Bifacial, trackers and AI: Lessons from the real world



Technology | Bifaciality and trackers have become almost synonymous with modern plant design, but modelling gains in a real-world environment is notoriously difficult. Liam Stoker reports from a panel at the Solar Finance & Investment Europe conference which explored how new technologies are driving yield upside

The combination of bifacial panels with trackers has been perhaps the technological advancement of note in the solar sector for years, but there remains some uncertainty over its real-word efficacy. Producing substantial gains in the lab or in a test site with ideal conditions is one thing, but doing so consistently in the field is another task altogether.

A panel debate at the Solar Finance & Investment Europe conference, organised by PV Tech Power publisher Solar Media, brought together a host of experts in the field to shine a light on how these technologies are performing in tandem, and how accurate modelling continues to be a thorn in the side of asset developers.

Lightsource BP has been using bifacial panels since 2018 and to date has installed around 500MW of bifacial solar in what the company's technical director Chris Buckland describes as a "pretty wild ride". The gains Lightsource BP has recorded from bifacial sites vary from the 10% recorded on a fixed-tilt site in the UK which features a design specifically upscaled for bifaciality, to the ~5% recorded on a project in Spain which features trackers and surroundings conducive for a strong albedo affect.

Evidently, and entirely predictably, bifacial yields differ site by site, and need comprehensive modelling to determine the ideal system size, modules selected and combination of technologies. In some

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Bifacial panels attached to Nextracker's Gemini tracker product.

cases, particularly on sites closer to the equator where the module can track the sun almost perfectly, the yield gain from the rear side of the panel could be negligible. "The amount of sunlight you can get from the rear side of the panel versus the cost of adding an additional module actually brings that discussion right back to what's the main motivator," Buckland said of those circumstances.

But, as the industry is increasingly becoming accustomed to, modelling bifacial gains is far from precise, made all the more complicated by the rapidlymaturing technologies at hand. Bifacial panels are, simply, not what they used to be, Buckland said, pointing towards the fact that now the industry can expect half-cut large-area modules that have bifaciality as standard. And these modules are set to change again over the coming quarters as even larger products come off manufacturing lines in China and enter the industry. "There are lots of moving parts keeping people on their feet... keeping abreast of this has become a fulltime job in itself," Buckland said.

Not all modules are created equal

The job becomes all the harder when bifacial modules themselves are not all created equal. Jörg Althaus, global solar segment leader for solar at testing provider TÜV Rheinland, noted that while the level of bifaciality in modules can vary from between 60% - 90% in the lab, there can be differences of between 2 – 5% per module. The introduction of N-Type modules – the anticipated 'next step' along many product roadmaps – could see the advent of bifaciality beyond 90%, a further potential gamechanger for the asset class.

In real world performance, a 15% change in bifaciality may only provide an increase in yield of 2%, but in the world of sharpened pencils and strict performance targets, such a change can be critical.

Those sharpened pencils are placing more importance on further metrics. While the albedo of a site can contribute as much as 50% to the bifacial yield, panel conditions such as operational temperature can, in turn, affect performance and yield. Buckland said this has prompted further analysis of the materials used, with Lightsource BP having determined that glass-glass bifacial panels operate at a different temperature compared to glass-glass monofacial modules, a change that hasn't yet been noted in modelling software.

Industry-standard modelling and design software is, Buckland said, struggling to keep up. "It's a very, very difficult task, and a lot of processing power is needed... it's almost become a lookup table," he added, a nod towards the computer science method of retrieving a specific value from memory as opposed to running a more complex computation.

Whether its conditions underneath the panel, ambient temperatures, the electrical design of a system or, in truth, any one of a number of other contributing factors, there does not appear to be an easily replicable way of modelling bifacial gains. The technology almost juxtaposes itself against calls from within the industry for greater standardisation. "There's a lot of opportunity to optimise and take the upside of bifacial," Buckland said, adding: "but there's also some practical discussions needed and it's not necessarily going to be the benefit you had anticipated."

Even standardisation is posing something of an issue to bifaciality performance it would seem. Althaus said he had seen some sites using bifacial panels that had been disrupted by industry-standard, copy-and-paste O&M contracts. Given the detailed thinking that can go into deciding the substrate below the panel – Lightsource BP has a host of preferred grasses and vegetation which offer better albedo effects than others – a more bespoke O&M offering that takes into account that potential reflection is required.

This also extends to trackers, with difficulties arising from clearing the grass beneath what is essentially moving electrical infrastructure. Funnily enough the panel concluded that perhaps the most ideal solution to this problem is relatively simplistic compared to the tech involved; grazing sheep.

Site intelligence more artificial

Once the confines of science-fiction, artificial intelligence (AI) is now being adopted by industries en masse and solar is no different. As the panel discussed, AI has so far offered demonstrable value in predictive maintenance and weather forecasting. PV Hardware CTO Ivan Arkipoff said the use of AI for predictive maintenance had come into its own since string inverters began to eat into central's

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> market share. Given there now stood to be far more components on a single site than ever before, it was even more important to ensure a robust supply of replacement parts, and what better way for that to happen than to predict a part's failure before it has happened. "We're always talking about performance, but if the site is not available you will experience the greater loss," he said.

But weather forecasting is a new area for solar and AI. Buckland provided the example of an operational solar array Lightsource BP has in Texas, sited within an area frequented by strong winds and hail storms. As larger modules come on stream – those in excess of 2.4 metres in length – the effect of wind on structural stability and integrity grows significantly, and stands to become even more prominent as tracker layouts progress from 1P to 2P. Storms stand to be even more damaging than before.

Challenges presented by weather conditions – brought into new light following recent events in both Texas, where a severe winter storm nearly crashed the state's grid, and in Spain, which received record snowfall in January 2021 – pose numerous challenges to asset operators, ones which Al can pose solutions to.

Tracker control is imperative in such situations, especially when deciding what the best course of preventative action to take is. In a severe hail storm, for instance, do you face your modules into the wind to preserve or your system, but face more direct hail strikes, or tilt away from the hail to take your chances with high wind speeds and the potentially devastating stress around clamping points?

Al is helping to educate such decisions by linking tracker controls with weather services, using APIs from weather predictors with the aim of getting detailed, advance forecasts 30 minutes before conditions change. Lightsource BP is looking to pilot this approach in Texas before potentially retrofitting it on a global scale.

But there are still challenges to this. There is not a commercial off the shelf solution, with Buckland having noted Lightsource BP is doing much of this itself, which has repercussions further down the chain. "Al is here to help, it does unfortunately however push us towards customizable solutions, and the more we customize the more difficult it becomes to do O&M, and the more difficult it becomes to standardize that across the globe. It's great to see the progress being made on AI, but what I would say is if we can get these products and capabilities out into the market rather than people such as ourselves having to develop our own, I think that would be better for the industry," he said.

Solar Finance & Investment Europe 2021 was held between 3 – 4 Feb 2021. More details can be found at financeeurope.solarenergyevents.com