in some of the faster moving industries that venture capital invests in the average time from initial funding to liquidity is 4-8 years. In energy, where large commercial facilities often take years to construct and cannot be financed until a technology has been fully de-risked, investors require piloting, demonstration, and operating track records. Even if a company can secure the financing for a first-of-a-kind commercial facility, they will then need to operate that facility for up to five years before they can secure conventional debt financing for future plants. That means the timeline can be 15+ years from early R&D to initial commercialization for some of these technologies. The timeline is even longer if we consider the need to attract researchers and other talent into the sector to invest their own time and energy well before the commercial development cycle even begins.

For early stage investors, we can only take risks on a new technology if we believe the talent is available to develop it and that other investors and acquirers will be there to invest in the technology along the way. Other investors will only be there if the market need is persistent over a long period of time. Therefore, any solutions that the government provides need to have the same persistence and stability. Many of the conventional energy credits have been made permanent over the last several decades, which enables these industries to plan and invest with certainty. In contrast, almost all of the credits for alternative technologies have been temporary and continually threatened, which in turn creates a dual impediment to financing these new technologies. Short-term extensions of demand-side credits such as the PTC and ITC do not provide the long-term certainty necessary to incentivize early investment in innovation.

The government could make these credits permanent, which would provide certainty, but would also create a permanent dependence. As a technology investor, I don't believe we should prop up any technology indefinitely, but rather support technologies to scale and then require that they compete on a level playing field. Federal structures already exist, such as the 30D advanced vehicle tax credits, which provide certainty without dependence. There are ways to replicate such credits in more

¹⁸Nancy Pfund & Ben Healey. What Would Jefferson Do? The Historical Role of Federal Subsidies in Shaping America's Energy Future. DBL Investors, Sept. 2011.

technology-neutral approaches that will provide the certainty necessary to draw capital into the innovation cycle even at the earliest stages, and do not require significant government expenditures.

Just as over the last few years we have seen the costs of alternatives drop significantly, we expect scale and continued innovation to drive costs lower. Eventually any given technology should not need support. If we as a nation want to reap the benefits of continued cycles of innovation then our focus should be on getting new and improved technologies down their respective cost curves and to a point of maturity where they can compete on their own two feet.

Ideally, government would merely provide the conditions for private capital to work effectively. In the case of energy, improved, safer, cleaner solutions are well within our capability to develop and deploy. But the private market is not confident in the direction and stability of our policies. In this case, the government is both failing to address persistent market failures and compounding them with inconsistent policies.

Solutions—Accelerating the Adoption of Clean Energy Technology

The good news for America is that for now our scientists and entrepreneurs are still churning out innovative energy technology ideas and companies. We still have a robust national lab system and we have some of the best university research labs in the world. We also still have a robust private capital ecosystem that has deployed significant investments in energy and clean technology over the last decade. In the first quarter of 2013, the venture capital industry has already invested more than \$369 million dollars into clean technology companies.¹⁹ If the history of venture capital is any guide, then those dollars can generate ten times the investment downstream. The challenge is how to draw the necessary investors into the segments that represent heavier capital lifts and riskier market entry.

Fortunately, there are several ways in which the U.S. can unleash private-sector investment and promote innovation at the same time. Government can do this without “picking winners” and without huge costs to the taxpayer.

1) Support the innovation pipeline

We need to make sure we continue to replenish the innovation pipeline. We cannot starve the research budgets that not only breed the next generation of innovation, but keep the talent here in the U.S. We have the talent, but we need the promise of commercialization to continue to keep that talent here. That’s why it is critical that Congress continue to support basic R&D at universities and labs, and fund the Advanced Research Projects Agency for Energy (ARPA-E).

ARPA-E was designed to spur exactly the type of early commercial research and development that our innovators and venture investors look for. ARPA-E is a small but critical program that has developed into a model program for how government should tackle these challenges. We should double down on the support for ARPA-E and also programs that provide follow on support for ARPA-E projects. These follow on programs help ensure that we continue to mature new innovations and support an ecosystem of researchers and entrepreneurs. We cannot afford for the sector to go dormant and expect that at some point we will be able to turn the lights back on. These communities take decades to build.

2) Fill the financing gaps

For those segments that have high strategic value to our nation, but do not attract private investment, we need a set of tools to help fill the financing gaps and draw private capital in. These tools should prioritize innovative technologies, and they need to be flexible, efficient, and technology neutral. Above all else, they must be predictable. Investors need to know that if they invest in a company that unlocks meaningful innovations they will be able to finance the company to scale.

The primary financing gap typically occurs where a company must scale up to a demonstration facility and then first commercial plant. We’ve seen this in solar manufacturing facilities, biofuel plants, battery production lines and a host of other technologies. The capital requirements tend to outstrip the capacity of most equity investors that are willing to tolerate technology risk. Without an operating track record, capital is difficult to secure.

We have already seen a mix of government solutions, ranging from grants to loans that target this gap. These are helpful but not sufficient. We need a solution that draws private capital in to fill these gaps, whether it is venture capital, debt financing, or corporate capital.

¹⁹ Source: PricewaterhouseCoopers/National Venture Capital Association MoneyTreeT Report, Data: Thomson Reuters

In the past the venture industry has supported efforts by the Chairman and Ranking Member to create a Clean Energy Deployment Administration. On behalf of the venture industry I would also like to call for reform of the current energy tax code with a focus on leveling the playing field for new alternative technologies.

The current process underway in the senate to re-evaluate the current tax code from the bottom up is a great opportunity to look at new approaches to energy. In particular, we support the creation of a new energy innovation tax credit that could replace many existing credits. This credit would provide incentives to companies as they scale an innovation and automatically sunset once a company hits a specified volume of production. The credit would be technology-neutral and accessible to all companies that invest in scaling innovative technologies across the entire energy industry. A one page overview of the proposal put forth by the National Venture Capital Association (NVCA) to streamline the energy tax code in this fashion is attached as Appendix A.

The establishment of a tax credit that is permanent in the tax code—though only available to individual companies up to pre-determined, commercial-scale thresholds—would create the long-term certainty necessary to drive private capital into the commercialization gaps discussed above. The capacity-based volume threshold and a secondary cap on qualifying capital expenditures would prevent companies from claiming the credit beyond what is necessary to level the playing field and allow companies investing in innovation here in the U.S. to compete on their own two feet.

The bottom line is that if we are serious about filling these gaps in sectors that have high strategic value to our nation, then government needs to create more enduring structures that can evolve with the market over time.

Conclusion

Let me conclude on a note of urgency. The global energy landscape is changing. New technologies are emerging, and the economic strength of our economy over the next several decades will depend not just on how effectively we use existing resources, but on how we choose to cultivate newer sources of energy.

The energy industry as a whole must continue to innovate and adopt new technologies to provide the strong economic base that the U.S. needs to remain competitive. To do so requires a new way of thinking about energy policy, particularly tax policy, that can be applied consistently across the entire energy industry and provides the long-term certainty that investors and corporations require to make rational decisions.

This committee has held many hearings on the deteriorating competitive position of the United States in new energy markets vis a vis China, Japan, Korea, and Germany, so I will not recount those details here. As the U.S. emerges from recession it is critical that resources should be targeted at the most effective ways to strengthen the American economy. We need to remember that our legacy of innovation is uniquely American and a huge reason for our success over the last century, but it can't be taken for granted. Federal policy plays a critical role in whether we continue to build new American energy solutions that will keep us competitive. We have begun to see some of the limitations of our innovation process. It could not be more urgent to reduce the uncertainty of our current tax credits for alternative energy technologies and explore the creation of innovative, performance-based tax credits that are permanent and provide certainty, but do not create dependence.

In this 113th Congress, the tax code is clearly front and center. I believe we have a rare opportunity to streamline the tax code to make it more efficiently support the development of the next generation of technologies. The focus must shift to accelerating the rate of innovation, continuing to reduce the costs to taxpayers, and reducing the long-term dependence on government support. Such a transformation need not be complicated. The tools and approaches already exist. But we must work to rationalize these structures to better support the innovative companies that fuel our economy. We have the talent, the capital markets, and the capacity to lead in energy technology. I look forward to the opportunity to work with this committee on addressing these challenges moving forward.

APPENDIX A—ENERGY INNOVATION TAX CREDIT OVERVIEW

Objective

Streamline the energy tax code; create a long-term policy that provides consistent, durable incentives for new technology across the entire energy industry; move away from the current practice of government picking winners through technology definitions; refocus federal support on early deployment and scaling of production where it is needed most; eliminate permanent dependencies on subsidies; and leverage private investment in innovation.

Credit Structure

Eligibility—The credit provides technology neutrality by supporting any innovative technology used for the production of fuels, energy generation property, or any technology that can be paired with energy generation property to improve the performance or efficiency. Companies eligible to receive the credit must be operating qualifying facilities in the United States that manufacture or produce an eligible technology. The credit is only received for actual production of fuels or energy generation property.

How is a technology deemed “innovative”?—Qualifying technologies must be determined to meet a threshold as “new and improved” relative to commercially available alternatives. This means that a technology must be only recently developed and not yet commercialized and provide improvements to production processes or end products—i.e. the technology must involve or constitute new or improved performance, reliability, or efficiency in comparison to commercial technologies. Such requirements include as eligible the adoption of existing or previously proven commercial technologies at a different scale and/or for a wholly separate function in the market relative to their initially intended commercial application. Like other tax structures the burden is on the filer to maintain records to justify these qualifications such that they can be audited and verified.

Permanence & Commercial Scale Roll-Off—The credit structure will be permanent in the tax code (until repealed by statute), but will not be permanently available to any given company. The structure uses two distinct “roll-off triggers” that reduce a company’s ability to take the credit over time for any given innovation. Since the credit is awarded per unit of production (measured in KW or gasoline gallon equivalent), the first trigger is a volume-based threshold which sets a cap on the total cumulative production volume that a company can receive the credit for from any given innovation. The second trigger is a cap on “qualifying capital expenditures,” calculated as the aggregate capital expenditures by an individual company associated with the implementation of the new or improved technology elements of the system. A company can receive the credit for additional innovations based on the capital expenditures associated with additional innovations.

The volume-based thresholds sufficient for an individual producer to have reached commercial scale will be determined for each qualifying technology by the Department of Energy (DOE) Secretary in consultation with the Secretary of Treasury. These thresholds will be subject to revision based on market conditions every five (5) years following enactment of this legislation and will be adjusted only in the case that technology development capabilities and market conditions have shifted significantly such that the volume at which commercial scale can be achieved is determined to have changed significantly. The Internal Revenue Service (IRS) in consultation with DOE will have authority to regulate the threshold on qualifying capital expenditures.

Transferability—The credit will be transferable up and downstream in a company’s supply chain via business relationships to allow pre-revenue and emerging growth technology companies to obtain its full value.

The CHAIRMAN. Mr. Coleman, well said. I’m very much looking forward to hearing about your innovation credit and particularly how you would pay for it, in your words, “by replacing many existing credits.” Senator Stabenow will be very interested in that on the Finance Committee.

Mr. Loris, welcome.

**STATEMENT OF NICOLAS LORIS, HERBERT AND JOYCE
MORGAN FELLOW, THE HERITAGE FOUNDATION**

Mr. LORIS. Thank you. Chairman Wyden, Ranking Member Murkowski, and distinguished members of the committee: Thank you for giving me this opportunity to discuss investment in America’s clean energy technologies. My name is Nicolas Loris and I am the Herbert and Joyce Morgan Fellow at The Heritage Foundation. I too have to appease the lawyers. The views I express in this testimony are my own and should not be construed as representing any official position of The Heritage Foundation.

The number of investment opportunities is broad and expansive, but the capital to finance them is not. This requires that choices be made among different investments. Through a number of financing mechanisms of their own, the Federal Government has clouded these decisions. But it is not the role of the Federal Government to play venture capitalist. Instead, Congress should adopt free market policies and reduce unnecessary roadblocks to clean energy investments. Private investors should take the risks and reap the benefits or suffer the losses from their own investments. Government-backed investments impede that process at the risk of the taxpayer and to the detriment of the American economy.

When we politicize the economic process by allowing the the Federal Government to highly influence decisions in investments, the incentive to lobby for these handouts is greater and the incentive to innovate, lower costs, and rely fully on private investment is substantially weakened. Such a process skews the rules of free enterprise. A dollar invested in a government-backed project cannot simultaneously be invested into another company. Department of Energy loans and loan guarantees pull capital out of the market and dictate who should receive it. This misallocation of labor and capital crowds out opportunities for new ideas and innovative technologies that may not reach the market because capital is diverted to projects that have higher political rates of return rather than economic ones.

These programs are not job creators, but merely shifting labor and capital to where the government wants. To be clear, there is nothing wrong with more renewable energy or alternative fuels replacing conventional sources of energy. But that shift should be more effective and will be more effective when driven by market forces, not dictated through government investment.

The market incentive for clean energy technologies already exists. The global market for energy is \$6 trillion. Any clean energy technology that captures just a sliver of that market share will earn billions of dollars annually. This is precisely why we do not need the government skewing capital markets to promote politically preferred technologies. Markets make these investments and take on risks all the time, but rather than privatizing the gains and socializing the losses, risk and reward are properly aligned.

It is also important to stress that whether a government-backed investment is profitable or goes bankrupt, the policy itself is a failure. First, there are companies like Solyndra, where the DOE's involvement artificially made this dubious investment appear more attractive and lowered the risk of private investment. Private investors sunk over \$1 billion into Solyndra, but much of that private financing came after the Department of Energy announced and closed the loan guarantee.

These private investors look at government loans as a way to substantially reduce their exposure. A project may be an economic loser, but can attract private investment when the government covers a substantial portion of the down side with guaranteed loans. It essentially becomes heads the investor wins and tails the taxpayer loses.

Now, supporters of these DOE programs offer a few failures are worth the risk and the number of success stories far outweigh

bankrupt companies or ones facing difficult financial times. But the fact is, even if a project receives a DOE loan or a loan guarantee, it is a mistake to attribute that company's success to the Federal Government's involvement. Many companies receive investments from the private sector because their technology is promising and worth the risk.

In these cases, especially when the government's investments go to more established companies, the DOE's involvement partially offsets private sector investments that would have been made without the Federal backing. This includes companies like Cogentrix, which received a loan guarantee for \$90.6 million. At the time Cogentrix was owned by a subsidiary of Goldman Sachs, which has a market capitalization of \$77 billion and is one of the most successful financiers in the world. This is not an investment that needed government backing.

Yet, when the government involves itself in capital markets Americans are continually promised the next Internet. Yet we continually experience the next Solyndra. That's not to say that innovative technologies cannot emerge from Federal spending, but there is a stark difference between how the Internet became commercially viable versus attempts to commercialize energy technologies.

Government projects that have become commercial successes, such as the Internet or computer chips or the GPS, were not initially intended to meet a commercial demand, but instead national security needs. Entrepreneurs saw an opportunity and created the commercially viable products available today. I think this could be the role for the Department of Energy, to conduct that basic research that the private sector would not undertake, and then the private sector can come in and spur those innovative investments and create the innovative technologies of tomorrow.

I think opportunities do exist to implement market reforms that would allow renewable energy companies and other energy technologies to be more competitive. I think we should allow all energy generation, including renewable energy generation, to form master limited partnerships because the combination of the partnership tax status and the liquidity of a publicly traded company make MLP's an attractive investment opportunity. We should make immediate expensing permanently available for all business, regardless of type, to allow new equipment and capital to come on line faster, which would improve energy efficiency and overall economic efficiency.

In conclusion, I believe that the market, not the Federal Government, is much better at determining how to allocate resources and meet consumer demand. The government's interference in capital markets merely distorts that process.

Thank you and I look forward to your questions.

[The prepared statement of Mr. Loris follows:]

PREPARED STATEMENT OF NICOLAS LORIS, HERBERT & JOYCE MORGAN FELLOW, THE HERITAGE FOUNDATION

My name is Nicolas Loris. I am a senior energy policy analyst and the Herbert & Joyce Morgan Fellow at The Heritage Foundation. The views I express in this testimony are my own, and should not be construed as representing any official position of The Heritage Foundation.

I want to thank Chairman Wyden, Ranking Member Murkowski and members of the U.S. Senate Committee on Energy and Natural Resources for this opportunity to discuss clean energy investments in the United States.

Over the past several decades Congress has implemented a number of policies to spur the investment of renewable forms of energy. Through a multitude of policies, the federal government has attempted to build a clean energy economy with the help of the American taxpayer and by doing so is skewing risk and reward of energy investments.

All energy sources and technologies should have an opportunity to compete in the market place. Those investment decisions are best left for the private sector. The government's intervention in capital markets artificially lowers the risk of a project, decreases the incentive to innovate and increases the incentive to use the political process to lobby for handouts. Full or partial government investments reward special interests over market viability; those technologies that are truly marketable should not need financial support from the taxpayer.

Congress should adopt free-market policies and reduce unnecessary roadblocks to clean energy investments, but it is not the role of the federal government to play venture capitalist. Private investors should take the risk and reap the benefits or suffer the losses from their investments. Government involvement impedes that process at the risk of the taxpayer and to the detriment of the American economy.

GOVERNMENT MEDDLING DISTORTS INVESTMENT OPPORTUNITY

The number of investment opportunities is broad and expansive but the capital to finance them is not. This requires that choices be made among the different investments. Through a number of mechanisms including grants, loans, loan guarantees, mandates and targeted tax credits, the federal government clouds these decisions. Government investments essentially pull capital out of those limited reserves and dictate who should receive it. While established and "sure-bet" companies will likely still receive a loan, those that are more on the margin may lose an opportunity.

Because capital is in limited supply, a dollar loaned to a government-backed project will not be available for some other project. This means that the higher-risk, higher-reward companies that drive innovation and bring new services and technologies into the marketplace may not get support, while companies with strong political connections or those that produce something that politicians find appealing will get support.

The market, not politicians in Washington, is a much better at determining how to allocate resources to meet consumer demand. When a firm minimizes costs, the firm not only maximizes profit but also maximizes value to the consumer. The government's interference in capital markets significantly distorts that process.

By attempting to force government-developed technologies into the market, the government diminishes the role of the entrepreneur and crowds out private-sector investment. This practice of the government picking winners and losers denies energy technologies the opportunity to compete in the marketplace, which is the only proven way to develop market-viable products. When the government attempts to drive technological commercialization, it circumvents this critical process.

Furthermore, when the government dictates how private-sector resources are spent, both industries that stand to benefit and those that are harmed by those policy decisions will concentrate more effort into lobbying for government handouts to prevent competitors from receiving the handout.

This process, which results in the political process continually picking winners and losers, has been identified by economist Gordon Tullock and later defined by economist Anne Krueger as rent-seeking.¹ Rather than engaging in a profit-seeking behavior the producer is engaging in a rent-seeking behavior. The more the government involves itself in decisions that should be made in private financial markets, the more the American economy will experience misallocated labor and capital. The result will be less economic growth, not more.

Capital Markets, Opportunity and the Valley of Wealth

The barometer of whether a good or service should be in the marketplace should be determined by the value of the output being greater than the input. We see investments that pay off, in both the short run and the long run, all the time without

¹ Tullock, Gordon (1967). "The Welfare Costs of Tariffs, Monopolies, and Theft". *Western Economic Journal* 5 (3): 224-232. doi:10.1111/j.1465-7295.1967.tb01923.x. Krueger, Anne (1974). "The Political Economy of the Rent-Seeking Society". *American Economic Review* 64 (3): 291-303. JSTOR 1808883.

the federal government artificially propping up the value by lowering the risk with taxpayer dollars.

Contrary to popular assertion, private investors will finance projects with longer term payoffs. Amazon.com was founded in 1994 and went public in 1997 with a business plan that did not expect a profit for four to five years. The dot-com bust delayed Amazon's progress, and it made its first full-year profit in 2003.²

More recently and in terms of energy development, the United States is witnessing a shift to a cleaner energy: natural gas. The investments are pouring in and the result has been lower energy prices, increased employment and resurgence in the manufacturing industry.

Proponents of government investments in energy are quick to respond that the federal government helped create the shale oil and shale gas boom. But government involvement came years after the private sector developed the method. The roots of hydraulic fracturing go back as far as the 1860s and Stanolind Oil and Gas Corporation began studying and testing the method, with a patent issued in 1949 and a license granted to Halliburton to frack on two commercial wells.

The Department of Energy partially funded data accumulation, microseismic mapping, the first horizontal well, and tax credits to extract unconventional gas. These activities would likely have occurred and should be driven by the oil and gas industry. Nevertheless, the real driver behind the revolution was George Mitchell, who invested millions of his own money in research and development for fracking and horizontal drilling. His company's geologist, Jim Henry, first identified Barnett shale as a possibility for more energy. It took 20 years for their experiments with fracking fluids and techniques to find one that was cost effective and, as we know now, wildly successful.

Saying that without government spending we would not have the natural gas production we have today is like saying without the grocery store down the street from your house, you would starve. You find another way to get food.

The problem with the federal government's investment in the clean energy economy is that it does not allow technologies and companies to find another way but instead rely on the crutch of the taxpayer. If the cost renewable energy technologies decreases or improves and price of conventional energy increases, we may see increased generation. However, the signals of profits and losses determine what adds economic value and should determine the extent of that transition and investors should obtain their financing in private markets to properly align the risk and reward of such investments.

To be clear, the market opportunity for clean energy investments already exists. Americans spent \$481 billion on gasoline in 2011.³ Both the electricity and the transportation fuels markets are multi-trillion dollar markets. The global market for energy is \$6 trillion.⁴ Clean energy investments alone totaled one trillion dollars from 2004-2011.⁵ Any clean energy technology that obtains a part of that market share will make tens, if not hundreds, of billions of dollars annually.

Families in the United States and all over the world desire to get their vehicles from point A to point B and to turn their light switches on with a sense of reliability and affordability. The market demand for transportation and electricity is incentive enough to spur competition in the industry and obtain private financing without distortions from the federal government.

More Internets, Less Solyndras

When the government involves itself in capital markets, Americans are continually promised the next Internet but we continually experience the next Solyndra. That is not to say, however, that the federal government does not have a role or that innovative technologies cannot emerge from federal research. But there is a stark difference between how the Internet became commercially viable versus attempts to commercialize energy technologies.

Government projects that have become commercial successes—the Internet, computer chips, the global positioning system (GPS)—were not initially intended to meet a commercial demand but instead national security needs. Entrepreneurs saw an

²Saul Hansell, "TECHNOLOGY; Amazon Reports First Full-Year Profit," The New York Times, January 28, 2004, <http://www.nytimes.com/2004/01/28/business/technology-amazon-reports-first-full-year-profit.html> (accessed July 16, 2013).

³Janice Podsada, "Americans Spent Record Sum on Gasoline in 2011," January 3, 2012, <http://articles.courant.com/2012-01-03/business/hc-gasoline-record-spending-2011-20111230> (accessed July 16, 2013).

⁴SelectUSA, "The Energy Industry in the United States," <http://selectusa.commerce.gov/industry-snapshots/energy-industry-united-states> (accessed July 16, 2013).

⁵Bloomberg New Energy Finance, "Clean energy attracts its trillionth dollar," December 6, 2011 <http://bnef.com/PressReleases/view/176> (accessed July 16, 2013).

opportunity in these defense technologies and created the commercially viable products available today. The role of the DOE should be to conduct the basic research that the private sector would not undertake and create a system that allows the private sector, using private funds, to tap into that research and commercialize it. Federal labs should allow basic research to reach the market organically.

Socializing Losses

Private investors look at government loans and loan guarantees as a way to substantially reduce their risk. Even if a project may be an economic loser but has a huge upside, private companies can invest a smaller amount if the government provides a loan. Those investments are especially attractive if the federal government complements loans with other policies like targeted tax credits, DOE research dollars, and fuel efficiency standards that allow electric vehicles to accumulate credits and then trade them with non-compliant manufacturers. If the project fails, private investors still lose money, but the risk was artificially distorted.

For instance, private investors sunk \$1.1 billion into the electric vehicle company Fisker but much of the private financing came after the Department of Energy approved and closed the loan for Fisker. Fisker, formed in August 2007, raised \$94 million before the DOE approved the loan in September 2009.⁶ After DOE closed the loan, Fisker raised over \$1 billion in various rounds of venture capital funding.⁷ The same holds true for the much-maligned bankrupt solar firm Solyndra. Private investors sunk \$1.1 billion into Solyndra. Much of the private financing came after the Department of Energy announced Solyndra was one of 16 companies eligible for a loan guarantee in 2007.⁸

When economically uncompetitive technologies and companies cannot survive without the taxpayer's crutch, there is a good reason these companies cannot fully attract private financing. These investors are using political calculus to hedge their bets. Thus far, Americans have witnessed 19 taxpayer-funded failures⁹

Privatizing Gains

Supporters argue a few failures are worth the risk and the numbers of success stories far outweigh bankrupt companies or ones facing difficult financial times. But even if a project receives government investment, it is a mistake to attribute that company's success to the federal government's investment.

There are companies that would, and often do, receive investment from the private sector because their technology is profitable or because investors find their technology promising and want to pursue the risk. In these cases, the government's investment partially offsets private-sector investments that would have been made without the federal backing. Although it remains to be seen if the electric vehicle company Tesla will be profitable in the long run, the automaker may be a prime example of this. Tesla, the recipient of a \$465 million loan through the ATVM program, had its initial public offering in June 2010 and paid off its loan early. If Tesla's electric vehicles are the wave of the future, they should have and could have secured investment and loans through the private sector.

In other cases, the government investment is blatant corporate welfare. For example, Cogentrix of Alamosa received a loan guarantee for \$90.6 million. Cogentrix is owned by a subsidiary of Goldman Sachs, a company that has a market capitalization of \$77 billion and is one of the most successful financiers in the world.¹⁰ NRG's biggest loan guarantee was for its BrightSource project, where NRG's partners include subsidiaries of BP, Chevron, and Statoil. The Dow Chemical Company received a \$9 million Advanced Manufacturing Program grant. The Dow Chemical Company also had \$57 billion in sales in 2012 and invests over \$1 billion annually in research and development.¹¹

⁶ Fisker raised \$68 million of the \$94 million after submitting the loan application

⁷ PrivCo, "FISKER AUTOMOTIVE'S ROAD TO RUIN: How a "Billion-Dollar Startup Became a Billion-Dollar Disaster" <http://www.privco.com/fisker-automotives-road-to-ruin> (accessed April 22, 2013).

⁸ IStockAnalyst, "Fremont's Solyndra Goes from Stealth to Solar Star," October 7, 2008, at <http://fefwww.istockanalyst.com/article/viewnewspaged/articleid/2686855/pageid/1> (September 30, 2011).

⁹ Rachael Slobodien, "Green Graveyard: 19 Taxpayer-Funded Failures," The Foundry, November 5, 2012, <http://blog.heritage.org/2012/11/05/green-graveyard-19-taxpayer-funded-failures/> (accessed July 16, 2013).

¹⁰ Bloomberg, The Goldman Sachs, Inc, <http://www.bloomberg.com/quote/GS:US> (accessed July 16, 2013).

¹¹ The Dow Chemical Company, "Our Company," <http://www.dow.com/company/index.htm> (accessed May 16, 2013), and The Dow Chemical Company, "Research and Development," <http://www.dow.com/michigan/locations/midmichigan/research.htm> (accessed July 16, 2013).

Furthermore, a successful federally-backed company does not mean it is a good deal for energy consumers, though federal involvement gives this impression. One of the loan guarantee recipients, SolarReserve, has a project under construction and recently entered a contract to sell power to California's largest utility.

But California law mandates that the utility must purchase 25 percent of its electricity from renewable sources by 2016 and 33 percent by 2020. With respect to SolarReserve entering into a contract with utility PG&E, the state utility commissioner acknowledged, "This is expensive, there's no getting around it, but I think this technology is something that's worth investing in." Those investments should be determined in the free market, not artificially skewed by using the political process to pick one technology over another.

If electricity generated by these projects were competitive with other sources of energy, there wouldn't be a law mandating its use. Instead, families are forced into buying pricier electricity and taxpayers are on the hook if the project fails.

Expanding Market Opportunities for Renewable Energy

Opportunities exist to implement market reforms that would allow renewable energy companies and all other energy technologies to be more competitive and operate on a level playing field. To that end, Congress should:

- Allow all energy companies to form Master Limited Partnerships—Under an MLP, businesses have the tax structure of a partnership or a limited liability company, but ownership equity trades publicly on a securities exchange. The partnership structure allows the business's owners to pay its tax on their individual tax returns while providing the flexibility and opportunity to raise capital from smaller investors directly from the stock market. About 81 percent of MLPs today are in the energy and natural resources industry, with investment and financial services making up most of the rest. Most of the energy MLPs constructed today are related to oil and gas activities; 52 percent of MLPs are in midstream and downstream activities, and 14 percent are in oil and gas exploration and production. Coal leasing and production comprises only 4 percent. The combination of the partnership tax status and the liquidity of a publicly traded company make MLPs an attractive investment opportunity for renewable energy companies as well.
- Make immediate expensing permanently available for all business investments—For exploration and production, companies have the ability to expense capital costs in the year of purchase. Immediate expensing allows companies to deduct the cost of capital purchases at the time they occur rather than deducting that cost over many years based on cumbersome depreciation schedules. Expensing is the proper treatment of capital expenditures for any business. Depreciation raises the cost of capital, which causes businesses to purchase less. Less capital means businesses create fewer jobs and are not able to increase wages as much as they otherwise would have for existing employees.
- Allow states to conduct the environmental review and permitting process for all energy projects—One of the primary reasons shale oil and shale gas production has been so successful economically and environmentally is state government management. State regulators and private land owners have the local knowledge and the proper incentives to promote economic growth while protecting their environment. They understand site-specific challenges and can address concerns efficiently. Congress should consider privatizing some of that land, but in the meantime, transferring the management of federal lands to state regulators would encourage energy resource development on the federal estate while maintaining a strong environmental record. This could bode well particularly for renewable energy projects who may have thinner profit margins. The United States Chamber of Commerce identified 351 energy projects stalled by "not in my backyard" suits, regulatory red tape and legal challenges, mostly from environmental activist organizations. Almost half these projects (140) are renewable-energy ones. Transferring authority to the state would allow renewable projects to come online in a timely manner while protecting the environment.

Conclusion

Congress should resist the temptation to distort the energy market even further. Specifically, Congress should refuse to expand loan guarantee programs or to implement any new capital subsidy programs. American taxpayers cannot afford these programs, and they would put taxpayers on the hook for an untold number of projects that could fail. If they are economically viable, they can be funded by the owner of the project. The government should pursue free-market policies that allow all energy technologies to compete rather than using financing programs to pick winners and losers in the marketplace. Renewable energy may be the way of the

future, but America's experiences with government interference regardless of the type of energy show that we're doing more to hurt renewables and the energy sector right now than help them.

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The CHAIRMAN. Thank you very much, Mr. Loris.

Let me start with you, Mr. Davidson. This is the first time that you've testified here and really the first time in a long time that we've heard from the Department with respect to the loan guarantees. As you know, there has been a pretty ferocious debate here in the Congress with respect to loan guarantees. I'm very appreciative of the comments that Senator Murkowski has made because we've been able to keep this a bipartisan issue here in the U.S. Senate, which, as you know, has not always been the case in this debate.

Both of us have indicated that there is a role for government to play and what we want to do is make it a smarter and more creative role. That was essentially the thrust of what Dr. Allison had recommended when he was last here, to look at some fresh approaches. He was particularly supportive of the risk-reward effort, so that we could look, for example, at somebody who is just getting started but had already been able to attract some private sector support, some private sector investing, and there was promise of substantial gains down the road.

Can you give us some examples, because you have cited on page 5, I think, of your testimony, you cited some areas where you felt the Department had made some changes. Can you kind of break it out in terms of some specific examples of what's changed, because this is really the first time the Department has been on record on this and I think it would be very helpful. It can include risk-reward, but other areas as well. What has actually changed?

Mr. DAVIDSON. Thank you, Senator, for the question. Let me try and respond to that.

A number of things have changed in how we've proceeded with the Department. First I'd like to talk about the quality of the port-

folio, which I think was a very interesting part of Mr. Allison's and other people's reports. I'm new to the Loan Office and one of the first things I really wanted to do in getting in there was to understand the quality and the strength of the portfolio. I've mentioned some of the statistics there, that of the overall loan, \$35 billion in the portfolio, which is \$24 billion of loans and \$10 billion in conditional commitments, 2 of those conditional commitments are 1703 loans to the nuclear industry. But within that \$35 billion portfolio, the losses to date are in the 2 to 3 percent range. So I think that is a very significant number, which is less than 10 percent of the loan loss reserve.

So that was a very large concern of Mr. Allison's looking into the portfolio and seeing the status of that. He confirmed that those type of numbers and the health of the portfolio was strong, so it was good to get that confirmation.

But in the whole area of procedures and policies, which we've had a number of comments, and the LPO was very receptive and eager to hear those from Mr. Allison, as I mentioned, from the GAO, many comments about how we can improve performance. We are in the process of continually improving, but let me focus on 3 specific areas when you kind of pool together all the comments about how we could be improving, fall into 3 general areas I'd like to respond to.

One is in the area of internal improvements and staffing. We have made a number of steps there, including putting in senior positions, principally in the risk area, chief risk officer, which was a concern. We've added that. We've also staffed up fairly significantly in the areas of portfolio management. As I mentioned, we have a \$34 billion portfolio. Many of those loans were put on the books in 2010, 2011, and now the government will be owning those loans for 20 to 30 years. That's the average time of these loans. So we have to be sure that we are sufficiently staffed to really track those in a very prudent fashion. So we've staffed up in our portfolio management division, which are the people who really track the loans and work them. That was a very large area to do.

The other thing we've done is we've tried to bring more more eyes onto our loans and our processes, first from within DOE. So outside of the loan program area we have other people throughout DOE participating in reviewing our procedures and our policies and our loans. Then we've also stretched out to other areas in the government, other agencies, for inter-agency coordination of the loans we're doing. So we think that has buttressed and helped our internal process.

The CHAIRMAN. Let me if I might, just so I can bring the private sector in: Mr. Coleman, what do you think of the changes that have been made there in the loan program for the government? In other words, you get a chance to give some tips. You're the private sector. You can give some tips to the feds.

Mr. COLEMAN. I can't say that I'm incredibly familiar with all the changes.

The CHAIRMAN. Fair enough.

Mr. COLEMAN. The one thing I would say is that I think that the loan guarantee program, my understanding of it is it has performed within the metrics, as you've pointed out, but also that I

think it is an incredibly important program for particularly areas that are of common need, so whether that is infrastructure or whether it is the kinds of common problems in industry that need to be solved.

The CHAIRMAN. Good.

I'm over my time. Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman.

Mr. Davidson, let's go ahead and just continue with this discussion in terms of some of the changes that we have seen following the Allison report. Contained within that report it was stated that DOE should better define the desired balance between policy goals and financial goals. Pretty basic managerial function. You have detailed to the chairman here some of the internal process changes that you have made with beefed-up staffing, more extensive outside review. I appreciate all that, but can you give me more details with plans to perhaps develop a more formal process for establishing these goals, the distinction then between the policy goals and the financing goals, and measuring there their attainment, because I think this notion or the concept of accountability and being able to determine whether or not we have achieved these goals is critical to the operations of the loan program. So if you can speak to that aspect of it.

Mr. DAVIDSON. Thank you, Senator. As you mentioned before, we are executing a number of programs, 1703, 1705, and the ATVM program. Each of those is very specific in the policy goals that are trying to be achieved. The policy is really coming from you in the Congress to what the policy of the policy of these loan programs should be.

The metrics of the type of loans that we can give are fairly well defined, which is what we execute against. As you know, every loan that we approve, first of all, it is a loan. We are not in the business, as is ARPA-E, as other demonstration areas of DOE, of giving grants. We are a loan-only program.

So any time we get involved in a project, it is a private developer who comes to us. It is the market that comes to the Department of Energy, a private company. That company must come with at least 20 to 25 percent of the total capital of a deal in the form of equity, and only then will we respond to what is put in front of us. We do not go out and seek companies. They come to us.

We then have to make a determination within the loan program area that the company has a reasonable prospect of repayment—that's the fundamental choice—also that a new technology or a new process that is innovative will be employed, and as a result of that innovative new technology or process there will be a meaningful reduction in greenhouse gases. Those are the 3 steps we have to do for every project.

Senator MURKOWSKI. So it gets into this area, particularly when we're talking about risk tolerance and probability or likelihood of success there, where it gets a little grey, certainly more subjective. Is there a more formal process for analysis when it comes to the risk and the risk tolerance there, rather than just somebody saying: This looks like a good idea.

Mr. DAVIDSON. As I mentioned, I'm new there. I've been there for 8 weeks. Before that, I come a significant time in the private sec-

tor, having been in the banking industry. My impressions coming in are that the policies, procedures, and oversight within the DOE and within the LPO are certainly comparable to things I've seen in the private sector, if not more rigorous. I believe the GAO report and others have pointed to the degree of oversight within our loan program.

But in terms of goal-specific, one of the things we are doing now—I mentioned the President has authorized and we're moving ahead on the \$8 billion fossil solicitation. What we are doing with that different than other solicitations, we are putting that out now for public comment, and we are right now in a 2-month public comment period. That is to have input from all the stakeholders, industry stakeholders, about how they feel the whole fossil availability of this \$8 billion can be most helpful.

Senator MURKOWSKI. I will have other questions for you. It may be that they're submitted for the record. But again, in these areas of the risk assessment, the issue of subordination, which I think we all learned a lot more about that as a consequence of several of the loans that were made in the last year.

Let me ask you very quickly here, and this relates to the ATVM program. The statutory authority for that is now expired. I think a very relevant question is whether or not the Federal Government needs to continue to make a direct loan program available exclusively for automakers, particularly when we've got zero active applicants. Can you give some explanation as to whether or perhaps why the administration believes that there is a continued need for a separate loan program for vehicles?

Mr. DAVIDSON. Thank you for that question. First, I'd like to get back to you, because I think recently a number of applications have been received within the program, but I'd like to confirm that and get back to you if I can.

There have been a number of very successful loans. \$8 billion of the \$25 billion has been put in that program. We have over \$4 billion of credit subsidy available still for that. I think you can look at the example of—excuse me. You can look at the example of Tesla as the type of thing. That was a significant amount of private equity coming to the government, the DOE providing a loan. There was no other debt capital available for that. The founders of Tesla had broadly canvassed the market. There was no debt available. The DOE debt made that project and that company possible. Obviously, we know what's happened and it's worked out.

So the ability to build a new car company, the ability to be a significant investor with new suppliers and components manufacturers, there are fewer of those applying, but the need for them is crucial, and the work being done in energy efficiency for companies like Ford, Nissan, and Tesla I think demonstrates the real value of the program. Our mission now is to make sure that applicants come forward and apply for the program.

Senator MURKOWSKI. This will be a subject of further discussion. We could talk about Tesla. That has—proven successful. We know that there are some that have not proven so successful, certainly Fisker. But I do think that this is, as you have noted—you're new, you're figuring out what's going on, what's not going on. I do think that this is something that should be subject to greater scrutiny,

greater discussion, as to whether or not we make vehicle technologies and components eligible for a broader loan guarantee program and not necessarily exclusive to the auto industry.

My time is well over, so I'll yield, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Murkowski.

This is Senator Stabenow's time. Let's just be clear in terms of the question. Senator Murkowski has an important one that you know about with respect to the vehicles. Also, Mr. Davidson, I have a question from Senator Manchin with respect to that fossil program that you mentioned, the \$8 billion one. By unanimous consent, we'll put Senator Manchin's question in the record. We need you to get back to us promptly. Could you get back to us with respect to Senator Murkowski's question and also Senator Manchin's question within 10 days?

Mr. DAVIDSON. Certainly, Mr. Chairman.

The CHAIRMAN. Very good.

Senator Stabenow.

Senator STABENOW. Thank you very much, Mr. Chairman, and thank you for each of you being here. It's been a very helpful discussion and one that we need to continue.

An overall theme I think from the majority of what I have heard is the fact that there are in fact either market gaps, Mr. Kauffman, as you talked about, or financing gaps, Mr. Coleman, as you talked about. We've heard over and over again about the valley of death, how do we go from R and D to a place where, frankly, Mr. Zindler, we can meet the standards that you put out, a pretty high bar for what folks will invest in in terms of meeting all the various criteria. So how do we make sure that we get there?

Mr. Chairman, just to back up a moment before talking about specifics, I just want to stress again how important it is that we be engaged in this area. We are in a global marketplace where every other country is rushing into this space. China's spending, the latest numbers are, \$178 million a day to develop clean energy technologies, \$178 million a day. I realize we could argue about how they're different and their structure is different and so on. But they want to make sure that if folks are going to be buying solar panels or advanced batteries or wind technology it's going to have "Made in China" on it.

So we're in a race and we've got to figure this out if we're not going to go from dependence on a certain kind of energy to other kinds of energy. The good news is for us that this is also creates jobs. So I want to go then to the jobs piece of this as well as the public piece of this, which is so important.

Obviously, as the author of the Advanced Technology Vehicle Program, manufacturing program, I believe that we have seen positives, although I believe that there are some things that need to be changed. I'm not happy with the slowness and what has happened in terms of the applications. But I can say that there is a public interest.

When we gave a higher CAFE standard in the public interest, there were 2 pieces of achieving that. One is being supportive on the R and D end; and then the other piece is making sure that the support is there to retool so that these are American jobs as we re-

tool for higher standards, lower—better fuel economy and so on, which is in the public interest.

Ford Motor Company is the poster child for that. Their largest facility, in Wayne, Michigan, has been retooled with a \$5.9 billion loan. They are bringing jobs, they have brought jobs back from Mexico, China, Europe, and we're we're creating more jobs here because we helped retool.

So I just want to say that—and we can show in other areas as well.

I do have concerns, though, Mr. Davidson, and that relates to having this program, frankly, work better, because we've had a number of companies, companies that were solid companies that would, if they had been given a loan, would be repaying it and doing well, who got caught in the bureaucracy, in the morass right now, one company spending \$25 million on a -year process and then finally said, forget it. We've had a number of folks that have said that. So I am anxious to work with colleagues on how we do this better, because I do believe there's a need.

I also believe, Mr. Chairman, on the tax side of things, we do have examples of things that have worked well but been limited. The effort that Senator Bingaman and I were able to put forward in 2009 for the advanced manufacturing clean energy tax credit, which has been dubbed 48C, was oversubscribed 3 times by companies in fact who have used this 30 percent tax credit for equipment and buildings and retooling to do clean energy extremely successfully.

I would love to show you in Michigan 12 different companies, from doing the towers for wind turbines to retooling a factory that did large boats to do wind turbine blades, to do generators at another company. So there are important areas where we have made a difference. I would ask, Mr. Davidson, just in the brief time that I have here to respond on ATVM: How do we make this better so it works?

Mr. DAVIDSON. Thank you, Senator, and thank you for your support in this program. One way I think—the point you speak to about the customer service aspect of the LPO is certainly something I'm very concerned about and we're working very hard to improve. The staff before I got there has put a number of work into that also. I think there we can see real improvement, and I think that was part of the issue of why there may have been some complaints from suppliers before.

One of the principal things we've done there is we've automated the whole front end application system. Before it was essentially a manual process and people would submit their applications, which are sometimes voluminous applications, and there was no way to get back to the applicant unless that had been physically checked, which sometimes took 2 or 3 months. We've now been able to automate that. It's an automated application system. So the initial response to the applicant has dropped down from months to a matter of days or weeks.

So this did not really exist the last time that some of the people you deal with maybe have applied to the program. So we have fixed that and we're looking forward now as the next group of applicants come in as a result of the fossil solicitation and the auto

that it will be a much more customer-friendly operation, which we hope will make some difference.

Senator STABENOW. I think we have a lot of work to do that, and I'm anxious to work with you and the leadership of the committee on it.

Mr. DAVIDSON. We're very happy to do that, Senator. Thank you.

Senator STABENOW. Thank you.

The CHAIRMAN. Thank you, Senator Stabenow.

Now, we've got a number of colleagues waiting, in order of appearance: Senator Heinrich, Senator Franken, Senator Baldwin. So let us then go to Senator Heinrich.

Senator HEINRICH. Mr. Coleman, I want to start with you for a moment. It's often been said that without risk there's no reward. If we were in the business of investing in zero-risk projects, we wouldn't be innovating at all, obviously. Are you concerned that the political reality of this is that politicians, the media, we're all happy to focus on the 2 percent of a program like 1703 epitomized by Solyndra—we heard Solyndra raised again today—while ignoring the 98 percent of the program that might be epitomized by Energy Solar or U.S. Geothermal or all the very successful implementation projects that are providing clean energy at a competitive price?

Mr. COLEMAN. I think the challenge is that those political conversations do obviously skew the risk tolerance. So there's no upside reward in a government program for taking that kind of risk, and what happens in my mind is that the initial scope of the program, which was intended to go even earlier—and 1703 was a perfect example of that—gets skewed later.

So it may be that the program is still significantly in need and that it is solving certain problems. But in terms of the challenges that we face as early stage investors, it is harder and harder for the program to target those kinds of problems. Those are problems—in particular, if you look at the actual structure of 1703, it's exactly what the challenge is, which is it was meant to be oriented toward technologies that were unproven and yet it was the unsubsidized portion of the program.

Senator HEINRICH. You've got to wonder if the point is to bridge the valley of death, but there's this incredible resistance to taking on any sort of risk, then you just start funding implementation projects and not the truly innovative ideas that can change the landscape from the bottom up.

Mr. COLEMAN. Yes. I think that the government has to be willing to take some element of risk in regards to things that are strategically important. If there is a national imperative, then there's a reason to take that risk. I would say that there is a need to make sure it's combined with the market making decisions about risks that are worth taking.

Senator HEINRICH. You mentioned our national laboratories as well and ARPA-9E, which is another program I'm very supportive of. What is your experience with regard to the national labs and whether or not they're doing the kind of job they could be doing in terms of making sure that technology actually transfers out of those institutions and into the private sector, particularly on the cultural side, where sometimes there are impediments that don't

need to be there, that can really make enormous differences in terms of getting things that we develop through basic R and D, out into the private sector world where we can see the most benefit on a national scale?

Mr. COLEMAN. I think that the national labs do a lot of great work and I think we should continue to support them. I sit on the Venture Advisory Board for the National Renewable Energy Laboratory and the constant conversation there is exactly this: How do you actually bridge the gap between the research that's being done and the marketplace?

One of the challenges that is a constant refrain is that there are limitations, that there is not necessarily an incentive structure that drives researchers to take the kind of risk with their time associated with actually doing applied research and taking time off to go and do that. Certain universities, like Stanford University and others, this is part of the culture, and it is not part of the incentive structure of the national labs.

The other is that there's a real constraint that is—I think it's driven by the policies associated with how these national labs are structured, which limits the amount of applied research and commercial work that they can do. I think the hard part there is just simply that if we don't have communication between the early research and the marketplace, then it's more likely that you're going to invest in things, in research things, that don't get there.

So I do think we need to open that up. I think we need to be less concerned about the overlap, particularly in a world where it's eroding.

Senator HEINRICH. I want to thank you for your perspective on that. It's helpful.

I want to get to one last question while I still have a little bit of time. I suspect, Mr. Kauffman, you might have an opinion on this, but I'm open to input from any of you. I'd like to know the relative relationship between the the limitations of finance and implementation and the challenges that we're having nationally and certainly in my State of New Mexico with getting transmission in place to utilize implementation in the places where it makes the most sense?

Mr. KAUFFMAN. The transmission questions—there is not difficulty in financing transmission. Generally speaking, the issues relate to whether or not you have all the various permitting in place.

Senator HEINRICH. My experience is that, not in the finance side, but that if you can't get the regulatory side and work through the NEPA process, then there are projects that could be financed in places like Arizona and New Mexico that don't end up being financed because of the lack of transmission and the inability to work through that.

Mr. KAUFFMAN. That's right, absolutely. You can't develop a project unless you can deliver the power. So transmission is an issue, no question about that, if that's the answer to your question.

Senator HEINRICH. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Franken has done good work on these issues and he is recognized.

Senator FRANKEN. Thank you, Mr. Chairman.

I have a bill I've introduced, the Local Energy Supply and Resilience Act. It speaks to a number of issues that we've raised on transmission. These are generally distributed generation projects, so they don't require—they don't really require transmission. They can work in island mode, etcetera. They can feed into a grid if they need to, and they do in certain areas.

Let me talk about combined heat and power. In the U.S. up to 36 percent of all energy we consume is lost from power plants and industrial facilities and buildings as waste heat. This is 36 percent of all energy that we produce in the country. We can capture waste heat and put it to use. We do that in the city of St. Paul. They burn biomass. It's really from the city, from the tree trimmings and that stuff. They burn that biomass, generate electricity. They heat and cool 80 percent of the buildings in downtown St. Paul.

There's another benefit from using biomass. Senator Risch has talked about all the hazardous fuel. We're having these terrible, terrible wildfires and he's talked about we don't have—we're not—actually, we're losing—all the money we're using to fight these fires sometimes comes away from eliminating some of this hazardous fuel.

So that's why I've done this bill. I'm kind of trying to thread a needle here, because I want to do this through 1703—and this is proven technology. I think the needle here, though, has a very big eye, because the 1703 program still has—am I right, it says \$34 billion still in loan authority? Is that right, Mr. Davidson?

Mr. DAVIDSON. Roughly that amount.

Senator FRANKEN. OK. Here it is a proven technology, so it's not about—but it's about—Mr. Zindler, you talked about scale, scale, scale. It's about scaling up something that works and that works well, works in island mode, so when you have these disruptive storms like Sandy and we save a lot of money in places, like in Princeton, New Jersey, where they had data centers that didn't go down because they had combined heat and power.

But to scale this up we need the up-front. We need—how big a problem is the up-front cost of these things, Mr. Kauffman?

Mr. KAUFFMAN. I think this issue of CHP is a very good example where there are financing gaps, because it's very difficult, for example, to have CHP as a service. In other words, somebody will have to buy the equipment. Energy is, after all, an operating expense, and so it's perfectly understandable that somebody would want to substitute one operating expense for another operating expense.

So CHP is a good example of where it's not so much the need for subsidized financing, but for the ability to get the financing, and that financing is difficult to obtain either on a large scale, with either banks or from the capital markets. So you don't have financing widely available.

I would also observe, by the way, that you talked about wildfires. In Texas, the Governor just signed a bill promoting CHP because it reduces the quantity of water that's used from central station power generation. So it's not only good in terms of capturing waste heat; it's actually, CHP is also good in terms of reducing water consumption.

Senator FRANKEN. How much could we scale up this sort of renewable, use of renewable energy, if we had the right financing? Do you want to talk about it, Mr. Davidson or Mr. Kauffman?

Mr. KAUFFMAN. I wanted to point out because, you know, I am in New York and so this issue about resiliency is really critical. So we have a financing product that's coming out of our green bank that's going to be focused specifically on trying to leverage private sector capital to finance CHP. So CHP is absolutely a critical area of interest for us for both resiliency as well as value for customers.

Senator FRANKEN. In my subcommittee I think we're going to have, pretty soon, I hope, a hearing on State-based programs, what States are doing. Minnesota has been—in—in terms of opening demand for these renewable and for energy efficiency and those kind of programs. I'd love to ask you to participate in that.

Mr. Davidson.

Mr. DAVIDSON. If I can just jump in on that, the issues of CHP are very significant. It is a huge way to reduce carbon footprint if we can start moving the needle ahead on that. There are great new technologies becoming available for that, that can really help speed the introduction and the market adoption of CHP.

I'd like you to be aware that in the new fossil solicitation that I've mentioned that's coming out, that is really about lower carbon uses, ways in the extraction of fossil fuels we can lower the carbon footprint, ways in dealing with existing industrial and energy processes we can lower the carbon footprint. Things like retrofits fit into that solicitation.

But a very large part of what we expect to be coming in as applications is the area of reducing fossil fuels through energy efficiency measures. So combined heat and power, waste heat recovery, microgrids, fuel cells are all things that will fully qualify, assuming the other metrics are met, a reasonable prospect of repayment, greenhouse gas reduction, and a new technology. Those are the type of programs that could be financed through the fossil solicitation.

So I would encourage you to look at that and if we could discuss that further. That is something we're very interested in doing.

Senator FRANKEN. I would love to follow up with that.

I'm out of time. Mr. Loris, I apologize because you won't have a chance to respond to this, but I'd just like you to think about things like the Erie Canal, which the government paid for, and Mr. Kauffman knows about it. It opened up, because—and this was actually the State government of New York. It increased the efficiency of moving good from the Midwest right to Europe, because it came through the Great Lakes to the Erie Canal, down the Hudson River. We could sell our timber and our—it opened the Midwest to the world and made transporting our goods, our crops, our timber, improved it by 97 percent, the efficiency. That was really just something the government paid for.

I had this discussion in the HELP Committee with a witness from AEI, who started his testimony saying that it's a myth that the Federal Government creates jobs and ended his testimony, after I went through all these things like the Interstate Highway System, etcetera, to him saying that to say the Federal Govern-

ment doesn't create jobs would be absurd, which was kind of a 180-degree change in that. So I that. So I wish we had had that chance.

I again apologize for going over, but it used to be my job to identify absurdity.

The CHAIRMAN. I thank my colleague.

I just want you to know I'm very interested in working with you on this combined heat and power technology. I think it is very important. With respect to the fire situation, you and the Senator from Idaho are spot on with respect to what's going on with the fires. What happens in the West, when we have one of these huge infernos, essentially the bureaucracy pilfers from the prevention fund in order to fight the fires, and then the problem gets worse.

So the fact that you're looking at some new technologies is very helpful, and I'm going to work with you on this issue.

Senator FRANKEN. Think of the waste heat that you have from those fires.

The CHAIRMAN. There you are. You say it all, as usual.

Senator Baldwin, welcome.

Senator BALDWIN. Thank you, Mr. Chairman and Ranking Member Murkowski. I really appreciate the fact that you're holding this hearing and having this deep discussion on such a critical topic.

I also want to just associate myself with the comments of Senator Stabenow. There's such exciting potential. It is so needed. Yet, especially as I represent a State with a lot of manufacturing traditions, legacy, and history, we want those jobs to be here, and we need to send the right signals.

Mr. Coleman, I took great interest in your discussion of the innovation pipeline and your emphasis on the importance of ongoing investment in research, research that debuts new technologies and can then be transferred out of our labs and into commerce. A few weeks ago I had the honor of introducing my first bill as a member of the U.S. Senate and it focuses on increased access to venture capital for early stage startups. It is wider in scope than clean energy technology, but certainly that's among the targets. It prioritizes funding for those technologies that were developed through federally supported research. So you can assume that it's gone through at least one stage of vetting in order to get that first whether it's NSF or NIH or SBIR support.

So this entire topic is of great interest to me. But it's the next few steps in the pipeline, the task, as you described it, of closing the funding gaps around the commercialization of new technologies that's so critical to address. There's a couple things I wonder if you could elaborate on further. Let me just put both of them out there.

Are there State-level programs or other models that are effectively responding to this challenge? Then I'd like you to also elaborate further on your comments about the loss of expertise that has been assembled to make these venture capital decisions and investments. What does it take to assemble this expertise in these teams, and what advice do you have for us along those lines?

Mr. COLEMAN. In answer to the first one, which was the State programs, I don't know of a lot of them, to be honest, that address this problem very well. There are some in the State of California that are using their funding mechanisms and particularly now are leveraging their AV32 funding in order to go focus on trans-

formative technologies that can help those States. So it's worth looking at some of those.

The provision that we put forward that is the innovation credit is something that I think can do this and it can do it at the Federal level, it could do it at the State level as well. It is a provision that is intended to address exactly this gap, but to do it in a way where specifically we're solving this problem of unproven technologies. I think that's what you're getting at. Most of the conversation has been revolving around how do we deploy proven technologies, and the unproven technologies are something that are really difficult. They're difficult because the more that we skew toward traditional financing the less risk debt is willing to take on those kinds of projects.

The challenge for us as early stage investors is that there is no class of capital that will fill that gap. So debt won't come in to a project that hasn't had a 5 to 10-year track record, and equity is way too expensive for an emerging technology, which will only be competitive once it's at scale, to actually get financed and get to scale.

So it is a sort of twofold problem. The reason I bring that up is the context of the expertise, which is the challenge in this space is it takes a long time. So to go and develop a technology and prove it at some sort of lab or bench scale and then demonstrate it for some amount of time and then build your first commercial plant and then operate it for enough time to actually build your second commercial plant, and your third, that takes decades.

So we have to figure out as venture investors how to invest in the innovation process in a small sliver of that, such that it makes sense, because there are other investors in the back end and such that—in a way where we can leverage the technology that exists before us, that's been created before us.

The challenge is that to build that ecosystem of talent takes decades. It takes those researchers looking out and saying, there's an opportunity here, it's worth doing, or the government saying, there's an opportunity here, it's worth doing. That's well in advance of it ever being executed. So we need provisions that assure that people see that opportunity and continue to invest their time and effort in building it.

If it goes away it's going to take a long time to rebuild.

Mr. ZINDLER. If I could just add one quick comment, which is that—well, first, there are some efforts at the States. I certainly would advise looking at Connecticut is doing some interesting things, among others, and certainly what Richard's looking at in New York.

The second thing is I would suggest looking globally, because the U.K. and Australia have now both established essentially green banks that are going to be looking at this area. So internationally, other countries have recognized that this is a national priority and have been thinking about ways to leverage national resources to invest in new technology development to bridge what I think Will very accurately points out is this sort of valley between when a technology is first being developed to when it has to actually be proven at some level of scale.

Senator BALDWIN. Thank you.

The CHAIRMAN. Thank you, Senator Baldwin.

I think we have a few additional questions. One I wanted to ask you, Mr. Coleman, just to sort of see if you can walk us through some of the things that you think are promising. I think you heard me talk earlier about storage technology. That's something I put a lot of chips into and, frankly, I was kind of skeptical. We've been at it for 3 or 4 years now and my staff started talking to me about it, and after a few algorithms I was pretty much asleep. It's clear now that it has such an important connection to renewables, because it's obvious that the sun doesn't always shine, the wind doesn't always blow, and then along comes storage technology to give us an opportunity to address those issues.

Anything else that you're particularly attracted to now, if you could just wave your wand? Again, this is not to light up everything on Wall Street this morning as if you're giving investment advice, but just in terms of—

Mr. COLEMAN. My investment advice, as an early stage investment it would take a long time to matriculate to Wall Street.

The CHAIRMAN. There you are.

Mr. COLEMAN. I would say that you should talk to the entrepreneurs because they're the ones who, their eyes light up when they talk about any one of these technologies. We try and pick the ones that can actually succeed, and we try and do it in a very broad way.

I would say that there is an opportunity now in the current market dynamic to go out there and think about the technologies that already exist and how to optimize those, in particularly new technologies like wind, solar, storage, CHP, you name it. There are a lot of opportunities to combine these technologies. So we're seeing an increasing application of the kinds of optimization software and approaches that you see in other sectors being applied to the assets that we have in place to make sure that we deal with things like intermittency and being able to deploy at the time of need. All those issues are important.

I wouldn't say there's a silver bullet out there. I would say that there are a lot of promising technologies, and I think, honestly, there's still way more to invest in areas like solar and wind and storage, particularly materials systems that change the way we think about those technologies.

The CHAIRMAN. Let me ask one last question and the entire panel can get into it. That's the question of pricing carbon. As you all know, some countries have taken the approach that they ought to just go ahead and put a price on carbon emissions directly. I'd be curious just by way of getting your assessment: How many of the issues, financing issues for example, go away if you take that step? In effect, you will continue to have questions about a variety of approaches with respect to climate, but how many of the issues that we're talking about here today, that we're thrashing about over here in the Congress, go away if you put a price on carbon emissions directly?

Mr. Zindler was reaching for his mike.

Mr. ZINDLER. I'll take a hack at that, which it's a very interesting question. I guess to just go back to my testimony for one moment, I would say that the best way to address all the financing issues

that are out there is to create a clear signal of demand for clean energy, and that in turn would make more projects more appealing, more financeable, immediately. So I should put that out there.

Now, whether a price on carbon is the thing to do that is an interesting question. If you put a CO₂ price into the market right now, I would argue that you will certainly help with the continuing development of natural gas, but you will not necessarily see the kind of growth in zero emissions energy projects that I think some people might always hope for.

We've done a survey, we did a survey of our clients a few years ago in Europe, where they have had a price on carbon and they've also had heavy feed-in tariff subsidies to support specifically solar and wind. We asked a number of the utilities, what was your motivation for adding wind and solar capacity? They were much more inclined to say the specific feed-in tariffs on renewables more than they pointed to the price of carbon.

So I'm always a little wary of people saying that it's just purely a panacea to put a price on carbon and then you'll get renewables here. You certainly will get some more renewable build, but it will be an unpredictable build for sure. I guess the question is back, obviously, to the committee, which is what's the priority? If it's purely to drive down CO₂ emissions, then obviously you can achieve that goal, I think, through a price on carbon. But if it's to drive down carbon emissions and develop other new technologies that are zero carbon, it may not be sufficient just to have a CO₂ price.

The CHAIRMAN. Mr. Coleman—Mr. Kauffman, why don't you go next, and then we'll go back to Mr. Coleman.

Mr. KAUFFMAN. I guess what I would say is that some of the things we're talking about in terms of financing gaps are not solved by a price on carbon. So I'll give you a good example which also picks up the question about ATVM. One of the issues with the ATVM program is it's focused on manufacturing and it's not focused on things that might enable manufacturing, like charging stations. So charging stations are economic—I'm talking about charging stations that are out, not in your garage, but out there, and you need a certain percentage of charging stations in order to—so people get comfortable driving.

Those charging stations are economic. They will generate a rate of return to the investors that would invest in the charging stations if they could get debt. They're not financeable. So it's an example of something that's economic today, but not financeable. The cost of carbon would not change that.

The CHAIRMAN. Others, carbon.

Mr. COLEMAN. I think it's actually a really interesting example of what a long-term program would do, whether it's carbon or any other metric. I think if you give the market the kinds of signals that a long-term price on carbon would give, you would see people feeling around to solve that problem.

I think that, particularly if you make it something that scales in over time, you could see something where early stage investors would get in to solve a problem where there's a clear reward for doing so.

On the other hand, I think that it wouldn't solve all the financing problems, exactly as Mr. Kauffman pointed out. I think that

there are scaling challenges, that still this this financing gap I've talked about for unproven technologies is still a problem. There is not a type of capital that will fill that void. I also think there'd be a problem with infrastructure. So I don't think that—I think the challenge would be areas where you can't tie a direct reduction back to the actual investment would be a challenge.

The CHAIRMAN. These are good answers, and part of the reason I worded the question the way I did is I think we're certainly hearing not everything is resolved. The question would be how many, if any, of the problems we're talking about today would be resolved by pricing carbon.

All right. Anybody else?

Mr. LORIS. Yes, I would like to just quickly add to Mr. Zindler's point. The Heritage Foundation recently ran a model as to what a phaseout of coal would do and we used the same model essentially that the Energy Information Administration uses and found a 42 percent increase in renewable energy, but that only makes up 4.5 percent of the market. The majority of it is made up by natural gas, and it increases natural gas prices, we found, over a 15-year period by 42 percent.

So I think this phaseout of coal, whether it's by a price of carbon or if it's by the regulations that are being imposed by this administration are going to have or the the consequence of raising natural gas prices and really I think squashing this manufacturing renaissance that we're seeing as a result of the shale gas revolution.

The CHAIRMAN. All right. Senator Murkowski.

Senator MURKOWSKI. Thank you, Mr. Chairman. Just one very quick, hopefully last question to you, Mr. Davidson, and then I'd like to pose a question to the panel here. This is back to the ATVM loans. You've noted the success of Tesla. I noted the very precarious position that Fisker is in, on the brink of bankruptcy. We've also got the Vehicle Production Group, which received a \$50 million loan from DOE and has ceased operations and fired nearly all of its employees.

So can you give me a very quick update on the status of these 2 loans for these 2 companies? Are we looking at any potential taxpayer losses with these, do you know?

Mr. DAVIDSON. Thanks, Senator, for the question. Both of those loans are now being worked on in real time. There are issues with both of them, so I can't give you specific commentary on them. But there has been public, widely disseminated information about Fisker and VPG in the press, and we are taking the steps really in real time to deal with both of those situations.

Senator MURKOWSKI. My hope, of course, is that we don't see losses that the taxpayers will be carrying on this. Again, I'm looking at this specific program and really questioning whether or not we need a specific program. It was not too many years ago that the industry voluntarily stepped forward and say, yes, we'll move on with the CAFE standards, and a big ceremony in the Rose Garden, and the next thing you know we now have a program to help them all out there with subsidies.

So anyway, I don't mean to dwell on that. I would appreciate, as you're responding to the questions that the chairman has asked

you to respond to, that you can give me more of an update on these 2 loans as well.

Then to the panel here: This is a broader question here, but it's one that I raised in the policy report that I issued some months ago, my "Energy 2020." In that I expressed my view that the Federal Government should prioritize more on the research activities side rather than deployment subsidies.

So the question that I would have to you is whether or not you think that the Federal Government has struck the right balance here between clean energy research and clean energy subsidies, and then whether or not you believe it's more appropriate and perhaps a more effective role for the government to act as a facilitator for fundamental research that might not be undertaken by the private sector, or is the role of government to serve as the provider of deployment subsidies?

So have we reached the right balance? Where should we be? Because I'm looking at this and saying we can spend a lot of money in a lot of different places, but where is that more appropriate role?

I don't care where I start. Mr. Loris, we can start with you and go on down the way.

Mr. LORIS. Sure. Heritage is opposed to all energy subsidies, so for oil and gas, for renewables. We don't necessarily view that as the role of the government. But when it comes to Department of Energy research, we think there is a critical role to provide that basic research to meet whatever security needs, whatever the necessary actions that are for the Department of Energy to undertake and allow the private sector come in and commercialize that research. We think there's tremendous opportunity there.

In fact, we recently released a report with the Center for American Progress on this very issue, identifying the bureaucracies and the challenges of the national labs to increase their flexibility and really return to that GOCO model that the labs were initially intended to serve. I could submit that report for the record to show how we can really remove some of the institutional bureaucracies in the lab to create these innovations, like we've seen in some of the national security research, like the Internet and like and like GPS. I think that's the model moving forward for innovation and economic success.

The CHAIRMAN. Thank you.

Mr. Coleman.

Mr. COLEMAN. I think it's a challenging and very large problem and question. I think that the question is what problem are you trying to solve as the Federal Government, and I think that I certainly agree with the fact that we need to be putting more into research. I think we as early stage investors have drawn on that historically throughout the entire existence of the venture capital industry. So I think it is something that if we ignore it will atrophy and it'll be very difficult for us to enter into these sectors.

I think in terms of the deployment side of the equation, we are biased toward thinking that we should help deploy technologies that need the help and get them to scale and then get out of the way and roll off and let the market work. I think the challenge on the deployment side is if it's purely a supply problem then there's a reason for the government to be involved in continuing to foster

supply. If it is a cost problem, then there's a different way of approaching the deployment problem. If it's an innovation problem, then there's a different way.

Our bias is that if you can support innovative technologies then you will solve those problems without having to create permanent structures that support them until we don't know when.

Senator MURKOWSKI. Which of course is the problem. We continue to support them.

Mr. Zindler.

Mr. ZINDLER. I guess I would say that if your goal—and this is the “if,” because I know not everybody agrees on this. But if your goal is to create a strong and vibrant and competitive U.S. clean energy sector over the long term, then I think, unfortunately, perhaps from a spending perspective, the answer is you need both, because they are part of an integrated whole.

If you want to inspire creativity and investment and venture investment back at the beginning of the technology chain, you need to show that at the end of the line there's going to be a big market at the end of it as well. I think scale, sort of on the theme of some of the things I've said earlier, scale really is important. I think Richard mentioned that these days we've seen this incredible decline in the cost of a solar module, right, but we've seen nowhere near as much of a decline in the cost of the end cost that the consumer gets.

So for instance, in Germany right now they're installing residential systems for as low as \$2.25 per watt, watt, but in California and other places it's \$4, \$5, \$6 a watt. There's no reason for that discrepancy other than that market in the U.S. has just simply not reached the kind of scale that we've seen in European markets.

So if the goal is to bring costs down, we need scale on deployment. We also need scale in terms of investment in R and D as well.

Senator MURKOWSKI. Thank you.

Mr. Kauffman.

Mr. KAUFFMAN. Thank you. We do need to support both innovation and deployment. Deployment matters because, as Mr. Zindler just said, scale matters. Renewable energy I believe is the only energy source that the more of it you make the cheaper it gets. So R and D is not going to be enough. Some of the deployment stuff isn't—and the innovation—isn't hard innovation. It may be just the learning that comes from taking what comes out of the truck first, and that just comes through lots of processes.

All of us have heard, I think, of Moore's Law about the semiconductor industry. It shows how every so many months you have a doubling of improvement. That's not a law of physics. That's a law of markets. It's because there's a market into which chips are sold.

I think when we talk about the financing of innovation it's hard to tell how much of the financing of innovation and the problems in the sector are due to the inherent nature of financing innovation and how much of it is due to the fact that we're trying to finance innovation on the back of a financing infrastructure generally in this sector that's incredibly old-fashioned and anachronistic.

That's one of the reasons why I think we have a valley of death that's as big as it is. So if you could imagine creating capital mar-

kets instruments that were for the kinds of things that are broadly available for both equity and debt for investment-grade large utility-scale projects that paid, say, for equity 6 or 7 percent yields, you could easily imagine the subsequent evolution of instruments that would pay a somewhat higher yield, that took a little bit more risk in technology or credit, just in the way that the high yield market followed the investment grade market.

That's what the bulk of the 1705 program's doing. So you could imagine actually the markets solving what was otherwise a government problem.

The last point I just want to make is, when we talk about deployment I think the things that I was talking about are not about subsidy. It's about government involvement removing some of these obstacles and creating a better and more up to date financing structure for deployment, which will lower the cost and shorten the valley of death for innovation.

The CHAIRMAN. Mr. Davidson.

Mr. DAVIDSON. Thank you, Senator. I like that term "integrated whole," because I think that really is what's happening. If I look at the Department of Energy, which I have a very good understanding of, we have certain parts—the national labs and ARPA-E—which are doing a very important part of contributing to innovation, and they essentially hand off a project to the deployment areas of DOE, the fossil area, energy efficiency, and the nuclear programs. They will do a demonstration project, and from that we'll have something proven but not yet commercialized.

Then we get into this valley of death, this tricky area, where there are equity investors willing to put in money, but because it's the first commercial scale deployment or the first, second or third, there is not the significant, oftentimes hundreds of millions of dollars, that need to be committed to the project to make it viable, to really test out the technology. Once that technology is proven, as Mr. Zindler said earlier, once the technology is proven, there is a great deal of capital ready to come in. So it is that fundamental question of how you prove out a new technology at scale so that it can really contribute to helping energy creation, greenhouse gas, or in automotive.

So I think all components are crucial. So it's very important—it's very tricky, but I would not want us to lose sight of the very significant resources that are needed, that you have committed to the programs that we oversee in the LPO, but that are absolutely crucial to deploying technology, new innovative technology, at utility scale.

Senator MURKOWSKI. Mr. Chairman, thank you.

To all our witnesses, thank you for the time you've given us this morning and the information shared.

The CHAIRMAN. Let's just recap on where we are. Mr. Davidson, we need to have a response from you to Senator Murkowski's important questions. We'll need that within 10 days; and also Senator Manchin's questions with respect to the fossil program that you talked about, the new \$8 billion program that he has important issues that he wants raised.

Then, Mr. Coleman, let me formally ask you that, with respect to your innovation credit—love the concept. I'm very interested in

hearing what you think ought to be struck from the tax code in order to fund that. I can tell you, I also serve on the Finance Committee. I've been at this tax reform effort for a full decade, and Rahm Emanuel and I introduced the first bill in almost 20 years, and that was some time ago because he's moved on to a number of other very valuable public service efforts, and then Senator Gregg and I sat across from each other for almost 2 years so that we could put together the first bipartisan bill. He then retired. In addition, Senator Coats has been very constructive on this, along with Senator Begich and a number of other Senators.

It always comes down to the question that I'm asking you: what you would strike from the code in order to actually address some of these issues? By the way, I think Mr. Loris knows that we have talked extensively to Heritage about these issues over the years.

So let's make that your question. Do you think you could get us an answer say within 10 days with respect to the credits?

Mr. COLEMAN. We can work on that completely uncontroversial question in the next 10 days.

The CHAIRMAN. I just thought since you volunteered it in your testimony, I'd follow up.

Here's the point with respect to where we are. I think you've heard from Senator Murkowski and I pretty clearly that we think that there is a very significant role that has to be afforded the private sector and marketplace forces and a broad berth to encourage the kind of investments that come from the private sector that can be so important. government, and the question, as we talked about today, is how do you do it and how do you do it in a smart and creative way. I tried to lead into it that this has a new sense of urgency on the question of climate finance now with that remarkable, really very ominous, finding from NOAA here a couple of weeks ago.

So you all have been very good and very helpful, and I think you've seen we want to tackle these issues in a bipartisan way. So we'll look forward to your responses.

With that, the Energy Committee is adjourned.

[Whereupon, at 11:43 a.m., the hearing was adjourned.]

APPENDIX

RESPONSES TO ADDITIONAL QUESTIONS

RESPONSES OF WILL COLEMAN TO QUESTIONS FROM SENATOR SCHATZ

Question 1. Several witnesses touched on this in the hearing, but it is important to further explore the effectiveness of county and state-level policies to support clean energy financing versus similar policies at the federal level. In recent years it seems safe to say that certain states have had far more success at implementing innovative programs than Congress. My home state of Hawaii is one example. We are making good progress in implementing the Hawaii Clean Energy Initiative, which establishes aggressive clean energy standards. In addition, the state legislature recently passed a Green Market Securitization Program (GEMS) which uses on-bill financing for residents of all income levels to avoid the high up-front costs associated with solar panels.

How effective can these state programs be, relative to federal government efforts, which invariably will have more financial resources? What is the opportunity for establishing regional initiatives—a “New England Green Bank” for example—that pool resources from multiple states. Would such a structure even be desirable?

Answer. State initiatives can be extremely effective at driving local deployment and in some cases local industry development. However, most of these programs are targeted at attracting existing businesses or creating market demand for existing technologies through regulation. Very few have addressed the need for private investment in innovative technologies and deployment of these innovative technologies. Only a few markets such as California or regional partnerships, if aggregated, have markets large enough to drive early stage investment in technologies that address regulated needs. But even these are typically not large enough to provide the necessary incentive for investors to take early stage technology risks. So regional programs can be set up, but often regulators are left asking why more companies don’t show up to meet the market need created.

Some states have begun to set up financing structures for clean technologies. My co-witness Richard Kaufmann spoke about New York State’s efforts to create a “green bank.” Such an entity could be very helpful in supporting deployment of current technologies and may attempt to address the early commercialization and scale-up challenges I discussed in my testimony; however, this approach is better as a rifle shot at specific high potential technologies. The advantage of a federal tax structure like the new energy innovation tax credit I discussed during the hearing is that it creates a single, clear incentive for investing in new technology commercialization across the entire energy sector. It provides the kind of long-term signal that draws capital into the market long before any single company or technology would actually use the credit. It would also be self-executing in the near term. Innovative energy companies entitled to the credit would claim the credit on their tax returns (much like a refined R&D credit), or transfer the credit to their strategic partners, and use the credit to finance their first commercial manufacturing plants. No organization needs to be set up, no screening needs to take place, and no funds need be appropriated for a “green bank” entity. The tax credit provides a unique level of transparency and simplicity due to its clear and consistent qualification criteria. Regional Green banks or other regionally specific programs could be excellent complements to such a credit.

Question 2. Most of the discussion at this hearing focused on options for creative financing policies for large entities building utility-scale projects. It is important to examine the suite of financing ideas directed at consumers for distributed generation and efficiency investments. Ideas such as property assessed clean energy (PACE), on-bill financing (similar to PACE but financed through electric bills instead of property taxes), and leasing structures (largely for residential solar), are three of the most often discussed methods.

Please discuss how financing structures directed directly to consumers can be helpful to clean energy deployment relative to structures such as a national green bank or innovation tax credit. How effective are these structures at spurring demand and overcoming high up-front costs to consumers? Designed properly could they be more effective than current federal tax credits, or are these credits also necessary? Are you aware of any barriers to smaller-scale financing efforts?

Answer. Consumer-focused financing structures such as property assessed clean energy (PACE), on-bill financing (similar to PACE but financed through electric bills instead of property taxes), and leasing structures (largely for residential solar) can help broaden the market support for new energy alternatives and overcome some of the additional financing costs typically associated with emerging solutions. Financing costs are higher on these technologies because the financing community perceives “new” as riskier even when these technologies have a fairly long operating track record. So they are harder to finance, insure, and sell than more proven technologies. These financing structures are helpful to overcoming early barriers to entry for emerging technologies because they can offset some of the market resistance that typically exists.

However, consumer-focused structures still typically drive demand only for the most proven technologies within a category and do not provide enough “pull through” to drive investment in the next generation of technologies. If we put these mechanisms in place but do not overcome the gap for financing and scaling less proven technologies to feed the demand then we may end up simply driving demand for technologies manufactured elsewhere. Countries like China, for example, chose the opposite approach of financing the manufacturing first to meet global market demand and then spurring domestic consumption to augment the market.

Question 3. Cheap financing is important to scale up renewable energy, and as a consequence, drive down costs. I agree with this in principle but since most renewables use power purchase agreements to sell energy to utilities, it seems that securing a long-term stream of income may be more important. Power purchase agreements typically need to be approved by Public Utility Commissions. Similar to transmission constraints, there may be other issues limiting the scaling of renewables even with improved financing. What are your thoughts on addressing these other issues? How do they compare to the need for cheap financing in terms of importance to the renewable industry?

Answer. Thank you for this question. It highlights some of the subtlety of how regulation and finance interact in energy markets. First, it is important to differentiate between the challenges of scaling renewables as a whole versus scaling an individual renewable technology. When I spoke at the hearing about the scaling challenge I was focused on the difficulty of financing and scaling the production of an individual new innovation such as a new type of solar cell or a new type of wind turbine blade. The question focuses on how regional regulatory bodies drive the growth of a specific category like renewables as a whole.

PPAs and Public Utility Commissions do play a large role in dictating the growth of renewables as a whole. For the newer innovations they also play a role in that it is important that utilities be willing to sign PPAs for unproven technologies to assure the financing community that if it is built then the utilities will buy it. Without these PPAs, project financing is impossible. Unfortunately, some of the changes in the tax code have actually made it harder for utilities to sign prospective PPAs due to how they impact their debt-coverage ratios. However, even with these PPAs, emerging technologies still need to get to a sufficient scale and operating track record to be used in a power project. The PPA helps, but does not solve the scaling challenge for individual new technologies, which means we risk not having the technologies necessary to continue driving down the costs of new PPAs and supplying them with U.S. manufactured products.

It’s also important to note that the innovation credit we are proposing is targeted at innovation across the energy industry broadly. PUCs and PPAs influence only regulated electric power production and not the broader energy industry such as distributed generation, private power assets, fuels, etc.

There are many obstacles to deploying new technologies, but the lack of financing for the scale-up of new technologies is a fundamental barrier that prevents the United States from continuing to develop better, more cost effective solutions. If we don’t address this financing gap then we will not be the ones to supply the solutions to meet regulated demand.

RESPONSE OF WILL COLEMAN TO QUESTION FROM SENATOR WYDEN

Question 1. What sort of impact on investment would it have for an entity like the DOE to take an expanded and more defined role to evaluate and report on the

technical progress of different technologies that companies were developing? In effect, the DOE would serve as an impartial reporter to benchmark these technologies and make that information available to potential investors.

Answer. To the extent that such an expanded and more defined role for DoE would establish a two-way dialog between DoE and energy investors, such a role could be useful. To some extent, this already happens. While information exchanges with the national laboratories has been sporadic over time, ARPA-e has made a concerted effort to share its analysis of breakthrough technology areas with the investment community. The highly successful ARPA-e Summit may be the most visible example, but the ARPA-e program managers have been consistently striving to gather and share information and perspectives with the energy technology investment community about developments in their program areas and areas of opportunity that could be transformative for future programs.

Some of the programs under the Assistant Secretary of Energy for Energy Efficiency & Renewable Energy have also been diligent in seeking industry input, both in terms of the realistic goals they should set for their programs and in terms of technology developments that are most likely to help them achieve those goals.

The value of a benchmarking program depends on the objective. It could be useful for creating more transparency about the state of technology development such that research and investment is not wasted on duplicate efforts or irrelevant performance targets. However, if the hope is to reduce the perceived risk of a new technology to make it easier to finance, technology qualification is not the primary issue. Many independent engineering firms exist that provide qualification and performance assurances. The risk associated with a novel technology that makes it hard to finance is a combination of technology, execution, market-timing, counter party (exacerbated for small companies), and lack of residual value if a one of a kind technology fails. Large amounts of capital and time may be required to build a first plant at a scale that produces a cost-competitive product. Benchmarking by the DOE may complement what independent engineering firms are doing, but it is one piece of the equation.

Any effort to create a more significant role for DoE to evaluate and report on technological progress would have to: (1) establish robust two-way communication channels between the technologists at DoE, on the one hand, and technologists in the investment and entrepreneurial community; (2) work in real time, by making fast-changing technology developments the center of the dialog; and (3) be transparent to, and open to sometimes critical input from the full scope of the technology community—including academia, corporate research labs, government research labs, technology investors, entrepreneurial technology companies, and technologists in similar non-US institutions. A real-time, two-way dialog is critical to the investment community as technology advancements occur frequently, and analysis needs to up to date to be useful.

RESPONSES OF RICHARD KAUFFMAN TO QUESTIONS FROM SENATOR SCHATZ

Question 1. Most of the discussion at this hearing focused on options for creative financing policies for large entities building utility-scale projects. It is important to examine the suite of financing ideas directed at consumers for distributed generation and efficiency investments. Ideas such as property assessed clean energy (PACE), on-bill financing (similar to PACE but financed through electric bills instead of property taxes), and leasing structures (largely for residential solar), are three of the most often discussed methods.

Please discuss how financing structures directed directly to consumers can be helpful to clean energy deployment relative to structures such as a national green bank or innovation tax credit. How effective are these structures at spurring demand and overcoming high up-front costs to consumers? Designed properly could they be more effective than current federal tax credits, or are these credits also necessary? Are you aware of any barriers to smaller-scale financing efforts?

Answer. Financing obstacles manifest most acutely in small renewable energy and energy efficiency projects. Bank capital rules make it difficult for banks to lend to smaller projects which, by their very size, are below investment grade. Without aggregation of smaller loans into instruments that can be sold to bond investors, bond markets cannot provide financing either. In fact, while the financing innovations highlighted in the question (solar lease, PACE, and on-bill recovery) offer benefits for consumers, the entities that may wish to offer these financing products have difficulty financing themselves because they have not been able to access bond markets for their underlying financing.

Moreover, large, utility scale projects can get access not only to bank and bond markets, but they have a much easier time tapping the limited tax equity market; smaller projects often can't get tax equity at any cost. Given that energy efficiency and rooftop solar are distributed solutions that can improve resiliency and help grid efficiency-and by definition are deployed at the individual building level-we cannot gain scale in advancing distributed solutions without addressing financing obstacles to smaller projects.

A national green bank along the lines of DOE's Loan Program Office would be helpful if it provided financing to wholesale intermediaries (finance companies and service providers) who served smaller customer segments. In addition, as discussed elsewhere in earlier testimony and in the following answers, a national green bank should standardize contracts, establish market standards for data, and aggregate smaller loans into large bonds that could be sold to the bond markets. Just as banks and other finance companies aggregate credit cards and car loans to sell into bond markets, these financial entities could similarly aggregate consumer related clean energy loans. As an early example of this approach, in August 2013, NYSEERDA sold a portfolio of residential energy efficiency loans to the bond market. Once there is a robust bond market that would provide underlying financing to entities offering financing to smaller projects, it may be that there is no further need for government involvement. Put differently, it is important to separate the roles of a national green bank in providing subsidy and the role of a state green bank in providing financing where market gaps make obtaining financing difficult. Many smaller projects do not require subsidy but instead require access to financing which bond market structures could provide.

It is not clear to me how an innovation tax credit would help in deployment of clean energy projects, unless its intent were to give a tax credit to deploy a more innovative product (a next generation solar panel, for example). If so intended, such a tax credit would face several obstacles. First, it is already difficult for exiting tax benefits to be monetized for smaller projects, so adding another tax credit will strain an already limited tax equity market. Second, banks only lend to technologies that they consider to be "bankable:" in other words, banks need to review performance of equipment for a considerable amount of time in the filed before lending against it. A tax credit might initially attract a customer to consider a new technology but without a government warranty or guarantee on equipment performance, a customer would be unable to get a loan. And the same is true for the tax equity market; since tax equity investors largely get a fixed rate of return over a period of time, they do not have much interest in providing capital to projects that use innovative technology.

Question 2. Several witnesses touched on this in the hearing, but it is important to further explore the effectiveness of county and state-level policies to support clean energy financing versus similar policies at the federal level. In recent years it seems safe to say that certain states have had far more success at implementing innovative programs than Congress. My home state of Hawaii is one example. We are making good progress in implementing the Hawaii Clean Energy Initiative, which establishes aggressive clean energy standards. In addition, the state legislature recently passed a Green Market Securitization Program (GEMS) which uses on-bill financing for residents of all income levels to avoid the high up-front costs associated with solar panels.

How effective can these state programs be, relative to federal government efforts, which invariably will have more financial resources? What is the opportunity for establishing regional initiatives-a "New England Green Bank" for example-that pool resources from multiple states. Would such a structure even be desirable?

Answer. There are several reasons that states and local level entities should play a role in financing of clean energy projects. The projects are local, building codes are local, much utility regulation is done locally, and it is increasingly clear that local communities can play a major role in stimulating interest in and demand for projects. This last point is particularly important in both residential solar and energy efficiency. Community involvement in residential solar can lower costs by as much as 25 percent since a service provider gets scale of installations. In residential energy efficiency, the challenge is less financing and more a result of a low level of demand; community involvement seems to show the most effective means of generating demand.

It is for these reasons that New York, along with several other states, is setting up a state green bank. As stated elsewhere in testimony and in answers to questions, it will work in partnership with intermediaries (financial institutions, service providers, or community groups) that are making progress with customers but where their growth is constrained by the lack of availability of financing rather than

cost of financing. The bank also intends to work in conjunction with other entities in establishing standards to encourage bond markets.

There are limits to what states can do alone, even large states such as New York working in collaboration with others (which we intend to do). First, states do not possess the borrowing costs of the federal government and therefore cannot offer the potential for providing subsidy. States must then use subsidies very scarcely; New York's green bank, as noted above, will emphasize opportunities where there are gaps in financing, rather than provide subsidy. The federal government can offer a financial guarantee that is superior to most states; such guarantee could provide assurance to financiers as to equipment performance or act as bond insurance to facilitate bond market instruments.

Question 3. Cheap financing is important to scale up renewable energy, and as a consequence, drive down costs. I agree with this in principle but since most renewables use power purchase agreements to sell energy to utilities, it seems that securing a long-term stream of income may be more important. Power purchase agreements typically need to be approved by Public Utility Commissions. Similar to transmission constraints, there may be other issues limiting the scaling of renewables even with improved financing. What are your thoughts on addressing these other issues? How do they compare to the need for cheap financing in terms of importance to the renewable industry?

Answer. While ongoing costs of renewable energy of electricity are very low in comparison to conventional generation since feedstock costs are zero, upfront costs are greater. Therefore, the challenge in achieving grid parity involves reducing all costs—hardware costs as well as a range of “soft costs” including customer acquisition and development costs, permitting, installation, and financing. The question above highlights the relationship between the importance of power purchase agreements (PPAs) and financing, although it is important to break the value of PPAs into two pieces. First, PPAs represent customer demand and since lower cost financing would reduce total systems costs, lower costs would increase the demand; put simply, through price elasticity of demand, lower costs mean more PPAs. Second, because upfront capital costs for renewable energy are inherently high, it is difficult to obtain either debt or equity financing without a long term purchase commitment.

The broader question is what other obstacles exist beyond financing costs that prevent utilities from entering into more PPAs. Even though Renewable Portfolio Standards (RPS) that states have adopted are the primary driver behind demand, this policy approach has some weaknesses. First, since overall demand for electricity in many parts of the US is low, utilities have limited inherent interest to add to generation of any sort. Second, utility scale renewable projects do not help in improving grid efficiency any more than conventional generation; in fact, given concerns about intermittency, renewable projects require some conventional backup. Smaller projects located near bottlenecks or in capacity constrained markets could help improve system efficiency, but few state regulators have created economic incentives for system efficiency; the industry and its regulatory regime is still oriented to deploying capital rather than on capital efficiency. Nor does the wholesale pricing regime adequately take in to account the value that distributed solar provides to grid stability.

In sum, removing financing barriers will go a long way to improve scale and adoption of clean energy, particularly for smaller projects, but financing alone is not enough. Getting the right market signals and regulatory rules are the other part of the puzzle.

RESPONSES OF RICHARD KAUFFMAN TO QUESTIONS FROM SENATOR WYDEN

Question 1. In your testimony, you recommended that the federal government should play a role to standardize contracts for small clean energy and efficiency projects, as well as collect data on these projects. Could you please expand on how the government would actually go about this standardization, and discuss how much of an impact you think it would have on clean energy deployment and job creation?

Answer. Federal government involvement in contract standardization and data collection could have a significant impact on clean energy deployment, which in turn will promote job creation and economic development across the United States. One particular area where the Federal government could play a role is through the bond market, as better access to bond market financing data would help advance clean energy. As one example, more than 70 percent of New York's homes were built before 1970; virtually all can be retrofitted with net savings to homeowners if there were adequate financing and business models to support the effort. To create bond instruments requires aggregating smaller loans into a single bond, and to accomplish aggregation requires standardization of contracts. In addition to aggregation,

certain data on credit quality or on equipment performance needs to collect on a consistent basis so that investors and credit agencies can evaluate bonds.

As it stands now, only large single projects (a large wind or solar park) with an investment grade power purchase counter party can issue bonds. Smaller projects or projects with weaker credit characteristics cannot access the bond market. As a consequence, there are many kinds of projects (commercial and industrial solar, most residential energy efficiency projects, combined heat and power projects, smaller wind projects) where financing availability is limited. This limited availability of financing means less clean energy deployed and less economic activity generated. The solar industry in the U.S. now employs more than 100,000 people. With greater access to financing through access bond markets and continued lowering of costs through scale, the number employed could grow much larger and the potential employment in energy efficiency becomes much greater.

While there are a number of banks, NGOs, and state governments working on these challenges, they are making only limited progress. The reason that there is a lack of standardization and inadequate data is that many market actors want to compete on a "closed architecture" basis; these actors include equipment manufacturers, utility companies that want to use their own power purchase agreements, and service companies that view specific equipment performance data as a proprietary advantage.

While federal leadership can help, to be clear, if the federal government merely acts as a "clearing house" in trying to standardize contracts and data collection, it will not meaningfully accelerate the creation of a bond market. To change the game requires actors with greater market power that will lead the industry to "open architecture" competition. A clearinghouse only acts as a facilitator to other actors that have decided that they want someone to play that role in their interest. Simply put, to make a difference, the federal government will need to play a direct role in the market itself.

There are two examples where the federal government can play an effective leadership role in accelerating the creation of the bond market. First, there are large energy efficiency and renewable energy projects deployed on federal and military facilities. None of these projects are financed with a structure that facilitates access to bond markets for financing or enables subsequent sales to bond markets. As a major customer, the federal government could use its market power to establish structures from which the private sector could also benefit. Second, for a restricted period of time, the federal government could provide a limited credit subsidy to borrowers; in exchange for receiving concessional financing, market participants would need to use certain standard contracts and supply certain data. Since rate payers would benefit from lower cost financing, public service commissioners would encourage utilities to standardize power purchase agreements.

Question 2. What sort of impact on investment would it have for an entity like the DOE to take an expanded and more defined role to evaluate and report on the technical progress of different technologies that companies were developing? In effect, the DOE would serve as an impartial reporter to benchmark these technologies and make that information available to potential investors.

Answer. This idea warrants further discussion with industry and investors. As there are third party testing laboratories (including universities and national labs) that already evaluate the technical performance of new technologies, it is not clear that there is any incremental benefit for an expanded federal "stamp of approval" on technical merits alone of a technology. We know from the experience with ARPA-E and the New York State Energy Research & Development Authority, that government investment in emerging technologies can attract multiples of subsequent private sector capital, but these involve not just an evaluation of technology but also government capital; it is hard to know whether the interest from the private sector is related to which factor. In addition, the challenges to financing are different for each stage of a company's development.

At the early VC (or pre-VC) basis, technology viability can (but not always) be the critical factor. However, other factors (the ability to bring down manufacturing costs, an effective publicity campaign en route to market, quality of management to execute plans and to attract and manage talent to grow a business are only a few examples) can typically become more important than the technology itself. As these are qualitative factors, they can be challenging for governments to assess.

In raising capital for deployment of technology, capital providers are worried about the longevity of product life, costs of operations and maintenance, and as a consequence, have doubts about warranty protection from companies that are new with limited financial resources. In short, the answer to this question can be determined by engagement with lenders and investors to ask if there are market gaps that can be filled by federal evaluation of technical progress. At a minimum, one

could imagine a “Better Buildings” type of challenge with lenders and early technology adopters (including government facilities) volunteering to work with new technology providers whose technical milestones have been evaluated by DOE.

Question 3. Senator Sanders and I have introduced a bill to help states with residential energy efficiency retrofits. The new program would provide loans to states, which they could in turn use to reduce the cost of efficiency retrofit financing for consumers.

What are the programs New York has in place to help homeowners retrofit their houses, and how would money loaned to the state from DOE help your efforts?

Answer. At present, various New York State entities collect and spend \$1.4 billion per year on renewable energy and energy efficiency projects. Of this amount, approximately \$140 million is allocated for the residential energy efficiency sector through grants, rebates, and financing. While the Senate bill introduced would be helpful in providing a source of low cost financing to states, it is important to consider the following:

a. The trigger to a homeowner’s energy conversion decisions is not typically low cost financing. Instead, customers appear more motivated about issues of comfort or become interested in energy efficiency conversion when there is community involvement. While there is indeed a need to establish financing instruments and markets to support residential energy efficiency, the bigger problem today is creating the demand for projects rather than supply of capital to finance them.

b. Part of the challenge to generating more demand for home energy efficiency projects is that the cost of customer acquisition is very high. Each home is different and the costs of eliciting customer interest, visiting homeowners and evaluating projects are high. Again, the solution is less about providing cheaper financing and more about finding ways to lower customer acquisition costs for service providers by other policies that can stimulate demand. These include grants to communities to “energize” activity where towns generate community interest for energy efficiency projects, accelerate permitting where required, and provide information on retrofits.

c. In order to make the financing arrangement more permanent, the use of federal funds should be combined with efforts to establish data and standardized contracts to establish securitized energy efficiency loans. NYSERDA recently released a Preliminary Official Statement for \$24.3 million in Residential Energy Efficiency Revenue Bonds to finance and refinance loans issued through the Green Jobs-Green New York program to fund energy efficiency improvements in 1-4 family residences. This offering will be one of the first energy efficiency bond financings in the country, and as such, they represent a helpful innovation, but the bonds could not have been sold without a financial guarantee provided by the AAA rating of the State Environmental Facilities Corporation. There was insufficient history in underlying valuation and credit history for rating agencies to rate the bonds at a high level without a guarantee.

d. The provision of low cost capital by the federal government could be used to finance the capitalization of state green banks. As Hawaii intends to do, by lending to energy efficiency and renewable energy projects at a cost greater than the federal rate, states would lower costs of financing to projects, build an institution that is self-sustaining, earn a modest surplus to cover losses, and to repay the federal loan.

Question 4. Bond programs like the Build America Bonds I championed during the recovery dramatically increase infrastructure investment, making communities safer and creating jobs.

In general, I like programs that increase the efficiency with which Federal dollars are used to support clean energy, and analysis shows that direct-pay tax credit bonds like the ones I’ve just mentioned achieve this. Both the Treasury Department and the Congressional Research Service have said that direct-pay tax credit bonds like these enable the federal government to use small amounts of money, leverage large sums of private capital, and build clean energy projects.

What is the role for bond programs such as these financing both public and private clean energy projects going forward?

Answer. As in the answer to question three, federal credit support to local projects can leverage private sector capital and thereby deploy more clean energy. In assessing this kind of federal intervention, it is important to consider the same general concepts discussed above. First, not every project requires subsidized financing; many projects simply need access to financing (or in the case of residential energy efficiency, the main constraint may not be financing at all). Second, for those projects that would benefit from subsidized financing, the subsidized financing costs

need to be incorporated in market competition so that it has the effect of improving price elasticity of demand, perhaps best illustrated in lower power purchase prices (more contracts signed up because power prices can be lower because financing costs are less). Without the incorporation of lower financing prices in markets, the effect of subsidized financing incurs to project owners, increasing returns, and will not likely result in more deployment.

By the same argument, it is best, then, for subsidized financing to be predictable for a period of time so that an industry can achieve scale, which itself will lower costs. Third, federal credit support should “buy” more than just more project deployment. Support should help create structures that extend beyond the support itself; these structures create even more leverage. One example is helping to create financing structures that will facilitate bond market development and a second is using federal credit support to capitalize a green bank.

Question 5. During our hearing, my colleague Senator Coons described the bill he has introduced to allow clean energy companies to take advantage of Master Limited Partnership structures.

What do you think will be the impact of that legislation on investment in commercialized and innovative clean energy technologies? How would you compare the effectiveness of that legislation in increasing the competitiveness of renewables to the effects of current incentives like the production tax credit or investment tax credits?

Answer. Although equity in a clean energy project is a small amount of the capital required (in a typical wind or solar project, equity is around 10 percent), creating an MLP structure for clean energy will have a compounding effect well beyond a lower cost of equity (although it would lower the cost of equity by at least 25 percent). MLP structures would accelerate the creation of a debt market, since equity investors will have incentive—and market power—to collect data and standardize contracts. Put differently, MLPs will have a lower cost of equity and better access to liquidity than many competitors, and as a result will have influence through the value chain to drive standardization. The benefits of standardization extend beyond financing to other soft costs (e.g. permitting and installation). MLPs will also be able to act as aggregators for smaller projects which have difficulty accessing capital. And finally, once equity and debt structures have been established for large utility scale projects, it is easy to see an evolution similar to what occurred in investment grade debt markets where once investors become comfortable with market structures, they wanted an opportunity to earn higher yields that led to creation of the high yield debt market.

Clean energy MLPs could offer investors higher yields if they took more credit risk (e.g., commercial and industrial solar) or technology risk (e.g., run of the river hydro, landfill gas, and anaerobic digesters). In this way, MLPs would play the role that DOE’s 1705 loan program served in promoting deployment of innovative generation projects.

Question 6. What, in your opinion, were the most significant changes DOE made to the loan guarantee program in response to Allison and other reports, and what do you think remains to be done?

Answer. I was a Senior Advisor to Secretary Chu from September 2011 until February 2013. While my original mandate was to help the Department with clean energy finance policy, in the wake of the Solyndra bankruptcy, part of my duties included helping oversee the DOE Loan Program Office. (LPO). In this regard, I was a key point of contact with the Allison team. I agree with the valuation conclusions of the Allison report (and with others that have also been done): the actual cash losses to tax payers of the program will be substantially less than the credit subsidy appropriated by Congress to cover losses. The bulk of the portfolio consists of loans to power generation projects and to large auto companies, not to smaller, riskier manufacturing companies.

Nonetheless, there are improvements that LPO has made in monitoring the portfolio. While the LPO staff is highly professional, the key to making good credit and monitoring decisions is a culture where there are many eyes looking at a situation. It is in this area where there have been substantial improvements due to increases in portfolio management and risk management staff and in governance processes. The Risk Committee, in particular, has created a forum where all non-routine issues—from deviations in forecasts, to covenant changes, to decisions on funding—are thoroughly debated among the senior LPO professional staff and with members of Credit Committee. In cases where there are material issues relating to covenant relief, loan modifications or funding, or in rare cases where the Risk Committee is unable to arrive at a consensus recommendation, matters are elevated directly to the Secretary.

At the time I left the Department, work was ongoing to implement a couple of the Allison report recommendations, including creating an advisory committee to

the Secretary, made up of other executive branch members, that will review LPO credit processes and an improved management information system.

RESPONSE OF PETER W. DAVIDSON TO QUESTION FROM SENATOR MANCHIN

Question 1. Mr. Davidson, as you state in your testimony, your department has just released a solicitation for advanced fossil energy projects. The President announced that this would happen during his climate change plan announcement last month, saying \$8 billion worth of loan guarantees for Fossil Energy projects.

While this sounds good, it doesn't mean anything unless we actually approve a project and it gets built. The truth is that this \$8 billion was already available through a 2008 Fossil loan guarantee solicitation, yet the President didn't approve any projects.

For example, I know that the loan guarantee department reviewed an application for a coal to liquids plant in Medicine Bow, Wyoming, and from what I understand, your department completed the technical review of the project, but it hasn't been approved. If we offer funding but never approve any projects, that's just smoke and mirrors, and I'm concerned that's what will happen with this "new" solicitation.

I know that you are new on this job, but I wanted to know if you can comment on the status of the Medicine Bow project and why it hasn't been granted a loan. I'd also like your assurances that we will actually fund some of these projects that are ready to go and just need a little help.

Answer. While the Department cannot address individual applications that are under consideration, I can assure you we work to reach decisions on projects as expeditiously as possible. In an effort to improve transparency and involve stakeholders early in the process, the Department has made the draft solicitation available for public comment.

RESPONSES OF PETER W. DAVIDSON TO QUESTIONS FROM SENATOR PORTMAN

Question 1. Under Section 1703 of the Energy Policy Act of 2005, DOE loan guarantees are available for energy projects that avoid, reduce or sequester air pollutants and anthropogenic greenhouse gas emissions and that "employ new or significantly improved technologies" as compared to technologies currently in commercial use. DOE recently announced that it would be renewing its focus on power generation projects employing carbon capture technologies. Certain components of CCS projects employ established commercial technologies, including elements of the power plant itself, the CO₂ pipeline and the injection of CO₂ for EOR. I have been told that the integration of the capture, transport and storage associated with power generation has not yet been accomplished on a commercial scale in the United States, and that the inability to finance all of the components required for a successful CCS project is a major stumbling block to achieving commercial scale CCS.

Would the financing of a pipeline that is a critical part of a project to carry CO₂ from a first commercial scale power plant using a carbon capture technology to a field where the CO₂ can be used for EOR qualify for a loan guarantee under Section 1703?

Answer. When issued, the solicitation will seek applications for projects and facilities that cover a range of technologies. These technologies could include any fossil technology that is new or significantly improved, as compared to commercial technologies in service in the U.S. Applicants must show that their proposed project avoids, reduces, or sequesters air pollutants or greenhouse gas emissions. In addition to soliciting public comment about the technologies that DOE identifies in the draft solicitation, DOE welcomes comments that identify other technologies within its statutory authority that DOE should consider supporting through this loan guarantee solicitation.

Question 2. Mr. Davidson, as you know, the House and Senate Appropriations Committees have recognized the critical national role the American Centrifuge project (ACP) plays in our nation's national security, and has included language in their respective Energy and Water measure to authorize DOE to transfer up to \$48 million to compete the RD&D phase of the program. With the closure of the Paducah enrichment facility, the ACP, located in Ohio, will be the only source of domestic uranium enrichment needed to produce the tritium for the US weapons program. The government has committed \$200 million to date, in this RD&D program, which will result in advanced centrifuge machines available to partially meet the nation's future domestic enrichment needs. The commercialization of the ACP will create over 8,000 jobs nationally, with 4,000 of them in my state alone. Companies in 28 states are manufacturing the centrifuge machines.

As the RD&D is completed late this year, the applicant for the \$2 billion loan guarantee intends to update and reactivate their application. It is hoped that with the successful conclusion of the RD&D program, your loan division will have all the data necessary to expedite the department's consideration of the application. With all this current and new information and knowledge obtained from the RD&D program, there is an urgent need to avoid bureaucratic delays in the transition from RD&D to the loan guarantee. Significant delays could derail the national security benefits of moving forward with the ACP.

In that regard, I urge you to include the critical knowledge and expertise obtained by Oak Ridge, NE and NNSA, as they have been monitoring and observing the RD&D program on a daily basis. In order to make the most knowledgeable assessment of the merits of the application, the knowledge and data obtained by Oak Ridge, NE and NNSA are essential.

Does your office intend to use the Department's collective expertise on this important technology by including Oak Ridge, NE, and NNSA in the loan guarantee review process?

Answer. During the due diligence process for any project, Loan Programs staff members collaborate with a wide range of experts and advisors to make the most knowledgeable assessment of the project's technology and creditworthiness, including, for example, relevant programs throughout the Department, DOE labs, and third party financial, technical, and legal advisors.

RESPONSE OF PETER W. DAVIDSON TO QUESTION FROM SENATOR SCHATZ

Question 1. Cheap financing is important to scale up renewable energy, and as a consequence, drive down costs. I agree with this in principle but since most renewables use power purchase agreements to sell energy to utilities, it seems that securing a long-term stream of income may be more important. Power purchase agreements typically need to be approved by Public Utility Commissions. Similar to transmission constraints, there may be other issues limiting the scaling of renewables even with improved financing. What are your thoughts on addressing these other issues? How do they compare to the need for cheap financing in terms of importance to the renewable industry?

Answer. Each project faces three major costs: equipment and labor, financing costs, and "soft costs", which represent permitting and other regulatory matters. While access to debt financing on reasonable terms is a critical component for the health of any industry, you are correct that it not in itself sufficient to ensure the viability of that industry. One issue that DOE cannot address through the Loan Programs Office is soft costs, such as the time it takes a project to achieve approval from a public utility commission. However, an industry can only become financeable by debt if it addresses many of the other concerns you allude to, including technological feasibility, regulatory compliance and creditworthiness.

RESPONSE OF PETER W. DAVIDSON TO QUESTION FROM SENATOR WYDEN

Question 1. In your testimony you gave a very brief overview of the actions DOE has taken to respond to feedback from audits of the loan programs by the GAO and Herb Allison. Could you please expand on this overview to discuss these actions in greater detail?

Answer. Please see the table below which tracks LPO's efforts to address all issues raised by the GAO, DOE IG, and Mr. Allison.

ISSUES RAISED AND ACTIONS TAKEN
BY THE LOAN PROGRAMS OFFICE

ISSUES ¹	LPO ACTIONS TO ADDRESS	STATUS
1. Personnel: Fill key management positions	Hired an Executive Director, Director of Risk Management, Permanent Chief Counsel	Completed
2. Internal Oversight: Risk function is not sufficiently strong and independent	Created a Risk Management Division, consisting of credit origination, credit review and compliance, and enterprise-wide compliance. Hired a Director of Risk Management.	Completed
3. External Oversight: Not sufficient external oversight, particularly for "best practices"	DOE is in the process of forming an Advisory Committee comprised of senior government officials from other government financial and lending institutions, such as OPIC, Ex-Im Bank, Department of Treasury, and USDA. This board will advise the Programs on best practices for both underwriting and portfolio management.	On-going
4. Application Process: Application process is slow and unwieldy	Developed and employ state-of-the-art proprietary workflow management system that includes an online application portal. Electronic submissions of applications through the portal have reduced average application review times by nearly 80 percent.	Completed
5. Records Management: Records management system is insufficient	Developed and employ state-of-the-art, centralized data system (Documentum) that is fully populated with records for all of the closed and conditionally committed transactions and is fully integrated with our portfolio management system (Quicksilver). Over 16K separate files and 27GB of data are stored. Revised records management protocol to better integrate document and records management into our daily business practices, ensuring that our records management practices continue to meet or exceed all applicable standards, regulations, and best practices.	Completed
6. Projects with No Offtake: Projects without a fixed-price offtake have caused all of the LPO losses to date	Revised the structure of the loan disbursement requirements for such loans, particularly those that are manufacturing. Originally, on manufacturing deals, we disbursed the loan funds in connection the initial manufacturing line (Solyndra). Now, we require many conditions to the first disbursement, including that the	Completed

¹ These are concerns that have been identified by LPO, GAO, IG, Independent Consultant's Report (Allison Report), and other third party reports (including some from Congress).

QUESTIONS FOR THE RECORD
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7.	<p>Early Warning System: There needs to be better formal communication to DOE about management of the C&ES loans.</p>	<p>First manufacturing lines performing as expected. This new structure has meant that manufacturing projects receive little to no loan funds until their business models are proven.</p> <p>EPCO has improved, and will continue to improve, processes and systems for proactive monitoring, loan administration, compliance, reporting, and resolution necessities.</p> <p>EPCO provides the following reports to the following entities on a regular basis:</p> <ul style="list-style-type: none"> • Annual credit reports to Risk Committee, CFO, CEO, OIG • Weekly watch list reports to Risk Committee, DOE Senior Management, OIG • Monthly watch list reports to OIG (sent out at the request of OIG) • Monthly portfolio reports to Risk Committee, DOE Senior Management, OIG (to commence after scope is confirmed with the new Executive Director) • Quarterly watch list reports (to commence after scope is confirmed with the new Executive Director) to Risk Committee, OIG, DOE Senior Management, OIG 	Ongoing
8.	<p>Lessons Learned No formal "Lessons Learned" process</p>	<p>The update policy and procedure manual (which is currently in draft form) and expected to become final will summarize in separate lessons learned, as do the day-to-day activities of the EPCO.</p>	Ongoing
9.	<p>Interagency Process: The interagency process is cumbersome, not user friendly, and not transparent.</p>	<p>EPCO and Treasury have started into an MOU regarding the interagency process for any future C&ES projects.</p>	Ongoing
10.	<p>Policy and Procedures Manual: Regularly update the EOP's policies and procedures manual to reflect current program practices to help ensure consistent treatment for applications to the program.</p>	<p>The policy and procedure manual has been updated and such updates, as they are expected to be completed in the near future.</p>	Ongoing
11.	<p>Public Communications: Improve reporting to and communication with the public.</p>	<p>EPCO has updated website to include more information pertaining to the public and its communications and will continue to update the website as program progress.</p> <p>EPCO will have to meet stakeholders directly, as they may require and consider comments from the</p>	Ongoing

		public before officially issuing it.	
12.	Credit Re-Estimation: Policies, procedures, and internal controls for the credit re-estimation process need to be improved	The Loan Policy Committee meets regularly and is comprised of portfolio, origination, and credit, with support from Summit (contractor that is in charge of the credit subsidy model). In conjunction with OMB, the Committee has revised the model to address errors and incorporate best practices.	Completed
13.	Law Firm Waiver Tracker: No formal tracking system for managing law firm waiver requests	Developed and employed a formal tracking system.	Completed
14.	Strategic Planning: Engage in long-range strategic planning	A three-year strategic and operating plan is currently under review. LPO is in the process of evaluating how its performance goals and measures align with the Department's goals. Performance measures for these goals will be incorporated in future solicitations.	On-going
15.	Application Tracker: Commit to a timetable to implement a system to track the status of applications and that measures overall program performance	LPO has an ongoing application tracker and continuously monitors several indicators of overall performance of the programs (e.g. project specific metrics such as greenhouse gases avoided or jobs supported)	Completed

RESPONSE OF ETHAN ZINDLER TO QUESTION FROM SENATOR MANCHIN

Question 1. Mr. Zindler, in your testimony you talk about how capital is still available for high quality clean energy projects, but that not as many of those projects are available. You also state that the demand for wind energy capacity is decreasing because many of the state mandates have been met or are already being met.

Is part of the problem here that those technologies are intermittent, and that's why they can't get the purchase agreements to hook up to the grid? And as a result, that's why they can't get financing?

It seems to me that we may be hitting a point where we need to do infrastructure upgrades—like adding battery storage and upgrading our electrical grid—before more of these projects can be handled by the grid.

Answer. These are very important points but I would be careful to avoid conflating them. Yes, there are indeed issues related the intermittency of renewable energy and there is little doubt that in the long run what will be needed are new power storage technologies that can ensure that clean power is available when it is needed most. However, by and large, the intermittency issue is not what we have seen hindering the most recent development of new clean energy capacity.

Capacity levels for renewables have been rising, but for the most part wind, solar, geothermal, biomass and other clean technologies still represent a relatively small enough fraction of overall generation. As a result, in most locations intermittency is not yet a major concern. Rather, it has been competition from low-price natural gas projects, the achievement of state-level renewable portfolio standard targets, and policy inconsistency on the Production Tax Credit that are mainly to blame for the current situation.

Looking longer term, as renewables begin to account for larger shares of overall generation, yes, there will inevitably need to be further power storage technology developed and capacity deployed.

RESPONSES OF ETHAN ZINDLER TO QUESTIONS FROM SENATOR SCHATZ

Question 1. Cheap financing is important to scale up renewable energy, and as a consequence, drive down costs. I agree with this in principle but since most renewables use power purchase agreements to sell energy to utilities, it seems that securing a long-term stream of income may be more important. Power purchase agreements typically need to be approved by Public Utility Commissions. Similar to transmission constraints, there may be other issues limiting the scaling of renewables even with improved financing. What are your thoughts on addressing these other issues? How do they compare to the need for cheap financing in terms of importance to the renewable industry?

Answer. Indeed, there are issues having nothing to do with financing inhibiting clean energy growth at the moment and potentially into the future.

One that immediately comes to mind is the need for streamlined permitting for small-scale photovoltaic installations. In the US, paperwork/legal costs associated with adding a PV system are far higher than elsewhere in the world, most notably Germany. The implications of this are clear enough: today, the “all-in” (capex) cost of going solar in California for a homeowner or small business is approximately twice as high as in Germany. One reason for this is the onerous amount of paperwork required to get the job done in California. (Another is that German installers have simply achieved greater economies of scale).

PV modules today cost less what they did just several years ago. Yet US consumers have yet to enjoy the full benefit of that price decline. The chart below demonstrates the gap between final system costs in Germany, Japan, and California while also showing how module prices have dropped. Clearly, more can be done to streamline solar permitting and to reduce all “soft costs” not associated with the photovoltaic equipment.

Small (<10kilowatt) photovoltaic system costs in Japan, Germany and California, \$/Watt (Source: BSW-Solar, California Solar Initiative filings, JPEA, Bloomberg New Energy Finance research)

Question 2. Most of the discussion at this hearing focused on options for creative financing policies for large entities building utility-scale projects. It is important to examine the suite of financing ideas directed at consumers for distributed generation and efficiency investments. Ideas such as property assessed clean energy (PACE), on-bill financing (similar to PACE but financed through electric bills instead of property taxes), and leasing structures (largely for residential solar), are three of the most often discussed methods.

Please discuss how financing structures directed directly to consumers can be helpful to clean energy deployment relative to structures such as a national green

bank or innovation tax credit. How effective are these structures at spurring demand and overcoming high up-front costs to consumers? Designed properly could they be more effective than current federal tax credits, or are these credits also necessary? Are you aware of any barriers to smaller-scale financing efforts?

Answer. These kinds of financing mechanisms are critical to the development of small-scale distributed clean energy capacity (photovoltaics primarily, but also micro-wind and other technologies). They also are vital to energy efficiency efforts.

The reality is that homeowners and many business owners tend to view their electricity consumption costs only on a marginal basis. That is, they recognize and are willing to pay a reasonable amount for power every month. Obviously, over months and years, these marginal costs add up to represent a major household burden or business cost. But smaller scale consumers rarely have either the capital or the willingness to pay “up front” for power.

This is where so-called 3rd party financing comes in and can be so critical. For photovoltaics, in particular, we have seen a dramatic expansion in options for customers to “go solar” without having to put up major sums of cash from the start. Companies such as SolarCity, Sunrun and others install systems atop customer roofs and finance those systems. The chart* below highlights the amount of capital these firms have raised from banks and other financial institutions that they in turn are using to finance small-scale photovoltaic systems. To date, these firms have raised over \$2bn cumulatively to support such efforts.

Our firm has written quite a bit on these issues in the past and I would recommend our June 2012 white paper entitled “Re-imagining US solar finance” which can be found here: <http://www.cohnreznick.com/sites/default/files/Re-imagining%20US%20Solar%20Financing.pdf>

The report seeks to explain the full range of new financing options being devised to foster deployment of distributed capacity.

Question 3. Several witnesses touched on this in the hearing, but it is important to further explore the effectiveness of county and state-level policies to support clean energy financing versus similar policies at the federal level. In recent years it seems safe to say that certain states have had far more success at implementing innovative programs than Congress. My home state of Hawaii is one example. We are making good progress in implementing the Hawaii Clean Energy Initiative, which establishes aggressive clean energy standards. In addition, the state legislature recently passed a Green Market Securitization Program (GEMS) which uses on-bill financing for residents of all income levels to avoid the high up-front costs associated with solar panels.

How effective can these state programs be, relative to federal government efforts, which invariably will have more financial resources? What is the opportunity for establishing regional initiatives—a “New England Green Bank” for example—that pool resources from multiple states. Would such a structure even be desirable?

Answer. It is worth noting that the state-level initiatives played a critical role in creating the boom in clean energy investment and deployment we’ve seen over the last decade. I would argue that the approximately 30 state renewable portfolio standards (RPS) provided the industry with far clearer guidance of policymakers’ intents than most initiatives offered at the federal level. Given that power generation is for the most part regulated at the state level, states will continue to play a leading role if the US wants to scale clean energy further.

In terms of “green banks”, Connecticut has made major progress developing its own. New York State, under the leadership of Richard Kauffman, is developing its own authority in this area. These types of institutions can play a vital role in fostering development of the newest technologies and promoting the roll-out of those technologies that have reached some level of maturity.

RESPONSES OF ETHAN ZINDLER TO QUESTIONS FROM SENATOR WYDEN

Question 1. What sort of impact on investment would it have for an entity like the DOE to take an expanded and more defined role to evaluate and report on the technical progress of different technologies that companies were developing? In effect, the DOE would serve as an impartial reporter to benchmark these technologies and make that information available to potential investors.

Answer. It certainly would not hurt for DOE to involve itself in this way though it should be noted that to some large degree this is already being done by private sector research firms, trade groups, and others.

That said, there is little question that the Energy Information Administration plays a critical role in setting benchmarks that are used by players throughout the

*All charts have been retained in committee files.

energy sphere. In recent years, EIA has made a concerted effort to stay more abreast of the latest pricing and other trends in renewable energy for its various reports. Our firm provides data and research to EIA which we hope the agency finds useful. EIA certainly seeks input from other private sector players as well.

Question 2. The Chinese have invested billions of dollars in US clean energy companies and projects in the last few years, in technologies ranging from solar, wind and batteries to clean coal, advanced engines, and shale gas. US taxpayers supported some of these companies and projects. But now, in several cases, manufacturing, operations, and even ownership of these companies is moving to China.

How concerned should we be about the major push the Chinese are making to lead the multi-trillion dollar global clean energy industry, much of which was launched here in US?

Answer. This is an enormously complex topic. I would direct the committee to a report our firm wrote in partnership with the Pew Center on the nature of US-China clean energy trade here: <http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/US-China-Report-FINAL.pdf>

One of the report's key conclusions is as follows:

"China's strength is more narrowly based on assembly and high-volume manufacturing. The data show that Chinese firms are relied on for large-scale manufacturing and high-volume assembly of finished products such as solar modules and LED fixtures, whereas the United States' strength lies in a wide variety of high-technology products across clean energy sectors. Domestic clean energy targets for solar and wind power in China have provided ready and proximate markets for rapidly expanding its manufacturing capacity and allowed Chinese firms to gain a competitive advantage in the global marketplace."

The US continues to be the world leader in developing the very newest clean energy technologies and in attracting the necessary venture capital that allows these technologies to flourish. The US also plays a key role in the most advanced forms of manufacturing of new products and of capital equipment. Where it has found difficulty competing is in manufacturing of products that have become commoditized and can be shipped across the globe at relatively low cost.

Question 3. During our hearing, my colleague Senator Coons described the bill he has introduced to allow clean energy companies to take advantage of Master Limited Partnership structures.

What do you think will be the impact of that legislation on investment in commercialized and innovative clean energy technologies? How would you compare the effectiveness of that legislation in increasing the competitiveness of renewables to the effects of current incentives like the production tax credit or investment tax credits?

Answer. Our firm has written a number of papers on this topic, some of which have already been provided to committee staff and all of which I will gladly share upon request.

In a nutshell, our view is that expanding access to MLPs would spur further clean energy deployment by potentially making more capital available at a lower cost. However, expanding MLP access should not be viewed as a proxy for extending other federal supports for clean energy, most notably the Production Tax Credit for wind. The PTC is simply a more potent policy tool for supporting development. It directly reduces the cost of building a new wind project for developers while the MLP takes a more indirect route to make an impact. There are also important questions to be answered about just how many projects would be moved into MLPs, given the nature of who owns these assets today and other issues.

Expanding access to MLPs would have the potential impact of raising the value of existing wind projects on the balance sheets of project developers. They could then essentially sell off such assets through the creation of an MLP that public market investors could buy stakes in. This would provide developers with new capital they could use to develop new projects.

This cycle would certainly prove positive for clean energy deployment in the US, particularly in the long run. But it would not have nearly the same direct stimulative impact that simply extending the PTC would.

It should be noted MLPs represent just one of several "exit vehicles" that developers are now seeking to exploit. These include Real Estate Investment Trusts, bond offerings, "yieldcos" (dividend-generating publicly-traded companies), and others. Each of these options allows developers to package up existing assets on their balance sheets into new entities they can then raise funds against via the public equities or bond markets. The public markets have thus far proven receptive to such exit vehicles and more are planned.

Our firm discusses all of these in a Aug. 16 research note entitled "Yieldcos, FAITs, and more: sizing the market for North American exit vehicles." We note the US could have up to 36GW of yieldco-eligible projects by 2014. But a considerably

smaller sub-set of that total (well under half) are likely to be candidates for MLP treatment. This research note has been sent to committee staff for review.

