# policy brief

GWSI PB15-01 | April 2015 | solar.gwu.edu

# Softer Solar Landings: Options to Avoid the Investment Tax Credit Cliff

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Federal tax policies have been an important driver for solar's recent remarkable growth, but without action during the 114th Congress, the 30-percent investment tax credit (ITC) for solar and other clean energy technologies will expire at the end of 2016. If Congress were to allow this policy shock to occur, the economics of solar investments would worsen, reducing solar deployments in 2017 and beyond. Solar jobs would be lost, and solar cost reductions would be delayed. While these negative impacts of current law are undeniable, their magnitude remains an open question. This policy brief estimates the impacts that current law would have on the solar industry. It also formulates several policy alternatives and estimates their effectiveness at mitigating the negative impacts of the investment tax credit cliff embedded within current law.

The authors find that current law would increase the cost of solar energy by at least 10 percent in 2017 compared to 2016. This estimated increase includes expected reductions in solar installation costs and a lower cost of capital as projects shift from tax equity toward increased debt. While such an increase may not seem large relative to the recent reductions in solar installation costs, the price spike coincides with saturating renewable energy markets in the leading solar states and minimal new incentives in lagging states. Ultimately, the failure to extend the ITC could result in 42 percent fewer utility-scale solar installations and 15 percent fewer distributed solar installations in 2017.

Considering several options that Congress could pursue to mitigate these impacts, the analysis finds that extending and phasing out the ITC for clean energy technologies as they reach full market maturity and scale would provide the softest landing. The authors specifically recommend extending the current ITC level for two years, phasing out the ITC gradually after 2018, and creating parity across energy sectors in accessing various financing structures. Given the uncertainty of when solar or another specific technology will reach full market maturity and scale, Congress would have to either revisit the timing of the phase-out periodically, generating policy uncertainty for industry, or enact a policy that includes an automatic phase-out for technologies based on their market maturity and scale. The authors recommend the latter approach, which complements and leverages other innovation policies, to provide certainty in the market and to spur activities seeking future technological breakthroughs.

## Current State of the Solar Industry

Solar energy is growing at a faster rate than any other domestic energy source. Since 2012, both residential and non-residential solar installations have doubled, and utility scale solar installations have more than quadrupled.[1] Market analysts expect another consecutive, record-setting year in 2015 with new solar installations totaling more than eight gigawatts – a 31 percent increase over 2014.[2] The solar industry employed roughly 174,000 workers in 2014 and is expected to create 36,000 new jobs in 2015, representing an employment growth rate nearly 20 times the economy wide average.[3] From these growth rates and associated economic output, federal and state policies supporting innovative new energy sources like solar are clearly paying dividends. In addition to employment and environmental benefits from solar energy, U.S. Partnership for Renewable Energy Finance (US PREF) found that the 30-percent ITC more than pays for itself in federal tax receipts, generating a 10 percent internal rate of return (IRR) to the federal government for its investment.[4]

With the support of the eight-year ITC extension at 30 percent,[*] the solar industry attained greater economies of scale, and through increasing efficiencies the cost of installing solar PV reduced from roughly $8 per watt in 2009 to $2 per watt today. According to a survey of solar businesses, 72.7 percent of solar businesses and 94 percent of solar installers stated that the 30-percent ITC has "significantly improved" their business.[5] The level of federal support per watt of solar power has also declined dramatically since 2009 due to the precipitous fall in installation costs. This is because the ITC value is a fixed share of the total installation cost.

State policies have also been important drivers of solar's remarkable growth. The five leading solar states account for 78 percent of all installed solar capacity, and the top ten solar states account for 90 percent.[6] Although not all of these leading states have the greatest solar resources, they all have robust policies in place, many of which are set to expire or decline in value without further action.[7]

In 2017 solar is unlikely to be competitive free of both federal and state subsidies, except for a few unique markets where solar insolation and electricity rates are the highest.[8] It will remain competitive in select other states that create or maintain sufficient levels of support to overcome the effects of the ITC cliff. While solar is positioned to be broadly competitive within a decade or sooner, the solar industry faces a critical transition period over the next several years when both state and federal policies are ramping down at the same time without further legislative action by states or Congress.

## Impact of Current Law on Solar Competitiveness

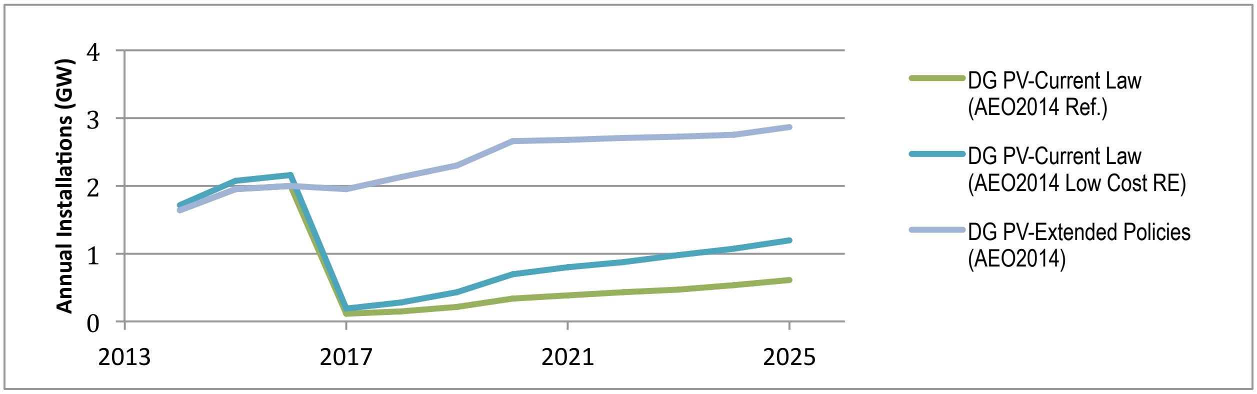
As lawmakers continue to debate how to reform the nation's tax code, the prospects of simply extending the 30-percent investment tax credit (ITC) beyond 2016, or maintaining the permanent 10-percent rate under Section 48 of the Internal Revenue Code are uncertain. Despite the recent precedent established in the extension of the Section 45 production tax credit (PTC),[9] a simple modification to the ITC project qualifying criteria to include those that commence construction by December 31, 2016 also faces headwinds. Changing the qualifying criteria from "placed-in-service" to "commence construction" is important, especially if the ITC is extended, because the ITC has already effectively expired for new larger scale solar projects whose planning and construction would take them beyond 2016 even if they were started today. In addition, homeowners would receive no credit,

[*] *The Energy Policy Act of 2005* (P.L. 109-58) established a 30 percent ITC for both commercial and residential solar systems for one year. It was subsequently extended for an additional year before Congress passed an eight-year extension (Cantwell-Ensign, *The Clean Energy Tax Stimulus Act of 2008*, S. 2821 [110th]) as part of the *Emergency Economic Stabilization Act of 2008* (P.L. 110-347). If Congress fails to extend the ITC before the end of 2016, the credit for residential systems will expire, and the credit for commercial systems will revert to the permanent 10 percent level established as part of the *Energy Policy Act of 1992* (P.L. 102-486).

as the Section 25D residential credit, which is separate from the corporate credit, expires completely after 2016.

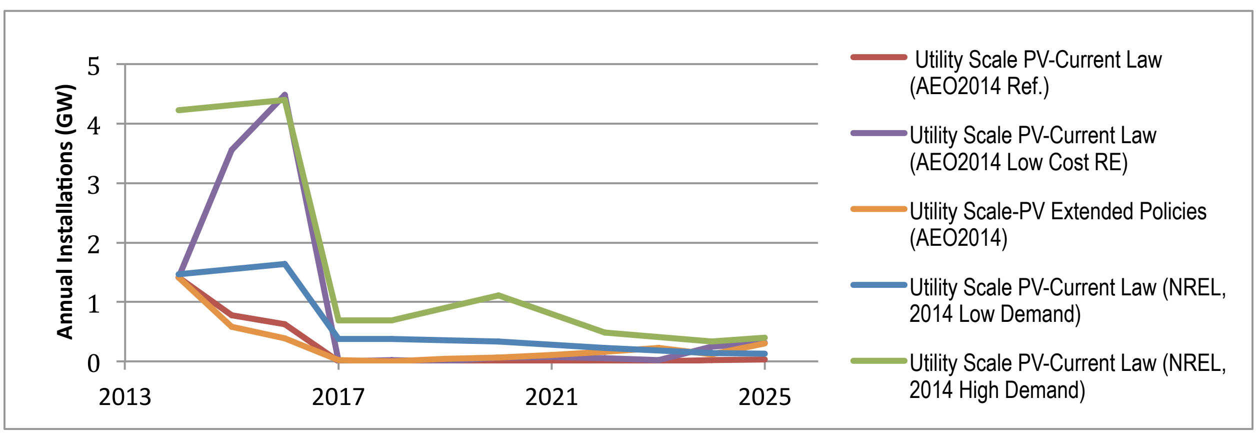
The policy shock embedded within current law would certainly have negative impacts on solar economics, deployment, and employment, but the scope of these impacts is not as clear. Some industry experts predict devastating impacts, while others expect a significant but manageable slowdown. For example, Solar Energy Industries of America (SEIA) President Rhone Resch recently stated: "The reality is that we will lose 100,000 jobs if we lose the ITC – and these are conservative numbers. Ninety percent of solar companies will go out of business."[10] While this may sound like industry hyperbole, the U.S. Department of Energy (DOE) models support this claim. The Energy Information Administration (EIA) updates and runs its National Energy Modeling System (NEMS) to provide a comprehensive energy outlook every year.

**Figure 1. EIA Projections of Distributed Generation Investment Tax Credit Cliff**




The *Annual Energy Outlook 2014* (AEO2014)[11] projects a 94.3 percent decrease in distributed generation (DG)[*] photovoltaic (PV) installations from 2016 to 2017 under current law. The shock is so devastating that even in 2025, installations remain well below 2016 installations levels. This DG cliff is shown in Figure 1, and results in a loss of 16.2 to 19.5 GW from 2017 through 2025 – exceeding the total amount of all DG installations today.

**Figure 2 Projections of Utility-Scale Solar PV Investment Tax Credit Cliff**




[*] Distributed generation includes all solar installations "behind the meter" from residential, commercial, and industrial sectors.

AEO2014 also predicts a cliff for utility-scale photovoltaic (PV) installations in its low-cost renewables side case, which more accurately reflects industry prices compared to its reference case. In that case, utility scale PV installations decrease by 100 percent from 2016 to 2017. The National Renewable Energy Laboratory (NREL), using its Regional Energy Deployment System (ReEDS) to model the U.S. electricity system, finds similar results. The 2014 update to the Renewable Electricity Futures Study[12] projects a 77.3-84.2 percent decrease in utility-scale PV installations from 2016 to 2017 under current law. Figure 2 shows this utility-scale PV cliff predicted by both of these leading models.

Another noteworthy result from these simulations is the slow recovery from and lasting impact of the ITC cliff. In NEMS, solar installation costs are endogenous to the model, such that future reductions in solar installation costs depend on further deployment. The ITC cliff not only decreases deployment sharply but it also delays cost reductions associated with increased deployment that could mitigate the impact of the ITC expiration.

While the costs of solar energy have decreased substantially with increased scale and market maturity, future cost reductions are uncertain and depend in large part on future deployment. As demonstrated below, even cost reductions that assume continued "learning-by-doing" efficiencies would unlikely be able to overcome the loss in ITC value before 2020.

To consider the impact of future installation costs, we consider the range of installation costs represented in the four sensitivity scenarios from DOE's SunShot Vision Study.[13] The "SunShot Goal" scenario envisions a 75-percent reduction in the cost of solar electricity between 2010 and 2020. The "High Cost" baseline scenario follows the installation costs provided in Black and Veatch (2012).[14] The remaining two scenarios project 50 percent and 62.5 percent reductions in solar prices, respectively, between 2010 and 2020. Following similar assumptions from the recent *Wind Vision Report,*[15] our "Best Guess" achieves the 62.5 percent reduction by 2020, and then linearly reduces to the SunShot Goals by 2040.[*]

We calculate the levelized cost of solar power following the approach in Reichelstein and Yorston (2013).[16] For 2016 and 2017, we assume the values in Table 1 for the levelized cost calculations under current law. The decrease of the ITC from 30 percent in 2016 to 10 percent in 2017 under current law is expected (but not guaranteed) to lower the weighted average cost of capital (WACC) due to a shift toward a greater percentage of project level debt.[†]

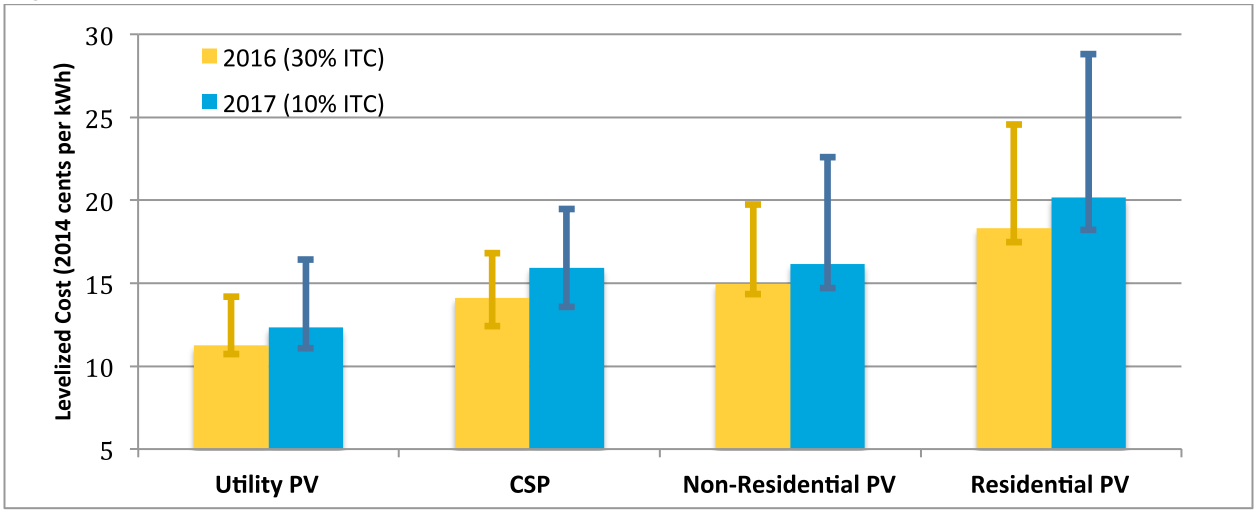
**Table 1 Financial and Solar System Assumptions**

| | Utility PV | CSP | Non-Residential PV | Residential PV |
|---|---|---|---|---|
| Debt Fraction | 30% in 2016 / 50% in 2017 | 30% in 2016 / 50% in 2017 | 30% in 2016 / 50% in 2017 | 40% in 2016 / 58% in 2017 |
| WACC[‡] | 9.5% in 2016 / 7.8% in 2017 | 9.5% in 2016 / 7.8% in 2017 | 9.5% in 2016 / 7.8% in 2017 | 8.6% in 2016 / 7.1% in 2017 |
| Capacity Factor (in DC for PV) | 25% | 43% | 25% | 21% |
| Duration | 25 years | 25 years | 25 years | 25 years |
| Degradation Rate | 0.5% per year | NA | 0.5% per year | 0.5% per year |
| DC/AC Derate Factor | 0.8 | NA | 0.8 | 0.8 |

[*] Please see the Appendix for tables of the assumed installation costs.
[†] We assume that the project debt level equals 60 percent minus the ITC level for utility scale and non-residential solar. For residential solar we assume 80% project debt for owned systems, which are assumed to make up 20% of the residential market.
[‡] The weighted average cost of capital (WACC) is calculated using the debt fraction, a 40% combined state and federal tax rate, a cost of debt at 6%, and a cost of equity at 12%.

Even with expected reductions in installation costs and a lower cost of capital due to shifting from tax equity to a greater percentage of debt, we find that the expiration of the 30-percent ITC increases the levelized cost of solar power by at least 10 percent between 2016 and 2017. Figure 3 shows the modeled levelized cost, as well as the range under the installation cost scenarios. While such an increase may seem insignificant relative to the recent reductions in solar installation costs, the price spike coincides with saturating renewable energy markets in the leading solar states and minimal new incentives in lagging states. In aggregate, state incentives seem to plateau, at best, during this period, which may explain partly why the energy models show such a dramatic impact on solar installations. Accordingly, our analysis assumes no state level incentives.

**Figure 3: Levelized Costs of Solar Power in 2016 and 2017 under Current Law**




It is important to note that the SunShot 2020 targets, which envision levelized costs of utility-scale solar electricity closer to 6 cents per kilowatt-hour, represent when solar can compete in the marketplace completely free of subsidies, both federal and state. In other words, solar costs, even when staying on track to meet the SunShot targets by 2020, are not expected to be competitive subsidy-free in 2016 or 2017 except for a few unique markets. They are also far from guaranteed to keep up with the SunShot targets through 2020 despite dramatic recent cost reductions. Also, the cost of capital may not be lower, as expected when the ITC decreases, because lenders may be less willing to allocate capital to solar due to the increase in overall levelized cost.

## Options for Softer Landings Compared to Current Law

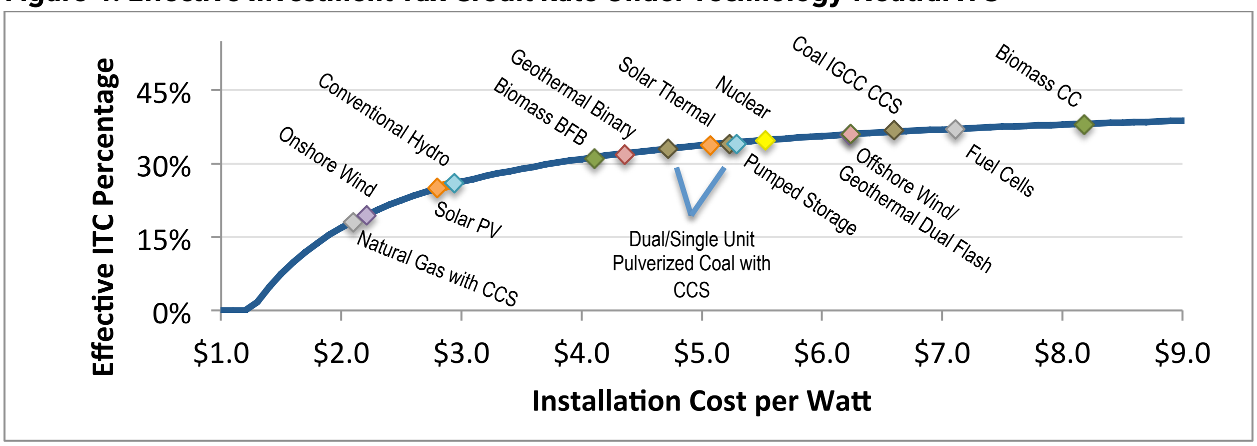
This policy brief considers four alternatives to current law that encompass the range of politically feasible approaches:

- Option 1: Current Law/No Action
- Option 2: Two-year Extension of 30-Percent Level with Commence Construction
- Option 3: Clean Energy Master Limited Partnerships (MLPs) and Real Estate Investment Trusts (REITs) Replace ITC
- Option 4: Gradual Ramp Down of ITC (5 Percent Level Reduction Each Year) with Commence Construction
- Option 5: Technology Neutral ITC

The first alternative to current law (Option 2) is a straightforward two-year "date-change" extension that also modifies qualifying projects to be those that commence construction rather than those that are placed in service. This change would be especially critical for utility-scale projects, which take two years or more to plan and construct.[17] While stopgap extensions are common for temporary tax provisions, they would not provide much certainty in the marketplace, and they would set up another cliff two years later because solar would unlikely have attained full cost parity yet. Congressional opposition to this approach has grown recently because these extensions are usually not paid for and contribute to the national deficit, and they historically have allowed little reform or oversight that could improve the cost-effectiveness of a particular provision. A two-year extension would greatly help the solar industry during a critical period of transition, but it would not have the same market impact of the eight-year ITC extension in 2008 that created longer-term policy certainty.

The next alternative to current law (Option 3) is ending the ITC altogether and allowing clean energy projects to use financing structures currently unavailable to them, such as master limited partnerships (MLPs) and Real Estate Investment Trusts (REITs). For this scenario, we assume the cost of capital is 6 percent. We also assume that the 5-year modified accelerated cost recovery system (MACRS) still applies. Under current law, it is not clear whether solar financed through REITs or MLPs could take advantage of MACRS.[18] The costs of losing accelerated depreciation would far outweigh the benefits from cheaper capital and would be much worse for solar than current law. Similarly, if Congress eliminated MACRS as part of tax reform, previous GW Solar Institute analysis found that even a 20-percent ITC could not make up the difference, resulting in cost increases of 34 percent or more over current law.[19] This option also would not help homeowners, who wanted to own their solar systems.

**Figure 4: Effective Investment Tax Credit Rate Under Technology-Neutral ITC**




The third alternative to current law (Option 4) is a prescribed "ramp down" of the ITC from the current 30-percent level. A gradual reduction of the ITC over time would avoid the current cliff and provide longer term certainty in the market. The structure and timing of any ramp down are of course subject to debate. Option 4 decreases the ITC level by 5 percent each year until it reaches zero in 2022. Note that the permanent 10-percent ITC for commercial projects under current law is eliminated under this scenario, meaning that the U.S. Treasury would recapture expenditures in the out-years that would have otherwise been spent under current law. Again, commence construction is assumed to be part of this option since utility-scale projects take multiple years to plan and construct.

The fourth alternative to current law (Option 5) is a technology-neutral ITC that includes an automatic phase-out provision based on market maturity.* This option would provide certainty in the marketplace, apply to any electricity generation technology as illustrated in Figure 4, and remove from Congress the burden of determining when a technology can compete completely unsubsidized. For solar technologies it phases out automatically as the solar technology reaches full market maturity and scale as defined by the SunShot goals. Except for solar PV, the installation costs follow EIA's estimates.[20] For solar PV, the effective ITC rate would be roughly 30 percent or lower, depending on how fast installation costs decrease. There would always be an incentive to reduce costs and limit investments to potential market winners because the majority of costs would have to be financed with private capital. Although a higher incentive rate for less mature, more expensive technologies would help to drive innovation, Congress could choose to set an explicit cap on this ITC to remain at 30 percent or below. Congress could also choose to disqualify projects that fall below a 5-percent ITC.

It is important to note that this technology-neutral ITC differs significantly from the one proposed by former Senate Finance Chairman Baucus,[21] both in structure and in aim. While both aim to remove the politics of picking technology winners and losers, Baucus's technology-neutral ITC, in conjunction with its production tax credit (PTC), focused on generating electricity with the least amount of carbon emissions and acted like an inverted carbon tax or carbon-free subsidy. To address the market failure of carbon externalities, we assert that a revenue neutral carbon tax system could offer a more productive use of taxpayer dollars.

This technology-neutral ITC, in contrast, focuses on addressing market failures related to the innovation and diffusion of new technologies. Technology innovation and diffusion issues include financing premiums due to incomplete information and higher perceived risk and adoption externalities, where the market is unable to capture a technology's full value in cases when technology adopters would be better off the more other people also used the same technology, often called dynamic increasing returns.† Without policy interventions, realizing these returns would remain relegated to a chicken-or-egg quandary: more people would adopt the technology if it cost less, and it would cost less if more people adopted it. This technology-neutral ITC – along with other complementary innovation policies, such as public investments in research, development, and demonstration (RD&D), loan guarantees/loan loss reserves, and Small Business Investment Research (SBIR) – would incentivize the innovation and diffusion of new electricity technologies and help to finance further innovations and bring them to scale. Because the private sector discounts the future

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*For utility-scale projects, the ITC would be 45-percent of the installation costs in excess of $1.25 per Watt (alternating current) or roughly $1.00 per Watt (direct current). For distributed projects, it would be 45-percent of the installation costs in excess of $1.25 per Watt (direct current) for non-residential systems and 45-percent of the installation costs in excess of $1.50 per Watt (direct current) for residential systems. These thresholds ensure that the ITC phases out automatically as the solar technology reaches full market maturity and scale as defined by the SunShot goals. The $1.25 and $1.50 per Watt thresholds should be indexed to the appropriate measure of inflation, such as electricity rates. For more details on this concept, please see "Fitting Clean Energy into a Reformed Tax Code" available at http://solar.gwu.edu/content/2014-solar-symposium-research-posters.

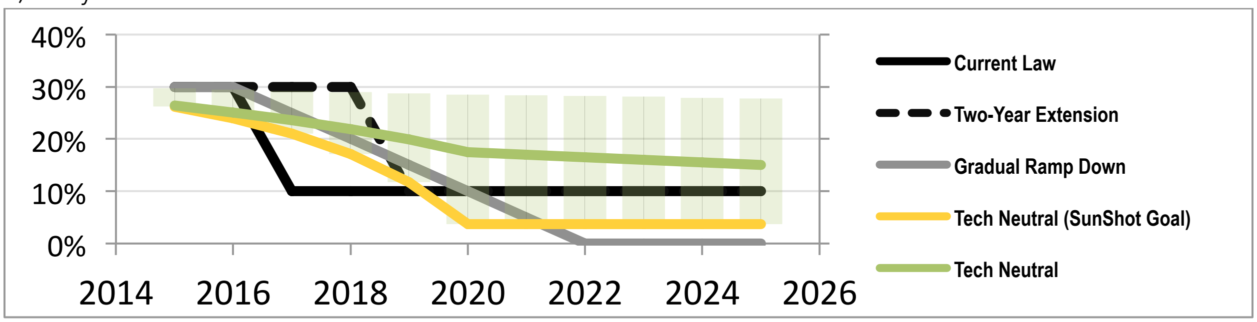
† Despite visible exceptions like flat-screen televisions and iPhones, most new technologies typically diffuse gradually. Potential adopters have to learn about the new technology, and an important pathway is through seeing others adopt the technology. The increasing return on the demand side is often referred to as "learning-by-using." Similarly, suppliers become more efficient in producing new technologies the more they produce and gain experience. This is often referred to as "learning-by-doing" and explains the rapidly falling costs of solar energy over the past several years as installations increased. Providing support across the learning curve, policies aimed at later phases also promote activities seeking breakthroughs at earlier phases of the learning curve, often referred to as "learning-by-searching", in which research, development, and demonstration (RD&D) of new technologies occur.

greatly, public policies across the innovation cycle are necessary to unlock investment and innovation. This technology-neutral ITC would accelerate the diffusion of new disruptive energy technologies and leverage previous public investments at earlier stages of the innovation cycle, allowing society to reap the rewards of its investments sooner and more completely.

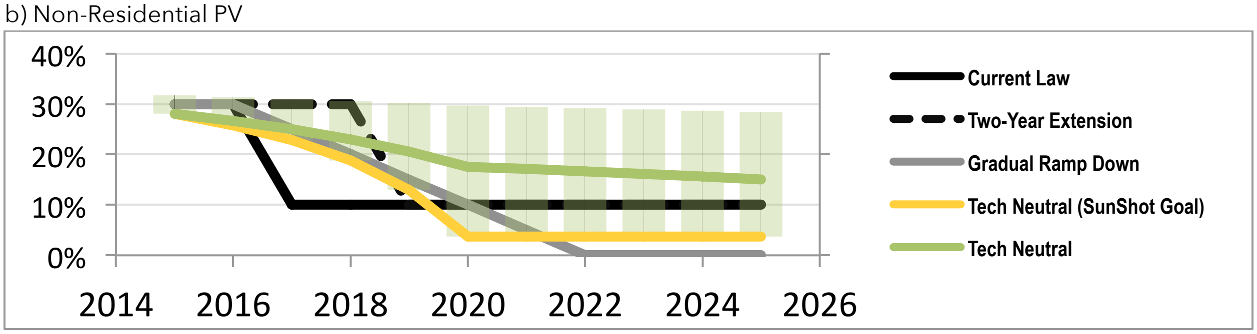
Figure 5 compares the alternatives for the ITC, except for Option 3, which replaces the ITC with new financing structures. Because the ITC level depends on the installation cost for the technology neutral ITC, the green bars show the range of ITC levels for the range of installation costs considered here. Despite the uncertainty for solar installation costs, the technology-neutral ITC could essentially phase out as soon as 2020, if the SunShot goals are met on time.

**Figure 5. Investment Tax Credit Levels for Various Policy Options**

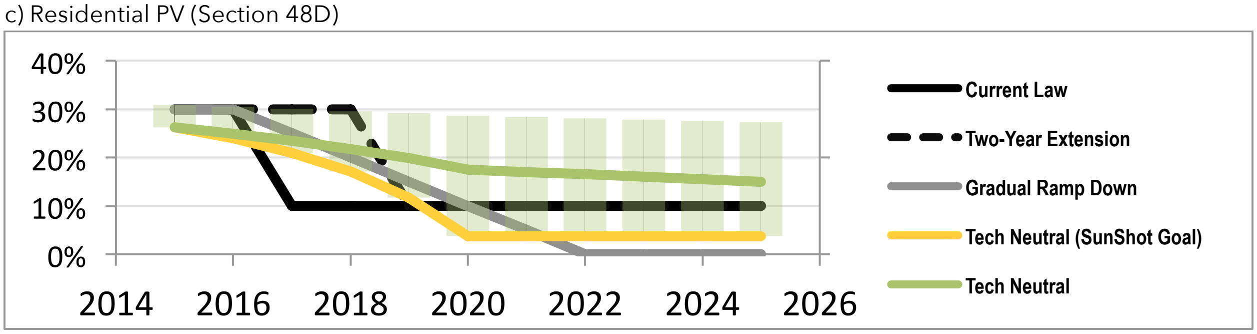
a) Utility-Scale PV




b) Non-Residential PV

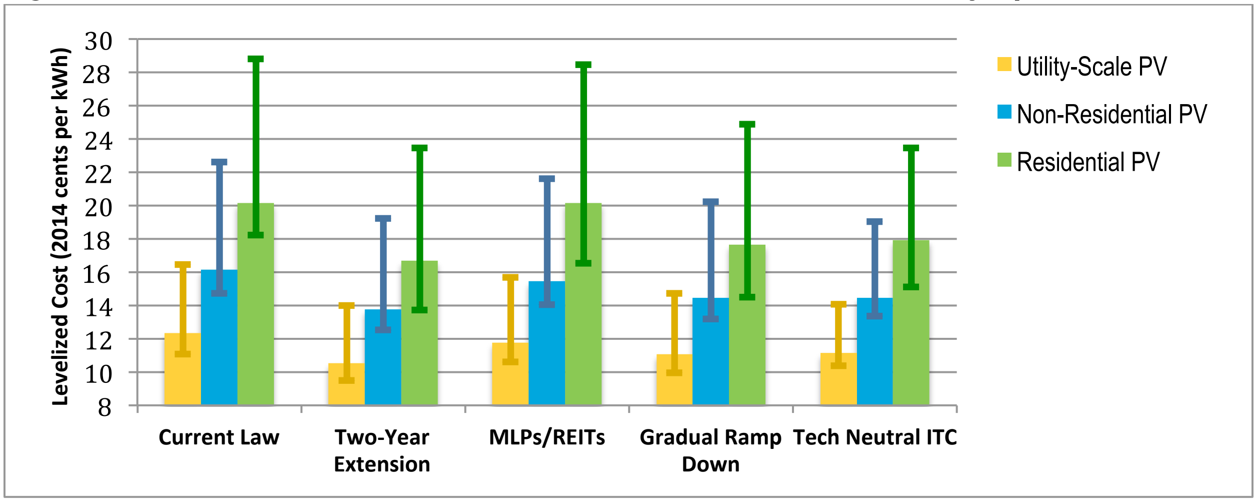



c) Residential PV (Section 48D)




Applying the ITC rates illustrated in Figure 5 (and associated WACC), we calculate the levelized costs of solar PV for each policy option. As shown in Figure 6, the two-year extension (Option 2) reduces the levelized costs in 2017 by roughly 15 percent compared to current law. The ITC ramp down (Option 4) and technology-neutral ITC (Option 5) reduce the levelized costs by roughly 10 percent below current law. The lower cost of capital from MLPs and REITs (Option 3) is within a few percent of current law but is able to compensate for the loss of the 10-percent permanent ITC level.

**Figure 6. Modeled Levelized Costs of Solar Power in 2017 under Five Policy Options**




Nevertheless, there are many cautionary considerations about pursuing Option 3. In addition to the assumption of accelerated depreciation for Option 3, the outcomes are sensitive to the exact cost of capital under these structures, which could be higher (or lower) and impact the levelized costs accordingly. Also, many other changes to the tax code would be necessary. Even if policymakers anticipated all of the challenges and applied the appropriate legislative solutions, the industry is unlikely to be ready to use these structures in 2017. While financiers may be willing and ready, project developers and installers would unlikely have established new business models and put them in place. Clean energy MLPs and REITs are likely to prove to be poor substitutes in the near term compared to the other proposed modifications of the ITC.

Figure 7 shows the estimated levelized costs in 2022. For both current law and the two-year extension options, the ITC level is 10 percent in 2022, and costs are equivalent. Lower financing costs associated with the MLPs/REITs option match the effects of a 10-percent ITC. The ramp down option, in which the ITC level declines to zero by 2022, is the only option that increases the levelized costs compared to current law. But the levelized cost is still below that for all policy options in 2017.

**Figure 7. Modeled Levelized Costs of Solar Power in 2022 under Five Policy Options**

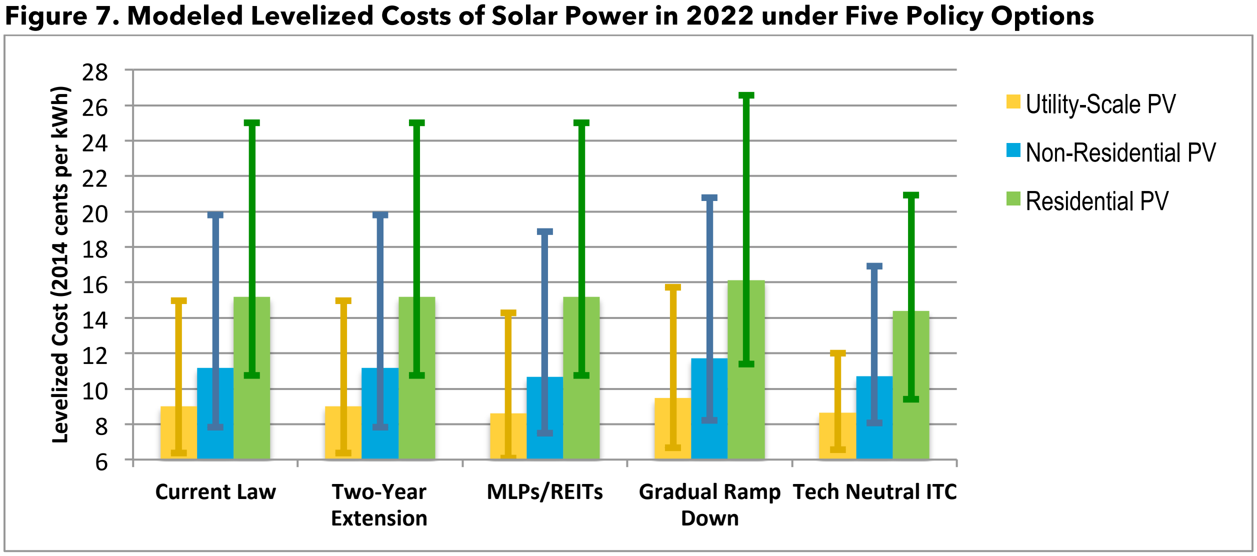
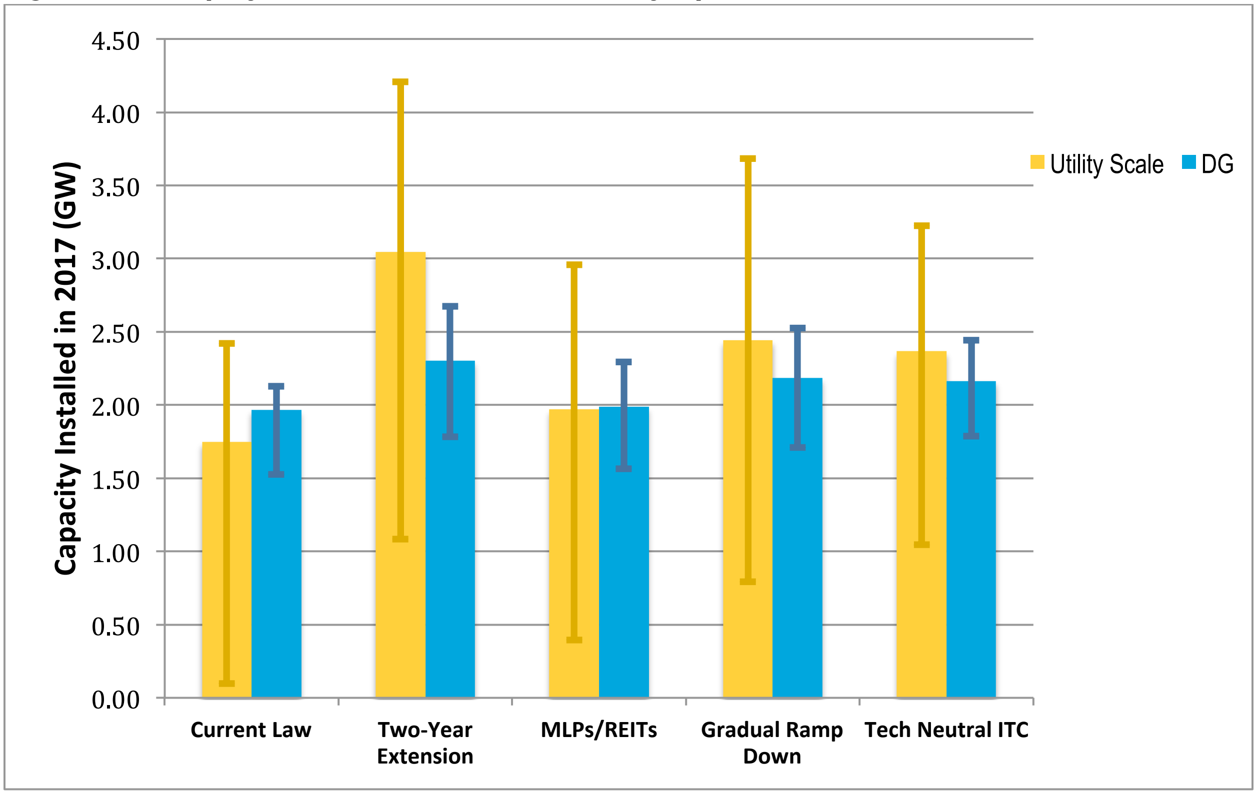


**Figure 8. PV Deployment in 2017 under Five Policy Options**



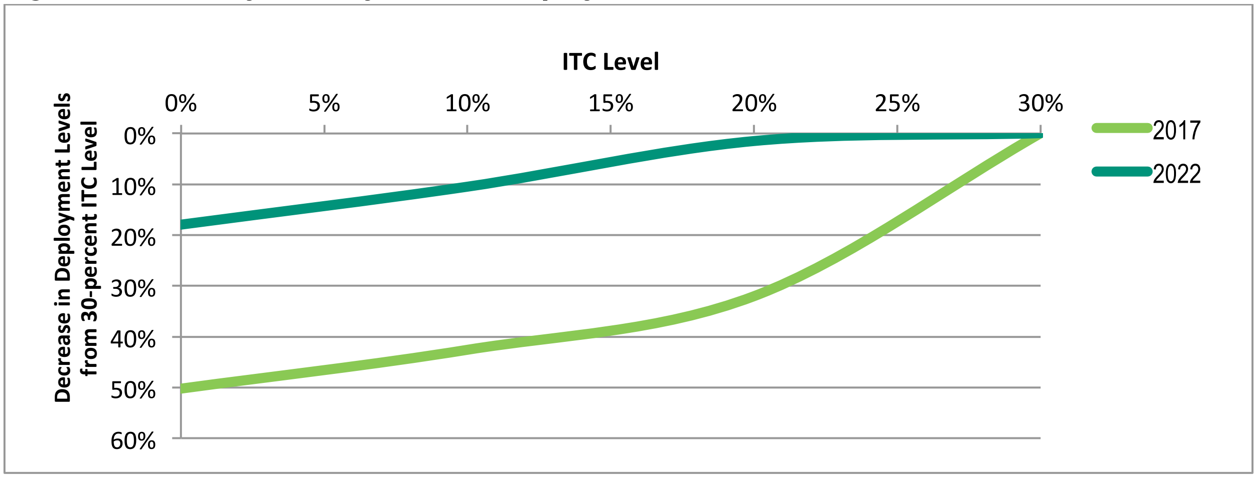

We estimate the relationship between levelized costs and deployment rates using the results from the SunShot Vision Study scenarios.[22] With the financing and technical assumptions from the study, we calculate the corresponding levelized costs for the scenarios.[*] This relationship between solar deployment and levelized cost that is embedded within NREL's ReEDS and SolarDS models is then applied to the calculated levelized costs for the policy options.

Figure 8 shows the estimated deployment of solar in 2017 under the five policy options considered here. From the modeled relationships, utility-scale solar PV appears to be more sensitive to the ITC level than distributed generation. Current law (Option 1) produces 43 percent less utility-scale solar PV than maintaining the ITC at the 30-percent level (Option 2). On the low end, utility-scale solar PV is all but eliminated under current law. Under the ITC ramp down and technology neutral ITC (Options 4 and 5), utility-scale PV deployments still decrease significantly, but by roughly half as much as the reductions under current law. DG solar deployment would decrease by about 15 percent under current law relative to a 30-percent ITC level.

While the deployment of utility-scale PV is sensitive to the ITC level in 2017, over time this sensitivity weakens. In 2017, even a 5-percent decrease in the ITC level results in close to a 20-percent decrease in deployment. In 2022, however, deployment stays roughly the same even if the ITC level were reduced by 10 percent. Figure 9 illustrates this shift in sensitivity to the ITC level. These results suggest that the timing of support under current law should be shifted to provide more support in the near term and less support in the long term.

[*] The deployment levels are provided in 5-year increments, so the values for 2017 and 2022 are linearly interpolated from the 2015, 2020, and 2025 values.

**Figure 9. Sensitivity of Utility-Scale PV Deployment to ITC Levels in 2017 and 2022**




## Conclusions and Recommendations

Given the extreme sensitivity to the ITC level in 2017, practical lag times for businesses to adapt to new policies, and uncertain cost reductions, extending the 30-percent level for a couple of years would be the most prudent path in the short-term to protect taxpayer dollars already invested in commercializing solar and bringing it to full scale. The cost of this increased support in the near term could be recovered over the long term by ending the permanent 10-percent ITC level in later years.

Over the medium term, the solar PV industry could become more independent and the ITC level could decrease gradually without extremely adverse impacts. Congress could prescribe this phase-out explicitly or create a new technology neutral investment tax credit that would expire automatically. The latter approach is recommended because the exact price path is uncertain and it supports new innovative energy technologies in the future.

Although the lower cost of capital from the replacement of the ITC with MLPs and REITs (Option 3) is not an effective substitute for the ITC in 2017, it will become a relatively more effective substitute over time. Over the long term as the ITC is phased out completely, policies to unlock new financing structures will be important. We recommend that whichever direction Congress decides to take on MLPs and REITs in tax reform, it should create a level playing field and parity across all energy sectors.

# APPENDIX

Table A1. Utility-Scale Installation Costs

| | Utility Scale PV (2014$/$W_{DC}$) | | | CSP (2014$/$W_{AC}$) | | |
|---|---|---|---|---|---|---|
| | *Sunshot Goal* | *Best Guess* | *High Cost Reference* | *Sunshot Goal* | *Best Guess* | *High Cost Reference* |
| **2015** | 2.40 | 2.42 | 2.94 | 5.60 | 6.32 | 7.49 |
| **2016** | 2.14 | 2.26 | 2.90 | 5.27 | 6.12 | 7.44 |
| **2017** | 1.87 | 2.10 | 2.86 | 4.93 | 5.92 | 7.39 |
| **2018** | 1.61 | 1.95 | 2.81 | 4.60 | 5.71 | 7.34 |
| **2019** | 1.35 | 1.79 | 2.77 | 4.26 | 5.51 | 7.29 |
| **2020** | 1.09 | 1.64 | 2.73 | 3.92 | 5.31 | 7.24 |
| **2021** | 1.09 | 1.61 | 2.70 | 3.92 | 5.24 | 7.10 |
| **2022** | 1.09 | 1.58 | 2.68 | 3.92 | 5.17 | 6.97 |
| **2023** | 1.09 | 1.55 | 2.66 | 3.92 | 5.10 | 6.83 |
| **2024** | 1.09 | 1.53 | 2.64 | 3.92 | 5.03 | 6.70 |
| **2025** | 1.09 | 1.50 | 2.62 | 3.92 | 4.96 | 6.56 |

Table A2. Distributed Installation Costs

| | Residential PV (2014$/$W_{DC}$) | | | Non Residential PV (2014$/$W_{DC}$) | | |
|---|---|---|---|---|---|---|
| | *Sunshot Goal* | *Best Guess* | *High Cost Reference* | *Sunshot Goal* | *Best Guess* | *High Cost Reference* |
| **2015** | 3.60 | 3.60 | 4.77 | 3.32 | 3.32 | 4.23 |
| **2016** | 3.20 | 3.37 | 4.64 | 2.93 | 3.07 | 4.12 |
| **2017** | 2.81 | 3.14 | 4.51 | 2.54 | 2.81 | 4.01 |
| **2018** | 2.42 | 2.91 | 4.38 | 2.15 | 2.56 | 3.90 |
| **2019** | 2.03 | 2.68 | 4.25 | 1.75 | 2.30 | 3.79 |
| **2020** | 1.64 | 2.45 | 4.12 | 1.36 | 2.05 | 3.68 |
| **2021** | 1.64 | 2.41 | 4.06 | 1.36 | 2.01 | 3.62 |
| **2022** | 1.64 | 2.37 | 3.99 | 1.36 | 1.98 | 3.57 |
| **2023** | 1.64 | 2.33 | 3.93 | 1.36 | 1.95 | 3.51 |
| **2024** | 1.64 | 2.29 | 3.87 | 1.36 | 1.91 | 3.46 |
| **2025** | 1.64 | 2.25 | 3.80 | 1.36 | 1.88 | 3.40 |

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**Acknowledgements:** The authors thank Stephen Comello, David Feldman, and Maggie Kesaris for their helpful feedback on an earlier draft and Jen Bristol for her help with the graphic design. The authors are also grateful for the assistance from Kelly Eurek, Ben Sigrin, Trieu Mai, and other researchers at NREL, who shared their data and insights on solar projections and energy models.

# ENDNOTES

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