INTERSTATE RENEWABLE ENERGY COUNCIL

2007 UPDATES & TRENDS

ANNUAL MEETING
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UPDATES & TRENDS

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State Solar Policy – News from DSIRE

By Susan Gouchoe

Introduction

During the past year, we've seen many states respond to concerns about climate change, escalating energy prices, dependence on foreign oil, and other energy challenges with wide-ranging legislation to foster the use of biofuels, energy efficient and green building practices, carbon sequestration, and renewable energy technologies. This article highlights some of the new policy developments that are particularly important for advancing *solar* markets, including renewables portfolio standards, rebates and other direct incentives, tax credits, net metering, and solar rights laws.

Solar Portfolio Standards on the Rise

This was the year of the renewables portfolio standard (RPS). Five states – Washington, Oregon, New Hampshire, North Carolina, and Illinois – established new renewable energy generation requirements, while three others – Missouri, North Dakota, and Virginia – adopted voluntary programs. That brings the count to 25 states and the District of Columbia with renewable energy mandates and four states with non-binding goals. Meanwhile, seven states significantly stepped up their existing commitments to renewables by increasing (and in many cases doubling) the percentage of electricity sales to be drawn from renewable energy sources. These states include Arizona, Colorado, Connecticut, Delaware, Minnesota, Maryland, and New Mexico. What's striking is that the majority of states revising their RPS policies did so with an eye toward promoting emissions-free solar technologies with the potential for significant economic development benefits. Two of the four new standards – New Hampshire and North Carolina – did the same. Legislation in Michigan is sill in play as of this writing and look for action in Ohio this fall. Here's a closer look at the new and recently expanded RPS policies that commit to boosting solar deployment.

> ***Maryland adds a 2% solar electric set-aside.*** Maryland revised the state's RPS in April 2007 to require electricity suppliers to derive 2% of electricity sales from solar energy *in addition to* the 7.5% renewables drawn from other Tier 1 resources as outlined in the initial 2004 RPS law. The solar set-aside begins at 0.005% of retail sales in 2008 and increases incrementally each year to reach 2% by 2022. The provision is projected to result in the development of approximately 1,500 megawatt (MW) of solar capacity by 2022. Electricity suppliers purchasing renewable energy credit (RECs) directly from a solar electric system owner to fulfill compliance obligations must enter into a contract for at least 15 years. However, owners of small photovoltaic systems (≤ 10 kW) will get a single up-front payment representing the value of the renewable energy credits over the 15-year contract. Maryland's Public Service Commission is charged with developing rules for the solar program.
>
> ***Delaware doubles RPS requirement, adds a 2% solar set-aside.*** In July 2007 Delaware boosted its mandate for renewable energy generation from 10% to 20% of retail electricity sales by 2019. Following Maryland's lead, Delaware added a provision specifying that 2% of electricity sales must be sourced from solar (photovoltaics, specifically) in 2019. Unlike

Maryland, which scrapped its solar multiplier for RPS compliance purposes when it created the set-aside, Delaware maintained the triple credit for solar PV-generated electricity. The new solar requirement will bring an estimated 100 MW online by 2019. The 2007 amendment also extended RPS compliance eligibility to solar heating and cooling that offsets electricity, but note that solar thermal does *not* count toward the 2% solar PV requirement.

New Mexico doubles RPS; adds 4% solar electric set-aside. In March 2007 New Mexico doubled its RPS for investor-owned utilities (IOU) from 10% by 2011 to 20% by 2020 and set a separate, lower standard for rural electric cooperatives at 10% by 2020. The original RPS offered triple credit for solar resources for the purposes of issuing renewable energy credits for RPS compliance. However, when the Public Regulation Commission adopted final rules in August 2007, they eliminated the multipliers and instead developed minimum standards for IOUs for various technologies, including solar electric, to achieve a "fully diversified renewable energy portfolio". The solar set-aside begins at 2% of electricity sales in 2011 and rises to 4% by 2020, potentially yielding an installed solar capacity of more than 500 MW.

In addition, no less that 1.5% of the renewable energy requirement can be met through distributed generation (DG) from 2011 through 2014 and no less than 3% beginning in 2015 -- translating to 0.6% of electricity sales from DG by 2015.

New Hampshire joins other New England states in adopting RPS; first to mandate solar. New Hampshire's Electric Renewable Portfolio Standard, enacted in May 2007, requires electricity providers to use renewables for 23.8% of retail electricity by 2025. The standard includes set-asides for four classes of renewables, including a solar electric carve-out of 0.3% by 2014 and continuing through 2025. The potential impact is 33 MW of installed solar capacity by 2025. Alternative compliance payments for solar resources have been set at $150/MWh. Customer-sited solar water heating that displaces electricity is eligible for RPS compliance but may not be used to satisfy the 0.3% solar electric mandate.

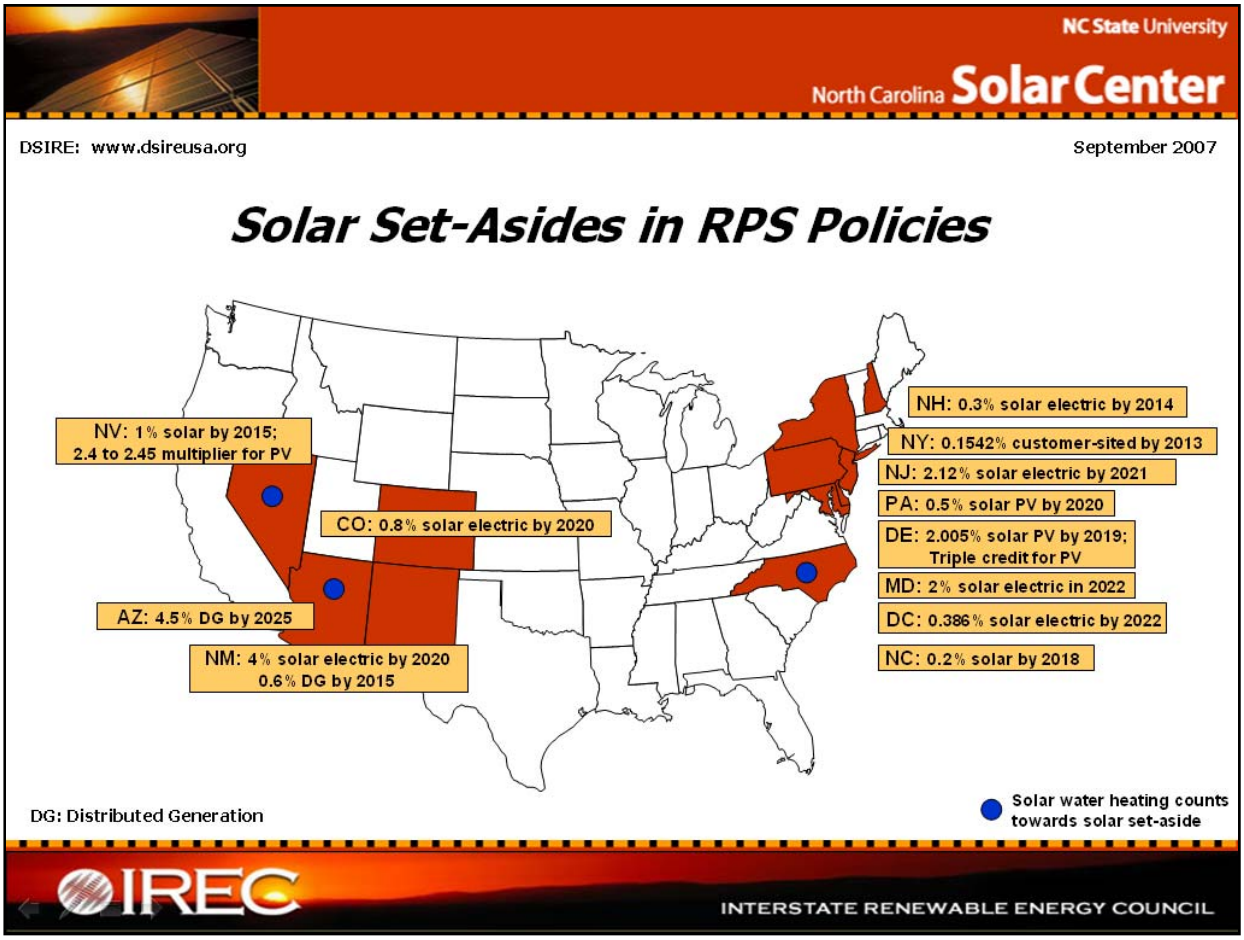
North Carolina becomes first state in Southeast to adopt an RPS; includes 0.2% solar set-aside. North Carolina became the first state in the Southeast to adopt an RPS with the enactment of the Renewable Energy and Energy Efficiency Portfolio Standard in August 2007. The law requires all investor-owned utilities in the state to supply 12.5% of 2020 retail electricity sales in the state from eligible energy resources by 2021. Electric cooperatives and municipal utilities are subject to lower standards. As is the case in a handful of other states, energy efficiency can also be used to meet RPS requirements.

The RPS calls for set-asides for several difference resources, including one for solar that begins at 0.02% by 2010 and increases to 0.2% by 2018, resulting in an estimated equivalent of 300 MW of solar capacity by 2018. The scope of eligible solar resources is broad, including PV, solar water heating, solar absorption cooling, solar dehumidification, solar thermally driven refrigeration, and solar industrial process heat.

Arizona finalizes renewable energy standard; calls for 4.5% distributed generation by 2025. In late 2006 the Arizona Corporation Commission adopted final rules to expand the state's Renewable Energy Standard to 15% by 2025, with 30% of the renewable energy to be derived from distributed energy technologies. But only in June of 2007 did the Attorney General certify the rule as constitutional, allowing the new rules to go forward. Investor-

owned utilities serving retail customers in Arizona, with the exception of distribution companies with more than half of their customers outside Arizona, are subject to the standard.

As part of the 4.5% by 2025 set-aside (30% of the 15% RES) for distributed renewables, one-half of the requirement must come from residential applications (presumably solar for the most part) and the remaining one-half from nonresidential, non-utility applications. A broad array of solar technologies is eligible for the distributed resources set-aside, including solar electric, commercial solar pool heating, solar space heating & cooling, daylighting, solar water heating, and solar industrial process heating/cooling. The result could be as additional installed solar capacity in the neighborhood of 1,800 MW.



Incentive Programs in Transition

Nearly two dozen states provide direct incentives -- rebates, grants, and production-based incentives -- for solar PV and/or solar thermal projects. These programs include state-administered incentives funded by public benefits funds or state appropriations as well as utility programs available to the majority of the state's electricity customers in states such as Colorado, Nevada, and Arizona resulting

from state RPS policies. Although no new state programs have emerged this year, two states representing the strongest solar PV markets – **California** and **New Jersey** – are transitioning to new incentive designs.

California Solar Initiative. In January 2007 California launched the *California Solar Initiative* (CSI) – a $3+ billion program that provides incentives for solar projects with the objective of installing 3,000 MW of capacity by 2017. The California Public Utilities Commission (CPUC) manages the solar program for commercial and existing residential customers, while the California Energy Commission (CEC) oversee the *New Solar Homes Partnership* program targeting the residential new construction market. Originally limited to customers of the state's investor-owned utilities, the CSI was expanded in August 2006 as a result of Senate Bill 1 to encompass municipal utility territories as well. Although many California municipal utilities already offer solar PV rebates, specific SB 1 incentive requirements go into effect January 1, 2008 for these utilities.

For the CPUC retrofit program, incentives for small systems (<100 kW) are structured as an up-front payment based on expected performance, taking into consideration system rating, location, tilt and orientation, and shading. Larger projects are metered and incentives disbursed monthly over 5 years based on actual system output – a performance-based incentive (PBI). Applicants for small installations can opt for the PBI incentive rather than the up-front payment if they determine they can achieve a higher incentive through the PBI. (Eventually, incentives for all systems greater than 30 kW will be subject to the PBI structure.) Incentive levels automatically decline over the duration of the CSI program in 10 steps based on the aggregate capacity of solar installed. Incentive amounts and targets within each step are broken out by residential vs. non-residential and commercial vs. non-profit, with non-profits receiving roughly a 25% higher incentive.

Commercial and non-profit projects have taken off, and incentives are already on "Step 4" of the 10-step incentive ladder for projects in Pacific Gas and Electric (PG&E) as well as Southern California Edison (SCE) territories. All residential incentives are still in Step 2, although PG&E is on the verge of jumping to Step 3. Such massive programs seldom proceed without a hitch, however. The first year has seen bottlenecks that have delayed incentive payments as new paperwork requirements were introduced to ensure the legislature's performance and consumer protection goals. The CPUC and solar stakeholders have been working to identify areas to streamline the process, and the CPUC expects that the payment timeframe will diminish as the market awareness improves for new application processes and installers begin to use the new online application database.

In addition, some customers faced a most unfortunate and unintentional consequence related to a requirement that incentive recipients switch to a time-of-use (TOU) electric rate. While customers were expected to benefit from TOU rates because solar production is credited to the customer at the higher-cost peak price, some customers (particularly in SCE territory) saw little or no savings after installing PV systems. There was a severe reduction in the number of residential applications during the first half of the year relative to the previous year. State officials scrambled to fix the problem and in June 2007, lifted the TOU requirement.

Although the CSI primarily funds PV projects, the CPUC also authorized $2.6 million for a pilot solar water heating program, involving inspections, performance monitoring, program metering and verification, of which $1.5 million is designated for incentives based on

expected performance. This program, launched in July 2007, is administered by the California Center for Sustainable Energy (formerly the San Diego Regional Energy Office) and is available to only retrofit systems for existing residential, commercial, agricultural, and industrial electricity customers of San Diego Gas & Electric. The results of this program will inform the legislature's decision on expanding the program state-wide in the future.

New Jersey Customer On-site Renewable Energy (CORE) Program. As of this writing, New Jersey is on the verge of announcing the details of a new market-based financing system that shifts away from the current capacity-based PV rebates as part of the NJ Clean Energy Program. New Jersey's PV rebate program, initiated in 2001, offers among the most generous incentives in the country. The overwhelming number of rebate applications in recent years, however, has outstripped the available funds; in fact, all of the money budgeted through 2008 has been spent. In April 2006, New Jersey increased its RPS requirement to 20% Class I Renewables by 2020, including a minimum requirement of just over 2% from solar electricity (~1,500 MW solar). Recognizing that the CORE budget could not support the volume of rebates necessary to meet the state's accelerated solar goal (40 MW had been installed as of June 2007), a stakeholder group was formed to consider various financing models to develop a more efficient and sustainable program. The new program may continue up-front payments for small systems (≤ 10 kW) but if so, look for incentives to be based on expected performance rather than capacity alone. Larger projects will involve a performance-based structure employing a renewable energy certificate financing program, but the full details are still forthcoming.

States Increase and Expand Scope of Tax Credits

At least a dozen states proposed new tax credits for solar installations over the past year, but as of this writing, only Louisiana and New Mexico were successful in approving them. **Louisiana** established a 50% tax credit for residential solar and wind applications, up to $12,500. **New Mexico** created a 6% credit against the gross receipts, compensating, or withholding taxes for solar thermal electric plants as well as a sustainable building tax credit for both residential and commercial buildings. Although solar installations can help a project qualify for this green building incentive, one can not claim both the sustainable building tax credit and the New Mexico's existing state solar tax credit.

Meanwhile, several other states already offering solar tax credits expanded or increased the incentive to the benefit of solar market development:

In **Arizona**, for example, the commercial/industrial solar and wind tax credit created in 2006 now extends to all non-residential entities, including those that are tax-exempt. That is, a third party that finances, installs or manufactures a system for a non-profit or government installation can claim the credit. This May 2007 revision is retroactive to January 1, 2006.

North Carolina amended its renewable energy tax credit statute to allow a taxpayer who donates money to a tax-exempt nonprofit to help fund a renewable energy project to claim a tax credit. The donor can claim a share of the credit--proportional to the project costs donated—that the nonprofit could claim if the organization were subject to tax.

While **Oregon's** business energy tax credit (BETC) "pass-through" provision has offered a mechanism for non-taxed entities and third-party project owners to take advantage of the incentive for many years, state lawmakers expanded the credit in July 2007 to homebuilders who install eligible systems on single-family residences. A homebuilder's credit is calculated according to the residential tax credit formula *plus* $3,000, up to a maximum credit of $9,000. This means $3 per watt for PV, *plus* $3,000. For solar space and water heating systems, the credit would be calculated at 60¢/kWh saved during the first year, *plus* $3,000. If the home qualifies as a "high-performance home," the homebuilder is eligible for a credit of up to $12,000 rather than the $9,000 maximum for installing a system on a standard home.

For non-residential renewable energy systems, the amendment increased BETC from 35% of project costs to 50% (taken over 5 years) and raised the cap on eligible project costs from $10 million to $20 million. This translates to a maximum credit of $10 million for a given project. And now, manufacturers of renewable energy equipment are eligible for the credit as well. These changes are retroactive to January 1, 2007 and sunset on January 1, 2016.

New Mexico reworked its existing production tax credit for large renewable energy facilities by decreasing the minimum qualifying facility capacity from 10 megawatts to 1 megawatt and increasing the incentive for solar electric facilities from 1¢/kWh of electricity generated over 10 years to an average of 2.7¢/kWh (up to 200,000 MWh annually) over the 10-year duration. For electricity generated on or after October 1, 2007, excess credit will be refunded to the taxpayer in order to allow project owners with limited tax liability to fully utilize the incentive.

More States Join 1+ MW Net Metering Club

As of this writing, 11 states allow net metering for certain renewable energy systems one MW or larger in capacity. Notably, Maryland and Connecticut raised their limit on individual systems to 2 MW, regardless of customer class, and Oregon raised its net metering limit to 2 MW for nonresidential customers of PGE and PacifiCorp. Pennsylvania raised its net metering limit from 1 MW to 3 MW for nonresidential systems, and from 2 MW to 5 MW for systems that are part of a microgrid or are available for emergency use. Curiously, New Mexico adopted net-metering rules for systems up to 80 MW in capacity, although net metering occurs on a monthly (as opposed to annual) basis. Delaware, Nevada and Rhode Island also joined the rapidly expanding 1-MW-or-more club.

The state regulatory authorities of New Mexico, Ohio, Oregon, South Carolina, Vermont and West Virginia adopted new interconnection standards for distributed generation, while new standards are currently under development in about 10 other states, including Connecticut, Illinois, New Mexico and South Dakota. Significantly, Delaware enacted legislation in July 2007 that requires the state Public Service Commission and certain utilities to develop new interconnection rules based on IREC's model interconnection rules.

Protecting Solar Access Rights Still on the Agenda

At least eight states proposed measures to create or strengthen protections for homeowners who want to install solar energy systems. Many consumers find that city ordinances, homeowner association, or other rules restrict such installations. As of this writing, Arizona and New Mexico were successful at strengthening existing solar access laws, while North Carolina created a new statute. Bills in New Jersey and Illinois are still in play.

Effective September 2007, **Arizona's** new provision stipulates that a homeowner association may adopt reasonable rules regarding the placement of a solar device so long as those rules do not prevent installation of the device, impair the functioning of the device, restrict its use, or adversely affect the cost or efficiency of the device. The bill also requires that the court award reasonable attorney fees and costs to any party who prevails in litigation related to solar access against an association's board of directors.

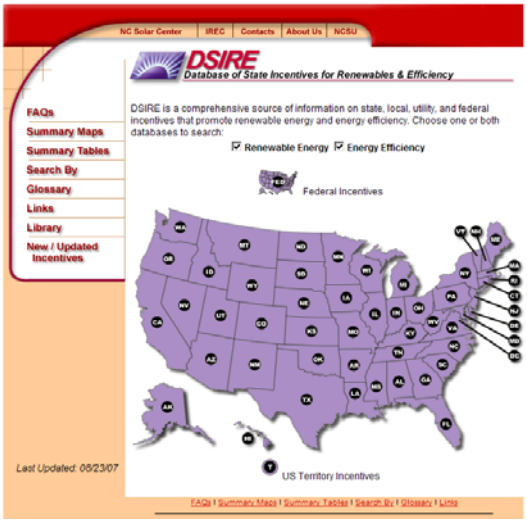
New Mexico enhanced its existing solar rights law by imposing limitations on the ability of a county or municipality to restrict the placement of solar collectors unless the location is within a historic district. The new law also voids all covenants and restrictions (from July 1, 1978 forward) that effectively prohibit the installation of solar collectors.

North Carolina's law provides that city or county ordinances, as well as deed restrictions, covenants, and other similar agreements established on or after October 2007, cannot prohibit or have the effect of prohibiting the installation of solar collectors that are not facing public access or common areas on detached single-family residences. In any civil action arising from disputes, the court may award costs and reasonable attorneys' fees to the prevailing party.

Visit DSIRE Online

For more information on these and other incentives and policies, visit DSIRE at www.dsireusa.org.

DSIRE provides detailed information on a wide range of incentives and policies at the state, local, utility, and federal level that promote renewable energy and energy efficiency. Established in 1995, DSIRE is an ongoing project of the Interstate Renewable Energy Council and the North Carolina Solar Center funded by the U.S. Department of Energy.



Solar and Distributed Wind Installation Trends

By Larry Sherwood

Introduction

U.S. solar and distributed wind installations by technology are detailed for 1997 – 2006. The growth and state distribution of installations for the following technologies are reported:

- photovoltaics,
- solar thermal electric,
- solar water heating and space heating,
- solar pool heating, and
- distributed wind.

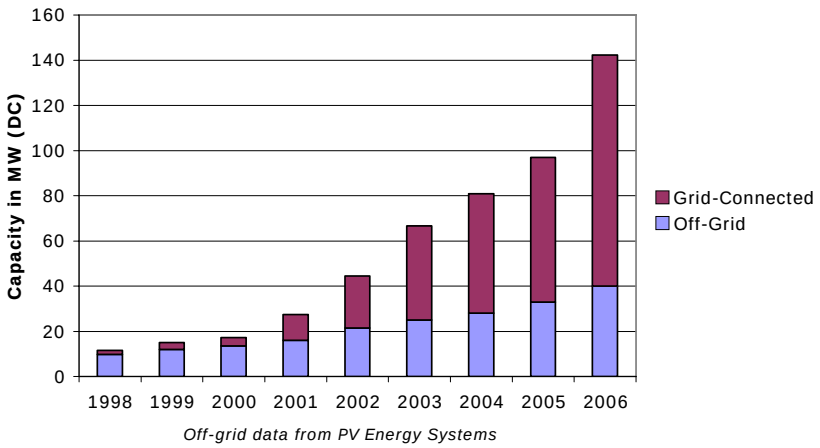
Assumptions are described at the end of the report. See the references for more detailed reports and papers on this installation data.

Photovoltaics

U.S. photovoltaic installations increased by 47% in 2006 (see Figure 1) and grid-connected installations increased by 60% to more than 100 MW_{DC} for the year. Grid-connected PV installations doubled every two years since 2002. The off-grid market growth has been steady, but significantly slower. The market share of grid-connected installations has increased from only 16% in 1998 to 52% in 2002 and now is 72% of the PV installations by capacity. The cumulative installed capacity for grid-connected photovoltaic installations was slightly more than 300 MW_{DC} at the end of 2006.

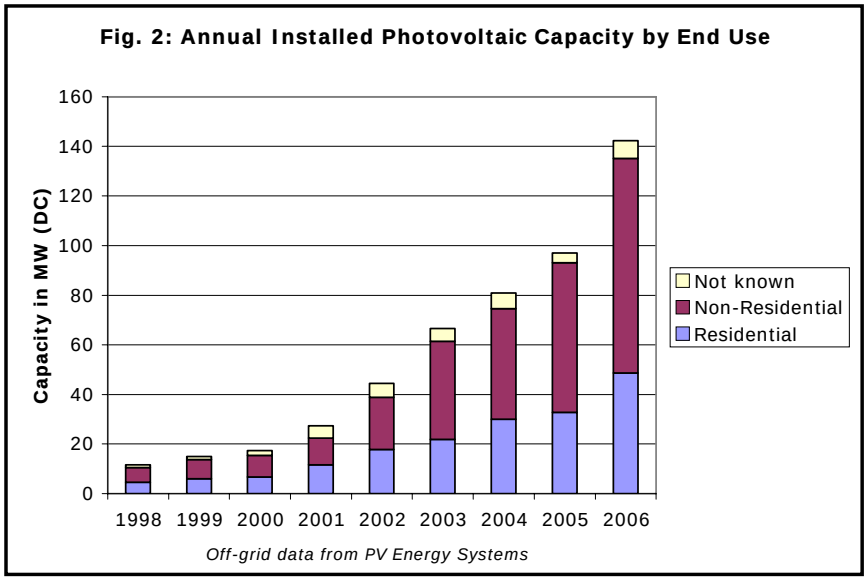
Consumer concerns about rising energy prices after Hurricane Katrina, the start of federal solar tax credits, and sustained or growing state incentives drove the robust sales. Concerns about PV supply shortages were real throughout the year. However, flat markets in Germany and Japan and increasing module production meant that PV modules were available for the U.S. market.

Fig. 1: Annual Installed Photovoltaic Capacity



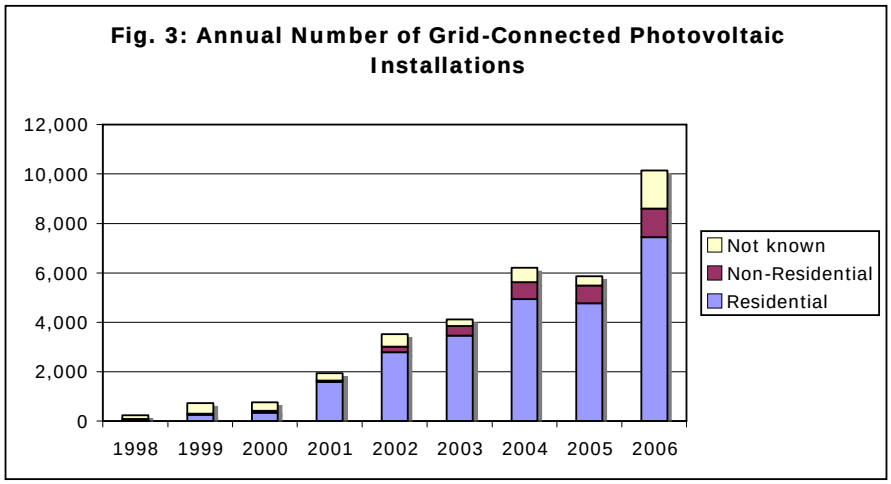
Off-grid data from PV Energy Systems

Figure 2 shows the same annual PV installation data segmented by residential and non-residential installations. Both residential and non-residential installations grew significantly in 2006. The long-term trend shows non-residential installations growing faster than residential installations. In 2001, non-residential installations were 48% of the market and only 28% of the grid-connected market. By 2006 the non-residential market share increased to 64%.



The trend toward more non-residential installations should continue because the new federal tax credits are more generous for commercial installations. In California, the largest incentive programs in the country have changed to a performance-based incentive basis and non-residential installations are booming.

The number of grid-connected installations grew by 73% in 2006 and topped 10,000 for the first time. 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 still much larger than non-residential installations.



Installations of grid-connected photovoltaic installations have been concentrated in California, New Jersey, New York, and Arizona as shown in Tables 1 and 2. California dominates the market with 75% of all grid-connected PV installations. No comprehensive data exists for off-grid installations by state.

Table 1: 2006 Installed Grid-Connected Photovoltaic Capacity (MW_{DC})
Top Ten States

	2005	2006	05-06%
1. California	52.0	70.6	36%
2. New Jersey	5.5	17.9	223%
3. New York	1.4	2.7	91%
4. Nevada	0.5	2.6	436%
5. Arizona	1.6	1.9	22%
6. Massachusetts	0.6	1.5	127%
7. Colorado	0.2	0.9	421%
8. Texas	0.6	0.7	20%
9. Connecticut	0.2	0.5	210%
10. Oregon	0.4	0.5	50%
All Other States	1.1	2.5	135%
Total	64.0	102.3	60%

In 2006, California installations increased by 36% to 71 MW and New Jersey installations more than tripled to 18 MW (see Table 1). On a per capita basis, New Jersey installed slightly more capacity in 2006 than California. In addition to New Jersey, the market more than doubled in Nevada, Colorado, Massachusetts, and Connecticut plus many states with smaller PV markets.

Table 2: Cumulative Installed Capacity per Capita (W_{DC}/person)_
Top Ten States

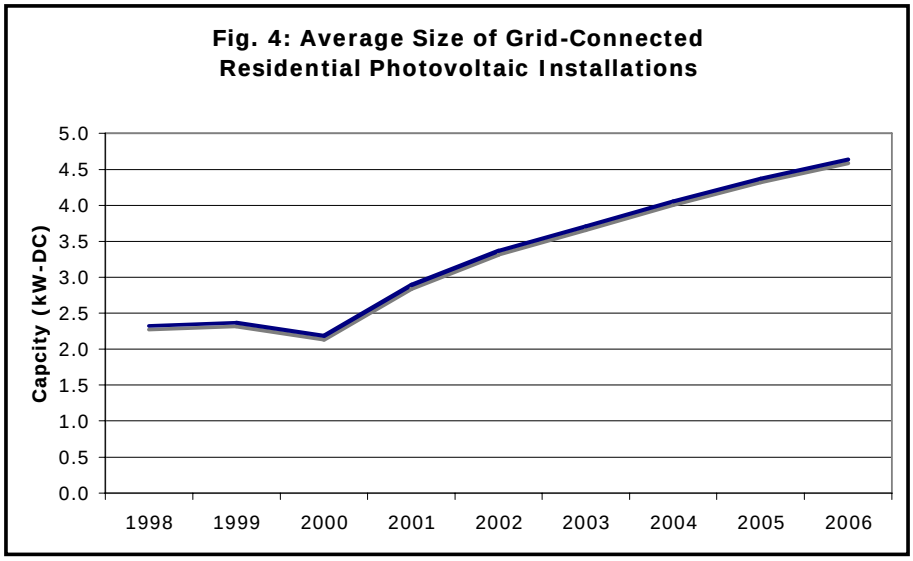
1. California	6.4
2. New Jersey	3.1
3. Arizona	2.6
4. Nevada	1.5
5. Hawaii	1.1
6. Delaware	0.9
7. Vermont	0.8
8. Massachusetts	0.5
9. New York	0.5
10. Oregon	0.4
National Average	1.0

Although new state markets emerged in 2006, the market remains very concentrated in a few states. From 2003 through 2005, 96% of grid-connected installations were in the top five states. In 2006, as new state markets developed, the top five states still accounted for 94% of installations.

All of the top states for grid-connected PV installations have financial incentives. Although, federal tax credits appear to encourage more installations throughout the country, installations in locations

with no state or local incentives remain rare. Quantifying installations in these states with no state or local incentives is more difficult.

Table 2 shows the cumulative per capita grid-connected PV capacity. Even with California's very large population, it has more than twice the per capita installed capacity as any other state and more than six times the national average. No mater 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 average size of a grid-connected PV residential installation has grown steadily (see Figure 4). In 2006 the average size exceeded 4.6 kW_{DC}, more than twice the average in 1997. The average size varies from state-to-state and is typically larger in states with rebates than in states without rebates.

The average size of grid-connected PV non-residential installations was 53 kW_{DC} in 2006. The average has varied between 38 and 55 kW_{DC} and does not show a consistent trend. Although there are larger numbers of very large installations, mid-size system installations are also growing so the average size is not increasing.

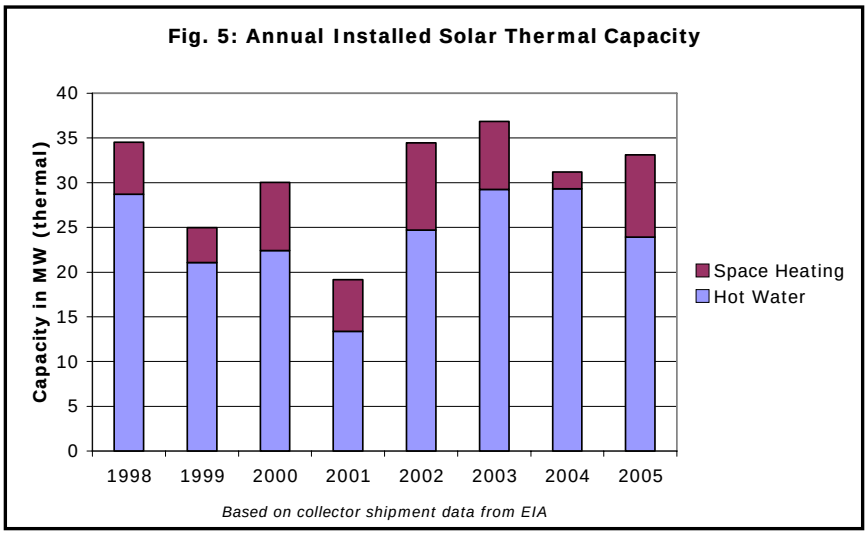
Solar Thermal Electric

A one MW solar thermal electric plant was completed in Arizona in 2006. This is the first new solar thermal electric plant in over fifteen years. Solar thermal electric plants with a capacity of 354 MW were constructed in California from 1985 to 1991 and continue to operate today.

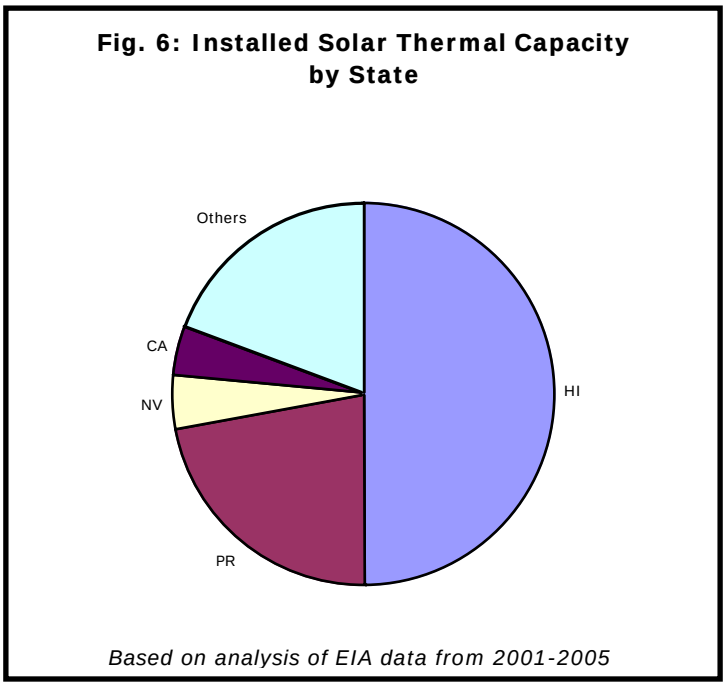
A 64 MW solar thermal electric plant in Nevada and began operation in the spring of 2007.

Solar Hot Water and Space Heating

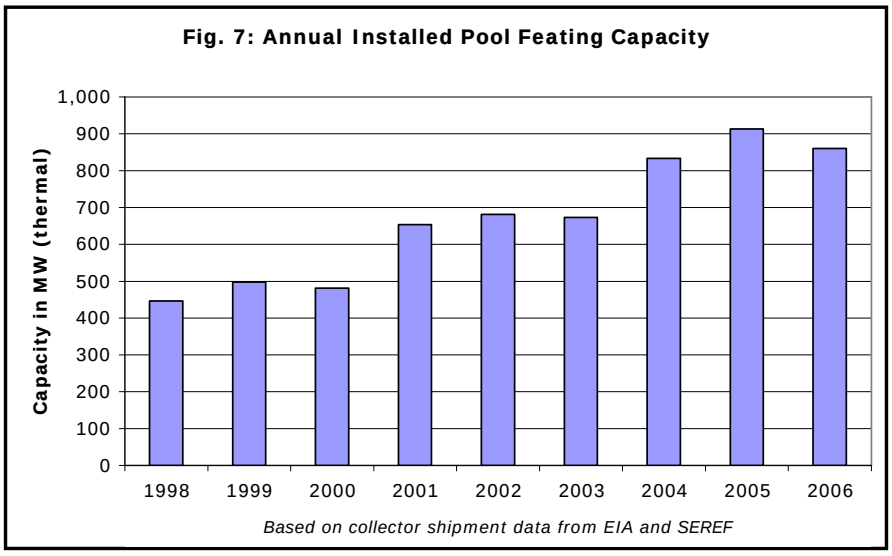
Unlike the photovoltaic market, the solar hot water and space heating markets have been generally flat with some variations from year-to-year (see Figure 5).



Although complete information on the solar hot water in 2006 in not yet available, information from a few utilities which provide solar hot water financial incentives show installations in their programs grew by 30% in 2006. With the launch of the federal solar tax credit in 2006, it is likely installations increased even more in parts of the country with no local incentives. Thus 30% is probably a low estimate of the installation increase in 2006.



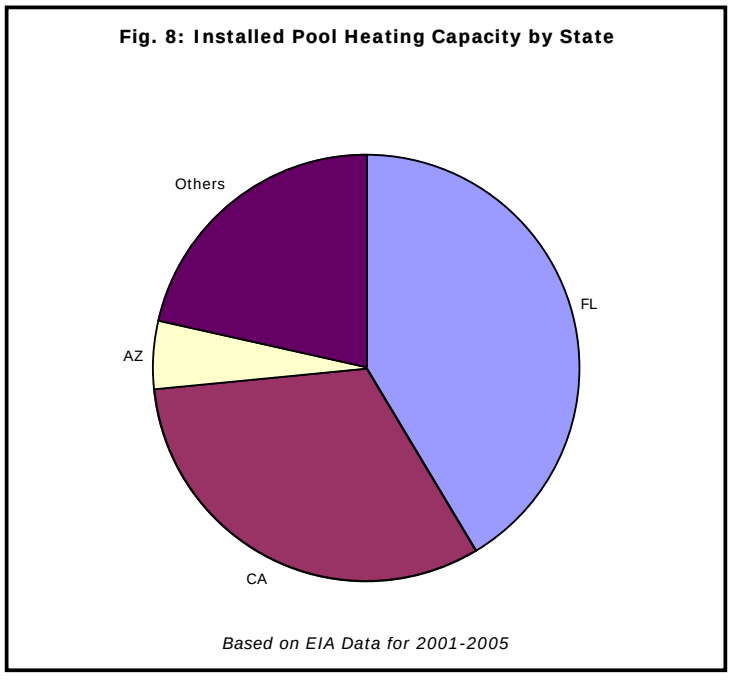
The solar thermal installation trends are consistent with state data showing stable markets or variations from year to year, but no significant state markets with steady sustained growth. The solar hot water market is significantly larger than the solar space heating market. Since a solar space heating system is larger, this means that the number of solar space heating installations is quite small.



Like photovoltaic installations, Figure 6 shows that 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 photovoltaics. Hawaii represents almost half of the solar thermal market and Puerto Rico over 20%.

Solar Pool Heating

Figure 7 shows the annual installed capacity for solar pool heating systems during 1998 to 2006. Installed capacity grew an average of 10% during the period, but decreased 6% in 2006.



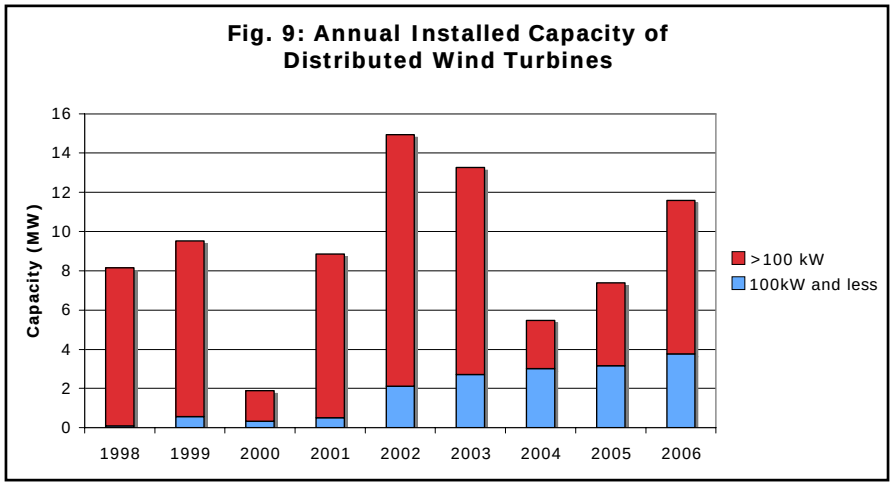
The installed capacity and annual installations of pool systems are significantly larger than for either photovoltaic or solar hot water installations.

Pool installation trends are often different than for other technologies. The residential construction slowdown in 2006, especially in Florida, meant less new swimming pools and therefore less solar pool heating installations.

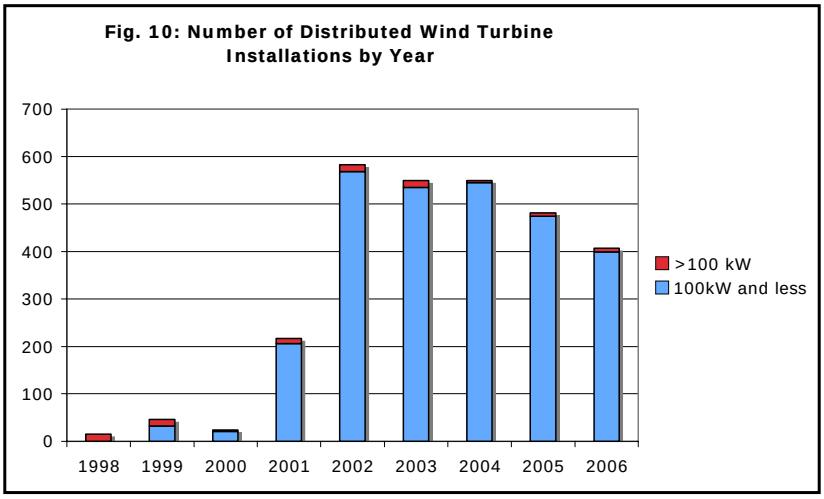
Figure 8 shows that the trend continues for pool heating systems of the installations concentrated in a few states with Florida and California leading the way. Unlike other solar technologies, virtually no incentives exist for solar pool heating systems.

Distributed Wind Turbines

The annual installed capacity of Distributed Wind Turbines (DWT) has grown each year for the past two years and was almost 12 MW in 2006 (see Figure 9). Much of this capacity is a few turbines larger than 100 kW. The cumulative installed capacity of DWT is 90 MW with 20 MW coming from turbines with a capacity of 100 KW or less.



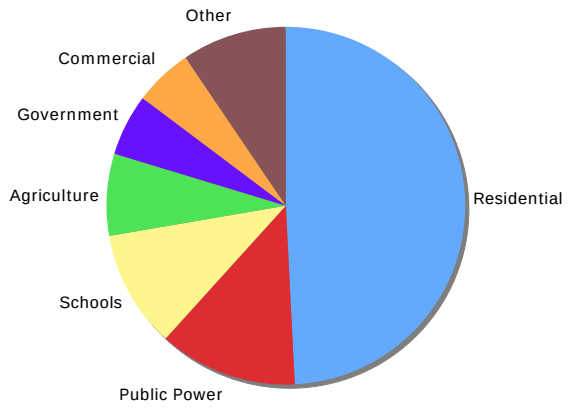
The number of DWT installed annual increased dramatically in 2002 and has slowed declined since



then. The 2002 increase is largely due to California installations driven by the California electricity crisis and the start of small wind incentives. California installations have generally declined each year until 2007 as the incentive level has been reduced. Capacity growth has continued because average size of a grid-connected turbine is increasing. Preliminary data indicates a large growth in DWT installations in 2007. The growth is party due higher energy prices and increased consumer interest in renewable energy products of all types and is also due to the introduction of a new residential grid-connected turbine from Southwest Windpower.

Many different end users install DWT (see Figure 11). Nearly 50% of DWT are residential installations. Public Power, Schools, Agriculture, Government, and Commercial each represent more than 5% of the installations.

Fig. 11: Distributed Wind Turbines by Sector



Residential installations are the core market segment for DWT which are 20 kW and smaller. Public Power includes installations by municipal utilities, rural electric cooperatives, and tribal power entities. These installations either provide on-site power for public power facilities or provide power for the public power grid. Schools include both public and private schools, and schools at all levels from elementary schools to universities. Agriculture includes farms, ranches, and agricultural production facilities.

Assumptions

Solar Capacity

Capacity measures the maximum power that a system can produce. For a solar energy system, the capacity is the output under “ideal” full sun conditions. Capacity is typically measured in Watts (W) or Kilowatts (kW). A kilowatt of one technology does not produce the same amount of energy (kWh) as a kilowatt of another technology. Thus, capacity for one energy technology is not directly comparable to the capacity for another technology.

Occasionally data are only reported as capacity or number of installations, but not both. In these cases typical data from other sources are used to obtain both pieces of data.

Photovoltaics

This study reports PV capacity in DC Watts under Standard Test Conditions ($W_{DC\text{-}STC}$). This is the capacity number that manufacturers and others typically report and is the basis for rebates in many states.

The notable exception to reporting DC Watts is the California Energy Commission (CEC), which reports AC Watts. CEC calculates AC Watts by multiplying DC Watts under PVUSA Test Conditions by the inverter efficiency at 75% of load. The resulting capacity ($W_{AC\text{-}PTC}$) is a more accurate measure of the maximum power output under real world conditions.

Based on an analysis of California systems installed in 2003:

$$W_{AC\text{-}PTC} = W_{DC\text{-}STC} \times .83.$$

This study converted data reported in AC Watts to DC Watts using this formula.

Solar Thermal

Data sources usually report solar thermal capacity in area (square feet). Representatives from the International Energy Agency's Solar Heating and Cooling Programme and several major solar thermal trade organizations developed a factor to convert aperture area of solar thermal collector to capacity (W_{TH}) (3). The factor is 0.7 kW_{TH}/m^2 (.065 kW_{TH}/ft^2). This study uses the IEA factor to convert EIA data reported in square feet to MW_{TH}.

Distributed Wind Turbines

For this study, "Distributed Wind Turbines" or "DWT" are defined as follows:

1. Turbines are connected to the grid. Off-grid turbine installations represent an important market, but are not included in this study.
2. Turbines must be less than 1.5 MW in capacity.
3. The installations include five or less turbines.
4. Turbine must either be on the customer-side of the meter and therefore primarily supply electricity for on-site use OR the turbines must be owned by a public entity.

Conclusion

Solar installations for all solar and distributed wind technologies, except solar pool heating, grew rapidly in 2006. The long-term market trends for photovoltaics, solar thermal electric, solar hot water, solar pool heating, and distributed wind turbines are distinct.

Photovoltaic installations grew 47% in 2006, with grid-connected installations concentrated in California. Preliminary data suggests hot water market grew at least 30% in 2006 and is concentrated in Hawaii and Puerto Rico. The pool heating market decreased 6% in 2006 and is concentrated in Florida and California. The first solar thermal electric installation in over a decade occurred in

Arizona. Distributed wind turbine installations increased by 57% in 2006 and are less concentrated in a few states compared with the solar installations.

Acknowledgements

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The author thanks the many people who provided data for this report including: U.S. Energy Information Agency, Solar Energy Industries Association, Paul Maycock (PV Energy Systems, Inc.), and solar energy program administrators.

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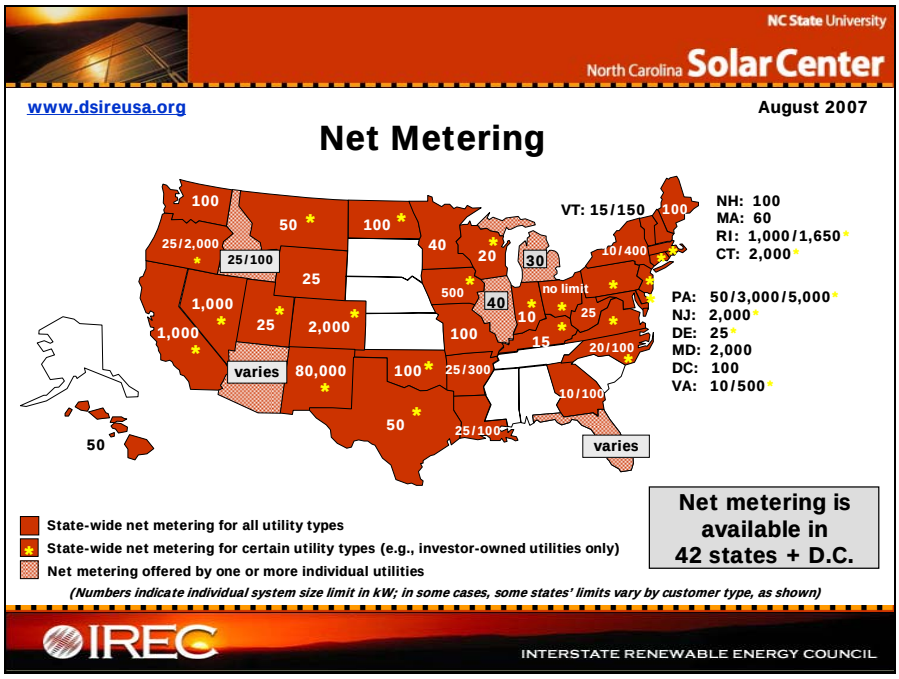
Net Metering & Interconnection Trends

Report by Rusty Haynes

Introduction

It's almost as if U.S. states are conspiring to ruin the already diminished social lives of IREC's Connecting to the Grid project staff. Since IREC's last annual meeting, held in October 2006 in San Jose, California, we've scrambled to track scores of legal developments related to interconnection and net metering; to participate consistently in key state regulatory proceedings; and to provide new and updated project resources to help policymakers, industry leaders, nonprofits and other stakeholders get a better handle on these very complex and ever-evolving issues. This article provides a concise summary of state and federal developments, and a description of IREC's project activities and resources, from September 2006 through September 2007.



State Developments: Super Net Metering!

As public, private and government interest in renewables and other forms of clean energy continues to accelerate, policymakers increasingly view net metering and interconnection standards as fundamental planks of a larger renewable-energy platform. Furthermore, states have been prompted by the federal Energy Policy Act of 2005 (EPAct 2005) to "consider" federal standards for interconnection and net metering. Accordingly, public policy is evolving rapidly in both of these arenas.

As of this writing, 11 U.S. states allow net metering for certain renewable-energy systems one megawatt (MW) or larger in capacity. Notably, Maryland and Connecticut raised their limit on individual systems to 2 MW, regardless of customer class. The Maryland Public Service Commission is currently putting the finishing touches on interconnection standards for distributed generation (DG) systems up to 10 MW, while the Connecticut Department of Public Service is weighing revising its current standards to align them with the Federal Energy Regulatory Commission's (FERC) standards for systems up to 20 MW.

Oregon raised its net-metering limit to 2 MW for nonresidential customers of PGE and PacifiCorp, and adopted interconnection standards with three levels of review for systems up to 2 MW. (*One clear trend in public policy is a preference by state public utility commissions for multiple levels of interconnection review based on system size, type and certification. Both the IREC interconnection model and the FERC interconnection model call for multiple levels of review.)* Delaware enacted legislation in July 2007 that requires the state's Public Service Commission and certain utilities to develop interconnection rules based on IREC's model interconnection rules. This new law also raised the net-metering limit to 2 MW for nonresidential customers of DP&L, and to 500 kW for DEC and the state's municipal utilities.

Pennsylvania raised its net-metering limit from 1 MW to 3 MW for nonresidential systems, and from 2 MW to 5 MW for systems that are part of a microgrid or are available for emergency use. In addition, Pennsylvania converted net metering from a monthly affair to an annual affair. Rhode Island temporarily increased net metering to 1.65 MW for systems owned by cities and towns and by the Narragansett Bay Commission, and to 1 MW for systems owned by other customers. Nevada increased its net-metering limit to 1 MW, although utilities may impose certain fees on systems greater than 100 kilowatts (kW).

Curiously, New Mexico adopted net-metering rules for systems up to 80 MW in capacity, and the New Mexico Public Regulation Commission is currently developing interconnection standards for all DG systems up to 80 MW. Unfortunately, net metering in New Mexico occurs on a monthly basis, as opposed to an annual basis. Ohio adopted new rules for net metering and interconnection. While there is no stated capacity limit on an individual net-metered system in Ohio, systems must be sized to match some or all of the customer's load. Due to multiple customer complaints about the treatment of net excess generation (NEG) by utilities, the implementation of the new rules is currently under litigation. Ohio's new interconnection standards provide for three levels of review for systems up to 20 MW in capacity.

Other State Developments

In addition to increasing the maximum capacity of individual net-metered systems, states continue to tweak existing statutes and regulations. Common amendments include extending net metering to additional types of renewable-energy systems, increasing the aggregate capacity limit of all net-metered systems in a utility's service territory, allowing additional classes of customers to net meter, improving carryover provisions for NEG, and addressing the ownership of renewable-energy credits (RECs). Furthermore, in addition to Oregon, New Mexico and Ohio, several other states have adopted new interconnection standards.

Missouri and West Virginia are the latest states to embrace net metering, although their approach is cautious. Missouri enacted legislation in June 2007 requiring all utilities of offer net metering for

renewable-energy systems up to 100 kW. Although the aggregate limit on net-metered systems (5% of a utility's peak load) is the highest *stated percentage* limit in the country, customer NEG is credited to the next bill at the utility's avoided-cost rate. Furthermore, any costs related to net metering that are incurred by a utility are recoverable in the utility's rate structure. West Virginia allows net metering for systems up to 25 kW, with NEG carryover at the utility's retail rate. However, the aggregate limit on net metered systems is 0.1%. Both states require system owners to install an external disconnect switch. West Virginia also adopted interconnection standards, which include two levels of review for systems up to 2 MW, for systems that are not net-metered.

Arkansas, New Hampshire and Virginia enacted modest amendments to their net-metering laws. Arkansas raised the maximum capacity of commercial systems from 100 kW to 300 kW, extended net metering (up to 300 kW) to all nonresidential customers, and clarified that customers own the RECs associated with customer generation. New Hampshire raised the limit on individual system capacity from 25 kW to 100 kW; raised the aggregate limit on net metering from 0.05% to 1% of a utility's peak energy demand; extended net metering to all renewables; and clarified the treatment of customer NEG. Virginia amended its net-metering statute for the fourth time in as many years by raising the aggregate limit on net-metered capacity from 0.1% to 1% of each utility's peak load.

In other net-metering developments, Lakeland Electric -- a municipal utility in Florida that voluntarily offers net metering -- raised its limit on commercial systems from 10 kW to 500 kW, and the Arizona Corporation Commission approved net metering for systems up to 100 kW for customers of APS, an investor-owned utility. The U.S. Virgin Islands Public Services Commission approved a pilot net-metering program for residential and commercial systems up to 10 kW. (*At least two U.S. territories have adopted net metering, whereas 13 U.S. states have not yet implemented net metering.)* The District of Columbia Public Service Commission approved Pepco's net-metering filings, but according to formal complaints filed by customers and the Solar Energy Industries Association (SEIA), Pepco's current practices do not constitute actual net metering. These complaints are currently under review.

Vermont adopted DG interconnection standards that include two levels of review for DG systems, based on system size, type and complexity, with no maximum system limit specified. Colorado enacted legislation extending the Colorado Public Utility Commission's interconnection rules -- which are among the best in the country -- to the state's electric cooperatives. South Carolina adopted interconnection standards that mirror North Carolina's standards; both states' standards apply to nonresidential systems up to 100 kW and residential systems up to 20 kW. *(These limits are among the lowest in the country for systems that are not net-metered.)* Massachusetts revised its existing model interconnection tariff by raising the limit for systems eligible for the simplified interconnection process from 10 kW to 25 kW for three-phase facilities, and by allowing more systems to connect to area networks.

Illinois and South Dakota have adopted the federal interconnection standard contained in EPAct 2005, which uses as its foundation the IEEE 1547 technical standard. These states -- and about 10 other states -- are still in the process of developing DG interconnection standards.

As a footnote, in separate actions that could have a significant impact on public policy and the economics of small renewable-energy systems, two California utilities -- PG&E and SMUD -- abandoned their requirements for an AC disconnect switch for certain small, inverter-based systems. SMUD noted that it took this action "to help reduce the costs of solar systems and increase the number of systems installed in the electric utility's service area."

Status of State EPAct Considerations

EPAct 2005 requires state public utility commissions and certain "nonregulated" utilities to consider federal standards for net metering and interconnection. ("Nonregulated" utilities generally are those that are not subject to state regulatory jurisdiction and that have annual retail sales exceeding 500 million kilowatt-hours.) Section 1251 of EPAct requires states and "nonregulated" utilities to commence consideration of a net-metering standard by August 8, 2007, and to make a determination regarding this standard by August 8, 2008. Section 1254 of EPAct requires states and "nonregulated" utilities to commence consideration of an interconnection standard based on the IEEE 1547 standard by August 8, 2006, and to make a determination regarding this standard by before August 8, 2007.

This federal law has prompted a deluge of "consideration" proceedings by states and utilities, and presents stakeholders with countless opportunities to become involved in the development of state and utility policy. IREC has been tracking these proceedings and has developed a table, available at www.irecusa.org, which provides an overview and the status of relevant state activities. The table is updated monthly. As of this writing, EPAct does not appear to have had a major impact on state policy. Only eight states are known to have adopted the federal interconnection standard or revised their existing standard to comply with the federal standard. Only three states are known to have adopted the federal net-metering standard or revised their existing standard to comply with the federal standard.

The U.S. Department of Energy has published a list of all electric utilities subject to the Public Utility Regulatory Policies Act of 1978 (PURPA), as applicable to EPAct 2005. The list is available at www.oe.energy.gov/purpa.htm.

National Developments

In March 2007, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) and Office of Electricity Delivery and Energy Reliability (OE) jointly issued a two-page document that highlights the current best practices of DG interconnection procedures. The document states that the two offices "recognize the importance of electric utilities adopting procedures for implementing interconnection requirements that allow for simple connection of distributed energy technologies to the electric grid." The document also states that "promoting distributed interconnection furthers administration policy of modernizing our nation's electric grid."

While EERE and OE do not endorse the model interconnection procedures of any single external organization, the document encourages states and "nonregulated" utilities to consider the following best practices in establishing interconnection procedures:

- Agreements and procedures for interconnection service "shall be just and reasonable, and not unduly discriminatory or preferential," according to EPAct 2005. As such, generators and utilities should be treated similarly in terms of state requirements.
- Create simple, transparent interconnection applications for generators up to 2 MW in capacity, as embraced in FERC Order 2006.
- Standardize and simplify the interconnection agreement for smaller generators and, if possible, combine the agreement with the interconnection application.

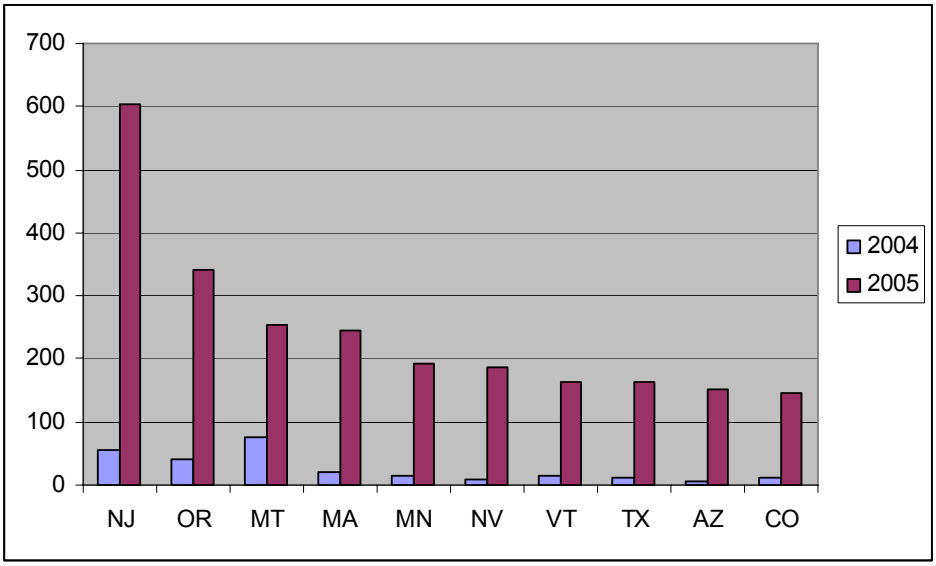
- Set minimum response and review times for interconnection applications. Provide expedited procedures for certified interconnection systems that pass technical screens.
- Establish small processing fees for smaller generators.
- Set liability insurance requirements commensurate with levels typically carried by the respective customer class.
- Require compliance with IEEE 1547 and UL 1741 for safe interconnection.
- Avoid overly burdensome administrative requirements, such as obtaining signatures from local code officials, unless such requirements are standard practice in a jurisdiction for similar electrical work.
- Develop administrative procedures for implementing interconnection requirements on a statewide basis through a rulemaking or other appropriate regulatory mechanism for state-jurisdictional utilities to apply uniformly to all regulated electric distribution companies in the state. Where practical, state procedures should reflect regional best practices and be comprehensive in scope. Administrative procedures should also be transparent to customers and utilities.

The full text of the document is available at http://www1.eere.energy.gov/solar/pdfs/doe_interconnection_best_practices.pdf.

With respect to net metering, data published by the U.S. Energy Information Administration (EIA) reveals massive percentage-wise increases in the number of systems installed in several states that have adopted strong policies to promote renewable energy. There were 21,146 net-metered energy systems in the United States in 2005, compared with 15,826 net-metered systems in 2004 and just 6,813 in 2003. The overwhelming majority of net-metered systems (82%) in 2005 were installed in California, and residential systems comprised 91% of all U.S. systems in 2005. Many states saw more than 10-fold increases in the number of net-metering customers in 2005 versus 2004.

The following table indicates the states with the most net-metered energy systems installed as of 2005. *However, to make matters more interesting, California has been removed.*

Cumulative Number of Net-Metered Systems, by State



Source: U.S. Energy Information Administration

IREC Project Activities and Resources

Under the guidance of the IREC Interconnection & Net Metering Advisory Board, which meets quarterly to discuss policy developments and set project priorities, project staff has become increasingly involved in regulatory proceedings in key states. Although some regulatory proceedings can drag on for years, it is critical for clean-energy stakeholders to become involved on an ongoing basis in order to ensure that national best practices for interconnection and net metering are adequately considered by public utility commissions and other stakeholders. Active, consistent IREC involvement in New Jersey and Colorado contributed to the adoption of some of the best standards for interconnection and net metering in the country. IREC remains involved in proceedings underway in Arizona and New Mexico, and the IREC Interconnection & Net Metering Advisory Board recently approved the addition of Maryland, Illinois, Texas, Florida and North Carolina as new high-priority states. We intend to participate in proceedings in each of these states. In addition, IREC is providing an ever-increasing amount of technical assistance and indirect support to stakeholders in lower-priority states.

Along with several other partners, IREC has begun work on a five-year award under the U.S. Department of Energy's Solar America Initiative (SAI). The overarching purpose of this project is to study and promote codes and standards that facilitate the deployment of solar-electric systems. In general, IREC's role in this effort involves studying issues related to net metering and interconnection, providing a forum for stakeholders around the country, and working with other SAI partners to provide best practices to solar stakeholders, including state and local governments.

In July 2007, IREC published a new edition of its *Connecting to the Grid* guide. The fifth edition of the guide addresses new and lingering interconnection issues relevant to all DG technologies. Because interconnection issues still lie largely in the domain of the states, the 44-page guide is designed for state regulators and other policymakers, utilities, industry representatives and consumers interested in the development of state-level interconnection standards. Included in the guide are discussions of (1) technical issues related to DG interconnection, such as safety, power quality, and national codes and standards; (2) legal and procedural issues, such as insurance requirements, standard form agreements and recent trends in policy development; net-metering issues, such as the ownership of renewable-energy credits and the rapid evolution of state policy in the absence of federal guidance; and (4) electrical and building inspectors. This free resource is available at www.irecusa.org/index.php?id=86.

We've updated our other web-based project resources, including the IREC state-by-state tables of interconnection standards and net-metering programs, and the status table of state activities related to EPAct "consideration," as of September 2007. The most recent version of IREC's model interconnection standards and model net-metering rules continue to provide guidance on best practices. IREC's project resources, including the detailed descriptions of state and utility policies in the *Database of State Incentives for Renewables and Efficiency (DSIRE)*, are commonly -- and increasingly -- referenced by public utility commissions and other participants in state regulatory proceedings. The *Connecting to the Grid* newsletter now has around 2,000 active subscribers, including significant representation from the federal government, state governments, industry, utilities, nonprofits, universities, banking and investment firms, and law firms.

Finally, IREC is working with SunEdison, the Vote Solar Initiative and the Network for New Energy Choices to publish a report that will rank states based on the merits of their net metering and interconnection policies (or lack thereof). To conduct this study, we identified 12 separate

components of net-metering policy and 15 separate components of interconnection policy, and assigned point values for each possible option under each component. Each state will receive a letter grade based on the sum of its points. The report is scheduled to be completed in time for the Solar Power 2007 conference.

IREC'S Training & Certification Activities

Report by Jane M. Weissman

Introduction

Significant growth in the renewable energy market sectors leads to jobs in manufacturing and distribution, design and engineering, sales and marketing, and installation and service as well as other building trades such as electricians, plumbers, and roofers. Along with the growth and new jobs comes the increasing demand for training. Quality and accessible training has been at the forefront of IREC's agenda for many years.

In tandem with well-established private training programs, labor and apprenticeship programs, and manufacturer's in-house training, community colleges and technical high schools are increasingly taking on the role of educating the renewable energy workforce. Some new educational strategies are emerging. Below, we take a look at the hybrid course delivery model; interdisciplinary instruction; linking technical high schools with the local community college; integrating a renewable energy concentration within an energy management degree program; expanding hands-on opportunities through internship programs; and an industry-sponsored certificate program.

Educational Strategies

Madison Area Technical College's Consortium for Education in Renewable Energy Technology (MATC CERET) is a partnership among multiple institutions to share instructional resources and expertise. The curriculum is designed to supplement traditional degree and apprenticeship programs and serve the needs of workers and employers.

The hybrid course delivery combines online and face-to-face instruction resulting in increased availability and accessibility of renewable energy certificate programs. Certificates require a minimum of 12 credits of instruction in energy management and renewable energy technologies. Students can choose from online and face-to-face courses in five technology areas: transportation, wind, biomass, photovoltaics, and solar thermal.

Courses are taught by instructors from the Midwest Renewable Energy Association, Solar Energy International, Madison Area Technical College, Brevard Community College, Oakland Community College and the University of Wisconsin – Madison. Through this collaborative relationship, students have the opportunity to enroll in online courses taught from locations across the United States. Face-to-face courses are delivered in a full-day, intensive format taught during weekends, winter break, spring break and/or summer sessions.

Certificates are issued and credits transcripted by Madison Area Technical College. Certificate credits may be combined with additional coursework to enhance traditional diploma, degree, transfer and associate programs. The credits also may be combined with additional training, job experience and/or professional examinations to qualify for certification by national renewable energy institutions.

The Renewable Energy Diploma Series at North Carolina State University (NCSU) is structured so that intensive technology training covers not only the technical aspects but also the policy and business parts of the industry. Since 1988, the North Carolina Solar Center at NCSU regularly provided 2-3 day hands-on technical workshops on solar thermal, PV, and later wind and green buildings. However, these short workshops did not necessarily offer enough instruction for students wanting to become professional renewable energy service providers. More intensive training was required.

As the first step, a skills and knowledge set was drafted for the "ideal" renewable energy professional. The key characteristics that emerged were that the professional has to be technologically competent, has to understand how policy and incentives works for their customers, and has to be business savvy to have a successful career in renewable energy.

When the decision was made to make the program interdisciplinary, a workable structure then had to be designed to incorporate the technical, managerial, financial and policy aspects of the renewable energy industry. The North Carolina Solar Center now offers four modularized, week-long workshops a year, usually with concurrent tracks. The student takes three week-long workshops out of the four within three years or 105 contact hours. The technology tracks include Solar Thermal, Photovoltaics, Wind, Biofuels, and Green Buildings. Policy and business presentations are scheduled on the first day before the class splits into technology tracks.

As of the spring, 223 students have been trained as part of the Renewable Energy Diploma Series. Results have shown that the intensive, week-long program format attracts serious potential practitioners. Interdisciplinary approach encourages professional diversity and allows participants to integrate new skills and view the renewable energy industry as a whole.

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

The curriculum at the two technical high schools has been developed so that renewable energy is integrated into existing shops and academic areas with articulations at Cape Cod Community College. Classroom curriculum includes the science and chemistry principles necessary for the installation, operation, and maintenance of these systems. The curriculum aligns with national learning standards and is currently being used as a statewide model in Massachusetts.

Renewable energy resources at Upper Cape Tech and Cape Cod Tech include solar thermal, photovoltaics, biodiesel processing, and wind energy. Energy efficiency is also part of the curriculum. Photovoltaics, solar thermal and small wind systems have been installed at the two high schools.

The goal for the high schools is to use renewable energy projects to improve student achievement, educate students about renewable energy, train faculty in renewable energy, update curricula to include renewable energy, and train students for local jobs. This project-based learning model integrates practical applications of academics to the technical areas.

The Community College/Tech High School partnership also allows Cape Cod Community College to offer a technical program utilizing the well-established technical shops at the vocational high schools.

Tech shops at the high schools are ideal locations for evening continuing education courses and workshops. This provides a beneficial balance of sharing resources and curricula resulting in the promotion of workforce development.

Currently, Cape Cod Community College is reaching out to other colleges in the state to share their success in developing a joint Renewable Energy Program with local vocational high schools. Representatives from the Upper Cape Cod Regional Technical School are also working with the State's Department of Education to examine the integration of renewable energy and energy efficiency concepts into the technical schools academic and shop curricula.

The Lane Community College Energy Management Program offers degree, certificate and customizable business and industry training. Students can earn a two-year Associate of Applied Science degree. In the fall of 2003, the Lane program began offering solar thermal and solar electric system installation courses leading to this 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 Renewable Energy Technical Program covers electrical theory, renewable energy systems, solar thermal design and installation, solar PV design and installation, and energy investment analysis.

The Lane Community College Renewable Energy Program takes a unique approach to solar system installer training. What separates the Lane program from others who are offering solar installation education is the attention to the entire building system. The Lane program emphasizes the need to assess a building for cost-effective energy efficiency options before installing a solar system. Student who are enrolled in the renewable energy program take the first year of the energy management program and develop analysis skills to the level necessary to make a reasonable assessment of a building.

Among other skill sets, the graduate of the Renewable Energy Management Program is able to evaluate the energy use patterns for residential and commercial buildings, recommend energy efficiency and alternative energy solutions for high-energy consuming buildings, and understand the interaction among energy consuming building systems and make recommendations based on that understanding. The graduate of the Renewable Energy Technician option also should be able to size and recommend renewable energy system types for particular situations and understand and put into practice the installation protocol for photovoltaic and solar domestic hot water systems.

Cooperative education is a required and important part of the Energy Management Program. It provides relevant field experience that integrates theory and practice while providing opportunities to develop skills, explore career options and network with professionals and employers in the field.

Through internship programs, students are gaining in-field, customer-based installation experiences. The New York State Energy Research and Development Authority (NYSERDA), in partnership with the New York Solar Industry Association (NYSEIA) and the U.S. Department of Energy, has developed a pilot-scale PV installer internship program to help practitioners obtain "on-the-roof" experience installing grid-connected PV systems. IREC also provides guidance in implementing the program.

NYSEIA manages the PV Installer Internship Program, which matches classroom-trained PV practitioners with installers certified by the North American Board of Certified Energy Practitioners (NABCEP) who participate in NYSERDA's PV Incentive Program. The NABCEP-certified installer becomes a mentor for PV practitioners, guiding them though all aspects of PV system design and installation. The mentors use the NABCEP-approved PV Installer task analysis as their teaching guide. Interns can work with more than one mentor to gain experience with three system installations, a prerequisite for becoming an eligible installer in NYSERDA's PV incentive Program.

While helping the intern gain vital practical experience necessary to become a qualified practitioner, the PV Installer Internship program also provides training to mentors and financial assistance to mentors to help offset any costs associated with working with an intern. NYSEIA manages all the logistics related to intern applications and matching interns with mentors

At the same time, through grants with six New York training institutions developing PV training programs, NYSERDA provided funding for these institutions to also develop internship programs for their students. For example, Hudson Valley Community College has teamed with a NABCEP-certified installer to train students in the classroom (the installer was named an adjunct professor) and then take the students out in the field for installations funded through the NYSERDA PV Incentive Program.

Since 2005, the North American Board of Certified Energy Practitioners has been offering a knowledge-based and end-of-course certificate for photovoltaics. Not to be confused with its professional certification program, NABCEP developed this entry-level certificate to offer Community Colleges and training programs an opportunity for their students to obtain an industry-sponsored certificate that demonstrates basic knowledge, comprehension and application of key terms and concepts of PV systems. While the Entry-Level Certificate of Knowledge by itself will not qualify an individual to install PV systems, it does recognize understanding of the basic terms and operational aspects of a photovoltaic system.

An educational provider interested in offering this entry-level certificate submits an application to NABCEP. Once approved, the educational provider determines the course requirements for the students and then administers the NABCEP Entry-Level exam at the end of the course. The exam is scored by NABCEP's professional testing service. Those who achieve the Entry-Level Certificate are placed on NABCEP's Employer Connection email list.

NABCEP convened a Committee of industry installers, subject matter experts and instructors who designed the learning objective for the course. The Committee meets once or twice a year to add new questions to the item bank for the exam.

To date, over 300 students have earned the NABCEP PV Entry-Level Certificate. There are now 25 provider institutions who participate in the Entry-Level Program.

The Entry-Level Certificate program achieves benefits for both students and for NABCEP. The certificate is a good way for a student to start their career ladder with an industry certificate demonstrating basic understanding and operations of photovoltaics. For NABCEP, this brings future installers and certificants into the pipeline.

Recommendations from the Experts

- Curriculum needs to include real-world preparation for an occupation. Planners of renewable energy courses and training programs should conduct a skills assessment by surveying local business, industry and government representatives. The expert worker is the best source for recognizing and describing job tasks. Required certifications and licenses should be identified and a list of tools and equipment that students should be proficient with should be compiled.

- Conduct a labor market assessment to match training curriculum with local labor needs. Clearly define the target population. Determine who currently employs or may be a source of employment for the selected occupation(s). What is the projected number of full-time and part-time openings for technicians?

- Emphasis should be on instructional system design. Utilize a team-based approach for developing curricula. Assess the use of classroom, technical shop, online, computer-based and internship delivery systems.

- Make sure prerequisites have been established for each course or program and student's performance is evaluated by written exams or other assessment methods. Develop skill proficiency measurements.

- Field and laboratory experiences should be provided.

- Develop alliances and establish an active advisory committee with business and industry. Utilize members for program support, potential adjunct faculty, internship sites, donations of equipment and supplies, and news about changing technology and skill sets. Meet on a regular basis to seek their guidance, assistance and program promotion.

- Establish partners for articulation and develop articulation agreements with technical high schools, community colleges, and four-year degree colleges and universities.

IREC's On-Line Course Catalog

Courses Listed by State & Technology

http://www.irecusa.org/courses.php

The second national Renewable Energy and Energy Efficiency Workforce Education Conference will take place the week of March 17, 2008 at Hudson Valley Community College in Troy (outside of Albany), New York. This conference will build on the experience and success of the November '06 educators' conference and will include sessions on curriculum development, new models for renewable energy and energy efficiency training, online and on-site course delivery, hands-on training, job forecasts, quality assessment, and credit and non credit courses. This conference is for educators and trainers from community colleges, technical high schools, training programs and related fields.

The New York State Energy Research and Development Authority is the prime sponsor of the Workforce Education '08 Conference. The Interstate Renewable Energy Council, the Partnership for Environmental Technology Education and Hudson Valley Community College are organizing the event.

www.hvcc.edu/energyconference

The Interstate Renewable Energy Council continues to implement the Institute for Sustainable Power's accreditation and certification programs for renewable energy training. IREC is the North American Licensee for the Institute for Sustainable Power Quality (ISPQ) International Standard #01021. To ensure continuity, consistency, and quality in the delivery of training, the ISPQ International Standard is a framework of requirements and metrics, along with a system of review and audit, to provide a means to compare content, quality, and resources across a broad range of training programs. The core goal is to ensure that the right skill sets are being taught by ensuring that training is set to industry-based competency standards. The ISPQ credentials send signals to students, employers, and government officials that standards for the curriculum, student services, and trainers have been met.

www.ispqusa.org

North American Board of NABCEP Certified Energy Practitioners

Since 2003, the North American Board of Certified Energy Practitioners (NABCEP) has been awarding professional credentials to renewable energy installers. NABCEP's rigorous competency standards for certification sends a clear message to consumers, financers, and public officials that the Industry stresses high quality, safe and ethical business practice and workmanship standards.

As of March 2007, there are 365 Certified PV Installers. The state breakdown is as follows:

State	**Number of PV Certificants**	**Percent of Total Certificant Pool**
California	133	36%
New York	29	8%
Colorado	24	7%
Vermont	16	4%
New Jersey	15	4%
Texas	13	4%
Ohio	11	3%
Wisconsin	11	3%
Massachusetts	10	3%
New Mexico	10	3%
There are a total of 40 states with PV Certified Installers including DC. There are 3 certificants from Canada.		

Just last year, NABCEP launched its Solar Thermal Installer Certification Program. Two Solar Thermal exams have been administered so far. There are now 40 certified Solar Thermal Installers. The state breakdown is as follows:

State	Number of Solar Thermal Certificants	Percent of Total Certificant Pool
Wisconsin	7	18%
California	6	15%
New Mexico	4	10%
Colorado	2	5%
Illinois	2	5%
Minnesota	2	5%
17 other states have 1 Solar Thermal Certificant each		

NABCEP has seen a jump in applications. There were 79 candidates who took the March 2006 PV Installer exam. That number shot to 148 candidates for the March 2007 PV exam.

The number of certificants will increase after the results of the September 29, 2007 exams are in.

IREC's Recommended Training Criteria

As part of IREC's Workforce Development Project, we support general criteria for practitioner training programs. Based on input from subject matter experts, IREC recommends that a practitioner "training course" should:

- Be designed to provide educational, training, and skill development experiences that lead to defined workplace knowledge, skills, and abilities.
- Appropriately addresses issues of safety, codes, and core competencies of an industry-approved task or job analysis.
- Be taught in an atmosphere with appropriate facilities, tools, safe practices as well as administrative and managerial quality.
- Offer a formal and planned learning structure where the learner receives some sort of feedback and the learner's progress is monitored.
- Be taught under the administration of a legally registered entity.
- Be offered by any accredited university, college, community college, or vocational-technical institute; or offered by any Joint Apprenticeship & Training Committee or U.S. Department of Labor approved apprenticeship program; or approved by the State Contractor Licensing Boards; or offered by a training program accredited by IREC to the ISPQ Standards or similar accrediting body; or taught by a certified installer with instructional experience.

IREC also supports a more rigorous accreditation and certification evaluation. This assessment is based on a standard developed by the Institute for Sustainable Power and is used internationally. See www.irecusa.org/fileadmin/user_upload/ISPQInternationalStandard_January_2006.pdf.

In response to the increase of web-based renewable energy training, IREC has released *Guidelines for On-Line Courses.* These guidelines are to be used in addition to the educational and management requirements defined in the Institute for Sustainable Power's ISPQ International Standard 01021.

Highlights of the Guidelines for on-line courses include:

- The instruction is presented in an organized and sequential learning format.
- The learning management system should provide the necessary assessment and reporting capabilities to help monitor and track the learning process.
- Instructor provides timely and specific feedback.
- Learning shall provide frequent and meaningful interactions among learners, between learners and instructional material and between learners and the instructors.
- Assessment should be an integral part of the learning experience.
- Advertising of any type is prohibited within the educational content.

See www.irecusa.org/fileadmin/user_upload/On-LineCourseGuidelines_Feb-07_v1.pdf.

These guidelines were prepared in consultation with educational and credentialing experts, the Institute for Sustainable Power Board of Directors, the IREC ISPQ Executive Advisory Board and other educational institutions and certification programs.

STATE TABLES

State & Utility Net Metering Rules

State & Utility Interconnection Rules

For current summary tables, visit IREC's *Connecting to the Grid* site at:
http://www.irecusa.org/index.php?id=31