Industry Analysis

Bright Prospects for Solar Energy

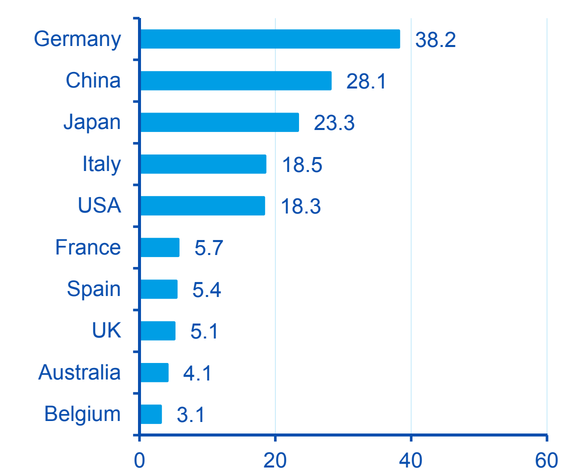
Marcial Nava

- **Solar generating electricity will grow faster than other renewables**
- **However, fiscal incentives may still be needed in order to support the industry**
- **Solar energy offers an attractive alternative to banks' energy portfolios**

Clear Skies for Solar Energy Around the World

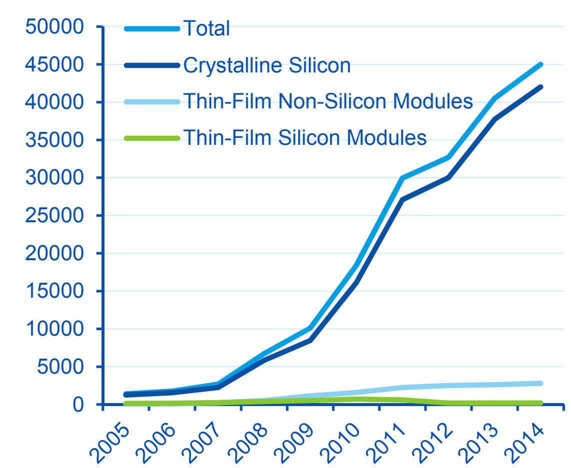
In the fight against climate change, solar generating electricity is one of the most effective solutions to reduce carbon dioxide (CO2) emissions to the atmosphere. There are two types of solar electricity technologies: photovoltaics (PV) and concentrated solar power (CSP). Photovoltaic technologies transform sunlight into electricity using semiconductors. A typical PV system employs solar panels that can be installed in rooftops or become part of utility-scale plants. On the other hand, CSP uses mirrors or lenses to direct and concentrate solar energy onto small surfaces that turn the sunlight into heat to be used by an electrical power generator. Because of its efficiency and cost advantages, PV is the fastest growing segment with 44% compounded annual growth (CAGR) in installations between 2000 and 2014.[1] Between 1980 and 2014, inflation-adjusted prices of all commercially available PV technologies declined by 20% every time the cumulative production (expressed in GWp) doubled.[2] This is the result of efficiency gains achieved through several decades of R&D as well as government policies to promote renewable energy and cut CO2 emissions.

Chart 1
Global | Cumulative PV installation in 2014 (GW)



Source: International Energy Agency

Chart 2
Global | PV modules production (MW)

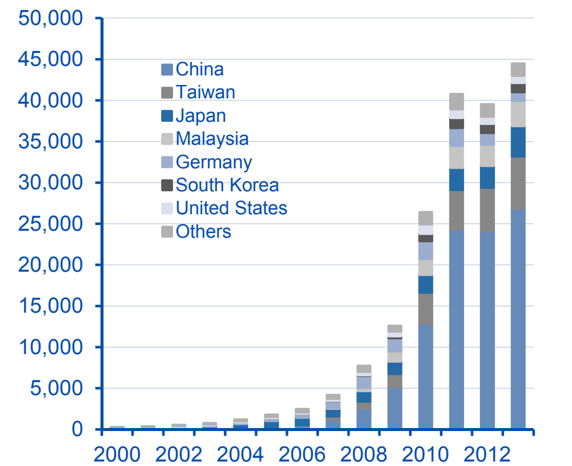


Source: Bloomberg

[1] Fraunhofer ISE: Photovoltaics Report, updated August 26, 2015. Available at https://goo.gl/y9L9dK
[2] *Ibidem*

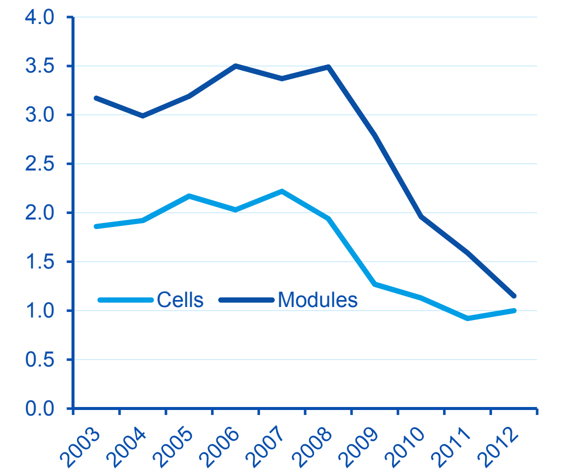
As of 2014, China and Taiwan dominated the manufacturing of PV with 69% market share; however, Europe has the largest share of cumulative installations (48%) followed by China and Taiwan (18%), Japan (13%) and North America (12%). Solar energy is expected to account for 35% of power-generating capacity additions worldwide, triggering investments in the order of $3.7 trillion between 2015 and 2040 from which $2.2 trillion could go to rooftop installations and $1.5 trillion to utility-scale projects.[3]

Chart 3
Global | Annual solar photovoltaics cell production in leading countries, 2000-2013 (MW)



Source: Earth Policy Institute with data from GTM Research

Chart 4
Average price of photovoltaic cells and modules, 2003-2012 (dollars per peak watt)



Source: Energy Information Administration

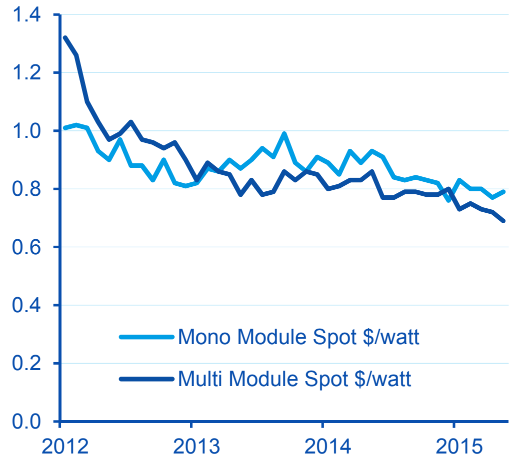
Solar Energy in the United States

In the U.S., the development of a solar energy industry started some decades ago, when advancements in solar photovoltaics were used in the space program and to power oil platforms in the sea. However, increasing concerns about the negative impact of CO2 emissions and the need to stimulate the economy after the 2008 financial crisis detonated a second wave of expansion for the solar energy industry. The Investment Tax Credit (ITC) of 2006 –and its subsequent extension in 2008– has been the most important federal policy supporting the development of the solar energy industry.

The ITC consists of a 30% tax credit for the installation of solar systems in residential and commercial properties before December 31, 2016. After this date, the credit will drop to 10% for commercial structures and to zero for residential structures. The ITC has had a positive impact on the industry. For example, since 2005, the growth of U.S. shipments of photovoltaic cells and modules has been exponential. Moreover, according to the Solar Energy Industries Association (SEIA), ITC has led to a 76% CAGR of solar installations since 2006.

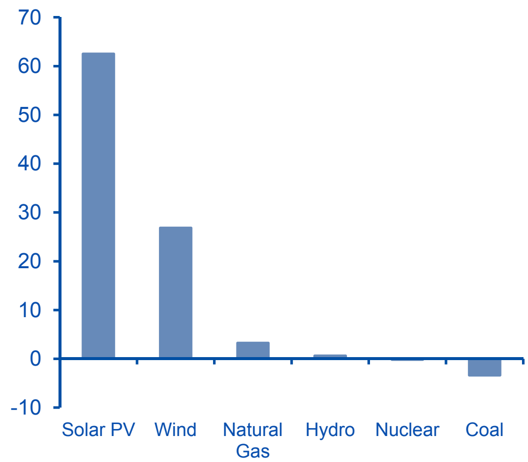
[3] Randall, Tom. “The Way Humans Get Electricity is About to Change Forever”, Bloomberg Business, June 23, 2015. Available at: http://goo.gl/3LDZO0

Chart 5
Crystalline silicon module prices (2012-2015)



Source: Bloomberg

Chart 6
U.S. | Annual growth in U.S. net electricity generation by selected sources, 2007-2014, %



Source: Earth Policy Institute with EIA data

The share of solar energy in electricity generation is growing fast. From 2005 to May 2015, net electricity generation from PV and CSP went from 535 thousand to 2.84 million MWh per year.[4] In 2014, the U.S. had approximately 18.3GW of installed PV solar energy capacity behind Germany (38.2GW), China (28.1GW), Japan (23.3GW) and Italy (18.5GW).[5]

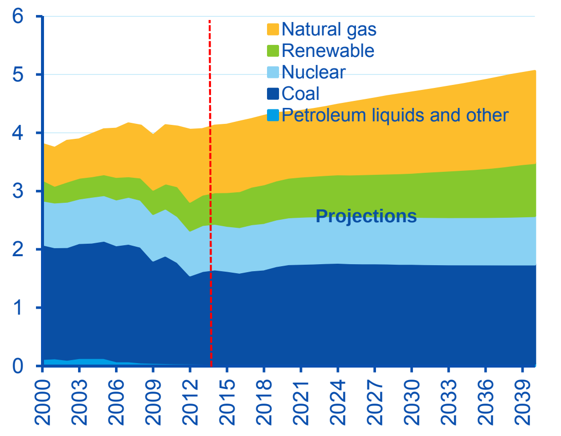
Although solar currently accounts for roughly 0.6% of total electricity generation, its future looks bright. Solar generation from utility-scale plants (≥ 1MW capacity) hit a record of 2.7GWh last June, a 35.8% annual growth rate with most of the increase coming from the installation of PV capacity. According to the Energy Information Administration (EIA), U.S. solar electricity output is 31 times what it was ten years ago and almost 90% of total solar electricity supplied to the grid comes from PV installations.[6]

In its reference case scenario, the EIA projects solar electricity's net summer capacity to experience a 4.9% CAGR –the fastest among renewables– and to account for nearly 10.4% of renewables net summer capacity by 2040. As a share of total electricity generation, solar energy is expected to go from 0.6% to 2.2% by 2040.

However, when adjusted for the impact of the federal government's Clean Power Plan, EIA Base Policy scenario points to an increase in the share of solar energy in total electricity generation to 5.6% by 2040. This share could go up to 7.7% under assumptions of high economic growth or down to 2.1% under assumptions of lower oil and natural gas prices. EIA projections reflect the importance that government intervention can have on the success of solar energy. They also reflect the exposure of solar energy to fluctuations in prices of hydrocarbons.

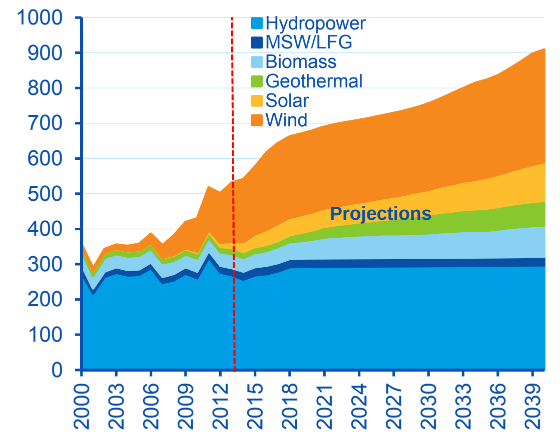
[4] Energy Information Administration (2015). "Annual Energy Outlook 2015." April, 2015. Available at http://goo.gl/JpkAhR
[5] International Energy Agency (2015). "2014 Snapshot of Global PV Markets." Available at: http://goo.gl/XhE123
[6] Energy Information Administration (2015). "Electricity Monthly Update." August, 2015. Available at: http://goo.gl/BdvSTx

Chart 7
U.S. | Electricity generation by fuel 2013-2040 (trillion kilowatthours)



Source: Energy Information Administration

Chart 8
U.S. | Renewable electricity generation by fuel type 2013-2040 (billion kilowatthours)



Source: Energy Information Administration

Government incentives and a good dose of technology and business innovation have impacted prices, making the industry more competitive in both the manufacturing and installation segments. Prices in the residential, commercial and large utility scale segments have gone down significantly. Barbose, Weaver and Darghouth (2014) calculate that prices paid to the installer prior to incentives and tax credits for residential and commercial PV declined 6% to 8% annually between 1998 and 2013. The median installed prices of commercial and residential solar declined from approximately $12 in 1998 to about $4.7 per watt in 2013 for systems ≤ 10kW; from around $11 to $4.30 per watt for systems 10-100kW; and from $9 to $3.9 per watt for systems >100kW. These trends are both the result of lower module (panel) costs and non-module costs such as inverters, hardware, labor, taxes, overhead and profits. In particular, non-module costs have declined by 44% between 1998 and 2013.[7] The Department of Energy estimates that in the utility segment, prices have gone from $0.21/kWh in 2010 to $0.11/kWh in 2013, with lower module prices accounting for most of the reduction, followed by a decline in the cost of inverters and soft costs such as permitting, inspection and installation. However, despite the downward trend in prices, the U.S. still has some of the highest compared to countries like Japan, France, Germany and the U.K., implying that further price reductions are possible.

Regional Perspective

States are also playing a critical role in the development of solar energy. Today, 29 states, Washington, D.C. and two territories have adopted renewable portfolio standards (RPS) that require utility companies to sell a portion of their electricity from renewable sources. Another eight states and two territories have established renewables goals. In particular, California is the indisputable leader in solar energy with 10,695MW of installed capacity, enough to power around 2,599,000 homes. In June 2015, around 57% of solar generation in the country came from California. According to the SEIA, the state installed more solar in 2014 alone than the entire country did between 1970 and 2011. California not only has plenty of sunlight during the year but also an RSP of

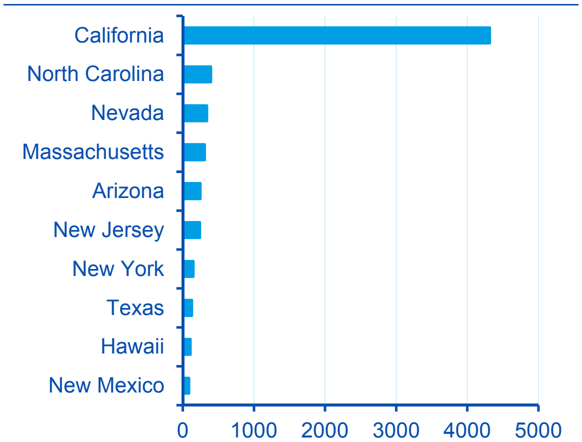
[7] Barbose, Weaver, and Darghouth (2015). "Tracking the Sun VII. A Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2013." Lawrence Berkeley National Laboratory. September 2014. Available at: http://goo.gl/f9JiKq

33%, the highest in the country. In terms of capacity installed in 2014, California is followed by North Carolina, Nevada, Massachusetts, Arizona, New Jersey, New York, Texas, Hawaii and New Mexico.

Solar energy is also booming in Texas despite the fact that the state has fewer incentives and mandates than California. This may reflect the fact that the state is rich in sunny days and has an abundance of affordable land. By 2029, Texas is expected to install between 10,000 and 12,500MW of solar generating capacity, nearly 68% of today's total solar installed capacity in the U.S. Pecos County in West Texas could become the epicenter of solar projects in the state with currently identified investments of about $1 billion.[8]

Shah and Booream-Phelps (2015) estimate that solar electricity is already competitive in 14 states without the need of more subsidies. In these states, the levelized cost of electricity, or the net cost to install a solar system divided by the expected energy production, ranges between $0.10 and $0.15 /kWh compared to average retail prices of $0.12 to $0.38 /kWh. The authors also project that 47 states will be at "grid parity" (when solar electricity equals the average price of electricity) by 2016.[9]

Chart 9
2014 Top 10 solar states (MW)



Source: Solar Energy Association of America

Chart 10
NYSE Global solar index

Source: Bloomberg. The NYSE Bloomberg Global Solar Energy Index is comprised of companies active across the solar energy value chain including the manufacture of solar energy equipment and the financing, development and operation of projects.

Challenges and Uncertainties

Despite its good prospects, the future of solar energy is still subject to uncertainty. A major technological challenge arises from the fact that sunlight is not constant and uniformly distributed around the Earth. Users of PV systems may end up producing more or less electricity than what they need during the day. Net-metering and feed-in tariffs are viable options for systems connected to the grid. When overproduction of electricity is reached by the system, users have the option to put that surplus into the grid and get credited for it; however, they have

[8] Gold, Rusell (2015). "Next Texas Energy Boom: Solar." The Wall Street Journal. August 21, 2015. Available at: http://goo.gl/wUonTH
[9] Shah and Booream-Phelps (2015). "Crossing the Chasm: Solar Grid Parity in a Low Price Era." Deutsche Bank. February 27, 2015. Available at: https://goo.gl/yZlMPD

to purchase electricity during the evening, when they may end up paying peak hour rates. Moreover, if conducted at a massive scale, net-metering requires a significant update to the transmission and distribution system which may come at the expense of all consumers, not only those who use solar electricity, making solar less efficient than intended. Storage solutions have been proposed as the best way to achieve a constant supply of solar electricity at a minimal social cost. Home storage technologies –based for the most part on the lithium-ion battery– are becoming more competitive with wholesale grid electricity. However, they still have some way to go before reaching the mass market. New developments in flow batteries, compressed air energy and other storage technologies will continue to evolve and become cost-competitive; however, their timing could delay the mass adoption of solar energy.

Another source of uncertainty has to do with government policy. An interdisciplinary study conducted by the Massachusetts Institute of Technology states that for the U.S. to effectively combat climate change though the use of renewables, the government needs to sustain and improve its support to the industry using the most efficient policies.[10] Despite recent improvements in cost and efficiency, solar energy would not be competitive in many areas if federal and state incentives were eliminated, a problem that becomes more evident in the current environment of low energy prices. A long period of low hydrocarbon prices could reduce the attractiveness of solar projects. Similarly, long periods of high fossil fuel prices could trigger further investments in solar energy. This negative correlation with hydrocarbons can be broken once solar becomes fully competitive with natural gas and coal. However, further government stimulus might be needed and this depends to a large extent on the political landscape. Fighting the negative effects of climate change appears to be gaining consensus on both sides of the aisle; however, Republicans may be less inclined to support renewables through fiscal policy. In addition, the development of solar energy also depends on how effectively policymakers support the correct pricing of CO2 emissions. This is not easy as uncertainty on the magnitude of environmental damages is high. However, pricing CO2 emissions correctly is important in order to level the playing field for solar and other renewables.

Finally, international efforts to curb CO2 emissions may create more opportunities for the solar industry. The 2015 United Nations Conference on Climate Change to be held in Paris will try to commit its members to intensify efforts to reduce CO2 emissions. The final results could trigger more investments in renewables; however, this is also uncertain. For instance, China's economic deceleration could alter the country's initial intentions to cut emissions despite diplomatic efforts from the White House and its European allies.

Financing Solar

Federal entities, such as the Department of Agriculture, Fannie Mae, Freddie Mac, the Department of Energy and the Small Business Administration provide financing alternatives for solar-thermal, photovoltaic systems and energy-efficiency measures. Private lenders, including solar energy firms, also provide funding through energy efficiency mortgages, home improvement loans and equipment financing/leasing. For large-scale projects, financial structures like Yieldcos are currently in vogue. Yieldcos are for the most part public companies that focus on dividend growth. A typical Yieldco is created by a parent company that manages a portfolio of renewables and/or conventional projects that generate a foreseeable cash flow. The cash available for distribution is paid to shareholders on a quarterly basis. Yieldcos have become a more attractive alternative to finance renewable projects than equity finance as they allow investors to avoid double taxation.

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[10] MIT (2015), "The Future of Solar Energy An Interdisciplinary MIT Study." Energy Initiative Massachusetts Institute of Technology. May 2015. Available at: https://mitei.mit.edu/futureofsolar

Solar Energy and Banks

As the impact of climate change becomes more evident, support for renewable energies is likely to continue. The BBVA footprint includes countries where solar energy has good prospects such as the United States, Spain, Mexico and Chile. From a corporate banking perspective, financing solar energy projects and suppliers could help to diversify and expand banks' loan portfolios and develop broader energy finance strategies that incorporate renewable and conventional projects. These strategies could also be extended to include public finance where local and state authorities are engaged in promoting solar energy. From a retail banking perspective, we expect climate change to increasingly influence consumers' preferences. This would imply stronger demand for electric cars, energy-efficient appliances and renewable electricity. Products such as energy efficiency mortgages, energy improvement home loans, electric car loans or special rewards for environmentally friendly purchases on credit cards are possible options to increase and differentiate banks' pool of products.