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REPORT

ENGINE OF GROWTH:

THE EXTENSIONS OF RENEWABLE ENERGY TAX CREDITS WILL POWER HUGE GAINS IN THE CLEAN ENERGY ECONOMY

The extensions of federal wind and solar tax credits will create more than 220,000 jobs and add nearly $23 billion to the U.S. economy this year, NRDC has found in this groundbreaking analysis. In December 2015, Congress passed bipartisan legislation to extend the federal wind and solar tax credits, providing important multi-year policy certainty for the clean energy industry. With increased power from wind and solar, the average household will save money on its monthly electric bills, and utility customers will be less exposed to potential spikes in fuel prices.

The clean energy growth will displace fossil fuel generation that emits the pollution driving climate change and other harmful air pollutants, producing substantial climate and public health benefits. Policymakers should seize the economic growth opportunities of clean energy and implement policies that build on the foundation of the tax credits to accelerate our urgently needed transition to a low-carbon future.

INTRODUCTION

The wind and solar industries have experienced remarkable growth over the past decade, thanks to a combination of falling technology costs and critical support from state and federal policies, including the federal renewable energy tax credits.[1]

In December 2015, Congress passed multi-year extensions of these tax credits, providing important short-term certainty for the clean energy industry. Under the extensions, the tax credits for onshore wind are gradually phased out and expire at the end of 2019. Solar credits are gradually phased out until they expire for residential projects after 2021; for utility-scale and commercial projects, credits are gradually reduced to 10 percent of investment costs after 2021 and then will remain at that level.[2] Prior to this extension, the production tax credit (PTC) for onshore wind had been allowed to lapse five times, and then had either been renewed at the last minute or retroactively, hampering the wind industry's ability to plan and grow.[3] With that uncertainty eliminated, the renewables industry is in a position to undergo a phase of sustained, rapid growth, producing significant job gains and economic expansion, cleaner air, and progress toward meeting our climate goals.

This report presents new analysis that projects the significant environmental and economic benefits that will accrue directly from the December 2015 tax credit extensions.

The analysis was conducted in two steps: power sector modeling and economic modeling. First, power sector modeling was performed by ICF using its Integrated Planning Model (IPM®) and relying on the underlying assumptions and scenarios developed by NRDC and M.J. Bradley & Associates for a separate analysis.[4,5]

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A "No Tax Credits" scenario was developed projecting outcomes without the federal tax credit extensions for comparison with the "Tax Credits" scenario.[6] The IPM projections provide an estimate of the amount of investment spurred by the renewables tax credits, as well as the impacts of those investments on the rest of the power sector. In the second step, the renewables investments and power sector impacts were used as inputs for the economic analysis, which was performed by ICF for NRDC using the REMI Policy Insight Plus model, a dynamic, economy-wide model of the entire United States.[7,8] The tax credit extensions result in lower government tax revenues than in the No Tax Credits case; in order to maintain budget neutrality, the analysis assumed equivalent reductions in government spending to offset this loss in revenues.[9]

THE TAX CREDIT EXTENSIONS WILL HELP ACCELERATE OUR CLEAN ENERGY AND CLIMATE PROGRESS

Multiple studies have concluded that wind and solar capacity is expected to nearly double from 2015 levels by 2021.[10] This study isolates the impact of the tax credits by examining a scenario in which, all else being equal, the tax credits had not been extended. The analysis concludes that the tax credits alone will prompt the development of nearly 29,000 megawatts of additional new utility-scale wind and solar capacity by 2020, enough to power nearly eight million homes and 23 percent greater capacity than in the No Tax Credits scenario (see Figure 1).[11]

Wind and solar energy can provide a range of customer benefits for households and businesses. Our analysis finds that, as a result of the tax credit extensions, average wholesale power prices and natural gas prices will be 2.2 percent and 1.5 percent lower, respectively, in 2020, compared with the No Tax Credits scenario. Increased wind and solar power reduces reliance on natural gas and provides a hedge against fuel price volatility, meaning that customers are less exposed to events such as spikes in natural gas prices.[13] And, the savings on fuel and reduced future capital expenditures for the expansion of conventional fossil energy capacity outweigh the utility customers' exposure from capital costs of building new wind and solar projects. As a result, the average U.S. household is projected to save 1.7 percent on its average monthly electricity bill in 2020, compared with the No Tax Credits case. These customer benefits are most substantial in the next several years, but persist through the next decade (see Figure 2).

Other policies focused on renewable energy growth have been demonstrated to deliver similar benefits in practice. An analysis by the Lawrence Berkeley National Laboratory found that in 2013 alone, renewable portfolio standards across the country saved customers up to $1.2 billion from reduced wholesale electric prices and up to $3.7 billion from lower natural gas prices (as a result of lower total demand for natural gas from the power sector).[14] Recent studies have also found that, over the past decade, the top 10 states in terms of investments in renewables have seen smaller retail electricity price increases than the bottom 10 states.[15,16]

Growth in clean energy will also help make progress toward

FIGURE 1: THE TAX CREDITS ARE PROJECTED TO DRIVE NEARLY 29,000 MEGAWATTS (MW) OF ADDITIONAL WIND AND SOLAR CAPACITY BY 2020[12]

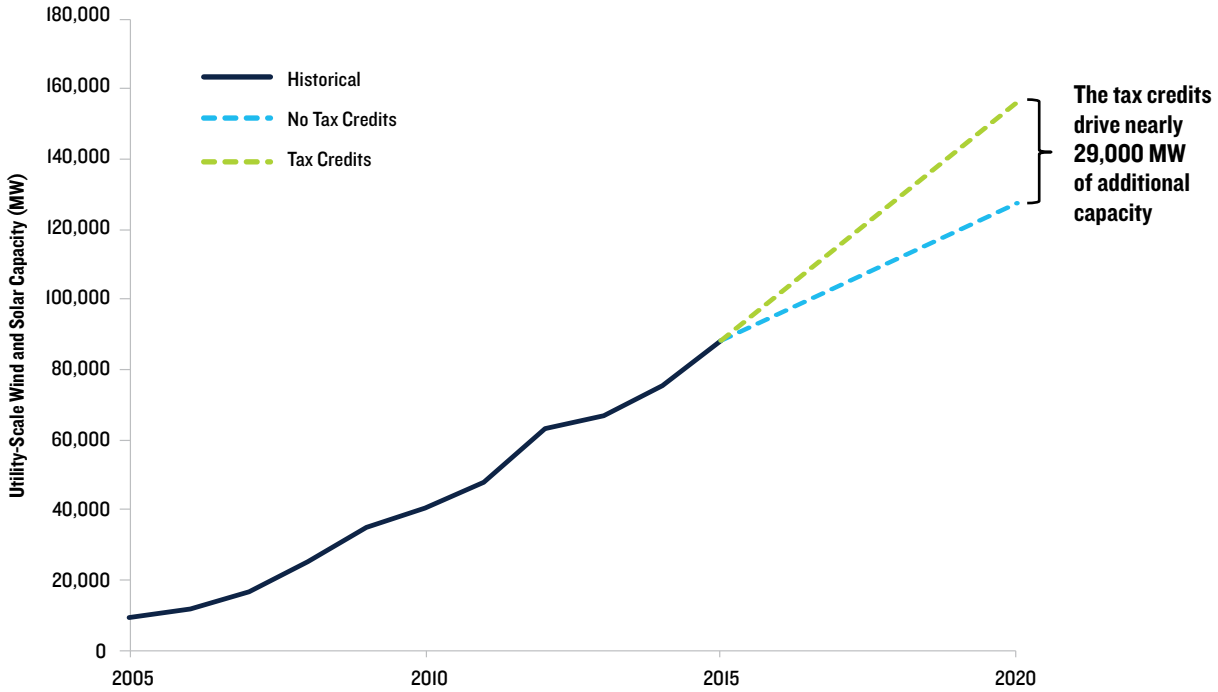
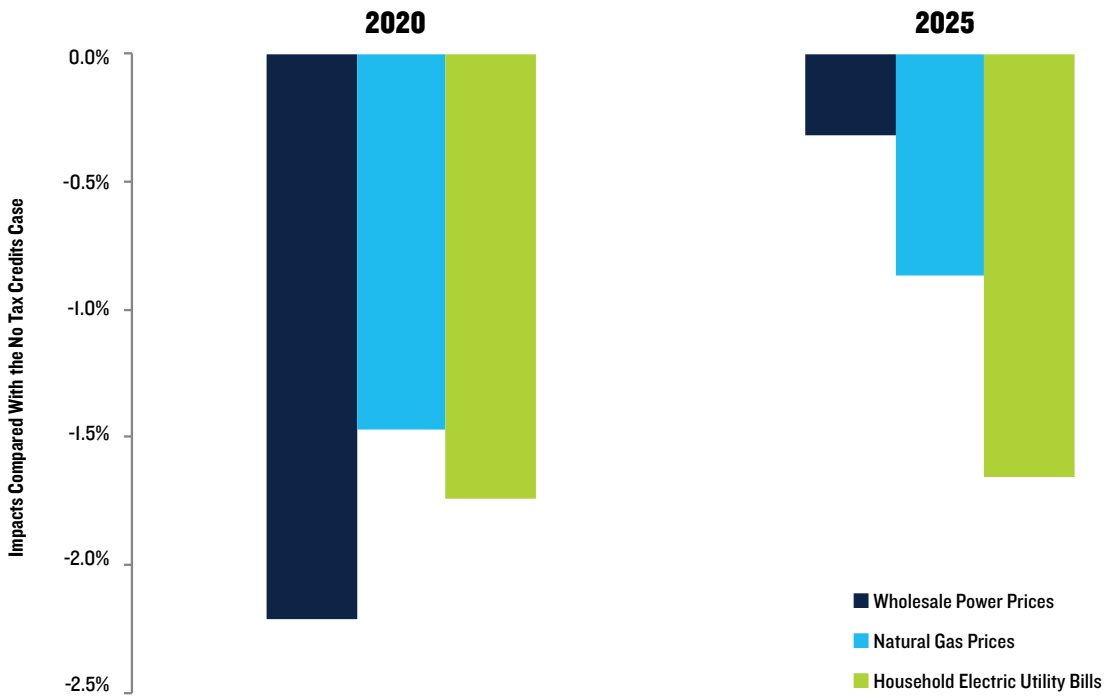


FIGURE 2: WIND AND SOLAR GROWTH BENEFITS CUSTOMERS, LEADS TO ELECTRIC UTILITY BILL SAVINGS



protecting both the climate and public health. By displacing fossil fuel generation, wind and solar power will drive down carbon emissions by 45 million tons (2.2 percent) in 2020, according to our analysis. The declines in fossil fuel generation will also result in air quality improvements, reducing harmful nitrogen oxide (NOx) and sulfur dioxide (SO_2) pollution by 40,000 tons (3.2 percent) and 22,000 tons (1.6 percent), respectively, in 2020.

WIND AND SOLAR GROWTH WILL DRIVE ECONOMY-WIDE GAINS

Clean energy is an important and quickly growing sector of our economy. As of 2016, the wind industry supported nearly 102,000 jobs, and more than 260,000 U.S. workers spent at least half of their time contributing to the booming solar industry, according to a new report by the Department of Energy.[17] Solar industry employment has nearly tripled since 2010, and the Bureau of Labor Statistics recently projected that wind turbine technician would be the fastest growing job in the country through 2024.[18,19] Now that the clean energy industry has received tax policy certainty for the next several years, the wind and solar sectors are well-positioned to continue their rapid growth.

Our economic analysis indicates that wind and solar growth will also result in new jobs in the clean energy industry, bringing overall net benefits for the economy. The boost in clean energy production fueled by the tax credits will spur more jobs for construction workers, solar installers, wind turbine engineers, and related jobs across the clean energy industry, and will stimulate local economies across the country. Overall, the tax credits will drive a net increase of more than 220,000 jobs across the country in 2017, and an average annual employment gain of over 80,000 jobs between 2016 and 2025 above the No Tax Credits scenario.

As shown in Table 1 and Figure 3, the states examined in this analysis are projected to see significant benefits to their economies as a result of the tax credit extensions.[20] Iowa, already fourth in the country in wind jobs, is likely to see additional job creation driven by the boost in wind growth in the region, and its economy stands to gain more than 3,300 jobs each year in 2017 and 2018, our analysis indicates.[21] Nevada, home to some of the cheapest solar power in the country, is projected to add more than 1,400 jobs in both 2017 and 2018. Ohio adds 9,700 jobs in 2017 and more than 10,000 jobs in 2018, and the state's gross domestic product gets a boost of over $1 billion per year. Pennsylvania is projected to gain nearly 9,300 jobs each year in 2017 and 2018, and its GDP gets a boost of more than $1 billion per year. In Virginia, the state gains about 5,000 jobs per year in 2017 and 2018.

The economic impact estimates reflect both direct investments and spillover effects. Wind installations in Iowa, for example, may contribute to an increase in both construction jobs in Iowa and manufacturing jobs in Michigan. The overall impacts described in this report are net effects for the entire economy, including increases in investments in renewables-related sectors as well as lower fossil fuel consumption and related supply-chain effects.

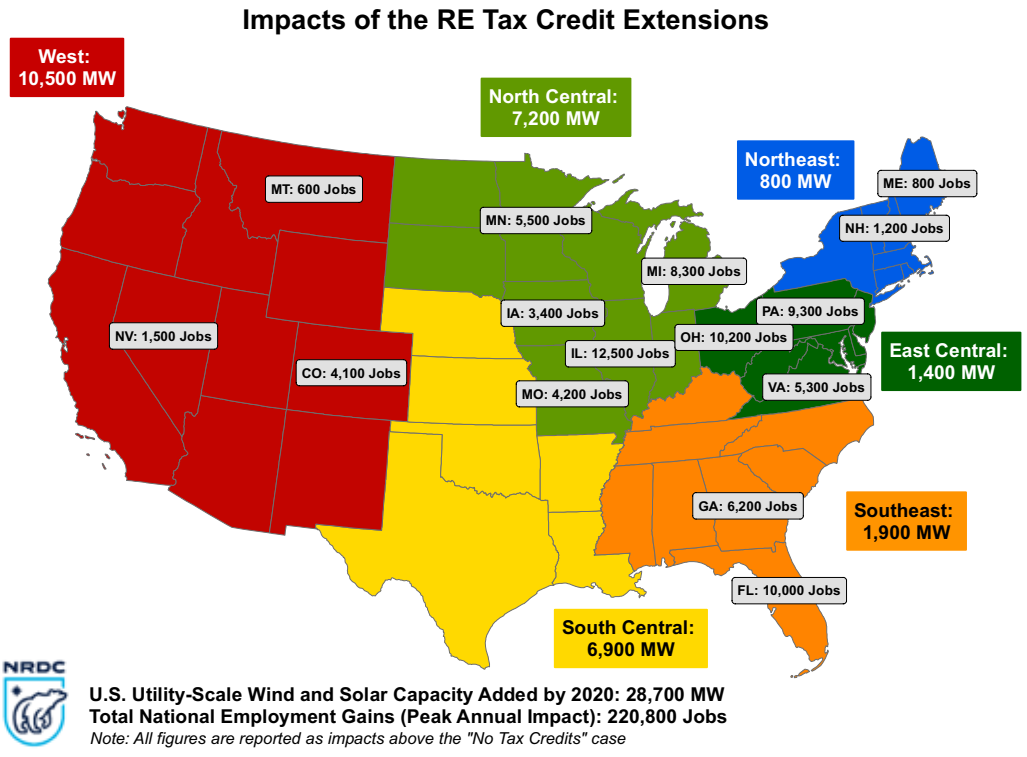
TABLE I: RENEWABLE ENERGY TAX CREDITS GENERATE EMPLOYMENT AND GDP GAINS ACROSS THE COUNTRY

Economic Impacts of the RE Tax Credits				
	Employment		GDP Value Added (Millions $2012)	
State	Peak Annual Impact	Average Annual Impact, 2016-2025	Peak Annual Impact	Average Annual Impact, 2016-2025
Pennsylvania	9,292	3,667	1,062	452
Virginia	5,289	1,800	562	225
Ohio	10,177	4,074	1,161	484
Michigan	8,264	2,720	908	340
Missouri	4,219	1,014	404	126
Illinois	12,479	4,895	1,498	644
Iowa	3,384	1,291	371	161
Minnesota	5,517	2,800	822	381
Montana	583	172	56	17
Colorado	4,085	885	402	112
Nevada	1,491	555	157	57
Florida	9,976	4,585	997	510
New Hampshire	1,217	435	183	72
Maine	775	239	70	24
Georgia	6,205	2,555	658	277
Rest of U.S.	139,277	51,719	15,458	7,208
Total[22]	**220,806**	**83,406**	**24,056**	**11,089**

Note: All figures are reported as gains over the "No Tax Credits" case.

FIGURE 3: RENEWABLE ENERGY TAX CREDITS GENERATE EMPLOYMENT AND GDP GAINS ACROSS THE COUNTRY

Economic impacts are provided for the entire U.S. and for select states examined in this analysis.



POLICYMAKERS SHOULD BUILD ON THE BENEFITS OF A CLEAN ENERGY ECONOMY

The benefits of a clean energy economy are clear and growing. Tax policy has long played an important role in the energy sector, and any adjustments to the tax code should take into account the significant economic, public health, and climate benefits of clean energy. The tax credit extensions will have the largest impact over the next few years until they phase out, but additional policies to accelerate clean energy deployment beyond 2020 would most likely lead to even stronger, more persistent job gains and economic growth. Policymakers should take advantage of the tremendous economic development opportunity that clean energy represents. Federal and state policymakers alike should implement policies that accelerate our urgently needed transition to a low carbon economy.

ENDNOTES

1 National Renewable Energy Laboratory, *2015 Renewable Energy Data Book* (U.S. Department of Energy, 2016). http://www.nrel.gov/docs/fy17osti/66591.pdf.

2 Congress extended the renewable energy tax credits as part of the *Consolidated Appropriations Act of 2016*. The Production Tax Credit (PTC) for onshore wind projects was extended at its full value of 2.3 cents/kWh through the end of 2016, and then will phase down to 80% of its full value in 2017, 60% in 2018, and 40% in 2019. The Investment Tax Credit (ITC) for solar projects was extended at its full value of 30% of project investment costs through the end of 2019, and will drop to 26% in 2020 and 22% in 2021. Without additional legislation, the PTC will expire after 2019, and after 2021, the ITC will drop to 10% of investment costs for utility-scale and commercial projects and will expire for residential projects.

3 Staff of Bipartisan Policy Center, *Reassessing Renewable Energy Subsidies* (Washington: Bipartisan Policy Center, 2011). http://bipartisanpolicy.org/wp-content/uploads/sites/default/files/BPC_RE%20Issue%20Brief_3-22.pdf.

4 IPM® is a detailed model of the electric power system that is used routinely by industry and regulators to assess the effects of environmental regulations and policy. It integrates extensive information on power generation, fuel mix, transmission, energy demand, prices of electricity and fuel, environmental policies, and other factors. The model runs are illustrative and are not intended to be a prediction of the future. For more information, see https://www.icf.com/solutions-and-apps/ipm.

5 M.J. Bradley & Associates, *EPA's Clean Power Plan: Summary of IPM Modeling Results With ITC/PTC Extension* (2016). http://www.mjbradley.com/sites/default/files/MJBA_CPP_IPM_Report_III_2016-06-01_final_0.pdf.

6 The Tax Credits case was derived from a Reference Case scenario in the M.J. Bradley Clean Power Plan modeling, referred to as the "BAU 2" scenario, (see FN5), and does not factor in the Clean Power Plan. The No Tax Credits case was developed by NRDC. It is identical to the Tax Credits case with regard to all other assumptions and economic conditions.

7 The REMI model is an economic model that incorporates elements of four economic modeling approaches: Input-Output, General Equilibrium, Econometric, and Economic Geography. For more information, see http://www.remi.com/the-remi-model.

8 For this analysis, the model is used to examine the U.S. economy divided into 16 linked subregions, and uses a Keynesian closure, meaning no central bank interest rate mechanism will be exerted to correct changes in U.S. employment that have been caused by a policy shock. It is also assumed that incremental shifts in investment activities are met by increases in domestic manufacturing and supply. Projections of the overnight capital costs for various renewable investments, developed as part of the power sector modeling, were also necessary for the economic modeling. For more details on the Reference Case calibration and other assumptions used throughout this modeling effort, please see: https://www.nrdc.org/sites/default/files/renewable-energy-tax-credits-economic-impact-methodology-appendix.pdf.

9 Government spending was reduced across the following ten categories, determined (from the REMI model) to be the industries most impacted by non-defense discretionary spending in the federal budget: administrative and support services; ambulatory health care services; hospitals; miscellaneous manufacturing; nursing and residential care; oil and gas extraction; petroleum and coal products; scientific and professional services; real estate; and telecommunications. This approach was chosen for simplicity; there are many different ways in which the tax credit extensions might actually be offset in the federal budget.

10 For a summary of these studies, see Natural Resources Defense Council, *The Clean Power Plan: Keeping Climate Progress on Track* (2016). https://www.nrdc.org/resources/clean-power-plan-keeping-climate-progress-track.

11 The rooftop solar market is growing rapidly and has received a significant boost as a result of the tax credit extensions, but this modeling only includes utility-scale generation resources. Bloomberg New Energy Finance projects that the ITC extension will result in an increase in distributed solar of 9.7 GW in 2016-2021 over what would have been built without the tax credits. See Amy Grace et al., *Impact of Tax Credit Extensions for Wind and Solar* (Bloomberg New Energy Finance, 2015). https://data.bloomberglp.com/bnef/sites/4/2015/12/2015-12-16-BNEF-US-solar-and-wind-tax-credit-impact-analysis.pdf.

12 The chart presents a linear interpolation between 2015 levels and the 2020 capacity levels projected in IPM assuming a constant annual buildout. Annual build levels will in reality fluctuate based on a number of market factors.

13 Jeff Deyette et al., *The Natural Gas Gamble: A Risky Bet on America's Clean Energy Future* (Union of Concerned Scientists, 2015). http://www.ucsusa.org/sites/default/files/attach/2015/03/natural-gas-gamble-full-report.pdf.

14 Ryan Wiser et al., *A Retrospective Analysis of the Benefits and Impacts of U.S. Renewable Portfolio Standards* (Lawrence Berkeley National Laboratory and National Renewable Energy Laboratory, 2016). http://www.nrel.gov/docs/fy16osti/65005.pdf.

15 Nancy Pfund and Anand Chhabra, *Renewables Are Driving Up Electricity Prices – Wait, What?* (DBL Investors, 2015). http://www.dblpartners.vc/wp-content/uploads/2015/04/Pfund-Chhabra-Renewables-Are-Driving-Up-Electricity-Prices-Wait-What.pdf?48d1ff.

16 Sierra Martinez, *Cleaning Up Our Act on Energy and Reaping the Benefits* (Natural Resources Defense Council, 2016). https://www.nrdc.org/sites/default/files/clean-up-energy-reap-benefits-ib.pdf.

17 U.S. Department of Energy, *U.S. Energy and Employment Report* (2017). https://energy.gov/sites/prod/files/2017/01/f34/2017%20US%20Energy%20and%20Jobs%20Report_0.pdf.

18 The Solar Foundation, *National Solar Jobs Census 2016* (2017). http://www.thesolarfoundation.org/national/.

19 Bureau of Labor Statistics, *Occupational Outlook Handbook: Fastest Growing Occupations* (U.S. Department of Labor, 2015). https://www.bls.gov/ooh/fastest-growing.htm.

20 In this analysis, the U.S. economy is divided into linked subregions that include the 16 states listed in Table 1 as well as a "rest of U.S." region. This structure was necessary in order to achieve state granularity while also understanding the impacts on the U.S. as a whole; analyzing more than 16 states at once would have involved considerable additional time and resources.

21 American Wind Energy Association, "US wind power jobs hit record, up 20 percent in 2016," April 2016. http://www.awea.org/MediaCenter/pressrelease.aspx?ItemNumber=8736.

22 The year in which the peak impact occurs varies by state (with all peak impacts occurring in either 2017 or 2018). As a result, the sum of the peak impacts for each state and region is not equal to the peak impact for the U.S. as a whole.