American Energy Innovation Council

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Good morning Chairman Gordon and Members of the Committee. As you well know, I was involved in the original *Gathering Storm* report. That report made specific policy recommendations on four areas critical to American competitiveness:

- Vastly improve K-12 science and mathematics education.
- Sustain and strengthen the nation's commitment to long-term basic research that has the potential to be transformational.
- Make the United States the most attractive setting in which to study and perform research. Attach a green card to the diploma for international students who pursue higher education in science, technology, engineering or math here in the United States.
- Ensure that America is the premier place in the world to innovate; invest in manufacturing and marketing; and create high-paying jobs based on innovation.

I will let my esteemed colleague, Norm Augustine, describe the details of that report and the related progress we've made on those issues in more detail. Instead, I will focus my remarks on a subsequent effort that Mr. Augustine and I were involved with focusing on energy innovation. So, I speak to you today on behalf of the American Energy Innovation Council (AEIC), which is comprised of a group of America's top business executives who came together earlier this year to recommend ways to promote American innovation in clean energy technology. Today, I will discuss why America must invest in clean energy innovation and how we can achieve a more productive national energy innovation system that will improve our prosperity, our security and our environment. In particular I will describe the five recommendations from our recent report, *"A Business Plan for American Energy Innovation."*

Indeed, technology innovation—especially in energy— is at the heart of many of the central economic, national security, competitiveness and environmental challenges facing our nation and I commend the Committee on Science and Technology, and especially Chairman Gordon, for the thoughtful consideration they are giving these issues.

Before discussing the specific recommendations of our report, I'd like to say a little more about the American Energy Innovation Council and how we came together. The AEIC was launched in January 2010 and, in addition to myself, its members include: Norm Augustine, former Chairman and Chief Executive Officer of Lockheed Martin; Ursula Burns, Chief Executive Officer of Xerox; John Doerr, Partner at Kleiner Perkins Caufield & Byers; Bill Gates, Chairman and former Chief Executive Officer of Microsoft; Jeff Immelt, Chairman and Chief Executive Officer of General Electric; and Tim Solso, Chairman and Chief Executive Officer of Cummins Inc. During our report deliberations, the AEIC was advised by a Technical Review panel consisting of preeminent energy, science and innovation experts.[1] The AEIC is supported, funded and staffed by the Bipartisan Policy Center and the ClimateWorks Foundation.[2] This group coalesced around the mission to foster strong economic growth, create jobs in new industries, and reestablish America's energy technology leadership in the development of clean energy technologies.

As business leaders, my AEIC colleagues and I have had the great privilege of building companies that lead our respective fields and employ hundreds of thousands of American workers. Our experience has given each one of us an unshakable belief in the power of innovation. Each of our companies achieved prominence because we invested heavily and steadily in new ideas, new technologies, new processes and new products. Indeed, innovation is the essence of America's economic strength, and it has been our nation's economic engine for centuries. Our leadership in information technology, medicine, aviation, agriculture, biotech and dozens of other fields is the result of our enduring commitment to innovation.

[1] A list of the Technical Review Panel can be found at the end of the document.
[2] More information about the Bipartisan Policy Center and the ClimateWorks Foundation can also be found at the end of this document.

The AEIC, however, came together around the belief that in energy investment— a realm central to America's economic, national security, and environmental future— our commitment to innovation is sorely lacking. Investment in energy innovation, from both the public and private sectors, is paltry— less than one-half of one percent of the national energy bill— and this neglect carries serious consequences.

Due to our constrained energy technology options, our economy is vulnerable to price shocks— in oil, natural gas, and even electricity. The United States sends about $1 billion overseas every day for imported oil, expenditure that represents the biggest part of the trade deficit and often causes economic hardship for American consumers and businesses. Our foreign oil reliance undermines national security by enriching hostile regimes while our military forces are often deployed to protect access to oil. And the environmental costs of limited clean energy options are steep and growing, with both conventional pollution and climate change harming human health, threatening lives and livelihoods, and imperiling the natural systems upon which we rely for food, water, and clean air. The scale of these threats, and the wealth of opportunities to do better, make the message clear: it is time to invent our future.

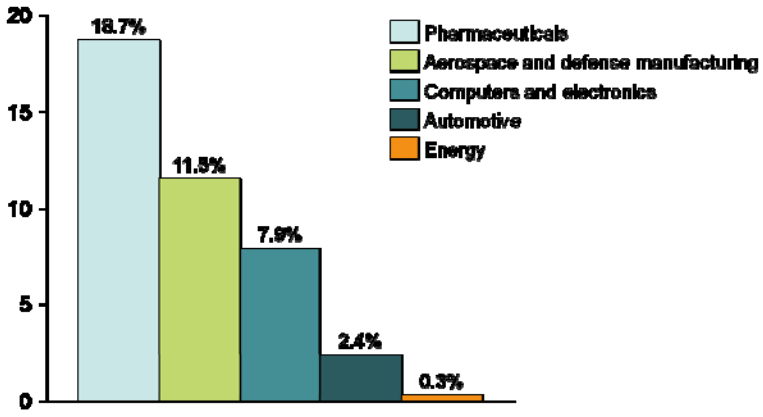
We must make a serious commitment to the goal of modernizing our energy system with cleaner, more efficient technologies. Such a commitment should include both robust, public investments in innovative energy technologies as well as policy reforms to deploy these technologies on a large scale. I joined with my AEIC colleagues to address ways we believe the United States can better meet this commitment.

Although the private sector will be paramount in commercializing and deploying clean energy on a national scale, it cannot achieve this goal alone. The fundamental differences between energy and most other economic sectors limit the ability of the private sector to solve large-scale energy problems on its own. For instance, national security, national economic strength, and the environment are not primary drivers for private sector investments, but they are critical to the health of our country. Large scale deployment of many new energy technologies requires massive capital expenditures that

are often too risky for private investors, and the product— electricity— is sold into a generic market that does not differentiate between clean and dirty sources. Additionally, America's long-term corporate R&D budgets, especially those run by utilities, have been in decline for several decades. Finally, the turnover of our energy infrastructure— particularly in the electrical generation system— is very slow.

Add these elements together, and it becomes clear why private sector investments in clean energy technology development have been so small. In fact, of all major technology-dependent sectors, the energy sector spends the smallest portion of its sales on research and development. [3]

R&D spending as a share of gross sales



The government must therefore act to spur investments in energy innovation and mitigate risk for large scale energy projects. After drawing on the large body of work and experts in the field of innovation, taking a hard look at what has worked to promote innovation in defense, medicine, information technology and other fields, and calling upon our experience managing large innovation programs in our companies, we developed five recommendations to spark a similar federal commitment to energy

[3] (1) National Science Foundation Data table 36. Federal research and development obligations, budget authority, and budget authority for basic research, by budget function: FY 1955–2009. http://www.nsf.gov/statistics/nsf08315/content.cfm?pub_id=3880&id=2
(2) G.F. Nemet, D.M. Kammen, *U.S. energy research and development*: *Declining investment, increasing need, and the feasibility of expansion*, Energy Policy 35 (2007) 746–755.
(3) Pharmaceutical Research and Manufacturers of America (PhRMA), Pharmaceutical Industry Profile 2008. Washington DC. http://www.phrma.org/files/attachments/2008%20Profile.pdf
(4) Science and Engineering Indicators 2010, National Science Foundation, www.nsf.gov/statistics/seind10/pdf/c04.pdf

innovation. By heeding these recommendations, we believe the United States can unleash our energy technology potential and mobilize the private sector to join in the effort.

Recommendation 1: Create a national Energy Strategy Board

Mr. Chairman, the United States does not have a realistic, technically robust, long-term national energy strategy. Without such a strategy, there is no way to assess the effectiveness of energy policies, nor is there a coherent framework for the development of new energy technologies. The result of this neglect is reflected in our nation's history— with oil-driven recessions, environmental degradation, trade deficits, national security problems, increasing CO_2 emissions, and a deficit in energy innovation.

We recommend the creation of a congressionally mandated Energy Strategy Board charged with (1) developing and monitoring a National Energy Plan for Congress and the executive branch, and (2) oversight of a New Energy Challenge Program (see Recommendation 5). The Board should be external to the U.S. government, should include experts in energy technologies and associated markets, and should be politically neutral.

Recommendation 2: Invest $16 billion per year in clean energy innovation

In order to maintain America's competitive edge and keep our economy strong, the United States needs sizable, sustained investments in clean energy innovation. The challenge must be met head on, and we believe that $16 billion per year— an increase of $11 billion over current annual investments of $5 billion— is the minimum level required. This funding should be set with multi-year commitments, managed according to well-defined performance goals, focused on technologies that can achieve significant scale, and be free from political interference and earmarking.

I must note that this second recommendation is critical to the success of any real effort to jump start any energy innovation efforts. Even in a time of constrained budgets,

bold action is required. Our other recommendations will not matter much if sufficient funding is not realized. Reliance on incrementalism will not do the job.

Recommendation 3: Create Centers of Excellence in energy innovation

In other high-tech fields, critical technologies have achieved large-scale market success through multi-disciplinary collaboration between the private and public sectors. Technology innovation requires expensive equipment, well-trained scientists, multi-year time horizons and flexibility in allocating funds. This can be done most efficiently and effectively if the institutions engaged in innovation are located in close proximity to each other, share operational objectives and are accountable to each other for results.

To provide the above attributes to the energy industry, we recommend the creation of national Centers of Excellence in energy innovation. The Department of Energy's newly created Energy Innovation Hubs are a good start at such centers, but are not sufficiently funded to achieve the desired results. Additional Centers of Excellence need to be supported, with recommended annual budgets of $150 to $250 million each. To function effectively and deliver results, each of these Centers will need the flexibility to pursue promising developments and eliminate dead-end efforts.

Recommendation 4: Fund ARPA-E at $1 billion per year

The creation of the Advanced Research Projects Agency-Energy (ARPA-E) has provided a significant boost to energy innovation. ARPA-E focuses exclusively on high-risk, high-payoff technologies that can change the way energy is generated, stored, and used; it has challenged innovators to come up with truly novel ideas and "game changers." The program has high potential for long-term success, but only if it is given the autonomy, budget, and clear signals of support to implement needed projects. It will need long-horizon funds on a scale commensurate with its goals, and a life extension beyond the current federal stimulus. We recommend a $1 billion annual commitment to ARPA-E.

Recommendation 5: Establish and fund a New Energy Challenge Program to build large-scale pilot projects

America's energy innovation system lacks a mechanism to turn large-scale ideas or prototypes into commercial-scale facilities. We recommend the creation of a New Energy Challenge Program to fund, build and accelerate the commercialization of advanced energy technologies— such as 4th generation nuclear power or carbon capture and storage coal plants.

This program should be structured as a partnership between the federal government and the energy industry, and should operate as an independent corporation outside of the federal government. It should report to the Energy Strategy Board (see Recommendation 1) and focus on the transition from pre-commercial, large-scale energy systems to integrated, full-size system tests. The public sector should initially commit $20 billion to the Program over 10 years through a single federal appropriation, which would unleash significant private sector resources as particular projects are developed.

Conclusion

In addition to our specific recommendations, I'd also like to note that successful energy innovation programs have three prerequisites: the first is a pipeline of new inventions; the second is a suite of policy reforms that will stimulate market demand for these new inventions; and the third is a highly skilled workforce with the ability to create and deploy these inventions. The plan put forth above addresses the first and provides a strategy to fill the American energy innovation pipeline with new technologies designed to deliver a more secure, sustainable future.

However, we recognize that research, development, and deployment all need complementary energy policies to advance innovation and drive market adoption of new technologies. Innovation without implementation has no value. A strong market signal will increase the intensity of energy research, add large private-sector commitments, reduce barriers between the lab and market, and ensure technologies perform better and cost less over time. Those policies may include some combination of a price or cap on

CO_2, a clean energy or renewable energy portfolio requirement, or technology performance standards.

In sum, I come before the Committee today with a challenge, but also with a sense of optimism. In the defense, health, agriculture, and information technology industries, this country has made a deliberate choice to use intelligent federal investments to unleash profound innovation. As a result, our country leads in all those realms. In energy, however, the country has failed the grade, and is paying a heavy price for that failure. We must change this course.

The good news is that if the United States invests in its clean energy future now, our nation can reap immense benefits. The members of the AEIC are optimistic about the potential for dramatic change in the energy realm. As business leaders, we know how the private sector can be mobilized to attack these problems, but we also know that the government must step up to protect the public interest. We have seen this work in other sectors, and know it can work in the energy sector, as well. Public- and private-sector innovators have made miracles happen right here on home soil— Americans developed the computer and the internet, delivered air and space travel, and decoded the human genome. The same transformations can happen in energy.

In closing, we are convinced that America has a great deal to gain from smart, ambitious investments in clean energy innovation. The recommendations laid out above are specific and affordable. They set forth the necessary actions that the public sector must take to unlock the ingenuity and capital of the American marketplace in pursuit of the nation's clean energy goals. To seize this opportunity, America must put aside partisan interests and make a strong, bold commitment. We challenge Congress, and indeed the country, to make this commitment. By tapping America's entrepreneurial spirit and long-standing leadership in technology innovation, we believe our country can set a course for a prosperous, sustainable economy— and take control of our energy future.

Thank you for the opportunity to testify before the Committee today.

The American Energy Innovation Council (AEIC) Technical Review Committee:

- **Chair** – Maxine Savitz, former General Manager of Technology Partnerships at Honeywell; member of the President's Council of Advisors on Science and Technology; Vice President, National Academy of Engineering

- Ken Caldeira – Department of Global Ecology, Carnegie Institution of Washington
- David Garman – Former Under Secretary of Energy and Assistant Secretary of EERE at DOE
- Rebecca Henderson – Senator John Heinz Professor of Environmental Management, Harvard Business School
- David Keith – Professor and Director of ISEEE Energy and Environmental Systems Group at the University of Calgary
- Richard Lester – Director of the Industrial Performance Center and Professor and Head of the Department of Nuclear Science and Engineering at MIT
- Nate Lewis – George L. Argyros Professor of Chemistry at the California Institute of Technology
- Ernie Moniz – Cecil and Ida Green Professor of Physics and Engineering Systems and Director of the MIT Lab for Energy and Environment and of the MIT Energy Initiative, MIT; member of the President's Council of Advisors on Science and Technology
- Franklin Orr – Professor, Stanford University
- Allen Pfeffer – Vice President of Technology, Alstom Power
- Dan Sarewitz – Director, Consortium for Science, Policy, and Outcomes, Arizona State University
- Chuck Shank – former Director of Lawrence Berkeley National Laboratory

About the Bipartisan Policy Center

In 2007, former U.S. Senate Majority Leaders Howard Baker, Tom Daschle, Bob Dole and George Mitchell formed the Bipartisan Policy Center (BPC) to develop and promote solutions that can attract the public support and political momentum to achieve real progress. Currently, the BPC focuses on issues including health care, energy, national and homeland security, transportation, science and economic policy. For more information, please visit www.bipartisanpolicy.org

About the ClimateWorks Foundation

The ClimateWorks Foundation supports public policies that prevent dangerous climate change and catalyze sustainable global prosperity. The ClimateWorks network includes partner organizations across the world, aligned to support smart policies in the regions and sectors that have the greatest potential for reducing greenhouse gas emissions. For more information, please visit www.climateworks.org