

# Track to the future



**Technology** | Falling prices have seen single-axis trackers become standard issue in utility PV plants in many parts of the world. As the tracker market becomes more crowded, manufacturers are developing increasingly sophisticated technologies to stay ahead of the game and support wider PV power plant innovation. Ben Willis reports

The presence of single-axis tracker systems in ground-mounted PV arrays has gone from oddity to near ubiquity in the space of just a few years. Until only relatively recently trackers were regarded as an expensive anomaly, but a combination of rapidly improving economics and a boom in utility-scale projects at latitudes where trackers add the most value has seen them become almost a default technology choice.

In its most recent report on the tracker market, analyst firm GTM Research documented a 250% jump in tracker installs between 2015 and 2016, from 5 to 12.6GW. By 2021 GTM predicts that annual tracker installations will grow to 37.7GW, accounting for over half of all ground-mount PV systems.

The tracker boom has brought with it the inevitable jostling for position by established players and new market entrants looking to get in on the action, one of the main reasons why trackers have become much more affordable. "It's a very crowded marketplace, meaning that not only have tracker prices fallen by virtue of products being more optimised, built at bigger scale, there's also been a lot of general market competition," says GTM Research senior analyst, Scott Moscowitz. "Because of the number of vendors out there, folks have been forced to drop margins to lower their prices."

This trend looks set to continue, with GTM predicting that tracker prices will continue falling by 5-7% annually through to 2021. For project developers this of course is a welcome fact,

**Innovation in tracker technology will become increasingly important as the sector becomes more competitive**

bringing prices down to a level where the relatively greater capital expenditure required to finance a tracker is more than offset by the greater yields and therefore returns a tracker will enable a PV system to generate over its lifetime.

For tracker vendors, meanwhile, increasing price pressures will mean an ongoing struggle to stay competitive. According to Stavros Mastorakis, technical director of Spain-based tracker specialist, Mecasolar, the price of trackers will always be dictated by their basic raw material – steel. "As of today, on cost approximately 70% corresponds to the cost of the steel. The price has a limit it can go down, because practically if you want to have a system that complies with local regulations there's a minimum of steel you need to use, if you are supplier

A or supplier B. So in the pushdown in prices, the tracker will come to a point where it will go to its bottom price and it will be very difficult to go below that," he says.

That fact will place an increasing emphasis on the ability of tracker manufacturers to continuously improve their products to ensure they remain relevant. According to GTM, ongoing design refinement that eliminates parts, minimises electrical components and reduces structural requirements will be a key priority for tracker suppliers, as will an ongoing awareness of how tracker systems must keep up with developments in other areas of PV power plant technology.

A number of recent notable product announcements offer some clues as to where the priorities are likely to be for tracker firms in the near future. Some of the emerging trends that look set to shape the tracker landscape in the years to come are outlined below.

### Predictive O&M

One development that is likely to become a defining characteristic of next-generation trackers is the incorporation of 'intelligent' capabilities that enable predictive maintenance of components. Broadly speaking, the single-axis market is split between so-called centralised and decentralised – or distributed – architectures, the former using a central drive to power multiple rows of modules, the latter having drives for independent rows. Both architectures have distinct advantages, but a challenge with decentralised systems is the generally larger

number of components they utilise.

"Predictive and preventative maintenance is a big focus, especially with the proliferation of decentralised tracking systems that have a large number of components in the field," says Moscovitz. "So if you can figure out a way to minimise failures and address them before they occur that could be really beneficial. But that's not specific to decentralised trackers; centralised trackers can look at ways in which they can increase performance as well and we expect all types of trackers to get, in a word, smarter. There's a software and hardware element to tracking systems and even marginal benefits can be significant over the 25-30 year lifespan of a tracking system."

Undoubtedly with exactly this in mind, leading US tracker manufacturer NEXTracker last summer announced the acquisition of BrightBox Technologies, a tech firm with specific expertise in predictive modelling software and machine-learning. At the time NEXTracker said it expected the acquisition to enhance its capabilities in a number of areas, including improved remote monitoring and asset management of systems using its technology.

Meanwhile, Mastorakis explains how Mecasolar is incorporating similar predictive capabilities in its Hyperion single-axis tracker: "The system information that you can gain during operation can give you some indication of what is happening to the system and how you can react from a predictive point of view and reduce your downtime in the operation. At the end of the day a tracking

system is a machine that will always give you some feedback about what is going on. Through our control system we are recording continuously all the operating data of the system, so our maintenance engineers can connect all over the world to existing installations to find out what is happening to the system [and] do some predictive maintenance to reduce the downtime of the plant."

### Moving with the times

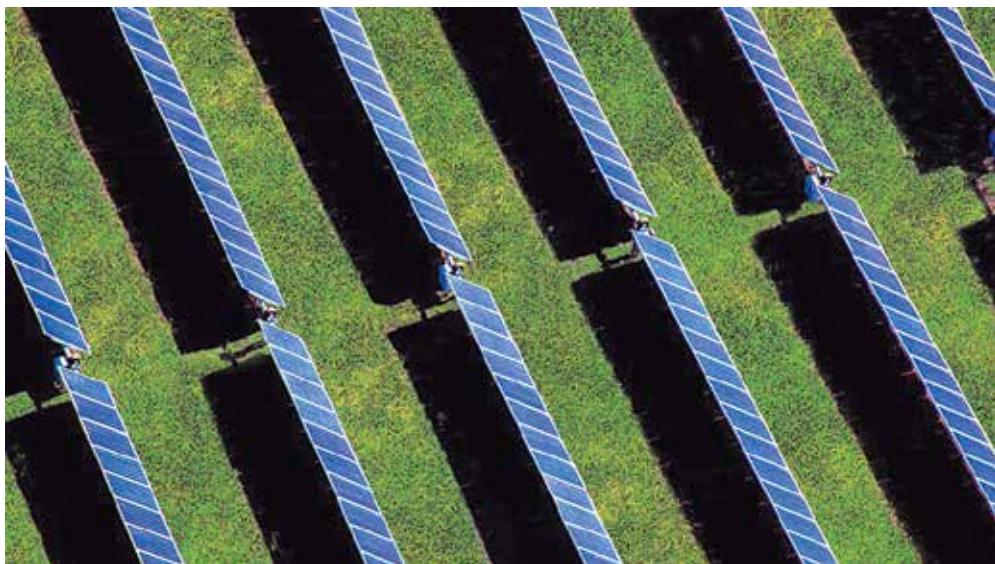
Tracker companies must of course also have an eye to developments taking place in other aspects of PV power plant technology to ensure their products keep pace with the rest of the industry. "Tracker vendors are always monitoring what their customers are doing either from the module or inverter perspective and figuring out how to adapt to that. And they have to be very reactive to those technology trends otherwise they get left behind," says Moscovitz.

One recent example of this point is the general industry-wide shift towards 1,500V plant architecture. This phenomenon affected all parts of the PV power plant supply chain, including tracker suppliers, which had to introduce a number of design modifications to adapt to the higher power systems. Looking ahead there are several other big-picture trends that are likely to have a bearing on tracker design or where trackers may indeed be integral in expediting wider power plant innovation.

### Cleaning

Cleaning is a significant consideration for PV plant developers and operators, particularly in markets where soiling from dust and sand is prevalent. Hitherto, much cleaning work has been undertaken either manually, or via cleaning systems fitted to the back of vehicles, but the trend is increasingly towards automated solutions as the appropriate technologies become cheaper and the size of plants makes manual cleaning impractical and costly.

This development will have obvious implications for tracker suppliers, says Lux Research analyst, Tyler Ogden. "Single-axis suppliers need to be aware of the increasing adoption of robotic cleaning systems in certain markets with high soiling like the Middle East, India, even the south-west US," Ogden says. "These systems are primarily built to be compatible with fixed-tilt racking, and



Credit: Mecasolar

**Mecasolar's Hyperion tracker enables predictive maintenance to reduce plant downtime**



**NEXTracker's NX Fusion Plus solution is among the first to integrate storage and tracker technologies**

there are some additional complications around making them compatible with trackers. So that's also an area where tracker companies need to branch out and form development partnerships. And it could be an area of differentiation."

Indeed for market leading firm Array Technologies, tracker-compatible robotic cleaning is a key priority and, says company president Tom Conroy, a central plank of its technology innovation roadmap.

"In some markets around the world panel cleaning is a very big issue, and the initial panel cleaning technology being deployed is tractors," Conroy says. "Now it does not appear to many people that tractors are going to be a long-term solution for cleaning. One of the obvious problems is road maintenance – so for a 100MW project, in order to do tractor cleaning you've got to maintain about 400km of roads for 30-50 years in order to not have potholes in the roads and these cleaners punching holes in modules. Array has an aggressive robotic cleaning programme underway that will reach a whole other level of efficiency and reliability and be a breakthrough for the market."

Conroy ventures no further details, but Array says it is expecting to begin rolling its robotic cleaning system out by mid-2018.

### Storage

Another major industry-wide development is the advent of energy storage. Conroy is unconvinced that the "economically optimised" place to implement storage in a PV power plant is at the tracker level.

Nevertheless, what now seems like the inevitable integration of PV and storage technologies has caught the interest of NEXTracker, which at the end of 2016 lifted the lid on its 'NX Fusion Plus' solution. This brings together a NEXTracker Horizon solar tracker, battery, storage-enabled inverter and control software into one package that, owing to NEXTracker's distributed architecture, can be deployed in as many or few individual rows as required, the company claims.

Mecasolar is also actively pursuing a storage solution, which Mastorakis describes as a "turnkey" system integrating modules, tracker, inverter and batteries. The system, on which Mecasolar is collaborating with three partner companies and which it has been trialling for the past year or so, will be tied together with a dedicated SCADA control system the company is developing that will bring the different technologies under "one umbrella" and ensure ease of use.

### Bifacial

As we explore elsewhere in this edition of *PV Tech Power* (see pages 18-26), bifacial module technology looks set to play an increasingly important future role as the solar industry begins to embrace the advantages offered by modules that generate power from their back as well as front sides. As a relatively new technology, how bifacial modules can best be deployed in conjunction with single-axis trackers is still a relatively unexplored area. GTM's Moscovitz believes that most trackers can currently be installed with bifacial modules, but

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concrete examples of this combination of technologies – or indeed the power gains they jointly offer – are few and far between.

One tracker company that has made some early moves forward in this area is Spain's Soltec, which at the end of 2016 was chosen by Italian utility Enel Green Power to provide a tracker solution for a bifacial test project in Chile. The 1.72MW 'La Silla' project is claimed to be the first to combine bifacial modules and single-axis trackers in a utility-scale power plant.

The company used its SF Utility Tracker for the project, employing a design that incorporates gaps between modules that allow additional sunlight to reach the ground surface for reflected radiation. As Soltec communications manager Tim Murphy explains: "In the case of bifacial PV tracking, it is the tracker application that both eliminates backside shading and achieves the higher mounting location (key to increasing bifacial performance) that is demonstrating product maturity to the customer's advantage.

"The bifacial tracking case is resolved simply by the SF tracker standard feature of two-up portrait module mounting whereby backside shading by the torque-axis is effectively eliminated, and bifacial performance is increased by the height of installation."

It seems likely that La Silla will be the first of many utility PV projects to come that will combine the benefits of bifacial modules and single-axis trackers.

### Getting the basics right

But while technological innovations such as those outlined above will undoubtedly play an important role in helping tracker companies maintain their competitive edge, so too will a continued focus on getting a few basic practices right. For example, says Mecasolar's Mastorakis, as solar continues to globalise and new markets open up, tracker manufacturers must be able to offer products that fit the specific and varied needs of the end user.

"We have to be more project oriented and we have to optimise the operating conditions of the system project by project," he says. "It's not always feasible; it's not the same to optimise a 1MW project in Turkey as a 500MW project in the Atacama – they are very different conditions. But this is where we need

### Niche solutions

Although the technology debate over the relative merits of single- versus dual-axis trackers has for now been overwhelmingly won by the single-axis variant, there are likely to be niche markets where similarly niche solutions are more appropriate than the products offered by mainstream suppliers.

France-based start-up HeliosLite has developed what it claims is a tracker solution that can fill such a gap. The company describes its tracker as '1.5-axis', and maintains that it offers most of the performance advantages of a dual-axis tracker, but at a much reduced cost owing to a simpler mechanism.

CEO and co-founder Jay Boardman explains that the HeliosLite tracker is "not a 'me-too' but a 'me-also' product". "We heard from developers that they have atypical projects – hillsides, snowy regions, weird forms, waste recovery sites, things like that – where, for whatever reasons, today's very good one-axis horizontal trackers don't fit the bill. So this isn't meant to be a gadget, it's bringing a new type of tracking to other types of markets."

Boardman says the sweet spot for the HeliosLite tracker is projects below 10MW, possibly in off-grid or isolated locations, where the performance advantages of a tracker are desired but may not be available. The technology is also well suited to more northerly or southerly latitudes, where dual-axis trackers are more effective than single but have so far proved too expensive to gain more than tentative foothold, Boardman adds.

The company has piloted the tracker in France and on a small project in Abu Dhabi, and is now seeking partners with which to roll the technology out commercially. South Africa, Morocco and India are among the target markets cited by Boardman.

"We can't compete with today's one-axis horizontal trackers, which are very good products for their markets, but there are so many other markets that would be very good for tracking, from rural electrification projects to industrial projects in northern and southern latitudes, where tracking makes a lot of sense but where solutions don't work because they're not designed for that kind of configuration," Boardman concludes.



**HeliosLite's 1.5-axis tracker is claimed to be suited to niche markets where mainstream trackers are less well adapted**

to arrive; we need to provide what our customers really want for the area and the conditions where he's having the system."

GTM's Moscowitz echoes this, emphasising that tracker companies should not let technological innovation become a distraction from getting the right fundamental building blocks in place to ensure long-term sustainability.

"Trackers are large capital intensive investments for long-term utility-scale

solar assets, so any type of feature really has to show some type of either performance benefit or materially lower upfront or lifetime tracker cost. Otherwise they're just gimmicks. The primary differentiator for a tracker company is going to be a competitive price, a superior track record and strong relationships with customers. The primary feature that buyers are looking for is just a very reliable product and a company they know will be there to service the product over its lifetime." ■