

SOLAR SECTOR UPDATE

The MAC Global Solar Energy Index (SUNIDX) is licensed as the tracking index for the Guggenheim Solar ETF* (NYSE ARCA: TAN)

Note: Index performance does not reflect transaction costs, fees or expenses of TAN

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MAC Global Solar Energy Index (SUNIDX)



SOLAR INDEX PERFORMANCE

The MAC Solar Index, the tracking index for the Guggenheim Solar ETF (NYSE ARCA: TAN), has rallied sharply since May and is up +30.0% year-to-date.

Recent bullish factors for solar stocks include (1) continued strong overall world demand for solar with particular new strength coming from India, Latin America, the Middle East, and Southeast Asia (see page 4 for the world solar growth outlook), (2) stronger demand for solar power due to the increasingly competitive price of solar versus alternatives as countries seek to meet their carbon-reduction targets under the Paris COP21 global climate agreement, and (3) continued low valuation levels that indicate that solar stocks are conservatively priced even after the recent rally.

Bearish factors for solar stocks include (1) continued downward pressure on solar pricing and panel oversupply caused largely by a hangover from the solar install spikes seen in China and the U.S. in 2016, (2) uncertainty about U.S. clean energy policy and global climate change initiatives due to the new Trump administration, (3) uncertainty for the U.S. residential solar market amidst a shift to purchase/loans from leases and cutbacks in net metering in some

states, and (4) ongoing solar trade disputes that have resulted in tariffs and various market dislocations.

Solar stocks are still trading at low valuation levels compared with the broad market even after the recent rally in solar stocks. The median forward P/E of companies in the MAC Solar Index is currently 15.3, which is well below the forward P/E of 19.0 for the S&P 500 index. In addition, the median price-to-book ratio of 1.18 for the companies in the MAC Solar Index is well below the 3.15 ratio for the S&P 500 and the median price-to-sales ratio of 1.63 for the MAC Solar Index is well below the 2.11 ratio for the S&P 500.

Solar stocks see a sharp recovery rally

Solar stocks have rallied sharply since May on signs of improved solar industry fundamentals and reduced concerns about Trump administration policies. The oversupply of panels that plagued the market over the last two years has eased and company profit fundamentals are improving. In addition, the market was encouraged to learn that Chinese solar demand remains very strong with 24 GW of solar installed in the first half, indicating that China should be able to easily exceed forecasts for full-year installs of 30 GW.

Solar stocks have also been boosted by the stabilization of solar cell and panel prices, which has helped company profit results. Part of the reason for the recovery in U.S. solar panel prices, however, is stockpiling and strong demand ahead of a decision later this year on Suniva's trade complaint, which could result in import curbs or duties (see discussion on page 3).

Regarding U.S. politics, the solar market has already absorbed the negative moves that President Trump took earlier this year, which included exiting the Paris climate agreement and moving to rescind the EPA's Clean Power Plan. There was relief, however, that the Trump administration did not go so far as to pull the U.S. out of the entire UN climate treaty nor did the administration try to rescind the EPA's legal obligation to regulate CO2 emissions. The solar market has also been relieved that the Trump administration has not mentioned any desire to curb or repeal the solar investment tax credit that lasts through 2021.

Indeed, there was an indication that President Trump may be favorably disposed to solar in general since he has now suggested on several occasions that his Mexico border wall should include solar panels to help defray the wall's cost.

World (ex-U.S.) continues with Paris agreement

President Trump on June 1 announced that the U.S. will leave the COP21 Paris climate agreement. That exit process will not be completed until the end of President Trump's term since the Paris agreement is binding for the next three years and then requires a 1-year notice to withdraw. The earliest date for an exit is November 4, 2020, one day after the next presidential election. At any time during that 4-year period, the U.S. could drop the exit process and recommit to the Paris agreement if Mr. Trump should have a change of heart. A Post-ABC poll taken in early June showed that nearly 6 in 10 American citizens opposed Mr. Trump's exit from the climate agreement.

There was some good news, however, in that President Trump did not take the more drastic action of withdrawing altogether from United Nations Framework Convention on Climate Change. That treaty established the overall UN climate negotiation process and was unanimously adopted by the Senate in 1992 and signed into law by President H.W. Bush. The U.S. can withdraw from that treaty on one year's notice. The U.S. therefore remains within the structure of UN climate negotiations even if it plans to relinquish its Paris commitments.

The White House on August 4 sent a formal notification letter to the UN of its intent to withdraw from the COP21 Paris climate agreement. However, the statement left open the option for the U.S. to "re-engage" on the accord at some point in the future if the U.S. can negotiate more favorable terms. The statement also said that the U.S. will continue to participate in UN climate discussions aimed at fleshing out the details of the Paris agreement in order to "protect U.S. interests and ensure all future policy options remain open to the administration."

Under the Paris COP21 agreement, the U.S. agreed to meet a voluntary goal of reducing carbon emissions by 17% by 2020, by 26-28% by 2025, and an intent to reduce emissions by 80% by 2050. There are 195 nations that agreed to the Paris climate agreement in the culmination of decades of climate negotiations. President Trump joined Syria and Nicaragua as the only nations in the world that are not part of the Paris agreement, and Nicaragua didn't join the Paris agreement because of its view that the agreement is not tough enough.

The question now is whether the rest of the world will uphold their respective carbon emission reduction targets even though the U.S. has rejected its targets. German Chancellor Merkel, French President Macron, and Chinese President Xi Jinping all recommitted to the Paris agreement after Mr. Trump's exit announcement.

Ms. Merkel said, "Since the withdrawal of the U.S. [from the Paris climate accord], we're more determined than ever that this be a

success. We can't wait for the last man on Earth to be convinced by the scientific evidence for climate change." The world's strategy is to proceed with emission reduction as best as possible without the U.S. and hope that the next U.S. president will bring the U.S. back into the climate fold.

There appears to be no chance that the Paris agreement will be renegotiated, as Mr. Trump has suggested. First, there is no real point in renegotiating the agreement since individual nation targets are voluntary. Nations can already change their targets if they wish and there is no penalty if nations do not meet their targets. Second, European leaders have already made clear that renegotiation is out of the question and that the Paris climate agreement is "irreversible."

Mr. Trump's exit from the Paris climate agreement is clearly a major setback for the global effort to address climate change. Most climate experts believe the Paris agreement was not tough enough in the first place to meet its goal of limiting global warming to two degrees Celsius (3.6 degrees Fahrenheit) from pre-industrial levels. Without the U.S. in the agreement, meeting that 2-degree goal is even less likely. Global warming is now likely to become an even bigger problem that will likely result in panicky reaction down the road as the world realizes it must dramatically slash carbon emissions in order to avoid the worst effects of climate change.

Global warming of 2 degrees might seem minor, but the earth's environment is very sensitive to changes in temperature. The last time the earth was 4 degrees warmer, the oceans were hundreds of feet higher, according to Peter Brannen in "The Ends of the World." When the earth was 5 degrees warmer 252 million years ago due to greenhouse gas warming from the release of methane from the Arctic, 97% of all life on Earth was extinguished.

Climate change warnings abound

Just six weeks after President Trump announced the exit from the Paris agreement, an iceberg the size of Delaware broke off from the Antarctica Larsen C ice shelf, one of the largest icebergs ever recorded. There isn't enough data to scientifically conclude that the iceberg broke off directly because of global warming. In addition, the breakup of the Larsen C ice shelf will not raise sea levels because a floating ice shelf is already submerged in the water. However, the breakup of ice shelves can in fact raise ocean levels by allowing glaciers behind the ice shelves to speed up their descent into the ocean.

The breakup of the Larsen C ice shelf could be a sign of a bigger breakup of Western Antarctica, according to the "[The Doomsday Glacier](#)" by Jeff Goodell. Ohio State glaciologist John Mercer back in 1978 wrote a paper entitled "West Antarctic Ice Sheet and the CO2 Greenhouse Effect: A Threat of Disaster." He postulated that the western Antarctic ice shelves were much less stable than anyone realized due to melting from underneath and that deglaciation of the West Antarctica would cause a 16-foot rise in sea levels. He said that the breakup of the Larsen ice shelves, which is occurring now, would be the first sign of impending disaster.

More generally on the topic of climate change, an article entitled "[The Uninhabitable Earth](#)" by David Wallace-Wells went viral in July as the most dramatic warning yet of climate change. In an alarmist tone, the author lays out a series of events that could happen on earth absent aggressive action to curb carbon emissions.

In his introduction, the author says, "It is, I promise, worse than you think. If your anxiety about global warming is dominated by fears of sea-level rise, you are barely scratching the surface of what terrors are possible, even within the lifetime of a teenager today. And yet the swelling seas -- and the cities that will drown -- have so dominated the picture of global warming, and so overwhelmed our capacity for climate panic, that they have occluded our perception of other threats, many much closer at hand. Rising oceans are bad, in fact very bad; but fleeing the coastline will not be enough." The author goes on to define a list of climate change effects that could include heat death, the end of food, climate plagues, perpetual war, permanent economic collapse, and poisoned oceans.

Trump administration shows hand on domestic clean energy policy

On the domestic front, the Trump administration has already taken its main action of moving towards rescinding the EPA's Clean Power Plan (CPP), which was designed to cut carbon emissions from the U.S. power sector. However, the good news was that the Trump administration left in place President Obama's 2009 CO2 endangerment finding, which means that the legal structure remains in place whereby the EPA is legally obligated to regulate CO2 emissions. The EPA's obligation to regulate CO2 emissions has already been litigated all the way up to the U.S. Supreme Court.

The Trump administration still hasn't mentioned any desire for Congress to repeal or curb the already-existing solar investment tax credit (ITC), which provides a 30% tax credit on solar installs. Congress in late 2015 extended the solar federal ITC for 5 years at 30% through 2019 with a step down to 26% in 2020 and 22% in 2021. The ITC in 2022 will expire entirely for direct-owned residential, but will remain at 10% indefinitely for utility PV projects, non-residential, and third-party-owned residential solar installations. The extension of the solar ITC was part of a bipartisan grand energy bargain in which the decades-old prohibition on exporting crude oil was dropped in return for extending alternative energy credits.

U.S. Energy Secretary Rick Perry created a stir in mid-April when he ordered a 60-day study of the U.S. electric grid with the purpose of analyzing whether the increase in renewable electricity

is accelerating the retirement of baseload coal and nuclear plants. Solar currently supplies about 1.6% of U.S. electricity and wind supplies about 6%.

There was concern that the Trump administration might be looking for an excuse to try to curb the amount of alternative energy on the grid. However, an early draft of the report that was leaked in mid-July concluded that the decline in baseload power has been caused by low natural gas prices and the flattening of customer peak demand, not by rising amounts of alternative energy on the grid. The final report has yet to be released, however, and it is possible that the report's conclusions will be revised.

Suniva case raises worries about U.S. solar trade sanctions

Suniva, a bankrupt solar manufacturing company located in the U.S. but owned by a Chinese company, filed a Section 201 trade complaint with the U.S. International Trade Commission claiming that low-cost solar panels made mainly in China severely damaged its business. The ITC is scheduled to issue a decision by September 22, 2017, about whether U.S. solar manufacturers have been "seriously injured" by solar panel imports.

If the ITC does find evidence of serious injury, it can recommend various remedies for President Trump to take such as a blanket halt to imports or large duties on solar cells and panels. That could seriously damage the U.S. solar installation sector since U.S. installers use mostly imported solar panels. The U.S. solar manufacturing industry is relatively small and can supply only about 15% of the panels installed in the U.S., according to Bloomberg New Energy Finance.

Any trade sanctions that push up the price of solar panels or restrict their access could severely damage U.S. solar installation companies. Indeed, the Solar Energy Industry Association (SEIA), with over 1000 solar installers and manufacturers as members, expressed alarm about the trade complaint and said that any trade sanctions would "cause wide-scale economic hardships on thousands of American workers and their families." SEIA said that as much as 260,000 jobs could be endangered by trade sanctions. SEIA said that bankrupt Suniva is not representative of other U.S. solar manufacturers and pointed out that no other U.S.-based solar manufacturers, except for bankrupt SolarWorld (owned by a German company), supported Suniva's trade complaint.

The U.S. solar industry is hoping that the trade complaint will be denied. Any trade sanctions that are imposed to try to protect U.S. solar manufacturers will do more harm than good because there are many more solar jobs involved with installing solar panels in the U.S. than with manufacturing solar panels.

SOLAR PV GROWTH OUTLOOK

Over the last five years, global PV annual solar installs have surged to 75.0 GW in 2016 from only 28.5 GW in 2011, producing a very strong +21% compounded annual growth rate, according to Bloomberg New Energy Finance (BNEF).

The global solar industry in 2016 showed a very strong growth rate of +34% year-on-year to 75.0 GW from 56 GW in 2015 mainly because of a surge of installations in the U.S. and China caused by developers trying to beat respective subsidy deadlines. However, those surges were temporary and the industry is expected to retrench a bit in 2017 before resuming more natural growth rates in 2018 and beyond.

For 2017, BNEF is forecasting world solar installs at 79 GW, which would represent a 5% annual growth rate. Other research firms have similar 2017 global solar forecasts with IHS forecasting +5% growth to 79 GW. However, GTM Research is more optimistic, forecasting +13% growth to 85 GW.

Regarding a longer-run solar growth rate, the International Renewable Energy Agency (IRENA) is forecasting 15% annual solar industry growth through 2030 with PV capacity up six-fold at 1,760 GW by 2030. IRENA expects solar PV to account for about 7% of worldwide electricity generation by 2030 versus only 1.2% in 2015.

The long-term demand outlook for solar remains very strong since solar will account for some 35% (3,439 GW) of all electricity capacity additions and a massive \$3.4 trillion of solar spending through 2040 (averaging about \$135 billion per year), according to BNEF. BNEF forecasts that solar PV will account for 15% of world electricity capacity by 2040, up from only about 1.2% today.

Demand for solar should continue to surge in coming years as unsubsidized solar pricing falls farther and increasingly beats other sources of electricity generation. Solar costs have already fallen by some 50% over the past several years. Looking ahead, the International Renewable Energy Agency predicts that the average solar electricity cost will plunge by another -59% by 2025, making solar the cheapest form of power generation in "an increasing number of cases."

China's 2017 solar installs expected to pull back after 2016 spike

China's solar installs in 2016 soared by 58% to 30.0 GW from 19.0 GW in 2015, according to BNEF. Solar surged in 2016 as developers scrambled to meet a June 2016 step-down in the feed-in-tariff. Most of the installs occurred the first half of 2016, leading to a glut of panels in the second half of 2016 that caused solar panel pricing to drop sharply.

Chinese solar installs in 2017 will be 29-31 GW, according to a forecast by BNEF, which would be little changed from the 2016 level of 30 GW. However, that estimate may be too low

considering that China has already installed 24 GW of solar in the first half of 2017.

China is making a push to install more solar on buildings, not just in big solar farms. In the first half of 2017, almost a third of new solar installs were distributed solar projects, i.e., solar on industrial buildings, malls and schools.

The Chinese government is trying to smooth solar growth to address recent problems such as (1) electricity oversupply in some northwestern districts that have led to some curtailment of solar electricity usage, and (2) delays by the government in making subsidy payments to developers. The Chinese government in its latest 5-year plan in fact cut its target for installed solar capacity by 2020 to 105 GW from a previous target of 150 GW as it tries to encourage a sustainable solar growth rate.

U.S. faces 2017 slowdown after 2016 utility solar surge

U.S. solar installs in 2016 soared by 90% to 13.7 GW, according to BNEF. U.S. solar has surged by a 48% compounded annual rate over the past five years.

Solar accounted for 39% of all new U.S. electricity generation capacity in 2016, up from 30% in 2015 and 27% in 2014, according to GTM Research. Solar was the largest source of new electricity generation in 2016, easily beating natural gas at 29% and wind at 26%.

The surge in 2016 solar growth was mainly due to a +148% y/y spike in utility PV, which accounted for about 72% of all U.S. solar installs in 2016. Utility PV saw a big spike in 2016 because many solar projects were hurried into 2016 to take advantage of the Investment Tax Credit (ITC) that was previously scheduled to expire at the end of 2016. Congress in December 2015 extended the ITC by 5 years, but most of the projects that were already planned moved ahead into 2016, thus causing the 2016 bulge. GTM estimates that about 4-5 GW of utility projects spilled over into 2017 from the 2016 ITC surge, which will keep utility PV strong in 2017. However, utility PV will then reset in 2018 to a more natural growth rate.

The drop in utility PV growth to more normal levels starting in 2017 is expected to cause overall U.S. solar installs in 2017 to fall by -10% to 13.2 GW, according to GTM Research. However, that is still a very strong install figure since it is +76% higher than the 2015 level. GTM is forecasting that U.S. solar installed capacity will nearly triple over the next 5 years and that annual installs will be 18 GW by 2022.

Solar is progressively becoming more diversified across the country rather than being concentrated in just a few states. A record number of 22 states in 2016 added more than 100 MW of solar PV. California saw the largest number of installs by far at 5.1

SOLAR PV GROWTH OUTLOOK (CONTINUED)

GW. Other state solar leaders in 2016 by ranking included Utah, Georgia, Nevada, North Carolina, Texas, Arizona, Massachusetts, Florida, and Colorado.

U.S. solar in the next five years will benefit from the federal investment tax credit (ITC), which stays at 30% in 2017-2019 and then steps down to 26% in 2020 and to 22% in 2021. In 2022, the ITC will expire entirely for direct-owned residential, but will remain at 10% indefinitely for utility PV projects, non-residential, and third-party-owned residential solar. Projects only need to commence construction by the end of the year in question to qualify for the ITC, as opposed to the previous requirement that the project had to be completed and grid-connected by year-end. The solar ITC extension was approved by Congress in late 2015 as part of a bipartisan energy bargain that involved trading the solar ITC extension in return for dropping the ban on exporting U.S. crude oil.

Japan is coming off its Fukushima solar boom

In Japan, solar surged after the Fukushima nuclear disaster in 2011 due to a generous government feed-in-tariff (FIT). Japan solar installs soared by +64% on an annual compounded basis in the five years through 2015. However, Japan is in the process of bringing nuclear capacity back on line and has cut its solar FIT, leading to expectations for substantially smaller Japanese solar installs over the next few years.

Japan solar installs in 2016 fell by -20% to 9.2 GW from the record high of 11.5 GW seen in 2015, according to BNEF. BNEF is forecasting that Japan solar installs will drop by -37% to 5.8 GW in 2017.

India solar boom in progress

The Indian government is pushing solar very hard as part of its goal of modernizing India's infrastructure and boosting its global business competitiveness. The government has a set goal of installing a cumulative 100 GW of solar by 2022, including 40 GW of rooftop solar. The 100 GW target would be 10 times India's cumulative installed solar capacity of about 10 GW at the end of 2016.

India's solar installs in 2016 more than doubled to 4.4 GW from the low base of 2.1 GW in 2015. India's solar installs in 2017 will roughly double again to 8.9 GW, according to BNEF. That means that India in 2017 should be able to easily take over third place from Japan as the third largest country for solar installs.

European solar growth remains weak on the move away from feed-in-tariffs

European solar growth has slowed substantially in recent years as previous booms ended when subsidies were cut. European governments are now relying more on auctions to buy solar rather than relying solely on feed-in-tariff schemes that are difficult to calibrate.

In 2016, German solar grew slightly by +1% to 1.5 GW, French solar fell by -24% to 675 MW, UK solar fell by -52% to 2.0 GW, and Italian solar grew by +37% to 407 MW.

Rest-of-world is coming on strong

In 2016, the top three countries of China, U.S., and Japan accounted for 70% of world solar installs. However, solar growth in coming years will diversify as a wide range of other countries ramp up installations.

The further geographical diversification of solar will be a very healthy development for the solar industry because it will reduce the industry's exposure to boom-bust events in various countries that have buffeted the solar industry in recent years. The diversification of growth should lead to a more stable and more predictable growth rate that allows the industry to better manage capacity additions and profit margins.

In 2016, solar installs from the "rest of world (ROW)" (countries other than China, U.S., Japan, India, and Europe), totaled 11.1 GW and accounted for about 15% of world installs. However, the ROW category over the next few years is expected to grow dramatically, becoming larger than even China with a total ROW market share of about 40% by 2019 versus only about 23% for China in the same year, according to BNEF.

Specifically, BNEF is forecasting that ROW solar will grow to 17.3 GW in 2017 (+56%), 33.7 GW in 2018 (+95%), and 36.5 GW by 2019 (+8%). Areas coming on strong include Latin America, the Middle East, and Southeast Asia.

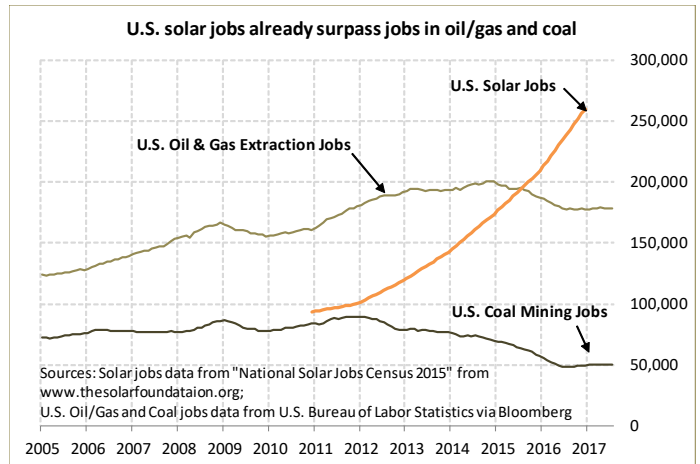
SOLAR JOBS

U.S. solar jobs have soared by an annual rate of 22% over the last four years to 260,077 jobs at the end of 2016, according to the "National Solar Jobs Census 2016" published by The Solar Foundation ([link](#)).

Solar jobs in the U.S. now exceed those in fossil fuel industries. Specifically, direct solar jobs now exceed the latest figures of 178,000 direct jobs in the oil/gas extraction industry and 50,600 direct jobs in the coal mining industry, according to figures from the U.S. Bureau of Labor Statistics.

Globally, solar is an even bigger employer with 2.8 million solar jobs worldwide in 2015, up 11% from 2014, according to the "Renewable Energy and Jobs - Annual Review 2016" from the International Renewable Energy Agency (IRENA) ([link](#)).

China is way ahead of the U.S. in solar jobs with a total of 1.7 million jobs in 2015 due to larger installation and manufacturing solar operations, according to the IRENA report. Japan also has more solar jobs than the U.S. at 377,100, according to IRENA.



SOLAR PV ANNUAL NEW INSTALLATIONS THROUGH 2016

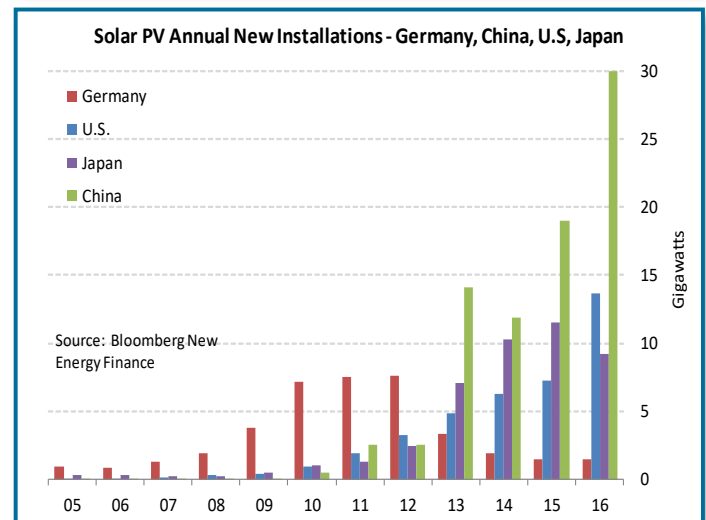
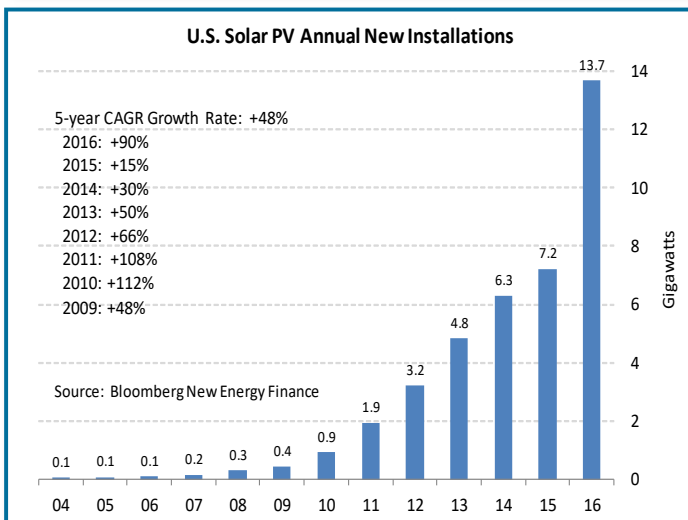
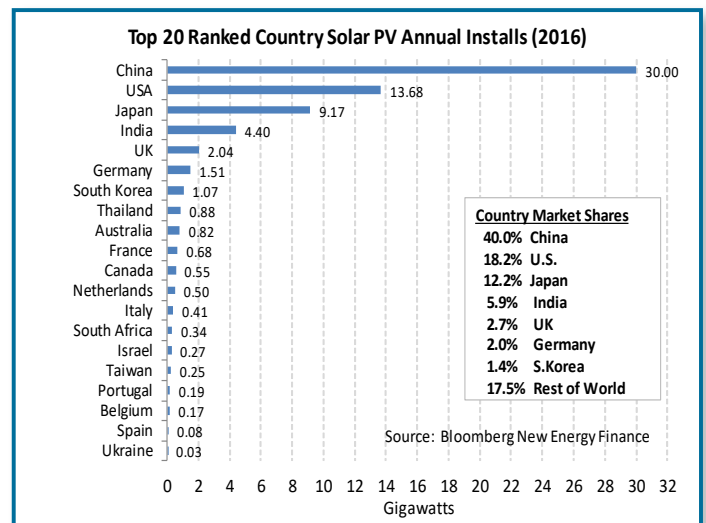
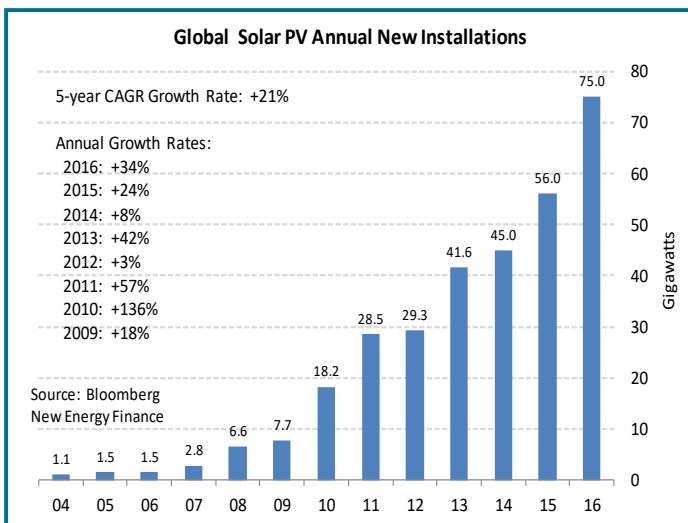
New global solar PV installations in 2016 grew by +34% y/y to a record 75.0 gigawatts (GW), according to Bloomberg New Energy Finance (BNEF). The 2016 growth rate of +34% followed growth rates of +24% in 2015, +8% in 2014 and +42% in 2013. Global solar PV installations have grown at a compounded annual rate of +21% over the last 5 years and have risen by eleven-fold from 2008.

In 2016, China was the top country in the world for annual PV installs for the fourth straight year with 30.0 GW of installs, up by +58% from the 19.0 GW of installs seen in 2015. The U.S. passed up Japan to take second place for new installs in 2016 with a 90% surge to 13.7 GW. Japan fell into third place with solar installs falling by -20% to 9.2 GW. India moved ahead of the UK into fourth place with +113% growth to 4.4 GW.

The sharp increase in installs in China, the U.S. and India more than offset the declines in continental Europe where installs continued to be undercut by low subsidy support. German solar

installs in 2016 rose slightly by +1% to 1.5 GW and remained far below the 2013 peak of 7.6 GW. French installs in 2016 fell by -24% to 675 MW, far below the 2011 peak of 1.8 GW. Italian installs in 2016 rose by +37% to 407 MW but remained far below the 2011 peak of 7.9 GW. UK installs fell by -52% to 2.0 GW as the government curbed feed-in-tariffs.

U.S. solar PV installations in the past five years have surged by a compounded annual rate of +48% and are up seven-fold from the 1.9 GW level seen in 2011, according to BNEF. The states with the largest amount of new PV solar installations in 2016 were California (+56% to 5.1 GW), Utah (+438% to 1,241 MW), Georgia (+313% to 1,023 MW), Nevada (+229% to 984 MW), North Carolina (-19% to 923 MW), Texas (+216% to 672 MW), Arizona (+155% to 657 MW), Massachusetts (+23% to 406 MW), Florida (+840% to 404 MW), and Colorado (+162% to 382 MW), according to GTM Research.



SOLAR PV CUMULATIVE INSTALLATIONS THROUGH 2016

The amount of cumulative PV electricity generation capacity across the world grew sharply by +30% y/y to 323 GW in 2016, according to Bloomberg New Energy Finance (BNEF). In just five years, global cumulative solar PV electricity generation capacity increased by more than four-fold from 73 GW in 2011 to 323 GW in 2016, representing a compounded annual growth rate of +35%.

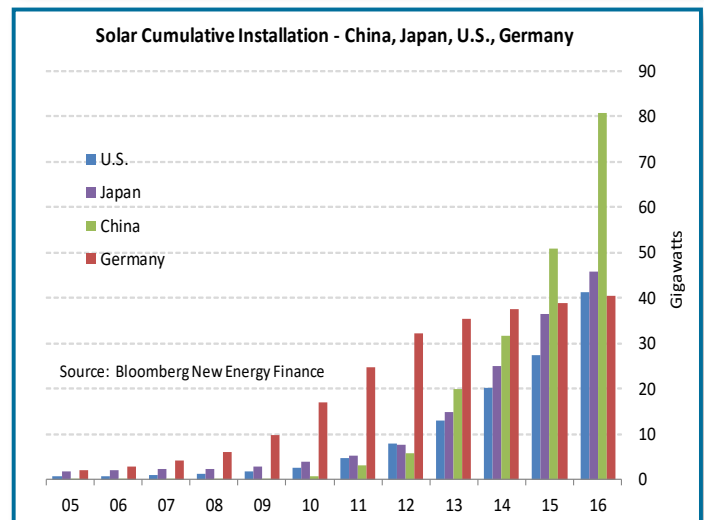
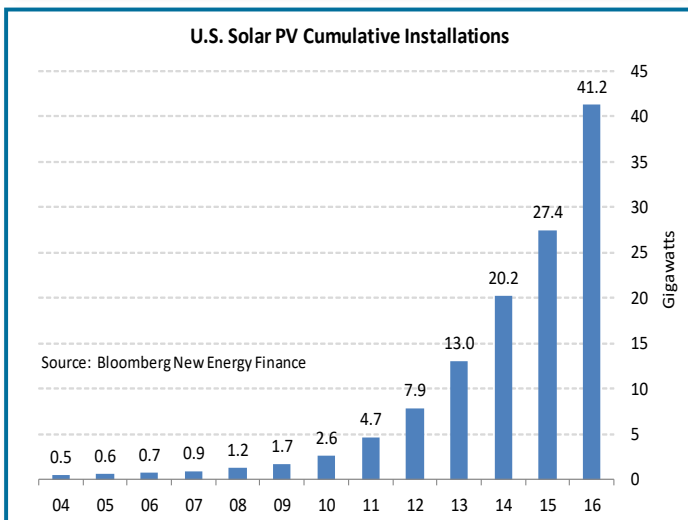
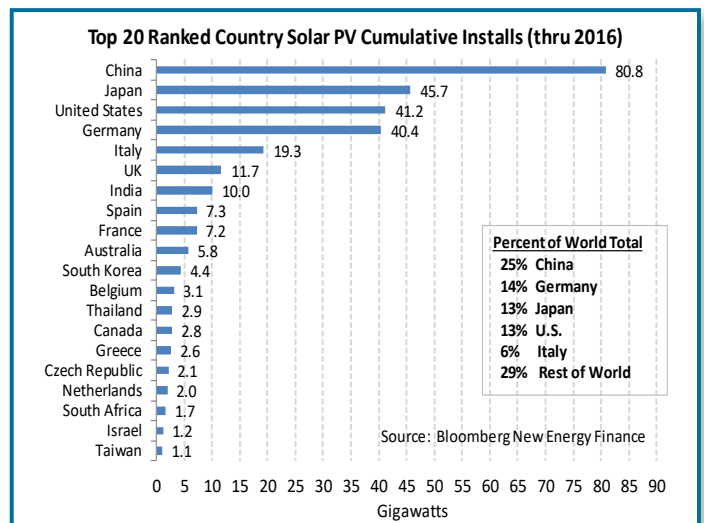
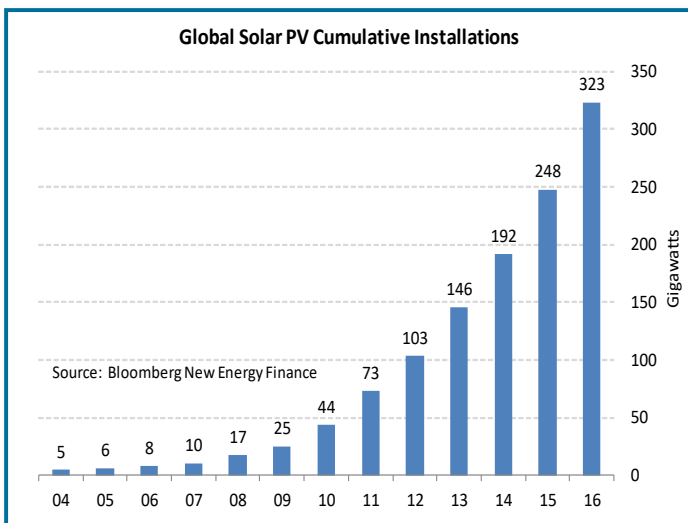
China remained in the world's top spot for cumulative solar capacity at 81 GW, according to BNEF. China at the end of 2016 accounted for 25% of the world's solar PV capacity. In the past five years, China's cumulative installed solar capacity has soared by about 25-fold from 3.2 GW in 2011 to the 2016 level of 81 GW, representing a 5-year compounded annual growth rate of 91%.

Germany in 2016 remained in second place with 40 GW of cumulative solar PV capacity, up by +4% from 2015. Germany's

cumulative solar electricity capacity in the past 5 years has risen 1.6-fold from 24.6 GW in 2011. Germany at the end of 2016 accounted for 14% of the world's total solar PV capacity.

Japan remained in third place for the third straight year. Japan's cumulative solar capacity in 2016 rose by +25% to 46 GW, representing 13% of world capacity. Japan's cumulative solar capacity in the past 5 years has risen by nearly nine-fold to 46 GW from only 5.2 GW in 2011, representing a 5-year compounded annual growth rate of 54%.

The U.S. remained in fourth place for the fourth straight year. U.S. solar capacity in 2016 rose by +50% to 41 GW, representing 13% of world capacity. U.S. cumulative solar electricity capacity over the past five years rose by nearly nine-fold to 41 GW from 4.7 GW in 2011 and showed a compounded annual growth rate of +55%.



SOLAR PRICING

Prices for solar cells and modules have started to stabilize after falling sharply over the past year. Specifically, the price of multicrystalline solar cells fell to a record low of 21 cents per watt in Sep 2016 but has since rebounded higher to 25 cents per watt, according to Bloomberg New Energy Finance (BNEF). Solar cell prices have fallen by -7% on a year-to-year basis and by a total of -69% in the past six years from the 81-cent level seen in mid-2011.

The average price of silicon solar modules has moved lower since early 2016 and is currently at a record low of 32.7 cents per watt, according to PV Insights. Solar module prices have fallen by -33% on a year-to-year basis and by -74% in the past 6 years from the \$1.25 level seen in mid-2011.

Spot polysilicon prices fell to a new record low of \$12.76 per kg in mid-Oct 2016, but have since rebounded mildly higher to the current level of \$14.50, according to BNEF. Polysilicon prices are

down by -7% year-on-year and have plunged by -72% in the past 6 years from the \$51.37 level seen in mid-2011. The decline in polysilicon prices is a key factor in allowing solar cell and solar panel prices to decline since polysilicon is the key raw material for most solar cells.

The price of thin-film modules made by First Solar and others has fallen to a record low of 34.5 cents per watt, according to PV Insights. Thin-film module prices have fallen by -33% on a year-to-year basis and by -64% from the mid-2011 level of 95.5 cents.

Solar prices have fallen sharply over the past 1-1/2 years mainly because of panel oversupply after the solar install spikes seen in China and the U.S. in 2016 caused by developers trying to beat respective subsidy reduction deadlines. Solar pricing is also moving lower in line with its natural long-term downward trend that is the result of lower production costs stemming from technology advances and from scale manufacturing.

