WHITE PAPER

Utilities and Distributed Solar: Go Bold (and Smart) or Go Home

By Craig Schultz and Matt Robison

Shareables

1. Distributed solar economics have improved so dramatically that upcoming incentive declines (e.g., Federal Investment Tax Credit step-down) will only temporarily slow deployment. Utilities in the majority of U.S. markets should expect a major, inescapable medium-to-long-term role for distributed solar.

2. Big threats and opportunities are ahead: Utilities may lose new load growth revenue to solar migration (along with a growing segment of their customers) or could aggressively insert themselves into the solar equation to deliver valuable and valued new products and services.

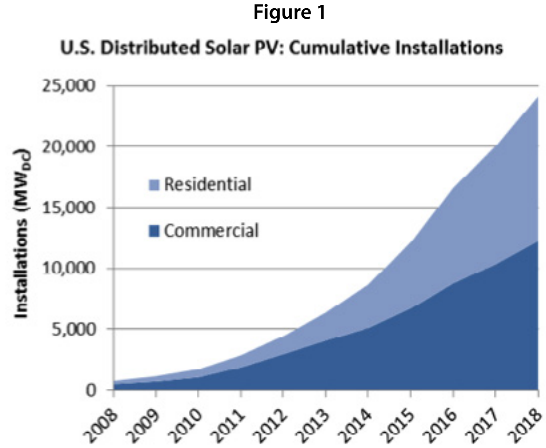
3. Utilities are rapidly adapting their business models: The second quarter of 2015 saw 87 important new distributed solar policy, program, or regulatory actions. Utility-led solar initiatives across multiple customer classes now total hundreds of megawatts in capacity.

Executive Summary

As distributed solar photovoltaic (DPV) generation is beginning to make deeper inroads in many markets, it is starting to change the way that utilities plan, invest, and engage with their customers. The growth of DPV has been astonishing over the past five years, while the rate of overall solar deployment has been rising so fast that in the first half of this year, 40 percent of all new online U.S. electric generating capacity came from solar (Figure 1).[1] Moreover, there is good reason to expect DPV growth to continue, even in the face of federal photovoltaic (PV) incentive reductions that are slated to occur in 2017 and ongoing decreases in some state incentives. This is in part because DPV represents the tip of the spear of the broader penetration and market role of distributed energy resources (DER). As technologies evolve and combine in powerful ways—think solar and storage or the impact of advanced load management—the pace of change will only accelerate.

If this growth continues as forecast (and as customers migrate to solar technology that is operational for 25+ years), it will require that utilities change the way they engage with customers and deploy and interact with resources—if they want to maintain a productive financial relationship with their full

Figure 1



Source: GTM Research/SEIA historical data, ICF future projection

[1] Solar Energy Industries Association. "Installing 1.393 MW of PV in Q2 2015, U.S. Solar Market Surpasses 20 GW." September 8, 2015. http://www.seia.org/news/installing-1393-mw-pv-q2-2015-us-solar-market-surpasses-20-gw

customer base. It is therefore better for utilities to take proactive, bold, strategic, and long-term approaches to DPV—in ways that enable customers to achieve their desired financial and environmental benefits with utility participation—than to take reactive, tactical steps that could inadvertently hobble future DPV program success and customer relationships.

In this paper we present case studies and outline DPV program and investment options that utilities can implement, often providing unique value to customers in their markets to adopt a smart and strategic solar plan. Depending on the regulatory environment, these studies include ways to shape incentives, enable customer ownership, or pursue utility ownership of solar assets, all of which can be pursued on their own or in combination with other distributed energy resources programs and technologies. In the second quarter of 2015, there were already at least 87 important new distributed solar policy, program, or regulatory actions[2] and utility-led solar initiatives across multiple customer classes now total hundreds of megawatts in capacity.

DPV's Impact: Significant and Growing

Some days, it is difficult to open a newspaper or business magazine without being bombarded with stories about how solar, energy storage, or other energy technologies are going to change the world. While some healthy skepticism is natural and there remains an open discussion on the pace and extent of that change for some technologies, the debate on distributed solar is largely over. The facts speak for themselves. DPV has already changed the game in some markets and is poised to do so in others.

Installed solar costs have declined dramatically—by more than 60 percent—in recent years, from over $10,000/kW in 2002 to under $3,000/kW for commercial systems in early 2015.[3] Credible industry players forecast the cost drop to continue. Deutsche Bank predicts that solar costs will fall a further 40 percent by 2017.[4] The CEO of First Solar predicts that by 2017, his company will be "under $1.00 per watt fully installed on a solar tracking system in the western United States."[5] Even if costs follow the much more conservative pattern forecast by DOE's EIA[6] and do not drop this substantially, there is a likelihood of system performance improvements of 5 percent to 10 percent to bolster DPV economics within the next decade.

These economics are also a big part of the reason DPV deployment in the United States has risen to almost 10 GW and is expected to grow by nearly 5 GW in 2016 and by approximately another 23 GW between 2017 and 2020.[7]

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[2] NC Clean Energy Technology Center and Meister Consultants Group. "The Fifty States of Solar: A Quarterly Look at America's Fast-Evolving Distributed Solar Policy Conversation." Q2 2015. http://nccleantech.ncsu.edu/wp-content/uploads/50-States-of-Solar-Q2-2015-final.pdf

[3] Michael Buckley, Rebecca Widiss, and Nick Grue. U.S. Department of Energy, SunShot. "GTM Research, U.S., Solar Market Insight Report, Q1 2015, Executive Summary," in Galen Barbose and Naïm Darghouth, Tracking the Sun VIII: The Installed Price of Residential and Non-Residential Photovoltaic Systems in the United States. August 2015. https://emp.lbl.gov/sites/all/files/lbnl-188238_1.pdf

[4] Giles Parkinson. CleanTechnica. "Solar Costs Will Fall Another 40% in 2 Years. Here's Why." (Based on a 2014E baseline and includes costs for the Panel, Inverter, Racking, Other BoS, Installation, Sales, and Other). January 29, 2015. http://cleantechnica.com/2015/01/29/solar-costs-will-fall-40-next-2-years-heres/

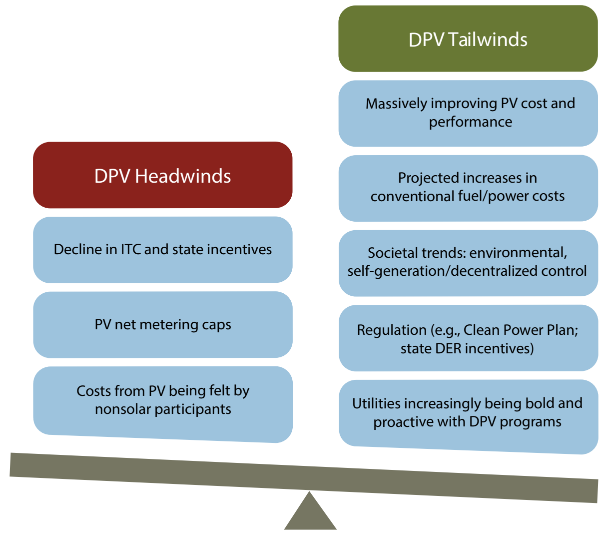
[5] Eric Westoff. Greentech Media. "First Solar CEO: 'By 2017, We'll Be Under $1.00 per Watt Fully Installed.'" June 24, 2015. https://www.greentechmedia.com/articles/read/First-Solar-CEO-By-2017-Well-be-Under-1.00-Per-Watt-Fully-Installed

[6] The U.S. Department of Energy's (DOE's) Energy Information Administration (EIA) forecasts declines averaging roughly 2% for distributed PV between 2015 and 2035. With inflation added to DOE's real capital cost forecast for PV, PV costs would essentially be at the same place in nominal dollars in 2035 as they were earlier this year. See EIA. Assumptions to the Annual Energy Outlook 2015. September 2015. http://www.eia.gov/forecasts/aeo/assumptions/pdf/0554%282015%29.pdf

[7] Solar Energy Industries Association and GTM Research. "Solar Market Insight Report 2015 Q1" (Executive Summary). http://www.seia.org/research-resources/solar-market-insight-report-2015-q1

This explosive growth is all the more impressive as it is occurring against the backdrop of historically low fuel prices and low price inflation. If and when these and other headwinds (Figure 2) abate, imagine what DPV growth might look like in an inflationary environment if: conventional utility retail power costs start to rise at 3 percent or 4 percent each year in nominal dollars; EPA's Clean Power Plan is implemented and renewables have further potential compliance cost advantages over higher-emitting generation; and after regulatory initiatives underway in California, New York, Hawaii, and elsewhere enable even easier DPV interoperability and penetration on distribution grids.[8] Further, the tailwinds should continue to build and gather momentum in the next 5 to 10 years.

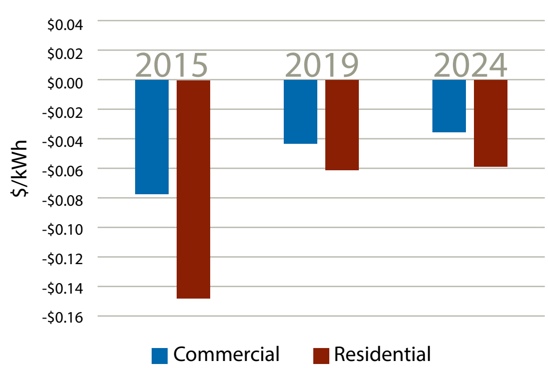
Figure 2 – Distributed Photovoltaic Drivers: Playing Field Dominated by Tailwinds



ITC Matters, but Solar Will Be Resilient and Recovery Will Be Faster Than You Think

The skunk at the solar garden party has been the looming decline in the federal investment tax credit (ITC)—from 30 percent to 10 percent or 0 percent in 2017 depending on system ownership. The fact that federal and state incentives have heretofore been such a key factor in driving solar growth has created a general sense that without this support, the solar boom would die off in 2017, or at least be hobbled long enough that it would not have to be a major factor in utility planning for quite some time. However, while the ITC step down is unquestionably an issue—and 2017 should certainly be a sharply down year for the PV industry compared to 2016—it is unlikely to reverse long-term solar momentum, for three reasons.

Figure 3 – DPV Better Than Break Even, Even After ITC Declines: Connecticut



Economics

Many analyses, including ICF's detailed review of DPV economics for ISO-New England earlier this year, point to PV economics remaining positive in many markets despite declining federal and state support.[9] Figure 3 shows an example from ICF's report: Connecticut residential and commercial PV economics certainly decline with the expiration of the ITC but remain several cents/kWh better than a break-even investment in both 2019 and 2024.

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[8] Steve Fine, Matt Robison, and Paul De Martini. ICF International. "On the Grid's Bleeding Edge: The California, Hawaii, and New York Power Market Revolution." July 7, 2015. http://www.icfi.com/insights/white-papers/2015/california-hawaii-new-york-power-market-revolution

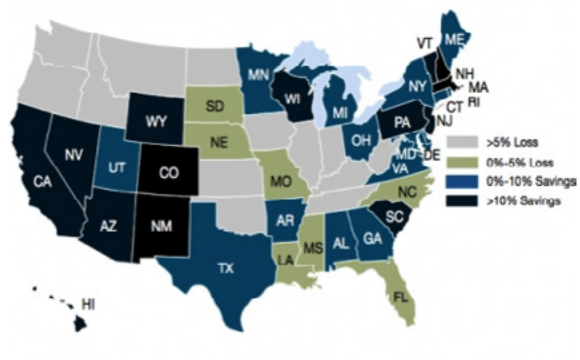
[9] Break-even economics in this example requires a 10% rate of investment return. Data below break-even ($0) imply a rate of return in excess of 10%. See ICF International. Economic Drivers of PV Report for ISO-New England, ISO-New England Distributed Generation Forecast Working Group. February 27, 2015. http://www.iso-ne.com/static-assets/documents/2015/02/icf_economic_drivers_of_pv_report_for_iso_ne_2_27_15.pdf

Case Study: One Utility Achieves Lower Costs, Smarter Incentives

A regulatory agency asked ICF to review adjustments in a utility solar incentive program and a solar integration cost study. The utility, which is in a market with very high rates, is experiencing rapid growth in commercial solar penetration and is already reducing its performance-based solar incentive to keep pace with improving PV economics. ICF provided insights into the advantages and disadvantages of moving from a flat incentive to one with higher payments in the early years of solar projects, as well as the risks of outright customer loss to solar + storage combinations. This analysis was used to help hone the incentive structure to balance support for PV deployment with the long-term financial interests of nonsolar owners. Solar integration enhancements can also lower the utility's operating costs by better planning for generation ramp rates and advances in solar inverter technology.

Moreover, the ITC is only one of a half-dozen or more factors[10] that can affect DPV economics by $.01/kWh or more on a long-term, levelized basis. A recent GTM Research analysis takes the view that the post-ITC recovery will happen fast, with residential solar reaching price parity with grid electricity by next year in many markets, falling off in 2017, but then returning to offer significant savings compared to grid electricity in 28 states by 2020 (see Figure 4 map from GTM Research report).[11] There are many external factors that will affect how quickly grid parity will be reached after 2016, including, importantly, what occurs when net metering caps are reached in many utility markets—but the direction is clear.

Figure 4 – Estimated 2020 Residential Solar Grid Competitiveness



Consumer Preferences

While cost is clearly a major factor, customers have demonstrated other significant preferences that push them to adopt solar. A Zogby Analytics 2015 homeowner survey conducted for SolarCity found that while 64 percent of homeowners selected "saving on monthly electrical bills" as one primary motivator for installing solar, 35 percent chose "reducing my environmental impact" as a key driver. Also, one out of five homeowners said they would choose general financial investments that offer social and environmental returns even if they provided a slightly lower monetary return than other options.[12] Put another way, if customers were interested only in short payback and environmentally desirable investments, we would see energy efficiency investments spiking at the same time as solar, but that is not the case. While DPV has become a strong economic choice with attractive financing choices in many U.S. markets, many consumers are willing to actually pay more for a solar investment, which will give the solar market resiliency even after the ITC decline impairs the economics of DPV. Moreover, consumers are also voters, and their preferences are helping put in place some of the other solar drivers like aggressive renewable portfolio standards (RPS) goals and DER integration programs. The well of popular support is likely to continue to exert pressure on regulators and elected officials to pursue solar-enabling policies.

DPV Support Coming from New Corners: Locational Value and Storage

Analytic and technological developments are likely to greatly enhance the potential investment returns from solar in the near term to midterm and in ways that have not yet been incorporated into analysts' projections. As detailed in ICF's recent paper, "The Value in Distributed Energy: It's All About Location, Location, Location," new methods are rapidly being developed—including by ICF—for understanding the precise locational value of solar and other DERs. Utilities can already use such approaches to make smarter investments, set rates to better balance their system needs, and optimize programs for energy

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[10] The other factors include retail electricity costs offset, net metering revenue, federal accelerated depreciation, low-cost debt, solar renewable energy credits [SRECs] in certain markets, other state incentives, and tax exemptions. See ICF International. Economic Drivers of PV Report for ISO-New England-ISO. February 27, 2015. http://www.iso-ne.com/static-assets/documents/2015/02/icf_economic_drivers_of_pv_report_for_iso_ne_2_27_15.pdf

[11] Eric Westoff. Greentech Media. "GTM Research: 10 Slides That Show the Complex Future and 'Tipping Point of US Solar.'" December 9, 2014. http://www.greentechmedia.com/articles/read/Shayle-Kann-and-the-Bratwurst-Problem

[12] SolarCity CleanEdge. U.S. Homeowners on Clean Energy: A National Survey: 2015 Poll Results & Clean Energy Growth Trends. March 2015. http://www.solarcity.com/sites/default/files/reports/reports-2015-homeowner-survey-clean-energy.pdf

Case Study: Getting Costs and Benefits Right Leads to Better Program Design

An investor-owned utility holding company in the central United States turned to ICF to conduct an analysis of leading Value of Solar (VOS) approaches being debated in the utility industry. We evaluated methodologies and results across areas including energy, capacity, transmission and distribution infrastructure, ancillary services, environmental, and other benefits assigned to distributed solar generation. ICF's review found that the studies were lacking consistent assumptions and methodologies, and several of them understated the net costs of integrating DPV into utility systems. Our client used ICF's work to inform its strategy for net metering proceedings in two states where it has operating utilities.

efficiency, demand response, and renewable deployment. As the understanding of locational DER value deepens, utilities will increasingly be able to shape the deployment of solar through the 3 Ps of pricing, programs, and procurements to extract (and deliver) greater value for themselves and their customers.

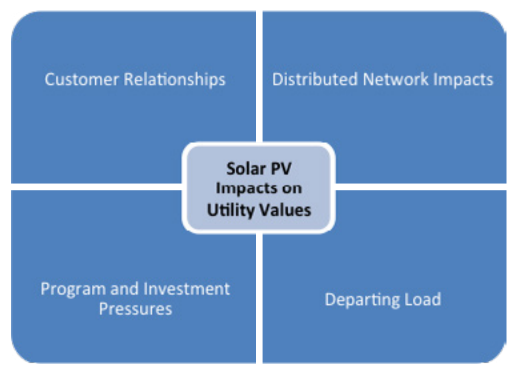
At the same time, the long-anticipated market pairing of solar and storage appears to be on the cusp of meaningful market penetration. This development will almost certainly accelerate solar momentum and push the value proposition past the tipping point for some markets that are on the brink. There remain open and critical questions about whether storage will most efficiently be placed on the utility or the customer side of the meter, who will control and dispatch it, and which entities should own it.[13] These complex dynamics will be the subject of an upcoming ICF paper. Regardless, the pairing with storage would push the economics of solar even further—even post-ITC decline—by allowing solar to be dispatched to more fully match load and by lessening the role of net metering.

Utilities Are Adapting

From the utility point of view, the potential threats from the solar trend are profound and hence, the danger of doing nothing is clear. If customer migration to solar (not to mention energy efficiency and other DERs) cancels out future load growth,[14] utilities not only lose a major source of new revenue, but also face entering an uncertain and yet-to-be-determined operational and business relationship with their customers. Unmanaged migration to solar is long term (since it is based around 25-year+ assets) and possibly unrecoverable.

Furthermore, utility strategic planning is significantly complicated by unplanned and unmanaged growth of distributed solar, given its locational uncertainty and diminished asset control. Several utilities are therefore pursuing programs that not only expand customer access to distributed PV, but also explicitly connect to the utilities' distribution planning efforts and allow for utility ownership and regulated returns on PV assets. These efforts, such as Dominion Virginia Power's Solar Partnership Program and Arizona Public Service's Solar Partner Program,[15] simultaneously address all of the quadrants in the "Solar PV Impacts on Utility Values" (Figure 5).

Figure 5 – Solar PV Impacts on Utility Values



[13] The recent announcement of a deal between the Kauai Island Utility Cooperative (KIUC) and SolarCity to purchase power from the first fully dispatchable utility-scale solar facility featuring a 52 MWh battery system represents one early example of potential models. See Gavin Bade, "Hawaii co-op, SolarCity ink deal for dispatchable power from solar-storage project." September 10, 2015. http://www.utilitydive.com/news/hawaii-co-op-solarcity-ink-deal-for-dispatchable-power-from-solar-storage/405408/

[14] Projected by EIA at 0.8% between 2013 and 2040. See EIA. Annual Energy Outlook 2015 with Projections to 2040. April 2015. http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf

[15] For more information on these programs, see Dominion Virginia Power. "Solar Partnership Program FAQs." 2015. https://www.dom.com/business/dominion-virginia-power/ways-to-save/renewable-energy-programs/solar-partnership-program/solar-partnership-program-faqs and APS®. "Solar Partner Program." https://www.aps.com/en/ourcompany/aboutus/investmentinrenewableenergy/Pages/solar-partner.aspx?src=news0715, respectively.

Case Study: Finding the Right Mix of Programs

An investor-owned utility in an area with strong solar resources but low penetration of PV systems asked ICF to determine the best way to manage solar proactively. We evaluated 10 solar program and investment options across several dimensions including speed to implement, ability to offset the utility's peak load, and fit with the utility's customer engagement goal. The options varied from utility-run programs (e.g., capacity- and performance-based incentives, community solar) to direct utility investments in projects and solar development and installation firms. Leveraging the insights developed in our prior work on the utility's energy efficiency (EE) implementation, we added the more complicated but higher yield possibility of combining solar options with EE programs. Based on this assessment, the utility was able to select two preferred options, and ICF provided input on optimal design and quantification of costs, including calibrating system design to help the utility identify the best match for its system's late afternoon peak demand. The utility was therefore able to decide how and when to implement a solar program proactively—one that matched what was allowable in their state and before facing new legislative or regulatory requirements—and in alignment with protecting some of its key values.

Of course, the other side of the coin is opportunity, and the clear consumer interest in solar, growing regulatory interest in enabling greater DER interconnection and eventually creating new markets, and ever-improving economics creates significant prospects for utilities to engage in new customer relationships and create valuable new services. This is a big market opening, and utilities can provide unique benefits to it. For example, PSE&G in New Jersey has built a strong record of success in a bold and proactive commercial and residential solar loan program that delivers a value-added service helping customers both overcome DPV first-cost barriers and minimize solar renewable energy credit price uncertainty. The utility has thereby strengthened its customer relationships across multiple customer classes and earned a regulated rate of return on the loan interest for this approximately 80 MW (growing to over 177 MW) program.[16]

Going forward, the onus will clearly be squarely on utilities to leverage their inherent advantages—customer relationships, distribution network ownership and/or operation, industry knowledge, and economies of scale—to productively manage solar growth, retain their customers, offer valuable new options and/or services, and generally become part of the solar solution.

The good news is that a year or two ago, the greatest potential pitfall for many utilities was not seeing the trend, not believing it would last, or hoping that it would only be a factor elsewhere but not in their own market. There has now been a palpable shift. While there are certainly some utilities feeling less impetus to have a proactive solar program, the majority are actively engaged and working effectively to protect their key values.

One example of this trend is in community solar initiatives, which can increase access to solar projects for interested customers, achieve economies of scale and customer contracting flexibility compared to smaller rooftop projects, permit utilities to earn regulated returns on their investments, and even offer distribution planning or locational value benefits. Community solar programs, which are developed mostly by utilities, have been experiencing tremendous growth across the country with the Solar Electric Power Association (SEPA) reporting that the number of such programs grew by 64 percent over 18 months in 2013 and 2014.[17]

The challenge is to look across the menu of available options and determine the right mix of programs and policies that yield the greatest long-term value. From the examples and case studies highlighted earlier, it is clear that utilities are actively and smartly trying to do just that. And they are finding that the best course is to be proactive, bold, and strategic.

[16] For more information on this PSE&G program, see https://www.pseg.com/home/save/solar/index.jsp and http://energy.gov/savings/pseg-solar-loan-program

[17] See Becky Campbell, Daisy Chung, and Reane Venegas. Solar Electric Power Association. Expanding Solar Access Through Utility-Led Community Solar: Participation and Design Trends from Leading U.S. Programs (Executive Summary). September 2014. https://solarelectricpower.org/media/214973/Community-Solar-Report-Executive-Summary-ver3.pdf

Figure 6 - Solar PV Program and Investment Options Available to Utilities

Value-Based Incentives	Enabling Customer Ownership	Utility Ownership
• Capacity-based incentives • Straightline performance-based incentives • Stepdown performance-based incentives • Discounted loans • Programs for solar and storage (including microgrids)	• Support/allow innovative financing • Net metering and meter aggregation policies • Allow retail contracting from remote projects	• Utility as off-taker of bundled power • Owner of project included in overall utility resource base • Owner of solar developer/ installation company • Utility-owned community solar

As they look to implement new solar initiatives, utilities should also consciously review combinations of options—such as pairing solar with storage, microgrids, electric vehicles (and other load growth), energy efficiency programs, or in amalgams of distributed and community solar avenues—in order to achieve the most beneficial, cost-effective, and far-reaching approaches for their customers and systems.

Conclusion

DPV is going to be a significant factor in much of the United States. A key differentiator among those that succeed and those that fail in dealing with solar in the next 10 years will be having a sound and proactive strategy. It is true that DPV adoption may slacken in a lower ITC world, but the effect will likely be temporary and eventually be more than overcome by other significant tailwinds. After 2016, states with existing mandates like California and an advanced regulatory process underway to enable DER will have only a pause in solar growth, while others—especially those with relatively low electricity costs for which solar is more dependent on policy incentives for competitiveness—may see a slowdown for a few years. But utilities cannot afford to wait, and increasingly, they are not waiting. They recognize that change is just around the corner on utility planning time scales, and the change will be significant.

As the Edison Electric Institute and National Resources Defense Council jointly stated last year, "If properly done, utilities can adapt to the changing needs of customers, modern electricity systems, and technologies…but utility regulatory and business model changes are necessary to accelerate progress and ensure transparent and equitable attainment of these objectives."[18] Those that are slow to keep up may find that the ground has shifted under them. For others, distributed solar can generate significant opportunities to cement customer relationships and utility investments for 25+ years if they take a proactive, bold, and strategic approach.

[18] Edison Electric Institute. "EEI/NRDC Joint Statement to State Utility Regulators." February 12, 2014. http://docs.nrdc.org/energy/files/ene_14021101a.pdf

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Craig Schultz manages renewable energy projects ranging from market assessments and feasibility analyses to project selection, policy formulation, negotiation, and implementation. Mr. Schultz has spent 19 years in the energy industry, working with solar, wind, and other renewable electricity projects as well as conventional energy supply, pricing, and risk management. His professional focus has been on helping retail and wholesale energy market participants manage the costs and volatility of their energy transactions and helping them optimize their conventional and renewable energy assets.

Prior to joining ICF, Mr. Schultz managed a wide range of departments and projects for two of the largest and most innovative energy sellers in the United States. In addition to client work, Mr. Schultz is a frequent author and speaker on energy issues.

Mr. Schultz has an MBA from the Booth School of Business at the University of Chicago and a BA in Economics from Wesleyan University.

Matt Robison has experience in writing and developing numerous papers, expert testimonies, and analyses on market design, the impact of regulatory programs and incentives, and asset valuation. His particular focus is on distributed energy resources grid integration and utility of the future models, as well as New England regional issues including gas-electric integration.

Mr. Robison has an M.P.P. degree from the Harvard Kennedy School of Government.

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