

The right time for repowering?

Repowering | As operational solar assets mature, news of repowering projects is steadily ramping up. Alice Grundy takes a look at what's influencing decisions and just when the right time to repower is.

Repowering is perhaps more frequently associated with wind power than solar PV, with there being many wind assets across the globe that have, to put it casually, been there, done that and got the t-shirt. But for many solar PV assets, what was once a far-off, distant prospect is now rapidly approaching and bringing with it a whole new set of financial and technical considerations.

Of course, there are various markets around the world where solar PV repowering is – if not necessarily common – certainly gathering pace. The likes of Germany and Italy, where the solar market is more mature, have already seen PV repowering to a certain or lesser extent.

The UK hadn't been expected to begin its repowering journey for several years to come, with its PV market a little younger than its European counterparts. However, the first smattering of solar plants are now beginning to repower, with BayWa r.e. recently undertaking the repowering of operational projects for UK solar and battery storage investor Gresham House. So the question then becomes, what's driving those decisions – both in the UK and further afield – and for those hanging back, just when is the right time?

The driving forces behind repowering

The first question that needs to be answered – and perhaps the simplest – is what's the point? While there are some fairly obvious benefits to repowering, some certainly take a little more digging into to get to grips with. But a full understanding of these benefits is key to being able to determine whether they outweigh the financial commitment inevitably involved in a repowering.

Chief in the list is improved revenue. Typically, an asset is repowered either when it is naturally nearing the end of its life or is experiencing a significant amount of down time due equipment that is faulty,

degraded or both. As such, repowering allows an asset owner to continue to earn revenue without the need to develop a new asset from scratch by enabling an existing asset to continue generating beyond its expected typical lifespan. It also reduces outages by replacing old equipment with new, more efficient kit.

"Repowering represents a clear opportunity for owners to modernise their portfolios with the newest technology available, to better integrate the variable solar resource into the electricity grids for example, through the installation of the newest inverters compliant with the latest development in the national grid codes, to harness higher percentages of the solar energy and ultimately achieving a significant economic benefit," Simone Mandica, team lead at UK-based asset manager WiseEnergy says.

The life expectancy of an asset is an important factor in repowering, with improvements to modules extending their operational lifespan to between 30-35 years.

"From a financial perspective the possibility that the plant will be operational for [an] additional 30-35 years, instead of the remaining 15-20 years, will make the revamping investment more attractive, i.e. higher IRR and higher NPV," Mandica says.

Indeed, usually the only complication to extending the plant life is the lease agreement, if there is one in place, which provides a precise date for the decommissioning of the existing plant and therefore needs renegotiating. Based on Mandica's experience, in the PV market there has been a rise in interest in the fiscal and economic benefits of longer plant lifecycles, and in turn the negotiations for extending the lease have become increasingly common.

Other reasons for repowering include sites using obsolete equipment, for instance if a manufacturer no longer exists. While this doesn't make repowering neces-

sary, a manufacturer being out of business means it takes a lot longer for faulty equipment to either be repaired or replaced due to there being limited availability, meaning the PV plant is shut down for a lot longer.

"It becomes a lot more attractive at that point for our clients to consider repowering options; changing out the old equipment for new equipment which is much more efficient," Natasha Kumar, managing director of BayWa r.e. Operation Services in the UK, says.

This also leads to better accessibility, with some new inverters for example having apps that give greater levels of understanding of how the inverters and the site is performing. This is compared to some older equipment, where you'd have to take much more of the site apart to do root cause analysis of any potential issues that are underlying, Kumar says.

Manufacturers going out of business is an issue run into by Enerparc. Inverter suppliers chosen for some of its projects are no longer in business so, in order to increase its stock, it changed out existing inverters before refurbishing, cleaning



and maintaining the legacy inverters and putting them back into its stock circulation, keeping the asset manager's technical availability high in the process.

Other benefits of repowering include being able to shrink the physical footprint while retaining the same capacity. Massimiliano Tarantino, head of wind and solar repowering and refurbishment at Enel Green Power, gives the example of an old wind farm with 30 wind turbines, each of them of 1MW rated capacity. By replacing legacy turbines with the latest technology available on the market today, an asset owner could maintain the same nameplate installed capacity using just five brand new turbines, all the while doubling power production in the process.

This is true of solar PV, too. PV modules are now hitting the market with outputs of 650Wp and greater, boasting at least three times as much power output as the corresponding technology of eight years ago. This means that less than a third of the area is now needed for the same nameplate capacity using these modules, which can free up space to build a new, potentially subsidy-free section of the plant.

This potential for expanding the capacity of a plant without expanding its footprint is becoming one of the key drivers in designing repowering strategies, according to Mandica, who adds that requests to assess constraints related to permitting or power export limitations, which could prevent the construction of a new section of the plant, are being made with increased frequency by owners.

New investment for an old project

On the surface, it seems like repowering should be a no brainer. Increased efficiencies and improved revenue are phrases any investor or asset owner loves to hear.

But while technology evolution is dramatically changing the renewable industry, Tarantino says the decision to repower an asset should instead be driven by the economic comparison between two possible options: maintenance coupled with lifetime extension and full repowering. These decisions are project specific and not directly driven by the latest available technology, but on the economic impact that such technology can have on a project's return.

Indeed, Kumar says it depends on how the site is performing, but the costs of repowering definitely play into the decision making due to there being more power density in some of the new modules.

"You've got more power in a smaller structure, and this ultimately increases capacity without having to increase the footprint. The modules are much more powerful and much more efficient, and that is much more appealing if you're looking at sites that have issues with some of the kit and the modules in particular."

This is true of some PV modules, but the solar market is also making a steady shift towards the production of large-format modules boasting higher rated power, while the production of smaller panels is decreasing correspondingly. That shift towards M10 (182mm) and M12 (210mm) size wafers, at the expense of M6 wafers (158.75mm) and smaller, is changing the shape of solar's manufacturing sector for good and, with it,

repowering prospects too.

"This certainly represents a complication for the implementation of repowering plans involving the replacement of the old modules only. Indeed, the retrofit of modern larger panels on old plants poses a challenge in terms of their suitability for the existing infrastructure," Mandica says.

From a mechanical perspective, these modules are not compatible with the existing supporting structures produced for the old, smaller sized panels. Typically, old panels are 1m wide and 1.7m long, while modern panels exceeding 500Wp can be wider than 1.1m and longer than 2.2m, meaning the existing supporting structures will more often than not need a complete replacement, adding additional complexity and costs to repowering.

This then means that the older panels of smaller size and with a capacity no higher than 400 - 450Wp are often the best solution to avoid a complete rebuilding of the plants, Mandica says, which may not be economically feasible.

The financial element is an important driving force behind decisions to repower. Kumar explains that BayWa r.e.'s clients will only be looking to sign off on a repowering investment if the numbers stack up, "because it is a significant investment". The investment has already been made to build the asset, and the additional investment required for repowering might be one that hasn't been forecasted for and as such will require approval.

The Hill Farm PV site located in Bicester, Oxfordshire, UK, managed by WiseEnergy.



Recycling and reusing

Thought must also be given to what happens to the removed equipment when repowering. Typically, old panels will be recycled by companies providing waste management services. The panels will be delivered to a waste management facility, where they are disassembled to separate any recyclable component, for example the glass, the aluminium frame and the connection cables.

This is also true of inverters, although it is also common that spare components are taken from replaced inverters and then used on other compatible inverters. Mandica says the remarketing of old modules is an economic opportunity that brokers in the solar sector have started exploiting.

"Used panels even of nine or ten years of age, still operating at the expected level of efficiency and with no visual defects, have a market in the developing countries in the Middle East or in Africa."

The winds of change

Repowering of solar is very much still novel in many markets, but for wind it is road well-trodden. As such, repowering is not a journey that the solar PV market has to go on alone, with the wind market able to offer up some advice based on its own experience. Indeed, individual companies operating in both the solar and wind space may even have an advantage, being able to draw on the experiences of their own colleagues. This is certainly true of UK solar investor Bluefield Solar Income Fund. James Armstrong, managing partner of the fund's internal asset manager Bluefield Partners, describes the company's experience in repowering of wind outside of the UK as a "big differentiator for us", indicating that when solar repowering opportunities present themselves, Bluefield will be in a "very good place to do it".

The key piece of advice Vattenfall's acting head of development, onshore wind Sweden, Daniel Gustafsson, gives for the solar PV industry is: "It's primarily about building on existing relationships and trust that you have. It's about making sure that you nurture your local stakeholders."

For wind, it's very similar to developing a wind farm from scratch, with a need for a new permit, new land leases and new connections, although with repowering the long-term relationships with all the stakeholders have already been built up. "It's usually a smoother process when it comes to permitting," he says.

Enel's Tarantino suggests there are a number of lessons learned on repowering across the renewables sector that can be applied to the PV industry. Firstly, the decision should be taken on a case-by-case basis. Secondly, it is "always important" to compare between alternative investment scenarios, Tarantino, says, particularly between lifetime extension and repowering a PV plant. Lastly, the impact that repowering could have on power purchase agreements (PPA), shareholder's agreements and interconnection agreements shouldn't be underestimated. When it comes to offtake, repowering projects may have an impact on electricity price, on electricity generation volumes and on generation profile. Therefore, if the PPA provides for a renegotiation of the electricity price in case of changes in the generation volumes or profile, this has to be considered in the repowering business case. As such, an evaluation on whether it's worth amending the existing PPA, selling the extra electricity generation on a merchant basis or going for another PPA should be carried out.

"Additionally, as the PV industry matures and more components are decommissioned through repowering, industry leaders should prioritise circular solutions in managing their inventory," Tarantino says.

The UK playing catch-up

Understanding of why repowering is beneficial is not as common in the UK as other markets, according to Stefan Müller, COO of Enerparc. "You really have to take a lot of effort to explain to the asset manager of the investor in the UK why you're doing this, and then generally they don't want to touch it. They don't want to change a running system, even if they see a direct benefit of it," he says.

For Bluefield, repowering is something not yet on the cards, with its assets only being around 5-7 years old. As such, it's not a priority, although James Armstrong, managing partner of Bluefield Partners, said it is an "interesting idea" and something the team is looking at.

Indeed, repowering is more common in continental Europe, at least partly due to the assets being older, although other factors are also at play.

Müller explains that in Germany, while there is a secondary market, there aren't as many investment funds who cycle projects compared to the UK, where buying portfolios of assets and then resell-

ing them is more common. In Germany the focus is on long term asset ownership, making repowering a more desirable undertaking. In addition, the banks in Germany have their technical auditors in house, making it easier to communicate.

"In Germany, all of our projects are non-recourse financed, and the banks have their own technical understanding, and this makes things very easy," Müller says.

Mandica says Italy is also a particularly attractive market for repowering, due to the high feed-in tariff from which old plants benefit and the current relatively low cost of the PV equipment. In the last year and a half, WiseEnergy has advised its clients on the revamping of approximately 135MWp of plants and has directly managed the optimisation works on 40MWp. The investments it has recommended to its clients has achieved IRRs of over 11-12%, with this confirmed by its monitoring of performance.

However, repowering is also picking up pace in the UK. WiseEnergy has been working on the replacement of inverters for a portfolio of 10 plants totalling 67MWp. Repowering is being undertaken for this portfolio due to the rate of faults of the inverters having increased significantly in the last two years. Alongside this, repair of the inverters is "particularly problematic" as the manufacturer left the market a few years ago.

Indeed, while repowering in the UK is starting to kick off, Armstrong says a significant portion of PV in the country is under 10 years old, and as such would be expected to perform for the next 15-20 years without too much of a problem, meaning repowering is perhaps not on the cards for the vast majority of UK solar just yet.

Overall, it's clear that the decision to repower must be made on a case-by-case basis, with both benefits – better revenues, the potential to increase capacity and reduce reliance on outdated or obsolete equipment – and potential drawbacks, which are largely financial. It is a decision that shouldn't be taken lightly, however that's not to say it's not worth pursuing if both the technical and financial considerations stack up. While certainly not par for the course yet, the repowering being undertaken in markets such as Germany and Italy shows it is both possible and beneficial. And as assets continue to age, and modules and inverters continue to improve, making the prospect of repowering more attractive, the potential for repowering is likely to only grow. ■