

# Designs on quality O&M

**O&M** | Operations and maintenance has traditionally been thought of as something that happens after a PV power plant has been built and connected. But as Emanuele Tacchino writes, planning for the successful operation of a project, particularly a new PV market, begins long before construction



**D**emonstrating to investors the strength of long-term commitment to a PV project is key to developing investor confidence in that investment. The time it takes to develop and build the facility is a drop in the bucket when compared to the time that the plant will be producing power.

A solar facility will ideally last for over two decades. An investor will be looking for assurance that the facility will continue to be a good investment long after the construction is complete and will be properly managed in the years to come. It is vital therefore to demonstrate at the very beginning of the development a strong operations and maintenance (O&M) plan based on the highest

industry standards and to offer assurance that details of the plant's design and engineering by the EPC contractor have been carried out in such a way as to simplify its maintenance over 20 or more years. There are various solutions, for example, in height and spacing of structures, for example, that can impact plant layout, power and, of course, maintenance. Some of these, such as leaving enough space between rows for vehicle access or cleaning machines, may sound obvious but in practice have not always been considered.

Typically during the development and construction phase investors focused in the past on the construction and grid connection of the project. Once this was

**Considering O&M at the design stage of a PV plant can help streamline the operation of remote assets**

completed, they started making considerations about what happens next. The trend is now moving to early inclusion of the solar O&M contractor as supervisor of the EPC engineering or eventually also on development permitting, instead of waiting for five years to see what issues come to the surface and then taking action.

A big part of the challenge in mature markets with operational assets is that they have not been properly maintained, but also that they have not been properly designed from the very beginning, starting from greenfield and from early stage development and permitting. There are no interests from the project developers after the project rights have been

sold or from the EPC contractor after the two-year warranty period is over aligned with the investor's interests. That is where a professional O&M contractor is a significant partner. The O&M contractor typically stays as a long-term partner of the investor, and stays with the investor in the investment for at least the next 20 years. So the asset perspective of the O&M contractor is different from the EPC contractor and from the developers, and investors are realising that O&M players are the only real long-term partners for them.

A clear O&M plan in the initial concept and development therefore offers the assurance of quality, responsiveness and reliability long after the developer and EPC has moved on to the next project.

### What makes this so important to investors?

Evidence of early consideration of how a plant will be managed has a number of benefits for investors. With the global PV project development business growing geographically and several new emerging markets that look very promising, having a solid operations and management plan demonstrates a long-term commitment to the project. In fact, given the lack of existing solar capacity in these new markets, O&M and asset management are arguably more important here; if a solar developer or an EPC firm wants to improve the bankability of their project to secure investors, they must demonstrate that they have a plan for the successful long-term operations and management of a solar facility. In many cases this will involve a partnership with an outside O&M company that has the knowledge and expertise to ensure smooth operations once the system is up and running.

It also increases confidence that a project will be compliant with both local and international operational standards. Investors want to be confident that their projects will not be subjected to any undue hold ups or fines due to non-compliance with industry standards. Providing a reliable professional expert in O&M with experience in standardised contracts, and knowledge of best practices will go a long way toward instilling investor confidence.

It ensures quality monitoring of sites in distant markets. A unique aspect of solar projects in emerging markets is that they tend to be very far away from the typical

resources available for troubleshooting and in hugely harsh environments, such as desert areas. Monitoring will depend on a team that is typically not on the ground at the site, with few, if any, local providers to pick up the slack. A company with a proven monitoring and response record will increase investor confidence in the project as a whole. With the knowledge of best practices to address any situations that may arise, even identifying potential problems and addressing them before they cause any damage, increases the confidence of investing in these markets. The solar monitoring system and state-of-the-art incident handling and management capabilities are crucial for successful O&M.

Linked to this is the optimal operation of a plant: a professional O&M provider's goal is to turn what is currently perceived as an operating cost – the O&M cost – into an additional source of profit for the investor. Having the right commitment and mindset is really the key not only for emerging markets, but in general for every sort of PV market around the world. With proper monitoring and alert systems in place, and proper incident and maintenance management to address the diverse environmental issues that can impact projects, investors can be guaranteed that their system will continue to provide optimum output. The extra performance derived from a good operating solar structure can make an enormous impact on system return on investment. A small increase in performance of percentage points, meaning two, three, four or five percent, creates enormous value for investors. At the end of the day, in many occasions, the O&M is actually no longer a cost for the investor; it generates more revenue than it costs.

Finally, judicious O&M planning guarantees solar delivery at the same level as in mature markets. Emerging markets often have few local solar resources. Solar investors are looking for local companies who are able to provide the services they're expecting from other markets, but they simply cannot find these competencies in all new and prospective markets. Thus there is a big gap between investor expectations and local market O&M competencies in emerging markets. The O&M team can provide training to local workers, but it will take a long time for them to learn the complex detail that goes into monitor-

ing and managing the operations of a PV plant and relevant troubleshooting. Global solar development provides a challenge not only in the distance of projects from established solar markets and the available local resources, but also in working in unfamiliar physical conditions. An O&M company with experience working in diverse conditions has the ability to study and adapt its practices to the environment while at the same time remaining committed to upholding the standards of current market conditions. The ability to provide flexibility is crucial in addressing any unforeseen issues that arise.

### Typical set up between developer, EPC and O&M contractors in emerging markets

The contractual set up among the various players involved, especially between EPC and O&M contractors must be clearly defined from the beginning, to identify the respective responsibility and warranties avoiding grey areas of uncertainty and potential overlapping among the various parties. One has to focus on construction (EPC) and the other has to commit on operations and maintenance of the PV Plant (O&M). A basic bankable term sheet can be structured as follows:

#### Scope

**Development and engineering:** The developer, EPC constructor and O&M contractor must cooperate to design the initial concept of the PV plant and the following permitting procedures and engineering, up to the detailed engineering prior actual construction, with the aim of properly operate and maintain the PV Plant. Specific attention must be paid to critical factors that could heavily impact plants operation and relevant costs and performances (roads, accessibility, availability or storage of waters, proper design of the PV arrays and inter row distances, specific climatic events (sandstorms, high temperatures, strong wind etc).

**Construction:** O&M contractor supervises EPC works and the proper installation of the SCADA/monitoring system.

**Mobilisation period:** During this period the O&M contractor undertakes the responsibility to:

- Identify, recruit, interview and hire

## Integrated O&M in practice: Arabia One Solar, Jordan

Alectris and its developer partner, MASE, applied such a model to Arabia One Solar, a 11.52MWp PV plant in the Ma'an area of Jordan, apex of making solar financially bankable in emerging solar markets. Key aspects of the business case are outlined below:

**Integrated, bankable O&M model:** The project, locally developed by MASE, represented an opportunity to integrate an early-stage O&M models that was implemented immediately after the grid connection of the plant. Arabia One Solar project development has been supported by tier-one sponsors and internationally recognised bankable EPC and equipment providers such Hanwha Q-Cells and Schneider Electric, with financing from the International Finance Corporation (IFC) and Finnish Fund for Industrial Cooperation (FINNFUND). A local partner leads the field operations and maintenance services for the solar plant, with proper training, supervision and support from the global asset care technical expertise and plant management capabilities of Alectris.

**Combined Expertise:** With a track record in operation and management support of far-flung portfolios of assets, Alectris has brought to the EPC constructor its on-the-ground experience with a wide variety of geographic environments along with its cloud-based enterprise resource planning (EPR) software platform, ACTIS, which has been implemented on the plant. MASE acted as a developer, and local partner for on field activities.

**Cloud-based reporting:** A critical component in the speed to market strategy of Alectris and MASE has been the utilisation of the ACTIS cloud-based solar ERP. All data monitoring streams are brought up into one login accessible platform. It is cloud based with modules to operations, maintenance and asset management, also tailored to solar PV plant optimisation. The system allows MASE team members to provide a wide range of alerting, analytics and reporting capabilities to the stakeholders in the Arabia One Solar project.



Arabia One Solar in Jordan took an integrated approach to O&M planning

all labour and professional, supervisory and managerial personnel as are required to perform all activities within the scope of contract;

- Identify and train eventual local subcontractors for on-field activities;
- O&M personnel and staff shall observe plant commissioning process and associated tests;
- O&M personnel and staff shall attend training courses provided by the EPC contractor and/or other suppliers;
- Purchase tools and equipment and vehicles as required to operate and maintain the plant.

**Operation period:**

- Full 24/7 operations;
- Preventive, predictive and corrective maintenance services following

investors' and lenders' requirements plus relevant monitoring and monthly or real-time reporting on activities performed;

- Module cleaning with the required frequency;
- Full site management including environmental, waste and health & safety management;
- Security management (video surveillance, patrols and guards), if required;
- O&M facility maintenance;
- High-voltage substation maintenance;
- Administration and operation of the plant and stocks including implementing dispatch instructions, tests and inspections, spare parts replenishment and warranty claim management;
- Increasing performance and continuous improvement: diagnostic, assess-

ment, engineering and execution of the proper actions and interventions that will continuously increase plant performance up to the maximum.

**Spares**

**Consumables:** During the EPC warranty period of the first two years and afterwards, only consumables shall be on charge of the O&M provider. "Consumable" means everything that needs to be replaced often for maintenance reasons, such as but not limited to: screws, bolts, fuses, sheaths, locks, light bulbs, lubricants, oils, water, freon, fuel etc. – in other words everything that is normally consumed by the normal operations and needs to be replaced.

**Spare parts:** All the spare parts costs under EPC or relevant manufacturer or provider warranty for the plant or the O&M facility are excluded from the O&M scope as well as spare parts needed as a consequence of proven systemic defects and force majeure events. Corrective maintenance shall always be included except the cases of *force majeure* events and systemic defects.

**Guaranteed performance and key performance indicators (KPIs)**

There are two KPIs clearly defined and that describe different things:

- A. **Availability** is calculated down to the inverter level and calculates to what extent equipment after the inverter is operating or not. It expressly measures how good, fast and reliable is the O&M contractor.
  - B. **Performance ratio (PR)** calculates the efficiency of the system when all equipment from inverter upwards is running/available. PR is calculated only in available hours of the equipment. It expressly measures how well the plant has been designed and built by the EPC constructor.
1. PR is guaranteed by the EPC contractor until the end of the EPC warranty period
  2. Availability is guaranteed by the O&M contractor from COD
  3. PR is guaranteed by the O&M contractor after expiration of the EPC warranty. In such a case, the O&M will start guaranteeing only if the plant has been performing above the guaranteed PR and in case not, if such issues have been permanently resolved.
  4. To define the line between O&M and

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EPC in terms of guaranteeing availability, the plant should be commissioned and documented according best industry practices, for example according to IEC 62446.

**Maximum intervention time**

A definition for MIT has been formulated which segregates **between the impacts the maintenance** event has on the performance of the plant. The general structure is:

- MIT for critical incidents is set at a specific number of hours, seven days of the week;
- MIT for non-critical incidents is set similarly;
- An incident is classified as critical in cases when one inverter capacity or more is offline, or when the incident involves a connectivity or SCADA failure that impacts the contractor's ability to monitor the facility;
- In cases when the fault cannot be fixed by the O&M contractor and the equipment supplier's intervention is required, the contractor will communicate the issue in writing to the principal within a fixed number of

hours from the MIT;

- If the replacement of equipment is needed, the O&M contractor commits to ensuring the availability of relevant spare parts and replacing the equipment within a certain number of hours from the MIT if the spare part is included in the portfolio of minimum spare parts or to order it within the MIT if not;
- *Force majeure* events are excluded from MIT obligations.

**Minimum guaranteed availability (MGA)**

MGA typically is a value around 99% with eventual bonuses for revenues as a result of availability achieved above this.

**Availability liquidated damages (ALD)**

The ALD rate shall be directly proportional to the losses caused by the shortfall from the guaranteed plant availability.

**Minimum guaranteed performance ration (MGPR)**

MGPR to be defined from guaranteed PR as per EPC schedule. Bonus granted if effective PR (PREff) shall be over 100% of

the PR achieved by the EPC contractor at the end of the two-year warranty period.

Finally this model draws on solar operations and maintenance expertise at the project design and development stage to engineer bankability and financial assurance into the plans for the investment team. It ensures long-term financial viability of the asset by structuring and deploying operations, maintenance and management of the site based on worldwide best practices. Working together the strengths of the partners are enhanced to meet the criteria of the investment community, making solar more attractive for new emerging markets. ■

**Author**

Emanuele Tacchino is a business development manager in the Western Europe and Middle East division of Alectris. He has over a decade of experience in solar PV project management, dealing with PV projects or plant transactions and involving the development, construction and operation of PV plants.



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