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State Incentives and Policy Trends

Justin Barnes, Rusty Haynes, Amy Heinemann, Brian Lips and Amanda Zidek-Vanega

Introduction

Amid a global financial crisis, historic and pervasive state budget crises, and federal bailouts and stimuli, state-level policy developments continued to be an important force for advancing solar markets. A few surprises, specifically feed-in tariffs (FITs) and property-assessed clean energy (PACE) financing, have emerged on the policy scene since our last report, published in October 2008. While several states failed to achieve much-needed policy progress, overall the DSIRE project staff witnessed a strengthening of state renewables portfolio standard (RPS) policies, continued support of state solar programs, new utility incentive programs, advancements in net metering and interconnection, an emphasis on *green jobs* growth, and an unprecedented federal commitment to renewable energy. This 2009 *State Incentives and Policy Trends* section highlights these policies and initiatives; state-specific details of these and other policies are available on the *Database of State Incentives for Renewables and Efficiency* (DSIRE) web site (www.dsireusa.org).

Federal Action – Creating Synergies with State Policy

The federal government took decisive action to try to address the 2008 financial crisis's impending impacts on the renewable energy sector. Taken together, the October 2008 *Energy Improvement and Extension Act* (part of the federal "bailout bill") and the February 2009 *American Recovery and Reinvestment Act* (aka, the federal "stimulus bill") made significant extensions and improvements to the most important federal solar policy: the investment tax credit (ITC). With the federal ITC stabilized though the end of 2016, looming expiration deadlines no longer stoke market uncertainty.

Although arguably less important to the solar industry than the stabilization of the ITC, the federal stimulus bill also appropriated billions of dollars to state energy offices for energy efficiency and

renewables. Our review of state energy offices' plans for spending $3.1 billion dollars in State Energy Program (SEP) funds reveals that approximately $1 billion is available for funding end-use renewable energy projects. Of that amount, more than $200 million is targeted directly for investments in solar and/or solar thermal installations in 13 states and Puerto Rico. The states with the largest stimulus-funded solar budget plans are Tennessee ($62 million), New York ($58 million), Florida ($45 million) and Arizona ($15 million). These federal policies and financial support have created opportunities for, and synergies with, state solar policy, as the rest of this report highlights.

Enabling Local Action – Property Assessed Clean Energy Authorization[1]

Property-assessed clean energy (PACE) financing authorization earns the distinction of being the trendiest state policy development over the last year. The federal stimulus bill facilitated the creation of these policies by repealing a provision that had limited the use of the ITC for projects also supported by "subsidized energy financing." (And because PACE financing programs probably qualified as "subsidized energy financing" under federal law, the removal of this provision was essential for these state policies to move forward.)

Thirteen states[2] enacted legislation enabling local governments to create PACE programs during the last year. (Most local governments do not have *carte blanche* authority to levy taxes, impose assessments or raise money; they require state authorization to do so.[3]) Through these programs, local governments effectively offer low-interest loans to property owners to help pay the upfront costs of permanent, renewable energy improvements to the property. The "loans" are usually repaid via a special assessment on the property, which becomes a lien on the property until the amount is paid in full. If the property owner moves or sells the property before the loan is paid back, the remaining balance—along with the renewable energy system—usually transfers to the buyer. Local governments that choose to offer PACE financing generally secure funds by issuing bonds, partnering with a financial institution, or tapping existing funds.

This policy is particularly appealing to state legislators because it does not impact state budgets and it has the ability to spur clean energy job growth at the local level. Several cities and counties in California and Colorado have implemented PACE programs for renewables over the last year. More are expected in these two states, as well as in Virginia, Louisiana, Texas,

[1] Search "Property Tax Financing Authorization" in DSIRE for more information on the state PACE enabling policies.
[2] In several cases, such as Oregon and North Carolina, last minute changes to legislation resulted in loose policy structures leaving questions as to how PACE financing programs would work in practice; additional amendments are likely in order for local governments in those jurisdictions to be able to implement PACE programs. North Carolina's policy is not in DSIRE or included in this tally because the policy design appears to stray too far from other PACE enabling legislation designs. Furthermore, it should be noted that that an analysis performed of existing laws in Hawaii and Florida for the Vote Solar Initiative reveals that PACE programs could be implemented without any additional legislative changes in those two states.

[3] Certain types of local governments, such as charter cities or those with extensive home rule powers, do have greater authority and theoretically could implement a PACE financing program, even if the state has not passed legislation specifically authorizing such programs. Berkeley, California, is an example of a charter city that developed its policy independently and, coincidentally, pioneered this policy trend.

Maryland, Wisconsin, Vermont, New Mexico, Illinois, Oklahoma, Ohio, Nevada and New York, and possibly in Oregon and North Carolina.

Direct Incentives

Federal legislation coupled with state budget problems have spurred solar policy and programmatic changes for direct financial incentives at the state level, but these changes have been far from uniform. Some states reduced overall incentive program budgets; some reduced individual system incentive levels. Yet, individual incentive levels in many states have remained constant, and overall program budgets have increased in several other states. Furthermore, some states have used federal stimulus money to create new direct cash incentives for solar, while other states have used federal stimulus money to boost funding or otherwise expand existing programs.

Between September 2008 and September 2009, approximately 40 new solar programs have been created in 19 states. Of these programs, 10 are state programs. Some of these programs represent large investments, such as the Alaska Energy Authority Renewable Energy Grant Program, which boasts a $125 million budget for fiscal year 2009, and the $100 million Pennsylvania Sunshine Solar Rebate Program.

Approximately 16 programs in 14 states increased funding for solar programs over the past year. Thirteen of these programs are state programs; the others are utility or local government programs. A few programs increased the incentive for individual systems. Washington expanded eligibility for the state's Renewable Energy Production Incentive to community solar projects. In total, eight programs in 12 states increased the incentive level for individual systems. One example is the Tennessee Valley Authority (TVA) production incentive offered by certain utilities in seven states. Three state programs increased the incentive for individual systems; the rest of the increases occurred with utility and local government programs.

A handful of states did reduce program budgets or incentive levels. Typically, states or utilities adjusted the individual incentive level or cap instead of reducing the overall program budget. Incentive levels in 10 states were reduced, with six of the incentive reductions occurring at the state level. In these states, programs offered a reduced incentive on a dollar-per-watt or cent-per-kilowatt-hour basis, or reduced the maximum cap. Historically, many states have run out of funding quickly because of a high demand for solar incentives. Reducing individual system incentive levels should make funding available to a greater number of systems and boost program stability. Colorado, Illinois and Vermont were the only three states that lowered overall program budgets during the past year, with the reductions in program funding in Illinois and Vermont resulting from a re-appropriation of public benefits funds to fill state budget gaps.

As the U.S. solar market matures, states and utilities have begun shifting away from simple rebate programs for photovoltaics (PV) and towards production- or performance-based incentives (PBIs). Over the last year, 15 PBIs were created, and the caps or rates for seven PBIs changed. There are 39 production-based incentives in 28 states, with 14 production incentives for solar

(excluding feed-in tariffs), 11 feed-in tariffs (FITs), and 14 REC-purchase programs (through which RECs are purchased separately from electricity). Most – but not all – PBIs involve the transfer of RECs from the generator to the utility. Table X provides a sample of existing PBIs. The emerging trend of implementing FITs is a more recent expression of the shift towards PBIs. Gainesville Regional Utilities (GRU), the municipal utility serving Gainesville, Florida, implemented the first European-style FIT in the United States. GRU's FIT pays a rate well above the retail rate for electricity generated from PV and offers long-term contracts to producers. More than a dozen states considered implementing FITs through legislation in 2009, and other states considered FITs in the regulatory arena. Two states, Vermont and Oregon, enacted FIT legislation in 2009, though the details of these programs must still be finalized. Both programs are limited in scope, and each will be used for compliance with the state's renewables portfolio standard (RPS). Hawaii's Public Utilities Commission also established a FIT for Hawaii in September 2009. The rates for different renewable technologies have not yet been determined.

Program Name	State	Rate, Terms	Incentive Type
Gainesville Regional Utilities – Solar Feed-in Tariff	Florida	$0.26-$0.32/kWh (higher incentive for building or pavement-mounted systems); 20-year contract	Feed-in Tariff
Oregon Pilot Solar Feed-in Tariff	Oregon	Rate not yet established (to be determined by utilities and approved by PUC); 15-year contract	Feed-in Tariff
Vermont Standard Offer for Qualifying SPEED Resources	Vermont	$0.30/kWh; 10- to 25-year contract	Feed-in Tariff
Wisconsin Power and Light (Alliant Energy) – Advanced Renewables Tariff	Wisconsin	$0.25/kWh; 10-year contract	Feed-in Tariff
Xcel Energy – Solar*Rewards Program	Colorado	$1.50/watt for systems up to 10 kW and $0.11-$0.125/kWh for larger systems (higher incentive for larger systems); 20-year contract	Rebate ($2/watt) + REC purchase
Illinois Solar Energy Association – Renewable Energy Credit Aggregation	Illinois	$0.06/kWh; 1-year payment	REC purchase (by non-profit)

Xcel Energy – Solar*Rewards Program	New Mexico	$0.10-$0.20/kWh (higher incentive for new systems); 10- to 14-year contract	REC purchase
TVA – Green Power Switch Generation Partners Program	AL, GA, KY, MS, NC, VA, TN	$0.12/kWh plus retail rate (approximately $0.22/kWh total); 10-year contract	Production Incentive
Washington Renewable Energy Production Incentives	Washington	$0.15-$1.08/kW (higher incentives for WA-manufactured components and community solar projects)	Production Incentive

A sample of PBIs, FITs, and REC-purchase programs created or modified over the last year (A total of 22 such programs were created or modified between September 2008 and September 2009).

Industry Recruitment

As recent national renewable energy discussions have focused on the promise of green jobs boosting our ailing economy, several states are positioning themselves to catch the wave of new jobs. In addition to the federal stimulus bill's $2.3 billion incentive program for renewable energy manufacturers, five states (Arizona, Kansas, Louisiana, Tennessee and Utah) created new incentives to attract renewable energy companies. Many industry recruitment incentives are tax-based and tied to what the company will provide to the state in return. Laws in Arizona, Kansas and Tennessee set minimum investment levels required to receive incentives, as well as the quantity and quality of jobs companies must create. Louisiana and Utah did not establish firm requirements, but each gave broad authority to state administrative bodies to review applications and to base decisions on minimum investment, quantity and quality of jobs, as well as other criteria. Overall, a total of 20 states, plus Puerto Rico, provide incentives specifically targeting renewable energy manufacturers, a sign that competition for coveted green jobs is fierce. Furthermore, at least a dozen states have indicated their intent to use federal stimulus funds to increase the amount available for industry recruitment and support manufacturing of renewable energy and energy efficiency technologies.

Tax Incentives

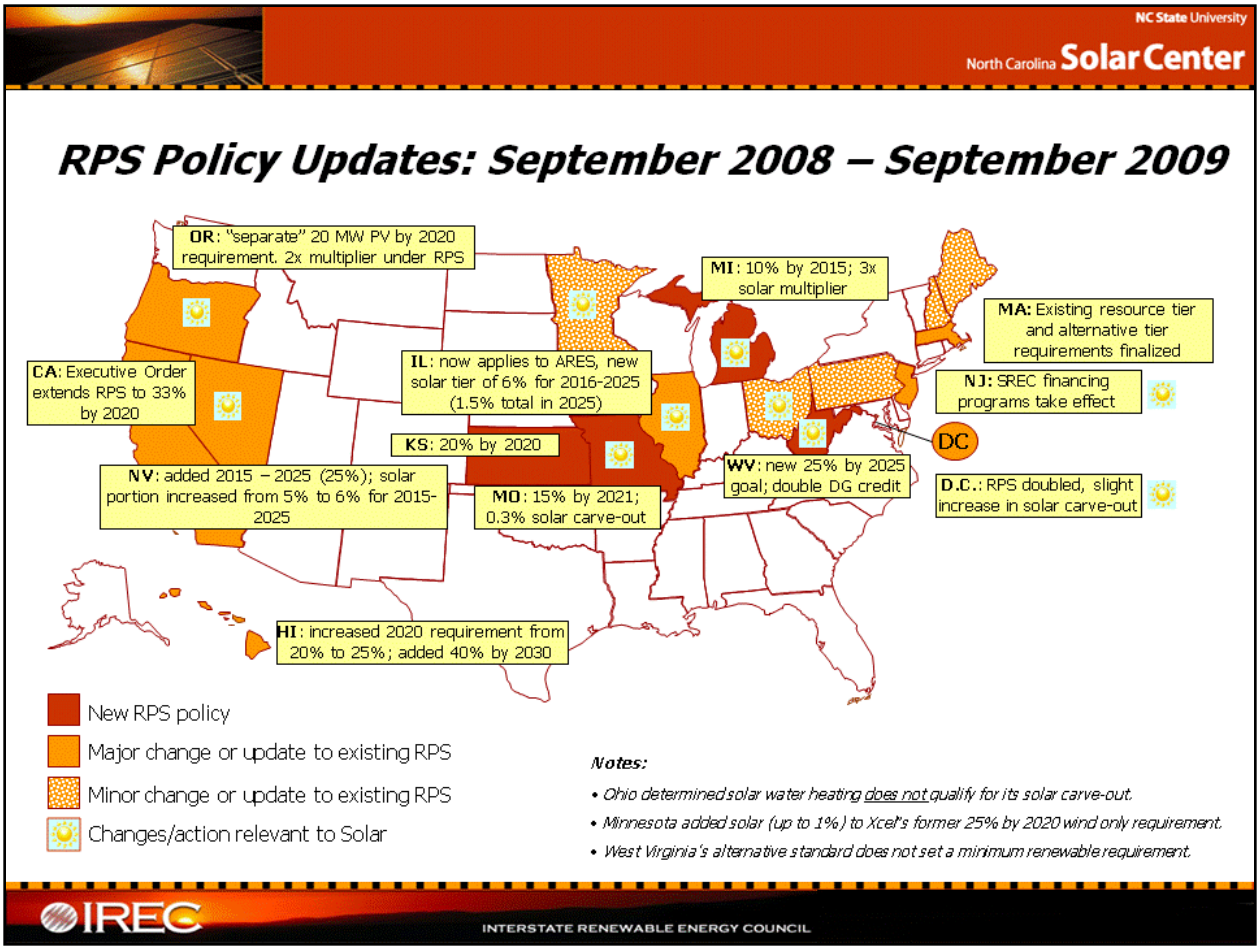
Considering the nationwide recession and the severe budget deficits in most states, it appeared that tax incentives in several states might be in jeopardy. Furthermore, an enhanced federal ITC presented an opportunity for states to reduce tax incentives. Despite these fears, and perhaps surprisingly, no existing state tax incentives were eliminated during the past year.

In general, there was plenty of action related to existing state tax incentives, with many states making adjustments, both large and small, to their incentives. With the exception of Hawaii and Vermont (which placed restrictions on their tax credits), all of the changes were either neutral or positive. North Carolina, for example, extended the expiration date of its generous 35% tax credit to 2016 and added geothermal as an eligible technology, while South Carolina extended its tax credit to small hydro. Nevada increased the value of its sales and use tax and property tax abatements, but it also increased the minimum system size from 10 kW to 10 MW and added job-creation requirements.

Renewable Portfolio Standards

In our 2007 article, we deemed the September 2006 – September 2007 period the "Year of the RPS." That period saw a total of five new RPS policies, three new state level renewables goals, and significant expansions to seven existing RPS policies. The following year (September 2007 – September 2008) did not measure up to the *Year of the RPS*, but there were in fact some significant new developments as well. A total of three new RPS policies (and one new renewables goal) were adopted; seven existing RPS policies were increased or modified in a significant way; and five others underwent more minor changes.

The most significant trend during the September 2008 – September 2009 period is a continued emphasis on solar energy in recent RPS adoptions and changes. Eleven states enacted or significantly modified standards; of those, seven states and DC included new provisions specific to solar energy. In addition, five states made minor adjustments to their policies, of which two involved solar provisions. Notably, Missouri replaced (via ballot initiative) an existing renewables *goal* of 11% by 2020 with a *standard* of 15% by 2021, and included a provision mandating that at least 2% of the *requirement* come from solar energy (equivalent to 0.3% of retail sales in 2021). Nevada tacked on additional years to its existing RPS compliance schedule and increased the solar portion for these added years from 5% to 6%, while Michigan's newly-adopted RPS contains a triple-credit multiplier for solar. Illinois expanded its RPS to cover competitive sales and adopted a solar carve-out of 6% of the annual *requirement* from 2015 – 2025. This represents a carve-out of 1.5% of sales in 2025 and catapults Illinois towards the top of the list of projected solar capacity among states with solar carve-outs. And, in September 2009, California extended its RPS to 33% by 2020, via executive order.



Also intriguing is the emergence of solar targets and programs that are separate from an existing RPS. Both Oregon and Rhode Island adopted provisions relating to long-term contracts for solar energy resources, coupled with targets for solar that are outside the scope of each state's existing RPS. New Jersey approved long-awaited utility-administered solar renewable energy credit (SREC) contracting programs in connection with its existing solar carve-out. While requirements for long-term contracts are not uncommon as a component of RPS policy, this new emphasis on solar is encouraging because these programs should help rectify some of the financing problems confronting the industry.

One final notable trend is the inclusion of non-renewable "alternative energy" resource tiers in state policies. Prior to 2008, Pennsylvania was the only state to permit these types of resources to qualify for a standard or as a separate tier exclusive of a standard. Subsequently, in 2008, Massachusetts, Ohio and Michigan adopted policies permitting the inclusion of alternative resources (in some capacity). In 2009, West Virginia adopted an alternative and renewable energy standard, with no minimum renewables requirement, and Illinois adopted a "clean coal" standard separate from its existing RPS.

Net-Metering & Interconnection

Twenty-two states and DC changed or adopted net metering laws/regulations over the last year. Of those, two states (Kansas and Nebraska) established new net-metering policies, raising the national state total to 42. Changes implemented in the other states address increasingly complex policy issues, including the treatment of net excess generation, renewable energy credit (REC) ownership, community-owned systems and third-party ownership. "Super-sized" net metering (i.e., a 1-MW or greater individual systems capacity limit for at least one customer type) now exists in 20 states. Interconnection standards continue to serve as an essential component of state renewable energy policy; seven states and Puerto Rico improved interconnection standards over the last year. See the *Net Metering & Interconnection Section* on page 23 for additional details on net metering and interconnection standards.

Solar Installation Trends

Larry Sherwood

Introduction

Different solar energy technologies create energy for different end uses. Two technologies—photovoltaics (PV) and high-temperature concentrating solar thermal electric—produce electricity. A third technology, low-temperature solar thermal collectors, produce heat for hot water, space heating, pool heating, and process heat.

Photovoltaic cells are semi-conductor devices that generate electricity when exposed to the sun. Manufacturers assemble the cells into modules, which can be installed on buildings, parking structures or in ground-mounted arrays. PV was invented in the 1950s and first used to power satellites. As PV prices declined, PV systems were installed in many off-grid installations – installations not connected to the utility grid. In the last decade, and especially in the last several years, grid-connected installations have become the largest growth sector for PV.

High-temperature solar thermal electric systems, more commonly known as concentrating solar power (CSP), use mirrors and collecting receivers to heat a fluid to a high temperature (300°F to more than 1000°F) and then run the heat extracted from the fluid through a traditional turbine power generator or Sterling engine. CSP can also be paired with existing or new traditional power plants, providing high-temperature heat into the thermal cycle. These generating stations produce bulk power on the utility side of the meter rather than generating electricity on the customer side of the meter. CSP plants were installed in the United States in the late 1980s and early 1990s, but installation stopped due to lack of supportive government policies. Installations have now resumed and two plants in the U.S. were completed in 2006 and 2007, with a significant number of announcements for new plants between 2010-2015. In another application, concentrating solar thermal can provide high temperature solar process heat for industrial or commercial applications and a small number of installations are made each year using this technology.

Low-temperature solar thermal collectors can heat water, heat and cool buildings, and heat swimming pools. A variety of flat plate, evacuated tube and concentrating collector technologies produce the heat needed for these applications. Solar hot water systems were common in

southern California in the early 1900s before the introduction of natural gas and many systems were sold in the late 1970s and early 1980s. In the mid-1980s, the expiration of federal solar tax credits and the crash of energy prices led to an industry slow-down, from which the industry is now recovering.

This section[4] provides public data on U.S. solar installations by technology, state, and market sector. Public data on solar installations help industry, government, and non-profit organizations improve their efforts to increase the number of solar installations across the United States. Analysis of multi-year installation trends and state installation data helps these sectors learn more about the state markets and evaluate the effectiveness of marketing, financial incentives and education initiatives. In addition, these data allow better understanding of the environmental and economic impact of solar installations.

For all solar technologies, the United States is only a small part of a robust world solar market. Product availability and pricing generally reflect this status. Germany is the top market for PV and China is the largest market for solar thermal collectors. However, this report does not analyze markets outside the United States.

PHOTOVOLTAICS

Overall Trends in Installations and Capacity

Annual U.S. PV installed capacity grew by 63% in 2008 compared with installations in 2007 to 332 MW_{DC} (including both grid-connected and off-grid markets — see Figure 1), bringing the cumulative installed capacity to 1,102 MW_{DC}. Although PV installation growth had been steady and impressive for many years, the annual growth rate doubled when the federal Investment Tax Credit (ITC) increased in 2006. By 2008, the capacity of PV installed each year was triple the annual amount installed in 2005. More than 30,000 sites installed PV in 2008, with 62% of these sites and 86% of the installed capacity connected to the grid. Most of these installations are mounted on buildings, but some are ground-mounted installations.

[4] The information here is a summary of information included in the report *U.S. Solar Market Trends 2008*, available on the IREC web site at http://www.irecusa.org/fileadmin/user_upload/NationalOutreachDocs/SolarTrendsReports/IREC_Solar_Market_Trends_Report_2008.pdf . In addition to more analysis, the full report contains details of the data collection methods and assumptions.

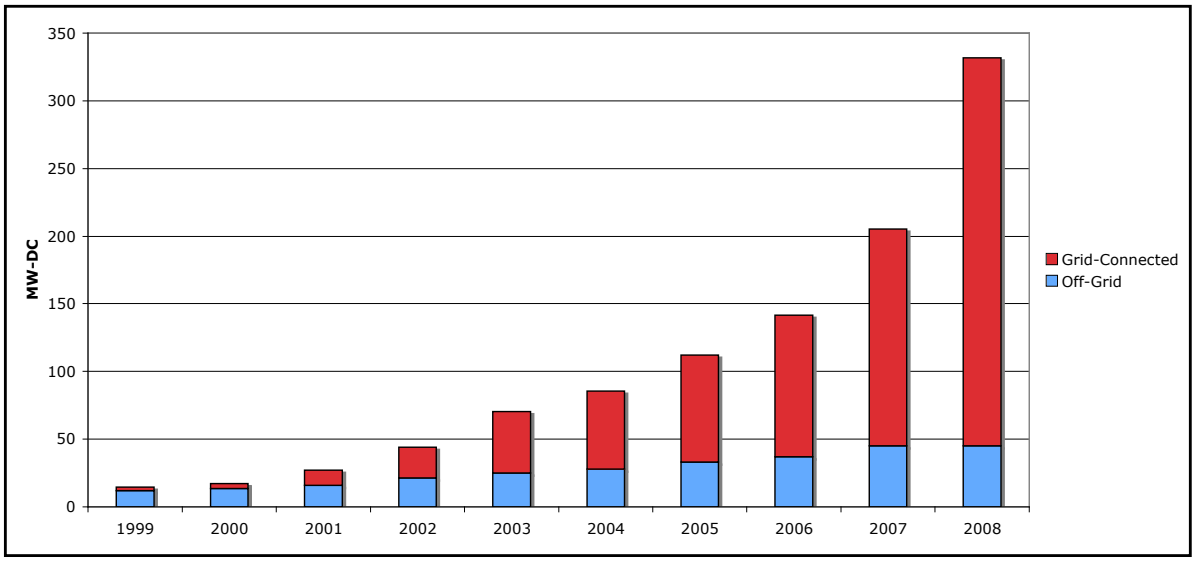


Fig.1: Capacity of Annual U.S. Photovoltaic Installations (1999-2008)

The following factors helped drive the large growth in 2008:

- The federal ITC was increased in 2006 for commercial taxpayers, and a credit for residential taxpayers took effect. These changes were scheduled to expire at the end of 2008. For larger systems, especially, contracts were written requiring installation by the end of 2008. Thus a large number of these large installations were completed in 2008 in anticipation of the ITC expiration. The federal ITC was renewed in October 2008 (through December 2016) and the $2,000 cap for residential installations was removed. This will influence future installations, but it was not a factor in 2008 installations.
- Many states are offering incentives, and system installation growth more than doubled in Arizona, Connecticut, Hawaii, Maryland, Massachusetts, New Mexico, North Carolina, Oregon, Pennsylvania and Wisconsin. Each of these states has one or more significant financial incentive and/or a renewable portfolio standard (RPS) program with a mandate for solar installations.
- Renewable portfolio standards with specific solar requirements had an impact in states that enacted such policies two or more years beforehand. Frequently, the market impact lags the enactment of the policy. For example, North Carolina's and Pennsylvania's RPS policies led to the first large solar installations in these states in 2008.
- The California Solar Initiative operated smoothly throughout 2008 and produced large growth in the largest market in the country. The program began in 2007 and experienced some start-up problems, which affected installations in that year. These problems have now been resolved.

Detailed data on off-grid PV installations are not available, so the remainder of the PV section of this report is limited to a discussion of the U.S. grid-connected PV market.

Grid-Connected Installations by Sector

Residential installations were 27% of all new grid-connected PV systems installed in 2008 by capacity. Although the capacity of residential installations grew in 2008, the market share declined compared with each of the previous three years, when these installations were 35-36% of the total capacity. Figure 2 shows the annual PV installation capacity data, segmented by residential, non-residential and utility installations. Non-residential installations include such sites as government buildings, retail stores, and military installations. Their larger average size means a larger aggregated capacity. Both residential and non-residential installations are on the customer's side of the meter and produce power used on-site. In contrast, the utility installations are on the utility's side of the meter and produce bulk power for the utility grid.

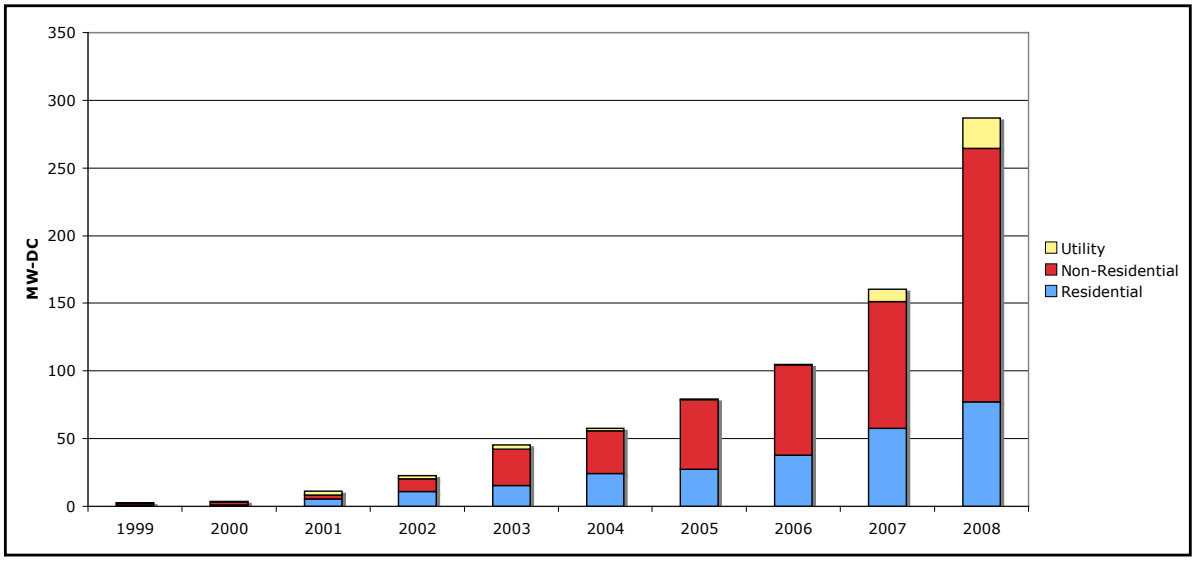


Fig. 2: Annual Installed Photovoltaic Capacity by Sector (1999-2008)

Part of the drop in market share for residential installations was due to changes in the federal ITC. On October 2008, the residential ITC was renewed and the $2000 cap was removed for residential installations beginning in January 2009. This caused some homeowners in the final quarter of 2008 to delay new installations until 2009 in order to receive a larger federal tax credit. This decreased the number of residential installations in 2008.

However, a larger factor was the strong growth in non-residential installations. For most of 2008, the future of the residential and commercial ITC was uncertain; the residential ITC was scheduled to expire and the commercial ITC was scheduled to decrease from 30% to 10% on January 1, 2009. Developers signed many contracts for new installations with a delivery date before the end of 2008. This resulted in a rush of installations in the last quarter of 2008.

Another factor favoring larger installations is that the installed price per watt is significantly lower for larger systems. Based on data from the California Solar Initiative database, installations of systems larger than 500 kW cost 17% less on a per-watt basis than residential installations, most of which are smaller than 10 kW.

Virtually all of the larger installations and many of the medium-sized non-residential installations use power purchase agreements (PPAs). At least one company provides PPAs for residential customers. In these agreements, a third party finances and owns the solar installation and receives the available tax advantages and other incentives. The third party then leases the system or sells the solar-generated electricity to the building or site owner through a long-term contract.

Utility installations, defined here as installations for bulk power on the utility's side of the meter, increased to 8% of the grid-connected PV systems installed in 2008 by capacity. A 13-MW installation in Nevada and a 3-MW installation in Pennsylvania were the largest PV systems installed in 2008, and accounted for much of the new utility installed capacity. Based on announced projects, this sector should continue to grow significantly each year moving forward.

Grid-Connected Installation Capacity

The average size of a grid-connected PV residential installation has grown steadily from 2.5 kW in 1999 to 4.8 kW in 2008 (see Figure 3). The average size of a non-residential system has also been growing in recent years, and was 106 kW_{DC} in 2008 (see Figure 4). The average size of grid connected PV installations varies from state-to-state, depending on available incentives, interconnection standards, net metering regulations, solar resources, retail electricity rates, and other factors.

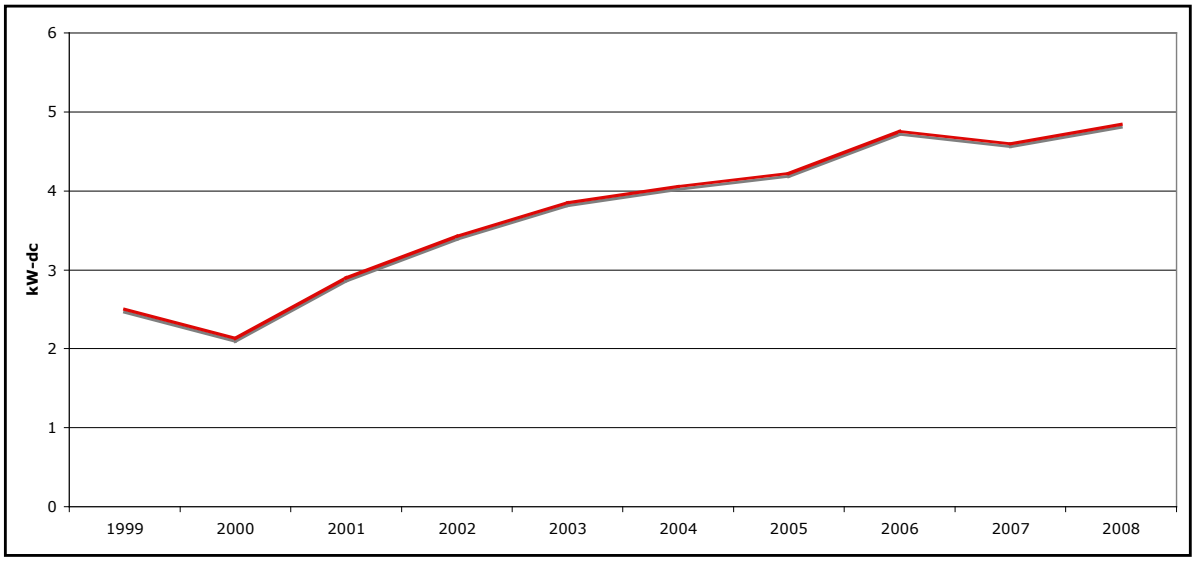


Fig. 3: Average Capacity of Grid-Connected Residential PV Installations (1999-2008)

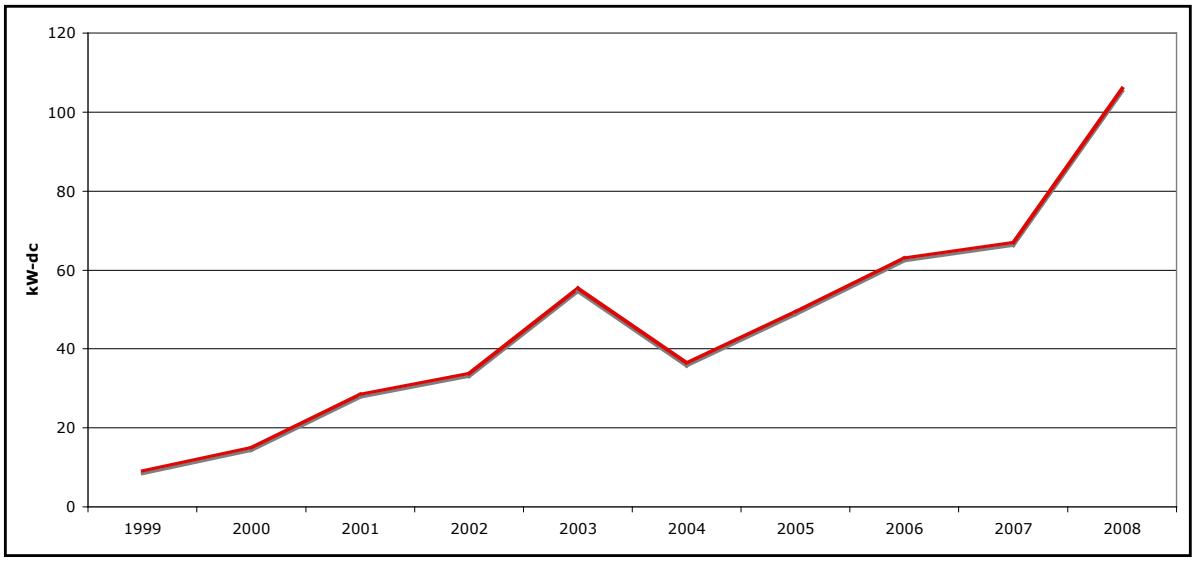


Fig.4: Average Size of Grid-Connected Non-Residential PV Installations (1999-2008)

Installation of large systems — those greater than 500 kW — grew faster than any other sector. Within the non-residential sector, large systems accounted for 46% of the annual installations on a capacity basis in 2008 compared with only 19% in 2005 (see Figure 5). A total of 82 systems larger than 500 kW accounted for 30% of the total PV capacity installed in 2008.

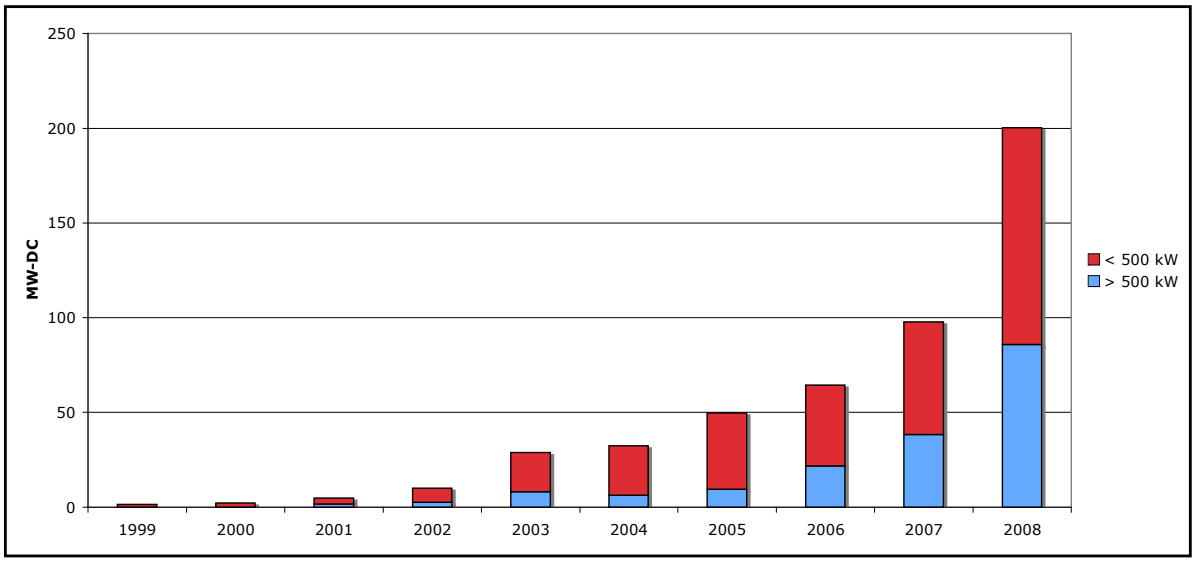


Fig. 5: Non-Residential Grid-Connected PV Installations by Capacity (1999-2008)

In several states, regulators are considering defining third-party owners of solar equipment as utilities (i.e. the PPA model discussed previously). Such rulings are generally unfavorable to the solar PPA model. If such rulings are made, third-party owners in these states may still be able to lease solar facilities (as opposed to owning and operating solar facilities) without being classified as utilities, but their ability to use the federal ITC will need to be clarified. If the federal ITC cannot be used as readily under the leasing model, PPAs will become less viable in these states, and the growth of solar installations in these states will be constrained.

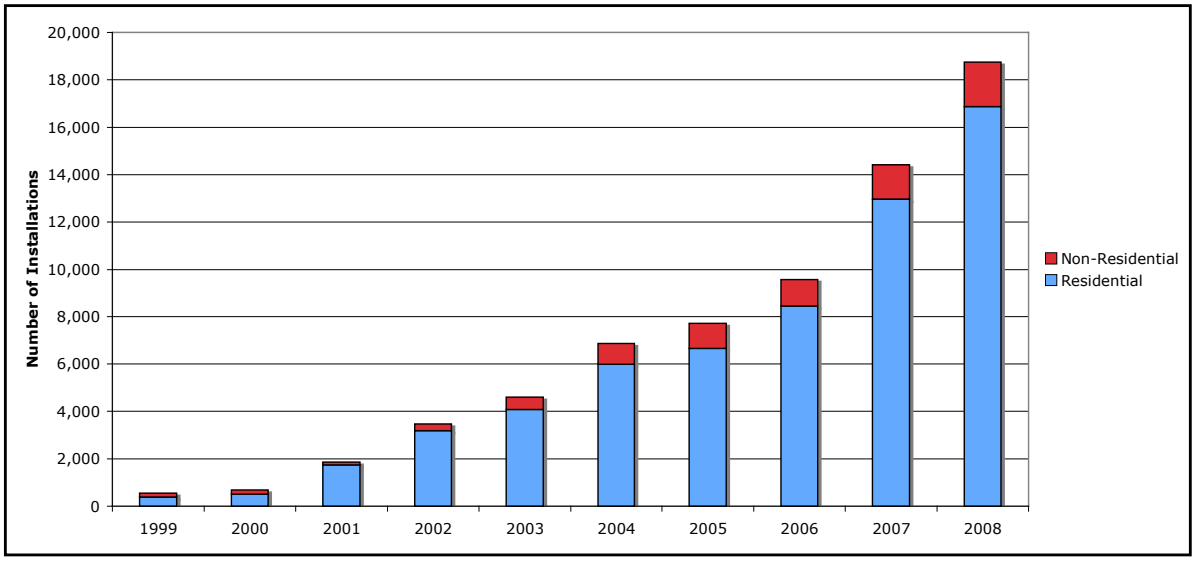


Fig. 6: Number of Annual Grid-Connected PV Installations (1999-2008)

Almost 19,000 grid-connected PV installations were completed in 2008, with 90% of these at residential locations (see Figure 6). At the end of 2008, 69,000 PV installations were operating on the grid, including 61,000 residential installations. Since the average size of non-residential systems is more than ten times the average size of residential systems, the number of residential installations is much larger than non-residential installations, even though the installed capacity of non-residential installations is greater.

Installations by State

In 2008, installations of grid-connected PV systems were concentrated in California, New Jersey, Colorado, and Nevada, as shown in Table 1. These same four states were the leading states for installations in 2007. Table 2 shows that 61% of all PV capacity installed in 2008 was in California. As noted earlier, no comprehensive data exists for off-grid PV installations by state.

Table 1: TOP TEN STATES BY 2008 CAPACITY
Ranked by Grid-Connected Photovoltaic Capacity Installed in 2008 (MW_{DC}/yr)

2008 Rank by State	2008 (MW_{DC})	2007 (MW_{DC})	07-08 % change	2008 Market Share	2007 Rank
1. California	176.0	91.8	92%	61%	1
2. New Jersey	22.5	20.4	10%	8%	2
3. Colorado	21.7	11.5	88%	8%	4
4. Nevada	14.9	15.9	-6%	5%	3
5. Hawaii	8.6	2.9	200%	3%	6
6. New York	7.0	3.8	85%	2%	5

7. Arizona	6.2	2.8	120%	2%	7
8. Connecticut	5.3	2.5	109%	2%	8
9. Oregon	4.8	1.1	330%	2%	11
10. North Carolina	4.0	0.4	899%	1%	16
All Other States	15.9	7.2	122%	6%	
Total	286.9	160.3	79%		

New California PV installed capacity in 2008 nearly doubled to 176 MW_{DC} compared with installations completed in 2007. The market more than doubled in Hawaii, Arizona, Connecticut, Oregon, North Carolina, Pennsylvania, Massachusetts, Maryland, Wisconsin, and New Mexico. Of the top ten states, only Nevada saw a decline in the capacity of systems installed in 2008 compared with those installed in 2007. Nevada was home to the largest single installation in both 2007 and 2008, but that one large installation was somewhat smaller in 2008 than in 2007.

Table 2: TOP TEN STATES BY CUMULATIVE CAPACITY
Ranked by Grid-Connected PV Cumulative Installed Capacity through 2008

	MW_{DC}	**Market Share**
1. California	526	67%
2. New Jersey	70	9%
3. Colorado	36	5%
4. Nevada	34	4%
5. Arizona	25	3%
6. New York	22	3%
7. Hawaii	14	2%
8. Connecticut	9	1%
9. Oregon	8	1%
10. Massachusetts	8	1%
All Other States	39	5%
Total	789	

Although new state markets emerged in 2008, the U.S. PV market remains very concentrated in a few states. Eighty-two percent of grid-connected installed capacity was in California, New Jersey, Colorado, and Nevada and 95% was in the top ten states.

Table 3 shows the cumulative per capita grid-connected PV capacity through 2008. Even with the largest population in the country, California has the highest total capacity of installations per capita – a capacity that is more than five times the national average. Both Hawaii and Nevada installed more on a per-capita basis than California in 2008. The large number of installations in a few states raises the national average, but 44 states have a per-capita PV installation rate that is less than the national average. As a point of reference, the city of Freiburg, Germany, with less solar resource than any of these states, has 41 watts installed per capita, considerably more than the average 3 watts installed per capita in the U.S.

Table 3: TOP TEN STATES BY PER CAPITA CAPACITY
Ranked by Cumulative Installed Capacity per Capita (W_{DC}/person) through 2008

	Cumulative through 2008 (W_{DC}/person)	**2008 Installations (W_{DC}/person)**
1. California	14.5	4.9
2. Nevada	14.2	6.7
3. Hawaii	10.6	6.2
4. New Jersey	8.1	2.6
5. Colorado	7.7	4.6
6. Arizona	4.2	1.0
7. Connecticut	2.5	1.5
8. Delaware	2.2	0.7
9. Oregon	2.1	1.3
10. Vermont	1.8	0.6
National Average	2.7	1.0

SOLAR THERMAL ELECTRIC

No new solar thermal electric plants were connected to the grid in 2008. At least one research and development facility was constructed this past year, but it does not have a generator to produce electricity. Sixty-five megawatts of solar thermal electric capacity were added in 2006 and 2007 and nine solar thermal electric plants with a capacity of 354 MW were constructed in California from 1985 to 1991. These plants continue to operate today.

The future prospects for solar thermal electric plants look bright, although developers are not expected to complete any new plants until at least 2010. According to the Solar Energy Industries Association, several different companies have announced plans totaling over 7,000 MW of generating capacity, and some have begun to receive required approvals from government agencies for these projects.

Solar Hot Water and Space Heating

Solar thermal collectors can heat hot water for domestic or commercial use or heat spaces such as houses or offices. More rarely, solar-thermal collectors can provide heat for industrial processes or air conditioning.

In 2006, the new residential federal ITC and the increased commercial ITC, together with rising conventional energy prices, contributed to a dramatic increase in the U.S. solar hot water market.

The credits were further increased in February 2009 with the removal of the $2,000 cap. Prior to 2006, about half of the solar water heaters sold each year in the United States were in Hawaii due to a combination of utility rebates, state tax credits, and high energy prices. By 2008, the national capacity of systems installed each year was triple the number in 2005, and installations outside Hawaii increased by 5-1/2 times (see Figure 7). After Hawaii, Florida and California lead the states in solar hot water installations. Data for solar thermal installations comes from the U.S. Energy Information Administration and lag the data from other sources by a year. Therefore these data are only available through 2007.

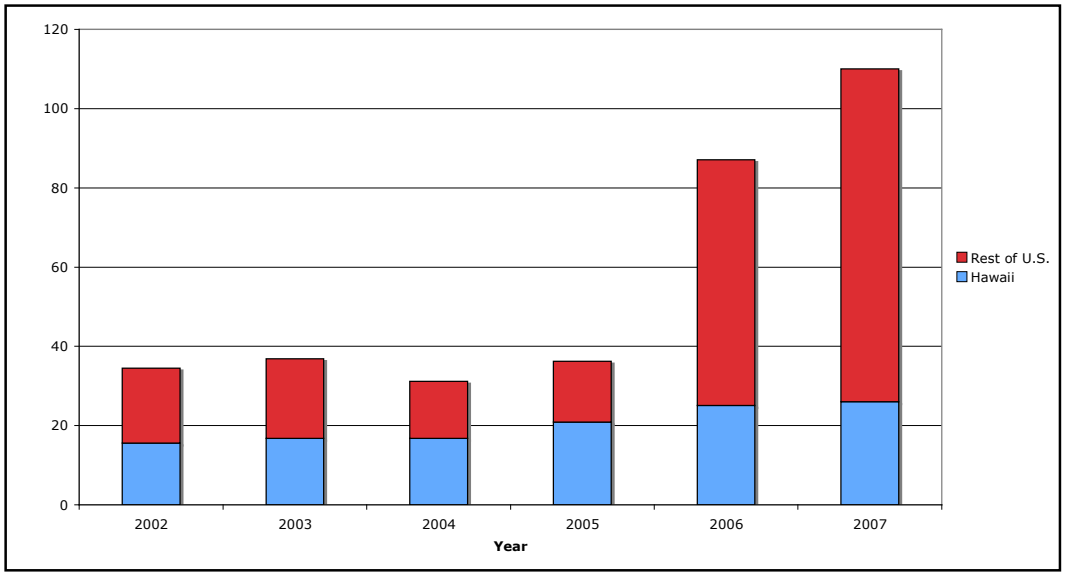


Fig. 7: Annual Installed Capacity for Solar Hot Water and Space Heating (2002-2007) Based on analysis of collector shipment data from EIA.

Figure 8 shows that, like PV installations, solar water heating and space heating installations are concentrated in a few states (and Puerto Rico). However, the states with the most installed capacity for solar hot water are different than the states with the most installed PV. Hawaii represents a quarter of the solar hot water market. High energy prices and strong government policies have built the solar hot water market in Hawaii. In addition, installation costs are lower in Hawaii than in most other locations in the United States because freezing is not a concern.

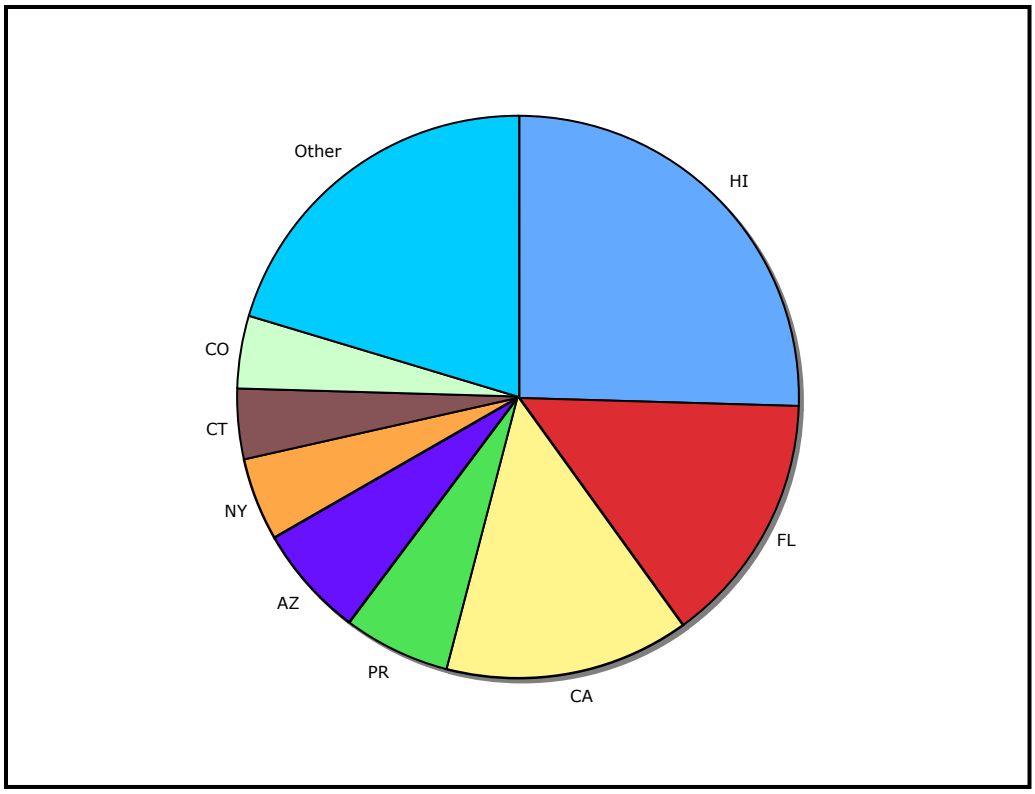


Fig. 8: Installed Solar Hot Water and Space Heating Capacity by State for 2006-2007
Based on analysis of EIA data for 2006-2007

Solar Pool Heating

Figure 9 shows the annual installed capacity for solar pool heating systems during 1999 to 2008. Installed capacity declined 3% in 2008 following a dramatic decline of 24% in solar pool heating capacity in 2007 compared with 2006. To a certain extent, the sales of solar pool heating systems follow the sales of pools. The economic decline in the real estate markets in Florida and California likely led to the decrease in pool installations and thus the dramatic decline in capacity installed of solar pool systems in 2007 and 2008 compared with earlier years.

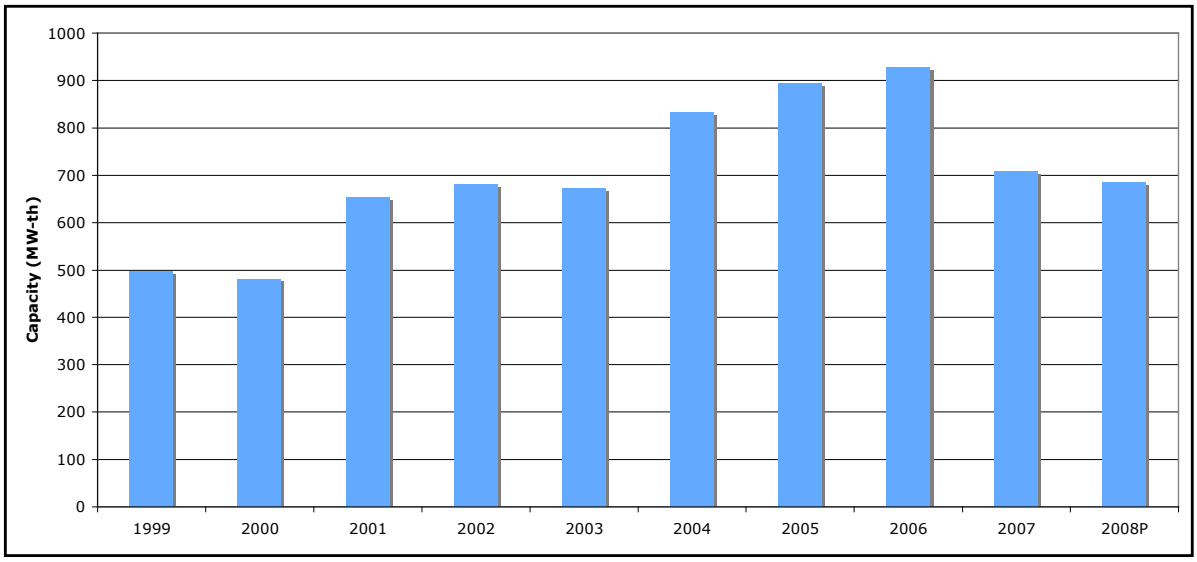


Fig. 9: Annual Installed Capacity for Pool Heating (1999-2008)
Based on collector shipment data from EIA and SEIA

The trend continues for solar pool heating systems, with installations concentrated in a few states, notably Florida and California (see Figure 10). Unlike other solar technologies, only a few states offer incentives for solar pool heating systems and those incentives are modest.

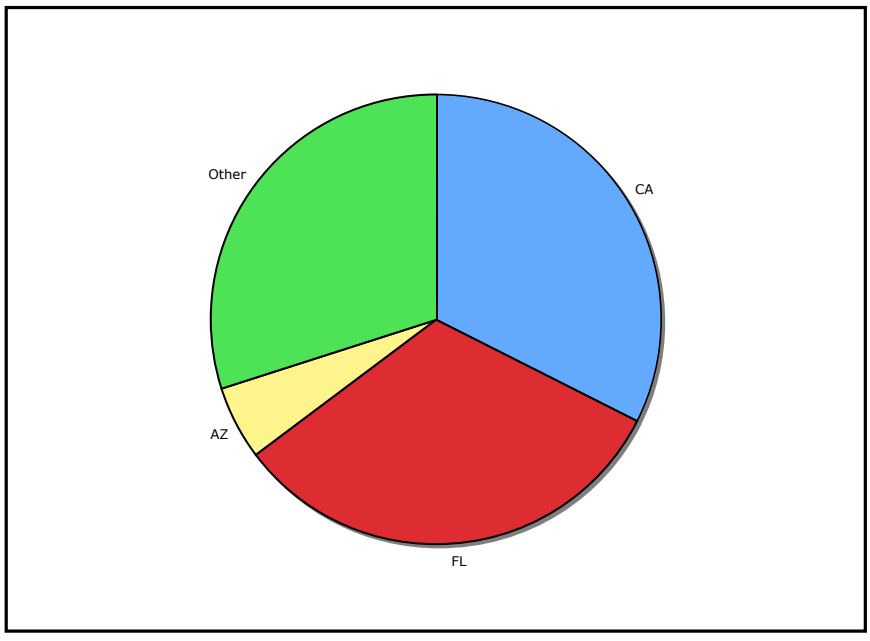


Fig. 10: Installed Pool Heating Capacity by State
Based on EIA Data for 2006-2007

PROSPECTS FOR 2009 AND 2010

Early indicators point to market growth in 2009, though likely at a slower rate than during the last several years. The market growth rate will likely accelerate in 2010. The long-term extension of the federal ITC, new rules that allow electric utilities to use the ITC, and the establishment of a grant alternative to the commercial ITC will all help drive market growth. In addition, the American Recovery and Reinvestment Act of 2009 (ARRA) provides funds for state energy offices. Many states are using some of these funds to increase budgets for incentive or grant programs or to install solar on government buildings. The market is now responding to these new policies. However, due to the poor housing market and restricted capital availability, the solar market will respond slower to these initiatives than it might have in a stronger economic environment. Companies have announced plans for many large solar projects, including solar thermal electric projects, utility-owned projects, and third-party owned projects. A few of these projects will be completed in 2009, but most will come on-line in 2010 and beyond.

Prices for PV modules are beginning to fall, and many analysts expect prices to continue to fall indefinitely. Lower PV prices offer the potential of installations in states without state or local incentives. However, in 2009, installations will continue to be concentrated in states with strong financial incentives and other strong solar policies, and these incentives and other policies will remain critical to market growth.

Electric utility announcements point to growth in installations on the utility-side of the meter. Many of these installations will be large arrays owned by the utility or a third-party. Others involve siting PV on residential or commercial buildings. These systems are configured on the utility-side of the meter and have no effect on the consumer's bill; instead the building owner receives a roof lease payment or similar type of compensation.

CONCLUSION

Solar markets are booming in the United States due to consumer interest in green technologies, concern about energy prices, and financial incentives from the federal government, states, local governments and utilities. Over 81,000 installations were completed in 2008. The markets for each solar technology are concentrated in a few states.

The number of new PV installations grew by 63% in 2008 compared with those installed in 2007 and the average size of PV systems is growing. A 12.6-MW installation in Nevada and a 3-MW installation in Pennsylvania were the largest PV systems installed in 2008, and together accounted for 5% of the annual installed capacity. The PV market is expanding to more states, and installations doubled in more than eleven states. However, California remains the dominant market.

Solar hot water installations have boomed since the enhanced federal ITC took effect in 2006. In the continental 48 states, annual installed capacity has quintupled since 2005. Hawaii remains the largest market for solar hot water.

No new solar thermal electric plants were connected to the grid in 2008. The future prospects for solar thermal electric look bright, although no new plants are expected to be completed until 2010.

Federal tax incentives expanded or renewed in October 2008 and February 2009 will lead to market growth in 2009 and accelerating market growth in 2010.

Acknowledgements

The author appreciates the data supplied by many national, state, and utility offices and programs and the assistance of David Colt from the Prometheus Institute with the collection of some of this data. The author also thanks Justin Baca, Galen Barbose, Annie Carmichael, Rusty Haynes, Neal Lurie, Colin Murchie and Mike Taylor for their reviews of the draft report. Jane Weissman, Executive Director of the Interstate Renewable Energy Council, supported this work and Janet Meyer provided valuable editorial assistance.

Net Metering and Interconnection Updates and Trends

Jason Keyes, Kevin Fox, Joe Wiedman and Michael Sheehan

Introduction

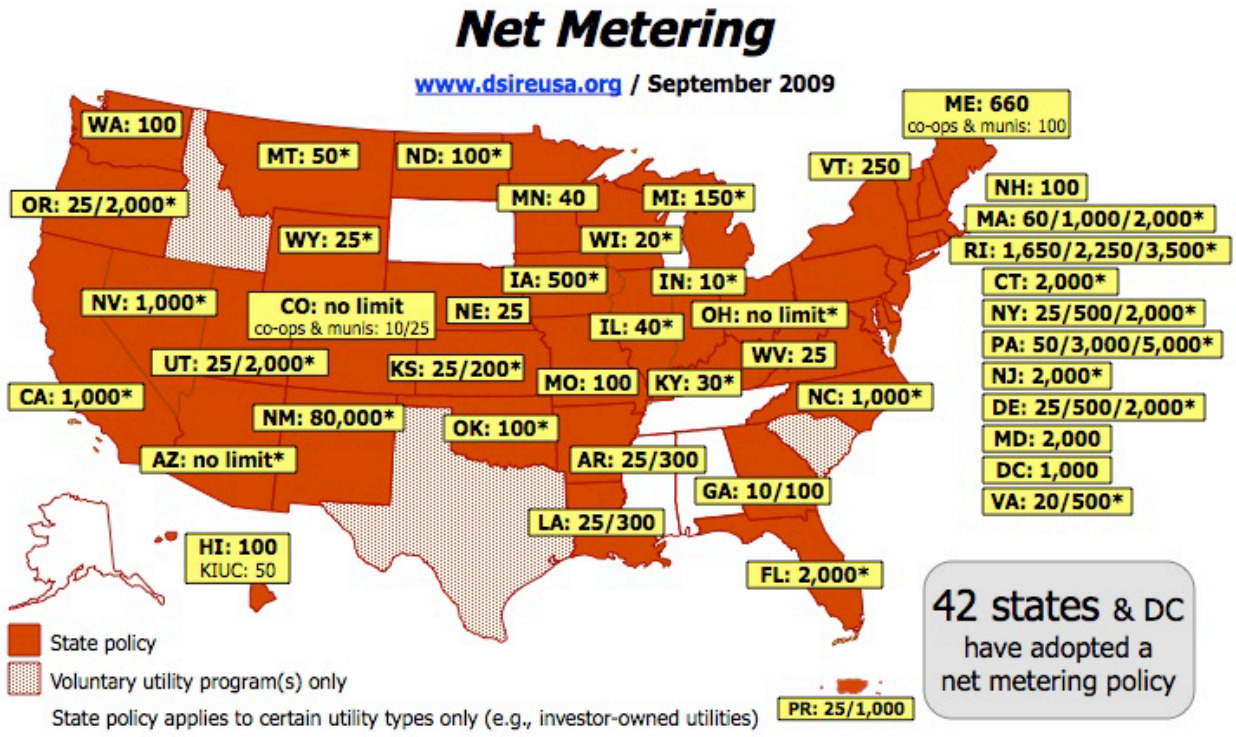
IREC participates in state and municipal level workshops, proceedings, and rulemakings focused on net metering, interconnection, and financing of distributed renewable energy technologies. In the twelve months through August, 2009, IREC was active in the development or modification of interconnection rules in Alaska, California, Colorado, Illinois, Kansas, Maine, Michigan, New Hampshire, New York, North Carolina, South Dakota, Utah and Virginia. For net metering, IREC was active in rulemakings in Alaska, Arizona, California, Colorado, Kansas, Kentucky, Massachusetts, Michigan, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Utah and Virginia. This section provides an overview of the major net metering and interconnection issues that IREC addressed in these states and previews the emerging issues that IREC sees on the horizon.[5] This section also provides information about IREC's plans for the coming year.

For a comprehensive description of IREC's positions on net metering and interconnection issues, see IREC's newly revised model procedures and other documents on IREC's website. For a thorough analysis of the procedures developed in the states in which IREC was active in the past year, see www.dsireusa.org.

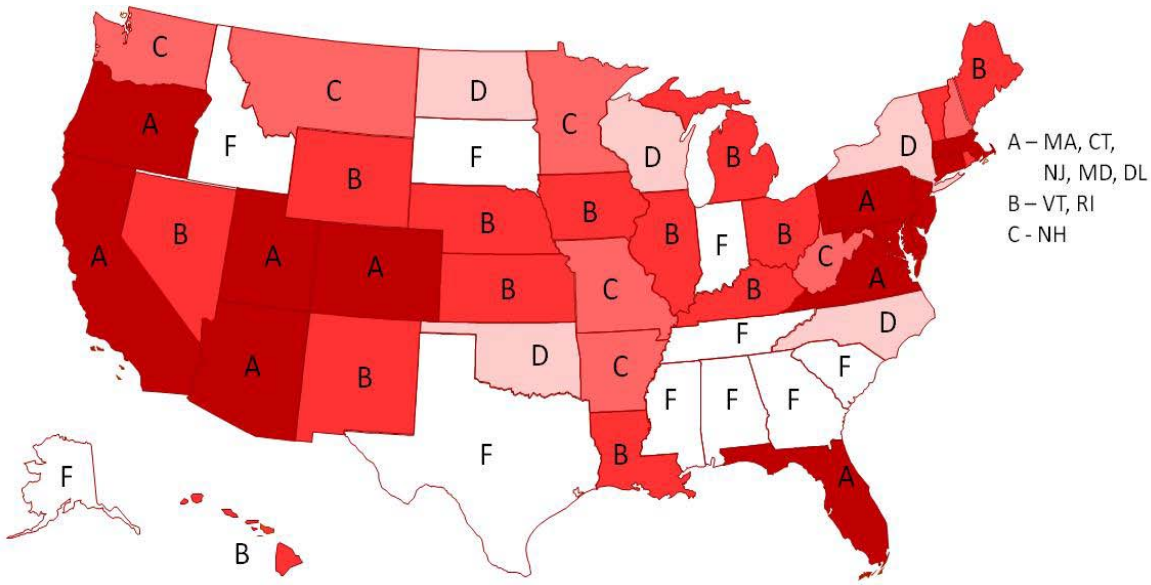
[5] As for rulemakings still in progress, little detail is provided here because a snapshot of an ongoing rulemaking is typically a poor reflection of the final product, making the snapshot marginally useful.

State Developments: Net Metering

Two net metering maps are provided below. The first shows net-metered facility size limits and is frequently displayed in net metering presentations. Over the years, the numbers have increased as states have improved and the map has filled in as states have adopted rules. However, this map gives the false impression that little work remains. Just the opposite is true; many states have seriously flawed rules that inhibit market growth. The second map addresses the status of net metering rules by state, using the grades applied in *Freeing the Grid 2009*, available at www.newenergychoices.org. Thirteen states receive A grades, up markedly in the past few years, but even these states can do better. For the rest, improvement is needed, and in most of the fifteen states graded at D or F, entirely new rules are in order. Progress was achieved in the past year. Substantial improvements in net metering occurred in Utah, Arizona, Kentucky and Massachusetts. IREC was involved in each of these states with Massachusetts becoming the first state to implement a community net metering program. As well, Kansas, Michigan, and Nebraska joined the list of states with statewide net metering.



Net Metering Grades per "Freeing the Grid 2009"
www.newenergychoices.org



The most important issue for net metering continues to be the treatment of energy delivered to the electric grid. The touchstone of the debate centers invariably on concerns over the potential for inter-class subsidies when implementing or expanding net metering programs. This issue was front and center in several states including California due to legislative efforts to expand the aggregate program cap for net-metered systems and the California commission's consideration and ultimate adoption of a cost-benefit methodology for assessing the costs and benefits of distributed generation including net metered systems. Utilities typically view any framework which values net metered excess generation above avoided costs rates as an undue subsidy to customer-generators from non-participating ratepayers. Many utilities continue to hold this view despite the ever mounting research finding that the benefits of renewable distributed generation justify valuing net metered excess generation from renewable resources well above a utility's typical avoided cost of generation.

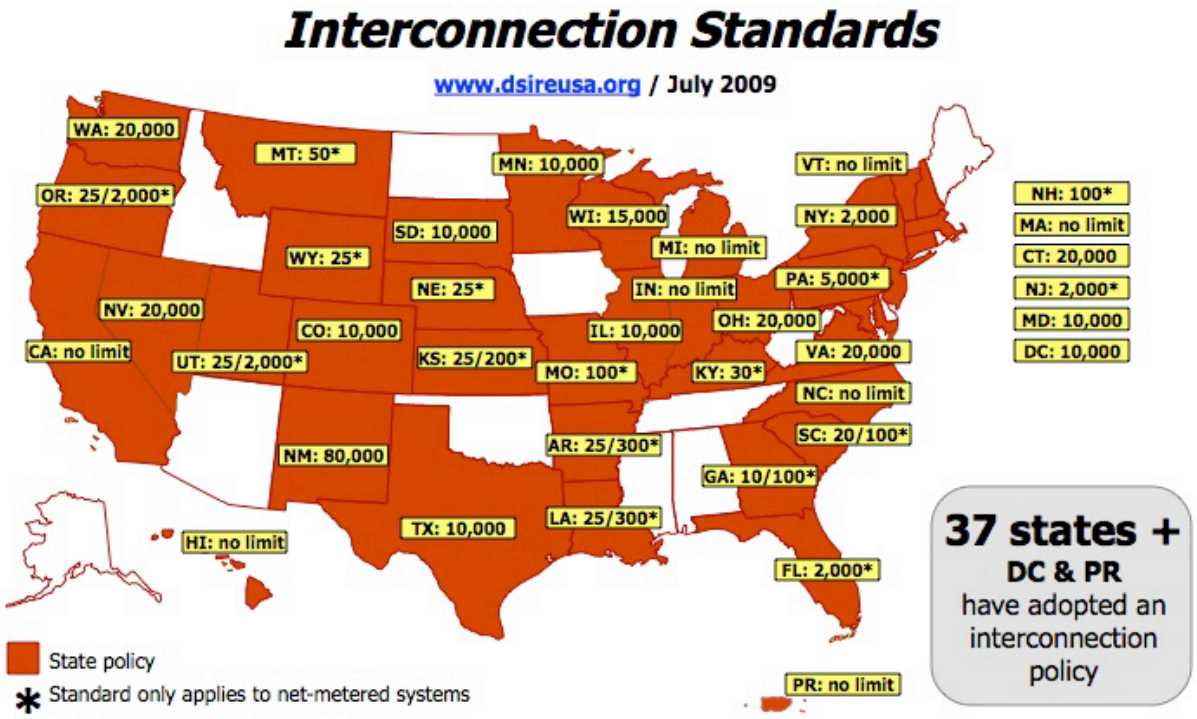
Concerns over the potential for inter-class subsidies underpin many decisions legislatures or state utility commissions make in placing arbitrary caps on the aggregate capacity of net metered systems allowed to participate in state net metering programs. Aggregate program caps are usually expressed as a percentage of a utility's annual peak demand. Over the past year, there has been some movement at expanding these caps. North Carolina updated its net metering rules to impose no aggregate cap. Arizona also finalized rules that contain no explicit cap; however, utilities may request a cap and one may be granted with sufficient justification. The Delaware Legislature raised that state's net metering program cap from 1% of peak load to 5%.

In response to legislation that was passed in Utah allowing that state's public service commission (PSC) to raise the net metering cap above 0.1%, the Utah PSC raised the cap to 20%. Limits on eligible system size continue to vary considerably from state to state. However, states continue positive movement towards allowing larger systems to net meter. In 2008, North Carolina updated its rules to increase eligible system size from 100 kW to 1 MW, however, all systems over 100 kW are subject to standby charges. Colorado joined Arizona and Ohio in accommodating systems of any size, so long as a system does not exceed 120% of a customer's average annual consumption and is sized no larger than the customer's service entrance capacity. Removing system size limits and allowing customers to size their systems based on load characteristics and economics places these three states at the forefront. Michigan and Nebraska joined the list of states offering statewide net metering though their adopted rules only allow net metering for systems up to 150 kW and 40 kW respectively, and Kansas legislation added that state to the list with rules to be established within a year allowing net metering of systems up to 200 kW.

While 2008 was marked by most states converging on payment of avoided cost rates for any annual excess generation, the last year saw several states move to allow indefinite rollover of annual excess generation. This approach was taken in Colorado, Massachusetts and Michigan. Moreover, while the past saw states adopting rules that credited monthly excess generation at avoided costs, movement in the past year was towards recognizing the inherent fairness of allowing customers to roll over excess kilowatt hours supplied to the utility in one month in exchange for kilowatt hours from the utility in a future month. In Utah, the PSC offered a choice of credits for demand-metered commercial customers including a rate for excess generation based on a proxy for full retail rate after embracing the view that a per kWh energy credit alone would be inadequate compensation. Legislation in Kansas established rollover of excess generation from one month to the next, though annual excess generation expires. Michigan's new rules establish rollover for systems 20 kW or less, while systems 20 kW to 150 kW are credited with the generation component of rates.

State Developments: Interconnection Standards

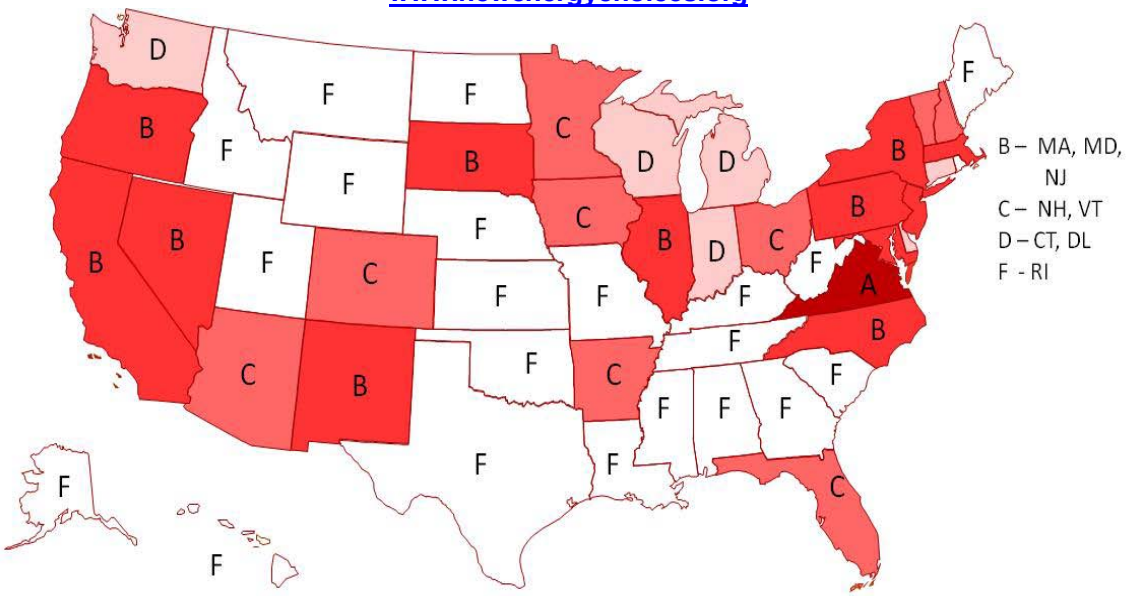
As with the net metering maps, the two interconnection maps below provide the facility size cap and the *Freeing the Grid 2009* grade. Even more starkly than is the case for net metering, it is clear from the state grades that many states have inadequate rules, or no rules at all. Grades of F include the thirteen states without rules and nine states with inadequate rules, and almost no distributed generation is installed in those states.



Notes: Numbers indicate system capacity limit in kW. Some state limits vary by customer type (e.g., residential/non-residential)."No limit" means that there is no stated maximum size for individual systems. Other limits may apply. Generally, state interconnection standards apply only to investor-owned utilities.

Interconnection Grades per "Freeing the Grid 2009"

www.newenergychoices.org



Progress achieved over the last twelve months includes substantial improvements in interconnection in Virginia, New York, Michigan, South Dakota and the District of Columbia. IREC was involved in each of these efforts. Colorado also improved its already solid interconnection standards and Kentucky and Nebraska instituted very limited statewide interconnection standards.

The most commonly debated interconnection provisions are often not the most important ones, but critical provisions are often widely adopted without debate. One example of this is the widespread use of the technical screens developed by the Federal Energy Regulatory Commission to determine which projects can be approved without study. Another standard feature is reliance on the IEEE 1547-2003 (Standard for Interconnecting Distributed Resources with Electric Power Systems) and UL 1741 (Inverters, Converters, and Controllers used in Independent Power Systems). The issues that are more often debated in state rulemakings include: (1) elimination of the utility external disconnect switch requirement for small inverter-based systems, (2) establishment of an upper limit on system size eligibility, (3) network interconnection screens, and (4) insurance requirements. We focus on these issues below.

Elimination of the Utility External Disconnect Switch

The trend towards eliminating the requirement for a utility external disconnect switch (UEDS) on small inverter-based systems continued to gain momentum over the last year. In early 2009, Xcel announced it was eliminating the requirement in its Colorado service territory. New York pushed the envelope of best practices in this area by eliminating the requirement for a UEDS for systems up to 25 kW (New Jersey has been the leader, with no requirement for any size, but no other state has followed suit). However, shortly after New York's move, New Hampshire went even further, eliminating the requirement for systems up to 100 kW. These states and Xcel join Delaware, Florida, Oregon, New Jersey, North Carolina, PG&E and SMUD in eliminating the UEDS for small inverter-based systems. Unfortunately, progress was not lockstep. Colorado missed an opportunity to join these states and instead concluded that requiring a UEDS should be left to utility discretion. Moreover, Virginia weakened otherwise excellent interconnection standards by requiring a UEDS.

Removal of an Upper Limit on System Size Eligibility

On the issue of maximum size, there has been further recognition that state procedures should cover all interconnections over which a state would have jurisdiction. Under PURPA, states have jurisdiction over the interconnection of certain generators, termed "qualifying facilities," when the entire output of such generators is sold directly to an interconnected utility. State jurisdiction applies in such situations regardless of the size of the generator and regardless of whether the interconnection is to a transmission or distribution line. By establishing an upper limit to the applicability of a state interconnection standard, regulators may leave large qualifying facilities without an applicable standard. To address this, Illinois added a new rule in the past year for interconnections from 10 MW to 20 MW. In new rules, Virginia covered all interconnections up to 20 MW, South Dakota established a 10 MW limit, and Michigan set no upper limit at all.

Adoption of Network Interconnection Screens

Network interconnections became much more likely in the past year, thanks to progress in New York and an important report out of the National Renewable Energy Laboratory (NREL) in early 2008. Utilities have particularly resisted interconnections on area networks, common in urban cores, on the basis that grid reliability might be impacted. However, Con Edison helped remove barriers by its reasonable analysis of the impact of a typical system under 200 kilowatts on an area network and the recognition that these systems rarely require special safeguards. Based on Con Edison's input, the New York Standard Interconnection Requirements contemplate rapid approval without study for the typical system, while retaining flexibility for utilities to consider special circumstances. Because New York City is served by area networks to an extent far beyond any other city's use, we expect other state rules to emulate New York's on this point. Virginia included network interconnection provisions in the rules adopted shortly after New York's. Along with the New York rules, the NREL study on network interconnections is certain to facilitate discussions in other states. NREL concluded that inverter-based systems can safely be interconnected on networks given the use of relays or other measures to assure minimum power flows into the network at all times (see www.nrel.gov/docs/fy08osti/42675.pdf).

Relaxation of Insurance Requirements

Insurance requirements as part of interconnection procedures continue to be an area of debate. Utilities and regulators often start from the view that, if a customer's generator damages the grid, then, as a matter of fairness, the customer generator should pay for the damage. From a cost causation standpoint, this view has intuitive appeal on fairness grounds: ratepayers should not bear the burden for damage to the utility grid caused by customer generation. However, with over 70,000 solar arrays interconnected across the United States, the authors are not aware of any case of line worker injury or significant utility property damage attributable to solar energy systems. Moreover, solar arrays are expensive assets that are almost always covered under a property owner's insurance which would typically provide protection if damage or injury occurs. Because of this, prohibiting additional insurance requirements in order to interconnect appears to have little practical cost impact for utility ratepayers, but requiring additional insurance does add cost for the system owner.

During the last twelve months, Virginia implemented interconnection procedures which require customer-generators to carry insurance, but the amounts are no more than what property owners would generally carry: systems under 10 kW must carry $100,000, systems between 10 kW and 500 kW must carry $300,000, and systems between 500 kW and 2 MW must carry $2,000,000. As part of Colorado's update to its interconnection procedures, that state eased insurance requirements for systems above 10 kW and also removed the requirement that systems below 500 kW name the utility as an additional insured. Adopting best practices, recent legislation in Kansas prohibits additional insurance requirements. Michigan adopted rules that exempt most net metered systems from additional insurance requirements including naming the utility as an additional insured.

TRENDS IN NET METERING AND INTERCONNECTION

Many issues continue to emerge in net metering and interconnection as renewables increase the depth and scope of their penetration on the grid and across the states, including: (1) regulation of solar services agreements; (2) community solar proposals and meter aggregation; (3) addressing issues surrounding the implementation of smart grid technologies and high penetration of PV on the grid; and, (4) leveraging the opportunity electrification of transportation offers to renewable resources. Some of these issues are increasingly familiar while others are just emerging. Over the coming year, IREC expects to continue to be engaged on each of these issues.

Regulation of Solar Services Agreements

Regulation of solar services agreements (SSAs) has emerged as an important issue in supporting the solar growth. Confusingly, "PPA" is often used in reference to SSAs, however, PPA has long been the term for an wholesale sales agreement between a generator and a utility, but a SSA is actually a retail sales agreement between a solar array owner and the utility customer hosting a solar array. This arrangement has become the norm, as SSA providers are able to use the available federal tax credits and depreciation, and free the host from tying up capital and taking on the risks of ownership. By overcoming a number of barriers to customer uptake of solar, SSAs have become the preferred means for the financing solar by commercial customers and the use of solar SSAs is beginning to be seen in residential markets.

Because the use of solar SSAs is so beneficial to the growth of solar markets, IREC has been actively involved in state proceedings addressing participation of solar SSA providers in net metering and regulation of solar SSA providers as public utilities. Over the past year, IREC has participated in proceedings in Colorado, Nevada, Arizona, New Mexico, Massachusetts and Michigan that addressed the legal and policy issues surrounding regulation of solar SSAs. Colorado and Nevada initially began discussion of solar SSAs in rulemakings but, ultimately, statutory changes clarified that SSA providers were not subject to regulation as public utilities. IREC was involved in both proceedings. As part of Michigan's adoption of net metering rules, the Michigan PSC clarified the definition of customer-generator to ensure that SSA providers would be allowed to participate in net metering. Likewise, Massachusetts clarified in its net metering regulations that net metered systems may be owned by third-parties. IREC continues to be involved in Arizona and New Mexico's consideration of the matter and anticipates being active in Washington as well.

Community Solar

Community solar continues to attract a lot of attention as a means to expand participation in solar. In the past year, Massachusetts has moved forward with implementation of a statewide neighborhood net metering program called for in 2008 legislation. Under the final rules, all net metered systems, including neighborhood net metered systems, may over-generate relative to on-site load. Regular net metered customers may either rollover credits in perpetuity or allocate excess generation credits to other customers of the same distribution utility. Neighborhood net

metered customers must have a minimum of ten residential customers identified for distribution of excess generation credits and all customers served must be within the same municipality, ISO-New England's load zone, and service territory of one distribution utility. Regular net metered system credits are based on a fully bundled retail rate, excluding customer charges and a public goods charge. Neighborhood net metered system credits are based on the fully bundled rate minus the distribution portion and also exclude the customer charge and public goods charge. Excess generation credits are allocated as a dollar amount and are based on the rate class for which a host customer takes service.

A number of states continue to discuss community net metering programs in various contexts including California, Colorado, New Jersey and Washington. Given the potential promise community solar programs offer in expanding solar markets and the intersection of community solar policies with net metering, IREC anticipates being involved in these states as they move forward with implementation. As part of those efforts, IREC has begun development of a community net metering model designed to incorporate the best practices of net metering within the larger framework of community solar.

Smart Grid Technologies and High Penetration of PV

Interest in smart grid has only intensified over the last year given federal stimulus funding for smart grid demonstration projects. Further embedding intelligence into the grid offers a host of benefits including facilitating higher penetration levels of renewable energy. One such source of embedded intelligence is grid-integrated, electrical energy storage (ES), including plug-in electric vehicles and battery electric vehicles (PHEVs and BEVs).

As ES technologies become increasingly financially attractive across a broad range of locations and applications, policy makers will need to address regulatory barriers that may impede the deployment of ES onto the grid. For example, state interconnection standards are often ambiguous in their treatment of ES devices. Moving forward, it will be important to clarify whether interconnection standards apply to the interconnection of ES devices. It will also be important to address the eligibility of PV-integrated storage for state net metering programs and to determine which utility retail rates are available to customers with PV-integrated storage. Policy makers will also need to address impediments to the integration of non-customer sited ES with distribution and transmission systems, including utility planning and procurement activities and issues related to utility cost recovery. IREC believes that as costs decline, it is important that the proper policies already be in place to facilitate deployment.

In March, IREC submitted comments to the California PUC regarding ES to assist that commission in understanding the promise and challenges ES offers. IREC's comments focused on the need to recognize and remove regulatory obstacles to deployment of ES even in advance of some of those technologies reaching levels of cost-effectiveness. In June, IREC participated in the DOE Solar Energy Grid Integration Systems – Energy Storage (SEGIS-ES) workshop. SEGIS-ES is a U.S. DOE project designed to support the deployment of ES onto the grid by developing ES components and systems specifically designed and optimized for grid-tied PV applications. SEGIS-ES aims to conduct targeted research and development on applications

most likely to benefit from a PV-Storage system (*i.e.,* peak shaving, load shifting, demand response, outage protection, and development of microgrids).

Electrification of Transportation

With the proper programs and policies in place, PHEVs/BEVs hold great promise. In addition to their function as clean transportation resources, electric vehicles could provide many megawatts of ES and improve the overall functioning of the electrical power system. Importantly, a high penetration of electric vehicles could both encourage and benefit from a high penetration of intermittent renewable generation, such as PV and wind power, enabling a significant reduction in transportation-related foreign oil consumption. At this early stage, integration of PHEVs/BEVs onto the grid and the intersection of these technologies with current net metering and interconnection standards is just beginning to be considered at a state level. However, the potential impact on net metering and interconnection should not be ignored or underestimated.

In August 2009, the California PUC opened a rulemaking to address a host of issues surrounding manufacturers' plans to introduce PHEVs/BEVs in the near future and their use of the grid. Among the issues identified for consideration are changes to California's net metering program necessary to support home charging of these vehicles. IREC anticipates being involved in this proceeding to assist the Commission in its consideration of what changes to California's net metering program might be necessary to support the introduction of PHEVs/BEVs while also maintaining the success of California's program.

OTHER IREC NET METERING AND INTERCONNECTION PROJECTS

Solar America Board for Codes and Standards (Solar ABCs)

In the past year, IREC presented its 2008 Solar ABCs reports in numerous forums and recently began its 2009 studies. Solar ABCs is a collaborative effort among experts to formally gather and prioritize input from the broad spectrum of solar photovoltaic stakeholders including policy makers, manufacturers, installers, and consumers resulting in coordinated recommendations to codes and standards making bodies for existing and new solar technologies. The reports authored by IREC in 2008 included (1) *Utility External Disconnect Switch: Practical, Legal and Technical Reasons to Eliminate the Requirement* by Michael T. Sheehan, PE, and (2) *Comparison of the Four Leading Small Generator Interconnection Procedures* by Jason B. Keyes and Kevin T. Fox. Both are available for review at www.solarabcs.org.

The two current studies relate to the rate impact of net metering and alternatives to net metering. In the first, IREC will consider the California PUC's cost benefit analysis of net metering and suggest how California and other states might want to structure that analysis. In the second study, IREC will focus on the various approaches to compensating renewable distributed

generation owners for the value their systems provide to the grid. Both studies will be completed in mid-2010.

Freeing the Grid

The Network for New Energy Choices (NNEC) first published *Freeing the Grid* in 2006 to analyze and compare net metering and interconnection rules from all of the states. *Freeing the Grid* provides a solid, easy-to-digest introduction to the aspects of interconnection procedures and net metering rules which matter most. By assigning number values based on these criteria and then assigning a letter grade based on a state's cumulative score, it provides decision makers, regulators and other stakeholders with an intuitive comparison of how their state is performing when compared to sister states. *Freeing the Grid* continues to be enormously important to IREC in support of our interconnection and net metering efforts.

In 2007, NNEC teamed with the Solar Alliance, the Vote Solar Initiative, and IREC to refine and expand this analysis. IREC participated in *Freeing the Grid* refinements again in 2009. Happily, NNEC has continued its important leadership role on this project. Given the usefulness of this publication, IREC looks forward to continued involvement.

Updating IREC Model Rules

During the last year, IREC updated its model net metering rules and interconnection procedures. Since the initial development of both models, best practices in net metering and interconnection have evolved as stakeholders have gained more experience. Indeed, over the last two years IREC has been involved in over 29 commission rulemakings on these two topics. The updated model rules capture the most exciting state-level policy changes occurring with these two foundational policies. For net metering, IREC's model rules uncap the size of eligible systems, allow for meter aggregation, and allow third-party ownership of eligible systems. The interconnection procedures have been similarly updated to capture important advances, including allowing Level 1 systems to be sized up to 25 kW, allowing online applications, and facilitating network interconnections.

IREC'S NET METERING AND INTERCONNECTION PLANS FOR THE COMING YEAR

IREC is involved in net metering and interconnection rulemakings in a number of states where activity is expected to continue into next year. Many of these states are considering statewide net metering rules and interconnection procedures for the first time or are considering expansions and refinements to their existing rules.

IREC is actively engaged in ongoing rulemakings for interconnection and net metering in New Mexico, Michigan, Iowa, Maine, Utah, and Kansas. IREC looks forward to assisting these states in developing rules that comport with best practices. For those states considering net metering

and interconnection rules for the first time, getting it right at the ground level will allow renewable energy markets to develop quickly and efficiently. For states updating and refining their rules, improvement in these policies will only add further momentum to renewable energy programs. IREC also looks forward to participating in efforts in New Jersey, Washington, and Colorado to develop rules that will allow for community solar projects.

In addition to involvement in state and local rulemakings, IREC will continue its Solar ABCs, *Freeing the Grid* and network screens efforts. For the fourth year, IREC will participate in the ongoing development of the grading criteria and grading of state procedures for *Freeing the Grid*. For the Solar ABCs program, IREC will continue to participate in meetings of various regulatory organizations to discuss the two papers written in the prior years and will begin the two new studies on net metering. For network screens, IREC will continue to work with the National Renewable Energy Laboratory and the Solar Electric Power Association to develop procedures for interconnection to area networks.

Finally, IREC will complete the community solar model to shape development in this vital area towards best practices. As of now, only Massachusetts has fully developed a statewide community renewables program. IREC believes that a model grounded in best practices and one that builds on the foundation of net metering and interconnection will be of practical benefit for states considering such a program or implementing one.

Workforce Development and Training

Jane Weissman, Jerry Ventre, Pat Fox and Brian Hurd

Introduction

One of IREC's primary focal points over the years has been to create a highly qualified renewable energy workforce sufficient in size and diversity to meet the projected needs of this country. The goal of a skilled workforce is to improve the quality of products and system installations, thereby increasing consumer acceptance and product demand.

A route to a qualified and successful workforce is through setting standards and implementing third-party assessment programs. IREC has and continues to be an active Board member of the North American Board of Certified Energy Practitioners (NABCEP), the voluntary credentialing body offering professional certification and entry level schemes. NABCEP has certified more than 1,000 PV and Solar Thermal Installers.

While NABCEP certifies practitioners, IREC, since 2005, has been offering renewable energy training programs and instructors credentials using the Institute for Sustainable Power's Quality (ISPQ) International Standard 01021. This Standard sets forth requirements for curriculum, facilities, resources, tools, and safety. It requires trainers and program staff to have appropriate experience, defined job descriptions, and adequate training to perform their jobs competently. It describes the ethical and practical requirements for candidates, including commitments to confidentiality, non-discrimination, quality, and professionalism. IREC has awarded credentials to 44 training providers, master trainers and instructors with another 13 applications under audit.

As renewable energy markets grow, the demand for training programs has increased. We've seen many new educational opportunities being offered at Community Colleges, Technical High School, the Trades, and by non profit and profit organizations. Applications for ISPQ accreditation and certification are on the rise. Emails continue to flood our boxes with requests for training information and certifications.

What are we finding?

As we look at the various training offered around the country, we're seeing some common trends that need to be addressed. They include:

- Training tends not to differentiate among the types of jobs that are emerging;
- There is a lack of clearly defined solar occupational areas, titles, tasks and skill sets;
- Career paths need to be better described;
- There is a lack of instructors with a combination of content expertise, practical and teaching experience;
- Training programs need to provide sufficient on-the-job experience and hands-on laboratories;
- Training does not sufficiently cross disciplines;
- Some short courses cover too much information in too short a time which can impact retention; and
- Some training does not adequately address local and state jurisdictional requirements.

To obtain a better understanding of workforce development issues, needs and preferred training approaches, a 12-item questionnaire was developed and distribute in 2008-2009 to representatives of both the PV industry and education and training organizations.[6]

One of the objectives of the survey was to obtain a priority ranking of those jobs in the photovoltaic industry that are most in need of training. The results were as follows:

- *PV installers*. Representatives from both industry and education agreed strongly that "PV installers" were the number one priority, ranking them considerably higher than the seven other categories. This group is and will continue to be the primary target group because it most significantly impacts the quality of system installations. It includes construction trade apprentices, journeymen electricians, incumbent workers who need to update and upgrade skills, and PV manufacturers and suppliers who need skilled technicians for market growth and maintenance. This is a large and growing group, and training needs to be provided locally for the most part.

- *PV system designers and engineers*. In the past, PV system design has been handled by the solar or electrical contractor, and this works well for small, simpler systems. However, with the rapid increase in large, three-phase, commercial and utility-scale systems, there is a growing need for training among electrical, mechanical and civil engineers to oversee the design process.

- *Contractors licensed to install PV systems*. Electrical, solar and other construction contractors are becoming increasingly interested in PV systems as the market develops, and they need to become much more knowledgeable about PV technology. With this increased

[6] *Workforce Development: A Survey of Industry Needs and Training Approaches*. Jerry Ventre and Jane M. Weissman, Interstate Renewable Energy Council. ASES Solar Conference, May 2009.

involvement, they will provide more opportunities for PV-specific on-the-job training for apprentices and journeymen installers.

- *Building code officials and inspectors*. The two separate functions of plan review and approval (i.e., permitting) and field inspection of installed systems need to be addressed because code officials typically provide the last assurance of satisfactory installations. Poorly trained installers and poorly trained building officials present a prescription for big problems for both customers and suppliers.

- *Sales and site assessment personnel, including estimators*. Over the past several years, there has been a growing realization of the important role for these individuals. Project cost estimation is one of the most critical functions within the construction industry. Because this task is typically performed by the PV sales and site assessment professional, greater emphasis is now being placed on specific training for these individuals.

- *Architects and building designers*. The overall trend has been toward more and larger residential and commercial PV systems on buildings. This requires more training of architects and building designers. Building-integrated PV (BIPV) applications are leading to more PV courses in schools of architecture. In addition, the design, integration and installation of large commercial and utility-scale applications have spurred new training specifically for architectural and engineering (A&E) firms.

- *Utility personnel*. The combination of investment tax credits, net metering, renewable portfolio standards, and energy efficiency and conservation programs has produced a surge of interest and activity among utility companies in solar applications. These applications range from residential-size systems to multi-megawatt commercial and utility-scale systems. Utilities are seeking more training for their staffs.

- *Construction cost accountants and financing professionals*. The PV industry is expanding rapidly, larger systems are being installed, and projects are becoming more complex. Consequently, finance and accounting professional need to become more knowledgeable of PV system technology, including all the cost parameters that affect economic viability.

What are we up to?

IREC has had a busy year addressing some of the issues discussed above. A series of *Train-the-Trainers* workshops have been held. Working with partners in California, IREC has put on multiple of *Introduction to Training* workshops. And, we continue to hold *Code Official* workshops for both PV and Solar Thermal. Hundreds of people have been part of these workshops but high turnout is not always our goal. For example, in the faculty workshops described below, we keep to a 25-person limit allowing for more focused instruction and interaction.

Faculty Workshops

IREC's train-the-trainer workshops have been offered in New York, California, and Florida. The purpose of the workshop is to help faculty at community colleges, vocational-technical institutions, high schools and universities develop high-quality PV systems courses and programs that will help meet their workforce goals and objectives.

The backgrounds of faculty that attended the workshops can be broken down in three categories: 1) Those with teaching experience in the construction trades, but not in PV, 2) Those well versed in PV systems, but new to teaching PV, and 3) Those with teaching experience in related disciplines (e.g., energy management, building sciences, electronics), but not in PV nor in the construction trades.

The instructors for these workshops have been Jerry Ventre, Barbara Martin, Jim Dunlop and Brian Hurd (Hands On Solar). In California, IREC partnered with the Advanced Transportation Technology and Energy Initiative (ATTE). In New York, it was the New York State Energy Research and Development Authority who sponsored the faculty workshop. And, the Florida workshop was for U.S DOE's Solar America Cities and was held at the Florida Solar Energy Center. All California workshops have been funded primarily by the U.S. Department of Energy.

Faculty Development Workshops

Date	Location
June 5 - 6, 2008	Hudson Valley Community College, NY
September 18 - 19, 2009	Diablo Valley College, CA
January 20 - 21, 2009	Miramar College, CA
January 22 - 23, 2009	Santa Monica College, CA
June 4 -5, 2009	Sierra College, CA
July 24, 2009	Florida Solar Energy Center - Solar America Cities
October 30 -31, 2009	Rio Hondo Community College, CA

Introductory Workshops

IREC has held a number of Introductory Workshops in California led by Brian Hurd and organized by Hands On Solar.[*] The goal of the Introductory Photovoltaic Workshops is to assist schools in starting effective programs in photovoltaics and alternative energy based on industry-set standards. This approach has three prongs: To stimulate the interest necessary for schools and administrators to actively start instructional programs in photovoltaics; to follow up helping individual schools develop a funding stream, organize an effective advisory committee, develop appropriate curriculum, identify potential teachers, prepare budgets, order equipment, and design work stations and lab areas; and to develop a pipeline of teachers for the faculty development workshops discussed above.

[*] A special thanks goes to Catherine Hurd for her tireless efforts organizing these workshops.

Introductory Workshops

Date	Location
July 24, 2008	Economic Alliance of the San Fernando Valley, CA
August 14, 2008	East Los Angeles College, CA
October 16, 2008	San Diego Miramar
November 14, 2008	Sierra College, CA
March 27, 2009	Shasta College, CA
April 3, 2009	College of the Redwoods, CA
August 26, 2009	College of the Sequoias, CA
September 4, 2009	UC Santa Barbara, CA

Code Official Workshops

IREC continues to hold workshops for code officials. This year, in addition to holding workshops on photovoltaics, we added four workshops on solar thermal for code officials. Bill Brooks was the Instructor for the PV workshops. They were organized by Larry Sherwood. Mark Thornbloom was the Instructor for the Solar Thermal workshops which were organized by Richard Michaud.

Code Official Workshop	Date	Location/Host
Solar Thermal	February 25, 2009	Tri-County Chapter of the New York State Building Officials Conference
Photovoltaics	March 5, 2009	Denver, CO
Photovoltaics	April 20, 2009	Ann Arbor, Michigan
Solar Thermal	April 27, 2009	California Center for Sustainable Energy, San Diego, CA
Solar Thermal	April 29, 2009	Arizona Public Service, Phoenix, AZ
Photovoltaics	May 1, 2009	Ventura County, CA
Photovoltaics	May 8, 2009	Knoxville, TN
Photovoltaics	May 19, 2009	Seattle, WA
Solar Thermal	June 18, 2009	National Grid, Boston, MA
Photovoltaics	July 13, 2009	Oahu, Hawaii
Solar Thermal	October 20, 2009	Milwaukee, Wisconsin
Solar Thermal	October 22, 2009	St. Paul, MN

Phone Seminars

IREC also organizes successful phone seminars on key topics which are organized by Larry Sherwood. We've seen an increase in participation. Usually, we have about 200 participants on a call. However, the January 26 phone seminar on Utilities and the Solar Tax Credit had over 400 callers and the May 4 seminar on Federal Solar Tax Incentives had almost 700 attendees.

	Seminar Topic	Speakers
November 12, 2008	National Electrical Code	John Wiles
January 26, 2009	Utilities and the Solar Tax Credit*	Keith Martin, Eric Silagy, and Christopher Cook
February 26, 2009	Recession and the Solar Market	Mark Crowdis and Travis Bradford
May 4, 2009	Federal Solar Tax Incentives*	Keith Martin
June 23, 2009	State Solar Policy and Market Trends	Rusty Haynes and Larry Sherwood
November 12, 2009	Expedited Permit Process	Bill Brooks
December 20, 2009	DOE's Market Transformation Activities	DOE Representatives
*Co-hosted with the Solar Electric Power Association		

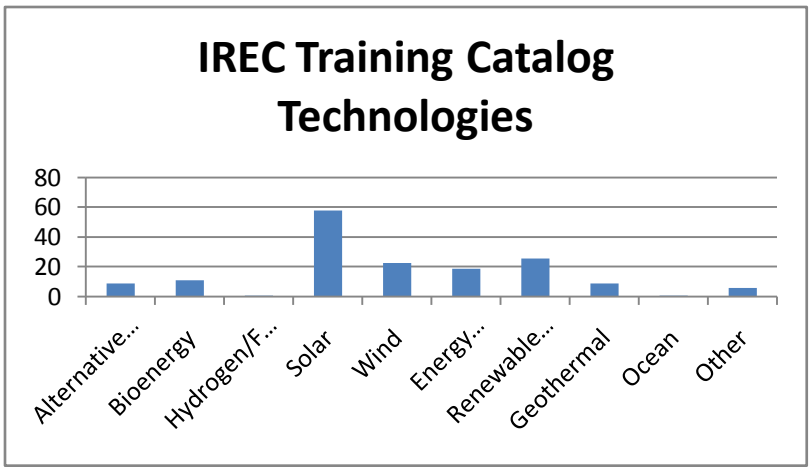
IREC Resource

IREC's *Renewable Energy Training: Best Practices & Recommended Guidelines* covers recommended guidelines and criteria, assessment tools, task analyses, credentialing programs, and other related resources to assist those offering or planning renewable energy training courses. It talks about national certification programs and standards that the solar industry has set for installers.
http://www.irecusa.org/fileadmin/user_upload/WorkforceDevelopmentDocs/Training-BestPractices_Sept_2008_FINAL.pdf

IREC Resource

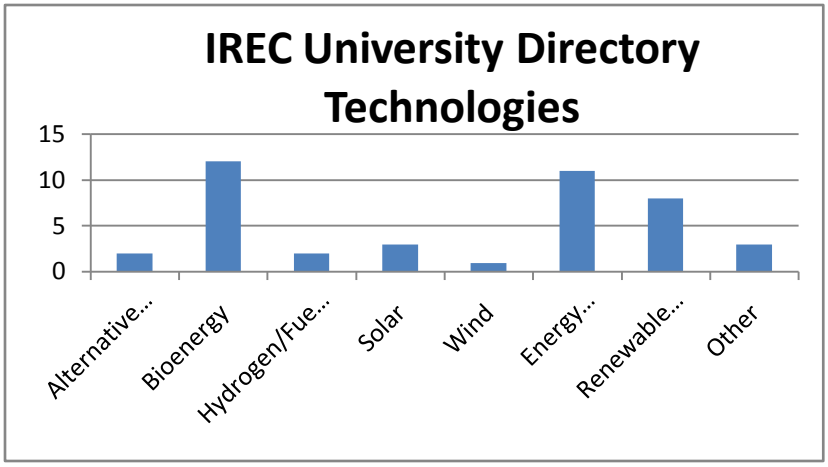
Training Catalog

Within the Workforce Development section of the IREC website we have developed a Training Catalog which is designed to present information about organizations who offer renewable energy and energy efficiency training in the United States. To enter a listing, a training organization sets up an account and enters descriptive information about their offering. They are then able to directly maintain their listing so it is always up to date.



The catalog is a searchable database that can be filtered by state, technology, and whether the training is onsite or online. A Google map of training locations assists prospective students in their search to find a program in their area. There are currently 106 entries in the IREC training catalog covering 22 states. There are training programs listed for most renewable energy technologies with the majority of the offerings in solar (58 listings), wind (23 listings) and energy efficiency (19 listings).

University Directory



The University Directory available on the IREC website is designed to catalog four year undergraduate and graduate programs being offered across the United States and Canada. It is designed for the university to establish an account which enables them to enter and maintain details of their offering including a program description and details about specific courses. As with the training catalog, the university directory offers a Google map display of locations to simplify the search process.

The prospective student also has the ability to filter the listing based on State/Province and technology. There are currently 24 universities listed in this directory with course offerings in 8 renewable energy technology areas.

NEWS FROM ISPQ

The ISPQ International Standard - Updated & Expanded
ISPQ International Standard 01022 to be Released in Early 2010

The Institute for Sustainable Power will be releasing a revised and expanded international standard which identifies requirements for competency, quality systems, resources, and qualification of a curriculum by which trainers and training programs are evaluated. IREC is the North American Licensee for the ISPQ Accreditation of Renewable Energy Training Programs and the Certification of Trainers.

The Standard describes the required experiences, structure, and resources that training programs and instructors must possess in order to be awarded ISP accreditation or certification.

There are three main changes that will go into effect in 2010:

1. The Instructor Certification designation has been reconfigured into Certified Affiliated Instructor and Certified Independent Instructor. This adds a sixth designation to the ISPQ credentials:
    1. Accredited Training Program
    2. Accredited Continuing Education Provider
    3. Certified Affiliated Master Trainer
    4. Certified Independent Master Trainer
    5. Certified Affiliated Instructor
    6. Certified Independent Instructor

The main difference between the master trainer and instructor designations continues to be contact hour requirements for both teaching and practical experience. The new Certified Affiliated Instructor designation mirrors the former Certified Instructor credential -- the candidate has to be in the employ or on contract with an ISPQ accredited training program, continuing education provider, or an independent master trainer. The new Certified Independent Instructor designation mirrors requirements for the Certified Independent Master Trainer except that the teaching and practical experience requirements are less and that an on-site audit is not required (though IREC/ISPQ reserves the right to hold one).

2. On-line course guidelines will become requirements.

3. Additional criteria have been added for the development and administration of examinations.

Information and all key documents for the ISPQ credentialing programs can be found at www.ispqusa.org. The new ISPQ International Standard 01022 will be posted later this year or in early 2010 along with a revised Candidate Handbook and updated applications.

For more information on ISPQ, contact Pat Fox at patfox@irecusa.org or Jane Weissman at jane@irecusa.org.

Jack Werner Takes the Helm at ISP

While IREC is the North American Licensee for the ISPQ Credentialing Programs, the Institute for Power (ISP) is the "owner" of the ISPQ Standard. Welcome **Jack Werner** as the new Executive Director of the Institute for Sustainable Power. Jack is busy shifting ISP operations from Colorado to Washington, DC and is working with the other ISPQ International Licensees and international organizations. Jack brings a strong credentialing background to ISP. He is a Qualified Assessor/Auditor for the American National Standards Institute and registered ISPQ Auditor. Jack's past Board affiliations include the North American Board of Certified Energy Practitioners and the Solar Rating & Certification Corporation.

States Look to ISPQ for Quality Training Standards

New York has been the leading state in promoting ISPQ accreditation for training programs that are funded by the New York State Energy Research and Development Authority.

This year, Pennsylvania required that all installers applying to participate in the PA Sunshine Program that do not have NABCEP Certification must provide proof of completion of an Interstate Renewable Energy Council (IREC) Institute for Sustainable Power Quality (ISPQ) accredited course or a solar manufacturer’s course.

New Ideas in Educating a Workforce in Renewable Energy and Energy Efficiency
November 18 - 20, 2009
Albany, New York

www.meetmax.com/2009conference.html

The ***New Ideas*** workforce education conference will take place on November 18-20, 2009 at the Marriott Hotel in Albany, New York. Conference sessions are planned for November 19 and 20. On Wednesday, November 18, six technical workshops will be offered.

With over 60 speakers, this event will offer the most current information on instructional strategies, curricula development, and best practices for training in the renewable energy and energy efficiency fields.

Sessions will cover the latest information on job forecasts and labor profiles, state and federal workforce initiatives, career pathways, training partnerships, model curriculum, standards, and new approaches to training in this rapidly emerging green economy.

Speakers represent community colleges, training organizations, skill centers, workforce development programs, technical high schools, state and federal government agencies, industry, utilities, and credentialing bodies.

The conference's primary sponsor is the New York State Energy Research and Development Authority. The event is organized by the Interstate Renewable Energy Council along with the Partnership for Environmental Technology Education, Hudson Valley Community College, and Lane Community College.

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