

# The growing pains of curtailling UK solar

**Grid** | Solar generators in the UK have been facing the prospect of having large volumes of capacity temporarily shut down due to grid capacity constraints. David Pratt reports on the efforts being made to minimise the impacts of curtailment



Credit: Wight Community Energy

This year has already proved to be a record breaking time for UK solar, with the spring sunshine of May delivering a generation peak of 8.7GW and meeting almost a quarter of demand for a half-hour period. However, the fact that the UK has become a c. 13GW market in less time than the transmission system operator National Grid predicted in 2012 it would take to reach 2.5GW throws up some issues, not least the suitability of our power system to deal with this change.

RegenSW, a not for profit organisation working to facilitate clean energy across all sectors, has noted an uptick in curtailment as a result of rising levels of renewables in the UK and the need to carry out upgrades. Project manager Olly Frankland explains:

"In terms of the number of outages they are probably going up. The planned ones are normally on behalf of connections

when there's a need for reinforcement in order to put more solar or more wind onto our networks. So we're a victim of our own success to a certain degree as the more renewables we need on, the more outages will be necessary to upgrade the network."

## The risk of summer switch-offs

The effect this can have was exemplified earlier this year on the Isle of Wight, a small island just four miles off England's south coast boasting 70MW of solar across 15 sites owned by some of the largest solar asset owners in the UK.

All were caught off guard in January this year when distribution network operator (DNO) Scottish and Southern Electricity Networks (SSEN) put out a notice of full curtailment for April. This was a result of National Grid conducting work on its super grid transformer serving the island.

**Wight Community Energy's 3.95MW scheme was fully curtailed in April, and had been under threat of a summer of switch-offs, as a result of upgrade works to the local grid**

As Nicola Waters, chair of the Solar Trade Association's strategic grid working group, explains: "Some outages are outside the DNOs control as they receive instructions from National Grid about curtailment that is required."

Generators like Wight Community Energy (WCE), a publicly funded energy scheme responsible for a 3.95MW solar farm, were notified just a few months before and had no choice but to face a switch-off in the absence of time to negotiate. This resulted in full curtailment of some generators on the island such as WCE, which saw the expected annual output of the community solar farm cut by 8.1% (410,577kWh), resulting in £46,521 of lost income.

A letter received by WCE chair Colin Palmer suggested worse was yet to come, with SSEN planning to schedule upgrade works to its 132kW overhead lines between July and October. Combined with additional plans by National Grid scheduled for August, the island's generators were faced with a daunting prospect.

"We would be fully constrained from July to October; that was the original position," Palmer said back in June. "This is an unprecedented level of outage beyond anything I've ever experienced in 25 years in renewables. The other generators who are equally affected are as surprised as we are."

The plans would have put over half of revenues at risk as a result of what was dubbed by WCE as "years of under-investment in island infrastructure". To make matters worse, SSEN were said to be "extremely difficult to engage effectively with" in the weeks following notification.

The issue was particularly acute for the Isle of Wight according to Waters, who said: "Curtailment for existing assets is a widespread issue but it's the concentration of curtailment that makes gives some asset



Efforts are underway to make better use of existing capacity of the UK's power network as more renewables come online

owners sleepless nights.”

The amount of solar generation in the small locale of the island in combination with infrastructure upgrades, the age of the network and the nature of the work needed all played a role in what would have seen 54% of revenues lost, and as Water added: “There is no official requirement for the DNOs to keep generators ‘on’ as much as possible.”

Faced with this possibility the generators – including the likes of Octopus, Bluefield, Low Carbon and Magnetar – banded together to confront the issue head-on and present a united front to SSEN in an attempt to limit the impact of the plans.

Following a few short weeks of intense negotiations, much of the curtailment is now being avoided with expected losses reduced to 15% after the group reached an agreement to be moved onto an inter-trip system, providing SSEN with greater transparency and visibility over the amount of capacity on the local grid. Instead of counteracting this by curtailing whole periods of expected instability, the inter-trip system allows SSEN to be more flexible.

Rob Rabinowitz, head of generation at Mongoose, which manages around 80MW of predominantly community schemes and worked on the negotiations on behalf of WCE, explains: “The problem they have there on the island is that they have parts of time where there appears to be quite a lot of capacity on the grid but at any point that could change very quickly and if they don’t have control over the inter-trip they may not be able to turn you off quickly enough. But the inter-trip gives them the transpar-

ency and visibility to be flexible with the levels of curtailment.”

The solar asset owners were also able to come to an arrangement with utility RWE to use the existing and underutilised grid capacity from the standby Cowes power station on the island. In the absence of curtailment avoidance, Waters explains that making commercial agreements with other asset owners to “flex capacity on the network” can prove to be a successful route for solar generators.

However, the key strategy to take away from the Isle of Wight case is that the reduc-

*“We’re a victim of our own success as the more renewables we need on, the more outages will be necessary to upgrade the network”*

tions in losses would likely have not been avoided were it not for the adoption of a consortium approach in negotiations, led by the smallest of its members.

“There were a couple of things in our favour, one was that we are a community group which I think made SSEN a bit more cautious about ignoring us because the story of [big energy] versus small social enterprise would not have played well,” Rabinowitz says.

“Other members of the consortium had engaged with SSE and hadn’t managed to get proper engagement from the DNO and I think that’s a lesson.”

Palmer adds: “After a lot of negotiation with SSE, I’m very pleased because I think we have a much better relationship with them. They’ve created a generators forum where all the generators who are or want to be on SSE’s network can get together and discuss issues with them. I see that as a direct result of what we’ve been doing.”

However the fact remains that while not as drastic as originally thought, losses of 15% are still an issue particularly in cases such as those on the Isle of Wight which have faced consecutive years of losses as grid upgrades look to catch up with the modern nature of networks.

### Making contact in the absence of alternatives

As this process continues, all while levels of intermittent generation from renewables increase, so too will curtailment and so the first thing that generators should look to do is follow the example set by the Isle of Wight consortium and engage with DNOs.

As mentioned by Palmer, SSEN has already implemented a generators’ forum to facilitate this process with the help of RegenSW, which is also working with another DNO, Western Power Distribution, on a similar initiative.

While seemingly obvious, forums do offer a solution to a simple yet significant hurdle – namely finding the right person to talk to at a DNO, as Rabinowitz explains: “There are the people you’ll be getting notifications from, if there is a curtailment there will be the people who are responsible for that particular project, there are those who are responsible for running the control room and then there are the people responsible for long-term strategy overall. You’ve got a complicated structure in a big organisation so the biggest challenge we had was finding the right person to speak to.”

Creating and maintaining an open dialogue through such forums is key to mitigating the impacts of planned curtailment periods in the absence of offline solutions. While it is conceivable that generators could use battery storage to store electricity at times of outages to the grid, such a process would face considerable barriers to success, not least due to the change needed in a network agreement to facilitate this solution.

“If you put a battery on you need new grid connection agreements and a lot of engineering due diligence to make sure everything is set up to fit with the DNO, which is going to look into the system

electronically to make sure it is set up safely," Rabinowitz says.

"I don't think DNOs at the moment could handle that kind of solution and I'm not sure the cost of the technology and the hassle would make it worthwhile. It feels like the kind of thing that could happen in the future; we just couldn't get it to work."

Frankland agrees, pointing out that the unpredictability of discharge from storage in comparison to solar could provide DNOs with challenges they often would not want to face.

"From a DNOs point of view they have to model the impact of any generation they have on their network. With solar it's easy as you've got the basic generation curve but with storage you don't really know when it's charging or discharging. It is likely DNOs will offer a choice of an unconstrained connection on which they will model the 'worst' case scenario for the network or a constrained connection which may reduce the amount of income streams available to the battery developer," he says.

### Taking the reins of active management

This is of course not to say that DNOs are doing nothing to address the issue; accounts from the Isle of Wight suggest that once engaged in negotiations SSEN worked hard to assist generators. Rabinowitz links this to the ongoing transition to a DSO, or distribution system operator, model which sees regional operators take a more active role in the management of their systems.

In an effort to take on this role and more accurately manage regional networks to use them to their full capacity before requiring upgrade works in service of customers, DNOs are adopting new 'flexible' network connections to allow more renewables to connect. At the time of a connection, new generators are being offered agreements that fall under 'active network management' (ANM) protocols whereby generators are offered faster and

cheaper connections if they are willing to accept a level of curtailment.

"This is good for both parties," says Nicola Waters. "DNOs are obliged to offer connections when they are requested so this gives them a way to deliver this obligation. It's good for asset owners as in theory it gives them a cheaper connection."

However, there is little way of knowing what level of curtailment this could lead to. One DNO routinely offering these flexible distributed generation (FDG) agreements is UK Power Networks (UKPN) after carrying out a trial in 2014 known as a Flexible Plug and Play.

Steve Halsey, UKPN's distributed generation development manager, explains: "When we receive an application for a FDG connection we show the customer what sort of curtailment a contract would include, giving them the opportunity to make an informed decision early on."

This prediction is based on "complex algorithms calculated on an annual basis", with Halsey adding that some UKPN customers have reported that actual curtailment is lower than the level initially anticipated.

As of July, 37% of FDG connected under ANM (111MW) is said to be connected to UKPN infrastructure, second only to SP Energy Networks with 40% (119MW). This has saved UKPN customers more than £70 million in spending to upgrade the network, as well as losses that would have been accrued from this work taking place.

In return, Halsey says customers have benefitted from both the speed of delivery – an important feature for UK solar in recent years with the diminishing windows for lucrative access to feed-in tariffs and Renewable Obligation certificates – and cheaper connections.

"As demand for electricity increases with the electrification of heating and transport for example, managed connections (whether by use of ANM or timed connections) are likely to be more widely used. Managing supply and demand and

the flow of electricity on our networks will become more and more important as we transition from a DNO to become a DSO," he adds.

The work is also not limited to DNOs, with National Grid increasingly getting involved – not least with UKPN. The two network operators are in the midst of the Kent Active System Management trial, which runs until December 2017. This aims to improve the service to existing generators by making better use of capacity on the network.

Enhanced monitoring is deployed on customer sites to enable full visibility of their status and output in real time, which it shares with National Grid's control room through an 'inter-control centre protocol' (ICCP) to improve operation of the transmission and distribution network and avoid curtailment of renewables.

### Incentivising curtailment

UKPN and National Grid are also developing a constraint management market that new generators can bid for in their willingness to be curtailed, which will later be offered to existing generators. If the customers are called on they will be compensated, potentially creating a market for curtailment and offering generators a form of compensation currently lacking from the market.

Efforts like these are being made across the UK, whether it's from the development of local tenders to offer incentives to decrease output, to projects like SSEN's NINES initiative in Shetland. This has combined domestic demand-side management (DSM) with a 1MW battery at Shetland's main power supply, Lerwick Power Station, and new monitoring and control systems to form an advanced ANM system.

This was then used to manage five renewable energy schemes connected to the distribution electricity network and according to SSEN allowed more than 8.5MW of new renewable energy to be connected on Shetland.

As the DSO transition continues and solar makes its inevitable march to widespread grid parity in the UK, curtailment may be growing but for the UK this may not be as serious a prospect as it once was. Developing technologies, markets and incentives are set to offer new abilities to turn down generation, leaving asset owners a new economic chance to find alternative uses for their clean energy resources.

