Data cleaning – How a growing, ageing solar fleet is changing O&M

Credit: Ecoppia.

O&M | As solar continues to proliferate and the very first large-scale arrays exceed 10 years of operational life, the value of operations and maintenance services is forecast to skyrocket. But as Edith Hancock writes, industry pressures such as new technologies and consolidation, are reshaping the industry.

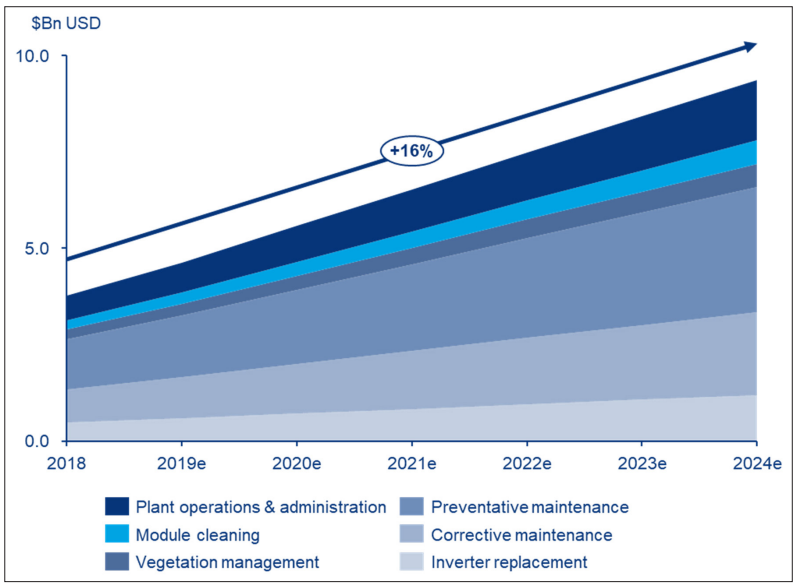
Renewable energy prices have plunged to record lows over the past year, and while that is good news for the end consumer and multinational developers who can benefit from economies of scale, it has left asset owners with far less room for error on their balance sheets.

Operations and maintenance (O&M) has become a hugely competitive part of the wider solar market as a result. While some companies see rich prospects for O&M as the global solar fleet ages, a report from research firm Wood Mackenzie published in June 2020 suggests that this itself will present numerous challenges to O&M, and will be further compounded by project auctions placing increased pressure on costs as developers look to save on project OpEx.

The research group forecasts that assets running into premature failures will rise from ~4.2GWdc this year to 36GWdc by 2025 as more solar plants pass 10 years of operational life. Solar power systems nearing inverter end of life, meanwhile, currently account for 5% of the global PV market, according to the report, but this number could grow to 16% - or 227GWdc of solar power generation globally within the next five years.

Still, there is plenty of optimism around the O&M sector's growth as governments worldwide commit to more renewables installations to meet net zero targets in the first half of the 21st century. Wood Mackenzie's June 2020 report predicted that the O&M market could be worth US$9.4 billion by 2025. Although the Asia Pacific market is expected to hold the bulk of this value at US$4.1 billion, Europe is expected to be an "especially important" area for inverter repowering, with more than 16GWdc of systems currently over ten years old, Daniel Liu, Wood Mackenzie's principal analyst, says. By 2025, he says, that number will grow to 100GWdc.

Liu believes that aging solar systems are an "opportunity for repowering activities, while new projects can take advantage of advanced analytics." But with pressure on margins from more solar coming on to the grid and lower auction prices, O&M providers need to come up with smart, low-risk solutions in a tight budget.



Credit: WoodMackenzie.

The solar O&M market is expected to be worth up to US$9.4 billion by 2025.

Ecoppia's automated panel cleaning robots whilst docked.

Robots and drones

The COVID-19 pandemic and subsequent restrictions on movement shook the O&M sector, which relies heavily on cohesion in the supply chain and the transportation of new equipment from the manufacturer to the asset owner. They must also think more frugally about the time staff spent on site, with crews working in fewer numbers, or even refraining from sending any unless absolutely necessary. O&M providers have been working with new automation

tools to bring more value to their clients long before 2020, but the pandemic has brought its value into sharp focus. Finally, finer margins in the sector as a result of lowering tariff rates at auctions and cheaper energy prices has highlighted the disadvantage of carrying out work manually. A recent survey by Wood Mackenzie found that reducing costs in the business operation was one of the key motivations for solar asset managers to automate their O&M services.

As such, companies that were able to capitalise on the emergence of robot cleaning technologies early made huge gains in their respective markets. Clean Solar Solutions, based in the UK, was borne from founder Steve Williams' window cleaning service in 2013, after one client asked if he could also take care of their rooftop panels. Within three months, he secured a national contract with British Gas Solar and went on to publish a health and safety manual for panel cleaning as there was "no information" available at the time. The company purchased its first robotic cleaning device in 2017, and now oversees the cleaning of between 1.8 and 1.9 million panels globally, with offices in Ireland and Australia.

Williams tells *PV Tech Power* that introducing robots and reducing on-site staff levels was central to sustaining the business as the national, and global, solar fleet expanded since 2013. Now, Clean Solar Solutions is looking for ways to refine their offering.

But, he says, robot development is really still "first generation" and can be unreliable. "They're not overly user friendly, have sharp edges, and are heavy and cumbersome, so the robots themselves will be developed massively over the next years. Hundreds of patents are pending for solar panel robots all over the world." One development Williams has his eyes on are those with "bigger and wider brushes, so we can increase our cleaning capacity with one pass," but speed and data acquisition are also important, especially in the field of fault detection.

"Thermal imaging can be integrated into the robots as well and pick up some faults for clients. There should be a way of fitting barcode scanners onto the panels as well, so that you can scan each as you clean, and that information could be collated on the robot. At the end of the job it would spin you out an excel file which would highlight where each panel is sat and when there is a weakness in that area they know which ones are playing up. You would be able to spot trends across the plant as you go along."

Aerial monitoring of solar power systems has proved popular in this space as drone technology has become more sophisticated. Aline Kirsten Vidal de Oliveira and Ricardo Rüther, researchers at the Federal University of Santa Caterina, and Mohammadreza Aghae of the Fraunhofer Institute for Solar Energy systems, published a report in June 2020 exploring the efficacy of aerial inspections of solar sites using mechanisms such as drones. The widespread adoption of such devices, they said, had increased the availability of controlling and route planning software, which has in turn added to the automation of aerial inspection.

One independent power producer harnessing this new technology is Enerparc, which partnered with data and analytics company Sitemark to use its "Fuse" platform and drone technology to carry out site inspections. The company said last July it would fly drones fitted with high-resolution visual cameras and thermographic sensors over more than 1GW of its own solar assets worldwide.

The data collected from such sensors is invaluable in making O&M as efficient as possible.

Solar's new data era

Although it accounts for nearly 15% of O&M costs, Wood Mackenzie's report points out that fewer than 1% of solar systems experience premature inverter failures, representing a generous margin for providers who can harness data well. The report believes the rate of failure will only grow as the market matures.

> "Once you've mapped out every single component and you see how they all hang together you can then play with component level maintenance, and condition-based maintenance."

O&M has broadened to mean far more than cleaning and vegetation management, although there is some dispute over where to draw the line on its definition. Declan O'Halloran, the managing director of asset management group Quintas Energy, says his company "never gets involved" with O&M, but does instead provide a layer of management that helps people measure the performance of their assets and contractors on any given solar plant. "We never send anybody to site to fix anything," he says, "but we do send people for site inspections, for modelling and drone inspection." It's a service that O&M providers are increasingly certain need to be a part of their playbook.

Israeli robotic solar panel cleaning business Ecoppia launched an initial public offering (IPO) after securing more than US$82.5 million through a public tender phase at the end of 2020, with investors valuing the company at US$300 million. This is on top of a US$40 million investment from US investor CIM Group, which acquired US$40 million of shares in Ecoppia, and with US$20 million of investment ploughed directly into the company. Now listed on the Tel Aviv Stock Exchange, chief executive Jean Scemama, says the company is readying itself for expansion into new markets, and developing a more intelligent form of data collection that would turn its cleaning robots into module performance analysts.

The robots Ecoppia use already collect a small amount of data on the more than 16GW of energy generation plants in its client portfolio, and they are all managed by a cloud-based solar panel cleaning solution, something Scemama believes gives the company a competitive advantage for this specific ambition. "The system is already quite smart," he says, but there is more value to be found in creating a system that makes a judgement call on the data it gathers.

"Adding on analysing the data we already gather from the system and providing alerts and insight for the site owners is the next stage. The more data we're going to have, the more precise the prediction will be. We therefore plan on adding multiple additional sensors on the site, including drones. Eventually our aim is to recommend to the site owner: 'in this block and in this row, in this panel, you have an issue. Our recommendation is to replace it and this is your ROI'. That's a significant value we plan on bringing to our customers."

Established asset managers are using the information they have to hand to create their own smart solutions and predictive maintenance systems. Quintas Energy has started using a system called Parklife, which gathers all available information about a solar power system to

module-level to create a digital twin, which can then be used to predict when specific components are due to be replaced. O'Halloran says the company is "obnoxious" in its conviction over their necessity to a plant's performance.

"Once you've mapped out every single component and you see how they all hang together you can then play with component level maintenance, and condition-based maintenance," he says. "That's when you're able to tell the operator on-site the condition of every component for the next period of time, say three, six or eight weeks."

As crucial as collecting data is to broadening the services an O&M provider can offer, there is still a significant skill gap that needs to be closed in order to turn that into reliably actionable insights.

Changing relationship between asset owners and contractors

In a bid to take greater control of the solar projects they manage, some asset owners have decided to invest in building their own teams rather than outsourcing to contractors, whose software Obton's technical director Robin Hirschl says often "does not deliver" what it promises. The company is to double the size of its technical team this year in a bid to streamline the maintenance of its own solar portfolio.

Obton, which manages some 800 PV projects globally with an overall capacity of 982MWp, is among Europe's largest solar asset owners. Hirschl, who had previously spent the last decade running his own O&M and facility management company, joined Obton as the company's technical director in 2019, overseeing a team of 15 people. The company has decided to bring more technical expertise in-house as profit margins are increasingly squeezed by falling feed-in tariff rates.

"Back in the days when we had feed-in tariffs of €30-€40 it was a lot easier to pay money to O&M providers", he says, but warns that as more, cheaper clean energy comes onto the grid, "asset owners need to think very carefully about what is really required. How do we control what our contractors are really doing? How do we organise the interface to our lenders, which is also something that has been completely neglected in recent years and why we as an owner need to ramp up our team."

While Obton still uses local contractors for preventative maintenance and day-to-day asset management, the newly-bolstered team will work to consolidate the data from developers on its 800 plants into one system which will provide a more automated approach to maximising the portfolio's effectiveness. Hirschl says ideal candidates will be working in "one-person teams" to coordinate directly with technical suppliers, and the company is looking for engineers with a background in EPC, technical service or at a technical asset management company.

Hirschl is recruiting more people into his team over the course of this year with a view to building their own overarching intelligent system that "helps us identify which systems are running well and which are not…is this due to causes we can't influence like grid issues or due to non-performing local contractors? That's one of our main concerns at the moment."

Meanwhile, Germany-headquartered Enerparc has already been on a recruitment drive to bolster its technical team over the past 18 months. Chief operating officer Stefan Müller says the challenge is to find data analysts "with an engineering mind" in order to ensure the information they can gather on their systems can be applied to optimise a plant's efficiency. In addition to incorporating drone technology into its asset management, Sitemark is also collaborating with Enerparc to build up its in-house capabilities in order to perform its own drone inspections over the years to come.

A consolidating but critical market

As the sector has become increasingly competitive, some big players in the industry have decided to sell off their O&M arms, while others buy up their teams and capabilities to create ventures of their own.

US residential solar software company Omnidian also acquired its O&M business partner PV Pros in March 2020, and went on to raise US$15 million series A funding to expand its monitoring business nationwide. Canadian private equity group Clairvest created NovaSource last year, snapping up two separate O&M businesses to do so. Having acquired SunPower's O&M business in May, the group then bought the maintenance arm of US module manufacturer First Solar in August, which had seen the division's margins contract over the past year.

Speaking to analysts after the results disclosure, chief executive Mark Widmar said in order "to justify incremental capital investment in O&M, the financial returns would need to exceed those available from further investment in our module business." NovaSource's acquisition offer was "compelling", he said.

At the start of 2021 Texas-based energy firm Consolidated Asset Management Services (CAMS) acquired developer Belectric's US solar operations and maintenance (O&M) business, after Belectric had managed to meet its target of managing 3GW of capacity for its clients and was ranked in the top five O&M service providers in the market globally by BloombergNEF. Explaining the decision to acquire the solar group's O&M business, CAMS COO Greg Bobrow said that CAMS' clients are "increasingly focused on the transition of energy generation towards renewable sources."

"CAMS always looks for ways to support an improved environment while at the same time providing cost savings and creating value for our customers. We at CAMS look forward to a growing marketing presence in the solar energy space."

Smaller businesses with a legacy of O&M provision have taken note. Clean Solar Solutions' Williams says he is "having conversations" about a potential acquisition from a larger player, but couldn't say more. The chief executive of robotic cleaning specialist Ecoppia also says he is "not ruling out" acquiring a company with expertise in AI software as it aims to dominate the global market.

Although falling energy prices and the gradual reduction of government subsidies has placed increased pressure on asset managers' margins, O'Halloran argues it also ensures the need for strong O&M providers. Businesses that can keep up will reap the benefits of Wood Mackenzie's projected US$9.4 billion value. "The most valuable thing we can do, especially in the Spanish market where solar farms are already viable, is to help owners use data and control rooms for real-time control to take on merchant risk," he says.

The managing director firmly believes that capacity will outstrip the ability of the PPA market to buy all subsidy-free energy well into the future, forcing rates down. "When that happens, the demand for control rooms for daily and hourly monitoring measurement verification and the provision of that data to the trading team whose job it is to find in the merchant market will create not just an additional demand for data, but additional liabilities for data providers who get it wrong. That's when everybody starts taking their job very seriously!" ■