TESTIMONY
OF
NORMAN R. AUGUSTINE
BEFORE THE
COMMITTEE ON FINANCE
OF THE
UNITED STATES SENATE

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WASHINGTON, DC

Mr. Chairman and members of the Committee, thank you for this opportunity to share with you some thoughts on the challenge of providing safe, clean, affordable, sustainable and secure energy in sufficient amounts to power our nation in the years ahead, and especially the critical role of tax policy and federal and private research and development in achieving these goals.

My remarks today will be based upon the work of the American Energy Innovation Council, an independent and informal group of seven members who came together in 2010 because of our common concern over what we consider to be America's insufficient response to one of the greater challenges facing our nation today; namely, the provision of energy. In this capacity we represent no other group. We speak simply as seven citizens who, in the course of our careers, have been called upon to meet various challenges and make difficult decisions and would like to share that experience as it relates to meeting the energy challenge.

My associates in this endeavor are John Doerr, partner at Kleiner Perkins Caufield & Byers; Bill Gates, chairman and former CEO of Microsoft; Charles Holliday, chairman of Bank of America and former chairman and CEO of DuPont; Jeff Immelt, chairman and CEO of GE; and Tom Linebarger, chairman and CEO of Cummins, Inc. Tim Solso, former chairman and CEO of Cummins and Ursula Burns, chairman and CEO of Xerox, are founding emeritus members of AEIC. Technical and administrative support for our work has been provided by the Bipartisan Policy Center (of which I am on the Board of Directors). The Bipartisan Policy Center was founded by Senators Howard Baker, Tom Daschle, Bob Dole and George Mitchell as a non-profit organization seeking principled solutions to difficult public issues through analysis and respectful dialogue.

Your committee is well aware of the extent to which energy issues permeate the challenges faced by our nation. These include the impact on the economy of the often uncertain availability of energy supplies, energy price volatility, and total energy costs; the hazards of energy-related pollution on our nation's and planet's natural environment; and the role of constrained and manipulated energy supplies as a source of geopolitical friction and even armed conflict. Thus, while fully recognizing the many demands facing America today, the provision of safe, clean, affordable and sustainable energy is, by virtually any standard, one of the foremost challenges we face—particularly given how intertwined energy is with a host of strategic issues.

While my testimony today is drawn from the work of the American Energy Innovation Council–or AEIC–and while I am honored to have been invited by the Committee to appear before you—I have no special authority to speak for the group as a whole. I do, however, believe that my testimony represents the general views of my colleagues. AEIC considers that a combination of robust government and private sector research and development (R&D) investment related to energy AND thoughtful tax policy must work together to drive innovation and encourage private sector development and deployment of new technologies.

In the past few years, AEIC has issued two major reports and a series of case studies on the role of government research, development and government/industry/academia partnerships in driving innovation in energy. The first of these reports highlighted the need for a more vigorous public commitment to energy technology development. America's investment in energy

innovation from the public and private sectors together is less than one-half of one percent of the nation's energy bill. This fraction is eclipsed by the innovation investment in most other sectors, particularly in the high-tech arena. Meanwhile, we send one billion dollars abroad each day to pay our energy bill to foreign producers, not all of whom share our overall interests. AEIC has called for roughly tripling U.S. energy R&D spending as a key economic, national security, energy policy and environmental priority.

AEIC's second report addressed the bounded but important role the federal government must play in catalyzing American ingenuity as it seeks to meet the nation's energy demands of the future. While most of the current means of energy production are likely to be with us for a very long time, each suffers from one or more shortcomings, whether it be cost, pollution, safety, limited scalability, sustainability, or lack of domestic sources. If these liabilities are to be overcome, the nation will need to depend much more heavily on innovation. By that, we mean utilizing high quality research to create new knowledge; world-class engineering to convert that knowledge into new or upgraded energy sources and delivery means; and enlightened entrepreneurship to translate those sources and delivery means into the marketplace. Fortunately, America has excelled in all three of these activities in a variety of different fields. Taken together, these activities make up innovation—although it must be noted that we are now losing our lead in at least two of these attributes.

More recently, our group released a series of staff papers showing the critical role the government has played as a catalyst to private-sector innovation. We examined several significant advancements such as unconventional gas exploration and production; aeroderivative gas turbines; alternative vehicle technologies; advanced diesel internal combustion engines; and, low-emissivity windows, to see just how the government and private sector interacted.

The government contribution has generally taken the form of supporting research into fundamental phenomena and lowering the risks of applying new technologies. The latter has been accomplished with mechanisms such as seed-grants, loans, cost-sharing of demonstration projects; diffusion of technical knowledge, partnerships, and standardizing information to help markets work better. The former role has taken the form of creating new knowledge, an asset that represents an important public good but one for which market participants generally lack incentives to pursue. This includes basic and, to a lesser degree, applied research, and driving demand for private-sector technology innovation, such as through direct procurement or establishing performance standards.

In both of these areas of government involvement, the government and private sector complement each other. The private sector translates ideas into products and markets; thus, feedback from private partners is critical for productive public-sector activities. But without the investment of the government in the creation of knowledge, the private sector would lack what is in many cases its most important resource. Furthermore, our case studies show that the dividing line between private-sector and government efforts is often blurred. For example, public-private partnerships generally use cost-sharing, generating R&D efforts that neither party on its own would undertake. Similarly, government funding of R&D through national laboratories and universities invests many young scientists and engineers with skills that they subsequently take

to the private sector. In some cases, the government has been the primary or even sole customer of particular energy technologies, resulting in a collaborative effort with private-sector vendors.

In pursuing the creation and deployment of new or improved technologies, it is not uncommon to encounter what many innovators refer to as "The Valley of Death"—that period wherein an idea appears promising but has not yet been demonstrably shown to be workable in practice—and therefore is deemed too risky to warrant support by most private investors. To surmount the latter generally requires some form of convincing proof-of-principle demonstration, which in turn requires significant, sustained, and hard-to-come-by financial resources—often leading to underinvestment in potentially promising innovation.

There is also a second valley of death that occurs between proof-of-principle, say using a prototype, to verification of market utility and economic viability with a near commercial-scale demonstrator. This second valley of death, which also deters investors, is a consequence of the size characteristic that often accompanies energy projects, making it very expensive to remove uncertainties as to ultimate scalability of an otherwise promising development.

Further complicating energy innovation is the capital intensiveness of most forms of energy production, delivery and storage, a characteristic that makes the economic threshold for replacing old plants with new ones very high. In short, due to the risk, expense, and uncertainty entailed, private sector investment will often be unavailable to bridge these valleys—which is why there is a critical role for publically funded support, particularly for basic energy research and developmental scaling. In both of these regards it is important that government efforts focus on approaches that offer the potential of quantum gains, even if accompanied by substantial risk of failure, since it is in this arena that the private sector, responding to the demands of the financial markets is unlikely to invest. Government should not devote its limited resources to seeking marginal gains, even if they are high confidence.

Each of these challenges can be addressed through a combination of robust government investment in basic scientific breakthroughs related to energy AND thoughtful tax policy. Working together, these pursuits can drive innovation and encourage private sector development and deployment of new technologies.

AEIC strongly supports robust, public investment in energy technology and innovation through such avenues as the Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E) and Energy Efficiency and Renewable Energy (EERE) programs. Similarly, we have supported the America INNOVATES Act that calls for better coordination among innovation activities at DOE and gives the National Labs needed flexibility for partnerships with businesses and universities while reducing administrative burdens. We have supported the aims of the 2007 America COMPETES legislation and strongly call for its reauthorization to include continuation and expansion of ARPA-E.

Regarding tax policies to spur clean energy innovation, technology development and deployment, AEIC supports a number of basic characteristics well known to the members of this committee. We believe that energy tax policies should:

1. Encourage development and deployment of domestic, clean, low emission sources of energy;
2. Strive to be technology- and energy source- neutral; and
3. Be predictable, not subject to year-to-year renewals, but also not permanent.

Under a technology- and source-neutral approach, existing source-specific tax incentives could be phased out over time in order to allow a predictable transition for investors and an optimal investment strategy for the nation. In this regard, former Chairman Baucus and current Chairman Wyden have both stressed the necessity of encouraging sustainable domestic, low emissions energy sources even as existing incentives are reformed. Phasing out existing source-specific energy subsidies and incentives will unencumber revenue, a portion of which we believe should be devoted to increasing U.S. energy R&D investments.

We recognize that large scale energy tax reform is most likely to occur in the context of broad-based, overall tax reform, which like almost all business leaders, and indeed most Americans, we strongly encourage. We only reiterate that such tax reform should provide clear incentives for energy research and innovation, as energy remains a critical driver of US economic growth and job creation.

Regarding the R&D tax credit, we would comment only that encouraging the private sector to invest in energy development is critical, and therefore that some predictable form of R&D tax credit for energy should continue.

Again, we believe it is the interplay between basic R&D investments and technology-neutral tax incentives that is most likely to lead to a bright future of US technology development and deployment.

As one who has long been involved in national security policy, including having served as CEO of Lockheed Martin and as Under Secretary of the Army, I would stress the security advantages of developing domestic sources of energy, especially those that transition away from dependence on foreign oil.

Although I must confess that I, and I believe my colleagues, are strong devotees of free enterprise are opposed to government intervention in markets to the extent practicable, the energy dilemma seems to be exactly the sort of issue which governments are designed to help solve, at least in democracies with free markets. That is, this is a case wherein there is an important public benefit to be had by the citizenry as a whole, but for which private entities cannot, or will not, provide all the needed investment because of financial risk, extensive delays in receiving returns, small or even negative returns and the possibility that the returns will not even accrue to the investor or performer. The latter is particularly true of the pursuit of basic research.

This circumstance is one that has long been recognized by our government in a number of areas, including many involving the application of technology. Commercial nuclear power was the result of government investments in Naval reactors; commercial jet aircraft trace their origin to military transports; GPS to military positioning systems; the internet to packet-switched

networks demonstrated by ARPA; and communication and weather satellites to military space programs. These achievements were in some cases by-products of the government's pursing other missions in the interest of its citizens—but the provision of energy is itself a mission of the utmost importance to the citizenry.

Principal objections to greater government participation in, and particularly the funding of, such activities are that: government involvement may unfairly favor one private entity over another; the government should not be in the business of "picking winners and losers"; foreign firms, not U.S. firms, may prove to be the ultimate beneficiary of the U.S. taxpayers' investments; and there are other important demands for the application of the government's finite financial resources.

In fact, the government's work in the early research phase can be, and generally is, made available to all interested parties. Consider NASA's aeronautics research and its impact on making commercial jet airliners a reality or the role of SEMATECH in the microelectronics industry. With regard to picking "winners and losers," the government in effect does this every day at places like DARPA, ARPA-E, NSF and NIH. The key to success under this circumstance is to maintain an open competition for ideas, transparency of results, and recent competent individuals to government service who can weigh the options that are available—having carefully considered the private sector's perspective along with all other relevant perspectives. In the case of funding large demonstrations, the solution once again resides in maintaining fair and open competition. With respect to foreign firms occasionally being the principal beneficiaries, this is simply a fact of life in the globalized marketplace permeated with instant communications. The way to prosper is not to seek to hide information but rather to be quicker to the market with a better overall product that one's competitors. Finally, with regard to the other funding demands faced by the government, few issues have greater potential positive or potential negative impact on our nation than the availability of clean, sustainable, safe and affordable energy.

It goes without saying that the members of the AEIC are aware of the intense fiscal problems facing the nation—and you as its leaders. But we are also aware from our own businesses that during difficult times it may be necessary and appropriate to *increase* spending in some areas while at the same time making overall reductions. There is an important distinction to be made between spending for investment and spending for consumption. Whatever the case, it is important to recognize that not all investments in innovation will "pay off"…some, perhaps most, will fail. This is simply a fact of life. Supporting innovation is neither a short-term strategy nor a pursuit for the uncommitted. This is why a "portfolio" approach is generally a sound approach to such investment.

Finally, it would be inappropriate for me to miss this opportunity to address briefly the precarious position in which America's overall innovation engine finds itself today, not just as it concerns energy needs but as it affects virtually all national issues. Our graduate schools of engineering now train mostly foreign engineers who increasingly say they will be returning home—often with the encouragement of our immigration policies; our public primary and secondary schools, on average, trail far behind those of most of the developed world; our great public research universities are challenged as never before by steep reductions in their funding;

the consumer market is moving to the developing nations; our national debt is so immense that it makes investment in the future particularly challenging; our stated corporate tax rates are now the highest in the world; our patent system is antiquated, as are our export controls; and U.S. corporations spend over twice as much on litigation as on research. This is not a formula for sustaining the success we have enjoyed in the past.

Fortunately, America still has a great deal remaining on the asset side of its balance sheet, foremost among which is our freedom and our free enterprise system. It includes our high-quality, albeit endangered, research universities; a culture of innovation and prudent risk taking; the rule of law; the sanctity of contracts; and so much more. But today's trends are not in our favor, and when one considers the rapidity of advancement in technology it is apparent that a nation can lose its position in a technology driven, innovative economy very quickly. We now rank number ten in the world in investment in R&D as a fraction of GDP. In terms of technological focus, we rank 79th among 93 nations in the fraction of Baccalaureate degrees that are awarded in the field of engineering—most closely resembling Mozambique in this regard. These developments have consequences that span from national security to health care and from our standard of living to the preservation of our planet's environment. The energy challenge we face today is, in my judgment, merely a reflection of this much broader challenge.

Thank you for the opportunity to share these candid thoughts with you, and, speaking as one of a group of private citizens, thank you for the attention you are devoting to this critical issue.

NORMAN R. AUGUSTINE was raised in Colorado and attended Princeton University where he graduated with a BSE in Aeronautical Engineering, magna cum laude, and an MSE. He was elected to Phi Beta Kappa, Tau Beta Pi and Sigma Xi.

In 1958 he joined the Douglas Aircraft Company in California where he worked as a Research Engineer, Program Manager and Chief Engineer. Beginning in 1965, he served in the Office of the Secretary of Defense as Assistant Director of Defense Research and Engineering. He joined LTV Missiles and Space Company in 1970, serving as Vice President, Advanced Programs and Marketing. In 1973 he returned to the government as Assistant Secretary of the Army and in 1975 became Under Secretary of the Army, and later Acting Secretary of the Army. Joining Martin Marietta Corporation in 1977 as Vice President of Technical Operations, he was elected as CEO in 1987 and chairman in 1988, having previously been President and COO. He served as president of Lockheed Martin Corporation upon the formation of that company in 1995, and became CEO later that year. He retired as chairman and CEO of Lockheed Martin in August 1997, at which time he became a Lecturer with the Rank of Professor on the faculty of Princeton University where he served until July 1999.

Mr. Augustine was Chairman and Principal Officer of the American Red Cross for nine years, Chairman of the Council of the National Academy of Engineering, President and Chairman of the Association of the United States Army, Chairman of the Aerospace Industries Association, and Chairman of the Defense Science Board. He is a former President of the American Institute of Aeronautics and Astronautics and the Boy Scouts of America. He is a former member of the Board of Directors of ConocoPhillips, Black & Decker, Proctor & Gamble and Lockheed Martin, and was a member of the Board of Trustees of Colonial Williamsburg. He is a Regent of the University System of Maryland, Trustee Emeritus of Johns Hopkins and a former member of the Board of Trustees of Princeton and MIT. He is a member of the Advisory Board of the Department of Homeland Security and the Department of Energy, was a member of the Hart/Rudman Commission on National Security, and served for 16 years on the President's Council of Advisors on Science and Technology. He is a member of the American Philosophical Society, the National Academy of Sciences and the Council on Foreign Relations, and is a Fellow of the National Academy of Arts and Sciences and the Explorers Club.

Mr. Augustine has been presented the National Medal of Technology by the President of the United States and received the Joint Chiefs of Staff Distinguished Public Service Award. He has five times received the Department of Defense's highest civilian decoration, the Distinguished Service Medal. He is co-author of *The Defense Revolution* and *Shakespeare in Charge* and author of *Augustine's Laws* and *Augustine's Travels*. He holds 33 honorary degrees and was selected by Who's Who in America and the Library of Congress as one of "Fifty Great Americans" on the occasion of Who's Who's fiftieth anniversary. He has traveled in 112 countries and stood on both the North and South Poles of the earth.