Global Solar Demand Monitor

Q1 2017 Market Trends Update

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Executive Summary

Record Demand in China Rewrites 2017 Outlook on the Back of 53% YOY Growth in 2016

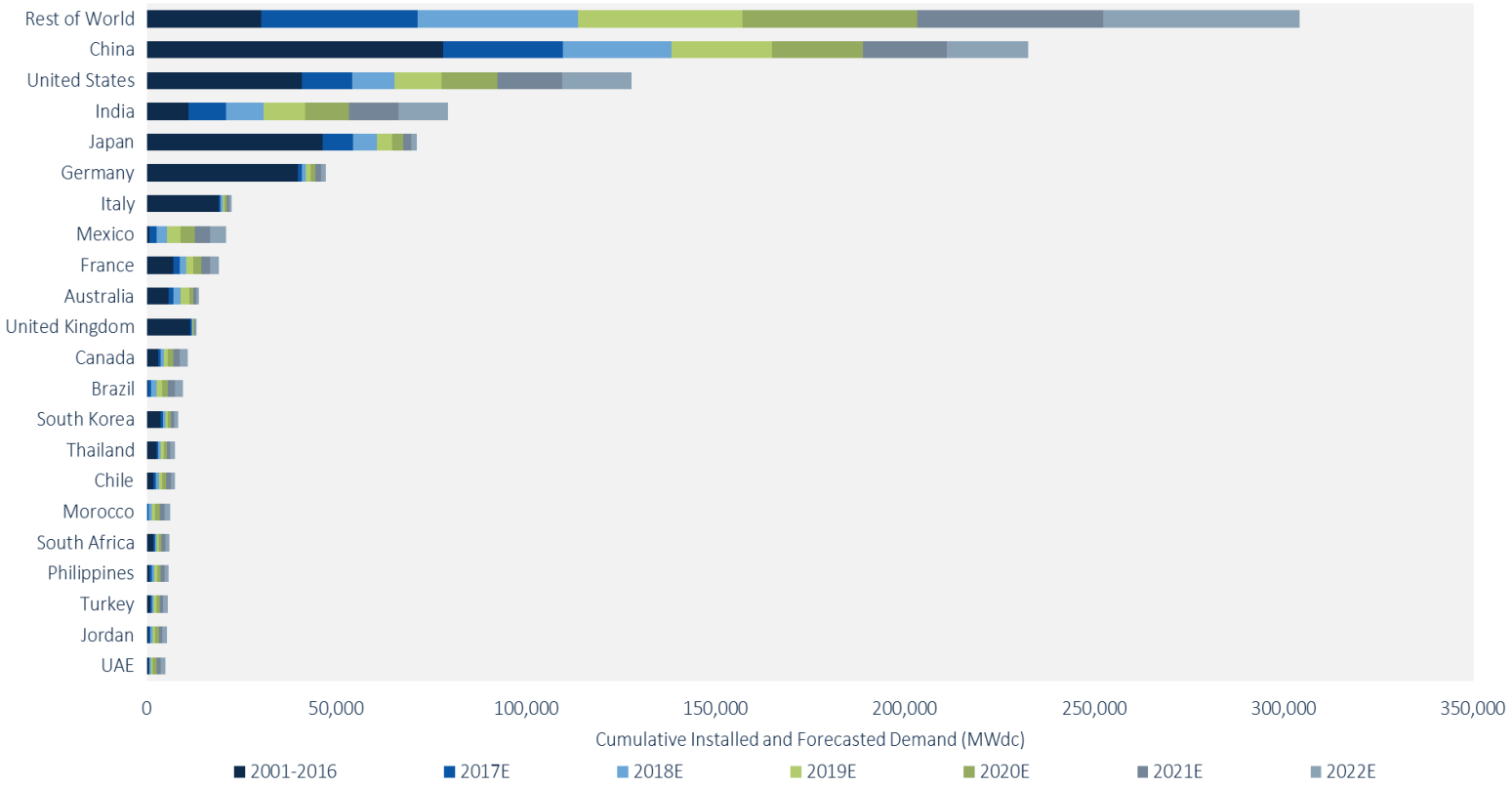
Global PV Demand, 2007-2022E

Source: GTM Research *Global Solar Demand Monitor Q1 2017*

- Chinese demand exceeded 34 GW of installed capacity in 2016, pushing 2016 actuals to just over 78 GW. Cumulative global installed capacity now tops 306.4 GW.
- Despite headwinds in other historically major markets such as the United States, Japan, Germany and the U.K., Chinese demand far exceeded consensus expectations for 2016. Significantly raised China forecasts in 2017-2022 have completely flipped the global demand story from a 7% contraction in 2017 to 9.4% growth, with a 5.3% CAGR in a five-year view.
- Demand in 2018 is likely to grow less than 1%, with more significant growth expected from 2019 onward as tendered projects from 2016 and 2017 reach their completion deadlines and new markets begin to take off.
- Tender-driven growth in South Asia, the Middle East, and West and sub-Saharan Africa, as well as a slight recovery in expectations for demand in Europe driven by France, Spain and Ukraine, will also contribute somewhat to higher expectations in 2017.
- Despite these significantly revised expectations, GTM Research maintains expectations that module oversupply conditions will persist, due to expected manufacturing capacity growth in excess of downstream demand needs. Component prices will continue to drop, especially in major markets, leaving opportunity for increased competitiveness in technology-agnostic tenders and record-low bids.

Market Concentration: Top 4 markets to Account for 73% of Total Demand in 2017

Top Ranked Markets by Cumulative Historical and Forecasted Demand, 2001-2022E

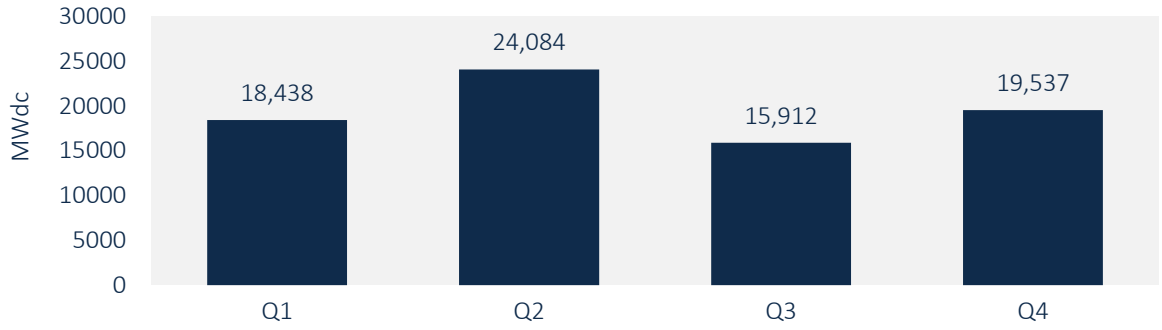


- A remarkable dichotomy is emerging within the global market: Among traditional major markets, consolidation of demand share by China, the United States, India and Japan is contrasted with a distribution of demand share among emerging markets as tender policies create significant pipelines in markets with little to no historical installations prior to 2016.
- This concentration of global demand share among traditional major markets is more pronounced than at any time in the industry in the last seven years, such that the top four markets are expected to account for 73% of total installations in 2017.
- India will overtake Japan as the third-largest global market in 2017, installing 9.875 GW over Japan's 8 GW this year.
- Slowdowns in Japan, Germany and the U.K. are made up for by increased demand shares in Mexico, France, Australia and a number of Middle Eastern markets.
- Expectations for incremental growth in 2018 and onward depend increasingly on middle-income countries and emerging markets (in addition to China) rather than expectations of long-term consolidated demand.

Source: GTM Research *Global Solar Demand Monitor Q1 2017*

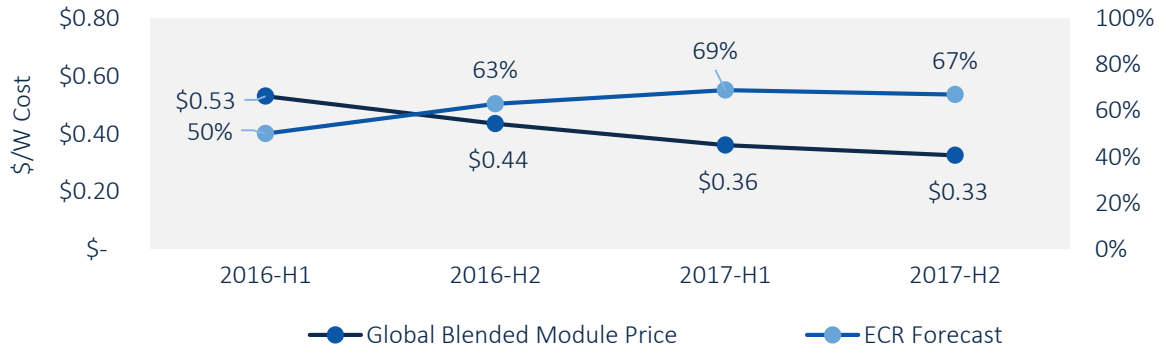
2016 Quarterly View Largely Driven by FIT Rush in China and Utility Spillover in the U.S.

Global Quarterly Demand, 2016E



Source: GTM Research *Global Solar Demand Monitor Q1 2017*

Global Blended Module Price and Excess Capacity Ratio Expectations, 2016-2017



Source: GTM Research *Global Solar Demand Monitor Q1 2017, GTM Research PV Pulse March 2017*

Seasonality and lumpy demand pose risks for upstream suppliers

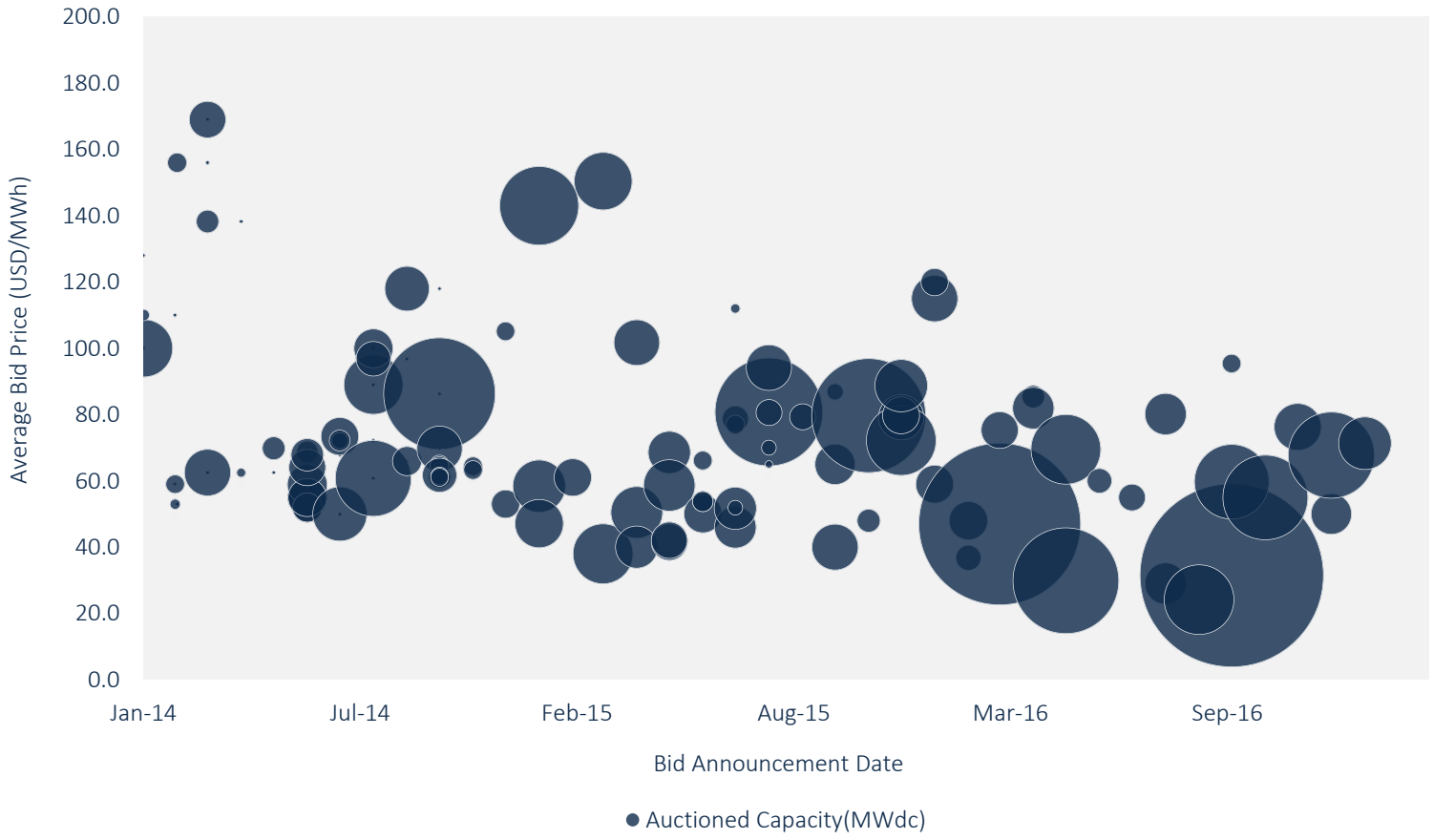
- The FIT rush in H1 in China pushed Q2 installed capacity to over 24 GW in a single quarter. H2 2017 was a bumpy ride for the supply side, as demand dropped significantly from Q2 and rebounded midway in Q4, allowing for a closer-to-equilibrium supply-demand balance. The Q4 rebound was largely due to China's NEA announcement of further FIT cuts at the end of H1 2017 as well, which caused a slightly smaller Q4 rush.
- The concentration and unpredictability of demand at a quarterly level, driven by uncertainty in China, can put the market at risk for module price instability and can require idling for suppliers due to overstocked inventory, and future bankability of the supply chain.
- In the aftermath of the NEA's announcement, it is clear that the supply-demand balance in the industry is heavily reliant on China's solar policy landscape, which poses a market-destabilizing risk in the long term.

Oversupply persists but to a less dangerous degree as module price slide continues through 2017

- GTM Research's PV Pulse definition of a healthy module Excess Capacity Ratio (ECR) is 30%-60%. Our most recent expectations represent a scenario in which a slight overcapacity scenario began in H2 2016 and will likely persist through 2018.
- As module prices decline precipitously on a global level, and even more steeply in large markets like India and China, predictability of quarterly demand becomes more important than ever.
- It is likely that 2017 demand seasonality will largely mirror the trends in 2016 due to the repeated FIT cuts announced for the end of H1 2017 and a large pipeline of U.S. utility projects that spilled over from 2016 likely to be interconnected in Q2 this year.

A $20/MWh Bid Is in Reach as Tenders Grow More Competitive Across Global Markets

Global Tendered Projects by Bid Price and Capacity, 2014-2016



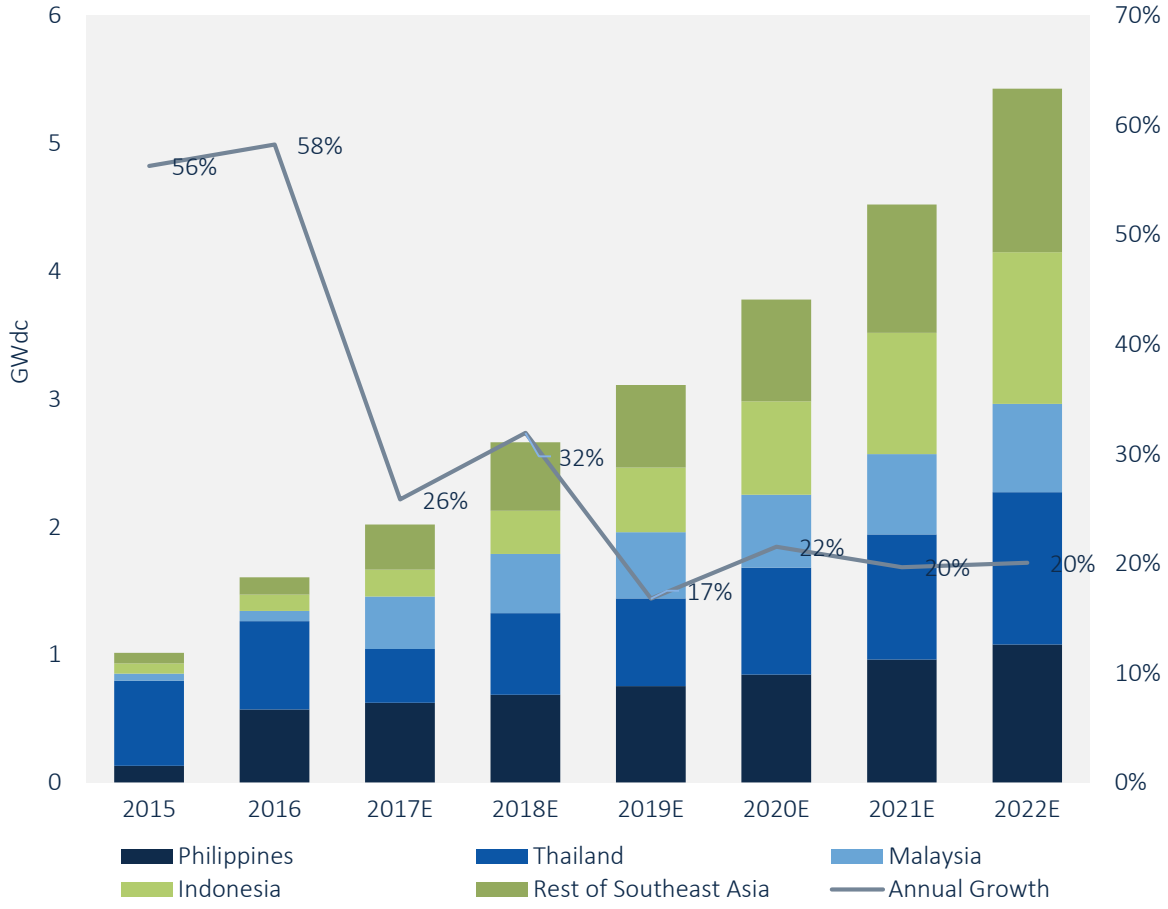
As price-competitiveness intensifies, tenders will be established as the ubiquitous governmental and non-traditional source procurement model, applying downward price pressure to tariffs globally and establishing a virtual price ceiling for unsubsidized solar.

Records set in Sweihan, UAE ($24.2/MWh) and Mexico ($26/MWh) in Q4 2016 and intense price competition driving prices down in India (as in the recent Rewa bid of Rs 3,590/MWh) demonstrate that globally, unsubsidized grid parity has arrived or is fast approaching. In fact, every 1+ GW market in 2018 with the exception of the United States will be auction-driven (Australia, China, Japan, France, Germany, Brazil, Mexico and India). Tender-driven development will create near-1 GW annual markets in Algeria, Iran, Jordan, Morocco, Turkey, Argentina, Chile, Taiwan, Canada, Pakistan, the Philippines, Thailand, Nigeria and South Korea by 2018.

Is it sustainable? While we do expect a 2-cent PPA to be signed in 2017, perhaps in Saudi Arabia, these ultra-low tariffs are not sustainable. Razor-thin margins and hedged bets on forward pricing, despite their inherent risk, are not enough to sustain these rock-bottom prices. It may happen again, and price competition will continue to push global average prices lower, but only projects that capitalize on scale, preferential non-recourse financing, and free land, permitting costs and long construction timelines can achieve these prices, and their viability as bankable assets is yet to be proven.

Southeast Asia: Foreign Investment in Thailand and Malaysia Is Driving 26% Growth in 2017

Southeast Asia PV Demand, 2016-2022E



Source: GTM Research *Global Solar Demand Monitor Q1 2017*

Highlights:

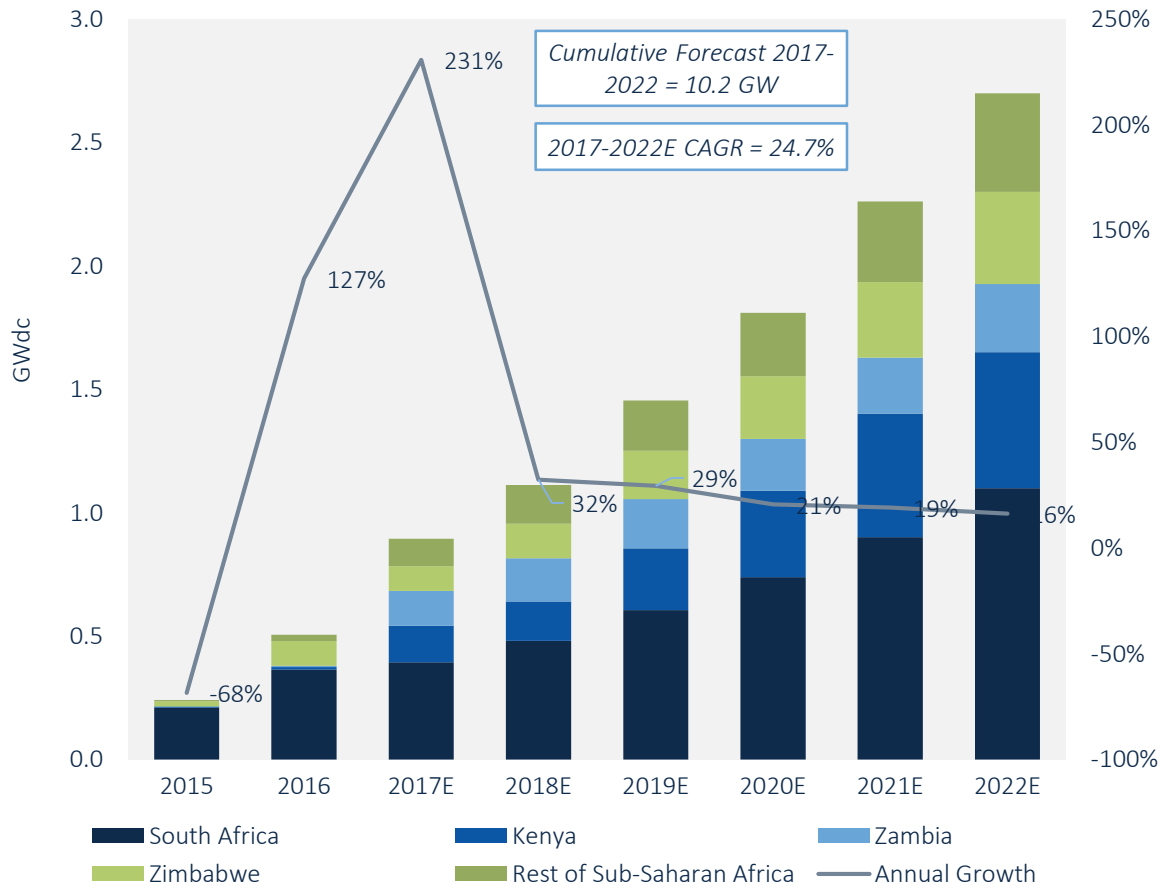
- Despite the sub-40% subscription of the self-consumption program in 2016, Thailand is expected to install over 4.6 GW of solar between 2017 and 2022 due to generous and increasing clean energy tariffs, which are currently THB 5.66 and expected to rise by 2020. Additionally, the second phase of the government agencies and agriculture co-op solar program will amount to 518 MW which is expected to be tendered out in Q1 2017 and will likely be heavily oversubscribed.
- We expect Malaysia to far exceed its 1 GW by 2020 national target, due to low-cost domestic wafering and module manufacturing, the recent introduction of net energy metering policies for 500 MW of rooftop projects, and 1,250 MW of tenders for 1 MW to 50 MW projects recently awarded and upcoming, including a recent 460 MW tender last month, with the first set of projects set to come on-line this year, and there are a number of foreign developers signing PPAs for utility-scale projects outside of the tender program.
- Overly bullish expectations in Cambodia and Myanmar from last quarter have yet to materialize into any consistent market growth, and have been pulled back significantly in this quarter's data.

Near Term: Vietnam's local cell manufacturing capacity and high levels of attractiveness for billions in foreign direct investment have materialized into a multi-gigawatt pipeline in the country, hinging on regulatory clarity from the Ministry of Industry and Trade on the FIT, which currently sits proposed at USD $0.112/kWh for utility-scale projects and USD $0.15/kWh for rooftop projects. The rates are expected to be passed in H1 2017.

Long Term: Indonesia's new FIT 1.0 policy indicates a slow start to what could be a massive market for distributed generation and islanded mini-grids, but long-term could see the true takeoff of Indonesia's market. The 5 GW national target, Wood Mackenzie estimates of 6.5% average annual power demand growth through 2020, and the strong potential for PV-plus-storage applications leave the market in the Indonesian State Electricity Company's (PLN) hands.

Sub-Saharan Africa: A Promising 10 GW Opportunity for Patient, Risk-Tolerant Developers

Sub-Saharan Africa PV Demand, 2015-2022E



Source: GTM Research *Global Solar Demand Monitor Q1 2017*

Highlights:

- 2016 saw at least 10 utility-scale projects commission in South Africa, Zimbabwe, Kenya and Namibia. The region is clearly a highly immature market (outside of South Africa), but still represents a significant investment opportunity for risk-tolerant capital.
- We expect nearly 1 GW of on-grid installations in sub-Saharan Africa in 2017, with the market adding over 10 GW between 2017 and 2022, especially under our assumptions regarding the restart of the Renewable Energy Independent Power Producer Procurement program in South Africa.

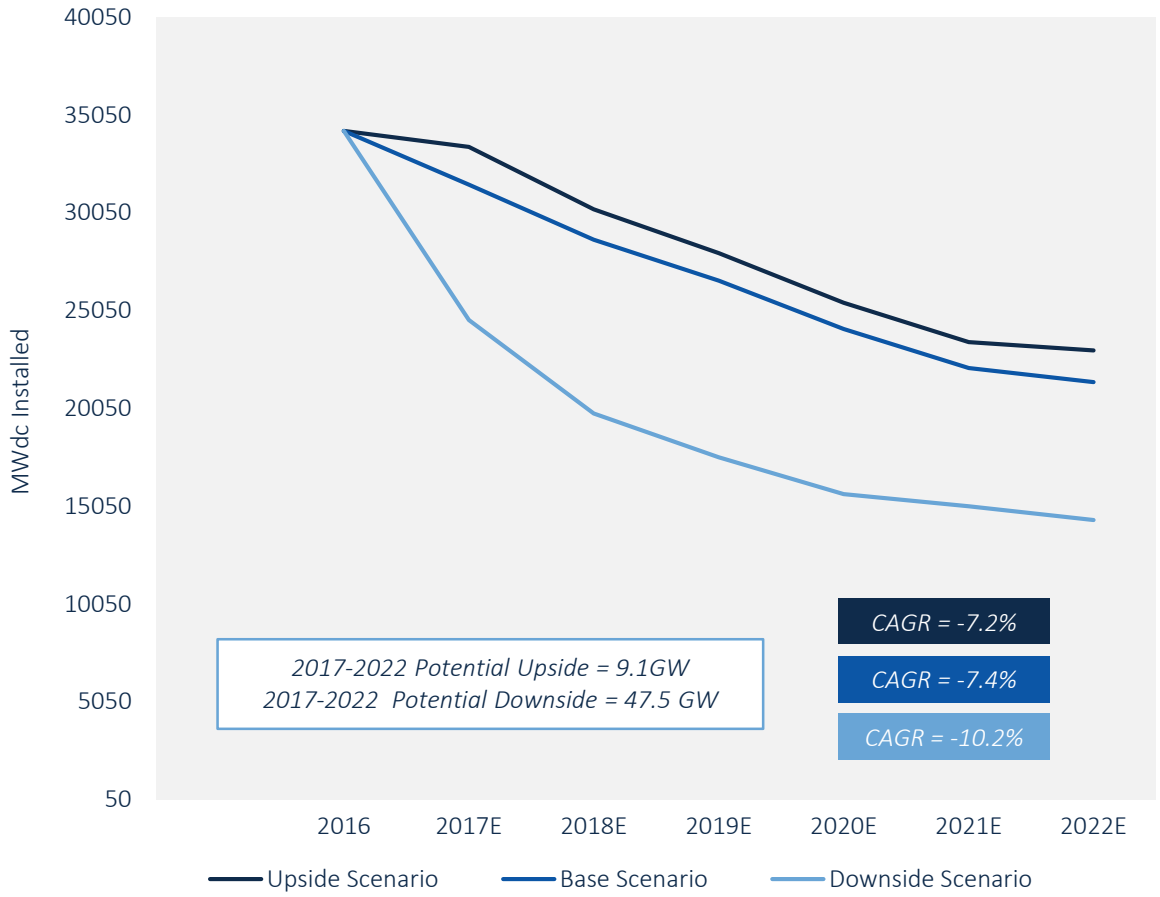
Near Term: The four tender programs in place and five announced and under discussion are likely to drive the majority of growth in the region in the near term.

- Zambia's Industrial Development Corporation Limited (IDC) has invited expressions of interest for Round 2 of the Scaling Solar program, which brought African record bids of $60.2/MWh in its first round. Round 2 will tender 150-250 MW, and a subsequent Round 3, likely at the end of 2017 or early 2018, will tender 250-350 MW more.
- NamPower's tender series is likely to remain relatively small-scale, tendering for projects under 40 MW in batches of one or two at a time, but it will represent a sizable portion of sub-Saharan Africa's demand in the near term.

Long Term: There is significant institutional focus on the energy sector in sub-Saharan Africa that will likely see the region move past MDB-financed development in the coming four to five years. As economic growth picks up considerably, power demand will follow, and solar's cost profile and rapid deployment timeline is well suited to meet the net short. Our five-year forecasts in this region assume considerable power demand growth does not begin until 2020, but a scenario where this occurs as early as 2018 is entirely possible and would ratchet up our demand expectations by a substantial margin.

NEA's Opaque Policy Environment Leaves 2 Likely Scenarios for Chinese Demand

China PV Demand Scenarios, 2017-2022



Source: GTM Research *Global Solar Demand Monitor Q1 2017*

We envisage two potential scenarios for Chinese PV demand to 2022. Both scenarios assume a shift toward smaller-scale installations and increased competitive auctions for utility-scale capacity.

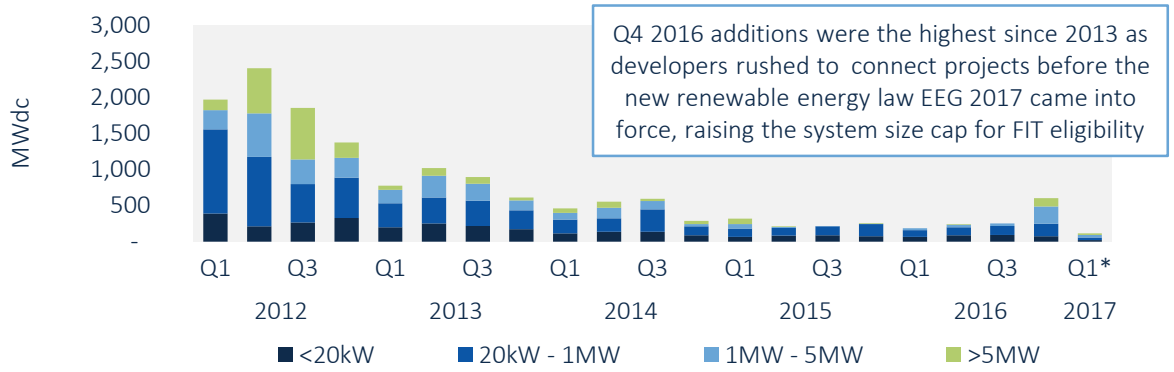
Scenario 1: Chinese demand remains FIT-driven and tapers gradually as FITs are cut further and are slowly replaced with competitive auctions. As the current 8% to 9% gross margins for developers thin out, Chinese players begin to seek juicier returns in other markets, and demand remains globally leading, but declines steeply from 2016 levels. Demand shifts relatively rapidly toward 'DG' (defined as projects up to 20 MW in China) projects, Top Runner projects, and Poverty Alleviation Program projects, with a stabilization of demand as coal retirements begin en masse in the 2020-2021 timeframe. This is likely to follow the trajectory of the base-case scenario, trending toward the upside.

Scenario 2: Chinese demand reaches above 30 GW for 2017, but the next expected FIT cut cycle on June 30, 2018 instead becomes a scrapping of the FIT entirely and a shift to competitive reverse auctions. Our checks confirm this is on the table for discussion. This scenario has implementation likelihood as the NEA may see tenders as a way to control demand, limit future curtailment, and reduce CREF's longstanding FIT back-payment issues. Further, it is unlikely that the FIT and a tendering scheme would coexist for long, so if this begins to play out, there will likely be a massive interconnection approval rush in Q4 2017, and then a similarly scaled installation rush in the likely Q2 deadline before the FIT expired. Auction volumes would be informed by the Five Year Plan, and with demand from DG customers and the Poverty Alleviation and Top Runner programs, totaling 15 to 20 GW of annual demand through 2022. This is like to follow the trajectory of the downside scenario.

Unpredictable and lumpy demand in China could create a module price cliff in H2 2017. Along these lines, future policy uncertainty (i.e., the possibility of scenario 2) is likely to add significant risk to forward module pricing assumptions for razor-thin bids, which may help stabilize tariffs in competitive auctions in the second half of this year and into 2018.

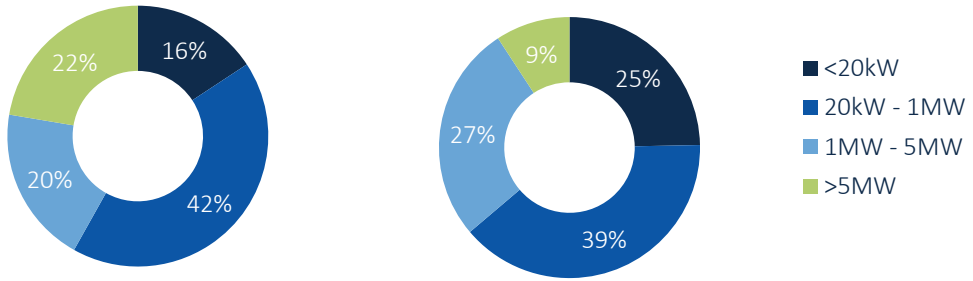
Annual Additions in Germany Stabilize, but There Will Still Be Quarterly Surges in Demand

Germany PV Capacity Additions – Quarterly History, 2012-Q1 2017



Source: Bundesnetzagentur, GTM Research Global Demand Monitor Q1 2017

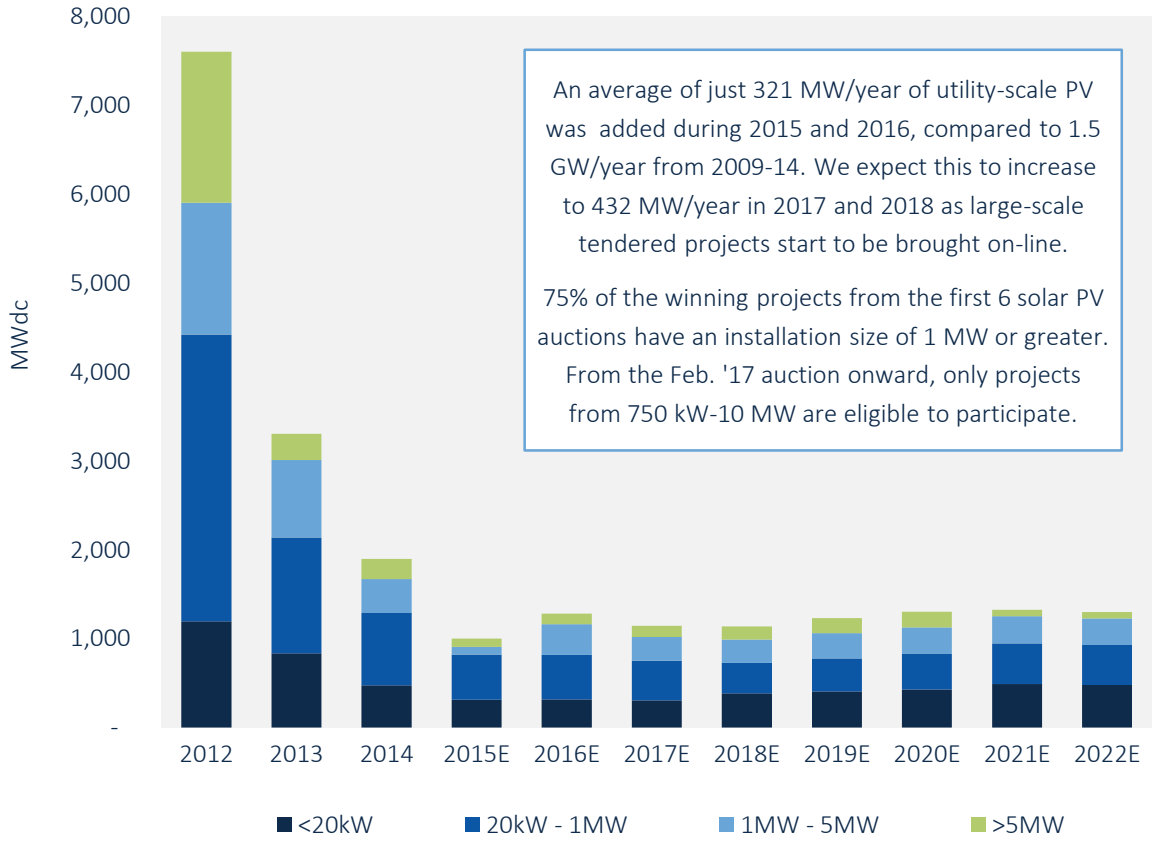
German PV Market Segmentation – 2012 (left) and 2016 (right)



Source: Bundesnetzagentur, GTM Research Global Demand Monitor Q1 2017

*Includes January 2017 capacity additions only

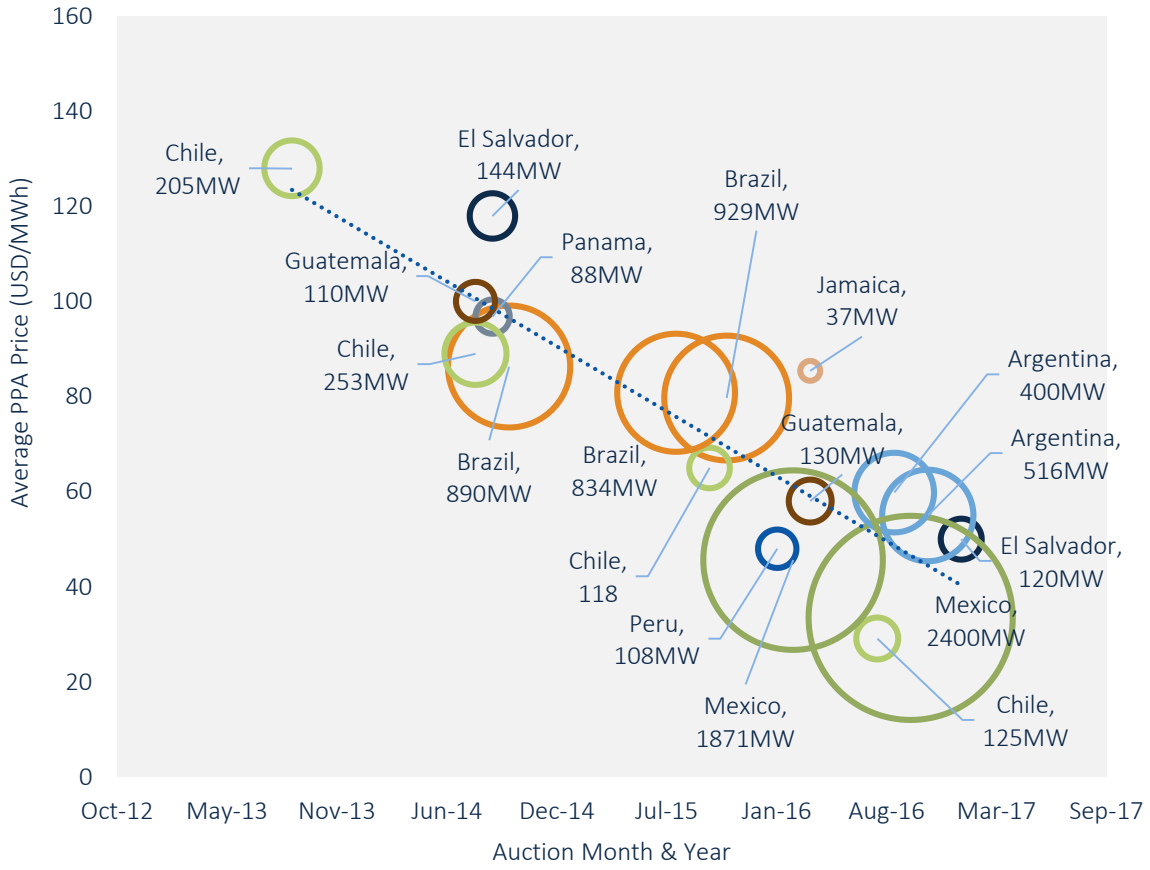
Germany PV Capacity Additions – Annual Forecast



Source: GTM Research Global Demand Monitor Q1 2017

Argentina: Will RenovAR 2 See Sub-$50/MWh Prices for PV in 2017?

Declining Average PV Award Price/MWh in Latin America, 2012-Present



Source: GTM Research's Latin America PV Playbook Q4 2016

- The only large developer that won projects in the November auction round was Jinko Solar, and even that was in a partnership with 360 Energy. Several smaller local developers were prevalent in both rounds because they are more comfortable with the lay of the land and current risk still associated with developing projects in Argentina.
- Based on recent Latin America PV trends, the next RenovAR will yield PPA prices lower than $50/MWh keeping with not only Argentina's lessening market risk, but also international developers seeing how projects progress from the first two rounds.
- Outside of RenovAR 1 and 1.5, any extra PPAs that are signed must meet two conditions: (i) there has to be spare transmission capacity in the node, and (ii) the node price can not be higher than 25% of the national PPA price minimum for such technology (solar PV, wind, mini hydro, biomass).
- There is considerable optimism that projects that won the auction will get financed. Argentina's Banco de la Nacion set up a $100M credit for projects using 30% local content, but thus far, the local content manufacturing base has been limited. For the government to ensure projects are financed, they must make sure a situation similar to that of Brazil does not occur where local content requirements stifle access to financing.
- IFC and Deutsche Investitions- und Entwicklungsgesellschaft mbH allocate pools of money per continent per renewable technology. IFC funded at least five projects in Chile totaling 364 MW and a few more utility-scale projects in Honduras and Mexico. With sufficient funding in Chile, and Brazil somewhat shutting down in the interim, look for financial institutions possibly to pour resources into Argentina.

1. Information on the Full Report

List of Figures from the Full Report

Get the Full Report

The Global Solar Demand Monitor is part of GTM Research's Global Downstream Solar Service, an annual subscription that analyzes the demand drivers, policies and risks that shape global solar markets. It enables companies to be successful in navigating the global market today, and anticipate trends in the future.

The report is also available for purchase at: https://www.greentechmedia.com/research/report/global-solar-demand-monitor-q1-2017

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