

Project briefing

STORAGE THE GAME-CHANGER IN UK'S FIRST SUBSIDY-FREE UTILITY-SCALE SOLAR PLANT

Project name: Clay Hill Solar Farm
Location: Flitwick, Bedfordshire, England
Project capacity: 10MW
Storage capacity: 6MW/6MWh

“This is where the market will go, and we need to build the first one,” Steve Shine, chairman at UK renewables developer Anesco says, recanting a conversation he shared with the rest of his board. That direction was co-located solar and storage, designed to lighten the load renewables have had on the UK’s grid; that first one was Clay Hill Solar Farm, the UK’s first solar farm built entirely free of government support, which Anesco connected in the summer of 2017.

Anesco first conceptualised the site around 18 months previously, having planned a separate solar farm on land adjacent to the site which would come to be known as Clay Hill. Land owned by the same farmer – literally across a small access road – hosts a 5MW solar farm connected to the grid some months prior. That solar farm, the Hermitage Solar Farm, was completed under the Renewables Obligation (RO) scheme, the now-defunct UK support mechanism for ground-mount utility-scale solar farms. Hermitage was one of the last to be completed and receives just 1.2 RO certificates for each unit of electricity it produces, but that was enough to finance its development.

Clay Hill is not fortunate enough to receive such support, but does directly benefit from Hermitage being built. Clay Hill doesn’t share a grid connection – it has its own – but it has been connected to the same part of the grid as Hermitage, allowing it to share some of the associated works. This shaved a little off the cost of the overall development, only helping its cause.

Construction was relatively swift. Development of the site started roughly two months after the RO window slammed shut on 31 March 2017 and the park was formally completed in August. It was then unveiled to the public the following month at an event which was also attended by UK climate change minister Claire Perry. Having joked about the site justifying its Clay Hill

name – weather conditions in the UK had meant the ground more closely resembled a bog than a power station – Perry lauded Anesco’s feat and described it as a momentous achievement for UK solar.

What she also mentioned was something Shine had been quick to stress to her and something he is only too quick to reiterate: that the farm could not have been developed without a considerable amount of collaboration with Anesco’s supply-chain partners.

Supply-chain engineering

It was akin to locking Anesco’s suppliers in a room and not letting them out until they could get it done, said one person who worked on the project.

Shine paints it in a slightly lighter manner, describing how Anesco held a series of workshops with its suppliers as it looked to reduce the overall cost of the farm’s development. “We completely re-engineered how we built [solar farms] in the past and rethought how it needs to be done,” he says.

Anesco elected to source both the solar

modules and accompanying batteries from Chinese manufacturer BYD and, in doing so, secured a better deal than most. In the end more than 30,000 315W BYD modules have been used, with five, 1.2MW batteries also included in the order.

It approached UK-based Hill & Smith Solar for the mounting frames and managed to remove several tonnes worth of steel from what was required for the project by electing for bespoke frames that took several millimetres off standard design sizes. This, too, contributed towards the overall savings achieved during the design and development stage.

Inverters were supplied by Huawei, which provided its brand new 1,500VDC string inverters for their first deployment in Europe. Shine admits that, at 10MW, there was the temptation to use a central inverter system at Clay Hill but the firm persevered with its belief that string inverters are too beneficial to overlook. Each of the Huawei inverters includes maximum power point trackers and 12 directly connected string inputs to improve flexibility in the PV





By Liam Stoker

strings, helping to maximise energy yield. The inverters are also expected to fail far less frequently – a problem which has reared its head for some of the UK's existing solar assets due to the country's surprisingly humid summers – and achieving savings in the long run.

Lord Browne of Madingley, chairman of Huawei UK, said the firm was proud to have a role to play in the site's development. "Significant technological advances, underpinned by industry collaboration have helped deliver the first subsidy-free solar farm in the UK and Huawei's smart PV solution has played a critical role in the successful delivery of this initiative... This project is evidence of how solar is not only one of the most competitive renewables, but is now able to compete with all forms of generation," he said.

In total, Shine says that Anesco managed to shave more than a third (35%) off the total development cost of the site just through the supply-chain engineering the company is quick to laud. It's these innovations that it holds up as examples that other developers could embrace to drive costs down further, although not every UK-based developer will have the leverage to lean on names like BYD as Anesco has done.

With the supply chain engineered and cost savings achieved, Clay Hill was ready to generate power. But it's not just power that solar projects have to produce, particularly if they're to be investable. It's the returns – especially so in subsidy-free environments – that will make or break a project.

The revenue stack

Such was the desire to see the project over the line that Anesco financed the site via its balance sheet. Anesco has historically sold the assets it has developed not long after their completion, but Shine says that this may change with Clay Hill. It could be sold in the coming years, but not before Anesco has used the site to demonstrate that its model works.

The panels are expected to generate more than 9,000MWh per year but, despite beneficial prices secured by Anesco's exhaustive supply-chain efforts, the export of power would not be enough to finance



the site's development alone. It is for this reason that Clay Hill has been developed with 6MW of battery storage facilities on-site.

These batteries are pivotal to Clay Hill's economic viability. Not only can they be used to shift the sale of solar-generated power to peak times, achieving more lucrative prices on the UK spot market; they will also be utilised by Anesco to provide grid-balancing services to the UK's system operator National Grid.

The UK's transmission network is maintained at a frequency of 50Hz – the frequency at which power is transmitted most effectively – and kept to within 0.5Hz of it either side. National Grid has various tools at its disposal to keep it within those parameters and has been called upon to use these tools more frequently as greater levels of variable generation has come onto the

grid. Battery storage has come to the fore as a pivotal technology in National Grid's suite of grid balancing tools.

In 2016 it handed out four-year support contracts to 200MW worth of batteries under its Enhanced Frequency Response (EFR) programme. Those batteries must respond within one second's notice should National Grid command them to and receive fees for both standing idle and being used in action.

While EFR has now closed to new applicants, battery storage plants can be supported through both the Fast Frequency Response (FFR) market – which acts in a similar fashion to EFR – and the Capacity Market mechanism, used by National Grid to procure reserve capacity at times in the winter months when the capacity margin is at its tightest.

Clay Hill's batteries will be eligible to

A brief history of UK solar subsidies

While some ground-mount solar farms in the UK, particularly those developed as part of community benefit schemes, have been developed using feed-in tariffs (and an even smaller number supported by the competitive auction process dubbed Contracts for Difference) the significant majority have been supported through the Renewables Obligation scheme. This was established by the UK government to incentivise the development of all forms of renewables generation and it lit a fire under the UK solar industry. The scheme rewarded developments with RO certificates for each unit of electricity generated that could be sold, providing a predictable revenue stream. Each year on 31 March the scheme degressed, awarding fewer and fewer certificates for completed projects. The ROC windows of 2015 and 2016 were particularly successful, bringing forward around 4GW of solar alone, which caused the government to close the scheme prematurely in 2017.

bid for any future frequency response markets and, crucially, have been entered into pre-qualification for the forthcoming Capacity Market mechanism. One of the criteria to bid for Capacity Market contracts is that generator stations are deemed to be newly built (to incentivise the development of new assets, rather than continue to support ageing, legacy infrastructure), and it is for this reason that while the solar farm connected and began generation in early September, the batteries were not switched on at the same time.

In that sense, Clay Hill has been built unlike any other solar farm operational in the UK today, although Anesco is also at the forefront of retrofitting existing, ROC-accredited solar farms with battery storage. It has done this at more than 10 sites in the UK to date following close work with the country's energy regulator Ofgem, done so to ensure that there is no chance of the site being subsidised twice; once for when the power is generated to the battery and another time for when it is dispatched from the battery.

Clay Hill has sought to set a standard that not just Anesco, but other solar farm developers in the UK and beyond, can replicate.

A replicable model

Anesco has another four solar farms just like Clay Hill that are shovel-ready. These will feature solar alongside batteries, in keeping with Shine's vision that renewable generators must do more to be accommodated into the future power system.

But the UK's Department for Business, Energy and Industrial Strategy, which is responsible for energy policy, has thrown something of a spanner in the works. The Capacity Market mechanism that could provide a highly bankable 15-year service contract looks like being tinkered to more



appropriately recognise the way in which different battery technologies work.

Given that the Capacity Market is designed to procure reserve capacity in the wake of a period of strain, National Grid expects them to deliver for a period of up to four hours. Lithium-ion batteries are unable to deliver their rated capacity for that period and, as a result, BEIS looks set to 'de-rate' them – allow them to enter the market at a set percentage of their overall capacity – from this or the next Capacity Market auction.

Shine acknowledges that some de-rating for batteries is inevitable, but says now is not the time. "It's a negative move at this particular time... it's not the revenue that investors want, it's the ability to raise debt and 15-year contracts that are vital," he says. Anesco is now investigating the potential for flow batteries to be installed rather than lithium-ion as a workaround, but given the comparative costs of the two technologies this looks more like being a longer-term play than anything else.

Anesco has replied to the government's consultation on the subject pitching a phased approach to de-rating. The full de-rating would be introduced in parts over three or four years in a similar fashion to how the RO subsidy scheme was phased out. This would, Shine insists, stave off investors' fears that the market could change overnight.

Even better still, Shine says, would be a set of tariffs that National Grid would pay projects like Clay Hill for the flexibility or reserve capacity services they could provide. Long-term contracts would provide

investment certainty and there would be no subsidy involved, with renewables-plus-storage developments earning their crust.

It is perhaps a fanciful vision, but one that fits very much with the changing power landscape the UK is currently experiencing. Such a scheme would establish a place for solar in the UK power market, solve a critical requirement for the country's energy infrastructure and undoubtedly save millions in grid reinforcement works.

But until such a set of tariffs is introduced solar in the UK will have to find its own way. Clay Hill may have been the first subsidy-free project in the country but it will not be the last. PV Tech Power publisher Solar Media's in-house market research team is tracking a multi-gigawatt pipeline or projects that could be built as early as 2018, with international developers Hive Energy and Wirsol having unveiled plans for a 350MW project for the Kent coast in early November – by far the UK's largest solar project if realised.

Clay Hill will however be regarded as a landmark for UK solar, one realised through intensive supply-chain engineering and a flexible approach to its revenues. Shine says that despite operating sans subsidies, Clay Hill is poised to generate a better IRR than some ROC-accredited sites in the UK given what these are currently selling for on the secondary market. Anesco is keen to hold on to the sites for now but could look to sell in the long term. Investor appetite for sites like Clay Hill would be the surest sign yet that the UK solar market is back on track. ■