

July 28, 2014

MORGAN STANLEY BLUE PAPER



Solar Power & Energy Storage

Policy Factors vs. Improving Economics

We have developed a model that calculates solar economics around the world based on local regulatory dynamics and solar conditions. We project combined solar growth for China, Japan, the US, Europe, India, and Brazil of 39 GW per year through 2020, and global demand of 47 GW. We are bullish on US demand growth due to improving solar economics. In Europe, we highlight the German “solar slowdown.” In China, we are below industry forecasts because we believe that the Chinese government will keep solar growth to rates similar to nuclear and wind to achieve emission reduction goals. In Japan, our projected demand is below industry estimates due to our bearish view of the pending government review of solar subsidies.

Energy storage, when combined with solar power, could disrupt utilities in the US and Europe to the extent customers move to an off-grid approach. We believe Tesla’s energy storage product will be economically viable in parts of the US and Europe, and at a fraction of the cost of current storage alternatives.

Potentially advantaged: Solar power “integrators” (SUNE, SCTY, NRG), renewable Yieldcos (NYLD, NEP, ABY, and TERP), and Tesla (TSLA) as a result of its energy storage product. Facing downside risk are solar panel and polysilicon manufacturers (Wacker Chemie, First Solar, GCL Poly, Trina Solar, Yingli Green Energy, Xinyi Solar, and Jinko Solar), given our expectation of bearish demand in China and Japan. US utilities in sun-rich, and/or rate-high states (HE, PNW, PCG, EIX, SRE) may be affected by the growth in both solar power and energy storage.

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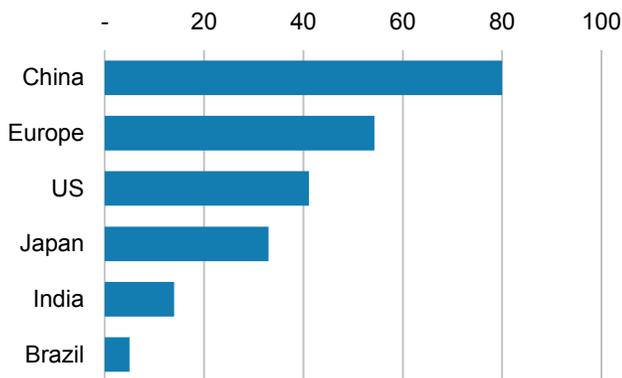
Executive Summary

We have developed a model that calculates solar economics around the world based on local regulatory dynamics and solar conditions. We believe investors can use this analytical framework to better understand solar economics in the context of local regulatory dynamics, solar installation costs, and solar operating conditions.

We project combined solar growth for China, Japan, the US, Europe, India, and Brazil of 39 GW per year through 2020, or 47 GW including Rest of World. We expect growth to be heavily driven by China, which we forecast will account for 27% of new demand globally. We are bullish on US demand growth due to improving solar economics. In Europe, we see a risk of a “solar slowdown.”

Exhibit 1

Solar Installation Forecast through 2020 (GW)



Source: Morgan Stanley Research

Our solar growth forecast is in aggregate below industry estimates, driven by a more bearish outlook on solar demand in China and Japan. While we project a 28% CAGR in solar capacity in China from 2013 to 2020, industry estimates call for a far more rapid growth rate. Our projected solar demand in China is below industry levels due to our view that the Chinese government will seek to grow solar at similar rates to nuclear and wind to minimize the cost of achieving emission reduction goals, and ineffective distributed generation policies. In Japan, we are relatively pessimistic regarding the outcome of the pending review of solar subsidies by the Japanese government. Without subsidies, solar power has a long road ahead in Japan before the technology can reach grid parity, driven by poor solar conditions in the country.

We are relatively bullish on solar demand growth in the US, driven by strong and improving rooftop solar economics and the likely continuation of favorable net metering subsidies for solar, which together more than offset a likely reduction (from 30% to 10%) of the solar Investment Tax Credit (ITC) in 2017. In the long term, we believe solar power will be economic in some US states without any form of subsidy.

In Europe, we see a mixed bag: a slowdown in additions in Germany, but with solid growth in other regions. Overall we expect European capacity additions to remain flat vs 2013, but with a different regional mix.

What sets our solar analysis apart? We believe our global analysis benefits from the close integration of local utility regulatory dynamics (subsidies, as well as explicit renewables goals set by government entities), solar operating conditions, and future trends in the local installed cost of solar. Each of these factors has a significant impact on solar demand estimates, and none of these factors is static. As solar economics continue to improve, however, there may be further reductions in government support, such as the current review of solar subsidies occurring in Japan. We also factor in physical limits, such as the availability of suitable land in India, that in the future may limit the growth of solar power. Our analysis factors in these evolving dynamics to drive our solar growth forecast.

Energy storage, specifically Tesla’s product, could be disruptive in the US and Europe, but is less likely to be economic in the rest of the world. Given the relatively high cost of the power grid, we think that customers in parts of the US and Europe may seek to avoid utility grid fees by going “off-grid” through a combination of solar power and energy storage. We believe there is not sufficient appreciation of the magnitude of energy storage cost reduction that Tesla has already achieved, nor of the further cost reduction magnitude that Tesla might be able to achieve once the company has constructed its “Gigafactory,” targeted for completion later in the decade. While “off-grid” applications are the most disruptive use of energy storage, we note that there are also less disruptive applications such as strengthening the grid to compensate for the variability of solar output.

Rooftop solar should be a major driver of growth in solar demand. While large-scale solar projects will continue to be an important source of growth for the industry in certain parts of the world, we see a global trend towards greater

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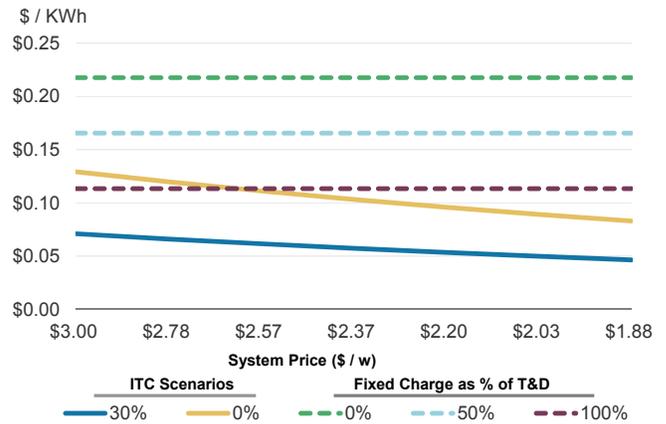
“distributed generation” in the form of rooftop solar, both on residences and on commercial buildings, driven by:

- *Significant reductions in installation costs.* As solar “integrators” such as SUNE and SCTY have become more experienced and have streamlined their installation process for rooftop solar, installation costs have fallen rapidly, improving rooftop solar economics.
- *Favorable regulatory treatment.* In Europe, the US, Brazil, and Japan, residential and commercial customers are able to avoid some portion or all of their utility bills by installing solar panels. The entire utility bill is far greater than simply the cost of generating power from the large-scale power plants that feed the power grid. As a result, solar panel project economics can often be attractive given the ability to “arbitrage” some or most of the utility bill. Under such incentives, we believe solar growth, and returns on solar investments by solar “integrators” that provide complete solar power solutions to customers, can surprise to the upside. However, in many countries/regions we may well see this favorable regulatory treatment change over time, and as a result solar power would be able to compete only against the portion of the utility bill associated with the cost of producing power from relatively efficient, large-scale conventional power plants. In sun-rich regions such as the Southwestern US and India, solar power may in the long-term become economic against large-scale conventional power plants, even without government subsidies.

The following two charts show US solar economics with and without the US Investment Tax Credit (ITC) subsidy for solar power, and applying varying “fixed grid fees” to solar customers (a 100% fixed grid fee indicates that the solar panel must compete solely against the power generation portion of the utility bill). These charts illustrate how further solar cost reductions can in some geographies offset the loss of subsidies, but in other geographies, the loss of subsidies would have a critical impact on the ability of solar power to be a competitive source of power. We expect subsidies may fall in the US, Europe, and Japan, but may remain, and even grow, in China, India, and Brazil.

Exhibit 2

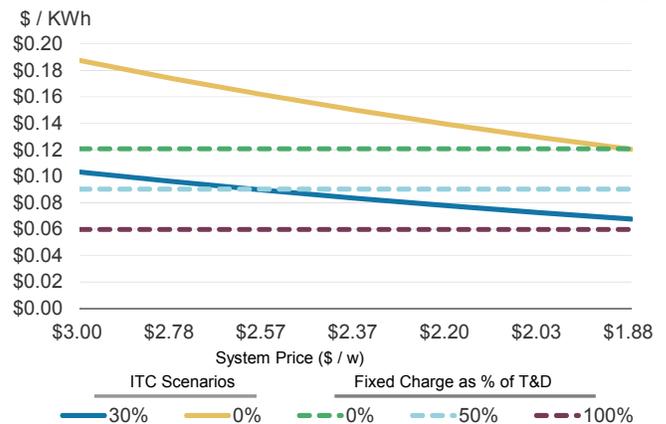
Residential Solar Will in Our View Become Competitive in California, Even without Subsidies



Source: Company Data, Morgan Stanley Research

Exhibit 3

However, in Midwestern US States Such as Illinois, the LT Outlook for Solar Is Much More Challenging



Source: Morgan Stanley Research

No significant impact to fossil fuel demand. While our solar power growth forecast shows significant volumes relative to the current installed base of solar power, the magnitude is not large enough to have a major impact on fossil fuel demand. Keep in mind that solar power is still an extremely small element of the overall global power generation asset base, and large increases off a small base will have modest overall impacts to demand for fossil fuels. For example, in the US the loss of natural gas demand from the growth in solar power in the Western US is dwarfed by the growth in gas demand from petrochemical demand and LNG export projects. In high-growth markets such as China and India, solar power is one of several tools needed to meet growing power demand; this solar growth will in our view likely not damage demand from coal and natural gas.

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Potentially Advantaged Companies, and Those Facing Downside Risk

Potentially Advantaged companies, according to our analysis:

Tesla (TSLA): From our analysis of the economics of energy storage products, we conclude that Tesla will likely have the most economic energy storage solution by a significant margin. This advantage is driven primarily by the company's very significant scale (Tesla will produce as many cells from its Gigafactory as are currently produced by all worldwide battery manufacturers combined) and integrated manufacturing efficiencies. We project the capital cost of Tesla's battery will fall from the current \$250/kWh to \$150/kWh by 2020, whereas its closest competitor will be at a cost of ~\$500/kWh. The utility sector market potential for Tesla's storage product is difficult to determine, given the number of variables that affect this market size, but based on our analysis we believe it could be above 10 GWh of storage per year, equal to at least \$2b in annual revenue to Tesla. By today's numbers, an incremental 10 GWh of storage sales at a 25% gross margin would boost TSLA's share price by \$17.

Solar power "integrators" (SunEdison, SolarCity, and NRG Energy): Given the falling cost of solar, we believe the "integrators" — companies that offer to finance, design, and install solar power solutions for customers — will create greater shareholder value than the panel manufacturers. This is the case because the integrators typically compete against a fixed utility rate in the US, Europe, Brazil and Japan. As solar costs fall and many utility rates increase with substantial grid investments around the world, returns on equity can rise significantly given the small number of companies positioned to capture meaningful share of a very large market.

In Europe, some of the utilities may pursue, successfully, an integrator business model — this could be a growth catalyst and a meaningful value driver. At present it is unclear who will develop the best and most successful European "integrator" business model. Of the larger integrated utilities, RWE seems most focused on developing a residential energy services model but many others are also focusing on this.

Renewable energy Yieldcos (NRG Yield, Abengoa Yield, NextEra Energy Partners, and TerraForm Power): We see a new investment class emerging, the renewable Yieldco, that is economically similar to Master Limited Partnerships (MLPs) but applied to renewable generation

assets. We think Yieldcos will have a cost of capital/valuation advantage over competitors, and will be able to create shareholder value by growing their renewables asset base at returns significantly in excess of a Yieldco cost of capital. Benefits of the Yieldco investment vehicle include: an appropriate focus on cash flow as the most important valuation metric (as opposed to multiples of GAAP earnings for example, given that earnings are often lower than cash flow for renewables), the ability to efficiently return capital to shareholders (often dividends are largely or entirely tax-free returns of capital), and a lower required rate of return from investors given the long-term contracted cash flow stream with creditworthy power purchasers.

SunEdison's (SUNE) recently completed Yieldco IPO, TerraForm Power (TERP), in our view should allow SUNE to capture long-term project value and monetize its asset base at a more attractive valuation, similar to what NRG is doing with its Yieldco, NRG Yield (NYLD). Both parent company and Yieldco subsidiaries can in our view create shareholder value through the parent selling assets to the Yieldco at values above the implied value of the assets reflected in the parent stock, driving significant dividend growth for the Yieldco. This approach has been pursued with great success in the MLP industry, and we believe the renewables segment is well suited to such an approach.

European utilities investing in regulated "good" capex: (SSE, RWE AG, E.ON, and Enel): Increasingly decentralized energy will emphasize the need for a reliable grid and require significant capex. Distributed power will become part of the network balancing solution. This should be a positive for regulated capex, which we view as "good" capex. The most increases in capex are likely where we see the biggest solar penetration — Germany, Italy, and the UK. In these markets SSE, RWE E.ON and Enel could benefit from higher grid capex and associated returns in the medium term.

Companies facing potential downside risks:

Solar panel manufacturers (First Solar, GCL Poly, Trina Solar, Yingli Green Energy, Xinyi Solar, and Jinko Solar), given the large amount of worldwide manufacturing capacity already on the ground (~50 GW) relative to our global estimate of 47 GW per year: Given that our solar growth forecast is bearish relative to solar industry growth estimates (some industry estimates reach 90 GW of solar demand per year by 2020), solar panel manufacturers' profitability may be impacted by the issue of over-capacity. Without larger, more rapid global

increases in solar demand, we believe margin expansion for solar panel manufacturers may be muted.

Given our view that rooftop solar will play an increasingly large role in solar demand growth, we believe silicon-based solar panels will in our view be more competitive than thin-film and concentrating solar. Silicon-based solar panels are the most appropriate technology for rooftop applications. As a result, we are cautious with respect to First Solar's thin film panel product, given the higher cost of this product relative to silicon-based panels and the inability of First Solar's thin film panels to be used economically for rooftop applications.

Polysilicon (PS) manufacturers (Wacker Chemie, GCL, OCI, and Hemlock), given that PS industry projections of solar panel installation growth are significantly more bullish than Morgan Stanley's projections for key countries such as China and Japan (PS is a key material used in the manufacture of silicon-based solar panels):. As with the solar panel industry, PS industry estimates of growth for China and Japan are significantly in excess of Morgan Stanley estimates through 2020. PS industry estimates for 2014-20 Chinese solar panel demand is ~2x-3x Morgan Stanley demand, and ~4x Morgan Stanley estimates for Japanese demand during the same period. If demand levels in these two key countries disappoint, it is likely in our view that PS prices would be disappointingly low, and manufacturing costs (due to low capacity utilization levels) disappointingly high (although those with the best quality product would likely remain fully utilized).

US and European utilities that see significant solar growth and either experience further generation headwinds, or lack sufficient regulatory protection from the loss of demand: Pinnacle West in the US; RWE, E.ON, Enel, GDF Suez, SSE in Europe:. Most US utilities in solar-heavy states, such as California and Hawaii, have a "decoupling" mechanism under which utilities are made whole from the loss of power demand due to customers self-generating power. However, as solar power grows in these states, so does the gap between the cost of power for solar customers and utility customers who receive their power from the grid.

This can result in a "tipping point" that creates ever greater incentives for customers to adopt solar, thus leaving utilities with the potential long-term issue of losing a significant portion of their customer base. As we highlighted in our report "[Batteries + Distributed Gen. May Be a Negative for Utilities](#)," given the very high cost of power in Hawaii, we

believe the solar power adoption rate could be very high, pressuring rates for non-solar utility customers, which in turn could create a sufficient incentive for customers to go fully off-grid. In Arizona, Pinnacle West has only partial insulation against loss of demand as customers self-generate power; we continue to monitor the solar penetration rate in Arizona closely. In 2014, solar applications have been rising throughout the year, although the absolute level has still not reached the point that we would expect a major impact on PNW's EPS.

In fast-growing economies such as China, Brazil, and India, solar power growth is driven by large power demand growth; as a result, solar power has a less severe "cannibalization" impact on other generation types and a smaller impact on utilities.

In Europe, the rollout of solar photovoltaic (PV) systems has had a big influence on power markets, especially in Northwest Europe (and particularly in Germany). This has been a major negative over the last few years for RWE, E.ON and GDF Suez. However, this was exacerbated by the decline in coal and CO₂ prices. The rollout of solar PV in the UK has also been faster than expected. We believe this is one reason for the slower-than-anticipated improvement in UK spark spreads, a negative for all UK generators, but especially for SSE, Centrica, RWE and E.ON.

Potentially significant negative impacts to the extent energy storage costs drop: Hawaiian Electric and California utilities Sempra Energy, Edison International, and PG&E Corp., and the generation divisions of European utilities, including Enel, SSE, E.ON, RWE, and GDF Suez. It is worth noting that due to important regulatory, market structure, and economic differences, we see limited scope for a material move of customers "off-grid" in Europe. This is different from our expectations in the US.

In Europe and parts of the US, utility bills are relatively high, which could encourage relatively greater numbers of customers to disconnect from the grid by using solar power coupled with energy storage, or in Europe to consume more self produced power but remain grid connected. Under this approach, a customer's solar panels would overproduce power during the day, and the excess power would be stored in batteries and drawn upon at night. This risk will likely materialize over many years (>5 years), and the degree of risk is subject to many variables that we discuss in this report. In Europe in particular, there are numerous issues that may hinder the ability of customers to move fully

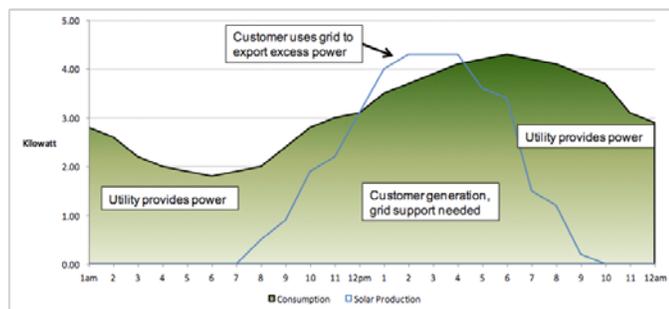
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off-grid. For example, the vast majority of customers' solar panels are not sized to allow for complete reliance on solar power – that is, such customers would still be dependent on the grid for a portion of their power. There are also regulatory impediments. Perhaps most importantly, adding sufficient storage capacity to provide full autarky is sufficiently expensive that it drives IRR's to unattractive (ie below breakeven) levels.

Exhibit 4

Solar Power Output Differs Substantially from Customers' Power Demand Profile



Source: Edison Electric Institute. The profile of power output and demand represents a typical customer in California.

Based on our analysis, for the US, we believe that Hawaii and California represent the greatest opportunity for off-grid approaches because of their significantly higher electricity rates and strong solar conditions. Given that utilities in Hawaii and California are decoupled, rates for non-solar customers will rise as more customers install solar panels; this “rate shift” accelerates the adoption rate for solar, because the delta between the utility rate for power and the cost of producing solar power increases.

Over time, to the extent regulators increase the fixed “grid fee” that solar customers must pay to remain connected to the grid (we do not believe there will be material increases in these fees in the near to medium terms), there will be a growing incentive for consumers to install energy storage

and avoid the fixed grid fees. The size of the storage market, and the corresponding negative impact to utilities, is quite sensitive to the fixed grid fee that regulators impose on solar customers. For example, moving from our US base case (50% of typical fixed grid costs imposed on solar customers) to our storage bull case (100% of typical fixed grid costs imposed on solar customers) results in a sharp increase in demand for energy storage in the US, from 70 GWh to 113 GWh.

For Europe, if storage is cheaper than we expect, and penetration is faster/bigger, the main negative implication we see for utilities would be peak shaving and the impact that this could have on the peak-baseload power price. We estimate that this would be an additional negative for all conventional generators. However, the additional impact is a function of how much more peak shaving is seen, and this is hard to quantify. Suffice to say that it would be negative for all European generators in markets where we see storage as economic, especially Germany and Italy. The stocks most negatively affected would be RWE, E.ON, GDF Suez, Enel, and SSE. Enel and SSE have the largest generation exposure by percentage of EBITDA. E.ON, RWE, Enel and GDF Suez have the biggest exposure by production (in TWh). We see the risk of stranded distribution assets as very low, as we expect few customers to move off-grid in Europe given the economic and regulatory issues.

Conversely, greater storage penetration would likely lead to faster development of a residential energy services model, and that could be a positive for utilities that successfully develop it. It is very early to identify potentially advantaged companies, though we note that RWE have been focused on this space. It is however possible that the big winners come from outside the utility space.

Analytical Approach

We have constructed a model that calculates returns associated with solar projects around the world.

Potential Approaches Customers Could Take

On the grid, but net zero grid power usage. Under this approach, a customer's solar panels produce excess power during the day (which is sold back to the grid), and at night the customer draws power from the grid. This approach could result in low or net zero usage of power produced by large-scale power plants attached to the grid.

On the grid, partial grid power usage. This approach is often taken in Europe, where solar panel systems are not sized to fully allow customers to eliminate their net usage of power from the grid, and where economics and regulation mean moving fully off-grid is very unlikely. It is thus unlikely that such customers pursue a fully off-grid approach.

Fully off the grid. In this approach, consumers fully depend on their on-site power generation, using storage and a power management system to provide power to the home when needed. Consumers could choose this approach for a number of reasons. For instance, in select markets, customers who choose to "net meter" as in the "on-grid" approach described above, have to pay a large non-bypassable, fixed grid charge; these consumers have an incentive to go fully off the grid. The key variable in this approach is the cost of power storage. Tesla's Gigafactory for battery production, which will in our view reduce the cost of batteries significantly below the cost of other storage options, may significantly affect how many consumers seek to go off the grid.

Methodology

Our model uses national system pricing and financing assumptions and statewide average irradiance and electricity rates to estimate the solar levelized cost of electricity (LCOE) versus grid-sourced electricity. Countries/regions with a combination of high irradiance and high electricity rates are at or nearing "grid parity"; those with less sunshine and/or lower electricity rates tend to be farther away. To calculate LCOE (measured in \$/kWh), we tally the present value of after-tax cash costs incurred over the lifetime of the system, then adjust for tax benefits. We then divide the result by the present value of all electricity produced over the lifetime of the system to arrive at each state's or country's LCOE.

We compare the resulting LCOE against the appropriate leverageable grid-supplied electricity cost. Next, we compare the solar LCOE against the relevant electricity rate. If the LCOE is lower than the relevant "threshold" electricity rate

(remember we have already taken into account the project owner's required equity return through LCOE), we consider the market in-the-money. We divide this addressable consumption by the same annual sunlight hours data that fed the original LCOE calculation to determine a country's solar addressable market, in megawatts (MW) of capacity.

In Europe, where the electricity produced is partially self consumed and partially sold either under a FIT or into the wholesale power market when subsidies end, we use the same model but focus on the IRR, rather than the LCOE which can be confusing given the different revenue streams for self consumption and power sold.

Solar Cost Assumptions

We assume that solar costs continue to decline, although at a lower rate than over the past 5 years. This decline rate varies significantly by country, with a slower pace in more mature solar markets (such as Germany). Whereas pricing has declined by 60% or more in key markets on a cumulative basis over the last few years, we expect pricing to decline at a lower rate (less than 40%) through 2020 in our base case. Cost declines should be driven by a combination of operational efficiencies with respect to design and installation of systems, as well as continued equipment cost declines.

Energy Storage System Cost Assumptions

In addition to battery cost declines of ~50% (consistent with Tesla's Gigafactory roadmap that could reduce battery costs by 50-60%), we forecast declines in costs of associated hardware to manage a storage system. We believe Tesla's combined battery/inverter product will be the most economically competitive, and we forecast that the inverter will cost \$0.45/watt in our base case. The following table highlights our energy storage assumptions.

Exhibit 5

Storage Costs Scenarios – for a Typical Household

	Bear	Base	Bull
Installation costs (USD)	5,000	3,000	2,000
Balance of System Costs (USD)	2,000	1,500	1,000
Inverter cost (USD/watt)	0.60	0.45	0.30
Total inverter cost (USD)	3,000	2,250	1,500
Battery cost (USD/kWh)	250	150	100
Total battery cost (USD)	3,125	1,875	1,250
Total system cost (USD)	13,125	8,625	5,750
Total system cost (EUR)	9,722	6,389	4,259
Total system cost (USD/kWh)	1,050	690	460
Total system cost (EUR/kWh)	778	511	341

Based on a typical household installing a 5kW solar panel and a 12.5kWh battery (one day's storage). We assume EUR/USD is stable at 1.35.
Source: Company Data, Morgan Stanley Research estimates

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Global Solar Market Landscape

Solar economics and regulatory dynamics vary significantly among the six regions/countries we analyzed. The following is a high-level overview of solar economics and regulatory treatment by region/country:

China (27% of projected demand): Solar power is one of three zero-carbon, zero-emissions power sources (the other two are wind and nuclear) that the government of China is increasingly promoting to address the growth in power demand. The magnitude of power demand growth in China is very significant as the country added ~90 GW per year in 2009-14, equal to ~8% of total US installed capacity. China uses feed-in tariffs (FiTs), a fixed payment stream for power produced by solar panels, coupled with local incentives to ensure that solar capacity growth meets government targets. Our projected growth in solar demand is in-line with the most recent Chinese government targets.

Europe (21% of projected demand): Given the very high cost of power in Europe, solar is already economic relative to the entire utility bill (which, as in all countries, is comprised of grid costs, taxes, subsidies and the costs of actually generating power). Governments in Europe primarily use FiTs and tax breaks to incent the growth of solar power. Many European countries (Germany being the most significant) already have relatively high solar penetration levels, but there is the potential for significant future growth given how competitive solar power is throughout Europe.

United States (17% of projected demand): In 43 US states, solar panel owners are allowed to net meter, effectively allowing panel owners to avoid the entire utility bill (both the portion associated with fixed grid costs and that associated with actual power generation). Given rapidly declining solar costs and rising utility bills, we believe solar growth potential is well above market expectations, even under our base case assumption in which the 30% Investment Tax Credit (ITC) steps down to 10% and the net metering rules are changed so solar customers must pay 50% of the typical fixed grid costs that a utility customer pays.

Japan (10% of projected demand): Much as in Europe, Japan uses FiTs to incent solar power installations, and these incentives have allowed for rapid recent solar growth in the country. However, we are concerned that a pending government review of the solar FiT may result in a substantial reduction in this rate, which would reduce solar's growth potential.

India (4% of projected demand): India conducts competitive auctions for the procurement of additional power plants, and growth in power demand has been very high (11% per year over the past several years). The government has conducted some plant procurement designed solely for solar power. In procurement auctions open to all generation types, solar has not been competitive, but recent data points highlight the potential for solar power to become closer to competitive with other generation sources. Given practical limits on the growth of other types of generation in India, we think solar power will have significant growth potential. But as solar grows, land requirements will increasingly become a limiting factor.

Brazil (2% of projected demand): The government of Brazil has recently pursued a number of approaches to encourage solar development, including tax breaks, solar-only procurement processes, and a net metering approach similar to that in the United States. The objective is to bring scale and turn solar into a competitive source in the country. Given the strong solar conditions in parts of Brazil and the net metering approach, we believe solar projects will become economically viable in parts of the country.

Africa (1% of projected demand): The solar potential is huge (NASA data suggests that 60% of the total global solar potential is concentrated in the Middle East and Africa) but current installed capacity is minimal (only 1GW at the end of 2013). We expect this to double by the end of 2015 and to double again to the end of 2020 to c. 4.4GW of capacity.

ROW (18% of projected demand): We estimate ROW installations by applying the same forecasted growth rate from China, the US, India, and Brazil. We exclude Europe and Japan from the calculation given their maturity relative to the remainder of our focus regions.

A note on the Middle East: Electricity consumption is rising rapidly across the Middle East (10-year CAGRs of 6% are common) and governments have struggled to boost their gas output fast enough to meet demand. Keen to maximize oil exports, some governments have identified solar as a potential solution (most notably, the Saudi Arabian government announced in 2012 a plan to build 41GW of capacity by 2032). However, developers in the region will need to overcome a number of technical and organizational challenges (dust, water scarcity, etc.) to meet its goal, and we do not have sufficient conviction that these challenges will be resolved to include separately in our forecast.

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Solar Energy in Africa

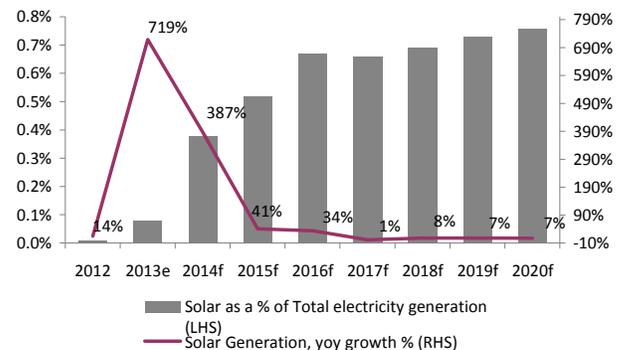
The solar potential in Africa is huge, but current installed megawatts are minimal (1 GW at the end of 2013) and our projected growth in solar installations, of 0.5 GW per year through 2020, is relatively small on an absolute basis. NASA data suggests that many countries in Africa and the Middle East have daily solar radiation ranging between 5 and 6 kWh/m², equivalent to roughly 60% of the total global potential. However, the speed with which this potential has been harnessed is still some way behind developments in all the other regions of the world. As at the end of 2013, according to the IHS, only 0.7% of the world's PV solar capacity was operating in the Middle East and Africa combined.

What next in Africa? PV solar capacity is growing quickly within the region. The drivers are a combination of government support, feed-in-tariff schemes and better economics as the price of solar capacity has continued to fall. However, given the abundance of competing (and cheap) energy sources in many African markets (e.g. coal in South Africa and Mozambique, oil across much of West Africa) the solar roll-out is (a) coming off a very low base and (b) unlikely to make-up a significant proportion of total electricity generating capacity in many of the African markets anytime soon. However, noteworthy initiatives include:

1. Ethiopia has an average daily radiation of 5.26 kWh/m² and a target of 2.5 GW of renewable energy (including solar) by 2025 was announced under the "Climate Resilient Green Economy" initiative.
2. Tanzania has recently launched the "Solar PV Scheme" an initiative to drive small-scale solar installations in 10 rural districts.
3. In Nigeria, the Minister of Power announced plans to add 1,000 MW of solar power over the next 10 years, targeting 5% energy generation mix from renewables.
4. In Mozambique the country has been granted a US\$35mn loan (by the ADB) to provide 400-500kw of power and has set up several solar plants in rural areas as the primary source of energy.

5. A 115 MW solar plant in Ghana is scheduled to be completed in 2015.
6. Morocco is currently building a 160 MW plant as part of their 2,000 MW solar build plan set to be achieved by 2020.
7. In South Africa, current total electricity generating capacity is 42 GW. Expansion plans are in place increase capacity by 17 GW by 2018 and a further 22 GW by 2030. Of the new build, coal will account for the bulk of it (46%), nuclear 13%, and renewables 21%, including 1.5 GW of solar capacity due to come on line by 2018. Obviously, this will still represent a very small percentage of total generating capacity.

Exhibit 6
Solar PV Energy as a % of Total Energy Generation in South Africa



Source: BMI, RMB Morgan Stanley

All in all, therefore, we expect significant growth in solar PV capacity across Africa, but the absolute numbers are still small. From a base of just over 1 GW at the end of 2013, we expect solar PV capacity for the region to increase to 2 GW by the end of 2015 and to double again to c. 4.4 GW of capacity by 2020. Lower costs of installation (and hence a shorter pay-back period) are the key to a faster rate of adoption.

Visualizing Market Attractiveness

From our analysis, we compared the relative attractiveness of markets, as well as subsidy levels, now and over time. The following chart highlights our view of:

- 1. Market attractiveness:** The degree to which the market offers attractive growth opportunities, given solar economics and magnitude of potential growth.
- 2. Subsidy level:** Amount of subsidy provided by the federal (and sometimes local) government.

We believe China will remain an attractive market for solar, driven by continued strong government support and improving solar economics. The Chinese government has targeted the growth of three zero-emissions power generation types (solar, wind and nuclear) to reduce the country's emissions intensity.

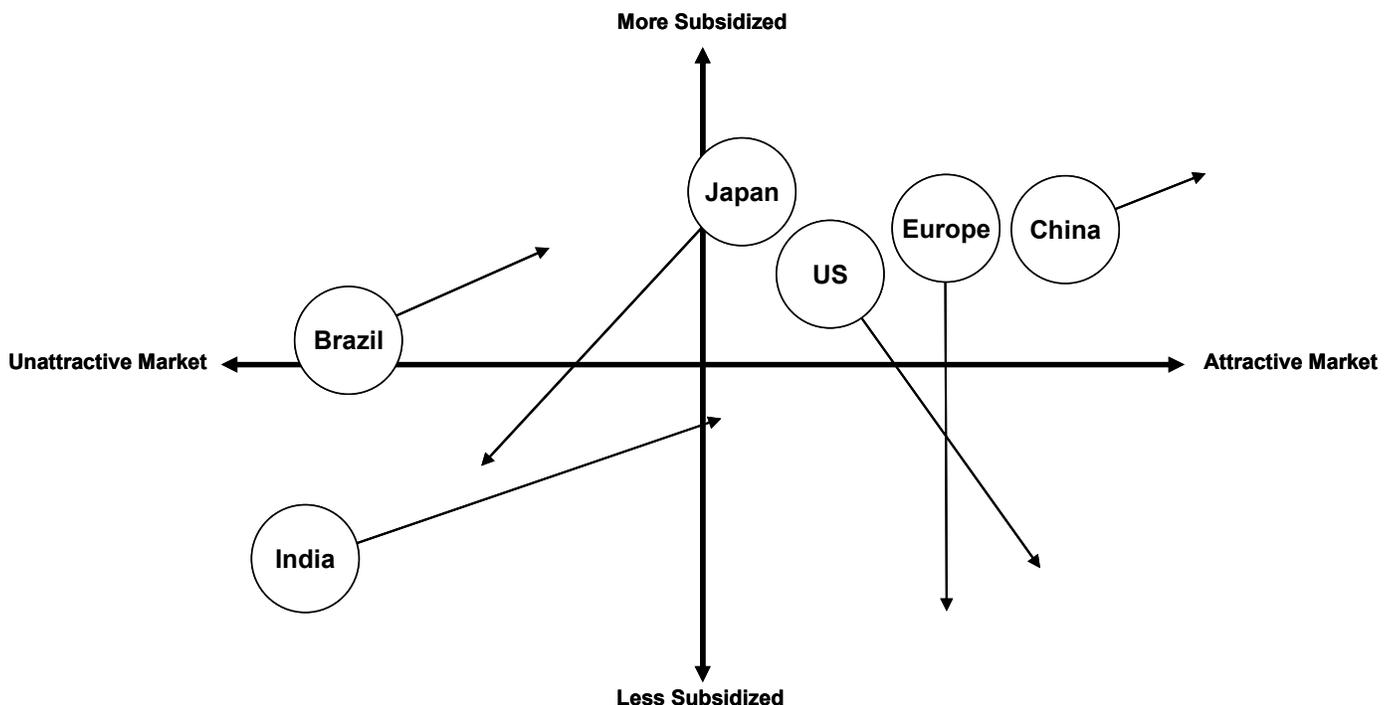
The United States should become the second-most attractive solar market, driven by low current penetration levels, favorable solar economics relative to utility bills, and further cost declines that we expect will more than offset upcoming subsidy decreases.

Europe remains an attractive market given high utility bills in the region, but there is a potential over the long term that the growth in solar penetration slows as Europe further considers subsidy reductions and as solar reaches high penetration levels (as in Germany).

India and Brazil are increasingly attractive markets for solar, driven by solar cost declines and a degree of further government support for solar power. However, in Brazil, other clean energy technologies (wind and hydroelectric) are far more economic than solar, and significant future solar cost reductions, combined with further government support, will be needed to incent large increases in solar development.

Japan may become a relatively unattractive market for solar to the extent that the current review of solar subsidies by the government results in a significant reduction in the solar feed-in tariff (FIT).

Exhibit 7
Market Landscape



Source: Morgan Stanley Research

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Summary of Key Takeaways by Region/Country

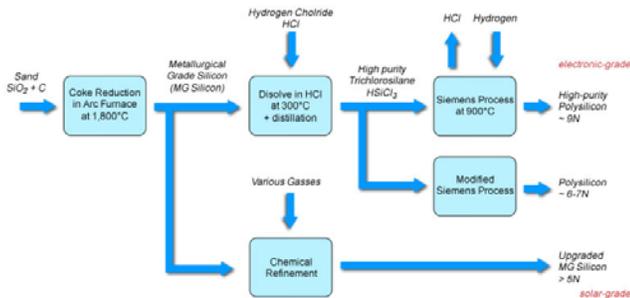
<p>China 27% of projected growth</p>	<p>13 GW per year solar growth through 2020, driven by very large absolute power demand growth, and the government's goal of improving air quality through a combination of solar, wind and nuclear.</p> <ul style="list-style-type: none"> • Power demand growth is significant by any measure, averaging ~8% of total US capacity per year. • Headwinds on other generation will aid growth in solar, nuclear and wind: coal growth constrained by growing environmental restrictions, hydropower limited by available sites. • Changes in China's renewables decisions has a strong impact on global solar demand – our 13 GW per year forecast for solar growth is a fraction of the country's ~90 GW per year demand growth. • Energy storage not economic as a grid substitute given the low cost of the Chinese power grid.
<p>Europe 21% of projected growth</p>	<p>10 GW per year solar growth through 2020, driven by strong solar economics relative to high European utility rates. There is, however, a risk of a "solar slowdown" in Europe.</p> <ul style="list-style-type: none"> • By 2020, we project solar will be economic in Europe without subsidies. • The slowdown of solar installations in Germany given the high current penetration level, even with strong solar economics, is a trend that could lead to lower overall solar growth in Europe. • Energy storage coupled with solar power could be commercially viable in Germany, Italy, Portugal and Spain, but many uncertainties exist and implementation of this approach has several challenges.
<p>United States 17% of projected growth</p>	<p>8 GW per year solar growth through 2020, driven by highly supportive net metering rules in 43 states, strong solar conditions in many states, and further solar cost reductions.</p> <ul style="list-style-type: none"> • By 2020, solar will be economic in some US states even without a subsidy. • The long-term addressable distributed solar market in the US is larger than appreciated, at 280 GW, even assuming net metering rules are changed to be less favorable to solar and the federal subsidy is reduced. • Energy storage coupled with solar power is in our view likely to be commercially viable in sun-rich, rate high states in the Western US. This dynamic could in the long run damage utilities in these states.
<p>Japan 10% of projected growth</p>	<p>5 GW per year solar growth through 2020, driven by improving solar economics and a supportive Feed in Tariff (FiT).</p> <ul style="list-style-type: none"> • There is a risk of a slowdown in solar growth in Japan as a result of the Japanese government's pending review of the solar FiT. • The path to grid parity for solar in Japan is a long one, given more gradual solar cost reductions in the future. • Energy storage not economic as a grid substitute given the low cost of the Japanese power grid.
<p>India 4% of projected growth</p>	<p>2 GW per year solar growth through 2020, driven by, in the near-term, government initiatives to procure solar power, and in the longer-term by economics for solar power that is approaching parity with other generation sources.</p> <ul style="list-style-type: none"> • Solar power is in our view approaching cost parity with other generation sources, without subsidies. • Headwinds facing new coal, hydropower and wind plant development all aid the growth of solar. • The biggest challenge facing solar development in the long-term is likely in our view to be land availability. • Energy storage not economic as a grid substitute given the low cost of the Indian power grid.
<p>Brazil 2% of projected growth</p>	<p>Slightly less than 1 GW per year solar growth through 2020, driven by strong solar conditions, but other renewable energy types have historically shown more favorable economics.</p> <ul style="list-style-type: none"> • Competitive renewable procurement auctions in Brazil have shown other renewable types, especially hydro and wind, as being more economic than solar. • Net metering rules, recently established, should help the growth of distributed solar power. • Storage does not seem viable in Brazil. All energy exported to the grid is taxable and, given that the pricing on energy export cannot be made on an hourly basis, this reduces the potential benefit of storage (e.g. storage would help to export in the higher price times, but this is not possible under the current regulation).
<p>Africa 1% of projected growth</p>	<p>0.5 GW per year solar growth through 2020 with most capacity installations focused in Saudi Arabia and South Africa.</p> <ul style="list-style-type: none"> • Despite strong solar conditions, cheap fossil fuel supply (coal in Southern Africa and oil in West Africa) still dominates planned capacity expansion in electricity generation.

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Implications for Polysilicon

What is polysilicon? Polysilicon is a hyper-pure form of silicon, the earth's second most abundant element. Due to its semiconductor-like material properties, polysilicon is used as feedstock material in manufacturing silicon based solar PV.

Exhibit 8
Polysilicon Manufacturing Process



Source: Green Rhino Energy, Morgan Stanley Research

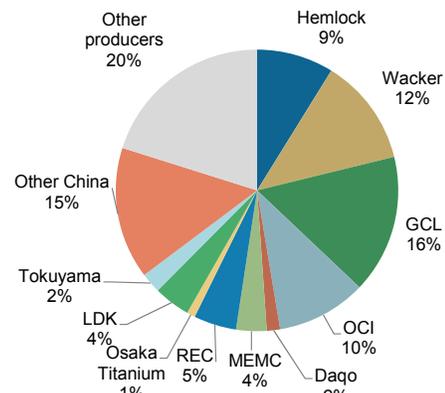
Who are the major producers? According to our analysis, the world's largest 4 producers of polysilicon based on 2013 data are (1) GCL, with a share of ~16%; (2) Wacker Chemie, with a share of ~12%; (3) OCI, with a share of ~10%; and (4) Hemlock, with a share of ~9%. Indeed, the top 4 players account for around half of global polysilicon supply. However, beyond the four "majors", the polysilicon market is very fragmented, with Chinese players, emergent and existing, having carved out substantial shares within the industry.

However, the extent to which some of the older, high cost and smaller PS facilities are operational or closed down remains a point of contention, and views vary greatly as to the amount of effective capacity that is available to the solar market. This is because weak PS prices over recent years led to high cost producers in China having to curb production and close down facilities. China is a highly opaque market when it comes to PS capacity, and to add to the complexity, it is quite clear that product quality varies greatly between the different producers (i.e. ultra-pure product is a "must" for market leaders like Wacker, Hemlock and OCI, whereas lower purity levels are a common problem for smaller Chinese producers). The quality of product from China's GCL, the world's largest producer, is the subject of much debate).

Wacker Chemie believes that total production capacities for solar-grade/electronics-grade polysilicon sat at 212k mtpa in 2013, whereas we would suggest this figure was actually closer to ~280k mtpa (i.e. excluding Chinese capacity from smaller players). REC Silicon suggests 2013 PS capacity of

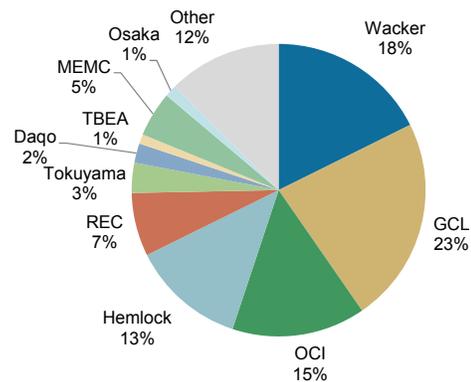
260k mtpa. Including all players, potential production capacity of polysilicon likely sits closer to ~400k mtpa, we think.

Exhibit 9
Major Global Polysilicon shares (2013) – All Capacities



Source: Company Data, Morgan Stanley Research Estimates.

Exhibit 10
Major Global PS shares (2013) of Those Likely Operating



Source: Company Data, Morgan Stanley Research Estimates

Polysilicon content in solar modules. It is widely accepted that today's solar modules contain approximately 5.5-6.0g/Wp of polysilicon, which is expected to creep down towards 4.5-5.0g/Wp medium-term (i.e. by 2017e according to Wacker Chemie). With module costs ranging from 50-60c/Wp and the implied silicon cost of ~11c/Wp, this suggests polysilicon is around 20% of the module cost. Wacker suggests total solar installations amounted to ~40 GW in 2013, equating to polysilicon demand of ~220-230k mt, equivalent to ~5.6g/Wp of polysilicon at the mid-point.

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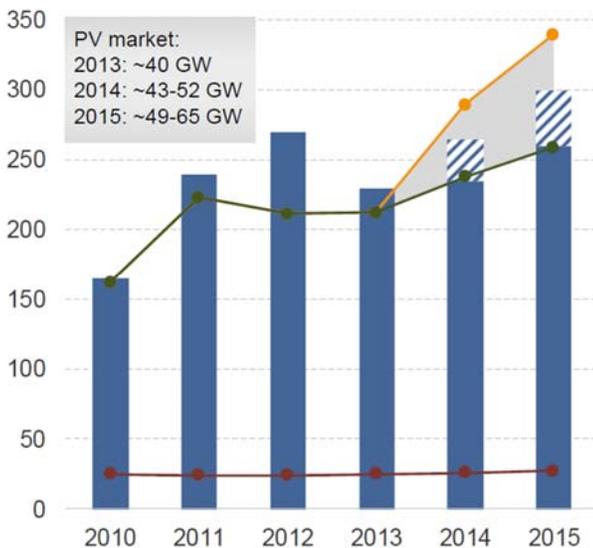
Exhibit 11
Solar Panel Spot Prices Have Been Declining
(USD/W)



Source: PV Insight
Source: REC, Morgan Stanley Research

Wacker estimates GW installations to grow way above Morgan Stanley's forecast. Wacker believes that annual global installations will fall within ~43-52 GW in 2014, rising to ~49-65 GW in 2015, before growing to ~80 GW in 2017. Based on silicon consumption of <5g/Wp (i.e. 4.5g/Wp), this should see polysilicon demand growing to ~360k mtpa by 2017, implying a CAGR over the next 4 years of >12%. In total, over the period 2014-17e alone, Wacker expects incremental solar installations totaling ~290-300 GW, a level we expect to be achieved only by 2020e.

Exhibit 12
Wacker's View on Incremental Solar Installations

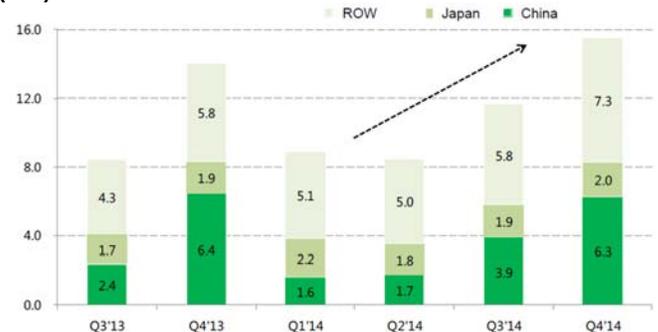


Source: Wacker Chemie, Morgan Stanley Research

GCL expects 44.6 GW of solar installations in 2014.

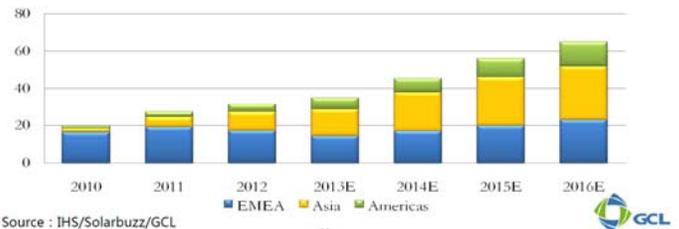
Although Chinese solar installations suffered in 1H14 due to the postponement of large solar farm installations to the end of of May, GCL believes total installations will reach ~44-45 GW in 2014, of which China will continue to be the largest contributor.

Exhibit 13
GCL's View on Q'ly Incremental Solar Installations ('14)



Source: GCL, Morgan Stanley Research

Exhibit 14
GCL's View on Annual Solar Installations Out to '16
Estimated Global Solar Installation 2013-2016 (GW)

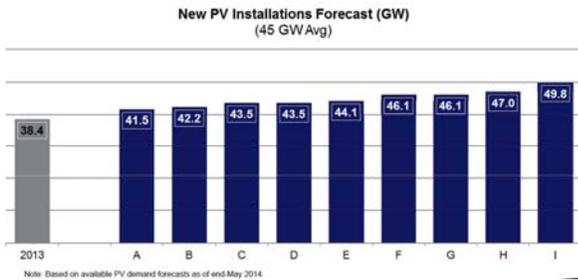


Source: IHS/Solarbuzz/GCL
Source: GCL, Morgan Stanley Research

REC Silicon suggests 45 GW of solar in 2014. Similar to GCL, REC Silicon suggests 45 GW of solar installations are likely in 2014, which is closer to the bottom end of Wacker's expectations. Importantly, what we can see is that the majority of polysilicon majors believe incremental solar installations will increase at a very rapid rate, driven by views of demand in the US (where Morgan Stanley's view is bullish and in line with industry estimates) and China and Japan (where industry estimates far exceed Morgan Stanley estimates). However, REC is a touch more conservative on China this year, suggesting just 10 GW of incremental solar (in line with Morgan Stanley projections), reflecting a lower forecast for distributed grid (rooftop) PV of 4 GW (from 8 GW previously).

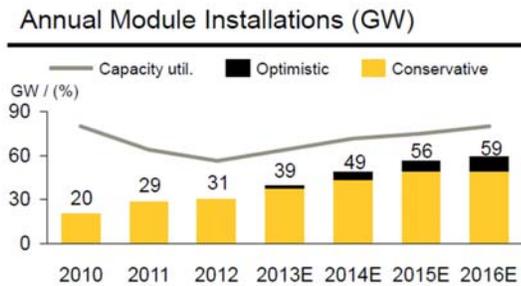
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Exhibit 15
REC Silicon's View on GW Installations



Note: Based on available PV demand forecasts as of end May 2014.
Source: REC Silicon, Morgan Stanley Research

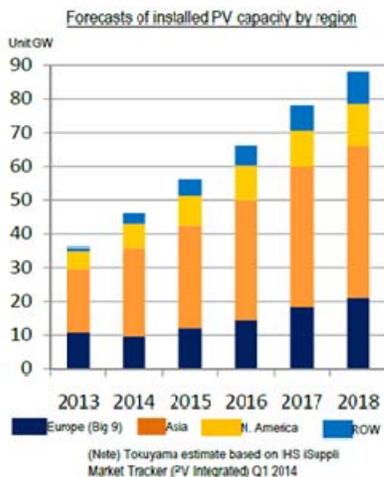
Exhibit 16
REC's View on Solar Installations Longer-Term
Annual Module Installations (GW)



Source: BNEF, IHS Integrated Market Tracker Q1 2014
Source: REC, Morgan Stanley Research

Tokuyama sees incremental PV installations at 85-90 GW by 2018. From a 2014 base of ~45 GW of solar installations, Tokuyama expects a CAGR in new installations of >18%, to ~88 GW of new installations in 2018. In China, it flags an upwards revision to 35 GW of new solar capacity by 2015.

Exhibit 17
Tokuyama Sees ~90 GW of Annual Installations by 2018

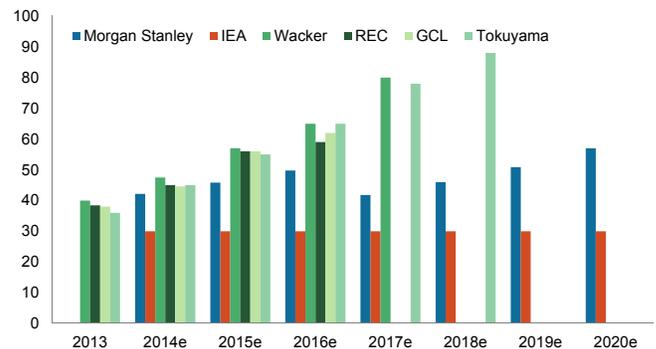


(Note) Tokuyama estimate based on IHS iSuppli Market Tracker (PV Integrated) Q1 2014
Source: Tokuyama, Morgan Stanley Research

What do our forecasts for solar installations mean for polysilicon supply/demand? Our forecasts are, in aggregate, considerably more cautious than the views of the polysilicon manufacturers. There has always been, and continues to be, an understandable degree of optimism regarding the success of solar within the raw material suppliers.

We are most bearish in our view of solar growth, relative to industry views, for China (some industry views as large as >30 GW growth per year by 2020, versus our 13 GW per year for 2014-20) and Japan (some industry views as large as >20 GW per year by 2020, versus our 5 GW per year for 2014-20). **Put simply, our base case solar installation forecasts see installation growth of an average 5% pa, far lower than the polysilicon manufacturers whose estimates range between 11% and 19%. In that context, our forecasts could mean significant downside risk for the industry.**

Exhibit 18
Polysilicon Producers are Much more aggressive on Solar Installations vs MSe and IEA



Source: Company Data, Morgan Stanley Research Estimates

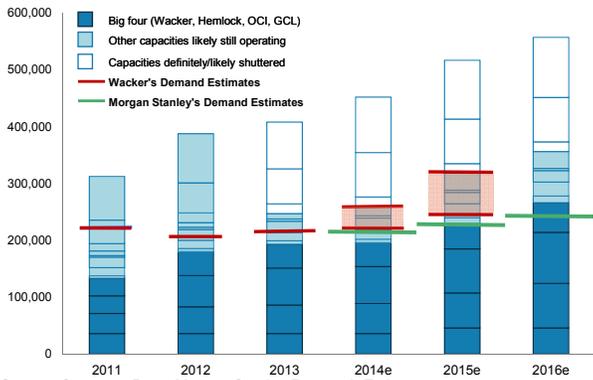
A disappointing outcome for polysilicon demand. A future where solar installations growth disappointed in key markets such as China and Japan would leave polysilicon markets in a complicated situation. We'd see limited growth for the raw material, which would lead to material reductions in polysilicon utilisation rates and put further pressure on pricing.

Supply is the other consideration. We estimate the "big 4" alone had polysilicon capacity totaling ~195k mtpa in 2013, which is set to rise to ~266k mtpa by 2016e, an increase of ~70k mtpa (equivalent to ~13 GW of additional annual solar installations). Other players still operating, i.e. excluding those Chinese players that likely shut their plants in 2012/13, are also expanding PS capacity by ~37k mtpa (equivalent to ~6.5 GW of solar installations). In aggregate, to ensure future PS capacity additions are utilized by the solar market, annual

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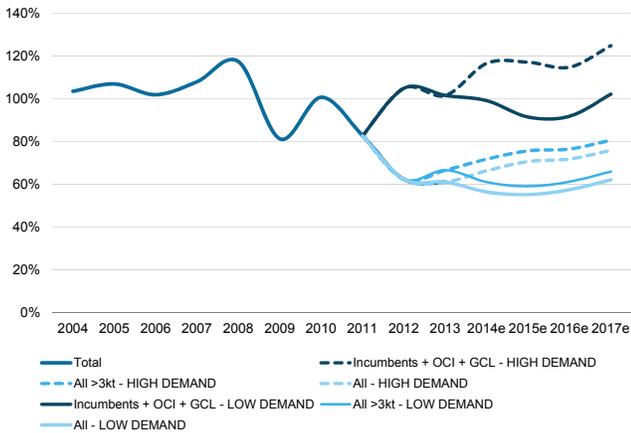
installations will have to rise by ~20 GW per annum from the 2013 rate of 40 GW (i.e. to ~60 GW per annum), a demand growth level that appears highly challenging based on our analysis, which shows installations still below this level in 2020.

Exhibit 19
Future Polysilicon Supply Additions



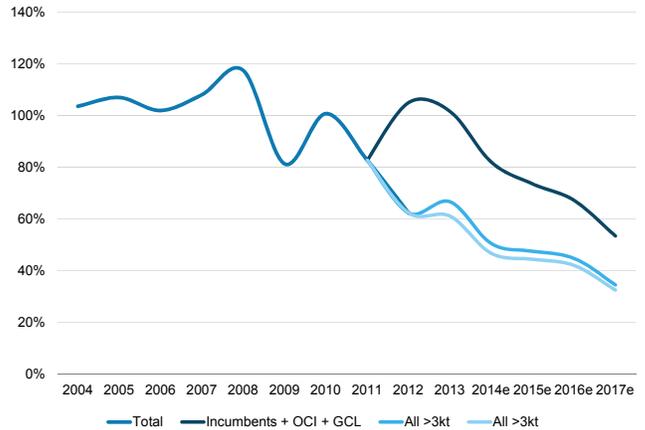
Source: Company Data, Morgan Stanley Research Estimates

Exhibit 20
Polysilicon S/D Model Based on WCH “High” & “Low” Case GW Installations



Source: Company Data, Morgan Stanley Research Estimates

Exhibit 21
Polysilicon S/D Model Based on Morgan Stanley’s Installations Assumptions



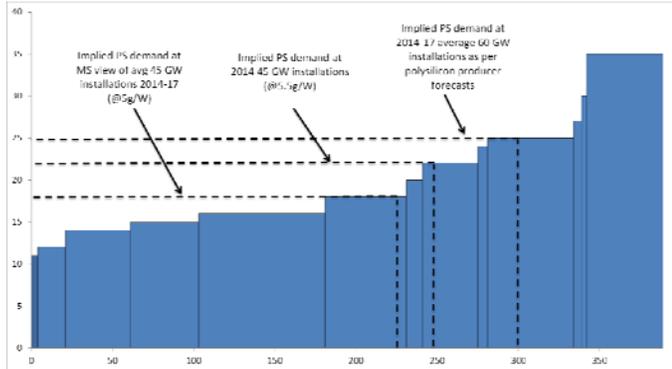
Source: Company Data, Morgan Stanley Research Estimates

Implications for polysilicon prices under a range of scenarios. In terms of the likely impact on polysilicon pricing, we illustrate 3 scenarios below. First, we take the Morgan Stanley view of average annual solar installations globally for the period 2014-2017. Second, we take the likely 2014 installation of ~45 GW (@5.5g/W). Lastly, we take an average 2014-2017 view on GW installations from the polysilicon producers (i.e. ~60 GW of installations @ 5g/W).

Building a polysilicon cost curve is notoriously difficult. Producers are persistently cutting costs, few are transparent about their production costs and opacity surrounding Asian players adds to the uncertainties. We have built an indicative cost curve using data that is available, but warn that the margin of error could be meaningful, with considerable change likely over the next few years as efforts to reduce cash costs continue. We also include an indicative cost curve from an industry producer of polysilicon for comparative purposes.

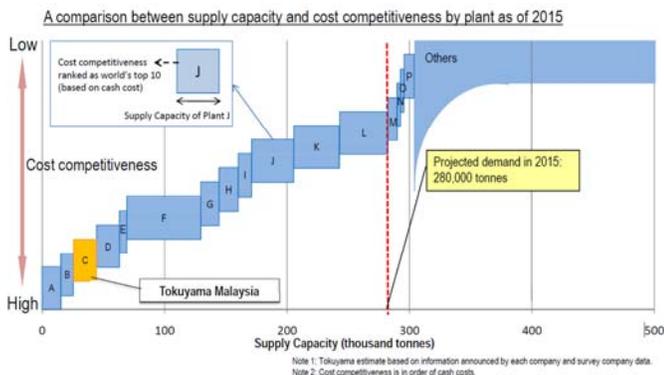
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Exhibit 22
Indicative Polysilicon Cost Curve (\$/kg = Y axis & '000 of PS Capacity = X axis)



Source: Company Data, Morgan Stanley Research

Exhibit 23
Tokuyama's View on the PS Cost Curve



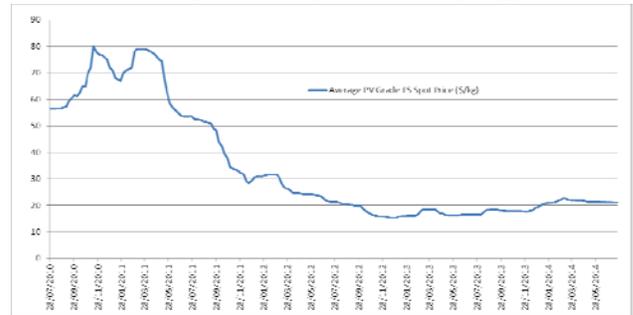
Source: Tokuyama, Morgan Stanley Research

Scenario 1. We take MS Utilities expectations of average annual solar installations of 45 GW/annum 2014-2017 (this compares with an average forecast from the polysilicon manufacturers over the same time period of ~60GW). At an average 5g/W, this would drive PS demand of ~225k mt, which given the current shape of the cost curve could see PS prices falling back down towards ~\$18/kg.

Scenario 2. The expectation of 45 GW of solar installations in 2014 (at the current level ~5.5g/W) would translate into PS demand of ~245k mt, which would imply a spot price of ~\$22/kg, which is largely where current pricing sits.

Scenario 3. Should we see the average of polysilicon industry expectations for 2014-20167 solar installations of 60 GW, polysilicon demand would be ~300k mt, under which scenario prices could lift to ~\$25/kg (assuming no further structural shift down in the PS cost curve).

Exhibit 24
Solar Grade Polysilicon Spot Prices (\$/kg)



Source: Bloomberg, Morgan Stanley Research

Potential implication of lower polysilicon prices on Wacker forecasts

We note that the implied marginal cost for the current likely demand level in 2014, ~\$22/kg, is consistent with the level at which prices are currently trading (and which we assume roughly flat through 2018 in our current Wacker forecasts). Our model suggests that prices could fall to a sustainable level of \$18/kg based on our more conservative demand forecasts. ***Were we to run this assumption in our Wacker model we would reduce our Wacker EBITDA forecasts by 18-20% for 2015-2018. Given the high level of the group's D&A, this would cut EPS by 40-50% for 2016-2018, and by potentially as much as 70% for 2015.***

Exhibit 25
Morgan Stanley Forecast Annual GW Installations by Region, 2013-2020e

	China	Japan	US	W Europe	India	Brazil	SUBTOTAL	Australia	Canada	Israel	Korea	Thailand	Ukraine	Taiwan	ROW	GLOBAL TOTAL
2013	12.9	6.8	4.8	10.3	1.0	0.2	36.0	1.0	0.4	0.2	0.4	0.3	0.3	0.2	1.2	40.0
2014e	10.5	10.0	5.5	9.8	1.2	0.3	37.2	1.0	0.5	0.3	0.5	0.4	0.3	0.3	1.5	41.9
2015e	11.3	10.0	7.2	9.8	1.4	0.4	40.0	1.0	0.5	0.4	0.7	0.5	0.4	0.4	1.8	45.6
2016e	12.4	8.3	10.3	9.8	1.6	0.5	42.8	1.0	0.6	0.5	0.9	0.7	0.4	0.5	2.1	49.6
2017e	13.5	1.3	6.4	9.8	1.9	0.6	33.5	1.0	0.6	0.6	1.3	0.9	0.5	0.6	2.6	41.6
2018e	14.1	1.3	7.6	9.8	2.2	0.8	35.8	1.0	0.7	0.8	1.7	1.2	0.5	0.8	3.1	45.8
2019e	14.4	1.3	9.2	9.8	2.6	1.1	38.3	1.0	0.8	1.1	2.2	1.7	0.6	1.1	3.8	50.6
2020e	15.0	1.3	11.0	9.8	3.0	1.5	41.5	1.0	0.9	1.5	2.9	2.2	0.7	1.5	4.6	56.8
Total 14-20	91.2	33.5	57.2	68.4	13.8	5.1	269.2	7.0	4.6	5.1	10.3	7.7	3.5	5.1	19.4	331.9
Avg 14-20	13.0	4.8	8.2	9.8	2.0	0.7	38.5	1.0	0.7	0.7	1.5	1.1	0.5	0.7	2.8	47.4

Source: Company data, Morgan Stanley Research estimates

Solar Power & Energy Storage Growth Potential by Region

China

Europe

United States

Japan

India

Brazil

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China

Simon Lee
Sheng Zhong

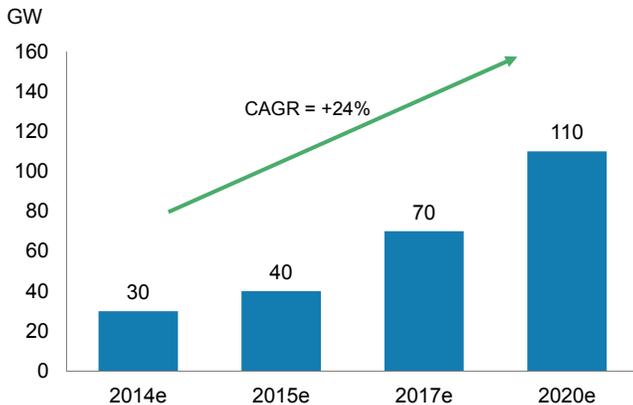
Solar Growth to Exceed All Other Countries/Regions

Key conclusions:

1. **China comprises 27% of our global 2014-2020 forecast (91 GW of growth, or 13 GW per year), driven by very large absolute power demand growth, headwinds facing other generation types, and the government's goal of improving air quality.**

Exhibit 26

We Expect Solar Power to Reach 70 GW by 2017 and 110 GW by 2020



Source: Morgan Stanley Research

2. **China is the fastest-growing solar market in the world today.** Solar PV installation in China, which effectively started up in 2010, has accelerated since 2012. In 2013 China surpassed Germany to become the fastest-growing PV market worldwide, with a record 12.8 GW new PV capacity installed. Note that the high level of installations in 2013 was primarily due to a rush ahead of impending changes in solar subsidy policies.
3. **Incremental renewable decisions in China have a greater impact than any other country/region.** China's power demand growth has been very large by any measure. On average over the past 5 years, China has added ~90 GW of new power plants per annum, equal to ~8% of total power plant capacity in the US. Our

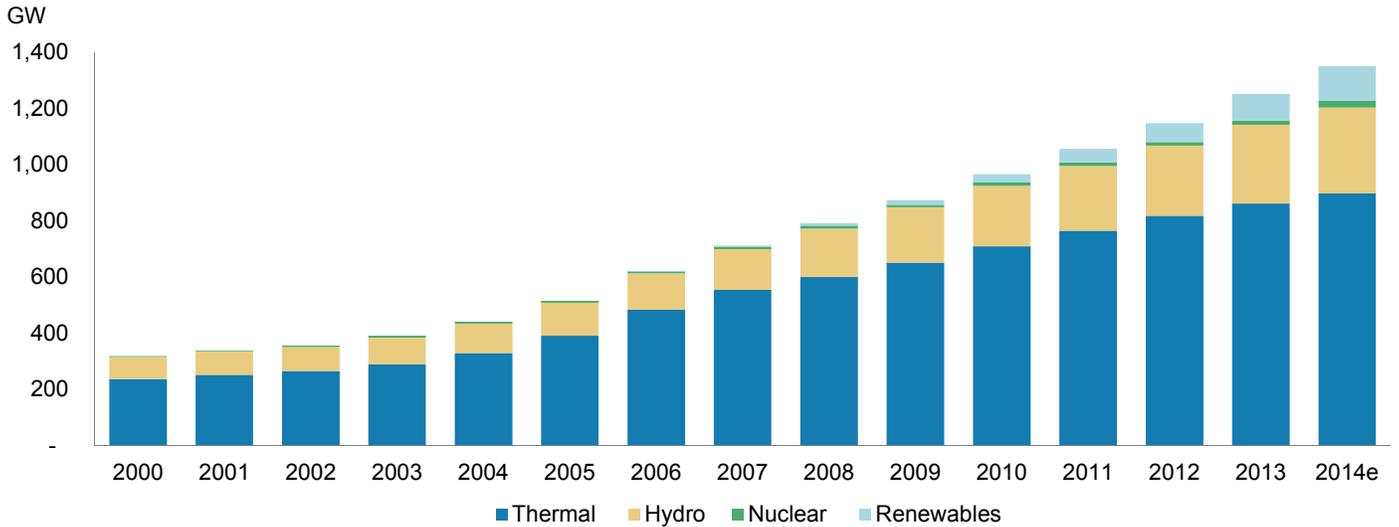
projected 13 GW per year of solar growth is a fraction of total power plant capacity growth in China, and a change in government goals would have a greater impact on our global solar forecast than any other single factor.

4. **Headwinds facing other generation types are an opportunity for solar to exceed our growth expectations.** Coal, the dominant source of power generation in China, accounted for 69% of cumulative capacity in 2013. However, because of severe pollution issues in China, new installation of coal power slowed from the peak 92 GW in 2006 to only 43 GW in 2013. Environmental protection cost increases in all industries may seriously challenge further coal power development in China. We expect hydropower, which constitutes 22% of the current installed base, to face growth headwinds due to insufficient water resources in most regions in China. For this reason, we expect most of hydropower resources to be fully developed by 2020. Renewable power is currently China's third-largest source of power, accounting for 6% of the installed base. Renewable power grew rapidly in the past two years as a result of significant cost decreases and government efforts to encourage development of clean energy. We expect the market share of renewable power to continue to expand.
5. **Energy storage is likely not economic in China, given relatively low grid costs.** China's power grid has been developed at a lower cost than in the US and Europe, and the system is younger, resulting in lower maintenance costs. As a result, we think there would not be sufficient savings to customers from installing solar power and energy storage at their home/business and disconnecting from the grid.
6. **Given that our projected 2014-20 solar demand in China is significantly (~50%) below solar industry estimates, this demand level is bearish for polysilicon solar panel manufacturers, because that returns may be impacted by overcapacity relative to global demand.** Silicon-based panel manufacturers (GCL Poly, Trina Solar, Yingli Green Energy, Xinyi Solar, and Jinko Solar) could see margin pressure if demand in China, while still growing at a rapid rate under Morgan Stanley estimates, fails to achieve projected industry growth rates.

Market Growth Review

Exhibit 27

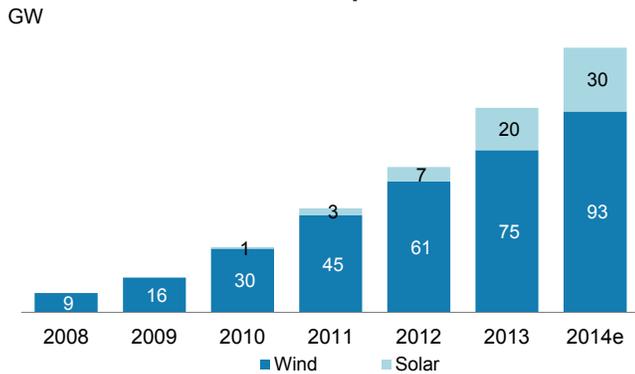
China's Installed Power Capacity (GW)



Note: Renewables includes Wind, Solar.
Source: NEA, Morgan Stanley Research e = Morgan Stanley Research estimates

Exhibit 28

Solar Power Capacity Has Been Rising as a Portion of Total Renewables Development in China

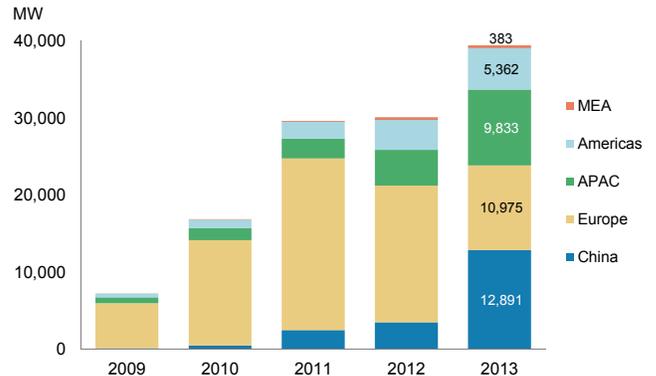


Source: NEA, Morgan Stanley Research e = Morgan Stanley Research estimates

Chinese power plant capacity will total ~1,350 GW in 2014, we estimate, the largest installed base in the world. In 2014, according to the latest statement from the Chinese National Energy Administration (NEA), the target of solar PV new installation in China is 10 GW, at a minimum, which is likely still the highest capacity addition volume globally. Solar farms are still the dominant format of PV in China, due to abundant ground resources, available financing, and easier power tariff collection from grid operators.

Exhibit 29

China Became the Fastest Growing Solar Market in 2013



Source: Company Data, Morgan Stanley Research, MEA: Middle East and Africa, APAC: Asia Pacific

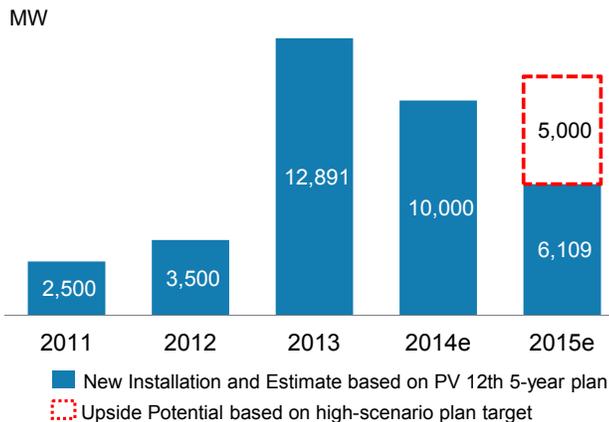
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Regulatory Dynamics and Market Outlook

Solar demand is still primarily a policy-driven source of power globally, due to the higher cost of solar relative to other sources, such as coal, gas, and hydro. In China, both the central and provincial governments have adopted supportive policies and provided subsidies to encourage faster growth of solar PV.

Solar development in the 12th five-year plan: We project solar PV capacity additions are likely to be >10GW per year in both 2014 and 2015. In the latest adjustments to the 12th five-year plan, the government of China has targeted solar PV new installation of 35 GW by year-end 2015; this is upwardly revised from the original target of 21 GW. According to media reports, the real upper target could be 40 GW.

Exhibit 30
Government Target of Solar PV New Installations in 12th Five-Year Plan



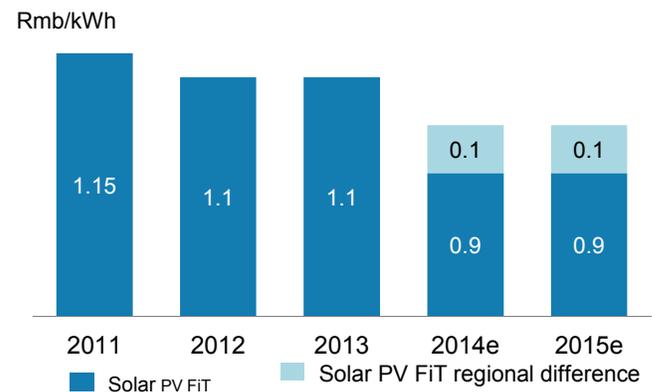
Source: Company Data, Morgan Stanley Research

“Golden Sun Program” drove the first wave of PV development: In July 2009, the government of China released the “Golden Sun” demonstration project program, providing up-front subsidies for qualified demonstrative PV projects through mid-2011. This program provided a subsidy equal to 50% of total costs for on-grid systems and 70% of total costs for off-grid systems that were above 300 kW. With that subsidy, solar capacity grew by ~3 GW in 3 years. The government now plans to install more than 500 MW of solar power pilot projects in the next 2-3 years.

Solar PV feed-in tariff and generation subsidy released to encourage more power generation from PV: In July 2009, after the Golden Sun program ended, and again in August 2013, the NDRC published new policies to subsidize PV development from the power generation perspective to

encourage consumption of PV-generated power. The announced solar PV FiT is a rate of Rmb0.9-1.0/kWh for ground-mounted projects. In addition, for distributed solar, the China’s central government provides a subsidy of Rmb0.42/kWh to total power generated from distributed solar PV projects. As a result, the distributed solar developer would receive total revenue equivalent to the end user power tariff (Rmb1/kWh) saved plus Rmb0.42/kWh subsidy (for a total of Rmb1.42/kWh) if the electricity is self-consumed; and a total of Rmb0.35/kWh on-grid power tariff plus Rmb0.42/kWh (for a total of Rmb0.77/kWh) when the electricity is sold to the grid.

Exhibit 31
Solar PV Benchmark FiT During 12th Five-year Plan



Source: NDRC, NEA, Morgan Stanley Research

Local government additional subsidies to support local PV development: In addition to central government subsidies, provincial and municipal governments provide subsidies to encourage local solar PV development — mainly additional power generation subsidy and one-off setup supportive funds, as well as some tax returns on purchasing PV products from local enterprises.

More policies to encourage PV distributed generation could be expected, mainly from the administrative and tax perspectives. In April 2014, the NEA stated that no electric business certificate is needed for electric generation installations below 6 MW from solar, wind, biomass, ocean, and geothermic energies. And in June 2014, China’s State Administration of Taxation stated that, in an effort to simplify the administrative operations of PV, the state grid will issue the invoice for electricity it buys from distributed solar PV projects. In addition, at the end of June, NEA sent a draft version of its “Further Implementation of Distributed Solar Photovoltaic Generations-Related Policies” to municipal governments, solar PV investment and construction companies, and grid companies as well as financial

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institutions, to collect the opinions from every party. Many key issues around distributed generation (DG) development were addressed, including the difficulties on solar PV project financing, rooftop resources, unstable profit return on DGs, etc.

We believe new installation in 2013 was a near-term record high: After the “Golden Sun Program” (details below) expired in 2012, the solar PV installation type changed significantly. DG as a percentage of total new installation declined. In 2013, one year after Golden Sun Program, DG only accounted for 6% of total installations, compared with 35% before 2012. This is mainly because of the relatively unfavorable incentives on DG comparing with “Golden Sun Program”.

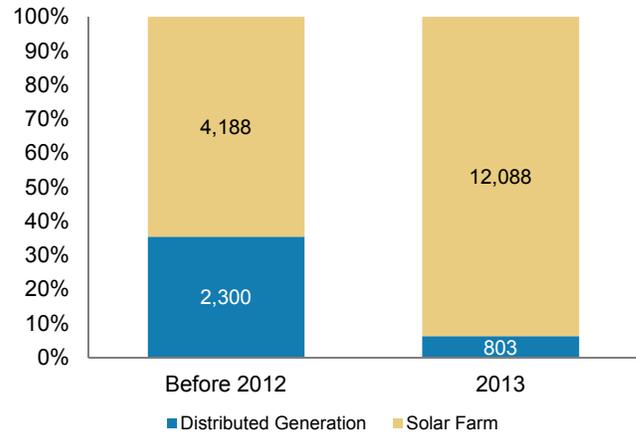
New installation may fall in 2014-2016 due to a slowdown in utility-scale development and current DG policies that do not attract necessary investments: We expect levels of solar PV installation to be lower than the peak in 2013, due primarily to a slowdown in utility-scale solar development. Western China is ideal for solar installation, but limited local power demand means solar power needs long transmission lines to remit electricity to load centers. We note transmission lines will only be commissioned in 2016-17, thus near-term growth in utility-scale solar will be limited.

On the other hand, the Chinese government has indicated that it will support substantial growth in distributed solar development. Present challenges in DG include: 1) estimated financial returns on DG are lower than on utility-scale solar farms; 2) difficulty in securing sufficient bank borrowing to fund projects; and 3) lack of good quality rooftop resources to install DG. We estimate the decline in utility-scale development will exceed growth in DG, and thus overall installation in 2014/15 to be lower than 2013. This estimate could be wrong if further favorable policies on DG are announced by the government.

New installation in 2017 back to 2013 level: For the period 2017-2020, we expect DG will continue to grow while utility-scale solar farm growth decelerates, as economics on DG

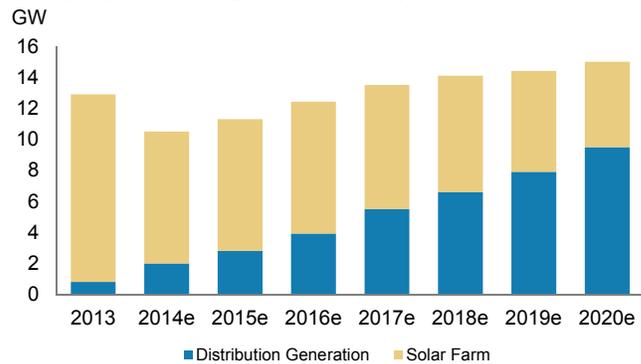
improve through lower costs while suitable land remains limited for utility-scale development. We estimate total installation by 2017 will be back to 2013’s peak level.

Exhibit 32
Solar Farm and Distributed Generation Installation Comparison During and After “Golden Sun Program”



Source: Company Data, Morgan Stanley Research

Exhibit 33
We expect Distributed Generation Installations Will Ramp up Gradually, while Utility Scale Decelerates



Source: Company Data, Morgan Stanley Research

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Exhibit 34

China's Central Government Rolled Out Solar PV FiT to Encourage PV Installation and Development

	FIT (CNY/kWh)	Province
Region 1	0.90	Ningxia
		Qinghai
		Gansu: Jiayuguan, Wuwei, Zhangye, Jiuquan, Dunhuang, Jinchang
		Xinjiang: Kumui, Tacheng, Altay, Karamay
		Inner Mongolia: excluding Chifeng, Tongliao, Hinggan League, Hulunbeier
Region 2	0.95	Beijing, Tianjin, Heilongjiang, Jilin, Liaoning, Sichuan, Yunnan
		Inner Mongolia: Chifeng, Tongliao, Hinggan League, Hulunbeier
		Hebei: Chengde, Zhangjiakou, Tangshan, Qinhuang Island
		Shanxi: Datong, Shuozhou, Xinzhou
		Shaanxi: Yulin, Yan'an
Region 3	1.00	All other regions of Qinghai, Gansu and Xinjiang not included in Region 1
		All other regions not included in Regions 1 and 2

Source: NDRC, NEA, Morgan Stanley Research

Exhibit 35

Solar PV Subsidies from Central and Municipal Government (Rmb/kWh)

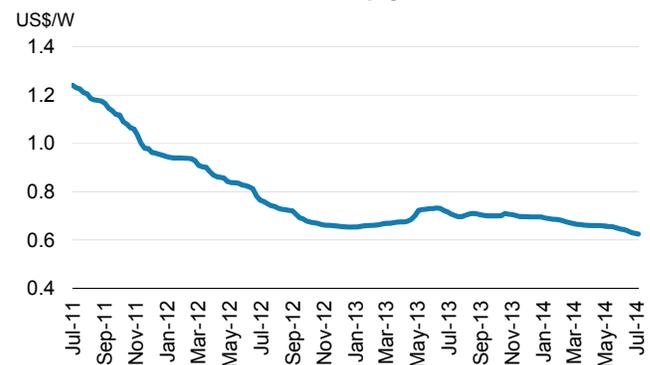
Province	City	National Subsidy	Provincial Subsidy	Municipal Subsidy	Total Subsidy	Comments
Zhejiang	Wenzhou	0.42	0.1	0.1 - 0.2	0.62 - 0.72	Solar farm subsidy
		0.42	0.1	0.3	0.82	DG subsidy
	Hangzhou	0.42	0.1	0.1	0.62	
	Tongxiang	0.42	0.1	0.2 - 0.3	0.72 - 0.82	One-off subsidy - Rmb1.5/Wp
	Jiaxing	Total subsidy at Rmb2.8 / 2.75 / 2.7 per kWh for 2013-15				
Anhui	Hefei	0.42		0.25	0.67	One-off subsidy - Rmb2/Wp
Jiangsu		0.42				FiT at Rmb1.2 / 1.15 for 2014-15 for non-central government subsidized projects
Shandong		0.42	0.78		1.2	
Jiangxi		0.42				One-off subsidy - Rmb4/Wp and Rmb3/Wp for Phases I and II projects respectively
Shanghai		0.42		0.3 - 0.4		Rmb0.3/kWh for solar farm; Rmb0.4/kWh for DG

Source: Government Official Website, Morgan Stanley Research

Capital costs have been declining. Capital costs for solar power projects in China have been declining consistently and rapidly, mainly thanks to the rapid decrease in PV module prices. As a result, solar power has come closer to achieving grid parity, from an end-user perspective. In the past 3 years, solar PV module prices declined by 53% to US\$0.58/Watt in June 2014; this drove down the cost of capital investment in solar PV projects by 50% in the same period. Currently, the capital cost of solar PV projects is Rmb8/W, with the solar module comprising ~50% of total costs. Some experts expect capital cost for solar PV will be down to Rmb6/W within 1-2 years. We agree that solar PV capital costs will keep trending down in the future, with steady module price declines. However, we project the panel and other component (inverter, installation) cost declines will be less rapid than in the past.

Exhibit 36

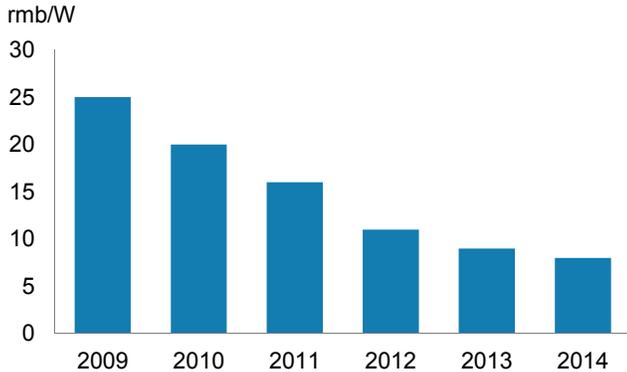
PV Module Price Down Sharply



Source: Solarzoom, Wind, Morgan Stanley Research

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Exhibit 37
Solar PV Capital Cost Has Come Down Quickly In Corresponding to Module Price Decline



Source: Morgan Stanley Research

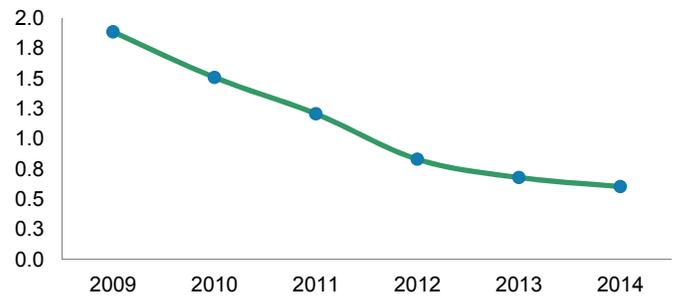
Levelized cost of solar power has been declining: The reduction in capital costs has led to a decline in the price of electricity generated from solar power projects. Assuming the solar project leverage at 80%, interest rate at 7%, with the capital cost down from Rmb25/W in 2009 to Rmb8/W today, the 25-year life solar levelized cost comes down from Rmb1.88/kWh in 2009 to Rmb0.6/kWh today.

In accordance with the decline in solar PV generation cost, the FiT has also been reduced. However, with current solar PV FiT and subsidies, we estimate some solar projects enjoy strong profitability. Thus, we believe that solar farms will attract strong investment interest, but scale of development will be subject to government approvals.

Solar Power cost is coming closer to grid parity: Currently, the coal power tariff is at a low level (Rmb 0.47-0.48/kWh) due to the low cost of coal. However, while coal cost is likely to remain low in 2014-15, we expect the environmental protection cost to trend up due to higher requirements emissions. In June 2014, the government of China released requirements for further improvements in desulfurization, denitration, and dust removal at coal power plants, which increase coal power cost by Rmb0.03/kWh.

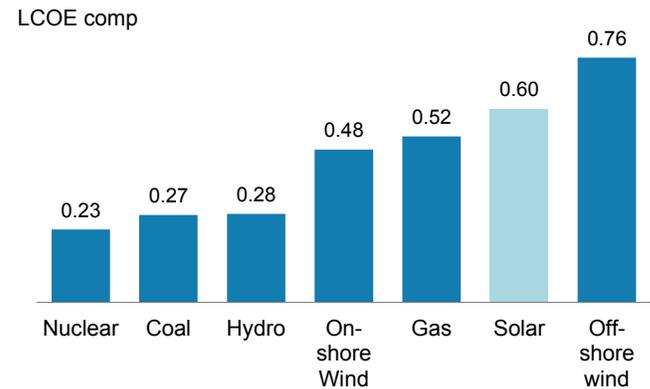
As coal costs increase, solar PV power costs keep decreasing, thanks to module and other component cost declines and module power generation efficiency improvements (currently, 0.5-0.8% efficiency improvement every year). However, solar will likely remain the most expensive source of clean energy and government subsidies and policies will therefore remain the key drivers of growth.

Exhibit 38
Solar PV Levelized Cost of Energy Has Been Coming Down Quickly



Source: Company Data, Morgan Stanley Research

Exhibit 39
Levelized Cost of Energy Comparison – 2014, (Rmb/kWh)



Source: Morgan Stanley Research

Europe

Bobby Chada
Dominik P Olszewski

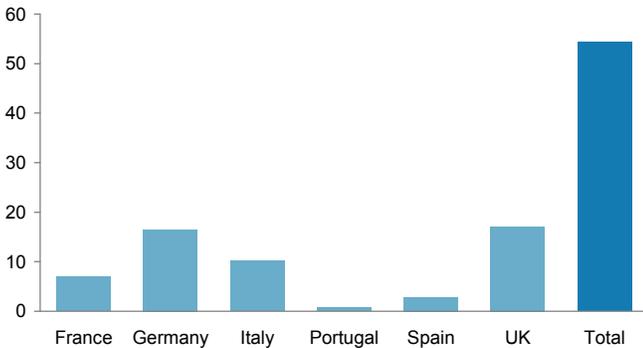
Solar & Storage Growth Potential Strong, but Recent Data Points to a Slowdown

Key conclusions:

1. Europe comprises 21% of our global 2014-2020 forecast (68.4 GW of growth, or 10 GW per year), driven by strong solar economics relative to high European utility rates.

Exhibit 40
Projected Solar Growth in Europe, 2014-20

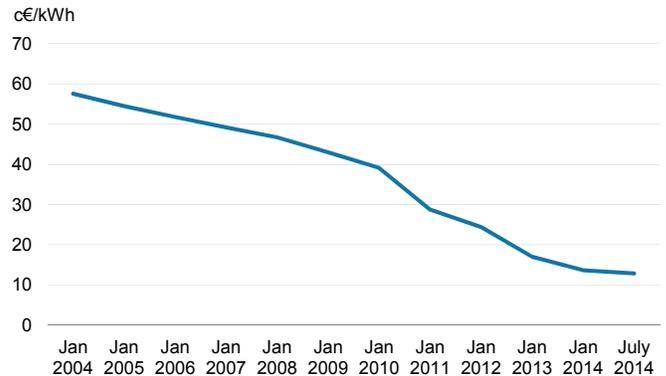
GW Solar Growth (2014-20)



Source: Company Data, Morgan Stanley Research

2. Looking forward to 2020, with lower solar PV capital costs, we calculate that solar should be competitive even without subsidies. Rooftop solar is therefore likely to remain a very important technology in Europe. The economics are partly driven by high retail power costs. This means that solar could run unsubsidised if necessary as a pure solar generation unit for a retail customer.
3. Including subsidies (generally feed-in tariffs, or FITs), solar is generally commercial in almost all countries in Europe, although we would argue that many of these subsidies are now becoming overly generous, as capital costs have decreased, and thus at risk. It would seem to us economically sensible for overall member state economies and for energy affordability in general, if solar subsidies are reduced markedly or even eliminated.

Exhibit 41
German Feed-In Tariffs Have Declined as Solar Capital Costs Have Declined



Source: BNetZa, Morgan Stanley Research

4. The slowdown of solar installations in Germany, given already high solar penetration levels, is a trend worth watching and one that could cause our solar growth estimates to be somewhat overstated. In 2013, the rate of growth slowed materially, and the first five months of 2014 have been even worse. For larger installations, the changes in legislation (coming this summer) could explain some of the slowdown, although in the past this has normally caused a rush to install before the new legislation takes effect. But for smaller, residential, installations the changes in legislation are not nearly as severe. IRRs remain healthy for residential installations, so it is unclear what is driving a slowdown. It is possible that the German market is approaching a saturation level, but we would like to see further data points given the favourable economics for further solar installations.
5. Energy storage, coupled with solar power, could be a commercially viable solution in Europe if battery and associated system costs decline significantly. Given our base case assumption is that installed solar and storage costs will decline materially, we believe that this can be a commercially viable solution in some European countries, although the IRR may be quite low in some cases. The most viable countries for energy storage are in our view Germany, Italy, Portugal and Spain.

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Europe Solar Power Market Size

We estimate that Europe will install an average of c.10GW per year up to 2020. We forecast c.8GW coming from the six markets we have analysed most closely, and c.2GW from the Rest of Europe. It is also worth noting that we forecast annual growth above the implied run rate for Europe in 2014 (based on YTD additions).

Our analysis of the European market has focussed primarily on developments in six countries (France, Germany, Italy, Portugal, Spain, and the UK). We expect these to be the most significant contributors to European installations. They accounted for 63% of European 2013 capacity installed (6.6GW from a total of 10.4GW).

But in the Rest of Europe, countries such as Greece and Romania both installed over 1GW in 2013. Regulatory changes have reduced installations dramatically in these countries. But we do see additions continuing in other countries. Thus we expect c.2GW of capacity to be contributed from the Rest of Europe (outside of the six largest contributors).

Exhibit 42

Scenarios for Installed Capacity (GW) by 2020

	France	Germany	Italy	Portugal	Spain	UK	RoE
Bull	29.8	75.4	36.9	3.2	18.3	35.3	50.7
Base	11.6	51.8	27.8	1.0	8.4	20.0	33.2
Bear	5.4	51.8	23.0	1.0	8.4	9.9	26.2

RoE – Rest of Europe

Bull Case: Blue Sky scenario based on theoretical rooftop potential.

Base Case: Based on currently installed capacity plus recent installation rate. (For Germany, Portugal, Spain and the UK we use the government targets).

Bear Case: National targets (For the UK we use current capacity plus run rate)

Source: Morgan Stanley Research

There are two ways to assess the potential solar market:

1. a physical assessment of suitable rooftop areas and
2. a market assessment based on current capacity.

1. Rooftop Assessment

Studies of roof cadastres such as that by Sun-Area estimate that approximately 20% of Germany's rooftops are suitable for solar energy use. We forecast that a physical assessment of European rooftops would imply residential capacity and production levels as displayed in Exhibit 43. We assume that residential installations are reduced to a smaller size (3kW) when the level of installations reaches government targets, because subsidies are likely to be reduced or removed when

targets are reached. Without subsidies, the value of power that is not self consumed is very low. Thus, we reduce the installation to a scale that is optimized for self-consumption. This leads to a 'blue sky' scenario in which PVs become increasingly commoditised and are installed nationally on rooftops. This is the driver of our bull case.

2. Market Assessment

Our market assessment, which makes up our base case, is based upon a combination of observable run rates, specific country conditions, coupled with country capacity targets.

For example, in Germany it is clear that solar is a mainstream technology and we see no reason why the government target of 52GW will not be reached given solar IRRs at ~6%. However, we do note a marked slowdown in 2014.

France and Italy show significant skew towards large-scale installations with lower take-up among households. Given their advantageous climate and lower relative take-up, households in France and Italy may be expected to increase their solar capacity in the near future as costs fall. For France, our base case assumes a pick-up in the current run rate to 11.6 GW by 2020. For Italy, our base case assumes the continuation of the current run rate.

In the UK, by contrast, small-scale installations under 4 kW account for 68% of total capacity. The UK Department of Energy and Climate Change has focused on encouraging installations among the residential and commercial segments. They estimate that the UK has 250,000 hectares of south-facing commercial roof space and hope to exploit it. Our UK base case assumes that the government targets are met.

Exhibit 43

Installed Capacity vs. National Targets

	Cumulative Capacity (End of 2013) (GW)	National 2020 PV Target (GW)	Capacity Installed During 2013 (GW)
France	4.63	14.00*	0.61
Germany	35.50	51.75	3.30
Italy	17.60	23.00**	1.46
Portugal	0.28	1.00	0.06
Spain	5.57	8.37	0.15
UK	2.90	20.00	1.00

*France is close to its (old) formal target of 5.4GW. Grid operator RTE plans for 14GW of solar capacity by 2020

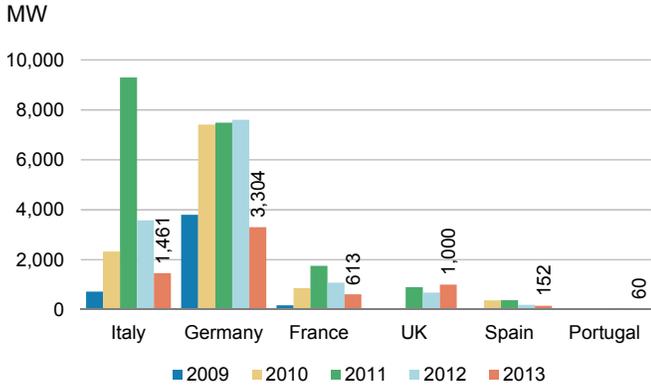
**Italy's target is for 2017

Source:EPiA, Morgan Stanley Research

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Exhibit 44

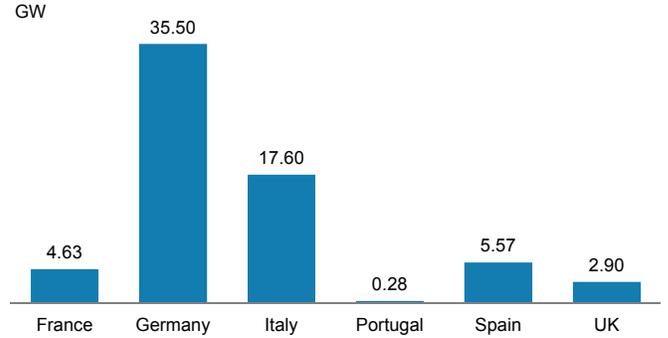
Annual Solar Capacity Additions



Source: EurObserv'ER, IEA-PVPS, Morgan Stanley Research

Exhibit 45

Installed Solar Capacity (as at Year-End 2013)



Source: IEA-PVPS, Morgan Stanley Research

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Regulatory Dynamics and Solar Economics

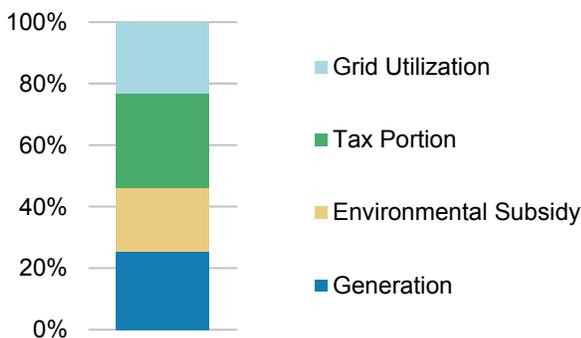
We expect downward pressure on solar subsidies due to (1) the ongoing decline in solar capital costs, (2) the fact that solar installations have been ahead of targets in many countries, and (3) the developing realisation that subsidies are often not needed to support residential solar deployment.

There are many “free rider” issues with solar PV across Europe. This would also apply to a combined solar panel and battery system. The free rider issue arises as a result of the inequality in the treatment of grid fees – charging utility customers on a fully variable basis, that is, on a per-unit of power consumed, solar customers can avoid paying the utility for fixed grid costs when solar customers eliminate/reduce their net power demand from the grid; as in the 43 US states with net metering rules, and in Brazil, this approach raises the retail price for standard (i.e. non-solar) customers. The same free rider concept applies to renewable subsidies. A per-unit of power consumed billing approach implies that the greater the renewable penetration, the higher the retail price for standard customers who must pay for the subsidy. Given that solar is moving from an emerging technology to one that is increasingly competitive, we believe it is likely that some of these charging systems are likely to be altered over time.

Germany has passed legislation to increase costs for self-consumption by SMEs. There are also discussions to mimic this in Austria. Exhibit 46 shows the makeup of the German retail tariff. Clearly any changes to the structure of grid fees, the EEG subsidy, or taxes would have a material impact on the commercial viability of solar power. Across Europe, there are various taxes included within the electricity bill. In Germany, the electricity tax is a material element of the bill.

Exhibit 46

German Electricity – Retail Tariff Breakdown



Source: Fraunhofer Institute, Morgan Stanley Research

In the UK, we expect the very generous FiT system to come under review as well, given the increasing focus on solar costs and the subsidy burden attached to solar power.

Recently, the UK government changed its proposed subsidies for large scale (>5 MW) solar. However, the UK remains very supportive of small and medium-scale installations.

In Spain, new solar installations have been disincentivized given the focus on affordability. No subsidies are available, and a tariff for backup (*peaje de respaldo*) was imposed on self consumption. This prevents the increase in self consumption from increase the deficit in the system (as in the past years, consumers tariffs in Spain have not been enough to cover the system's costs, generating the so-called annual tariff deficit).

In Portugal, the government is currently working on changing the authorization process for solar PV (*Jornal de Negocios, June 24*). Up to now, the government imposed caps on new capacity for small producers that limited the potential of the market. The government is considering giving more flexibility for self-consumption, which could improve the market outlook. However, the potential for new capacity will depend on the framework approved by the government. As the Portuguese electricity system also runs a deficit, we do not believe new capacity will be strongly incentivized.

In Italy, the solar FiT has been stopped for new capacity. Under existing tax legislation, solar panels are considered to be equivalent to energy efficiency spending. This implies that a consumer may subtract part of the investment from its taxable income over 10 years in equal installments. For investments made in 2014, 50% of the initial investments can be subtracted up to a maximum total investment of €96,000. For investments carried out in 2015, 40% of the initial investments can be subtracted, up to a maximum total investment of €98,000.

Including subsidies (generally feed-in tariffs, or FiTs), solar is generally commercial in almost all countries in Europe, although we would argue that many of these subsidies are now becoming overly generous, as capital costs have decreased, and thus at risk. It would seem to us economically sensible for overall member state economies and for energy affordability in general, if solar subsidies are reduced markedly or even eliminated.

We believe it is important to analyse the situation on an unsubsidised basis because a number of countries are already seeing solar capacity increase to levels close to, or above, the 2020 targets. Thus, there is a risk that the

subsidies are changed, and that the treatment of grid charges will change, meaning that solar would compete only against a smaller part of the retail bill. So, should we expect domestic customers to pursue solar PV on an unsubsidised basis, if it is now commercial? This depends on (1) how they finance the upfront installation costs, (2) their attitude to economic returns, and (3) their personal preferences. There is some evidence that adding solar could be viewed as a longer-term investment in a low interest rate environment. However, there is little evidence of unsubsidised solar appetite as yet, since most PV installations still get some form of support (via FiTs, tax allowances etc.).

For example, we calculate that, for household installations (typically around 4-5 kW), it would make sense for Germany to cancel its PV FiT. Continuing the subsidy for a technology that is now economic is irrational and costly to the nation. The industry should be cognisant of this, and should work to minimise system costs.

Exhibit 48

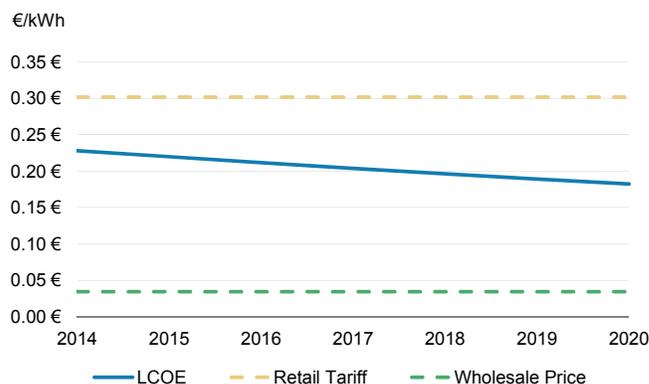
Country-by-Country Regulatory Overview

	Comment	Target PV Capacity
France	Feed-in Tariff in place for systems up to 100kW. Greater transparency on tendering schemes for larger installations. France doubled its target for 2013 installations but did not meet it	Latest NREAP targeted 5.4GW by 2020. Given France is close to reaching its target already, pressure is being applied to raise this target to 15-20GW
Germany	There is relatively high visibility on FIT support into the future. The new EEG reform comes into force from 1 August 2014. Annual growth of up to 2.5GW of new solar capacity is targeted. The existing "breathing cap" for excess capacity will be tightened so FIT support will reduce more sharply should the target be exceeded. There are restrictions on utility-scale installations in order to limit market growth.	Current feed-in tariff system capped at 52GW
Italy	No subsidy but domestic users can benefit from tax allowances as PV installation constitutes energy efficiency investment. For investments made in 2014, 50% of the investment (40% in 2015) is deductible in 10 equal annual installments.	Target of 23GW by 2017.
Portugal	Clear FIT evolution for small-scale producers (<8kW). The Financial Crisis limited market growth.	Limit on new installations in 2014 of 11.45MW (microproduction - up to 3.85kW) and 30.35MW (miniproduction - above 3.85kW)
Spain	There is currently a moratorium on solar panel installations. Support for solar installations was frozen at the beginning of 2012. The Spanish electricity tariff deficit is a blockade on future developments.	Given the moratorium on solar support, there is no target.
UK	Government solar support is in flux as the UK seeks to support Residential, Industrial and Commercial installations. This comes at the expense of support via RO for large-scale installations (over 5MW). However, without FIT support, most projects would not be economically viable.	Total target of 20GW by 2020. The specific target for large-scale solar (>5MW) is 2.4-4.0GW

Source: Morgan Stanley Research

Exhibit 47

German Solar LCOE – Assuming 4% PV Cost Reduction Per Annum



Source: Morgan Stanley Research

July 28, 2014

Solar Power & Energy Storage

Energy Storage Economics

Exhibit 49

Where Does Solar, and Solar + Storage, Give a Positive Financial Return Today?

	France	Germany	Italy	Portugal	Spain	UK
Solar (with subsidy)	✓	✓	✓	✓	n/a	✓
Solar (no subsidy)	✓	✓	✓	✓	✓	×
Solar + Storage (with subsidy)	×	×	×	×	n/a	×
Solar + Storage (no subsidy)	×	×	×	×	×	×

n/a – Spain does not offer subsidies for new capacity. There is currently a moratorium on additional solar installations

Note that Italy does not offer FITs, only offering tax deductions for solar installations (which we consider economically similar to a subsidy).

Source: Morgan Stanley Research

Exhibit 50

Where Will Solar, and Solar + Storage, Give a Positive Financial Return in 2020?

	France	Germany	Italy	Portugal	Spain	UK
Solar (with subsidy)	✓	✓	✓	✓	n/a	✓
Solar (no subsidy)	✓	✓	✓	✓	✓	✓
Solar + Storage (with subsidy)	✓	✓	✓	✓	n/a	✓
Solar + Storage (no subsidy)	×	✓	✓	✓	✓	×

n/a – Spain does not offer subsidies for new capacity. There is currently a moratorium on additional solar installations

Note that Italy does not offer FITs, only offering tax deductions for solar installations (which we consider economically similar to a subsidy).

Source: Morgan Stanley Research

Is solar PV plus battery storage commercially viable?

Battery storage has been the “holy grail” of the power generation sector for many years. It is now obvious that this is potentially on the cusp of becoming a commercially viable technology, assuming that various factors can drive storage system costs lower.

In Germany there have been around 5,000 systems installed, subsidised not only with a FiT but with a discrete battery subsidy in addition – albeit this is limited in scale. As Exhibit 51 shows, we currently calculate that storage is uneconomic (i.e., the IRR is slightly negative).

Exhibits 49 and 50 shows a variety of scenarios for the commercial viability of solar PV including and excluding battery storage. This shows that, for solar PV, it is widely commercial. The markets where it is most “in the money” versus retail tariffs are Germany, Italy and the UK.

So what return are households/investors seeking? In our view the answer is probably quite a low IRR given prevailing interest rates. It may be that any IRR above zero is acceptable. It could also be that some financing solutions become available in order to reduce the upfront capital costs. At present, fitting a typical solar/battery home system (5kW solar panels with a 12.5kWh battery) costs around €25,000 – a material outlay for many families. However, our base case

assumes that by 2020 this declines (based on a 5kW panel and 12.5kWh battery) to just €12,500, which is much more manageable.

Exhibit 51

We Project Positive IRRs for Solar + Storage in European Households by 2020 (Without Any Government Subsidy)

	France	Germany	Italy	Portugal	Spain	UK
Bear	nm	nm	nm	nm	nm	nm
Base	nm	2.09%	0.83%	2.11%	2.78%	nm
Bull	nm	4.12%	3.17%	4.71%	5.44%	nm

NM = not meaningful

Source: Morgan Stanley Research

But can solar and battery storage be a commercially viable solution in Europe? The answer very much depends on how much the battery and associated system costs decline. Given our base case assumption is that installed solar and storage costs will decline materially, we believe that this can be a commercially viable solution in some European countries, although the IRR may be quite low in some cases. Exhibit 51 shows some conclusions on the commercial viability of solar PV and battery storage systems across Europe. In our base case, which incidentally assumes a ~40% reduction in storage costs, battery storage would be economic in Germany, Italy, Portugal and Spain, even without a subsidy.

Recent German Solar Slowdown

The rate of solar additions in Germany is falling. In 2013 the rate of growth slowed materially, and the first five months of 2014 have been even worse. For larger installations, the changes in legislation (coming this summer) could explain some of the slowdown, although in the past this has normally caused a rush to install before the new legislation takes effect. However, for smaller, residential, installations the changes in legislation are not nearly as severe. IRRs remain healthy for residential installations, so what can explain the slowdown? Is this just a blip, or is it a sign of market saturation?

Recent German Trends – just 818MW in January-May 2014

Recent solar additions have disappointed. As Exhibits 52 and 53 show, Q1 2014 saw only 460MW of additions (vs. 773MW in Q1 2013 and 1,968MW in Q1 2012). Total Germany solar capacity stood at 36.86GW in April, so we are 70% of the way to the long-term national cap. Capacity additions have been surprisingly low, and the rate of slowdown in installations is clear both for Q1 and for the last year or so.

New regulations to take effect later in 2014 – But these do not explain the German residential slowdown

In July 2014, the German coalition passed bill that amends the Renewable Energy Sources Act (EEG). Under the terms of the new law, the self-consumption levy is introduced, but does not apply to household installations below 10kW. We expect these to slow the pace of renewable additions, as has been evident in 2014 to date.

The bill introduces a 40% levy on self-consumption from new renewable plants over 10kW. This will impact the economics of many larger solar PV installations (the current EEG surcharge stands at €62.4/MWh). The levy is aimed at slowing down installations within the SME market, which took up solar with gusto between 2009 and 2013. The regulations also seek to limit utility-scale solar installations (1MW and above).

The revised EEG legislation does not explain the slowdown in residential installations, as the self consumption changes do not impact these smaller sites. The levy itself is no reason for any slowdown in the residential market (<10kW). The legislation is set to come into effect in August with the overall

aim of having renewables account for 40-45% of energy by 2025; total production from solar in 2013 was 29.66TWh. The new laws reaffirm the previous installation 'corridor' of 2.5GW – installations above this target cause sharper falls in government subsidies.

The new legislation comes into effect on 1 August 2014, so one might expect a surge in installations before that date. Exhibit 54 demonstrates that over the past few years, the expectation of a decline in the FiT rate has caused a spike in installations. But surprisingly, no such spike seems evident yet.

Exhibit 52

Quarterly Solar Additions over the Past Four Years

(GW)	Q1	Q2	Q3	Q4
2010	717	3,136	1,681	1,844
2011	513	1,200	1,644	4,128
2012	1,968	2,404	1,853	1,377
2013	773	1,020	895	611
2014	460			

Source: BNetZa, Morgan Stanley Research

Exhibit 53

The First Quarter Has Seen Disappointing Capacity Additions

Additions (MW)	Jan	Feb	Mar	Apr	May
2014	193.4	110.4	155.8	158.0	200.0
Average 2010-13	319.4	175.8	497.6	344.6	385.5
2014 vs Average 2010-13	-39%	-37%	-69%	-54%	-48%

Source: BNetZa, Morgan Stanley Research

Exhibit 54

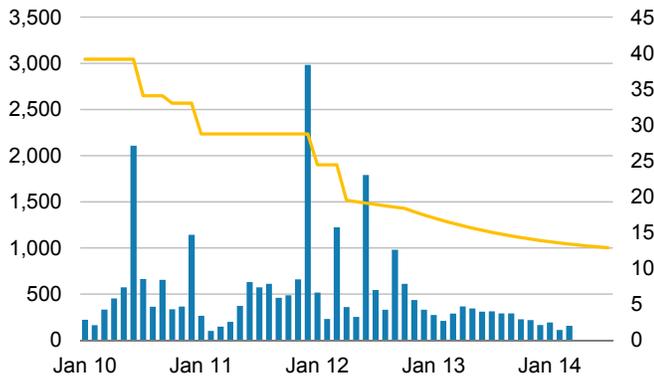
Year-on-Year Comparison Shows Persistent Slowdown in Installations

	Capacity Additions (MW)	YoY % Change
March 2013	289	-76%
April 2013	367	2%
May 2013	344	35%
June 2013	309	-83%
July 2013	312	-42%
August 2013	292	-11%
September 2013	291	-70%
October 2013	226	-63%
November 2013	219	-50%
December 2013	166	-50%
January 2014	193	-29%
February 2014	110	-48%
March 2014	156	-46%

Source: BNetZa, Morgan Stanley Research

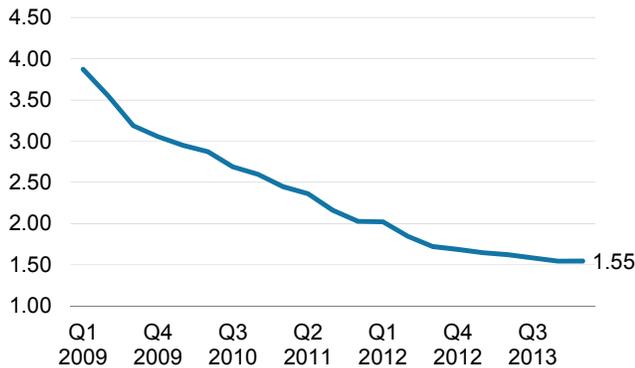
July 28, 2014
Solar Power & Energy Storage

Exhibit 55
Feed-In Tariffs (€/kW) (RHS) Continue to Decline as Monthly Additions Slow (MW) (LHS)



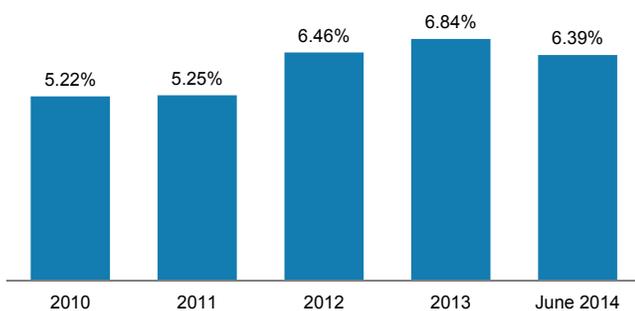
Source: BNetzA, Morgan Stanley Research

Exhibit 56
As the Cost of Installed PVs Continues to Fall (€/W)



Price Index based on an installation size of 1-100kW
Source: Morgan Stanley Research

Exhibit 57
But IRRs Are More Attractive Today – So Why the Residential Slowdown?



Historical IRRs (2010-13) assume actual, observed electricity tariff increases over the period
Source: Morgan Stanley Research

Do economics explain the Residential slowdown? We think this is not the case

As the cost of installed PVs fell sharply; the German feed-in tariff (FiT) was repeatedly cut and eventually placed on a ‘degression’ schedule – see Exhibits 55 and 56. In our view, solar is clearly commercially attractive versus high German retail tariffs (partly inflated due to the high subsidies that are collected from retail consumers). Yet even after the cuts to the FiT, lower PV costs mean that a German household installing solar panels in June 2014 is rewarded with an IRR of 6.4% (post-tax, unlevered). This is still an attractive return and higher than many alternatives in a low interest rate environment.

If it’s not explained by subsidy changes or by economics, is it due to market saturation, or is it just a blip?

Its still very early days, and it is possible that the slowdown in the first five months of 2014 is just a temporary blip. But if this is not the case we cannot explain the slowdown by the EEG changes – as residential installations are not really impacted by these – or by the economics of solar – as IRRs remain healthy. So what else could explain this? One option is that the market is reaching a point of saturation. Physically, we would argue that there is still scope for a huge amount of further residential solar installations in Germany – as some 20% of rooftops are suitable for solar – and thus our base case is that the market will restart, and that we will see more rooftop solar than Q1 2014 suggests.

But counter-intuitively, our experience has seen that whilst households are aware of FiTs, they don’t tend to calculate their own projected IRRs, focussing rather on payback periods and affordability. One possible explanation then is that the fall in residential demand is more likely to be a result of market saturation among consumers interested in installing solar PV. In other words, perhaps the majority of those households that were interested in having solar PV, had the financial wherewithal to afford it, and have a suitable rooftop location have already installed solar panels. This is a difficult thesis to prove, but unless the rate of residential solar installations picks up, it may be that it is correct. It is also possible that households have witnessed the decline in cash FiTs and subsequently decided against solar purchases. It is conceivable that only (1) sharply falling PV costs; or (2) above-average electricity tariffs increases – which the German government is keen to avoid – would stimulate residential purchases again.

Implications for Power Markets and Stocks

Solar additions (with or without storage) are likely to continue at a high rate, further depressing power markets. However, if we see a further slowdown of solar in Germany, this would be a positive surprise for utilities, in our view, primarily benefiting RWE. There are also significant upcoming power plant retirements which will improve market fundamentals and improve utility margins, which partially offsets the growth in solar power. These retirements, which should help return oversupplied systems back to balance, are happening at different speeds across the European power markets. For example, in Germany and Benelux there will be 31GW of plant closures in the coming years. Nevertheless, it seems obvious that, all else equal, the higher the rate of solar additions, the longer it will take to see European power markets recover.

Solar and battery storage could become a solution to meeting peak demand. This would be the solution to the power generation “Holy Grail”. Renewables are by nature intermittent, and produce substantially less than their nameplate capacity. As such, they are problematic for grid operators and consumers. However, with the right smart grid technology, smart meters, software, regulation, and agreements between customers and TSOs, solar and energy storage could be used to help balance the grid system, not just as generation units. In other words, they could act as peak shaving and supply-demand management devices, as they can provide power that has been stored back onto the grid. This negative demand is sometimes called “negawatts.” This could mean that, rather than simply continuing to build large centralized power capacity to cover for peaks in consumption and troughs in intermittent production, transmission system operators (TSOs) gradually would be able to call on consumers to reduce consumption, through direct pricing signals, or with the intermediation of ‘aggregators’.

Solar and battery storage could have negative impacts to utilities, but many technical issues/obstacles would need to be overcome. For solar power and energy storage to be truly disruptive to utilities, customers would need to be capable of, and motivated to, fully disconnect from the grid. For this to be feasible for the residential market, we think a number of complex system architecture changes need to fall into place.

- A number of regulatory developments including (1) the legal framework for contracts, (2) the role and power of TSOs which can vary country by country, and (3) the

ownership and economics of power that has been stored and is available to be exported on demand

- Increased availability of battery storage, produced on a big enough scale to justify the efforts on the regulatory issues above
- Standardization of smart meter devices and applications, partly dependent on smart meter rollout and other issues.
- Integration of software on customer-side devices that allows TSOs to govern “interruptibility,” i.e., the switching on or off of household freezers, electric heating, and air conditioning for short periods of time according to the needs of the greater grid.

We note that our models in this report are based on the principle that the solar economics are driven by avoiding the cost of retail electricity – we focus on the residential side of the market. Selling power back to the TSO at the wholesale price (~€35/MWh versus retail price at €300/MWh in Germany for example) would thus detract materially from the economics for the consumer. And paying a price as high as the retail price to extract stored electricity would be very expensive for the TSO, relative to current balancing power.

Regulation is going to be critical for many reasons, and the devil will be firmly in the details. In the short term, we expect material solar additions, a steep decline in storage costs, and therefore increasing numbers of solar + battery additions. This will focus the debate on how grid fees, and other parts of the retail tariff, should be treated. Utilities should be heavily involved in this debate. But even changing the treatment of grid fees is unlikely to reduce material additions of residential solar and battery storage, assuming our forecast cost reductions are correct.

The industry would be well-advised to stop investing in unsubsidised thermal generation, in our view. The last decade has shown that it is very hard to accurately predict the economics of thermal generation. The relationship between gas, coal and CO₂ costs, the supply-demand balance, the renewable capacity additions – all have been underestimated in importance by the European utilities.

Governments, whether by accident or design, have been only too willing to let thermal generation economics suffer at the expense of other areas like small-scale renewables. The reduction in costs of solar, and the potential competitiveness of solar and battery storage, make the debate even more complex.

But one gets what one pays for There is a good chance that thermal generation cannot exist profitably without a capacity market, or controls on solar. If the governments do not impose these, utilities should not invest. And they should make this clear, soon. Recent data from the IEA suggests that Europe will still require 100GW of new thermal capacity and nuclear capacity over the period 2014-35, costing some €390bn. It seems unlikely to us that this will be forthcoming.

The logical conclusion should be a well-functioning capacity market, alongside an energy market and a large renewable fleet that operates basically as must run. The economics of storage, even at our low cost estimates, still mean it is very expensive to be self sufficient, or to rely on negawatts for system security. So in our view, thermal is still critical, but it cannot, and should not, be viewed as a free resource.

More aggressive carbon reduction goals could further encourage solar development. Europe is comfortably on course to meet its 2020 target of reducing greenhouse gas (GHG) emissions by 20% (compared to 1990 levels). By 2012 the EU had achieved 19.2% reductions in emissions, almost eight years ahead of schedule.

Projections from Member States indicate that total EU emissions will further decrease between 2012 and 2020. EU emissions are expected to reach a 2020 level which is 21% below 1990 levels (incl. international aviation). Implementing the additional measures in Member States is expected to achieve a reduction of 24% below 1990 levels in 2020. Given the ease with which the EU is set to reach its 2020 goal, the EU has placed growing importance and focus on the negotiations for the 2030 targets. The EU's 2030 framework is for a 40% reduction on 1990 levels. EU leaders agreed at the European Council meeting on 21 March 2014 to take a final decision on the framework in October 2014 at the latest.

Assuming existing national measures continue up to 2030, there would only be an average reduction in emissions of 0.2% per year between 2020 and 2030 (i.e. in 2030 we would only see a 22% reduction on 1990 levels, compared to the target of 40%). Even with the implementation of additional measures (in planning stages) the EEA estimates that GHG emissions would decrease to 28%. This is still a significant shortfall on the 2030 target. It is clear that there is still a lot of work to do in order to reach the 2030 goal. At this point, greater clarity on the 2030 framework would be extremely welcome.

And a potential key surprise The logical extension of this could be a much bigger focus on cash flow at the generation businesses of the EU Utilities. The cash flow from the large integrated gencos is much more attractive than the accounting earnings. Thus, we theorise that one or more integrated operators could decide to take action and externalise its depressed generation business to highlight the value case. This could take the following form:

1. **Companies could start to show generation cash flows separately to highlight the value case.** In our view, most generation portfolios are undervalued if one assumes the businesses are put in run-off mode. And with no support and low power prices, we do not see any other mode that would make sense.
2. **Eventually, one EU integrated utility hypothetically could take this a step further and split its generation unit,** and possibly associated decommissioning liabilities, into a separate business. This would make further closures politically easier to implement, in our view, as some of the assets would now be visibly loss making. Further impairments could follow suit, rebasing D&A to a more realistic level and enhancing earnings. Other developments could include an announcement that staff incentives would be changed materially, and the company would likely focus almost solely on reducing cash costs, minimising maintenance costs, and beating forecast decommissioning costs. This would highlight that (1) the internally generated CFs would be sufficient to deal with the decommissioning liabilities, and (2) that after stripping out the generation business and the non cash interest charge on the provision, the rump earnings power would be much higher than expected. This would crystallise material value and could attract interest from financial buyers in a minority stake. We note that we are speaking theoretically, and have no knowledge of any such action under consideration..

Another potential scenario is that, in an effort to hurry change, as policy on capacity markets is slow to change, two large utilities take matters into their own hands, combine their EU generation fleets and announce (1) material further impairment charges, which would serve to boost accounting earnings of the generation business, and (2) a raft of closures of thermal capacity and some early nuclear closures in Germany. The staff incentives would also change materially, and a number of minority financial investors could conceivably be attracted to take stakes. As a result, the associated stocks could be expected to re-rate, as the value of the non-generation assets would gain more visibility.

United States

Stephen Byrd
Timothy Radcliff

Very Strong Growth Outlook, Even as Subsidies Likely to Fall Later in the Decade

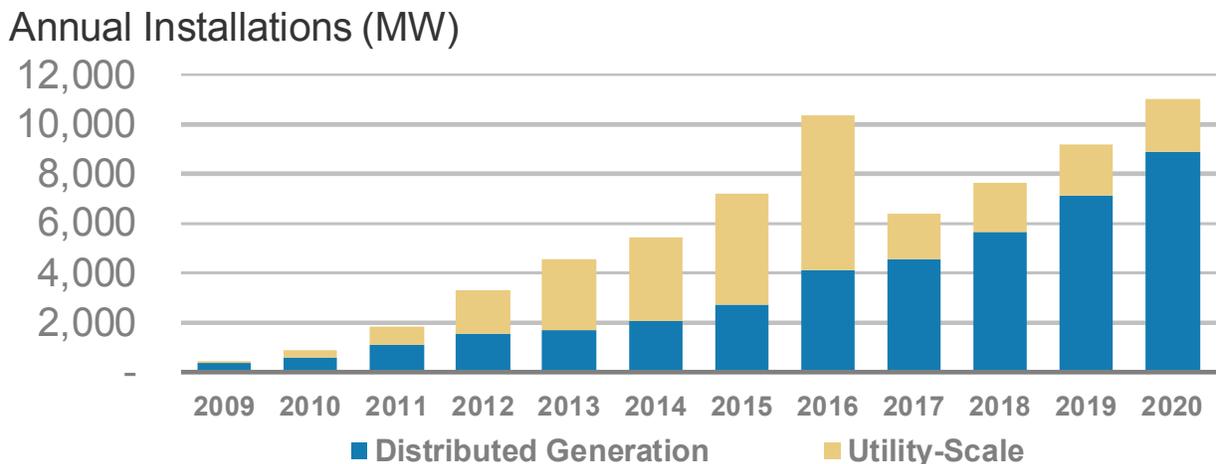
Key conclusions:

- 1. The United States comprises 17% of our global 2014-2020 forecast (57 GW of growth, or 8 GW per year), driven by supportive net metering rules in 43 states, strong solar conditions in many states, and further solar cost reductions.** Looking forward to 2020, with lower solar PV capital costs, we calculate that solar would be competitive in many US states even without subsidies.
- 2. The long-term addressable solar market in the US is larger than appreciated.** In our base case, with only 10% federal Investment Tax Credit (ITC) and solar customers paying 50% of a typical fixed grid charge, we see a US commercial and residential solar market of ~265 GW. Our bull case, a 30% ITC and 0% fixed grid charge, implies ~435 GW; our bear case, no ITC and 75% fixed grid charge, less than 30 GW.
- 3. The addressable household market for solar panels is quite dependent on two key factors:** net metering rules and the 30% solar Investment Tax Credit (ITC). Currently, distributed generation customers can eliminate

all or most of their power bill in 43 states by using distributed generation, including the part associated with utilities' investments in providing a reliable grid; this net metering approach will in our view likely change over time. In our base case, with 10% ITC and customers paying 50% of a typical customer's fixed grid charge, we see ~265 GW US solar market potential.

- 4. Projected decrease in costs of batteries and distributed generation could significantly disrupt the relationship between utilities and their customers in states with high utility rates and favorable sun conditions.** Over time, many US customers could partially or completely eliminate their usage of the power grid. We see the greatest potential for such disruption in the West, Southwest, and mid-Atlantic. However, utilities in some regions could adapt to distributed generation to minimize the impact on shareholders.
- 5. Potentially advantaged based on our analysis:** solar "integrators" that provide financing, design and construction of solar projects, such as SunEdison (SUNE), NRG Energy (NRG) and SolarCity (SCTY), and Tesla (TSLA), given its highly competitive energy storage product. **Potentially disadvantaged:** Pinnacle West (PNW) as a result of solar growth, and to the extent energy storage costs achieve our projected level, all 3 California utilities (SRE, PCG, and EIX) and Hawaiian Electric.

Exhibit 58
US Forecast



Source: SEIA, Morgan Stanley Research estimates

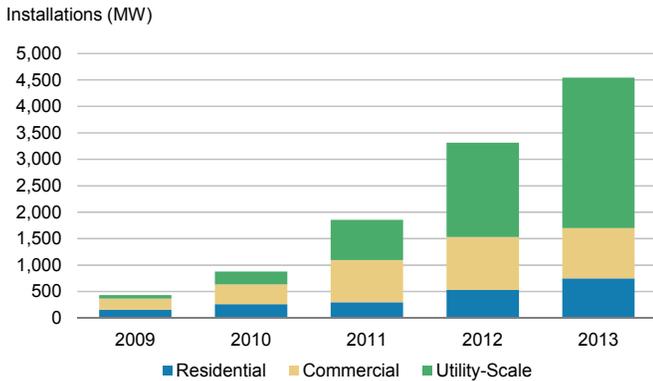
July 28, 2014
Solar Power & Energy Storage

Market Size

Current Installed Solar Capacity

The US market has grown steadily from less than 500MW in 2009 to more than 4.5GW in 2013.

Exhibit 59
US Solar Capacity Has Grown Steadily



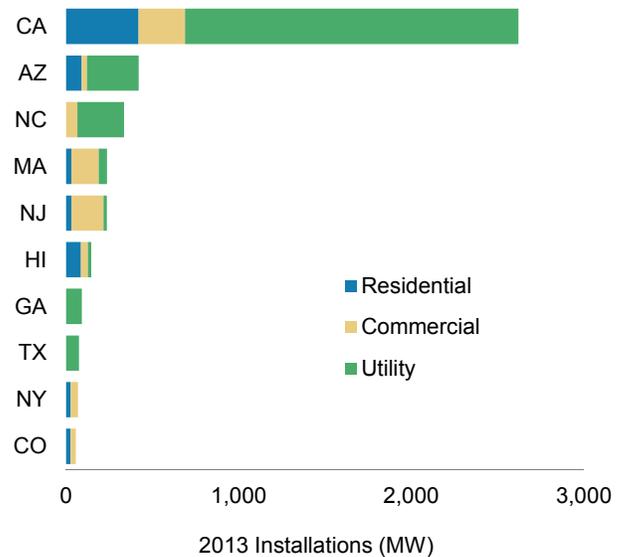
Source: SEIA, Morgan Stanley Research

The solar market has historically been driven by the utility-scale segment, driven in large part by state-level Renewable Portfolio Standards (RPS) that incentivize renewable buildout through above-market power pricing from qualifying generation technologies. California has been the most active satisfying its renewable portfolios standard through utility-scale solar buildout, and all three major utilities have reached 20% renewable penetration. Given the success of the RPS program over the last 5 years and limited need for incremental renewable (and particularly solar) capacity, we believe that utility-scale buildout will slow significantly following expiration of the federal investment tax credit that currently supports economics of these projects.

The remainder of the market – the distributed generation (or DG) segment – is comprised of residential and commercial applications and has been driven by a greater number of

states. Although California still leads this segment by a wide margin, other states such as New Jersey, Arizona and Massachusetts have all installed considerable DG capacity, driven by state-level tax advantages and availability of renewable energy credits that can be sold to industry for additional income. Although Hawaii is small in absolute capacity, it is notable in the sense that the large proportions of customers within certain service territories (for instance 10% of Hawaiian Electric’s customers) have installed solar systems given highly favorable economics for solar power in Hawaii..

Exhibit 60
California Dominated Installations in 2013



Source: SEIA, Morgan Stanley Research

Solar Penetration in Hawaii

Hawaii now has almost 10% rooftop solar penetration (versus ~2% in California), driven by favorable solar conditions, a high per-unit utility bill (\$.37/kWh residential rate, versus \$.16 in California and \$.10-\$.12 in many Southern states), and a significant state subsidy for solar in addition to the federal solar ITC. Solar rooftop volumes increased ~40% in 2013 relative to 2012.

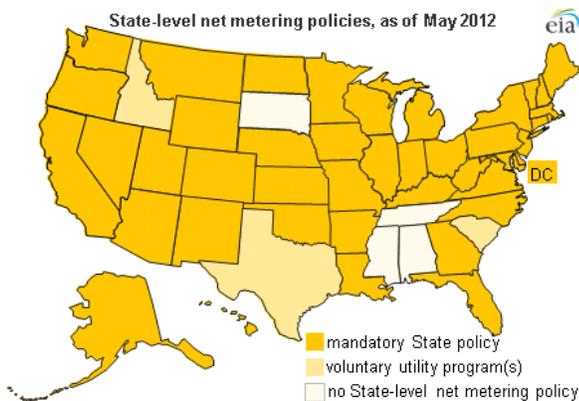
July 28, 2014
Solar Power & Energy Storage

Regulatory Dynamics and Solar Economics

Net metering, which is permitted in 43 US states (the largest exception to this being Texas), involves utility customers who self-generate sufficient power to meet their own needs, but the power generated is not coincident with the hourly profile of their power demand. For example, a net metered solar customer would “over-produce” power during the day, sell the excess power back to the grid, and buy power from the grid at night. While the net power consumption from the grid, net metering customers depend on the grid to (1) manage the volatile output of their self-generated power, (2) provide power whenever customers need it, and (3) ultimately provide reliable, round-the-clock power.

Exhibit 61

43 States Currently Allow Net Metering



Source: Morgan Stanley Research

If utilities succeed in altering the regulatory construct such that solar customers are required to pay all or a large percentage of the fixed grid fees, the impacts to solar penetration would be significant. Ultimately, we believe that state regulators will likely impose some degree of fixed charge on solar customers, because we believe there will be support for the logic that solar customers connected to the grid do derive a significant reliability benefit from their connection to the grid. Our commercial solar market potential is especially dependent on the fixed grid charge that commercial customers using solar power must pay. This is the case because, in many states, the “power-only” rate (the portion associated with the cost of large power plants to produce power) for commercial customers is lower than for residential customers. Therefore, if the fixed grid charge that a commercial customer must pay were to be at 100% (not likely in our view), solar power would need to compete solely against the relatively low rate charged for power production from large power plants connected to the grid

The following table shows the high degree of sensitivity that the solar market opportunity has to net metering rules:

Exhibit 62

Solar Market Potential in the US Is Very Large, Depending on Grid Charges

	Base	Bull	Bear
ITC	10%	30%	0%
Fixed Charge (as % of T&D Bill)	50%	0%	75%
Residential Market Size (GW)	167.6	221.9	11.7
% of Total	63%	51%	43%
Commercial Market Size (GW)	98.7	213.6	15.8
% of Total	37%	49%	57%
Total Solar Market Size (GW)	266.4	435.6	27.6
Total Storage Market Size (GWh)	71.1	-	71.1

Source: Morgan Stanley Research

There may be a “tipping point” that causes customers to seek an off-grid approach – Higher fixed charges to distributed generation customers are likely to drive more battery purchases and exits from the grid. The more customers move to solar, the remaining utility customer bill will rise, creating even further “headroom” for an off-grid approach. For every \$25/kWh reduction in the cost of lithium-ion batteries, we estimate the all-in cost of power to customers falls by about \$.01, or about 15% of the residential customer price for grid charges.

Solar Economics Reaching Highly Competitive Levels

In our work covering the solar sector, we have witnessed significant reductions in the installed cost of solar panels, as well as improved power output efficiency gains. Much, but not all, of future installed cost reductions will come from improved installation economics, driven by the scale and experience of large solar service providers such as SolarCity (SCTY). We project that, by 2017, the national average installed cost/Watt for commercial projects will be ~\$2.14/watt, falling to \$1.84/Watt in 2020.

Although the US solar market has historically been dominated by the utility-scale market, these projects have been profitable primarily due to above-market power prices associated with renewable projects to satisfy state-level renewable portfolio standards. As key states (most particularly California) reach interim targets, pricing support has declined rapidly, along with corresponding project returns.

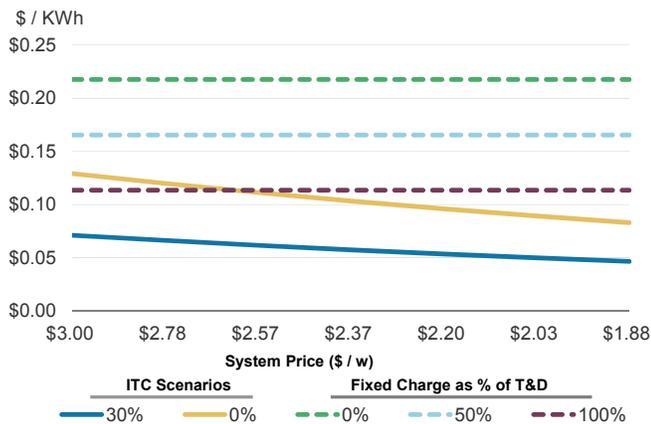
On the other hand, distributed generation projects compete against relatively high retail pricing to residential and commercial customers. In distributed markets, cost declines have rendered profitable substantial portions of the market with the help of the investment tax credit, and we expect

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further cost declines in the coming years to improve economics to a point where the federal tax credit is unnecessary to generate sufficiently attractive returns to incentivize investment.

Exhibit 63

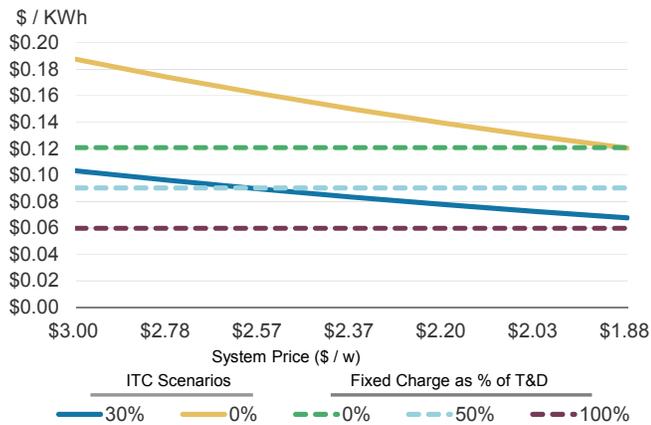
In California, We Expect Residential Solar to Be Competitive with the Grid, Even without ITC and with Fixed Grid Fees



Source: Morgan Stanley Research

Exhibit 64

However, in Midwestern States Such as Illinois, the LT Outlook for Solar is Much More Challenging



Source: Morgan Stanley Research

Recent US State Net Metering Regulatory Activity

Two recent state regulatory developments are worth studying given their relevance to how the debate around net metering may play out at the state level. In California, the legislature passed Assembly Bill (AB) 327 in October 2013, which imposes a fixed charge of \$10/month (~20% of the typical monthly bill for fixed grid charges, as opposed to the portion of the bill for the production of power) on all residential customers, regardless of net amount of power usage. AB 327 also authorizes the California utility regulator to (1) flatten the tiered rate structure (high users of power pay more per unit of power, affording improved economics for solar projects that reduce the grid power usage of such customers) and (2) determine the fees that should be charged to net metering customers.

In Arizona, the issue of net metering was the subject of intense debate in 2013. A large Arizona utility, Arizona Public Service (APS; its parent company is PNW), proposed that distributed generation (primarily solar) customers pay a monthly fee for grid maintenance costs. As highlighted by the utility’s spokesperson, “[t]his is about fairness. It’s about addressing the cost shift that clearly exists. The current net metering structure creates a cost shift that unfairly burdens non-solar customers. We should fix that problem now before it gets worse.” APS proposed charging a fixed monthly fee of \$45-80 for customers using distributed generation. Ultimately the Arizona utility regulator approved a monthly fee of ~\$5/month, far below what was requested by APS. At \$5/month (~10% of a typical Arizona customer’s monthly bill for fixed grid charges), we do not believe the fixed grid charge in Arizona will materially slow down the pace of rooftop solar development.

We view Pinnacle West (PNW) as exposed to margin reductions from solar demand. Unlike California and Hawaii, where utilities are fully “decoupled” and are made whole from lost power demand from solar customers, Pinnacle West does not have a perfect hedge against lost demand. We will continue to monitor solar penetration levels in the state of Arizona to determine impacts to PNW’s earnings.

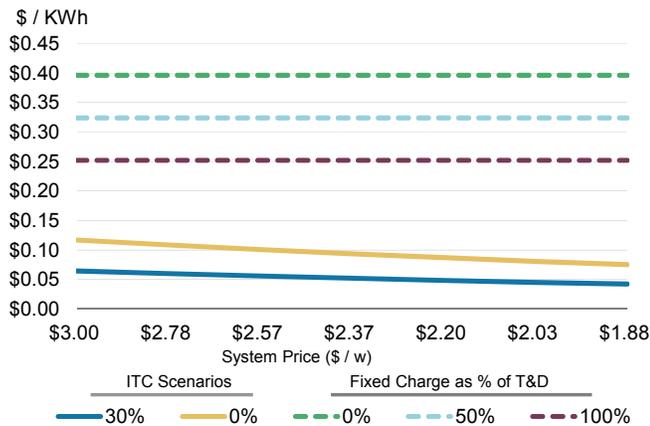
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Storage Costs: Dropping to Levels That Could Be Grid-Competitive

Historically, power storage costs have been too high to realistically allow customers to disconnect from the utility power grid. However, given the prospect of reduction in battery production costs to \$125-\$150 per kilowatt-hour of storage capacity, and perhaps lower (a few years ago, a typically battery would cost >\$500/kWh), we see the potential for customers to decide to move off-grid. For example, in California the typical annual residential cost for fixed utility grid costs was ~\$500 in 2012. California rates are projected to increase materially, likely 4-6% through 2020 in our view. Given that most of the rate increases in our view relate to “wires” costs (rather than to the cost of power production from large power plants), we believe the grid charge in California could grow faster than 4-6%. If grid charges grew by 5% annually, by 2020 the typical fixed grid cost for a California utility customer would be ~\$750.

Given Hawaii’s high utility tariff rate and strong solar conditions, the state may serve as an early test of the viability of customers using a combination of solar power and energy storage to go fully off-grid.

Exhibit 65
In Hawaii, Solar Is Very Competitive



Source: Morgan Stanley Research. Analysis does not include financial incentives given to solar by the State of Hawaii.

The higher the fixed charge required of distributed generation (primarily solar) customers, the greater the potential that customers purchase batteries on a large scale and go completely off the grid. Such an outcome would be bullish for Tesla, whose batteries we believe will be the most competitive energy storage solution. Tesla’s batteries and the solar leasing companies are, for a period of time, somewhat diversifying products in the sense of their

opposite exposure to the fixed fee that solar customers must pay. However, we believe in the long term, both products will experience significant growth. As solar penetration rises, the “rate headroom” for Tesla’s batteries will increase.

As mentioned, the “tipping point” could come if two dynamics come into play: increasing rates paid by utility customers, and the potential that utilities may encounter operational challenges in interconnecting large amounts of renewables (see our discussion of Hawaii for further information). For example, if (a) California utility bills increase 5% per year, (b) solar penetration reaches 20%, and (c) fixed grid fees paid by solar customers is 50% of the typical customer’s transmission/distribution bill, a residential utility customer’s solar customer’s bill would be \$.26/kWh in 2020, whereas a solar/storage off-grid approach under our assumptions would result in total costs per kWh below this level.

The scale of Tesla’s battery production, even for its own use as an auto manufacturer, thrusts the company into ‘key player’ status for grid storage. There are currently around 15 Lithium Ion battery deployments with >1MW of capacity in the US with the largest installation being 40MW. Tesla’s current Model S production (assuming 80 units per day with an 80kWh average battery capacity – i.e., 80% of Model S’s delivered with 85 kWh packs, 20% with the 60kWh) is equivalent to 6.4 MW hours of battery capacity per day. At that rate, by our calculations Tesla’s Model S production could produce a combined vehicle population with as many MW of battery storage for the US grid as exists today (304 MW) including all chemistries.

Analysis of Tesla’s growing car population offers a valuable perspective to its position in energy storage. By 2028, we estimate Tesla’s 3.9 million units NA car population (or “park”) will have an energy storage capacity of 237 GW (443 GW globally), equal to 22% of today’s US production capacity and nearly 10x larger than the entirety of US grid storage that exists today. These figures excludes any recycled (2nd life) battery after EV use.

- 1 Tesla Model S (85 kWh) can store enough energy to power the average US household for 3.5 days.
- By 2020, we estimate Tesla’s 690k unit US fleet will contain the stored energy capacity to provide 1 full hour of electricity to 1.6% of US households.
- By 2028, we estimate Tesla’s 3.9m unit US fleet will contain the stored energy capacity to provide 1 hour of electricity to 8% of US households.

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Japan

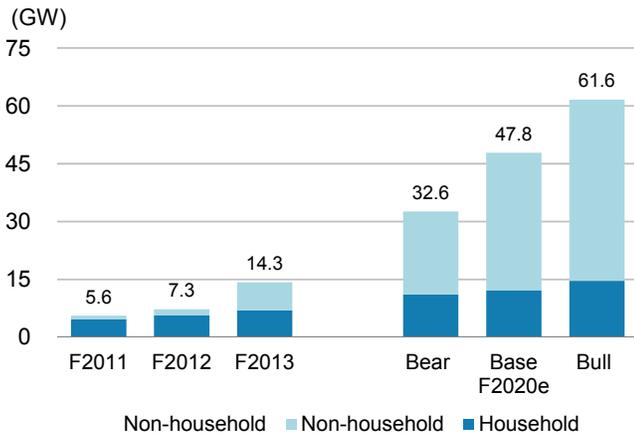
Yuka Matayoshi

Solar Power Highly Economic Under Current Feed-in Tariff Scheme, but Downside Risk Exists

Key conclusions:

1. **Japan comprises 10% of our global 2014-2020 forecast (33.5 GW of growth, or 4.8 GW per year based on our base case scenario), driven by a supportive feed-in tariff (FiT) and improving solar economics.** Most of this growth will be larger-scale, non-residential solar projects, driven by more favorable economics for these larger projects.

Exhibit 66
Japan Installed Solar Capacity by 2020 Based on our Bear/Base/Bull Scenarios



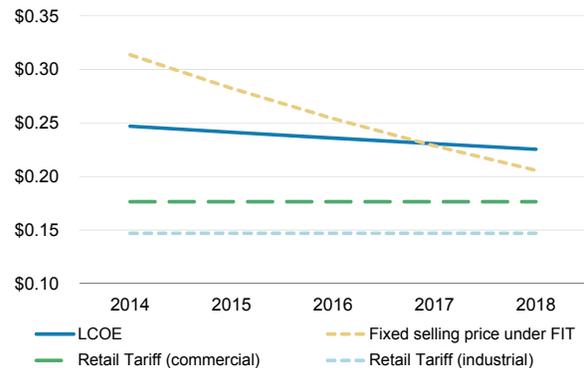
e= Morgan Stanley Research (Japan Utility team) estimate.
Source: METI, Morgan Stanley Research

2. **While renewable additions have been consistently strong since 2013 (300-700 MW online per month), there is a risk that the pending review of the FiT by the Japanese government could result in a significant reduction to the solar FiT rate, which would reduce solar economics and volumes, in our view.** In June 2014, the Japanese Ministry of Economy, Trade and Industry (METI) started to consider a review of the current FiT scheme, which guarantees high solar power generating profitability. In the background are factors including: (1) growing resistance from the consumer side over increased surcharge burdens, (2) criticism of high solar power operator profitability as a

result of solar purchase prices set at high levels, and (3) limits on the amount of solar power that electric power companies can accept due to shortages of excess grid capacity.

3. **The path to grid parity for solar in Japan likely to be a long one. It is possible that solar cost declines will be slower than FiT price declines, resulting in a slowdown of Japanese demand for solar power.** Further solar panel and installation costs reductions will in our view bring the cost of power produced from solar panels cost closer to grid parity. However, assuming that electric power operators maintain their current rates, the prospect of solar power reaching grid parity appears to us to be not something achievable in the near- to medium-term, given our view that cost declines will begin to slow in the future. The following chart shows a scenario in which solar cost declines are slower than the reduction in the FiT, eventually leading to the potential that solar installations would be uneconomic.

Exhibit 67
Non-household Solar: Solar Generation Cost, Purchased Price under the FiT and EPCOs' Retail Tariff for Commercial/Industrial Customers



Source: METI, Morgan Stanley Research

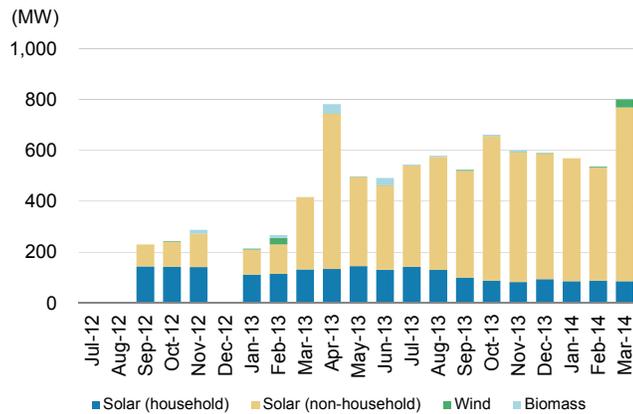
4. **Energy storage is unlikely to be economic in Japan when coupled with solar power, because solar power economics are challenging on a standalone basis and grid costs are not sufficiently high to offer energy storage the potential to allow customers to save money by moving off-grid.** This is in contrast to portions of the US and Europe, in which solar economics are more promising and the utility bill is relatively high, allowing customers the potential to avoid utility fees through a combined solar/energy storage product.

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Market Size

Renewable energy capacity has continued to increase rapidly since the adoption of a renewable energy FiT in July 2012. There has been a marked increase in new non-residential solar capacity (10kW or more). Since 2013, added solar volumes per month has stayed in the 300-700MW range.

Exhibit 68
Monthly Renewable Capacity Additions by Sources

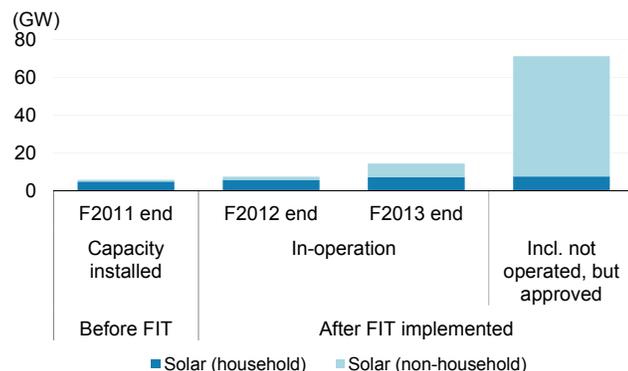


Note: The data in Dec-2012 are invalid, due to definition change.
Source: METI, Morgan Stanley Research

We expect solar power capacity — mainly non-residential — to continue to increase

The amount of solar power capacity certified for fixed-price purchase by end-March 2014 was 65.7GW (2.7/63.0GW household/non-household). Only 8.7GW has already entered service; assuming a steady entry into operation of certified projects, going forward there should be a 57.1GW increase in capacity (0.5/56.6GW household/non-household), and we calculate cumulative solar power capacity deployed of 71.3GW (household 7.4GW, non-household 63.9GW).

Exhibit 69
Installed and Approved Solar Capacity



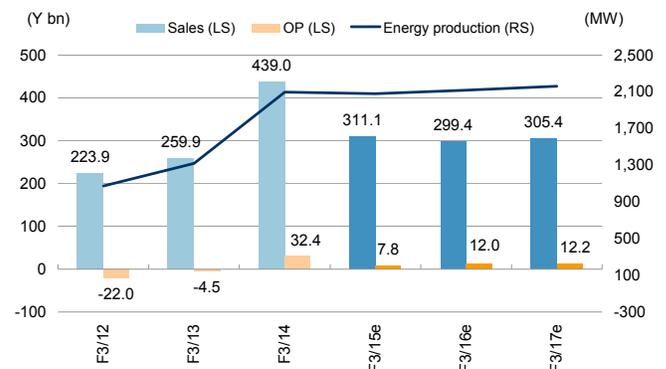
Note: Projects approved but not in operation may include projects for which operation plans could be put on hold. Source: METI, Morgan Stanley Research

Japanese Solar Cell/Panel Volumes

Domestic cell module shipments double in F3/14: Japan domestic cell module shipment volume was 8.5GW in F3/14, according to JPEA (Japan Photovoltaic Energy Association) data. Japanese companies top market share rankings on a total shipment basis, with Sharp at 23%, Kyocera 13%, Toshiba 9%, Panasonic 9%, and Mitsubishi Electric 7%. On a production basis, however, the domestic production ratio is down 18%YoY to 44%, with overseas production and OEM procurement rising. Total shipments rose 2.2-fold YoY in F3/14, buoyed by the FiT scheme and run-up in residential demand ahead of Japan's consumption tax hike, and yet all companies expect a pullback in shipments in F3/15. Further, companies that are unable to offset the reduction in purchase prices with conversion efficiency gains are likely to be forced to curtail the size of their operations.

Sharp (6753.T, covered by Masahiro Ono): Demand pullback and reduction in FIT purchase prices to squeeze profitability from F3/15: Sharp has the leading share of Japan's market, and in F3/14 had solar cell sales volume of 2.1GW (+59% YoY) and sales of ¥439bn (+69% YoY). While the business produced a strong 7.4% OPM, Sharp guides for F3/15 sales volume of 2.0GW (-5% YoY) and sales of ¥290bn (-34% YoY). While we think Sharp's guidance is conservative and expect the business to stay in the black, we do expect to see an ongoing trend toward low module prices, assuming continual reductions in FiT purchase prices. Given the inevitable need to increase OEM procurement in this business, profitability looks set to remain under pressure.

Exhibit 70
Sharp Sales, Operating Profit and Energy Production



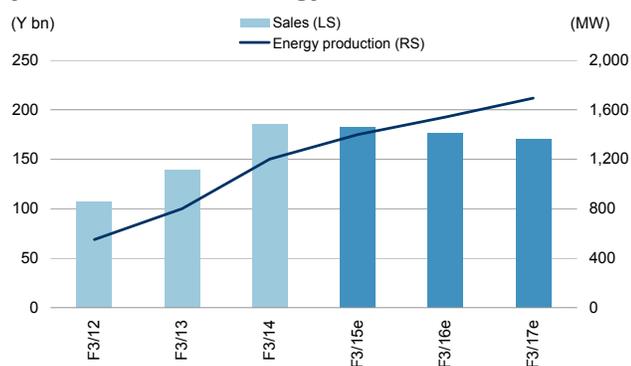
Source: Company Data, Morgan Stanley Research

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Kyocera (6971.T, covered by Shoji Sato): Shipment volume to keep rising, but expect F3/14 to have been the peak for sales and profits as prices fall: Kyocera is No.2 in Japan after Sharp in terms of solar panel-related sales. The firm's solar business sales and profits jumped in F3/13 with the start of FiT in July 2012, and we attribute the ¥185bn record solar sales marked in F3/14 to contributions from FiT for the full 12-month period. However, FiT purchase prices (excluding the consumption tax) have declined from ¥40 in F3/13 to ¥36 in F3/14 and ¥32 in F3/15. We expect weaker prices and tighter price competition triggered by the growing entrance of overseas competitors into the Japanese market to send both sales and profits on a downtrend in F3/15. Also in F3/16 onward too, we foresee ongoing declines in sales and profits as, assuming a continued slide in FiT purchase prices, we expect price competition with overseas rivals to stiffen in the Japanese market.

Exhibit 71

Kyocera Sales and Energy Production

Source: Company Data, Morgan Stanley Research

Exhibit 72

Purchase Prices, Purchase Periods, and Purchase Price Calculation Assumptions by Source (F3/15 FIT Scheme)

	Solar		Wind			Geothermal		Hydro		
	Above 10kW	Below 10kW	Above 20kW	Below 20kW	Offshore	Above 15MW	Below 15W	Above1MW Below30MW	Above200kW Below1MW	Below200kW
Purchase price (yen/kWh)	32+tax	37	22+tax	55+tax	36+tax	26+tax	40+tax	24+tax	29+tax	34+tax
Capital cost (yen/kW)	--	--	300,000	1,250,000	565,000	790,000	1,230,000	85,000	800,000	1,000,000
System cost (yen/kW)	275,000	385,000	--	--	--	--	--	--	--	--
Land development cost (yen/kW)	4,000	--	--	--	--	--	--	--	--	--
Connection cost (yen/kW)	13,500	--	--	--	--	--	--	--	--	--
Operating & maintenance cost (yen/kW/yea)	8,000	3,600	6,000	--	22,500	33,000	48,000	9,500	69,000	75,000
Intensity	13%	12%	--	--	30%	--	--	--	--	--
IRR (before tax)	6%	3.2%	8%	--	10%	13%	13%	7%	7%	7%
Purchase period (year)	20	10	20	20	20	15	15	20	20	20

Source: METI, Morgan Stanley Research

Regulatory Dynamics and Solar Economics**FiT scheme, which favors solar power, behind the increase in capacity**

The advantages created by the various conditions laid down in the FiT scheme are behind the remarkably strong increase in solar power capacity deployed, especially non-household. Exhibit 72 shows the purchase prices, purchase periods, and purchase price calculation assumptions established by METI. Project risk for solar power generation is relatively low due to the absence of a mandated environmental assessment, but the project IRR assumption when calculating the purchase price is a high 6% (before tax, unleveraged), and the fixed-price purchase period is a long 20 years. Partly due to government efforts aiming to cultivate domestic solar power-related industry and accelerate the ramp-up period for renewable energy, the scheme gives prominent advantages to large-scale "mega solar" solar power operators

Purchase prices falling year after year, but

The purchase price and purchase period are revised every year based on the recommendation of a METI procurement price setting committee and set by the METI minister. The committee gathers data on the installed system costs of solar power operators that have begun operations under the FiT scheme, and has the purchase prices to be applied to operators entering the scheme from the following fiscal year reflect the effect of decreases in actual costs. Exhibit 73 shows purchase prices from F3/13 through F3/15 since the start of the FiT scheme. Solar power purchases prices have fallen by an average of 6% per year for residential-use and an average of 13% per year for non-residential use.

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Purchase price calculation method still assumes project IRR of 3-6%

However, in the three years (F3/13-F3/15) since the adoption of the renewable energy feed-in tariff scheme (FiT) in July 2012, the policy has remained to set purchases prices with particular consideration given to operator profits. Project IRR assumptions (3% for residential solar power and 6% for non-residential solar power) used for calculating purchase prices have not changed, and the situation still allows for relatively high profitability despite low project risk.

Exhibit 73

Purchased Prices by Sources/Start-Years

	Purchased price (Yen/kWh)				Duration (Years)
	F3/13	F3/14	F3/15	F3/13-15 CAGR	
Solar (non-household)	42.0	36.0	32.0	-13%	20
Solar (household)	42.0	38.0	37.0	-6%	10
Wind	22.0	22.0	22.0	0%	20
Off-shore Wind	-	-	36.0	-	20
Geothermal	27.3	27.3	27.3	0%	15

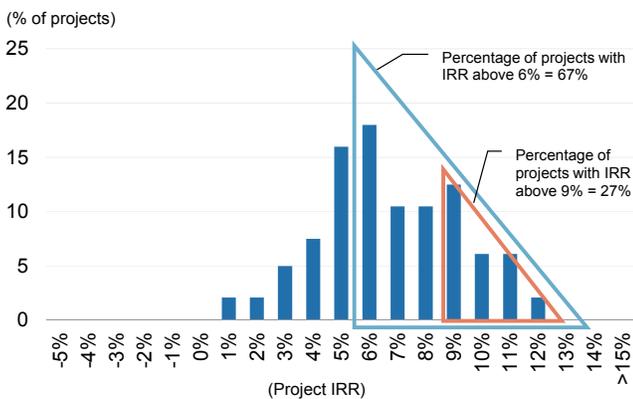
Source: METI, Morgan Stanley Research

Project IRR of over 10% on some large-scale projects

In March 2014, METI disclosed anticipated pretax IRR recovered by operators starting operations in October-December 2013. According to these materials, the majority—67%—of large-scale solar power projects with output of over 1MW known as "mega solar" had anticipated IRR of over 6%. Among which, 27% of projects, such as those using idle land, were in the high anticipated IRR range of 9-12% (Exhibit 74).

Exhibit 74

Reported Project IRRs (above 1MW)



Source: METI, Morgan Stanley Research

Equity IRR >10% for some leveraged mega solar projects

IRR in Exhibit 74 is "project IRR", which calculates the investment effect of entire projects. Mega solar projects with output of over 1MW generally use project financing and are looking for a leverage effect. In cases with about 70% leverage based on bank loans with fixed interest rates about 3-4ppt lower than project IRR (6%), we calculate equity IRR of over 15-18%.

Major risk of solar power becoming less economic in Japan from F3/16

We believe there is risk of non-residential solar power generation becoming sharply less economic for projects entering operation from F3/16. That is because a drastic review of the current FiT scheme is likely to cause purchases prices to fall faster than system cost.

Exhibit 75

Non-household Solar: Solar Generation Cost, Purchased Price under the FiT and EPCOs' Retail Tariff for Commercial/Industrial Customers

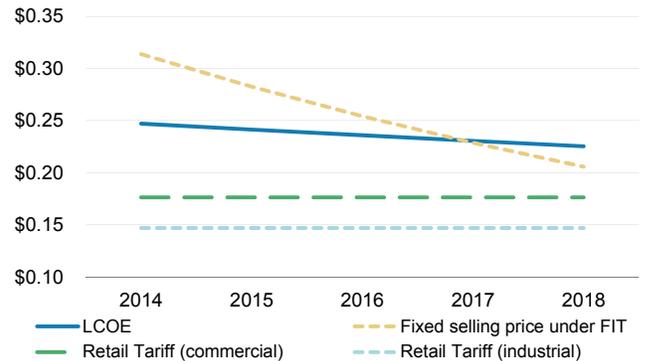
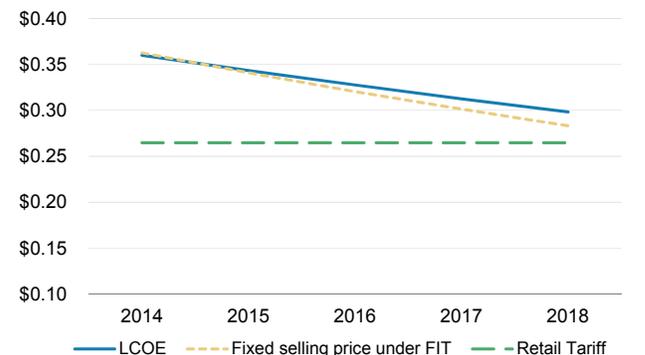


Exhibit 76

Household Solar: Solar Generation Cost, Purchased Price under the FIT and EPCOs' Retail Tariff For Commercial/Industrial Customers



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Drastic review of FiT scheme likely

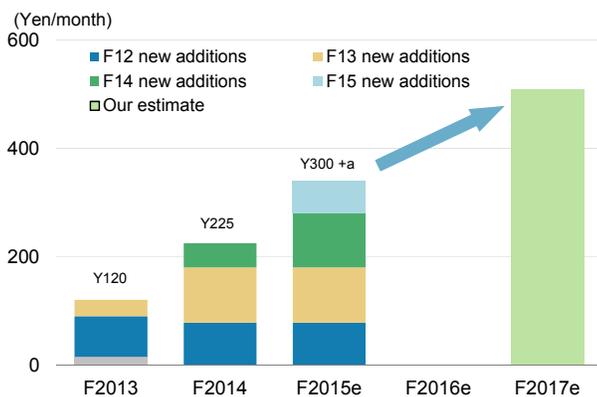
In June 2014, METI started to consider a review of the current FIT scheme, which guarantees high solar power generating profitability. In the background are factors including: (1) growing resistance from the consumer side over increased surcharge burdens, (2) criticism of high solar power operator profitability as a result of solar purchase prices set at high levels, and (3) limits on the amount of solar power that electric power companies can accept due to shortages of excess grid capacity.

Surcharge burdens may go beyond what is acceptable over the next 2-3 years

Consumers shoulder the expenses which electric power operators are required to procure at through the renewable energy feed-in tariff scheme in the form of surcharges proportional to electric power usage as a portion of electricity charges. Exhibit 77 shows surcharge levels (the amount shouldered monthly by a standard household). The amount was ¥120/month in F3/14 (a 1.3% increase on the total amount paid for electricity monthly) and is ¥225/month in F3/15 (a 2.7% increase). Once projects become part of the purchase scheme, the same purchase price is applied for 1-20 years, and thus the structure is such that the newly purchased portion in the new fiscal year is added to the surcharge on top of the portion purchased under the purchase scheme up until the previous fiscal year. Given the current pace of expansion in capacity certified under the current purchase scheme, we calculate an increase in the surcharge burden for a standard household to ¥500/month (a 6.1% increase on the total amount paid for electricity monthly) as soon as F3/18. There is starting to be the risk of going beyond the range of what is acceptable to consumer groups.

Exhibit 77

Monthly Surcharge for a Standard Household



Source: METI, Morgan Stanley Research

Adoption of controls on total purchase volume being considered

METI has indicated its intention to complete a review of the renewable energy feed-in tariff scheme favoring solar power by around end-2014. The main revisions proposed to date include: (1) the adoption of controls on total volume setting upper limits on volume purchased at fixed prices (the obligation to purchase the portion above the upper limited would be eliminated, and buying and selling at freely-determined prices would be permitted), and (2) changes in the frequency of feed-in tariff reviews (the existing review frequency is once per year; this could be changed to multiple times, such as in Germany, where there is a monthly review). The changes are likely to reduce the incentives for new solar power projects that guarantee high profitability.

Uncertain whether profitability can be guaranteed at lower purchases prices/lower volume

At this point, it is hard to make projections because it is unclear where upper limits might be set, how far prices might be lowered (how far project IRR used for calculating purchase prices might be brought down). We cannot deny the possibility of large-scale solar project development plans being toned down due to the difficulty of securing the kind of profitability seen until now.

Road to grid parity still long

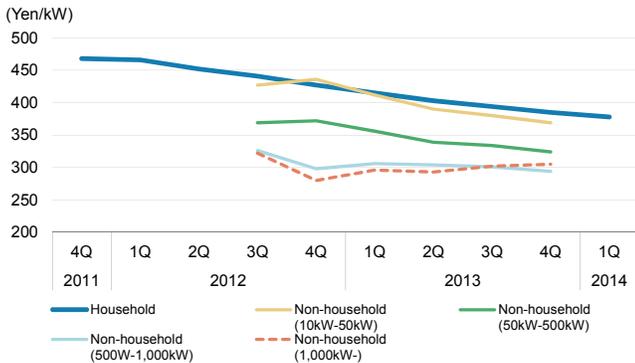
After a major review to the FIT scheme, procurement cost reductions and such would lead solar power cost closer to grid parity (purchase prices from electric power companies), making it more important to secure profitability mainly from in-house consumption rather than power sales. However, assuming that electric power operators maintain their current rates, reaching grid parity does not look at all easy, as we expect the procurement cost reduction curve to be gentle.

If the current rate of system cost decline were to continue, we calculate that residential solar power cost would approach grid parity, but

Solar power generation system cost have been falling at an annual rate of 10% since the launch of the FIT scheme in 2H 2012 due to the effect of solar module volume production and intensified price competition along with the rise of Chinese makers (Exhibit 78). If costs were to continue to decline at an annual rate of about 10%, we calculate that solar power generating cost could reach the level of residential electrical power rates (grid parity) around F3/19-F3/20). However, the system price decline curve is declining at a slower rate.

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Exhibit 78
Cost of Installed PVs to Fall, but Rate of Decrease Become Moderate

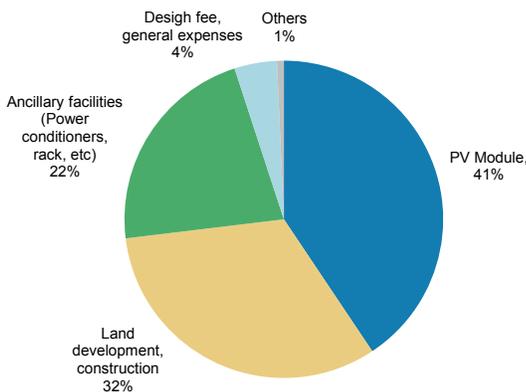


Source: METI, Morgan Stanley Research

System costs may decline at a slower rate

We believe the cost decline curve for solar power generating systems is likely to moderate over time. As volume production effects surface and next-generation module technology is developed, we expect a continued degree of cost reduction effects for PV modules, but there are likely to be limits to how far costs can fall for braces and other peripheral equipment and for installation work, which we estimate account for about 40-50% of deployment cost. Indeed, for relatively large-scale non-residential mega solar projects, there are starting to be cases where deployment costs increase, due for instance to higher land development cost.

Exhibit 79
Cost Structure of Mega Solar Projects (2MW class)



Source: METI, Morgan Stanley Research

Our Market Size Assessment

We have calculated F3/21 solar power capacity based on bull and bear scenarios

Considering the change in profitability of solar power deployment due to the far-reaching review to the FIT system, and limits to the amount of solar power capacity that can be accepted by the electrical power system generated locally, it is markedly difficult to work out estimates for solar power capacity deployment up ahead. We have therefore drawn up three scenarios based on the following assumptions for the increase in capacity deployed (flow) by F3/21 and the cumulative capacity deployed (stock) by end-F3/21.

Greatest wildcard non-residential solar power capacity deployment forecasts

The greatest variable in solar power capacity deployment forecasts is the extent to which non-residential solar power projects that have already had fixed purchase prices certified under the current FIT system as of end-March 2014 (corresponding to 56.6 GW on an output basis) actually go live. In April 2014, METI partially changed calculation methods for the renewable energy feed-in tariff scheme. Projects unable to secure land and facilities within six months of obtaining fixed-price purchase certification are to have their certifications revoked. Of power plants obtaining certification in F3/13, those that have settled either location or facilities are likely to be spared revocation so long as they secure what is missing by end-August 2014. Our trial calculations produce different capacity deployment forecasts for bearish and bullish scenarios depending on the variable of what percentage of certified but not yet running projects are cancelled.

Base scenario: we come up with 47GW in total solar capacity by end-F3/21: In calculating new residential solar power capacity deployment, we assume 4kW per dwelling for 60% of new housing starts (not including collective housing) to F3/16, when we expect purchase prices under the FIT system to be set at a relatively high level, and for 40% from F3/17. In calculating new capacity deployment of non-residential solar power, we assume that 50% of projects that had obtained fixed-price purchase certification by end-March 2014 but had not yet entered operation (56.6GW) enter operation. We thus calculate cumulative capacity deployment of 47GW (of which household 12GW and non-household 35GW) at end-F3/21.

Bull scenario: 61 GW in total solar capacity by end-F3/21:

In calculating new residential solar power capacity deployment, we assume 4kW per dwelling for 70% of new housing starts (not including collective housing) to F3/16, when we expect purchase prices under the FiT system to be set at a relatively high level, and for 60% from F3/17. In calculating new capacity deployment of non-residential solar power for this scenario, we assume that 70% of projects that had obtained fixed-price purchase certification by end-March 2014 but had not yet entered operation (56.6 GW) enter operation. We thus calculate cumulative capacity deployment of 61 GW (of which household 14GW and non-household 47 GW) at end-F3/21.

Bear scenario: 32 GW in total solar capacity by end-F3/21:

In calculating new residential solar power capacity deployment, we assume 4kW per dwelling for 60% of new housing starts (not including collective housing) to F3/16, when we expect purchase prices under the FIT system to be set at a relatively high level, and for 30% from F3/17. In calculating new capacity deployment of non-residential solar power for this scenario, we assume that 25% of projects that had obtained fixed-price purchase certification by end-March 2014 but had not yet entered operation (56.6 GW) enter operation. We thus calculate cumulative capacity deployment of 32 GW (of which household 11 GW and non-household 21 GW) at end-F3/21.

India

Parag Gupta
Satyam Thakur

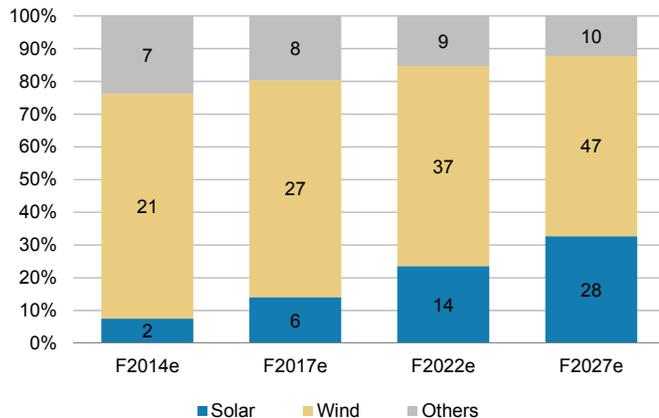
Solar Reaching Parity with Other Generation Sources, Fueling Growth, but Land Requirements a Limiting Factor

Key conclusions:

1. India comprises 4% of our global 2014-2020 forecast (14 GW of growth, or 2 GW per year) driven by, in the near term, government initiatives to procure solar power, and in the longer term by economics for solar power that is approaching parity with other generation sources.

Exhibit 80

We Expect the Share of Solar Power in the Renewable Portfolio to Rise



Notes:
1) The figures in the chart above are actual capacities estimated in GW.
2) Renewables capacity includes Wind, Solar, Biomass, Biogas and Small hydro capacities.
e = Morgan Stanley Research estimates
Source: SECI, MNRE, CEA, Ministry of Power, Morgan Stanley Research

2. Coal is the largest source of electricity in India, but domestic coal production limits growth. In the last few years, several issues have surfaced that have impeded the growth of coal capacity, predominantly relating to difficulties in securing environmental clearances and a shortfall in domestic coal production.

3. A slowdown in hydro and wind power additions favors the growth of solar power. Hydropower capacity constitutes the 2nd biggest source of power in India. However, growth in hydropower capacity has been slow due to construction challenges, longer gestation periods

and environmental impacts. Hitherto, a large chunk of the renewable power portfolio has come from wind power plants, given grid parity of wind power and attractive government policies. However, with the discontinuation of accelerated depreciation benefits and lack of good wind sites, wind additions have slowed down, giving way to large-scale solar projects over the last 2 years.

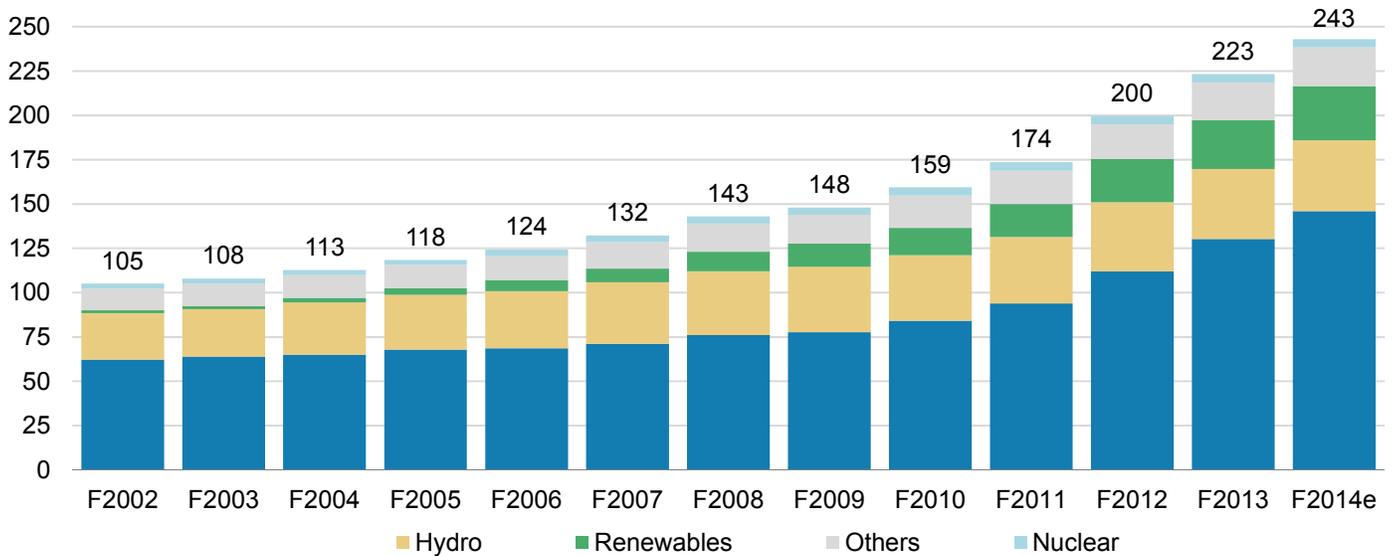
- 4. Solar capital costs have been declining, and are approaching levels competitive with other generation types.** The cost of setting up Solar PV projects declined by 53% from Rs170 mn/MW in F2010 to Rs80 mn/MW in F2014. Solar power tariffs discovered through competitive bidding have witnessed significant declines as well. The average solar PV tariff has fallen from Rs12.1/kWh (Dec 2010) to Rs6.8/kWh in the latest round of bidding (Jan 2014). This brings the tariffs very close to achieving grid parity, with gas-based electricity, which is the next costliest source of electricity, priced at around Rs5/kWh. At the same time, the Indian government has begun pursuing further support measures for solar power.
- 5. While the government has attractive incentive plans for promoting solar power, and solar tariffs have fallen, a key challenge remains land.** While thermal power plants require about 0.5-0.7 acres per MW, solar power plants require over 5 acres per MW. With limited land supply, this is likely to pose a formidable challenge for the future of solar power in India. We factored land limitations into our sizing of the Indian solar market.
- 6. Energy storage is not likely economic in India, given relatively low grid costs.** India's power grid has been developed at a lower cost than in the US and Europe, and utility rates are much lower in India. As a result, there would not be sufficient savings to customers from installing solar power and energy storage at a customer's home/business and disconnecting from the grid.
- 7. Advantaged from the growth of solar power: power project developers (Tata Power, Lanco, NTPC, Reliance Power).** Niche renewable players such as Azure Power, Welspun Renewables Energy and Swelect Energy are also likely to benefit from the scale-up in solar capacity. We do not believe the growth of solar power will be disruptive to the coal power business, given the rapid growth of power demand in India allows both generation types to prosper.

Market Size

The majority of capacity addition in India has been through coal-fired plants, which now comprise 60% of the total capacity in the country. However, in the last few years, several issues have surfaced that have impeded the growth of coal capacity, predominantly relating to difficulties in securing environmental clearances and a shortfall in domestic coal production.

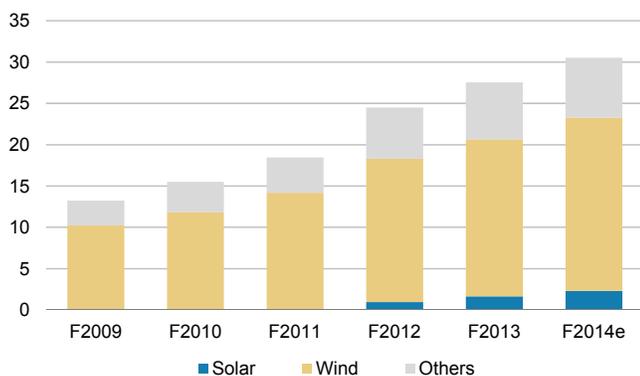
Renewable power (13% of the installed base) has seen rising investor interest in India, with the segment growing at the fastest pace CAGR (18.2%) over the last 5 years, albeit over a small base.

Exhibit 81
India's Installed Capacity Base (GW)



Note: Renewables includes Wind, Solar, Biomass, Biogas and Small hydro capacities.
e = Morgan Stanley Research estimates
Source: CEA, Morgan Stanley Research

Exhibit 82
Solar Power Capacity Has Been Rising in the Renewable Segment



Note: Renewables capacity includes Wind, Solar, Biomass, Biogas and Small hydro.
e = Morgan Stanley Research estimates
Source: MNRE, CEA, Morgan Stanley Research

The total installed power capacity in India currently stands at 243 GW, and power demand growth is robust. Power plant additions grew at a CAGR of 10.4% between F2009-14e. While wind has historically been the biggest source of renewable growth, due to lack of good wind sites, we expect a significant slowdown in new wind development.

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Regulatory Dynamics and Solar Economics

Ambitious government targets: The government in India has a stated objective of increasing the proportion of renewable energy as a whole and solar energy in particular, in India’s total electricity consumption to 3% by 2022, which implies a solar power capacity of ~35 GW by 2022. Of this target, 20 GW is being planned through the JNNSM program, while the balance remains unplanned.

While the government has attractive incentive plans for promoting solar power, and solar tariffs have fallen, a key challenge remains land. While thermal power plants require about 0.5-0.7 acres per MW, solar power plants require over 5 acres per MW. With limited land supply, this is likely to pose a formidable challenge for the future of solar power in India. Given land and technological challenges, we assume slower solar additions than stated government targets. We expect solar capacity to reach 35 GW only by F2029.

The Indian government has enacted a number of policies and programs to support the growth of solar power:

JNNSM: The government has clubbed all solar power capacity addition plans for India under the Jawaharlal Nehru National Solar Mission (JNNSM) program. Under the program, the government planned up to 2 GW of capacity additions by 2013, addition of 4-10 GW by 2017 and a total of 20 GW by 2022 (Exhibit 83). The long-term target is to add 100 GW of solar power capacity by 2030.

Exhibit 83

JNNSM Total Solar Capacity Addition Targets

Segment	Ph I Targets By 2013	Ph II Targets By 2017	Ph III Targets By 2022
Grid connected power including rooftop	1 – 2 GW	4 – 10 GW	20 GW
Off-grid applications	200 MW	1,000 MW	2,000 MW

Source: SECI, Morgan Stanley Research

GBI & VGF: The government has been providing generation-based incentives (GBI) earlier for small solar PV plants and Viability Gap Funding (VGF) now (in JNNSM Ph II Batch I), ensuring the government bears the burden of the difference between the solar power tariffs and an assumed grid parity tariff of Rs 5.45/unit. This ensures that the power distribution companies at the state level do not have to bear any incremental burden on sourcing solar power.

Solar RPOs & REC Trading: The government has mandated obligations on each state’s power distribution company to buy a certain portion of their power requirement from solar power

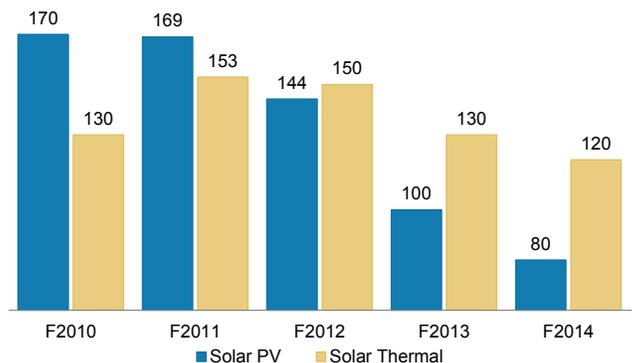
plants. The government has specified these limits as Solar RPOs (Renewable Purchase Obligation), which keeps increasing annually to reach a target of 3% by 2022. In 2010, CERC also announced the Renewable Energy Certificate (REC) trading scheme under which a solar power generator gets an opportunity to earn RE certificates for each MWh of electricity generated. The state discoms can also purchase these solar RECs to make good their RPO targets.

Net Metering Policy: Many state regulators are currently working on drafting net metering policies, though the state of Gujarat is expected to implement its policy soon. Most states are considering limits on how much power can be injected back into the system, with 80-90% of the sanctioned grid connected load likely to be decided upon as the limit.

Favorable solar resource, and improving solar economics. The average daily solar radiation received in India varies between 4 to 7 kWh/sqm for most parts of India and there are on an average 250 to 300 clear sunny days a year. Thus, the country receives about 5,000 trillion kWh of solar energy in a year, which is equivalent to more than 600 GW of solar power potential. The cost of setting up Solar PV projects declined by 53% from Rs 170 mn/MW in F2010 to Rs 80 mn/MW in F2014, though the cost of setting up solar thermal power projects declined by only 8% in the same period from Rs 130 mn/MW to Rs 120 mn/MW (Exhibit 84). The fall in capital cost has come despite a 19% depreciation in the Rupee vs. the US dollar in the same period, as a lot of the solar equipment is imported. The cost decline has not been significant for solar thermal due to project delays, which has led to cost inflation due to higher interest cost incurred during construction.

Exhibit 84

Capital Cost (Rs mn/MW) Has Come Down Over the Last 5 years



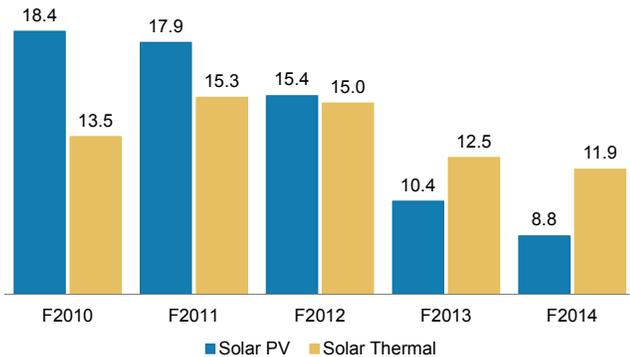
Source: CERC, Morgan Stanley Research

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Levelized cost of solar power has been coming off as well: The reduction in capital costs has led to a fall in the price of electricity generated from solar power projects. The regulated tariff (fixed ROE) based on CERC norms for solar PV projects has fallen from Rs18.4/kWh in F2010 to Rs8.8/kWh in F2014 (Exhibit 85). The regulated tariff for solar thermal projects has fallen from Rs13.5/kWh to Rs11.9/kWh in the same period.

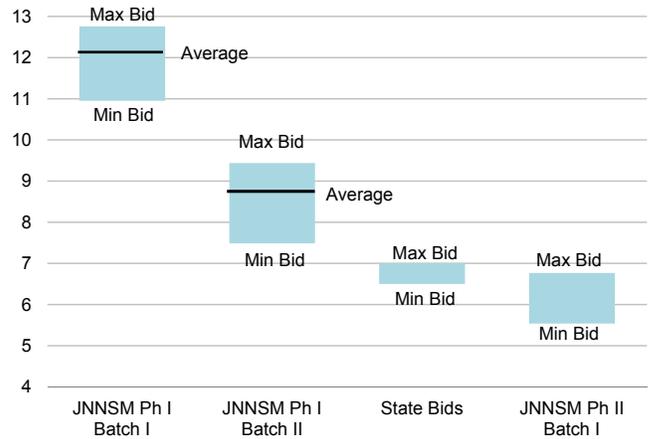
Solar Power on the verge of achieving grid parity: Solar power tariffs discovered through competitive bidding have witnessed significant declines as well. The average solar PV tariff, bid in JNNSM Ph I Batch I, was Rs12.1/kWh (Dec 2010). This fell to Rs8.8/kWh in JNNSM Ph I Batch II (Dec 2011) and Rs5.5/kWh to Rs6.8/kWh in the latest round of bidding in JNNSM Ph II Batch I (Jan 2014) (Exhibit 86). This brings the tariffs very close to achieving grid parity, with gas-based electricity, which is the next costliest source of electricity, priced at around Rs5/kWh (Exhibit 87). Interestingly, due to the paucity of domestic natural gas, gas-fired power plants currently run at very low PLFs and hence the tariff required to run such plants profitably at low PLFs is much higher. Also, while the cost of coal-based power from operational power plants could range from Rs3.2-4.3/kWh, some of the bids floated by SEBs in the recent past have seen tariffs being quoted in the range of Rs4.2-6/kWh. This suggests that solar tariffs are close to becoming comparable with other sources of fuel.

Exhibit 85
Regulated Solar Power Tariffs (Rs/kWh) Have Trended Down



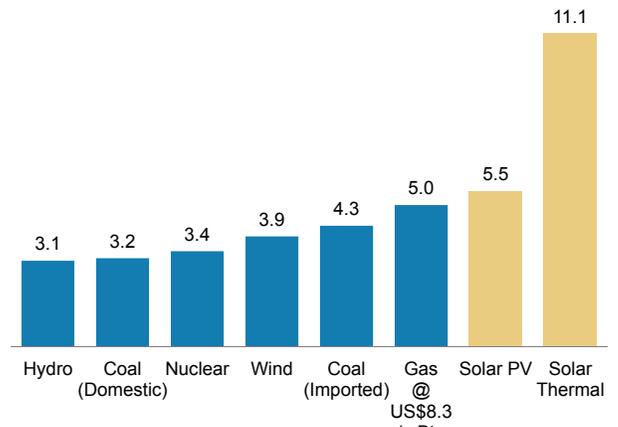
Source: CERC, Morgan Stanley Research

Exhibit 86
Competitively Bid Solar Power Tariffs (Rs/kWh) Have Trended Down As Well (Solar PV)



Note: Tariffs for JNNSM Ph II Batch I shown above are ex-VGF payment by the government. Post VGF tariff is a flat Rs 5.45/unit for all projects to be set up in this batch. Source: CERC, SECI, Morgan Stanley Research

Exhibit 87
Power Tariffs by Generation Type (Rs/kWh)



Note: For coal, hydro, nuclear and wind we have estimated the tariff of existing plants based on current operational parameters. For solar, we have taken the lowest bid tariffs from JNNSM. Source: Company Data, CERC, Morgan Stanley Research

Brazil

Miguel Rodrigues

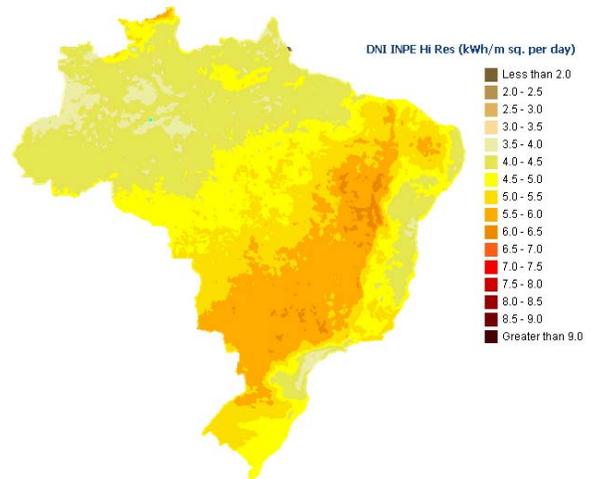
Attractive Growth Potential, but High Competition with Other Renewables

Key conclusions:

- Brazil comprises 2% of our global 2014-2020 forecast (5 GW between 2014 and 2020), a small amount relative to larger countries/regions.** Brazil has significant potential to develop solar energy as the country’s average daily solar irradiation is high compared to other countries. While Germany, the world’s leader in solar installed capacity, has a maximum irradiation of 3.4 KWh/m²/day, Brazil has an average level of 4.0 KWh/m². Currently, Brazil has a negligible installed capacity of solar PV (~10MW), representing just 0.01% of the total Brazilian power matrix.
- The main reason behind the stagnation of solar generation is the lack of competitiveness,** due to high costs associated with the product, especially when compared to wind, biomass, and hydropower. Only recently, solar projects became available on the regulated market auctions, but under still unattractive conditions compared to other renewable sources..
- Solar energy can be developed in Brazil through new energy auctions or distributed generation,** and we see potential for both mechanisms. The former involves larger-scale projects and was critical for making wind power more competitive in Brazil. The latter just had its regulation defined and benefits from not having transmission costs.
- Growth potential:** The Brazilian energy planning body (EPE) expects new auctions to contract 3.5 GW from solar power between 2014 and 2018. This represents 10% of the additional capacity expected for this period, and could attract suppliers to Brazil, similar to what happened with the wind segment. This is possible, in our view, only if dedicated auctions and/or special conditions are created for solar (e.g. financing conditions, tax exemption, etc), as competition with other renewable types would not allow such a large amount of solar in the expansion of the electricity matrix in the medium-term. Regarding smaller-scale distributed generation, EPE expects installed capacity of residential and commercial segments to reach 1.1 GW by 2021.

Exhibit 88

Brazil less irradiated regions have an average level of 4.0 KWh/m², among the highest in the world



Source: ANEEL, INPE, Morgan Stanley Research

Energy Auctions: The Path for Large-Scale Projects

Auctions can bring scale and accelerate the expansion of wind power in Brazil. At the end of 2013, the A-3 auction was the first auction to register solar projects, but it was not attractive at the ceiling price of R\$126/MWh. In the last A-5 auction, 88 solar projects were registered (ceiling price of R\$122/MWh), but again these projects were not able to compete against the other renewable projects (i.e. small hydro, biomass and wind) that were contracted at an average price of R\$110/MWh, as shown in the exhibit below. Although the government allowed solar to participate in recent auctions, competition with more competitive sources did not allow the development of new solar projects.

Exhibit 89

A-5 Auction Results

Power Source	Installed Capacity (MW)	Assured Capacity (Mwavg)	Load Factor	Wgt. Avg. Price (R\$/MWh)
Wind	2,338	1,083	46%	119.03
Biomass	162	95	58%	133.75
Small Hydros	308	149	48%	137.35
São Manoel (Hydro)	700	422	60%	83.49
Total	3,507	1,748	50%	109.93

Source: CCEE, Morgan Stanley Research

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In our analysis, a competitive solar project requires a price of roughly R\$250/MWh, in order to achieve a minimum equity IRR of ~10% in real terms. Considering that this price level is still significantly above other renewable sources, large-scale solar projects currently depends on dedicated auctions or specific incentives. We believe capex would need to be as low as R\$3mn/MWp to make solar as competitive as wind, a level that is not realistic in the short-term. The main assumptions in our analysis are: i) load factor: 20%, ii) Capex: R\$4.75mn/MWp; iii) Asset life: 25 years; iv) PPA duration: 20 years (re-contracted in the free market at R\$115/MWh during the last five years); v) Financing: 70% at TJLP + 2.5%; vi) Tax regime: *lucro presumido*, which allows the projects to benefit from lower tax rates.

Exhibit 90
IRR for Large-Scale Solar Projects

	Capex (R\$m/MW)				
	4.25	4.50	4.75	5.00	5.25
300	24.7%	21.6%	18.8%	16.2%	13.8%
275	20.2%	17.3%	14.6%	12.2%	10.0%
250	15.6%	12.9%	10.4%	8.1%	6.0%
225	11.0%	8.4%	6.1%	3.9%	1.9%
200	6.2%	3.8%	1.6%	-0.4%	-2.3%

Energy Price (R\$/MWh)
Source: Morgan Stanley Research

Solar power should gain momentum through the development of dedicated auctions. The state of Pernambuco was the first to promote a solar exclusive auction, which took place in December 2013 and contracted 122MWp to start supplying energy in 2017 at ~R\$230/MWh. In the regulated market, two auctions should negotiate solar energy in 2014: i) A-5 auction that should take place on September. In this auction, solar energy will be negotiated on the same category of wind energy and at the same prices, limiting the potential for new projects; and ii) a reserve auction to take place on October, which will have solar projects registered in an exclusive category for the first time in the regulated market; this should allow the development of the most competitive PV projects. Although details such as ceiling prices and BNDES financing conditions are not available yet, the government expects success contracting solar projects to supply energy for a period of 20 years starting in 2017.

The Brazilian government offers a series of incentives for renewables expansion, in order to enhance the diversification in the Brazilian energy matrix. However, these incentives have not been sufficient in order to transform solar projects into a competitive source in Brazil. The majority of these incentives are also available to wind, small hydroelectric and biomass sources, which are relatively more competitive than solar. Specific to solar, the Resolution nº 481 from

ANEEL gives solar projects that start operating until Dec/17 a discount of 80% in the distribution and transmission tariffs (TUSD and TUST) during the plant's first 10 years of operation, being reduced to 50% after this period. If a project becomes operational after the mentioned date, the discount in the tariffs becomes 50% during its whole operation period.

However, financing and taxation are still challenges towards solar generation development. Since Brazil does not have a robust and developed solar industry, obtaining financing from BNDES becomes difficult, as the development bank requires the project to have national inputs. In terms of taxes, according to Rodrigo Sauaia, president of the Brazilian Association of Photovoltaic Solar Energy, taxes are responsible for ~30-40% of the total production cost required for such activity.

Brazilian Energy Research Company (EPE) expects new auctions to contract 3.5 GW from solar power between 2014 and 2018. This represents 10% of the additional capacity expected for this period, and could attract suppliers to Brazil, like happened with the wind segment. The International Energy Agency (IEA) estimates that the solar PV electricity will demand USD1.0bn of investments per year from 2014-2020. This suggests that ~3.0 - 4.0 GW of additional solar PV capacity will be added in the period, which is in-line with the aforementioned scenario from EPE that solar would contribute with ~10% of the capacity expansion in Brazil over the next years. This is possible, in our view, only if dedicated auctions and/or special conditions are created for solar (e.g. financing conditions, tax exemption, etc), as competition with other renewable would not allow such a large amount of solar in the electricity matrix in the medium-term.

Exhibit 91
EPE Expects New Auctions to Contract 3.5 GW from 2014-18, which Implies that Solar Would Contribute with ~10% of the Capacity Expansion in Brazil
Installed GW of Solar Power in Brazil under different weights on the national capacity expansion



Source: EPE, Morgan Stanley Research

Distributed generation

Regulation for distributed generation was only defined in Brazil in 2012. Distributed generation consists in the generation of energy by the final consumer, which can be connected directly or indirectly to the grid. In this system, a consumer that has a photovoltaic (or other renewable driven plant) at his residence might sell the excess energy back to the grid. No monetary transaction occurs in Brazil; instead, the consumer earns energy credits that can be used to reduce its bill on the following months. This was defined in April 2012, based on Resolution n° 482, in which ANEEL defined the concepts of micro and mini-generation, distributed generation and created the energy compensation system (net metering). The net metering system allows the consumer with a small sized plant (<1MWp) that uses renewable sources to sell the excess energy to its distribution company for the same tariff it would charge him, minus the taxes.

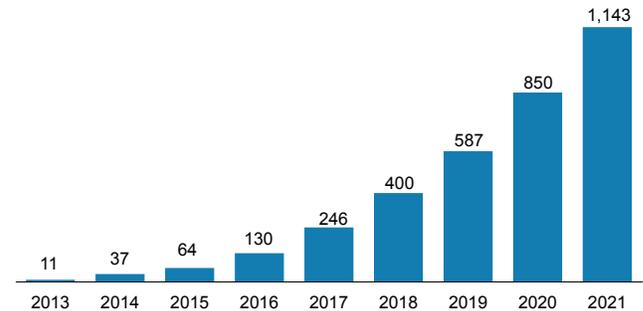
The improvement of energy taxation could accelerate the development of distributed energy. The challenge, in this case, lies on the fact that the legislation should be adjusted in each state as it involves ICMS taxes. The state of Minas Gerais has already adjusted its taxation to favor this mechanism and, combined with the relatively high irradiation, should put the state at the forefront of the distributed generation development. On the equipment side, there is a national resolution from CONFAZ that foresees exemption of ICMS and IPI in the photovoltaic module. Some states are considering the extension of this benefit for other components. Mr. Sauaia states that both distributed generation and centralized generation (large projects) are heavily affected by taxation. He believes that the excess energy that might be traded with the grid is still discounted by taxes that can reach 33% of the value per kWh.

EPE expects installed capacity of residential and commercial segments to reach 1.1 GWp by 2021. Although this may look conservative considering that it implies a penetration of less than 1% in the residential and consumer segments, this could prove realistic in the proposed time-frame, as the PV power will be not yet economically viable for several regions, what should happen gradually over the next years.

Exhibit 92

EPE expects solar installed capacity of residential and commercial segments to reach 1.1 GWp by 2021

Installed capacity (MWp)



Source: EPE, Morgan Stanley Research

Distributed generation offers clear benefits for the system. In our view, the key benefits are: i) environmental impact, as it reduces the requirement to invest in generation projects with higher environmental impact; ii) it does not require transmission investments – a significant cost when we consider that a large portion of the wind and hydropower potential in Brazil is distant from the consumption centers; iii) lower energy losses in the transmission and distribution of electricity. Once viable from an economic point of view, the benefits are clear, and so is the growth potential.

We expect distributed generation to become more attractive after 2018, compared to average tariffs in the Southeast region, as depending on the distribution concession area, the development is already close to breakeven. The next exhibit shows our assessment of distributed PV generation competitiveness in the Southeast region. The estimated system cost in Brazil (which includes the installation and required components) ranges from R\$ 6/Watt to R\$ 10/Watt and it depends heavily on the size and

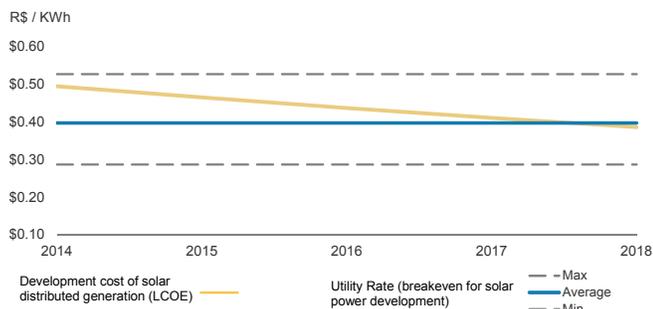
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consumption levels of the client. In our analysis we assume an average system cost for 2014 of R\$ 8.5/Watt, with a decline rate of 6.0%/year. Other key assumptions are: i) asset life of 25 year; ii) overhaul investment of 40% of original capex, in the 15th year; iii) annual O&M cost of 1.0% of original capex; iv) weighted average of utilities tariffs in the Southeast region (2013). We note the economic feasibility of this power source is very sensitive to the solar irradiation level and tariff of the utility in the specific concession area. This means that a specific site could already be viable while others may not be viable, even after a significant reduction in the development costs.

Exhibit 70

We expect PV distributed generation to become viable after further reduction in costs is achieved (Brazilian Southeast region Competitiveness)



Source: ANEEL, EPE, CCEE, INPE, Morgan Stanley Research

Storage does not seem viable in Brazil, due to taxes and high battery costs. All energy exported to the grid is taxable and, given that the pricing on energy export cannot be made on an hourly basis, benefiting from peak hours, this reduces the potential benefit of storage (e.g. storage would help to export in the higher prices time, but this is not possible on the current regulation). Also, storage does not make sense considering that the customer payments for the "minimum consumption" level are far lower than the cost of a storage system. The availability cost is calculated multiplying a fixed value of consumption, which depends on the connection type (number of conductors) of a consumer and his electricity bill. These values are 30KWh for consumers with one conductor (mono-phasic), 50KWh and 100KWh for consumers with two or three conductors respectively (bi and tri-phasic). Storage seems to make sense currently only for those who are located in areas of poor quality of services and cannot be exposed to disruptions in supply.

Key Players

CPFL Renovaveis (CPRE3): inaugurated in 2012 the project of Tanquinhos (1MWp), an operational solar power plant in the state of São Paulo. The company believes that solar energy will have a promising outlook, although it still requires special attention to become feasible. The company has registered 330MW in the last A-5 auction, which took place in Dec/2013, but as is known, no company managed to sell solar contracts, as solar was being negotiated in the same category of more competitive renewable sources (e.g. wind). Currently, CPFL Renovaveis only develops large-scale solar projects, while CPFL Serviços, a subsidiary of CPFL Energia (CPFE3 – OW), is responsible for distributed generation.

Eletrobras (ELET6): inaugurated its first commercial solar project, through its subsidiary Eletrosul, which installed 4,200 photovoltaic modules in its headquarters. The amount generated will produce enough energy to supply 540 residences and has an installed capacity of 1MW. The company aims to negotiate 800MWh/year with this project. Eletrosul played an important role in the expansion of wind segment.

Renova (RNEW11): The company has currently more than ten distributed generation solar projects and recently announced the construction of its solar power plant, which will be a hybrid project alongside a wind farm. The company sees the government efforts to enable solar generation in Brazil as quite positive and exclusive auctions will be key to organize the sector and nationalize the production of the equipments, facilitating access to BNDES financing. The company plans to register ~200MW in the upcoming reserve auction, but believes that solar could reach wind power competitiveness in about 10 years.

Tractebel (TBLE3): the company has under construction the Cidade Azul photovoltaic solar project in Brazil, which is the largest in the country with 3MW of installed capacity. In addition, Tractebel has been developing a few solar trial modules of 70kWp set in different locations in Brazil. The trial's goal, according to the company, is to assess the solar generation potential in Brazil and identify the most appropriate technologies matching the climate conditions for several regions. Total expected investment is R\$56.3mn.

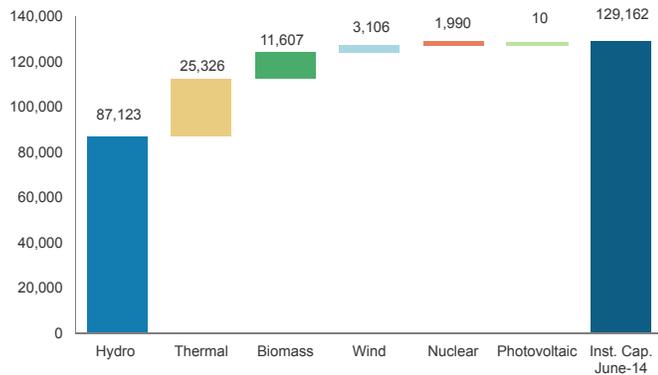
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Brazilian Electricity Matrix Snapshot

Currently Brazil has an installed capacity of ~130GW and relies heavily on hydro generation, with ~65% of its installed capacity from hydro plants. The high weight of hydro in the matrix has been the main driver of low short-term prices for a long period, due to low variable costs (no fuel required and low O&M). Thermal plants in Brazil are considered as a support source, helping to complement energy generation by hydro and other sources. Nevertheless, it has also been an important concern during bad hydrology periods, like in 2001, 2013 and 2014, when the deterioration in reservoir levels has significantly increased the rationing risk.

Exhibit 71

Brazil's Currently Relies Heavily on Hydro Sources (Installed Capacity in MWp)

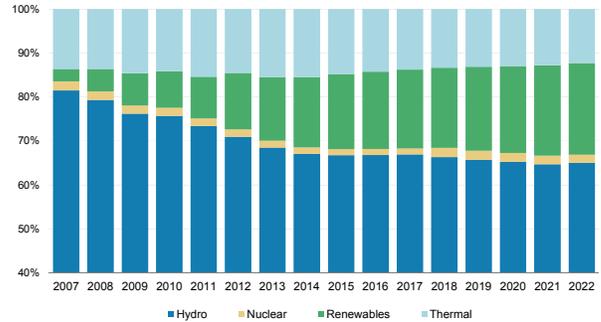


Source: ANEEL, Morgan Stanley Research

Renewables energy sources should represent a growing share of Brazil's energy supply, given their relatively low environmental hurdles and easier approval compared to large hydro or thermal plants. Government energy plans (PDE 2022) estimate an installed capacity CAGR of 4% in 2013-22, with an outsized contribution from renewables (8.2% CAGR).

Exhibit 72

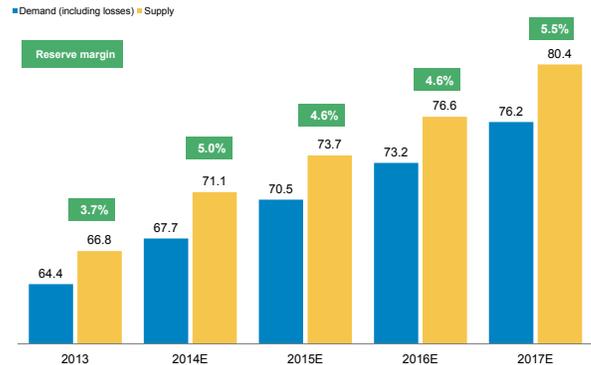
Brazilian Installed Capacity Projections



Source: EPE, Morgan Stanley Research

Exhibit 73

Supply and Demand Balance in Brazil



Source: EPE, Morgan Stanley Research

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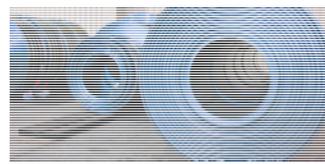


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Total	3,078		957		

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Ticker	Company	Close Price (as of 07/28/2014)
ABY	Abengoa Yield PLC	39.80 USD
CNA.L	CENTRICA PLC	315.20 BPN
FSLR.O	First Solar Inc	64.05 USD
6971	Kyocera Corp	4,982.50 JPY
6752	Panasonic Corp	1,239.00 JPY
PNW.N	Pinnacle West Capital Corp	56.29 USD
6753	Sharp Corp	331.00 JPY
EONGY-5	E.ON SE	19.65 USD
RWEG.DE	RWE AG	31.24 EUR
0750.HK	China Singyes Solar Technologies Holdings Ltd	11.48 HKD
3800.HK	GCL-Poly Energy Holdings Ltd	2.62 HKD
HE	Hawaiian Electric Industries Inc	24.20 USD
JKS.N	Jinkosolar Holding Co Ltd	25.85 USD
NEP	Nextera Energy Partners LP	34.30 USD
RNEW11	Renova Energia SA	40.99 BRL
SCTY	SolarCity Corp	72.57 USD
SWELECTES-IN	Swelect Energy Systems Ltd	438.05 INR
TERP	TerraForm Power Inc	33.35 USD
TSL.N	Trina Solar Ltd	11.36 USD
0968.HK	Xinyi Solar Holdings Ltd	2.14 HKD
YGE.N	Yingli Green Energy Holding Company Ltd	3.50 USD
GCI.N	Gannett Co Inc	33.21 USD
CPRE3	CPFL Energias Renovaveis SA	12.92 BRL
EIX	EDISON INTERNATIONAL	56.62 USD
ENEL	Enel SpA	4.24 EUR
GSZ.PA	GDF Suez SA	19.68 EUR
LAIN.NS	Lanco Infratech Ltd	9.40 INR
6503	Mitsubishi Electric Corp	1,357.00 JPY
NRG.N	NRG Energy Inc	31.35 USD
NYLD.N	NRG Yield Inc	53.96 USD
NTPC.NS	NTPC Ltd	149.05 INR
PCG.N	PG&E Corp	47.10 USD
RELI.NS	Reliance Industries Ltd	1,005.60 INR
SRE.N	SEMPRA ENERGY	101.54 USD
SSE	Seventy Seven Energy Inc	24.20 USD
SUNE.N	Sunedison Inc	20.95 USD
TTPW.NS	Tata Power Company Ltd	101.25 INR
TSLA	Tesla Motors Inc	223.57 USD
6502	Toshiba Corp	461.10 JPY
WGSR.NS	Welspun Corp. Ltd	84.10 INR
ELET6	Centrais Eletricas Brasileiras SA - Eletrobras	11.20 BRL
WCHG.DE	Wacker Chemie AG	91.06 EUR
OCI.AS	Oci NV	28.25 EUR