Renewable Electricity Standards:

Delivering Significant Economic Benefits Across the United States

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SUMMARY OF UCS TESTIMONY

- State renewable electricity standards (RES) adopted by 29 states and the District of Columbia have been a key driver of renewable energy development, representing more than two-thirds of all non-hydro renewable energy capacity installed in the U.S. between 1998 and 2012.
- Seventeen states and D.C. have renewable standards of more than 20 percent. California's 33 percent by 2020 standard creates the nation's largest market for renewable energy, followed by Illinois, New Jersey, Texas, and Minnesota.
- RES policies are creating jobs and delivering investments, income, and tax revenues to state and local economies. The U.S. wind industry has invested over $100 billion in the U.S. since 2007 and supports 50,500 direct jobs. More than 560 facilities in 43 states manufacture wind turbine components that have increased the domestic content of U.S. wind projects from less than 25 percent in 2005 to over 70 percent in 2012. Nine of the top 10 states in total installed wind capacity have RES policies (TX, CA, IA, IL, OR, OK, MN, KS, WA, CO).
- The U.S. solar industry has invested nearly $34 billion in the U.S. economy over the past three years, and supports more than 142,000 jobs at 6,100 businesses located in every state. All of the top 10 states in total installed solar photovoltaic (PV) capacity have RES policies (CA, AZ, NJ, NC, NV, MA, HI, CO, NY, NM).
- The falling costs of wind and solar have allowed most utilities to fully comply with state RESs at little to no cost to consumers, and in some cases net savings.
- Stronger federal policies are needed to complement state RESs, such as extending federal tax credits, allowing renewables to be eligible for lower cost financing such as Master Limited Partnerships, adopting a national RES of 25 percent by 2025, and increasing the contribution of renewable energy to achieve stronger power plant carbon standards.

On behalf of the Union of Concerned Scientists (UCS), I would like to thank Chairman Whitfield, Ranking Member Rush, and the other distinguished members of the Subcommittee for the opportunity to testify today. My name is Steve Clemmer. I am the 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 450,000 members and 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.

My comments today will focus on how renewable electricity standards have been an effective and affordable state policy that have delivered significant economic benefits across the United States, as discussed in more detail in a recent UCS report (UCS 2013a). 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 utilities in most states are meeting or exceeding their targets at little to no cost to consumers. Finally, I will highlight how stronger federal policies are needed to complement state renewable energy policies.

A Primary Driver of Renewable Energy

A renewable electricity standard (RES) requires electric utilities to gradually increase the amount of renewable energy in their power supplies over time. It uses a market-based approach that stimulates competition among renewable energy developers and multiple technologies to provide the greatest amount of clean power for the lowest price, and an ongoing incentive to drive down costs. It requires minimal government involvement in setting the targets and

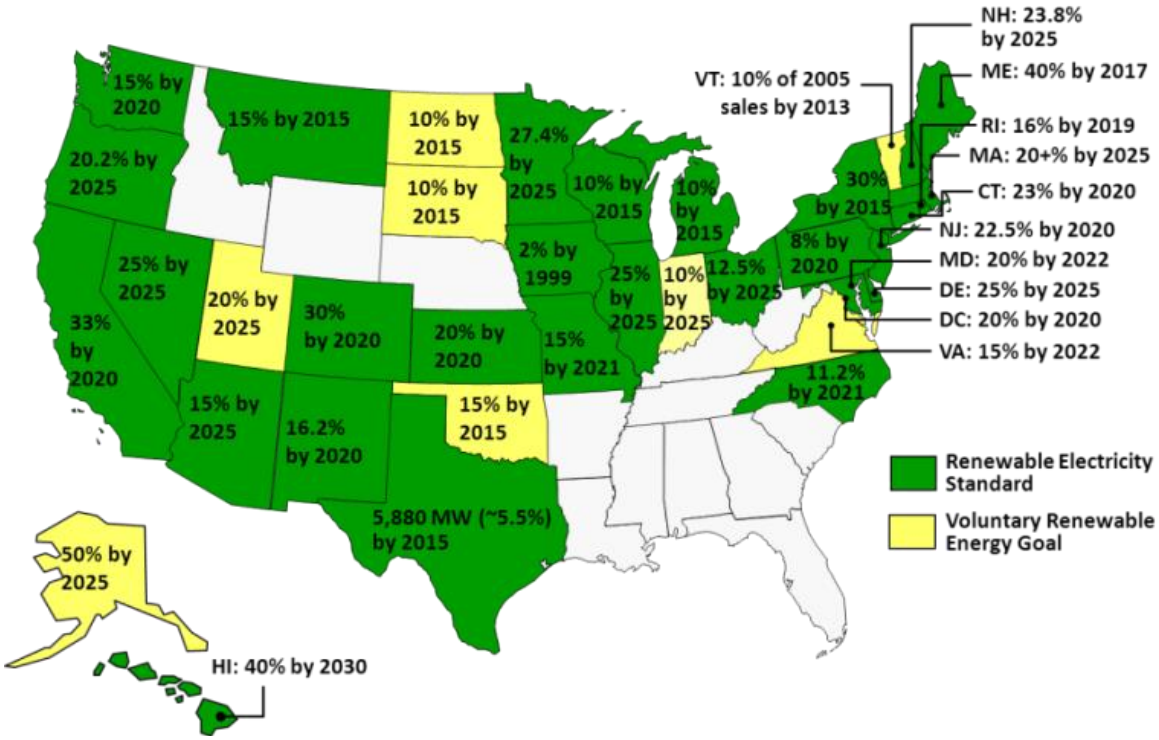
verifying compliance, while the market decides which renewable energy technologies and companies win or lose based on cost and performance. An RES also represents a way to value the environmental and other important public benefits of renewable energy that are currently not priced in energy markets, providing a more level playing field to compete with the more mature fossil fuel and nuclear industries.

State RESs have enjoyed strong bi-partisan support since they began in the late 1990s. To date, RESs have been adopted in 29 states and the District of Columbia, and another 8 states have adopted voluntary goals (Figure 1). Of the 37 states with standards or goals, 22 were enacted by states with mixed party control of the House, Senate, or Governor's office (Governor's Wind Energy Coalition, 2013). While the remaining 15 were enacted in states with single-party control, they were split evenly with eight all-Democrat and seven all-Republican control. And 20 RESs were adopted in states with Republican governors at the time, including in 1999 when President Bush was governor of Texas. A primary reason for the bipartisan nature of the RES is that both Democrats and Republicans alike recognize the jobs and other economic benefits that renewable energy development brings to their state and local economies.

Collectively, renewable standards applied to 55 percent of total U.S. electricity demand in 2012, according to Lawrence Berkeley National Laboratory (Barbose, 2013). LBNL also estimates that 46,000 megawatts (MW)—representing 67 percent of all renewable energy capacity from wind, solar, geothermal, and bioenergy installed in the U.S. between 1998 and 2012—occurred in states with renewable standards. LBNL projects this amount to more than double to 94,000 MW of new renewables by 2035, as states continue to ramp-up their standards. This should be relatively easy to achieve as it will require less than half the renewable capacity installed per year on average in the U.S. since 2008. In addition, four major transmission

projects completed in 2013 in Texas and the West could carry 10,000 MW of new wind capacity, while 15 other near-term transmission projects in advanced stages of development could carry an additional 60,000 MW of wind (AWEA 2014). This clean electricity is sorely needed as the nation's aging fleet of fossil fuel power plants retire.

Figure 1. State Renewable Electricity Standards

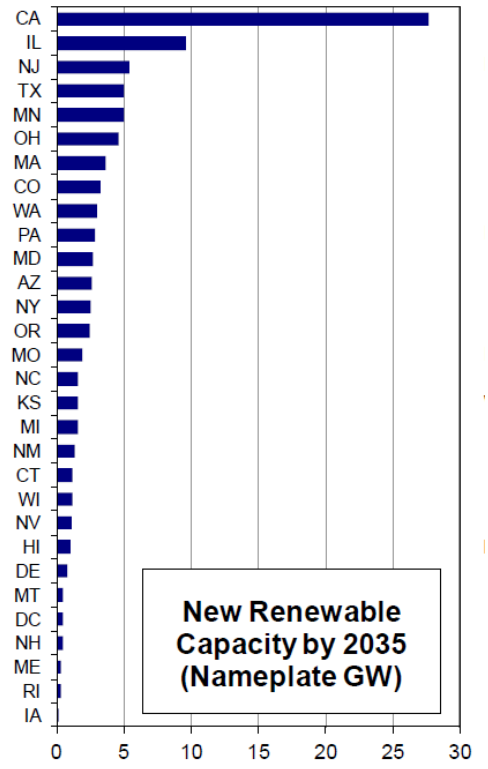


Source: Union of Concerned Scientists

California's 33 percent by 2020 standard creates the nation's largest market for renewable energy, followed by Illinois, New Jersey, Texas, and Minnesota (Figure 2). Hawaii and Maine have the highest renewable energy targets at 40 percent, but because of their small populations and lower electricity demand, the renewable energy markets are smaller than in other states. Seventeen states and D.C. have renewable standards of 20 percent or more, and 18 states have increased or accelerated their targets since originally adopting them. Numerous studies by utilities, regional grid operators, and state and federal agencies have shown that variable

renewable energy sources such as wind and solar can be integrated into the electricity system at similar or higher levels, while maintaining reliable and affordable electricity (UCS 2013b).

Figure 2. New Renewable Energy Capacity Needed to Meet State RESs in 2035



Source: Barbose 2013.

RES Policies Deliver Economic Benefits

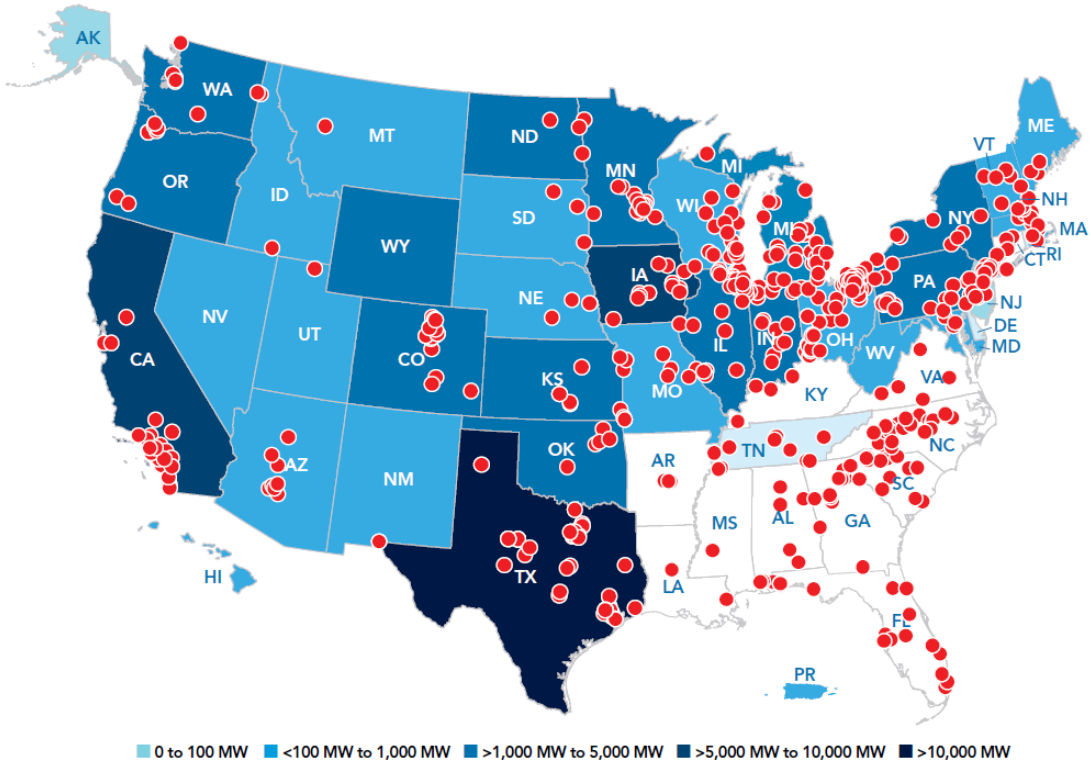
The long-term markets created by state RESs, combined with federal tax credits, played a key role in the rapid growth the wind and solar industries have experienced in the United States over the past several years. Nine of the top 10 states in total installed wind capacity have RES policies. Wind power accounted for 88 percent of the state-RES driven renewable energy capacity additions between 1998 and 2012, according to LBNL (Barbose 2013). Wind power has also accounted for 31 percent of all new electric generating capacity over the past five years, and has invested over $100 billion in the U.S. economy since 2007 (AWEA 2014). The wind

industry broke a record in 2012 by installing more than 13,000 MW, which represented 42 percent of all new U.S. electric capacity additions and a $25 billion investment in the U.S. economy (AWEA 2014).

At the end of 2013, the U.S. wind industry supported 50,500 direct full-time equivalent jobs in construction, manufacturing, operations, planning, and development (AWEA 2014). Texas, the national leader in installed wind capacity, also has the most wind-related jobs with over 8,000. The rest of the top 10 states for wind jobs include Iowa, California, Illinois, Colorado, Kansas, Michigan, North Dakota, Oregon, and New York, with each state employing between 1,000 and 4,000 people. All of these states have RESs except North Dakota, which has a non-binding goal.

Domestic manufacturing of wind turbine components has also grown significantly as the long-term market certainty provided by state RES policies has ramped up. The domestically sourced content of U.S. wind projects installed in 2012 was over 70 percent, up from less than 25 percent in 2005, and eight of the world's 10 largest wind-turbine manufacturing firms now have facilities in the United States (Wiser and Bolinger 2013). All told, there are now more than 560 facilities employing 17,400 people in 43 states (Figure 3) that manufacture components for the wind industry (AWEA 2014). Many of these facilities are located in states with RESs -- such as the Michigan, Ohio, Illinois, Pennsylvania, Texas, Colorado, and California. However, the markets created by state RESs are also benefitting states that don't have RESs, particularly the Southeast, which is a major wind manufacturing hub with more than 95 facilities.

Figure 3. U.S. Wind-Related Manufacturing Facilities, 2013



Source: AWEA 2014.

Wind power is providing a significant source of income for many rural communities. The National Renewable Energy Laboratory (NREL) recently found 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 the agricultural communities where many wind projects are sited. With over 98 percent of all projects located on private land, wind energy provided an estimated $180 million annually in lease payments to landowners in 2013 (AWEA 2014). In 2013, wind lease payments exceeded $38 million in Texas, $27 million in

California, $16 million in Iowa, and $10.9 million in Illinois, while providing $5-10 million in seven other states (CO, KS, MN, ND, OK, OR, and WA).

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, wind projects in Iowa, which now generates more than 27 percent of its electricity with wind, provided more than $19.5 million in annual property-tax payments to state and local governments in 2011 (AWEA 2011).

State RESs and federal tax credits have also been key drivers for the recent growth in the U.S. solar industry over the past few years. U.S. solar capacity has increased by a factor of ten since 2009 (SEIA 2014). More than 5,000 MW of solar electric capacity was installed in the U.S. in 2013, shattering the previous year's record of 3,300 MW and making solar the second largest source of new capacity behind natural gas.

This development has provided important economic benefits. The solar industry injected $13.7 billion into the U.S. economy in 2013, and nearly $34 billion over the past three years (SEIA 2014). More than 142,000 people work in the U.S. solar industry -- a 20 percent increase over 2012 levels -- at 6,100 businesses located in every state (Figure 4). While California leads the nation with over one-third of these jobs, states in the Midwest, Northeast, Southeast, and Southwest are also in the top ten (Figure 5).

All of the top ten states with the highest total installed solar PV capacity in 2013 have RES policies in place (SEIA 2014). The majority of current U.S. solar investments are concentrated in the northeast and western regions of the country, where solar resources are particularly strong or where RES policies have solar-specific targets or other incentives.

Figure 4. U.S. Solar Company Locations

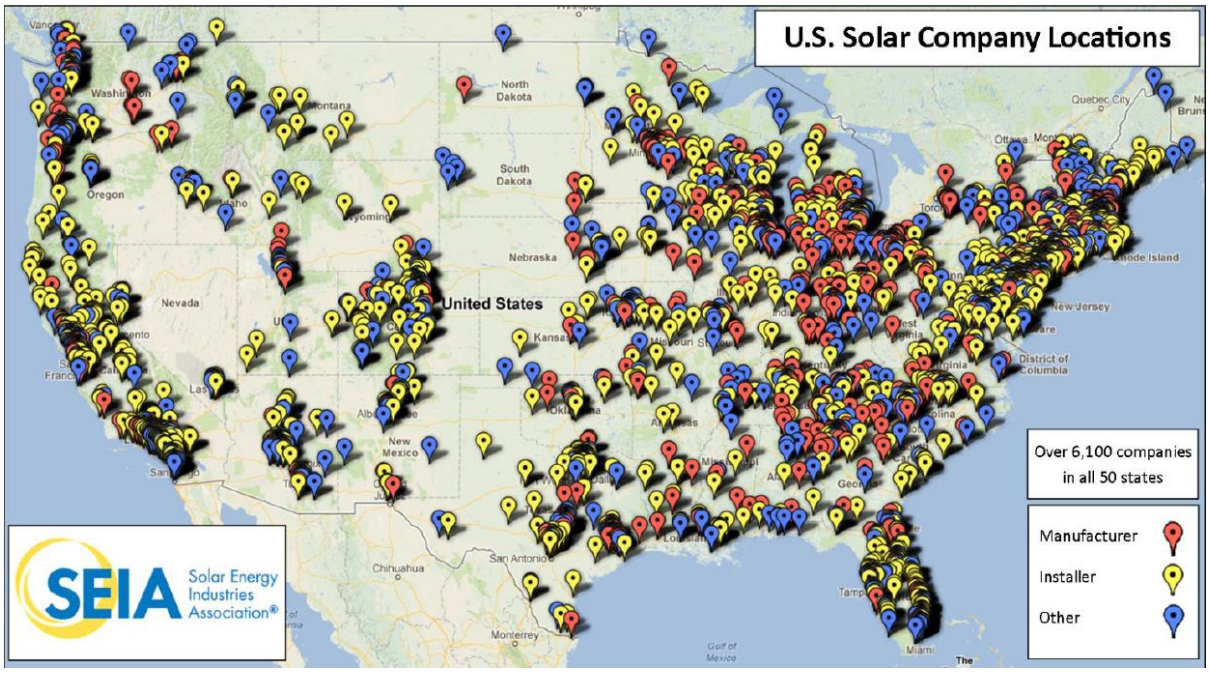


Figure 5. Top 10 States for Solar-Related Jobs

Source: The Solar Foundation, 2014.

RES Policies Drive Innovation and Lower Costs

By creating a long-term market for renewable energy, RESs have been a key driver for technology innovation and the recent cost reductions for wind and solar. For example, a recent peer-reviewed study by Carnegie Mellon University that analyzed patenting activity over the past 35 years found that RESs have been a significant driver of innovation in wind power technology

along with R&D, while federal tax credits have been less effective (Horner 2013). Improvements in wind turbine technology, particularly taller towers and longer blades, has also opened up new opportunities to develop wind power in places such as Michigan, Ohio and 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.

Increased domestic manufacturing, combined with increased efficiencies 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 90 percent since 1980, and 43 percent since 2009 (Wiser and Bolinger 2013).

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 the beginning of 2011, the average price of a solar PV panel has declined 60 percent, while the average installed cost has fallen by more than 35 percent (SEIA 2014). The cost of solar PV is already equal to retail electricity rates in 10 states, and this number could more than double over the next year and a half as the costs of solar continue to fall, according to a recent study by Deutsche Bank.

A Good Deal for Consumers

The falling costs of wind and solar have allowed most utilities to fully comply with state RESs at little to no cost to consumers, and in some cases even net savings. In May, NREL and LBL released a comprehensive peer-reviewed study of state RES costs and benefits, relying primarily on data directly reported by electric utilities and state regulators (Heeter et al. 2014). The study found that between 2010 and 2012, the cost of complying with RESs in 25 states

ranged from a net savings of 0.2 percent of retail electricity sales to a net cost of 3.8 percent (or -$4 to $44 per megawatt-hour (MWh) of renewable generation), with a weighted average cost of 0.9 percent. In the most recent year available, most states had compliance costs of less than two percent of retail rates.

They also evaluated several published studies of RES benefits that were conducted at the request of state legislatures, public utility commissions, or other state agencies. This included six studies that quantified the emissions and health benefits of state RES policies, which found benefits ranging from tens to hundreds of millions of dollars per year or approximately $4 to $23/MWh of renewable generation. Six other studies examining economic development impacts found benefits on the order of $1-6 billion or $22-30/MWh of renewable generation. Six states also quantified wholesale market price suppression benefits ranging from $2-50/MWh of renewable generation, resulting from low variable cost renewable resources displacing higher priced generation on the margin (usually natural gas) and reducing the market clearing price of electricity. While the study acknowledges that comparing these costs and benefits is challenging, it does show that benefits could offset and potentially exceed the relatively modest costs impacts in many cases.

Diversifying the electricity mix with renewable energy technologies like wind and solar can also help stabilize electricity and 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 recent LBNL study by 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 last winter during the polar vortex 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.

Stronger Federal Policies Needed to Complement State RESs

The Energy Information Administration (EIA) projects that existing state and federal renewable energy policies would increase non-hydro renewable energy sources from more than 6 percent of the U.S. electricity generation in 2013 to 9.4 percent by 2030. Clearly, we can and should do much more to capture the *national* economic, environmental, and energy diversity benefits of renewable energy.

Federal tax credits and R&D funding have been an important complement to state RES policies in promoting renewable energy development, driving technology innovation, and lowering costs. They have also helped create a level playing field for renewables to compete fairly with fossil fuels and nuclear power, which have benefitted from large federal subsidies for decades. However, the production tax credit (PTC) has suffered from inconsistent and short-term support from Congress over the past decade that has created significant market uncertainty and a boom-bust cycle for the wind industry. For example, the most recent expiration of the PTC in January 2013 resulted in significant layoffs in the wind industry. According to AWEA, direct employment in the U.S. wind industry declined from 80,700 FTE direct jobs at the end of 2012 to 50,500 jobs at the end of 2013. This can largely be attributed to the policy uncertainty that led to a 92 percent decrease in new wind capacity installed in the U.S. in 2013. To eliminate this uncertainty and encourage the sustained orderly growth of the industry, UCS recommends

that Congress extend the PTC by at least four years and transition to national policies that provide more stable, long-term support. We also recommend allowing renewable energy technologies to be eligible for Master Limited Partnerships (MLPs), Real Estate Investment Trusts (REITs) and other innovative financing mechanisms to lower the cost of capital and provide parity in the tax code with fossil fuels.

The success of state RESs so far makes a strong case for enhancing them. State governments and Congress should establish RES policies that require electric utilities to procure at least 25 percent of their power from renewable energy sources by 2025. Senator Markey and Senators Mark and Tom Udall both introduced bills (S. 1595 and S. 1627) last year that would achieve these targets. Since 2002, a national RES has passed the Senate three times and the House twice, but has never made it through both houses. UCS and EIA have conducted several national RES analyses over the past 15 years showing that targets of up to 25 percent by 2025 can be achieved affordably, while creating jobs and reducing carbon emissions (UCS 2009, EIA 2009, and EIA 2007). For example, a 2009 UCS analysis showed that by 2025, a 25 percent national RES would result in net increase of more than 200,000 new jobs, $263 billion in new capital investment, $64 billion in cumulative savings on consumer electricity and natural gas bills, and a 10.6 percent reduction in power plant carbon emissions.

EPA's proposed carbon standards for new and existing power plants also provides an important opportunity for increasing renewable energy use and reducing carbon emissions. UCS believes that EPA's proposed building block approach for reducing emissions from existing plants provides a flexible and cost-effective framework for states to decide how best to achieve their emission reduction targets. EPA's proposal allowing states to use renewable energy and efficiency for compliance is a smart strategy that builds on the success of what states are already

doing. However, a recent UCS analysis shows that EPA can go much further and achieve about twice the level of emission reductions and renewable energy than included in their proposal at a net savings (Cleetus et al. 2014). Using a modified version of EIA's National Energy Modeling System (NEMS), we found that the U.S. could reduce power plant carbon emissions by nearly 60 percent below 2005 levels, while increasing non-hydro renewables to 25 percent of U.S. electricity sales by 2025. We also found that the annual health and environmental benefits of reducing carbon and other emissions were much larger than the annual compliance costs by a factor of 3:1 in 2020, and 17:1 in 2030. Finally, we found that increasing the contribution from renewables and efficiency to achieving state emission reduction targets could help reduce the economic and climate risks of a potential over-reliance on natural gas (UCS 2013c).

Conclusion

State renewable standards are powerful, cost-effective tools 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 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 stronger federal policies, state renewable standards 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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