

## 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), rallied in mid-December but then showed a sharp decline in early January and is currently down -22% year-to-date in 2016. The MAC index in 2015 closed -15% lower after the -2% decline seen in 2014 and the +127% gain seen in 2013.

Solar stocks fell in early January due to (1) the renewed sell-off in the Chinese stock market and the downward correction in the U.S. stock market, which resulted in a "risk off" trading environment, (2) concern that slower economic growth in China may translate into reduced solar power growth in China, (3) weakness in crude oil and natural gas prices, and (4) continued solar trade disputes.

January's sell-off in solar stocks was mainly due to factors external to the solar sector since the solar industry itself is performing very well with strong demand and improving margins. Global solar demand continues to be very strong with both increasing unit sales and decreasing costs due to technology advances and economies of scale. Global solar growth in 2015 is estimated at +36% y/y by GTM Research, with about 37% growth in China and 29% growth in the U.S. Meanwhile the long-term demand outlook

for solar remains very strong since solar will account for 35% (3.439 GW) of all electricity capacity additions and a massive \$3.7 trillion of solar spending through 2040, according to Bloomberg New Energy Finance (BNEF). BNEF also expects all-in project costs for solar to plunge by another 48% by 2040, thus making solar a cheap electricity capacity source and beating most other sources of electricity generation.

The solar sector received very positive news in December that included (1) the surprise 5-year extension of the U.S. investment tax credit (ITC) and the elimination of the so-called "ITC cliff" at the end of 2016, (2) the Paris COP21 global climate agreement, which provides a long-term framework for the world to reduce carbon emissions, and (3) a favorable new net metering program in California.

Solar stocks are currently trading at bargain-basement prices compared with the broad market. The median trailing P/E of companies in the MAC Solar Index is currently 8.5, which is far below the P/E of 16.8 for the S&P 500 index. The median price-to-book ratio of 1.03 for the MAC Solar Index is well below the 2.53 ratio for the S&P 500. The median price-to-sales ratio of 0.77 for the MAC Solar Index is well below the 1.66 ratio for the S&P 500.

### December's Paris climate agreement provides a long-term framework for carbon reduction with the need for \$13.5 trillion of investment

An historic global climate agreement to reduce carbon emissions was reached in December among 195 countries at the UN COP21 conference in Paris. The agreement will require massive spending of \$13.5 trillion through 2030 to meet the carbon reduction targets, according to the International Energy Agency. This will involve the annual expenditure of \$840 billion on various low-carbon solutions such as solar, wind, nuclear, carbon capture/storage, and energy efficiency.

The Paris climate agreement was criticized by some because the carbon reduction targets were not binding. The targets had to be voluntary because binding targets would not get through the U.S. Congress and would pose ratification problems in other countries as well.

Nevertheless, the agreement provides a permanent framework by which the world can now measure its intended progress towards reducing carbon emissions. The agreement also puts strong peer pressure on all nations to meet their stated goals. Moreover, the monitoring and reporting requirements in the agreement are actually binding, which means the world will at least be able to agree on which countries are, or are not, reducing carbon emissions in line with their stated targets. The agreement in short provides a critical monitoring and transparency framework for reducing carbon emissions.

Prior to December's Paris agreement, there effectively was no global climate agreement in place. The old 1997 Kyoto Protocol agreement was limited mainly to Europe, was never ratified by the U.S. Congress, and didn't apply to developing nations. The last major climate conference in Copenhagen in 2009 failed to produce a global climate agreement due in part to foot-dragging by the developing world.

The Paris climate agreement will come into force after it is ratified by at least 55 countries representing at least 55% of global emissions. The Obama administration can sign off on the agreement without the approval of Congress because the climate agreement is specifically structured so that it is not a treaty under U.S. law, meaning there is no way that the U.S. Congress at this point can block U.S. participation in the agreement. President Obama plans to meet the U.S. targets for carbon reduction by promoting renewable energy, boosting vehicle efficiency, and implementing the Clean Power Plan to reduce emissions from the all-important utility industry.

Under the Paris climate agreement, there will be a review every five years starting in 2018 to determine whether the pledges are strong enough to meet the climate change goals. Moreover, countries will be required every five years starting in 2020 to update their pledges and prepare tougher pledges if necessary. The targets of the Paris climate agreement do not take effect until 2020. In the meantime, countries will complete any required national ratification processes and will discuss a variety of implementation rules.

As part of the Paris agreement, the U.S. pledged to reduce emissions by 26-28% by 2025 from 2005 levels, The European Union pledged a 40% cut in greenhouse gases by 2030 from 1990. China pledged to cut carbon emissions per unit of economic output by 60-65% by 2030 from 2005 and increase the share of energy from renewables and nuclear to 20% by 2030. India set a goal of cutting carbon emissions per unit of economic output by 33-35% by 2030 from 2005 and to get 40% of its electricity capacity from non-fossil fuels by 2030. Russia committed to a 25-30% reduction in greenhouse gas emissions by 2030 from 1990.

While some members of the U.S. Congress objected to U.S. participation in the Paris climate agreement, the fact remains that the U.S. public generally supports efforts to reduce carbon emissions. In fact, two-thirds of Americans support the idea of the U.S. joining a binding international agreement to curb the growth of carbon emissions, according to the latest NY Times/CBS News

poll. Moreover, Republican voters are increasingly convinced that global warming is real, which means that climate change is gaining more grass-roots political support. A Yale poll found that 74% of self-identified Republicans now believe that climate change is real, up sharply from only 52% in 2013. Unfortunately, some representatives in Congress continue to lag behind the public on climate change issues.

## Paris climate agreement will not meet its goal of capping global warming and will likely require sharper carbon cuts down the road

While the Paris agreement was certainly a step in the right direction, researchers generally believe that the targets in the agreement will not be enough to stop global warming.

The Paris agreement seeks to cap global warming at 2 degrees Celsius (3.6 degrees Fahrenheit) from pre-industrial levels and calls on the parties to implement further carbon cuts to limit warming to 1.5 degrees Celsius. However, Climate Action Tracker is forecasting a 2.7 degree (Celsius) increase in global warming even if the pledges are met. Another group, Climate Interaction, is forecasting an even larger 3.5 degree (Celsius) increase in global temperatures.

As an indication of the scale of the global warming problem, NASA and the National Oceanic and Atmospheric Administration in January announced that 2015 was the earth's hottest year since record-keeping began in 1880. NASA said that 2015 was 1.8 degrees Fahrenheit warmer than the late 19th century. In a separate analysis, NOAA said that 2015 was 1.62 degrees Fahrenheit warmer than the 20th century average.

The Paris climate agreement allows for carbon reduction targets to be "ratcheted up" in the future if global warming is not halted. However, the longer the world waits to cut carbon emissions, the sharper the cuts will need to be down the road. Moreover, there is the issue of whether it may soon become too late to stop global warming due to feedback loops such as increased methane emissions from thawing Arctic permafrost, the release of methane-trapped-ice, reduced sunlight reflection as polar and glacial ice melts, and the reduced ability of the oceans to absorb carbon dioxide as they become more acidified by CO<sub>2</sub> absorption.

## Paris climate agreement means \$100 trillion of stranded fossil fuel reserves

The fossil fuel industry was clearly the big loser in the Paris climate agreement since the world committed itself to curb the use of fossil fuels and move towards low-carbon energy solutions. In order to meet the Paris climate targets, Citigroup analysts estimate that the world has to stick to a "carbon budget" and must leave in the ground one-third of the world's oil reserves, one-half of global natural gas reserves, and 80% of global coal reserves. This amounts to a massive \$100 trillion of stranded fossil fuel reserves that cannot be exploited, according to Citigroup analysts.

In addition to reserves left in the ground, the fossil fuel industry is expected to be forced to mothball a large number of extraction facilities as demand for fossil fuel ebbs. Carbon Tracker Initiative says that oil, natural gas, and coal producers are risking \$2.2 trillion on projects for which there will be no demand as countries move towards meeting the Paris COP21 climate targets.

Investors are clearly getting the message about the risks of the fossil fuel industry. A recent survey of 200 global institutional investors by Ernst & Young found that 62% of respondents expressed concern about stranded-fossil-fuel asset risk and 36% said that their funds had already divested some stock investments because of concern about stranded assets. The risks in the fossil fuel industry are clearly rising as the world shifts toward renewables and are making the renewable energy industry look less risky by comparison.

## **Gates, Zuckerberg and others found the “Breakthrough Energy Coalition” with a \$2 billion commitment for climate investment**

To kick off December’s UN COP21 conference, a group of tech leaders and philanthropists announced their commitment to a new \$2 billion fund to promote research for climate solutions. Bill Gates himself committed up to \$1 billion to the effort. There are 26 members of the group that included Microsoft Founder Bill Gates, Facebook founder Mark Zuckerberg, Amazon founder Jeff Bezos, Alibaba founder Jack Ma, Khosla Ventures founder Vinod Khosla, fund manager George Soros, HP CEO Meg Whitman, billionaire entrepreneur Richard Branson, Ratan Tata of India’s Tata heavy industry group, and Saudi Prince Alwaleed bin Talal.

Bill Gates said in a July blog post, “If we create the right environment for innovation, we can accelerate the pace of progress, develop and deploy new solutions, and eventually provide everyone with reliable, affordable energy that is carbon free. We can avoid the worst climate-change scenarios while also lifting people out of poverty, growing food more efficiently and saving lives by reducing pollution.”

Also at the beginning of the COP21 conference, 20 major countries announced their participation in a new program called “Mission Innovation” in which they agreed to double their respective clean energy R&D over five years. These investments amount to \$10 billion annually, with \$5 billion coming from the U.S., according to the New York Times. The public “Mission Innovation” and the private “Breakthrough Energy Coalition” agreed to work together in a public-private partnership to help solve energy problems.

## **5-year U.S. solar ITC extension provides huge boost for U.S. solar industry**

Congress in mid-December approved a surprise 5-year extension of the solar investment tax credit (ITC) as part of an “energy grand bargain” in which the renewable tax credit extensions were traded for dropping the 40-year ban on exporting U.S. crude oil. In reality, the extension of the solar ITC was more bipartisan than

it might appear since there were undoubtedly many Republicans in Congress who favored the extension of the solar ITC extension, even if they were not forced to say so, due to the importance of solar jobs in many states and due to the increasing acceptance among Republican voters that global warming is real.

Specifically, Congress extended the solar 30% ITC until 2019 when it will be phased down to 26% in 2020 and 22% in 2021, thereafter remaining permanently at 10%. If it were not for the extension, the solar ITC would have dropped to 10% at the end of 2016. In another big win for the solar industry, solar projects now only need to commence construction by the year-end ITC deadlines, rather than the previous rule of being completed and connected to the grid by the year-end ITC deadlines, which gives solar companies more time and certainty about using the ITC credit.

The extension of the solar ITC will keep solar electricity costs low and will help solar to better compete against other sources of new electricity generation over the next five years. In addition, the increased level of unit sales from the ITC extension should help the solar industry reduce solar costs more quickly by taking advantage of larger economies of scale and a steeper experience curve.

The 5-year solar ITC extension will attract \$40 billion in new solar investment over the next four years and will double the number of jobs in the U.S. solar industry to 420,000, according to the Solar Energy Industries Association. The SEIA also said that the ITC extension will boost total U.S. solar electricity capacity to 100 GW by 2020, which would nearly match U.S. nuclear capacity and would be 25 GW higher than if the ITC had not been extended.

The ITC extension also means that power purchase agreements (PPAs) for utility-scale solar will now be regularly signed for 4 cents/kWh and below, according to GTM’s vice president of research Shayle Kann.

The 5-year ITC extension to 2021 also provides a favorable runway for the solar industry leading up to the EPA’s Clean Power Plan (CPP), which does not come into full effect until 2022. The Clean Power Plan will push utilities to get more of their electricity generation capacity from clean technologies such as solar and wind. The EPA’s CPP targets a 32% reduction in national greenhouse gas emissions from 2005 through 2030 and a goal for the U.S. to get 28% of its power from renewable energy sources by 2030, more than double the 2014 level of 13%. As a side note, the CPP received a big boost in January when a U.S. federal court said that the requirements of the Clean Power Plan can move ahead while a suit against the plan by 27 states is being considered in the courts. Opponents to the CPP have therefore failed thus far to block the CPP.

The so-called “ITC cliff,” which would have occurred if the ITC had expired at the end of 2016, had previously given investors a reason to be cautious about the solar sector as they waited to see how much new solar installations in the U.S. would dip without the ITC. However, the 5-year ITC extension now gives the U.S.

solar industry better visibility and a much stronger longer-term demand picture. Cowen and Company in an ITC research note written in December noted that their solar research analysts were receiving calls from a much broader range of investors after the ITC was extended since the U.S. solar industry is now on much more certain ground.

## Solar industry gets big win on net metering in California but sees setbacks in Nevada and Hawaii

The U.S. solar industry received a big win when the California Public Utilities Commission in December issued a proposal for a “net metering 2.0 program” to take effect when the current program expires in 2017. The proposal preserves net metering payments made to solar households at retail rates, rather than at something below retail rates such as wholesale rates. However, there were some negatives in the proposal such as an initial interconnection fee of \$75-100 for new solar customers, imposing a 2-3 cent per kWh fee on net metering customers that is paid by other utility customers, and a move to make net metering tariff payments in the future tied to the variable “time-of-use” cost of electricity at various times during the day. A final decision is scheduled to be issued on January 28.

On the whole, the solar industry was pleased with the proposal since the California PUC preserved net metering at retail rates. The industry hopes that the California proposal will provide a regulatory model for other states. The California decision is also very important because roughly half of the residential solar installed in the U.S. is in California.

The solar industry also had a win in Wisconsin where a circuit court threw out a decision by the Wisconsin Public Service Commission to allow the “We Energies” utility to charge a monthly “grid fee” to its customers that have solar. The judge ruled that the utility was not able to show sufficient proof that the extra fee was justified.

However, the solar industry faced set-backs in Nevada and Hawaii. In Nevada, the state’s Public Utility Commission not only cut net metering payments from retail to wholesale electricity rates, but applied the new rules retroactively to existing customers, which will have a significant negative impact on the economics of existing solar systems. The ruling does not require solar customers to give back higher net metering fees that they received in the past, but the ruling is “retroactive” in the sense that existing solar customers were not grandfathered into the payments that were previously promised by the state and upon which solar customers relied when they bought their solar system. Solar customers argue that they should receive the full retail price of electricity for feeding their excess electricity into the grid because otherwise the utility is capturing a profit on that electricity that solar customers generate with their own equipment.

The PUC also allowed Nevada utilities to boost a fixed charge to all customers and reduce the per-kWh rate, meaning solar users will now have to pay a 40% higher minimum fixed charge.

There were vociferous protests against the Nevada PUC decision, particularly because it retroactively cut net metering payments. SolarCity responded by announcing that it was pulling out of Nevada and would relocate 550 jobs out of the state. SunRun, another major residential installer, announced that it was pulling out of Nevada as well. Sunrun also sued Nevada’s governor in attempt to get the governor to comply with a previous public records request that called for the release of all communications between the governor’s staff and employees and lobbyists for Nevada monopoly utility NV Energy. SunRun is looking for evidence about whether the governor and his advisors coordinated net metering policy with NV Energy in order to slow down solar adoption and protect the utility’s profits. A class action lawsuit by existing solar customers was also filed against NV Energy over the PUC decision. In response to the backlash, the Nevada PUC said it will reconsider its decision not to grandfather existing customers.

Meanwhile, Hawaii cut net metering rates from retail electricity prices to fixed prices of 15-28 cents/kWh depending on which island the customer is on. If a solar customer is not providing electricity to the grid and is not in a net metering program, then the solar customer will have a minimum monthly bill from the utility of \$25 for residential customers and \$50 for small business customers. The Hawaii decision avoided significant backlash from the solar industry since the decision did not apply retroactively to existing customers and since the net metering rates remained high. Regardless of the revision of its net metering program, Hawaii is still heavily promoting solar as a solution to meeting its goal of going 100% renewable by 2045. Hawaii already has the highest solar adoption rate in the country with about 12% of all homes having solar.

The bottom line in the net metering battle is that solar is economical regardless of lower net metering rates, just with longer payback periods. There will be a long battle between the solar industry and the utility industry as the utility industry tries to slow solar adoption and preserve its profit models by eliminating net metering and imposing fixed charges on solar. But the reality is that the utility industry is fighting a losing battle over the long run as electricity customers gain the power to generate their own electricity at progressively lower costs and thus sidestep the monopoly utility industry.

## American solar jobs now exceed oil/gas jobs

There are now 209,000 people who work in the U.S. solar industry, according to the non-profit Solar Foundation, with 20% growth in solar jobs in the year through Nov 2015. The number of solar jobs is now more than the 185,000 people working in the U.S. oil and gas industry, representing a dramatic shift in energy technology jobs and potentially political clout. Moreover, the U.S. solar industry is just getting started and could add more than 1 million jobs by 2030 and nearly 2 million jobs by 2050, according to a report by NextGen Climate America.

## SOLAR PRICING

Prices for solar cells and modules since mid-2014 have been moving sideways to mildly lower. Specifically, the price of multicrystalline solar cells fell to a new record low of 30 cents per watt in May 2014 but then rose mildly to the current level of 34 cents by January 2016, according to Bloomberg New Energy Finance. Solar cell prices in the past 4-1/2 years have plunged by a total of -58% from the 81-cent level seen in mid-2011.

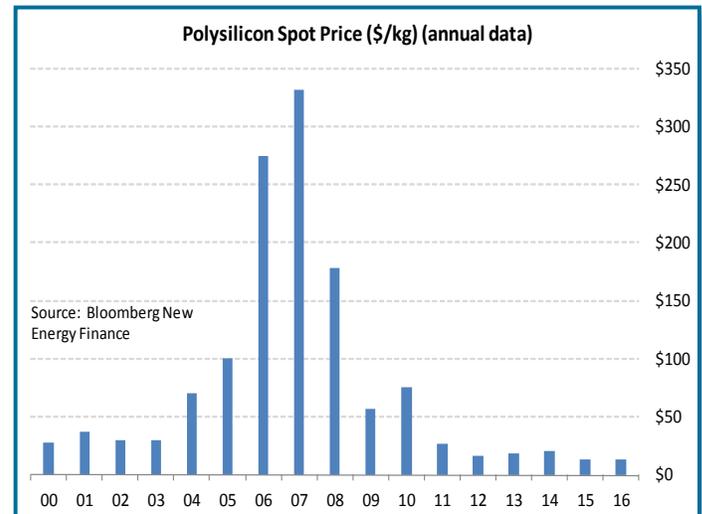
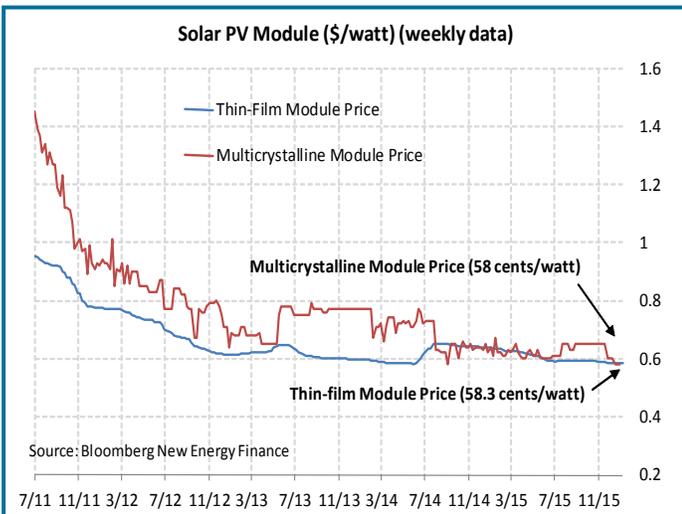
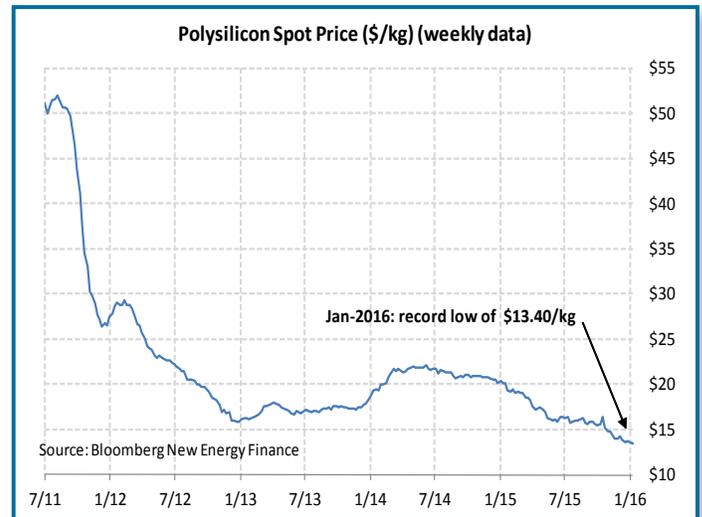
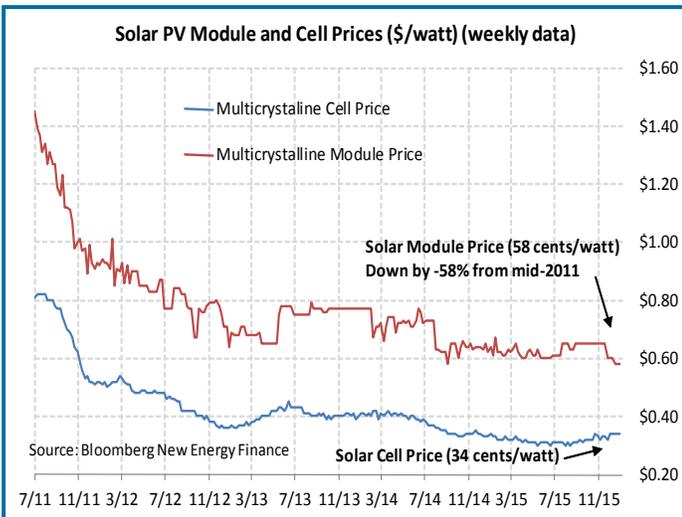
Meanwhile, the price of multicrystalline solar modules in early January 2016 fell to match the record low of 58 cents per watt originally posted in September 2014, according to data from Bloomberg New Energy Finance. Solar module prices in the past 4-1/2 years have plunged by a total of -60% from the \$1.45 level seen in mid-2011.

Spot polysilicon prices fell fairly sharply in late 2015 and posted a record low of \$13.40 per kilogram in early January 2016, according to data from Bloomberg New Energy Finance. Polysilicon prices in the past 4-1/2 years have plunged by a total of -74% 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.

The price of thin-film modules made by First Solar and others posted a record low of 58.2 cents in early June 2014 and then recovered modestly, according to Bloomberg New Energy Finance. However, thin-film module prices starting in late 2015 edged lower to the current level of 59.3 cents per watt, which is just slightly above the record low of 59.2 cents per watt.

Solar prices fell sharply in 2011-12 as new Chinese solar firms flooded the market. However, solar prices then stabilized in 2013-14 due to strong demand and tighter supplies after the 2011-12 shakeout forced the smaller and higher-cost producers out of the market. The large players are now calibrating their production more closely to demand. Various trade spats have also provided some support for solar module prices due to solar tariffs and minimum pricing schemes.



## SOLAR PV ANNUAL NEW INSTALLATIONS

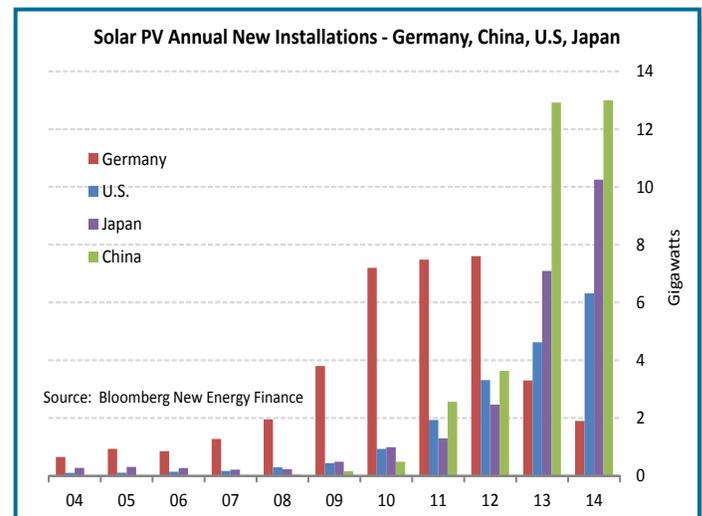
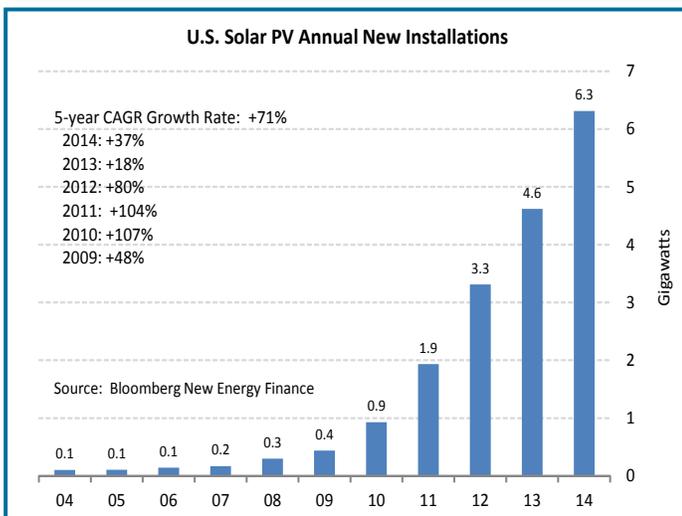
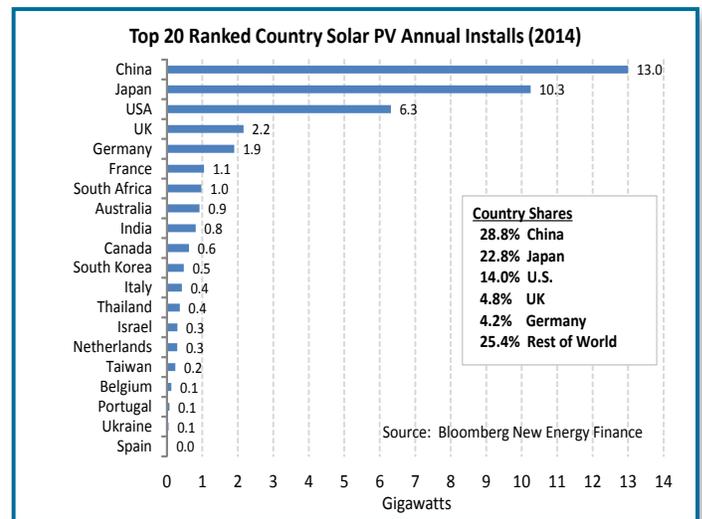
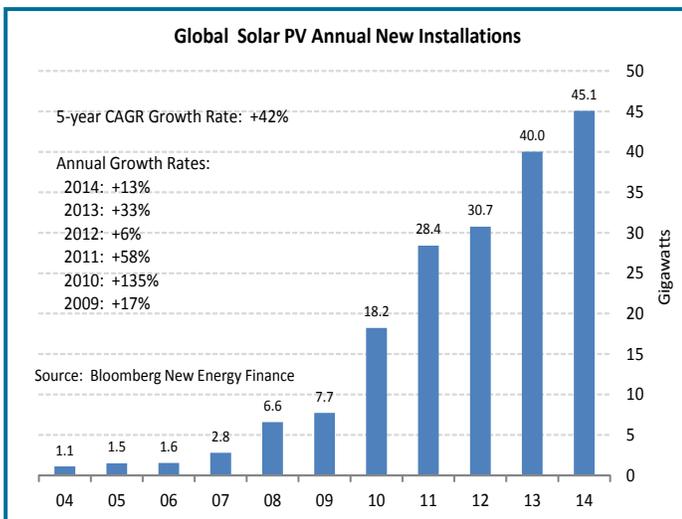
Global new solar PV installations in 2014 grew by +13% y/y to a record 45.1 gigawatts (GW), according to Bloomberg New Energy Finance. The 2014 growth rate of +13% followed growth rates of +30% in 2013 and +8% in 2012. Global solar PV installations have grown at a compounded annual rate of +42% over the last 5 years and have risen by six-fold from 2008.

China in 2014 remained in the number one world spot for annual PV installs for the second straight year with 13.0 GW of installs in 2014, up by +1% from its 2013 level of 12.9 GW. Japan remained in second place for the second straight year with 10.5 GW of new installs in 2014, up by +45% from 7.1 GW in 2013. The U.S. stood third in new installs for the second straight year at 6.3 GW, up by +37% y/y. The UK moved into fourth place for new installs in 2014.

The sharp increase in installs in China, Japan and the U.S. more than offset the declines in Europe, which were caused by reduced subsidy support. German installs in 2014 fell by -43% to 1.9 GW,

adding to the -57% decline seen in 2013 from the peak of 7.6 GW seen in 2012. Italian installs in 2014 fell by -69% to 424 MW, adding to the overall plunge of -95% seen in 2012-13 from the peak of 7.9 GW posted in 2011. French installs in 2014 rose by +62% to 1.0 GW, but that was still below the peak of 1.8 GW posted in 2011. UK installs in 2014 rose by +99% to a record 2.2 GW, adding to the +37% growth rate seen in 2013.

U.S. solar PV installations in 2014 grew by +37% to a record high of 6.3 GW from 4.6 GW in 2013, according to Bloomberg New Energy Finance. U.S. PV installations over the last 5 years have grown by a compounded annual growth rate of +71%. GTM Research is forecasting that U.S. PV installs will grow by +29% in 2015 to 8.1 GW. The states with the largest amount of new PV solar installations in 2014 were California (+35% to 3,549 GW), North Carolina (+19% to 397 MW), Nevada (+621% to 339 MW), Massachusetts (+28% to 308 MW), Arizona (-41% to 247 MW), New Jersey (+2% to 240 MW), according to the GTM Research.



## SOLAR PV CUMULATIVE INSTALLATIONS

In 2014, the amount of cumulative PV electricity generation capacity across the world grew sharply by +32% y/y to 191.2 gigawatts (GW), according to Bloomberg New Energy Finance. In just five years, global cumulative solar PV electricity generation capacity has increased by nearly eight-fold from 24.8 GW in 2009 to 191.2 GW in 2014, representing a compounded annual growth rate of +34%.

Despite the sharp drop in new installs in the past two years, Germany at the end of 2014 still had the world's largest amount of cumulative installed solar electricity generation capacity at 37.4 GW, according to Bloomberg New Energy Finance. Germany's cumulative solar electricity capacity in the past 5 years has risen by four-fold from 9.9 GW in 2009 to 37.4 GW in 2014.

China remained in second place in 2014 with 32.9 GW of installed PV, representing 17.2% of installed global PV capacity. China's

cumulative solar electricity capacity in the past 5 years has risen by 110-fold from 300 MW in 2009 to 32.9 GW in 2014. China in 2015 will easily move ahead of Germany into first place for cumulative solar PV capacity.

Japan moved into third place in 2014 from fourth place in 2013. Japan's cumulative solar capacity in 2014 rose by +69% to 25.0 GW, representing 13.1% of world capacity. Italy fell to fifth place in 2014 from third place in 2013 with cumulative capacity in 2014 of 18.3 GW, representing 9.6% of world capacity.

The U.S. moved up to fourth place in 2014 in world PV cumulative capacity from fifth place in 2013. U.S. solar capacity in 2014 rose by 57% to 20.2 GW, representing 10.6% of world capacity. U.S. cumulative solar electricity capacity over the past five years rose by 12-fold from 1.7 GW in 2009 to 20.2 GW in 2014 and showed an annual compounded growth rate of +51%.

