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to the
House Committee on Natural Resources
Hearing on
"American Energy Initiative: Identifying Roadblocks to Wind and Solar Energy on Public Lands and Waters, Part II - The Wind and Solar Industry Perspective"
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Mr. Chairman, Ranking Member Markey, and members of the committee, my name is Dan Reicher and I am pleased to share my perspective on obstacles to renewable energy deployment on public lands. I am Director of Stanford University's Steyer-Taylor Center for Energy Policy and Finance and a faculty member of the Stanford Law School and the Graduate School of Business. I also chair the board of directors of the American Council on Renewable Energy (ACORE) and serve on the Board on Energy and Environmental Systems of the National Academy of Sciences and the board of directors of the American Council for an Energy Efficient Economy (ACEEE).

Prior to my role at Stanford, I was Director of Climate Change and Energy Initiatives at Google. Prior to Google, I was Co-Founder and President of New Energy Capital, a private equity firm that invests in clean energy projects and Executive Vice President of Northern Power Systems, a venture capital-backed renewable energy company.

Prior to my roles in the private sector, I served in the Clinton Administration as Assistant Secretary of Energy for Energy Efficiency and Renewable Energy, the Acting Assistant Secretary of Energy for Policy, and Department of Energy Chief of Staff and Deputy Chief of Staff. Earlier in my career I was a staff member of President Carter's Commission on the Accident at Three Mile Island and an Assistant Attorney General in Massachusetts.

In my testimony I will review the many obstacles to a long-sought goal: the successful deployment of renewable energy at large scale and reasonable cost in our country, with all the resulting economic, security and environmental benefits. Let me emphasize that siting renewable energy projects on public lands – the focus of this particular hearing – is indeed an obstacle to large-scale renewable energy deployment. But it is a relatively modest one and an obstacle that, to a large extent, the Department of the Interior under Secretary Salazar and the Department of Agriculture under Secretary Vilsack are effectively addressing.

What I worry more about more than *siting* renewable energy projects on public lands is successfully *navigating* the long and complicated road that takes a renewable energy technology from the first gleam in a scientist's eye and an early pilot project *all the way* to the routine construction and operation of hundreds of full-scale commercial plants with low-cost financing and good paying jobs on all kinds of land – private and public. And in this regard I am concerned that we are increasingly getting beaten in the race down this road by the European Union and Asia, in particular China. Thus, while in 2004 the U.S. was the focus of approximately 20% of total global clean energy investment and China accounted for just 3%, in 2010, China saw 20% of that investment and the U.S. 19% – and this investment gap is widening rapidly.

And Mr. Chairman, the stakes are very large. The International Energy Agency forecasts that over $5.7 *trillion* will be invested in renewable energy globally over the next two decades. 2010 alone saw over $127 billion invested globally in renewable energy project financing. Unfortunately, it is looking less and less likely that investment will be here in the U.S. As Will Coleman, a venture capital investor in clean energy companies, said in a recent Senate Energy and Natural Resources Committee hearing: *"We are not only seeing companies start here in the U.S. and then move overseas, but we are increasingly seeing companies start overseas and stay overseas."* And as we cede our competitiveness in renewable energy we are also losing the national security benefits that come with their development and deployment in our nation. As U.S. Navy Vice Admiral Ret'd Dennis McGinn told the House Select Committee on Energy Independence last December:

> *[W]ithout comprehensive clean energy legislation, market enhancing policies and decisive action by our nation, fierce global competition, instability and conflict over dwindling supplies of fossil fuels and increasing global warming will be a major part of the future strategic landscape. Moving expeditiously toward clean and sustainable energy choices can greatly lessen that danger, improve global and national economic security and help us to confront the seriously growing challenges of global climate change and energy insecurity.*

I would note that Admiral McGinn recently became President and CEO of the American Council on Renewable Energy.

Mr. Chairman, I strongly urge you to take a walk down this road to get a real sense about what it will take to put the U.S. back in the leadership position it once had in renewable energy. There is some merit in taking a look at renewable energy siting issues on federal lands and waters – the focus of this hearing – but if that is where you begin and end you will be seriously short-changing U.S. national security, competitiveness, job creation, and environmental protection. And as you look at renewable energy development on public lands and waters, let me make a critical point: deployed significantly and well, renewable energy technologies can actually be central to *protecting* these important public resources from the *impacts* of climate change such as habitat loss and species decline. Put simply, addressing climate change – through careful but significant development of zero carbon renewable energy sources on public lands and waters – offers a new strategy for stewardship of these public resources.

Mr. Chairman, your May 13 hearing on the subject we are addressing today saw several committee members and witnesses emphasize that the real problem for renewable energy development is not so much Interior Department permitting – which is being improved – but instead obstacles to getting a renewable energy project built and operating like a power purchase agreement, adequate financing, the availability of transmission, and reliable tax incentives. I would echo this conclusion The testimony that follows explores these and other obstacles to the successful deployment of renewable energy at large scale and low cost including inadequate R&D funding and the serious challenges of technology demonstration, commercialization, and cost competitiveness. I conclude by providing my perspective on the siting of renewable energy projects – solar, wind, and geothermal – on public lands and waters.

1. Obstacle: Inadequate Funding of Research and Development

The first step on the road to the successful deployment of renewable energy at large scale and low cost begins with research and development: a scientist or engineer pushing the boundaries of an existing technology, inventing an entirely new one, or advancing the basic science which underlies both. R&D funding by the U.S. government has played a pivotal role in energy technology innovation for decades, probably more than any other single source globally. As a 2010 National Academy of Sciences (NAS) Study concluded, "[f]ederally funded basic R&D provides the starting point for many (if not most) significant energy-related innovations, and federally funded assistance for technology development often is the catalyst for turning technological innovations into practical products that are sought in the marketplace. " With these practical cost-effective clean energy products come many benefits starting with significant job creation. They can also greatly reduce the price needed to control carbon emissions. And they can enhance national security by cutting dependence on foreign oil.

The good news is that U.S. has led the world over the last several decades in basic and applied research – both public and private – leading to major progress in a broad array of renewable energy technologies from solar, wind and hydropower to geothermal and biomass. The bad news is that more recently we have been increasingly starving U.S. federal energy R&D, while private sector energy R&D funding has also been declining. Measured in multiple ways we have a seen dramatic overall reduction in the *federal* commitment to energy R&D funding. The 2010 NAS study found that measured across different key research areas, federal R&D spending on energy in FY 2008 was approximately one-twentieth federal R&D spending on health, one-sixth of federal R&D spending on space, and one-fifth of federal R&D spending on general science. *Compared across time, the study found that energy R&D spending in FY 2008 accounted for approximately 2.6 percent of total federal (nondefense) R&D spending, a 10-fold decline from its peak of approximately 25 percent* in FY 1980.

In 2008, total U.S. RD&D spending on low-carbon energy technologies amounted to less than $2.5 billion, with just $500 million assigned to R&D for renewables. In contrast, the

National Institute of Health (NIH) received federal R&D funding worth close to $30 billion. Over the past fifty years, such generous funding for innovation in the health sector has created vast economic growth and jobs, ensuring U.S. global leadership in related technologies. It is time the energy sector followed this example.

Compared internationally, the NAS study found that U.S. spending on energy R&D as a share of GDP is considerably lower than that of several other leading industrialized countries. As an example, since 1990, Japan's energy R&D spending as a share of its GDP has remained at about 0.08 to 0.10 percent. In contrast, U.S. spending as a share of GDP continued to fall until about 1997, eventually leveling off at between 0.02 and 0.03 percent. It is worth noting that, from 1992 to 2007, Japanese government spending on energy R&D also exceeded U.S. federal spending on an absolute basis, even though Japan's GDP is about one third that of the United States. And the big new player on the block is China where in just the last couple of years government energy R&D funding has not only surged but U.S. companies are opening new research facilities. As an example, the Applied Materials Corporation, the world's largest supplier of the equipment used to make semiconductors, solar panels, and flat-panel displays, recently opened its newest and largest research lab in China.

All of this suggests that energy R&D is less of a national priority in the United States than in other industrialized nations. And while the 2009 American Recovery and Reinvestment Act provided a significant one-time increase in federal energy R&D expenditures, this is simply not the kind of sustained change in federal R&D spending that would indicate advanced energy technologies to be a high national priority. President Obama's recently released budget request for FY 2012 would provide $3.2 billion for DOE's Office of Energy Efficiency and Renewable Energy, a 44% increase over Fiscal Year 2010 and, within that, $1.1 billion for renewable energy programs, an increase of about $430 million over FY 2010. It would also provide significant funding for the offices of electricity, fossil energy and nuclear energy. If enacted, this budget would provide a significant increase in total spending in DOE energy programs -- to about $5.5B -- at a time of fiscal austerity but, as emphasized above, the potential returns from energy R&D are very large. And by comparison with federal R&D spending in other areas this spending level would still be relatively modest. The American Energy Innovation Council, a group of current and former CEO's from major American companies like GE, Lockheed Martin and Microsoft recently recommended that federal energy R&D spending should be increased to something on the order of $16 billion.

One particularly deserving recipient of federal R&D funding is the recently created Advanced Research Projects Agency-Energy (ARPA-E). DOE's ARPA-E has the potential to mirror the success of DARPA, within the Department of Defense. Designed to pursue an entrepreneurial approach to energy R&D, ARPA-E focuses on "out-of-the-box" transformational energy research that industry by itself cannot or will not support due to its high risk but where success would provide dramatic national benefits. Without adequate federal funding, however, the institutional promise of ARPA-E will not be realized. At present, ARPA-E is significantly underfunded, with current budget allocation under the recently passed Continuing Resolution of $180 million. This represents about

0.6% of NIH's annual funding and 6% of DARPA's annual budget. As a result, in its first year of operation, ARPA-E was able to support only 37 of the 3,700 proposals it received. President Obama has requested $550 million in the FY12 budget for ARPA-E.

In addition to public sector funding of energy R&D, transforming the U.S. energy sector to be more secure, competitive, and clean will also require a significant increase in *private* sector R&D. Compared with other U.S. industries, the U.S. energy sector currently spends very little on R&D as a ratio of sales, a standard measure. The NAS report, cited above, concluded: *"Private-sector funding of energy-related R&D is also critical for achieving the innovations needed to reduce GHG emissions on a large scale. Here too, however, the current picture for U.S. industries appears rather bleak."*

Data suggest that the current rate of R&D spending by U.S. energy industries is far below that of other industries. In 2006-2007, R&D spending for all U.S.-based companies in the top 1,400 global R&D performers was 4.5 percent of sales, while firms in 11 research-intensive U.S. industries spent an average of 6.5 percent. Three industries showed especially high percentages: pharmaceuticals and biotechnology (16.7 percent), software and computer services (10.6 percent), and technology hardware and equipment (9.6 percent). By comparison, R&D spending by top U.S. utilities (among the top 1,400 global R&D performers) averages 0.7 percent of sales. And utility R&D managers have reported that, due to deregulation, utilities were shifting their R&D focus from collaborative projects benefiting all utilities to proprietary R&D and from long-term advanced technology R&D (e.g., gas turbines and fuel cells) to short-term projects that would be profitable and provide a near-term competitive edge.

The level of private sector spending on R&D is motivated mainly by its value to a firm's profitability. The NAS study concluded that *"substantial increases in [private sector] energy-related R&D expenditures will occur only if government policies create conditions under which firms anticipate that such spending is likely to yield attractive financial returns in the foreseeable future."* These include the federal government's own commitment to energy R&D spending as well as policies that can help move R&D results down the road to successful commercialization

2. Obstacle: Demonstration of Technologies

We have seen a serious increase in recent years in venture capital investment in clean energy technology with $7.8 billion invested in 2010 alone. This investment generally moves energy R&D from the lab to a point where a technology is demonstrated at pilot scale and ready for initial commercialization and subsequent broad-scale deployment. There are a number of challenges in moving venture-backed clean energy technologies out of the lab to this point. A recent hearing in the Senate Energy and Natural Resources Committee considered global investment trends in clean energy technologies and the impact of domestic policies on that investment. Will Coleman, a partner at Mohr Davidow, a venture capital firm, discussed four obstacles that energy technology start-ups face in demonstrating their technologies are ready for initial commercialization.

First, energy markets are often difficult to enter for a new player because they are either heavily regulated or dominated by incumbents, and in the case of electricity markets we often have both. The patchwork of state and federal regulations is often difficult to navigate for any company, in particular a small start-up. Second, Coleman stressed that in the case of renewable energy technologies that generate electricity, the only road to market is often through utilities – and the public utility commissions that oversee them – both often risk averse. Market entry for these grid-based based technologies can often take five to ten years in the pilot stage and small deployments before a state public utility commission will typically approve cost recovery for broad technology deployment. This timeframe seriously dampens interest among many venture investors in renewable energy start-ups who often need to see growth much more rapidly.

A third challenge for most energy technology start-ups is that without operating track records, they are unable to get access to low cost capital to advance their technologies toward commercialization and full-scale deployment. This means that they typically need to raise higher cost equity or some combination of equity, mezzanine financing, and debt to build early plants. Often the latter two sources of lower cost capital are not available at this high-risk stage. And Coleman notes that this can have a perverse effect: *"if venture capital firms don't anticipate low cost capital being available to move these technologies to scale, then they are unlikely to invest in the early technology development in the first place."*

The fourth obstacle is that even where there are incentives and tax credits to support new technologies, many of them are not designed for small emerging companies. Startups do not have the balance sheets or track records of larger corporations and have trouble securing and monetizing the credits, incentives, and loans that have been made available. This often forces start-ups to enter into awkward third party relationships or go to market through the big incumbents, which can have dramatic impact on their value and, importantly, investor interest.

Coleman concluded in the Senate hearing:

> *"If time didn't matter, if we were not in a race to remain competitive in the global economy, if the private market valued our national security, the domesticity of our products, and the health and environmental impacts, then ideally we would let the market work to adopt the best solutions. Unfortunately, time does matter and the market does not value these national strategic interests. For these reasons, whether we like it or not, our government must play a proactive role in encouraging clean energy development."*

3. Obstacle: Technology Commercialization -- The "Valley of Death"

Moving down the renewable energy road, the step from R&D and venture capital-backed demonstrations to full-scale commercial projects and products may well be the biggest obstacle of all in the successful deployment of renewable energy at large scale and low

cost. This part of the road involves crossing the colorfully but accurately named "Valley of Death" that sits between the early stages in the research and development of an energy technology and its full commercial deployment.

Earlier in my career I helped form and lead a private equity firm to invest in clean energy projects. We worked with bankers, engineers, and construction firms to get real energy projects financed and built. It was at this firm that I reached the toughest point along the road to large-scale cost-effective deployment of renewable energy. Day after day we received investment proposals for energy projects with profiles that simply exceeded the risk threshold of our capital. Had the underlying technologies been proven in a lab? Generally yes. Had they operated in a pilot plant? Sometimes. Had they operated at commercial scale? Rarely. There were relatively few proposals that fit our investment profile. In the end, we used the biggest chunk of our capital to finance corn ethanol plants – a technology well proven at large commercial scale for decades.

It was at this firm that I first peered into the Valley of Death, seeing there the remains of hundreds of abandoned energy projects: based on exciting technologies supported by DOE or venture capital-firms; that worked well in pilot plants but died trying to get to commercial scale; from wind, solar, biomass and geothermal, to advanced coal and natural gas, transmission and distribution, nuclear power and beyond. We and most other private equity firms simply couldn't shoulder the risk in the commercial scale-up of an energy technology, where a *single* project can cost hundreds of millions or, in the case of nuclear plants, even billions of dollars.

It was interesting landing next at Google, where engineers spend months writing computer code for a new software product, test it, and then one day, in my simple terms, push a button and it's deployed. Google engineers make improvements to the product and then launch a new version. There are certainly tough engineering challenges and products that fail. It's just that with software, products generally succeed and fail faster and more cheaply than in the energy world. In the energy technology world, months turn into years, and years into decades, and billions can be spent on a single technology before even one commercial plant or factory is operating. In the Valley of Death companies struggle to obtain the financing needed to deploy their technologies at commercial scale – ironically, the very point at which their technologies could begin to have a meaningful impact on job-creation, energy security, and environmental protection.

The Department of Energy Loan Guarantee Program, to its credit, has been working hard to address the investment challenges of the Valley of Death for renewable energy and other technologies. As the program's director Jonathan Silver said in a recent Senate Energy and Natural Resources Committee hearing:

> *The Department of Energy's loan programs were designed to address these impediments and fill this financing gap. Loan guarantees lower the cost of capital for projects utilizing innovative technologies, making them more competitive with conventional technologies, and thus more attractive to lenders and equity investors. Moreover, the programs leverage the Department's expertise in technical due diligence, which private sector lenders*

are often unwilling or unable to conduct themselves.

The DOE loan program office administers the Section 1703, Section 1705, and ATVM loan and loan guarantee programs. The 1703 program, created as part of the Energy Policy Act of 2005, supports the deployment of innovative energy technologies. As a result of the recently passed 2011 Continuing Resolution, the program currently has $18.5 billion in loan guarantee authority for nuclear power projects, $4 billion for front-end nuclear projects, $8 billion for advanced fossil projects, $1.5 billion for energy efficiency and renewable energy projects, and $2 billion in mixed authority. In addition, and for the first time, the 1703 program, historically a "self pay" credit subsidy program, now has $170 million in appropriated credit subsidy, which will support a small number of loan guarantees for renewable energy projects.

The Section 1705 program was created as part of the American Recovery and Reinvestment Act of 2009 to jump-start the country's clean energy sector by supporting energy projects having difficulty securing financing in a tight credit market. Under the 1705 program, the credit subsidy costs associated with the loan guarantees are paid through funds appropriated by Congress. Additionally, to qualify for 1705 funding, projects must begin construction no later than September 30, 2011.

The ATVM program issues loans in support of the development of advanced vehicle technologies to help achieve higher fuel efficiency standards and reduce the nation's dependence on oil. Congress funded this program with $7.5 billion in credit subsidy appropriations to support a maximum of $25 billion in loans.

In the recent Senate Energy Committee hearing noted above, Jonathan Silver commented on the loan program's results to date explaining that between 2005, when the program began, and 2009, DOE did not issue a loan or loan guarantee. Mr. Silver said that since March 2009, the Department had issued conditional commitments for loans or loan guarantees to 27 projects, 16 of which have reached financial close. This represents nearly $30 billion in financing to these 27 projects, which have total project costs of nearly $47 billion and include an array of clean energy technologies, such as wind, solar, advanced biofuels, geothermal, nuclear, transmission, and battery storage. The projects include the world's largest wind-farm, two of the world's largest concentrating solar power facilities, the first nuclear power plant to begin construction in the United States in decades, the world's first flywheel energy storage plant, and a biodiesel refinery that will triple the amount of biodiesel produced in the United States. Project sponsors estimate that these 27 projects will create or save over 61,000 direct jobs and hundreds of thousands more indirect jobs, and generate enough energy cumulatively to power over two million households.

President Obama's FY 2012 request would provide $200 million in credit subsidies to support approximately $1 to $2 billion in additional loan guarantees for renewable energy and other technology deployment. It would also provide up to $36 billion in additional authority to loan guarantees for nuclear power projects.

Those of us watching from the outside have been impressed with the recent progress and professional skills of the DOE team, but continue to be concerned about the intricate multi-agency review process in the loan guarantee program and the great uncertainty of the yearly budgeting cycle. I and many others *across the energy technology spectrum* – from renewables to fossil to nuclear power -- believe that as long as the loan guarantee program remains as currently structured inside DOE, it will continue to be subject to these challenges. And I and many other observers of *the global clean energy race* believe that our country would be better served by taking a new approach to the critically important task of energy technology commercialization.

We support significant FY 2012 funding for the DOE Loan Guarantee Program to continue its important work in the near term. Congress should substantially increase the funding for credit subsidies to support renewable energy and other projects. Something on the order of $1.5 to 2.0 billion in credit subsidies, versus the $200 million requested, would support a good proportion of projects currently in due diligence. *However, over the longer term, supporting the financing of capital-intensive energy projects with serious scale-up risks – in close collaboration with the private sector – is not a good match for the current structure, oversight, risk tolerance, and financial tools of the Department of Energy.*

Commercializing energy technology requires a new more effective approach – and that approach is the Clean Energy Deployment Administration (CEDA). CEDA, in strong partnership with the private sector, could more effectively support the scale-up of clean energy technologies – and U.S clean energy competitiveness – than the current approach. CEDA, as developed over the last couple of years in the Senate Energy and Natural Resources Committee – on a bipartisan basis – would have an array of tools, such as loan guarantees, insurance products, and bonds to accelerate private sector investment. Initially funded with an appropriation of $10 billion, CEDA could become a self-sustaining entity – that is no additional appropriations – based on mechanisms in the bill that would allow it take financial stakes in projects. Also, while CEDA would be established as an agency within DOE it would have an administrator and board of directors, and enjoy an important degree of independence, like the Federal Energy Regulatory Commission, an independent arm of the DOE. *As one expert in clean energy finance put it: "CEDA is the current loan guarantee program with more tools and less fuss."*

In the Senate, CEDA enjoys bipartisan cosponsors and was adopted in the last Congress by the Senate Energy Committee on a bipartisan basis. The Senate bill has broad support including renewable energy trade associations, the Nuclear Energy Institute, and the U.S. Chamber of Commerce. In the House, a version of CEDA was added by a 51-6 vote of the House Energy and Commerce Committee to the Waxman-Markey bill.

Mr. Chairman let me emphasize that one way or the other – creating CEDA and/or making additional funding available for the loan guarantee program – we need to ensure that we provide a serious financing mechanism for moving U.S. clean energy projects through the Valley of Death. Opponents of these mechanisms are concerned about "the government setting industrial policy," "picking winners and losers," etc. These are

understandable issues but they do not recognize several key facts. First, virtually all our nation's economic competitors, including China, are providing major help to companies facing the Valley of Death. Congress, in part recognized this fact, when it created the loan guarantee program. Second, U.S. agencies, like the Export-Import Bank (ExIm) and the Overseas Private Investment Corporation (OPIC) regularly provide help that is not terribly different from the loan guarantee program and CEDA for U.S. companies wanting to build projects in other countries. *Mr. Chairman, it simply can't be that Congress intends to make it easier to help finance energy projects in India than Indiana.*

Third, and most importantly, if the DOE loan program office finds itself without additional funding next year, if the Section 1603 Grant program is not renewed (see below), and if the enactment of CEDA stalls, the federal government could find itself with almost no tools to help with the financing of higher risk energy projects, involving renewables and other technologies. This would be a terrible blow to one of the highest potential areas of U.S. economic growth – and job creation – over the next two decades.

4. Obstacle: Cost-competitiveness

Proceeding down the renewable energy road we now reach the stage where a technology has been proven to work at commercial scale but where it often can't yet compete fully because of higher costs than traditional technologies. The good news is that renewable energy costs have come down significantly over the last two decades with technology improvements and expanding manufacturing and deployment. At the same time, many of the renewable energy technologies still have some distance to go in terms of cost. This is where federal tax incentives, financing help, and related support have been so critical to the deployment of renewable energy in our country. It is also where state renewable energy standards have helped lower the cost of renewable energy and drive deployment.

Federal tax incentives help lower the delivered cost of a project or the energy it produces. There are two general categories: Investment Tax Credits (ITC) and Production Tax Credits (PTC). The ITC and PTC enhance renewable energy project economics, complement state renewable energy policies, and as such have been a major driver of growth. Yet these policies are incapable of sufficiently scaling renewable energy development for two main reasons. First, is the generally short-term nature of these tax credits and uncertainty surrounding their extensions. This has resulted in a wax and wane cycle for wind and solar development. For example, in 1999, 2001 and 2003 when the PTC expired, new U.S wind capacity decreased by over 75% from the prior year. This "on again, off again" behavior creates strong market uncertainty and causes abrupt changes in business investments and R&D spending.

The other significant drawback of the ITC and PTC is that they force renewable energy development to be calibrated around the projected availability and size of the tax equity market. Only investors with sufficient capacity to "monetize" the tax credit, i.e. with sufficient taxable income to off-set, can take advantage of them, forcing many renewable energy project developers to rely on third party "tax equity investors." This raises

financing costs, driving up the delivered cost of energy and driving down the public benefits the tax credits produce in terms of megawatts of renewable energy delivered.

The risks of tax-based incentives were seen in the recent ups and downs of the Investment Tax Credit for solar. The good news is that it was extended for eight years in 2008, providing an attractive degree of certainty for project investors. The bad news is that during the recent financial crisis and recession the renewable energy tax equity market shrank by 83%, from $6.1 billion in 2007 to $1 billion in 2009

To promote economic recovery, stimulate private investment, and maintain market momentum, the "Section 1603 Grant in lieu of tax credits" program ("Section 1603 Grant") was adopted in the 2009 American Recovery and Reinvestment Act to specifically address insufficient tax equity in the market and corresponding inability to take advantage of the PTC and ITC. The Section1603 Grant allows project developers eligible for the ITC and PTC to elect to obtain an equivalent grant from the Treasury Department in lieu of these credits. It has provided certainty for tax equity financing and boosted insufficient tax equity supply to meet developer demand. It originally required projects to begin construction by December 31, 2010 but in 2010 Congress extended this date to December 31, 2011.

As of May 2011, $7 billion in grants have been awarded to 2601 renewable energy projects leveraging approximately $22 billion in private sector investment. There is a rising view that the Section 1603 Grant is a more cost effective approach to providing incentives for renewable energy projects than tax credits. A study conducted by Bloomberg New Energy Finance estimated the 19,000 megawatts of wind installed in the U.S. between 2005-2008 – costing the government $10.3 billion via the PTC – could have been achieved with $5 billion in Section 1603 Grants.

There are a number of other market-based policy mechanisms that can help lower the cost of and drive private sector investment in renewable energy technology. Under a "feed-in tariff," eligible renewable electricity generators are paid a premium price for renewable energy they produce. Typically regional or national electric utilities electric are obliged to take the electricity. Feed-in tariff policies have been enacted in more than 60 countries and 12 U.S. states with impressive results in driving scale and cost reduction.

Another policy mechanism is a Renewable Electricity Standard (RES) that typically places an obligation on electric utilities to produce a specified fraction of their electricity from renewable energy sources. RES programs are often implemented through utility renewable energy systems or bidding processes for independently developed generation. In the latter approach, certified renewable energy generators earn certificates for every unit of electricity they produce and can sell these to utilities. The utilities then pass the certificates to a public utility commission to demonstrate their compliance with their regulatory obligations. RES programs can promote significant competition and innovation allowing renewable energy to compete with cheaper fossil energy sources. RES-type mechanisms have been adopted in 29 U.S. states as well as several countries.

Congress has been considering a national RES for several years. The Senate Energy and Natural Resources Committee adopted an RES in 2009 in the American Clean Energy Leadership Act. The Waxman-Markey bill, enacted by the full House in 2009, contained an RES. More recently, President Obama proposed a broader Clean Energy Standard requiring that the nation derive 80 percent of its electricity from a broad array of clean energy technologies by 2035. The Senate Energy Committee is considering the proposal.

5. Obstacle: Siting

Having moved a renewable energy technology to a point where it works at full scale and where the energy it produces can be sold competitively, at least with attractive financing and some reliable incentives, the issue of siting now is worth a look. Public lands hold significant potential for renewable energy development. The Interior Department estimates that more than 23.000 megawatts of utility-scale solar is reasonably foreseeable to be developed on public lands in the desert southwest. Offshore, DOE's National Renewable Energy Lab estimates that the wind potential off the coasts of the lower 48 states exceeds the entire U.S. electricity generating capacity. And U.S. geothermal potential, using traditional and advanced technologies, is estimated at roughly half of U.S. electricity generation. Although not without some challenges, the Obama Administration has stepped up well to siting renewable energy on public lands.

In May, the Departments of Interior and Agriculture issued a major report – "*New Energy Frontier: Balancing Energy Development on Federal Lands*" – that reviews issues associated with the development of both renewable and conventional energy on Federal lands, both on and offshore. The report emphasizes that these lands have:

> *"[V]ast potential for renewable energy production from wind, solar, geothermal, hydropower, and biomass that – together with conventional energy sources – can contribute to the Nation's energy security and to the clean economy of the future. However, the development of these energy resources must be carried out in balance with many other uses and values that serve the public interest and support the quality of life American citizens enjoy."*

Both Secretaries Salazar and Vilsack have developed strategies to advance renewable energy development while balancing these other important interests. These strategies include: developing research, policy and management tools to minimize impacts of energy development; supporting key agencies like the Department of Energy, Federal Energy Regulatory Commission, and relevant state agencies; and involving interested stakeholders. The May report from the two Departments emphasizes that:

> *"[T]he renewable energy strategies of both the DOI and USDA are guided by the fundamental belief that renewable energy for America will allow us to diversify energy sources and ultimately reduce our reliance on fossil fuels. The development of new renewable energy sources need not come at the expense of our Nation's natural and cultural heritage. If promoted and sited in a thoughtful*

way, new energy development can, instead, contribute to conservation and protection of the environment."

Two of the biggest renewable energy siting issues on public lands have involved solar projects on desert lands and wind farms off the Atlantic coast. Siting issues around geothermal energy projects – an important renewable energy technology with a vast resource and 24/7 operation – is also worth consideration.

a. Desert Solar

Some of the best solar resources in the world are located on public land overseen by the Interior Department's Bureau of Land Management (BLM) in Arizona, California, Colorado, Nevada, New Mexico, and Utah. Federal agencies have developed extensive processes to authorize use of these lands for a variety of purposes, including recreation, grazing, mining, and energy development. There is also great potential for these lands to produce safe, clean solar energy, yet limited agency action has delayed the permitting of solar projects for years. By contrast, over the past 20 years, federal agencies approved about 74,000 oil and gas drilling permits.

In June 2009, Interior Secretary Salazar moved to "fast-track" development of solar energy projects on federal lands. First, by secretarial order, he withdrew from other development activities 670,000 acres in 24 potential solar energy zones that had been identified through a number of different processes. At the same time, Interior kicked off a long-term planning process based on a Solar Programmatic Environmental Impact Statement (SPEIS) to designate priority areas for development in the longer term, beginning with the study of the 24 zones.

At the time of these announcements, BLM had already received 155 applications for solar installations. Since existing statutes provide specifically for leasing federal land for oil, gas and geothermal activities but *not* for solar energy, these applications were received under the authority of a grant of a federal Right of Way under the Federal Land Policy and Management Act (FLPMA). Secretary Salazar announced that when the SPEIS was completed, that document would guide considerations of applications going forward but that pending applications would be evaluated based on interim standards.

The Secretary also announced that a set of fourteen large projects, which had greater potential to be permitted and begin construction by the end of 2010, would be given special "Fast Track" status. These projects would not be subject to less stringent environmental analysis, but they would receive priority attention from federal regulatory officials. This December 2010 date was critical because, at the time, the Section 1603 Grant Program (see above) could only be claimed for projects that started construction by December 31, 2010. For many of these large projects, the ability to monetize tax credits was critical to their ability to secure financing because the recession froze – and continues to negatively affect – credit markets and available tax equity.

Under California law, concentrating solar thermal power projects (which use mirrors to boil water, create steam, and drive a turbine to generate electricity) are treated as power generation facilities and must be permitted, like all other power plants, by the California Energy Commission, even if they are located on federal land. (Solar photovoltaic facilities, however, do not fall under the California power plant jurisdiction and only need Interior Department approval.) Thus, solar thermal projects have to move through two separate regulatory processes and two separate environmental analyses, one under the federal National Environmental Policy Act (NEPA) and one under the California Environmental Quality Act (CEQA). To avoid this duplication, and to make certain that the State and federal agencies were fast-tracking the same projects, Interior Secretary Salazar and then California Governor Arnold Schwarzenegger signed a Memorandum of Understanding in October 2009 to integrate the two processes.

As a result of this more coordinated and focused program, nine large solar projects were approved by the BLM prior to the end of 2010, seven using concentrating solar technology and two using solar photovoltaics, comprising a total of about 3650 MW. Six of these projects are in California and three in Nevada. In addition, the California Energy Commission permitted an additional 1100 MW of solar thermal capacity in 2010 that is not on federal land.

Looking ahead, the further development of utility-scale solar in the Southwest faces some challenges. These include finalizing the SPEIS which, done well, can help provide predictability and speed in the permit process by steering solar development into Solar Energy Zones (SEZ) where the solar resource is high, which are near existing transmission (or to which transmission will be constructed), and where there are few environmental conflicts. Solar project developers have raised concerns that the Solar Energy Zones (SEZ), as currently conceived, do not adequately evaluate the suitability of the proposed zones from a technical, environmental, transmission, and cultural perspective and therefore make planning more difficult. Further, some of the developers have stated that successful application of the SEZ approach will likely require a larger universe of solar zones than is described in the draft SPEIS and flexibility in expanding the zones.

A broad group of solar developers and environmental organizations have joined together to suggest establishing Areas of Facilitated Development (AFDs) for utility-scale solar development. AFDs would be established, based on: technical criteria (e.g. insolation, slope); low conflicts with biological, cultural, and other resources; and access to transmission and proximity to load. Solar developers have said that AFDs could provide real incentives for development within their boundaries, such as project-specific Environmental Assessments instead of broader Environmental Impact Statements and assurance of transmission interconnection. AFDs could also be large enough to allow for siting flexibility, and BLM could establish a clear process for expanding AFDs and adding new ones.

As indicated above, to a large extent, issues related to the *permitting* of solar on public lands are being addressed by the Interior Department in coordination with developers and

environmental organizations. The current challenges in solar energy development have little to do with permitting issues, but instead the current unpredictability of federal incentives, financing help, and other programs. If there is one refrain we hear constantly from industry it is this: "We need a consistent long-term energy policy from the federal government." As discussed above, the Section 1603 Treasury Grant program's deadline for start of construction was extended in November 2010 but only for one year. Also, as noted, important components of the federal loan guarantee program added by the American Reinvestment and Recovery Act, which have been instrumental in promoting solar energy development, will expire September 30, 2011 unless extended. These challenges will likely cause many projects to be delayed.

Added to these policy and market uncertainties is the balkanized jurisdictional system in the U.S. for making needed upgrades to the transmission system to improve access to renewable generation and simultaneously enhance grid efficiency and reliability. While the Federal Energy Regulatory Commission (FERC) and a number of state public utility commissions are struggling with these issues, there is a pressing need for more regional multi-state/federal cooperation – and for Congressional attention – to address these problems. This industry cannot flourish without multi-state and federal cooperation on transmission issues in the southwestern states.

It is the lack of predictability and consistency of federal incentives and financing help, and the need for greater federal leadership on regional transmission planning, which are the major barriers to the growth of the utility-scale solar industry today. Federal permitting of solar projects on federal lands needs continued attention, and must be further improved, but that effort is on course.

b. Offshore Wind

Although existing law governing energy development on the Outer Continental Shelf was designed for oil and gas, not for offshore wind or wave energy, the Obama Administration has moved expeditiously to design and streamline the permitting process and help build an offshore wind industry. First, for years there had been serious and unresolved disputes among federal government agencies about jurisdiction over off-shore wind and wave development, particularly between the Federal Energy Regulatory Commission (FERC) and the Department of Interior's Minerals Management Service (MMS). The Obama Administration settled this dispute through a Memorandum of Understanding between the two agencies signed in March 2009.

Second, in April 2009, MMS issued a final "Renewable Energy Framework" rule specifying the steps necessary to permit an offshore wind farm. Third, shortly thereafter MMS announced a decision to issue "limited leases" for five years for sites off Delaware and New Jersey, based on its own completed environmental analysis. These leases would allow developers to erect meteorological towers to test wind conditions and do other studies for potential wind farms. MMS issued four leases to three different companies

later that year. These sites had been narrowed down from 40 initial nominations and 16 areas chosen for potential study.

In the spring and summer of 2010, considerable uncertainty was generated by how the environmental analysis required under the National Environmental Policy Act (NEPA) and other environmental statutes would be integrated with various stages of the permit process. Concerns were also raised by several states eager to go forward with off-shore wind about the federal process, in particular about the Cape Wind project in Massachusetts that had struggled for nearly a decade to secure the nation's first off-shore wind permit.

In response to this uncertainty, the Department of Interior, which had already worked with coastal state governors on joint state-federal planning for off-shore wind development, resolved the Cape Wind issues, and issued a permit. In November 2010, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), the successor agency to MMS, announced the "Smart From the Start" program to streamline the permitting and NEPA requirements for off-shore wind. BOEMRE announced: that it had identified targeted areas off North Atlantic states as zones for off-shore wind farms that had local support and few environmental conflicts; that coordinated environmental studies including Environmental Assessments (EAs) under NEPA would be performed by the federal and state governments for these targeted areas; and that within a year thereafter leases could be advertised and entered into by developers.

Earlier this year, Secretaries Chu and Salazar announced the first joint departmental "National Off-Shore Wind Strategy" including final designation of the targeted zones off Delaware, Maryland, New Jersey and Virginia that would be the subject of accelerated environmental analysis leading to prospective leases. At the same time, DOE announced $50 million in grants aimed at improving turbine blade design for increased efficiency, reducing market barriers, and supporting research into "next generation" drive trains. Gearless or "direct drive" wind turbines now under development are expected to have many fewer maintenance requirements than current products, which is important for off-shore facilities because of the high cost of accessing these machines.

The principal barriers that now confront the development of offshore wind off the Atlantic Coast today are not permitting and NEPA barriers, they are market barriers. The Cape Wind project off Massachusetts has its permit, but must still negotiate a power purchase agreement for the second stage of the project under less favorable market conditions than when it signed its first agreement, and then find financing. As discussed above, the future of the DOE loan guarantee program is highly uncertain, the Section 1603 Grant program is expected to expire at the end of this year, and tax equity investors are still scarce. The large capital investment required, low natural gas prices leading to lower off-take prices, and the lead-time required for a project all combine to make it more difficult to successfully develop an offshore wind facility today.

If we are to see significant development of offshore wind, with substantial associated domestic manufacturing, we need to ensure predictable and sustained demand at a

reasonable level. This can be done through federal policy and, perhaps more expeditiously, through the federal government promoting and supporting regional and state efforts to procure offshore wind. This may include the federal government encouraging Regional Transmission Organizations and Independent System Operators, such as the PJM Interconnection, the NYISO, and ISO New England to plan for large-scale transmission that will facilitate the development of significant offshore wind projects rather than rely on individual developers to plan and pay for separate tie lines for each offshore project. The lack of coordinated federal policy that addresses all barriers to creating an industry will leave a valuable clean energy resource – in the vicinity of large population centers – largely untapped. If we want to encourage a robust offshore wind industry, like that which has developed in Europe and now is expanding rapidly in China, further incremental streamlining of permitting and related environmental processes would be helpful, but this is only a small piece of the interrelated set of factors inhibiting growth of the industry.

c. Geothermal

Geothermal energy is a 24/7 resource providing clean base-load power in utility-scale quantities. The federal government figures prominently in the future of geothermal energy in the U.S. First, approximately 90% of known hydrothermal resources lie under Department of Interior and Department of Agriculture lands. Second, as of 2005, approximately half of US geothermal production occurred on federally managed lands and many of the 7,000 megawatts of geothermal projects currently under development will be developed on federal lands. Third, much of the nation's advanced geothermal resources such as Enhanced Geothermal Systems and Geo-Pressured Geothermal -- which exceed 500,000 megawatts of potential -- lay beneath federal lands in the west.

Compliance with NEPA and other federal and state environmental laws add complexity throughout the development cycle. After a lease has been acquired, completing the necessary permitting for even initial exploration drilling can take well over a year – adding cost, risk, and time to project development. The good news is that BLM is stepping up to the plate as an active development partner. In 2008, the BLM, as well as the U.S. Forest Service opened over 190 million acres to geothermal exploration and leasing, potentially facilitating an additional 11,100 megawatts of hydrothermal development by 2025. And the Obama Department of Interior has moved aggressively to accelerate geothermal development on federal lands including:

- Leasing dozens of parcels of land in California, Idaho, Colorado, and Nevada;
- Approving the 236-mile ON Line transmission project connecting Las Vegas to geothermal zones in northern Nevada;
- Fast tracking over 200 megawatts of geothermal projects in Nevada for approval;
- Reaching an agreement with Colorado to accelerate geothermal permitting.

Additionally, the Department of Energy has reinvigorated the Geothermal Technologies Program, investing in badly needed new technologies and demonstration projects.

Conclusion

Wrapping up, I spent the last four years at Google helping to develop and implement the company's approach to energy policy, investment and technology. Coming from the energy sector, I was struck at Google by how innovation, investment and policy came together so effectively to help build an entirely new industry – the Internet – that has fundamentally transformed life as we know it and created vast numbers of good paying U.S. jobs. The federal government had a large role in the creation of the Internet, providing early R&D support and becoming one of its initial users. Critical policy decisions by Congress, a series of Democratic and Republican Administrations, and regulatory bodies like the FCC, set smart rules of the road for development and use of the technology. Trade policy has helped ensure opportunities for U.S. companies in advancing the Internet across the globe.

We must take a similarly coordinated approach between the private sector and the U.S. government in order to seize the opportunities in clean energy technology. We face declining federal R&D funding, inadequate financing mechanisms, unreliable incentives, and a lack of transmission capacity. While siting of renewable energy projects on public lands needs some continuing attention, it is this broad array of other obstacles that really cry out for help.

And arguably, cooperation between industry and government is even more critical in clean energy technology than the development of the Internet as the stakes are higher in terms of our nation's security, competitiveness, health, and environment. We tend to measure progress in information technology in months or years. In contrast, we measure progress in energy technology in decades. If we don't get our act together between our government and the private sector, other countries, like China and Germany, that are taking the long view when it comes to clean energy technology, will be the winners of this marathon. A prize worth trillions of dollars and millions of jobs hangs in the balance – to say nothing of our national security and the future of the planet.