THE UNSEEN COSTS OF WIND-GENERATED ELECTRICITY

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"In the economic sphere an act, a habit, an institution, a law produces not only one effect, but a series of effects. Of these effects, the first alone is immediate; it appears simultaneously with its cause; it is seen. The other effects emerge only subsequently; they are not seen; we are fortunate if we foresee them." -- Frederic Bastiat, 1848

EXECUTIVE SUMMARY

This report explores both explicit and implicit factors that influence the cost of producing electricity from wind. The explicit, or seen costs of wind-generated electricity, include cost components such as power plant development and construction, operation & maintenance, and transmission infrastructure costs. Often overlooked, however, are the implicit costs of wind power, caused by government subsidies, mandates, and regulations that distort the electricity market. This report does not estimate an actual value for the cost of producing electricity from wind, rather, it identifies and analyzes those factors that policymakers should consider.

Rather than creating a new cost estimate, we analyze the findings of prominent cost studies by experts in the energy field. Each study includes different factors in its estimate of the cost of wind power. We break down each of these factors and explain the significance of each. These factors include: capital costs, operation and maintenance costs, capacity factor, transmission costs, baseload cycling, social and environmental costs, and the cost of government subsidies. Other factors are more difficult to quantify, but nevertheless add to the cost of wind power. Such factors include: opportunity cost of taxpayer dollars, reduced reliability of the grid, and higher electricity prices. We conclude that, when estimating the cost of wind power, all of these factors should be included.

Proponents of wind energy claim that it is superior to traditional forms of power generation such as coal and natural gas. They claim that wind energy is cheaper to produce and it is renewable. Sometimes, when cursory and incomplete cost accounting is used to calculate wind energy's costs, these claims appear to be correct and wind energy appears to be not only advantageous to consumers, but also friendly to the environment.

The actual cost of wind power, however, is what consumers and society as a whole pay both to purchase wind-generated electricity and also to subsidize the wind energy industry through taxes and government debt. The cost of electricity generated from wind includes both traditional cost accounting and the seen and unseen costs of policies that seek to artificially bolster renewable energy development and production. When examined more closely, many claims about wind energy are found to be indefensible.

To more closely examine the cost of wind energy, this report will discuss in detail aspects of wind energy that are often overlooked, aspects which lead to dramatic underestimation of the cost of producing electricity from wind. These include the cost of massive government subsidies and mandates to incentivize development and production of renewable energy. They also include the costs of building transmission lines to the often-remote locations where wind

power is plentiful. As important but more difficult to quantify are the costs of reduced reliability. Wind energy distorts the market and drives more reliable energy sources out. Finally, the actual cost of wind must also include opportunity costs paid by taxpayers, whose money could have been spent more productively than subsidizing the wind industry.

By including the cost of government subsidies and other unseen costs of wind power, it is easy to conclude that the cost of wind energy is much higher than many studies estimate. Before the enactment of more policies and mandates that bolster the no-longer-infant wind industry, the actual costs of wind power to American taxpayers should be calculated. This will ensure that future policy decisions are based on comparisons of the actual costs and benefits of wind power.

INTRODUCTION

Since the 1990s, wind power has grown rapidly in the United States. In Texas, for example, almost 10 percent of electricity supplied to the main electrical grid was generated by wind energy in 2013.[1] Other states similarly aspire to move their energy production to wind power and other renewable energy sources in the near future.

The growth of wind energy is not the result of new technology and favorable market forces. Instead, wind energy's rapid emergence is largely a response to generous federal subsidies intended to boost the technology and shift the nation's energy portfolio away from fossil fuels. Governments, from the federal level to the local, have enacted policies to address constituent concerns about the potential negative environmental consequences of burning fossil fuels. The perceived environmental benefits of wind power include increased sustainability, reduced carbon emissions, and reduced potential for catastrophic human-caused climate change. As this report will discuss, however, wind power may not be as environmentally beneficial as many claim. What's more, any environmental benefits must be weighed against the economic costs of wind power borne by electricity consumers and American taxpayers.[2]

In 2012 wind energy represented 43 percent of all new electricity-generating capacity, more than any other type of energy.[3] Environmentalists and wind industry lobbyists tout these numbers as indications of great success and as a path to America's renewable energy future. The growth of wind energy, however, comes at a substantial cost to taxpayers and competitors in the energy marketplace. Government subsidies and state mandates, enacted to help the wind power industry get on its feet, are responsible for the rapid growth in wind installations over the past decade.

Unfortunately, subsidies, tax breaks, and other incentives do not seem to be generating substantial returns in terms of electricity. In fiscal year 2010, for example, wind energy received 42 percent of direct federal subsidies for energy, more than any other type of electricity generation. Despite this, wind produced only 2 percent of the nation's total electricity.[4] In 2013 that number grew to 4 percent, while still receiving 37 percent of direct federal subsidies for energy. As Figure 1 shows, however, generation of electricity from wind remained insignificant compared to generation from coal, nuclear, natural gas, and hydropower.5

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[1] American Wind Energy Association (AWEA). 2014, March 5. "American Wind Power Reaches Major Power Generation Milestones in 2013." Retrieved from: http://www.awea.org/MediaCenter/pressrelease.aspx?ItemNumber=6184

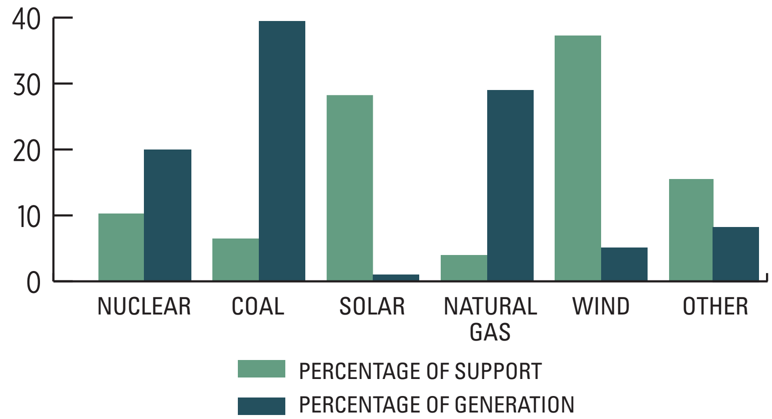
[2] It should be noted that this cost study is meant to be just that—a study of the costs of wind power. It is not intended to provide a complete cost-benefit study of wind power.

[3] Department of Energy (DOE). 2013. "America's Wind Industry Reaches Record Highs." Retrieved from: http://energy.gov/articles/americas-wind-industry-reaches-record-highs

[4] de Rugy, V. 2013, May 21. "Renewable-Energy Subsidies and Electricity Generation." The Mercatus Center at George Mason University. Retrieved from: http://mercatus.org/publication/renewable-energy-subsidies-and-electricity-generation

[5] Energy Information Administration. 2015, March 23. "Direct Federal Interventions and Subsidies in Energy in Fiscal Year 2013." Department of Energy. Retrieved from: http://www.eia.gov/analysis/requests/subsidy/

FIGURE 1: FEDERAL ELECTRICITY SUBSIDIES AND ELECTRICITY GENERATION BY SOURCE[6]



Government policies enacted to incentivize the development of renewable energy create economic distortions, which drive more reliable sources of electricity generation out of the market. These artificially induced disturbances in the energy marketplace make energy sources less reliable than they would ordinarily be. This reduced reliability is a hidden cost of wind energy, paid for by the American public. In other words, federal wind policies do not lead the United States into a future of renewable energy, but instead create problems in the present energy market, which are paid for by American taxpayers.

This report begins with an overview of current federal wind policies and an in-depth analysis of how those policies increase the unseen costs of producing electricity from wind power. We then examine state policies meant to boost renewable energy, primarily through mandates called Renewable Portfolio Standards (RPS). Using several state-level case studies, we show that state policies further increase the unseen costs of wind power. Finally, we carefully review the most commonly cited cost estimates for wind power to create a more complete list of the factors that should be included in estimating the cost of wind.

CURRENT FEDERAL WIND POLICY

Modern energy policy favors renewable sources of electricity like wind and solar over conventional sources such as coal and natural gas. Appendix A provides an overview of U.S. tax incentives across the energy sector. Our analysis here focuses on the most influential policies that affect wind power producers today.

PRODUCTION TAX CREDIT (PTC)

Data collected by the U.S. Energy Information Administration show that federal wind energy subsidies have grown by an average of 32 percent each year since 2000, and in 2010 the federal government spent nearly $5 billion on subsidies for wind energy.[7] Of those subsidies, the Production Tax Credit (PTC) is the foremost federal policy supporting wind

[6] Energy Information Administration (EIA). 2015, March. "Direct Federal Financial Interventions and Subsidies in Energy in Fiscal Year 2013." Pg. xix and xxi. Retrieved from: http://www.eia.gov/analysis/requests/subsidy/pdf/subsidy.pdf. The data for this chart were taken from Table ES4 and Table ES5. The numbers may not sum to 100 percent because of independent rounding.

[7] de Rugy, V. 2013, May 21. "Renewable-Energy Subsidies and Electricity Generation." The Mercatus Center at George Mason University. Retrieved from: http://mercatus.org/publication/renewable-energy-subsidies-and-electricity-generation

energy in the United States. The PTC was originally passed in 1992, and provided a subsidy of $15 per megawatt-hour to producers of wind energy.[8]

The American Recovery and Reinvestment Act of 2009, commonly known as the Recovery Act, made small wind producers (those with a generating capacity of 100 kilowatts or less) eligible for refunds of up to 30 percent of total investment cost. Producers can choose to accept this option, known as the Investment Tax Credit, in lieu of the PTC.[9] Finally, the Recovery Act provided $31 billion for clean energy research, development and deployment.[10] In 2013, the US Congress increased the amount of the PTC from $22 per megawatt-hour to $23 per megawatt-hour.[11] According to the Institute for Energy Research, that equates to $38 per megawatt-hour in post-tax subsidy.[12]

The Tax Increase Prevention Act of 2014 extended the PTC further so that any project that began work before January 1, 2015 is eligible for the credit. The Act also allowed these facilities to claim the Investment Tax Credit in place of the PTC through the end of 2014.[13] The extension will not have a significant effect on the wind industry because it was passed only 3 weeks before the end of the year. The only investors able to benefit from this most recent expansion would need to begin construction immediately.[14] Some members of Congress are dissatisfied with the extension, and are debating about whether to expand the tax credit for an additional 2 years or to implement it permanently.[15]

The Recovery Act also established the 1603 Treasury Program, which allowed taxpayers who are eligible for either the Production Tax Credit (PTC), a tax benefit for producing energy from certain sources, or the ITC, to receive a payment from the Treasury in lieu of a tax credit. The program is meant to increase liquidity to quickly spur renewable energy development.[16] The 1603 cash grant program applies to wind, geothermal, biomass, and solar among other forms of renewable energy. Through May 8, 2012 the 1603 program provided almost $8.4 billion to wind projects and in total awarded about $11.6 billion to over 37,700 renewable projects.[17]

Figure 2 shows the extent to which the wind energy industry is dependent on subsidies. New wind energy production plummets every time the PTC is set to expire. In 2003, the wind industry added almost 2,000 megawatts of capacity; in 2004, when the PTC expired again, investments in new capacity fell 76 percent. An even more dramatic decline occurred in 2013 when there was a 92 percent drop in installations due to uncertainty regarding the fate of the PTC.

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[8] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, April 13. "Renewable Electricity Production Tax Credit (PTC)." U.S. Department of Energy. Retrieved from: http://programs.dsireusa.org/system/program/detail/734

[9] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, March 18. "Business Energy Investment Tax Credit." U.S. Department of Energy. Retrieved from: http://programs.dsireusa.org/system/program/detail/658

[10] Department of Energy (DOE). n.d. "Recovery Act." Retrieved on December 3, 2014 from: http://www.energy.gov/recovery-act

[11] Hanson, C. 2014, September 2. "The IRS Is Giving Away $13 Billion A Year In Wind Energy Subsidies, Without Congressional Authorization." Retrieved from: http://www.forbes.com/sites/realspin/2014/09/02/the-irs-is-giving-away-13-billion-a-year-in-wind-energy-subsidies-without-congressional-authorization/

[12] Institute for Energy Research (IER). 2014, October 8. "Why Are States Reevaluating Wind Energy?" Retrieved from: http://instituteforenergyresearch.org/analysis/states-reevaluate-wind-energy/

[13] Database of State Incentives for Renewables & Efficiency (DSIRE). 2014, December 22. Department of Energy. Retrieved from: http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F

[14] Guillen, A. 2014, December 4. "House sends one-year tax extenders to Senate – Wind, efficiency groups unhappy – Hearing for FERC nominee Honorable – Landrieu dings Cantwell on policy." Politico. Retrieved from: http://www.politico.com/morningenergy/1214/morningenergy16330.html

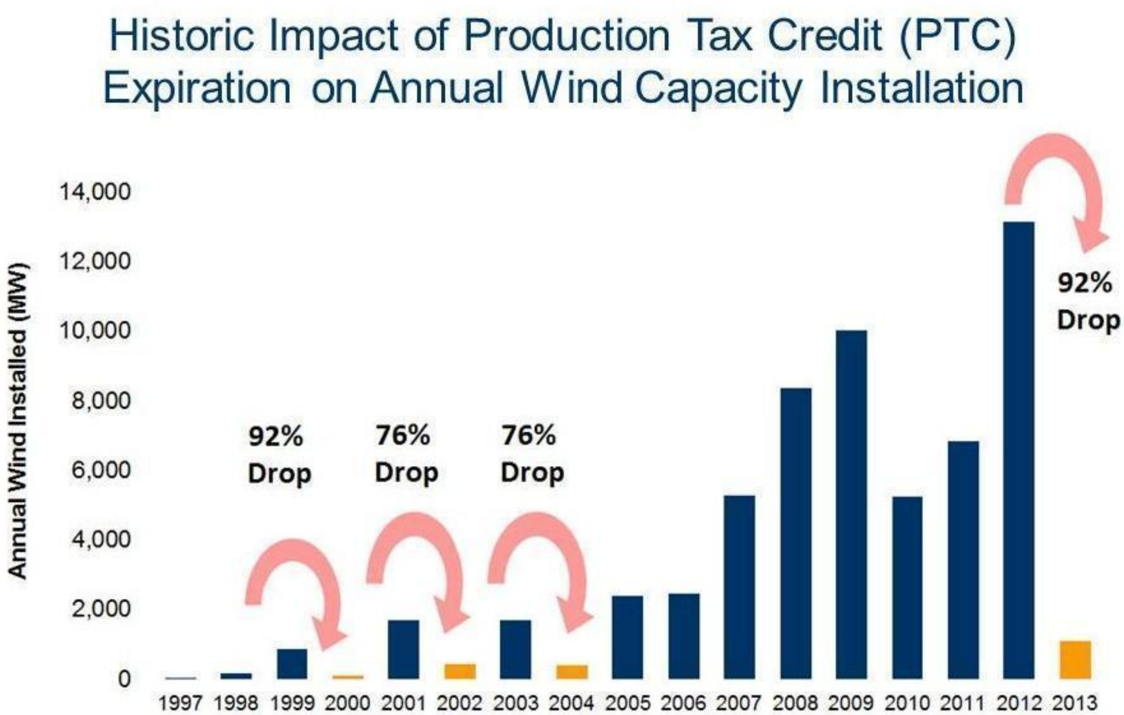
[15] Stokols, E. 2014, December 3. "Bennet blasts House's three-week extension of wind PTC, other tax breaks." KDVR. Retrieved from http://kdvr.com/2014/12/03/bennet-blasts-houses-three-week-extension-of-wind-ptc-other-tax-breaks

[16] Solar Energy Industries Association (SEIA). (n.d.). 1603 Treasury Program. *Solar Energy Industries Association*. Retrieved on May 14, 2015 from http://www.seia.org/policy/finance-tax/1603-treasury-program

[17] Mendelsohn, M., J. Harper. 2012, June. "§1603 Treasury Grant Expiration: Industry Insight on Financing and Market Implications." Pg. 22-23. National Renewable Energy Laboratory (NREL). Retrieved from http://www.nrel.gov/docs/fy12osti/53720.pdf

If the PTC permanently expires in 2016, it is unlikely there will be any new wind installations.[18] If wind energy were a competitive source of electricity, wind installations would continue without federal subsidies.

FIGURE 2: HISTORIC IMPACT OF PRODUCTION TAX CREDIT (PTC) EXPIRATION ON ANNUAL WIND CAPACITY INSTALLATION[19]



Including the PTC, Congress has created 82 initiatives overseen by nine different federal agencies to promote the production of wind energy. *Figure 3* below shows these initiatives broken up by agency. These initiatives support wind energy through research grants and financial support for demonstration, commercialization, and deployment of wind energy technology. Of these initiatives, the PTC represents the largest portion of government spending on wind energy. In 2011 the PTC represented almost 39 percent of the revenue losses for the Treasury's wind-related tax expenditures.[20]

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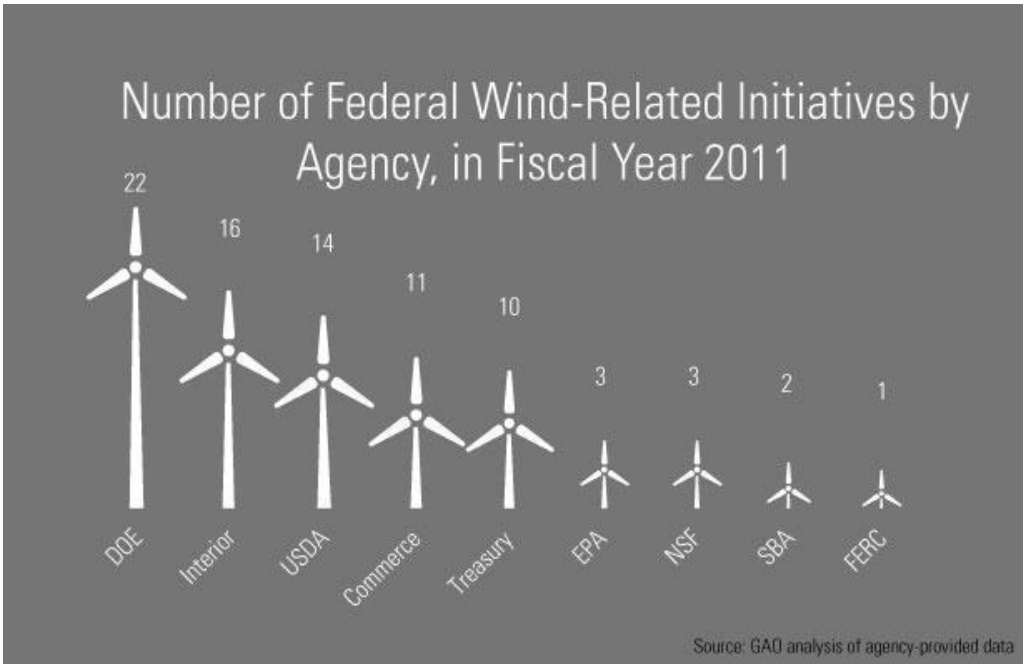
[18] American Wind Energy Association (AWEA). 2013. "Federal Production Tax Credit for Wind Energy." Retrieved December 5, 2014 from: http://www.awea.org/Advocacy/content.aspx?ItemNumber=797
[19] Ibid.
[20] Government Accountability Office (GAO). 2013, March. "Wind Energy: Additional Actions Could Help Ensure Effective Use of Federal Financial Support." Pg. 14-15, 80. U.S. Office of Government Accountability Office. Retrieved from: http://www.gao.gov/assets/660/652957.pdf; Figures are calculated from the numbers available on page 80.

FIGURE 3: NUMBER OF FEDERAL WIND-RELATED INITIATIVES BY AGENCY IN FISCAL YEAR 2011[21]



THE UNSEEN COSTS OF THE PTC

Federal policies such as the PTC enable producers to sell wind power at prices well below what the market would otherwise dictate. Even with these incentives in place, wind has been slow to take hold as a viable energy source. By 2013 it accounted only for 4 percent of annual energy consumption.[22] If these policies did not exist at all, wind power would be economically unsustainable—it would be prohibitively expensive to construct wind energy facilities and too expensive for consumers to use the resulting electricity.

By paying for the PTC with their taxes, American citizens subsidize private investments in wind energy development. Wind and solar energy both receive 20 times more federal subsidies than coal or natural gas in terms of average electricity generation.[23] Since it was expanded in 2009, the PTC has cost an average of $5 billion per year. Recent IRS changes expanded the number of wind producers and the conditions for eligibility so that a one-year extension is expected to cost taxpayers approximately $13 billion over the next decade.[24] These considerations increase the unseen costs of electricity produced from wind power. While the costs of subsidizing wind power are dispersed across all Americans, the benefits are enjoyed by a select few wind industry favorites.

Without the PTC, many private investors would have no incentive to invest in wind energy because such investments would no longer be profitable. Warren Buffett, who has invested billions in renewable energy, stated, "[W]e get a tax

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[21] Ibid.

[22] American Wind Energy Association (AWEA). 2014, March 5. "American Wind Power Reaches Major Power Generation Milestones in 2013." American Wind Energy Association. Retrieved from: http://www.awea.org/MediaCenter/pressrelease.aspx?ItemNumber=6184

[23] Bell, L. 2014, February 9. "Loss of Production Tax Credit brings big wind chill to cooling subsidy-dependent market." Forbes. Retrieved from: http://www.forbes.com/sites/larrybell/2014/02/09/loss-of-production-tax-credits-brings-big-wind-chill-to-cooling-subsidy-dependent-market/

[24] Hanson, C. 2014, September 2. "The IRS Is Giving Away $13 Billion A Year In Wind Energy Subsidies, Without Congressional Authorization." Forbes. Retrieved from: http://www.forbes.com/sites/realspin/2014/09/02/the-irs-is-giving-away-13-billion-a-year-in-wind-energy-subsidies-without-congressional-authorization/

credit if we build a lot of wind farms. That's the only reason to build them. They don't make sense without the tax credit."[25] Thus, when the PTC is allowed to expire, investments in wind energy plummet.[26]

NEGATIVE PRICING AND REDUCED RELIABILITY

Federal subsidies for wind power lead to an economic phenomenon called "negative pricing," which is when the seller pays the buyer to receive the product. In the case of wind energy, negative pricing works this way: demand for electricity is lowest at night, which is when wind blows most powerfully in most geographic regions.[27] This means high levels of wind power are being produced when demand for electricity is lowest.[28] Electricity produced from wind cannot easily be stored, and if more is produced than is being demanded, the only way wind energy producers can get rid of the excess electricity is to pay utilities to accept it.

The PTC pays wind producers $23 for every megawatt-hour of electricity produced, regardless of market factors like supply and demand. Wind producers can then pay utilities (up to $23 per megawatt-hour) to take their power while still making a profit or at least breaking even. Subsidies, and the negative pricing they cause, distort the market for electricity and flood it with subsidized wind power. In some cases, this drives more conventional producers of electricity, such as nuclear plants, out of the market.[29]

Conventional energy sources are also more reliable. When they are forced from the market by subsidized competition, the overall reliability of the supply of electricity is threatened. When the supply of any commodity is threatened, its price increases. Here is another unseen cost of wind energy—consumers may pay higher prices for energy because of government policies they are required to fund with their taxes.

OPPORTUNITY COST

Another hidden cost of these policies is opportunity cost—the cost of opportunities that could have been paid for by taxpayer money that was instead spent on policies such as the PTC. While it is easy to quantify the billions of dollars taxpayers have spent on wind energy subsidies, it is more difficult to predict how that money would have been spent without the subsidies.

If large federal subsidies for wind power did not exist, taxpayer money could have been spent more productively. In a free energy market, consumers would be free to make decisions about energy consumption based on preferences about price, environmental impact, and other factors such as reliability. In such a market, prices would ensure that resources flow to their most highly valued use.

The US energy market, however, is not a free market. Large federal subsidies like the PTC lock Americans into paying for wind power, no matter how high the cost. Because policymakers have limited information, they cannot predict what the future of energy will look like. Subsidizing wind power gives the industry an advantage over other energy

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[25] Pompeo, M. December 2, 2014. "Congressman's response to Sierra Club and union's call to extend wind PTC." The Hill. Retrieved from: http://thehill.com/blogs/congress-blog/energy-environment/225619-congressmans-response-to-sierra-club-and-unions-call

[26] American Wind Energy Association (AWEA). 2013. "Federal Production Tax Credit for Wind Energy." Retrieved December 5, 2014 from: http://www.awea.org/Advocacy/content.aspx?ItemNumber=797

[27] Fisher, T. 2014, April 23 April. "AWEA's Bold Push for More Wind Welfare." Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/analysis/aweas-bold-push-for-more-wind-welfare/

[28] Ibid.

[29] Fisher, T. 2014, April 23 April. "AWEA's Bold Push for More Wind Welfare." Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/analysis/aweas-bold-push-for-more-wind-welfare/

sources, effectively picking wind as the energy winner. This limits competition from new and potentially better energy technologies that might develop in a free market.

STATE-LEVEL WIND POLICY

Voters in many states favor renewable energy because they believe it will lead to environmental benefits. Policymakers have responded to their constituents by enacting state-level policies to spur the growth of wind and solar. As states put these policies into place, they have learned that the reality of wind power is much more complex. States have had to confront unintended consequences that come along with incentivizing wind power. These include the large burden placed on taxpayers, the rising price of electricity, and the need for a costly expansion of transmission capability.

The Database of State Incentives for Renewables and Efficiency (DSIRE) categorizes state policies that promote renewable energy as either financial incentives or rules and regulations. The DSIRE then sorts these into roughly 30 other specific types of incentives and policies.[30] State rules and regulations regarding wind energy include solar and wind access policies that establish a right to install and operate solar and wind energy systems at homes or other facilities. Financial incentives comprise policies like grant and loan programs that finance renewable energy expansion and performance-based incentives that provide cash payments based on the amount of energy generated by renewable energy systems.[31]

States also offer rebates for the installation of new renewable energy systems and equipment. Thirty-eight states have at least one rebate program for renewable energy. Seventeen of those states have rebates that support wind power.[32] The American Wind Energy Association (AWEA) argues that the rebate program is a major driver of the small wind market in California. New Jersey and Oregon have rebate programs similar to California's. These programs, however, have failed to stimulate notable market growth.[33]

The primary renewable energy policies states most commonly pursue include the following: Renewable Portfolio Standards (RPS), tax credits, and transmission improvements. Each of these is reviewed in the following sections.

RENEWABLE PORTFOLIO STANDARDS (RPS)

Renewable Portfolio Standards (RPS) are state policies intended to increase the percentage of a state's electricity that is generated from renewable sources.[34] For example, an RPS may require utilities to supply 15–25 percent of a state's total electricity from renewables by 2020 or 2025.[35] Because federal subsidies make wind profitable for investors, wind power is often used to meet RPS requirements.

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[30] Database of State Incentives for Renewables and Efficiency (DSIRE). 2014. "Glossary." U.S. Department of Energy. Retrieved December 20, 2014 from: http://www.dsireusa.org/glossary/

[31] Ibid.

[32] Lantz, E. and E. Doris. 2009, March. "State Clean Energy Practices: Renewable Energy Rebates." Pg. 1-3. National Renewable Energy Laboratory (NREL). Retrieved from: http://www.nrel.gov/docs/fy09osti/45039.pdf

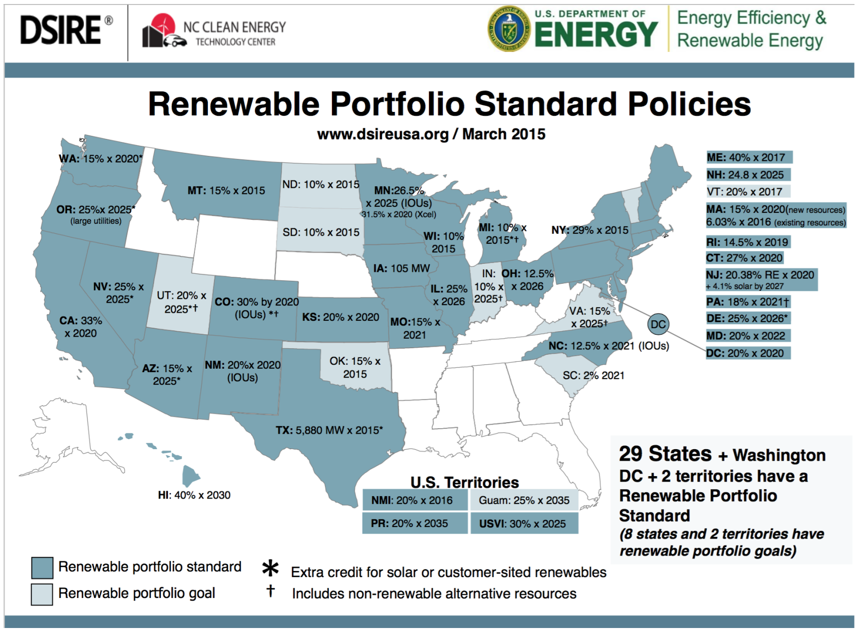
[33] Lantz, E. and E. Doris. 2009, March. "State Clean Energy Practices: Renewable Energy Rebates." pg. 9-10. National Renewable Energy Laboratory (NREL). Retrieved from: http://www.nrel.gov/docs/fy09osti/45039.pdf

[34] Char, C. and S. Abramson. 2006, March 13. "Renewable Portfolio Standards in Energy Policy: A Policy Analysis for the State of New Hampshire." pg. 4. Rockefeller Center at Dartmouth College. Retrieved from: http://rockefeller.dartmouth.edu/library/RPS_NH.pdf

[35] Center for Climate and Energy Solutions. 2009. "State RPS and AEPS Details." pg. 1-3. Retrieved December 21, 2014 from: http://www.c2es.org/docUploads/state-rps-aeps-details.pdf

Figure 4 shows that, as of March 2015, Washington DC, two territories, and 29 states have binding RPS requirements. There are nine other states and two territories with renewable portfolio goals.[36] Goals are not enforceable or mandatory.[37] California's RPS is one of the most aggressive, requiring the state to consume 33 percent of its energy from renewables by 2020.[38]

FIGURE 4: RENEWABLE PORTFOLIO STANDARD POLICIES[39]



Some states also have requirements for specific forms of energy they wish to promote. For example, North Carolina uniquely requires that, by 2018, 0.2 percent of its electricity is generated from swine waste.[40]

Because producing electricity from renewable sources is more expensive than producing it from conventional ones, RPS entail costs that fall to electricity consumers.[41] When RPS require a certain percentage of electricity come from renewable sources, energy prices increase. In other words, in markets where subsidized energy sources are mandated, energy prices will be generally higher. The Institute for Energy Research found that states with RPS legislation have electricity rates 38 percent higher, on average, than states without RPS.[42]

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[36] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, March. "Renewable Portfolio Standard Policies." U.S. Department of Energy. Retrieved from: http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf
[37] Solar Energy Industries Association (SEIA). n.d. "Renewable Energy Standards." Retrieved December 14, 2014 from: http://www.seia.org/policy/renewable-energy-deployment/renewable-energy-standards
[38] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, March. "Renewable Portfolio Standard Policies." U.S. Department of Energy. Retrieved from: http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf
[39] Ibid.
[40] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, February 3. "Renewable Energy and Energy Efficiency Portfolio Standard." U.S. Department of Energy. Retrieved from: http://programs.dsireusa.org/system/program/detail/2660
[41] Institute for Energy Research (IER). n.d. “The Status of Renewable Electricity Mandates in the States.” Pg. 1. Retrieved December 11, 2014 from: http://instituteforenergyresearch.org/wp-content/uploads/2011/01/IER-RPS-Study-Final.pdf
[42] Institute for Energy Research (IER). n.d. “The Status of Renewable Electricity Mandates in the States.” Pg. 5. Retrieved December 11, 2014 from: http://instituteforenergyresearch.org/wp-content/uploads/2011/01/IER-RPS-Study-Final.pdf

Jonathan Cook, in a report by the Energy Efficiency Center at UC Davis, argues that any prediction of future price is, "inherently subject to a high degree of uncertainty."[43] Predicting the cost of renewable energy generation against the cost of fossil fuel generation with any degree of certainty, he concludes, is nearly impossible.[44]

Mike Hager, a member of North Carolina's House of Representatives, argued that the state RPS creates hidden costs by deterring businesses from starting or expanding in the state. Because it entails higher electricity prices, North Carolina's RPS dissuades entrepreneurs and businesses from starting up or expanding.[45]

TAX INCENTIVES

Many states have also created tax credits to incentivize the development of renewable energy and wind power in particular.[46] These include exemptions, exclusions, abatements and credits provided to producers of wind power and other forms of renewable energy. The tax incentives, as defined by DSIRE, "[P]rovide that the added value of a renewable energy system is excluded from the valuation of the property for taxation purposes."[47]

One of MidAmerican Energy's wind projects in Iowa, for example, is expected to reap a total of about $300 million in tax benefits over the next 20 years due to the federal PTC and forgiveness of state property taxes. Of those benefits, about $175 million stem from the federal program and $130 million from the state's incentive programs.[48]

In addition to incentives that benefit retail producers of wind energy, states have also created programs that benefit consumers. The State of Vermont, for example, offers a sales tax exemption for renewable energy systems with up to 250 kilowatts in capacity. Vermont does not require any sales tax be paid on any parts needed for a wind system to be built.[49] The State of Oregon funds the Alternative Energy Device Credit, which provides up to $6,000 in income tax credits for the installation of a small-scale wind system.[50]

TRANSMISSION COSTS

Most wind resources within the U.S are located in the Great Plains states.[51] These states are far from population centers where demand for electricity is high, creating a complication that has prompted many states to make billion-dollar investments in transmission infrastructure. Because state policies often mandate that such investments involve taxpayer dollars, transmission costs must be counted as another hidden cost of wind energy.

Nebraska's Power Review Board recently reported that it would cost $4 billion to install the required infrastructure to export wind energy to other states. The analysis concludes that, "A potentially significant portion of this cost would

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[43] Cook, J. 2013, December. "The Future Of Electricity Prices In California: Understanding Market Drivers And Forecasting Prices To 2040." Pg. 18-20. Retrieved from: http://eec.ucdavis.edu/files/02-06-2014-The-Future-of-Electricity-Prices-in-California-Final-Draft-1.pdf
[44] Ibid.
[45] Mendenhall, G. n.d. "Capturing Methane to Make Energy." Whole Hog. Retrieved from: http://www.wholehognc.org/energy.html
[46] National Conference of State Legislatures. 2014, January 16. "State Renewable Portfolio Standards and Goals." Retrieved from: http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx
[47] Database of State Incentives for Renewables and Efficiency (DSIRE). 2014. "Glossary." U.S. Department of Energy. Retrieved December 20, 2014 from: http://www.dsireusa.org/glossary/
[48] Schleede, G. 2005, April 14. "'Big money' discovers the huge tax breaks and subsidies for wind energy while taxpayers and electric customers pick up the tab." AWEO. Retrieved from: http://www.aweo.org/Schleede.html#subsidies
[49] Renewable Energy Vermont. 2014. "Incentive Types." Retrieved from: http://www.revermont.org/main/go-renewable/incentive-types/
[50] Oregon Department of Energy. n.d. "Wind Information for Land Owners." Retrieved December 21, 2014 from: http://www.oregon.gov/energy/RENEW/Pages/wind/windinfo.aspx
[51] U.S. Energy Information Administration - EIA - Independent Statistics and Analysis. 2011, August 2. Retrieved from: http://www.eia.gov/todayinenergy/detail.cfm?id=2470

likely have to be borne by Nebraska utilities and their customers."[52] These higher costs may be partially offset by reducing the congestion of transmission already inherent in the electrical grid.[53] Many other states, including Texas, have already undertaken large-scale transmission improvement projects at substantial cost to taxpayers.

STATE-LEVEL CASE STUDIES

In this section, we examine the cases of two states that have enacted significant wind energy policy to illustrate how state-level policy creates unseen costs for taxpayers and ratepayers alike. California and Texas are both national leaders in wind power production, and both have enacted policies to boost wind power production—with differing results.

WIND ENERGY IN CALIFORNIA

At the end of 2013, California had over 6,000 megawatts of installed wind capacity, generating over 12 million megawatt-hours of electricity.[54] This equates to 6.6 percent of total in-state energy generation. This makes California the third largest producer of wind energy in the nation.[55] As will be shown in this case study, these statistics do not tell the entire story.

California has a history of enacting policies to encourage the development of renewable energy. These policies, combined with federal incentives, have resulted in the growth of renewable energy capacity in the state. This capacity, however, is the total amount of electric output the generators can produce under specific conditions, not the amount of energy that is actually generated. This wind capacity has come at a substantial cost to California taxpayers, who are ultimately paying for an energy source that must have backup power. Thus, Californians are paying twice—once for the intermittent renewable power and then again for the reliable backup power.

HISTORY OF CALIFORNIA STATE POLICIES

In 1978 Congress passed the Public Utilities Regulatory Policies Act (PURPA). Before this act, utilities produced their own power. PURPA, however, required utilities to purchase electricity from independent electricity producers, as long as these producers could produce power at a cheaper rate than the utility itself.[56]

The federal agency responsible for overseeing PURPA left responsibility to the states for determining the price that utilities were required to pay for non-utility power. The California Energy Commission (CEC) established a rate three to seven times higher than that of most other states, incentivizing development of wind energy in the state.[57] The California Public Utilities Commission (CPUC) negotiated the first "Interim Standard Offer Contracts" with independent

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[52] Hubbard, R. 2014, December 16. "Building infrastructure to sell wind energy could cost $4 billion, Nebraska power board says." *Omaha World-Herald*. Retrieved from: http://www.omaha.com/money/building-infrastructure-to-sell-wind-energy-could-cost-billion-nebraska/article_e8385988-abde-5013-9cdc-f046bac43344.html

[53] Ibid.

[54] California Energy Commission. 2014. "Electricity From Wind Energy Statistics & Data." Retrieved December 18, 2014 from: http://energyalmanac.ca.gov/renewables/wind/index.php

[55] McFarland, A. 2014, April 15. "Twelve states produced 80% of U.S. wind power in 2013." U.S. Energy Information Administration. Retrieved from: http://www.eia.gov/todayinenergy/detail.cfm?id=15851

[56] Union of Concerned Scientists. No date. Retrieved from: http://www.ucsusa.org/clean_energy/smart-energy-solutions/strengthen-policy/public-utility-regulatory.html#.VGP1xpPF9yE

[57] Hinman, J. 2009 "The Green Economic Recovery: Wind Energy Tax Policy After Financial Crisis and the American Recovery and Reinvestment Tax Act of 2009." Pg. 50. University of Oregon School of Law. Retrieved from: http://law.uoregon.edu/wp-content/uploads/2014/03/Hinman.pdf

energy producers. These contracts established standard, long-term agreements with high guaranteed prices for wind producers.[58] These contracts, combined with the high non-utility rate set by the CEC, helped ensure the early development of wind power in California.

Oil and natural gas prices dropped in the late 1980s, however, and renewable energy became expensive in comparison. As the contracts with wind producers expired, many utilities did not renew them. This ended the booming construction of new turbines.[59]

ADDITIONAL STATE INCENTIVES

In 1980, California passed a 25 percent state investment tax credit, along with accelerated depreciation and property tax exemptions for property that contained renewable energy generating facilities.[60] Nearly 50 percent of the installation costs for new wind projects during the 1980s was covered by the combination of state and federal tax incentives.[61]

These state incentives, combined with federal tax incentives, encouraged small companies and entrepreneurs to install enough turbines to generate 1,200 megawatts of power capacity in California by 1986.[62] Many projects were built primarily for the tax credits and without concern for how successful the project would be in the long run.[63] But when federal investment tax credits expired in 1986, wind power's growth slowed across the nation.[64] This was the first "wind bust" in the state. California's wind industry would not see its next big boom until passage of the state's Renewable Portfolio Standard.

CALIFORNIA'S RENEWABLE PORTFOLIO STANDARD

Although political debate on the topic began in 1995, California's RPS was not adopted until 2002. The standard originally required that 20 percent of the state's electricity come from renewable sources by 2017. Eligible renewable sources include wind, solar, small hydroelectric, and biomass facilities. This RPS was accelerated in 2006 to require that 20 percent come from renewable resources by the end of 2010.[65]

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[58] Harris, F. and P. Navarro. 1999. "Policy Options for Promoting Wind Energy Development in California." Pg. 12-19. Prepared for the Governor and State Legislature of California. University of California-Irvine. Retrieved from: http://www.e-renewables.com/documents/Wind/Promoting%20Wind%20Energy%20in%20California.pdf

[59] Hinman, J. 2009 "The Green Economic Recovery: Wind Energy Tax Policy After Financial Crisis and the American Recovery and Reinvestment Tax Act of 2009" Pg. 52-53. University of Oregon School of Law. Retrieved from: http://law.uoregon.edu/wp-content/uploads/2014/03/Hinman.pdf

[60] Harris, F. and P. Navarro. 1999, November. "Policy Options for Promoting Wind Energy Development in California." Pg. 13. Prepared for the Governor and State Legislature of California. Irvine, California. Retrieved from: http://www.e-renewables.com/documents/Wind/Promoting%20Wind%20Energy%20in%20California.pdf

[61] Hinman, J. 2009. "The Green Economic Recovery: Wind Energy Tax Policy After Financial Crisis and the American Recovery and Reinvestment Tax Act of 2009." Pg. 50. Journal of Environmental Law and Litigation, 35-74. Retrieved from: http://law.uoregon.edu/wp-content/uploads/2014/03/Hinman.pdf

[62] American Wind Energy Association (AWEA). 2013. "Turbine Timeline: 1980s." AWEA. Retrieved November 26, 2014 from: http://www.awea.org/About/content.aspx?ItemNumber=773

[63] Hinman, J. 2009. "The Green Economic Recovery: Wind Energy Tax Policy After Financial Crisis and the American Recovery and Reinvestment Tax Act of 2009." Pg. 52. Journal of Environmental Law and Litigation, 35-74. Retrieved from: http://law.uoregon.edu/wp-content/uploads/2014/03/Hinman.pdf

[64] Wind Energy Foundation. n.d. "FAQs." Retrieved November 26, 2014 from: http://www.windenergyfoundation.org/about-wind-energy/faqs

[65] Behles, D. 2011, July 1. "Why California Failed to Meet Its RPS Target." Pg. 164-167. Golden Gate University School of Law. Retrieved from: http://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?article=1431&context=pubs

Between 2002 and 2007, California added only 242 megawatts of renewable energy, and was lagging behind in meeting the RPS requirement.[66] Despite this, in 2008 California further accelerated its RPS to require utilities to serve 33 percent of their load with renewable energy by 2020. [67]

As of 2010, California failed to meet its RPS goal. Only 18 percent of the state's electricity comes from renewable sources, just shy of the 20 percent mandated.[68] Lieutenant Governor Gavin Newsom called the 33 percent requirement "a stretch goal," indicating that the state expected the goal to be difficult to reach.[69]

California's RPS allows hefty fines of up to $25 million per year to be imposed on utilities that fail to meet the standard.[70] To date, however, no non-compliance penalties have been issued [71] Although utilities are not reaching the goal as mandated, flexible compliance programs allow utilities the freedom to choose how they satisfy RPS program targets. The result is a non-stringent compliance program that allows utilities to fail to meet RPS goals.[72]

Despite the state's failure to meet its current RPS goals, groups like CalCEF, the California Clean Energy Fund, propose even more aggressive RPS policies. They hope to raise the 20 percent target to over 50 percent of the state's electricity coming from renewables. Governor Jerry Brown supports these efforts, telling reporters "I believe we can get to 40 percent, and I think we should."[73]

These costs extend beyond the residential electricity market, as California's industrial electricity prices are 65 percent higher than the US average. Approximately 700,000 manufacturing jobs have been lost because of high electricity pricing, and these prices help contribute to California being ranked the worst state in the nation for business. Over three businesses leave California each week for the friendlier business climate and lower energy costs of Texas.[74]

THE UNSEEN COSTS OF CALIFORNIA'S WIND POLICY

RPS may serve to increase the use of renewable energy, but they also have negative consequences for California's consumers. RPS require utilities to purchase electricity from renewable sources that are more expensive than their non-renewable counterparts. By requiring utilities to purchase more expensive fuel, utilities must make up that cost by increasing the rates they charge customers.

Before California enacted its RPS, residential electricity prices rose 8 percent from 1993 to 2003. In 2003, the state RPS was enacted. The next 10 years saw an increase in rates of 34 percent; a four-fold increase over the previous

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[66] Behles, D. 2011, July 1. "Why California Failed to Meet Its RPS Target." Pg. 169. Golden Gate University School of Law. Retrieved from: http://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?article=1431&context=pubs
[67] California Energy Commission. 2014, November 14. "Renewables Portfolio Standard (RPS)." Retrieved from: http://www.energy.ca.gov/portfolio/
[68] Behles, D. 2011, July 1. "Why California Failed to Meet Its RPS Target." Pg. 170. Golden Gate University School of Law. Retrieved from: http://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?article=1431&context=pubs
[69] Bryce, R. 2012, February. "The High Cost of Renewable Electricity Mandates." Manhattan Institute. Retrieved from: http://www.manhattan-institute.org/html/eper_10.htm
[70] Institute for Energy Research (IER). n.d. "The Status of Renewable Electricity Mandates in the States." Pg. 12. Institute for Energy Research. Retrieved December 11, 2014 from: http://instituteforenergyresearch.org/wp-content/uploads/2011/01/IER-RPS-Study-Final.pdf
[71] Behles, D. 2011, July 1. "Why California Failed to Meet Its RPS Target." Pg. 176. Golden Gate University School of Law. Retrieved from: http://digitalcommons.law.ggu.edu/cgi/viewcontent.cgi?article=1431&context=pubs
[72] Ibid.
[73] Wesoff, D. 2011, April 12. "It's Official: 33% RPS Now the Law in California." Greentech Media. Retrieved from: http://www.greentechmedia.com/articles/read/its-official-33-rps-now-the-law-in-california
[74] Clemente, J. 2014, October 27. "Hey EPA: 'The California Model' Doesn't Work, and We'll Need More Electricity." Forbes. Retrieved from: http://www.forbes.com/sites/judeclemente/2014/10/27/hey-epa-the-california-model-doesnt-work-and-well-need-more-electricity/

decade.[75] The RPS helps contribute to California having retail rates 53 percent higher across all sectors than the US average.[76]

The RPS creates a demand for wind energy that normally would not exist. Without an RPS, wind producers would be forced to make wind technology cost effective for consumers. Clean wind technology is attractive in theory, but the price paid for wind is too high when the price of energy from other sources is considered.

The success of wind farms in California depends on the availability of subsidies and other incentives. If the PTC and other incentives are extended, these farms will continue to operate at taxpayer expense. If these policies were allowed to expire, then California's wind industry would stand or fall on its own merits.

The actual cost of wind energy in California has been obscured by government subsidies and regulations, both state and federal. Subsidies leave taxpayers to cover the costs of a product that cannot succeed in a free and competitive market. Regulations increase costs for consumers by requiring utilities to purchase expensive power. Ending state policies such as the RPS and other subsidies, both federal and state, is the only way to know if wind energy is actually viable in a competitive energy market.

WIND ENERGY IN TEXAS

Texas has more wind power capacity than any other state. At the close of 2012, Texas boasted an installed wind capacity of over 12,000 megawatts, with an additional 7,000 megawatts under construction in 2014.[77] In total, wind generated about 8 percent of Texas's electricity in 2012.[78] This figure is almost twice the US average.[79] Texas ranks second for commercial viability of wind resources according to the U.S. Department of Energy.[80]

Texas has sought to take advantage of its plentiful wind resources by enacting state policies to incentivize the development of the wind industry. The state's policies have largely been successful in encouraging wind development, although such development has come at a substantial cost to the state's taxpayers.

STATE POLICIES

Texas provides a plethora of financial incentives for renewable energy generation within the state. For example, Texas Tax Code § 11.27 allows for a 100 percent property tax exemption for any property value increase from renewable facilities built, and this includes wind energy.[81] The Manhattan Institute reports that local jurisdictions in Texas have

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[75] Ibid.
[76] Zycher, B. 2013, January. "The Looming Rate Bomb." Pg. 10. Pacific Research Institute. Retrieved from: http://pacificresearch.org/fileadmin/templates/pri/images/Studies/PDFs/2013-2015/ElectricityCosts_Zycher_F2.pdf
[77] American Wind Energy Association (AWEA). 2014, March 5. "American Wind Power Reaches Major Power Generation Milestones in 2013." Retrieved from: http://www.awea.org/MediaCenter/pressrelease.aspx?ItemNumber=6184;
Del Franco, M. 2014. "Nearly Completed CREZ Lines Unlock Wind Congestion." Pg. 4. Zackin Publications. Retrieved December 6, 2014 from: http://www.nawindpower.com/issues/NAW1307/FEAT_01_Nearly_Completed_CREZ_Lines_Unlock_Wind_Congestion.html
[78] Department of Energy (DOE). 2013, August. "2012 Wind Technologies Market Report." Pg. 9. Retrieved from: http://www1.eere.energy.gov/wind/pdfs/2012_wind_technologies_market_report.pdf
[79] Permian Basin Energy Magazine. 2014, May. "Texas Takes Top Spot in the US Rankings for Wind Power in 2013." Pg. 38. Permian Basin Energy Inc. Retrieved from: http://issuu.com/pbenergy/docs/pbemag-may-2014-virtual/38
[80] Elliott, L., Wendell, L., and Gower, L. 1991, August. "An Assessment of the Available Windy Land Area and Wind Energy Potential in the Contiguous United States." Pg. 59. Pacific Northwest Laboratory. Retrieved from: http://www.osti.gov/scitech/servlets/purl/5252760
[81] Database of State Incentives for Renewables and Efficiency (DSIRE). 2014, August 8. "Renewable Energy Systems Property Tax Exemption." U.S. Department of Energy. Retrieved from: http://programs.dsireusa.org/system/program/detail/173

foregone over $700 million in property taxes from this exemption and other laws designed to encourage the growth of the wind industry.[82]

In 1999, the Texas state legislature passed the state's first RPS legislation. The RPS required Texas to have 2,000 megawatts of electricity generated from renewable sources before the year 2009.[83] Texas quickly met the quota and the state legislature amended the RPS, raising the required amount of renewable energy to 10,000 megawatts by 2025. The 2025 goal was surpassed in 2010, 15 years before the deadline.[84] The renewable energy developed to meet this goal was almost entirely wind energy, which prompted the state to encourage diversification by adding a voluntary stipulation that 500 megawatts of the generated renewable energy required by the RPS be from non-wind sources.[85]

Texas's RPS program places the burden of compliance on the retail electric providers. The RPS also includes a Renewable Energy Credit (REC) market whereby the electricity providers meet the portfolio standards. The tradable credits program allows utilities with little access to renewable energy to purchase credits from utilities with greater access to renewable energy.[86] The REC market was intended to incentivize renewable energy development in the private sector. But according to a report by the Center for Energy Economics at the University of Texas at Austin, the prices collapsed and failed to provide incentives for wind developers. The researchers attribute wind's success in Texas to the PTC, not the RECs.[87]

The Texas Public Policy Foundation (TPPF) estimates that the cost of compliance with the RPS, specifically through the REC market, will be about $1.4 billion by 2025. These costs, however, are likely to be lower than estimated. The Foundation's analysis assumed the average cost of a REC would be $4.50.[88] According to the U.S. Department of Energy the actual price of each REC has been significantly lower than $4.50 since late 2008.[89] This means the cost of purchasing RECs to comply with the RPS would be lower than TPPF's analysis suggests. Despite this, there are other compliance costs associated with complying with the RPS and with buying RECs, and most of these costs are ultimately passed on to the consumer.

Texas's government is losing revenue and distorting the electricity market through state policies intended to incentivize renewable energy development.[90] Demand for renewable energy, specifically wind, is unnaturally

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[82] Bryce, R. 2012, February. "The High Cost of Renewable Electricity Mandates." Manhattan Institute. Retrieved from: http://www.manhattan-institute.org/html/eper_10.htm
[83] Durrwachter, H., and W. Lasher. 2012. "Wind Power in the Power System in Texas." T. Ackermann (Ed.), Wind Power in Power Systems (2nd ed. pp. 649-666). John Wiley & Sons.
[84] Ibid.
[85] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, February 4. "Renewable Generation Requirement." U.S. Department of Energy. Retrieved from: http://programs.dsireusa.org/system/program/detail/182; Energy Information Administration (EIA). U.S. Department of Energy. 2014, November 20. "Texas State Profile and Energy Estimates." Retrieved from: http://www.eia.gov/state/analysis.cfm?sid=TX
[86] Gülen, G., M. Foss, R. Makaryan, and D. Volkov. 2009, January 1. "RPS in Texas - Lessons Learned & Way Forward." Pg. 5-6. Center for Energy Economics, Bureau of Economic Geology, University of Texas at Austin. Retrieved from http://www.usaee.org/usaee2009/submissions/OnlineProceedings/Gulen et al.pdf
[87] Center for Energy Economics. 2009, July. "Lessons Learned from Renewable Energy Credit (REC) Trading in Texas." Pg. 7-8. Jackson School of Geosciences at the University of Texas at Austin. Retrieved from: http://www.beg.utexas.edu/energyecon/transmission_forum/CEE_Texas_RPS_Study.pdf
[88] Peacock, B. 2008, October. "The True Cost of Wind Energy." Pg. 1-2. Retrieved from: http://www.texaspolicy.com/sites/default/files/documents/2008-10-PP18-truecostofwind-bp.pdf
[89] Department of Energy (DOE). 2014. "Renewable Energy Certificates (RECs)." Retrieved from: http://apps3.eere.energy.gov/greenpower/markets/certificates.shtml?page=5
[90] Thornley, D. 2009, June 9. "Texas Wind Energy: Past, Present, and Future." Pg. 99. Environmental & Energy Law & Policy Journal: University of Houston Law Center. Retrieved from: https://www.law.uh.edu/eelpj/publications/4-1/Thornley.pdf

increased by the state's RPS.[91] The RPS also raises the cost of running a utility in Texas by increasing the cost of meeting electricity demand. These higher costs are inevitably passed onto consumers.[92]

TRANSMISSION COSTS

The small west Texas town of McCamey became the state's wind energy capital in 2001 by virtue of a resolution passed by the Texas state legislature. The city gained its distinction because of its plentiful wind resources and the large number of wind projects in the area.[93] Wind development in McCamey was soon so successful that it outstripped the capabilities of the transmission lines in the small town. McCamey's wind production capabilities stood at about 750 megawatts, but the area's transmission lines could only carry 450 megawatts.[94]

Transmission infrastructure problems like those McCamey experienced are common throughout areas that are developing renewable resources, and many states have started investing in their transmission lines to order to solve the problem. Texas, for instance, created the Competitive Renewable Energy Zone project to determine areas ripe for connection to the grid because of the wind energy potential and fund construction of transmission lines to these regions.[95]

The $7 billion CREZ project is Texas's most expensive subsidy to date, and its total cost falls on consumers served by the Electrical Reliability Council of Texas (ERCOT).[96] The Texas Public Utility Commission has stated the typical ratepayer was charged an additional $6 every month because of the CREZ project.[97] Proponents of the program, however, argue that increasing transmission capability will decrease energy congestion on the transmission lines leading to lower electricity costs. Less congestion on the grid means fewer price hikes for consumers during peak demand periods.[98]

Unfortunately, only PTC-fueled wind farms are likely to be able to compete in areas where CREZ lines have been built, as these areas are generally remote and were chosen for their wind resources. This means the CREZ program essentially functions only as a subsidy to the wind industry. While the benefits of this subsidy will go to wind producers, the costs will be borne by Texas' electricity consumers.[99]

These costs are not always considered in analyses of the cost of wind energy. The TPPF estimates that adding over 11,000 megawatts of wind generation capacity to take advantage of the additional transmission lines would increase backup generation and reduced reliability costs by $1.82 billion per year. These costs stem from the variable nature

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91 Thornley, D. 2009, June 9. "Texas Wind Energy: Past, Present, and Future." Pg. 75. Environmental & Energy Law & Policy Journal: University of Houston Law Center. Retrieved from: https://www.law.uh.edu/eelpj/publications/4-1/Thornley.pdf

92 Peacock, B. 2010, December. "Texas' Renewable Energy Experiment: High Costs, Poor results." Pg. 4-5. Texas Public Policy Foundation. Retrieved from: http://www.texaspolicy.com/sites/default/files/documents/2010-12-PP25-TexasRenewableEnergyExperiment-paper4-bp.pdf

93 McCamey. n.d. "Wind Energy Capital of Texas". McCamey, Texas. Retrieved January 7, 2015 from: http://mccameycity.com/index.php?tag=5TGKF0Y6M8

94 Durrwachter, H., & Lasher, W. 2012. "Wind Power in the Power System in Texas." T. Ackermann (Ed.), Wind Power in Power Systems (2nd ed. pp. 649-666). John Wiley & Sons.

95 Lee, A. 2014, June 24. "Fewer wind curtailments and negative power prices seen in Texas after major grid expansion." U.S. Energy Information Administration. Retrieved from: http://www.eia.gov/todayinenergy/detail.cfm?id=16831

96 Peacock, B. 2010, December. "Texas' Renewable Energy Experiment: High Costs, Poor results." Pg. 2. Texas Public Policy Foundation. Retrieved from: http://www.texaspolicy.com/sites/default/files/documents/2010-12-PP25-TexasRenewableEnergyExperiment-paper4-bp.pdf

97 Wald, M. 2014, July 23. "Texas is Wired for Wind Power, and More Farms Plug in." New York Times. Retrieved from: http://www.nytimes.com/2014/07/24/business/energy-environment/texas-is-wired-for-wind-power-and-more-farms-plug-in.html?_r=1

98 Minora, L. 2014, May 5. "CREZ RE-energizes Texas, Reduces Congestion Costs." Oncor. Retrieved from: http://thewire.oncor.com/News/Archives/CREZ-Re-energizes-Texas-Reduces-Congestion-Costs.aspx

99 Peacock, B. 2010, December. "Texas' Renewable Energy Experiment: High Costs, Poor results." Pg. 2-3. Texas Public Policy Foundation. Retrieved from: http://www.texaspolicy.com/sites/default/files/documents/2010-12-PP25-TexasRenewableEnergyExperiment-paper4-bp.pdf

of wind and the resulting necessity of keeping other forms of energy on backup.[100] If these costs were evenly shared among Texas households, each would pay $204.81 to subsidize wind power added onto the electrical grid.[101]

THE PRODUCTION TAX CREDIT (PTC)

The PTC is another key policy that fuels the expansion of the Texas wind industry. The PTC is crucial for enabling wind energy to compete with fossil fuels.[102] The policy is the driving force behind negative pricing in the state. Negative pricing occurs when producers of electricity pay others to take their electricity, rather than charging positive prices. Wind farm operators do this because the PTC and other tax credits only accrue when the farm is generating electricity.[103]

The PTC pays wind energy producers $23 for each megawatt they produce, allowing them to bid lower than other power sources. This large subsidy incentivizes wind producers to run their facilities even when the demand for electricity is low. The Energy Information Administration's data show that negative pricing in Texas has become less common as the Competitive Renewable Energy Zones initiative nears completion. As more transmission lines are built, excess electricity is allowed to flow more freely to areas with higher demand. Thus, wind power producers are less likely to have to pay utilities to accept their power.[104]

Travis Fisher, a researcher with the Institute for Energy Research, argues that even if negative pricing has decreased, there is the additional hidden cost of reduced reliability from wind energy, an inherently unreliable resource.[105] As more wind energy is added onto the grid, backup generation must be maintained in order to account for times when the wind unexpectedly stops blowing.

Donna Nelson, the Chairwoman of the Public Utility Commission of Texas, notes that federal tax incentives have, "distorted the competitive wholesale market in ERCOT." Nelson also asserts that the PTC and other federal incentives are the primary cause of Texas's resource adequacy problems.[106] Resource adequacy is having the necessary supply of electric generation to meet demand and support grid reliability.[107] According to Nelson, the flood of subsidized wind turbines threatens to push coal and natural gas power plants out of business, destabilizing the state's electricity grid.[108]

An analysis by the economic and strategic consulting firm, the NorthBridge Group, affirms the fears of Chairwoman Nelson about the threat the PTC poses to grid stability. The NorthBridge Group's report finds that the PTC threatens

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[100] Ibid, Pg. 5.
[101] Based on US Census data that puts the number of Texas households at 8.886 million.
[102] Durrwachter, H., & Lasher, W. 2012. "Wind Power in the Power System in Texas." T. Ackermann (Ed.), Wind Power in Power Systems (2nd ed. pp. 649-666). John Wiley & Sons.
[103] Baldick, R. 2011, February 17. "Wind and Energy Markets: A Case Study of Texas." Systems Journal, IEEE. Retrieved from: https://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.429141.de/baldick_wind_energy_markets.pdf
[104] Lee, A. 2014, June 24. "Fewer wind curtailments and negative power prices seen in Texas after major grid expansion." U.S. Energy Information Administration. Retrieved from: http://www.eia.gov/todayinenergy/detail.cfm?id=16831
[105] Fisher, T. 2014, April 23 April. "AWEA's Bold Push for More Wind Welfare." Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/analysis/aweas-bold-push-for-more-wind-welfare/
[106] Huntowski, F., A. Patterson, and M. Schnitzer. 2012, September. "Negative Electricity Prices and the Production Tax Credit." Pg. 2. The NorthBridge Group. Retrieved from: http://www.hks.harvard.edu/hepg/Papers/2012/Negative_Electricity_Prices_and_the_Production_Tax_Credit_0912.pdf
[107] Electricity Reliability Council of Texas (ERCOT). 2005. "Resource Adequacy." Retrieved December 21, 2014 from: http://www.ercot.com/gridinfo/resource
[108] Huntowski, F., A. Patterson, and M. Schnitzer. 2012, September. "Negative Electricity Prices and the Production Tax Credit." Pg. 3-4. The NorthBridge Group. Retrieved from: http://www.hks.harvard.edu/hepg/Papers/2012/Negative_Electricity_Prices_and_the_Production_Tax_Credit_0912.pdf

the long-run stability of the grid system by discouraging the development of conventional generation sources that are critical for reliability.[109]

Relying on wind power requires backup generation in case there is no wind. Only conventional sources can provide the backup power necessary to ensure the lights stay on when the wind stops blowing. Unsubsidized conventional generation sources cannot compete with wind generators who can draw a profit despite negative pricing and are, therefore, forced out of the market. As these conventional sources are driven out, reliability will be reduced even further.[110]

Any attempt to fully understand the wind industry's impact on the cost of energy must also consider the costs of maintaining the grid system's reliability, and the risks of creating a system based on a volatile source of energy. Any benefits provided by the developing wind industry must be analyzed within a wider context that includes these costs.

THE UNSEEN COSTS OF TEXAS WIND POLICY

The wind industry in Texas has thrived not because of wind energy's own merits, but rather because state policies like the RPS create artificial demand for renewable energy. State and local policies alike have brought in lavish subsidies for wind power developers in Texas. The PTC, for example, provides a direct subsidy for electricity generation from wind facilities. Wind development has also been fueled by indirect subsidies, such as transmission programs, that the citizens of Texas will fund through higher costs.

Texas has created a favorable legal and political environment, which allowed wind energy to quickly develop. The costs of development, however, have not been borne by wind developers. Rather, the costs have largely been externalized and dispersed among consumers in Texas through the CREZ program, and onto other citizens in the United States through the federal PTC.

Wind assets in Texas are being developed, but only because of a legal and political environment that provides lucrative subsidies and benefits to developers. Eventually these costs will find their way to the consumer, either through higher electricity prices or steeper taxes. The actual cost of wind energy in Texas is obscured by these massive subsidies, transmission projects that are difficult to factor into cost estimates, and threats to reliability created by flooding the energy market with underpriced wind power.

COMPARING STATE POLICIES: CALIFORNIA VS. TEXAS

Although both states have enacted policies to incentivize the growth of wind power, Texas has more than double the installed wind power capacity of California.[111] Several major factors account for this difference in wind energy development between the two states. These include the quality of wind resources, the amount of tax subsidies received, and the regulatory environment.

Texas has some of the best wind resource potential in the country, while California's are much more limited.[112] California’s optimal wind production areas are confined to three specific locations.[113] These locations are now home

[109] Ibid.
[110] Ibid.
[111] WIND Exchange. 2014, October 23. "Installed Wind Capacity." United States Department of Energy. Retrieved from: http://apps2.eere.energy.gov/wind/windexchange/wind_installed_capacity.asp
[112] National Renewable Energy Laboratory (NREL). 2010. "Texas Annual Average Wind Speed at 80 m." Retrieved from: http://apps2.eere.energy.gov/wind/windexchange/images/windmaps/tx_80m.jpg
[113] National Renewable Energy Laboratory (NREL). 2010. “California Annual Average Wind Speed at 80 m.” Retrieved from:

to San Gorgonio, Tehachapi, and Altamont Pass wind farms, and nearly all of California's wind energy is produced there.[114] Because Texas has much more plentiful wind resources, wind energy production in Texas is much more viable and attractive in comparison. A side-by-side comparison of the two states, seen in *Figures 5 and 6*, clearly depicts the significantly greater wind potential in Texas.

FIGURE 5: CALIFORNIA ANNUAL AVERAGE WIND SPEED[115]

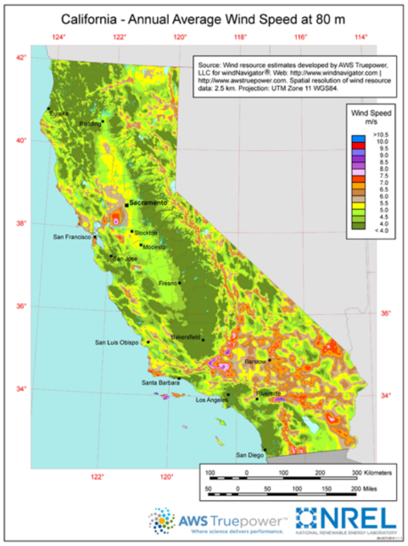
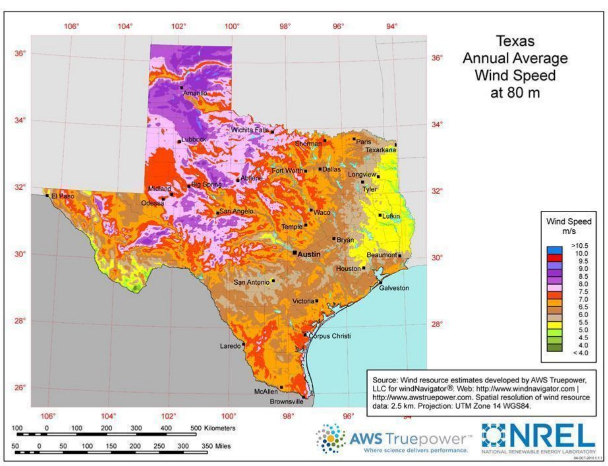


FIGURE 6: TEXAS ANNUAL AVERAGE WIND SPEED[116]



http://apps2.eere.energy.gov/wind/windexchange/images/windmaps/ca_80m.jpg

114 California Energy Commission. (n.d.). Overview of Wind Energy in California. Retrieved May 12, 2015, from http://www.energy.ca.gov/wind/overview.html

115 National Renewable Energy Laboratory (NREL). 2010. "California Annual Average Wind Speed at 80 m." Retrieved from: http://apps2.eere.energy.gov/wind/windexchange/images/windmaps/ca_80m.jpg

116 National Renewable Energy Laboratory (NREL). 2010. "Texas Annual Average Wind Speed at 80 m." Retrieved from:

One of the primary differences between wind development in the two states is likely due to Texas receiving a much larger net benefit from the PTC than California.[117] California carried a total tax burden of $330.8 million in 2012 from the PTC, while receiving only $134.9 million in subsidies. California is therefore an overall net payer by almost $196 million. Texas, however, carried a tax burden of $248 million from the PTC, while receiving $642.5 million. This makes Texas a net taker by over $395 million.[118] Although Texas has put this money to use by installing wind power capacity, it has done so at the expense of taxpayers nationwide.

Texas and California also have very different regulatory environments. Like most states, California's electrical grid system is under the control of the Federal Energy Regulatory Commission (FERC). Texas's grid regulation, however, is unique because ERCOT, the Independent Service Operator that fulfills 85 percent of electricity demands in Texas, is entirely governed by Texas's state legislature and run by Texas's Public Utility Commission.[119] The uniformity that ERCOT provides has allowed the state to avoid potential bureaucratic obstacles during its development of wind power. Other projects, especially those spanning multiple states, are sometimes delayed due to the difficulty of dealing with multiple grid authorities and incompatible federal and state regulations.[120]

The transmission infrastructure improvements in Texas have been more successful than those in California. Texas's CREZ program to build transmission lines out to remote wind resources is almost complete and, once finished will add almost 3,600 miles of transmission lines and infrastructure to carry 18,500 megawatts of energy.[121] California's attempt to build transmission lines, however, has been slowed by the state's more stringent environmental regulations.[122]

Finally, although both states have enacted an RPS, California's is much more aggressive. California requires 33 percent of electricity come from renewable energy by 2020.[123] Texas, on the other hand, has an RPS that only requires 10,000 megawatts by 2025. Texas was able to meet its 2025 goal early.[124] California is, according to the Governor's 2015 inaugural address, on track to meet its RPS by 2020. The Governor even proposed increasing the RPS to 50 percent.[125]

Wind energy's success in Texas and its failure in California has resulted from the natural advantages Texas has in wind resources as well as the more favorable business and regulatory environment Texas provides. A comparison of both states' wind resources clearly shows Texas has a huge natural advantage over California. In California the

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http://apps2.eere.energy.gov/wind/windexchange/images/windmaps/tx_80m.jpg

[117] Institute for Energy Research (IER). 2013, December. "Estimating the State-Level Impact of Federal Wind Energy Subsidies." Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/12/State-Level-Impact-of-Federal-Wind-Subsidies.pdf

[118] Ibid.

[119] Texas Office of Public Utility Counsel. n.d. "Electric Reliability Council of Texas." Retrieved December 5, 2014 from: http://www.opuc.texas.gov/ERCOT.html

[120] Malewitz, J. 2013, October 14. "$7 Billion CREZ Project Nears Finish, Aiding Wind Power." Texas Tribune. Retrieved from: http://www.texastribune.org/2013/10/14/7-billion-crez-project-nears-finish-aiding-wind-po/

[121] Del Franco, M. 2014. "Nearly Completed CREZ Lines Unlock Wind Congestion." Pg. 1-2. Zackin Publications. Retrieved December 6, 2014 from: http://www.nawindpower.com/issues/NAW1307/FEAT_01_Nearly_Completed_CREZ_Lines_Unlock_Wind_Congestion.html; Note that 18,500 MW converts to 18.5 GW.

[122] Galbraith, K. 2009, October 17. "California and Texas: Renewable Energy's Odd Couple." New York Times. Retrieved from: http://www.nytimes.com/2009/10/18/weekinreview/18galbraith.html?_r=0

[123] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, March. "Renewable Portfolio Standard Policies." U.S. Department of Energy. Retrieved from: http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2014/11/Renewable-Portfolio-Standards.pdf

[124] Database of State Incentives for Renewables and Efficiency (DSIRE). 2015, February 4. "Renewable Generation Requirement." U.S. Department of Energy. Retrieved from: http://programs.dsireusa.org/system/program/detail/182

[125] Brown Jr., E. (2015, January 5). Governor Brown Sworn in, Delivers Inaugural Address. Retrieved from http://gov.ca.gov/news.php?id=18828

development of wind resources has been slowed by stringent environmental regulations, while wind development in Texas enjoys a less restrained regulatory climate.[126]

COST FACTORS

The price of wind is constantly changing, and many studies and reports have attempted to calculate that price. Some focus on capital costs, others on wind's place in the energy market. Still others look to comprehensively understand the entire cost of wind energy projects. Each looks to answer the question: "what is the cost of wind energy?" In this section we look to analyze key studies that examine the cost of wind power, comparing the factors included in the reports and the methods used to measure them.

The reports examined for this review are the Energy Information Administration's(EIA) *Annual Energy Outlook* (AEO), the National Renewable Energy Laboratory's (NREL) *2011 Cost of Wind Energy Review*, and Lazard's *Levelized Cost of Energy Analysis Version 8.0*.

While these studies are straightforward calculations of the explicit costs of wind energy, other studies take the traditional cost estimate techniques and attempt to integrate the social costs of energy, as is the case with the Hamilton Group's report, *A Strategy for America's Energy Future: Illuminating Energy's Full Costs*. Two other reports, George Taylor and Thomas Tanton's *The Hidden Costs of Wind Electricity* and Michael Giberson's *Assessing Wind Power Cost Estimates* seek to modify the wind costs provided by the EIA and the NREL, respectively, by estimating their own costs based on including the cost of backup power, among other factors. Giberson calculates his own costs based on a 2011 NREL report and arrives at a final cost of $109 per megawatt-hour. We added some of his estimates for costs not traditionally calculated in the LCOE, including transmission costs ($15 per megawatt-hour), baseload cycling ($2 per megawatt-hour), and the PTC ($23 per megawatt-hour) to create a final $149 per megawatt-hour figure. This figure is referred to as modified Giberson. The $23 per megawatt-hour estimate for the cost of subsidies does not take into account the fact that the PTC also provides some benefits, especially to wind power producers. Calculating the net cost of the PTC by netting out these benefits, however, is beyond the scope of this study. Thus, we count the PTC as an unseen cost because it represents a wealth transfer from taxpayers to wind power producers.

In estimating the cost of energy from wind power, we examine only onshore wind power. Although offshore wind has the benefit of being able to take advantage of plentiful coastal winds, the technology's costs are much higher than onshore wind energy production. Offshore wind projects enjoy different federal and state incentives, face different environmental siting issues, and require much higher maintenance costs than onshore wind. Because onshore wind and offshore wind differ so dramatically in so many different ways, this report leaves the study of the cost of offshore wind to future research.

[126] Galbraith, K. 2009, October 17. "California and Texas: Renewable Energy's Odd Couple." New York Times. Retrieved from: http://www.nytimes.com/2009/10/18/weekinreview/18galbraith.html?_r=0

TABLE 1:ESTIMATED COST OF ONSHORE WIND ENERGY (PRICED LOW TO HIGH)

	LAZARD	NREL	EIA	HAMILTON	MODIFIED GIBERSON	TANTON/TAYLOR
Total Cost ($/MWh)	$59[127]	$72	$80.3	$97	$149[128]	$151

The studies examined show a market where subsidized wind is competitive, and one where unsubsidized wind is much less viable. Wind energy is dependent on subsidies, and when these are removed from the calculation, the costs of wind energy increase enough to make it an unfavorable choice in the energy market.

There is no single best method for calculating the cost of a given energy type; wind energy has many factors and is at the center of a contentious and ongoing debate. Various factors are included or ignored depending on the focus of the report. Here we examine some major factors and determine their value in finding the actual cost of wind energy.

CAPITAL COSTS AND OPERATION AND MAINTENANCE COSTS

The two core components of the cost of an energy project are the capital costs and the operations and maintenance costs. The capital costs of wind energy are generally made up of turbine costs, construction and installation costs, transmission costs, and financing costs. Operations and maintenance costs cover both fixed (planned) and variable (unplanned) costs. These are the most basic, easily understandable costs that apply to all projects across all energy types. Although there is some variation in cost estimates for capital and operations and maintenance, most cost estimates fall within $20 per megawatt-hour of each other. The only significant outlier for either cost is Giberson's 2013 report, whose estimates fall almost $22 per megawatt-hour above the average of the reports examined, a difference that is attributable to his use of a lower-than-average capacity factor, an adjusted discount rate, and the inclusion of the additional cost of the Modified Accelerated Cost Recovery System, a 5-year tax depreciation system that saves tax costs and frees revenue for future investment.[129]

[127] This value was found by taking the average of the high ($81 per megawatt-hour) and low ($37 per megawatt-hour) estimates used by Lazard.

[128] To reach this number, we took Giberson's modified $109 per megawatt-hour levelized cost of electricity and added his estimates for costs not traditionally calculated in the LCOE, including transmission costs ($15 per megawatt-hour), baseload cycling ($2 per megawatt-hour), and subsidies ($23 per megawatt-hour) The $23 per megawatt-hour estimate for the cost of subsidies does not take into account the fact that the PTC also provides some benefits, especially to wind power producers. Calculating the net cost of the PTC by netting out these benefits, however, is beyond the scope of this study. Thus, we count the PTC as an unseen cost because it represents a wealth transfer from taxpayers to wind power producers.

[129] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 5-7. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf

TABLE 2: CAPITAL COST

	LAZARD	NREL	EIA	HAMILTON	GIBERSON	TANTON/TAYLOR
Capital Cost ($/MWh)	$48[130]	$61	$64.1	N/A	$88	$71.8

TABLE 3: OPERATIONS AND MAINTENANCE COSTS

	LAZARD	NREL	EIA	HAMILTON	GIBERSON	TANTON/TAYLOR
O&M Cost ($/MWh)	$11.5[131]	$11	$13	N/A	$21	$9.8

CAPACITY FACTOR

The capacity factor of a power plant is its annual utilization rate, which is a measurement of how much electricity the plant generates in a year as a percentage of how much electricity it would generate if it could run at full power for the entire year.132 In the AEO, the EIA notes that the "LCOE values [for wind and solar] are not directly comparable to [the LCOE estimates] for other technologies (even where the average annual capacity factor may be similar)."133 The technologies cannot be directly compared because the capacity factor of dispatchable technologies can be operator controlled while the capacity factor of wind and solar is outside the realm of human control (i.e., the wind doesn't blow, blows too strongly or too weakly; sunlight is blocked by clouds or unavailable because it is night). A high capacity factor can drastically lower the cost of wind energy, and vice versa. The capacity factor is a significant part of calculating the cost of wind, yet estimates of the average market capacity factor vary widely from report to report. While moderate studies such as the EIA's *Annual Energy Outlook* and the NREL's *Cost of Wind Energy Review* use capacity factors at around 35 to 38 percent, more generous reports, like that from Lazard (2014), use a 41 percent capacity factor.[134]

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130 The value for Lazard's capital costs was found by averaging the high ($66 per megawatt-hour) and low ($30 per megawatt-hour) estimates used by Lazard.

131 The value for Lazard's operations and maintenance was found by averaging the high ($15 per megawatt-hour) and low ($8 per megawatt-hour) estimates used by Lazard.

132The capacity factor used in calculating cost estimates has a strong effect on how affordable a given energy technology appears to be. For example, say the levelized fixed costs of a power plant are calculated to be $30 per MWh at a 90 percent capacity factor. If the plant utilization rate turns out to be only half of what was projected–resulting in a capacity factor of 45 percent–the levelized fixed cost doubles to $60 per MWh. Counterintuitively, levelized variable costs do not vary with capacity factor but levelized fixed costs vary inversely with change in capacity factor.

133 U.S. Energy Information Administration (EIA). 2015, June 3. "Annual Energy Outlook 2015: Levelized cost and levelized avoided cost of new generation resources in the Annual Energy Outlook 2015." Retrieved from: http://www.eia.gov/forecasts/aeo/electricity_generation.cfm

134 Energy Information Administration (EIA). U.S. Department of Energy. 2014, April. "Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2014." Retrieved from: http://www.eia.gov/forecasts/aeo/pdf/electricity_generation.pdf; Tegen, S., E. Lantz, M. Hand, B. Maples, A. Smith, and P. Schwabe. 2013, March. "2011 Cost of Wind Energy Review." National Renewable Energy Laboratory. Retrieved from: http://www.nrel.gov/docs/fy13osti/56266.pdf; Lazard. 2014, September. "Lazard's Levelized Cost of Energy Analysis - Version 8.0." Lazard. Retrieved from: http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf

More conservative estimates, like that found in Giberson's *Assessing Wind Power Cost Estimates,* fall around 33 percent.[135] The *2013 Wind Technologies Market Report* found that capacity factor technology has stagnated at approximately 33 percent since 2005, though in recent years it has breached roughly 38 percent.[136]

TABLE 4: CAPACITY FACTOR

	LAZARD	NREL	EIA	HAMILTON	GIBERSON	TANTON/TAYLOR
Capacity Factor	41%[137]	38%	35%	34%	33%	33%

TRANSMISSION COSTS

Both Giberson, and Taylor and Tanton remark that established studies on the cost of wind energy neglect to include the total cost of creating new transmission lines once the existing infrastructure is occupied.[138] As a location-dependent power source, these costs are specific to the availability of wind and would not be required if not for power generation from wind. Wind-friendly sites are rarer than natural gas or coal sites. They accurately claim that the extra cost of building transmission lines should be included in any calculation of the cost of wind energy. To calculate transmission construction costs, Giberson returns to a Berkeley Labs 2009 technology review, finding that the median cost to build transmission lines was $15 per megawatt-hour.[139] Taylor and Tanton calculated a $27 per megawatt-hour added cost.[140]

TABLE 5: TRANSMISSION COSTS

	LAZARD	NREL	EIA	HAMILTON	GIBERSON	TANTON/TAYLOR
Cost of adding transmission($/MWh)	N/A	N/A	N/A	N/A	$15	$27[141]

[135] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 6. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf

[136] Wiser, R., and M. Bolinger. 2014, August. "2013 Wind Technologies Market Report." Prepared for the U.S. Department of Energy. Retrieved from: http://emp.lbl.gov/sites/all/files/2013_Wind_Technologies_Market_Report_Final3.pdf

[137] The value for Lazard's capacity factor was found by averaging the high (52%) and low (30%) estimates used by Lazard.

[138] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf; Taylor, G., and T. Tanton. 2012, December. "The Hidden Costs of Wind Electricity." Pg. ES-1. American Tradition Institute. Retrieved from: http://www.atinstitute.org/wp-content/uploads/2012/12/Hidden-Cost.pdf

[139] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 8. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf

[140] Taylor, G., and T. Tanton. 2012, December. "The Hidden Costs of Wind Electricity." Pg. ES-1. American Tradition Institute. Retrieved from: http://www.atinstitute.org/wp-content/uploads/2012/12/Hidden-Cost.pdf

[141] This number was found on the first page of the Executive Summary of Taylor and Tanton's report, in Table 1: Levelized Cost of Wind Electricity, (starting from the assumptions in the Energy Information Administration's 2012 Annual Energy Outlook). Added to the existing 12.4 cents per kilowatt-hour of wind added to natural gas is the estimated cost of transmission and transmission losses, which comes out to 2.7 cents per kilowatt-hour. This figure was then converted to $27 per megawatt-hour.

BASELOAD CYCLING

In areas with high levels of wind power, the grid relies on existing energy plants to provide electricity when the wind is not blowing. These generators ensure that the station is always supplying a minimum amount of energy, also known as "baseload" power. Even though the generators are not used when the wind turbines are supplying plenty of power, they must be kept on standby, ready to be fired up at a moment's notice. The generators "cycle" between use and non-use, hence the term "baseload cycling."[142]

Baseload cycling increases operation and maintenance costs as two energy plants (the wind farm and the baseload generator) are kept running to do the job of one.[143] Researchers at the National Renewable Energy Laboratory note that cycling increases emissions because firing up a plant multiple times in a single day uses more fuel than running at a steady rate throughout the day.[144]

TABLE 6: BASELOAD CYCLING

	LAZARD	NREL	EIA	HAMILTON	GIBERSON	TANTON/TAYLOR
Cost of baseload cycling ($/MWh)	N/A	N/A	N/A	N/A	$2	$23[145]

Taylor and Tanton include baseload cycling in their summary of the hidden costs of wind not included in the EIA's *Annual Energy Outlook*. They estimate that baseload cycling adds $23 per megawatt-hour to the cost of wind energy.[146] Giberson also discusses baseload cycling, citing research that adds only $2 per megawatt-hour to the NREL's original cost.[147]

Many studies fail to account for the cost of baseload cycling, however. Baseload cycling is a required component of wind power that adds to the hidden costs of wind energy. Therefore, baseload cycling should be included in any estimation of the cost of wind power.

SOCIAL AND ENVIRONMENTAL COST

One of the key justifications for government intervention in the energy market is to address social and environmental costs. An accurate estimate of the cost of producing electricity should include health and environmental costs imposed on society that are not borne by producers or consumers, often known as externalities. Social and environmental costs

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[142] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 9. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf
[143] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 9. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf
[144] Cochran, J., D. Lew., and N. Kumar. 2013, December. "Flexible Coal: Evolution From Baseload to Peaking Plant." Pg. 8. National Renewable Energy Laboratory. Retrieved from: http://www.nrel.gov/docs/fy14osti/60575.pdf
[145] This number was found on the first page of the Executive Summary of Taylor and Tanton's report, in Table 1: Levelized Cost of Wind Electricity, (starting from the assumptions in the Energy Information Administration's 2012 Annual Energy Outlook). Added to the existing 10.1 cents per kilowatt-hour of wind added to natural gas is the cost of keeping the primary plant available and the extra fuel that these plants consume, which comes out to 2.3 cents per kilowatt-hour. This figure was then converted to $23 per megawatt-hour.
[146] Giberson, M. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 9. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf
[147] Ibid.

include potential health problems that power plants create for the nearby population, negative effects of energy production on the environment, and effects on global climate change.

Analysts have attempted to price carbon emissions based on their social and environmental effects; however, these numbers are so arbitrary that they do not provide clear policy direction. According to a CATO report, estimates for the correct tax on carbon emissions vary widely—from $5 to $100 per ton—while estimates for the damages caused by carbon dioxide range from $5 to $35 per ton.[148] The only study we reviewed that assigned a dollar value to social and environmental cost is Hamilton's *A Strategy for America's Energy Future*.[149] Hamilton calculates the added social cost of a new wind project at $9 per megawatt-hour.[150] These added costs are a result of carbon emissions associated with the construction and installation of energy plants, and the non-carbon costs that construction can have on the environment. Comparatively, the added social and environmental costs of coal amount to $53 per megawatt-hour, due to continued emissions after construction.[151]

Because of the high degree of uncertainty involved in the calculation of social and environmental costs, attempts to accurately quantify this factor generally fail. Economist Robert Pindyck, a professor at the Massachusetts Institute of Technology, notes that economists have attempted to quantify the social cost of carbon by developing integrated assessment models. Pindyck notes, "these models have crucial flaws that make them close to useless as tools for policy analysis."[152] Because so little is known regarding the magnitude of the link between carbon emissions and the potential for human-caused catastrophic climate change, attempts to quantify social and environmental costs rely on too many assumptions to provide accurate, or even useful, estimates. For this reason, we do not recommend making policy decisions that impose billions of dollars of costs on American taxpayers in the hopes of securing some uncertain, future environmental benefit.

COST OF SUBSIDIES

Of all the non-private costs associated with wind energy, the cost of subsidies is the most important. Because federal and state subsidies are intrinsic to the success of wind energy, calculations that do not include subsidies return a cost of wind energy that is artificially low.

TABLE 7: COST OF SUBSIDIES

	LAZARD	NREL	EIA	HAMILTON	GIBERSON	TANTON/TAYLOR
Cost of subsidies ($/MWh)	$19[153]	Subsidies included but no values given	Subsidies included but no values given	N/A	$23	$19[154]

[148] Litterman, B. 2013. "What Is the Right Price for Carbon Emissions?" CATO; Regulation: Energy & Environment. Pg. 38. Retrieved from: http://object.cato.org/sites/cato.org/files/serials/files/regulation/2013/6/regulation-v36n2-1-1.pdf

[149] Greenstone, M., and A. Looney. 2011, May. "A Strategy for America's Energy Future: Illuminating Energy's Full Costs." Pg. 18. The Hamilton Project. Retrieved from: http://www.hamiltonproject.org/files/downloads_and_links/05_energy_greenstone_looney.pdf

[150] This value was found by adding coal's Non-Carbon Social Costs and Carbon Emission Costs found in the table on page 18 of "A Strategy for America's Energy Future," and then converting the sum from cents per kilowatt-hour to dollars per megawatt-hour.

[151] This value was found by adding coal's Non-Carbon Social Costs and Carbon Emission Costs found in the table on page 18 of "A Strategy for America's Energy Future," and then converting the sum from cents per kilowatt-hour to dollars per megawatt-hour.

[152] Pindyck, R. S. 2013, July. "Climate Change Policy: What do the Models Tell Us?" National Bureau of Economic Research. Retrieved from: http://web.mit.edu/rpindyck/www/Papers/Climate-Change-Policy-What-Do-the-Models-Tell-Us.pdf

[153] The value for Lazard's cost of subsidies was found by subtracting the average of their values for subsidized wind (40.5 per megawatt-hour) from the average of their values for unsubsidized wind ($59 per megawatt-hour) and then rounding the result to the nearest one ($19 per megawatt-hour).

[154] This number was found on page 1 of the Executive Summary of Taylor and Tanton's report, in Table 1: Levelized Cost of Wind Electricity, (starting from the assumptions in the Energy Information Administration's 2012 Annual Energy Outlook). Added to the existing 8.2 cents per

Some reports examined here make an effort to show the influence of federal and state subsidies on the cost of wind. Each of those reports has taken a different approach with different results. Lazard calculates both the subsidized and unsubsidized cost of wind in their 2014 report, finding a $19 per megawatt-hour cost of subsidies.[155] Taylor and Tanton also found a $19 per megawatt-hour subsidy cost.[156]

SUMMARY

Estimating the actual cost of wind power is inherently difficult, as a wide variety of factors must be included. Some factors, like opportunity cost and reduced reliability of the electrical grid, are difficult to quantify, but every attempt should be made to estimate them as they add significant costs that must be borne by taxpayers and ratepayers alike. In order to come up with the most accurate estimate possible, both the explicit and implicit costs of producing electricity from wind power should be included.

Of the reports examined here, Michael Giberson's *Assessing Wind Power Cost Estimates* is the most comprehensive and evenhanded, correcting the NREL report's mistakes and relying on more realistic expectations about the cost of wind energy. The inclusion of Giberson's estimates for transmission and baseload cycling costs are as important as his modifications to the original estimates for capital and operation and maintenance costs. Giberson attempts to correct the NREL study by including the PTC in his calculations. This subsidy adds $23 per megawatt-hour to the cost of wind.[157] Estimates of subsidy costs range from $19 to $23 per megawatt-hour, all of which could drastically affect whether wind energy is feasible in the market.

When compared to the modified Giberson standard, the other cost estimates examined underestimate the actual cost of wind power by an average of 48 percent. These studies range from the Hamilton report, which underestimates the cost of wind by 35 percent, to Lazard's *Levelized Cost of Energy Analysis Version 8.0*, which underestimates the cost by 60 percent.[158]

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kilowatt-hour of wind added to natural gas is the implicit cost of subsidies, which comes out to 1.9 cents per kilowatt-hour. This figure was then converted to $19 per megawatt-hour.

155 Lazard. 2014, September. "Lazard's Levelized Cost of Energy Analysis - Version 8.0." Pg. 3. Lazard. Retrieved from: http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf

156 Taylor, G., and T. Tanton. 2012, December. "The Hidden Costs of Wind Electricity." Pg. ES-1. American Tradition Institute. Retrieved from: http://www.atinstitute.org/wp-content/uploads/2012/12/Hidden-Cost.pdf

157 Giberson, Michael. 2013, October. "Assessing Wind Power Cost Estimates." Pg. 15. Institute for Energy Research. Retrieved from: http://instituteforenergyresearch.org/wp-content/uploads/2013/10/Giberson-study-Final.pdf

158 This does not include the Taylor and Tanton study, as the authors actually estimate wind power as being even more expensive than Giberson's finding.

KEY FINDINGS

Regardless of how cost factors are considered, the actual cost of wind energy in the United States is higher than most estimates claim. This is because generating electricity from wind power entails many hidden costs. An accurate estimate of the cost of wind power to the American public must account for the following factors:

- The federal PTC, a crucial subsidy for wind producers, has distorted the energy market by artificially lowering the cost of expensive technologies and directing taxpayer money to the wind industry.
- States have enacted Renewable Portfolio Standards (RPS) that require utilities to purchase electricity produced from renewable sources, which drives up the cost of electricity for consumers.
- Wind resources are often located far from existing transmission lines. Expanding the grid, whether by private or public funding, is expensive, and the costs are passed on to taxpayers and consumers.
- Because wind power is unreliable, conventional generators must be kept on backup to meet demand when wind is unable to do so. This drives up the cost of electricity for consumers, as two plants are kept running to do the job of one.
- Billions of taxpayer dollars are used to subsidize the wind industry. Allowing consumers to pick which energy to use, based on price, would result in greater economic efficiency than allowing government to decide how the resources of consumers should best be allocated.

		Federal Policies		
		State Policies		
Capital Costs		Opportunity Cost		
O&M		Reduced Reliability		
Capacity Factor		Baseload Cycling		
Transmission Costs		Social & Environmental Costs		
Explicit Costs	+	Implicit Costs	=	The Overall Cost of Wind Energy

CONCLUSION

The actual cost of wind-generated electricity is higher than most cost estimates calculate. Mandates requiring the use of wind energy increase electricity costs for consumers, and subsidies mask the actual cost of doing so. RPS require intermittent renewable energy to exist, but at the expense of utilities and consumers. The PTC makes wind power cheaper for utilities and consumers, but at the expense of taxpayers.

Through such policies, US policymakers have essentially decided that electricity consumers will have wind power, even if it is more expensive. The cost of this decision has fallen to US taxpayers and consumers of electricity. When weighing the costs and benefits of wind power, not including all of the unseen costs makes wind power appear to be a more attractive option than it actually is. Energy policy decisions, however, should be based on a more complete estimate of the cost of wind energy.

APPENDIX A:

COMPARATIVE ANALYSIS OF TAX CODE PROVISIONS RELATED TO ENERGY PRODUCTION

By: Jonathan E. Jenkins, JD, LLM

1. ABSTRACT

This note aggregates sections of the Internal Revenue Code and comparative studies of federal tax policy towards energy production, and answers the question about whether tax policy treats equally all sources of energy production (coal, oil, natural gas, wind, solar, etc.). Tax policy does not treat all energy sources equally, but instead, during the past ten years, federal tax policy has shifted to give greater tax preferences to renewable energy sources over fossil fuels. Congressional Budget Office (CBO) estimates show significantly more tax expenditures for renewable energy than for fossil fuels during the years 2008-2011, by ratio of approximately four to five times greater.[159] A graph prepared by the CBO illustrates the estimated tax expenditures/preference by the type of fuel or technology (see the CBO graph attached at the end of this note as **Exhibit A**).

2. BRIEF HISTORY OF TAX INCENTIVES FOR ENERGY PRODUCTION

"The Internal Revenue Code (I.R.C.) has been intimately linked to tax subsidies for investment, development, and production of American energy sources for much of this nation's history. The same year that Congress adopted the federal income tax in 1913, it also passed legislation permitting oil companies to receive a subsidy for depleting an oil-based resource."[160]

"In contrast to the first traditional energy tax subsidies in 1913, Congress passed the first renewable energy tax credits in 1978,[161] likely as a response to the energy crisis of the late 1970s.[162] From 1978 until 2015, Congress created new incentives, extended existing incentives, and renewed expired incentives for renewable energy."[163] In December 2015, as part of the spending bill for the 2016 federal budget, Republicans in Congress agreed to extend the tax incentives for renewable energy, which would lapse, in exchange for an agreement with the Obama Administration and Democrats to end the four decade long ban on the export of US produced crude oil.[164] This note does not identify or discuss special appropriations or spending measures made by Congress (*i.e.*, "pork"), because those are beyond the

[159] Congressional Budget Office. Federal Financial Support for Fuels and Energy Technologies. Testimony before U.S. House of Representatives, Subcommittee on Energy (March 2013).

[160] Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845 (2015) (Quoting Mona L. Hymel, Environmental Tax Policy in the United States: A "Bit" of History, 3 Ariz. J. Envtl. L. & Pol'y 157, 159 (2013)).

[161] The first legislation creating tax credits for renewable energy was the Energy Tax Act of 1978, Pub. L. No. 95-618, 92 Stat. 3174 (1978). Hymel, supra note 1, at 160.

[162] See Hymel, supra note 2, at 160.

[163] In 2005, Congress passed the Energy Tax Incentives Act of 2005, Pub. L. No. 109-58, 119 Stat. 986 (2005). In 2008, Congress passed the Emergency Economic Stabilization Act of 2008, Pub. L. No. 110-343, 122 Stat. 3765 (2008) (codified at 12 U.S.C.§§5201-61). In 2009, Congress passed the American Recovery and Reinvestment Act of 2009, Pub. L. No. 111-5, 123 Stat. 115 (2009). In 2012, Congress passed the American Taxpayer Relief Act of 2012. Hymel, supra note 2, at 160 n.11-13; Database of State Incentives for Renewables and Efficiency (hereainfter "DSIRE"), Federal Incentives/for Renewables & Efficiency: Modified Accelerated Cost-Recovery System (Jan. 1, 2013), available at: http://www.dsireusa.org/; American Taxpayer Relief Act of 2012, Pub. L. 112-240, 126 Stat. 2313 (2012), and see,

[164] Associated Press. "Congress OKs '16 Budget, Tax Breaks, Even Sledding." Denver Post [Denver] 17 Dec. 2015, sec. A: 20. Print.

practical spoke of this note. For example, part of the $1.1 trillion spending bill to fund the federal government for the 2016 budget included a provision, at the request of Senator Thad Cochran (Republican, Mississippi), for an appropriation of "at least $160 million to a financially troubled 'clean coal' power plant" located in Kemper County, Mississippi.[165] Identifying all such special appropriations is not feasible.

Most subsidies to fossil fuels were written into the U.S. Tax Code long ago as permanent provisions, while subsidies for renewables are time-limited initiatives implemented through energy bills that have set expiration dates.[166] The expiration dates built into short term renewable subsidies, lasting one or two years, and this short term expirations create an unstable investment environment for renewable energy. The short term nature of these subsidies has the effect of discouraging long term investment into renewable energy.[167]

An overlap of tax incentives exists among fossil fuels, and also among renewable energies, so it is not always possible to allocate the value of the annual subsidy for a specific energy industry, such as coal or wind.[168] Some subsidies though are industry specific, and are noted below.

3. COAL

3.1 CREDIT FOR PRODUCTION OF NONCONVENTIONAL FUELS

(annual subsidy: $14 billion)

I.R.C. Section 45K. This provision provides a tax credit for the production of certain fuels. Qualifying fuels include: oil from shale, tar sands; gas from geopressurized brine, Devonian shale, coal seams, tight formations, biomass, and coal-based synthetic fuels. This credit has historically primarily benefited coal producers.[169]

3.2 CHARACTERIZING COAL ROYALTY PAYMENTS AS CAPITAL GAINS

(annual subsidy: $986 million)

I.R.C. Section 631(c). Income from the sale of coal under royalty contract may be treated as a capital gain rather than ordinary income for qualifying individuals.[170]

3.3 EXCLUSION OF ALTERNATIVE FUELS FROM FUEL EXCISE TAX

(annual subsidy: $343 million)

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[165] Id.
[166] "Federal Coal Subsidies." SourceWatch. The Center for Media and Democracy, 9 July 2014. Web. 03 Mar. 2016.
[167] See Harrison, supra note 2, at 861-66.
[168] See, e.g., Oil Change International. Cashing In on All of the Above: U.S. Fossil Fuel Production Under Obama. July 2014.
[169] "Federal Coal Subsidies." SourceWatch. The Center for Media and Democracy, 9 July 2014. Web. 03 Mar. 2016.
[170] Id. (Quoting the 2011 report, "What Would Jefferson Do?: The Historical Role of Federal Subsidies in Shaping America's Energy Future" calculated this subsidy totaled over $1.3 billion in government tax expenditures from 2000 – 2009).

I.R.C. Section 6426(d). This section applies to liquified petroleum gas (LPG), P-series fuels (defined at 42 U.S.C. 13211(2)), compressed natural gas (CNG), liquefied natural gas (LNG), liquefied hydrogen, liquid coal, and liquid hydrocarbon from biomass.[171]

3.4 OTHER-FUEL EXPLORATION & DEVELOPMENT EXPENSING

(annual subsidy: $342 million)

I.R.C. Section 617. Identical provisions as applied to oil and gas (above). Including, for example, the costs of surface stripping, and construction of shafts and tunnels.[172]

3.5 OTHER-FUEL EXCESS OF PERCENTAGE OVER COST DEPLETION

(annual subsidy: $323 million)

I.R.C. Section 613. Taxpayers may deduct 10 percent of gross income from coal production.[173]

3.6 CREDIT FOR CLEAN COAL INVESTMENT

(annual subsidy $186 million)

I.R.C. Sections 48A and 48B. Available for 20 percent of the basis of integrated gasification combined cycle property and 15 percent of the basis for other advanced coal-based generation technologies.[174]

3.7 SPECIAL RULES FOR MINING RECLAMATION RESERVES

(annual subsidy $159 million)

I.R.C. Section 468. This deduction is available for early payments into reserve trusts, with eligibility determined by the Surface Mining Control and Reclamation Act and the Solid Waste Management Act. The amounts attributable to mines rather than solid-waste facilities are conservatively assumed to be one-half of the total.[175]

3.8 CARBON DIOXIDE (CO2) SEQUESTRATION CREDIT

($0 in 2009, $60 million in 2013, for both coal and oil combined)

Tax credit of $20 per ton of CO2 sequestered (largely from coal plants); $10 per ton for CO2 used for enhanced oil recovery.[176]

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[171] Id.
[172] Id.
[173] Id.
[174] Id.
[175] Id.
[176] Id.

3.9 BLACK LUNG DISABILITY TRUST FUND

(total subsidy $1 billion)

Pays health benefits to coal miners afflicted with pneumoconiosis, a long-term degenerative disease from constant inhalation of coal dust, also known as "black lung." Created in 1978, it is funded through an excise tax on coal to support a trust fund covering health costs of affected workers, however the tax is not sufficient to cover all costs, and the BLDTF was given "indefinite authority to borrow" from the U.S. General Fund. By the end of FY 2008, the BLDTF had accrued nearly $13 billion in debt. In 2008, Congress partially "bailed out" the BLDTF, which the Environmental Law Institute (ELI) tabulated as a subsidy to coal.[177]

3.10 EXCLUSION OF BENEFIT PAYMENTS TO DISABLED MINERS

(annual subsidy: $438 million)

30 U.S.C. 922(c). Disability payments out of the Black Lung Disability Trust Fund are not treated as income to the recipients.[178]

4. OIL AND NATURAL GAS

Estimates for annual tax expenditures for oil and natural gas production are often grouped together, since those tax expenditures come from the same sections of the I.R.C., and because the extraction methods are similar. Total oil and gas subsidies are estimated at $5.3 billion in 2009, and $10.5 billion in 2013.[179]

4.1 MASTER LIMITED PARTNERSHIPS (MLP)

($2.3 billion in 2009, and $3.9 billion in 2012)

More than three-quarters of MLPs are fossil fuel companies.[180] The MLP is a complicated and creative tax avoidance structure.[181] "[The MLP] 'is a business structure that is taxed as a partnership, but whose ownership interests are traded on a market like corporate stock.'[182] Instead of a typical corporate structure - investors, managers, and officers - an MLP's members resemble more closely a partnership and are split into two categories: limited partners, who usually hold ninety-eight percent of the enterprise but have no control in the MLP's operation, and general partners, who hold a two percent ownership stake in the enterprise and oversee the MLP's operation.[183] Similar to forming one's business as a corporation, an MLP seeks investors and promises to reward them with dividends from the

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[177] Id.

[178] "Federal Coal Subsidies." SourceWatch. The Center for Media and Democracy, 9 July 2014. Web. 03 Mar. 2016.

[179] Cashing In on All of the Above: U.S. Fossil Fuel Production Under Obama. July 2014.

[180] Id.

[181] The explanatory discussion in this section comes from: Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 855-56 (2015).

[182] For instance, the I.R.C. states that, for corporations in general, "[a] tax is hereby imposed for each taxable year on the taxable income of every corporation." I.R.C. § 11(a) (2012). Partnerships, a taxable entity that will be discussed, infra, are another type of taxable entity that receives unique treatment under the I.R.C.. However, a type of partnership that specifically targets oil and gas companies is best understood as a subsidy and will be treated in the following section about subsidies. See U.S. Sen. Chris Coons, The Master Limited Parity Partnership Act 1 (Apr. 24, 2013), available at http://coons.senate.gov/download/mlp-white-paper/ (explaining that Master Limited Partnerships are traded on the market like a corporate organization but only taxed at the lower level of a partnership).

[183] Id.

company's profits following investment. Unlike a corporation, however, if particular conditions are met, then the MLP is be treated as a partnership instead of a corporation.[184] This means that the entity's income is only taxed once, on the dividends it gives out to its investors. Thus, MLPs provide many of the same benefits of incorporation without the added double tax liability. The result is more money saved and, thus, more money for an MLP's investors in the form of dividends. Only businesses that fall under a categorical exception[185] may take advantage of all that an MLP structure provides. The default position of the I.R.C. is to treat MLPs as corporations.[186] However, if ninety percent of an MLP's gross income comes from a qualifying source, the I.R.C. treats the MLP as a partnership.[187] Qualifying sources include interest-based income, real property rents,[188] and, most importantly, 'income and gains derived from the exploration, development, mining or production, processing, refining, transportation (including pipelines transporting gas, oil, or products thereof), or the marketing of any mineral or natural resource [...]'[189] Ultimately, if an oil and gas producing taxpayer structures its business as an MLP, the taxpayer may avoid corporate double taxation and instead give that money to its investors. The current market capitalization of MLPs is nearly $ 490 billion."[190]

4.2 INTANGIBLE DRILLING COSTS (IDC)

(Estimated between $43 billion and $55 billion during 1968-2000, $1.6 billion in 2009, $3.5 billion in 2013)

This expenditure provides a 100% tax deduction for costs not directly part of the final operating oil or gas well (such as labor costs, survey work, and ground clearing, including oil and gas exploration and development costs.)[191] The value of the IDC between 1968 and 2000 was between forty-three and fifty-five billion dollars in lost revenue.[192]

4.3 ENHANCED OIL RECOVERY CREDIT (EORC)

($1 billion between 1990 and 2000) [193]

"This subsidy[194] covers expenses related to oil and gas in hard-to-drill areas and nearly dry wells in addition to oil and gas wells that are particularly difficult to drill.[195] As a result, the EORC 'encourages oil companies to go after reserves that are more expensive to extract, like those that have been nearly depleted or that contain especially thick crude oil.'[196] The EORC awards taxpayers a credit for any taxable year in an amount equal to fifteen percent of the taxpayer's qualified enhanced oil recovery costs for such taxable year.[197] Qualified costs include the IDC costs detailed above,

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[184] See I.R.C. § 701 (2012) (stating that, in partnerships, partners owe taxes in their individual capacities, not the partnerships in their capacities as entities).
[185] See I.R.C. § 7704(c) (2012).
[186] I.R.C. § 7704(a) (2012).
[187] I.R.C. § 7704(c) (2012).
[188] I.R.C. § 7704(d)(1) (2012).
[189] I.R.C. § 7704(d)(1)(E) (2012)
[190] Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 855-56 (2015).
[191] Id.
[192] U.S. Gov't Accountability Office, Tax Incentives for Petroleum and Ethanol Fuels 7-9 (2000), available at http://www.gao.gov/new.items/rc00301r.pdf. See also, Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 855-56 (2015).
[193] U.S. Gov't Accountability Office, Tax Incentives for Petroleum and Ethanol Fuels 9-13 (2000), available at http://www.gao.gov/new.items/rc00301r.pdf.
[194] Discussion in this section comes from: Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 854-55 (2015).
[195] I.R.C. § 43 (2012).
[196] Mark Zepezauer, Take the Rich Off Welfare 3, 119 (2nd ed. 2004).
[197] I.R.C. § 43(a) (2012).

expenses exceeding those costs that are integral parts of the project incurred in an attempt to extract more oil (tertiary injectant expenses), and depreciation of tangible property.[198] Certain restrictions and limitations apply to the EORC as well,[199] and the EORC is only available to parties who have an operating mineral interest in the property."[200]

4.4 NONCONVENTIONAL SOURCE CREDIT (NSC)

($11 billion between 1980 and 2000)[201]

"In general,[202] the NSC provides an incentive for taxpayers to produce oil and gas domestically from sources that typically require more investment to extract oil and gas.[203] The difficult-to-drill sources include "oil from shale and tar sands, gas from geopressured brine, Devonian shale, coal seams, [and] tight formations."[204] The NSC gives a three dollar-per-barrel credit, which is adjusted for inflation and may be reduced if the market cost of oil per barrel increases above a predetermined price.

4.5 LOST/REDUCED ROYALTIES FROM LEASING

($2.2 billion in 2009, and again in 2013)

Lost/reduced royalties from leasing of federal lands for onshore and offshore drilling.[205]

4.6 PERCENTAGE DEPLETION ALLOWANCE

($340 million in 2009, $900 million in 2013)

Independent producers can deduct 14-15% of large investment costs from income taxes. "Percentage depletion allows the firm to deduct a fraction of the revenue arising from sale of the resource. Historic percentage depletion rates have been as high as 27.5%. Currently percentage depletion is allowed for independent producers at a 15% rate for oil and gas and 10% for coal.[206] Percentage depletion is allowed on production up to 1,000 barrels of average daily production of oil (or its equivalent for natural gas). In addition, the depletion allowance cannot exceed 100% of taxable income from the property (50% for coal) and 65% of taxable income from all sources.[207] Despite the curtailed

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198 Mona L. Hymel, Environmental Tax Policy in the United States: A "Bit" of History, 3 Ariz. J. Envtl. L. & Pol'y 157, 171 (2013); I.R.C. § 43(c) (2012).

199 I.R.C. § 43(b) (2012) (detailing a pro-rated credit if the price of the oil is above a certain price per barrel); I.R.C.§§43(c)(2)(A) (2012) (detailing that a party must domestically produce a significant increase in amount of crude oil recovery), 43(d) (detailing that a taxpayer must also reduce the otherwise deductible or capitalizable costs).

200 Enhanced Oil Recovery Credit, 57 Fed. Reg. 54,919, 54,920 (Nov. 23, 1992) (codified at 26 CFR pt. 1, 601).

201 U.S. Gov't Accountability Office, Tax Incentives for Petroleum and Ethanol Fuels 9-13 (2000), available at http://www.gao.gov/new.items/rc00301r.pdf.

202 Discussion from this section comes from: Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 854-55 (2015).

203 I.R.C. § 45K (2012).

204 In determining what constitutes taxable income, the I.R.C.'s congressional underpinnings play a large part in what amounts to a series of political, accounting, economic, and social considerations. See Boris I. Bittker & Lawrence Lokken, Federal Taxation of Income, Estates and Gifts §§ 2.1, 27.6. (2012) ("The statutory base is 'taxable income,' a term whose content not only reflects accounting principles and economic concepts but also embodies numerous legislative judgments about fairness, administrative convenience, and the desirability of encouraging or not impeding a host of social, personal, and business activities.").

205 Oil Change International. Cashing In on All of the Above: U.S. Fossil Fuel Production Under Obama. July 2014.

206 Id. "Independent producers are defined as producers who do not engage in refining or retail operations. EPACT increased the amount of oil a company could refine before it was deemed to engage in refining for this purpose from 50,000 to 75,000 barrels per day."

207 Id. "Amounts in excess of the 65% rule can be carried forward to subsequent tax years. The net income limitation has been suspended in

availability of percentage depletion, it continues to be a significant energy tax expenditure, costing $3.2 billion over five years in the federal budget."[208]

4.7 DOMESTIC MANUFACTURING DEDUCTION

($605 million in 2009, $574 million in 2013)

Allows oil producers to claim a tax break intended for U.S. manufacturers to prevent job outsourcing.[209]

4.8 EXEMPTION FROM PASSIVE LOSS LIMITATION

($20 million in 2009, $20 million in 2013)

Exempts investors from limits on deductions of losses from oil and gas activities in which they are not directly involved.[210]

4.9 DEDUCTION FOR TERTIARY INJECTANTS

($0 in 2009, $7 million in 2013)

Allows companies to deduct the costs of fluids, gases, and other chemicals used for enhanced oil recovery from existing wells.[211]

4.10 DEEP GAS AND DEEP WATER PRODUCTION ROYALTY RELIEF

($1 million in 2009, $1 million in 2013)

Suspension of royalty payments for deepwater oil and gas production.[212]

4.11 DEDUCTION FOR OIL SPILL REMEDIATION COSTS

($679 million in 2011, with a spike of $9.9 billion in 2010)

This deduction allows companies to deduct from tax payments the costs associated from cleaning up oil spills. In 2010, an extraordinary spike occurred with the claim of this deduction, because of the British Petroleum Deepwater Horizon oil spill in the Gulf of Mexico.[213]

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years past but the suspension lapsed as of this year."

[208] Gilbert E. Metcalf. Federal Tax Policy Towards Energy. The MIT Joint Program on the Science and Policy of Global Change. January 2007.

[209] Oil Change International. Cashing In on All of the Above: U.S. Fossil Fuel Production Under Obama. July 2014.

[210] Id.

[211] Id.

[212] Id.

[213] Id. Joint Committee on Taxation score of H.R. 3852 of the 112th Congress bill to amend the Internal Revenue Code of 1986 to disallow a deduction for amounts paid or incurred by a responsible party relating to a discharge of oil as cited by Senator Bernie Sanders, End Polluter Welfare Act list of current subsidies, 2012, http://www.sanders.senate.gov/imo/media/doc/EPW_Act_Section_by_Section.pdf , and see, Russ Britt, "BP taking $10 Billion Tax Credit from Gulf Spill", The Wall Street Journal, July 27, 2010.

4.12 THE LOW INCOME HOME ENERGY ASSISTANCE PROGRAM

(annual subsidy $6.3 billion)

"The main structure of the program is to provide low-income households with the means to make their utility payments, the vast majority of which is energy generated by fossil fuels [mostly natural gas]. The U.S. Department of Health and Human Services has tabulated the percentage of households using fossil versus non-fossil heating fuels in 2001, and ELI used the percentage as a proxy for fossil versus non-fossil expenditures for 2002-2008."[214]

5. WIND AND SOLAR

Estimates for annual tax expenditures for wind and solar renewable energy production are often grouped together, since those tax expenditures come for the same sections of the I.R.C..

5.1 MODIFIED ACCELERATED COST-RECOVERY SYSTEM (MACRS)

I.R.C. Section 168. This incentive,[215] "permits businesses to recover investments in certain property through depreciation deductions at a faster rate than otherwise permissible under the IRC's standard depreciation deduction.[216] The relevant qualifying properties include a variety of solar technologies and small-scale wind turbines.[217] For example, the MACRS allowance permits a business to purchase solar or small-scale wind technology that would normally depreciate over a lifetime of five to ten years, and instead deduct its depreciation over five years.[218] Additionally, the 2012 extension of the MACRS deduction extends a bonus depreciation, which "allows industrial and commercial businesses to recover investment in, among other renewables, solar and wind and deduct a depreciation allowance up to 50 percent in the first year that the equipment is purchased and placed into service,"[219] as long as it was purchased between 2008 and 2012."[220]

5.2 PRODUCTION TAX CREDIT

($18 billion between 1992 and 2015)[221]

I.R.C. Section 45. This incentive,[222] "allows taxpayers to receive a credit on their taxes for the electricity that they produce from qualifying renewable energy technology and sell to unrelated parties.[223] It is 'a per-kilowatt-hour tax

[214] Id.
[215] Discussion in this section comes from: Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 857-58 (2015).
[216] I.R.C. § 168 (2012).
[217] I.R.C. § 168(e)(3)(B)(vi) (2012).
[218] Id.
[219] Wang Mingyuan, Government Incentives to Promote Renewable Energy in the United States, 24 Temp. J. Sci. Tech. & Envtl. L. 355, 362 (2005); see DSIRE; and see American Taxpayer Relief Act of 2012, Pub. L. 112-240, 126 Stat. 2313 (2012).
[220] Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 857-58 (2015).
[221] Impact of Tax Policies on the Commercial Application of Renewable Energy Technology: Hearing Before the H. Comm. on Science, Space, and Technology, Subcomm. on Investigations and Oversight & Subcomm. on Energy and Environment, 112th Cong. 3 (2012) (statement of Molly Sherlock, Specialist in Public Finance), available at http://.house.gov//.science.house.gov////-SY21-WState-MSherlock-20120419.pdf at 3.
[222] Discussion in this section also comes from: Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 857-58 (2015).
[223] I.R.C. § 45.

credit for electricity generated by qualified energy resources and sold by the taxpayer to an unrelated person during the taxable year.'[224] Unlike the MACRS, which primarily allows a party to deduct the purchased renewable energy technology's depreciated value from their taxes and thus pay fewer taxes on the technology, the PTC benefits parties who produce and sell electricity with their renewable energy technology by giving the taxpayer a credit on their income taxes. The PTC is available for any scale wind project, but not for solar energy production.[225] This restriction against solar panels may be due to the disturbance that a production tax credit's application could have on a taxpayer's income tax burden as well as on the utility industry. Because residential scale solar energy production is becoming increasingly feasible and popular across the country,[226] tax credits for electricity production by owners of small-scale solar panels would disadvantage utility competitors and reduce individual homeowners' income tax burdens. A taxpayer who wishes to produce and receive a tax credit for wind power must follow certain conditions. First, according to the most recent legislation passed in January 2013, a wind developer must begin construction on the project prior to January 1, 2014 in order to receive a tax credit.[227] Second, a PTC-eligible facility only qualifies if it is within its first ten years of operation.[228] If a wind farm meets both conditions, once the wind farm begins to produce wind energy, the taxpayer is eligible for a tax credit - currently 2.2 cents per kilowatt-hour - for each kilowatt of electricity the facility delivers to the grid.[229]

5.3 THE RENEWABLE ENERGY INVESTMENT TAX CREDIT (ITC)

($2.7 billion between 2011 to 2015)[230]

I.R.C. Section 48. This incentive is smaller than PTC.[231] The ITC[232] permits "businesses and energy producers to deduct up to thirty percent of the cost of purchasing solar and small-scale wind technology (less than 100kW), but not large-scale wind technology.[233] The ITC historically represented a smaller loss of tax revenue, compared to the PTC. […] Although some of these parties would be glad to receive a tax credit for potential investments in large-scale wind, the thought of making it easier for competitors to enter the electricity market would result in significant pushback from utilities and the producers of traditional energy sources. Although the ITC does not apply to the full range of renewable energy technology, its benefits are numerous. Unlike the PTC, the ITC does not require the purchaser to produce any electricity to earn the credit.[234] Additionally, the Tax Code does not limit how many credits a taxpayer

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[224] See DSIRE; and see American Taxpayer Relief Act of 2012, Pub. L. 112-240, 126 Stat. 2313 (2012).
[225] See I.R.C. § 45 (2012) (omitting solar as a qualifying energy source).
[226] Shayle Kann et al., Solar Market Insight Report 2014 Q1, at 3 (Solar Energy Indus. Ass'n 2014).
[227] Melissa Powers, Sustainable Energy Subsidies, 43 Envtl. L. 211, 222 at n54 (2013), see also I.R.C. § 45(d)(1) (2012) (limiting the production tax credit to those facilities whose construction begins prior to January 1, 2014); U.S. Internal Revenue Serv., Notice 2013-29 (2013)
[228] Powers at 222, see also I.R.C. § 45(a)(2)(A)(ii) (2012) (limiting the credit for the first ten years of the operation of a facility).
[229] Powers, at 222, see also 26 I.R.C. § 45(b)(2) (2012) (credit and phase-out adjustment based on inflation).
[230] Impact of Tax Policies on the Commercial Application of Renewable Energy Technology: Hearing Before the H. Comm. on Science, Space, and Technology, Subcomm. on Investigations and Oversight & Subcomm. on Energy and Environment, 112th Cong. 3 (2012) (statement of Molly Sherlock, Specialist in Public Finance).
[231] Discussion in this section also comes from: Blake Harrison, Expanding the Renewable Energy Industry Through Tax Subsidies Using the Structure and Rationale of Traditional Energy Tax Subsidies, 48 U. Mich. J.L. Reform 845, 859-61 (2015).
[232] I.R.C. § 48. See generally DSIRE.
[233] I.R.C.§§48(a)(1)-(2) (2012) (percentage deduction and duration of credit); I.R.C. § 48(a)(3)(A)(i) (2012) (solar energy); I.R.C. § 48(a)(3)(A)(vi) (2012) (small wind energy). Large-scale wind investment is likely not included in the ITC for political and economic reasons. It is unlikely that coal and gas companies would permit Congress to heavily subsidize investments in large-scale wind technology because more investment in wind technology would lead to less coal and gas investment. In addition, large-scale wind technology paired with the PTC makes wind technology investments cost competitive with subsidized natural gas. But, in line with the Note's central theme, wind technology being cost competitive is insufficient because it does not fully incentivize the adoption of renewable energy.
[234] Erin Dewey, Sundown and You Better Take Care: Why Sunset Provisions Harm the Renewable Energy Industry and Violate Tax Principles, 52 B.C. L. Rev. 1105, 1116-17 (2011).

may receive in a taxable year for purchasing solar and wind technology.[235] However, the ITC has its disadvantages. For example, it explicitly disallows companies to elect the ITC for property for which, in the same taxable year or in prior taxable years, they elected the PTC.[236] In other words, for renewable energy technology that produces electricity, a party cannot in the same year deduct the cost of purchasing the technology and receive a tax credit for producing renewable energy. The qualifying investments under the ITC include costs such as 'installation costs and the cost for freight incurred in construction of the specified energy property.'[237] Absent an exemption from the restriction on deducting capital expenditures, however, the ITC does not include all potential project costs such as the cost of land, buildings, certain land improvements,[238] siting the technology,[239] and connecting transmission lines to the grid."[240]

6. QUANTITATIVELY *DE MINIMIS* TAX EXPENDITURES

The following tax provisions are viewed as tax expenditures by the staff of the United States Congress, Joint Committee on Taxation,[241] but these expenditures are not itemized or quantified in federal reports, because the estimated revenue losses for fiscal years 2013 through 2017 are below the *de minimis* amount ($50 million/year):

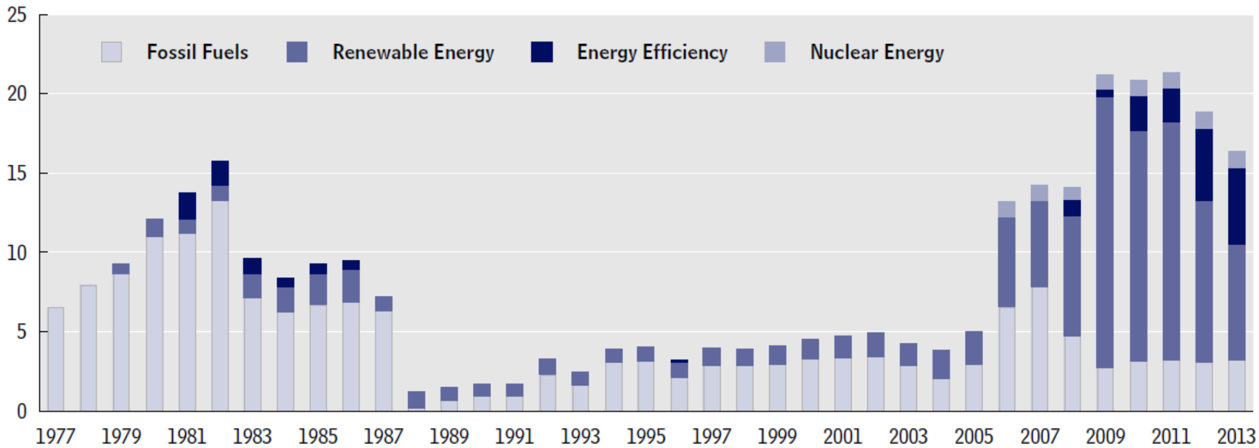
- Credit for producing oil and gas from marginal wells (I.R.C. 45I)
- Credit for producing fuels from a nonconventional source (I.R.C. 45K)
- Seven-year MACRS Alaska natural gas pipeline (I.R.C. 168(e)(3)(C))
- 50-percent expensing of cellulosic biofuel plant property (I.R.C. 168(1))
- Partial expensing of investments in advanced mine safety equipment (I.R.C. 179E)
- Expensing of tertiary injectants (I.R.C. 193)

[235] See DSIRE.
[236] "Such term shall not include any property which is part of a facility the production from which is allowed as a credit under section 45 for the taxable year or any prior taxable year." I.R.C. § 48(a)(3).
[237] Howard Cooper, PTCs, ITCs and Section 1603 Grants: Compare and Contrast, U.S. P'ship for Renewable Energy Fin. (Feb. 2011), available at http://reffwallstreet.com/us-pref/wp-content/uploads/2011/06/PTC-ITC-and-Section-1603-Grants-v2.2.pdf
[238] Id.
[239] See Shalini P. Vajjhala, Siting Renewable Energy Facilities: A Spatial Analysis of Promises and Pitfalls, Res. for the Future, 2-3 (July 2006), available at http://www.rff.org/rff/Documents/RFF-DP-06-34.pdf
[240] Compare I.R.C.§§48(a)(3)(A)-(B), referring only to equipment technology and construction, with the interpretation of intangible drilling costs to include all costs reasonably related to drilling wells.
[241] U.S. Congress Joint Committee on Taxation (2013). Estimates of Federal Tax Expenditures for Fiscal Years 2012-2017. (USGPO Publication No. 78-317 JCS-1-13) Washington, DC: USGPO.

EXHIBIT A

Cost of Energy-Related Tax Preferences, by Type of Fuel or Technology

(Billions of 2013 dollars)



Source: Congressional Budget Office based on data from Molly F. Sherlock, *Energy Tax Policy: Historical Perspectives on and Current Status of Energy Tax Expenditures*, Report for Congress R41227 (Congressional Research Service, May 2, 2011), p. 26; Joint Committee on Taxation, *Estimates of Federal Tax Expenditures for Fiscal Years 2012–2017*, JCS-1-13 (February 1, 2013), pp. 33–35, www.jct.gov/publications.html?func=startdown&id=4503; and the Office of Management and Budget.

Note: The estimates of costs resulting from individual tax preferences do not account for any potential interactions between preferences and do not include tax provisions estimated to cost less than $50 million. Nor do they reflect the budgetary effects of eliminating those preferences and of taxpayers' adjusting their activities in response to those changes.