
MAKING
SOLAR
SHINE

Christian Hürlimann, MET Group, Switzerland, identifies the technological advancements in the solar industry which companies need to embrace in order to optimise their photovoltaic portfolio.

The relentless advance of technology presents countless opportunities for businesses to optimise efficiency and operations. At the same time, ongoing technological developments force companies to try and identify future scenarios and possibilities to make their business as future-proof as possible. MET Group pursues a strategy of incorporating the latest commercially-viable technological solutions in the development and operation of its renewables portfolio.

Long gone are the days when artificial intelligence (AI) and machine learning were a favourite of sci-fi scriptwriters in Hollywood. The business community is relying increasingly on AI-driven solutions not only to get a tech edge, but also to stay in the game. The energy industry and renewables are no exception to the rule. The sector is embracing digitalisation and technological developments to spur the energy transition.

Lowest levelized cost of energy

MET Group, an integrated energy company headquartered in Switzerland, seeks to establish a pure-play renewables portfolio in Europe diversified along all key dimensions: technology, geography, revenue model, size, and lifecycle stage. With a strategic aim of reaching a capacity of 2 GW in renewable capacity by 2026, MET leverages the latest technological solutions along the entire value chain of renewables projects (development, construction, operation and maintenance, and asset management) with a special focus on photovoltaics (PV). At its core, successfully developing and operating a power plant hinges on presenting a viable business case to investors while reaching the lowest levelized cost of energy (LCOE). The goal is to attain the lowest generation cost for injecting power into the grid, utilising the available technology in the market.

The renewable sector abounds in digitised solutions and products designed to aid companies in developing PV projects. From cloud-based software that finds suitable surfaces for solar parks by analysing a range of factors, such as the distance to the grid or substations, topography, soil depth, and solar radiation, to ultra-efficient solar cells, solar panel integration in roof tiles, facade elements, and transparent glass windows, or solar panels that collect energy at night through thermoelectric generation, the advance in solar energy development seems unstoppable. High-powered panels and new plant designs are contributing to drastically increasing capacity at PV projects as the evolution of solar modules leads to higher outputs.

To keep pace with the drive within the renewables sector of boosting project yields wherever possible based

on topographical and cost-efficiency considerations, the company has opted to install single-axis solar trackers that follow the sun's position by adjusting the position of the panels on the axis. In addition, bifacial solar modules are applied to benefit from the reflected surface solar radiation, known also as albedo effect, using the solar panel's backside, and increasing the yield even more.

Agrivoltaics have their moment in the sun

Thanks to technological development, agriculture and solar projects are no longer mutually exclusive. Scientific research published by Germany's Fraunhofer Institute for Solar Energy Systems proves that combining solar generation with agricultural activity is now not only viable at lower costs, but it significantly raises land use efficiency and may be particularly suitable for arid regions. While higher sunlight radiation leads to an increase in solar power production, solar irradiation under the PV panels can be significantly lower, thus certain cultivation can benefit from greater yields due to reduced dryness and reduced solar irradiation in case of shade-loving cultures and contributing to an uptick in land use efficiency.

Combining agriculture and solar energy production is the natural next step for the industry. In addition to allowing and aiding agriculture production, this technology can also protect the water supply and guard arable areas from wind erosion with solar fences. Several countries have recognised the added benefits of agrivoltaics and some national regulators have even made the model compulsory. By making the land dual-purpose, developers can also secure land for such projects more easily, removing considerable barriers to their expansion. In addition, these installations can be decommissioned after their lifetime expires without leaving any environmental impact. Having recognised the environmental and business benefits of the agro PV model, MET has partnered with agrivoltaic experts in project development and technology providers to evaluate and integrate agrivoltaic characteristics into future PV project developments.

The point of no return

The development phase of a PV project requires businesses to thoroughly map the landscape and identify commercially available technologies to put forward a compelling business case. Short of looking into their crystal ball, those in the PV business need to gauge the possible direction and outcome of technological developments and align their projects accordingly. Even though certain technologies may not yet be commercially viable at the time a project is in the development phase, they also need to be considered, as they may become mainstream by the time the project becomes operational. Once a project is developed and authorised, it reaches a point of no return and large scale modifications become nearly impossible to implement. The course is set for the next 25 years.

Innovations in PV construction and operation

The second phase of the value chain, namely construction, also comes with its own set of considerations and requires identifying the latest technological developments. Advancements in robotics allow novel solutions to become widespread in the construction of solar installations. Developments, such as AI-based robots developed by specialised companies, can meaningfully accelerate solar installations as a complement to existing construction programmes. Robots can now perform the 'heavy lifting', including the placing and attachment of solar panels, leading to more rapid, precise, and cheaper installation, as well as the ability to install larger panels, along with increased worker safety. Robots can complement members of the current solar workforce, easing the strain of labour shortages worldwide as the number of solar projects predicted to come online is set to rise steeply. Other innovations to enhance solar system construction, operations, and maintenance are also in the pipeline. Prefabricated modular systems are being developed that can be shipped to sites ready for rapid deployment with very minimal labour requirements.

Even when a PV project reaches the operational phase, there are multiple options to optimise the plant for higher efficiency. Operators can rely on digital solutions to manage operation and maintenance, and power dispatching into the grid in an increasingly cost-effective manner. Supported by machine learning and AI, these solutions make faster and more reliable decisions to help operate such assets. Ranging from maintenance scheduling to making sure that the modules are aligned or precisely predicting the expected amount of energy that can be injected into the grid, as well as intelligent diagnostics of performance degradation in solar plants, the possibilities are almost endless for optimisation. There are considerable advances in developing drone solutions for solar panel cleaning, anti-soiling solutions, and coating for solar modules which can considerably improve power yield.

MET is currently working on a software solution for energy aggregators, which will allow the commercial and operational optimisation of the group's asset portfolio. The goal is to tackle the challenge posed by intermittent power generation via data-driven, digital tools.

Given that PV projects are highly standardised, AI-driven solutions can help operators benchmark the different projects within the portfolio with respect to operational efficiency and optimise the entire fleet of power plants. MET experts and consortium partners are working on training an algorithm to learn what the company considers to be a healthy operational state of a given power plant, and the next phase is to have the algorithm learn by itself to identify what the healthy status is and compare it to actual operations.

As technological advancement constantly reshapes the renewables industry, MET seeks to constantly optimise and even refurbish existing projects to bolster efficiency or potentially replace existing project components with more efficient ones by applying the latest technology with the aim of reaching and maintaining the lowest LCOE. Long-term cost predictability is the key to a higher level of stability and an unbeatable value proposition for commercial partners. As regulatory support becomes less substantial for renewable projects, monitoring and optimising the efficiency of assets throughout their lifetime has become indispensable.