

Solar trackers: Market assessment and outlook

November 2018

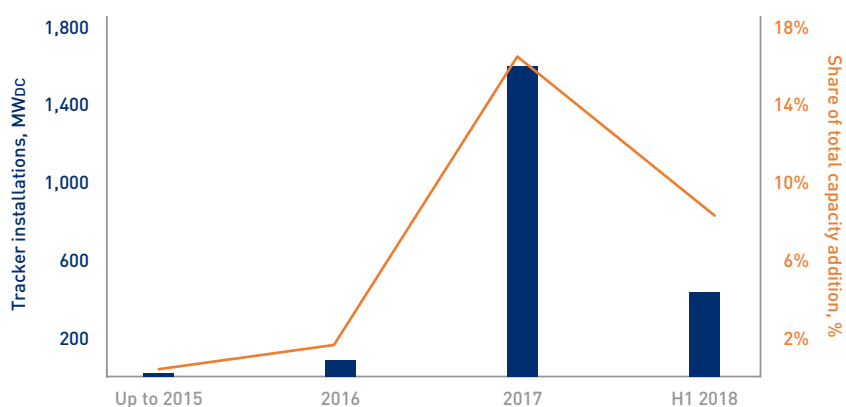
Executive summary

Tracker based installations picked up significantly in India in 2017 due to decline in prices and improved commercial viability

Global cumulative installed tracker capacity reached 44.5 GW in December 2017, growing at a CAGR of 43% over the last six years. Growth has been driven by fall in tracker prices, efficiency gains over time and intense competition in the downstream market forcing developers to optimise operational design of projects.

Trackers started gaining acceptance in the Indian solar market in 2016. Installations picked up significantly in 2017 due to decline in prices and improved commercial viability. Increased investor awareness and need to maximise power output in a competitive market also resulted in an increase in demand.

Figure: Tracker based solar installations in India, MWdc



Source: BRIDGE TO INDIA research

However, market environment has turned negative in the last year as module prices have fallen sharply. DC:AC overloading is a more cost-effective option in comparison to using trackers for increasing power output.

Tracker companies are therefore having to innovate to improve efficiency and reduce cost of manufacturing. Demand pick up is dependent on improvements in design, adoption of bifacial modules and a more sophisticated time-of-the-day pricing system for power.

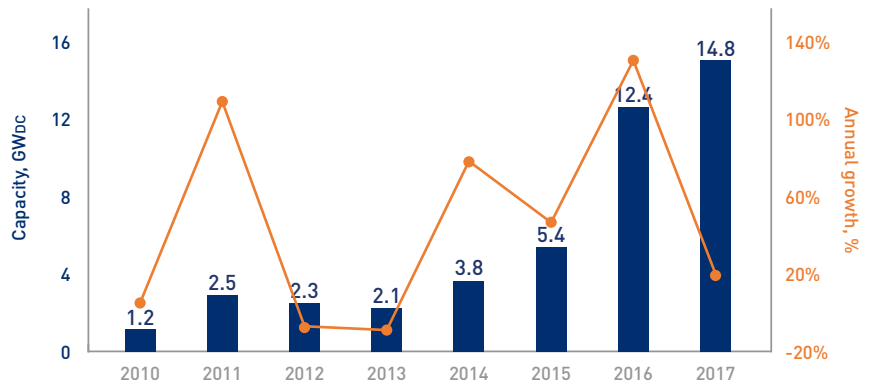
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1. Introduction

Global cumulative installed tracker capacity reached 44.5 GW in December 2017, growing at a CAGR of 43% over the last six years. Multiple factors are responsible for such rapid growth – steep fall in tracker prices (25% in 2016), efficiency gains over time and intense competition in the downstream market forcing developers to optimise operational design of projects.

Figure 1.1: Global tracker capacity addition

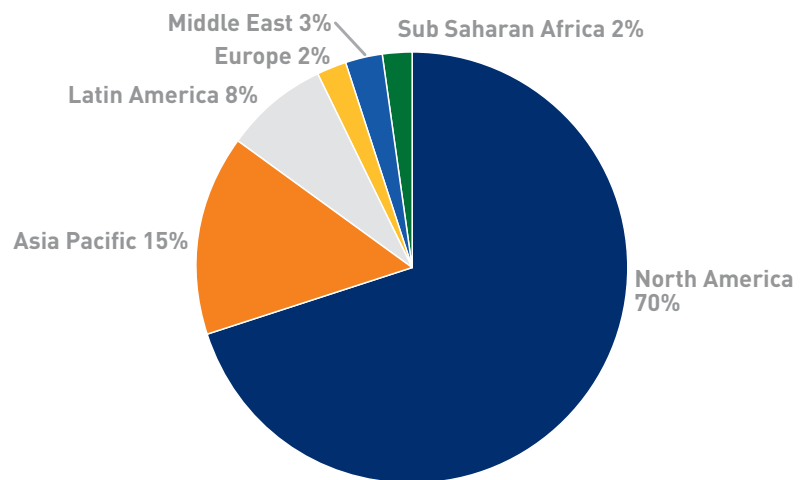


Source: GTM research, BRIDGE TO INDIA research

1.1 Major markets

North America has been the largest market for trackers globally; it accounted for 70% of global market in 2016. However, imposition of solar tariffs in the US has dampened demand. Asia Pacific, led by India, was the second largest market historically but it is also slowing down due to declining module prices.

Figure 1.2: Regional share in global solar installations in 2016



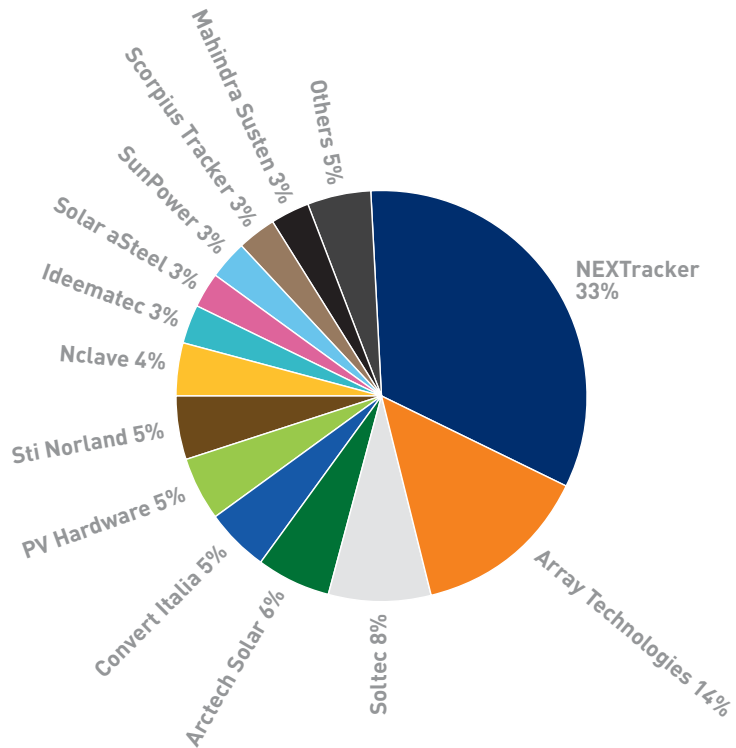
Source: GTM research

In contrast, demand in Latin America is growing rapidly – there was 305% increase in shipments in 2017.

1.2 Leading global players

US-based NEXTracker and Array Technologies were the global market leaders in 2017 with 33% and 14% market share respectively. European players including Convert Italia, Nclave and Soltec commanded a combined 34% market share, followed by Asian players like Arctech, Mahindra Susten and Scorpius Trackers with a combined 14% market share.

Figure 1.3: Global solar tracker shipments market share in 2017, MW



Source: GTM research

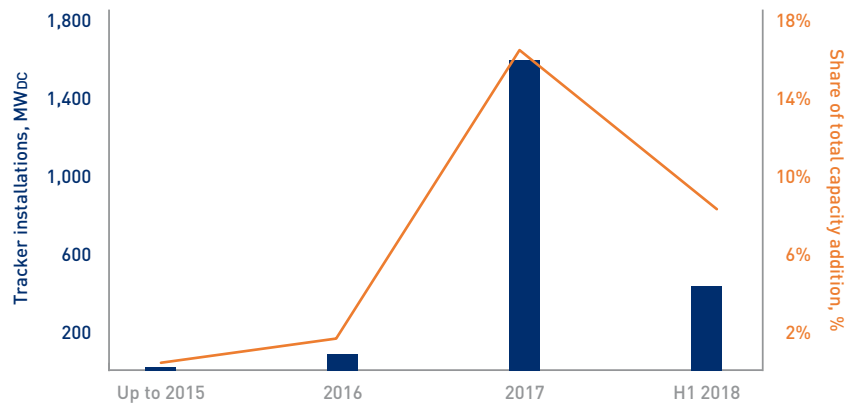
The market is going through a consolidation phase. In 2018, ArcelorMittal acquired France-based Exosun and Valmont Industries acquired majority stake in Italy-based Convert Italia. In 2017, Spain's Grupo Clavijo and MFV solar merged to form Nclave, which has been subsequently acquired by Chinese module manufacturer Trina Solar.

2. Indian Market

2.1 Market size

Trackers are a relatively new introduction to the Indian solar market. Until 2016, total installed tracker capacity was only about 100 MW. Installations picked up significantly in 2017 with 1.6 GW of capacity addition – mainly because of improved commercial viability of trackers due to rising module costs in H2 2017 as well as decline in tracker prices. Increased awareness and need to maximise power output also resulted in an increase in demand. However, we estimate that capacity addition in 2018 and subsequent years would fall significantly due to sharp fall in module prices (refer Section 3 for more details).

Figure 2.1: Tracker based solar installations in India, MWdc

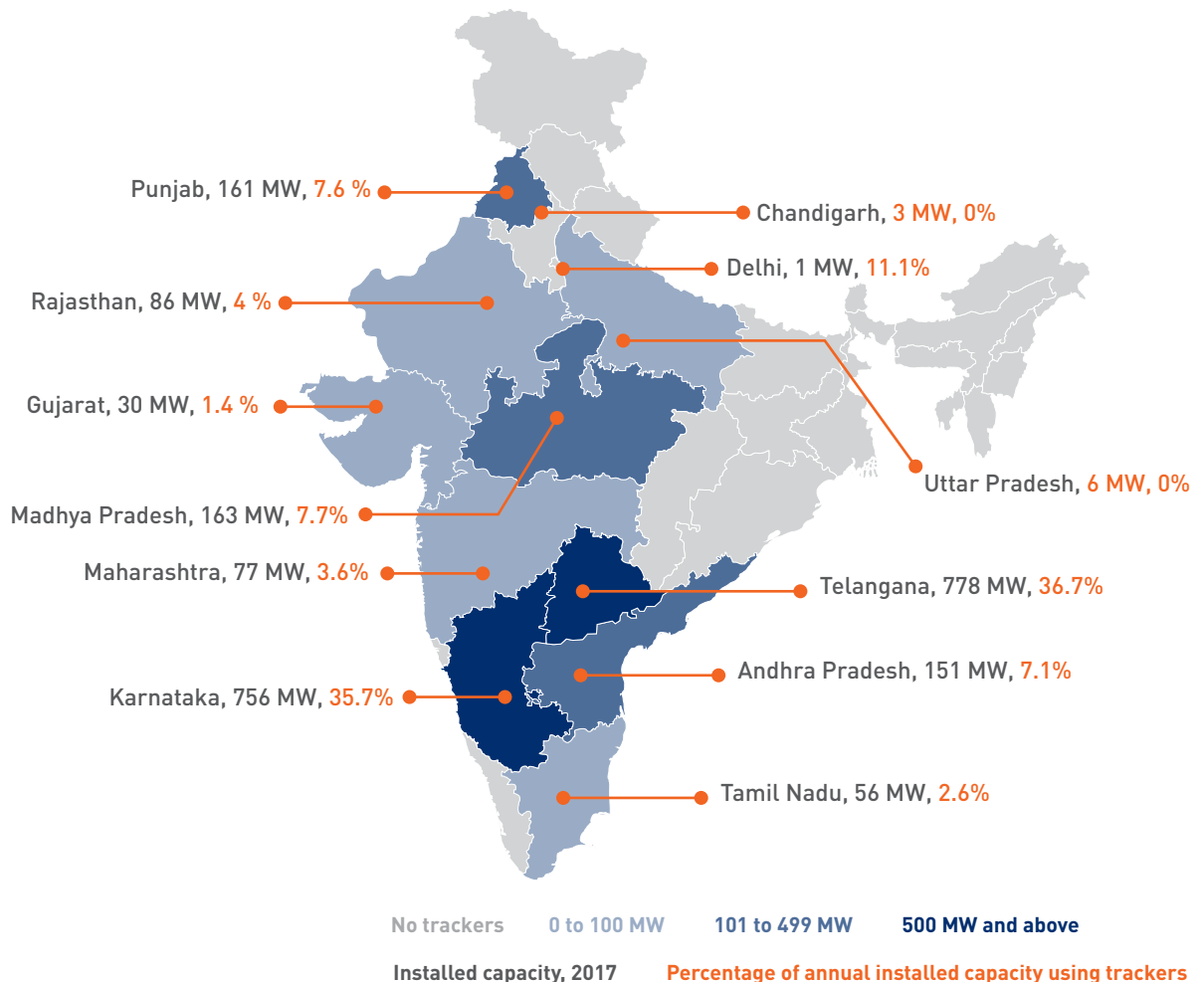


Source: BRIDGE TO INDIA research

Locations closer to the equator are more suitable due to higher direct normal incidence

Tracker performance gains depend on two factors: latitude and insolation. Locations closer to the equator are more suitable due to higher direct normal incidence (DNI). Therefore, we see southern states take the lead with 82% (1,741 MW) of total market.

Figure 2.2: Geographical distribution of tracker capacity across India



Source: BRIDGE TO INDIA research

In north India, where performance gains from use of trackers are lower, there has been an increasing trend of using modules with seasonal tilt structures. In such systems, tilt can be changed manually in different seasons. Performance gains are typically in the range of 3-5% as compared to fixed tilt systems and additional operational cost is minimal because of low labour cost in India.

2.2 Types of trackers, their cost and performance

Solar trackers are classified into two main types: single axis trackers and dual axis trackers. Market share of dual axis trackers in India is extremely small due to their increased complexity, significant additional capital cost and increased land requirements. This is in line with the global trend where dual axis trackers constitute less than 1% of the total market.

Table 2.1: Types of trackers

Features	Fixed tilt system	Single axis trackers		Dual axis trackers
		Centralised	Decentralised	
Ground coverage ratio	0.45 - 0.50	0.35 - 0.40	0.42-0.45	0.20
Land requirement, acres/ MWdc	4.00	5.00 - 5.25	4.50	NA
Ground levelling cost	Low	High, ground undulation tolerance is around 3mm	Low, ground undulation tolerance is higher	NA
Mechanical complexity	None	Low – movement is centrally driven	Moderate	High – more moving parts
Reliability	High	Moderate – centralised drive means more O&M downtime	High	Low – more moving parts

Source: BRIDGE TO INDIA research

Cost and performance

Output gains for single axis trackers are at around 11-13% and 14-16% in northern and southern India respectively

Cost and performance differ widely depending on the type of trackers used and project location. Cost is driven mainly by cost of steel, which accounts for more than 70% of total manufacturing cost. Despite an increase of 20% in global average steel prices in 2018, tracker prices have continued to decline because of increased volumes and competition in the market.

Average cost of centralised single axis trackers including civil construction is in the range of INR 4.50-5.50 million/ MW, an additional 11-14% over the cost of a fixed tilt system. O&M cost is in the range of INR 45,000-50,000/ MW/ annum, 7-10% over O&M costs for a fixed tilt system.

Manufacturers claim power output gains for single axis trackers of 14-16% for northern India and 18-21% for southern India. However, we understand that actual performance gain is lower at around 11-13% and 14-16% respectively.

2.3 Comparison between trackers and DC:AC overloading

A sharp reduction in module prices in the past few months has made DC:AC overloading a commercially more attractive option over trackers. We believe that tracker demand in India will continue to slow down in the near future. The table below compares the cost of overloading with that of using trackers to achieve the same performance gain of 15%.

Table 2.2: Comparison of DC:AC overloading with trackers

	15% DC:AC overloading	Trackers
Performance gain over a fixed tilt system	15%	15%
Additional land requirement, acres/ MWac	0.60	1.00-1.25 for centralised trackers; 0.50 for decentralised trackers
Additional capital cost per MWac, excluding land	INR 3.80 – 4.10 million	INR 4.60 – 5.10 million
Additional O&M cost per MWac per annum	INR 45,000	INR 45,000 – 50,000

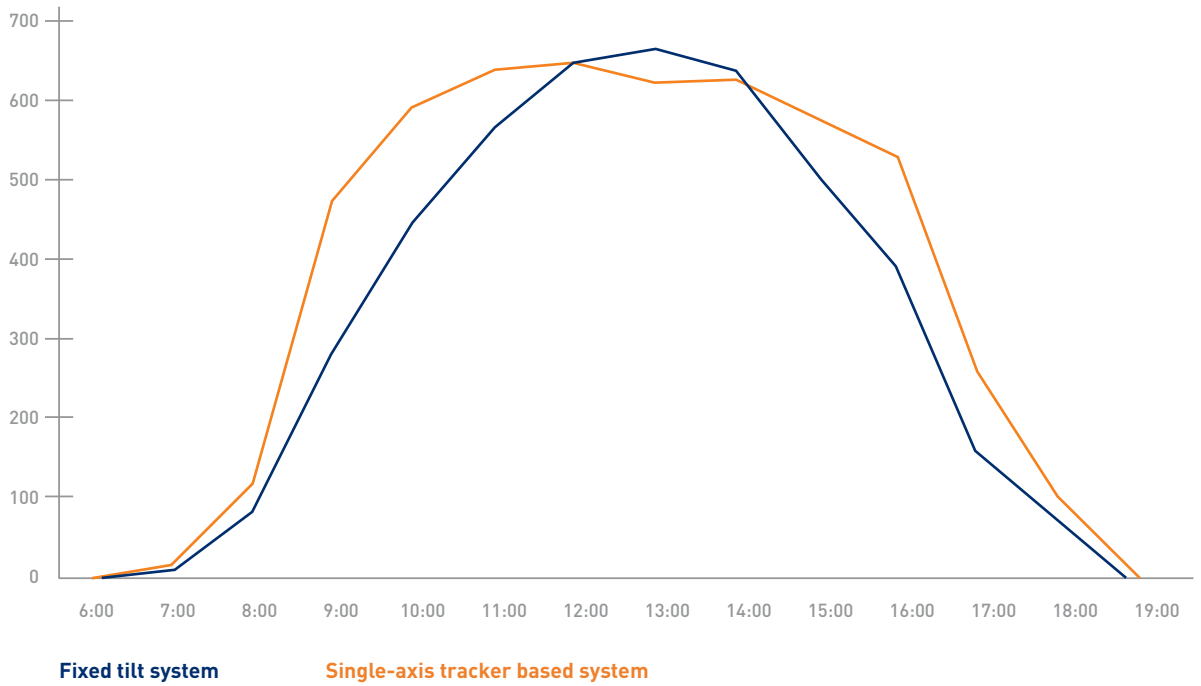
Source: BRIDGE TO INDIA research

Trackers may not be commercially competitive with DC:AC overloading, but they offer a compelling benefit of flatter power generation profile

Trackers may not be commercially competitive with DC:AC overloading, but they offer a compelling benefit of flatter power generation profile. Majority of increased energy generation from trackers occurs in mornings and evenings, when sun rays hit solar panels at a much lower angle than during noon (see figure below). This is likely to justify tracker installation at locations where a premium is paid for reliable power supply and grid stability.



Figure 2.3: Hourly power generation from a 1 MWdc solar system, kWh



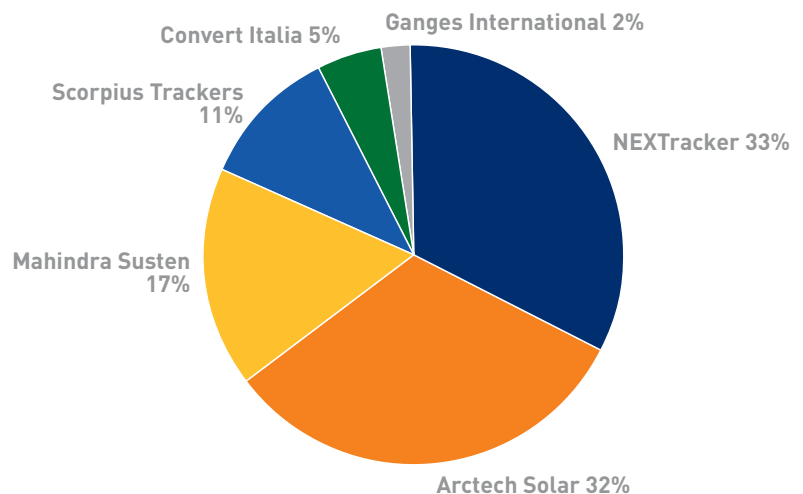
Source: Jakson; BRIDGE TO INDIA research

Note: Data shown is actual performance observed for an operational utility scale project in Punjab.

2.4 Leading players

The tracker market in India is fairly concentrated. US-based NEXTracker and China-based Arctech are the market leaders with almost equal market shares (33%), followed by domestic manufacturer Mahindra Susten (17%).

Figure 2.4: Cumulative market share of tracker suppliers in India until June 2018



Source: BRIDGE TO INDIA research

Note: Market shares are estimated based on installed MWdc capacity.

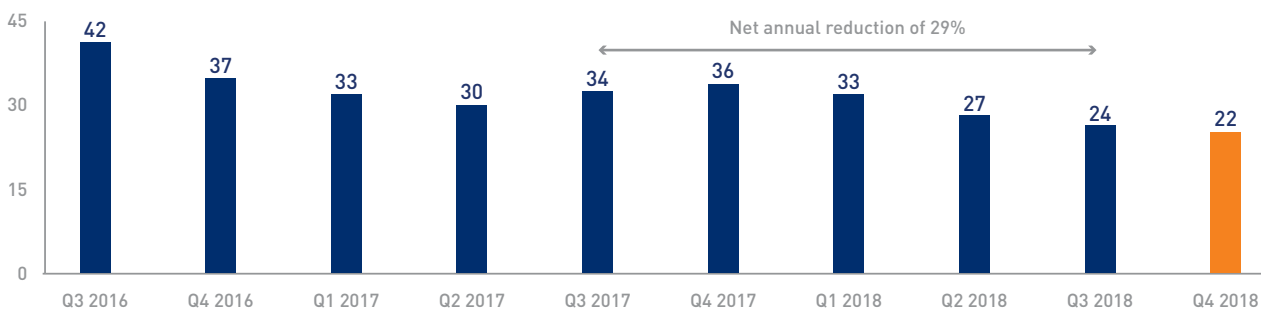
3. Market outlook

We expect tracker demand to stay low in the coming years unless power purchasers start placing a premium on additional power generation in the morning and afternoon hours.

3.1 Weak module prices

Depressed module prices disincentivise tracker installations as developers prefer installing additional modules depending on land availability. Module prices have fallen from an average of USD 0.33/ W in 2017 to USD 0.24/ W in September 2018 and are expected to fall by a further 15% in the coming year.

Figure 3.1: BTI India Module Price Index, US cents/ W



Source: BRIDGE TO INDIA research

Note: These prices are for imported modules on a CIF basis.

3.2 Steel price rise

Cost of steel has risen by 20% so far in 2018 and is expected to increase further in the near future. Tracker manufacturers are exploring opportunities to source steel from lower priced markets in Ukraine and Vietnam compared to traditional suppliers in China and India. They are also trying to improve tracker designs and reduce steel tonnage to improve overall economic viability.

3.3 Land availability constraints

Tracker installations require an additional 10-15% land over fixed tilt systems. They also necessitate ground levelling cost for uneven sites to make them appropriate for installation of trackers. Limited availability of vast pieces of flat land makes installation of trackers a less attractive proposition.

Increasing adoption of bifacial modules may increase demand for trackers because of higher expected performance gains

Increasing adoption of bifacial modules may increase demand for trackers because of higher expected performance gains. However, we expect bifacial technology to be introduced in the Indian market from H2 2019 onwards and large-scale installations to be at least 3 years away. Meanwhile, tracker manufacturers are using artificial intelligence to provide innovative features in their existing products. For instance, some manufacturers are using machine learning to improve performance gain for undulated sites.



4. Conclusion

Trackers are currently experiencing weak demand in India. This is mainly on account of falling module prices. Despite being one of the cheapest tracker markets in the world, near-term demand is expected to be muted.

Possible demand drivers include – adoption of bifacial modules and a more sophisticated time-of-the-day pricing system for power. As solar sector matures further, projects will increasingly be required to meet peak load demand during morning and evening hours. In this scenario, demand for trackers should see a boost as being already witnessed in some Middle East and South-East Asian markets.

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