US Solar Industry Year in Review

2007

Federal Policy Propels U.S. Solar Energy Industry

In 2007, the U.S. solar energy industry saw a glimpse of a gigawatt future. There was significant growth in the commercial and residential photovoltaic (PV) markets and a new utility-scale segment for PV emerged with the fastest growth of all segments representing over 15 percent of the annual U.S. installed PV capacity. The first concentrating solar power plant was built in more than 15 years with dozens more utility-scale projects in the pipeline. The expansion of the solar water heating market continued. Thousands of U.S. jobs were created and billions of dollars were invested. And, the industry strengthened its presence in Washington and our united coalition support across the country.

Solar continues to provide a cost-effective solution for daytime energy needs as well as provide peak shaving benefits. But for all the potential, the industry continues to face a growing threat. As the year ended, Congress had failed to pass an extension of the Investment Tax Credit, putting at risk much of the progress that the industry has experienced in the last two years. While analysts have acknowledged recent growth and remain bullish about the future of solar energy, this growth will be disrupted if the solar ITC expires in December. Indeed, many larger projects are already being put on hold. The industry remains determined to pass an extension of the ITC as soon as possible.

Photovoltaics

The U.S. continues to lead the world in the manufacture of both next-generation thin-film technologies and the polysilicon feedstock used in most PV applications. U.S. PV manufacturing grew by 74 percent this year and U.S. PV installations grew by 45 percent this year to 150 MW-dc (grid-tied only), both among the fastest growth rates in the world.

Concentrating Solar Power

Utility-scale solar electricity using concentrating technologies continued to see surging interest this year. Announced contracts grew to over 4,000 MW of new concentrating solar over the next decade in the sunny southwestern U.S., and dozens of U.S. companies are entering this growing market.

Solar Thermal

The domestic solar water heating market received a significant boost from the federal tax credits, while the pool heating industry continued its steady progress. Growth is expected to accelerate as increasing costs for traditional heating sources such as natural gas make solar alternatives more cost-effective.

Prometheus Institute

SEIA SOLAR ENERGY INDUSTRIES ASSOCIATION

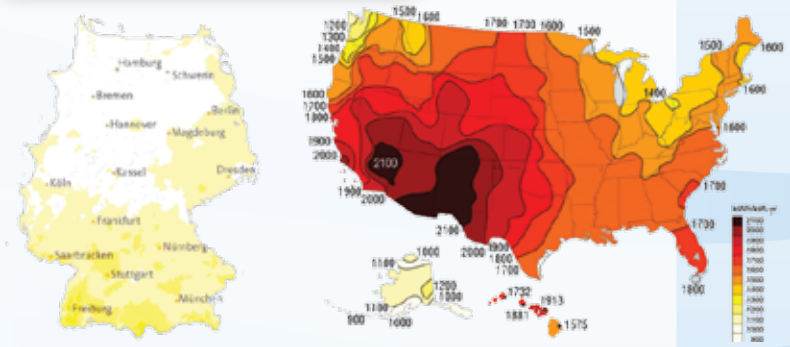
Benefits of Solar Energy

Solar energy provides users, utilities, and communities many benefits beyond its direct energy services. These include:

Energy security

Access to vital energy supplies is critical to the smooth function of homes, businesses, and the whole economy. The hurricanes in the fall of 2005 were a stark reminder of the vulnerability of our domestic supplies of oil and natural gas to severe weather and environmental factors. Not only does solar energy provide reliable access to energy where it is used, but it can also supplement energy needs in blackouts and disaster recovery for electricity, water pumping, and hot water.

Solar Resources – Germany vs. US



U.S. solar insolation (the amount of usable solar resources) far exceeds that of Germany. Yet Germany is the top market for installed solar energy in the world due to far greater policy support. Source: SEIA

Energy independence

Solar can be used to decrease our overdependence on foreign sources of oil and natural gas. According to the Energy Information Agency, two-thirds of the petroleum and 20 percent of the natural gas consumed in the U.S. is imported from other countries, and U.S. production of both is dropping while consumption continues to rise. With many of the remaining global reserves of these vital fuels located in distant and unstable regions around the world, the U.S. needs to ensure that domestic energy alternatives like solar are developed.

No emissions

As environmental and global climate change impacts of how the U.S. harnesses energy are increasingly understood, we urgently need to switch to carbon-neutral forms of modern energy. Solar energy is an emission-free source of electricity and hot water that can be immediately deployed to reduce the nation's growing carbon footprint.

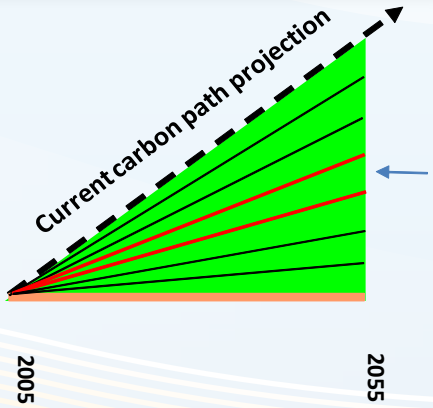
Economic benefits

In many applications today, solar energy on a home or business, when properly installed and financed, can immediately begin to save money on energy bills. Customers combat volatile energy prices by locking in these low prices for the life of the system, which can be as long as 30 years for PV systems. For utilities, solar energy can provide valuable intermediate and peak load power. Also, for utilities with an aging transmission and distribution infrastructure, distributed solar can help stabilize grids and offset expensive infrastructure upgrades.

Job creation

If appropriate long-term incentives are enacted, the solar energy industry in the U.S. will contribute billions of dollars of investment and income as it ramps up over the next decade. The 62,000 new jobs (by 2015) it would create include manufacturing and distribution, but will also include many solid building trade jobs for electricians, plumbers, roofers, designers, and engineers.

Carbon Mitigation Through Solar Energy



With continued growth, Solar can eliminate one of the seven wedges to help stabilize carbon emissions

Source: Carbon Mitigation Initiative; SEIA

Bringing Solar Power to Market

The U.S. possesses the best solar resources in the world (see map on previous page), and yet Germany installs 8 times as much PV as the U.S. because Germany has provided generous incentives that stimulate demand for solar energy. In the past few years, the U.S. saw new major solar federal and state programs emerge as well.

In the 2005 EPAct, the U.S. created the first residential tax credits for solar energy in almost 20 years and significantly expanded the commercial tax credits. These credits started on January 1, 2006 and have expanded markets for all solar technologies, but unless these credits are extended beyond December, 2008, their long-term impact will be limited.

In 2006, the state of California enacted the largest solar program outside of Germany through the passage of the California Solar Initiative on January 12 by the CPUC and the Million Solar Roofs Bill signed into law on August 21st. These programs target installing 3,000 MW of electricity capacity in the next ten years (see CSI box). Eight other states improved programs this year that expand incentives or require the use of solar as part of their renewable portfolio standard (see box below). Twenty-five states and the District of Columbia now have mandatory renewable portfolio standards, with 12 of the programs having specific solar or distributed generation set-asides.

California Solar Initiative

- The program is funded at $3.35 billion over 11 years.
- 10 percent of the program is set aside for low income homes.
- Expands the net metering cap to 2.5 percent, allowing approximately 500,000 new solar systems into the net metering program.
- Mandates that solar systems are a standard option for all new homeowners.
- Requires the state's municipal utilities to create their own solar rebate programs, totaling $800 million in rebates.
- Directs the California State Licensing Board to review current licensing requirements for solar installers.

As demand for solar grows it is increasingly important to ensure that solar electric systems have access to the electricity markets. To achieve President Bush's vision of a solar system on every house providing electricity to the grid, substantial regulatory and legislative changes must occur.

Expanding Programs,

- New Jersey
- Florida
- Maryland
- New York
- Nevada
- North Carolina
- Washington
- New Mexico

Connecting to the Grid

Currently there is no national interconnection standard that allows solar systems to connect to the grid. Only 36 states and the District of Columbia have interconnection policies to govern connection to the grid and even within these programs there are a patchwork of different technical and legal requirements, limiting the ability for manufacturers to sell a "standard" solar system nationwide or build large solar systems in many parts of the country. A national interconnection standard must be created.

Selling Electricity

Net metering allows the owner of a solar system to sell their excess electricity back to the grid. Forty-two states and D.C. have state-wide programs, but these programs vary significantly; some limit the homeowner's ability to sell excess electricity, or force solar systems to receive wholesale electricity prices like a centralized coal-fired power plant. A national net metering law must be created that allows homes and businesses to sell their excess electricity at retail prices, with no size restriction.

The Big-Box Boom in Solar

In 2007, big-box stores across the country went green and declared that commercial PV is a wise investment for their future electricity needs. Safeway, Whole Foods, Staples, Target, Home Depot, Macy's, and Costco, among others have installed and announced installations that will help stabilize their electricity prices for decades to come.

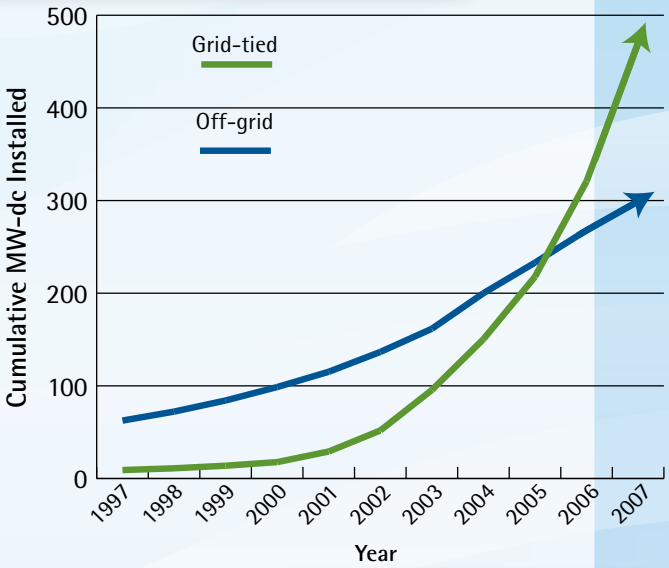
Wal-Mart and Best Buy have been especially aggressive. In 2007, Wal-Mart installed a 624 kW system on a store in Palm Desert, Calif., and plans for installations at 22 more stores across California and Hawaii, totaling as much as 20 MW. Also riding the wave, Best Buy has plans for PV installations on 35 stores in 2008 throughout the U.S. The big-box businesses helped to drive PV installation numbers in 2007. However, if the investment tax credit for solar is not extended, the economics will change and the clean energy big-box boom may fail to carry over into 2009.

Photovoltaics (PV)

SUMMARY – PV

- Growth rate of 45 percent in U.S. PV installations to 150 MWdc (grid-tied) in 2007 was among the highest in the world in part due to new state programs. All sectors (residential, commercial, utility-scale) grew in 2007, but utility-scale installations grew the fastest, accounting for 15 percent of the annual installed capacity. Globally, the U.S. fell to the fourth largest market in the world, behind Germany, Japan, and Spain.
- Growth rate of 74 percent in U.S. PV manufacturing shipments was driven primarily by First Solar. New announced manufacturing plants for PV came staggeringly fast. U.S. manufacturers Evergreen Solar, Enegy Conversion Devices, and First Solar all grew.
- In addition to Solarworld's announced Oregon Plant, other European manufacturers are looking to expand here including Schott Solar and Isofoton.
- Global polysilicon supply remained very tight in 2007 but should start to ease in late 2008. Polysilicon remains a strong export business for the U.S.

Cumulative U.S. PV Installations by Year



Source: Larry Sherwood, IREC, *PVNews*

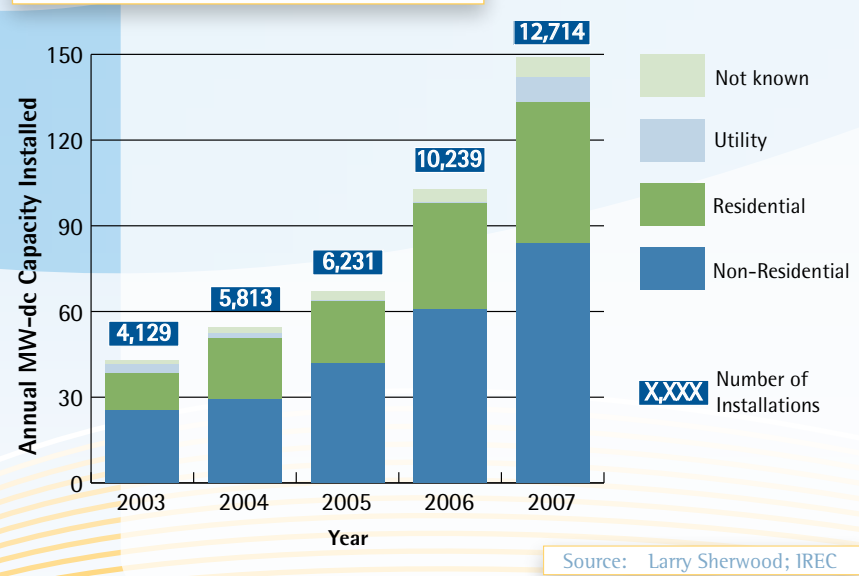
Historically a global leader in PV, the U.S. has been losing ground to Japan and Germany over the last decade. Despite the new CSI program in California, state renewable portfolio standards and federal tax credits from 2006, the U.S. fell behind Spain to become the fourth largest global market for PV due to disparity levels in domestic government support for solar. Manufacturing growth remains strong and technologically well-positioned with the next generation of thin-film PV. The goal for U.S. policy is to increase support to levels akin to our foreign competitors.

PV Installations

Current projections show that annual U.S. grid-tied installations grew by 45 percent in 2007 over 2006 to nearly 150 MW-dc. The annual installed capacity has more than doubled since 2005. More than 12,700 sites connected photovoltaics to the grid in 2007. California continues to dominate the U.S. market with 58 percent of the market, but annual installations grew an impressive 83 percent outside California. Nevada, Colorado, Hawaii, Connecticut and Oregon doubled their annual installations compared with 2006.

All sectors grew in 2007, but installed capacity of large installations grew the fastest. A 14 MW MMA Renewables Ventures installation at Nellis Air Force Base in Nevada and an 8 MW Sun Edison installation for Xcel Energy in Colorado were the largest installations and together accounted for 15 percent of the annual installed capacity. A total of 30 systems larger than 500 kW accounted for 30 percent of the 2007 installed capacity.

Annual U.S. Grid-tied PV by Application



Source: Larry Sherwood; IREC

The average size of a residential installation increased 7 percent to 4.8 kW and the average non-residential installations increased by 27 percent to 69 kW.

California is still the dominant U.S. market for PV, but shrank from a U.S. market share of 73 percent of the grid-tied installations in 2006 to about 58 percent in 2007, primarily due to large projects in Colorado and Nevada. New Jersey remained the second largest market, despite a change in the state's policy support mechanism. Large projects drove Nevada and Colorado's growth, while many states broke the 1 MW mark - a result that indicates a broadening of support for the U.S. PV industry.

Projected 2007 Grid-tied PV **

State	Capacity (MW-dc)
California	87.1
New Jersey	16.4
Nevada	14.6
Colorado	12.4
New York	4.4
Hawaii	2.4
Arizona	2.1
Connecticut	1.8
Massachusetts	1.4
Oregon	1.1
Other States	4.4

Source: Larry Sherwood, IREC (** Some Data Estimated)

PV Manufacturing

First Solar of Arizona expanded its Ohio and Germany manufacturing capacity to over 300 MW by the end of 2007. This combined with announced manufacturing capacity in Malaysia will bring First Solar's total manufacturing capacity to over 1 GW by the end of 2009. SunPower of California rapidly grew production at its plant in the Philippines to 214 MW of capacity at the end of 2007 and has plans to increase it again to 414 MW by the end of 2008. SolarWorld of Germany, is planning a major expansion of crystalline silicon PV in Oregon, hoping to reach 500 MW annually by 2010. Evergreen solar announced an expansion in Massachusetts of 70 MW of wafer-to-module capacity expected to come online in mid 2008, with the potential for future expansions at the site. Evergreen continues to see its joint venture with REC and Q-Cells in Germany expand, and has publicly discussed the possibility of spinning that entity out into a publicly traded company.

BP Solar is looking to expand production worldwide, and some other European producers such as Schott Solar of Germany and Isofoton of Spain are eyeing new plants in the U.S. Clearly, many producers are hoping to scale up quickly to improve cost structures and hold on to market share.

Capital markets in 2007 helped finance many manufacturing expansions through IPOs and secondary equity offerings. Venture capital is flooding into clean tech and PV companies with promise of third-generation and nanotechnologies. Companies like Heliovolt and Miasole received significant VC and expansion capital for their growth in 2007. VC investment in solar was more than $1.05 billion in more than 70 financing rounds last year.

Thin Film Rising

Strong PV production growth in the U.S. was driven primarily by thin-film. Thin-film production accounted for about 11 percent of worldwide PV production and over 30 percent in the U.S. during 2007. The U.S. leads the world in thin-film production, with nearly half the global output. The massive support of the VC community in expanding these technologies is no accident. The value proposition of these technologies has the potential to be highly disruptive within the PV industry, as demonstrated by Arizona-based First Solar, the world's largest thin-film manufacturer, whose per Watt production costs averaged $1.12 for the 4th quarter of 2007. The potential to produce modules at less than $1 per Watt using a variety of technology can more than offset the lower module selling price of the less efficient modules while creating much more unsubsidized demand as the system prices reach grid parity sooner. This is particularly true for utility-scale PV plants sited to leverage the existing transmission and distribution network. U.S. companies are driving the emergence of thin-film technologies including:

Cadmium Telluride - First Solar and newer Primestar are leading the charge in production of these glass based modules.

Amorphous Silicon - Applied Materials has now turned its expertise in large precision glass deposition to making, designing and installing thin-film manufacturing plants. Initial orders for the systems showed strong worldwide demand, and the first system was delivered to India in 2007.

CIGS - At least half a dozen U.S.-based CIGS (Copper, Indium, Gallium, and Selenium-based thin-film) companies received substantial VC backing in 2007. Once efficiency targets are reached, the potential for high speed and low capital manufacturing could be game-changing in solar.

Concentrating Solar Power (CSP)

SUMMARY – CSP

- New 64 MW parabolic trough plant in Boulder City, Nevada came online in 2007.
- The readily accessible solar resource in the Southwest is large enough to play a major-role in meeting the region's future energy and peak power needs.
- Potential CSP production in the U.S. Southwest is approximately 200 GW which could-produce about 473,000 GWh per year.
- With the installation of 4 GW of new CSP capacity, the cost of electricity is projected to be 8¢/kWh making it competitive with natural gas combined cycle plants.
- Large-scale CSP deployment would add thousands of new jobs; add billions to both the tax revenues and the economic activity where those CSP plants are located.
- Total systems in the pipeline grew to approximately 4,000 MW of new CSP capacity, almost double the year before.

Concentrating solar power (CSP) plants are utility-scale generators that produce electricity by using mirrors or lenses to efficiently concentrate the sun's energy. The four principal CSP technologies are parabolic troughs, dish-Stirling engine systems, central receivers, and concentrating photovoltaic systems (CPV).

CSP Technologies: Tower, tough, dish-Stirling, CPV

Source: Morse & Assoc.

Current CSP Developments

2007 continued the substantial momentum that the U.S. CSP industry has enjoyed in the last couple of years. In 2007, Solargenix-Acciona finished their 64 MW parabolic trough plant in Boulder City, Nevada. Meanwhile, Stirling Energy Systems, a Phoenix-based provider of dish-Stirling engine systems, moved forward on development after signing Power Purchase Agreements (PPAs) for two large plants in Southern California. The first of these contracts is with Southern California Edison to purchase all the electricity generated from a 500 MW facility, with an option to purchase power from a 350 MW addition. The second is with San Diego Gas & Electric, for the power from a 300 MW plant, with options for up to another 600 MW. Combined with upgrades with the equivalent capacity of 24 MW that will be done at FPL Energy's SEGS plants in the Mojave Desert, total systems in the pipeline in 2007 grew to approximately 4,000 MW of new CSP capacity, almost double the year before.

Announced CSP Plant Construction in the US

Installation Name and Technology Developer	Technology Type	Output (MW)	Status
Solel SEGS	Trough	353.8	Operational
Acciona Nevada Solar One	Trough	64	Operational
Solargenix Saguaro APS Plant	Trough	1	Operational
Stirling Energy SDG&E Plant	Dish-Engine	300	Feasibility
Ausra & PG&E Plant	LFR	177	Feasibility
BrightSource Energy - Ivanpha 1	Tower	100	Feasibility
Victorville Hybrid Gas-Solar Plant	Trough	50	Feasibility
Sopogy Demonstration Plant	MicroCSP	1	Feasibility
Solel PG&E Plant	Trough	553	Planning
Stirling Energy Systems SCE Plant	Dish-Engine	500	Planning
Stirling Energy Systems SCE Plant Exp.	Dish-Engine	350	Planning
Ausra & Florida Power & Light Plant	LFR	300	Planning
Stirling Energy SDG&E Plant Exp 1	Dish-Engine	300	Planning
Stirling Energy SDG&E Plant Exp 2	Dish-Engine	300	Planning
Harper Lake Solar Plant	Trough	250	Planning
Arizona Public Services/ Abengoa	Trough	280	Planning
BrightSource Energy - Ivanpha 2 and 3	Tower	300	Planning
Emcore/SunPeak Power	Lens CPV	200	Planning
Palmdale Hybrid Gas Solar Plant	Trough	50	Planning
Future U.S. CSP contract potential		**4,430 MW**	

Source: Prometheus Institute, Sorin Grama

Future Outlook

The Southwestern United States possesses a world-class, well-distributed, and nearly untapped solar energy resource. It is most abundant in California, Nevada, Arizona, and New Mexico and can ultimately support CSP plants with a capacity of hundreds of GW. The Western Governors' Association in 2006 commissioned a report on the potential for clean solar development in the Southwest that has identified areas with a potential for CSP generation capacity of approximately 200 GW. This capacity could produce about 473,000 GWh per year.

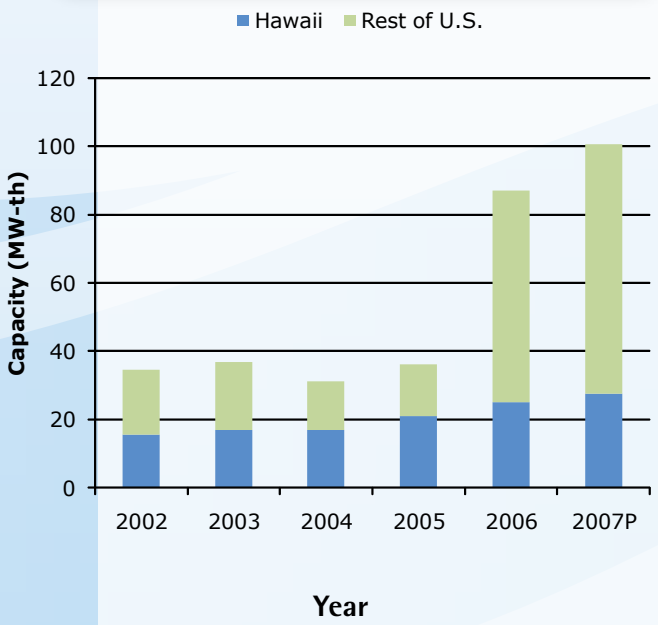
Utility RFPs in California are expected to result in PPAs for additional CSP capacity. A group of Southwest utilities from Arizona, California, Colorado, Nevada and New Mexico are considering aggregating their future demand for CSP in order to benefit from lower costs associated with larger plants.

Solar Water, Space, and Pool Heating

SUMMARY – Solar Heating

- The solar water heating market from 1997 – 2007 represents 366 MW thermal equivalent of generating capacity.
- The domestic water heating (non-swimming pool) segment has been galvanized by federal solar tax credits. The annual market in the continental U.S. is now four times the pre-tax credit market in 2005.
- The pool heating market continues to grow steadily at an 8 percent CAGR and accounts for the largest number of solar energy systems installed per year.

Solar Water and Space Heating Installed Annually



Source: Energy Information Administration

In 2006 new federal tax credits together with rising conventional energy prices caused the solar hot water market to explode. Prior to 2006, about half of the solar water heaters sold each year in the U.S. were in Hawaii due to utility rebates, state tax credits, and high energy prices. In 2006, national installations were 2.4 times the number in 2005 and installations outside Hawaii increased by 4 times. In addition to Hawaii, Florida and California lead the states in installations (see list).

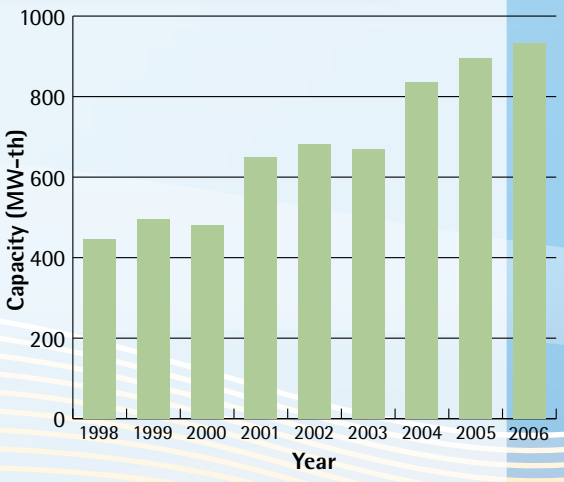
Top Solar Thermal States

1. Hawaii
2. Florida
3. California
4. New York
5. Puerto Rico
6. Arizona
7. Colorado
8. Illinois

On the manufacturing side, new products continue to be introduced in the U.S. market, from both foreign and domestic manufacturers. To qualify for the federal investment tax credit authorized through EPAct 2005, solar water heating property must be certified for performance by the nonprofit Solar Rating and Certification Corporation (SRCC, www.solar-rating.org). Since the ITC took effect in January 2006, SRCC has certified 92 additional solar collector models, bringing the current total to 216, an increase of nearly 75 percent. Of the 45 manufacturers with certified collectors today, 20 are based outside the U.S., and are hoping to replicate strong markets for solar thermal systems which exist in Europe and elsewhere (at this time, U.S. solar water heating installations represents 0.4 percent of the world market). However, domestic solar water heating manufacturers remain reluctant to increase manufacturing capacity until a long-term U.S. market policy has been established.

Solar pool heating accounts for the largest number of installations in the U.S. and has grown at an average annual rate of 8 percent for the past 4 years (see chart). California and Florida represent two-thirds of the solar pool heating market. Unlike other solar technologies, the pool heating market thrives with virtually no incentives. Altogether, the U.S. solar industry has shipped over 100 million square feet of non-glazed solar collectors for pool heating in the past 10 years.

Pool Heating Installed Annually



Source: Energy Information Administration

U.S. Government Leadership Poised to Tip Scales for Solar

Participating Organizations

SOLAR ENERGY INDUSTRIES ASSOCIATION

SEIA is the national trade association of the U.S. solar energy industry. We represent the interests of all solar technologies, including photovoltaics, solar thermal, concentrating solar power, and solar hybrid lighting. SEIA is comprised of more than 500 companies that manufacture, distribute, sell, design, own, install, and finance solar power plants and systems. Founded in 1974, our mission is to make solar mainstream by expanding markets, removing market barriers, increasing research and development and educating the public on the benefits of solar energy. Visit our website at www.seia.org.

Prometheus Institute

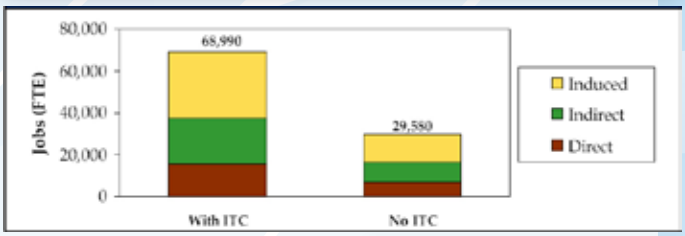
Founded in 2003 and based in Cambridge, MA, the Institute's mission is to accelerate the deployment of socially-beneficial sustainable technologies, including those of energy, water, and food, by educating industry participants, advocates, and policymakers about their economic and environmental benefits.

The Institute targets market-based solutions through collecting and disseminating reliable data, quantitative analysis, and practical information about these industries. Visit our website at www.prometheus.org.

Special thanks to:
Larry Sherwood, IREC, Les Nelson

Developing solar energy has proven to be an economic engine that creates high-quality jobs and drives billions of dollars of investment. Indeed in 2007, strong growth in the solar industry offset a downturn in the U.S. economy, by creating more than 6,000 jobs, particularly where they were needed most - in construction and manufacturing.

Loss of 39,400 Solar Jobs 2008-2009 if ITC Not Extended



Source: Navigant Consulting

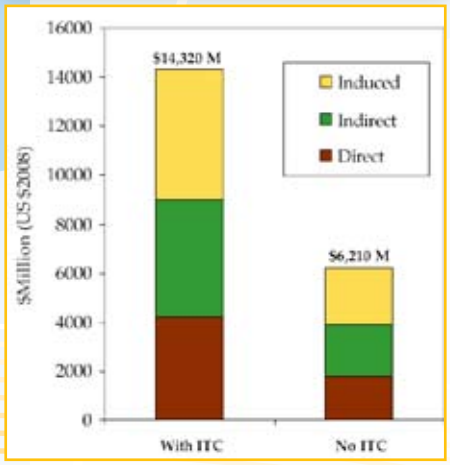
The U.S. Department of Labor reported a nationwide job loss for the first time since 2003 that has carried over into early 2008. Some 17,000 pink slips were issued in January 2008, with construction and factory workers especially hard hit, according to DOL.

If the solar investment tax credit is not renewed in 2008, it will disrupt this high-growth sector, impact tens of thousands of U.S. jobs, and undermine advances in clean energy production.

An economic analysis by Navigant Consulting Inc., in Washington, D.C., found that more than 116,000 U.S. jobs and nearly $19 billion in U.S. investment for solar and wind could be lost in 2009 if renewable energy tax credits are not extended by Congress. Specifically, Navigant found that 39,400 jobs are put at risk in the solar industry. The Feb. 13 study also noted the losses would begin in 2008 and accelerate as businesses anticipate an expiring ITC.

Looking out further, to 2030, experts at the National Renewable Energy Laboratory analyzed the long-term benefits of an 8-year extension of the solar ITC. An additional 30 gigawatts of solar energy would result – enough to power 5 million homes, tens of thousands of more jobs would be created, and over 130 million metric tons per year of CO2 emissions would be avoided.

Loss of $8.1 Billion in Investment 2008-2009 in Solar Industry



Source: Navigant Consulting

Furthermore, NREL analysts noted that the ITC-structured growth of the solar market in the next few years would continue to drive increased deployment of solar even after 2016 when the extended tax credits would sunset.

With the necessary federal leadership today, the economic engine of solar jobs and investment will spur economic growth in the U.S. economy for decades to come.