

**Federal Renewable Energy Tax Credits:
Creating American Jobs and Investment in State and Local Economies**

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Consumers”

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SUMMARY

- Federal tax credits for renewable energy have been an effective and affordable policy, delivering significant economic benefits across the United States.
- Federal tax credits have improved the playing field for renewables to compete with fossil fuels and nuclear power, which have benefitted from large federal subsidies for decades and market prices that do not reflect many external costs of burning fossil fuels
- Subsidies for different energy technologies should be compared over a long period of time since many incentives for conventional energy sources are part of the permanent tax code
- AWEA analysis shows that wind energy only received 3% of all federal energy incentives between 1947 and 2015, compared to 65% for fossil fuels and 21% for nuclear power.
- Tax credits have been a key driver for the recent growth in the U.S. wind and solar industries, creating new jobs, income, and tax revenues for local communities
- Tax credits have helped drive down the cost of wind and solar power, which has helped stabilize electricity prices and make renewable energy more affordable for consumers.
- DOE analyses show that the benefits of increasing renewable energy use are about 2-3 times higher than the costs of the PTC.
- Until the U.S. can transition to national policies that provide more stable, long-term support for low carbon energy, Congress should extend the federal tax credits by at least five more years to maintain industry growth and provide more parity and predictability in the tax code.
- A long-term tax credit extension for renewable energy could also be part of a well-designed low-carbon technology neutral tax credit. Tax credits should be expanded to encourage investments in energy storage to help accelerate deployment and cost reductions.

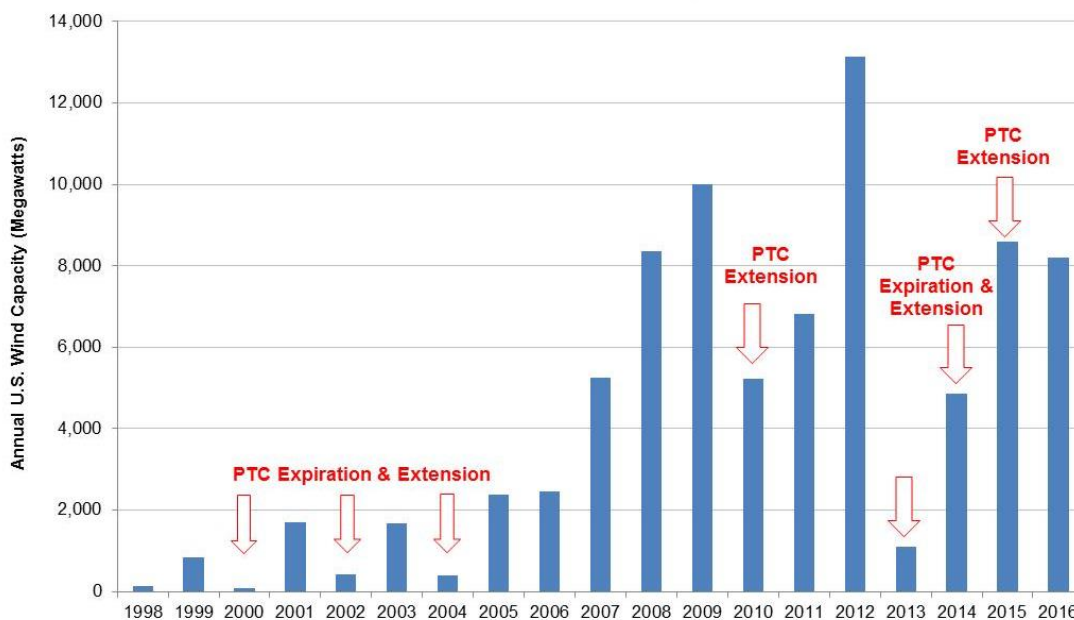
On behalf of the Union of Concerned Scientists (UCS), I would like to thank Chairman Upton, Ranking Member Rush, and the other distinguished members of the Subcommittee for the opportunity to testify today. My name is Steve Clemmer, Director of Energy Research and Analysis for UCS' Climate and Energy Program. UCS is the nation's leading science-based nonprofit organization with more than 500,000 supporters. We put rigorous, independent science to work to solve our planet's most pressing problems. Our Climate and Energy Program focuses on developing a sustainable and affordable energy system—one that does not degrade natural systems or public health. UCS has been a leading advocate of increasing renewable energy use at the state and national levels for many years. We also care deeply about jobs and communities affected by a transition to a clean energy economy, and we support strong targeted policies for economic diversification, workforce development, and R&D to help create more opportunities for impacted communities.

My comments today will focus on how federal tax credits for renewable energy have been an effective and affordable policy, delivering significant economic benefits across the United States. I will describe how they have been a key driver for the recent growth in the U.S. wind and solar industries, spurring innovation and creating new jobs, income, and tax revenues for local communities. I will also show how they have helped drive down the cost of wind and solar power, which in turn has helped stabilize electricity prices and make renewable energy more affordable for consumers. Finally, I will highlight the need to extend the tax credits, provide more parity in the tax code with fossil fuels, and transition to policies that provide more stable, long-term support for renewable energy.

A Brief History of Federal Renewable Energy Tax Credits

The federal Production Tax Credit (PTC) is tied to the amount of electricity generated from eligible renewable energy facilities, which encourages efficiency and innovation to maximize production. Originally enacted as part of the Energy Policy Act of 1992, Congress has extended the PTC seven times and has allowed it to expire on six occasions. This "on-again/off-again" status resulted in a boom-bust cycle of development. In the years following expiration, installations dropped between 76 and 93 percent, with corresponding job losses (see Figure 1). After many years of this policy uncertainty, Congress passed a five-year extension and phase-down of the PTC for wind projects commencing construction through 2019, as part of the Consolidated Appropriations Act of 2016. The credit was extended for other eligible renewable energy technologies commencing construction through 2016.

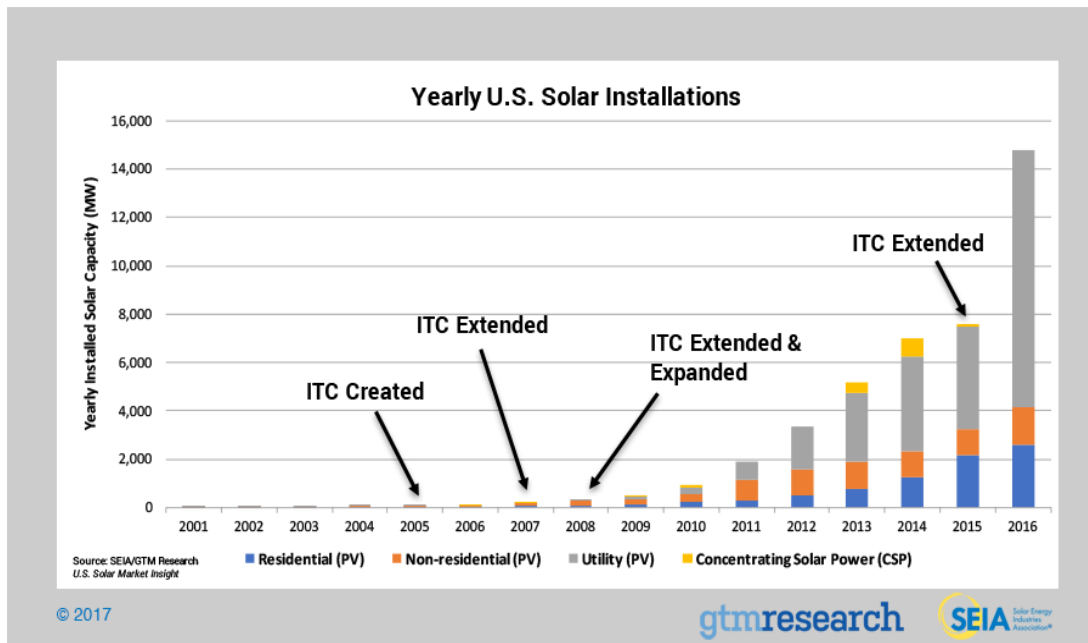
Figure 1. Impact of Production Tax Credit Expiration and Extension on Annual U.S. Wind Capacity Installations



Sources: Wisner and Bolinger 2016, AWEA 2017a.

The federal Investment Tax Credit (ITC) allows residential, commercial, and utility investors to claim 30 percent of the up-front capital investments for solar and other qualified renewable energy technologies against their tax liability. Created as part of the Energy Policy Act of 2005, the ITC has been extended and expanded several times. In contrast to the PTC, however, the ITC has been a relatively stable policy, avoiding most of the boom-and-bust cycle that wind energy projects have faced (Figure 2). In 2008, the ITC was extended for eight years for commercial, utility, and residential projects. In December 2015, Congress passed a five-year extension and phase-down of the ITC as part of the Consolidated Appropriations Act of 2016. Like the PTC, the ITC was also modified so that projects are now eligible for the credit based on when they commence construction rather than when they begin to produce power. Together with decreasing prices for solar energy technologies, the certainty these longer-term extensions provided investors has resulted in a rapid increase in U.S. solar installations over the past decade.

Figure 2. Impact of Investment Tax Credit Expiration and Extension on Annual U.S. Solar Capacity Installations



Source: SEIA 2017b.

Federal tax credits for renewable energy are needed to provide more parity in the tax code with fossil fuels and nuclear power, industries that have received huge tax benefits and other subsidies over the past 100 years. The Majority Memorandum cites EIA studies that only quantify subsidies for a single year in recent history to claim that renewable energy sources have received far greater subsidies than fossil energy sources. They also provide cost estimates from a 2017 Joint Committee on Taxation report that only include a limited number of years (2016 to 2020) for certain tax provisions. A more accurate comparison would be to look at subsidies for different energy technologies over a longer period of time since many incentives for conventional energy sources have been part of the permanent tax code for decades. For example, using a compilation of data from several government and third party sources, a 2016 analysis by AWEA found that wind energy only received 3 percent of all federal energy incentives between 1947 and 2015, compared to 65 percent for fossil fuels and 21 percent for nuclear power (Wanner 2016). The estimated \$27 billion in subsidies for wind pales in comparison to the \$619 billion in subsidies for fossil fuels and \$197 billion for nuclear over this time frame. The data used by AWEA includes all federal spending for research and development, tax incentives, direct deployment incentives and other interventions. Based on 2015 government projections of the costs of the PTC through 2025, AWEA estimates that wind energy will still only account for around 6 percent of total federal incentives.

A 2011 UCS analysis of nuclear power subsidies shows that existing nuclear plants have already received subsidies that have cost taxpayers more than the market price of power they helped generate, and they continue to receive ongoing subsidies ranging from 1-6 cents per kilowatt-hour (kWh) (Koplow 2011). For comparison, the PTC for wind is currently worth

about 2.3 c/kWh for 10 years. New nuclear plants are also eligible for a PTC for a limited period of time, which was included in the Energy Policy Act of 2005.

As I discuss in more detail below, federal tax credits also represent a way to value the environmental and other important public benefits of renewable energy that are currently not priced in energy markets or captured by other policies. This improves the playing field for renewable energy to compete with the more mature fossil fuel and nuclear industries.

Federal tax credits for renewable energy have enjoyed strong bi-partisan support since they were adopted in 1992. A primary reason for the bipartisan nature of the tax credits is that both Republicans and Democrats alike recognize the jobs and other economic benefits that renewable energy development brings to their state and local economies. The tax credits have also helped make the U.S. a global leader in manufacturing and deploying renewable energy.

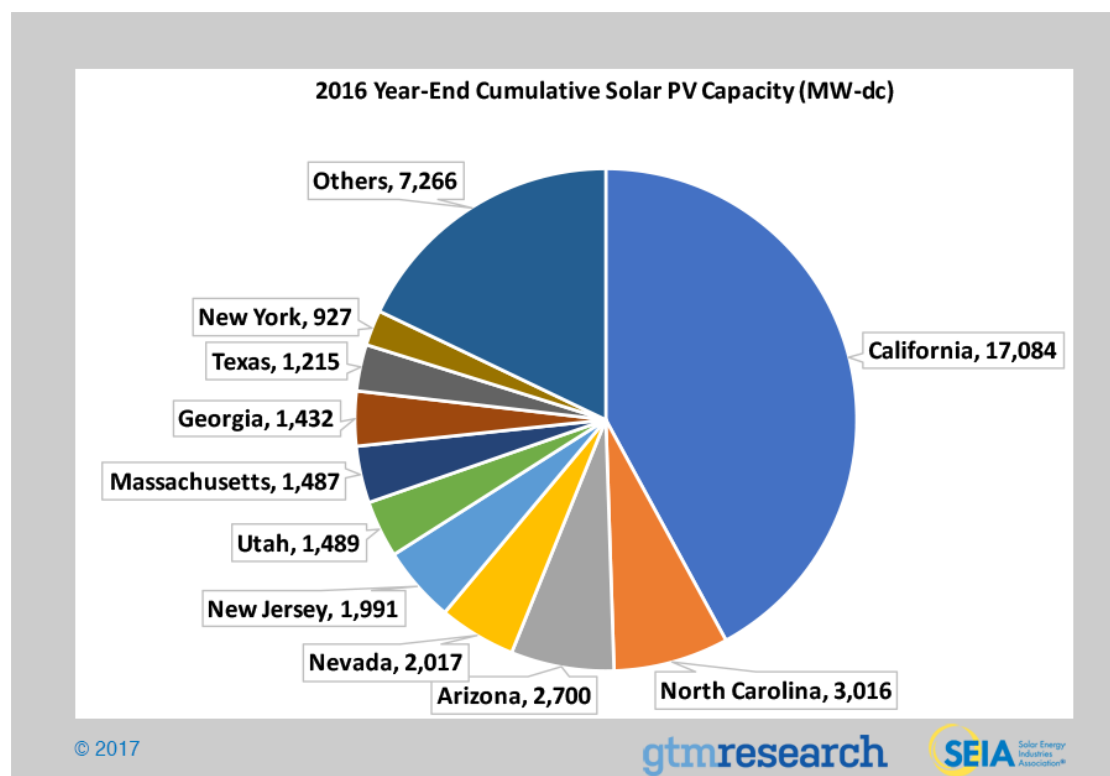
Federal Tax Credits are a Key Driver of Renewable Energy Development

Federal tax credits, combined with state renewable standards, have been a key driver for the recent growth in the U.S. wind and solar industries. U.S. wind capacity has more than doubled since 2010 and has accounted for nearly one-third of all new electric generating capacity since 2007. The wind industry installed more than 8,200 MW of wind capacity in 2016, reaching a total installed capacity of more than 82,000 MW (AWEA 2017a). The American Wind Energy Association (AWEA) estimates that 88 percent of the wind power added in 2016 was built in states that voted for President Trump, while 86 percent of total U.S. installed wind capacity in 2015 and 65 percent of wind manufacturing facilities are located in Republican districts (AWEA 2016a and 2017a). Texas leads the national with 20,300 MW of installed wind capacity, followed by Iowa, Oklahoma, California, Kansas, Illinois, Minnesota, Oregon,

Washington, and Colorado. An additional 18,300 MW are under construction or in advanced development, according to AWEA.

A record 14,800 MW of solar electric capacity was installed in the U.S. in 2016, nearly doubling the previous year's record and making solar the largest source of new capacity for the first time (SEIA 2017a). Over 42,000 MW of total solar capacity is now installed in the U.S., producing enough electricity to power 8.3 million homes. The industry has experienced a compound annual growth rate of nearly 60 percent since 2010. California leads the nation with more 17,000 MW of installed solar capacity, followed by North Carolina, Arizona, Nevada, New Jersey, Utah, Massachusetts, Georgia, Texas and New York (Figure 3). The Solar Energy Industries Association (SEIA) projects total installed U.S. solar PV capacity to nearly triple over the next five years.

Figure 3. Leading States for Installed Solar PV Capacity



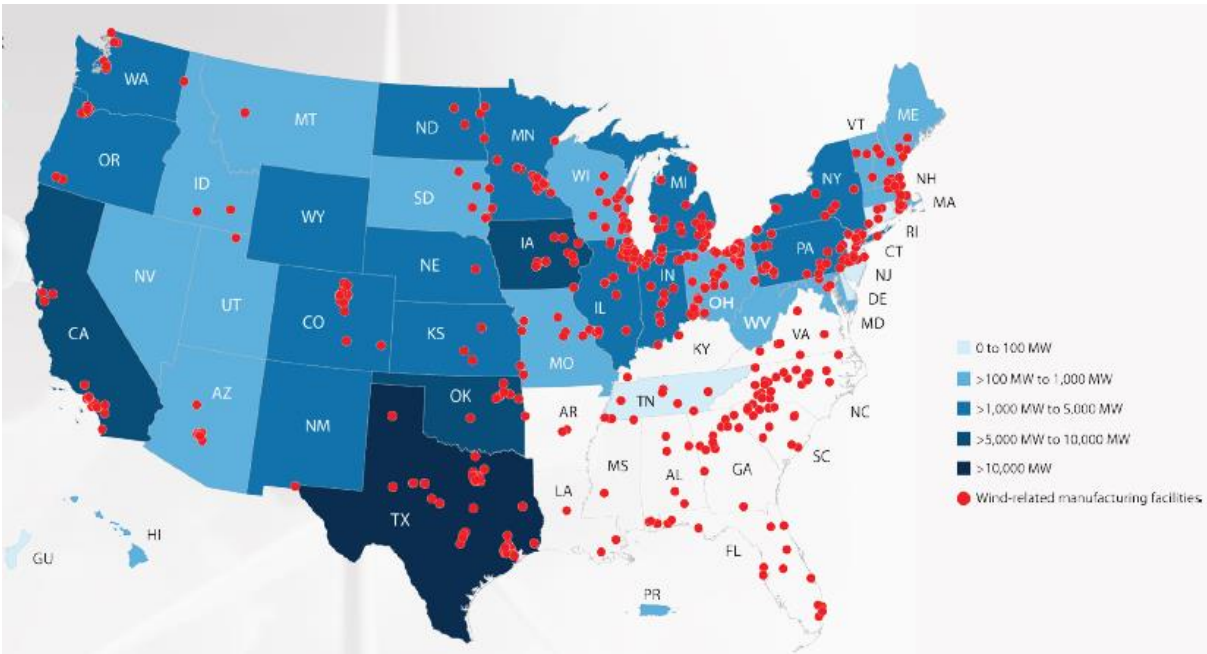
Federal Tax Credits Create American Jobs and Other Economic Benefits

The rapid growth the wind and solar industries have experienced in the United States over the past several years due to federal tax credits and state policies has resulted in significant economic benefits for state and local economies. Over the past decade, the wind industry has invested more than \$143 billion in the U.S. economy, with much of this investment flowing to rural areas where the wind projects are located (AWEA 2017). In 2016, the U.S. wind industry added nearly 15,000 new jobs, reaching a total of 102,500 direct and indirect full-time equivalent jobs in construction, manufacturing, operations, planning, and development in all 50 states, up from 50,500 jobs in 2013 (AWEA 2017b). Texas, the national leader in installed wind capacity, also has the most wind-related jobs with more than 22,000. Other top states for wind jobs include Iowa, Oklahoma, Colorado, and Kansas, each having between 5,000 and 9,000 employees, and California, Illinois, North Dakota, Minnesota and Nebraska, with each employing more than 3,000 people. Navigant Consulting projects total wind-related jobs will reach 248,000 by 2020, including 146,000 direct and indirect jobs and 102,000 induced jobs (AWEA 2017b).

Domestic manufacturing of wind turbine components has also grown significantly over the past decade. More than 500 manufacturing facilities located in 43 states produced 50-85 percent of the major wind turbine components installed in the United States in 2015, up from 20 percent in 2007 (Figure 4) (Wiser and Bolinger 2016, AWEA 2017b). Ohio is the leading state for wind manufacturing with more than 60 facilities, followed by Texas (40), Illinois (35), North Carolina (27), and Michigan, Pennsylvania and Wisconsin (26 each). Colorado, Iowa, Texas, and California are also national leaders manufacturing major wind turbine components. While

the Southeast currently has a small number of wind projects, they are a major wind manufacturing hub with more than 100 factories.

Figure 4. U.S. Wind-Related Manufacturing Facilities, 2016



Source: AWEA 2017b.

Wind power is providing a significant source of income for many rural communities. AWEA estimates that nearly all wind projects installed through 2015 were located in Census Bureau-designated rural areas, with 70 percent of that development located in low-income counties that fall below U.S. median household income levels (AWEA 2016). The National Renewable Energy Laboratory (NREL) estimates that wind projects have a county-level annual-earnings impact of \$5,000 to \$43,000 per megawatt of installed wind capacity, depending largely on whether the project has a local-ownership component (DOE 2012). This impact—typically in the form of lease, royalty, or right-of-way payments to local landowners—is becoming an increasingly important revenue stream in rural agricultural communities where many wind projects are sited.

With over 98 percent of all projects located on private land, wind energy provided an estimated \$222 million annually in lease payments to landowners in 2015, with more than \$156 million occurring in low-income counties (AWEA 2016). In 2015, wind lease payments provided more than \$50 million in Texas, \$15 million in California, Iowa, and Oklahoma, \$10 million in Illinois and Kansas, and \$5 million in six other states.

State and local governments also collect property and income taxes and other payments from renewable energy project owners. This money is being used by communities to build schools, hospitals, and other important infrastructure. For example, MidAmerican Energy estimates that their new 2,000 MW project in Iowa will generate approximately \$12.5 million in annual property-tax payments for local communities (MidAmerican 2017).

The solar industry is also a major source of new jobs and investment across the U.S. due in large part to federal tax credits. Total industry employment has more than doubled since 2012. More than 51,000 solar workers were added in 2016, bringing the industry total to 260,000 jobs at more than 9,000 businesses located in every state (Solar Foundation 2017). The top 10 states for solar jobs in 2016 are California, which leads the nation with over 100,000 solar jobs, followed by Massachusetts, Texas, Nevada, Florida, New York, Arizona, North Carolina, New Jersey and Colorado. A recent DOE report found that more Americans worked in solar or wind power generation in 2016 than in either nuclear, coal, natural gas, or hydroelectric generation (DOE 2017).

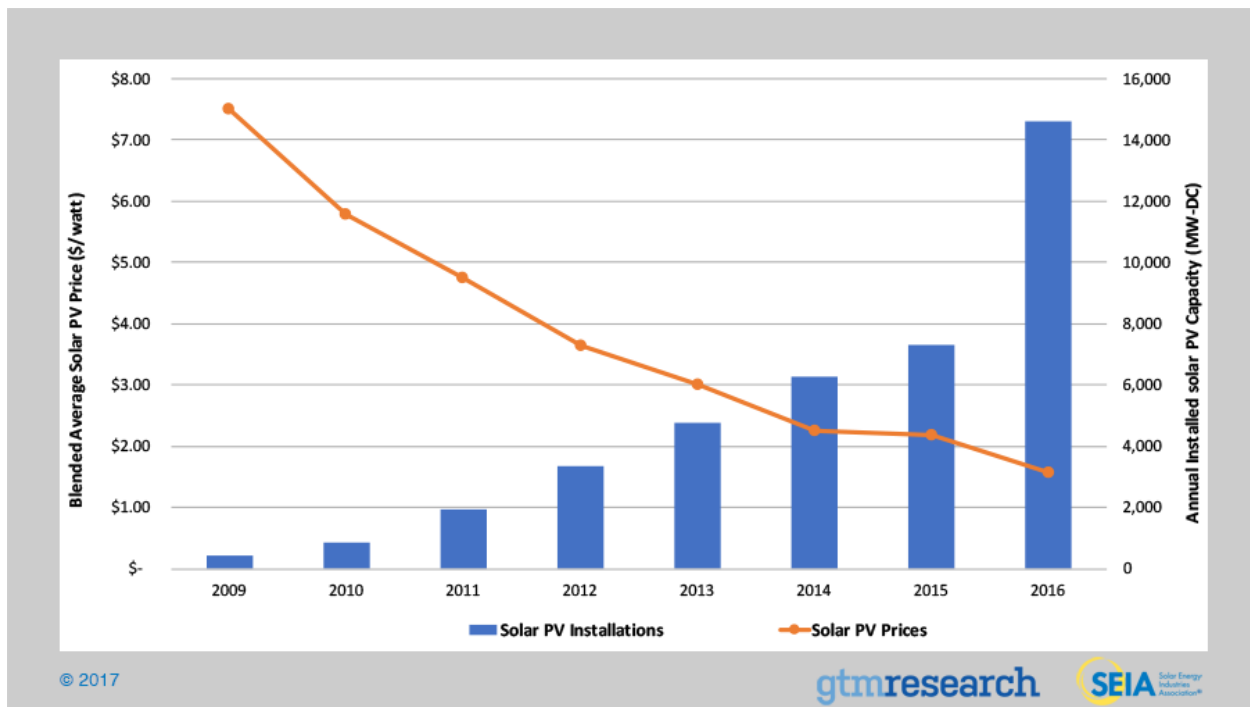
Federal Tax Credits Drive Innovation and Lower Costs

Improvements in wind turbine technology, particularly taller towers, longer blades and more efficient power electronics, has opened up new opportunities to develop wind power in

places such as the Southeast, which were previously considered economically marginal. These improvements are also resulting in greater wind power output, with capacity factors for new wind projects now exceeding 50 percent at the best locations. Higher capacity factors combined with increased efficiencies and economies of scale in manufacturing, installing, and operating wind turbines, have led to significant cost declines for U.S. wind projects. The total cost of generating electricity from wind power has dropped by more than two-thirds since 2009 (Wiser and Bolinger 2016).

The cost of solar photovoltaics (PV) has also fallen rapidly over the past few years, as the industry has achieved much greater economies of scale in manufacturing and installation. Since 2009, the average installed cost of utility scale and rooftop solar PV systems has fallen by more than 60 percent (SEIA 2017b).

Figure 5. Solar PV Costs Decline as Deployment Increases



Source: SEIA 2017b.

Federal Tax Credits are a Good Deal for Consumers

The falling costs of wind and solar driven by federal tax credits and state renewable standards has made the cost of renewable more affordable to consumers. Recent analyses show that the benefits of increasing renewable energy use greatly exceeds the costs of federal tax credits. For example, a 2016 NREL and LBNL analysis quantifying the benefits of complying with existing state renewable standards found that renewable energy provided an estimated \$32 to \$165 per megawatt-hour (MWh) in health and environmental benefits from reducing carbon emissions and other air pollutants, with a central estimate of \$75/MWh. This benefit is about three times the current cost of the PTC at \$23/MWh. The study also found that renewables would reduce wholesale electricity prices and natural gas prices, resulting in consumer savings of \$1.3-\$4.9 billion or \$13-49/MWh of new renewable generation. In addition, the study found that renewables would reduce water use from thermoelectric power plants, reduce natural gas price volatility, and create new jobs, but did not assign the economic value to these benefits in the above estimates.

Similarly, DOE's 2015 wind vision study found that increasing wind power to 10 percent of U.S. electricity generation by 2020 and 20 percent by 2030 would result in benefits worth \$41/MWh in avoided health and environmental benefits from avoided air pollution for a modest \$1/MWh or 1% increase in electricity prices in 2030. The study also found that achieving these wind power targets would result in additional \$23/MWh or \$280 billion in consumer savings from reduced natural gas prices due to a reduction in demand for natural gas in the power sector (DOE 2015).

These studies demonstrate that diversifying the electricity mix with renewable energy technologies like wind and solar can also help stabilize electricity prices and lower natural gas prices. These technologies are not subject to fuel price volatility and can offer fixed prices for 20

years or more. In contrast, natural gas prices, which have experienced significant volatility over the last decade, are difficult to lock-in for any significant duration. A 2013 LBNL study comparing prices from a large sample of wind power purchase agreements to a range of long-term natural gas price projections found that wind projects can provide a long-term hedge against natural gas, even in an era of low natural gas prices (Bolinger 2013). While the recent increase in U.S. shale gas production has resulted in lower natural gas prices, it has not eliminated the price volatility. This was readily apparent during the Polar Vortex in January 2014 when natural gas and electricity prices reached record high levels in the Northeast and Midwest due to high natural gas demand for both home heating and electricity generation.

Recent claims that the production tax credit for wind is distorting market prices and adversely affecting other energy sources such as nuclear power are greatly overstated. Analysis by AWEA shows that only a small share of all occurrences of negative prices appear to be linked to wind generation, with low electricity demand and the inflexibility of nuclear plants the primary cause of negative prices (Goggin 2016). Low natural gas prices are the primary cause of the economic challenges facing both nuclear and coal plants, as well as renewable energy projects. While additional wind and solar deployment does have the effect of pushing the generation supply curve out, this has a minimal impact on market prices, as the supply curve in most parts of the country is very flat due to low natural gas prices. In addition, any low-marginal cost generation, like nuclear, hydro, and even coal, can have the same impact as wind and solar.

Strong Federal Policies Are Needed

Federal tax credits and R&D funding have been an important complement to state renewable standard policies in promoting renewable energy development, driving technology innovation, and lowering costs. As discussed above, they has improved the playing field for

renewables to compete with fossil fuels and nuclear power, which have benefitted from large federal subsidies for decades and market prices that do not reflect many important externality costs from burning fossil fuels. They have also allowed the U.S. to maintain its global leadership in the manufacturing and deployment of renewable energy technologies. Until we can transition to national policies that provide more stable, long-term support for clean, low carbon energy, Congress should extend federal tax credits by at least five more years to maintain the sustained orderly growth of the industry and provide more parity and predictability for renewables in the tax code.

A long-term tax credit extension for renewable energy could also be part of a well-designed technology neutral tax credit that encourages investments in a wide range of low and zero carbon technologies. This would help level the playing until carbon emissions and other externality costs from burning fossil fuels are factored into market prices through other policy mechanisms. Tax credits should also be expanded to encourage investments in energy storage technologies to help accelerate deployment and cost reductions. Deployment of renewable energy, combined with storage, on a large-scale will help dramatically reduce carbon emissions from the power sector, while creating thousands of new jobs. Energy storage technologies can also enable micro-grids to shield communities and critical infrastructure from the disruption of storm-induced power outages. As the costs of energy storage continue to fall, the economic benefits to households, businesses, local communities, and utilities will grow.

Conclusion

Federal tax credits are a powerful, cost-effective tool for driving significant levels of renewable energy development. In turn, the deployment of wind, solar, and other renewable resources is attracting investments from manufacturers, creating new jobs, and producing

revenue streams for land owners and local communities, all while providing clean energy that reduces air pollution and helps stabilize our climate. Together with state policies, extending federal tax credits and transitioning to stronger federal policies for clean, low-carbon energy can help maintain the nation's momentum toward a clean and prosperous economy.

Thanks again for the opportunity to testify. I'd be happy to answer any questions.

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