MJB & A

CONCORD, MA - WASHINGTON, DC

47 Junction Square Drive
Concord, MA 01742

978-369-5533
www.mjbradley.com

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Tax Credit Extension: Impact on Renewables Investment and Emissions Outcomes

On December 18, 2015, Congress passed extensions to the investment tax credit (ITC) and production tax credit (PTC) for renewable energy projects. The extension of these tax credits is widely anticipated to have significant implications for the electric power sector, including a potentially substantial boost in near-term renewable energy investment and an accelerated reduction of greenhouse gas emissions.

Key Takeaways

- The extensions of the ITC and PTC are projected to accelerate renewable capacity additions between now and 2020 by up to 225%.
- Though the ITC and PTC clearly drive short-term increases in renewable additions, their impact on longer-term additions (through 2030) are highly dependent on renewable and gas costs. Under certain assumptions, the ITC and PTC do not boost long-term, cumulative additions.
- Though both the Clean Power Plan and tax credit extensions spur additional renewables, a Rhodium Group analysis projects that the tax credit extensions alone would result in 50% higher renewable capacity additions than the Clean Power Plan alone.
- The emissions impact of renewable additions is magnified when renewable generation displaces coal generation (as opposed to replacing natural gas); both low gas prices and the Clean Power Plan increase the amount of coal displaced.
- The ITC and PTC extensions are likely to improve long-term emissions outcomes, since higher earlier additions will lower total emissions trajectories.
- The Clean Power Plan may not necessarily always be a binding force on emissions: in fact, the combination of the tax credit extensions, low gas prices, and NREL's low renewable prices result in *over*-compliance with the Clean Power Plan.

Summary & Insights

On December 18, 2015, as part of the omnibus spending bill, President Obama signed into law a five year extension of the investment tax credit (ITC) for solar energy projects and the production tax credit (PTC) for wind projects. The ITC for both commercial and residential solar systems is currently set at 30 percent of the investment in a qualifying solar project and, under the terms of the extension, will continue at 30 percent through 2019 then taper off in yearly increments to settle at 10 percent in 2022 for non-residential systems and will phase out entirely in 2022 for residential systems (*see table 1*). The PTC is a tax credit earned for every kilowatt-hour (kWh) of electricity generated by qualifying facilities. The PTC for wind energy will remain at full strength (2.3 cents per kWh) for facilities commencing construction in 2016, followed by significant incremental reductions in value from 2017 through 2019 before expiring in January 2020 (*see table 2)*.[1]

Table 1. Comparison of Extended Solar ITC Amounts to Prior Credit Amounts
Percentage = Tax Credit

		2015	2016	2017	2018	2019	2020	2021	Future
Utility & Commercial / Third-Party Owned	**New**	30%	30%	30%	30%	30%	26%	22%	10%
	Prior	30%	30%	10%	10%	10%	10%	10%	10%
Residential	**New**	30%	30%	30%	30%	30%	26%	22%	0%
	Prior	30%	30%	0%	0%	0%	0%	0%	0%

Table 2. Comparison of Extended Wind PTC Amounts to Prior Credit Amounts
Percentage = Adjustment to Credit Value

	2015	2016	2017	2018	2019	2020	2021	Future
New	100%*	100%	80%	60%	40%	0%	0%	0%
Prior	0%	0%	0%	0%	0%	0%	0%	0%

**In 2015, the PTC for wind is equal to 2.3¢ per kWh*

The extension of these tax credits is widely anticipated to have significant implications for investment in renewable energy and for greenhouse gas emissions from the electric power sector. As wind and solar costs have declined in recent years, production cost models have projected higher penetration rates for both technologies. The extensions of the tax credits will only increase projected penetration rates in coming years.

Since the passage of the tax credit extensions, a number of parties have analyzed the impact of these ITC and PTC extensions under various policy and cost scenarios. One assessment by the National Renewable Energy Laboratory (NREL) analyzed annual renewable capacity additions and generation as well as greenhouse gas emissions outcomes under two natural gas price scenarios. Additional analyses from the Rhodium Group and Bloomberg New Energy Finance (BNEF) also examine how the tax credit extensions will spur renewables investment, especially in the short-term. In light of the uncertainty caused by the Supreme Court's recent stay of the Clean Power Plan, Rhodium Group has recently completed additional modeling that evaluates how these tax credit extensions could continue to increase renewable development over non-tax credit scenarios even if the Clean Power Plan fails to come into effect. This assessment also begins to assess how changes in renewable or gas costs can shape total renewable investment trends. Together, these studies emphasize that, while tax credit extensions will certainly have an impact on short-term renewables development, renewable and natural gas costs over the next decade will also have a significant impact on the level of investment, especially in the longer-term. These costs will also be a strong driver of emissions outcomes.

A Surge in Short-Term Renewable Investment

All analyses show a clear acceleration in short-term renewable development in response to the ITC and PTC extension.

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[1] The act also extended through 2016 the PTC for geothermal and closed-loop biomass (at 2.3¢/kWh) and open loop biomass and qualifying hydropower (at 1.2¢/kWh); however, modeling shows no meaningful changes in development of these resources as a result of these tax credit extensions.

In a February 22 analysis, NREL analyzed annual renewable capacity additions and generation as well as greenhouse gas emissions outcomes under two alternative natural gas price scenarios.[2,3] Under each gas price assumption, NREL modeled the electric system, including existing policies such as state RPS programs and the Clean Power Plan,[4] with and without the ITC and PTC extensions.

The results under both natural gas cases suggest that the extensions of the tax credits will result in significantly more renewable capacity additions by 2020 than otherwise projected without the extensions.[5] Under the higher "base case" gas assumptions and without tax extensions, total cumulative renewable additions between 2016 and 2020 were 41.5 gigawatts (GW), or an average of 8.3 GW of wind and solar capacity additions per year. With the extensions, however, NREL projects 94.5 GW, or an average of 18.9 GW per year, of capacity additions over the same period.[6] In 2020, total renewable capacity is 53 GW higher with the tax credit extensions than without. Under NREL's lower gas price assumption, short-term annual average renewables additions are 15.8 GW per year between 2016 and 2020 with the tax credit extensions, and only 7.5 GW annually without the extensions.

A separate Research Note by Rhodium Group uses a different analysis to examine the short-term effect of the tax credit extensions.[7] In late January, Rhodium Group published a Research Note observing that tax credit extensions had "changed the game for CPP compliance," shifting the compliance action of choice away from coal-to-gas switching and toward deploying additional renewable resources.[8] Rhodium Group projects upwards of 130 GW of renewable capacity additions between 2016 and 2022, or about 18.5 GW per year on average, topping out at an unprecedented 30 GW in 2021. This is in line with NREL's annual average projections for the period.[9] Without tax extensions, Rhodium Group projected only around 35 GW of additions, or 5 GW per year, over the same period; in this case, CPP compliance is achieved primarily through coal-to-gas switching.

Finally, a BNEF analysis from December, shortly after the tax extensions passed Congress, also suggests the tax extensions will have a strong impact on short-term renewable development, though it projects lower total renewable

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2 Mai *et al*, NREL, "Impacts of Federal Tax Credit Extensions on Renewable Deployment and Power Sector Emissions," February 2016. Available at http://www.nrel.gov/docs/fy16osti/65571.pdf.

3 NREL used the Regional Energy Deployment System (ReEDS) model (capacity expansion and dispatch) and Distributed Solar (dSolar) for rooftop PV (consumer adoption), both of which are designed specifically to model renewable generation. Key assumptions: renewable cost and performance are NREL 2015 Annual Technology Baseline; conventional, natural gas, and demand costs and performance are from the Energy Information Administration's 2015 Annual Energy Outlook (AEO). The two natural gas cases are based on two AEO fuel price cases: the "Base Case" utilizes AEO Reference Case (in which prices peak around $6.5 per MMBtu in mid 2020s, and mostly stay through the end of the decade), while the "Low Gas Case" utilizes AEO's High Oil & Gas Case (in which prices remain around $4 to $4.50 per MMBtu through the study period).

4 CPP was modeled as a mass-based, new plus existing, national trading model. The stay was not modeled.

5 Nearly all additions are solar and wind. NREL showed wind to be much more sensitive to tax credits than solar, partially due to the relative size of the PTC compared to the ITC. Additionally, over half of solar additions are residential rooftop (roughly 80 GW of rooftop additions with extensions, 70 GW without; compared to ~55 GW of PV under either case), the drivers for which are less linked to economic incentives affected by tax credits.

6 For reference, in the five year period from 2010 to 2014, wind and solar additions averaged 10.6 GW per year, peaking at 17.6 GW added in 201.

7 Larsen *et al*, Rhodium Group, "Renewable Tax Extenders: The Bridget to the Clean Power Plan," January 27, 2016. Available at http://rhg.com/notes/renewable-tax-extenders-the-bridge-to-the-clean-power-plan.

8 Rhodium Group used their proprietary version of the National Energy Modeling System (NEMS) and incorporated most cost and performance assumptions from AEO 2015 (which track with NREL's base gas assumptions).

9 Additionally, John Larsen of Rhodium Group has stated that such high renewable additions may not be reasonable since NEMS does not consider transmission and other infrastructure costs and development constraints (though NREL's analysis does).

additions than the other sources discussed in this brief.[10] In comparison to NERL and Rhodium Group, which projected roughly 130 GW of wind and solar between 2016 and 2022, BNEF forecasts solar and wind additions of 103 GW with tax extensions between 2016 and 2021 (and only 66 GW without). Most of the incremental renewable capacity driven by tax extensions is shown in 2017-2019, with decreasing impact of tax extensions after that point (wind additions in 2021 are actually lower with tax credit extensions than without). BNEF assumes that the Clean Power Plan comes into effect as planned in 2022.

Key Variables Shape Longer Term Outlooks

Though the ITC and PTC clearly drive short-term increases in renewable additions, their impact on longer-term cumulative additions (through 2030) are highly dependent on assumptions about renewable energy costs and natural gas prices. The Clean Power Plan will also likely have an impact on total development over this period, though the discrete impact of the Clean Power Plan may possibly be less than tax credit extensions alone.

Gas Prices

The NREL analysis, which utilizes two distinct gas price forecasts, illustrates how gas prices may impact long-term renewable development. The results of this analysis indicate that the Clean Power Plan may not drive additional renewable investments beyond what is stimulated by the ITC and PTC under higher gas price scenarios.

NREL's "Base Gas Case" uses the AEO Reference Case (i.e., higher gas prices), in which prices peak around $6.5 per MMBtu (2013$) in the mid-2020s and mostly stay flat through the end of the decade. Although, as discussed above, short-term (2016-2020) renewable additions are over twice as high with the tax credit extensions as without, the cumulative renewable capacity forecast by 2030 is the same *with or without* the extensions, resulting in total additions of around 270 GW and renewables providing 33% of national electricity production by 2030 (see Figure 1). NREL hypothesizes that the long-term convergence is driven by multiple factors, such as the values of the ITC and PTC decreasing, renewable energy prices continuing to drop, and Clean Power Plan compliance starting in 2022.

Alternatively, the "Low Gas Case" utilizes AEO's High Oil & Gas Case (i.e., lower gas prices), in which prices remain around $4 to $4.50 per MMBtu (2013$) through the study period. In total, because gas generation is made more competitive due to low prices, this case shows fewer renewable additions. In addition, unlike under the base gas assumptions, the with- and without-tax credit extension cases do not converge. The tax credit extension case retains a higher penetration of renewables even through 2030: 25% with extensions, and 22% without extensions, reflecting 170 and 134 GW of capacity additions, respectively. In other words, the ITC and PTC do drive long-term increases in renewable development under low gas prices. See Figure 1 below.

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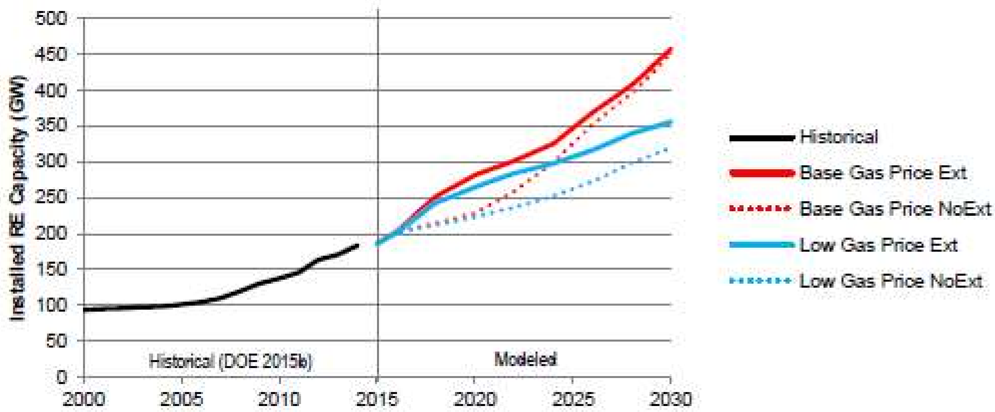
[10] Grace *et al*, BNEF, "Impact Of Tax Credit Extensions For Wind And Solar: Based on omnibus budget bill released 15 December 2015," December 16 2015. Available at http://about.bnef.com/content/uploads/sites/4/2015/12/2015-12-16-BNEF-US-solar-and-wind-tax-credit-impact-analysis.pdf.

Figure 1. Cumulative Installed Renewable Capacity, by Scenario

Source: NREL



Renewable Costs

Renewable cost assumptions also have an impact on the model projections for the ITC and PTC extensions. While the January Rhodium Group Research Note used AEO 2015 renewable costs for its modelling, NREL utilized its 2015 Annual Technology Baseline, which represents a 20 to 40 percent decrease in costs. Other assumptions, such as gas prices (AEO 2015 reference case) and the inclusion of the Clean Power Plan, are similar across these analyses.

As mentioned above, NREL's base analysis shows that long-term additions of renewables are unchanged with the addition of the tax extensions: both cases result in around 450 GW of renewables on the system in 2030, around 270 of which was added between 2016 and 2030.

However, Rhodium Group's analysis using higher renewable prices shows a significant difference in renewable additions over the long term. With tax credit extensions, capacity additions between 2016 and 2030 are estimated to be around 165 GW; without the extensions, Rhodium Group projects less than 100 GW of additions. In other words, the ITC and PTC extensions under this high renewable price analysis increase long-term renewable capacity additions by over 50 percent.

Rhodium Group also highlights the impact of changing renewable cost assumptions, even in a case without implementation of the Clean Power Plan.[11] For example, they note that utilizing NREL's lower renewable cost assumptions in an analysis without the Clean Power Plan increases the impact of the tax credit extensions on renewable energy generation in 2022 by 250%, and triples capacity additions between 2016 and 2025. Further, a combined low renewable cost and low gas price case, with tax credit extensions, results in comparable renewable additions to Rhodium Group's original Clean Power Plan plus tax credit extensions scenario.

Clean Power Plan

Rhodium Group has also recently released modeling results that demonstrates the possible impact of the Clean Power Plan on long-term development.[12] This follow-up assessment used base natural gas and renewable cost and performance assumptions from their original analysis but removed the Clean Power Plan from the model. The results showed that tax credit extensions alone may actually provide a bigger medium-term boost to renewables than just the Clean Power Plan, though not as much as a combination of both policies: an only-tax credit extension

[11] Larsen *et al*, Rhodium Group, "What Happens to Renewable Energy Without the Clean Power Plan?" February 25, 2016. Available at: http://rhg.com/notes/renewable-energy-without-the-clean-power-plan.

[12] Id.

case results in 92 GW of renewables between 2016 and 2025, compared to 60 GW from the Clean Power Plan alone and 142 GW in a combined policy scenario.

Emissions Outcomes Driven By Resources Displaced and Timing of Additions

What does this all mean for emissions outcomes? Here too we have to take into account gas price assumptions as well as the total amount of renewable generation built. For example, the NREL and Rhodium analyses show that low gas prices lead to much higher displacement of coal: lower gas prices mean that coal is less competitive, and more likely to be the marginal resource as renewable capacity increases, resulting in more renewable MWhs displacing coal generation. The NREL analysis indicates that under low gas prices, renewables are projected to displace coal 70% of the time, while under higher gas prices renewables displace coal only 20% of the time. The Rhodium analysis shows a similar dynamic in cases without the Clean Power Plan. Thus, with or without the Clean Power Plan, each added MWh of renewables has a larger emissions reductions impact under a low gas price scenario.

The Clean Power Plan itself may also result in a larger portion of renewable additions displacing coal, increasing the emissions impact of each incremental renewable MWh added. The Rhodium Group analysis indicates that without the Clean Power Plan (i.e., only tax credit extensions), renewable additions replace natural gas around two thirds of the time, and only replace coal around a quarter of the time. Imposing a carbon limit under the Clean Power Plan not only increases total renewable capacity additions, it also results in nearly all incremental renewables replacing coal, not natural gas (see figure 2).[13]

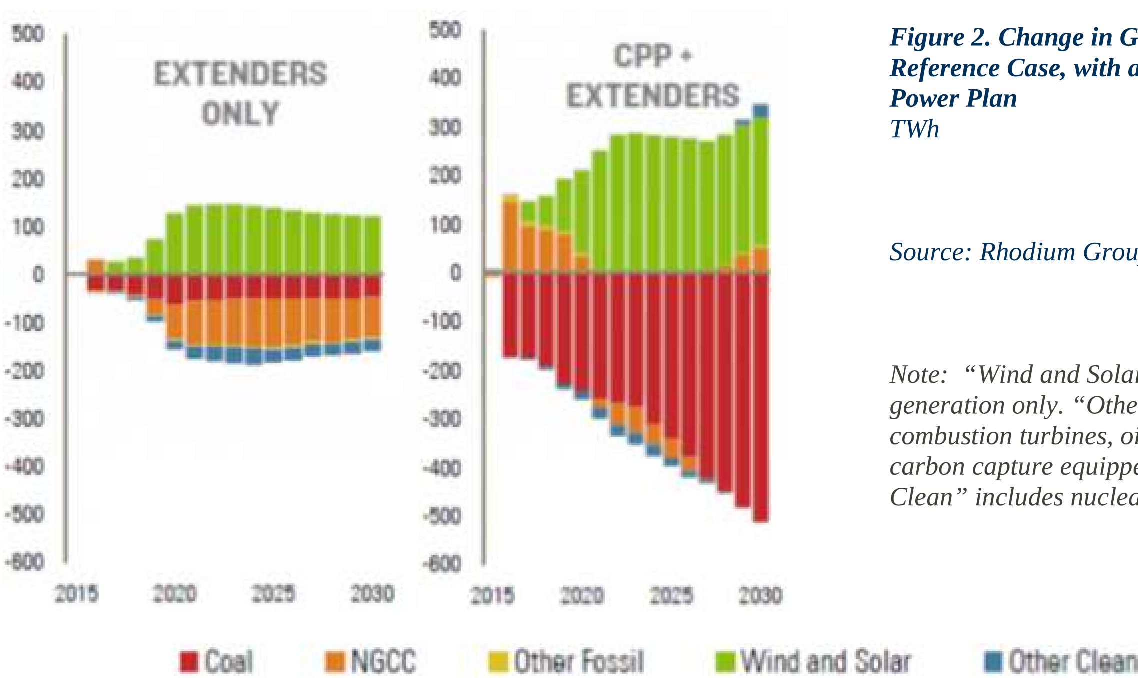


Figure 2. Change in Generation from Reference Case, with and without Clean Power Plan
TWh

Source: Rhodium Group

Note: "Wind and Solar" includes utility scale generation only. "Other Fossil" include combustion turbines, oil/gas steam, and carbon capture equipped units. "Other Clean" includes nuclear, hydro, and biomass.

However, changing certain economic cost assumptions in these analyses indicate that the Clean Power Plan may not necessarily always be a binding force on emissions. In fact, the combination of the tax credit extensions, low gas prices, and NREL's low renewable prices result in *over*-compliance with the Clean Power Plan. Emissions are

13 This analysis assumed base gas prices.

lower than the Clean Power Plan's limits. This is true even though there are fewer renewables on the system than under the base gas prices, due to the combination of more economic coal-to-gas switching and a majority of renewable additions replacing coal. This points to the power of economic drivers – low costs and subsidies in the form of tax credits – in lowering emissions.

Additionally, the amount of renewable capacity added as well as the timing of additions – which are driven by both tax extensions and commodity costs – can have a significant impact on emissions. NREL's analysis highlights how both of these factors change emissions outcomes under the Clean Power Plan. Under base gas prices, as discussed above, long-term renewable additions are equivalent by 2030 with or without the tax extensions. However, the accelerated development schedule under tax credit extensions has real implications in terms of greenhouse gas emissions and Clean Power Plan compliance, since the slower rate of renewables additions without tax credit extensions means higher emissions per year until total renewable penetration catches up to "with tax credit extensions" levels in 2030. In effect, the extensions of the tax credits help the U.S. avoid 540 million metric tons of CO_2, primarily before 2022. Annual emissions are nearly identical in the two cases after 2022, likely because the Clean Power Plan becomes the primary driver for further emissions reductions.

Under low gas prices, the impact of the ITC and PTC extension are slightly different from an emissions perspective, largely because long-term renewable development does not converge with and without tax credit extensions. Lower renewable deployment in each year without tax credit extensions results in higher emissions – over 1,420 million tons between 2016 and 2030 – and this annual difference would be projected to continue to grow beyond the 2030 period (unlike under a base gas price scenario, in which emissions trajectories are projected to converge). In a low gas price future, these tax credit extensions play a much more permanent role in renewables development and emissions reductions outcome.

Contacts

For more information on this topic, please contact:

Chis Van Atten
Senior Vice President
vanatten@mjbradley.com
(978) 369-5533

Tom Curry
Vice President
tcurry@mjbradley.com
(202) 525-5770

Grace Vermeer
Policy Analyst
gvermeer@mjbradley.com
(202) 525-5770

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