



TEXAS PUBLIC POLICY
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The Production Tax Credit: *Corporate Subsidies & Renewable Energy*

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Table of Contents

Executive Summary	3
Introduction	3
The Cost of the Production Tax Credit	4
The Winners	6
Market Distortions	7
The Web of Programs Supporting Wind Energy	8
Implications and Recommendations	9
Appendix A: Methods	10
Total PTC Future Estimates	11
NextEra's 10 GW Project PTC Estimates	11
Appendix B: Additional Subsidy Information	11
References	13

THE PRODUCTION TAX CREDIT: CORPORATE SUBSIDIES & RENEWABLE ENERGY

by Angela C. Erickson

Executive Summary

Wind energy is a \$14 billion industry made up of wind facilities, turbine manufacturers, and financiers. While the industry grew over the past few decades, the American Wind Energy Association (AWEA) and its corporate members pushed for new and continued subsidies that would enable large energy corporations to profit at the expense of taxpayers.

This study investigates the Production Tax Credit (PTC) and the corporate beneficiaries of billions of taxpayer dollars. The PTC is a federal subsidy for the commercial production of wind energy that provides a \$24 tax credit for each megawatt-hour of energy sold. It is scheduled to phase out and expire at the end of 2019.

This report finds:

- The PTC costs taxpayers billions of dollars in revenue. In 2017 the PTC cost \$4.2 billion. The PTC will cost at least an additional \$48 billion before it fully phases out as currently scheduled.
- The PTC is a subsidy that benefits a few energy corporations. Only 15 parent companies account for more than three-fourths of all PTC eligibility—more than \$19 billion in 10 years (2007-2016).
- The PTC distorts electricity markets. The PTC encourages wind energy producers to accept negative prices. The negative prices increase costs for other energy producers and electricity suppliers.
- The PTC operates within a web of wind energy incentives that increase costs to taxpayers, further distort electricity markets, and benefit large corporations.

Providing subsidies for wind energy benefits large corporations while distorting electricity markets. To further simplify the tax code, federal legislators should resist calls to renew the PTC and instead allow it to fully expire at the end of 2019.

Introduction

In 1992, the federal government introduced subsidies for renewable energy with the goal of providing “for improved energy efficiency” ([HR 776](#)). The Renewable Energy Production Tax Credit was for a variety of energy sources including wind, solar, and biomass. While the subsidy expired for the other energy sources at the end of 2016, wind energy special interests, with the help of their national industry association American Wind Energy Association (AWEA), successfully lobbied to continue receiving this incentive.

Wind energy is a \$14 billion industry in the United States ([Pyper](#)). The industry operates within a web of government incentives—from subsidies, to loan guarantees, and various other federal, state, and local government incentives. Typically, these policy incentives are created to reduce greenhouse gas emissions and petroleum consumption. In 2017 the PTC, just one of the incentives, cost taxpayers \$4.2 billion in foregone revenues that will be made up by increased taxes now or in the

KEY POINTS

- The Production Tax Credit (PTC) is a federal subsidy that provides a \$24 tax credit for each megawatt-hour of renewable energy sold.
- The subsidy cost taxpayers \$4.2 billion in 2017 and will cost at least an additional \$48 billion before it fully phases out as currently scheduled, in December 2029.
- The PTC distorts electricity markets by encouraging wind energy producers to accept negative prices.
- The PTC primarily benefits only a few energy corporations, with just 15 parent companies accounting for more than three-fourths of all PTC eligibility, or more than \$19 billion between 2007 and 2016.

future to pay off government debts. However, research on the cost-effectiveness of this policy is mixed ([Baldrick; Cullen; Metcalf; Palmer and Burtraw; Siler-Evans et al.](#)).

The government should not be in the business of picking winners and losers by giving some companies an advantage over other companies and taxpayers. But the PTC does just that. For example, between 2007 and 2016 the PTC was worth \$5.7 billion for NextEra Energy, which is the biggest wind energy producer with approximately 10,000 wind turbines and annual revenues of \$17.5 billion across its entire portfolio.¹ And NextEra Energy received \$7.8 billion in federal tax breaks in an 8-year period (2008-2015) making it one of the most subsidized Fortune 500 companies ([Gardner et al.](#)).

The PTC and other wind energy incentives distort electricity markets and make it difficult for other electricity generators to operate efficiently. The PTC's \$24 per megawatt-hour (MWh) credit sometimes results in wind energy producers paying electricity suppliers to take their energy rather than turning off wind turbines during surplus energy hours (e.g., early mornings while most people are sleeping). By keeping wind turbines running, producers will receive the tax credit even though the grid does not need the energy. The resulting low prices may harm the reliability of the grid by reducing the incentive for investment in energies that can support baseline generation.

This report determines how much money parent companies—the majority owners of commercial wind farms—were eligible to receive from the PTC. I analyzed the U.S. Energy Information Administration's electricity generation data to estimate the value of eligible production tax credits for all commercial wind turbines. Just 15 large energy companies of approximately 300 total account for more than three-fourths of the eligible tax credits. The results show that the PTC primarily benefits just a few large corporate entities.

In addition to showing the few large corporate entities that benefit from the PTC, this report demonstrates how the PTC distorts electricity markets and briefly discusses how the web of tax credits, grants, and other programs at the various levels of government encourage companies to put little equity into wind facilities.

Congress should stop choosing winners and losers and allow the PTC incentive to expire at the end of 2019. Legislators at the federal, state, and local levels should also review the web of tax credits, grants, and regulations that favor one energy source over

another and remove those that distort electricity markets to the benefit of a few energy corporations.

The Cost of the Production Tax Credit

Tax incentives, or subsidies, promote one industry or model at the expense of taxpayers and all other alternatives. The production tax credit is a subsidy that the federal government has provided to the wind energy industry. The PTC is scheduled to phase out over three years (2017-2019). However, over the next 12 years, the federal government will transfer at least an additional \$48 billion in PTC subsidies to owners or financiers of commercial wind farms.

The U.S. government has favored different types of energy producers (coal, nuclear, renewable, etc.) for decades. Today, wind energy subsidies dominate. In 2013, wind energy cost taxpayers \$5.9 billion in federal government revenue—40 percent of the subsidies for energy production (see **Figure 1**). Despite the enormous amount taxpayers are paying for wind energy, it represents only a tiny fraction of total energy generated—2.2 percent in 2016 (see **Figure 2**).

The PTC accounts for a majority of the subsidies received by wind energy producers. As **Table 1** indicates, the wind energy portion of the PTC is estimated to have cost taxpayers \$17.1 billion over the past 10 years. The PTC will cost taxpayers at least another \$48 billion by the time benefits fully phase out sometime after 2029.

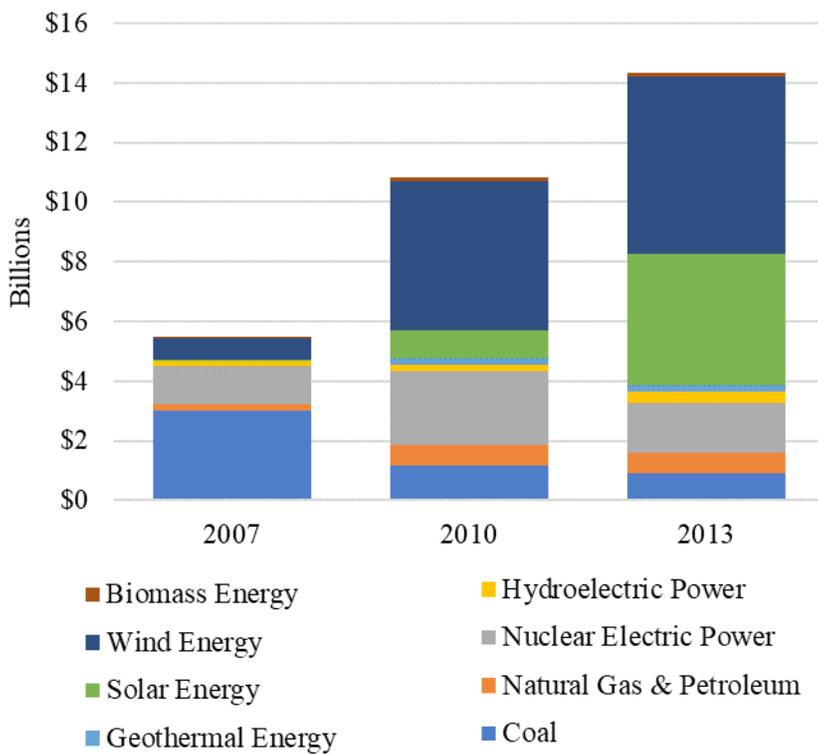
Taxpayers will be paying for the subsidy with reduced revenues through at least 2029 because the corporate owner collects the tax benefit based on kilowatt-hours sold during the first 10 years of the turbines' operation. Under the current rules, corporations must start construction on wind facilities before December 31, 2019, to take advantage of the benefit. They can claim \$24 for each megawatt-hour (MWh) of energy sold from wind facilities that began construction before 2017. The credit is scheduled to be reduced for facilities that begin construction between 2017 and 2019 and eliminated at the end of 2019.

In addition to new commercial turbines, companies can “repower” old turbines to capture the benefit again. Repowering older turbines requires them to first be taken offline and can include anything from updating 80 percent of the components to erecting an entirely new turbine. Many corporations are opting to double down on the PTC benefits by repowering before the subsidy expires ([Fago](#)).

NextEra provides one example of how corporations are responding to these government incentives. In 2016 NextEra began construction on 10 GW of wind projects ([Wachman](#)).

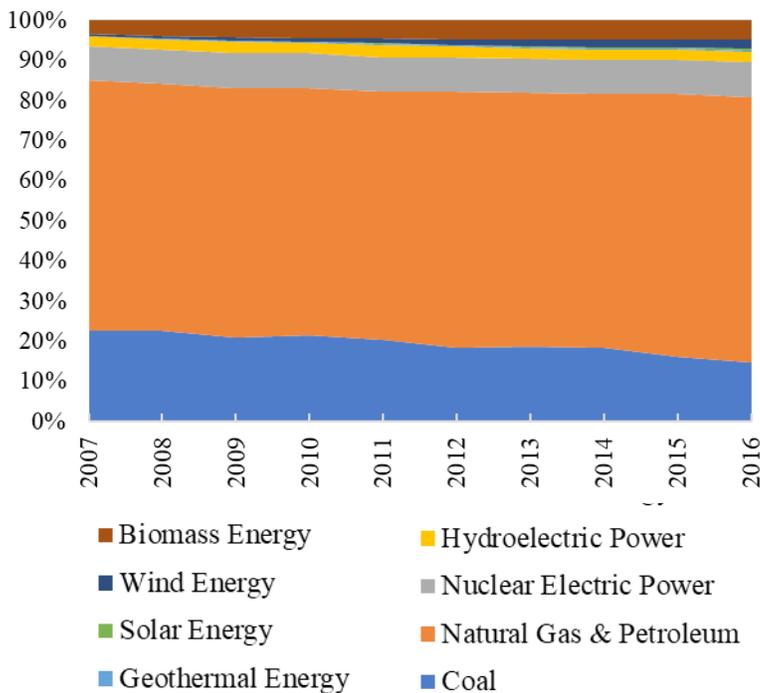
¹ Throughout the report dollar values are nominal.

Figure 1. Electricity production subsidies by source, fiscal years 2007, 2010, & 2013



Notes: Data are in billions from the U.S. Energy Information Administration (2008; 2011; 2015). In 2007 coal included refined coal subsidies, which subsequently expired. More recent data are not available.

Figure 2. Energy consumption by source, 2007-2016



Note: Data are from the U.S. Energy Information Administration (2018a).

Table 1. Production tax credit estimate for wind energy, 2008-2029

Year	Corporate	Individual	Total
2008	\$0.6	<\$0.1	\$0.6
2009	\$0.7	<\$0.1	\$0.7
2010	\$1.0	<\$0.1	\$1.0
2011	\$1.1	<\$0.1	\$1.1
2012	\$1.3	<\$0.1	\$1.3
2013	\$1.4	<\$0.1	\$1.4
2014	\$1.1	\$0.1	\$1.2
2015	\$2.2	\$0.1	\$2.3
2016	\$3.1	\$0.2	\$3.3
2017	\$4.0	\$0.2	\$4.2
2018	\$4.8	\$0.3	\$5.1
2019	\$5.2	\$0.3	\$5.5
2020	\$5.4	\$0.3	\$5.7
SUBTOTAL	\$31.9	\$1.5	\$33.4
2021			\$5.4
2022			\$4.8
2023			\$4.7
2024			\$4.4
2025			\$4.0
2026			\$3.8
2027			\$2.7
2028			\$1.4
2029			\$0.4
TOTAL			\$65.1

Notes: Data are in billions of dollars. The estimates for 2008 through 2020 come from the Joint Committee on Taxation (2008; 2010a; 2010b; 2012; 2013; 2014; 2015; 2017) and author's calculations for years 2021 through 2029 (see Appendix A for methodology).

These projects must be under continuous construction and completed in three to four years. Because construction commenced in 2016 all of these projects will be eligible for the full \$24/MWh credit. Assuming wind turbines do not become more efficient and operate at approximately 37 percent of their capacity (EIA 2017), NextEra's 2016 construction projects will cost taxpayers \$7.7 billion in production tax credits (see Appendix A for calculation).

Because of the size and scope of the PTC, it is only accessible for commercial wind energy producers and not community wind energy producers, nonprofits, or small businesses that use the electricity. To obtain the subsidy, companies have to sell energy produced by the turbine. The tax credit is then subtracted from the corporation's income taxes owed to the federal government. These requirements exclude companies that have little revenue or that use or donate the electricity they produce.

The Winners

The government should not be in the business of picking winners and losers, but that is exactly what it is doing with the production tax credit. The billions of dollars in benefits

are granted almost entirely to a small number of energy corporations who either erect new wind turbines or refurbish turbines that have already qualified for the subsidy. In addition to the energy corporations benefitting from these subsidies, there are several other players who benefit, including financiers, manufacturers, and major energy users.

Unfortunately, neither the IRS nor the companies who collected the PTC have to report the corporate use of the PTC to the public. The lack of transparency means it is unclear who is truly benefitting from this program. However, energy generation is reported to the Energy Information Administration within the Department of Energy. These figures were used to determine PTC eligibility. (Further details about the analysis can be found in Appendix A.)

Three-fourths of the PTC eligibility belongs to just 15 energy companies—half of which are foreign corporations. As **Table 2** illustrates, the combined top 15 wind energy producers were eligible for more than \$19 billion in 10 years (2007-2016). Most—possibly all—of these corporations are represented by AWEA, a wind energy advocate at the federal, state, and local level. NextEra Energy and several other companies serve on the board of directors (AWEA 2018a).

NextEra Energy is an example of one energy company benefitting from the PTC along with the web of other incentives provided to energy companies. During an 8-year period (2008-2015) NextEra Energy had profits of \$21.5 billion and received tax breaks worth \$7.8 billion. Duke Energy is another example. It received \$7.3 billion in tax breaks to its \$19.8 billion in profits during that time. Both corporations received enough taxpayer money to completely offset their total income tax and receive rebates (Gardner et al.).

The tax benefits for some of the projects owned by the above companies may have been collected by a different corporation.

Table 2. Production tax credit eligibility by top 15 parent companies

Parent Company	2016	2007-2016	# of Turbines
NextEra Energy, Inc.*	\$778	\$5,702	9,287
Iberdrola/Avangrid Renewables (Spain)*	\$301	\$2,651	3,497
EDP-Energias de Portugal*	\$217	\$1,671	2,487
Invenergy, LLC*	\$227	\$1,290	2,181
NRG Energy, Inc.	\$178	\$1,143	1,553
E.ON (Germany)*	\$171	\$1,134	1,987
Duke Energy*	\$158	\$938	1,636
BP plc (England)	\$148	\$913	1,179
Brookfield Asset Management Inc. (Canada)	\$189	\$770	1,525
Dominion Energy, Inc.	\$107	\$727	762
EDF-Electricite de France*	\$174	\$622	1,783
Exelon Corp.	\$95	\$528	839
Pattern Energy*	\$131	\$500	870
Enel (Italy)*	\$144	\$462	1,320
AES Corporation	\$36	\$330	1,191
Subtotal	\$3,054	\$19,380	32,097
Share of PTC Market	71%	76%	59%
TOTAL	\$4,298	\$25,474	54,528

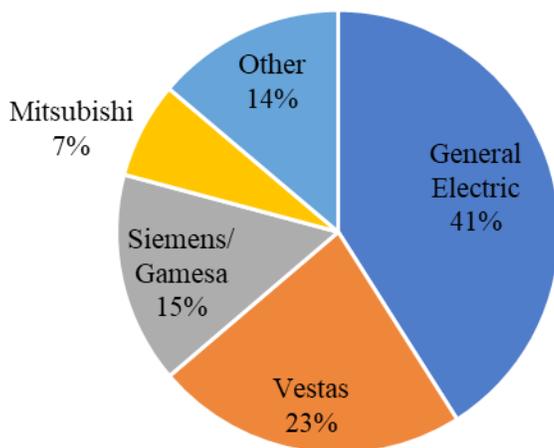
Notes: Data are in millions of dollars from the U.S. Energy Information Administration (2018b; 2018c) and author's calculations. These values represent PTC eligibility and do not account for investment tax credit claims made in lieu of the PTC during some of the years.

*Current AWEA board of directors member (AWEA 2018a)

Around two-thirds of commercial wind farm developments are paid for through tax-equity financing ([Plummer](#)) by companies like JPMorgan Chase & Co., Bank of America Merrill Lynch, and GE Energy Financial Services—all of which are board members of AWEA ([AWEA 2018a](#); [CohnReznick](#)). These financial institutions are establishing contracts to provide the upfront capital to build the wind facility in exchange for direct access to the PTC and depreciation tax benefits. Many of the parent companies above have their own financial arms that will provide financing to their wind energy businesses.

The PTC also benefits manufacturers of turbines. Subsidies increase demand for wind turbines and the price commercial wind farm developers are willing to pay for the turbines. This, in turn, allows manufacturers of turbines to charge more while also selling more, increasing their profits. **Figure 3** illustrates the three big players in the U.S., which are also on the board of directors for AWEA ([AWEA 2018a](#)). These top three manufacturers accounted for 100 percent of turbines put into service in 2016 and 79 percent of all operating turbines. U.S. orders in 2016 for General Electric turbines amounted to \$5.6 billion ([McCabe](#)); for Vestas turbines, orders were \$4.8 billion ([Vestas](#)).

Table 3. Manufacturers of operating wind turbines in the U.S., 2016



Notes: Data are from the U.S. Energy Information Administration (2018c) and author's calculations.

Large consumers of energy can also benefit by locking in low rates provided by the subsidies. Power purchase agreements (PPA) allow energy consumers to lock in subsidized electricity rates for 10 to 25 years into the future. Several major corporations have PPAs including Apple, Google, Walmart, General Motors, and Microsoft ([AWEA 2018b](#)). “We expect to have a very significant savings, because we have a fixed price for the renewable energy, and there’s quite a difference between that price and the price of brown

energy,” said Apple CEO Tim Cook regarding Apple’s power purchase agreement for solar energy ([Hughes](#)).

The major corporations who benefit directly from the PTC are receiving both the subsidy and the benefit of the 2017 tax reform. With the tax reform and open loopholes like the PTC, major corporations may be able to deduct enough taxes to pay no income tax in future years. For example, JPMorgan Chase & Co. received \$22.2 billion in tax breaks from 2008 through 2015. During that time, it paid no income tax one of the years ([Gardner et al.](#)). With a reduced tax burden, the PTC may provide enough of a tax deduction for JPMorgan Chase and other companies to pay no income tax in future years.

Market Distortions

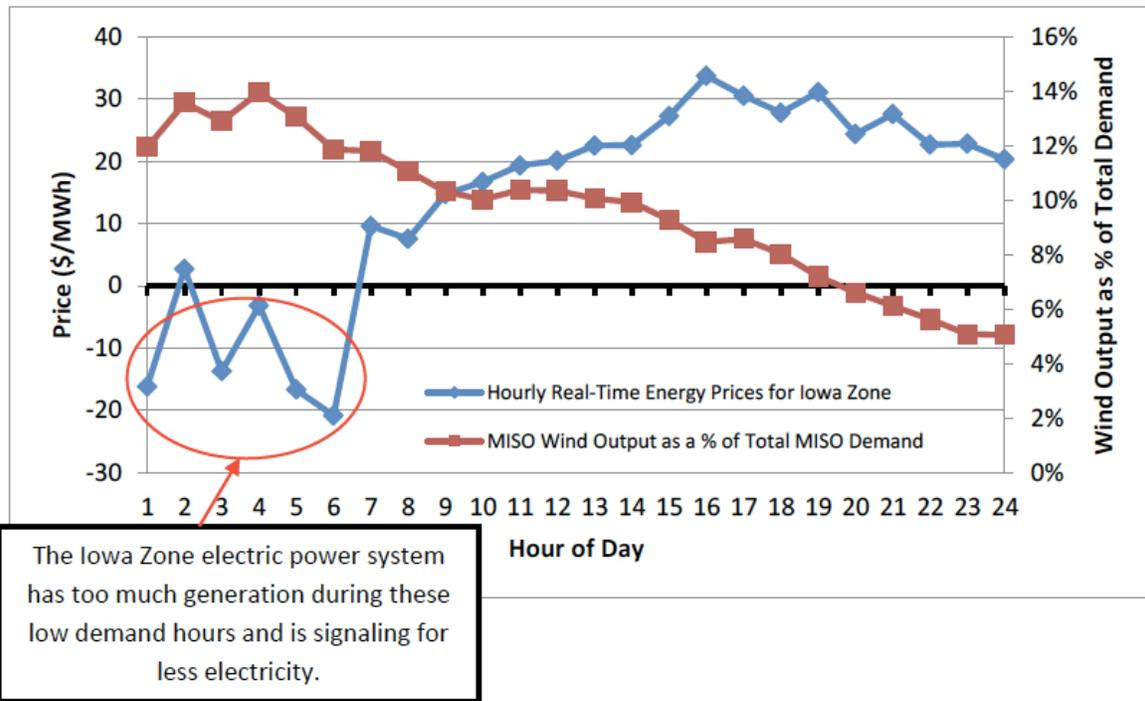
Energy subsidies are not only expensive for taxpayers who will see higher taxes or higher government debts to make up for the benefits, it also distorts electricity markets. Because of the \$24 per MWh credit and other subsidies, generators that produce wind energy can actually turn a profit while paying their customers to take their energy ([Baldick](#); [Huntowski et al.](#); [Schmalensee](#)). Another way of describing this is that wind energy generators are willing to accept negative energy prices. With just the PTC, wind energy generators may be willing to pay a retail electric provider \$10 or even \$20 per MWh to accept the energy generated by their wind turbines because they will be able to deduct \$24 per MWh from their taxes. Add in the incentives they receive at the state level and wind energy generators may be willing to pay even more.

Figure 4 is an example of wind turbines continuing to operate and generators paying the electric providers to take their energy. Negative prices could occur for short periods of time without market distortions because of the time it takes to shut down production from some sources. However, it is notable in **Figure 4** that the negative pricing lasts for nearly six hours, during times of high wind but low energy use.

The ability to pay to get rid of energy forces prices down and imposes a cost on generators who operate without the high level of subsidies that renewable energy gets. This is especially the case when it comes to generators whose plants are relied on to provide baseline energy needs and balance energy flows, i.e., maintain the reliability of the grid ([Peacock and Neeley](#)).

Negative prices, or even low positive prices, mean that other generators lose money. In such a situation, it would seem to make sense for them to shut down their plants until the wind stops blowing and the prices increase. However, deciding whether to stay online is not that simple. Unlike wind

Figure 4. Real-time hourly electric energy prices and wind output in the Iowa Zone of MISO, June 14, 2012



Source: [Huntowski et al.](#)

turbines, most other generation cannot simply flip a switch to turn their energy off or on. Because these sources may take hours to power on and off—if they can effectively do so at all—these energy producers will need to decide if the cost of paying negative prices outweighs the cost of shutting down and of possibly missing the ability to sell energy when prices surge again during peak demand times ([Baldick](#)).

Though the PTC may encourage payments to wholesale and retail providers, it can also cost them money. If generators decide it is not worth the cost to stay online, providers are then faced with an issue. If too many other electricity sources go offline, providers will be unable to supply electricity when people need it, leading to electricity outages. To maintain grid reliability, providers need to increase supply quickly when peak hours hit (say 7 a.m.). To have generators ready to go, providers may have to pay them to stay online during negative prices ([Huntowski et al.](#)).

Absent subsidies, wind energy would not distort the market in this way. Wind energy producers would turn off their wind turbines when it no longer became profitable to operate them—somewhere above \$0. Without the subsidies, we would expect prices to work more effectively to keep a mix of energy sources on the grid, which would provide greater flexibility to match electricity demand without increasing costs to non-wind generators or providers.

2 Notably, solar energy’s subsidy is 6.5 times the size of wind. The majority of solar energy subsidies comes from the investment tax credit, which should also be allowed to expire.

The Web of Programs Supporting Wind Energy

The federal production tax credit is not the only program distorting energy generation at the cost of taxpayer money. The PTC operates within a web of other government programs to promote wind energy and other electricity sources. Corporations can use a combination of these tax benefits, grants, loan guarantees, and regulations to pay for a majority of their wind projects with little risk to the company.

The federal government has 11 other federal credits, grants, and loan guarantees to support wind facilities (see **Table 6** in Appendix B). Combined, these federal subsidies cost \$35.33 for every MWh of wind energy produced in 2013 (see **Table 3**). Wind energy received the second highest subsidy per MWh of net generation—24 times the subsidy for renewable energy from hydroelectric power.²

States have an additional 265 programs that support wind energy ([DSIRE](#)). Unfortunately, we do not know the full cost of these programs. The state incentives consist of:

- Tax incentives, including tax credits, deductions, exemptions, property tax breaks, and sales tax breaks;
- Financing benefits such as bonds, grants, loans, and rebates;

Table 3. Total federal subsidies per MWh generated by electricity source, fiscal year 2013

Electricity Source	Subsidies (Millions)	Net Generation MWh (Millions)	Subsidy per MWh
Coal	\$901	1,586	\$0.57
Natural Gas & Petroleum	\$690	1,141	\$0.60
Hydroelectric Power	\$392	269	\$1.46
Biomass Energy	\$118	60	\$1.97
Nuclear Electric Power	\$1,660	789	\$2.10
Geothermal Energy	\$245	17	\$14.41
Wind Energy	\$5,936	168	\$35.33
Solar Energy	\$4,393	19	\$231.21

Notes: Data are from the U.S. Energy Information Administration (2015) and author's calculations.

- Renewable portfolio standards and similar programs; and
- Industry recruitment incentives.

Renewable portfolio standards either mandate or create a voluntary system for electricity utilities to use a minimum percentage of energy from renewable energy sources. In addition, there are numerous local programs and other support structures.

The existence of so many programs allows corporations to double-dip, receiving benefits from several programs and putting little equity into wind projects. For example, Caithness Energy committed only 11 percent of its own resources into Shepherds Flat Wind Farm in Oregon. The project received or was eligible to receive ([Browner et al.](#); [Bryce](#); [Sickinger](#)):

- A \$1.1 billion Department of Energy loan guarantee that went to pay for General Electric turbines (the loan guarantee was valued at \$300 million);
- A \$490 million Treasury Department grant once the turbines started operating;
- \$30 million in Oregon state tax credits from three different programs;
- \$200 million in tax breaks from federal and state depreciation rules; and
- \$220 million premium on a PPA with Southern California Edison, which takes advantage of California's mandatory renewable electricity standard.

Because of the lack of transparency regarding these various programs it is unclear whether Shepherds Flat is an outlier. It came to the public's attention after Larry Summers wrote a White House memo detailing the benefits Shepherds Flat would accrue and his concern about

corporations double-dipping ([Browner et al.](#)). When corporations are able to put very little equity into a project, they are willing to take on greater risk, which then becomes a problem for the taxpayers who are footing the bill.

The ability to bundle incentives further misdirects resources, costs taxpayers billions, and distorts electricity markets. Federal and state lawmakers need to provide transparency for the subsidies and regulatory benefits wind energy and other electricity sources operate under or, better yet, stop providing these benefits altogether.

Implications and Recommendations

The production tax credit will cost at least an additional \$48 billion before it is scheduled to expire. A majority of these subsidies will go to a few energy corporations, many of whom may be able to pay little to no income tax in the next few years. The PTC encourages negative prices and market distortions that impose costs on other electricity generators and providers. But the PTC is not the only problem. It operates in a web of programs that incentivize wind projects for which taxpayers and consumers pay the cost. It is time for Congress to let the production tax credit expire.

In 2018, billionaire Warren Buffett's Berkshire Hathaway could receive as much as \$37 billion in tax cuts ([Oyedele](#)). As the parent company to several subsidiaries that own commercial wind farms, Berkshire Hathaway owns 7 percent of the commercial wind turbines in the U.S. and is among the top 20 PTC-eligible corporations.

In 2016, the Berkshire Hathaway subsidiaries were eligible for \$51 million in subsidies from the PTC—a tiny fraction of the tax cuts Berkshire Hathaway will receive in 2018. They will be eligible for even more over the next few years as several Berkshire Hathaway subsidiaries plan to expand operations before the subsidy expires:

- BHE Renewables LLC will get a new wind facility online this year ([Petrova](#));
- PacifiCorp wants to add 1,100 MW in capacity before the PTC expires ([PacifiCorp](#)); and
- MidAmerican Energy plans to add 1,000 turbines and "repower" 706 turbines ([Eller](#)), allowing it to collect the PTC on facilities that previously received the tax benefit.

Berkshire Hathaway’s push to benefit from the subsidy (even twice) in light of tax reform illustrates how energy corporations benefit from the PTC. Legislators considering renewing the PTC again would do well to examine who is benefitting and its cost to taxpayers. The government should not be in the business of picking winners and losers.

Congress should resist calls by the American Wind Energy Association and beneficiaries of the subsidy and ensure that the PTC expires no later than the end of 2019, which is the time set for its expiration under its current phase-out schedule. In addition, Congress should end the various other energy generation subsidies, grants, loans, and regulations. Removing incentives for a few would allow the electricity market and competitive energy alternatives to flourish to the benefit of American consumers and workers, and the economy. ★

APPENDIX A: METHODS

PTC Eligibility Estimates

Unfortunately, data regarding the production tax credit are not required to be reported (except as part of tax filings, which are not public records) and therefore unavailable. I calculated the subsidy that companies are eligible for using two data sources from the U.S. Energy Information Administration (EIA): (1) survey Form EIA-923 (2018b), which collects energy generation by plant including sales, and (2) survey Form EIA-860 (2018c), which collects plant-level data on ownership.

The ownership data often consists of small subsidiaries. I supplemented that data with additional sources to determine the parent company. I merged the parent company of wind plants from the Good Jobs First’s Subsidy Tracker, which collected American Recovery Act 1603 program awards (Good Jobs First). I collected additional information from company websites, the Wind Power website, and Open Energy Information website. To the extent possible I tried to get to the current parent company of the subsidiaries. Because farms may change ownership, the parent company label may not properly reflect ownership over time.

To determine the value of the PTC for which a company is eligible I added “Retail Sales” and “Sales for Resale” from Form EIA-923 to determine the megawatt-hours produced and sold that companies can claim in kilowatt-hours on “IRS Form 8835 – Renewable Electricity, Refined Coal, and Indian Coal Production Credit.” I multiplied this value by the percentage of ownership for the parent company and the value of the tax credit in that year (see Table 4). These values were only collected from wind plants that were in their first 10 years of operation.

Table 4. PTC inflation adjustment schedule

Year	Rate per kWh
2017	\$0.024
2016	\$0.023
2015	\$0.023
2014	\$0.023
2013	\$0.023
2012	\$0.022
2011	\$0.022
2010	\$0.022
2009	\$0.021
2008	\$0.020
2007	\$0.019

Companies may choose to claim other subsidies, like the investment tax credit, in lieu of the PTC. The American Recovery and Reinvestment Act allowed companies to receive the ITC or the section 1603 cash grant in lieu of the PTC

if they began construction before the end of 2011. Though the eligible tax credits may not have been received by the company, it is fair to assume that the values are minimum tax benefits that the company or its financier had received. Companies have an incentive to claim the most advantageous subsidies, so if they opt for a different subsidy it was likely worth more than the PTC would have been.

Total PTC Future Estimates

I estimated the future cost of the PTC out to 2029 using the Joint Committee on Taxation estimates and the annual eligibility value calculations from the EIA data. I estimated total eligibility for all plants in operation by 2016 from through 2025 using the EIA data. I then discounted the eligibility estimates by a factor to match the JCT estimates for 2016. I subtracted the discounted value of 2017 through 2020 eligibility estimates from the JCT estimates from those years in order to determine the value of new wind plants in service between 2017 and 2019.

I added the discounted 2021 through 2025 estimates to the JCT estimates for new wind plants. Once I got past 2025, I used the JCT estimates minus the discounted eligibility values for wind plants that would have received 10 years of subsidies. The calculated values are an underestimate as they do not take into account IRS inflation adjustments for the future. Nor do they account for wind plants that start construction between 2017 and 2019 but do not complete construction until 2020 or later.

NextEra's 10 GW Project PTC Estimates

To determine the value of NextEra's 10 GW wind projects that began construction in 2016 I used the following calculation:

$$10,000 \text{ MWh} * \$24 \text{ PTC} * \text{hours per year} * \text{wind turbine capacity factor (36.75\%)} * 10 \text{ years}$$

As with the total PTC future estimates, it will undercount the total PTC eligibility of the projects for two reasons. One, it does not take into account future tax credit increases as part of the IRS inflation adjustments. Two, it uses the average capacity factor of all operating wind turbines. Newer wind turbines are more efficient.

APPENDIX B: ADDITIONAL SUBSIDY INFORMATION

Though subsidy data for all federal and state wind energy programs are sparse, some data are available and collected by Good Jobs First's Subsidy Tracker. **Table 5** illustrates some of the known wind energy subsidies that the top 15 wind energy producers have collected between 2007 and 2016, which excludes any production tax credits.

Table 5. Wind-related subsidies to top 15 wind energy production parent companies, 2007-2016

PARENT COMPANY	SUBSIDIES
NextEra Energy, Inc.	\$1,289
Iberdrola/Avangrid Renewables (Spain)	\$2,120
EDP-Energias de Portugal	\$734
Invenergy, LLC	\$551
NRG Energy, Inc.	\$869
E.ON (Germany)	\$738
Duke Energy	\$373
BP plc (England)	\$122
Brookfield Asset Management Inc. (Canada)	\$0
Dominion Energy, Inc.	\$0
EDF-Electricite de France	\$333
Exelon Corp.	\$118
Pattern Energy	\$334
Enel (Italy)	\$0
AES Corporation	\$337
TOTAL	\$7,918

Notes: Data are in millions and come from Good Jobs First's Subsidy Tracker (2018) and author's calculations. Known subsidies do not include the PTC, but they do include Recovery Act 1603 payments that were collected in lieu of the PTC.

Table 6. Federal programs that support wind projects

NAME	DESCRIPTION
Tax Credits	
Business Energy Investment Tax Credit (ITC)	A corporate tax credit equal to 30 percent of expenditures for small wind turbines (up to 100 kW in capacity) that begin construction before 2019. The credit is scheduled to step down between 2019 and 2022.
Residential Renewable Energy Tax Credit	A personal tax credit equal to 30 percent of expenditures for a system that serves a residence that is owned and used by the taxpayer and placed into service between 2008 and 2016.
Depreciation	
Modified Accelerated Cost-Recovery System (MACRS)	Businesses may recover investments through depreciation deductions.
Grants	
High Energy Cost Grant Program	An ongoing grant program through the U.S. Department of Agriculture (USDA) for the improvement of energy generation, transmission, and distribution facilities in rural communities that have average home energy costs at least 275 percent above the national average.
Rural Energy for America Program (REAP) Grants	The USDA provides financial assistance to agricultural producers and rural small businesses to purchase, install, and construct renewable energy systems. These grants are limited to 25 percent of a proposed project's cost. The combined amount of a grant and loan guarantee must be at least \$5,000 (with the grant portion at least \$1,500) and may not exceed 75 percent of the project's cost.
Tribal Energy Program Grant	This U.S. Department of Energy (DOE) supports the development of renewable energy and energy efficiency technologies.
Loans	
Clean Renewable Energy Bonds (CREBs)	These tax credit bonds were eliminated at the end of 2017. Previous borrowers who issued the bonds receive federal tax credits in lieu of the traditional bond interest.
PowerSaver Loan Program	These Federal Housing Administration loans provide three financing options for homeowners to make renewable energy upgrades or improvements.
Loan Guarantee Program	The DOE is authorized to issue loan guarantees for projects with high technology risks that "avoid, reduce or sequester air pollutants or anthropogenic emissions of greenhouse gases; and employ new or significantly improved technologies as compared to commercial technologies in service in the United States at the time the guarantee is issued."
Qualified Energy Conservation Bonds (QECBs)	These tax credit bonds were eliminated at the end of 2017. Previous borrowers who issued the bonds receive federal tax credits in lieu of the traditional bond interest.
Rural Energy for America Program (REAP) Loan Guarantees	The USDA provides financial assistance to agricultural producers and rural small businesses to purchase, install, and construct renewable energy systems. The loan guarantee may not exceed \$25 million. The combined amount of a grant and loan guarantee must be at least \$5,000 and may not exceed 75 percent of the project's cost.

Note: List is from DSIRE (2018).

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