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2008 UPDATES & TRENDS

ANNUAL MEETING
Interstate Renewable Energy Council
October 13, 2008
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UPDATES & TRENDS

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Interstate Renewable Energy Council©
October 2008

Acknowledgment: This material is based in part upon work supported by the Department of Energy under Award Number DE-FG36-05NT42401.

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Information for this report was compiled as of September 15, 2008. Policies and programs may have changed since this document was published. Please check www.dsireusa.org and www.irecusa.org for updates.

Interstate Renewable Energy Council
P.O. Box 1156
Latham, NY 12110-1156
www.irecusa.org
Jane Weissman, Executive Director
jane@irecusa.org

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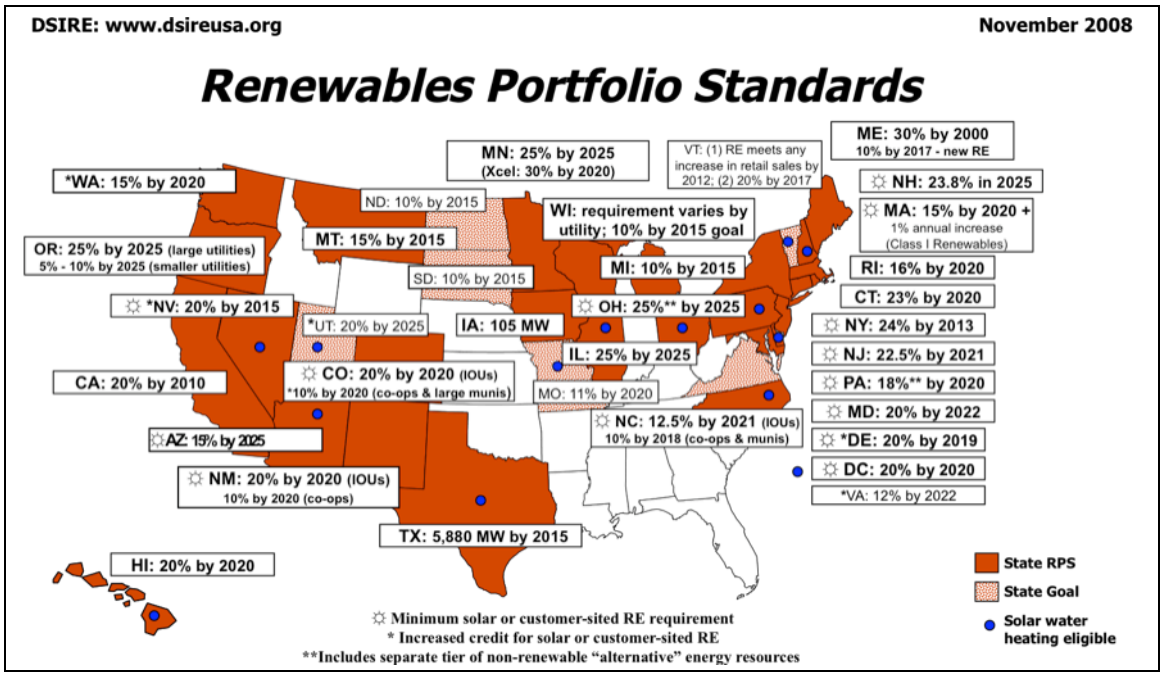
State Incentives & Policy Trends

Rusty Haynes, Justin Barnes, Brian Lips and Laurel Varnado

Introduction

Each year, for IREC's annual *Updates & Trends* publication, the DSIRE staff provides a report of significant renewable-energy policy developments in the United States, with an emphasis on state-level solar policy. This year's report addresses a selection of major developments that occurred between September 2007 and September 2008. Details and additional information regarding each of the policies discussed below are available at www.dsireusa.org.

In 2007-08, a handful of states – Maryland, Massachusetts, Ohio and Pennsylvania – stood out among others by establishing a swirl of robust policies designed to promote in-state renewable-energy growth. This report will discuss this 2007-08 "All-Star Cast" of states, as well as policies adopted by other states to encourage the growth of renewables. In addition, this report will address policy trends, new issues and opportunities for improvement.



The All-Star Cast: 2007-08 State Highlights

Maryland

Maryland reaffirmed its status as a renewable-energy leader in 2008 by enacting an armada of bills supporting the growth of renewables. First and foremost, the "Tier I" requirement of the state's renewable portfolio standard (RPS) was jacked up from 9.5% to 20% by 2022. "Tier I" resources generally consist of solar, wind, hydropower and certain forms of biomass. (Note that Maryland's RPS, one of the most aggressive in the country, already included a solar carve-out of 2% by 2022.) Second, a capacity-based rebate program for small wind-energy systems was established. This new rebate program complements Maryland's existing rebate program for photovoltaic (PV) systems and solar water-heating (SWH) systems (the maximum incentives of which were slightly modified) and the state's existing rebate program for geothermal heat pumps. Third, the state's solar-access law was strengthened, and more guidance was provided for the creation of solar easements. Fourth, the state's existing property-tax exemption for residential solar was extended to non-residential PV systems and geothermal heat pumps. Fifth, the state established an exemption from sales and use tax for solar-energy systems and geothermal heat pumps. Lastly, in a separate but related action, the Maryland Public Service Commission adopted comprehensive interconnection standards for renewables and other forms of distributed generation (DG) up 10 megawatts (MW) in capacity.

Massachusetts

Massachusetts enacted a massive energy bill promoting renewables and energy efficiency – *The Green Communities Act* – in July 2008. Among many other renewables and energy-efficiency provisions, this act established three separate energy portfolio standards for certain retail electric providers: (1) a standard for "Class I" renewables, (2) a standard for "Class II" renewables, and (3) an alternative energy portfolio standard. "Class I" renewables generally consist of solar-electric power, wind, ocean resources, certain forms of biomass and hydropower, and geothermal energy. "Class II" renewables are similar to "Class I" renewables, but the term includes a broader array of biomass and applies only to facilities operating before 2008. "Alternative energy resources" include combined heat and power (CHP), gasification with capture and permanent sequestration of carbon dioxide; energy efficient steam technologies and certain other facilities.

The Class I renewables standard mimics the state's previous renewable portfolio standard (RPS), which required 4% Class I renewables by 2009 and an additional 1% for each year thereafter. The new Class I renewables standard effectively requires 15% Class I renewables by 2020, and an additional 1% for each year thereafter. In meeting the Class I standard, retail suppliers must provide a portion of the required Class I renewables from new, in-state, on-site systems not larger than 2 MW in capacity. The Massachusetts Department of Energy Resources will establish the terms of this portion of smaller Class I renewables, of the Class II renewables standard and of the alternative energy portfolio standard, and the department will develop rules to implement each of the three standards.

The new law also created a host of incentive programs for renewables, including grants and loans, and raised the capacity limit for net metering from 60 kilowatts (kW) to 1 MW for most systems that generate electricity using solar, wind or agricultural resources (and to 2 MW for

systems used by government entities). A new option known as “neighborhood net metering” is now permitted. In addition, the new law authorizes utilities to build and own solar-energy systems and to enter into 10- to 15-year purchase contracts with renewable-energy developers.

Furthermore, a new statewide, capacity-based rebate program, Commonwealth Solar, was unveiled in January 2008. This four-year, $68 million program currently provides rebates ranging from $2.00 to $5.50 per watt for grid-tied PV systems at residential, commercial, industrial, institutional and public facilities. This program will yield an estimated 27 MW of installed PV in Massachusetts.

Ohio

In May 2008, Ohio became the 26th U.S. state to establish an RPS. Under Ohio’s RPS, the state’s competitive retail providers must use renewables to account for at least 12.5% of electricity sales by 2024. The RPS includes a solar carve-out of 0.5% by 2024, which will result in an estimated 820 MW of solar-electric capacity, according to the Lawrence Berkeley National Laboratory. As part of the same bill (SB 221), Ohio also created an accompanying standard that requires providers to use certain “alternative” resources (e.g., nuclear power, CHP) and demand-side management account for 12.5% of electricity sales by 2024. These new policies are of particular interest because Ohio ranks fourth nationally (behind Texas, California and Florida) among states in power consumption.

Pennsylvania

In July 2008, Pennsylvania enacted legislation establishing a $650 million fund to support renewables and efficiency. Solar energy will benefit significantly as a result. The new fund will provide $100 million for loans, grants and rebates to cover up to 35% of the costs of solar energy for homes and small businesses, and $80 million in grants and loans for economic development projects in the solar sector. In addition, the fund will provide $165 million for loans and grants to encourage the development “alternative” and renewable-energy projects (excluding solar) for businesses and local governments; $25 million for wind and geothermal projects; $25 million for grants and loans to support green buildings; and $50 million in tax credits of up to $1 million per year per project for developing and implementing renewable-energy projects, alternative-energy projects and energy-efficiency projects. The details of Pennsylvania’s new incentive programs are under development.

In a separate development during the same month, the Pennsylvania Public Utilities Commission strengthened the state’s already-solid net-metering rules by clarifying that (1) any customer net excess generation remaining at the end of a monthly billing period will be carried forward to the following month at the utility’s full retail rate, and (2) a net-metered system is not required to primarily offset a customer’s on-site energy consumption.

A Footnote: California & New Jersey

Because California (to a greater extent) and New Jersey (to a lesser extent) have dominated the U.S. PV market for the last several years, in large part due to proactive state policy decisions, a brief policy update on these two states is in order. According to IREC data, the installed capacity of grid-tied PV systems in California and New Jersey stood at 329 MW and 44 MW, respectively, at the end of 2007. However, whereas the capacity of grid-tied PV systems installed in California in 2007 increased by 28% over the amount installed in 2006, the capacity of grid-tied PV installed in New Jersey in 2007 *decreased* by 8% over the amount installed in 2006.

The California Solar Initiative (CSI), which provides rebates (in the form of expected performance-based buy-downs) for systems less than 50 kW and performance-based incentives for larger systems, has been extended to certain non-PV solar technologies, including solar forced-air heating, solar cooling, solar troughs and other concentrating solar technologies. The new solar capacity installed during the first six months of 2008 through the CSI program – which applies only to customers of investor-owned utilities – is equal to the total amount of PV installed statewide in all of 2006, according to the California Public Utilities Commission (CPUC). California's municipal utilities also activated PV incentive programs in late 2007, as required by state law. In addition, the CPUC created a pilot rebate program for SWH systems.

The CPUC also expanded the California Feed-In Tariff, which originally applied to renewables owned by water and waste-water treatment facilities, by requiring Southern California Edison and Pacific Gas & Electric to extend tariff options to renewables up to 1.5 MW in capacity that are sited anywhere in the utilities' service territory. Under these tariffs, customers may enter into 10-, 15- or 20-year purchase contracts with their utility, with payments ranging from $0.08 to $0.31 per kilowatt-hour. However, owners of facilities generating electricity under this tariff may not participate in other state incentive programs. This program will most likely benefit biomass systems.

New Jersey's extensive PV market is a direct result of the state's robust RPS and solar carve-out, interconnection standards, net-metering policy, and rebate program. However, the PV market has been hobbled by the popularity of the state's solar-rebate program, which has been in "queue" mode for more than a year. The New Jersey Board of Public Utilities (BPU), in turn, stopped accepting applications for PV rebates in December 2007 for non-government-owned systems and in April 2008 for government-owned systems. Only applications for systems serving affordable, multi-family housing are currently being accepted.

New Jersey is still in the process of converting the state's capacity-based rebate program to a performance-based incentive program. In 2007, the BPU initiated a pilot incentive program for Solar Renewable Energy Certificates (SREC) *only,* effectively allowing applicants to circumvent the stalled rebate queue (but only by foregoing a rebate). In New Jersey, SREC payments have ranged, on average, from $0.25 to $0.31 per kilowatt-hour (kWh). As of the August 2008, 25 projects totaling roughly 2.8 MW had been completed under the SREC-only pilot program, and an additional 178 applications totaling 65 MW had been accepted.

On a peripheral note, the BPU converted New Jersey's capacity-based rebate program for small wind to an expected performance-based rebate program. The BPU also approved a $105 million loan program, designed and implemented by PSE&G, to support an aggregate total of 30 MW of PV at customers' facilities.

Other State Policy Developments

Other states have not exactly been sitting on their hands. In addition to the major policy developments described above, other states marched forward in 2007-08 with new and amended laws and regulations to encourage the development of renewables through rebate programs, tax credits, property and sales tax incentives, net metering, interconnection standards, solar access laws and renewable portfolio goals.

Rebate Programs

Clearly, rebate programs have been one of the most significant drivers of distributed renewables in U.S. states. New rebate programs for renewables were unveiled in Colorado *(multiple local government rebates for solar and small wind)*, Connecticut *(PV for affordable housing)*, Indiana *(geothermal heat pumps)*, Maryland *(small wind)*, Massachusetts *(PV)*, Minnesota *(SWH)* and Oregon (small wind). Furthermore, renewable-energy rebate programs were revised in several states, including Arizona *(utility rebates extended from PV to other renewables)*, California *(PV rebate levels lowered)*, Connecticut *(PV rebate levels lowered)*, Maine *(extended from solar to small wind)*, Maryland *(solar rebate levels revised),* Nevada *(utility rebate levels revised)* and New Jersey (*PV rebate applications currently not accepted).*

New Jersey, incidentally, is not the only state that has had a tough time juggling rebate levels with consumer demand. Several other states, including Florida, Maine, Maryland and Minnesota, have run out of PV rebate funding at a surprisingly fast clip.

Tax Credits

Several states established new tax credits for renewables:

- Georgia created 35% corporate and personal tax credits for renewables, with credit limits that vary by system type and with an annual cap on the aggregate amount of credits awarded.
- Oregon doubled the maximum amount of the state's 50% business energy tax credit for renewable energy equipment manufacturing facilities from $10 million to $20 million.
- Vermont established a 30% corporate income tax credit for solar. (This credit, which is aligned with the federal corporate investment tax credit for solar, will decrease to 10% on January 1, 2009, if the federal credit is not extended.)
- Kentucky established corporate and personal tax credits equal to $3.00 per watt for PV and 30% of the cost of other renewables, but the limits for these new credits, which vary by technology, are very low. Kentucky also allows a tax credit of up to 100% of the income tax and limited liability tax owed by renewable-energy companies, and companies may assess 4% of employee gross wages, which employees may take as an income tax credit.
- Pennsylvania has allocated $50 million over eight years to support tax credits for 15% of the cost of certain alternative energy projects, with a $1 million cap per year per project.

Other Tax Incentives

Several states established or modified other tax incentives, including property-tax exemptions and sales-tax exemptions, to promote renewables:

- Florida enacted legislation in June 2008 that revived a property-tax exemption for solar, wind and geothermal; this exemption previously had expired in 1990.
- North Carolina enacted legislation in August 2008 that exempts 80% of the appraised value of PV systems from property tax.
- Arizona extended a reduced property tax assessment for renewables owned by utilities (and certain other power generators) through 2040.
- Maryland extended the state's existing property-tax exemption for residential solar to non-residential solar and geothermal heat pumps. Maryland also established an exemption from sales and use taxes for solar and geothermal property.
- New York enacted legislation in August 2008 granting building owners in New York City a property-tax abatement against the installed cost of a PV system. For new systems installed before 2011, the abatement is equal to 8.75% of the installed system cost – up to $62,500 per year – each year for four years. For systems installed in 2011 or 2012, the abatement is equal to 5% of the installed system cost – up to $62,500 per year – each year for four years. This incentive effectively allows building owners to reduce their total real property taxes by a portion of the expenditures associated with installing a PV system.
- Kentucky enacted legislation in April 2008 that effectively allows an exemption from sales and use taxes on property bought for the purpose of manufacturing renewable-energy systems.

Net Metering & Interconnection Standards

Most states are now aware that a strong net-metering policy and comprehensive interconnection standards are necessary to lay the foundation for an in-state renewable energy industry. Accordingly, these two issues continue to attract increasing attention.

The laundry list of states that enhanced their net-metering policies during this period includes Colorado, Florida, Hawaii, Illinois, Kentucky, Louisiana, Massachusetts, New York, Ohio, Pennsylvania, Rhode Island, Utah and Vermont. (Washington, DC, also clarified and enhanced its policy.) However, Texas now has the dubious distinction of being the first state to abandon net metering. In addition, several states – Connecticut, Florida, Illinois, Maryland, Michigan, North Carolina, New Mexico and Utah – adopted new or expanded comprehensive interconnection standards for DG.

See page 20 for more detailed state policy developments related to net metering and interconnection standards.

Solar Access & Permitting

Five states – California, Colorado, Florida, Maryland and Virginia – enacted legislation in 2008 that strengthened and/or clarified an existing right to access solar resources. Notably, Colorado's

new law protects owners of solar and wind-energy systems by awarding reasonable attorney fees to the prevailing party in any court case involving a significant increase in a system's cost based on aesthetic requirements. In addition, Arizona and Colorado enacted legislation designed to rein in permitting fees and unnecessary permitting requirements for solar-energy systems.

On a related note, Hawaii enacted legislation in June 2008 that requires builders to install SWH systems on all new single-family home construction, beginning January 1, 2010. However, the law includes several escape hatches that significantly reduce the force of Hawaii's new policy.

Renewable Portfolio Standards & Goals

As discussed earlier in this report, Maryland and Massachusetts significantly expanded their RPS policies in 2008, and Ohio became the 26th U.S. state to establish an RPS. Ohio's new RPS includes a 0.5% solar-electric carve-out, while the Massachusetts Department of Energy Resources will develop a special standard for "Class I" renewables from new, in-state, on-site systems not larger than 2 MW. Including Massachusetts, half of the 26 U.S. states with an RPS now also have a solar (or DG) carve-out.

Whereas a RPS is a legal requirement that certain utilities must meet, utilities are generally not legally obligated to comply with a *renewable energy goal*. Six states that do not have an RPS now have a renewable portfolio goal. Two of these states – South Dakota and Utah – established such goals in 2008, and the U.S. territory of Guam created a goal of 25% by 2035. (Note that several states, including Hawaii, Massachusetts and Vermont, added new goals to existing standards or goals.)

South Dakota enacted legislation in February 2008 establishing an objective that 10% of all retail electricity sales be obtained from renewable and recycled energy by 2015. Utah enacted legislation in March 2008 directing utilities to use renewables to account for 20% of their 2025 adjusted retail electric sales – but only to the extent that it is cost-effective to do so. Under Utah's goal, adjusted retail sales include the total kWh of retail electric sales reduced by the kilowatt-hours attributable to nuclear power plants, demand-side management, and fossil-fuel power plants that sequester carbon emissions.

A Footnote: U.S. Cities

Several U.S. cities, including Columbia (MO), Orlando, San Antonio, San Francisco and Tallahassee adopted new policies or strengthened existing policies to promote solar and other renewables. Not coincidentally, San Francisco, San Antonio and Orlando are "Solar America Cities," as designated by the U.S. Department of Energy. Each of the 25 Solar America Cities has committed to developing a sustainable solar infrastructure to removes market barriers and encourages the adoption of solar energy by residents and businesses. (For more information about the efforts of each of the 25 Solar America Cities, see www.solaramericacities.energy.gov.)

Policy Trends & Opportunities for Improvement

Based on the ongoing research conducted by the DSIRE project staff, several current policy trends have become apparent. This report will close by providing a brief discussion of these trends and opportunities for improvement.

Trends

- Regional solar markets are continuing to solidify and expand, especially in (1) the Southwest, (2) the West, (3) the Mid-Atlantic and (4) the Northeast. Public policy has played a critical role in the development of solar markets in these states.
- States and regions have displayed more interest in coordinating policies and establishing multi-state initiatives to promote renewable-energy growth and to rein in carbon emissions from the power sector.
- The Southeast, led by North Carolina and Florida, is beginning to emerge as a renewable-energy player.
- State policymakers increasingly understand that comprehensive interconnection standards and strong net-metering policies are prerequisites to promoting in-state renewable-energy deployment, and states are moving quickly to establish, improve and expand these policies.
- State RPS policies remain a significant driver of both the U.S. wind and solar industries.
- As the average size of PV installations increases, primarily due to the success of the solar power-purchase agreement (PPA) business model, states are beginning to wrestle with the dilemma of whether policy should be designed to maximize installed PV capacity – potentially at the expense of the market for small and medium-sized PV systems – or to ensure market opportunities for small and medium-sized PV systems.
- Roughly a decade after the creation of an initial round of state clean-energy funds during the electric restructuring era, states are creating next-generation funds and programs to support clean energy. These funds and programs are supported by a wide variety of funding mechanisms, including per-kWh surcharges, carbon or greenhouse-gas auctions, state appropriations, alternative compliance payments associated with RPS policies, and – in one state – gaming revenue.
- A few state public utilities commissions, increasingly wary of the impacts of carbon emissions and of the likelihood of federal carbon regulations, are beginning to require utilities seeking approval of new coal-fired power plants to provide additional support for renewables.

Opportunities for Improvement

- Changeable federal policy continues to hamper the growth of renewables. The looming expiration of federal tax credits for wind and solar have prompted many developers to put planned projects on ice, effectively driving up project costs or shutting down projects altogether. In addition, under the assumption that federal regulation of carbon emissions is imminent, states and utilities are clamoring for the federal government to act so that the rules are clear.

- While a few states have clarified that solar and wind-energy facilities owned or leased by a third party will not be regulated as utilities, this issue is ambiguous in many other states. The feasibility of the solar PPA model in any given state hinges on this issue.
- In most states, there are still very few opportunities for owners of small renewables to sell the renewable energy credits (RECs) associated with these systems.
- A handful of states, including California, have adopted utility rate structures that actively encourage the use of customer-sited renewables. However, favorable rate structures are lacking in most states.
- Government entities, non-profits and other non-tax-paying entities continue to express interest in renewables, but these entities' inability to take advantage of state and federal tax incentives (in most cases) inhibits additional deployment.

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.

This report provides data on U.S. solar installations by technology, state, and market sector. 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 and product availability and pricing generally reflect this status. Germany and Spain are the top markets for PV; Spain is the leader for solar thermal electric; and China is the largest market for solar thermal collectors. However, this report does not analyze markets outside the United States.

The information here is a summary of information included in the report *U.S. Solar Market Trends 2007*, available on the IREC web site at www.irecusa.org. In addition to more analysis, the full report contains details of the data collection methods and assumptions.

Photovoltaics

Overall Trends in Installations and Capacity

Annual U.S. PV installed capacity grew by 48% in 2007 over 2006 to more than 205 MW_{DC} including both grid-connected and off-grid markets. Although PV installation growth had been steady and impressive for many years, the annual growth rate doubled when the federal investment tax credits increased in 2006. By 2007, the capacity of PV installed each year was more than double the annual amount installed in 2005. More than 26,000 sites installed PV in 2007, with about half of these sites connected to the grid. Most of these installations are mounted on buildings, but some are ground-mounted installations.

The following factors helped drive the large growth in 2007:

- The federal investment tax credit was increased in 2006 for commercial taxpayers, and a credit for residential taxpayers took effect. For larger systems, especially, it takes time to get the financing, product and other installation details in place. Many of the large systems conceived with the start of the tax credits in 2006 were actually installed in 2007.
- Many states are offering incentives, and system installation growth was especially strong in Colorado, Connecticut, Hawaii, Nevada, and Oregon. Each of these states has a significant incentive program that supports solar.
- Energy prices generally, and electricity prices specifically, continue to increase, and consumer concern about rising energy costs is high.
- Renewable portfolio standards with specific solar requirements had an impact in states that enacted them two or more years previously. Because installations from these standards ramp up over time, states with new requirements in 2007 will not see much installation growth until 2008 or later.

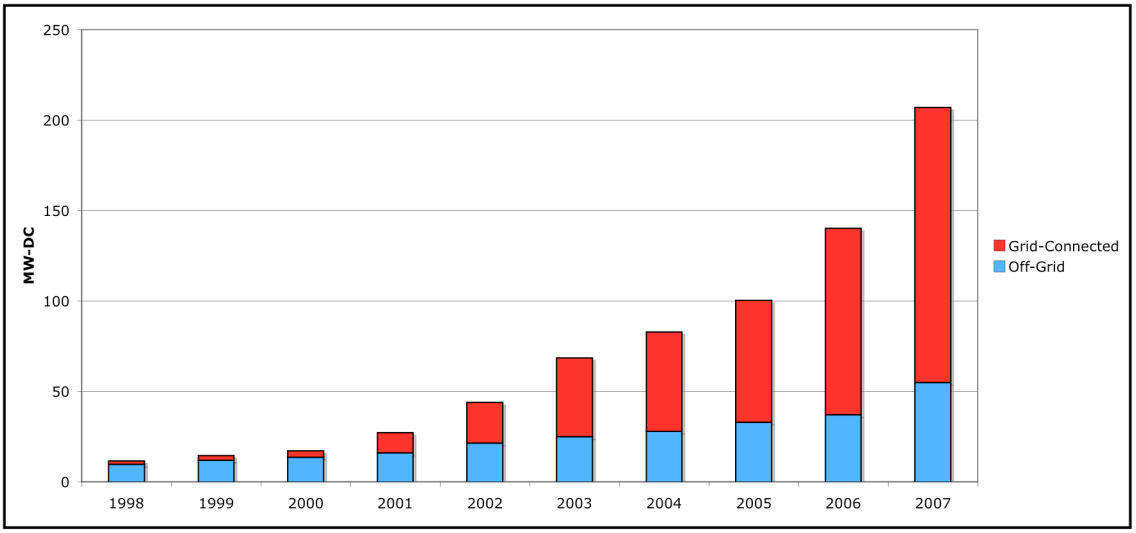


Fig. 1: Capacity of Annual U.S. Photovoltaic Installations (1998-2007)
Off-Grid Data from PV Energy Systems

Installations by Sector

Residential installations currently account for slightly more than one-third of all grid-connected PV installations by capacity. Over the past three years, these installations have varied from 34% and 38% of the total. Figure 2 shows the annual PV installation capacity data, segmented by residential and non-residential installations. Non-residential installations include such sites as government buildings, retail stores, utility installations, and military installations and their larger average size means a larger aggregated capacity.

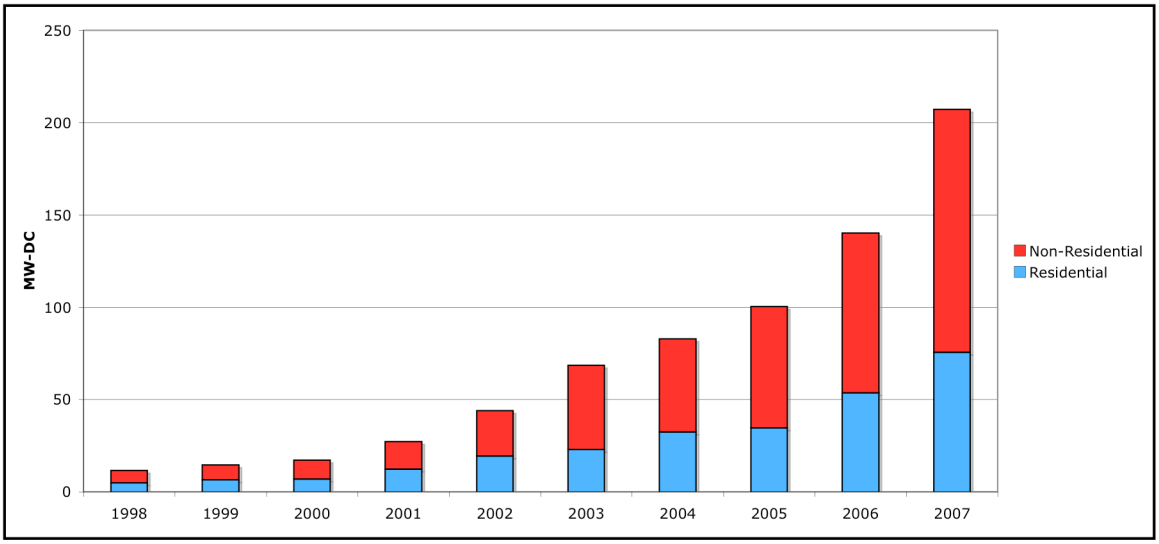


Fig. 2: Annual Installed Photovoltaic Capacity by Sector (1998-2007)

The trend toward more non-residential installations should continue, because the federal investment tax credits are more generous for commercial installations. In California, the largest incentive program in the country was (for the most part) converted to a performance-based incentive in 2007. Early reports for 2008 indicate that the commercial market is booming as a result.

Detailed data on off-grid PV installations are not available, and so the remainder of the PV section reports just on the U.S. grid-connected PV market.

Installations by Size

All sectors of PV installations grew in 2007, but installed capacity of large installations grew the fastest. A 14-MW PV installation at Nellis Air Force Base in Nevada and an 8-MW PV installation for Xcel Energy in Alamosa, Colorado were the largest PV systems installed in 2007, and together accounted for 15% of the annual installed capacity. A total of 30 systems larger than 500 kW accounted for 29% of the total 2007 installed capacity. Figure 3 shows the dramatic growth in these larger installations, which in 2007 accounted for 47% of all non-residential installations.

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

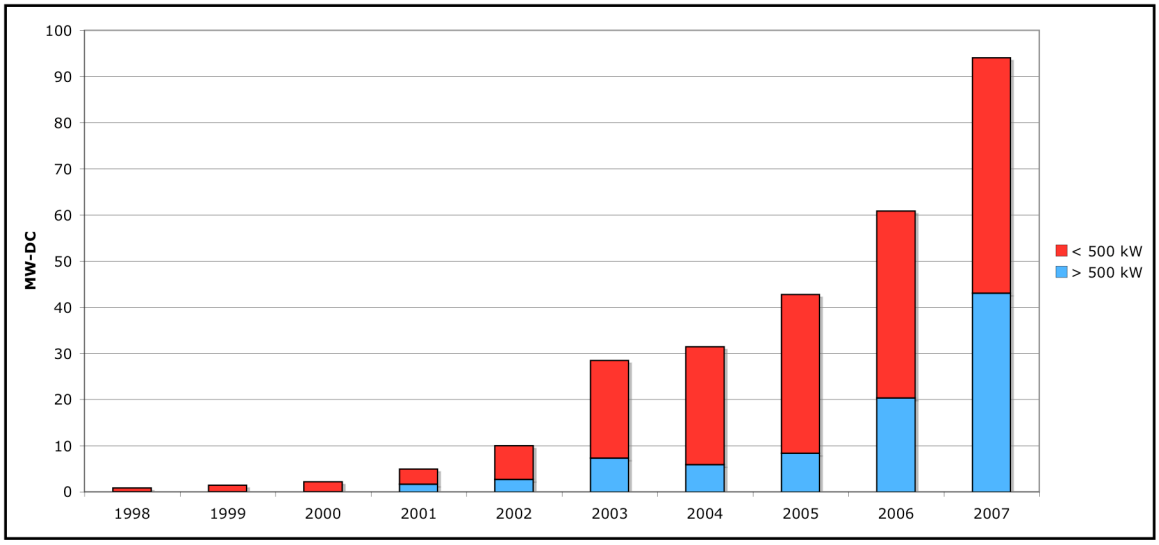


Fig. 3: Non-Residential Grid-Connected Photovoltaic Installations by Size (1998-2007)

In several states, regulators are considering defining third-party owners of solar equipment as utilities. If such rulings are made, third-party owners in these states may still be able to lease solar facilities without being classified as utilities, but their ability to use the federal investment tax credit will need to be clarified. If the federal tax credit 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.

The trend toward greater market share for large installations should continue at least through the end of 2008. At the end of 2007 in California, 56% of the California Solar Initiative incentive reservations were for installations 500 kW and larger. The federal investment tax credit is critical to make these deals financially viable, and this credit is currently scheduled to expire at the end of 2008. If Congress renews the federal investment tax credit, the trend toward more PPAs and larger non-residential installations will likely continue.

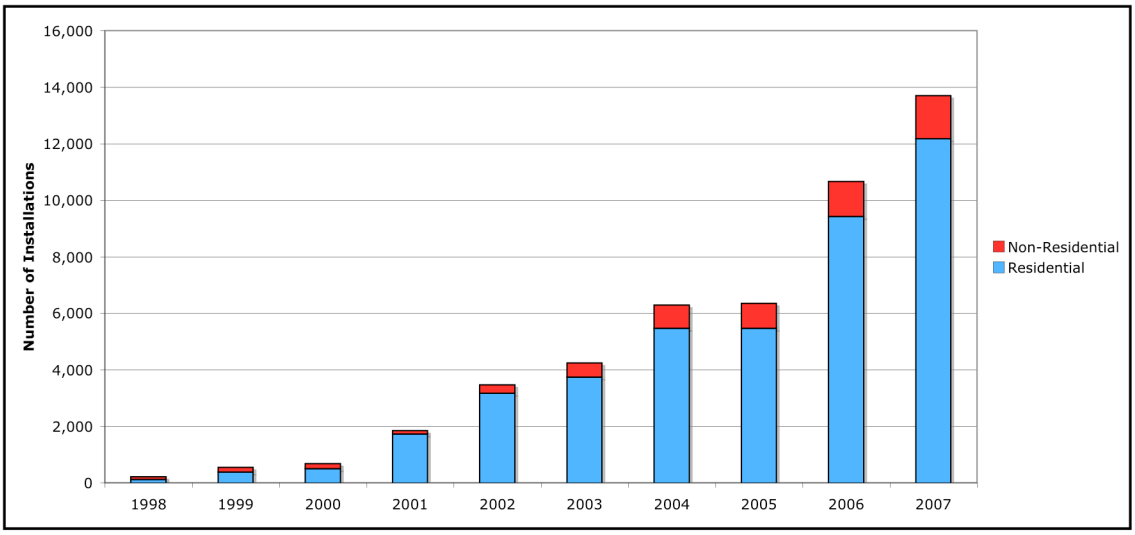


Fig. 4: Number of Annual Grid-Connected Photovoltaic Installations (1998-2007)

Over 13,000 grid-connected PV installations were completed in 2007, with 84% of these at residential locations (see Figure 4). At the end of 2007, 48,000 PV installations were operating on the grid, including 39,000 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 2007, installation of grid-connected PV installations was concentrated in California, New Jersey, Nevada, and Colorado, as shown in Table 1. As noted earlier, no comprehensive data exists for off-grid PV installations by state.

In 2007, California installations increased by 28% to 89 MW_{DC}. The market more than doubled in Nevada, Colorado, Hawaii, Connecticut and Oregon, as well as in many other states with smaller PV markets. Of these top ten states, only two saw a decline in 2007. New Jersey and Massachusetts expect to grow again in 2008.

Although new state markets emerged in 2007, the U.S. PV market remains very concentrated in a few states. Ninety percent of grid-connected installations were in five states.

All of the top states for grid-connected PV installations have financial incentives. The combination of state or local incentives and federal investment tax credits has resulted in most of the installations around the country. There are relatively few installations in locations with no state or local incentives or RPS mandates.

Table 1: TOP TEN STATES
Ranked by Grid-Connected Photovoltaic Capacity Installed in 2007 (MW_{DC}/yr)

State	2006 (MW_{DC})	2007 (MW_{DC})	06-07 % change	2007 Market Share	2006 Rank
1. California	69.5	88.8	28%	58%	1
2. New Jersey	17.9	16.4	-8%	11%	2
3. Nevada	3.2	14.7	365%	10%	3
4. Colorado	1.0	12.5	1178%	8%	7
5. New York	3.0	4.3	45%	3%	4
6. Arizona	2.1	2.8	30%	2%	5
7. Hawaii	0.7	2.4	236%	2%	9
8. Connecticut	0.7	1.8	174%	1%	10
9. Massachusetts	1.5	1.4	-5%	<1%	6
10. Oregon	0.5	1.1	112%	<1%	11
All Other States	3.2	5.6	75%	4%	
Total	103.2	151.9	45%		

Table 2 shows the cumulative per capita grid-connected PV capacity. Even with California's very large population, it has the highest rate of installations per capita – a rate that is more than five times the national average. No matter how one analyzes the data, California dominates the PV

market. Three small states, Hawaii, Delaware, and Vermont show significant solar installations on a per capita basis. 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. For reference, the city of Freiburg, Germany, with less sunshine than any of these states, has 41 watts installed per capita.

Table 2: TOP TEN STATES
Ranked by Cumulative Installed Capacity per Capita (W_{DC}/person)

State	Cum. Installed Capacity per person (W_{DC}/person)
1. California	9.1
2. Nevada	7.8
3. New Jersey	5.0
4. Arizona	3.1
5. Colorado	3.1
6. Hawaii	3.0
7. Delaware	1.4
8. Vermont	1.2
9. Connecticut	0.8
10. New York	0.8
National Average	1.6

Solar Thermal Electric

The 64-MW Solar One solar thermal electric plant built in Boulder City, Nevada went on-line in June 2007. Other than a smaller 1-MW plant built in Arizona in 2006, this was the first new U.S. solar thermal electric plant constructed in over 15 years. Nine solar thermal electric plants with a capacity of 354 MW were constructed in California from 1985 to 1991 and continue to operate today.

The future prospects for solar thermal electric plants look bright. Several different companies have announced plans for over 3,500 MW of generating capacity, and some have begun to receive required approvals from government agencies for these projects. None of this new capacity will be constructed in 2008, and development of these announced projects will depend on long-term extension of the federal investment tax credit.

Solar Hot Water and Space Heating

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

In 2006, increased federal investment tax credits, together with rising conventional energy prices, caused the solar hot water market to increase dramatically. Prior to 2006, about half of the solar water heaters sold each year in the United States were in Hawaii due to utility rebates, state tax credits, and high energy prices. In 2006, national installations were 2.4 times the number installed in 2005 and installations outside Hawaii quadrupled. In addition to Hawaii, Florida and California lead the states in solar hot water installations.

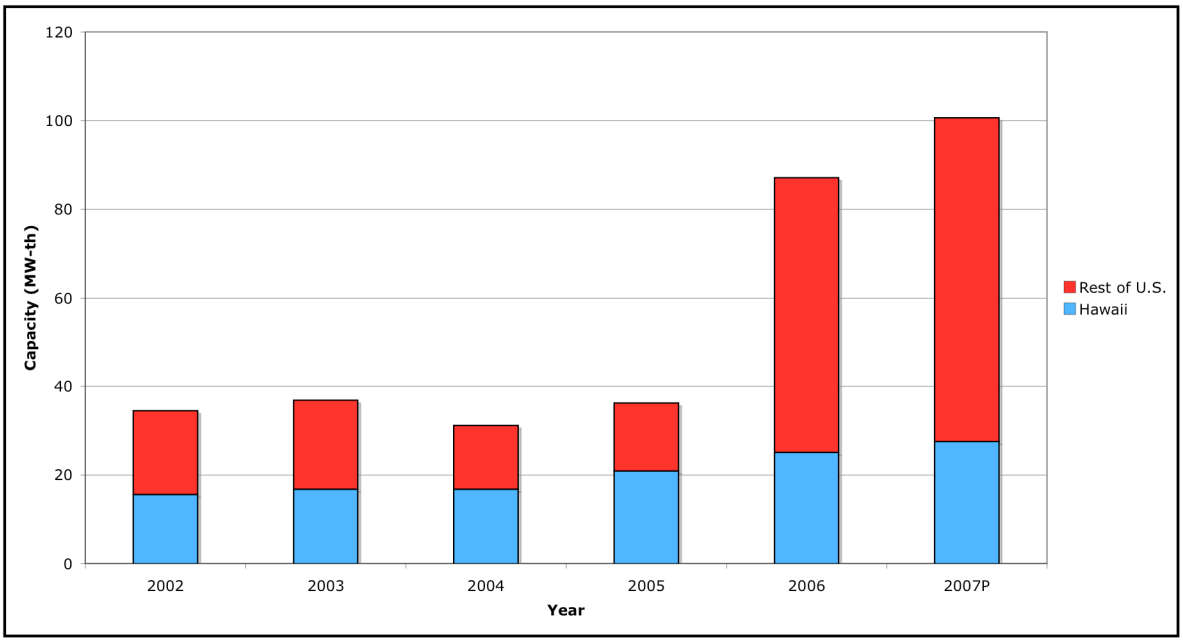


Fig. 5: Annual Installed Capacity for Solar Hot Water and Space Heating (2002-2007)
Based on analysis of collector shipment data from EIA.

Figure 6 shows that, like PV installations, solar water heating and space heating installations are concentrated in a few states and territories. However, the states with the most installed capacity are different for solar hot water than for PV. Hawaii represents almost half of the solar hot water market. High energy prices and good 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. New policies under development will likely continue Hawaii's status as a market leader for solar hot water.

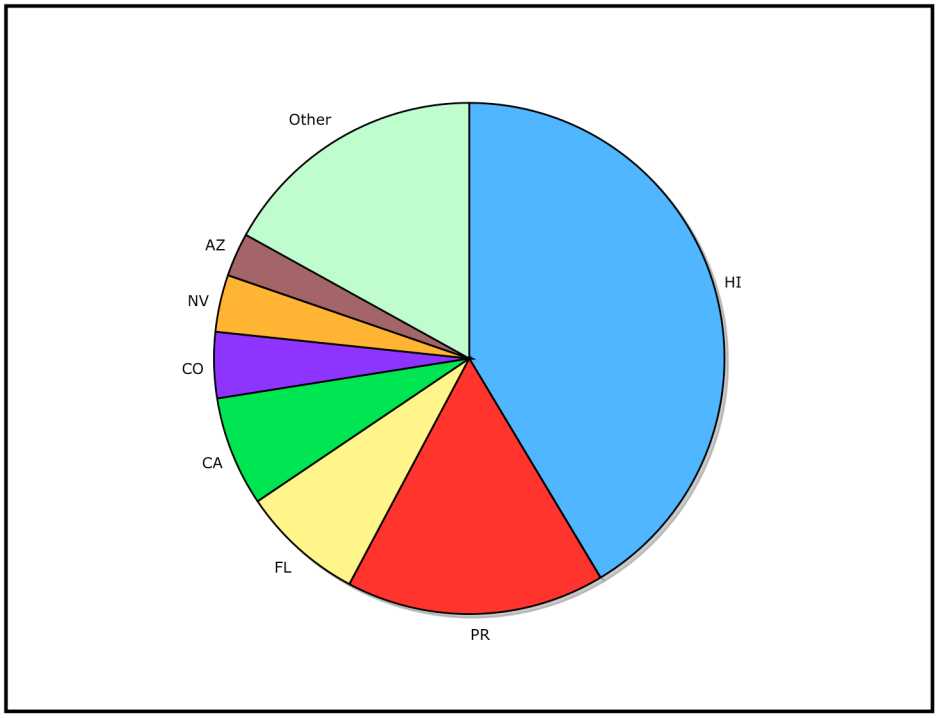


Fig. 6: Installed Solar Hot Water and Space Heating Capacity by State
Based on analysis of EIA data for 2001-2006

Solar Pool Heating

Figure 7 shows the annual installed capacity for solar pool heating systems during 1998 to 2007. Installed capacity grew an average of 10% per year through 2006, but decreased 7% in 2007. 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 has likely led to the decrease in pool installations in 2007.

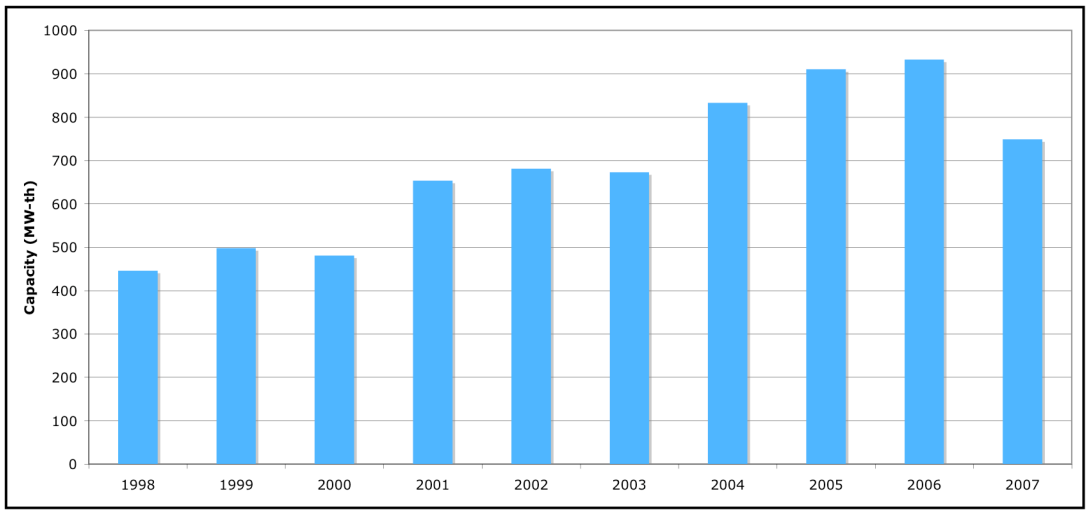


Fig. 7: Annual Installed Capacity for Pool Heating (1998-2007)
Based on collector shipment data from EIA and SEREF.

The trend continues for pool heating systems, with installations concentrated in a few states, notably Florida and California (see Figure 8). Unlike other solar technologies, virtually no incentives exist for solar pool heating systems.

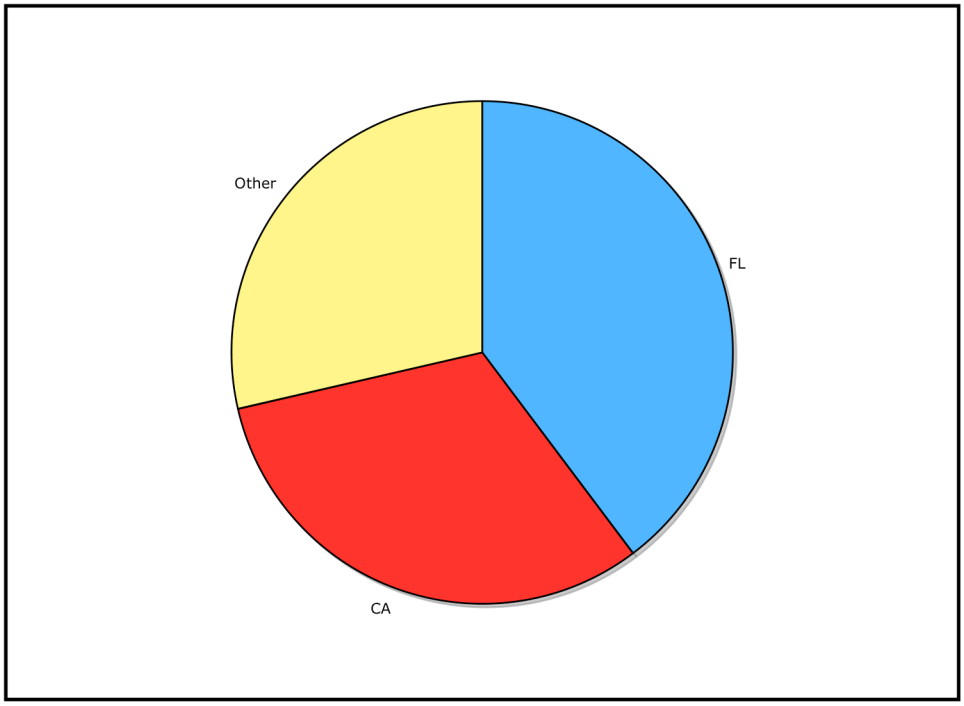


Fig. 8: Installed Pool Heating Capacity by State
Based on EIA Data for 2001-2006

Prospects for 2008 and 2009

The market growth for 2008 and 2009 will be largely tied to the fate of the federal investment tax credit. As this report goes to press in July 2008, Congress has not renewed the investment tax credit. Uncertainty will increase the number of installations in 2008 as owners rush to install systems in time to quality for the federal credits.

If the investment tax credit is not renewed or if renewal is significantly delayed, the impact on the market in 2009 will be disastrous, with a large drop in installations. When the wind production tax credit expired in 2000, 2002, and 2004, the installation of wind turbines plunged by 74-90% compared with the previous year. This choppy market growth hinders the long-term development of the value-added benefits of renewable energy through manufacturing and installation job development. Even if the investment tax credit is renewed early in 2009, solar installations will be down early next year due to the unwillingness of customers and investors to commit to new solar installations when the investment tax credit's fate is uncertain.

Installations will continue to be concentrated in states with strong financial incentives, and those incentives will remain critical to the market in 2008 and 2009. However, good state incentives will be unable to overcome the market turmoil caused by uncertain federal incentives.

Conclusion

Solar markets are booming in the United States due to rising energy prices, strong consumer demand, and financial incentives from the federal government and many states and utilities. Over 80,000 installations were completed in 2007. The markets for each solar technology are concentrated in a few states.

PV installations grew by 48% in 2007 and the average size of PV systems is growing. The two largest U.S. installations, one in Nevada and one in Colorado, were completed in 2007. The PV markets are expanding to more states, though California remains the dominant market.

Solar hot water installations have boomed since the increase in the federal investment tax credit in 2006. In the continental 48 states, installations have quadrupled since 2005. Hawaii is still the largest market for solar hot water.

The 64 MW Solar One solar thermal electric plant built in Nevada went on-line June 2007. Other than a smaller 1 MW plant built in Arizona in 2006, this was the first new solar thermal electric plant in over 15 years.

The fate of the federal investment tax credits, currently scheduled to expire at the end of 2008, will have a strong influence on whether or not the markets continue to grow in 2009.

Acknowledgements

This work was funded by the U.S. Department of Energy through the Solar America Initiative. The author appreciates the reviews provided by Justin Baca, Rusty Haynes, Neal Lurie, Janet Meyer, Mike Taylor, and Jane Weissman.

Net Metering & Interconnection Trends

Jason Keyes, Kevin Fox and Michael Sheehan

Introduction

IREC participates in state utility commission rulemakings involving net metering and interconnection of renewable energy systems, and has recently begun work at the municipal utility level as well. In the twelve months through August, 2008, IREC was active in the development of interconnection rules in New Mexico, Illinois, Florida, North Carolina, Virginia, Utah and to a lesser extent, Maryland, South Dakota and the District of Columbia. For net metering, IREC was active in rulemakings in Alaska, Arizona, Florida, Illinois, Kentucky, Nevada, Virginia and Texas. This section provides an overview of the major net metering and interconnection issues that IREC addressed in these states and previews the new issues that IREC sees on the horizon. This section also provides a summary of IREC's activities over the last year along with 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 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. 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

The net metering map below displays the progress achieved in the past year, with substantial improvements in Florida, Arizona, Illinois and New York. IREC was involved in the first three, and will participate in New York's rulemaking, which will implement recently adopted legislation. As well, Nebraska and South Carolina have joined the list of states with net metering.

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Perhaps the most important issue for net metering is the treatment of energy delivered to the electric grid. Legislatures and public utility commissions frequently express concern about the potential for inter-class subsidies when implementing or expanding net metering programs. Utilities are typically able to frame the issue by comparing distributed generation output to generation purchased from qualifying facilities and other wholesale generators. Using this comparison, utilities argue that net metered excess generation should be credited at no more than a utility's avoided cost of generation. However, a growing body of research is finding that, to the contrary, the benefits of distributed generation may justify a value well above a utility's typical avoided cost of generation.

Regardless, concerns about the potential for inter-class subsidies has lead many state utility commissions to place an arbitrary cap on the allowable aggregate amount of net metering enrollment. Typically, such caps are expressed as a percentage of a utility's annual coincident peak demand. There has been some movement at expanding these caps during the past year. Florida recently implemented net metering rules that impose no aggregate cap. Arizona is also poised to adopt a rule that contains no explicit cap; however, utilities may request a cap and one may be granted with sufficient justification. The Virginia Legislature increased that state's aggregate enrollment limit from 0.1% to 1% of utility peak demand. Legislation that was passed in Utah has set an initial limit of 0.1%, but allows that state's public service commission to raise the cap.

Over the past year, states have demonstrated considerable variability in setting net metering system size limitations. In 2008, New Mexico revised its net metering program, retaining net metering of systems up to 80 MW, though New Mexico limits excess generation payments to avoided cost. Arizona's program accommodates a system of any size, so long as the system does not exceed 125% of a customer's total connected load and is sized to meet a customer's on-site electrical needs. Florida adopted rules that apply to systems up to 2 MW, joining the ranks of states setting the bar above 1 MW. The Utah Legislature adopted a 2 MW limit for commercial systems but maintained a limit of 25 kW for residential net metered systems. Illinois adopted rules that allow systems up to 40 kW to net meter with rollover; systems up to 2 MW are allowed to interconnection but must be dual metered with exports paid at avoided cost. The Kentucky Legislature adopted legislation that only accommodates systems of only up to 30 kW.

Most states appear to be converging on the payment of avoided cost rates for any annual excess generation. During 2008, this approach was taken in Arizona, Florida and Virginia. Several states adopted rules that apply avoided cost credits to monthly excess generation. The Utah Legislature passed legislation in 2008 that requires payment of avoided cost for monthly excess generation; however that amount may be increased by the state's public service commission and municipal and cooperative utility governing bodies. As mentioned above, Illinois net metering accommodates systems between 40 kW and 2 MW but exports are dual metered and paid at avoided cost. Ohio and New Mexico also adopted rules that provide for only a wholesale credit for

excess generation. Ohio has a Supreme Court case that limits payment for monthly excess generation to wholesale avoided generation costs (not including T&D). The worst in class for this criterion goes to Texas, which adopted net metering rules that require customer-generators to negotiate with retail electric providers to arrive at a price paid for exports.

Both Arizona and Ohio also addressed the issue of which on-site generation technologies are eligible for net metering. In most states, eligibility is open to only renewable fuel generators. The issue in Arizona was whether non-renewable fueled combined heat and power (CHP) systems would be allowed to net meter, and if so, would they need to meet Federal Energy Regulatory Commission (FERC) cogeneration efficiency standards established under the Public Utility Regulatory Policies Act of 1978 (PURPA). In its final order, Arizona decided to accommodate CHP systems that meet the PURPA efficiency standards. In contrast, Ohio adopted legislation that allows micro-turbines but not CHP (though depending on the definition of a micro-turbine, one is typically included in a CHP system)

State Developments: Interconnection Standards

States often look to other states or model interconnection procedures as a starting point in developing their own state standards. Both New Jersey and Colorado have adopted significant portions of the IREC interconnection procedures and are ranked among the best state standards in the country. North Carolina passed a bill calling for the state utility commission to consider the FERC Small Generator Interconnection Procedures (SGIP). Virginia's proposed rules use the FERC's SGIP as a base but incorporate aspects from New Jersey's interconnection procedures. Illinois used Maryland's procedures, Utah and South Dakota used Oregon's. Maryland and Oregon in turn used the Mid-Atlantic Demand Resource Initiative (MADRI) procedures developed in 2005 by the utility commissions of Delaware, New Jersey, Maryland, Pennsylvania, and the District of Columbia. It is rare, but not unheard of, for a state to start from scratch. One example is Florida, which created simple procedures that allow easy interconnection of systems under 100 kW, but require study of larger systems at customer expense. For the most part, cross-pollination of state interconnection standards means that state interconnection procedures often have more in common than they have apart.

For this edition of the IREC Trends & Updates report, we thought it important to focus on the areas of interconnection standard development that are most often debated in state interconnection rulemakings. Issues like the choice of technical screens and certification criteria form the backbone of state interconnection standards, but there is often little variability or debate on these issues as most states follow the technical screens contained in FERC's SGIP and defer to technical standards established by IEEE 1547-2003 (Standard for Interconnecting Distributed Resources with Electric Power Systems) and UL 1741 (Inverters, Converters, and Controllers used in Independent Power Systems) without significant modification. The issues that are more often debated in state rulemakings include (1) elimination of the 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.

There appears to be a trend in favor of eliminating the requirement for a utility external disconnect switch (UEDS) on small inverter-based systems. In 2007, PG&E and SMUD in California voluntarily dispensed with the need for a UEDS on most inverter-based solar systems under 10 kW. Then, in early 2008, the U.S. National Renewable Energy Laboratory published a report titled *Utility-interconnected photovoltaic systems: Evaluating the rationale for the utility-accessible external disconnect switch*.[1] The report concluded that a UEDS is not necessary for inverter-based systems under 10 kW. These events have proven influential. Over the past year, Florida and North Carolina adopted interconnection standards that ensure customers with inverter-based systems under 10 kW will not have to pay an additional cost for installing a UEDS. This brings the number of states to six that have waived the requirement for a UEDS on small inverter-based systems. These states include Delaware, Florida, Oregon, New Jersey, New Hampshire and North Carolina. In addition, California and Nevada prohibit the use of a UEDS for systems under 1 kW. However, this trend is not uniform. Illinois recently required the use of a UEDS, even for the smallest systems. A UEDS requirement has also been proposed in Virginia.

States often establish a maximum system size to which a state interconnection standard will apply. The interconnection procedures adopted in Illinois set this limit at 10 MW, but recognizing the possibility that larger interconnections may come under state jurisdiction, Illinois opened a new docket to address interconnection of larger systems. New Mexico set its limit at 20 MW. North Carolina took a different approach and simply did away with a size limitation on the applicability of its standard. This approach, which has also been taken in California, has significant advantages. 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. The potential for a jurisdictional interconnection gap has been raised in an ongoing interconnection rulemaking in Virginia where State Corporation Commission Staff has proposed a 10 MW upper limit on the applicability of that state's standard. A final decision on this issue should be forthcoming in Virginia by the end of 2008.

Network interconnections are shaping up to be a thorny issue. Some utilities simply refuse to interconnect distributed generation to a network distribution grid.[2] This has become an increasing important issue as it has come to light that at least 15 U.S. Department of Energy Solar America Cities are served by network distribution grids. These cities include Austin, Boston, Denver, Houston, Minneapolis, New Orleans, New York City, Orlando, Philadelphia, Pittsburgh, Portland, Sacramento, Salt Lake City, San Francisco, and Seattle. Over the last year, a couple states have taken initial steps at overriding utility reluctance to accommodate network interconnections. Illinois' new standard adopts a technical screen that allows non-exporting systems up to 50 kVA

[1] Coddington, M.H., Margolis, R.M., & Aabakken, J. (2008). *Utility-interconnected photovoltaic systems: Evaluating the rationale for the utility-accessible external disconnect switch* (TP-581-42675). Golden, CO: National Renewable Energy Laboratory.

[2] Networks are highly reliable electric grids used in many urban cores and on some college and corporate campuses. Networks are typically supplied from multiple dedicated primary feeders and designed to prevent simultaneous feeder outages so that loads on networks can still be served even when a particular feeder is inoperative.

to interconnect to an area network. Virginia has preliminarily suggested that it may follow New Jersey and Colorado in adopting a network interconnection screen similar to the one contained in IREC's model interconnection procedure.

Another issue of contention in the formulation of state interconnection rules regards insurance requirements. Underlying policy decisions about insurance requirements are issues of cost allocation. If something goes wrong with a customer's generator, utilities contend that other ratepayers should not bear the expense of damage to the utility grid. However, with over 50,000 grid-connected solar arrays in the US, the authors are not aware of any case of line worker injury or significant utility property damage attributable to solar energy systems or any other systems. In any event, solar arrays are expensive assets that are almost always covered under a property owner's insurance. Such insurance typically provides protection if damage or injury occur. In short, it appears unlikely that a prohibition on additional insurance requirements would have any cost impact for other ratepayers, but requiring additional insurance will add cost for the system owner.

During the past year, Illinois and New Mexico set a new trend of not requiring insurance except on larger systems on the basis that grid damage is hard to envision from smaller systems. New Mexico set the cutoff at 250 kW; Illinois at 1 MW. North Carolina, in contrast, requires all customer-generators to carry insurance, but the required amounts are no more than what a property owner would typically carry: $100,000 for residential systems and $300,000 for commercial systems up to 250 kW. These amounts are significantly less than the amounts adopted in Florida: $1,000,000 for systems between 10 kW and 100 kW and $2,000,000 for systems larger than 100 kW, though Florida did waive the insurance requirement for systems of 10 kW or less.

New Trends in Net Metering and Interconnection

Over the next year, IREC expects to become increasingly engaged on three issues that came to the fore over the last year: (1) the impact of utility solar proposals on net metering and interconnection, (2) regulation of solar power purchase agreement (PPA) providers and the ability of PPA providers to qualify for net metering, and (3) community solar proposals and meter aggregation.

At this early stage, not much can be said on the issue of utility solar proposals and their potential impact on net metering and interconnection policies. Utility solar proposals have only begun to proliferate and those that have been made have been varied in shape and size. That said, the brief experience gained from the current proposals suggest the possibility that utility solar proposals may create a venue for addressing inadequacies in state solar policy. For example, solar proposals by California utilities may open the door to an expansion of California's limited feed-in tariff program and a proposal by Duke Energy in North Carolina may offer a means of seeking an incentive program for net metered customers. One promising eventuality is that these utilities will have to comply with state interconnection procedures, which should induce them to seek streamlining of those procedures.

Another important issue is shaping up around the issue of regulation of solar PPA providers. Solar PPAs are fast becoming the preferred means for the financing of solar system by commercial customers, accounting for as many as two-thirds of all such installations. Although several states have statutes or regulations that allow third party ownership of net metered systems, a number of other states have taken a close look during the past year to determine whether PPA providers are eligible for net metering, or worse yet, are subject to regulation as public utilities. Oregon addressed this issue in July 2008 and determined that solar PPA providers are not public utilities. Moreover, they are not subject to regulation as competitive retail providers. Oregon also determined that solar PPA providers are eligible for net metering. Florida, in contrast, determined that 30 year old case law prohibits the PPA model, but a public service commission-adopted regulation specifically allows for a solar leasing model. Two other states – Nevada and Arizona – have recently begun proceedings to address this issue with decisions expected in 2009. IREC was an active participant in Oregon and Florida and will be active in Nevada and Arizona as well.

We also expect increasing focus on community solar developments in 2009. Massachusetts and New Jersey are both looking at an expansion of their net metering rules to allow community solar projects to move forward by allowing meter aggregation under net metering rules. Meter aggregation would allow excess generation on one meter to be applied against load on other meters. A few states allow for meter aggregation under their net metering rules; however aggregated meters under these programs must be located on adjacent property under ownership of one utility customer. The neighborhood solar program created by the Massachusetts Legislature in 2008 would expand on this approach by allowing different customers on potentially non-contiguous property to apply centralize solar generation against load on multiple meters.

Other IREC Net Metering and Interconnection Projects in the Past Year

Solar America Board for Codes and Standards (Solar ABCs)

During 2008, IREC authored two reports on interconnection standards for the Solar America Board for Codes and Standards (Solar ABCs). 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 U.S. Department of Energy funds Solar ABCs as part of its commitment to facilitate wide-spread adoption of safe, reliable, and cost-effective solar technologies. The reports authored by IREC include (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. These reports are introduced briefly below.

Utility External Disconnect Switch: Practical, Legal and Technical Reasons to Eliminate the Requirement by Michael T. Sheehan, PE

The utility-accessible external disconnect switch has been identified as an issue/barrier since publication of the "Gardner Report"[3] in 1991. Currently, eight states – Arkansas, Delaware, Florida, Nevada, New Jersey, New Hampshire, North Carolina and Utah – have incorporated provisions into their interconnection procedures that appear to waive the requirement of the external disconnect switch. In addition, many utilities around the country have eliminated the requirement of the external disconnect switch on systems less than 10 kW. More than half the inverter-based photovoltaic installations in 2007 were installed without an external disconnect switch. This report recommends adherence to established Best Practices for PV system interconnection because they provide safety without the external disconnect switch or its cost.

Comparison of the Four Leading Small Generator Interconnection Procedures by Jason B. Keyes and Kevin T. Fox

Distributed generation is far more likely to be deployed if developers and utility customers can readily discern the costs of interconnection and the length of time the approval process will take. While regulators have a challenging task in formulating interconnection procedures, the benefits of implementing procedures that function effectively are substantial. With this in mind, this paper looks at the pros and cons of four interconnection procedures that are in wide use and are often used as convenient starting points for utility regulators to build upon in configuring their own regulations. The four sets of interconnection procedures are: (i) FERC's SGIP; (ii) California's Rule 21; (iii) The Mid-Atlantic Demand Resource Initiative procedures; and (iv) IREC's Model Interconnection Standards and Procedures for Small Generator Facilities.

[3] Experiences and lessons learned with residential photovoltaic systems F.C. Kern and M.C. Russell, July 1, 1991

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* has been enormously important to IREC in support of our interconnection and net metering work. *Freeing the Grid* provides a straight forward, easy to understand introduction to the key aspects of interconnection procedures and net metering rules. It also provides legislators and regulators with a useful comparison of how state policies differ.
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 2008. Beginning in 2009, IREC and the Vote Solar Initiative will take a leadership role in overseeing future editions. Given the usefulness of this publication, IREC looks forward to continued involvement.

Solar America Cities

During the past year, IREC has forged relationships with several U.S. Department of Energy's Solar America Cities. IREC provided support to New York and New Orleans on network interconnections and provided technical guidance and support on solar and distributed generation interconnection issues in San Antonio and Austin. As noted below, this effort is closely aligned with a broader effort to pursue reasonable procedures for interconnection to area networks.

Network Interconnection Screens

At least 15 U.S. Department of Energy's Solar America Cities are served by network distribution grids. As mentioned above, these cities include Austin, Boston, Denver, Houston, Minneapolis, New Orleans, New York City, Orlando, Philadelphia, Pittsburgh, Portland, Sacramento, Salt Lake City, San Francisco and Seattle. Although some utilities are unwilling to interconnect distributed generation to their network distribution grids, a number of other utilities, including Pacific Gas & Electric and Arizona Public Service, have put policies in place to facilitate network interconnections.

Unfortunately, there has been little attempt at compiling the experience gained by these utilities into a form that may be useful to other utilities who are looking to get comfortable with network interconnections. To remedy this problem, IREC has teamed with the U.S. Department of Energy, the National Renewable Energy Laboratory and the Solar Electric Power Association to assemble information on utility experience with network interconnections. IREC will be looking to shape the knowledge gained from this experience into technical screens that can be used to identify network interconnections that may be facilitated without concern for detrimental impacts to safety or reliability. IREC expects this work to continue through the end of 2008 and into 2009.

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 expansions and refinements to their existing rules.

IREC is actively engaged in ongoing net metering rulemakings in Ohio, Nevada, North Carolina and Alaska. New York and Utah are gearing up for an expansion of their net metering programs, having been spurred on by legislation that was passed during the past year. IREC also looks forward to participating in rulemakings in Massachusetts and New Jersey, two states that are looking at an expansion of their net metering rules to allow for community solar projects.

For interconnection procedures, IREC expects to be active in California, Utah, Illinois and South Dakota. Recently, the California Public Utilities Commission requested comment on future revisions that should be considered to California's state interconnection procedures. IREC submitted comments and expects to be an active participant in California during the remainder of 2008 and into 2009. In Illinois, excellent interconnection procedures for systems up to 10 MW were recently enacted, but the utility commission decided to consider procedures for larger system interconnections under a separate docket, in which IREC will participate.

IREC also expects to be an active participant in Hawaii. Given that state's natural endowment of solar radiance and its high utility rates, solar and other distributed technologies would seem an ideal fit for the Aloha State. Unfortunately, Hawaii is still searching for the right mix of net metering and interconnection policy necessary to make a robust solar market a reality. IREC looks forward to working with state regulators and utilities to turn that situation around.

As noted above, IREC has developed relationships with several Solar America Cities. IREC provided support to New York and New Orleans on network interconnections and provided technical guidance and support on solar and distributed generation interconnection issues in San Antonio and Austin. We expect our support for these cities to continue into the upcoming year.

In addition to involvement in state and local rulemakings, IREC will continue its Solar ABCs, Freeing the Grid and network screens efforts, and will undertake a review of its model rules. 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 participate in meetings of various regulatory organizations to discuss the two papers written in the past year (see above), and potentially begin new studies if funding from the U.S. Department of Energy is allocated. 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 update its model net metering rules and interconnection procedures. In response to a call in the Energy Policy Act of 2005 for states to consider adoption of best practices, IREC developed model rules for net metering and interconnection in 2005, with final versions produced in November 2006. IREC's model rules draw on IREC's extensive experience working on state interconnection and net metering rule development. IREC has gained substantial new insight from participation in state rulemaking over the past few years. Larger

systems and new financial models have evolved. As a result, IREC feels it is time to revisit and update its model rules. As utilities and states gain experience with distributed generation, best practices in net metering and interconnection change. IREC wants to ensure that its model rules continue to serve as a compilation of these emerging best practices. IREC expects to issue revised model standards in early 2009.

Major Published Studies

Several recent additional studies regarding interconnection procedures deserve mention. The DOE – Energy Efficiency and Renewable Energy identified the technical and analytical challenges that must be addressed to enable high penetration levels of distributed renewable energy technologies. The Renewable System Interconnection Study[4] (RSI) consisted of 15 reports that address a variety of issues:

- Distributed systems technology development
- Codes, standards, and regulatory implementation
- Resource assessment
- Technical and market analysis

We would like to highlight two of the 15 RSI reports for the direct impacts to state rulemaking process. First, the "Photovoltaics Value Analysis Study" is a very comprehensive study that identifies 19 key values of distributed PV. The study then quantifies PV values and allocated the benefits to several categories of stakeholders: customer participant, utilities/ratepayers, and society.

The second RSI study is "Distribution System Voltage Performance Analysis for High-Penetration Photovoltaics." Two of the major conclusions of the study are:

- At a low PV penetration level (5%), inverters do not make a significant impact on the feeder's voltage regulation during peak load.
- At medium a PV penetration level (10%), inverter voltage support can help reduce the size of the conventional voltage support capacitors by nearly 40%.

[4] http://www1.eere.energy.gov/solar/solar_america/rsi.html

Workforce Development and Training
Trends, Challenges and Updates

Jane Weissman

Trends

Last March, 350 people gathered for *the New Ideas in Education a Workforce in Renewable Energy and Energy Efficiency* Conference. This was the second national conference organized by the Interstate Renewable Energy Council and sponsored by the New York State Energy Research and Development Authority. Close to 40 Community Colleges attended as well as other technical schools, 4-year colleges, non profits, industry and others representing 33 states.

This conference focused on instructional strategies, curricula development, and related training and market trends. Breakout sessions covered topics such as New Approaches to Course Delivery; Designing Training for Different Audiences; Lessons Learned from Training Programs; Hands-On Laboratories; Resources to Start or Improve Energy Programs; and Training the Electrical Trades.

Plenary sessions included presentations by Roger Bezdek talking about the economic and jobs impacts of the renewable energy and energy efficiency industries; Dr. Tom Starrs describing how renewable energy markets are undergoing rapid expansion; and Dr. James McKenney from the American Association of Community Colleges addressing the role of Community Colleges in meeting our nation's current and future workforce needs.

Based on presentations by over 60 speakers, the following trends, newest teaching practices and model training programs emerged.

Trend – The Solar Job Is Changing

Not that long ago, a solar installer handled many facets of the job – it was not unusual that "one guy did it all." But today, there is differentiation in job categories as markets grow; systems are moving from small residential ones to larger, commercial projects requiring a variety of contractors and crews; and work is governed by state licensing laws. As renewable energy markets grow, there is increasing availability of jobs at all levels, including manufacturing and distribution, design and engineering, sales and marketing, and installation and service. Accompanying these are jobs in the traditional building trades, such as electricians, plumbers, and roofers.

Jerry Ventre, retired from the Florida Solar Energy Center and now an advisor and consultant with IREC, says that the "Biggest delineation in [PV] job specialization is directly tied to system

size and associated contracting arrangements. Large system may involve an A&E firm, or a general or electrical contractor as lead, with roofing and construction contracted out. Tasks like installing support structures for large arrays, making roof attachments, installing glazing support frames for building-integrated PV would usually be done by contractors that have much broader construction experience, for which PV is an easy extension."

Jim Dunlop, formerly with the Florida Solar Energy Center and now with the National Joint Apprenticeship Training Committee (NJATC), cautions that "In the case of PV installations, these are clearly electrical power systems, and nearly all aspects are governed by the North American Electrical Safety System. That is, the standards are promulgated by IEEE, products are listed and certified by UL, and installation and safety requirements are covered by the National Electrical Code (NEC) and OSHA and enforced by the local AHJ [Authority Having Jurisdiction] through the electrical plans review, permitting and inspection/approval process. The NEC has a lot to do with tying all this together, which is adopted as law by most states and local jurisdictions, and impacts contracting rules and regulations as well as a guide for inspections and code compliance."

Trend – Accessible Local Training

The renewable energy industry is fortunate to have a number of first-rate training centers – the Florida Solar Energy Center, Solar Energy International, the Midwest Renewable Energy Association, the North Carolina Solar Center, and the Great Lakes Renewable Energy Association, to name some. These dedicated programs at these centers have provided experienced instructors and well-trained students but as the market grows, the workforce need is outstripping the training opportunities. While the training structure for installers is reasonably well developed in the U.S., it is currently limited. More local training is needed so that students can easily find opportunities within a reasonable distance to where they work and live.

Enter Community Colleges.

Community Colleges and Technical Schools are responding to the increasing demand for a skilled workforce by offering renewable energy courses. These courses cover the broad range from stand-alone seminars, energy certificates, associate degrees, and customized training for business and industry. In response to increasing demand, classes are expanding from short workshops to semester-long courses.

Lane Community College is the Grand Daddy of them all. Lane's Energy Management Program offers degree, certificate and customizable business and industry training. Students can earn a two-year Associate of Applied Science degree. The first year curriculum of the Renewable Energy Management Program focuses on fundamentals and includes courses covering physics, residential and light commercial analysis, lighting fundamentals, air conditioning fundamentals, and alternative energy sources. The second year, the Renewable Energy Technical Program covers electrical theory, renewable energy systems, solar thermal design and installation, solar PV design and installation, and energy investment analysis.

Austin Community College has established a 2-year Associates Degree in Renewable Energy as well as two certificates and several Continuing Education courses.

Diablo Valley College, which is located in the San Francisco Bay area, is offering an AS Degree and Certificate in Photovoltaic Systems.

Since March 2005, the Ulster County Board of Cooperative Educational Services (BOCES) Adult Career Education Center in upstate New York delivers non-credit, solar energy training through its Photovoltaic Practitioner Institute.

The Center for Business and Technology at Springfield Technical Community College offers a 40-hour, Photovoltaic Installer Certificate Program designed for architects, engineers, electricians, general contractors and others interested in developing a career in photovoltaics.

The list goes on. The North American Board of Certified Energy Practitioners (NABCEP) has approved over 60 Providers to offer their Entry Level Certificate program for PV. Many of these providers are Community Colleges.

Trend - Incorporating renewable and alternative energy technology into existing trade programs

Some Community Colleges are also incorporating renewable and alternative energy technology into existing trade programs such as construction, electrical, HVAC, and industrial maintenance trades.

Recently, Hudson Valley Community College outside of Albany, NY received state approval to offer a five-course, 19-credit certificate program in photovoltaic installation. This certificate is offered through the School of Engineering and Industrial Technologies, which is part of its Electrical Construction and Maintenance program.

The College of Technology at the State University of New York at Delhi also offers photovoltaic training courses as an extension of its existing curriculum in Electrical Construction and Maintenance. The merging of the two at SUNY Delhi allows an individual who is qualified to work as an electrician, the opportunity also to become skilled in PV installation. Delhi offers a for-credit introductory PV design and installation course as well as continuing education training for contractors and PV practitioners through short-term workshops.

Trend - Secondary to Post-Secondary Pathways

There is collaboration among Community Colleges and High Schools. Curriculum, resources, staff, faculty, funding and expertise are being shared between local technical high schools and the local Community College.

In partnership with Cape Cod Community College, Upper Cape Technical School and Cape Cod Technical School in Massachusetts have implemented interdisciplinary classroom and lab activities in the environmental technology and construction trade programs. These programs focus on energy efficiency, conservation and renewable energy. The real world projects enable contextual learning and promote workplace readiness.

Also in Massachusetts, the Clean Energy Tech School Task Force meetings are now attended by close to 40 people, representing 25 of the State's technical schools.

The Florida Solar Energy Center's (FSEC) Banner Center for Alternative Energy goal is to develop a network of training and workforce placement in alternative energy technologies for students located throughout the state of Florida. FSEC's training partners are Brevard Community College, Westside Technical High School, Tallahassee Community College, and Broward Community College in Ft. Lauderdale. Two other vocational schools, Manatee Technical High School and Lely High Construction Academy also participate.

Challenges

One of the challenges that Community Colleges, trade schools and others are facing is finding instructors. Local expertise can be limited and Industry experts can have knowledge about technologies but not necessarily teaching experience.

Some colleges are hiring NABCEP-certified installers to teach courses. The lead instructor at SUNY Farmingdale's workshops is NABCEP-certified Gay Canough. Hudson Valley Community College has formed a partnership with Renewable Power Systems, a local PV installation company, to provide its students with practical hands-on PV training. One of the owners, Kevin Rose, is also NABCEP-certified. At Bronx Community College, instructors Jonathan Lane and Anthony Periera are NABCEP-certified. Richard Gottlieb, another NABCEP-certified installer, teaches at Ulster BOCES and at Greenfield Community College, and Chris Kilfoyle, also NABCEP-certified, teaches the PV Installer Certificate Program at Springfield Technical Community College.

Since June 2008, IREC has held two faculty development workshops. The first was held at Hudson Valley Community College outside of Albany, New York and was a NYSERDA-sponsored 2-day workshop. The second one was in mid September at Diablo Valley College in Northern California and was part of IREC's DOE Solar Outreach grant. Jerry Ventre and Barbara Martin were the instructors.

The purpose of these workshops was to provide interested faculty not only with a set of photovoltaic curriculum materials, but also with expert instruction on how best to use the materials to successfully develop high-quality courses that address current and projected workforce needs. The workshops were designed for instructors who are already well versed in photovoltaic systems. Emphasis was placed on the process of integrating strong PV content materials into course instruction through appropriate analysis, design, development, implementation and evaluation.

Additional faculty development workshops are being planned.

Training Needs Assessment

On May 5, 2008 DOE's Solar America Initiative's Market Transformation group and IREC hosted a meeting in San Diego to bring together educators, industry, states, and experts to discuss solar energy training needs and how to meet them.

All participants agreed that the target groups that are most in need of training are solar installers, designers, code officials and licensed contractors. Other groups mentioned for training are salespeople, entrepreneurs, engineers, accountants for construction cost accounting, and architects.

However, the type of training needed for these different occupations and industry roles varies greatly. The length of these programs, the prior experience and prerequisites of the participants, and the credentials awarded are important considerations.

Local training should be of consistent quality and meet minimum standards if it is intended to qualify or prepare individuals for occupations.

The National Joint Apprenticeship and Training Committee's (NJATC) model of developing nationally standardized curriculum implemented by qualified instructors at local JATCs can be emulated in other sectors. The greatest challenge for all programs will be in providing related on-the-job and apprenticeship opportunities with PV and electrical systems in general, and in assessing the minimum skill standards, and the length and scope of training that should apply.

All participants agreed that training should be available at the local level for both the construction trades involved with solar installations and building officials involved with code enforcement. Additionally, those who train code officials should also be trained.

There was agreement that for the construction trades involved with solar installations, emphasis should be placed on developing add-on skills that will make them less susceptible to fluctuations in solar markets.

There was agreement that community colleges and vocational-technical schools offer excellent opportunities to provide needed training locally to the identified target groups.

And, it was concluded that the greatest assistance that could be provided to instructors and faculty at the local level would be train-the-trainer workshops. It was suggested that the focus of these workshops should be on how to utilize curriculum resources in course delivery and include ongoing updates on technology trends, new products, codes and standards.

Credentialing Programs

As renewable energy markets grow, consumers will increasingly look for quality assurance through third-party credentialing programs. There are a number of credentialing programs underway that are raising the bar for installers, products, and training programs.

First off, some definitions from the credentialing world. We define these terms using the National Organization for Competency Assurance's terminology (*The NOCA Guide to Understanding Credentialing Concepts*, 2005).

Credentialing is the umbrella term that includes the concepts of accreditation, licensure, registration, and professional certification.

Professional certification is the voluntary process by which a non-governmental entity grants a time-limited recognition and use of a credential to an individual after verifying that he or she has met predetermined and standardized criteria.

The North American Board of Certified Energy Practitioners (NABCEP) offers two professional certifications; one for the PV Installer and one for Solar Thermal Installers. A Small Wind Certification program is under development. Both the photovoltaic and solar thermal programs are based on strict, psychometric principles and credentialing guidelines. The program is rigorous, requiring documentation of experience and/or training and the passing a 4-hour exam (administered twice a year).

A **curriculum-based certificate** is issued after an individual completes a course or series of courses and passes an assessment instrument. NABCEP offers a PV Entry Level Certificate of Knowledge. The Certificate by itself does not qualify an individual to install PV systems but it does prepare them to enter the field.

Accreditation is the voluntary process by which a nongovernmental agency grants a time-limited recognition to an institution, organization, business, or other entity after verifying that it has met predetermined and standardized criteria.

IREC offers the ISPQ Accreditation for Training Programs and Certification for trainers. To ensure continuity, consistency, and quality in the delivery of training, the Institute for Sustainable Power developed a framework of standards and metrics, along with a system of review and auditing, to provide a means to compare content, quality, and resources across a broad range of training programs. IREC is the North American Licensee for the ISPQ Standard for Accreditation & Certification of renewable energy training programs.

Licensure is the mandatory process by which a governmental agency grants time-limited permission to an individual to engage in a given occupation after verifying that he/she has met predetermined and standardized criteria, and offers title protection for those who meet the criteria.

States have different licensing requirements which usually fall under a General Contractor (or equivalent) License, Electrical Contractor License for PV or Plumbing License for Solar Thermal, Solar Contractor license or sublicense or other licensing requirements. NABCEP is clear that

their certification is not a substitute for licensure or any other credential or certification which may be required by state or local laws or regulations.

Credentialing Updates

The North American Board of Certified Energy Practitioners

There are 514 Candidates that have become NABCEP certified as PV Installers since the credential started in the fall of 2003. Certificants represent 40 states plus the District of Columbia. These figures do **not** include the results of the September 13, 2008 exam.

Top States – PV	# of Certificants	% of All PV Certificants
California	178	35%
New York	41	8%
Colorado	39	8%
New Jersey	18	4%
Vermont	18	4%
Massachusetts	17	3%
Texas	16	3%
Arizona	15	3%
Oregon	14	3%
Ohio	13	3%
Wisconsin	13	3%

There are 72 NABCEP-Certified Solar Thermal Installers since the program started in September 2006. Solar Thermal Certificants represent 26 states. These figures do **not** include the results of the September 13, 2008 exam.

Top States – Solar Thermal	% of All ST Certificants
Wisconsin	13%
California	10%
Colorado	10%
Illinois	7%
New Mexico	7%
Pennsylvania	6%

The Institute for Sustainable Power Quality Assessment Credentials

As of September 2008, the following educational providers have been awarded accreditation for their renewable energy training courses:

Florida Solar Energy Center (FSEC)
Accredited Training Program for their Photovoltaic Training Courses

Solar Energy International (SEI)
Accredited Training Program for their courses in PV Design and Installation:

- PV Design and Installation
- PV Women's PV Design and Installation
- Utility Interactive PV Systems
- PV Online
- Advanced PV Online

Midwest Renewable Energy Association (MREA)
Accredited Training Program for their Basic Photovoltaic Course and PV Site Assessor Training Class

State University of New York at Farmingdale
Accredited Training Program for their Installation and Maintenance of Residential Photovoltaic Grid-Connected Systems courses

North Carolina Solar Center
Accredited Continuing Education Provider for their Renewable Energy Technologies Diploma Series

State University of New York at Delhi
Accredited Training Program for their Photovoltaics Design and Installation Course

Sun Pirate, Inc.
Accredited Continuing Education Provider for their Fundamentals of Solar Hot Water Heating On-Line Course and Photovoltaic System Design and Installation On-Line Course

Lane Community College
Accredited Training Program for their Renewable Energy Technician Program

Great Lakes Renewable Energy Association
Accredited Training Program for their PV Apprentice Training Program and PV Advanced System Integrator Certification Program

The Center for Sustainable Energy at Bronx Community College
The City University of New York

Accredited Continuing Education Provider for their Introductory Photovoltaic Installation and Advanced Photovoltaic Installation Courses

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Small Wind Certification Council

Earlier this year, the Small Wind Certification Council (SWCC) was spun off from IREC and incorporated as an independent non profit organization. A Board of Directors was elected and appointed Larry Sherwood as the first Executive Director.

The Small Wind Certification Council will certify that small wind turbines meet or exceed the performance, durability, and safety requirements of the Small Wind Turbine Performance and Safety Standard, currently under development by the American Wind Energy Association. This certification will provide common North American reporting of turbine energy and sound performance and will help small wind technology gain mainstream acceptance.

It is expected that SWCC will begin to accept certification applications later in 2009.

IREC Workforce Development Publications

Available at www.irecus.org

- ***Best Practices & Recommended Guidelines for Renewable Energy Training***. September 2008.
- ***Occupational Profiles for the Solar Industry***. August 2008.
- ***Job Trends Index***. June 2008.

November 18, 19, & 20, 2009
Workforce Education Conference

Plans are underway for the third national conference on ***New Ideas in Educating a Workforce in Renewable Energy and Energy Efficiency***. This event will be held in the on November 18, 19 and 20, 2009 in Albany, New York.

"Green" jobs are the foundation for the new clean energy sector emerging across the country. The conference will offer the most current information on instructional strategies, curricula development, and best practices for training in the renewable energy and energy efficiency fields. Pre-conference, technical workshops will be held followed by 2 days of conference sessions.

A "Call for Presentations" will be released in January 2009. Please watch www.irecusa.org for more information or email Jane Weissman at jane@irecusa.org to be put on the mailing list.

The conference is sponsored by the New York State Energy Research and Development Authority and organized by the Interstate Renewable Energy Council. The conference planners include representatives from the Partnership for Environmental Technology Education, Hudson Valley Community College, US Department of Energy, Lane Community College, Oakland Community College, SunPower Corp., the Workforce Development Institute and others.

Contact Information

State Incentives & Policy Trends

Rusty Haynes
DSIRE, North Carolina Solar Center at NCSU
rusty_haynes@ncsu.edu

Justin Barnes
DSIRE, North Carolina Solar Center at NCSU
justin_barnes@ncsu.edu

Brian Lips
DSIRE, North Carolina Solar Center at NCSU
brian_lips@ncsu.edu

Laurel Varnado
DSIRE, North Carolina Solar Center at NCSU
lavarnad@ncsu.edu

Solar Installation Trends

Larry Sherwood
Sherwood Associates
Larry@sherwoodassociates.com

Net Metering & Interconnection Trends

Jason Keyes
Keyes & Fox, LLP
jkeyes@keyesandfox.com

Kevin Fox
Keyes & Fox, LLP
kfox@keyesandfox.com

Michael Sheehan
sheehan.mt@gmail.com

Workforce Development and Training

Jane Weissman
Interstate Renewable Energy Council
jane@irecusa.org