Invited Testimony for the U.S. Senate Finance Committee

Prepared Statement of
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Mr. Chairman, thank you for this opportunity to discuss important issues related to the nation's energy policies as we move to reduce our dependence on foreign oil, maintain a healthy environment and fully meet the energy demands of the future. I am the director of the National Renewable Energy Laboratory in Golden, Colorado. NREL is the U.S. Department of Energy's primary laboratory for research and development of renewable energy and energy efficiency technologies. I am honored to be here, and to speak with you today.

For those of us who have devoted our careers to energy research, the era in which we find ourselves today is both exciting and challenging. Never before have we witnessed such intense interest in – and rapid growth of – renewable energy and energy efficiency technologies. The industries for solar, wind and biomass energy systems are expanding at rates exceeding 30 percent annually. While this is certainly a welcome development, much remains to be done to sustain our current momentum.

If we are to ensure the nation receives the full range of benefits that renewable energy technologies can provide, we will need a carefully balanced blend of new technology, market acceptance and government policies. It is not a question of whether to rely solely on the market, or on new research, or on government action, as we work to solve our energy problems. To accelerate deployment of renewable energy technologies effectively, we need to effectively combine all three.

It's also crucial that this mix of technology, markets and policies be crafted so that each works in conjunction with the others. The reality is that distinct renewable energy technologies – be they solar photovoltaic, solar thermal, wind, biomass power, biofuels or geothermal – are in different places in terms of their economics, technological maturity and market acceptance. While a broad range of policies are needed to spur on these varied technologies, the specifics of policies and incentives to be enacted ideally must be tailored to fit the unique requirements of each of the systems and devices we are seeking to deploy.

At the same time, policies must be put in place with a view to the long term, and maintained and supported consistently, to maximize their effectiveness. The Production Tax Credit for wind power is a case in point. The history of the PTC has been one of fits and starts – the tax credit has been on in some years, off in others. As a result, wind turbine manufacturers, developers, utilities and consumers who have wanted to see more of their energy come from renewable sources, have all endured the predictable boom-and-bust problems that come with on-again, off-again policies. While I can only imagine the challenges that confront those who deliberate and adopt a federal budget, anything we can do to move beyond a year-to-year approach, and chart a long term course for renewable energy policy, will provide us with lasting benefits.

Losing Global Renewable Energy Market Leadership

So, to be successful, any new policy commitment must be consistent and sustained. We have already witnessed what can happen if our commitment is inadequate or short-lived.

Over the last decade, Denmark, Germany and Spain have surpassed the U.S. in production and deployment of wind turbines**,** and Japan and Germany have surpassed the U.S in production of electricity-producing solar photovoltaic panels.

Ironically, they did so largely by adopting technologies that had been developed here in the United States. We came up with the right technologies, but we did not capitalize on these innovations with policies adequate to spur deployment. While the U.S. remains the technological leader for renewable energy, industries in Europe and Asia have grown to dominate this greater than $40 billion international business. Our foreign competition were able to leapfrog U.S. businesses because of public policy driven investment incentives, aggressive renewable energy targets and other bold national policies adopted in their home countries.

Given where our national markets and technologies stand today, a particular need exists for sound government policies and incentives – at the local, state and federal level – that stimulate smart domestic energy development within the framework of the marketplace. Such policies should support the mobilization of private sector capital and the fostering of robust competition. The competition of the marketplace drives improvements in technology and economic efficiencies. Market competition has been and should remain a vital ingredient in the successful evolution of renewable energy in the United States.

Energy policy must also take into account the realities and complexities of our growing economy, modern lifestyles and our natural environment. We risk much if we fail to grasp the totality of the energy landscape before us, and not plan for and address the full range of contingencies upon which the success of our new energy ventures depend.

Granted, gaining both a broad and detailed understanding of such a complex mission may be daunting – but resolving the issues therein is fundamental to all else that we do.

Opportunities and Challenges of Biofuels

The evolution of biofuels as a national priority provides a timely lesson. Researchers at NREL have been working on biofuel technologies since our laboratory was founded in 1977. However, it only has been recently that public policy has looked to biofuels as a way to supplant petroleum use in a near-term, meaningful way.

Recent studies have shown that there is sufficient biomass potential in the U.S., and worldwide, to produce significant amounts of transportation fuels – enough to displace a major portion of the petroleum we use today. Clearly, this is an area that has great promise; but it must be done correctly.

The Department of Energy, NREL and other national laboratories, have embarked upon a concerted effort to move beyond the use of corn grain for ethanol, and develop a new industry that will produce tens of billions of gallons of ethanol from corn stover, switch grass, wood chips, crop and forest residues and other forms of cellulosic biomass, over the next several decades.

As the enormity of this task is considered, a range of formidable challenges is coming into sharper focus. We understand that the research we are performing today to make cellulosic ethanol technologies more efficient and affordable is precisely the correct first step. But we also are coming to understand that there are a number of other essential pieces to this puzzle.

To achieve the unrealized potential of biofuels, we need to carefully examine such questions as: Where will this huge new supply of biomass come from? How will we achieve improvements in agricultural practices? How will massive new volumes of biomass get to refineries, and how will commensurately

large volumes of fuels get to retail stations? Will new fuels be consistently energy dense and free of contaminants? How will vehicle fleets have to evolve? How will the value chain components and bi-products alter existing value chains? And perhaps most importantly, what are the ultimate impacts on our land use, water and air? And how will those who adopt these technologies affect the global environment? These are just a few of the factors in play.

Of equal concern are the longer-range needs of the biofuels industry itself. We should begin today to conduct the research that will be needed for a time in the future when industry and consumers will require new and better fuels, chemical feedstocks and a range of other products, we know we can make from biomass.

Answers to these essential questions have profound implications – this is no simple, academic exercise. For this work to be lasting and useful, it all must be done in close collaboration with industry. What is called for then is a comprehensive, integrated program for biofuels development, which identifies and plans for all the critical factors such a massive undertaking will entail.

Our Nation's Energy Future

Beyond advancing individual energy technologies, we as a nation should establish durable criteria and priorities to determine what our national energy landscape will look like in the future. You may have heard that we could meet all of our nation's electricity needs by building a giant solar power farm in the Nevada desert. Although that may indeed be a useful metaphor to illustrate the vast solar resource available to us, it isn't helpful at all in determining what our nation should actually do in any practical sense.

The same holds true for other energy choices as well. For instance, we know the U.S. has immense reserves of conventional and non-conventional fossil resources, and we know that technologies might be developed to turn those into fuels. But as we plot a course for the future, and consider the range of energy, environmental and economic choices that confront us, we must demand that the decisions we make today are not only technologically defensible, but also practical, environmentally sound and sustainable long into the future. The appropriateness of new technology, and sustainability over its entire life-cycle, must be guiding forces in decision making.

The Role of R&D in Advancing Renewable Energy

As for renewable energy technologies, we are at present confronted with something of a double-edged sword. On one side we have existing renewable energy systems that should be encouraged into the marketplace here and now – through a combination of viable technology, government policy and market mechanisms. On the other side, if we are to achieve "significance" in the level of contribution renewable energy can make to our future energy mix, we must make technological advances to make today's technology more efficient and less costly.

There has never been a greater need for new research into subsequent generations of renewable energy technologies, even though the drive to commercialize existing renewable energy technology has never been more brisk. We still need to make tomorrow's energy solutions more productive, economical and environmentally beneficial than those available today.

For renewable energy research, here again, a sustained, long-term commitment is required. Our Laboratory may provide a useful example. While we at NREL work with industry to perfect and deploy existing renewable energy systems, we also are working on new technologies that industry will be using, five, ten, twenty and perhaps even fifty years hence.

A melding of basic and applied science is essential in the energy research field. It is only through a sustained commitment to research that the nation will meet its long range energy needs. Researchers at NREL and elsewhere are closing the gap between basic science and applied research and development – all the while focusing a bright light on the valuable end uses of our work. The result is that we are shortening the time it takes to push new renewable energy technology off the lab bench and into the marketplace.

To guarantee this progress continues, we must make necessary new investments in our research capabilities now – because having adequate research facilities is essential to all other R&D goals. The nation's world-class laboratory system and its leading academic institutions must be re-tooled, and funded at an adequate level, so we have the necessary capabilities to see this vital mission to its successful conclusion.

Beyond the need to invest in research capabilities and facilities, we need to focus the resources and attention of universities and other academic institutions into renewable energy research. In the biofuel industry, we are already encountering a dearth of qualified engineers and scientists with the appropriate education and training to make the contributions that are needed in the field. Meanwhile, a looming shortfall of potential researchers in the undergraduate system will only be compounded as industry ramps up its hiring demands in the future.

Balancing R&D Investments, Short and Long Term

In conclusion, to address our near-term needs, we need a national strategy that promotes the rapid deployment of the renewable energy systems and processes that are ready and able to serve us today. At the same time, to address needs longer-term, we must make a major new commitment to the research required to deliver the next, and subsequent, generations of new technologies.

This will not come without cost, but recent experience suggests that investment in renewable energy technologies will produce significant economic benefits. And, by investing in technologies not tied to the unpredictable price of oil, we may very well pay less than we ultimately would have for more conventional sources of energy.

New research can and will make these technologies more practical, and more affordable. In the less than three decades since our laboratory was founded, the cost of producing energy from the sun, wind and biomass has been reduced by more than 80 percent – a favorable cost trajectory that continues today.

The good news is that the United States can take back the leadership it once had in the renewable energy field – what is likely to be one of the most important new industries of this century – through investing wisely now, and into the future. The timing is fortuitous, because by most all accounts, the next big market for global renewable energy growth is here in the United States.

Thank you.