Statement before the Commission on Security and Cooperation in Europe

"The Power of Solar Energy"

A statement by

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May 6, 2008

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SCHOTT
glass made of ideas

SCHOTT
solar

Summary

- Solar energy represents a proven and reliable technology.
- Solar energy is relevant for almost every country in the world, especially the United States, where conversion of only 2.5% of the nation's usable area into solar farms would satisfy the entire nation's energy needs.
- Investment in solar will lead to the creation of hundreds of thousands of jobs.
- Electricity produced from the sun benefits from stability in energy production costs, since there no fossil fuel required and only minimal operating costs.
- By 2050, solar power could end U.S. dependence on foreign oil and slash greenhouse gas emissions.
- With the necessary investments, electricity produced by the sun could become cost competitive with fossil-fuel based technologies by 2020.
- Germany installed eight times more PV capacity in 2007 than the U.S. – demonstrating the market potential with proper incentives
- The United States has the opportunity today to address the challenge of global warming while creating jobs and growing the economy.

A Proven Resource with Almost Limitless Potential

In just one hour's time, the amount of energy from the sun that shines upon the earth's surface exceeds the energy consumption of all of mankind in an entire year. In the time it takes you to read this document, the sun shining upon the U.S. alone contains enough energy to satisfy America's power demands for several months. Energy from the sun is an integral part of a renewable energy portfolio. A portfolio that would strengthen our nation's economy, secure our energy independence, and provide clean energy to meet the ever increasing demand.

The idea of harnessing the power of the sun is not new. Documents dating back to Archimedes have shown theories on how this can be accomplished. Yet it hasn't been until recently that major strides have been made on mass-producing solar technology, and not until the last few years that technological innovations have been made to dramatically reduce costs.

Figure1: "Burning mirrors", Invention of Archimedes, 287-212 v.Chr.
Wall painting of Stanzino delle Matematiche in the Galleria degli Uffizi (Florence, Italy)
Of Giulio Parigi (1571-1635)

The most commonly known type of solar energy is Photovoltaic power, or PV. The other proven type of solar energy for utility-scale application is commonly referred to as Concentrating Solar Power (CSP). A brief explanation of each follows.

Photovoltaics

Photovoltaic (PV) power is a term used to describe the process of converting sunlight into electricity utilizing solar cells. These cells are specially constructed from semiconductor materials that generate a flow of electricity when sunlight shines on them.

Solar cells are solid-state devices in which photons (or packets of light) are absorbed by atoms. This process results in the production of electrons which flow into wires connected to the cell, thus providing electric current to appliances, lighting systems or other electrical loads. All of the electricity produced by the cell comes directly from the sun. Solar modules (also commonly referred to as solar panels) are series of solar cells, wired together and enclosed in self-contained glass units which protect the cells from the environment.

Concentrating Solar Power

Concentrating Solar Power (CSP) plants are utility-scale power plants that generally produce more than 50 MW of electricity, enough to supply the energy needs of thousands of homes. In one variation of CSP, called parabolic trough, hundreds of trough-shaped parabolic mirrors continuously tract the sun. These parabolic mirrors concentrate the sun's thermal energy onto receivers, located along the mirrors' focal line.

The concentrated solar radiation heats the thermo-oil Heat Transfer Fluid (HTF), flowing through the receivers, to approximately 750° F. This hot fluid is then used to produce steam, which drives a turbine, generating electricity. These parabolic trough facilities are well suited for utility-scale power generation.

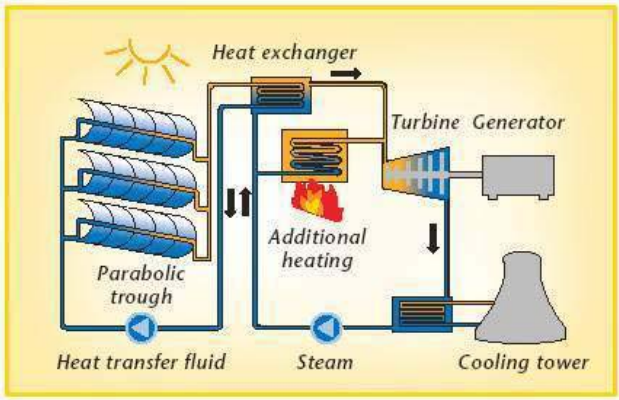

Figure 2: Diagram of a CSP Power Plant

Reliable and Proven Clean Electricity Generation

Over the decades, solar technologies have been reliably providing clean energy to tens of thousands of Americans. Photovoltaics have been in production for 50 years, and SEGS in the Mojave Desert, a group of CSP parabolic trough power plants, have been operating for more than 20 years, providing 350 MW of clean energy to the residents of California. Just last year the Nevada Solar One parabolic trough facility went online producing 64 MW of clean electricity.

United States - A "Sleeping Giant"

When you consider that Germany installed eight times more photovoltaics than the United States in 2007, it is not difficult to understand how large the potential for the solar market would be in the U.S.. Germany is not only much smaller than the United States, but solar resources within the Continental U.S. are much better than those of Germany.

The U.S. has at least 250,000 square miles of land in the Southwest alone that are suitable for constructing solar power plants, and this land area receives more than 4,500 quadrillion British Thermal Units (BTU) of solar radiation a year. Converting only 2.5% of that radiation into electricity would match the nation's total energy consumption for 2006.

While the "sun-belt" of the desert Southwest is generally considered to be the ideal location for the installation of solar, photovoltaics will work just about any where in the Continental U.S.. New Jersey is second behind California in installed capacity of PV in the U.S. However, since CSP technologies require direct normal solar insolation to efficiently generate electricity, these technologies are best suited for the desert southwestern United States.

According to the American Solar Energy Society: "Generation from CSP technologies, especially those that can be augmented with thermal storage or hybridized with natural gas, is well matched with southwest load profiles, which tend to peak in the late afternoon and early evening."

"States with the best solar radiation for CSP plants include Arizona, California, Colorado, Nevada, New Mexico, Texas and Utah. According to independent analysis, resource calculations show that these seven states in the U.S. Southwest could provide more than 7 million MW of solar generating capacity – roughly 10 times the total U.S. generating capacity from all sources today.

The Desertec model, which has been developed to supply solar energy to Europe, provides a realistic model in exporting electricity. In the Desertec model, electricity would be generated in Northern Africa and Southern Spain and then shipped to Northern Europe. A similar model can be adapted and applied to the Southwest of the United States, where states like Nevada and New Mexico could potentially export electricity produced by solar technologies to many areas of the U.S. and Canada creating a national distribution system for solar energy.

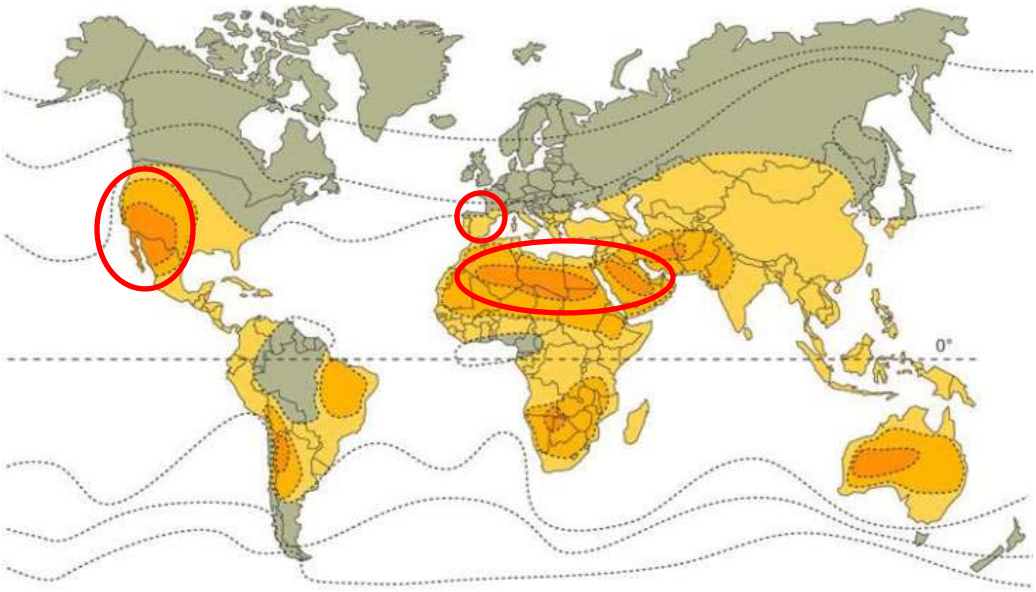

Figure 3: Ideal Locations for CSP: where the sun is most powerful

In a December, 2007 a report issued by Emerging Energy Research titled “Wind Power Strategies in the U.S. 2007-2015” stated: “CSP production in the U.S. and Spain expected to reach 7500MW by 2020 enough to power 6.75 million homes”

"CSP is the fastest growing utility-scale renewable energy alternative after wind power, with up to $20 billion expected to be invested in CSP over the next five years."

The long-term potential for solar technologies is even higher, as represented by the following chart (Figure 4) from the Solar Wirtschaft (Germany).

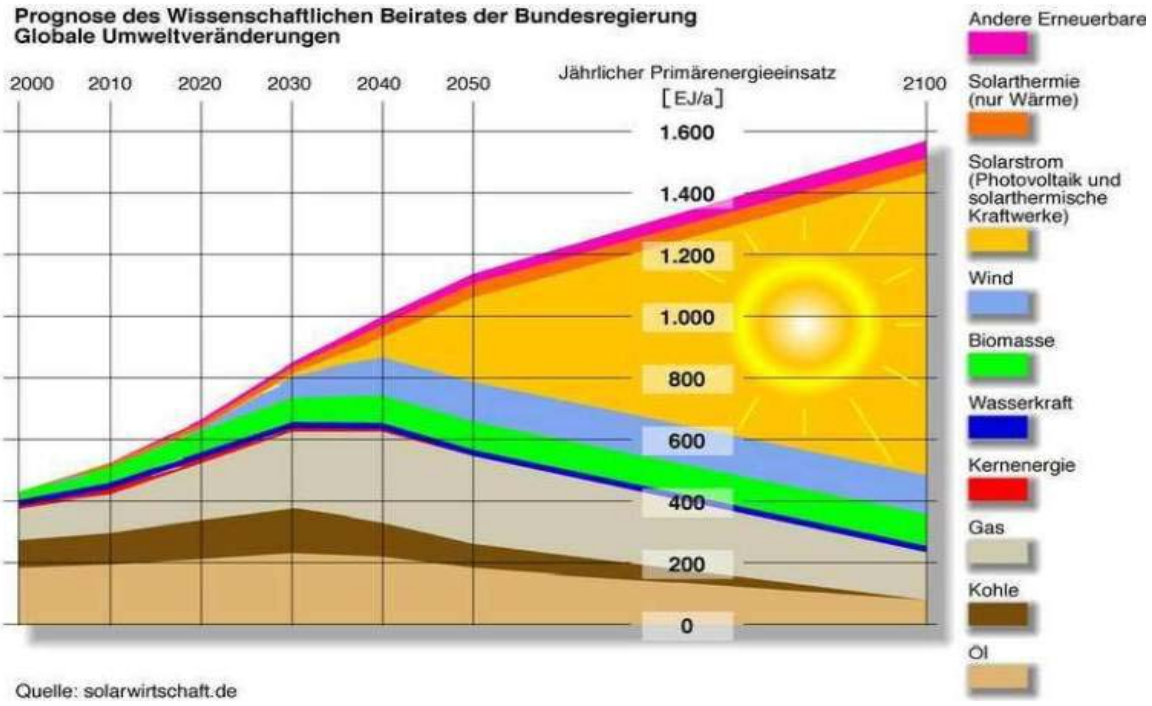

Figure 4: Electricity production and potential by energy source.

Advantages of solar energy production are numerous. In addition to no carbon emissions, harnessing the energy from the sun draws energy from a never-ending resource. The costs are fixed, and energy prices remain stable since there is no reliance on a fossil fuel. Solar is a complimentary technology to other forms of renewable energy, such as wind and biomass.

Challenges in Developing the Solar Market

Many view solar technology to be cost-prohibitive, while this was true 20, even 10 years ago, thanks to innovations and improvements in efficiency from industry, the cost per kW/h is steadily decreasing. It is only through continued government support however, that the industry will continue to make investments in research and development, which will further reduce costs to the level of those associated with generating electricity from traditional fossil-fuels.

The following chart (Figure 5), prepared by EREC/Greenpeace: “Future investment – A sustainable investment plan for the power sector to saver the climate, 2007” shows a cost model for solar vs. other fuel types.

The chart represents maximum and minimum electricity generating costs of renewable and non-renewable energy sources. PV vs. Oil/Diesel including peak power and residential power prices. The chart shows that there will be grid parity within the next decade. Increased productivity includes: reduction of Silicon (the key raw material in solar cells) required in PV modules,

increase in cell efficiencies, and economy of scale. The chart assumes productivity of 10% per year required in the following model, and it assumes long-term funding through 2015 (eight year extension of the Federal Investment Tax Credit – ITC).

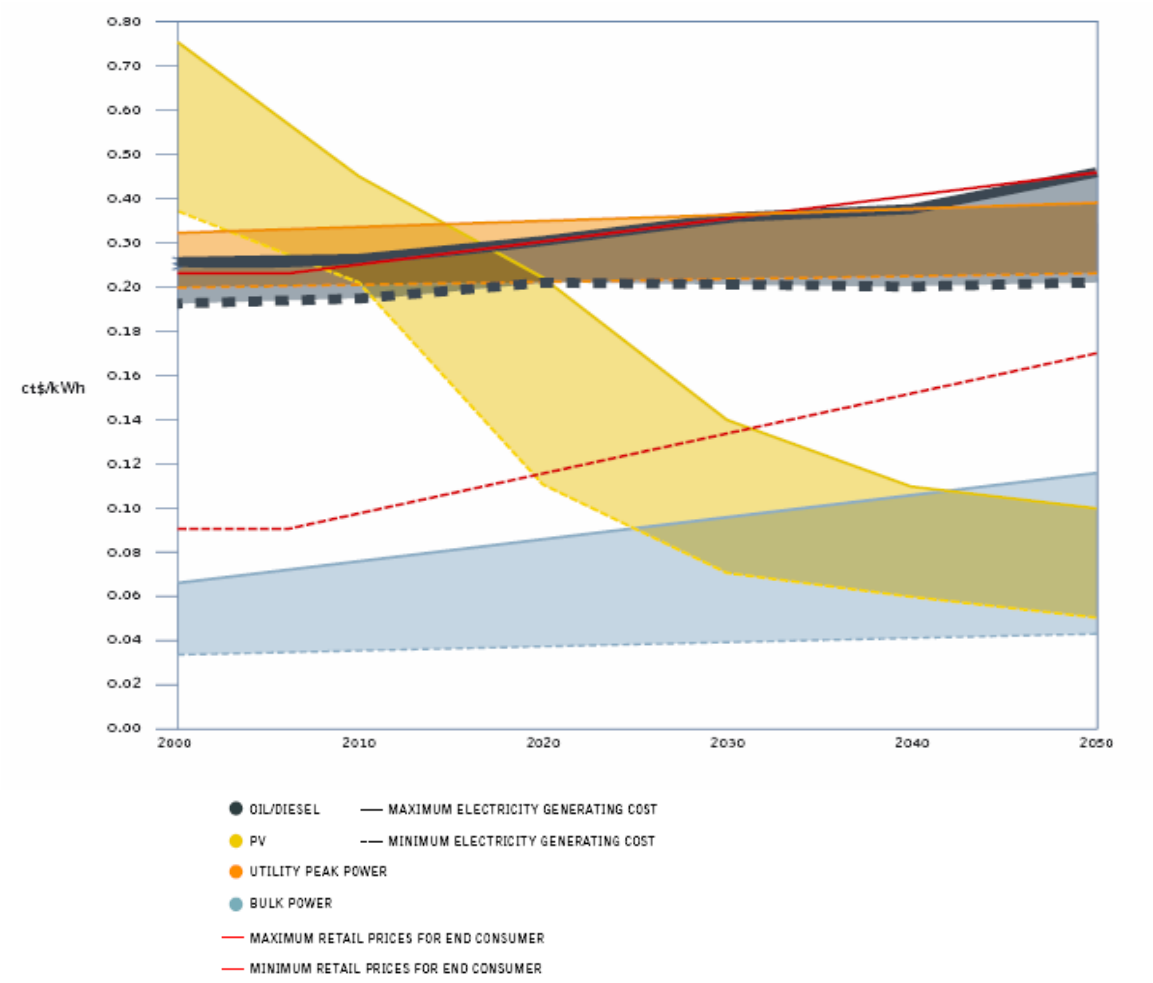

Figure 5: Midterm: What does it take to make PV cost competitive.

A similar chart (figure 6) for CSP technologies again shows parity within the next decade with key productivity sources in economy of scale, increase of efficiency and the development of storage technologies. Funding is again assumed for eight years through the extension of the ITC.

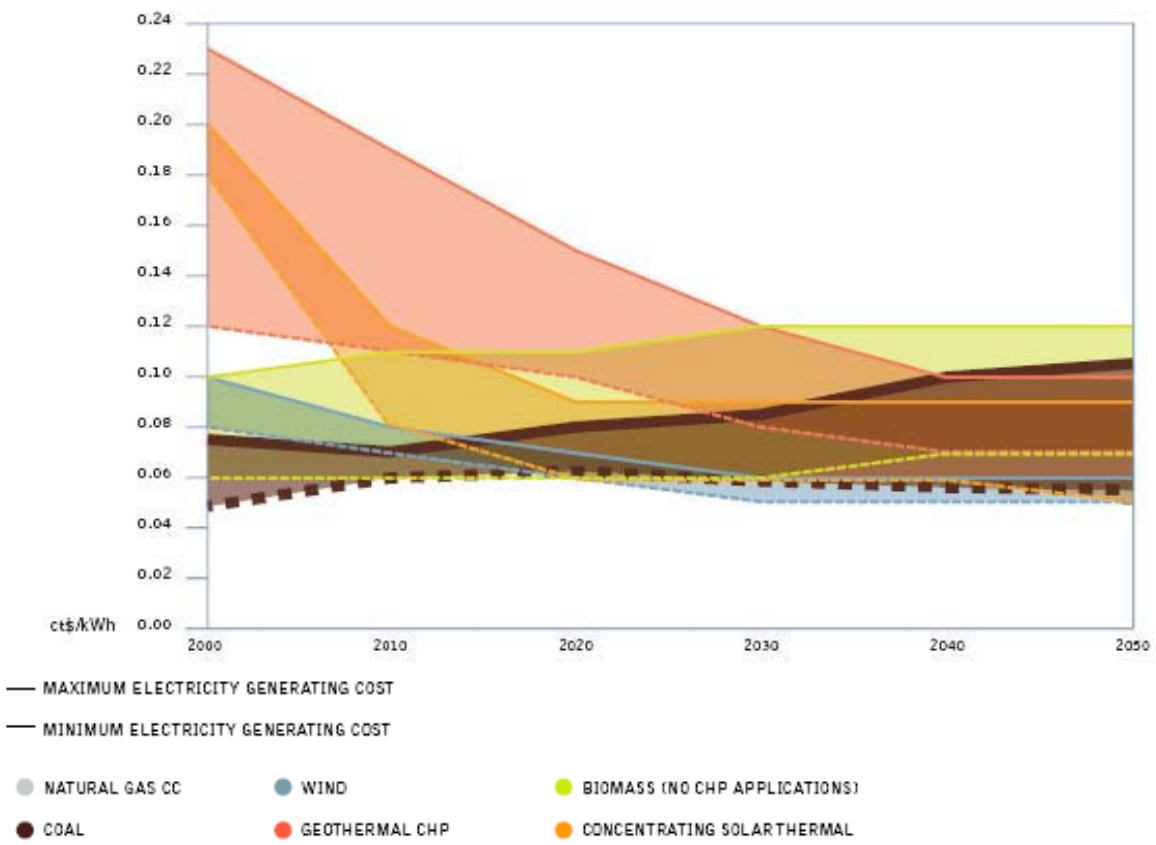

Figure 6: Midterm: What does it take to make CSP cost competitive
(Source: EREC/Greenpeace)

Currently in the United States electricity generated from renewable energy sources accounts for less than 6.5% of the U.S. energy consumption, of which solar is 1%. However the U.S. is showing one of the biggest growth rates with CAGR of 36% from 2006 – 2011.

In a conservative market scenario, the overall U.S PV market will reach ~900 MW in 2012. Through an aggressive market scenario, the U.S. market can more than triple, to almost 3GW of installed capacity by 2012. The aggressive scenario assumes a long-term (8 year) extension of the investment tax credit. This extension of the ITC will allow for sustained manufacturing capacity expansion, as evidenced by companies like SCHOTT, who is investing $500 Million in a solar technology production facility in Albuquerque, NM. Strong demand growth must continue. The 3GW market in the U.S. compares to a 7.6GW world market.

Solar Energy as an Economic Engine

Solar energy is domestic energy. The economic engine created by a powerful solar energy policy is multi-faceted. The most powerful component of the strengthening in the economy is in job creation. The University of California Berkley estimates “green jobs” will reach one million in the United States by 2020. These are high-wage manufacturing and professional jobs. In addition, there will be a demand for plumbers, electricians, roofers and others.

It’s forecasted that if the ITC is extended, 62,000 manufacturing and distribution jobs will be created—directly as a result of increased adoption of renewable energy in the first year of the extension.

This is job growth for Americans, by Americans, for an industry that will benefit America.

As an example, SCHOTT Solar, the company I represent, is in the construction phase of a large manufacturing facility in Albuquerque, NM. This plant will employ 1,500 people in the production of photovoltaics and receivers for CSP power plants. Over the long-term SCHOTT's investment in New Mexico will reach $500 million and the economic impact is forecast to exceed $1 Billion. But this growth will only happen if effective legislation is passed.

That's just what one company is doing in one community. There are other companies undertaking similar large projects, and many more that are ready to do so, once a clear commitment from the U.S. government is established in the form of a long-term Investment Tax Credit.

If the renewable energy credits expire, the impact next year would be more than 116,000 jobs either lost or not created according to SEIA and Navigant Consulting. Additionally, there will be more than $20 billion worth of investments that won't be made. And no doubt that that money, and those jobs, would go overseas. Considering the current economic climate of the country, these job losses, and investments moving overseas would be detrimental to the overall health of the nation's economy.

Solar as a Component of National Security

Currently the United States is reliant upon politically unstable regions of the world for much of its energy. According to the Energy Information Agency, two-thirds of the petroleum and 20% of the natural gas consumed in the United States is imported from other countries, and U.S. production of both is dropping while consumption continues to rise.

By utilizing solar energy to produce electricity and installing the necessary infrastructure to transmit energy across the nation, states in the desert southwest could become an exporter of electricity, helping economies in the region grow. Increasing energy consumption from renewable energy will stabilize energy costs and minimize wild fluctuations on the economy caused by volatile energy prices.

According to an article in Scientific American (January, 2008) by 2050, solar power could end U.S. dependence on foreign oil and slash greenhouse gas emissions.

With sun shining all across the world, every country can develop solar energy as a means to create energy independence. Already, through photovoltaics, rural villages in South East Asia are benefiting from having electricity for the first time. Solar is scalable and deployable.

Summary and Recommendations

Renewable energy, specifically solar, represents tremendous potential for the United States. Through effective legislation, the United States can develop an industry with proven successes in Germany, Japan, and Spain. An industry that has the potential to create up to a million jobs domestically, reduce the country's dependence on foreign energy supplies, and improve the environment for future generations.

- With the eight year extension of the Investment Tax Credit (ITC), an additional 62,000 jobs will be created. Up to a million will be clean-energy employed in the sector by 2020 according to UC Berkeley
- By fostering developing of renewable energy, and specifically solar, costs will become competitive with fossil fuel based technologies by 2020.
- With the development of a National grid connection policy, the barriers inherent in the current federal system with multiple jurisdiction would be greatly reduced if not eliminated. These bureaucratic roadblocks slow down or completely stall the development of many large-scale solar energy projects.

- With multiple GW of installed solar capacity, the U.S. will be reducing its growing dependence on foreign energy sources, which often come from politically unstable regions of the world.
- Strong support for solar will enable the industry to continue to make technological advances such as thermal storage to extend the operating hours of solar power plants beyond daylight hours.

Appendix

1) Case Study: A model for economic development powered by the sun: Spain

2) The Navigant study on the Economic Impacts of the Investment Tax Credit Expiration

3) The Solar Energy Industries Association (SEIA) report “U.S. Solar Industry Year in Review – 2007”

Case Study: A model for economic development powered by the sun – Spain

After an early start as a world leader in solar energy, the United States lags behind several countries in both solar energy development and deployment. However, global warming and rising prices for fossil fuel are causing the United States to consider how it can regain world leadership in the generation of solar energy. Overseas best practices offer proven models for how the U.S. can increase solar energy production. One of the leading examples may be found in Spain, where the government has undertaken aggressive initiatives that have made that country one of the world's solar power leaders. Not only have these initiatives helped increase the amount of solar energy generated in the country, but they have spurred the development of Spain's solar power industry as well proving to be an economic stimulus and creating jobs.

There are some obvious reasons for Spain's leadership in solar power. For one thing, solar energy generation is simply the exploitation of one of the country's most abundant natural resources. As British and Scandinavian sun worshippers can attest, Spain enjoys more sunlight than any country in Europe. Yet, in many ways, this resource remained untapped until 2004, when the Spanish government issued Royal Decree 436, which made sweeping reforms to solar energy policy, creating a new system for renewable energy development and deployment, with its own regulatory framework.

The decree ended a regime of small steps toward promoting the use of solar power and instead initiated the adoption of bold policies that would strongly encourage the deployment of solar energy. These policies included grid connection and tariff reform, promotion of large-scale concentrated solar power (CSP) plants and later, solar panel mandates for new and renovated buildings. Their initial goal was ambitious – 30 percent of the nation's electricity to be supplied by renewable energy sources by 2010.

Grid Connection

Grid-connection is critical to the development of renewable energy anywhere. In Britain, for example, the Labour government refuses to remove obstacles to grid-connection, and solar energy development lags. Without some form of guaranteed grid access, it is difficult for companies other than the grid owners to develop large-scale solar power plants, severely limiting the number of companies who can enter the market.

In 2004 the Spanish government removed the economic barriers to grid-connection for renewable energy sources. With this single measure, large-scale solar power plants were guaranteed access to the electricity grid and a market was created for the solar energy generated at these plants.

Economic incentives

Spain has made economic incentives, particularly feed-in tariffs, a key feature of its solar energy program. In 2002, Spain became the first European country to adopt a feed-in tariff of 12 euro cents for every kilowatt-hour supplied to the grid. In order to further accelerate the development of solar power the government passed a decree in 2004 that almost doubled the feed-in tariff for solar energy kilowatt hours, to 23 euro cents, and guaranteed these rates for 25 years. Instantly, large-scale photovoltaic and CSP generation were transformed into profitable business propositions as the 23 euro cents per KWh tariff was made specifically applicable to 100 KW to 50 MW plants. To keep the ball rolling, in 2007, the subsidies were raised yet again to 27 euro cents per KWh.

When combined with grid connectivity, these economic incentives made the development of solar energy in Spain practical. Planning and construction of solar generating plants in Spain accelerated, creating jobs and stimulating the economy.

Large Scale CSP

Though CSP is less well known than PV, since the 1980s CSP plants have reliably and cost-effectively generated large amounts of clean energy in California's Mojave Desert. Recognizing the tremendous potential that CSP offers geographic areas located in the world's sunbelt, Spanish policy essentially makes CSP fully equal to PV technology. With large areas that receive strong amounts of direct sunlight, Spain is very well suited for the development of CSP plants.

At the end of this year Spain plans to start operation of its first commercial CSP plants. The first plant, Andasol 1, will be the first commercial parabolic trough CSP plant in Europe. It will have a half-million square meter collector field and will be capable of supplying electricity to as many as 50,000 homes. This plant is the world's first to include thermal storage technologies that allow the plant to produce power at night. It does this by storing up to seven hours of energy in hot molten salt reservoirs. The heat in these reservoirs can be tapped to generate electricity after the sun goes down. Ultimately, this technology could enable solar plants to operate around the clock.

The Andasol plants are only the beginning. As of early 2008, five other Spanish CSP projects were underway, with a total expected capacity of 190 MW. Spain's tremendous CSP potential recently led my company, SCHOTT, to invest approximately $28 million in a new parabolic trough CSP receiver production facility in Spain.

Solar Mandates for New and Renovated Buildings

In addition to opening up the grid, providing aggressive tariffs to solar power generators and encouraging the development of both PV and large-scale CSP, Spain has undertaken another step towards a solar energy future. A new policy, introduced in 2006, mandates that all new and renovated buildings include either solar water heating systems or PV arrays. New homes must have solar heating systems capable of providing from 30 to 70 percent of their hot water, with the specific requirements to be determined by the building's location and expected water usage. These panels will not generate electricity, but they will help cut the demand for electrical power significantly. For non-residential buildings, such as hospitals and shopping malls, the standard is different. They are required to have PV panels that generate a portion of their electricity. The Environmental and Housing Ministries expect these mandates to bring energy savings of 30 to 40 percent for each building, and reduce carbon dioxide emissions by 40 to 55 percent.

In 2004 the Spanish government set a goal of 400 installed MW of PV and 500 MW of CSP by 2010. Currently, it seems likely that Spain will easily exceed these goals before 2010. By 2007, about 600 total MW of solar generating capacity were installed, with more projects under construction and scheduled for completion in 2008 and 2009. In fact, four of the 13 largest PV power plants in the world are in Spain. Two plants in Jumilla and Beneixama each produce 20 MW and each deploys more than 100,000 PV panels. The two other plants are a 13.8 MW facility in Salamanca and a 12.7 MW operation in Lobosilla.

Lessons for the United States

The Spanish experience offers important lessons for the United States, and especially the American Southwest, given that its climate is similar to that of Spain. The first and most important lesson is that without bold long-term policies, solar energy generation will only grow in fits and starts. Unfortunately, U.S. federal solar energy policy legislation has been short-term, with incentives periodically allowed to lapse, providing developers with no certainty that these incentives will be renewed or changed. This deters investment, and does not persuade the public that Congress and the Administration are serious about renewable energy policy.

Solar power plants – like any power plants – are major commitments, expected to be operational for at least 30 years. These kinds of investments require long-term federal energy policies.

For example, the U.S. tax credit now applies to a range of renewable energy projects and affords a 1.9¢ per kilowatt-hour benefit for the first 10 years of operation for a renewable-energy facility. It

also lapses at the end of 2008. So projects – solar, wind and other renewables – languish while their developers await Congressional action.

The U.S. could benefit from adopting other aspects of Spain's solar energy policy. If the U.S. instituted a national grid connection policy, developers would be better able to overcome the obstacles inherent to a federal system with multiple jurisdictions. Currently, these bureaucratic roadblocks slow down or completely stall the development of many large-scale solar energy projects. In addition, the U.S. could further spur solar energy development by mandating the installation of solar energy in residential or commercial buildings.

The United States, and especially its desert Southwest, possesses great potential for rapid solar expansion if policies akin to those of Spain are adopted. Many government officials, utility executives and citizens in the American Southwest already recognize this, and are taking action to develop the region's abundant solar resources, despite federal inaction. The Western Governors Association has set an ambitious goal of generating no less than 8,000 solar MW by 2015, and has recommended many regulatory and other public policy changes to promote solar and other renewable energy development. Early this year, Arizona Public Service announced plans to build the 280 MW Solana Generating Station near Phoenix.

Another lesson the U.S. can learn from Spain is that strong support for solar power provides many economic benefits. For instance, Spain's Ministry of Industry estimates that the solar and other renewable energy industries will create 200,000 new jobs by 2010.

The United States has found itself behind in the deployment of important technologies before, and found ways to catch up and secure world leadership. However, if our country adopts renewable energy policies similar to Spain, we can catch up just as we did with other technologies. And catching up will not just help the U.S. move beyond the use of fossil fuels and reduce its greenhouse gas emissions. Despite not having solar energy policies as aggressive as Spain's, the Solar Energy Industries Association (SEIA) estimates that 314 megawatts of new solar were installed in the U.S. in 2007, contributing $2 billion to the U.S. economy and creating 6,000 new jobs.

Economic Impacts of the Tax Credit Expiration

Final Report

Prepared for the

American Wind Energy Association (AWEA) and the Solar Energy Research and Education Foundation (SEREF)

February 13, 2008

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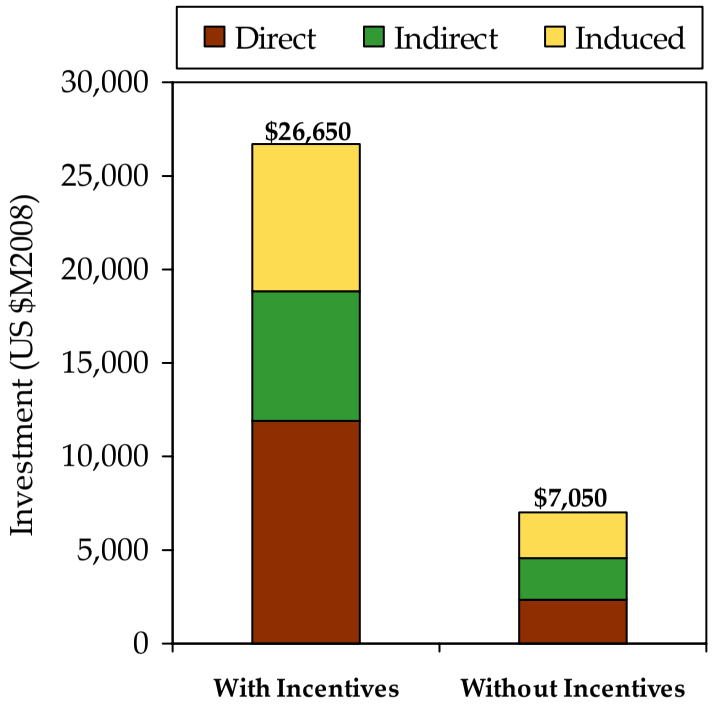
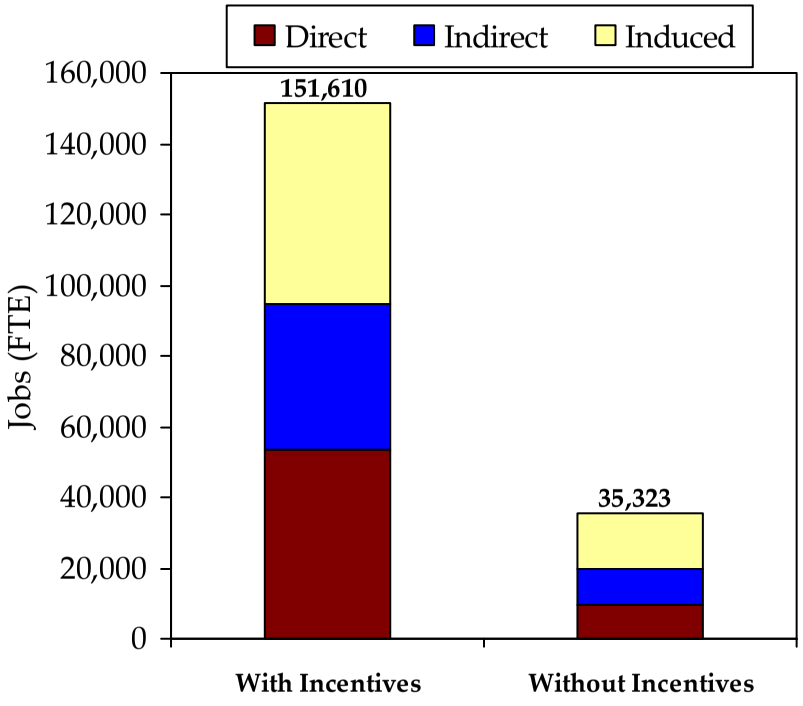
PV and Wind federal tax credit expiration could result in ~$19 billion of lost investment and ~116,000 of lost employment opportunity.

2009 Economic Impact of Federal Tax Credit Extension for PV and Wind*





* Analysis uses 6,500 MW of wind and 790 MW of PV installations in 2009 if tax are credits extended, and 500 MW of wind and 325 MW of PV without tax credits in 2009.

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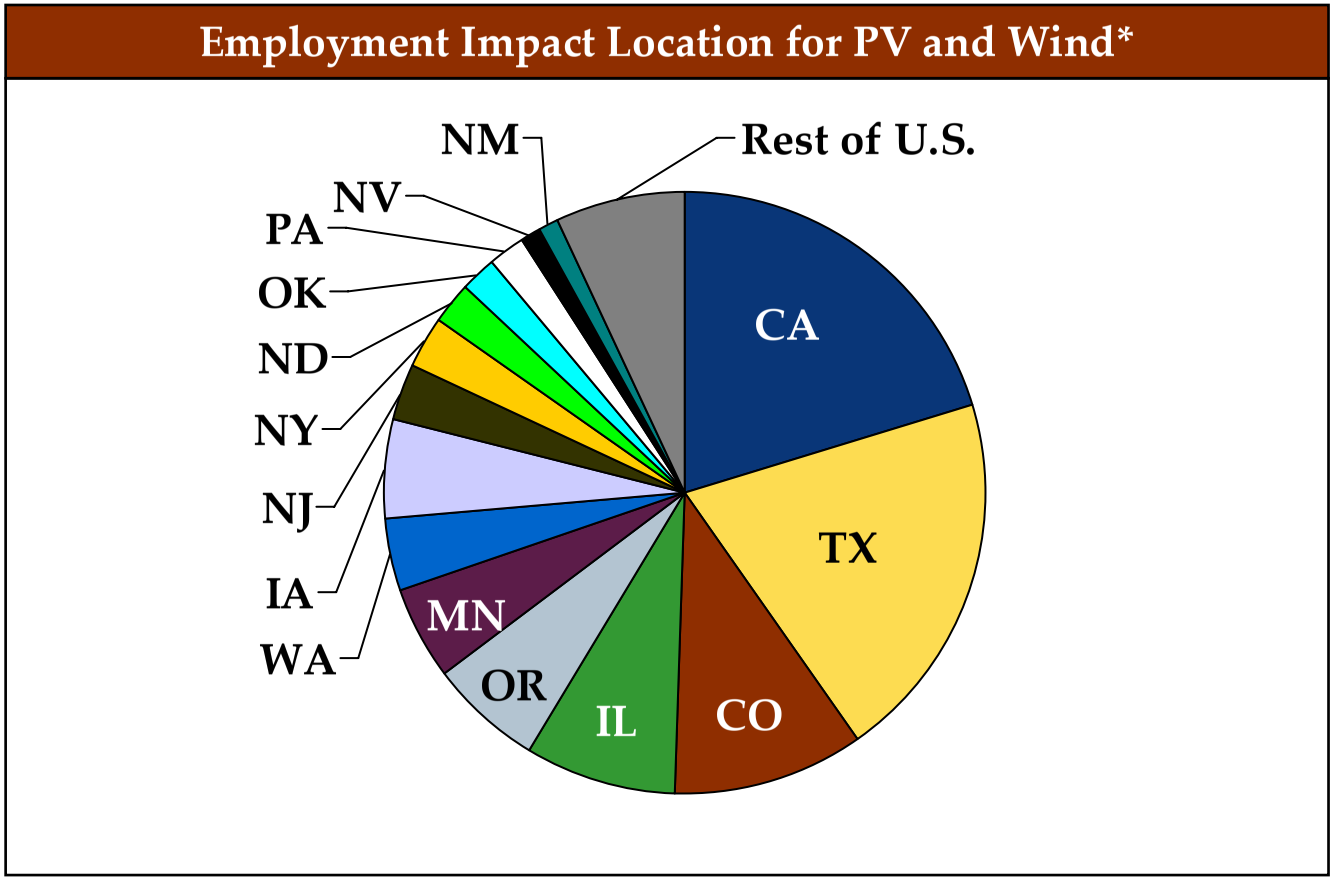
California and Texas would feel the biggest employment impact.



* Employment impact location was calculated by projecting the location of 2006 (PV) and 2007 (Wind) installations to 2009 and attributing job loss to the state of installation. This is accurate for construction and installation jobs, but only provides a *very* rough indicator for manufacturing jobs.

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Navigant Consulting, Inc. assessed lost investment and employment opportunities in wind and PV* due to the tax credit expiration.

Navigant Consulting, Inc. (NCI) Calculation Methodology

1. Estimate 2009 Market Size	2. Project System Costs	3. Calculate Labor Intensity	4. Find Economic Multipliers	5. Calculate Lost Employment	6. Calculate Lost Investment
• Purpose - Estimate 2009 market size with and without federal tax incentives. • Method - Use NCI market knowledge, *NCI Wind Market Model*, *NCI PV Services* market data, and industry interviews.	• Purpose - Project direct investment due to wind and PV installations. • Method - Use *NCI's PV Services* projections and NCI studies on wind system costs.	• Purpose - Calculate direct labor intensity (in FTE/MW) for each step of the wind and PV value chains. • Method - Conduct analysis based upon DOE's JEDI Wind model and NCI's PV labor intensity analyses.	• Purpose - Estimate indirect and induced employment and investment impacts. • Method - Use economic multipliers from JEDI Wind model and NREL study on the Solar America Initiative.	• Purpose - Calculate lost employment opportunity due to expiration of federal tax credits. • Method - Apply economic multipliers to direct jobs calculated in step 3 using the market sizes from step 1.	• Purpose - Calculate lost investment opportunity due to expiration of federal tax credits. • Method - Apply economic multipliers to direct investment calculated in step 2 using the market sizes from step 1.

*This study did not analyze concentrating solar power, solar hot water or solar heating, cooling, & lighting technologies.

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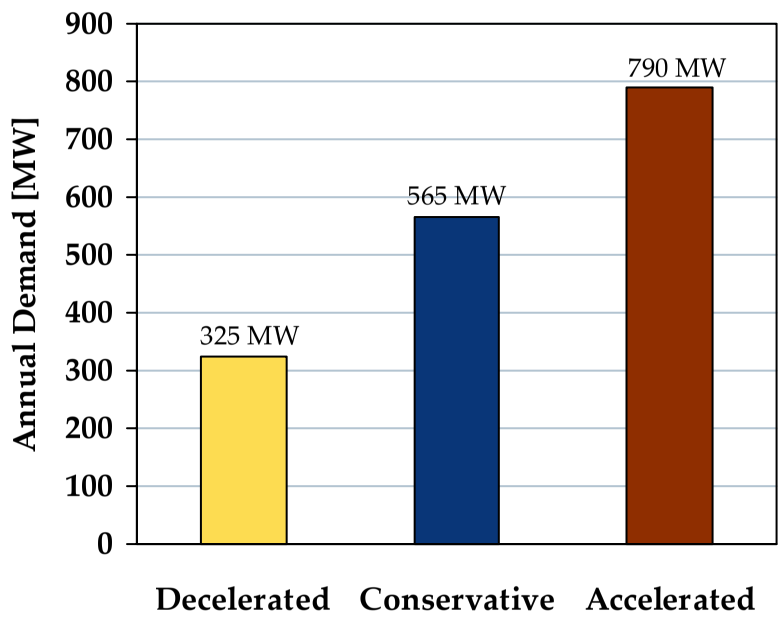
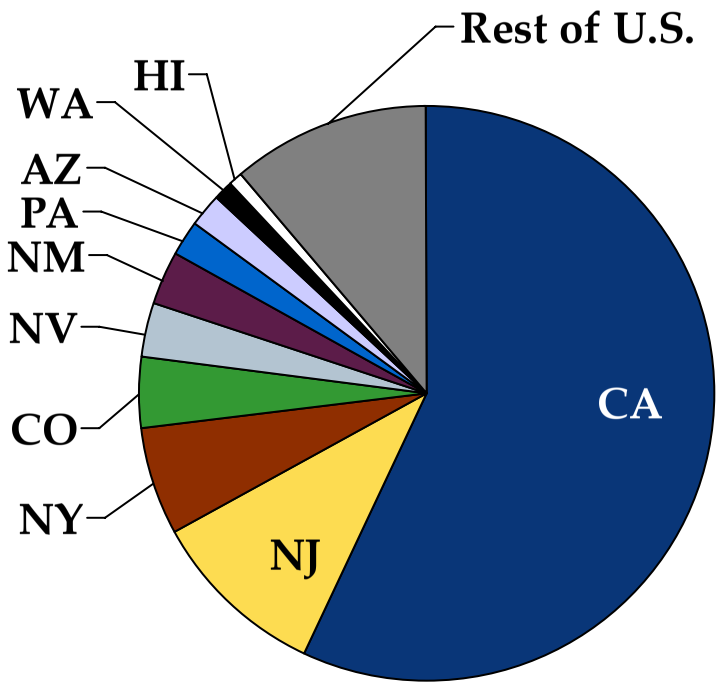
NCI's *PV Service's* 2009 accelerated forecast (790 MW) was used for the ITC market scenario, and the decelerated forecast (325 MW) for the scenario without the ITC.

2009 U.S. Demand Forecasts



Source: NCI PV Services Program, January, 2008.

Assumed Location of 2009 U.S. Installations*



Source: NCI PV Services Program, May, 2007.

*NCI used data on location of 2006 installations and assumes the same proportions for 2009.

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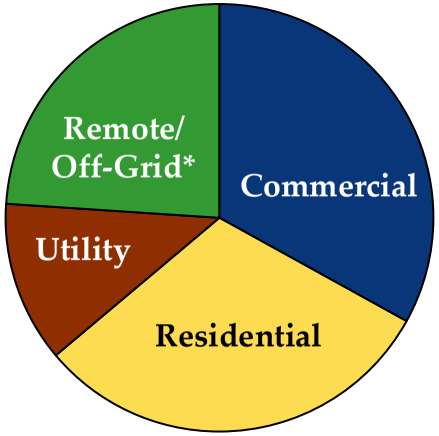
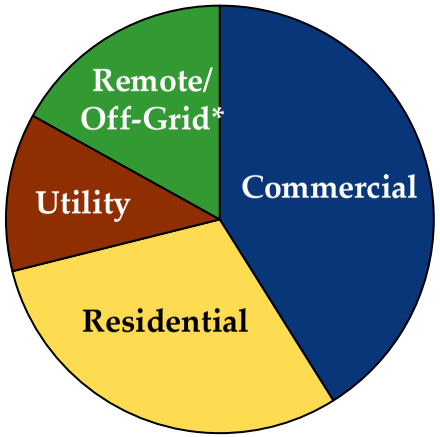
Commercial and residential applications will dominate the U.S. market in the decelerated and accelerated scenarios.

Projected 2009 U.S. PV Sales by Application

Decelerated Forecast: 325 MW in U.S. for 2009



Accelerated Forecast: 790 MW in U.S. for 2009



Source: NCI PV Services Program, January, 2008.

*Remote/Off-Grid applications include remote habitation, remote industrial and consumer products.

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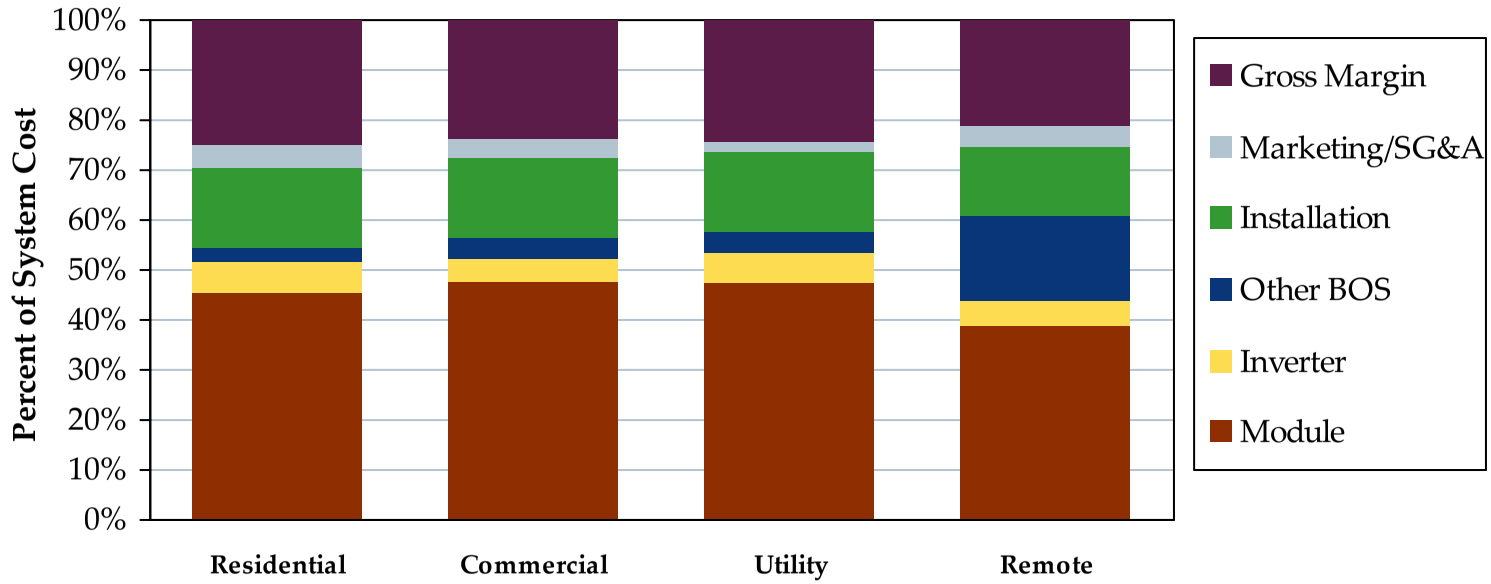
2009 installed system costs range between $5,400/kW$_{DC}$ and $12,000/kW$_{DC}$.

2009 System and Component Costs



	Residential	Commercial	Utility	Remote
Total Installed Cost [$/kW$_{DC}$][3]	6,620	6,150	5,400	12,000
O&M[1] [$/kW-Yr]	10	12	12	N/A[2]

Sources: NCI PV Services January, 2008; "Renewable Systems Interconnection: Rooftop PV Market Penetration Scenarios", J. Paidipati, L. Frantzis, H. Sawyer, A. Kurrasch December, 2007; "Comparative Costs of California Central Station Electricity Generation Technologies", California Energy Commission June, 2007, CEC 200-2007-011-SD; NCI Analysis January, 2007.

1. This does not include inverter replacement costs because this analysis is only looking at the first year of operation.
2. Most remote systems are only serviced once per year. This analysis is only looking at the first year of operation, so O&M will not likely occur.
3. Using an 80% DC to AC derating, these values are $8,280, $7,690, and $6,750/kWac for residential, commercial and utility systems, resptectively.

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NCI calculated potential PV-related employment rates as a function of time.

Primary Data Sources and Data Elements[1]	• NCI's PV module manufacturing cost model and Levelized Cost of Energy (LCOE) model. — These models provide detailed labor and non-labor cost estimates for all aspects of PV system manufacturing and installation • Interviews with PV industry sources – manufacturers, equipment suppliers, and installers • *The Work That Goes Into Renewable Energy*, Renewable Energy Policy Project (REPP), November 2001, Research Report No. 13.
Method	• Use NCI models and interview results to confirm and update REPP labor estimates. — NCI accounted for changes in technology, automation and material prices, and applied the updates to the range of available PV technologies • Weight the hour estimates by technology market shares to derive a weighted average hour for each labor task category. • Convert weighted estimates to job-years (1 job-year = 1,960 hours). • Using labor-hours and material estimates per installation task from NCI's LCOE model, and labor rate data from interviews with industry professionals and R. S. Means, calculate labor costs for residential: 3.5-kW, commercial: 1,500-kW and utility central station: 2-MW system installations. • Convert all results to per-MW costs.

1. In the manufacturing model, a process flow details each step and its costs, with technology improvements tracked as they occur. For each step, a detailed activity-based accounting is made of material, labor, capital and overhead costs, based on material quotes, machine capability spec sheets, machine cost quotations, U.S. labor rates, and industry financial parameters. The LCOE model accounts for module prices, inverter costs, installation labor, system integration, installer margins, etc. to build total system price, based on interviews with a wide array of industry sources.

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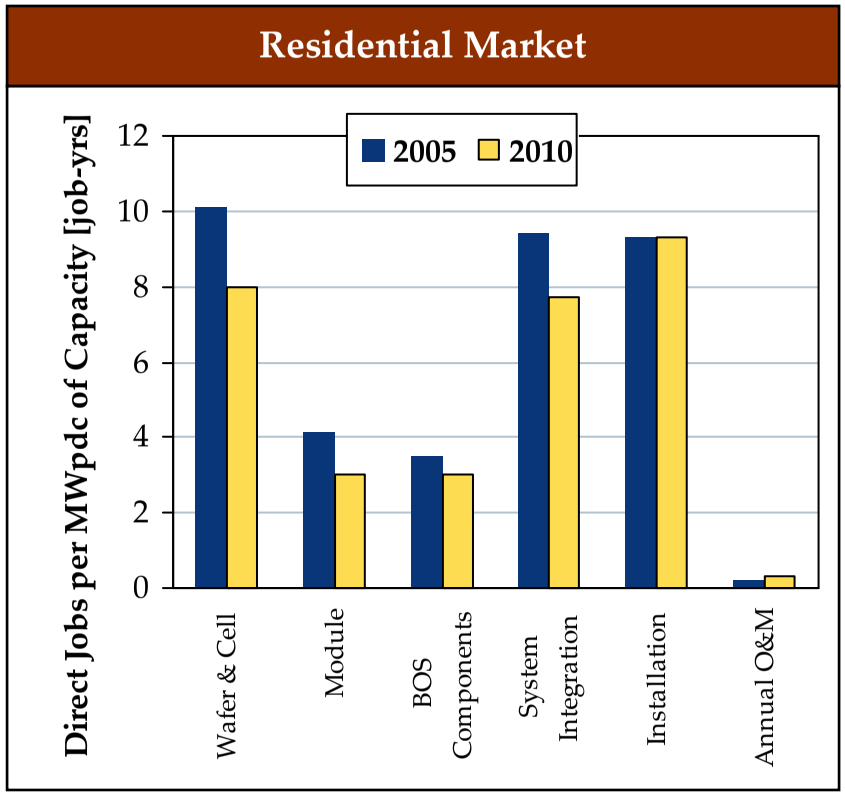
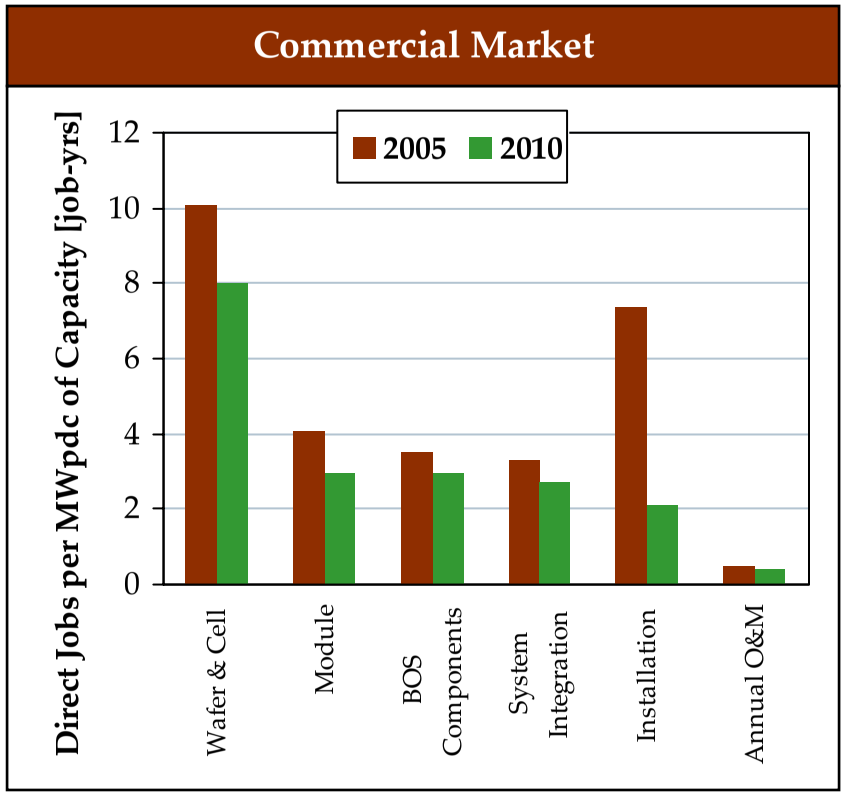
NCI expects employment rates to decline over time as PV manufacturing becomes more automated and installation practices mature[1].





Notes:

1. For this analysis, NCI assumed similar labor intensity between the commercial and utility markets and between the residential and remote.

Notes: One job-year is equal to 1,960 hours (40 hours per week, 49 weeks per year). System Integration includes system integration, design and distribution.

Source: Navigant Consulting, Inc. estimates, June 2006.

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A recent NREL study looked at the economic impacts of DOE's Solar America Initiative and reported economic multipliers.

Employment Economic Multipliers			
Construction and Manufacturing		Operation & Maintenance	
Ratio of Indirect to Direct*	Ratio of Induced to Direct*	Ratio of Indirect to Direct	Ratio of Induced to Direct
1.4	2.1	0.5	0.8

Investment Economic Multipliers			
Construction and Manufacturing		Operation and Maintenance	
Ratio of Indirect to Direct	Ratio of Induced to Direct	Ratio of Indirect to Direct	Ratio of Induced to Direct
1.1	1.3	0.7	0.9

Source: S. Grover,"Energy, Economic, and Environmental Benefits of the Solar America Initiative", August 2007, NREL/SR-640-41998.
Economic multipliers calculated using IMPLAN regional economic modeling software.
*Refer to the appendix for definition of direct, indirect, and induced impacts.

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ITC expiration could accelerate lost employment opportunity to 39,400 jobs through 2009…

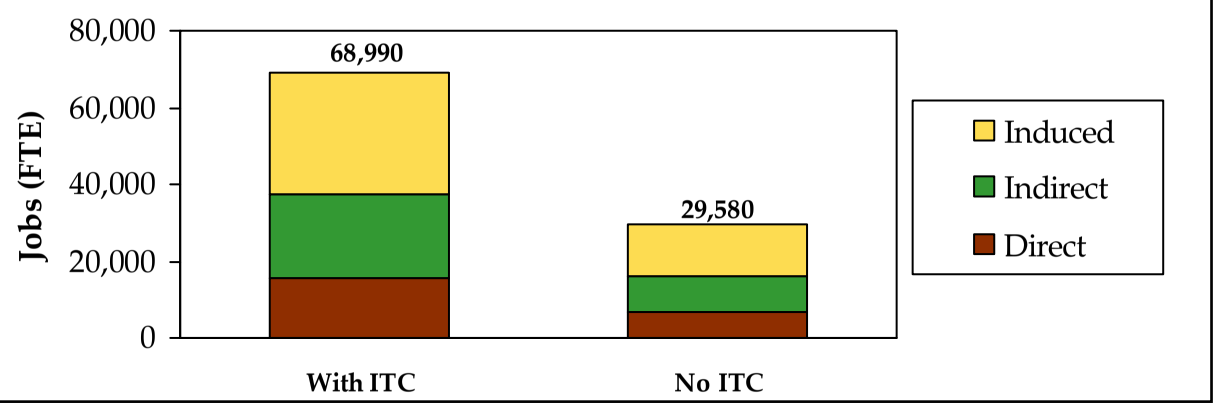
2009 Market Projections [MW]		
Market	**With ITC**	**Without ITC**
Residential	237	101
Commercial	325	107
Remote	134	78
Utility	95	39

X Labor Intensity[1,2] X

Employment Economic Multipliers			
Construction and Manufacturing		Operation and Maintenance	
Indirect: Direct	**Induced: Direct**	**Indirect: Direct**	**Induced: Direct**
1.4	2.1	0.5	0.8

=

Employment Impact of ITC Expiration[3]



1. Refer to slide 11 for details on labor intensity.
2. Analysis assumes, per EIA form E-63B for 2006, 55% of manufacturing is done in the U.S.
3. Refer to appendix for assumed state-by-state impacts.

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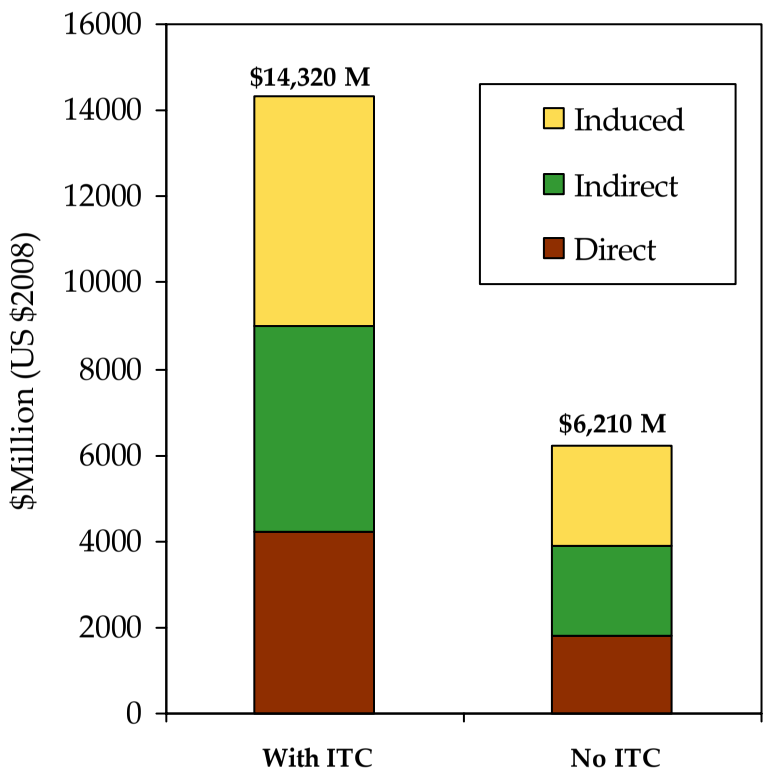
… and accelerate lost investment opportunity to ~$8.1B through 2009.

2009 Economic Impact of ITC extension ($Million) – PV



Key Assumptions

- 2009 PV Installation Assumptions:
  - 790 MW if ITC extension is enacted
  - 325 MW otherwise
- PV CAPEX (Installed Cost): $5,400 – 12,000/$kW_{DC}$
  - Assume 55% of manufacturing investment stays in U.S.
  - Assume 100% of integration, installation and O&M stays in the U.S.
- PV OPEX (O&M): $10-12/kW-yr
- Indirect Economic Impact: 110% of Direct Impacts for CAPEX
  - 70% for OPEX
- Induced Economic Impact: 130% of Direct Impacts for CAPEX
  - 90% for OPEX

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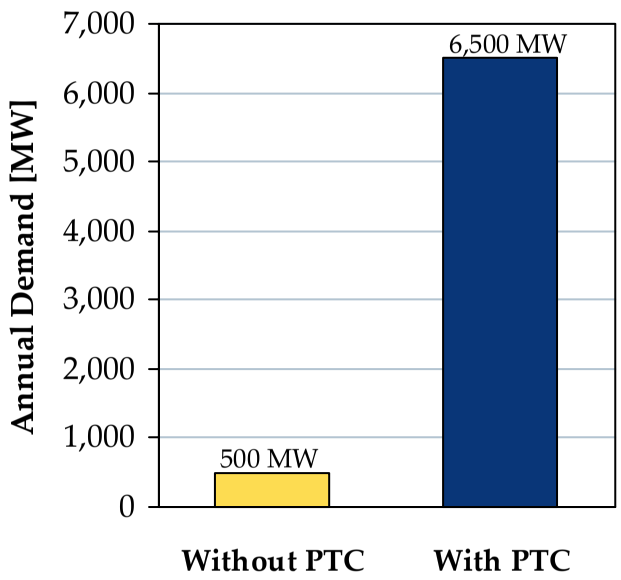
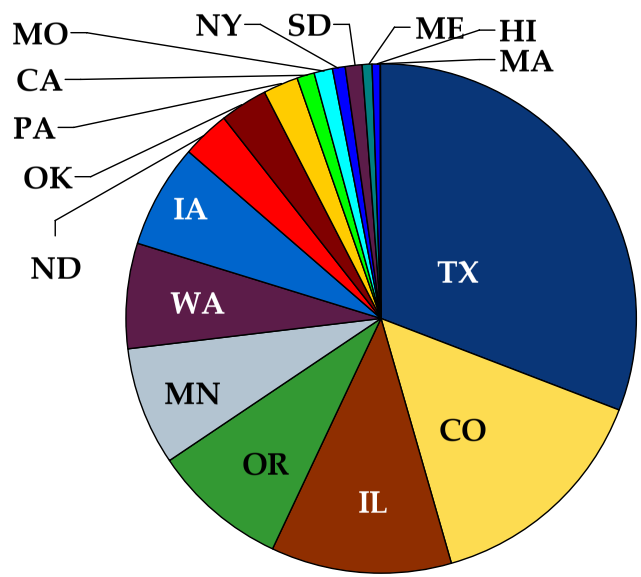
NCI projects 2009 installations to be between 500 MW and 6,500 MW, depending on the PTC availability.

2009 U.S. Demand Forecasts



Assumed Location of 2009 U.S. Installations*



An installed system price of $1,900/kW was assumed for wind power.

Source: NCI Analysis January, 2008; "U.S. Wind Energy Projects" AWEA January, 2008; "Comparative Costs of California Central Station Electricity Generation Technologies", California Energy Commission June, 2007, CEC 200-2007-011-SD; NCI Analysis January, 2008
*NCI used AWEA data on location of 2007 installations and assumes the same proportions for 2009.

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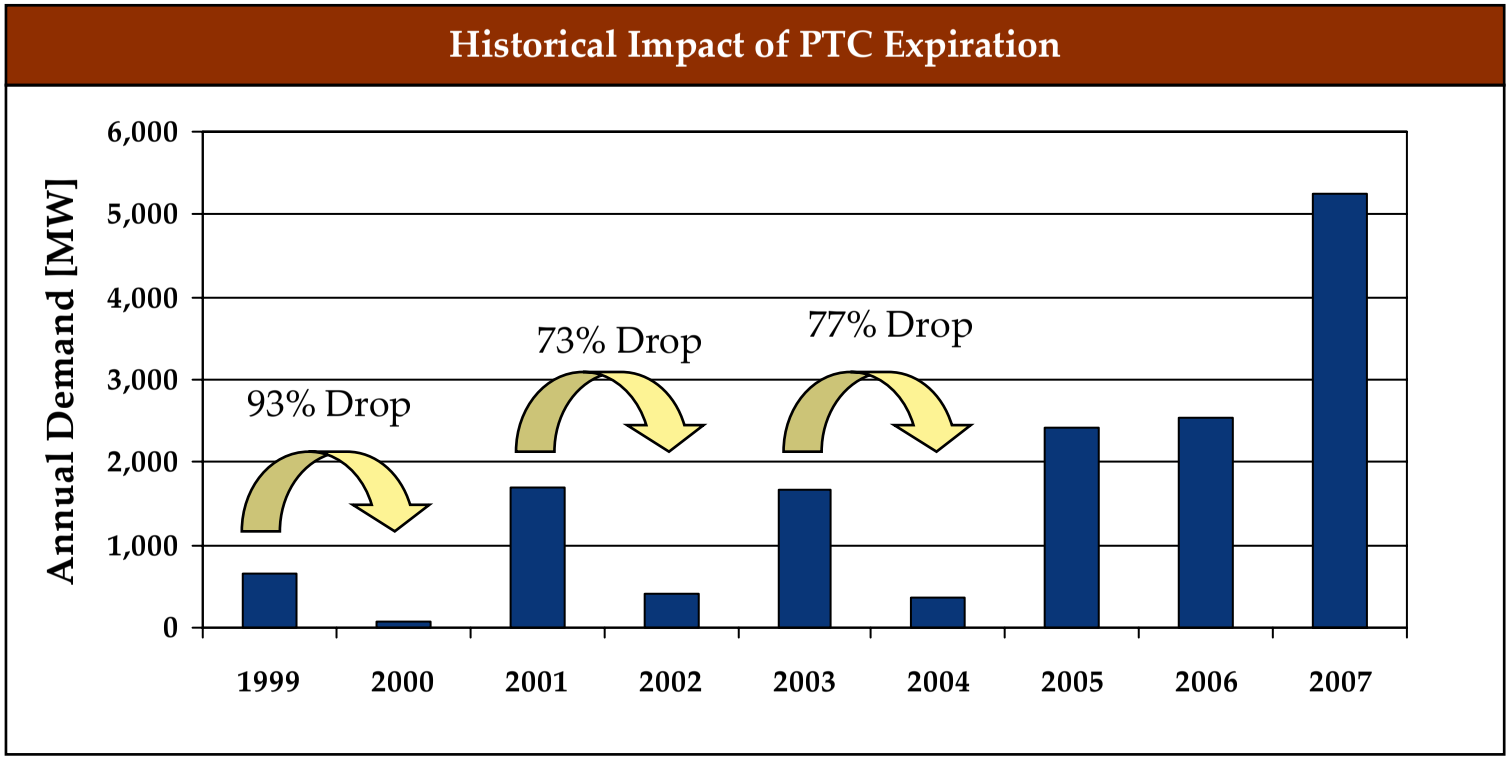
Historically, the PTC expiration has caused a 73% to 93% market drop to around 400 MW of annual installations.



Source: AWEA, January 2008

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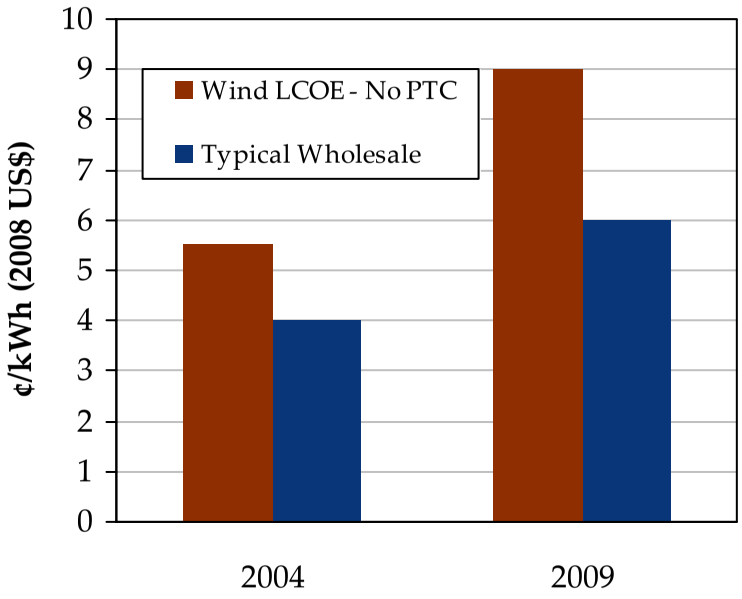
Without the PTC the LCOE for wind power in 2009 is expected to be even less competitive with wholesale power than in 2004 when about 400 MW were installed.

Cost of Electricity for On-Shore Wind Power Projects – Developed Financed

Cost of Electricity without Incentives for Given Year of Installation



Market Projection Rationale

- Typical wholesale power prices have risen ~2¢/kWh since 2004.
- In that same time frame, wind power LCOE has risen ~3.5¢/kWh because of rising steel and other raw material prices.
- Wind power is therefore expected to be less competitive in 2009 that in 2004, when the market was 400 MW.
- Furthermore, the 93% drop occurred in a year in which the PTC was extended late in 2000, as could happen in 2008 given the recent economic stimulus package passing without the PTC.
- Thus, NCI believes a ~90% market drop is more likely than a ~75% market drop.
- However, other market factors exist that did not exist in 2004 such as RPS requirements, REC sales and public ownership (e.g. community wind) – that will maintain a U.S. market.
- NCI believes this level will be ~500 MW.

Source: NCI analysis, January 2008.

*This is NCI's best estimate based upon NCI market knowledge and high level analysis done within the scope and budget of this work.

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NCI used DOE's Wind Jobs and Economic Development Impact (JEDI) model to assess labor impacts.

Sample JEDI Outputs*		
Output	**Jobs [FTE]**	**Investment [$M]**
During Construction		
Direct	500	106.0
Indirect	248	31.2
Induced	326	36.3
During Operation		
Direct	27	12.4
Indirect	7	4.1
Induced	15	4.6

JEDI Model

- The JEDI model was developed for the U.S. Department of Energy to analyze the economic benefits of constructing and operating wind power plants.
- JEDI contains labor intensity data and then uses the IMPLAN model to project indirect and induced economic impacts.
- NCI ran a separate JEDI run for each state of interest.
  - Indirect and induced impacts vary regionally.

Sources: Department of Energy's Wind and Hydropower Technologies Program at http://www.eere.energy.gov/windandhydro/windpoweringamerica/filter_detail.asp?itemid=707

* Analysis done for a 100 MW wind farm in Texas assuming $1,900 kW installed, $27/kW-Yr O&M, and 40% local turbine and blade manufacturing.

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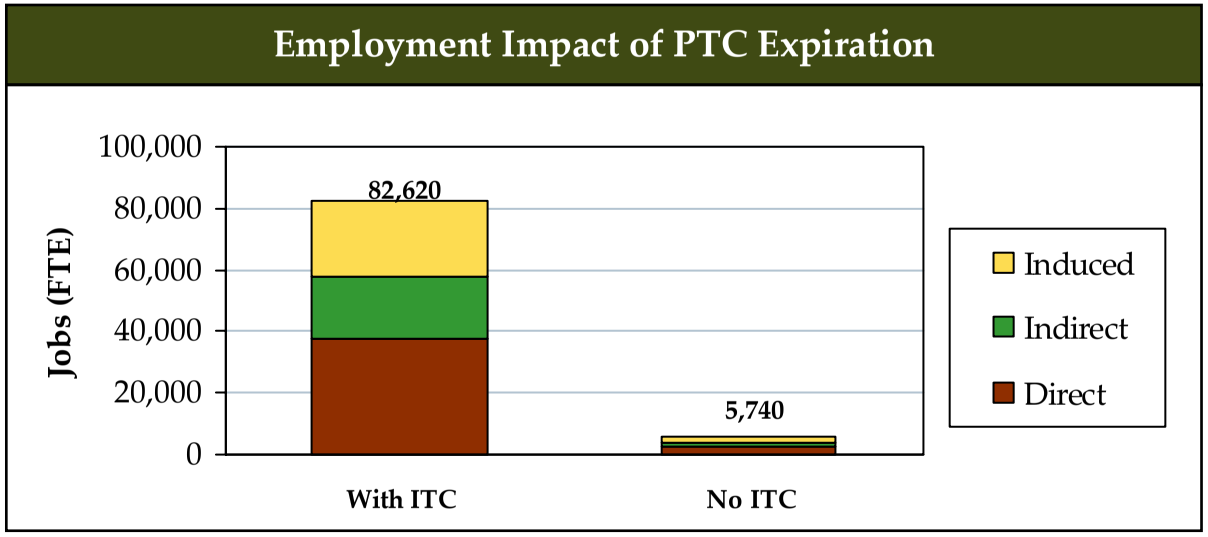
PTC expiration could accelerate lost employment opportunity to 76,800 jobs through 2009…

Market drop of 6,000 MW without the PTC → Distribution of installations per slide 16 → State-by-state analysis using JEDI



Source: NCI analysis, January, 2008. Refer to appendix for assumed state-by-state impacts.
* Analysis assumes 40% local turbine and 30% local blade manufacturing if the PTC does not pass and 50% local turbine and 40% local blade if it does pass.

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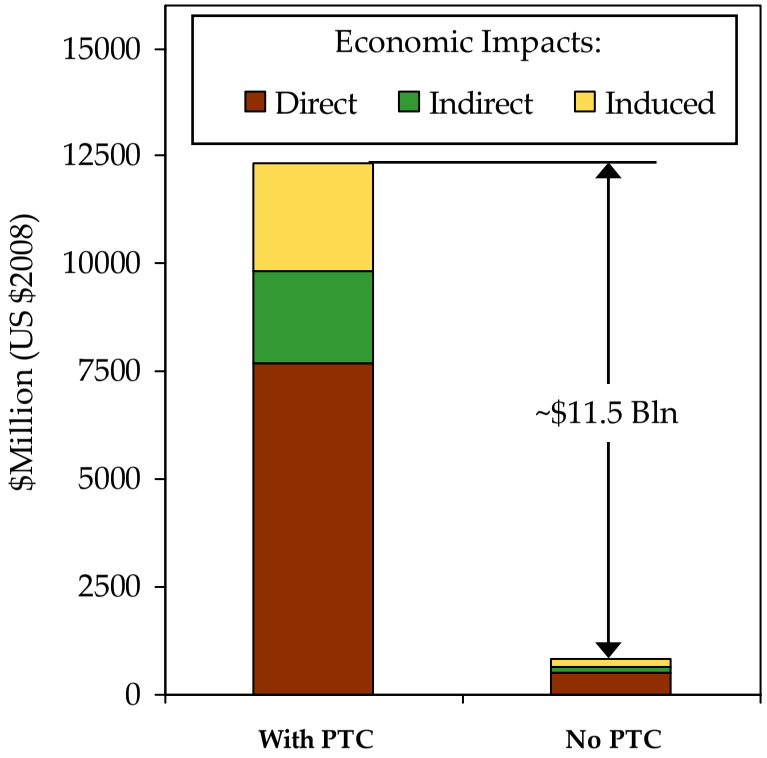
…And lack of PTC extension beyond 2008 would "cost" the US economy ~$11.5 billion through 2009 from decreased economic activity in the wind sector.

2009 Economic Impact of PTC extension ($Million) – Wind Power



Key Assumptions[1]

- 2009 Wind Installation Assumptions:
  - 6,500 MW if PTC extension is enacted
  - 500 MW otherwise
- Wind Turbine CAPEX (Installed Cost): $1,900/kW
  - 10% for Construction Material & Labor (100% stays in US economy)
  - 55% for Turbine (50% stays in US economy if PTC extension is enacted, 40% otherwise)
  - 18% for Blade (40% stays in US economy if PTC extension is enacted, 30% otherwise)
  - 12% for Tower (100% stays in US economy)
  - 5% Other Costs (100% stays in US economy)
- Wind Turbine OPEX (O&M): $27/kW-yr
- Indirect Economic Impact: 28% of Direct Impacts for both CAPEX and OPEX)
- Induced Economic Impact: 32% of Direct Impacts for CAPEX; 50% for OPEX)

1. Assumptions are derived from the Jobs and Economic Development Impact (JEDI) Model and NCI estimates, January 2008.

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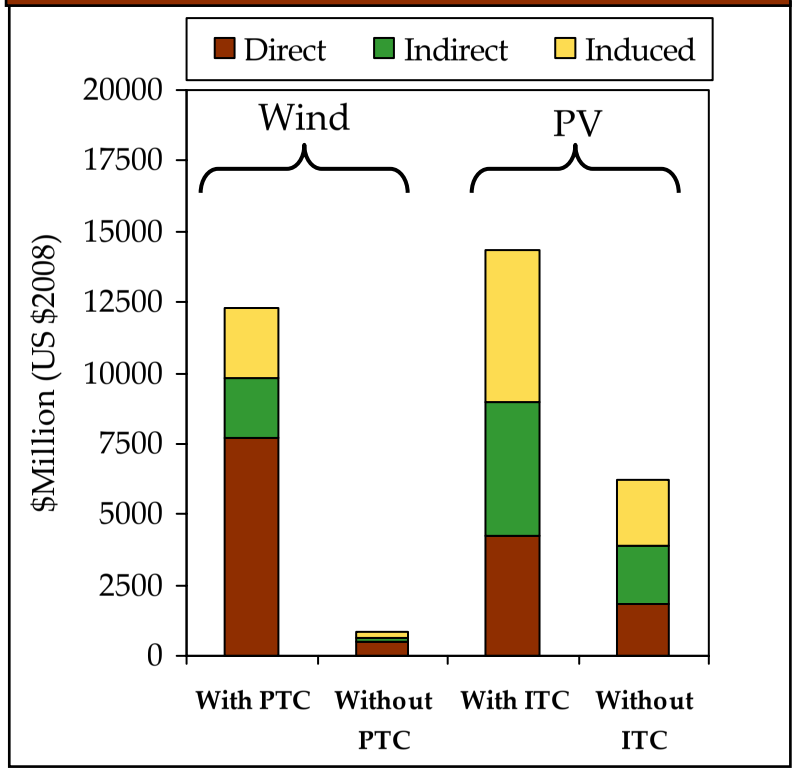
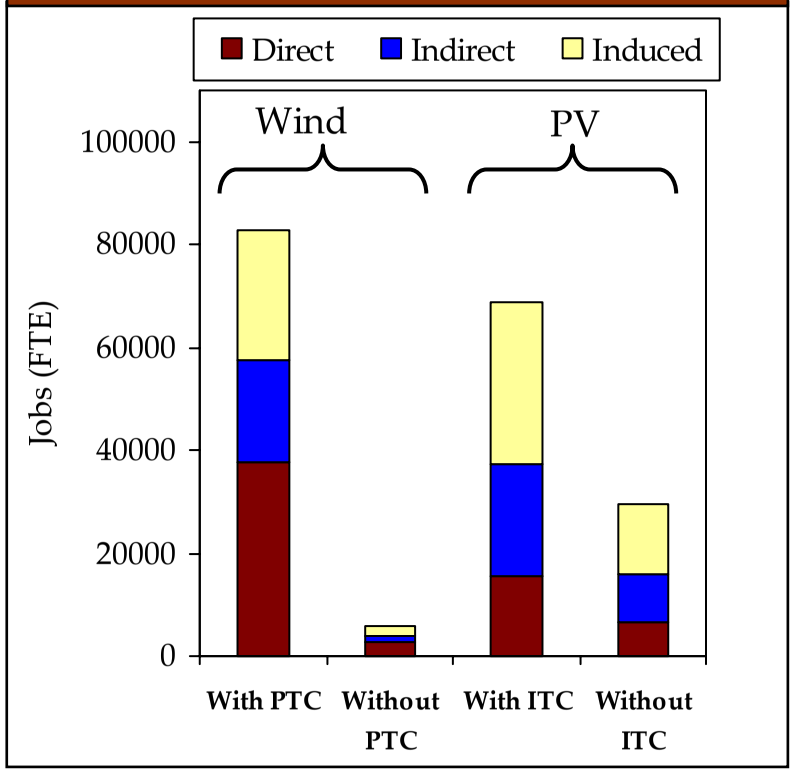
The Federal tax credit expiration could result in ~$19 billion of lost investment and ~116,000 of lost employment.

2009 Investment Impact of Federal Tax Credit Extension



2009 Employment Impact of Federal Tax Credit Extension



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Appendix

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NCI used the following definitions of economic impacts.

2009 Investment Impact of Federal Tax Credit Extension
• **Direct Impacts** - represent the initial change in final demand for the industry sector in question. Direct impacts describe the changes in economic activity for sectors that first experience a change in demand because of a project, policy decision, or some other stimuli. • **Indirect Impacts** - represent the response as supplying industries increase output in order to accommodate the initial change in final demand. These indirect beneficiaries will then spend money for supplies and services, which results in another round of indirect spending. • **Induced Impacts** - are generated by the spending of households who benefit from the additional wages and business income they earn through all of the direct and indirect activity. The increase in income, in effect, increases the purchasing power of households.

Source: S. Grover,"Energy, Economic, and Environmental Benefits of the Solar America Initiative", August 2007, NREL/SR-640-41998.

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NCI apportioned lost employment by state of installation.

PV Employment Impacts	
State	**Lost Employment Opportunity Without ITC**
California	22,583
New Jersey	3,894
New York	2,352
Colorado	1,557
Nevada	1,168
New Mexico	1,168
Pennsylvania	7,79
Arizona	7,79
Washington	389
Hawaii	389
Rest of US	4,283

Wind Employment Impacts	
State	**Lost Employment Opportunity Without PTC**
Texas	23,139
Colorado	10,625
Illinois	8,938
Oregon	7,297
Minnesota	6,304
Washington	4,744
Iowa	5,254
North Dakota	2,343
Oklahoma	2,468
Pennsylvania	1,617
California	809
Missouri	976
New York	696
South Dakota	978
Maine	472
Hawaii	196
Massachusetts	24

Employment impact location was calculated by projecting the location of 2006 (PV) and 2007 (Wind) installations to 2009 and attributing job loss to the state of installation. This is accurate for construction and installation jobs, but only provides a *very* rough indicator for manufacturing jobs.

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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 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.

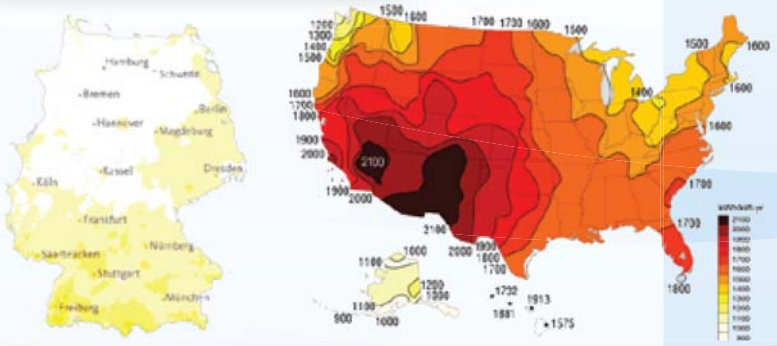
Prometheus Institute

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:

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 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 supplement energy needs in blackouts and disaster recovery for electricity, water pumping, and hot water.

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.

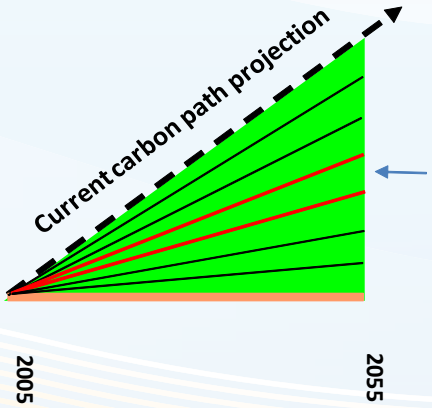
No emissions

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.

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

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.

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, 2007

- 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. 42 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.

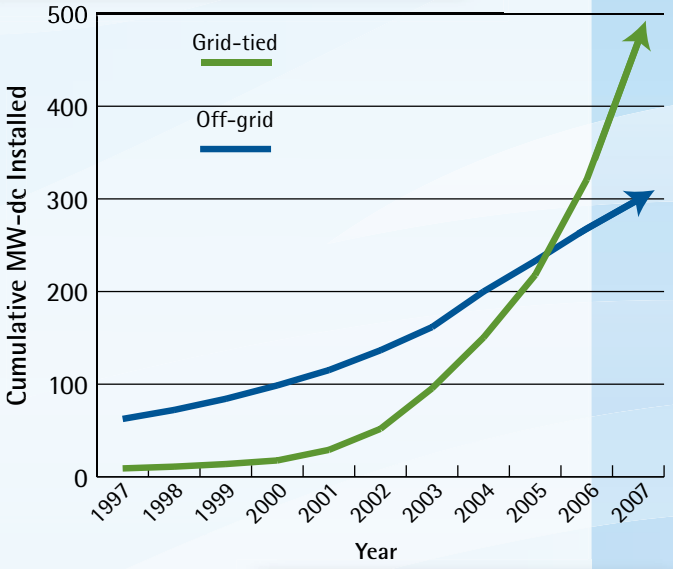
Wal-Mart and Best Buy have been especially aggressive. In 2007, Wal-Mart installed a 624 kW system on a store in Palm Desert, CA, and plans for installations at 22 more stores across California and Hawaii, totaling as much as 20 MW. Also riding the wave, Best Buy has plans for PV installations on 35 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*

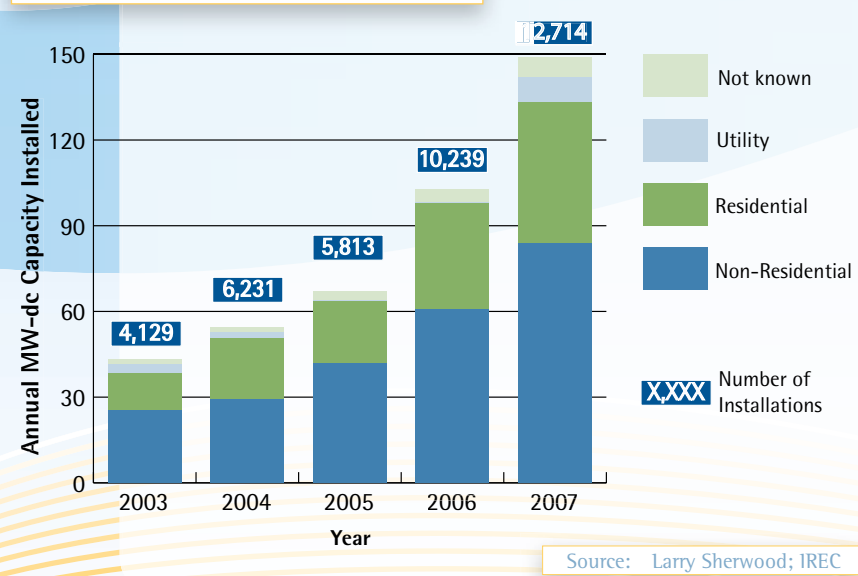
Historically a global leader in PV, the U.S. has been losing ground to Japan and Germany over the last decade. Despite the new CSI program in California, state renewable portfolio standards and federal tax credits from 2006, the U.S. fell behind Spain to become the fourth largest global market for PV 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 very 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.

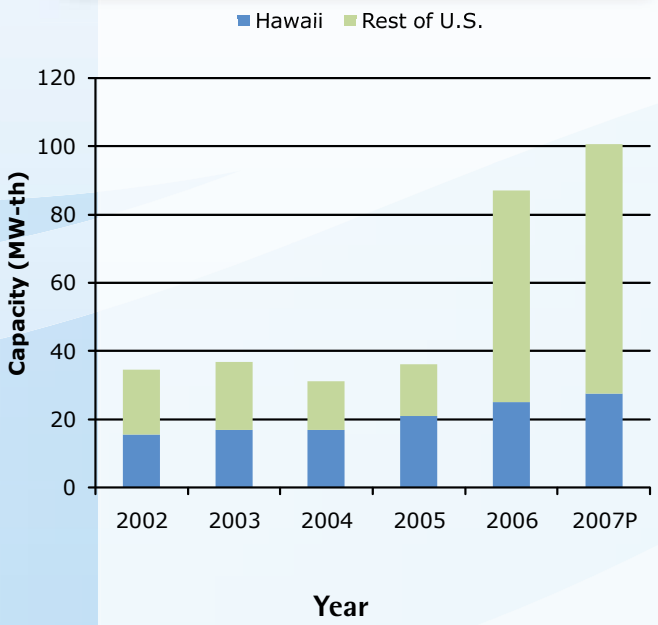
Utility RFPs in California are expected to result in PPAs for additional CSP capacity. A group of Southwest utilities from Arizona, California, Colorado, Nevada and New Mexico are considering aggregating their future demand for CSP in order to benefit from lower costs associated with larger plants.

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).

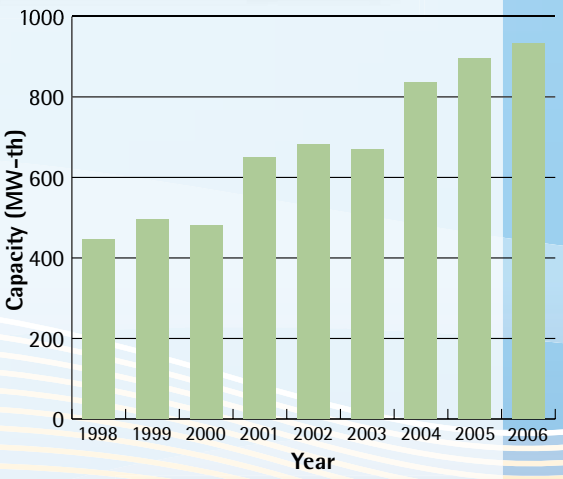
Top Solar Thermal States

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

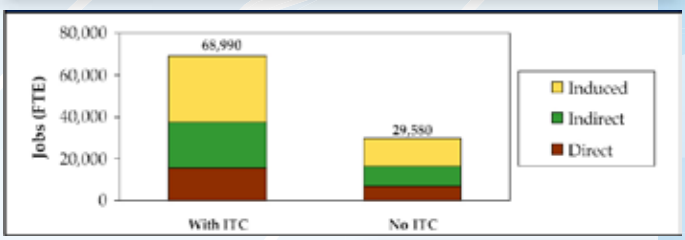
Founded in 2003 and based in Cambridge, MA, the Institute's mission is to accelerate the deployment of socially-beneficial sustainable technologies, including those of energy, water, and food, by educating industry participants, advocates, and policymakers about their economic and environmental benefits.

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

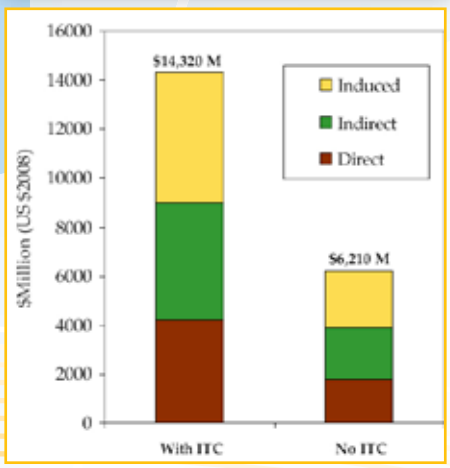
The U.S. Department of Labor reported a nationwide job loss for the first time since 2003 that has carried over into early 2008. Some 17,000 pink slips were issued in January 2008, with construction and factory workers especially hard hit, according to DOL.

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 CO_2 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.