

**FINAL REPORT**

**Project Title:** “Regulatory and Utility Solutions to Advance SunShot Initiative Goals”

**Covering Period:** 09/01/11 through 02/28/15

**Date of Report:** 04/20/2015

**Recipient:** Interstate Renewable Energy Council, Inc. (IREC)

**Award Number:** DE-EE0005352

**Working Partners:** Keyes, Fox & Wiedman LLP  
Michael T. Sheehan  
Sherwood Associates, Inc.  
Kris Mayes Law Firm (KMLF)

**Cost-Sharing Partners:** None

<b>Contacts:</b>	Jane Weissman	Louise Uργο
	Phone: 781-461-8167	Phone: 617-566-5965
	Email: <a href="mailto:jane@irecusa.org">jane@irecusa.org</a>	Email: <a href="mailto:louise@irecusa.org">louise@irecusa.org</a>

<b>DOE Project Team:</b>	Contracting Officer	Lalida Crawford
	Project Officer	Rose Marie Holsing
	HQ Project Contact	Christina Nichols

## EXECUTIVE SUMMARY:

IREC's work over the past three years under the United States (US) Department of Energy (DOE) SunShot grant "Regulatory and Utility Solutions to Advance SunShot Initiative Goals" has significantly expanded state solar markets by removing regulatory policy barriers to solar photovoltaics (PV) and enabling more streamlined access to affordable distributed solar energy.

Over the course of the grant, the US grid-connected solar PV market experienced record growth, ramping up from a cumulative installed capacity of 4 Gigawatts (GW<sub>dc</sub>) in 2011 to over 18 GW<sub>dc</sub> of solar PV as of the end of 2014 (see Figure 1).<sup>1</sup>

Distributed residential and non-residential solar PV markets have made promising gains as well, with over 600,000 homes and businesses now hosting on-site solar systems.<sup>2</sup>

In addition to the recent improvements in economics, financing mechanisms, and technologies, these impressive gains are largely attributable to the improved market conditions and policies that attract consumers to solar energy.

These gains include, but are not limited to, state adoption of best practice interconnection standards that streamline the process of connecting to the grid; development and implementation of attractive shared solar programs that expand access to solar for those unable to install rooftop systems; foundational distributed generation policies and rules, such as net metering, that create simple ways for customers to connect to the grid and receive benefits for the energy they generate; and enhanced methodologies that facilitate planning for and integrating increasing penetrations of renewable energy.

Over the past three years, IREC has provided critical and timely technical and legal support on the aforementioned efforts in over 30 states, educating and engaging hundreds of stakeholders in the process. Through all of our efforts, IREC served as an independent source of education and guidance on best practices, a purveyor of reputable analytical tools and resources, an aid to states seeking to remove common barriers to solar energy, and a collaborator capable of achieving consensus with diverse entities on the myriad technical, legal, and economic issues surrounding solar deployment.

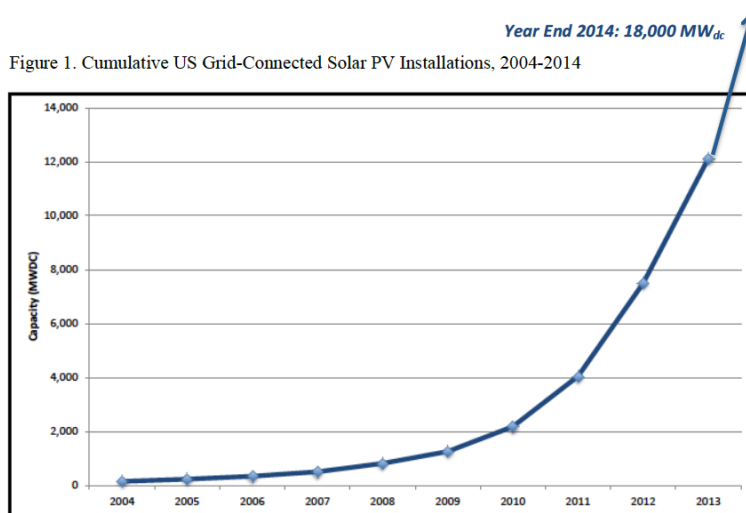


Figure 1. Cumulative US Grid-Connected Solar PV Installations, 2004-2014

Sources: IREC US Solar Market Trends Report, 2014 and GTM/SEIA 2014 Year in Review.

<sup>1</sup> Sherwood, Larry. US Solar Market Trends Report 2011, Interstate Renewable Energy Council, August 2012, page 4, available at: <http://www.irecusa.org/annual-u-s-solar-market-trends-report/> and GreenTech Media, Inc. and Solar Energy Industries Association, *US Solar Market Insight Report: 2014 Year in Review - Executive Summary [GTM/SEIA 2014 Year in Review-ES]*, page 3, available at: <http://www.greentechmedia.com/research/ussmi>

<sup>2</sup> GTM/SEIA 2014 Year in Review-ES, page 3.

From 2011-Q1 2014, IREC focused our efforts on expanding market opportunities for solar PV in the 20 states with the highest potential for significant market growth and removing technical barriers in the 10 states poised to achieve the highest penetrations of solar PV.

Notable is the fact that IREC has been actively engaged in all of the largest solar markets – in some cases in several proceedings – helping to establish strong foundations for robust solar market growth (see Figure 2).

Through involvement in state regulatory proceedings and by providing technical assistance, IREC has advanced solar best practices in Arizona, Arkansas, California, Colorado, Georgia, Hawaii, Illinois, Iowa, Maryland, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Texas, New Jersey, Washington and Wisconsin.

Figure 2. State Solar PV Installation Rankings, 2012-2014

State	Rank			Installations (MWdc)		
	2012	2013	2014	2012	2013	2014
California	1	1	1	1,046	2,621	3,549
North Carolina	6	3	2	124	335	397
Nevada	4	12	3	198	47	339
Massachusetts	5	4	4	134	240	308
Arizona	2	2	5	719	421	247
New Jersey	3	5	6	419	236	240
New York	10	9	7	63	72	147
Texas	12	8	8	51	75	129
Hawaii	7	6	9	109	144	107
New Mexico	18	13	10	24	45	88

Source: *GTM/SEIA 2014 Year in Review-ES*

IREC was also engaged in proceedings and work group efforts related to distributed solar involving PJM (a regional transmission organization, the territory of which includes Delaware, Illinois, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia); the Mid-Atlantic Distributed Resources Initiative (MADRI - which includes Delaware, District of Columbia, Maryland, New Jersey and Pennsylvania); the California Independent System Operator (CAISO), and Western Electricity Coordinating Council (WECC).

IREC’s path-defining achievements on interconnection, shared solar, and solar valuation in high-profile solar states, such as California, Hawaii, Massachusetts, Minnesota, and Ohio, have raised the bar for national best practices, and these states continue to provide replicable models and lessons learned for other states.

Throughout the grant, IREC focused its involvement in state utility commission proceedings, coordinating closely with local, state, regional, and national stakeholders to maximize our impact. We also conducted extensive national outreach, via in-person presentations, webinars, technical assistance, monthly *Connecting to the Grid* newsletters and blogs, and dissemination of nine (9) landmark solar market publications, some of which continue to define national best practices for solar market regulatory policies and programs, including:

- 1) *Model Interconnection Procedures (April 2013)*
- 2) *Integrated Distribution Planning (May 2013)*
- 3) *Model Rules for Shared Renewable Energy Programs (June 2013)*

4) *Deploying Energy Storage: Near-Term Regulatory Considerations to Maximize Benefits (February 2015)*

IREC's free publications, technical assistance tools, and resources generated during the grant continue to serve as foundational sources of information for stakeholders in nearly every state, which has enabled IREC to extend our reach and leverage our efforts well-beyond those states in which we were engaged during the grant period.

With guidance from an Advisory Board of diverse local, regional, and national experts<sup>3</sup>, IREC prioritized activities and issues that had the largest potential impact in state and regional markets.

Namely, IREC focused on the following core efforts:

- 1) Facilitating a robust development of shared and community solar programs and adoption of model rules.
- 2) Providing needed leadership and guidance on state solar valuation and net metering proceedings, including third party financing and meter aggregation issues, to increase the adoption of best practices that enable simple and economic consumer-driven distributed energy investments.
- 3) Removing technical barriers to cost-effective interconnection by eliminating inefficiencies in interconnection standards.
- 4) Demonstrating how reliance on distributed storage technologies can optimize system performance while facilitating maximum penetration of solar PV.
- 5) Facilitating the incorporation of specific solar scenarios into regional transmission planning efforts, and ensuring accurate assumptions, to help ensure distributed solar energy is adequately valued as a resource in transmission planning.

Our activities and successes are highlighted in more detail in the Significant Accomplishments and State Activities section of this report.

In addition, a map summarizing highlights of our combined state efforts is provided in the Appendix to this report.

#### **ACHIEVEMENT OF PROJECT GOALS AND OBJECTIVES:**

IREC achieved or exceeded all of the goals and objectives set out in the original project proposal. As outlined below, IREC proposed to participate in a certain number of state regulatory proceedings during each of the three years for tasks one through four. IREC's SunShot funding for year 3 was approximately two thirds of its funding in years 1 and 2. Therefore, participation by grant year was based on some proceedings concluding within a given year and others

---

<sup>3</sup> Regulatory Advisory Board Members (2011-2013): Gerry Bingham, Massachusetts Department of Energy Resources; Adam Browning, The Vote Solar Initiative; Michael Coddington, National Renewable Energy Laboratory; Jason Coughlin, National Renewable Energy Laboratory; Megan Walseth Decker, Renewable Northwest Project; Bob Gibson, Solar Electric Power Association; Carrie Cullen Hit, Solar Energy Industries Association; Bradley Klein, Environmental Law and Policy Center; Barbara Lockwood, Arizona Public Service; Karl Rábago, Rábago Energy; Thomas Starrs, SunPower; Jennifer Szaro, Orlando Utilities Commission; Elaine Ulrich, U.S. Department of Energy; Sarah Wright, Utah Clean Energy.

extending from one year to the next.<sup>4</sup> The following summarizes the goals and achievements of this project, relative to the tasks.

### **Task 1.0 Participate in Net Metering Proceedings**

Many states with the potential for significant market growth are held back by limitations in their net metering rules, including restrictions on third party ownership and meter aggregation. IREC focused on the states and proceedings that represented the greatest potential to strengthen programs and reduce costs and, thereby, expand markets.

#### Proposed Deliverables:

- 1) Participate in 5-10 net metering proceedings at the state utility commission level, chosen from among the 20 states with the highest potential for significant market growth.
- 2) For each proceeding, attend workshops, technical conferences, and hearings, submit comments, and work with other parties to achieve consensus based on IREC's model net metering rules.

#### Achievements:

IREC exceeded our deliverables, participating in net metering proceedings or detailed technical outreach in Arizona, California, Colorado, Georgia, Hawaii, Illinois, Iowa, Maryland, Minnesota, Nevada, New Jersey, New Mexico, New York, Ohio and Texas. IREC also participated in MADRI efforts. As a result of IREC's engagement, several of these states advanced improvements to their net metering rules to enable more customers to connect to the grid. Please refer to the Significant Achievements section below for details on each state effort.

### **Task 2.0 Participate in Community Solar Proceedings**

IREC proposed to participate in shared and community solar proceedings to expand markets and establish the option of larger-scale solar arrays for the residential market, thereby driving down costs.

#### Proposed Deliverables:

- 1) Participate in 4-6 community solar proceedings at the state utility commission level, chosen from among the 20 states with the highest potential for significant market growth.
- 2) For each proceeding, attend workshops, technical conferences, and hearings, submit comments, and work with other parties to achieve consensus based on IREC's model community solar rules.

#### Achievements:

IREC met our deliverables for this goal, participating in all available regulatory proceedings that involved shared and community solar during this project period. This work included three separate California dockets related to shared solar, a Colorado Community Solar Gardens docket and Minnesota's shared solar proceeding. As a result of IREC's engagement, several of these states advanced promising shared solar policies and programs that enable more customers to

---

<sup>4</sup> For example, 4-6 interconnection proceedings per year would correspond to roughly 4-6 started in the first year, 3-4 of which were to continue into the second year, with 1-2 new rulemakings started in the second year that would likely continue into the third year, and possible engagement in a new proceeding in the third year. Altogether, 4-6 rulemakings per year therefore translates into 6-9 rulemakings over the entire three-year period.

connect to the grid. Please refer to the Significant Achievements section below for details on each state effort. In addition, IREC participated in PJM's Net Energy Metering Senior Task Force that addressed shared solar jurisdictional issues for PJM's territory that includes 13 states and the District of Columbia. IREC also produced a comprehensive overhaul of its *Model Rules for Shared Renewable Energy Programs (June 2013)*. IREC has also conducted significant education and outreach related to shared solar activities, providing critical expertise on the still-nascent model.

### **Task 3.0 Participate in Interconnection Standards Proceedings**

Building on our experience in proceedings regarding interconnection standards, IREC worked in numerous states to address issues of timing, insurance and technical requirements, while also focusing on the emerging issues of enabling the efficient and cost-effective interconnection of distributed solar PV at higher penetration levels.

#### Proposed Deliverables:

- 1) Participate in 4-6 interconnection standards proceedings at the state utility commission level, chosen from among the 10 states poised to achieve the highest penetrations of solar PV.
- 2) For each proceeding, attend workshops, technical conferences, and hearings, submit comments, and work with other parties to achieve consensus based on IREC's model interconnection rules.

#### Achievements:

IREC surpassed our goal, participating in rulemakings in California, Hawaii, Illinois, Massachusetts, New York, North Carolina and Ohio. IREC additionally filed comments in Maine, supported pre-rulemaking work in New Jersey, Washington and Wisconsin. As a result of IREC's engagement, several of these states adopted best practices for interconnection. In the case of California, Ohio, and Massachusetts, the reforms enacted raised the bar for state interconnection standards, which continue to provide replicable models for state level interconnection reforms. Please refer to the Significant Achievements section below for details on each state effort. In addition, IREC published a comprehensive overhaul of *IREC's Model Interconnection Procedures (April 2013)*.

### **Task 4.0 Participate in Energy Storage Proceedings**

In most states, regulatory policies that enable energy storage to compliment solar PV generation are at a nascent stage. Much of the push for storage is taking place in connection with large-scale storage facilities at grid scale, even though such projects face long and difficult permitting and siting challenges. IREC participated in those discussions, but also emphasized the very important role that distributed storage can play in the integration of smaller PV installations at the distribution level. Mid-way through the grant, when it was evident there would not be as many state proceedings as originally anticipated, IREC (with approval from DOE) shifted its focus to the development of an energy storage report to identify key regulatory considerations to expand state markets.

#### Proposed Deliverables:

- 1) Participate in 4-6 energy storage proceedings at the state utility commission level, chosen from among the 10 states poised to achieve the highest penetrations of solar PV.
- 2) For each proceeding, attend workshops, technical conferences and hearings, submit comments, and work with other parties to achieve consensus.

*Please Note: Under the Negotiated No-Cost Time Extension for this grant, IREC and DOE agreed to a modification of these deliverables to focus on the development of the Energy Storage Report, in lieu of engagement in state proceedings.*

Achievements:

IREC met our goal, participating in storage-related work in several proceedings in California, Hawaii, New York and Massachusetts, along with participating in Oregon's inaugural state energy storage workshop. While there were not yet as many available regulatory opportunities to participate in energy storage as IREC had anticipated, IREC was able to help drive conversations and achieve some significant advances on the energy storage front, which is finally beginning to gain national attention. In the last year of the grant, IREC conducted extensive research and published a landmark regulatory report on distributed energy storage, *Deploying Energy Storage: Near-Term Regulatory Considerations to Maximize Benefits (February 2015)*. Since the market for distributed energy storage is still in its infancy, there is a significant need for regulatory guidance and proactive policies to ensure a smooth integration into the existing electrical system. In this report, IREC offers independent insight on how to address these new challenges – and opportunities – in the regulatory arena.

**Task 5.0 Participate in Transmission Planning Proceedings**

Throughout the project period there has been an unprecedented transmission planning effort going on throughout the 48 contiguous states. Technical requirements, costs and timelines were established in these proceedings that have directly impacted solar energy costs. IREC's engagement focused on ensuring accurate assumptions and proactive planning to ensure distributed solar energy is adequately considered and valued as a resource in transmission planning.

Proposed Deliverables:

- 1) Participate in Western Electricity Coordinating Council (WECC) transmission planning efforts. IREC expected this regional planning effort to be active for several years and intended to be active throughout all three years.
- 2) For each WECC proceeding, attend workshops, submit comments, and work with other parties to achieve consensus on draft rules.

Achievements:

IREC participated in numerous in-person and call-in meetings related to this task in addition to submitting frequent rounds of comments. As a result of IREC's participation, WECC's transmission planning process incorporated lower cost assumptions for distributed solar energy. IREC also contributed to a CAISO transmission planning process and transmission-related discussions between Arizona and California. IREC surpassed its stated goals in transmission-related activities.

## **Task 6.0 Perform Public Outreach and Stakeholder Coordination Functions**

IREC provided extensive outreach to targeted stakeholders, partners, and the general public through its website, a monthly newsletter, conference involvement, and publications.

### Proposed Deliverables:

- 1) Produce three annual reports of U.S. solar installations by state and sector
- 2) Develop and maintain interactive webpage with documents from state proceedings related to Tasks 1-5
- 3) Produce monthly newsletter regarding issues in Tasks 1-5 and related state proceedings
- 4) Produce 2-3 articles for publication related to Tasks 1-5
- 5) Participate in four national conferences on topics related to Tasks 1-5

### Achievements:

IREC exceeded the goals of Task 6, participating in numerous outreach efforts, through presentations, webinars, technical assistance, publications and the monthly *Connecting to the Grid* Newsletter, as detailed in the Significant Accomplishments section of this report. IREC published three annual *U.S. Solar Market Trends Reports (2011, 2012, 2013)* and several in-depth regulatory policy papers and insight articles (see Publications/Articles list below). IREC also updated its website to highlight regulatory news and information from each state.

## **Task 7.0 Project Management and Reporting**

IREC maintained regular reporting throughout the grant period and participated in annual planning meetings and DOE SunShot Summits, monthly calls, and regular interaction with the DOE, the Regulatory Advisory Group, and partner stakeholders.

### Proposed Deliverables:

- 1) Produce quarterly and annual reports, and reports at the conclusion of each rulemaking or other proceeding

### Achievements:

IREC submitted all quarterly progress reports in a timely manner over the span of the project. In addition, IREC submitted monthly update reports on our activities as well as occasional reports when a rulemaking reached a successful conclusion. IREC also held annual planning meetings, attended annual SunShot Summits and coordinated on a quarterly basis with our Regulatory Advisory Board. IREC completed all management and reporting requirements of Task 7.

## **SIGNIFICANT ACCOMPLISHMENTS AND STATE ACTIVITY DETAILS**

*(All state activities for each task are listed in alphabetical order)*

### **TASK 1: NET METERING**

#### ***Arizona Net Metering and Solar Customer Fee***

In 2013, the Arizona Corporation Commission (ACC) considered an application from Arizona Public Service (APS) regarding its net energy metering (NEM) tariff, which also involves issues related to the benefits and costs of NEM in Arizona. IREC formally intervened in the docket in



August and also filed a protest of APS' application along with analysis from Clean Power Research (CPR). IREC monitored this docket and coordinated with other involved stakeholders. In September, the ACC Staff filed a proposal in the docket, recommending that the ACC take no action on APS' application and defer the discussion to APS' next general rate case, which IREC supported in written comments. ACC Staff also offered two alternative proposals, both of which amounted to some level of an additional charge on net-metering customers' bills. In addition, several commissioners submitted filings asking specific questions or requesting information from docket participants. IREC responded to these filings as appropriate, consistently emphasizing the need for more transparent analysis and better data to inform changes to net metering policy, and the need to consider these issues in the next rate case rather than making changes based on unsubstantiated changes today. Ultimately, the ACC passed a \$0.70/kilowatt (kW)/month interim charge on net metering customers, substantially lower than any of the charges proposed prior to the meetings, and agreed to examine the issue in APS' next rate case. **While not ideal, this outcome was far superior to APS' initial request in its Application, which would have been hugely detrimental to Arizona's nascent solar market. The \$0.70 charge may slow the market but will not completely halt one of the country's largest solar markets.**

#### ***Arkansas Aggregate Net Metering***

In late September 2012, IREC submitted public comments to the Arkansas Public Service Commission supporting the Commission's proposal to adopt aggregate net metering (ANM). The Commission's proposal is closely modeled on provisions from IREC's 2009 Model Net Metering Rules, and would allow customers with multiple meters on a single property to aggregate their loads against an on-site generator. This simple change does not drastically change a state's net metering policy but tends to have a market-expanding effect, allowing a larger pool of customers, including farmers, local governments and businesses with multiple meters, to more efficiently take advantage of net metering. IREC commended the Commission for moving toward best practices and explained why ANM does not represent an expansion of any subsidy that may or may not be embedded in net metering in any of the utilities' service territories. **While Arkansas is not traditionally thought of as top solar state, its policies have been influential in the Southeast as Louisiana and New Orleans have updated their net metering policies to match Arkansas' on several occasions. The Commission ultimately adopted a provision for meter aggregation in September 2013, and IREC believes this small investment continues to have a larger, market-expanding impact in the region.**

#### ***California Net Metering Cap Calculation***

In May 2012, IREC marked a significant achievement regarding net metering when the California Public Utilities Commission (CPUC), issued a decision that clarifies how the state's net metering cap should be calculated for California utilities. IREC was joined by several other organizations and submitted comments proposing an alternative interpretation to the "aggregate customer peak demand" definition for net metering. The Commission voted unanimously to adopt IREC's interpretation. In its order, the CPUC clarified that the 5% cap on net metering codified in California statute should be calculated using non-coincident peak demand rather than the coincident peak demand metric that the state's three large utilities had been using in the past. The Commission's ruling is projected to more than double the amount of net metering capacity available under current law, as compared to how the utilities interpreted the statute prior to the decision. **This decision represents a significant accomplishment for IREC, which led the**

**effort for Commission clarification and put forward the proposal that the Commission ultimately adopted. Ultimately, the decision could pave the way for an additional 2 GW of net metering capacity in the state.**

### ***California Insurance Provisions for net metering customers***

In November 2012, San Diego Gas & Electric (SDG&E) issued a proposal that would have required an insurance provision for net metering customers, mandating that they provide the utility with information about their insurance policies and agree that they will maintain such policies during the term of the net metering agreement. In our comments on this issue, IREC pointed out that this provision was contrary to California net metering law and recommended striking the insurance provision in its entirety. IREC also suggested striking the identical provision from SDG&E's interconnection agreement. **Following direction from the CPUC, SDG&E agreed with IREC and indicated that it would strike these provisions. This change prevents an unnecessary and inappropriate burden on California net metering customers, making it easier for them to participate in SDG&E's net metering program.**

### ***California Aggregate Net Metering***

In late September 2013, the CPUC adopted Resolution E-4610, which requires the state's investor-owned utilities (IOUs) to provide for NEM aggregation for all eligible customer-generators. The Commission was prompted by Senate Bill 594 (2012) to determine by September 30, 2013 whether implementing NEM aggregation would increase the incremental cost of administering the NEM program, overall. The Energy Division's analysis, which IREC supported in comments on the Draft Resolution, found that NEM aggregation would not increase those incremental costs based on two assumptions: (1) larger non-residential customers are more likely to participate in NEM aggregation; and (2) those larger non-residential NEM customers tend to represent less risk of a cost shift to non-participating customers than residential NEM customers. Accordingly, the Commission reasons that increasing the percentage of non-residential capacity in the NEM program will improve the overall cost-effectiveness of NEM, supporting its decision to authorize NEM aggregation. **Though the IOUs argued that these larger non-residential systems would likely come with increased interconnection costs, the Resolution mirrored IREC's comments that the IOUs have not produced any data in recent years that supports that argument. The IOUs will file advice letters implementing NEM aggregation in October, marking an important advance in the state's NEM policy.**

### ***California Net Metering 2.0***

In the fall of 2013, IREC intervened in an effort at the CPUC to determine a transition period for California's net metering program, as the Commission was required by statute to consider a replacement tariff or program to be in place by July 2017. This effort was initiated to address how long current NEM rules will apply for customers who have already installed facilities, as well as those who install facilities under the cap on the current program (5% of a utility's aggregate customer peak demand). The central issue in this docket was whether the Commission was required to base the transition period on a reasonable expected payback period, which is mentioned in the statute as a factor that the Commission must consider.

In early 2014, IREC filed comments to address the appropriate lifetime assumption for solar facilities, and the fact that the IOUs' payback analyses for solar facilities are based on current

rate structures that are more favorable to NEM than those proposed by the IOUs in a concurrent residential rate design docket. In March, the CPUC voted to approve a proposed decision that will "grandfather" customers taking service under the existing NEM tariff for a period of 20 years. The Commission's decision to establish a 20-year transition period was opposed by utilities and at least one ratepayer advocacy group, who claimed that the transition period should be based on a reasonable expected payback period of a range of 6-10 years. The Commission, instead, determined that a fair, but conservative, estimate of expected system life would be a better measure. Largely agreeing with the proposed decision, **IREC encouraged the Commission to adopt at least a 25-year transition period, citing this as the standard length of performance warranties for many leading panel manufacturers. The CPUC echoed IREC's reasoning in its final decision, noting that the Legislature had left the Commission the discretion to determine a transition period, and settled on a 20-year transition period.** Once the Commission approves a new tariff or program for customer-generators, those that are "grandfathered" on the current NEM tariff may choose to take service under the new tariff. **This decision is a significant victory for NEM in California, as it creates sufficient certainty for customers that their investments in solar will be respected for at least the next 20 years as they can continue to participate in NEM. The decision also caps and solidifies the gains made by IREC in persuading the Commission, in 2012, to adopt an interpretation of the state's NEM cap that essentially doubled the capacity of the program.**

#### ***Louisiana Net Metering Cost and Benefit Analysis***

In early December 2013, IREC met with several commissioners with the Louisiana Public Service Commission (PSC) to discuss issues related to determining the costs and benefits of NEM and provide IREC's perspective on best practices. As the Commission was contemplating raising NEM program caps, utilities and some stakeholders were asking the Commission to conduct a cost-benefit study to examine NEM. IREC had hoped this assistance would help the Commission identify reasonable study assumptions based on best practices at the outset of their process.

#### ***Maryland Net Metering Tariffs and Guidebook Assistance***

Early in 2011, the Maryland Public Service Commission requested draft tariffs from the state's IOUs to implement new net metering rules concerning meter aggregation, rollover of excess generation, payment for annual excess generation, and system sizing. IREC was active in September 2011 on these issues and followed up in October by reviewing the draft tariffs and suggesting changes to the draft tariffs to comport with the new rules. **A pilot program for ANM based on terms proposed by IREC moved forward and was incorporated into all of the drafts.** The pilot program was scheduled to expire in late 2013 and IREC provided information to the Maryland Energy Administration (MEA) regarding other ANM programs elsewhere in the United States, including in respect to their pilot status and whether other programs have capacity caps, to support MEA's effort to make ANM a permanent program in the state.

Additionally, all Maryland utilities allow net metering for system sizing up to 200% of annual electricity demand. Maryland was the first state to allow such sizing for net-metered systems, which led to a discussion of whether such systems, and any system using aggregate metering, must seek interconnection approval from PJM. **IREC suggested that PJM review is not**

**necessary, and all but one of the state's utilities agreed to not require PJM approval for any systems under 1 MW.**

In late 2012 and throughout 2013, IREC also participated in Maryland's net metering working group in order to stay up-to-date on net metering issues in the state and to provide technical advice on net metering best practices. IREC developed a draft guide to net metering for discussion by the net metering working group in early 2013. IREC shared this guide with the Maryland Energy Authority (MEA) for review and worked with MEA to finalize the guide.

### ***Massachusetts Net Metering***

As part of Massachusetts' NEM system of assurance, in order to obtain a NEM cap allocation, developers must meet a number of eligibility requirements, including providing an executed ISA, evidence of site control, etc. On March 13, 2013, the Massachusetts Department of Public Utilities (DPU) issued an order that, among other things, created a new designation for particular interconnection services agreements (ISAs) called the "early ISA". Under Massachusetts' new interconnection tariff, which IREC helped to develop, developers are now allowed to obtain an ISA after an impact study with 25% cost certainty (an "early ISA") rather than waiting until the detailed study and 10% cost certainty. However, it was not clear whether the so-called "early ISA" qualified as an ISA for the purposes of the system of assurance.

On October 30, the DPU issued Order 11-11-F, which resolved this "early ISA" question. When this issue emerged earlier in 2013, IREC submitted a letter to the DPU jointly with the Solar Energy Industries Association (SEIA) and the Solar Electric Businesses Association of New England (SEBANE), which urged the DPU to resolve this issue as soon as possible in order to eliminate market uncertainty. Based on our participation in DPU 11-75 and DPU 11-11, IREC indicated that we believed it was appropriate to treat early ISAs the same as traditional ISAs for the purposes of the system of assurance. In its October order, the DPU indicated that "early ISAs" issued on or after January 1, 2014, would meet the requirements of system of assurance. For early ISAs issued before January 1, 2014, the applicant will also have to include an attestation of a complete Detailed Study from the utility to be eligible (i.e., basically look like a traditional ISA). **IREC considers this order a positive development for NEM in Massachusetts in that it resolves market uncertainty and because it allows for the equal treatment of all ISAs going forward.**

### ***Minnesota Net Metering***

In September 2013, IREC jointly filed comments with ELPC, Fresh Energy, Vote Solar and others in response to a net metering tariff filed by Xcel Energy. IREC's comments generally requested that the Minnesota PUC reject Xcel's proposed modifications not mandated by recent energy legislation, including in particular Xcel's proposal to automatically obtain RECs with no compensation to the customer-generator. In January 2014, the PUC issued an order rejecting many of Xcel's proposed changes to its tariff, including the REC proposal that IREC opposed. The PUC approved the modified tariff only to the extent it implemented clear statutory mandates.

### ***Nevada Net Metering***

In 2013, the Nevada PUC opened an investigation regarding the costs and benefits of NEM in the state, and solicited comments over the course of August and September. In early October, IREC filed comments solar valuation, and in mid-October, the PUC finalized its work plan for securing a consultant to analyze the benefits and costs of NEM in Nevada. For this work, the Commission selected the consulting firm E3, which is well known and capable of a thorough analysis based on its work in California. A stakeholder committee assisted with this effort by advising the Commission on its choice of consultant, providing input on the study's scope and critiquing the consultant's report. The PUC appointed Jason Keyes to represent IREC on the committee. Mr. Keyes participated in numerous Stakeholder Advisory Committee meetings throughout late 2013 and early 2014.

E3 issued a draft report in April 2014, showing that NEM plus the state's solar incentives collectively will provide a slight net benefit to other ratepayers in 2014 and 2015, switching to a slight net cost in 2016. Of particular note, the PUC asked E3 to revise the report to break out the costs and benefits of NEM separately from the incentive program, which led to a showing of a long-term net benefit. Based this request, E3 agreed to several changes and shared its very expansive spreadsheet model for data and process review. **In June 2014, E3 released the model, including the requested changes, with the preliminary results that NEM in Nevada provides a net benefit upwards of \$174 million to other ratepayers under the ratepayer impact test.** This is a very positive result that was included in the final report, issued on July 2. As the PUC was ordered to conduct this study and submit it to the Legislature, presumably a showing of a net benefit would be an important consideration in the context of potentially expanding the state's NEM program, which is currently capped at 3% of utility peak demand.

#### ***New Mexico Outreach on Net Metering Crediting Issues***

In November 2012, at the request of a member of the New Mexico Public Regulation Commission, IREC provided a summary of research on how other states treat the rollover of net excess generation. Specifically, the Commission wanted to know if other states allowed credits to rollover at the full retail rate and, if so, how many states allow indefinite rollover. The Commission was considering allowing indefinite rollover of net metering credits at the retail rate for systems 10 kW or less, but wanted the benefit of IREC's perspective on state practices on this issue. A summary of IREC's research on how other states handle this issue was subsequently presented and accepted into the record at a hearing.

#### ***New York Net Metering Cap***

In the first quarter of 2013, IREC was involved in New York's consideration of its NEM program capacity limit, which prompted a significant advance for NEM in that state. In June of 2013, the New York PSC issued an order that raised the statutory NEM cap from 1% to 3%, taking advantage of a statutory provision that allows the Commission to increase the size of the NEM program if it finds the program to be in the public interest. IREC and other stakeholders emphasized the benefits of NEM to New York and put forward specific proposals to increase the limit beyond 1% of 2005 peak demand. **The Commission ultimately heeded the message of IREC and these parties, and tripled the potential capacity of the NEM program by increasing the limit to 3% of 2005 peak demand for all jurisdictional utilities (one utility's cap was previously raised to 3%).**

### ***PJM (Regional Transmission Organization) Net Metering Task Force***

In the first half of 2012, IREC participated in PJM's Net Energy Metering Senior Task Force (NEMSTF) to consider issues related to net metering in the area served by the regional transmission operator. PJM serves, completely or in part, 13 states and the District of Columbia, including New Jersey with its net metering program that is second only to California in terms of enrollment. Through the NEMSTF, IREC provided its knowledge of state net metering rules and helped the group understand PJM's jurisdictional limits with regard to net metered and community solar facilities. Since net metering is a state policy and net metering systems typically interconnect pursuant to state law, IREC shared its analysis and provided specific research on the circumstances under which a net metering customer might engage in wholesale sales and, thus, become subject to the jurisdiction of the Federal Energy Regulatory Commission (FERC). **IREC's early participation in this process helped to clarify these boundaries and to limit PJM's focus to the potential wholesale market impacts of excess net-metered generation. In particular IREC sought to avoid a determination that PJM has jurisdiction over the interconnection of facilities built pursuant to state programs for community solar, virtual net metering and meter aggregation, based on the view that these rely on netting of generation against consumer load, akin to traditional net metering. IREC produced a memo on the issue for the NEMSTF, and a final report produced by the group reflects that PJM is not taking a position on the issue, and simply states that FERC needs to make the determination. This is the result IREC hoped to achieve and preempts potentially costly burdens on small solar facilities in the PJM territory.**

### ***Texas Third-Party Ownership and Interconnection***

On December 23, 2011, the Texas Register published a notice proposing to implement legislation regarding third-party ownership of distributed generation (DG) and make a limited number of changes to the intent and dispute resolution provisions of the state's interconnection procedures for customer-sited DG. In January 2012, IREC filed comments at the Public Utilities Commission of Texas (PUCT) in support of implementation of the proposed third party language, with noted exceptions regarding the proposed removal of dispute resolution language. Additionally, IREC urged the PUCT to consider opening a separate proceeding to investigate the benefits of implementing full retail net energy metering to fully realize the market-expanding potential of third-party ownership of DG.

In May 2012, the PUCT voted to approve rules that exempt third-party owners of DG from PUCT regulation. Given the complex regulatory landscape in Texas, with both competitive and traditionally regulated service areas within the state, one utility challenged the applicability of the rules to its service territory. The Commission followed IREC's reasoning to conclude that the enabling legislation was intended to apply throughout the state.

### ***Washington Net Metering Costs and Benefits Analysis***

In November 2013, IREC participated in a panel before the Washington Utilities and Transportation Commission (UTC) addressing net metering costs and benefits. The UTC was considering undertaking an analysis of costs and benefits in 2014 and this workshop laid the groundwork for the scope of the analysis, which is still in progress to date.

## **TASK 2: COMMUNITY AND SHARED RENEWABLES**

### ***California Low-Income Customer Access to Solar via Shared Renewables Pilot - CleanCARE***

To address the potential for community renewables to serve as a way for low-income customers to participate in and benefit from renewable energy more directly, IREC developed a proposal to revise the California low-income rate assistance program, California Alternative Rates for Energy (CARE), such that it would provide customers with the option of energy efficiency improvements coupled with shared renewables bill credits to reduce their monthly bills. IREC believes that this program restructuring would be a more efficient use of CARE funding and would benefit not only low-income customers but also all California ratepayers through lower rates in the future. IREC discussed these ideas with California solar and low-income customer advocates in order to refine the concept. Notably, in 2014, IREC gained some traction regarding this “CleanCARE” pilot program proposal: the CA NEM 2.0 docket and the current CARE docket are both considering IREC’s CleanCARE proposal as a possible strategy to expand low-income customer access to renewable energy. In addition, IREC continues to consider low-income customer participation options in its engagement in other state community renewables efforts.

### ***California Shared Renewable Energy***

In September 2013, California enacted SB 43, which provides for 600 MW of shared renewables in the state from facilities with capacities up to 20 MW each. The law stipulates that 100 of the 600 MW should be reserved for small (< 1 MW) facilities in low-income and environmentally disadvantaged communities. At least 100 MW would also be reserved for residential participants. Individual subscriptions of up to 2 MW are allowed. The bill contains other restrictions and requirements, but generally allows utilities substantial flexibility in setting up a shared renewables program in their service territory. Throughout late 2013 and the first half of 2014 IREC was involved in the implementation of these green tariff shared renewables (GTSR) programs at the CPUC.

Prior to the passage of SB 43, shared solar programs voluntarily proposed by SDG&E) and Pacific Gas and Electric Company's (PG&E) were already under consideration at the Commission. These programs, called *Connected to the Sun* and *Green Option*, were not necessarily fully compliant with SB 43 but have progressed substantially through the stakeholder review process at the CPUC. Southern California Edison (SCE) also proposed a program and filed it in the consolidated docket. The docket has proceeded in two phases. Phase 1 considered proposals from PG&E and SDG&E. Phase 2 considered the proposal from SCE. Throughout the proceeding, IREC has focused on the valuation of bill credits, and has coordinated with Vote Solar and SEIA on other program issues focused on the shared renewables program components.

In early 2015, the CPUC formally issued an Order on the GTSR, and although the program design reflects many of IREC’s model rule best practices, the pricing structure for the energy is neither favorable nor reflective of the full benefits of community solar. The CPUC is initiating a phase IV proceeding to continue to work through some of the remaining issues, and in the meantime, the IOUs are proceeding with their program rollout efforts.

### ***Minnesota Community Solar Gardens***

From the fall of 2013 to spring of 2014, IREC was involved in helping implement community solar garden (CSG) legislation in Minnesota. On April 7, the Minnesota PUC issued an order on Xcel's proposed community solar gardens program, offered in compliance with Minnesota's statute. **In its order, the Commission rejected Xcel's proposal and required the utility to re-submit it within 30 days incorporating important changes, all of which IREC had suggested or supported in our comments in this docket.** These modifications include: implementing no cap on the program and accepting applications on a first-ready, first-served basis; valuing a participant's bill credits at the retail rate until Xcel files a value-of-solar tariff for community solar gardens; compensating solar garden operators for unsubscribed energy at avoided-cost rates; and compensating solar garden operators for the renewable energy credits associated with their generation at fixed rates, if the operators choose to sell those credits. With the Commission's mandated improvements, IREC views the community solar gardens program as very promising, representing an exciting opportunity for Xcel's Minnesota customers.

### ***National – IREC Shared Solar Model Program Rules and Program Catalog***

From late 2012 through the first half of 2013, IREC researched and re-evaluated its community solar model program rules and recommendations. Specifically we reconsidered the definition and nomenclature of community solar, regarding whether to include an investment-based model in IREC's definition and other important considerations. These discussions involved other solar stakeholders in the community solar arena, including Vote Solar, with whom we partnered to review and update the rules. Our updates revolved around distinguishing community-shared (retail/credits) models from community-based (wholesale/investment) models, as well as updates to the model rules based on this reevaluation. IREC released its updated *Model Program Rules for Shared Renewables* in June 2013, which include a number of important changes:

- Replacing the term “community renewables” with the terms “shared renewable energy” or “shared renewables”;
- Updated guiding principles for shared renewable energy programs to illustrate better these programs' critical aspects. A more detailed discussion of the opportunity that shared renewables programs represent;
- An explanation of the similarities and differences between shared renewables programs and other related programs;
- A more refined discussion of the valuation of the energy produced by a shared renewable energy facility, as reflected in a participant's electricity bill credits;
- The removal of the two-megawatt facility size limitation in the original *Model Program Rules*;
- A discussion of the role for shared renewable energy programs in restructured energy markets;
- A discussion of low-income energy consumer participation in shared renewable energy programs.

As part of this effort, IREC compiled a matrix of existing community solar programs, collecting relevant details about these programs such as whether they are retail versus wholesale, how they value their bill credits/payments, and other criteria. IREC worked with the Solar Electric Power



Association (SEPA) to coordinate and refine our matrices of shared renewables program information. IREC uploaded its matrix, called the *Shared Solar Program Catalog*, to the IREC website in March 2013 and has updated it regularly since.

### **Florida Shared Solar Outreach**

In December 2013, IREC participated in a two-day workshop with the Southeast Florida Regional Climate Change Compact, a regional governmental organization focused on preparing the four counties - Broward, Miami-Dade, Monroe and Palm Beach for impacts from climate change. The Compact has become particularly interested in utilizing shared solar program models as a means to allow their citizens to participate in renewable energy programs. IREC provided stakeholders with resources on program design, discussed how those resources can be used to design a program based on emerging best practices, and generally supported the stakeholders discussion on the topic over two days of presentations and Q&A sessions. Representatives from Florida Power & Light (FP&L) were at the meeting and agreed to work collaboratively with the members of the Compact, IREC and the Florida Solar Energy Center to begin developing a program that could be offered in their service territory. FP&L covers about one-third of Florida's land mass and over a quarter of the citizens of Florida are served by the utility.

### **General Shared Solar Outreach Efforts**

In 2012, IREC:

- Wrote a paper on Community Solar for the annual conference of the American Solar Energy Society, which was held in May 2012;
- Held a call with the Orlando Utilities Commission (OUC) regarding their community solar program. OUC representatives provided us with additional detail about the structure of their meter aggregation and community solar programs, and IREC provided some advice and resources on several unresolved questions from OUC;
- Participated in a call with Solar San Antonio. Solar San Antonio was in the early stages of considering a community solar program, potentially in partnership with the San Antonio municipal utility, CPS Energy. IREC reviewed their initial project ideas and provided feedback;
- Met with the Rocky Mountain Institute (RMI), Solar Mosaic, and Community Power CA to assess how our respective organizations might collaborate on community solar and other issues;
- Responded to an interview request with the *Wall Street Journal* concerning the growth of community solar programs in the U.S.;
- Worked with SEPA to discuss that organization's efforts with respect to community solar and to avoid duplication of work;
- Attended Solar Power International (SPI) to present on emerging trends in community-shared solar and how those trends relate to IREC's model program rules;
- Corresponded with Tennessee Valley Authority about their community solar program;
- Participated in a series of three meetings in Sacramento, California, concerning the development of community solar in the state. IREC provided participants with a national perspective on programs developed or under development nationally. IREC followed up

these meetings with outreach to stakeholders to provide more details concerning the development of community shared solar;

- Reviewed a National Renewable Energy Laboratory's (NREL) report related to retail rate policy and its impact on net metering economics;
- Attended a meeting regarding SDG&E's proposed Community-Shared Solar program, wherein parties discussed next steps in the proceeding, the development of a record that could lead to settlement, and the content and scope of workshops planned for the following year. IREC offered to assist in the development of the workshops, including outreach to low-income community stakeholders and developers of projects in other states so that their expertise can be brought to bear in the proceeding;
- Coordinated with SEPA to develop and publish a blog post regarding net metering and the perceived subsidy. As part of the effort, IREC coordinated the post with Ron Binz, a former commissioner on the Colorado Public Utilities Commission;
- Presented on a webinar facilitated jointly by ICLEI and IREC, attended by over 150 people;
- Developed a case study handout highlighting three successful programs at Tucson Electric Power (IOU), Colorado Springs Utilities (muni) and Florida Keys Electric Co-op (co-op). IREC is considering how to further develop this case-study document for future use, including potentially as an appendix to our model rules;
- Discussed the development of shared solar with a major transmission cooperative located in the Upper Midwest; and
- Provided information on shared solar to representatives from Berea, Kentucky looking to expand their shared solar program to a municipal facility located in a local cooperative's territory.

In 2013, IREC:

- Wrote a blog post focused on shared-solar in Renewable Energy World, highlighting recent developments on the issue;
- Presented on shared solar at the Advancing Renewables in the Midwest conference on March 28 in Columbia, Missouri. IREC also met with representatives from the local municipal utility, Columbia Power & Light, which is interested in setting up a shared solar program in its territory;
- Presented on shared solar at the 2013 American Solar Energy Society (ASES) conference in Baltimore, Maryland (April 16 - April 19);
- Met with the DOE soft costs team to discuss shared solar;
- Met with representatives of Hawaii Electric Company (HECO) regarding their interest in developing a shared solar program. IREC provided HECO representatives with materials on shared solar program development and committed to continuing the conversation with HECO after representatives had time to digest the materials and develop questions regarding the concepts the materials contain;
- Responded to inquiries from several members of the Great Lakes Renewable Energy Association, which has been awarded a grant from the State of Michigan Energy Office to study the development of Community Solar in Michigan;
- Continued to update the shared solar program matrix and Vote Solar's shared renewables tracking website;

- Delivered a webinar on shared solar to the NREL State Technical Assistance Team (STAT), targeting local stakeholders interested in learning more about such programs and establishing them in their areas. The webinar was well attended and IREC answered provided additional assistance to several stakeholders with follow-up questions;
- Participated in meetings and gave presentations in Denver, Colorado related to America's Power Plan, including its net metering, interconnection, permitting and shared solar recommendations. The timing coincided with the NARUC Summer Committee Meetings;
- Held a telephone call with representatives of the Salt River Project (SRP), an Arizona utility, to learn about their planned program expansion and to provide guidance on valuation that could assist them as they consider ways to lower the cost of participation in the program based on feedback SRP received from potential subscribers regarding the current program. We expect continued conversations with SRP on these issues;
- Held a telephone conference with Orlando Utilities Commission (OUC) to discuss their planned program expansion and valuation issues to assist their decision making on program changes that could drive participation while so addressing OUC's concerns regarding costs. One of the primary items of discussion was valuation and ways to use program design to ensure savings to the utility that could be shared with participants. OUC noted that interest in shared solar is growing among municipal and cooperative utilities in Florida so she offered to assist with outreach to interested stakeholders;
- Met with the U.S. Department of Energy to discuss planning and outreach around the DOE's shared solar workshop taking place on October 21, 2013, including IREC's participation at the workshop. IREC also met with stakeholders from DC Sun to get an update on the status of shared solar efforts in Washington, D.C.;
- Attended the DOE's Shared Solar Workshop in Chicago, consisting of shared solar stakeholders from around the United States, to discuss shared solar barriers and opportunities. IREC assisted in facilitating break-out sessions;
- Continued dialogue with HECO surrounding shared solar opportunities in Hawaii.
- Presented on shared solar at the SPI conference and attended a number of shared solar-related strategy meetings with the DOE and other stakeholders;
- Provided information to an interested stakeholder regarding California's shared solar program development and opportunities for involvement;
- Reviewed tax guidance from the IRS regarding the residential solar tax credit and its use for offsite systems, and evaluated its potential impact on CSG programs and projects; and
- Corresponded with the New Hampshire PUC regarding new interim rules implementing that states group net metering legislation. IREC will review these rules and the final rules issued early next year, and provide feedback to the PUC as appropriate to ensure a robust and effective program is implemented.

In 2014, IREC:

- Published a blog post on the IREC website and Renewable Energy World regarding the importance of location and other characteristics to shared solar customers, based on IREC's ongoing research related to shared solar projects and programs;
- Delivered a webinar presentation along with a representative from the City of Davis regarding shared solar models and the potential role for cities for the Sustainable Cities Exchange;

- Replied to a stakeholder inquiry from University of Arkansas request additional information about community solar gardens;
- Responded to a stakeholder inquiry regarding shared solar securities issues from the City of Palo Alto, California;
- Provided the Sierra Club (National) with information regarding active shared solar programs and their design referencing IREC's shared solar program catalog;
- Reviewed shared solar program applications from Xcel (Colorado, Solar\*Connect) and Florida Power and Light (Community-Based Voluntary Solar Program), and began considering the proposed program designs and possible improvements to suggest.
- Delivered a presentation on shared solar at the Solar Powering Illinois Conference, which focused defining shared solar, highlighting the opportunities shared solar unlocks for consumers, utilities, and solar companies, and exploring how shared solar could fit within the unique structure of Illinois' energy market;
- Reviewed a shared renewable energy program application submitted by Rocky Mountain Power in Utah;
- Discussed successful shared solar models with RMI, and the information shared was highlighted in subsequent RMI blog posts;
- Highlighted shared solar policies and developments in its Connecting to the Grid newsletter in June: <http://www.irecusa.org/2014/06/getting-a-fair-share-of-solar/>;
- Attended a joint meeting of the DOE and the Securities Exchange Commission, held in Washington D.C.; and
- Served as a shared solar expert at Minnesota workshop (July 23) at the invitation of the RMI, where IREC helped inform the discussion of potential shared solar models for Minnesota cooperatives.

### TASK 3: INTERCONNECTION

#### *California Interconnection*

In late 2011 and early 2012, IREC played a critical role in building consensus in California on important interconnection reforms. IREC assisted the CPUC in working with California's largest IOUs and a diverse group of stakeholders to draft key interconnection tariff reforms. IREC was also asked by the CPUC to draft a motion requesting acceptance of the settlement that parties had reached with regard to interconnection reforms. On March 16, 2012, IREC filed this motion to accept the settlement reached between the parties and implement a number of important revisions to California's interconnection procedures. The settlement represented nearly eight months of intensive efforts in which IREC worked closely with the IOUs to produce a draft interconnection tariff for stakeholder review. **The tariff revisions led by IREC and agreed upon by the parties include a number of new national best practices, particularly with respect to expediting interconnection of PV systems on distribution circuits at penetration levels up to 100% of minimum daytime load. The settlement achieved in California was instrumental in setting the stage for similar work in other states.**

In September 2012, the CPUC issued a final decision that adopts a settlement agreement modifying the state's interconnection procedures to allow exporting systems to proceed under expedited review procedures and offers a robust supplemental review process for systems that

failed one or more of the initial fast track review screens. Of particular note, the decision adopted a supplemental screen to the 15% line section screen, which has become a barrier to expedited interconnection in high penetration areas in California. Now, under a new supplemental review process, interconnection requests that fail the 15% screen may still interconnect on an expedited basis if they pass the supplemental screen based on 100% of minimum load. IREC has promoted this approach in Hawaii and other jurisdictions, and California's adoption of this new screen constitutes a best practice. In addition, the revised rule allows developers to obtain a pre-application report that can help applicants screen possible project locations prior to submitting an interconnection request. The new rule also has clearer timelines and additional explanation of the technical factors that will be applied to projects. IREC played a key role in the settlement process by facilitating communications between the stakeholders and the utilities, and by drafting significant portions of the newly improved tariff. This decision concludes Phase 1 of the interconnection reform process.

On April 10, 2014, the CPUC issued another decision approving further changes to California Rule 21. The decision adopted a distribution group study process, put into place the necessary applications and agreements for the different study tiers, and implemented a new interconnection data reporting requirement. **California's decision on the group study process has been a positive outgrowth of the major Rule 21 overhaul. It acknowledged that small generators often have limited or no impact on the electrical system and therefore created a tiered study process that would only require the appropriate amount of study for each project.** The decision finalizes the creation of a new study tier for projects that individually do not cause impacts on the transmission system but that are electrically related to other queued projects on the distribution system. The utilities will study these projects together in "distribution groups." This may enable some projects requiring study to avoid the extended transmission cluster study process, while also offering the potential benefit of cost sharing for system upgrades triggered by the group. This will be the first formal distribution group study process in the nation.

### ***Hawaii Interconnection***

For nearly two years, IREC was highly involved in drafting and building consensus for modifications to Hawaii's interconnection process and technical requirements for distributed generation. This work culminated with a Decision and Order on November 29, 2011. In this order the Hawaii PUC accepted nearly all of the stipulated revisions to Hawaii's Rule 14H interconnection procedures. The Commission deferred consideration of the disputed issues, including the proposed revisions to Appendix I of the rules regarding supervisory control systems, until a subsequent Decision and Order. The Commission's Decision and Order means that Rule 14H now has substantially improved features, including incorporation of a supplemental review process for applications that fail one or more of the technical screens and a 150 day cap on the amount of time the utility has to complete a more intensive Interconnection Requirements Study. Additionally, when a generator fails just the "penetration screen" (i.e., aggregate generation exceeds 15% of line section peak load), the supplemental review process will now allow generators interconnections to avoid more detailed study if aggregate generation does not exceed 50% of minimum load (measured during daytime hours for PV). This modification established a national best practice for generator interconnections proved to be a useful precedent in efforts in other states experiencing high PV penetration. **Based on the modifications achieved through settlement and now approved through this Decision and**

**Order, Hawaii's Freeing the Grid score for interconnection increased from an "F" to a "B."** *(Note: While the majority of this work at the Hawaii PUC was accomplished through previous funding, SunShot provided funding for the last two months of comments in this proceeding.)*

### **Illinois Interconnection**

In the spring of 2014, at the request of the Environmental Law & Policy Center (ELPC) and the Citizens Utility Board's (CUB), IREC drafted proposed revisions to Illinois' interconnection procedures. The revisions reflect best practices as represented in the recently updated FERC Small Generator Interconnection Procedures (SGIP), state procedures from California, Hawaii, Ohio and Massachusetts, and IREC's model interconnection procedures. IREC also participated in three interconnection workshops in Illinois. Working off of the redline proposed by IREC, the utilities provided their perspectives on the proposed changes in conjunction with the ICC staff, ELPC, CUB and participating solar developers. The utilities expressed openness to some of IREC's proposals including inclusion of a pre-application report, increasing of the size limit for the 10 kW inverter process, and inclusion of electronic processing of interconnection applications.

On August 8, IREC, along with its local partners, filed an updated, redlined version of the interconnection rules into the ongoing interconnection docket. We largely retained our suggested changes, including the introduction of a pre-application report, the inclusion of a more detailed supplemental review process, and the removal of the external disconnect requirement. However, we made some modifications based on discussions with the working group over the past few months. On August 22, IREC, ELPC and CUB jointly submitted verified comments in support of our redlined rule, which included detailed explanations of the changes and support from other states and FERC. IREC remains hopeful that new, favorable rules will be approved before the end of the year and will continue to work closely with the utilities on these proposals to provide additional, objective technical expertise to the discussions.

### **Maine Interconnection**

On August 21 2013, the Maine PUC issued an order in Docket 2013-00263, in which IREC had participated earlier in the year. In June, IREC had submitted brief comments regarding a narrow question posed by the PUC regarding Professional Engineer review for system design. Because Maine largely adopted IREC's 2005 Model, IREC felt uniquely qualified to respond to this question. In its comments, IREC pointed out Maine's existing Professional Engineer review requirement for systems exceeding 50 kilowatts (kW) in the expedited review track, found in the standard forms and agreements adopted by the Maine PUC. IREC then provided various examples for comparison, including neighboring states and the Federal Energy Regulatory Commission's identical requirement, which has been adopted by several other states. While there was limited participation in this proceeding, Central Maine Power did submit comments requesting the threshold be lowered to 10 kW, which is much lower than most states require. In its order the PUC agreed with IREC's assessment and retained the 50 kW limit for Professional Engineer review.

### **Massachusetts Interconnection**

In 2012, IREC participated in Massachusetts' Distributed Generation Working Group (DGWG), which began working to reform the state's interconnection rules in May 2012. The DGWG

submitted its final report with recommended revisions to the DPU in October 2012. On March 13, 2013, the DPU issued an Order in the interconnection docket, DPU 11-75, addressing the DGWG report. In its Order, the DPU adopted the majority of the DGWG's recommendations, including several promoted by IREC through its involvement in the working group. **IREC views the new interconnection procedures as a significant success and should facilitate easier access to renewable energy in Massachusetts. The Order identified a few outstanding issues, including two that were important to IREC: the penetration screen in the revised supplemental review process and the development of an effective group study process.**

Regarding supplemental review, the DPU adopted a penetration screen of 67% of minimum load whereas IREC and many others recommended using 100%, as FERC, California and Hawaii had done. The DPU required the newly established Technical Standards Review Group (TSRG) to re-evaluate the issue over the following year and report back on the possibility of increasing the screen from 67% up to 100% by February 2014. IREC provided input in this process through the DGWG as well as the non-utility members of the TSRG. At a January 29, 2014 meeting, the TSRG agreed to recommend that the DPU move to a 100% penetration screen, along with safety-and-reliability and voltage-and-power-quality screens, issuing its formal recommendation to the DPU in February. **The DPU formally adopted the 100% screen in late July 2014. IREC views this as a very positive development in Massachusetts and nationally; this TSRG recommendation was the critical first step in bringing the Massachusetts interconnection procedures in line with best practices.**

#### ***New Jersey Interconnection***

On August 3, 2012, IREC participated in a New Jersey Board of Public Utilities (BPU) interconnection workshop to provide technical expertise and guidance. Having submitted a series of questions to the state's utilities regarding interconnection and monitoring requirements for solar energy installations of a megawatt or more, IREC led a significant part of the discussion. The meeting helped establish possible improvements to the state's interconnection procedures for larger systems. During a workshop of the same group on September 21, the workgroup addressed an issue IREC has raised multiple times with stakeholders: the restrictive range of allowable voltage drop used by Atlantic City Electric (ACE). The participating utilities agreed to fashion a proposal and to submit a petition to the BPU that would adopt the standard ANSI C.84 standard, which allows a range of +/- 5% from nominal voltage, as opposed to the current +/- 4% range allowed by ACE's current standards. This issue is important because it affects the amount of solar PV that can operate on a line section without violating the allowable range.

#### ***New York Interconnection***

In early January 2013, IREC filed interconnection comments in a New York PSC proceeding (Cases 12-E-0393 through 12-E-0398). The Commission had previously issued a notice directing New York's major electric utilities to propose changes in the state's Standardized Interconnection Requirements (SIR), which were jointly submitted by the utilities in mid-October, 2012. IREC suggested several revisions that would reduce costs and significantly improve upon the transparency and efficiency of interconnection procedures for applicants. IREC recommended that the SIR provide more clarity regarding when applications are eligible for expedited review (specifically that eligibility be based solely on the use of UL 1741 Certified Equipment) and that the expedited review process provide more transparency regarding fees,

timelines and requirements. Additionally, IREC recommended that the SIR include the FERC SGIP's technical screens in the second application tier (for systems sized 25 kW to 2 MW), which had no clearly specified screens. Lastly, IREC asked for the inclusion of certain technical definitions as well as clarification regarding when technical requirements (such as a utility grade relay or dedicated transformer) will be required. On January 15, 2013, IREC attended a technical conference held by the Commission to review the proposed changes to the SIR and Application Process that were suggested in comments. In February 2013, IREC filed follow-up reply comments to address a subsequent revised Joint Utilities Proposal for SIR modifications.

On March 15, 2013 the NY Public Service Commission issued an order in which it declined to adopt IREC's proposal to incorporate technical review screens. The Commission did, however, incorporate changes to the SIR that simplify and expedite the interconnection application and review process. For example, applications for inverter-based systems sized between 25 kW and 300 kW are now generally eligible for the expedited review process as long as the system is certified and tested in accordance with UL 1741 and the utility approves the project accordingly. The order also increased the upper limit for such systems to 300 kW, from the previous 200 kW. Additionally, the Commission increased the eligibility for expedited review for all residential DG systems (both inverter and non-inverter based) from the current upper limit of 25 kW to 50 kW. As of March 2015, the NY Commission is now taking up the issue of interconnection reform as part of its larger Reforming Energy Vision proceeding, in which IREC is actively involved.

### ***North Carolina Interconnection***

On the heels of the FERC's update of the SGIP, IREC began exploring the possibility that North Carolina's interconnection rules, which are closely modeled on the previous SGIP, would be appropriate for an update. Early in 2014, IREC prepared a redline of North Carolina's current rules that includes the FERC changes that are relevant to distribution-level interconnections and that incorporate elements of IREC's model interconnection rules (i.e., increasing the Level 1 process to 25 kW from the current 10 kW). IREC has worked closely with local stakeholders, including solar developers and advocates that regularly work before the North Carolina Utilities Commission (NCUC) on behalf of those interests. IREC also participated in a meeting with the NCUC staff on February 26, who seemed relatively supportive of the concept and open to further discussions. In late March, the North Carolina Sustainable Energy Association (NCSEA) and IREC shared a copy of the redline version with Commission staff and the state's investor-owned utilities in order to start the consensus building process to re-opening the interconnection proceeding. IREC, NCSEA, Duke Energy and Dominion all participated in a conference call to discuss moving forward with the docket and to identify the preferred procedural timeframe and path forward. In April, the NCUC reopened the interconnection rulemaking docket, upon receiving a petition from NCSEA, along with the redline prepared by IREC. In early June, IREC facilitated a workshop in an effort to bring utilities, the solar industry and other stakeholders to consensus on the proposed reforms. After the workshop, IREC continued to coordinate with local stakeholders and provide further information as needed, including drafting a model pre-application form for use by the NC utilities. On July 31, IREC attended a second workshop with interested stakeholders to discuss a redlined tariff (red-lined by both IREC and the utilities), and points of consensus and disagreement. **While this proceeding has not yet come to a conclusion, IREC expects this effort to result in several positive changes to North**



**Carolina’s interconnection procedures, making them more efficient and cost-effective for applicants.**

***Ohio Interconnection***

**On December 4, 2013, the Public Utilities Commission of Ohio (PUCO) issued an order adopting substantial changes to that state's interconnection procedures, citing heavily to IREC's participation and adopting several key recommendations.** IREC first became involved in Ohio in November 2012, offering suggestions for substantive modifications to the Staff's proposed interconnection rules. IREC worked closely to assist Staff in understanding IREC's proposals, which also tracked closely with the contemporaneous proposed changes being considered by FERC in its notice of proposed rulemaking to reform the SGIP. The interconnection standards adopted by the PUCO represent best practices, and have provided a helpful example to other states considering modifications to their own interconnection standards to more closely match the FERC's recently adopted changes to the SGIP. The Ohio order made the following key changes:

- Increased the capacity threshold for simplified Level 1 interconnection review from 10 kilowatts (kW) to 25 kW for inverter-based systems and reduced the initial review time from 1 month to 15 business days;
- Adopted flexible size eligibility requirements for Level 2 “Fast Track” interconnection review that expands beyond the current two-megawatt limit, depending on proximity of a generator to a substation and line voltage levels;
- Implemented a uniform, well-defined supplemental review process for applications that fail one or more initial review Fast Track screens, but that do not impose challenges significant enough to warrant a more extensive study process;
- Adopted the emerging best practice of using 100% of minimum load as a penetration screen in the supplemental review process; and
- Required utilities to provide interested customers with a pre-application report, for a \$300 flat fee, to help identify areas on the grid that will accommodate distributed generation.

***Washington Interconnection***

In July 2013, the Washington Utilities and Transportation Commission (UTC) issued a final order approving significant revisions to the state’s interconnection rules. The order reflects many of the recommendations that IREC provided to the UTC during reform efforts on the topic. These efforts began in 2011 with the submission of comments suggesting an overhaul to the state's interconnection procedures to make them more consistent with neighboring states as well as the mainstream structure employed in the FERC SGIP. This order adopted a three-tier review structure and objective technical screens for expedited review of interconnection requests (similar to the SGIP), a prohibition against an external disconnect switch requirement for Tier 1 systems (inverter-based systems 25 kW or less), and a definition of “interconnection customer” that clarifies that NEM systems can be owned by a third-party. Additionally, the UTC answered the request made by IREC during a June 2013 hearing to consider whether third-party owned systems are allowed to operate in Washington free of UTC regulation. The UTC’s order indicates that a separate ruling would be forthcoming to interpret state law to determine whether or not the UTC has any legal authority to regulate third-party owners, which was issued in July 2014. In an Interpretive Statement, the UTC indicated that it likely would assert at least limited jurisdiction over third-party owners of rooftop systems who contract with ordinary homeowners,

at least in the near term, until the legislature directs otherwise or the UTC issues a rulemaking docket to consider the matter further.

### **National - *Interconnection Model Rules***

After finishing a first draft of a revision to its Model Interconnection Procedures in December 2012 and conducting an internal review of the procedures in January 2013, IREC vetted a revised draft with a broader group of stakeholders in February. IREC published the updated Model in April 2013. The revised Model Procedures incorporated new concepts and experience gained from interconnection reform in California, Hawaii and Massachusetts, at FERC, and elsewhere. Revisions to the rules include a more robust and transparent supplemental review process, a pre-application report, a more appropriate size eligibility matrix for Level 2, certain updated Level 1 and 2 screens, and the elimination of the Feasibility Study, among other changes.

## **TASK 4: ENERGY STORAGE**

### **California Energy Storage**

On February 13, 2013 the CPUC directed SCE to procure at least 50 MW of energy storage as part of its long-term plan to meet electricity demand in the western Los Angeles area. The energy storage mandate, approved unanimously by the five Commissioners, is part of a larger ruling allowing SCE to contract for 1400 to 1800 MW of new resources to meet local capacity needs. Of the first 1400 MW of energy capacity that SCE purchases, 50 MW must come from storage and 150 MW must come from “preferred resources” such as energy efficiency, demand response, and renewable power sources. Any energy procured beyond the first 1400 MW must also be from energy storage or preferred resources. SCE must comply with the CPUC’s Order by 2021. **IREC has spent the past year working with the CPUC and other stakeholders to deploy energy storage technologies in California. The need for the new generation capacity is driven by constraints on the transmission system and by new environmental regulations that prevent negative thermal impacts on ocean habitats.** The CPUC anticipates a number of power plants will either close or repurpose in response to the regulations, causing the need for new resources in SCE’s service territory.

### **California Energy Storage Goal**

On October 21, 2013, the CPUC adopted a groundbreaking decision, adopting the nation's first ever electricity storage portfolio requirement that would be applicable to regulated electric utilities. The decision established a target of 1,325 MW of energy storage to be procured by the Commission's jurisdictional utilities by 2020, with installations required no later than the end of 2024. **IREC actively supported the CPUC's adoption of this decision, while offering constructive recommendations for how the proposed decision could be enhanced to facilitate the achievement of the Commission's stated "goal of market transformation," to assist in the elimination of some of the perceived barriers to the effective and cost-effective deployment of energy storage systems, and to help to achieve Governor Brown’s 12,000 MW goal for distributed generation in a cost effective manner.** The targets adopted in this decision will significantly buttress the policies of the State of California that favor a continuing and growing deployment of renewable resources, in particular on the distribution side of the

electric system, and that will require a continuing reduction in the emissions of greenhouses gases in the state over the longer term.

### ***California Net Metering With Energy Storage***

On May 15, 2014, the CPUC issued a final decision to extend the interconnection cost waiver to joint renewable plus storage NEM systems. This decision came after an Assigned Commissioner's Ruling (ACR) requesting comments and a proposed decision to extend the cost waiver. The decision clarifies that NEM systems with storage are eligible for the waiver, but it also puts in place some sizing and metering restrictions to ensure the systems do not abuse the NEM program. IREC responded to the ACR and the follow-up ACR that recommended extending the cost waiver for at least a two-year period. IREC proposed an approach to limiting the size of the storage systems in order to preserve the integrity of NEM (to prevent systems from storing brown power) that the decision adopted. The systems would be limited relative to NEM-generators based on the amount of energy stored in the battery relative to the daily peak output NEM-generator. IREC believes that the decision provides a reasonable path forward to allow early expansion of customer-sited storage and will allow the state to gather information on the costs and benefits of these systems.

### **Hawaii Reliability Standards Working Group (RSWG)**

In January 2013, IREC achieved a successful conclusion to its efforts participating in the Hawaii Public Utilities Commission's RSWG. IREC had spent the previous year addressing the technical challenges and policy strategies to accommodate a higher penetration of renewable resources in Hawaii. Those efforts included work in three RSWG sub-groups: the photovoltaics sub-group, the reliability definitions and metrics sub-group, and the reliability standards drafting sub-group.

**At the conclusion of the RSWG, IREC achieved the unanimous approval of three photovoltaics sub-group work products, including revised Rule 14H interconnection procedures, a proactive distribution planning approach, and an interconnection queue proposal. IREC also achieved consensus on the sub-group's 25-page Final Report, which summarized the three work products and included a recommendation for the Commission to adopt and implement the provisions in a subsequent proceeding. Further, IREC assisted in drafting a sub-group analysis of the usefulness of a GE study on renewable integration in Hawaii.** Specifically, the GE study considers the existing and needed ancillary services, including energy storage, to accommodate high penetrations of renewable energy. IREC also helped achieve the approval of a final revision to a reliability standard, one of ten approved in the proceeding. These standards, which are similar to NERC standards on the mainland, will be a step forward in creating objective reliability benchmarks for the Hawaiian Electric Company (HECO) companies' grids.

### ***Hawaii Distribution System Planning***

Following up on late October, 2013 meetings in Honolulu with the PUC and HECO, IREC submitted a proposed schedule to the PUC to convene workshops to establish proactive distribution system planning and rate structures to accommodate the extremely high demand for solar energy in the state. Given the state's high rates due to its reliance on diesel-fired generation, solar energy is cost-effective for the residential sector without subsidies, and even

more attractive given existing federal and state incentives. The pace of installations has led to more than 20% of circuits being deemed “closed” because rated capacity of solar generation on the circuit exceeds daytime minimum load, and many more are likely to close in the coming year. System upgrades, demand response, battery storage and curtailment are all options that are likely to be considered to allow greater solar PV penetration. Fortunately, thanks to collaborative efforts with Sandia, NREL, and Solar City, HECO recently issued a proposal to the commission to overcome the closed circuit challenge. Outside of this effort, with additional funding support, IREC continues to engage on this issue, developing a valuation methodology for solar+storage, which we anticipate will provide an important tool in the toolkit for the Hawaii solar market.

### ***Massachusetts Grid Modernization***

On June 12, 2014, the Massachusetts DPU issued Order 12-76-B, which finalized its mandate to the Massachusetts utilities to develop 10-year grid modernization plans (GMPs), which must include short-term investment plan (STIP) addressing incremental grid modernization capital expenditures over the next five years, including investments in achieving advanced metering functionality. IREC was involved in this docket for more than a year, providing input to the DPU regarding the components of the GMPs and the goals for grid modernization in the state, including in particular the integration of solar and other distributed energy resources (DER), such as energy storage. **In Order 12-76-B, the DPU incorporated several changes suggested by IREC into its grid modernization vision.** For example, the DPU required the utilities to work with the Department of Energy Resources (DOER) to explore distribution grid mapping and integrated planning, in direct response to recommendations from IREC, which the DOER echoed. In addition, in response to comments from IREC and several others, the DPU acknowledged that it needed to provide more guidance to utilities in developing their GMPs than it provided in its initial straw proposal. Specifically the DPU expects to provide guidance with respect to showing a business case for grid modernization investments, including exploring the benefits and costs that should be considered.

### ***New York Reforming the Energy Vision (REV)***

In late April 2014, the NY PSC initiated an expansive grid modernization proceeding (known as the “Reforming Energy Vision,” or REV) in which IREC has been actively involved. On July 18, 2014, IREC filed two sets of comments, focusing on integrating distributed energy resources into the grid and the distribution planning process, as well as improved consumer engagement and laying out our higher-level vision of the grid and utility of the future. Our Track 2 comments were more detailed and focused on the tools available to implement the REV proposal, including ratemaking and rate design. IREC has also continued to coordinate with local stakeholders in this docket via weekly calls. On August 22, 2015 the New York Public Service Commission (PSC) released an updated Track 1 straw model, which calls out several of the issues IREC raised in our comments. We anticipate that Track 2 will provide more opportunity for expanded engagement.

### ***Oregon Energy Storage Workshop***

On March 19, 2014, IREC participated in an all-day energy storage workshop in Portland sponsored by the Oregon Department of Energy and the Oregon PUC. The meeting inaugurated the state’s efforts to evaluate costs and benefits of energy storage technologies and to determine how the state could best begin to incorporate storage into its grid planning efforts. The policy

leaders at the conference clearly stated the state's commitment to reduce greenhouse gas (GHG) emissions from the electric power sector, and they were enthusiastic about the ability of storage to help protect against the greatest vulnerabilities of a power system relying on increased amounts of variable resources in a cost-effective manner. There was clear recognition that currently there are unwarranted barriers to the deployment of energy storage that can be removed through "collective action." This workshop was the state's attempt to identify what it could do to help move such collective action forward.

## **TASK 5: TRANSMISSION**

### **General Background on Transmission and Solar**

As the market penetration of renewable resources (including solar) has increased in recent years, new challenges have emerged on the bulk transmission system. For example, increased operational flexibility will be needed to address intermittency and meet ramping needs (e.g. the California ISO "duck curve").<sup>5</sup> Additionally, transmission build-out will also be needed to deliver low-cost utility-scale solar resources to load. Moreover, new planning approaches must be developed to capture the effects of demand-side resources (e.g. rooftop solar PV) on the transmission system. And finally, the displacement of thermal resources by wind and solar may reduce system inertia with implications for reliability.

These challenges and others could increase the overall cost of adding solar to the grid or otherwise constrain future deployment. Solutions are required in order for solar deployment to continue at a pace consistent with the DOE SunShot's objectives. Fortunately, many of these issues can be addressed in whole or in part through better regional coordination of transmission planning and operations. Better planning and operation of the transmission system will provide many benefits for solar integration. More specifically, it will enable the delivery of least-cost solar resources to load; create geographic diversity that helps mitigate variability of wind and solar resources; and provide additional operational flexibility to facilitate the integration of variable resources.

The Kris Mayes Law Firm (KMLF), on behalf of IREC, has advanced the ability to integrate solar into the Western grid by improving transmission planning and operations through several key venues and initiatives. Below we briefly describe our activities in these areas.

#### **1) WestConnect and FERC Order 1000**

##### *Background*

For many years, the Western Interconnection has lacked the robust regional transmission planning processes that are necessary to support high penetration of renewable energy. FERC has attempted to address this problem through its issuance of FERC Order No. 1000. Order 1000 requires transmission owners to develop regional planning processes that identify the most efficient and cost-effective transmission solutions to meet reliability, economic, and public policy needs. These public policy requirements could include renewable portfolio standards, emissions standards or other requirements that lead to additional renewable energy. Thus Order 1000 will help to ensure that the transmission system is built to support delivery of renewable

---

<sup>5</sup> See [http://www.caiso.com/documents/flexibleresourceshelfrenewables\\_fastfacts.pdf](http://www.caiso.com/documents/flexibleresourceshelfrenewables_fastfacts.pdf)

energy (including solar). Order 1000 also has provisions to incorporate non-transmission alternatives (“NTAs”, e.g. distributed generation) into the planning process. Four regions in West have emerged to comply with Order: WestConnect, Columbia Grid, Northern Tier Transmission Group, and the California ISO.

### *IREC's Contribution*

On behalf of IREC, KMLF worked to promote and improve the development of the Order 1000 planning process across the West, but primarily in WestConnect where high solar penetration is anticipated.<sup>6</sup> We actively participated in monthly WestConnect meetings and weekly Order 1000 Transition Task Force meetings to help develop WestConnect’s new policies and procedures for transmission planning under Order 1000. We also submitted formal comments to FERC on WestConnect’s Order 1000 compliance filings and comments directly to WestConnect on its tariffs and business practice manuals. Throughout these activities, we focused on ensuring that WestConnect’s planning process is well suited to accommodate higher amounts of renewable energy. Some overarching issues that we consistently took positions on include following:

- Development of a process that is truly regional and well coordinated with rest of WECC,
- Openness and transparency to stakeholder groups,
- Development of a tariff, business practice manual, and planning procedures that will adequately study high penetrations or renewable energy and offer fair treatment of NTAs,
- Fairness for competitive merchant providers to provide cost-effective interstate transmission, and
- Consistent forward progress on establishing the planning processes.

## **2) Western Electric Coordinating Council (WECC)’s Transmission Expansion Planning and Policy Committee (TEPPC)**

### *Background*

WECC’s TEPPC develops and maintains the data and models that underpin most transmission planning efforts in West. Thus the assumptions that go into developing these data and models are critically important for ensuring that transmission planners anticipate an appropriate level of renewable resources. Many of data and models were created through the development of TEPPC’s 10-year and 20-year transmission plan. Some major products that emerged from these efforts include:

- A common case set of transmission expansions that are expected in the next 10 years,
- Load and resource assumptions for each load serving entity,
- A 10-year production cost model to identify optimal power flows,
- A 20-year capital expansion model to identify optimal new generation and transmission expansions, and
- Environmental data for optimizing line siting.

The first 20-year WECC transmission plan was completed in 2013 and provided a wealth of information about how the transmission system could be planned and operated to accommodate different scenarios, including those with increased amounts of renewable energy.

---

<sup>6</sup> WestConnect covers areas in states that include Arizona, California, Colorado, New Mexico, and Nevada.

### *IREC's Contribution*

On behalf of IREC, KMLF was an active participant in quarterly meetings and periodic conference calls that were part of TEPPC's effort to develop 10-year and 20-year transmission plans for the Western Interconnection. We also worked with regional transmission planning groups (e.g. WestConnect) to develop specific study efforts to be included as part of WECC's 2014 planning activities. One study we requested was a comparison of high-DG and high utility-scale solar. Another focused on evaluating a high amount of solar resources developed in the Desert Southwest for export to California. We provided input to the discussions around the appropriate assumptions for the capital costs of solar resources, as well as forecasts for the penetration of distributed resources. We also reviewed and provided extensive comments on the 2013 transmission plan, and its treatment of solar resources (particularly distributed PV). During WECC's recent reorganization and bifurcation, KMLF also provided support for the continuation of TEPPC's efforts within the new organization. We provided support to ongoing data quality and modeling issues related to load and resources. And finally, we worked to ensure a productive interaction between WECC and regional transmission planning groups.

### **3) California ISO, Energy Imbalance Market**

#### *Background*

One of the most significant recent developments in the Western Interconnection is the imminent creation of an Energy Imbalance Market. In most parts of the West, electric generation is scheduled and energy is traded on an hourly basis. Utilities generally predict how much energy they will need ahead of time and make sure they have enough generation online each hour to meet demand. However, at any given moment, there may be slightly more or less demand than what was predicted for that hour — this is called an "energy imbalance." Each utility must find a way to correct this imbalance in real time, typically by procuring additional reserve generation capacity. Procuring reserves can be costly though, particularly if the reserve options are limited to a small local area. Moreover, as the penetration of variable energy resources (e.g. solar) increases, the ability to manage imbalances will become more challenging to do at a low cost. However, an Energy Imbalance Market (EIM) can help provide lower-cost integration of renewable energy. At its core, an EIM is a market mechanism for settling energy imbalances across a broad geographic area. Generators can choose to bid a portion of their dispatch-able resources into the market. The EIM market operator automates and coordinates the dispatch of these resources in real-time – a process currently performed manually by grid operators. This automation helps find the most efficient and cost-effective way to correct the imbalance. The EIM corrects imbalances over short intervals, but participating entities are still responsible for meeting overall load requirements. Several studies have calculated the potential cost savings to ratepayers from implementing an EIM. Additionally, it's anticipated that an EIM could provide certain reliability benefits; however these benefits are more difficult to quantify.

This real-time correction of energy imbalances will enhance the ability to integrate variable energy resources (such as solar) into the bulk electric system. By providing more flexible operation of the grid, the EIM will help to manage the variability and uncertainty associated with additional variable energy resources such as wind and solar.

### *IREC's Contribution*

On behalf of IREC, KMLF helped to advance the development of the EIM in the West through several parallel efforts. First, we participated in the PUC-EIM meetings that took place periodically over the last several years. We also met directly with PUC commissioners, and other stakeholders, in several states to educate them about the EIM's development and encourage them to take action in support of the EIM. KMLF also participated in the creation of the California ISO's Transitional Governance Committee, which was set up to establish the governance of the CAISO's EIM. Finally, we provided formal comments on EIM to the Arizona Corporation Commission as part of several proceedings including the Biennial Transmission Assessment and investigation into retail competition.

### **4) Other Transmission Planning Issues**

In addition to the primary efforts identified above, we also participated in handful of other venues to promote the integration of solar into the planning of the transmission system. For example, as part of the Southwest Area Transmission group (SWAT), we initiated and chaired the California interface group as an effort to promote more interregional coordination on transmission planning between California and the desert southwest in anticipation of high levels of solar energy developed in the southwest for export to California. We also participated in a SWAT-led initiative to study coal retirements in the desert southwest and the implications of replacing these resources with wind and solar. We submitted formal comments as part of the California ISO's transmission planning process in support of proposed interregional transmission projects and better coordination of regional planning efforts. And finally, we submitted formal comments to the Arizona Corporation Commission as part of their Biennial Transmission Assessment and the Integrated Resource Planning process to encourage more renewable energy-related transmission projects.

### **Key Findings**

To reduce the costs of integrating solar energy resources into the bulk electric system, there is an ongoing need for participation and consistent input to the transmission planning processes. No single technology or innovation is likely able to displace this requirement for continued and coordinated planning efforts across the interconnection. **IREC's diligent and persistent participation in the planning processes in the West have yielded tremendous dividends for renewable energy integration.** However, there remains a strong need to support stakeholder engagement in these efforts.

## **TASK 6: OUTREACH AND STAKEHOLDER COORDINATION**

As part of IREC's national outreach and engagement efforts, IREC developed the following publications:

### ***Model Interconnection Procedures (April 2013)***

First developed in 2005 and updated in 2009, the 2013 edition of IREC's Model Interconnection Procedures synthesizes a number of best practices in the evolution of safe and reliable connecting of renewable energy systems to the utility grid.



***Model Rules for Shared Renewable Energy Programs (June 2013)***

Revised in collaboration with The Vote Solar Initiative, these model rules were updated in 2013 to assist stakeholders in developing shared renewables programs that broaden renewable energy access to more consumers.

***Deploying Distributed Energy Storage: Near-Term Regulatory Considerations to Maximize Benefits (February 2015)***

Since the market for distributed energy storage is still in its infancy, there is a significant need for regulatory guidance and proactive policies to ensure a smooth integration into the existing electrical system. In this report, IREC offers independent insight on how to address these new challenges – and opportunities – in the regulatory arena.

***Blueprint for the Development of Distributed Generation in California (February 2013)***

On February 21, 2013, IREC published a *Blueprint for the Development of Distributed Generation California*, with recommendations designed to help the state capture the greatest range of benefits from its continued support of DG in coming years. The Blueprint highlights that in order to fully unlock the potential of DG in California, policy efforts need to be integrated across a number of areas that are often regulated independently. In the area of procurement, the recommendations focus on strategies to continue to allow customers to self-supply their energy needs through net energy metering, while broadening the scope of DG programs so more customers are able to support and benefit from renewable energy investments. On the wholesale side, the recommendations concentrate on how to refine procurement programs in a manner that directs projects to locations that offer the greatest system benefits. The state has not always been proactive about providing signals to developers about the importance of siting in the most high-value locations. IREC's recommendations seek to provide feasible methods for achieving this. Building upon these procurement program changes, the blueprint addresses aspects of transmission and distribution system planning that can be improved to better integrate DG that is wisely sited, thereby preventing unnecessary and duplicative infrastructure investments. Finally, the blueprint addresses changes to the permitting and interconnection process that will facilitate efficient DG development in the state as higher-penetrations of DG are realized.

***Integrated Distribution Planning (May 2013)***

IREC and Sandia National Laboratories co-published a concept paper that IREC had drafted on an approach to proactive planning for growth in distributed generation, called Integrated Distribution Planning (IDP). IDP is a new interconnection and distribution-planning concept drawn from a variety of on-going utility and state efforts in different parts of the country. These efforts look to proactively plan distribution systems to accommodate DG before interconnection screens are applied, allowing projects to interconnect more efficiently and with greater cost certainty. Generally, IDP proceeds in two steps by (1) determining the ability of distribution circuits to host DG and (2) identifying additional infrastructure that may be necessary to accommodate the anticipated growth. The results of IDP inform the processing of subsequent interconnection requests by determining in advance the level of penetration that can be accommodated without impacts. For higher penetration levels, IDP will give a utility foreknowledge of the upgrades that may be required to ensure maintenance of safety, reliability and power quality standards. The paper discusses proactive planning efforts that are being contemplated or implemented in utilities across the United States and discusses the ways in

which IDP increases the efficiency and cost-effectiveness of interconnecting DG at high penetrations while maintaining the safety, reliability and power quality of utility distribution systems.

***Unlocking DG Value: A PURPA-based Approach to Promoting DG Growth (May 2013)***

IREC released a concept paper that considers states' ability to expand options for DG technologies. The paper explores benefits that can be quantified and incorporated into the development of PURPA-based avoided cost rates. A comprehensive PURPA-based approach to DG policy design would incorporate many as-yet-unquantified benefits of exports to the distribution system, including line-loss avoidance; the ability to make smaller capacity additions that more closely follow incremental load changes; the deferral or avoidance of utility capital expenditures; and the environmental benefits of displacing fossil-based resources. This paper describes several recent FERC decisions that have provided the needed justification to value the benefits of DG facilities and it discusses the advantages and disadvantages of such an approach. The paper concludes that several considerations may need to be addressed before PURPA could become a viable option for promoting DG growth in many states.

***A Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation (October 2013)***

This publication offers lessons learned from 16 regional and utility-specific DSG studies summarized in a recent review by the Rocky Mountain Institute (RMI), and then proposes a standardized valuation methodology for public utility commissions to consider implementing in future studies. This report suggests standardized approaches for the various benefits and costs, and explains how to calculate them regardless of the structure of the program or rate in which this valuation is used. IREC has subsequently cited this report and entered it into the record in many benefit cost proceedings around the country.

***IREC Solar Market Trends Reports (2011-2013 editions)***

IREC's Solar Market Trends annual report provides public data on U.S. solar installations by technology, state and solar market sectors. It offers insight on the major factors affecting the solar market, such as photovoltaic prices, strong consumer demand, available financing, renewable portfolio standards in some states, and financial incentives from the federal government, states and utilities. The report also includes ranking of Top 10 States in several categories. SunShot provided funding to continue this important report for the past three years.

***Connecting to the Grid Newsletter***

This free, monthly newsletter provided federal, state and local policy updates, capturing emerging regional trends in net metering, interconnection, shared solar, energy storage, transmission and related topics. The *Connecting to the Grid Newsletter* provided an original, timely focus article each month, as well as regulatory updates and links to news stories from other sources. The newsletter has a subscription base of around 4,000 readers, primarily composed of solar and renewable energy industry members and regulatory and legislative policymakers. All newsletters are available on the IREC site.

## Outreach

In addition to the reports mentioned above, IREC engaged in many other outreach efforts over the course of this contract, including the following.

In 2012, IREC:

- Replied to an information request from the Virginia House Commerce and Labor Committee, regarding a net metering cost-benefit assessment from the state's Corporation Commission Staff;
- Attended and presented at a Brookings Institute event in Washington D.C., on Distributed Power Systems' Role in the U.S. Power Sector;
- Met with a SEPA representative regarding a partnership with IREC on utility solar integration issues;
- Presented on best practices in assessing the rate impacts of net energy metering based on the Solar America Board for Codes and Standards report titled *A Generalized Approach to Assessing the Rate Impacts of Net Energy Metering*, attended by over 250 people;
- Attended the SEPA Utility Solar Conference in Tucson, Arizona and participated in a policy panel discussion with members of SEPA, RMI, SDG&E, and the Arizona Residential Utility Consumer's Office to address the topic of the future of DG;
- Attended the Sandia National Laboratory's Variable Wind Integration Group meeting in San Diego, California and gave a presentation on recent updates to interconnection procedures for DG;
- Presented at a SDG&E stakeholder meeting on best practices in methodologies for assessing the rate impacts of NEM;
- Presented in Memphis, TN, for a TVA Solar Solutions conference on community solar;
- Presented in Burlingame, CA, for the Solar Instructor Training Network;
- Presented on community solar issues in Portland, OR at the Future Energy Conference;
- Participated in an IREC "Google hangout" discussion in celebration of Earth Day;
- Traveled to the World Renewable Energy Forum in Denver, Colorado in May 2012, presenting a paper on community solar and holding several community solar-focused side meetings at the conference;
- Prepared a memo on installer certification requirements across the country at the request of ELPC, which was filed with the ICC;
- Responded to an interview request with the *Wall Street Journal* concerning the growth of community solar programs in the U.S.;
- Attended an IEEE 1547.8 meeting in San Francisco on Aug. 23-24, 2012;
- Gave a webinar presentation on IREC's Solar Market Trends Report attended by 200 people;
- Hosted IREC's Annual Meeting in Orlando, Florida, attended by 80 people including local government officials, industry and utility representatives;
- Presented on Community Solar at SPI;
- Presented on interconnection reform at a workshop that was co-hosted by the Electric Power Research Institute, Sandia, and the NREL;
- Participated in a debate regarding NEM at the GreenTech Media Solar Insights Conference in San Francisco, CA;

- Presented on net metering at the Energy Symposium at the University of San Diego, alongside California Energy Commission and CPUC presenters; and
- Presented on the status of net metering across the country at a MADRI workshop in Washington, DC on December 13, 2012. MADRI membership includes the state utility commissions of Delaware, District of Columbia, Maryland, New Jersey and Pennsylvania, along with the U.S. DOE, U.S. Environmental Protection Agency, FERC and the PJM Interconnection.

In 2013, IREC:

- Presented on interconnection reform at PV America East, in Philadelphia, PA;
- Participated on a net metering panel at the Winter Meeting of the National Association of Regulatory Utility Commissioners (NARUC);
- Presented at the Living Future Conference in Seattle, WA;
- Presented on cost/benefit analysis of net-metered solar energy at the NREL “Soft Costs” workshop;
- Presented at a Utility Wind Integration Group meeting in Denver, CO;
- Presented on net metering at the Arizona Residential Utility Consumer’s Office (RUCO) workshop in Phoenix, AZ;
- Gave a presentation on Solar Market Trends in a State of the Markets Session at Renewable Energy Markets Conference in Austin, Texas;
- Responded to a number of information requests including those from the U.S. Energy Information Administration, Navigant Research, Environment & Energy Publishing and The Solar Foundation, the Electric Power Research Institute, enerG Magazine and the JOBS Project, regarding the Solar Market Trends Report;
- Participated in meetings in Colorado, first at NREL in Golden, regarding alternative business models to accommodate high penetration of distributed solar generation, and then at the summer committee meetings of NARUC in Denver, CO;
- Joined a California Inverter Task Force on Effective Grounding (ITFEG) to address a Temporary Overvoltage concern;
- Participated in the NEM and Interconnection working group, an informal stakeholder process facilitated by New Jersey’s BPU to discuss net metering issues related to hybrid solar photovoltaic/combined heat and power systems and systems paired with energy storage;
- Attended Solar Power International in Chicago and presented during IREC’s 3i Forum, on topics including net metering, shared solar, distribution planning, interconnection and solar trends data;
- Presented on net metering at three meetings: the Sierra Club meeting, the Northwest Energy Coalition conference in Seattle, and the EUCI “Utility Solar Rates” conference in Denver;
- Included a Regulatory Efforts section in its annual *Updates and Trends* publication, which detailed many of the efforts covered by this SunShot award; and
- Engaged in several technical assistance efforts including the following:
  - An IEEE 1547 Standards meeting in New Brunswick, NJ;

- A New Jersey BPU conference call regarding the state's Renewable Energy /Non-Renewable and Fuel Cell and Energy Storage Interconnection working group meeting;
- A conference call on the California Rule 21 Smart Inverter working group;
- A Northwest Solar Communities kickoff meeting in Olympia, WA;
- Conference calls with the Industrial Task Force on Effective Grounding, a group formed by inverter manufactures that have recognized that the utilities have different requirements on what is 'effective grounding.

In 2014, IREC:

- Provided information on interconnection, permitting and inspection for the University of Maryland, in conjunction with the Maryland Energy Administration's Smart Energy Communities initiative as well as a Senior Commission Advisor with the Maryland Public Service Commission;
- Participated in a panel discussion on regulatory constraints to continued transformation in the energy sector as part of Infocast's Power Industry Transformation Summit 2014 in San Francisco, CA;
- Participated in a webinar with the National Association of Utility Consumer Advocates (NASUCA) Distributed Energy Resources (DER) Committee to provide an overview of IREC's regulatory work, to introduce the resources we have available for stakeholders and to provide a deeper dive on NEM and DG valuation;
- Participated in the Solar Access to Public Capital Workshop in New York City, NY;
- Delivered a presentation at the Northwest Solar Summit in Seattle, WA;
- Regarding the Annual Trends Report, responded to information requests from Ron Pernick of Clean Edge, Michael Coddington of the NREL and Jacob Levine, of Energy Analysis;
- Drafted an article on market trends for the July/August issue of the *Solar Today* magazine;
- Provided an update and overview of shared renewable energy movement in D.C. for an upcoming WAMU radio interview;
- Published and released its *U.S. Solar Market Trends 2013* report;
- Responded to several media and info requests regarding the US Solar Market Trends Report, including those from RENEW Wisconsin, Energy Magazine, the Los Angeles Times, Stanford University, Apparent, Inc., Vote Solar and Arizona State University;
- Included a Regulatory Efforts section in IREC's annual *Updates and Trends* publication, which detailed many of the efforts covered by this SunShot award;
- Provided training for the Pacific Northwest Solar Partnership in Redmond, Oregon. At a workshop, IREC (represented by Michael Sheehan) delivered four presentations on 1) the National Electric Code and Codes and Standards relating to Interconnecting Renewable Energy, 2) Voltage Management & Mitigation Strategies IEEE 1547.7, 3) Safety & Work Practices and 4) Interconnection Changes California Rule 21 Smart Inverter Working Group; Low/High Voltage Ride Through (LVRT) and Low/High Frequency Ride Through (FRT); IEEE changes; and

- Attended the 2014 SPI Conference in Las Vegas, Nevada and presented during IREC's 3i Forum, on topics including net metering, shared solar, distribution planning, and interconnection.

## **TASK 7: PROJECT MANAGEMENT AND REPORTING**

IREC team members engaged in regular reporting and management tasks, including: providing monthly reports regarding regulatory updates and plans; submitting quarterly reports; and participating in monthly IREC team calls and monthly communication calls. In addition to these regular activities, IREC also participated in DOE events and planning activities, including the following:

- January 10, 2012: members of the IREC team met for a post-award orientation teleconference to meet with DOE personnel and understand the structure of the team and reporting requirements.
- January 17, 2012: the IREC team and a DOE representative held a daylong SunShot planning meeting in Oakland, CA.
- June 13-14, 2012: IREC staff attended the SunShot Grand Challenge Summit and Technology program, where they presented a poster they had developed to highlight SunShot regulatory work under this award.
- May 19-21, 2014: IREC participated in the Department of Energy's SunShot Grand Challenge Summit to share successes, challenges and experience from our efforts.

In addition, IREC convened the Regulatory Advisory Board<sup>7</sup> on a quarterly basis to discuss SunShot activities in depth and to gain the Board's perspective on IREC's efforts. These meetings included the following topics:

- February 2012 - Discussion and Overview of SunShot
- April 2012 - Net Metering
- July 2012 - Shared Renewables/Community Solar
- October 2012 - Interconnection
- January 2013 - Integrated Distribution Planning Paper
- April 2013 - PURPA
- July 2013 - Shared Renewables Model Rules
- Nov 2013 - Costs and Benefits of Distributed Solar
- Feb 2014 - Energy Storage
- May 2014 - Transmission
- August 2014 - Summary of Activities and Next Steps

---

<sup>7</sup> See note 3 for list of Advisory Board members.

## PRODUCTS DEVELOPED:

### *Publications/Articles*

- *2011 U.S. Solar Market Trends Report and Summary*, August 2012, available at <http://www.irecusa.org/annual-u-s-solar-market-trends-report/>
- *2012 U.S. Solar Market Trends Report and Summary*, July 2013, available at <http://www.irecusa.org/annual-u-s-solar-market-trends-report/>
- *2013 U.S. Solar Market Trends Report and Summary*, July 2014, available at <http://www.irecusa.org/annual-u-s-solar-market-trends-report/>
- *Blueprint for the Development of Distributed Generation in California*, February 2013, available at [http://www.irecusa.org/wp-content/uploads/DGBlueprint\\_2.21.13\\_final.pdf](http://www.irecusa.org/wp-content/uploads/DGBlueprint_2.21.13_final.pdf)
- *Community Shared Solar: Diverse Approaches for a Common Goal*, December 2012, available at <http://www.irecusa.org/publications/>
- *Connecting to the Grid Newsletter*, October 2011 through August 2014, Vol. 14, No. 11 through Volume 17, No. 8, available at <http://www.irecusa.org/category/newsletters/connecting-to-the-grid-newsletter/>
- *Deploying Distributed Energy Storage: Near-Term Regulatory Considerations to Maximize Benefits*, February 2015, available at <http://www.irecusa.org/deploying-distributed-energy-storage/>
- *Integrated Distribution Planning Concept Paper: A Proactive Approach to Accommodating High Penetrations of DG Growth*, May 2013 (developed in conjunction with Sandia National Laboratories) available at: <http://www.irecusa.org/wp-content/uploads/2013/05/Integrated-Distribution-Planning-May-2013.pdf>
- *IREC Model Interconnection Procedures*, April 2013, available at <http://www.irecusa.org/wp-content/uploads/2013-IREC-Interconnection-Model-Procedures.pdf>
- *Location, Location, Location: How much does it matter for shared solar participants?*, January 2014, available at <http://www.irecusa.org/2014/01/location-location-location-how-much-does-it-matter-for-shared-solar-participants/>
- *Model Rules for Shared Renewable Energy Programs*, June 2013, available at <http://www.irecusa.org/wp-content/uploads/2013/06/IREC-Model-Rules-for-Shared-Renewable-Energy-Programs-2013.pdf>
- *Moving Forward: Trends Shaping a Clean Energy Nation*, December 2014, available at <http://www.irecusa.org/2014/12/moving-forward-regulatory-trends-shaping-a-clean-energy-nation/>
- *Regulator's Guidebook: Calculating the Benefits and Costs of Distributed Solar Generation*, October 2013, available at <http://www.irecusa.org/a-regulators-guidebook-calculating-the-benefits-and-costs-of-distributed-solar-generation/>
- *Regulatory Efforts*, *IREC's 2013 Annual Updates and Trends Report*, October 2013, available at <http://www.irecusa.org/wp-content/uploads/2013/10/IREC-Trends-Report-2013-Web-1.pdf>

- *Renewable Energy Regulation: Follow the Leader*, December 2013, available at <http://www.irecusa.org/2013/12/follow-the-leader/>
- *Shared Solar Financing Goes Local*, February 2014, available at <http://www.irecusa.org/2014/02/shared-solar-financing-goes-local/>
- *Trends Shaping our Clean Energy Future: The 2014 IREC Perspective*, October 2014, available at <http://www.irecusa.org/2014/10/trends-shaping-our-clean-energy-future-2014/>
- *Unlocking DG Value: A PURPA-based Approach to Promoting DG Growth*, May 2013, available at <http://www.irecusa.org/wp-content/uploads/2013/05/Unlocking-DG-Value.pdf>

### ***Presentations***

(Note: most presentations are available at <http://www.slideshare.net/janep512/>)

- *Foundational Policies for Unleashing Clean Energy Investment in Your State*, Sierra Club State Colloquium, Sonoma, CA, Dec. 9, 2011.
- *Financing Solar Energy – PPAs & the Morris Model*, Sierra Club State Colloquium, Sonoma, CA, Dec. 9, 2011.
- *SolarTech Solar Leadership Summit Policy Panel*, March 7, 2012.
- *IREC Proposed Work Plan for Ancillary Services*, presented to the Reliability Definitions, March 19, 2012.
- *DG Interconnection and IEEE 1547 Update*, presented to the Reliability Standards Working Group, March 20, 2012.
- *Best Practices in Assessing the Rate Impacts of Net Metering*, San Diego Gas & Electric Stakeholder Meeting, San Diego, CA, April 3, 2012.
- *Financing Solar Energy: PPAs Community Solar and the Morris Model*, Tennessee Valley Authority Solar Solutions Conference, Memphis, TN, April 10, 2012.
- *Driving Down BOS Costs: The Role of Policy* Tennessee Valley Authority Solar Solutions Conference, Memphis, TN, April 11, 2012.
- *Future of Distributed Generation*, SEPA Utility Conference, April 17, 2012.
- *IREC's Regulatory Efforts Under SunShot*, Solar Instructor Training Network Meeting, Burlingame, CA, April 24, 2012.
- *California Rule 21: Interconnection Reform Issues*, Sandia National Laboratory's Variable Wind Integration Group, April 24, 2012.
- *Community Shared Solar: Unleashing Solar in Oregon*, Future Energy Conference, Portland, OR, April 26, 2012.
- *Community Renewables: Where are we now?* World Renewable Energy Forum, Denver, CO, May 2012.
- *Credentialing*, Illinois Commerce Commission Workshop (via teleconference), June 28, 2012.
- *The Need for Data to Assess Rate Impacts of Net Metering*, Intersolar North America, July 11, 2012.
- *U.S. Solar Market Trends*, Larry Sherwood, IREC Webinar, September 5, 2012.
- *U.S. Solar Market Trends*, Larry Sherwood, IREC Annual Meeting, September 10, 2012.



- *Shooting for the Sun: The Role of Regulatory Policy*, IREC Annual Meeting, Orlando, FL, September 10, 2012.
- *Community-Shared Solar: Unleashing Solar in the US*, Solar Power International, Orlando, FL, September 13, 2012.
- *Achieving High Penetration PV: California PUC Rule 21 and Hawaii PUC Rule 14H*, EPRI Interconnection Workshop, Orlando, FL, September 14, 2012.
- *Interconnection Procedures Next Steps*, SolarTech Webinar, October 3, 2012.
- *Interconnection Queue Proposal*, Reliability Standards Working Group, Honolulu, HI, October 24, 2012.
- *Net Energy Metering Debate*, GreenTech Media Solar Insights Conference, San Francisco, CA, October 29, 2012.
- *Net Metering – Past, Present and Future*, University of San Diego Climate and Energy Symposium, November 9, 2012.
- *Community-Shared Solar: Success Stories*, ICLEI's Reducing Barriers to Solar for Local Governments 2012 Webinar Series, November 28, 2012. (This presentation was in collaboration with the SunShot Solar Outreach Partnership project and was not funded by IREC's regulatory SunShot agreement.)
- *Reliability Standards Working Group Solar PV Subgroup Substantive Recommendations*, Reliability Standards Working Group, Honolulu, HI, December 11, 2012.
- *Net Metering – Past, Present and Future*, MADRI Workshop, December 13, 2012.
- *Getting to Know the New California Rule 21*, SEIA webinar, December 13, 2012.
- *Integrated Distribution Planning: A Proactive Approach for Accommodating High Penetrations of Distributed Generation Resources*, IREC Regulatory Advisory Board Meeting, January 16, 2013.
- *Community-Shared Solar: A National Perspective*, Solar Power Colorado, February 5, 2013.
- *Net Metering –National Perspective*, NARUC, Washington D.C., February 5, 2013.
- *Using System Information to Improve Efficiency of the Interconnection Process*, PV America East, February 5, 2013.
- *Achieving High Penetrations of PV Through Interconnection Reform*, PV America East, February 6, 2013.
- *California: Proposed Distribution Group Study Tariffs*, Massachusetts' Distributed Generation Working Group, March 14, 2013.
- *Community Solar Programs in the United States*, Advancing Renewables in the Midwest Annual Conference, March 28, 2013.
- *Shared Solar Policy and Programs*, US DOE SunShot Team Meeting, Washington, DC, April 15, 2013.
- *Streamlining Processes – Applications, Interconnection and Permitting*, 2013 SEPA Utility Solar Conference, Portland, OR, April 17, 2013.
- *Shared Solar Policy and Reality*, American Solar Energy Society 2013 Solar Conference, Baltimore, MD, April 18, 2013.
- *The Costs and Benefits of Net Energy Metering*, American Solar Energy Society 2013 Solar Conference, Baltimore, MD, April 18, 2013.

- *U.S. Solar Market Trends*, American Solar Energy Society 2013 Solar Conference, Baltimore, MD, April 18, 2013.
- *Resiliency in the Electrical Grid: Is Your City's Electrical Grid Net-Zero Ready?* Living Future unConference, Seattle, WA, May 17, 2013.
- *FERC Notice of Proposed Rulemaking (NOPR) on Revised Small Generator Interconnection Procedure (SGIP)*, Utility Wind Integration Group, Denver CO, May 21, 2013.
- *IREC's Soft Cost Reduction Efforts*, NREL Soft Costs Workshop, Golden, CO, May 21, 2013.
- *Net Metering Across the U.S. and in Arizona*, Net Metering Workshop, Arizona Residential Utility Customer Office, Phoenix, AZ, May 29, 2013.
- *U.S. Solar Market Trends*, IREC webinar, June 4, 2013.
- *Net Metering Across the U.S. and in Hawaii*, Hawaii Public Utilities Commission, Honolulu, HI, June 18, 2013.
- *Model Rules For Shared Renewable Energy Programs*, IREC Webinar, June 26, 2013.
- *Shared Solar Programs: Opportunities and Challenges*, NREL Webinar, July 9, 2013.
- *Calculating the Costs and Benefits of Distributed Solar Generation*, IREC Webinar, September 4, 2013.
- *U.S. Solar Market Trends*, Renewable Energy Markets Conference, Austin, TX, September 24, 2013.
- *Embracing the Challenges and Opportunities: Interconnection for Wholesale DG, PV Insider Conference*, September 25, 2013.
- *Shared Solar Programs: An Overview*, SPI and DOE Shared Solar Workshop, October 21, 2013.
- *Net Metering: Status and Drivers*, Sierra Club Clean Energy Conference, Chicago, Illinois, October 22, 2013.
- *Future of Net Metering*, SPI (3i Forum), Chicago, IL, October 22, 23, 2013.
- *Improving Interconnection: Integrated Distribution Planning*, SPI (3i Forum), Chicago, IL, October 22, 23, 2014.
- *Interconnection Issues at Higher Penetrations*, SPI (3i Forum), Chicago, IL, October 22, 24, 2014.
- *IREC's Annual Solar Market Trends Report*, SPI (3i Forum), Chicago, IL, October 22, 23, 2014.
- *Shared Solar Programs: Growing the Market*, SPI (3i Forum), Chicago, IL, October 23, 24, 2014.
- *Net Metering Issues Panel*, Northwest Energy Coalition Conference, Seattle, WA, November 8, 2013.
- *Distributed Solar Drivers in the U.S.*, EUCI "Utility Solar Rates" Conference, Denver, CO, December 5, 2013.
- *Shared Solar Programs: An Overview*, SFRCC Compact Implementation Workshop, December 10, 2013.
- *Maintaining Distributed Solar Growth in the U.S.: Trends and Needed Reform*, Sierra Club Annual Colloquium, December 11, 2013.

- *Funding Options and Critical Attributes for Solar Gardens*, Sustainable Cities Exchange, January 14, 2014.
- *Valuing Net Metering Programs*, Nevada Committee on Energy, April 7, 2014.
- *Shared Solar: Creating Access and Advancing the Market*, Solar Powering Illinois, April 8, 2014.
- *Consumer Access to Renewable DG*, National Association of State Utility Consumer Advocates, DER Committee (via teleconference), April 10, 2014.
- *What it All Means – Solar Regulatory World 101*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.
- *What's Next in Interconnection*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.
- *6 Trends to Watch in 2015*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.
- *Fair Compensation for Distributed Solar Generation*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.
- *IREC's Annual Solar Market Trends Report*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.
- *Shared Solar: What's Working & What's Next*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.
- *Envisioning an Integrated Grid: Transforming Distribution System Planning*, SPI (3i Forum), Las Vegas, NV, October 20-23, 2014.