# A different direction

**System design |** As Europe and other hot PV markets transition to low- or no-subsidy environments, could a different direction help improve solar economics? Liam Stoker looks at why east-west orientated projects are increasing in popularity

Credit: Neoen

**Neoen's Cestas PV plant in Bordeaux, France, used an east-west design to cram 1MW of solar per 0.8 hectares of land**

The vast majority of utility-scale solar farms across the world have been built facing just one way – south in the northern hemisphere, and vice versa – but, in the pursuit of greater economics, is a different direction emerging?

One major project planned for the UK could be leading the way, breaking the mould of the country's usual solar design by going east-west.

Cleve Hill Solar Park, a significant development planned by a joint venture including Hive and Wirsol, is earmarked for more than 400 hectares of land based on England's south eastern coast in Kent. Having originally intended to develop the site for the country's Contracts for Difference support scheme, solar PV's continued exclusion from it has forced the developers to pursue its development without government support.

The location is beneficial given that one of the UK's numerous offshore windfarms connects to a 150/400kV National Grid substation located just a stone's throw from it. This will allow the site to connect to the country's less-congested transmission grid, rather than the local distribution grid.

But in the absence of subsidy, the site's development has taken on a more complex and thought provoking nature. Hugh Brennan, managing director at Hive Energy, explains that the duo examined two different schools of thought before going east-west.

"One is that you feature south-facing panels, and each panel is working as efficiently as it can. You have a lower output, but your costs are lower and ultimately that's what you're trying to do. You're trying to provide each kilowatt for the lowest price," he says.

The other, ultimately more beneficial path in this case, is one wherein size matters. And in a big way.

"The other school of thought is that the bigger the output the better. Your headline output is going to guide the value of what you're doing," Brennan adds.

This is where the east-west orientation comes into effect. It's something that has been applied to commercial rooftop PV systems for some time and whilst not exactly unique in ground-mounted solar, is coming to the fore, particularly in post- or low-subsidy environments by squeezing in as much capacity as possible.

Brennan explains that having looked at where panel prices and efficiencies were headed – including some estimations out to the expected build-time of 2020/21 – east-west orientation made sense for Cleve Hill. "We just realised how much more we could get on the site for an east-west layout," he says.

Simon Turner, technical director, power and renewables, at RINA Consulting, which has worked on the modelling of some east-west farms, explains that it boils down to a cost benefit analysis.

"[It's] mainly due to material costs, you can get more megawatts in the same area as you can with a south facing one and you only have to have one row of piles for two sets of modules, so there's a lot less piping involved and you can squeeze them in a bit tighter," Turner says.

How much more? A significant amount, it turns out.

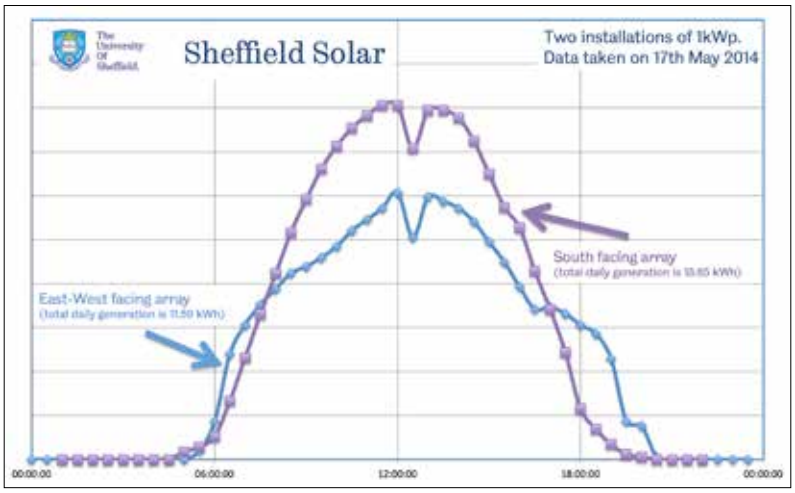
## Every last kilowatt

Brennan says the capacity that has been added to Cleve Hill by adopting east-west has been "pretty dramatic". In its first iterations the project was expected to come in at around 250MWp, however the site now expects to come in at closer to 350MW, and potentially even greater if panel efficiencies continue to climb.

In essence, by switching to east-west Hive and Wirsol have managed to squeeze in around one million panels in a 400-hectare piece of land. "It's a huge difference, and to a degree we still don't know [the final size]… We're looking at a million panels and if the estimates [for panel efficiency] are 480/500W then suddenly it makes a big difference," he says.

Other east-west projects in Europe have experienced similar leaps in capacity. The 300MW Cestas project in Bordeaux, developed by Neoen, is particularly high-density, using just 0.8 hectares of land per megawatt of solar as opposed to the usual two hectares per megawatt.

It is not for everyone, however. INRG, another solar developer in the UK with eyes on subsidy-free developments, is sticking with its south-facing guns. Ian Gannon, commercial director at INRG, said that his firm had been able to max out its grid connection capacity with south-facing




Credit: Sheffield Solar

**Sheffield Solar research into east-west orientation in 2014 showed the smoothed generation curve and impact on total output.**

panels, hinting towards the still problematic nature of grid connections in the UK. East-west orientations might help smooth out the generation curve but there is a slight trade off in total capacity.

Sheffield Solar, the research division of the UK's University of Sheffield, has been noting the performance of different panel orientations since 2014. Aside from the obvious shift of load towards a smoother curve, total generation has also been found to dip. Results from a Sheffield Solar test on a 1kWp system in 2014 showed total generation fell by around 15%.

While that might be more problematic for rooftop installations backed by subsidies, the loss in generation seen in ground-mounted projects could be offset by other effects of shifting that load. Jamie Taylor, a research associate at Sheffield Solar, said that the boosted generation in the morning and evening hours – peak, and therefore more expensive, times – would see more "useful" energy generated.

But production capacity is not the only thing that has or will contribute towards Cleve Hill's final design.

## Below biodiversity

What enables Cleve Hill to maximise its potential by going east-west is its topography. The land is essentially a large, flat, area described in the local council's own consultation as being largely barren. Brennan says this lends well to the east-west design and the only design impacts look likely to be access roads and overhead cables that run across the site, taking power from the on-site transformers.

In truth, it is something of a work in progress due to the UK's planning laws. As the project intends to be greater in capacity than 50MW, it must be signed off by the country's Planning Inspectorate as a nationally significant piece of infrastructure (PINS). This is a more complex and lengthy process than regular planning that comes with more scrutiny. Developers needing to go down this route end up jumping through more hoops than most.

One particular hoop thrown up by the developer's intent to go east-west is the potential impact of the design on the land underneath. By squeezing more rows of panels in, and the ground-covering apex that creates, there is scant evidence of what it will do to the ground due to the reduction in natural sunlight and rainwater. The land is still a habitat to an abundance of wildlife and Hive fully intends to have sheep graze around the panels once complete.

Hive has had to commission specialist university-backed studies into the impact to appease the planning bodies. "That's a body of work we're now commissioning because the other thing with PINS is you can't just say 'we think it'll be fine', somebody has to analyse light and water levels, the soil content and everything. Each part of the puzzle we have to get world class experts on it," Brennan explains. Wirsol, Hive's development partner, has previously developed a 30MW east-west site in the Netherlands (pictured below) and faced similar questions, findings from which are to feed into Hive's own research

Potential issues surrounding sub-panel biodiversity, or at least the lack of evidence in this field, is testament to the comparative lack of experience or expertise surrounding east-west installs in general. Taylor explains that this lack of evidence stems as far as the modelling software used by EPC firms around the world.

> "[East-west] is coming to the fore, particularly in post- or low-subsidy environments by squeezing in as much capacity as possible"

The very behaviour of east-west plants is more difficult to model, Taylor says, because of the way global horizontal irradiance figures usually supplied by meteorological stations is transposed onto the inclined plane of the modules. "When you do that for an east-west system, it's not particularly accurate because the bulk of the methodologies for conducting that transposition have been developed for south- or north-facing arrays. They tend to break down as you move towards east-west systems," Taylor says.

In truth, east-west is not a particularly new or innovative approach to solar deployment but it is one that's resonating in new markets. But far from being a cast-iron certainty it boils down to simple cost-benefit analyses to determine whether or not individual projects work. In that way they are almost emblematic of solar's growing maturity – it is no longer a question of where solar can work, but how it works best for that particular location. And it looks as if east-west will find resonance the world over. ■

Credit: Wirsol

**Findings from Wirsol's project in Groningen, the Netherlands are feeding into its JV with Hive in Kent, England**