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**“Federal Financial Support for Energy Technologies:
Assessing Costs and Benefits”**

Testimony before the U.S. House of Representatives
Subcommittee on Energy
Science, Space, and Technology Committee

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Chairwoman Lummis, Ranking Member Swalwell, and Subcommittee Members, thank you for affording me the opportunity to testify today.

My name is Malcolm Woolf, and I am the senior vice president for policy and government affairs of the Advanced Energy Economy (AEE). AEE is a national association of business leaders who are making the global energy system more secure, clean, and affordable. Just as the Internet economy transformed society in ways we did not expect, the advanced energy economy is creating dramatic new opportunities for economic growth in the United States and around the world.

AEE’s mission is to influence public policy, foster advanced energy innovation and business growth, and provide a unified voice for a strong U.S. advanced energy industry. Founded in 2011, AEE has a national network of business members across states and across industries to help the advanced energy industry succeed. In addition, AEE has partner organizations in Arkansas, Colorado, Illinois, Michigan, North Carolina, New Mexico, Nevada, Ohio, South Carolina and New England, with more to come, as well as active engagements in California, New York and Maryland.

I commend the Subcommittee for convening this hearing on *“Federal Financial Support for Energy Technologies: Assessing Costs and Benefits.”* With global energy consumption projected to rise nearly 40 percent by 2030, future prosperity depends on meeting growing demand with energy that is secure, clean and affordable.

After briefly addressing the significant opportunities for U.S. businesses in advanced energy, my testimony today will focus on two important themes:

- 1) New energy technologies face a series of structural market barriers to entry that often have required federal financial support to overcome; and
- 2) Congress should utilize a core set of principles that we have developed to reorient federal financial support to more effectively encourage private sector innovation in technologies that promote a secure, clean and affordable energy future.

What Are the Advanced Energy Opportunities for U.S. Businesses?

Advanced energy encompasses a broad range of products and services that constitute the best available technologies for meeting energy needs today and tomorrow. It includes such diverse technologies as energy efficient appliances, renewable energy systems, nuclear power, advanced gas turbines, hybrid vehicles, and information technology as applied to the energy industry. Advanced energy is dynamic, as innovation and competition produce better energy technologies, products and services over time.

The business opportunity in advanced energy for U.S. companies is large and growing, both at home and globally. A recent report, commissioned by our partner educational organization, the Advanced Energy Economy Institute, documented that the global advanced energy industry is larger, by revenue, than pharmaceutical manufacturing, and roughly two-thirds the size of telecommunications. In the United States, advanced energy is larger than the trucking industry and more than twice the size of the commercial casino industry.

The key findings of this first-of-its-kind study include:

- In 2011, global revenue from the seven advanced energy segments reached nearly \$1.12 trillion.
- The U.S. advanced energy market reached \$132 billion in 2011, representing nearly 12% of the global market.
- Based on information available in late 2012, the U.S. advanced energy market was expected to grow to an estimated \$157 billion in 2012, with the U.S. share of the global market expected to rise to 15%.
- The U.S. advanced energy market contributed \$13.9 billion in federal tax revenue in 2011, plus another \$6.7 billion in state and local tax revenue, for a total tax contribution of \$20.6 billion.

Are There Structural Barriers That Necessitate the Government Playing a Role in the Development of New Energy Technologies, Products and Services?

As AEE's member companies can attest, new energy technologies face a series of structural market barriers to entry. As such, the federal government needs to continue to play a vital role in supporting new energy technologies, products and services. AEE notes, however, that the federal government's engagement in technology development should be limited to those situations where there are public benefits that the private sector does not capture.

Let me highlight a few of the most significant structural barriers that hinder innovation in the energy markets.

First, the market fails to appropriately reward innovations that do not directly affect price. There are a wide range of important externalities in energy, such as grid reliability and resiliency, energy security, safety, fuel diversity, and public health impacts. Since these externalities are difficult to monetize and reflect in the price of energy, the market systematically undervalues them. For example, the free market may not appropriately value a new technology that is more expensive but makes the system less vulnerable to a cyber attack.

Second, the legal framework of electric and natural gas utilities, along with their long-lived assets, discourages investments in innovation. Since the early days of electrification, electric and natural gas utilities have received a guaranteed rate of return as long as their investments were prudent. While this is a sound public policy for keeping the lights on, it creates a powerful disincentive for utilities to innovate. After all, why should they take a risk on unproven, innovative technology that regulators may not deem worthy of reimbursement when they would receive the same rate of return by using established, existing technologies? When coupled with the institutional inertia that comes from having billions invested in long-lived assets, new technologies and services have an extremely high barrier to entry.

Finally, the federal government needs to compensate for the chronically low level of private sector energy research, demonstration and deployment. According to a 2010 report, "U.S. energy firms reinvest well below one percent of their revenues in R&D, with much of that amount chiefly spent on improving current technologies instead of developing new ones."² The chronically

² "Post-Partisan Power: How a Limited and Direct Approach to Energy Innovation can deliver Clean, Cheap Energy, Economic Productivity and National Prosperity," S. Hayward, American Enterprise Institute, M. Muro, Brookings Institute, and T. Nordhaus and M. Shellenberger, Breakthrough Institute, October 2010, at p. 13.

low level of private sector investment isn't surprising in light of the high barriers to entry already discussed. In contrast, innovation-intensive industries like telecommunications, semiconductors and pharmaceuticals invest 10-20% of their revenues in research and new product development.

Other significant market barriers beyond the initial higher price of new energy technologies include the capital-intensive nature of energy technologies, the inherent technology and policy risks in energy markets, the long time horizon of many advanced energy projects, and a lack of wide-spread enabling infrastructure to support advanced energy technology deployment, such as electric transmission capacity or alternative energy fueling stations.

When Has Federal Support Been Successful in Encouraging Innovation and Helping Businesses Overcome These Market Barriers?

Different forms of government support and tools are needed to help overcome different market hurdles. Let me offer a few examples of how federal financial support has been critical in accelerating innovation in the energy sector:

- Renewable electricity generation benefits from a fuel source that is free (e.g., wind, solar, geothermal), yet needs to overcome high upfront capital costs. This barrier is reduced if the industry can build sufficient economies of scale, which is why federal tax credits have generally proven to be effective. Federal tax credits stimulate a national market of sufficient size and stability to spur innovation and support domestic manufacturing capacity, which has helped to dramatically reduce the levelized energy production cost over the last decade.

In 2012, wind energy for the first time became the number one source of new U.S. electric generating capacity, providing 42 percent of all new generating capacity. Similarly, the price of PV cells has fallen from over \$76 dollars a watt in 1977 to about 75 cents a watt in 2013, with many technological developments yet to move from the laboratory to the factory.⁴ Both land-based wind and solar PV are becoming increasingly cost competitive and have actually reached "grid price parity" in certain local markets.

- The private sector typically does not invest heavily in energy research and development because they cannot easily capture the "spillover" benefits that result. For this reason, DOE supported research on shale gas going back to

⁴ "Alternative Energy Will No Longer Be Alternative," The Economist, Nov. 21, 2012, available at <http://www.economist.com/blogs/graphicdetail/2012/12/daily-chart-19>

1976, including assessments of the resource base, experiments in directional drilling and hydraulic fracturing techniques. As a result of this research and a series of public-private collaborations, America is now reaping the benefits of the current natural gas production boom.

- To help drive innovation in energy efficient lighting, DOE created the L-prize in 2008, a government-sponsored technology competition designed to spur lighting manufacturers to develop high-quality, high-efficiency products to replace the common light bulb. The winner was the Philips AmbientLED. If these bulbs were widely used across the country, the nation would save about 35 terawatt-hours of electricity or \$3.9 billion in one year. That's enough electricity to power the lights of nearly 18 million U.S. households, or nearly triple the annual electricity consumption in Washington, D.C.

Most major energy technologies over the last half-century have benefited from a federal role in its research, demonstration and/or deployment, including most fossil fuels, renewables and energy efficiency technologies. In the landmark National Academy evaluation of DOE R&D from 1978-2000, Congress asked the Academy: "Was it worth it?" The resulting study found that the \$15 billion spent on energy efficiency and fossil fuel R&D over a 22-year period yielded a "realized benefit" of about \$41 billion, in addition to the "options benefits" and "knowledge benefits".⁵ The technologies evaluated included building and industrial efficiency technologies, such as low-e glass, electronic ballasts for fluorescent lighting, compact fluorescents, oxygen-fueled glass furnaces, and the development of more efficient gas turbines through the Advanced Turbine Systems program. The \$41 billion in benefits did not include the environmental benefits conservatively estimated as ranging from \$60-90 billion over the 22 year period.

What are the Core Principles that Should Guide Federal Support for Innovation in Energy Technologies, Products and Services?

AEE believes there are significant opportunities to better utilize taxpayer dollars and, at the same time, more effectively promote secure, clean and affordable energy.

The ongoing conversations about fiscal reform provide an immediate opportunity to help build a better paradigm for the advancement of energy technology by applying business-focused principles to R&D investments. Rather than engage in a political food fight, where only those provisions supported by the strongest special

⁵ "Energy Research at DOE: Was It Worth It?," Energy Efficiency and Fossil Energy Research 1978 to 2000, Committee on Benefits of DOE R&D on Energy Efficiency and Fossil Energy, Commission on Engineering and Technical Systems, National Research Council, (Free Executive Summary at <http://www.nap.edu/catalog/10165.html>)

interest can survive, AEE suggests a fresh approach whereby we refocus the federal energy outlays on a core public purpose – promoting innovation to give the United States energy that is secure, clean and affordable.

Over the decades, federal expenditures on energy, from the tax code to loan programs, have become a complicated patchwork of technology-specific benefits, with the size and scope of dollar flows differing greatly even between technologies that compete in the same markets. A lack of consistent, core principles underlying the use of federal funds in energy technology limits the effectiveness of those investments.

Through a series of conversations and interactions with numerous stakeholders, AEE has created a set of core principles that can act as a guide to federal expenditures in the development of energy technologies, products and services:

1 - Be targeted: limit federal funds to where innovation is needed to build a more secure, clean and affordable energy future. Federal energy programs should only be provided where there is an essential public purpose. Rather than providing permanent support to mature technologies that already have significant market penetration, the federal government's role should be limited to driving innovation and commercializing the next generation of technologies, products and services that promise public benefits. These public benefits include enhancing energy security through fuel diversity and grid modernization, providing cleaner energy that better protects public health, reducing energy costs for consumers and businesses, and developing products that can be competitive in world markets.

2 - Sunset or automatically update provisions when market-based objectives are achieved. No company or technology should be entitled to permanent subsidies or investments. For example, when left in place too long, tax incentives distort price and market signals and ultimately create barriers to entry for new technologies. Therefore, such incentives should remain in place only long enough to achieve a measurable, market-based objective (for example, gigawatts installed or share of market) that represents a point at which emerging technologies have reached sufficient maturity that they should stand on their own. Each provision should have an automatic phase-out or periodic update built in from the beginning to send clear signals to businesses and investors.

3 - Provide stability and certainty for businesses and investors. Businesses and investors need certainty to make the investments and set the plans necessary to grow. Rules that change frequently or unpredictably are disruptive to markets and harmful to the businesses, investors, and consumers participating in them. Using meaningful, performance metrics tied to maturity in the marketplace, rather than calendar deadlines, to sunset a program or automatically update federal

standards would provide certainty to investors, focus businesses on bringing their technologies to scale and moving down the cost curve, and allow market dynamics to drive business success.

4 - **Be technology neutral to support all forms of advanced technology.**

Many of today's energy policies were written by Congress with one sector in mind, even favoring a single technology. Such an approach distorts market signals and puts the weight of Congress behind investment decisions. This is inefficient and imposes unnecessary risk to taxpayers. In addition, this approach can inadvertently freeze out next-generation technologies since the best available technology today will not necessarily be the best in the future. Energy R&D programs play an especially critical role in driving the development of next generation technologies. Such programs should be applied as broadly as reasonable to stimulate innovation across technologies, including those that have not yet emerged.

A New Approach to Energy Policy

In closing, AEE believes that the federal government needs to continue playing a vital role in helping energy technologies overcome multiple structural barriers. I believe that the four principles I articulated represent a common sense approach that would reorient federal energy financial support to more effectively spur innovation. At the same time, these principles represent a dramatic break from the status quo. I look forward to working with the Committee to reform federal energy policy to drive a more secure, clean and affordable energy future.

Thank you. I am happy to answer any questions.