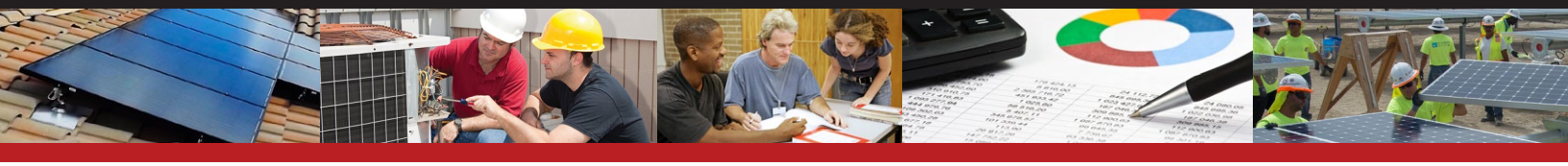
IREC
Interstate Renewable Energy Council Inc.

2013 Annual UPDATES & TRENDS Report

Shaping our future with clean energy



OCTOBER 2013 / CHICAGO

Annual UPDATES & TRENDS Report

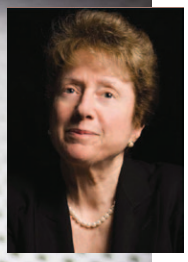
Shaping our future with clean energy

CONTENTS

ACKNOWLEDGMENT: This material is based upon work supported by various state and foundation grants and by the U.S. Department of Energy under Award Numbers DE-EE0005352, DE-EE0004093, and DE-EE004137.

Information for this report was compiled as of August 2013. Policies and programs may have changed since this document was published. Please check www.irecusa.org for updates.

Interstate Renewable Energy Council, Inc.
P.O. Box 1156
Latham, NY 12110-1156
www.irecusa.org



To assure balance in all of our activities, we draw on business associations, employers, educational institutions, the trades, and government agencies.

Jane Weissman

IREC Perspective

It has been a year of creative challenges inside and outside the Interstate Renewable Energy Council, Inc. (IREC). New policies, propelled by IREC's thought leadership, are gaining traction. Tried and true policies are being questioned. Reasonable balances are being sought. The call for a credentialed workforce is getting louder and the push for demonstrated competency and quality has taken hold.

Not that long ago, IREC's main issues were mostly invisible. Defining and tackling those hidden and stubborn barriers has always been our mode of operation. To move clean energy markets forward, we realize that friction-free, quick results are not always achievable. IREC's principled approach, however, generates objective, analytical, fact-based products that ultimately benefit industry, government decision makers, consumers, and the general population. Our collaborative style results in progress—not necessarily overnight progress, but progress nonetheless.

This report summarizes IREC's A-game. In it, our team of highly qualified, smart, and amazingly constructive professionals present a snapshot of our work over the past year. Our website provides deep dives into the issues highlighted in the following pages. A summary of many months of hard work, the report offers an expansive collection of updated models, new best practices, and higher-ground training standards.

IREC continues to promote shared renewables, a promising policy tool allowing multiple customers to share a single renewable energy facility. We recently updated model rules for shared programs, adding new information and an increased level of detail to help state and local stakeholders create programs that meet their particular needs.

IREC has noticeably advanced best practices in interconnection standards through our involvement in states like Hawaii, California, and Massachusetts. Through collaborative work in these states and an update of IREC's Model Interconnection Procedures, we provide pathways for efficiency, reduced costs, and increased certainty for distributed generation markets, while maintaining the safety, reliability, and power quality of the electric grid.

For the past nine years, IREC has been tracking solar market trends. The recent publication on 2012 installations reports that the capacity of distributed, grid-connected PV installed in 2012 increased by 36 percent compared with 2011. Nearly 95,000 distributed PV systems were installed in 2012. Residential installations grew by 61 percent. In some areas with the most distributed generation growth, applications to interconnect new distributed generation have overwhelmed utility processes, causing project delays and sometimes prohibitive costs. One of IREC's solutions is integrated distribution planning, which encourages proactive planning for distributed generation that anticipates upgrades to accommodate growth.

IREC has been supporting approaches to ensure efficient permitting practices are in place that benefit local code officials

IREC's unique credentialing program has been subtly and successfully closing the divide between energy efficiency and renewable energy.

and solar installers and result in safe installations. IREC publications that share effective approaches and best practices are augmented by workshops and direct technical assistance to local building officials. Added to these resources is the newly improved and easily accessible online PV training for code officials now available on the IREC website. This dynamic collection of guidance documents and instruction increases the reach and scale of assistance for code officials and authorities having jurisdiction.

Early in 2013, we decided that because IREC is one of the nation's leaders in building a quality, industry-ready workforce through the establishment and promotion of credentials, we wanted to "do what we say," and march to our own marching orders with our credentials and standards held high. So we set out to reach the highest level available for a standards development organization. The outcome is that IREC is now accredited by the American National Standards Institute (ANSI) as a developer of American national standards. We believe this is much more than an important step for IREC or even for the credibility of our standards. It's another sign that the bar is raised for the energy efficiency and renewable energy industry.

The corresponding side of standards development is the assessment schemes needed to determine compliance. This past year, the number of people with IREC credentials increased by almost 20 percent and shifted from 100 percent renewable energy credentials to roughly a quarter of credential holders now holding energy efficiency credentials. IREC's unique credentialing program has been subtly and successfully closing the divide between energy efficiency and renewable energy.

Our position as the national point of contact for educators and industry has produced a long list of innovative resources. The Solar Instructor Training Network Best Practices series offers a wealth of expert guidance highlighted recently with the release of the Photovoltaic Labs guide, which brings resourceful and affordable approaches to indoor and outdoor laboratory workstations.

Inside IREC, we've shaken things up by shifting IREC's organizational model and relationship with our thousands of supporters. We continue to run by our own rule of disciplined agility as we change with the times.

What hasn't changed is IREC's ongoing valued relationships with a full complement of industry representatives. To assure balance in all of our activities, we draw on business associations, employers, educational institutions, the trades, and government agencies. These experts are on our advisory boards, committees, and review panels, contributing to the development of our standards, publications, model rules, and best practices. Since the beginning of 2013, a working group of very smart and dedicated stakeholders have been hard at work painstakingly revising and improving IREC's standards for training providers and instructors. We are deeply grateful to all of the volunteers and partners who give us their time and expertise and who demand excellence and innovation from IREC.

Our work is made possible with funding from government agencies, foundations, corporate sponsorships, and individual donations. On behalf of IREC's Board of Directors, we deeply appreciate and are thankful for this generous support. We are held to our cultural practice of using the funds as efficiently as possible in order to maximize the positive impact we have on shaping our clean energy future.

Jane Weissman
President and Chief Executive Officer
October 2013

REGULATORY EFFORTS

Joseph Wiedman and Laurel Passera

What a difference a year makes! Over the course of the past year, we saw our fair share of challenges, yet we also saw tremendous growth and diversification in renewable energy markets across the country. As a result, we are looking at a profoundly different renewable energy landscape than we did last year at this time.

IREC's work on the regulatory and policy front has helped shape this landscape into a more sustainable setting for steady market growth. IREC accomplished this by removing barriers and helping guide policy development that expands consumers' access to safe, affordable, reliable renewable energy options. Our regulatory work may not make the hottest headlines, but it is essential to establishing fair, transparent, efficient rules for connecting renewables to the grid. The following recap provides highlights of IREC's successful track record over the past year.

NET METERING AND INTERCONNECTION — GROWING IN NEW DIRECTIONS

IREC has successfully advanced the national dialogue on net energy metering (NEM) and interconnection issues since 1994, facilitating the deployment of customer-friendly policies that encourage widespread investment in distributed renewable energy systems. Over the past year, IREC has continued to support the growth and development of these policies as they evolve to meet market demands and enable state energy goals. Our ultimate objective remains the same—provide the regulatory environment that allows more consumers to access and benefit from fair net metering.

Net Energy Metering

Despite many challenges, NEM programs across the country have gained momentum over the past year, enabling more consumers to access this important self-generation policy. This is clear from the numbers—between 2011 and 2012, the United States saw a 46 percent growth rate for NEM systems.[1] And over the past year, IREC engaged in NEM efforts in 13 states, in addition to the Mid-Atlantic Distributed Resources Initiative (MADRI).[2] IREC's work on NEM issues falls largely into three categories: improving the availability and effectiveness of NEM programs; engaging in debates that highlight the many benefits of distributed generation (DG) to the grid, utilities, and ratepayers; and continuing to provide outreach and technical assistance to a diverse array of market participants.

Despite many gains in recent years, states are still working to improve the availability and effectiveness of NEM to utility customers. This year, for example, IREC voiced support to increase NEM participation caps in New York from one to three percent of 2005 peak demand for five of the state's largest utilities, clearing the way for an additional 462 megawatts (MW) of DG deployment. IREC also participated in an Ohio proceeding supporting the implementation of virtual and aggregated net metering policies that expand the number of customers as well as the geographical boundaries of net metering. Additionally, IREC contributed to removing barriers to third-party ownership models, most notably clarifying that statutory definitions of "customer-generator" do not prohibit the practice in Washington State. This effort could greatly expand the accessibility of NEM in the state going forward.

Some of IREC's most significant efforts over the past year included deeper-level discussions on the costs and benefits of NEM policies and how they impact non-participating ratepayers. This work reflects a larger trend across the country as states begin to examine the broader effects of net metering. IREC has worked to ensure key benefits, such as line loss avoidance, grid support, and capacity benefits, are fully considered along with programmatic costs. IREC participated in these open dialogues in several key states, including Arizona, California, Colorado, and Nevada.

Over the past year, IREC has also continued its long tradition of education and outreach to support NEM efforts around the country. For instance, IREC has been participating in a Maryland Public Service Commission initiative to draft a net metering guidebook to educate Maryland consumers, and has proposed a similar effort in Illinois. IREC has also engaged in numerous outreach efforts with stakeholder groups, utility commissions, and others seeking assistance to help clarify the many benefits and advantages of net metering.

1 Ratemaking, Solar Value and Solar Net Energy Metering: A Primer. Solar Electric Power Association (Jul. 2013), available at http://www.solarelectricpower.org/media/349530/sepa-nem-report-0713-print.pdf.

2 CA, AZ, AR, CO, HI, IL, NJ, NV, MD, MA, NM, NY, and OH

Over the past year, IREC has been working to update key assumptions used in the first interconnection-wide transmission plan for the western grid.

Interconnection

The United States is experiencing a renewed interest in interconnection policies as progressive states realize the need to reform interconnection procedures to keep up with growing demands on utilities and the grid. Over the past year, IREC engaged in interconnection efforts in nine key states across the country.[3] Much of this work improves upon the best practices established in key states while designing procedures that can expedite the transition to higher penetrations of DG on the grid.

Following the successful outcome of IREC's groundbreaking work on interconnection reform in Hawaii in late 2011, IREC continued to support ongoing efforts in the state. Specifically, IREC participated in a working group process with stakeholders and Hawaii utilities to suggest revisions to the state's interconnection tariff, Rule 14H. IREC also collaborated on a proposal to allow all of Hawaii's distribution-level procurement programs to use Rule 14H. This proposal will help eliminate uncertainty regarding which queues, interconnection processes, interconnection agreements, and technical review analyses apply to which distribution-level programs in the state.

Last year, IREC also concluded the first phase of a highly successful effort in California in which the California Public Utilities Commission (CPUC) unanimously approved a settlement agreement to implement significant interconnection reform for the state's investor-owned utilities. The revised procedures dramatically improve the clarity of the supplemental review process by adding technical screens and including concrete timelines for application review. The procedures retain the ubiquitous 15 percent of peak load penetration screen in the initial fast track review process. Under the supplemental review, however, the utilities will apply an expanded 100 percent of minimum load threshold. This was a substantial change, one that will allow projects to move through the interconnection process in a more timely manner, without compromising grid safety, reliability, or power quality. IREC followed up on this work by participating in the second phase of interconnection reform and collaborating with utilities to clarify tariff language and further refine the process.

Additionally, IREC participated closely in Massachusetts' and Washington's processes for interconnection reform. We also intervened or provided technical assistance in a number of other states, including Wisconsin, New York, Maine, and Ohio.

IREC is helping to create policy examples for other states to replicate as they begin to find their interconnection procedures inadequate for a growing renewable energy demand. Significantly, IREC used its experience in these key states to update its *Model Interconnection Procedures*, which provide a best practices starting point for states to use in their interconnection reform processes.

Over the past year, IREC has also been engaged in a significant ongoing effort at the Federal Energy Regulatory Commission (FERC) to update federal rules for small generator interconnection procedures. Overdue for an update, these procedures are critically important, because they apply to interconnection applications across the country that fall under federal jurisdiction. Since 2005, when these procedures were implemented, the distributed generation market has grown 40-fold, and has changed considerably in complexity, technology mix, and siting considerations.

IREC has spent considerable time working with a spectrum of parties to build support for a FERC Notice of Proposed Rulemaking to negotiate changes that would improve the process and build broader support for these changes. IREC also played a very active role in the informal working group process organized by the Edison Electric Institute, coordinating work with industry groups, utilities, nonprofits, and national laboratories. Ultimately, we believe that these efforts significantly narrowed the areas of disagreement and resulted in broad support for pre-application report modifications and for changes to fast track eligibility. While this effort is still ongoing, we believe IREC's work in this process will lead to more streamlined and efficient federal procedures, which will save time and money throughout the interconnection process.

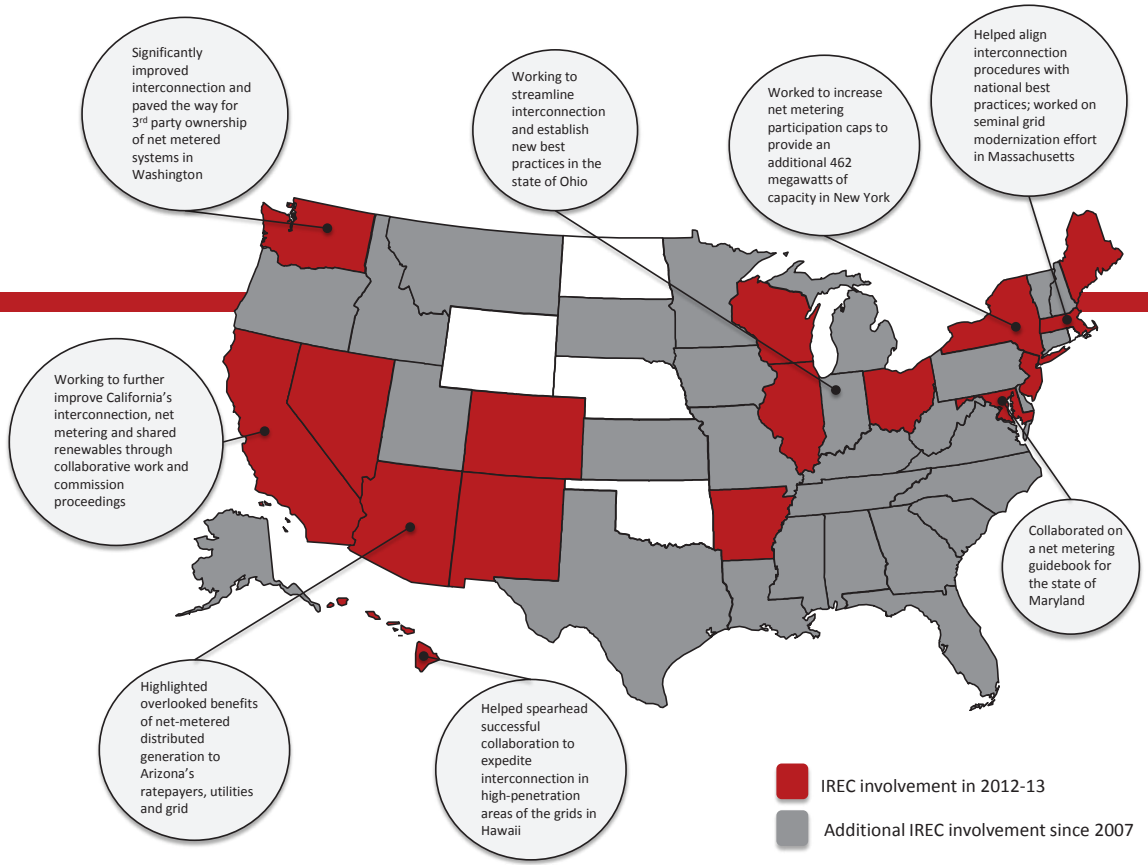
SHARED SOLAR—A POLICY FOR THE REST OF US

It is estimated that only about 25 percent of U.S. roofs are suitable for solar,[4] so states, local jurisdictions, and utilities across the country have been turning to shared solar programs as a way to increase access to solar for the other 75 percent. Demonstrating the success of this novel solution, over the past year shared solar programs across the

3 CA, HI, MA, ME, NJ, NY, OH, WA, and WI

4 Supply Curves for Rooftop Solar PV-Generated Electricity for the United States (Nov. 2008), Nat'l Renewable Energy Lab., available at www.nrel.gov/docs/fy09osti/44073.pdf.

IREC REGULATORY STATE INVOLVEMENT



United States have been cropping up almost faster than we can track them. With every program comes innovation and new policy designs, and IREC has been following these programs to understand major trends and developments within this effort. Based on our research, IREC published two important resources in 2012—an update to our *Model Rules for Shared Renewable Energy Programs*, published in collaboration with the Vote Solar Initiative, and our *Shared Solar Program Comparison Chart*, published in collaboration with the Solar Electric Power Association.

The updated Model Rules represent cutting-edge thinking for shared renewable programs. They are intended to help stakeholders understand the key considerations and elements of these programs, and move toward setting up programs if they are interested in doing so. The revised Model Rules *i*nclude a number of important updates and changes. First and foremost, IREC and Vote Solar have moved from using the term "community renewables" to the terms "shared renewable energy" or "shared renewables." This new term reflects the core innovation of these programs—enabling multiple consumers to share the benefits of a single renewable energy facility. In addition, IREC updated its guiding principles for shared renewable energy programs with an explanation of the similarities and differences between shared renewables programs and other related programs. The update also includes a more detailed discussion of the valuation of the energy produced by a shared renewable energy facility, as reflected in a participant's electricity bill credits.

On the regulatory front, IREC participated in proceedings at the CPUC to evaluate the proposed shared solar programs of San Diego Gas & Electric and Pacific Gas & Electric, called "Connected to the Sun" and "Green Option," respectively. Although California's consideration of shared solar has slowed due to legislative activity and procedural issues at the CPUC, IREC anticipates the combined capacity of the two programs, in addition to a likely program at Southern California Edison, will result in more than 500 MW of shared solar capacity.

IREC also continued work developing its CleanCARE proposal. This effort seeks to change California's CARE program from an energy consumption subsidy for low-income participants to a program that invests in renewable energy resources on behalf of low-income enrollees under a shared renewables framework. IREC worked with stakeholders to offer its ideas on this front in a docket at the CPUC, where proposals for revamping California's complex residential rate structures are currently being considered. Shared solar is increasingly identified in the policy community as a

IREC has successfully advanced the national dialogue on net energy metering and interconnection issues since 1994.

natural extension of existing renewable energy efforts, much like net metering serves to meet consumers' growing demand for renewable energy through innovative program design. To support this evolution and to ensure the latest thinking on the topic is being disseminated, IREC will continue to monitor developments in shared renewables and to engage in outreach and educational efforts.

TRANSMISSION AND ENERGY STORAGE—ENABLING MORE DG ON THE GRID

Transmission

Transmission planning in the United States is mired in a complexity that is uniquely its own. IREC's role in this realm, however, is limited to studying and supporting the role that transmission planning plays in facilitating DG deployment. IREC goes about this in a number of ways, including updating DG assumptions used in transmission planning, establishing linkages among transmission planning bodies to better coordinate widespread efforts, and expanding the presence of diverse groups on the voting boards of transmission committees.

Over the past year, IREC has been working to update key assumptions used in the first interconnection-wide transmission plan for the western grid. The plan will serve as a foundational document that policymakers throughout the West will refer to in their decisions regarding transmission. IREC's input helped guide the cost assumptions for DG in this scenario and will provide a good starting point for future iterations of the plan. These lower cost estimates will ultimately benefit DG, which is only now beginning to be seriously considered in regional transmission planning efforts. As utilities and transmission planners become more familiar with DG as a cost-effective alternative, they will be more likely to forego unnecessary and costly transmission system enhancements in the future.

Additionally, the plan investigated the grid's transmission needs under a "High Distributed Generation/Energy Efficiency" scenario. An accurate assessment of a high-DG future will help utility resource planners, transmission planners, and regulators identify the potential benefits of DG to their system and to ratepayers. In some cases, DG can help defer costly transmission investments. In other cases, DG deployed in conjunction with new transmission can significantly lower the cost of power to customers in the region. In any case, distributed energy resources can help provide a hedge against future uncertainties, such as fuel and carbon costs.

The California Independent System Operator (CAISO), which operates the grid in most of California, is beginning to look seriously at DG, energy efficiency, and demand response as resources that can and should be counted in their transmission planning efforts. Over the past year, IREC has worked towards a more coordinated interaction between transmission planners in the California market and the southwest desert area. This includes an effort to link transmission planning processes both formally (e.g., through FERC Order 1000) and informally (e.g., through active participation groups such as the Southwest Area Transmission [SWAT] planning group). Recently, IREC facilitated a dialogue between CAISO and SWAT, resulting in a significant opportunity to promote the potential expansion of transmission efforts between Arizona, Nevada, and California that will encourage additional utility-scale solar in these states.

Lastly, IREC has successfully negotiated a place for nongovernmental organizations such as IREC on the voting board of a major regional transmission planning group (WestConnect). Through participation in forums such as WestConnect, IREC and other groups will have ongoing opportunities to identify how DG, renewable energy, and non-transmission alternatives can contribute value to the grid.

Energy Storage

Energy storage enables growth and development of DG resources on the grid. Energy storage is a relatively new topic on the regulatory front, however, and IREC has been charting a course for energy storage regulation in several forward-thinking states. Not surprisingly, California has been a national leader in energy storage deployment, as it currently has by far the most installed DG capacity in the nation. Given that, IREC recently participated in a California regulatory proceeding to establish energy storage procurement targets for California utilities.

This initiative offers California a path-charting, first-in-the-nation new policy direction that could play a critical role in supporting the state's impressive renewable energy goals. If implemented, the proposed energy storage targets would

directly increase consumer access to renewable energy and significantly bolster California's policies that favor a continuing and growing deployment of renewable resources, especially on the distribution side of the electric system. In this proceeding, IREC advocated that energy storage procurement should be weighted toward distribution-interconnected facilities and that the CPUC should encourage the siting of storage near areas of strong DG growth, among other provisions. Going forward, IREC will help disseminate the experience gained in California to states that follow this path.

PERMITTING: STREAMLINING SOLAR'S PATH FORWARD

Like many of IREC's other regulatory efforts, rooftop solar permitting work is more of a marathon than a sprint. However, unlike other regulatory efforts that happen on a state level, permitting happens locally in more than 25,000 jurisdictions across the United States. Local building and electrical permitting processes were generally not designed with solar energy in mind, with the result that the requirements are often ambiguous, the fees are inappropriately high for the amount of staff time required, the turnaround time is unnecessarily lengthy, and the documentation requirements are more burdensome than necessary to ensure safe and reliable systems. The impact of these inefficiencies affects not only solar installers, but also municipal staff, who are facing higher application volumes without additional staff to review them. The challenge is sizable: how do we lead a permitting reform process across a vast and differentiated landscape and in a manner that benefits both solar installers and municipal governments?

IREC tackles this challenge in a number of ways. Over the past year, IREC has begun working regionally to inform key jurisdictions about the permitting process and the possibilities for reform. After delivering interactive workshops to local planning staff, IREC follows up with direct technical assistance to local building officials implementing permitting reform. Recently, IREC assisted jurisdictions with the drafting of permit guidance documents and inspection checklists, and advised them on process reforms they might consider. By branching out on a regional basis, IREC can extend its reach. When a regional leader implements positive reforms, nearby cities and counties tend to follow. IREC communicates directly with municipalities and helps building officials understand how improved permitting processes can benefit them and the solar industry.

Our broader impact can be seen through publications such as the *Solar Permitting Best Practices*, which IREC jointly published with Vote Solar and its companion document, *Residential Solar Permitting: Best Practices Explained*. IREC has been collaborating with Vote Solar on its Project Permit campaign, providing technical input on permitting process improvements and content that is directed to municipal leaders. IREC has also been publishing handy guides on aspects of the solar permitting process for use by building officials, including guides on preparing permitting and inspection checklists and on the benefits of permitting consistency. Additionally, IREC just released a *Model Inspection Checklist for Rooftop Photovoltaic (PV) Systems* that could be adopted by jurisdictions across the United States, improving the consistency of the inspection process and the quality of those inspections. Finally, IREC's earlier report, *Sharing Success: Emerging Approaches to Efficient Rooftop Solar Permitting*, describes successful approaches of jurisdictions across the country and identifies where reform is needed most. This sharing success document has become one of the most widely cited guides on solar permitting, and is now the industry standard for the permitting process.

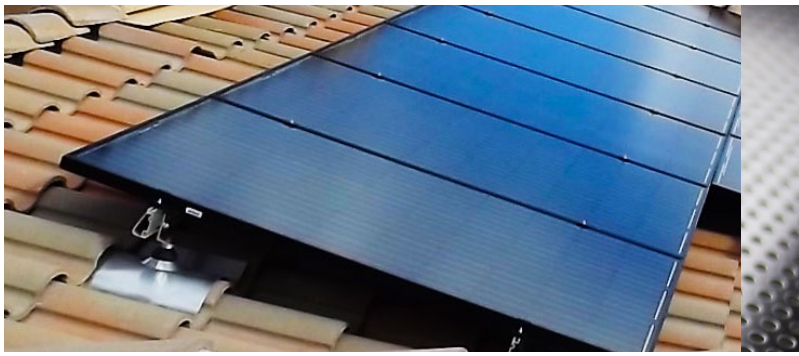
RESOURCE DEVELOPMENT: LEADING THE WAY THROUGH THOUGHT-BASED RESEARCH

IREC has long been known for developing and publishing resources that clarify complex policies and summarizing the insight we have gained from working in the regulatory sphere. This year was a prolific one for IREC publications and resources. In addition to the aforementioned *Model Interconnection Procedures and Model Rules for Shared Renewable Energy Programs*, IREC published a number of other influential resources, circulating them to key audiences to help drive the national discussion around several nascent topics.

Early in the year, IREC teamed with Sandia National Laboratories on a concept paper outlining a strategy to accommodate high penetrations of DG resources on utility distribution systems. The report, *Integrated Distribution Planning Concept*

As utilities and transmission planners become more familiar with DG as a cost-effective alternative, they will be more likely to forego unnecessary and costly transmission system enhancements in the future.

Paper, is important because of the dramatic rise in requests for interconnection of renewable energy systems, particularly solar photovoltaics, to utility distribution systems. In areas with the most robust DG growth, applications to interconnect new generation have overwhelmed utility processes, caused project delays, and, in some cases, imposed prohibitive costs. In areas where DG penetration is already high, these delays and increased costs have slowed DG growth and resulted in public criticism of utility interconnection processes. IREC's solution is integrated distribution planning, which is drawn from a variety of efforts being contemplated or implemented in utilities across the United States. These efforts offer a proactive plan for DG growth and anticipate distribution system upgrades that may be necessary to accommodate that growth.



Another potential trend for policy development was detailed in the IREC report, *Unlocking DG Value: A PURPA-Based Approach to Promoting DG Growth*, which explores benefits that can be quantified and incorporated into the development of avoided cost rates based on the Public Utilities Regulatory Policy Act of 1978 (PURPA). This concept paper considers states' ability to expand options for DG technologies. PURPA may provide a solution that supports greater DG development close to load, where DG value is highest.

Our regulatory work may not make the hottest headlines, but it is essential to establishing fair, transparent, efficient rules for connecting renewables to the grid.

The *Connecting to the Grid Newsletter,* now in its 16th year of publication, predates most state net metering and interconnection policies. Over the past year, IREC continued to publish the newsletter, distributing it to nearly 4,000 subscribers each month. Moreover, IREC improved upon the accessibility of its regulatory reform news by adding a regulatory news database to its website. This map-based tool allows users to click on a state and get links to the latest news developments in that state.

Celebrating its sixth year and its first full year on an internet-based platform, *Freeing the Grid* continues to be a valuable resource for policymakers, regulators, advocates, journalists, and a host of others who are interested in these crucial DG topics. This year, to keep up with evolving best practices, IREC substantially revamped the grading criteria for state interconnection policies. New features and functionality for the Freeing the Grid website will come online in the coming months.

U.S. SOLAR MARKET TRENDS

Larry Sherwood

The solar market, although relatively young, is an increasingly important and vital part of the American economy. What are the trends in this market, and what forces are at work? Which sectors of the market are strongest, and why? What are the prospects for solar energy in the near future?

The Interstate Renewable Energy Council (IREC) collects and publishes public data on U.S. photovoltaic (PV) installations by state and market sector. Public data on solar installations help industry, government, and nonprofit organizations improve their efforts to increase the number (and capacity) of solar installations across the United States. Analysis of multiyear installation trends and state installation data helps these stakeholders learn more about state solar markets and evaluate the effectiveness of marketing, financial incentives, and education initiatives.

The following is a summary of information included in the IREC report *U.S. Solar Market Trends 2012*. In addition to more analysis, the full report contains details of the data collection methods and assumptions.

Here are some of the highlights of 2012 market trends:

• Solar installations were 12 percent of all electric power installations in 2012.

• **PV capacity installed in 2012 more than doubled for larger systems in the utility sector.** State renewable portfolio requirements are an important reason for the large growth in the utility sector. Four of the largest 10 installations received a federal loan guarantee from the U.S. Department of Energy.

• **The five largest installations** all supply power to Pacific Gas and Electric Company (PG&E) in California. In fact, 30 percent (1 GW_{DC}) of the total U.S. PV capacity installed in 2012 goes to supply PG&E.

• The capacity of **distributed grid-connected PV installed in 2012 increased by 36 percent** compared with 2011. Nearly 95,000 distributed PV systems were installed in 2012. Residential installations grew by 61 percent, fueled by the increasing use of leases and third-party ownership of these systems.

• In 2012, more than two-thirds of grid-connected PV system installations were concentrated in California, Arizona, New Jersey, and Nevada. Of the top ten states for 2012 installations, Arizona, Hawaii, Maryland, Massachusetts, Nevada, and North Carolina more than doubled the capacity installed the year before.

OVERALL TRENDS IN INSTALLATIONS AND CAPACITY

2012 was another banner year for solar, with large increases in both the number and capacity of PV facilities. The capacity of 2012 PV installations increased by 80 percent to 3.3 GW_{DC} compared with 2011 (Figure 1). The annual capacity growth rate has exceeded 40 percent for six straight years, and the compound annual growth rate for the last 10 years is

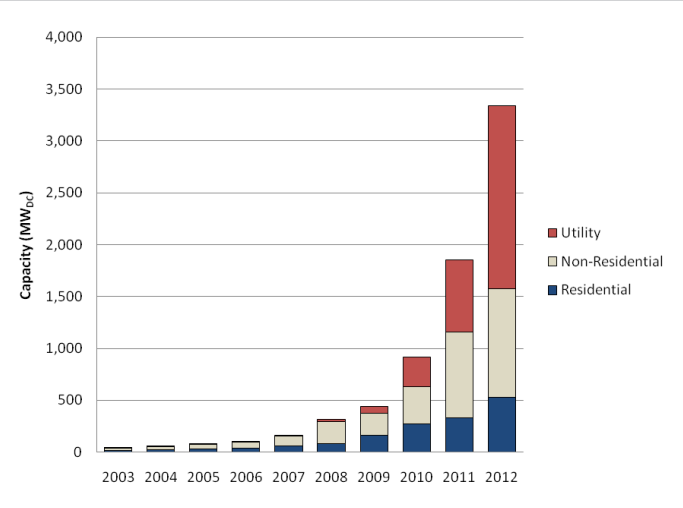


Figure 1: Annual Installed Grid-Connected PV Capacity by Sector (2003-2012)

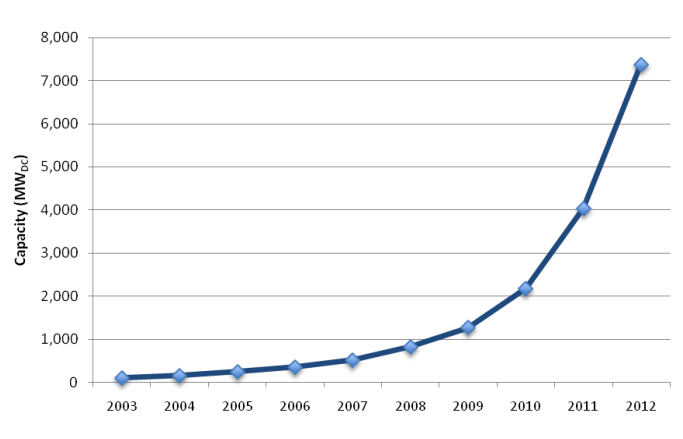


Figure 2: Cumulative U.S. Grid-Connected PV Installations (2003-2012)

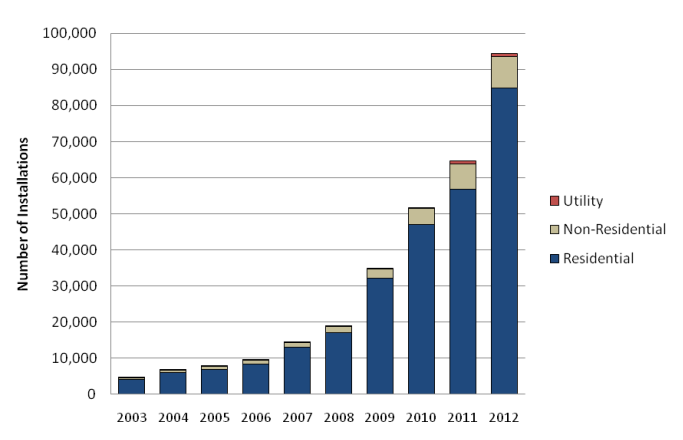


Figure 3: Number of Annual U.S. Grid-Connected PV Installations (2003-2012)

an astounding 65 percent. The total installed capacity of utility installations increased by two-and-one-half times, and distributed installations, largely on residential, commercial, and government buildings, increased by 36 percent.

The cumulative installed grid-connected PV capacity increased to 7.4 GW_{DC} (Figure 2).The capacity of PV systems installed in 2012, 3.3 GW_{DC}, was more than 10-times the capacity of PV installed in 2008, just four years earlier. In 2012, 0.5 GW_{DC} were installed on residential buildings, 1.0 GW_{DC} at nonresidential sites, and 1.8 GW_{DC} in the utility sector (Figure 1).

Almost 95,000 grid-connected PV installations were completed in 2012, a 46 percent increase over the number of installations in 2011. Residential systems accounted for 90 percent of these installations (Figure 3). By contrast, residential systems accounted for only 16 percent of the PV capacity installed in 2012. At the end of 2012, 316,000 PV installations were connected to the U.S. grid, including 283,000 residential installations.

In 2012, PV installations were 12 percent of new electricity generation installed during the year (Figure 4). In 2011, PV installations were eight percent of new additions. The electricity generated by PV and CSP installations was 0.3 percent of all electricity generation in the United States during 2012, 65 percent of which was used at the customer site. The remainder was shipped through the utility distribution system.

The important factors driving PV installation growth vary by sector and state. The following factors helped drive PV growth in 2012.

• **Federal Investment Tax Credit (ITC)**. There was stability in the federal ITC at 30 percent and the accelerated depreciation schedule for commercial installations was also unchanged. Tax credits for both residential and commercial installations are currently in place through 2016. With this stable incentive, developers and installers can plan and market their products and consumers can make rational decisions without arbitrary incentive deadlines.

• **Lower Installed Costs.** The total installed cost for distributed installations fell 12 percent in 2012 and has fallen 33 percent over the past three years. The cost decline is even greater for utility installations. Falling module costs is the primary reason for the cost declines, but all cost components have fallen, including inverter costs and soft costs such as permitting.

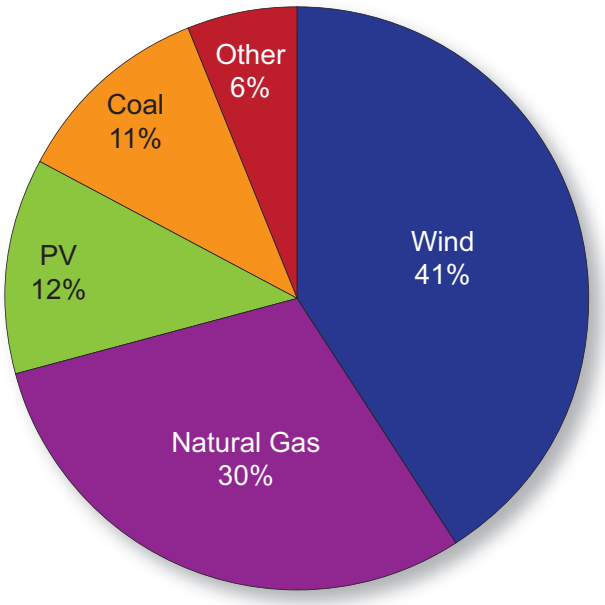


Figure 4: New U.S. Generation Installed in 2012 by Technology

Source: Energy Information Agency (EIA 2013) with IREC PV data

• **Federal Cash Grants.** In February 2009, as part of the American Recovery and Reinvestment Act (ARRA), Congress enacted the U.S. Treasury Grant in Lieu of Tax Credits Program. This program, commonly known as the 1603 Treasury Grant Program, provides commercial installations with the alternative of a cash grant instead of the tax credit. The program was originally scheduled to expire at the end of 2010, but was extended through the end of 2012. This expiration caused many projects to begin construction late in 2012 to qualify for the program, with completion scheduled in 2013 through 2016. In 2012, 3,460 completed projects were awarded $2.3 billion in cash grants. This is more than double the amount awarded in 2011. Solar projects received 35 percent of 1603 Treasury Grant funding in 2012 compared with only 17 percent in 2011.

• **State Renewable Portfolio Standard (RPS) Requirements.** States encourage investments in utility scale solar plants with RPS policies. An RPS requires that a certain percentage of electricity generation come from renewable energy. Some states have a solar carve-out that also requires a certain percentage of the renewable generation come from solar energy. The terms of each state's RPS are different. In some states, RPS guidelines have led to solar renewable energy credit (SREC) markets, which in turn have resulted in increased demand for and installation of distributed solar installations. SREC markets are most developed in the mid-Atlantic states and in Massachusetts. Of the 14 states and territories with more than10 megawatts (MW) of utility-sector installations in 2012, 12 have an RPS, usually with a solar requirement.

• **Federal Loan Guarantees.** As part of ARRA, the U.S. Department of Energy was authorized to offer loan guarantees for renewable energy and other energy projects. The program expired in September 2011, but projects that received loan guarantees by that date can still be completed. In 2012, the three largest PV installations each received loan guarantees from this program for at least a portion of the project's capital cost.

• **Third-Party Ownership.** Third-party ownership of solar installations has long been the dominant ownership model for utility and nonresidential distributed installations. In recent years, this ownership model has expanded to the residential sector and is now the dominant ownership model in all sectors. This structure is called a lease, a power purchase agreement (PPA), or third-party ownership. In each case, a third-party owns the system and the consumer makes regular payments to the owner. For distributed systems, the system is located at the consumer's facility or home and the consumer uses the electricity generated at their site. With a third-party owner, the consumer avoids paying the large upfront capital cost of a PV system.

• **Net Metering.** Net metering is a simple option for consumers to offset their monthly electricity bills by producing their

Analysis of multiyear installation trends and state installation data helps... stakeholders learn more about state solar markets and evaluate the effectiveness of marketing, financial incentives, and education initiatives.

own energy. It allows customers to send excess energy from an onsite renewable energy system back to the grid, and receive a 1:1 kilowatt-hour credit for that energy. In 2012, 90 percent of distributed installed capacity was net metered. IREC provides summary tables of state net metering policies.

• **State and Utility Rebates.** State and utility financial incentives have historically been one of the most important factors driving PV growth, especially for residential and commercial distributed installations. Of the 2012 annual top 10 states (Table 3), nine have state or utility rebate programs available for at least some of the installations. However, the importance of rebates is declining. The impact of these rebates varies greatly from state to state and, in general, rebates per watt have decreased as the cost of PV installations has decreased. The largest rebate program in the country, the California Solar Initiative, has been reducing rebates in a planned manner for years and the rebates will end in 2013. However, solar markets continue to grow in California. The Database of State Incentives for Renewables & Efficiency provides summary tables of state and utility financial incentives.

Table 1: SAMPLE INSTALLATIONS BY SECTOR

Sector	Example Installations
Residential	• Residential installation owned by homeowner or building owner; electricity generated is used on-site • Residential installation owned by third party, with electricity sold to or used by the homeowner or building owner
Nonresidential	• Nonresidential installation owned by building owner; electricity generated is used on-site • Nonresidential installation owned by third party, with electricity sold to the building owner and used on-site
Utility	• Installation owned by utility; electricity generated goes into bulk power grid • Installation owned by third party; electricity generated goes into bulk power grid • Installation owned by building owner (residential or commercial); electricity generated goes into bulk power grid through a feed-in tariff, PPA or other agreement

Grid-Connected Installations by Sector

The growth rate of grid-connected PV varies by market sector: residential, nonresidential, and utility. Distributed installations, on the customer's side of the meter, produce electricity used onsite and include both residential and nonresidential facilities. Examples of nonresidential facilities are government buildings, retail stores, and military installations. In contrast, utility installations are on the utility's side of the meter and produce bulk electricity for the grid. Table 1 shows examples of installations in each sector.

Utility Sector Installations

Utility sector PV installations more than doubled in 2012 compared with 2011. The utility sector's share of all U.S. grid-connected PV installations grew from virtually none in 2006 to 15 percent in 2009, 32 percent in 2010, and 53 percent in 2012. The factors that influence the large growth in utility-sector installations include RPSs, lower installed costs, and federal loan guarantees.

In 2012, 50 utility sector plants larger than 5 MW_{DC} were installed with a total capacity of 1.5 GW_{DC}. These large facilities were 85 percent of the utility sector PV installations in 2011. An additional 11 installations of 5 MW_{DC} or larger were installed in the nonresidential sector with a combined capacity of 105 MW_{DC}. These 61 generators larger than 5 MW_{DC} accounted for 48 percent of the total PV capacity installed in 2012.

State RPS requirements with solar carve-outs are encouraging investments in utility scale solar plants in some states. Although the California RPS does not have a solar carve-out, it is still encouraging many utility solar installations. In 2012, 1.6 GW_{DC} or 94 percent of the utility sector installations were in states with RPS requirements. More than three-quarters of utility installations are located in just four states: Arizona, California, Nevada, and North Carolina.

Financing is also important. The three largest utility-sector installations received a federal loan guarantee for at least a portion of their installation costs, and these loan guarantees supported 574 MW_{DC} of installations. Although this program is known for high profile failed loans to Solyndra and other manufacturers, none of the guaranteed loans for specific solar installations failed and these loan guarantees are a crucial component of the overall financial package for these projects. Federal tax incentives, grants, and the lower cost of PV modules also made these investments attractive.

Construction began or continued in 2012 on many additional utility sector installations, and utilities and developers have announced plans for even more projects to be built in the next few years. Installations in this sector seem poised for continued growth.

The solar market, although relatively young, is an increasingly important and vital part of the American economy.

Distributed Installations
Distributed installations provide electricity for use at the host customer's site, like a home or business. In 2012, the amount of distributed grid-connected PV capacity installed annually in the United States increased by 36 percent to 1.6GW_{DC}. Nearly 94,000 distributed PV systems were installed in 2012, a 46 percent increase over the number of distributed PV systems installed in 2011. The distributed growth was strongest in the residential sector in 2012, a change from the previous year, when nonresidential installations were surging.

Nonresidential Sector Installations
The capacity of nonresidential sector installations, which includes sites such as government buildings, retail stores, and military installations, increased by 26 percent in 2012 compared with 2011. The average size of a nonresidential distributed installation remained virtually the same at 120 kW_{DC}. The largest 2012 installations in this sector were a 20 MW_{DC} installation at an Apple data center in Maiden, North Carolina, and a 16 MW_{DC} installation at Maryland's St. Mary's University with power sold to the Maryland Department of General Services and the University of Maryland System. Factors that influence the growth in nonresidential installations include the federal ITC and the cash grant program, lower installed costs, net metering, and state and utility rebates.

The 1603 Treasury Grant Program expired at the end of 2012. Projects begun by the end of 2012 can still qualify for this grant program, but new installations begun in 2013 and later will not qualify. One-third to one-half of 2012 nonresidential sector installations received a grant through this program.

Residential Sector Installations
The number of residential installations increased by 61 percent in 2012 compared with 2011. Residential installations are 16 percent of the total U.S. market on a capacity basis, but 90 percent of the number of installations. The average size of a residential PV system increased seven percent to 6.2 kW_{DC}. Factors that influence the growth in residential installations include the federal ITC, lower installed costs, retails PPAs and solar leases, net metering, and state and utility rebates.

An increasing number of residential systems are financed using the leasing or third-party ownership model. For example, in the California Solar Initiative, the capacity-basis percentage of residential systems owned by a third-party has increased from seven percent in 2009 to 28 percent in 2011 to 40 percent in 2012. In states with high-cost electricity, the combination of lower installed costs, stable federal tax incentives, and favorable net metering policies are growing the residential market, even with declining local incentives. California and Hawaii were the two largest residential markets in 2012; 57 percent of all residential installations were in these two states. Both rely less on rebate incentives than in the past.

For residential consumers not using the lease or third-party ownership model, federal incentives remained stable in 2012. Stable incentives encourage more homeowners to purchase solar (incentive levels are set through 2016). In addition to federal incentives, most residential installations occur in states with state or local incentives.

Grid-Connected Installations by State
In 2012, more than two-thirds of grid-connected PV system installations were concentrated in California, Arizona, New Jersey, and Nevada, as shown in Table 3. Of the top ten states for 2012 installations, Arizona, Nevada, Massachusetts, North Carolina, Hawaii, and Maryland more than doubled their installed capacity from the prior year. Nevada, Hawaii, and Maryland joined the top ten installation list for 2012, replacing New Mexico, Pennsylvania, and Texas. In Nevada, four large utility installations totaling 215 MW_{DC} were completed in 2012

Table 3: 2012 ANNUAL TOP 10 STATES
Ranked by Grid-Connected PV Capacity Installed in 2012

2012 Rank by State	2012 (MW_{DC})	2011 (MW_{DC})	11-12 Percent Change	2012 Market Share	2011 Rank
1. California	983	547	80%	29%	1
2. Arizona	709	288	146%	21%	3
3. New Jersey	391	305	28%	12%	2
4. Nevada	226	19	1062%	7%	15
5. Massachusetts	123	42	190%	4%	10
6. North Carolina	122	45	169%	4%	9
7. Hawaii	114	40	182%	3%	11
8. Colorado	103	76	36%	3%	6
9. Maryland	80	24	227%	2%	12
10. New York	56	68	-18%	2%	7
All Other States	434	402	8%	13%	–
Total	**3,341**	**1,856**	**80%**	**--**	**--**

2011 and 2012 columns include installations completed in those years. “2012 Market Share” means share of 2012 installations. “2011 Rank” is the state ranking for installations completed in 2011.

and represent most of the Nevada capacity installed last year. Nevada is a popular location for utility installations. Its ranking in the top ten installation list fluctuates wildly, depending on how many utility installations are completed in a given year. Hawaii and Maryland made the top ten installation list due to large growth in distributed installations. New Mexico and Pennsylvania both saw large drops in capacity installed last year. In New Mexico, utility sector installations dropped significantly, and in Pennsylvania, distributed installations dropped due to the end of the Pennsylvania Sunshine Rebate Program. In Texas, installation capacity grew, but not enough to keep Texas on the top ten installation list.

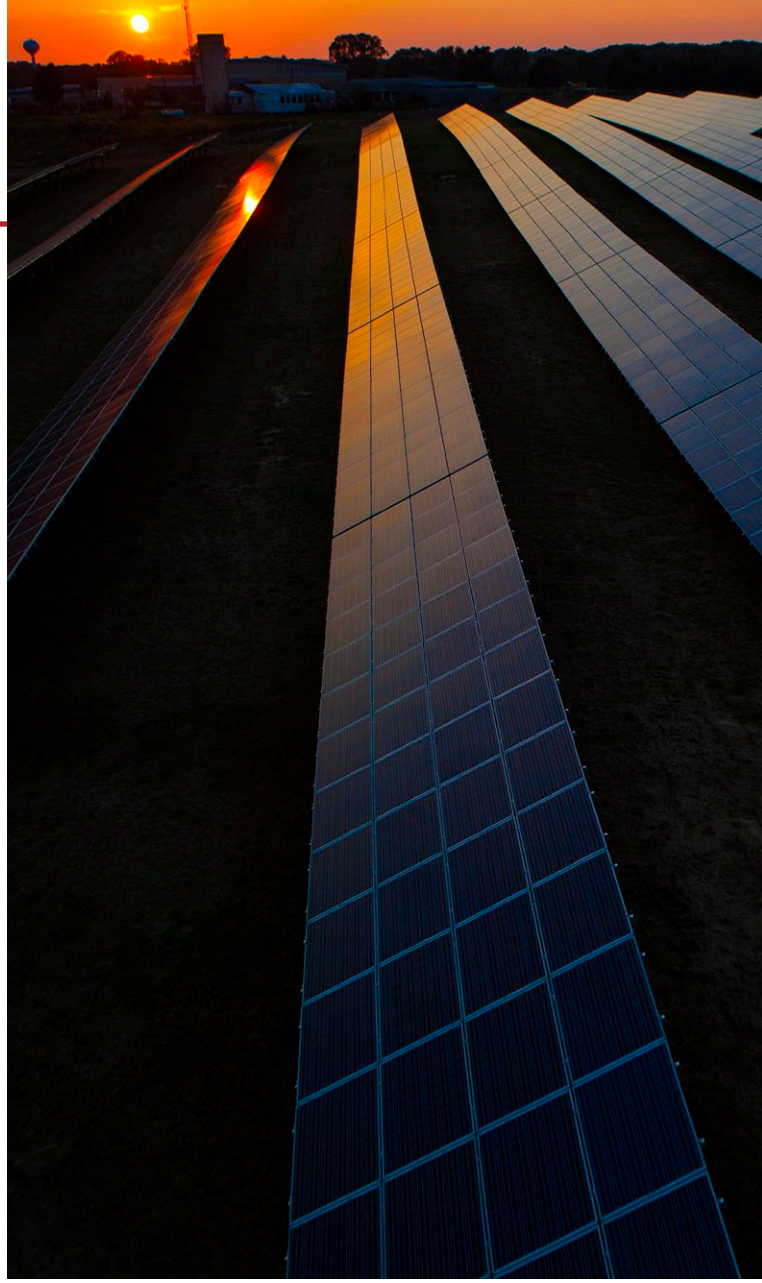
State policies affect PV installations, with most installations occurring in the few states with good solar policies. All states in the top ten installation list have state RPSs, which mandate that utilities generate a percentage of their power from solar or other renewable sources, and tend to encourage larger installations. Arizona and Nevada also benefit from solar installations supplying power to PG&E to help meet the California RPS requirement. The RPS requirements and structure vary widely from state to state.

Though their impact on the total market is declining, financial rebates are important state policies, especially for smaller installations. Five years ago, owners of most PV installations received a cash rebate from a state or utility incentive program and this rebate was the most important element of the financial package. In that era, no state had a significant number of installations without also having a rebate program. For the past three years, the incentive expenditures have been declining, in part because the rebates per watt have been declining and in part because some states have stopped these programs. Despite the decreasing expenditures, installed capacity of facilities with rebate support continues to increase. When PV is less expensive, less incentive money is necessary to encourage installations.

2011 and 2012 columns include installations completed in those years. “2012 Market Share” means share of 2012 installations. “2011 Rank” is the state ranking for installations completed in 2011.

Table 4: CUMULATIVE TOP 10 STATES Ranked by Grid-Connected PV Cumulative Installed Capacity through 2012

	MW_{DC}	Market Share
1. California	2,559	35%
2. Arizona	1,106	15%
3. New Jersey	956	13%
4. Nevada	350	5%
5. Colorado	300	4%
6. North Carolina	208	3%
7. Massachusetts	207	3%
8. New Mexico	203	3%
9. Hawaii	199	3%
10. New York	179	2%
All Other States	1,106	15%
Total	**7,374**	**--**



Prospects for 2013

What can we expect in U.S. solar markets in 2013? As of June 2013, indicators pointed to continued growth in grid-connected PV. Reductions in PV module prices, continuation of the federal ITC, strong state RPSs, net metering policies, and available capital for third-party ownership will help drive market growth.

Many large solar projects began construction in 2012 in order to take advantage of the 1603 Treasury Grant Program. These installations, both distributed and utility sector projects, will be completed in 2013 through 2016. Because projects that begin construction in 2013 will no longer have the cash grant option, developers will need to find entities, such as banks and insurance companies, with tax bills large enough to take advantage of remaining tax credits. Solar developers have announced several large funding packages in 2013, indicating that financing continues to be available for more installations.

Although [the federal loan guarantee] program is known for high profile failed loans to Solyndra and other manufacturers, none of the guaranteed loans for specific solar installations failed and these loan guarantees are a crucial component of the overall financial package for these projects.

IREC
Interstate Renewable Energy Council, Inc.

To achieve a sustainable

and *economically strong future*,

IREC expands

consumer access to clean energy,

develops best practices and

market-valued standards,

and *leads programs* to build a

quality clean energy workforce.

IREC CREDENTIALING PROGRAM AND STANDARDS DEVELOPMENT

Pat Fox and Laure-Jeanne Davignon

INTRODUCTION

There are more than 600 training organizations in North America offering clean energy training and new programs are developed every year. This proliferation of programs drives the need for a method to distinguish good quality training. Employers need to be able to identify which training programs are teaching the job skills required in the workforce, students need to know which programs are well designed and will teach them the skills they need to succeed in a job, and funders need to know which programs are worth the investment.

The Interstate Renewable Energy Council (IREC) addresses this challenge in two distinct ways—standards development and credentialing. IREC standards delineate the requirements and provide a quality framework for certificate programs and for training providers and instructors. The credentialing program offers a third-party mark of excellence to providers that demonstrates that they meet the requirements of the standards and provide safe, effective training that is aligned with industry needs.

The past year has been characterized by continued rapid growth and expansion of both credentialing programs and standards development efforts within IREC. Projects and initiatives continue to focus on increasing the value of the credentials IREC offers by enhancing the standards upon which they are based and increasing outreach efforts to educate stakeholders on the importance of third-party credentials in the clean energy space.

STANDARDS DEVELOPMENT EFFORTS ACCELERATE

On June 19, 2013, the American National Standards Institute (ANSI) awarded IREC accreditation as a Standards Developing Organization. This is an important milestone and mark of distinction from the organization that safeguards the U.S. standards and conformity assessment system. Accreditation by ANSI signifies that the procedures used by IREC in connection with the development of American national standards meet requirements for openness, balance, consensus, and due process. It paves the way for more universal adoption of IREC standards and represents a crucial step for both IREC and the industry.

On June 19, 2013, the American National Standards Institute awarded IREC accreditation as a Standards Developing Organization...an important milestone and mark of distinction from the organization that safeguards the U.S. standards and conformity assessment system.

Standard 14732: General Requirements for Renewable Energy and Energy Efficiency Certificate Programs was finalized and published as an IREC Standard on January 10, 2013. It is now available to the public on the IREC website. This IREC Standard for certificate-awarding training programs is the result of almost two years of intensive work by subject matter experts throughout the United States, and reflects input from three public comment periods. Distinguishing features include requirements for a systematic program plan, summative examination, and correlation of curriculum to an industry validated job task analysis. It lays out requirements for administration, curriculum, assessment, personnel, resources, and linkage with industry that programs must meet to demonstrate that they issue a market-valued certificate. IREC Standard 14732 has been adopted for use by the ANSI-IREC Accreditation Program (see below.)

IREC has forged ahead with additional, bold standards activities through a comprehensive review and revision of IREC Standard 01022, which is used for the IREC Credentialing Program. The project was undertaken to keep the Standard 01022 current with the industry, increase the value of credentials based on this standard, and better distinguish between requirements for accreditation and certification.

Throughout 2013, a diverse group of subject matter experts worked to produce standards that raise the bar for high quality training and instructors (see Features of IREC's Revised Standards on page 20). As a result, two new standards were launched in September 2013, IREC Standard 01023: 2013

Figure 1: Current IREC Credentials by Technology

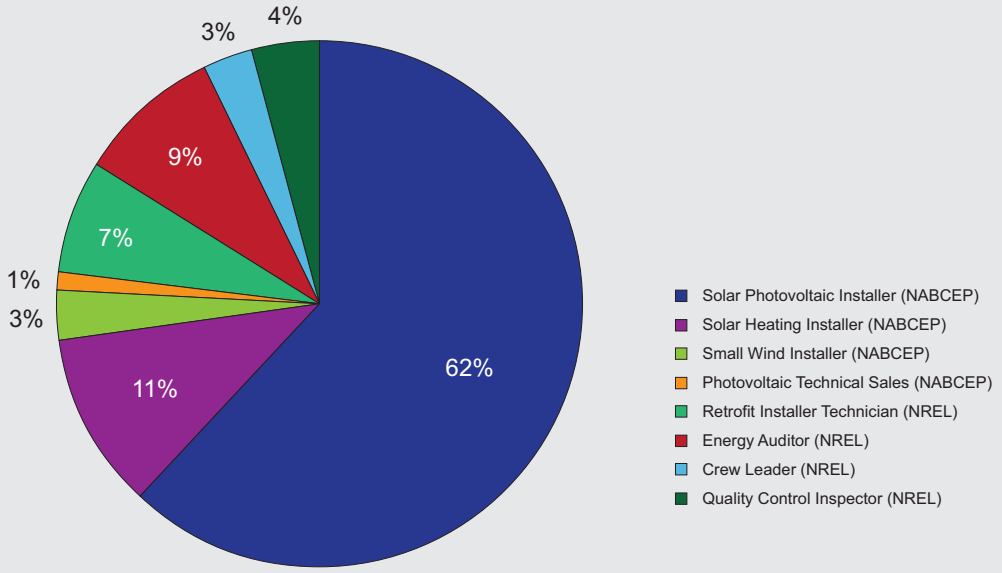
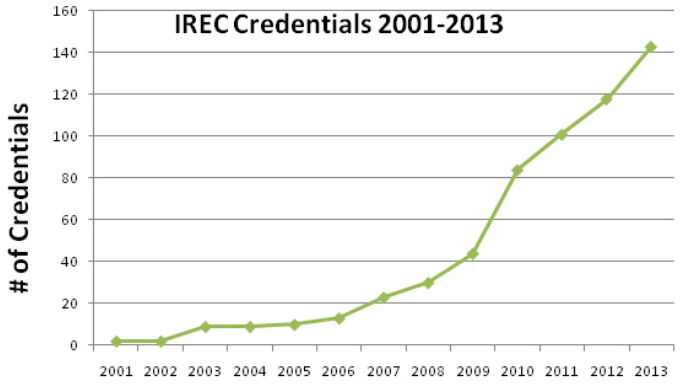


Figure 2: Growth of the IREC Credentialing Program



FEATURES OF IREC'S REVISED STANDARDS

IREC Standard 01023: Training Providers

- Student assessment required
- Increased rigor with regard to personnel
- Requirement for a written safety plan
- Updated provisions for online/electronic media

IREC Standard 01024: Instructors and Master Trainers

- Support a "portable" certification
- Requirements for a documented instructional philosophy
- Enhanced experience requirements
- More pronounced distinction between instructor and master trainer

Requirements for Accreditation of Clean Energy Technology Training and IREC Standard 01024: 2013 General Requirements for Certification of Clean Energy Technology Instructors and Master Trainers, and adopted for use by the IREC Credentialing Program.

CREDENTIALING PROGRAM GROWTH AND TRANSITION

The IREC Credentialing Program has expanded into the weatherization and energy efficiency sector, enhanced operational efficiency, increased diversity, and inter-rater reliability of our assessor pool and has focused on future areas of development. The achievements in each of these areas have been significant.

As of August 2013, there were 142 active IREC credential holders (Figure 1), representing an almost 20 percent increase from 2012 (Figure 2). Future growth potential is demonstrated by 33 applications in process and 33 letters of intent in the queue. Applications for weatherization and energy efficiency technologies continue to increase exponentially, while applications related to photovoltaics and solar heating remain steady.

The past year has seen eight of the U.S. Department of Energy's Weatherization Training Centers earn accreditation, bringing the total to 10. This trend has driven a transition from almost 100 percent renewable energy credentials to the point where almost a quarter of present credential holders provide energy efficiency training. In addition, 2013 marked the certification of the first instructors and master trainers in energy efficiency topics.

Finally, the online Credentialing Management System (CMS) implemented in 2012 has been almost universally adopted for new applications and is used by all credential holders for

Employers need to be able to identify which training programs are teaching the job skills required in the workforce, students need to know which programs are well designed and will teach them the skills they need to succeed in a job, and funders need to know which programs are worth the investment.

annual maintenance. Performance and functionality of the CMS has increased, with notable enhancements including online payment and form printing capabilities. Starting in October 2013, all applications are in the CMS, completely eliminating the use of paper for the IREC credentialing process.

BUILDING ON SUCCESS: IREC INVESTS IN ASSESSOR DEVELOPMENT

Last year marked an unprecedented increase in the size of the IREC assessor pool to support an increase in applications, as well as the expansion into energy efficiency/weatherization. Currently, IREC has 14 active assessors who are subject matter experts in renewable energy and energy efficiency technologies, curriculum development, and instructional design and technologies.

Building on this expertise, IREC has undertaken several assessor development initiatives, focused on increasing the quality of assessments and inter-rater reliability. These efforts culminated with the first in-person assessor training meeting, held prior to the Clean Energy Workforce Education Conference, November 12-13, 2012. Topics during the interactive, hands-on session included assessing curricula and syllabi and evaluating instructor experience. Assessors also benefited from in-person networking with their peers, which involved the exchange of ideas and best practices. Additional in-depth remote quarterly trainings for assessors continue throughout the year.

ANSI-IREC ACCREDITATION PROGRAM LAUNCHED

Immediately following the publication of the IREC standard for certificate programs (14732) in January 2013, the ANSI-IREC Accreditation Program was launched. Developed through a partnership between ANSI and IREC, this program is designed to provide quality assessment and a mark of distinction to training programs in the clean energy sector that result in a market-valued certificate. There are currently three organizations that have been awarded this mark of distinction for one or more of their certificate programs—CalCERTS, Inc., Midwest Renewable Energy Association Inc., and National Solar Trainers.

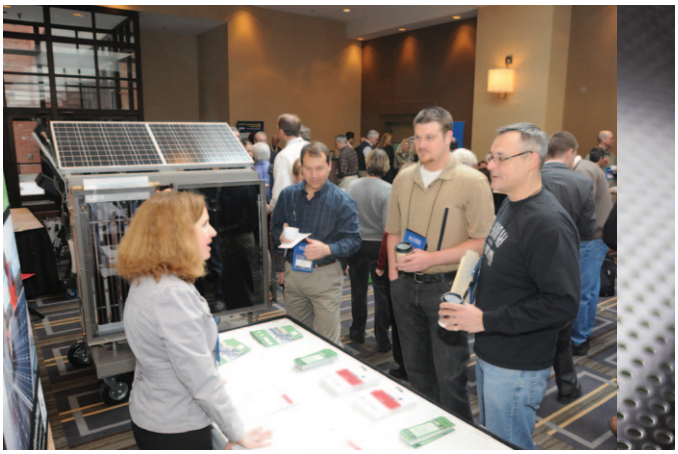
Since the launch of this program, efforts have been focused on outreach and communication to raise awareness, and in September 2013, an intensive, hands-on workshop was held to prepare potential applicants for the rigorous assessment process.

Energy Coordinating Agency of Philadelphia, Inc. Credential Holders

IREC Assessor Training Meeting at CEWEC

ANSI-IREC Credential Holders at CEWEC reception

The IREC Credentialing Program offers a third-party mark of excellence to providers that demonstrates that they meet the requirements of the standards and provide safe, effective training that is aligned with industry needs.



Attendees at the CEWEC

OUTREACH—INTRODUCING IREC TO NEW AUDIENCES

The last 12 months have been active, focused on expanding awareness of the IREC Credentialing Program and educating the clean energy community about the value of credentials. In November 2012, the credentialing program made efficient use of the time at the Clean Energy Workforce Education Conference (CEWEC), giving presentations, interviewing credential holders, holding a forum focused on standards development, and hosting a reception to recognize the newly awarded ANSI-IREC Accreditation credential holders.

During spring 2013, program staff participated in several conferences to broaden their base of knowledge about credentials and how credentials can be leveraged in the development of a workforce for the clean energy sector. IREC began the season by attending the Residential Energy Services Network (RESNET) conference and networking with energy efficiency contractors. In March, IREC hosted a booth at the National Association of Workforce Boards (NAWB) conference in Washington, DC, learned more about how Workforce Investment Boards (WIBs) manage their Eligible Training Provider Lists (ETPLs), and educated representatives about how IREC credentials could be leveraged to support their efforts.

As a result of participation in NAWB, connections were made with representatives from state WIBs and, after several follow-up meetings, the value of IREC credentials has been recognized in California. San Bernardino County now requires energy efficiency and renewable energy training programs to indicate whether they are accredited by IREC when they apply to be included on the ETPL. This is a significant step in building a broadly recognized program.

IREC also hosted a booth at the American Association of Community Colleges conference in April and participated in the Affordable Comfort Inc. national conference in May, giving presentations, hosting a booth, and holding a reception.

OUTREACH—THE COLLECTIVE VALUE OF CREDENTIALS

IREC has convened a prestigious group of credentialing bodies to form the Clean Energy Credentialing Coalition (CECC). Founding members of this group include the National Association of Certified Energy Practitioners, the Building Performance Institute, the Small Wind Certification Council, and the Solar Rating and Certification Corporation. The purpose of the CECC is to raise awareness and promote the collective importance of quality assessment and the value it brings to building strong and competent renewable energy and energy efficiency markets.

LOOKING AHEAD

In the fall of 2013, the IREC Credentialing Program will adopt the newly developed IREC standards for training providers and instructors/master trainers (see page 20). This will result in a stronger credential program that brings more value to the clean energy industry.

In addition, with the adoption of a distinct standard focused on trainers, all certifications awarded to individuals as instructors or master trainers will now be portable and no longer be tied to an institution. This allows trainers to benefit more broadly from their certification.

The IREC Credentialing Program recognizes that efforts to train the workforce for the clean energy sector go beyond renewable energy and energy efficiency technologies. In alignment with our goals of driving and supporting the development and delivery of high quality training resulting in market-needed skills, we are expanding our scope to include other clean energy technologies. There is a growing volume of training for sustainability, and IREC is setting the stage to bring standards, quality assessment, and credentials to these nascent fields as they develop.

SOLAR INSTRUCTOR TRAINING NETWORK

Joseph Sarubbi and Mary Lawrence

INTRODUCTION

In our pursuit of a highly qualified and competitive renewable energy workforce, the Solar Instructor Training Network (SITN) is a powerful national tool. Now active in nearly every state, at its core are "train-the-trainer" programs, projects, and tools that are making significant strides in fulfilling the critical need for quality, accessible, industry-driven training in solar system design, installation, sales, and inspection.

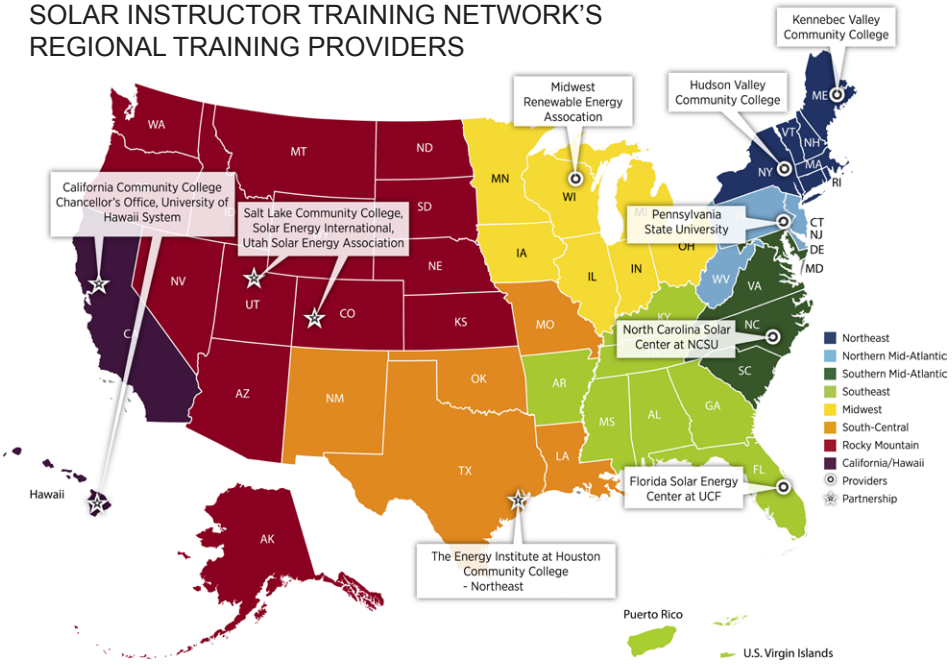
As the national administrator of SITN, the Interstate Renewable Energy Council (IREC) has worked with the network's nine Regional Training Providers (RTPs) and the solar industry to develop several new and improved training resources this past year. These new resources include two new documents in the Solar Energy Education and Training Best Practice series and an innovative online photovoltaic (PV) training program for municipal code officials in charge of permitting and inspections. The overall goal is quality, safe, cost-effective solar system installations for the growing number of consumers who want to benefit from the sun's renewable energy.

As one of the U. S. Department of Energy's highly regarded SunShot Initiative projects, the success of the SITN cannot be overstated. Over the last 3 ½ years, the RTPs partnered with 378 institutions in 45 states; Washington, DC; Puerto Rico; and the U.S. Virgin Islands. Their train-the-trainer programs have been conducted in first-class training facilities across the country, primarily targeting full-time and part-time community college instructors within their regions. The programs provide resources that support and guide these "instructor trainees" to develop quality solar training programs.

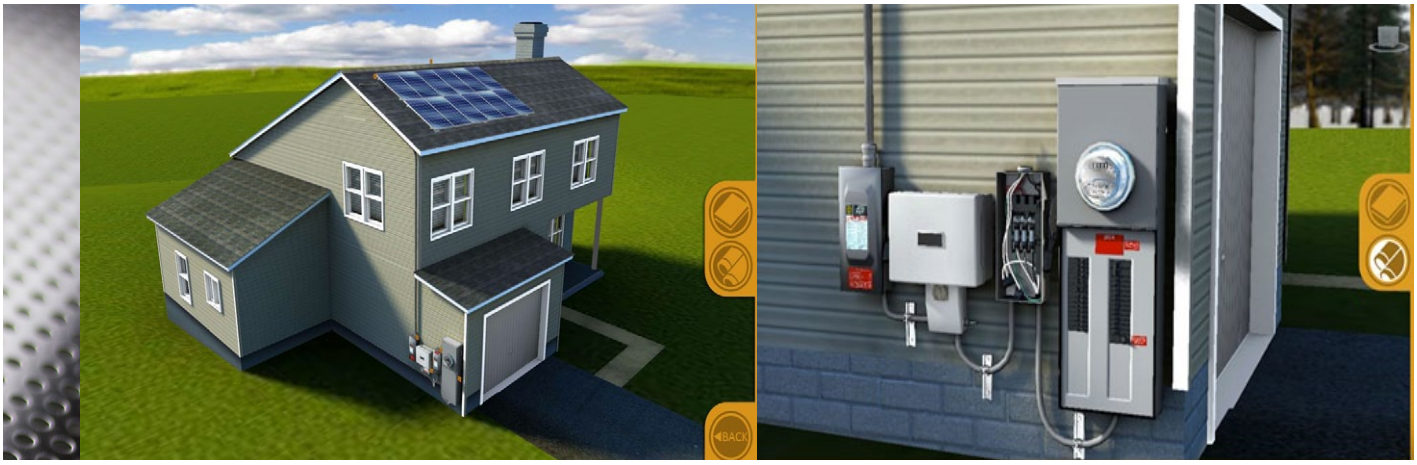
An initial goal of SITN was to create a geographic blanket of solar training throughout the country. That goal is being met—more than 874 instructor trainees have received instruction from the RTPs since the project began. Moreover, the RTPs continued to engage new institutions seeking to start solar programs in states that saw a sharp increase in solar installations. In these cases, the RTPs provided necessary solar training and resources to instructors and institutions. Today, thousands of individuals have received solar training from instructors and programs established through SITN.

Each RTP offers training through a variety of innovative methods, from online courses and open source learning platforms to enhanced hands-on training, webinars, mobile training, and mentoring. In addition, instructor trainees take home significant resources to help them build effective solar training programs at their respective institutions.

SOLAR INSTRUCTOR TRAINING NETWORK'S REGIONAL TRAINING PROVIDERS



SCREEN SHOTS FROM PV ONLINE TRAINING



IREC and the RTPs are taking advantage of lessons learned over the past year to build upon already successful endeavors, and, at the same time, develop new resources for improved solar training. In 2013, in addition to expanding its best practice series and improving the very successful Photovoltaic Online Training for Code Officials (PVOT), the RTPs held in-person, nationwide, one day workshops in support of the online training. Code officials had the opportunity to receive expert training from many of the best solar installation instructors in the country. Many code officials are not familiar with the elements of a quality PV installation, so this training is a crucial link to ensure consumers benefit from quality, timely, and cost-effective inspections and permitting.

INNOVATIVE TOOLS PROVIDE SOLUTIONS

Photovoltaic Online Training for Code Officials

PVOT instructs users such as code officials and authorities having jurisdiction in reliable field inspection practices and endorses efficient permit processes for residential PV installations. Continuing education units (CEUs) for PVOT are offered through the International Association of Electrical Inspectors.

The online course substantially increases the reach and scale of training available to code officials throughout the United States. It offers training that quickly and cost-effectively reaches a large number of code officials, which in turn increases the number of consumers who can benefit from knowledge-based PV system inspections for installation quality and safety.

Recent modifications to the training make PVOT easier to use. It is now on the Moodle platform, and, using this open source learning management system, IREC is able to include ad ditional course tools and resources. To access the PV Online Training, users login and create an account at www.pvonline-training.org.

The PVOT "capstone" lesson is a unique training tool that engages the student with a virtual house and roof-mounted PV installation.

This free online training features six "page-turner" lessons with assessment quizzes on: 1) Roof Mounted Arrays and Wire Management; 2) Electrical, Roof and Ground Mounted Arrays; 3) Ground Mounted Arrays; 4) Appropriate Signs; 5) Equipment Ratings; and 6) Expedited Permitting. The training also includes a "capstone" lesson that uses an immersive 3-D learning platform and an information icon (i-button) with references to the *National Electrical Code®*.

The PVOT "capstone" lesson is a unique training tool that engages the student with a virtual house and roof-mounted PV installation. This immersive 3-D lesson includes three different simulation options:

- Guided instruction provides the user with layover text screens that display the necessary information for the selected object.
- Exploration allows the user to discover correctly or incorrectly installed PV components without being tested or graded.
- Assessment (or testing) mirrors the Exploration option but includes a quiz at the end, testing the ability of the student to identify correctly or incorrectly installed PV components.

Onsite Companion Workshop for Code Officials

The RTPs have been offering onsite, one-day companion workshops in support of PVOT. To date, the RTPs provided nearly 30 code official workshops across the country with

more than 1,000 code officials attending. RTPs will continue to offer the workshops throughout next year. The workshop is also eligible for CEUs from the International Association of Electrical Inspectors.

Two New Best Practice Documents
Two new best practice documents were added to the Solar Energy Education and Training Best Practices library. Dr. Jerry Ventre, as lead author, worked closely with several IREC subject matter experts to develop the ***Textbooks, References, and Other Instructional Resources*** document, which provides PV and solar heating and cooling (SHC) instructors with recommended training textbooks, key references, and resources. Key references relate to occupational safety and health, electrical codes, structural building codes, and plumbing codes in addition to design and installation, minimum standards for equipment certification, and effective training methods. In addition to technical references for both PV and SHC systems, there are links to magazines, online documents, and websites that may be useful to instructors.

The latest in the series of Best Practice documents is an excellent new resource—***Photovoltaic Labs***. As lead authors, Brian Hurd, Chris LaForge, and Jerry Ventre developed this document to assist faculty and administrators at colleges, universities, and other technical and training institutions interested in developing new PV laboratories or improving existing ones. Such laboratories can then be used for a variety of courses and programs to enhance learning and develop the skills of several target audiences. This document presents information on developing laboratories that are inclusive enough for PV system installation courses and programs. From this more comprehensive list, selected equipment can then be used in courses for PV designers, contractors, code officials, site assessors, sales personnel, building designers, utility personnel, business professionals, and other PV-related occupations. *Photovoltaic Labs* is an online document and is filled with photos and internet links to assist instructors in finding information to support their courses.

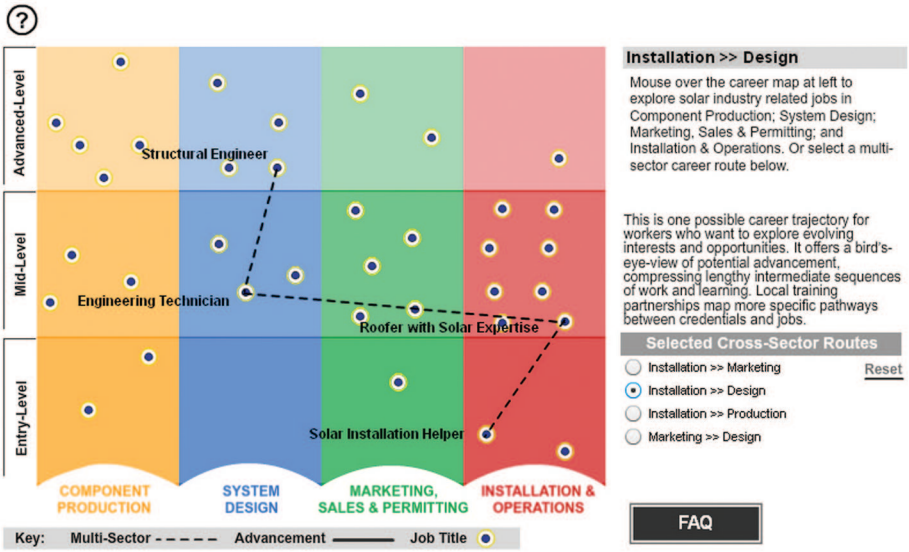
Together, these documents provide a compendium of national best practices for instructors in solar training, education, and workforce development written by leading experts in the solar industry and education fields. These in-depth resources support instructors in developing new solar programs, integrating solar content into related trades programs, and enhancing existing solar education and training programs.

IREC Training Directory
Together with IREC's credentialing staff, the SITN team has designed an updated, user-friendly, and searchable renewable energy and energy efficiency training program directory. The directory content has been simplified and streamlined,

Previously Published Best Practice Documents

1. **Curriculum and Program Development:** An overview of the curriculum development process, with special attention to DACUM (Developing a Curriculum) methodology and Job Task Analysis (JTA).
2. **Becoming an Effective Teacher:** Shares teaching and learning strategies that promote effective instruction.
3. **Developing a Quality Course:** Describes, using the instructional systems design (ISD) model and the ADDIE (analysis, design, development, implementation, and evaluation) Model, how to design and develop a course or workshop.
4. **Solar Content Integration:** Shares strategies for educating and training individuals by integrating or infusing solar content into existing education and training programs.
5. **Exemplary Solar Education and Training Programs:** Details six exemplary solar education and training programs in the United States.

SOLAR CAREER MAP



concentrating on a list of technologies offered at a given education institution or organization. Profiles in the training directory are added and updated by the organizations themselves, with IREC providing the database platform and oversight of the listings. Programs can be designated IREC accredited, ANSI/IREC accredited, and SITN trained.

Working Together

One of the advantages of a five-year project is the opportunity for individuals, organizations, and institutions to develop long-term relationships that will continue long after funding for the SITN project sunsets. IREC has worked hard to foster engagement of all the RTPs and the efforts are producing results. This past year, IREC and the RTPs have collaborated regularly through three working groups. Two working groups were created to enhance two existing resources: the Solar Career Map (http://www1.eere.energy.gov/solar/careermap/) and the solar content integration best practice document (www.irecusa.org/publications/best-practices-4-solar-content-integration/). A third working group was created to develop a new best practice document, which will help solar instructors develop online solar courses. IREC's subject matter experts are leading each group, which are made up of representatives from each RTP.

Solar Career Map Working Group—Part Two

The SITN Solar Career Map has received significant praise from industry stakeholders since its release in October 2011. An online interactive tool, the map explores 36 occupations and accompanying career pathways available in the solar industry. Dr. Sarah White, from the Center on Wisconsin Strategy, serves as chair. The group plans to give the map a real-world feel using photographs and short video clips. The videos will contain brief interviews with students, instructors, or industry representatives about career pathways and the skills and training needed for specific occupations. The group hopes to connect map users with the real lives of current solar

Many code officials are not familiar with the elements of a quality PV installation, so this training is a crucial link to ensure consumers benefit from quality, timely, and cost-effective inspections and permitting.

As the national administrator of the Solar Instructor Training Network, IREC has worked with the network's nine Regional Training Providers and the solar industry to develop several new and improved training resources this past year.

professionals. Additional updates to the map include new wage information and clarification of map terms. Watch for updates.

Solar Content Integration Working Group
Through the leadership of chair Dr. Jerry Ventre, the Solar Content Integration Working Group is developing a new guide to enrich courses, curricula, and programs through solar content integration. Given rapidly expanding solar markets in many locations around the country, the guide will help educators meet the related demand for highly trained and well-educated solar tradespersons, technicians, and professionals. Numerous examples of successes in developing new solar courses, improving curricula, and updating programs will be included in this IREC Web-based guide. The guide will also include case studies that describe the processes used, identify obstacles encountered, and highlight keys to success in achieving solar content integration. These case studies will be based on interviews with faculty and/or administrators who have successfully spearheaded and championed the integration of solar content into their courses, curricula, and programs. The guide should be available online by the summer of 2014, and will be a useful complement to both the SITN Solar Career Map and the IREC best practices document on solar content integration.

Online Training and Education Working Group
The Online Training and Education Working Group believes that solar instructors who experience effective online modules and courses will learn more, and learn it more efficiently, than those who just read about what makes a good online course.

Chaired by Dr. Barbara Martin, the Online Training and Education Working Group is designing a tool to describe how best to teach solar content in an online environment. This type of resource has the added benefit of giving the online "instructor-students" many examples of successful online solar content that they may be able to use or adapt for their own classes. To be hosted on the IREC website, this solar online training best practice tool will address these questions:

- What is effective online instruction?
- What content lends itself to online instruction?
- What are the key skills for effective online teaching?

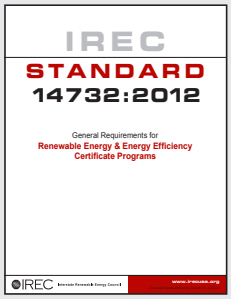
The online training will be developed using Moodle, an open source learning management system (LMS) popular with educators as a tool for creating websites for their students. Examples will be incorporated from as many varied solar online courses and modules as possible, representing many different aspects of the solar industry. The working group will be soliciting examples from RTPs and SITN partnering institutions. A draft of Module 1 will be ready for pilot testing in the fall of 2013. Results of the Module 1 pilot test will be "fed forward" to the other two modules. All three modules should be ready for use by instructors and students by the first quarter of 2014.

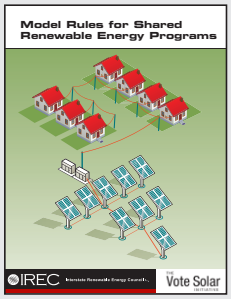
We are looking ahead to another busy year. Keep in touch with SITN through its website (www.sitn.org), as well as the SITN quarterly newsletter and seminar series.

On-Site Code Official Training in Custer, Wisconsin

Each Regional Training Provider offers training through a variety of innovative methods, from online courses and open source learning platforms to enhanced hands-on training, webinars, mobile training, and mentoring.

RECENT IREC PUBLICATIONS





PUBLICATIONS

http://www.irecusa.org/publications/

U.S. Solar Market Trends 2012

Simplifying the Solar Permitting Process/ Residential Solar Permitting Best Practices Explained

Simplifying the Solar Permitting Process: The Importance of Consistency

Model Rules for Shared Renewable Energy Programs

Unlocking DG Value: A PURPA-Based Approach to Promoting DG Growth

Integrated Distributed Planning Concept Paper

Model Interconnection Procedures

Solar Permitting Best Practices

Solar Permitting Checklist

Blueprint for the Development of Distributed Generation in California

Community-Shared Solar: Diverse Approaches for a Common Goal

A REGULATOR'S GUIDEBOOK: Calculating the Benefits and Costs of Distributed Solar Generation

SOLAR ENERGY EDUCATION AND TRAINING BEST PRACTICES: SERIES

http://www.irecusa.org/publications/ (workforce education)

- #1: **Becoming an Effective Teacher**
- #2: **Curriculum and Program Development**
- #3: **Developing a Quality Course**
- #4: **Solar Content Integration**
- #5: **Exemplary Solar Education and Training Programs**
- #6: **Textbooks, References and Other Instructional Resources**
- #7: **Photovoltaic Labs**

IREC STANDARDS

http://www.irecusa.org/standards-development/

IREC Standard 01023:2013 General Requirements for the Accreditation of Clean Energy Technology Training

IREC Standard 01024: 2013 General Requirements for the Certification of Clean Energy Technology Instructors and Master Trainers

IREC Standard 14732: 2013 General Requirements for Renewable Energy & Energy Efficiency Certificate Programs

Job Task Analysis Guidance Document

ADDITIONAL ACTIVITIES

2013

Clean Energy Workforce Education Conference

Hundreds of the nation's innovators in clean energy workforce development and education came together at the fifth national workforce education conference November 2012 in Albany, New York. Over three days, more than 60 presenters shared the latest instructional strategies and practices in clean energy education. They looked at new and thought-provoking next generation technologies and workforce needs. They shared insight into what's working and what's not, gaps to close, and directions to take.

"We've moved past the point when 'green jobs' was just a marketing term, a sound bite," said IREC President and CEO Jane Weissman. "The way forward is to embed green knowledge and green skills into every job and every education program—to train a quality workforce that meets industry needs."

The primary conference sponsor was The New York State Energy Research and Development Authority. IREC was the conference organizer. To view the 2012 presentations, visit http://www.irecusa.org/presentations-from-2012-cewec/.

Energy Efficiency Standardization Coordination Council

IREC has been selected to serve in a leadership position as co-chair of the Workforce Credentialing Working Group, one of five groups that make up the American National Standards Institute (ANSI) Energy Efficiency Standardization Coordination Council (EESCC). This national forum is assessing the energy efficiency standardization landscape and writing a roadmap that will identify what standards, codes, and conformance programs are available or under development, what gaps exist, and what additional standardization activities are needed to advance energy efficiency in the United States. EESCC's roadmap will increase awareness to support the adoption and implementation of standards, codes, and conformance activities in the public and private sectors. For more information, visit www.ansi.org/eescc.

Solar America Board for Codes and Standards

The Solar America Board for Codes and Standards (Solar ABCs) is a collaborative effort among experts to formally gather and prioritize input from the broad spectrum of solar photovoltaic stakeholders including policymakers, manufacturers, installers, and consumers resulting in coordinated recommendations to codes and standards making bodies for existing and new solar technologies. Since 2007, IREC has been one of 11 partners in the project, which is managed by New Mexico State University and funded by the U.S. Department of Energy. IREC wrote five Solar ABCs reports. The project ended in mid 2013.

Small Wind

IREC published the quarterly Small Wind Newsletter in order to provide stakeholders with the latest news and trends in this sector. The market for small wind has been challenging, however. The good news is that over the past several years, turbine certification programs and improved siting tools have made it more likely that customers will get the performance they expect. The combination of high quality products and installations with good government incentives and regulations will return the small wind industry to a growth trajectory. To see the current issue of the newsletter, visit www.irecusa.org/news-events/irec-newsletters/.

Regional Permitting Workshops: a Focus of Solar Outreach Partnership

In the spring of 2013, IREC offered three regional permitting workshops for permitting staff in California's Eastern Sierras and Alameda County and in Westchester County, New York. The workshops were designed to help municipalities evaluate their solar rooftop permitting processes and learn about streamlining efforts that other jurisdictions across the country have found effective. Sponsored by the Solar Outreach Partnership (Solar OPs) and funded by the U.S. Department of Energy's SunShot Initiative, Solar OPs achieves its goals through a mix of educational workshops, peer-to-peer sharing opportunities, research based reports, and online resources. IREC's approach to improving solar permitting is rooted in two overarching principles—responsibility for

change should be shared between permitting authorities and the solar industry; and changes to permitting policies should benefit local governments, solar installers, and their customers.

Local Code Official Training

IREC continued to provide local code official training in New York State under an existing contract with the New York State Energy Research and Development Authority (NYSERDA). The focus of the training workshops was to highlight mistakes that PV installers often made in regard to the National Electrical Code and safety. Several professional organizations hosted the training, such as the International Association of Electrical Inspectors, the New York State Building Officials Conference, the New York State Fire Marshal's Association and the New York State Society of Professional Engineers, as well as local jurisdictions reacting to the increase in PV installations in New York.

IREC 3i AWARDS
INNOVATION. INGENUITY. INSPIRATION.

INNOVATION AWARDS

State and Local Project of the Year:
California Public Utilities Commission for its Rule 21 Interconnection Tariff

Community Renewable Project of the Year:
Solar San Antonio for its Bring Solar Home Campaign

Clean Energy Training Program of the Year:
The Energy Coordinating Agency

Clean Energy Trainers of the Year:
Clay Sterling, Midwest Renewable Energy Association
Timothy Wilhelm, Kankakee Community College

SPECIAL RECOGNITION AWARDS

- **Dr. Roy A. Swift**, American National Standards Institute
- **David Clements**, International Association of Electrical Inspectors
- **Hawaii Public Utilities Commission**
- **County of San Bernardino Workforce Investment Board**

IREC Interstate Renewable Energy Council Inc.

IREC TEAM

As of September 2013

Jane Weissman, President and Chief Executive Officer
Larry Sherwood, Vice President and Chief Operating Officer

REGULATORY PROGRAM

Keyes, Fox & Wiedman, LLP
- Jason Keyes, Partner
- Kevin Fox, Partner
- Joe Wiedman, Partner
- Erica Schroeder McConnell, Associate
- Tim Lindl, Associate
- Thad Culley, Associate
- Laurel Passera, Senior Renewables Analyst
- Sky Stanfield, Of Counsel
- Larry Chaset, Of Counsel

Michael Sheehan, PE

SOLAR INSTRUCTOR TRAINING NETWORK

Joe Sarubbi, Project Manager
Mary Lawrence, Project Coordinator

CREDENTIALING AND STANDARDS DEVELOPMENT

Laure-Jeanne Davignon, Director
Patricia Fox, Director of Credentialing Development
Brian Mattiske, Application Process Manager
Michelle Barrett, Project Manager
Kristen Ferguson, Manager of Assessor Training & Development

WORKFORCE SUBJECT MATTER EXPERTS

Jerry Ventre, Ph.D., Photovoltaic Systems Engineering
Barbara Martin, Ph.D., Instructional Design
Diane DePutdt, Ph.D., Educational Consultant

OTHER PROGRAMS

Richard Michaud

COMMUNICATIONS

Ruth Fein
Jane Pulaski

ADMINISTRATION

Louise Urgo, Business Manager
Maryteresa Colello, Administrative Coordinator

IREC Interstate Renewable Energy Council, Inc.

IREC BOARD OF DIRECTORS

September 2012 – October 2013

David Warner, Chair
National Renewable Energy Laboratory

Larry Shirley, Vice Chair
Nicholas Institute for Environmental Policy Solutions, Duke University

Jennifer Szaro, Treasurer
Orlando Utilities Commission

Jane Pulaski, Secretary

Carolyn Appleton, Carolyn M. Appleton, Inc.
Christopher Cook, Solar Grid Storage LLC
Brian Gallagher, Brian Gallagher Consulting
Julia Hamm, Solar Electric Power Association
Kenneth Jurman, Virginia Department of Mines, Minerals & Energy
Stephen Kalland, North Carolina Solar Center
Karl Rábago, Rábago Energy LLC
Marc Roper, Tioga Energy

New Directors beginning October 2013
John Hoffner, CH2M HILL
Eric Martin, Florida Solar Energy Center

COLLABORATIVE ACTION THROUGH ADVISORY BOARDS AND COMMITTEES

REGULATORY ADVISORY BOARD

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 Hitt, 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

CREDENTIALING ADVISORY BOARD

Vicki Colello, New York State Energy Research and Development Authority
Roger Ebbage, Lane Community College
Patricia Fox, Interstate Renewable Energy Council, Inc.
Brian Gallagher, E3 Energy Services, LLC
Michael Kuhn, ImagineSolar
Kirk Laflin, National Partnership for Environmental Technology Education
Barbara Martin, University of Central Florida
Richard Michaud, Interstate Renewable Energy Council, Inc.
Josh Olsen, U.S. Department of Energy
Jane Weissman, Interstate Renewable Energy Council, Inc.
Jack Werner, Institute for Sustainable Power

COMMITTEE ON STANDARDS

Richard Knaub, Ph.D.(CHAIR), National Renewable Energy Laboratory
Brian Hayden, HeatSpring Learning Institute
John Manz, National Sustainable Structures Center at the Pennsylvania College of Technology
Ryan Mayfield, Renewable Energy Associates/Lane Community College
Harold C. Ohde, Electrical Joint Apprenticeship and Training Trust, IBEW #134
Josh Olsen, U.S. Department of Energy
Paul H. Raymer, Heyoka Solutions, LLC
Sydney G. Roberts, Ph.D., Southface Energy Institute
Jane Weissman, Interstate Renewable Energy Council, Inc.

SOLAR INSTRUCTOR TRAINING NETWORK ADVISORY BOARD

Barry Friedman, National Renewable Energy Laboratory
Julia Hamm, Solar Electric Power Association
Jack Hyer, International Brotherhood of Electrical Workers
Jeannine LaPrad, Corporation for a Skilled Workforce
Chris Nichols, U.S. Department of Energy
Joe Sarubbi, Interstate Renewable Energy Council, Inc.
Todd Stafford, National Joint Apprenticeship and Training Committee
Frank Surdey, New York State Department of Labor
Jerry Ventre, Interstate Renewable Energy Council, Inc.
Jane Weissman, Interstate Renewable Energy Council, Inc.
Sarah White, Center on Wisconsin Strategy

PHOTOS COURTESY OF: Front cover left to right: Sungevity, Dreamstime, Dreamstime, Dreamstime, SunPower Corporation. Page 6 – SunPower Corporation. Page 8 – SolarCity. Page 9 – Long Island Power Authority. Page 10 – Sungevity. Page 11 top – Massachusetts Clean Energy Center. Page 13 – Congentrix. Page 15 – Dreamstime. Page 17 – lower left: SolarCity, upper right: Standard Solar. Page 19 – Dreamstime. Page 21 – top to bottom: Energy Coordinating Agency of Philadelphia, Jane Pulaski, Jane Pulaski. Page 22 – Jane Pulaski. Page 23 top – SunPower Corporation. Page 26 bottom – NREL. Page 27 – Midwest Renewable Energy Association.

Annual UPDATES & TRENDS Report

Shaping our future with clean energy

Interstate Renewable Energy Council, Inc.
P.O. Box 1156
Latham, NY 12110-1156
(518) 458-6059
info@irecusa.org
www.irecusa.org

IREC's Credentialing and Workforce Programs
125 Wolf Road
Albany, NY 12205
(518) 621-7379
credentialing@irecusa.org
www.irecusa.org