

Testimony of Dan W. Reicher
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Clean Energy Jobs and American Power Act
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Introduction

Chairman Boxer and members of the committee, my name is Dan Reicher and I am pleased to share my perspective on legislation to address climate change and build a clean energy future. I serve as Director of Climate Change and Energy Initiatives at Google. At Google we have been working to lower the cost and increase the deployment of renewable energy through our Renewable Electricity Cheaper than Coal (RE<C) Initiative and also to accelerate the deployment of plug-in vehicles through our RechargeIT Initiative. We have also developed a product called Google PowerMeter which facilitates monitoring of home energy use. We pursue these various initiatives through engineering, investment, and policy and also apply the broad range of Google's information tools including Google Earth, Google Maps and YouTube. Google engineers have also been working for nearly a decade to optimize the efficiency of our data centers. And we are focused on increasing the sustainability of our offices in both the U.S. and other countries as well as using on-site renewable energy.

Prior to my position with Google, I was President and Co-Founder of New Energy Capital, a private equity firm funded by the California State Teachers Retirement System and Vantage Point Venture Partners to invest in clean energy projects. Prior to this position, I was Executive Vice President of Northern Power Systems, one of the nation's oldest renewable energy companies. 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.

I also am a member of the National Academy of Sciences Board on Energy and Environmental Systems. I testified earlier this year in the Senate Energy Committee on a key provision of the Committee's pending American Clean Energy Leadership Act (ACELA) and in the House Energy and Commerce Committee on the American Clean Energy and Security Act (ACES). Recently I served on President Obama's transition team where I focused on the development of the stimulus package for clean energy.

I want to thank Chairman Boxer for her outstanding leadership on the climate issue and the impressive piece of legislation that we are focused on at this hearing: *S. 1733, The Clean Energy Jobs and American Power Act*.

An Unprecedented Opportunity

My key message today is that the critical need to address the climate crisis provides us with an unprecedented *opportunity* to rebuild our energy system with vast economic, security and environmental *benefits*. By putting serious limits on carbon emissions – and adopting strong complementary energy policies – we can help advance several critical priorities:

- **Create millions of new domestic jobs in 21st century industries**

- **Reduce our dangerous dependence on foreign energy supplies**
- **Protect us from a global climate crisis**

Aggressive federal policy can drive private sector investment – measured in the *trillions* of dollars – that will be required to move the nation and the globe toward a more sustainable energy future. We have a real opportunity to transform our economy from one running primarily on fossil fuels to one based largely on clean energy. Technologies and know-how to accomplish this are either available today or are under development. We can build whole new industries and create millions of new jobs. We can cut energy costs, both at home and at the gas pump. We can improve our national security. And we can confront climate change. With serious and timely limits on climate emissions – and complementary energy policies -- we can offset the significant costs of rebuilding our energy infrastructure with real economic gains and job creation.

Google published a scenario in the fall of 2008 called *Clean Energy 2030*, which outlines one potential path to weaning the U.S. off of coal for electricity generation and cutting oil use for cars by more than 40%. *Altogether the Clean Energy 2030 proposal reduces US CO2 emissions about 50% below the baseline projection, while creating 9 million jobs and doing so with net savings of \$800 billion.* Importantly, under the *Clean Energy 2030* Plan, investment in energy-efficient technology would keep electrical demand flat at the current level rather than allowing it to grow 25% as currently projected.

Having kept demand flat with efficiency, *Clean Energy 2030* proposes gradually replacing coal and oil for electricity generation with wind, solar, geothermal, biomass, and hydropower. By 2030, about 68% of generation would come from these sources, with continuing use of nuclear power and natural gas. In the personal vehicles sector, by increasing fuel efficiency in conventional cars to 45 mpg, and massive deployment of plug-in electric vehicles, we would reduce fuel consumption 44% relative to the baseline, and dramatically cut oil imports. Together, these changes would reduce CO2 emissions in 2030 enough to move the nation about halfway to the 83% by 2050 greenhouse gas reduction goal in the bill we are reviewing today. Such a massive build-out of electric generation capacity, efficiency improvements, and plug-in vehicles would cost \$3.9 trillion, but save \$4.7 trillion from avoided fossil generation capacity, and lower electricity and fuel costs.

A study in this month's *Scientific American* by Mark Jacobson at Stanford and Mark Delucchi at the University of California Davis moves a step beyond the Google scenario. Professors Jacobson and Delucchi chart a path to a world in 2030 powered 100% by renewable energy, concluding that such a system would not only be technically but also economically feasible.

Considering global energy use, the International Energy Agency estimates that between 2007 and 2030, the world will need to invest \$26.3 trillion in energy supply infrastructure across the economy to meet currently projected demand. As the venture capitalist John Doerr has said, global energy spending "is the mother of all markets," and one that could make clean technology "the biggest economic opportunity of the 21st century."

Chairman Boxer, the ability of the US to seize this historic economic opportunity will be

influenced, to a large extent, by decisions made by Congress and the Administration. There is an array of actions available to secure these kinds of benefits. Foremost among them is to put a significant price on carbon emissions and do so quickly in order to internalize the costs of climate change and move energy investments toward more efficient and lower carbon technologies.

But let me emphasize that putting a price on carbon, while absolutely necessary, is not sufficient to address the climate problem and, importantly, will not put the US in the position to seize the extraordinary opportunities that will come with rebuilding the global energy economy. My primary focus today is on the complementary energy policy mechanisms that are critical to securing dramatic reductions in greenhouse gas emissions and the broad range of accompanying economic, security and environmental benefits. Some of them have been addressed by the Senate Energy and Natural Resources Committee in the American Clean Energy Leadership Act (ACELA) and by the House of Representatives in the American Clean Energy and Security (ACES) Act. In this testimony I review four of the most important mechanisms. In brief:

- **We must significantly increase public funding of research and development of advanced energy technologies**
- **We must increase the capital available to deploy these advanced technologies at commercial scale**
- **We must build a smarter and bigger electric grid to better harness energy efficiency and renewable energy**
- **We must set national standards to accelerate the uptake of cleaner and more efficient technologies**

I conclude the statement with two examples -- involving solar thermal and advanced geothermal energy -- of how these policy mechanisms, working together, can help accelerate the shift to clean energy. Before I review these important policy mechanisms let me make three important points.

First, at Google we believe that ultimate success in solving the climate problem will largely be measured by our ability to move innovations in clean energy technology along the pathway from early research to development and demonstration to cost competitive commercial deployment. We feel strongly that each step along the way needs significant policy support – both push and pull mechanisms – from increased R&D funding and project finance to a better electric grid and aggressive clean energy standards. And all of this must be built on a critical foundation – a serious price on carbon emissions.

Second, let me stress that we need *both* a serious price on carbon *and* complementary energy policies. A serious price will definitely send a signal about the need to reduce carbon emissions but it won't, by itself, ensure that the technologies that can address the problem are invented and deployed here in the US – with massive resulting economic and security benefits. And while smart energy policies can strongly advance solutions to the climate crisis, they will not ensure that these solutions can compete straight up with fossil fuels – without a serious price on carbon.

Third, it should go without saying but success in confronting climate change will require a *global* commitment to cutting emissions, involving nations across the planet. The US must take a major step itself but reductions at the level required to address the problem will require a concerted effort among many countries, driven by strong international agreements.

Expanding Clean Energy R&D

To successfully confront the climate crisis – and secure the associated economic and security benefits – we must nurture the seed corn that leads to further technological breakthroughs in clean energy. From energy efficiency and renewable energy to advanced nuclear and fossil technologies, we need to greatly accelerate US energy R&D efforts. Unfortunately, no matter how you measure it, U.S. government investment in clean energy R&D is woefully inadequate. Today federal energy R&D expenditures are just one-fifth of their 1980 peak as a percentage of GDP. In contrast, Japan has kept a steady investment in energy research and actually outspent the US as of 2004. And China is rapidly increasing energy R&D spending as well.

Our failure to invest becomes glaringly apparent when we realize that of the top five manufacturers of wind turbines only one is American and further that the US is home to only one of the 10 biggest solar panel producers in the world and only two of the top 10 advanced battery manufacturers. In contrast, all five of the world's leading Internet technology companies – Amazon, eBay, Google, Microsoft and Yahoo – are American. The Internet itself, was the product of federally funded R&D work by the DARPA in the 1970's. In 2007, electronic commerce made possible by the Internet, contributed over \$3.3 trillion to the U.S. economy.

Since 1980 U.S. federal investment in energy R&D has dropped by 58 percent. At that time, 10 percent of the total government R&D investment was in energy. Today, the percentage has shrunk to only two percent. The federal stimulus package has certainly provided a much needed shot in the arm for US clean energy programs and projects but there is a clear risk of falling off a “funding cliff” when these investments run out and we return to the normal appropriations process.

We were encouraged when President Obama, in his February budget address, called for investing \$15 billion per year over the next decade to develop clean energy technologies. And this Spring, in a speech at MIT, Energy Secretary Chu said that to address the climate crisis energy R&D spending must move closer to the levels of the high-tech industry, which are generally around 10 percent of company sales. Some experts go even further. Professors Dan Kammen and Gregory Nemet at the University of California Berkeley, propose that annual energy R&D levels up to and exceeding \$30 billion will be necessary to address the climate challenge, a view shared by the Brookings Institution.

There is a view that somehow the private sector will fill the serious gap that exists today in energy R&D. First, energy companies large and small are cutting not expanding their research budget. Second, university research budgets have been hit hard in the recent recession. And third, while venture capital investment has helped address the R&D shortfall, by its nature this kind of funding is more at the applied end of R&D where a commercial "exit" has serious promise. The high risk early stage research funded by government that has brought us major breakthroughs in

biotech, information technology, and energy is generally not the province of venture investment.

The CEJAPA has only a brief energy research subtitle with no specific authorization and there are scattered additional R&D programs such as one to address the reliability, aging, security and other aspects of nuclear power. The Senate Energy Committee's American Clean Energy Leadership Act would double the authorization level of the Department of Energy's energy R&D program from \$3.28 billion in fiscal year 2009 to \$6.56 billion in fiscal year 2013. This is a start but a long way from the President's plan. The House of Representatives in the ACES bill has also not stepped up fully.

As a result of this serious energy R&D funding gap, 34 Nobel laureates recently wrote to President Obama asking him to press Congress to adopt legislation that would fund clean energy R&D at an amount approaching the level he proposed in February. The Nobel laureates stressed that funding at this level “is essential to pay for the research and development needed if the U.S., as well as the developing world, are to achieve their goals in reducing greenhouse gases at an affordable cost.” And they went on to emphasize that “stable R&D spending is not a luxury, it is in fact necessary because rapid scientific and technical progress is crucial to achieving these goals, and to making the cost affordable.”

Chairman Boxer, it is essential that Congress address this serious energy R&D short-fall by incorporating President Obama's goal of \$15 billion per year in federal energy R&D spending in final climate legislation.

Increasing Access to Capital for Clean Energy Deployment

Beyond support for R&D, federal climate and energy legislation must directly address a critical issue in advancing our clean energy economy: increasing access to capital to deploy clean energy projects essential to meet our climate goals. Moving from a nation that derives 70% of its power from fossil technologies to one where low carbon technologies provide the lion's share of electricity will require literally trillions of dollars of investment in generating plants and transmission infrastructure. Renewable energy projects often need more construction capital upfront than traditional energy projects but less operating capital down the road because fuel is free. The challenge is that in bad times – as well as good – raising this kind of capital, especially for innovative technologies is not easy.

From an economic competitiveness perspective we should also address this issue. In a number of cases clean energy technologies invented in the U.S. have failed domestically but succeed in foreign markets with more supportive commercialization policies. Our nation often finds itself in the peculiar position of purchasing technologies such as wind turbines, solar panels, and solar thermal plants originally invented in the United States from foreign companies who have advanced past their U.S. competitors.

At Google we've been major supporters of pending Senate legislation that would create a federal Clean Energy Deployment Administration – or CEDA – to spur private investment in innovative clean energy projects. The primary CEDA mission, as proposed by Senators Bingaman and

Murkowski – and contained in the Senate Energy Committee's American Clean Energy Leadership Act (ACELA) -- would be to encourage deployment of clean energy technologies that are perceived as too risky by commercial lenders but with high potential to address our environmental, economic and security challenges.

The problematic moment of moving a technology from a small pilot project to a full commercial-scale plant is often the point at which many promising energy technologies falter – and a significant number die. In the clean energy technology industry we call it the “Valley of Death”. Valley of Death projects sit precariously between the venture capital and project finance worlds. They are generally too big in terms of required capital and too small in terms of returns for the venture capital community. And they are often too risky for the project finance players, especially for the banks that typically provide the great majority of a project investment.

CEDA would use a portfolio investment approach in order to mitigate risk and also work to become self-sustaining over the long term by balancing riskier investments with revenues from other services and less risky investments. CEDA would provide various types of credit to support deployment of clean energy technologies including loans, loan guarantees and other credit enhancements as well as secondary market support to develop products such as clean energy-backed bonds that would allow less expensive lending in the private sector. CEDA would also assume responsibility for DOE’s current loan guarantee program. CEDA would be an independent administration within DOE, like the Federal Energy Regulatory Commission. It would be governed by a Board of Directors and an Administrator, all of whom would be appointed with the advice and consent of the Senate. CEDA will also have a permanent Technology Advisory Council to advise new technologies.

Chairman Boxer, it is essential that Congress establish a public mechanism like the Clean Energy Deployment Administration to spur private investment in higher risk innovative clean energy projects.

Building a Smarter and Bigger Electric Grid

A smarter and bigger electric grid is also critical to advancing – and seizing the benefits of – a clean energy economy. A *smarter* grid will let us "see our energy use, measure it, price it and manage it in a way that lets us cut waste and get the most out of every watt." (*Smart Grid Briefing Document*, Foundation Capital). And a *bigger* grid will allow us to tap our nation's vast clean energy resources – wind in the midwest, solar in the southwest, geothermal in the west and gulf coast, biomass in the southeast – and deliver them where needed.

The compelling aspect of the smart grid is that like the Internet it will enable multiple applications – real time energy measurement, energy efficiency management, grid support capabilities – to operate over a shared interoperable network. Like the Internet, the smart grid is a core technology that can help revitalize our economy. And as with the Internet the government has an essential role in setting the policy framework and providing the incentives that will encourage a smart grid.

At Google we are working to advance the smart grid on several fronts:

First, over the last year, our engineers have developed a simple and secure software tool called Google PowerMeter. This free software product gives consumers an easy means to draw data regarding their home electricity use – from a smart utility meter or other simple device – and see it on their computer, smart phone or an in-home display. With it comes the opportunity for significant reductions in home energy use, an important element of cost-effective implementation of climate legislation.

Second, we have developed a fleet of plug-in hybrid-electric vehicles that have provided significant public data on fuel efficiency under driving conditions that simulate common US driving patterns. We have also worked on “smart charging” of plug-in vehicles, with a particular focus on how large numbers of plug-in cars can be effectively integrated into the electric grid in a way that actually stabilizes the grid and enables a greater share of renewable generation.

Third, we are exploring how we might accelerate the integration of smart appliances and other equipment to cut energy use and reduce peak load.

Overall, we believe:

- **We need to develop the smart grid in a way that spurs innovation, drives competition, and supplies maximum information to consumers.**
- **We must develop and deploy smart grid technology in a manner that empowers consumers with greater information, tools and choices about how they use electricity, including access to real-time energy information.**
- **And energy information should be made available based on open non-proprietary standards to spur the development of products and services to help consumers save energy and money.**

The 2007 Energy Independence and Security Act (EISA) took a number of steps to advance the development of a smarter US grid. The House ACES bill takes this further with measures, for example, to develop home appliances with the capability to interact with the grid, and, through FERC, to reform regional planning to modernize the electric grid. The CEJAPA includes some helpful additional provisions including Section 201 that would establish a Clean Vehicle Technology Fund to back the deployment of plug-in vehicles and the electrical infrastructure to support them, and Sections 202-204 that would provide emissions allowances to states, local governments, tribes and others to support smart grid development.

Beyond building a smarter grid we also need to build a bigger grid. The lack of transmission capacity to move electricity from where it is generated to where it is used is a major constraint on the accelerated deployment of clean energy technologies to meet our climate, economic and security goals. *The nation’s transmission grid is in serious need of modernization to enable massive deployment of renewable electricity and other advanced technologies.* Significant new transmission capacity must be built if we are going to tap, for example, the vast wind resources of the midwest and the solar resources of the southwest. At the same time, we must ensure that

all potentially cost-effective alternatives to new transmission lines are fully addressed in public planning processes, and that siting decisions take full account of environmental values and constraints.

The CEJAPA includes improvement in transmission capacity among the uses of emissions allowances for states, local governments, tribes and others under sections 202-204. In the American Clean Energy Leadership Act, the Senate Energy Committee included some important provisions designed to improve regional or interconnection-wide transmission planning for high-priority national transmission projects, including the high-voltage lines necessary to connect renewable energy resources to demand centers.

The National Commission on Energy Policy, a bipartisan group of energy experts, has recently proposed a number of measures to strengthen the existing transmission-related provisions in the Senate Energy Committee bill. We would highlight two areas in particular. First, FERC “backstop authority” can advance the siting of critical transmission infrastructure that has been stalemated by local or state disputes, undermining the broader national interest. Second, we need clear and consistent methods to allocate costs of new high-priority national transmission projects across the broad regions that enjoy the benefits of access to domestic, low-carbon resources.

Chairman Boxer, it is essential that Congress drive the development of a bigger and smarter electric grid.

Setting National Standards for Clean Energy

A final energy policy mechanism that could drive massive clean energy deployment involves national renewable energy and energy efficiency standards. Google strongly supports the adoption of a strong national renewable energy standard (RES), following the lead of 28 states that have already set such requirements. Google also strongly supports the adoption of a strong Energy Efficiency Resource Standard (EERS) which could be a compelling complement to an RES by significantly cutting electricity demand and thereby lowering the investment needed for broad-scale deployment of renewables.

An RES is an important tool for accelerating renewable energy technology development, lowering energy costs for consumers, reducing harmful carbon emissions, and improving energy security. Portfolio requirements like the RES provide clear market signals for policy makers, utilities, investors, researchers and entrepreneurs. Existing state requirements have definitely promoted renewables, but a national standard – designed and implemented well – could do much more to increase renewables deployment and at lower cost.

An EERS is also an important tool for advancing our clean energy objectives. Under an EERS suppliers would be required to obtain energy savings from customer facilities and distributed generation installations in amounts equal to designated percentages for base year energy sales for electricity and natural gas. Eligible energy savings measures include efficiency improvements to new or existing customer facilities, combined heat and power systems, and recycled energy from a variety of defined commercial and industrial energy applications. The EERS builds on policies now in place in a number of states including California, Texas, Pennsylvania, Colorado,

Connecticut, Nevada, Vermont, and Hawaii.

The EERS and RES are compelling complements. An EERS moderates demand growth so that RES targets can actually reduce fossil fuel consumption. In the Google Clean Energy 2030 Plan, energy efficiency deployment reduces projected electricity demand 33%. This is equivalent to about 175,000 megawatts of coal generation. By moderating demand growth through an EERS and accelerating clean generation through an RES, we can slow and begin to decrease carbon emissions in the utility sector, while we work to implement a comprehensive cap-and-trade system.

State RES and EERS policies have sparked entire new industries and created thousands of jobs. National standards could produce much more. But we should avoid setting standards so weak that they simply replicate business as usual. We need RES and EERS provisions that stimulate significant new development of clean energy projects involving a broad array of technologies and putting us on an accelerated path to significant carbon reductions.

The Senate Energy Committee's American Clean Energy Leadership Act establishes a combined renewable energy and energy efficiency target of 15% by 2020. The Union of Concerned Scientists estimates that existing state Renewable Portfolio Standards will result in at least 11% renewables by 2020 and the American Council for an Energy-Efficient Economy has estimated that existing state energy-efficiency requirements and efforts will achieve 5% energy efficiency savings by 2020. Thus, current efforts for renewables and efficiency exceed the Senate targets and these targets could very well have no effect. The House climate bill is a little better, with a combined renewable and efficiency 2020 target of 20% of electricity sales. We recommend that the final Senate climate bill raise the efficiency and renewable energy targets substantially above the current 15% level in the current Senate Energy Committee bill.

Beyond an RES and EERS, the CEJAPA has the potential to greatly incentivize efficiency and renewables through the allowance process. *We believe that substantial emissions allowances should be provided for energy efficiency and renewable energy investments, as these investments save or produce energy for many years.* The Waxman-Markey bill makes a good start by providing about 10% of allowances to states for energy efficiency and renewable energy programs, and by requiring that natural gas utilities spend one-third of their free allowances on energy efficiency. These provisions should be continued in the Senate bill and a similar provision should be added requiring electric utilities to spend one-third of their free allowances on energy efficiency.

Chairman Boxer, it is essential that Congress adopt a national RES and EERS, and ensure a significant allocation of climate emission allowances to incentivize efficiency and renewables.

Putting It All Together

A serious price on carbon along with strong complementary national energy policies – increased federal support for clean energy R&D and finance, a bigger and smarter electric grid, and an array of national clean energy standards – could accelerate dramatically the development and deployment of clean energy technologies on a massive scale. This would be a real boon to a

range of clean energy opportunities – from efficiency and renewables to fossil and nuclear.

There are some solid examples of how this works. One is solar thermal, the technology that uses mirrors to concentrate the sun's heat to make steam and produce electricity at utility scale. To a large extent it was DOE-funded RD&D that proved the solar thermal concept in a set of early demonstration projects. More recently government-backed finance is helping utility-scale US plants get built. Demand for the projects is being driven by state renewable energy standards. And without an expanding network of transmission lines, moving the vast solar resource from deserts to cities would not be possible.

Looking ahead, an advanced geothermal energy technology called Enhanced Geothermal Systems (EGS) presents another opportunity where strong energy policy – and a price on carbon – could drive a high potential new industry. EGS has the potential to produce cheap, renewable, baseload generation 24 hours a day, year-round and nationwide, directly replacing coal capacity on the grid. With EGS, geothermal reservoirs can be "manufactured" to very large scale. While naturally existing geothermal reservoirs are relatively limited and concentrated in the Western U.S., high temperature rock capable of supporting power production with EGS is massive and nationwide.

A 2007 M.I.T. study found EGS to be a highly promising technology, concluding that just 2% of the heat below the continental U.S. between 3 and 10 kilometers depth is equivalent to over 2,500 times total U.S. annual energy use. At Google we have taken several steps to help advance EGS including making Google Earth maps of state EGS resources, supporting EGS-related technologies, helping to advance federal policy, and raising public awareness of the technology. EGS could benefit greatly from the spectrum of policies we've addressed in this testimony – increased R&D funding and clean energy finance to advance the technology; a more robust grid to get the electricity to market; and a national renewable energy standard to stimulate demand – and all of this put in place in with a serious and timely price on carbon emissions.

These are just two examples where a price on carbon *and* complementary energy policies could catalyze transformative energy technologies. There are many other technologies like them today and, excitingly, many more to be developed!

Conclusion

Chairman Boxer, we are convinced that climate change – an unprecedented crisis of global dimensions – can also provide an economic opportunity of vast proportions. The decisions made in Washington, D.C. on the policy front will greatly determine how much of this opportunity is brought home for the benefit of the citizens of our nation. At Google we stand ready to help develop and advance the energy policies that could allow our nation to seize this opportunity.