Solar acceptance testing in the time of Covid-19

Once installed, a solar farm needs to undergo rigorous testing, independent inspection and performance verification. This demonstrates that the construction contractor has fulfilled their obligations, and it allows the owner to officially accept the site. But what happens when a global pandemic causes a country to enter lockdown and prevents independent engineers from physically going to a site?

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In this paper, Mohamed Hatimy, senior solar advisor, and Silvia Raineri, solar PV consultant, use a case study from the UK to explore the challenges that owners and investors are facing due to Covid-19 and present best practice for solar acceptance testing.

THE PROJECT: BUMPERS SOLAR FARM

Natural Power recently provided technical support during the acceptance and testing process at the Bumpers solar farm, which is located near Thame in Buckinghamshire, England. Typically, this would include a desktop review of commissioning documentation and a site inspection to assess construction quality and to compile a list of snags for the construction contractor to rectify. Two days before the scheduled site inspection, the UK government announced strict Covid-19 lockdown measures, and we could no longer carry out a physical site inspection. Our client, Gresham House, wanted to avoid delaying provisional acceptance if possible and complete its acquisition of the solar farm. We had to find a way to verify the quality of the installation and compile a snagging list remotely.

REMOTE SITE INSPECTION

As we could not visit the site, we compiled a snagging list based on photo and video evidence requested from the engineering, procurement and construction (EPC) contractor. A snagging list is essentially a list of defects that the contractor has to address before their scope of work is considered completed.

To remotely assess the condition of the solar farm in as much detail as possible, we asked for evidence of:

- installation quality and compliance with industry best practice;
- equipment specifications;
- perimeter fence and security system;
- site access and signage;
- shading from nearby vegetation potentially affecting project performance;
- health and safety considerations;
- compliance of the installation with approved design and planning requirements.

Our experience at Bumpers showed us that this type of remote inspection is more time consuming than a standard site visit, as we had to review each piece of photo and video evidence individually. We kept in close contact with the EPC contractor to:

- obtain evidence covering all relevant aspects;
- verify measurements that we would typically make on-site (e.g. module and pyranometer tilt, module height above ground, cable bend radius);
- make sure that we received a representative view of the site.

A strong relationship between the independent advisor, EPC contractor and owner was key to make sure we captured any defects in the snagging list fairly.

EVALUATING PHOTOGRAPHIC EVIDENCE

We asked for a comprehensive list of photographic evidence to make sure that we could review key parts of the system installation in detail. This included:

- Full array – multiple photos or aerial imagery may be needed to verify the site layout and system capacity.
- Array mounting/flashing detail – close-up shots of mounting bracket connection to roof, associated use of flashing/sealant and module clamping.
- Under-array wire management – close-up shots showing the wire management under the array. Multiple photos may be necessary.
- Wiring of junction and/or combiner box – showing splicing/termination method and conductor fittings.
- Balance of system (BOS) overview – showing general location/configuration of DC disconnects, inverters, production meter, panel boards and other co-located equipment, both indoor and outdoor. Multiple photos may be needed.

- DC disconnect exterior – showing nameplate/labelling details. Multiple photos may be needed.
- String inverter exterior – showing enough detail to verify labelling.
- String inverter interior – showing all wiring terminations.

Due to the number of pictures and large file sizes, downloading and reviewing the photos was a time-consuming process. However, it is essential to work with high-resolution images so we can verify small details, such as torque marks on bolts and plating on the inverters and switchgear.

The images below show a selection of site photography confirming the quality of the installation is in line with industry best practice.

INVERTER

Installed correctly with cables clearly labelled.

SWITCHGEAR

Switchgear is clearly labelled with locks in correct positions.

TRANSFORMER

Transformer is fenced off with appropriate warning signs displayed.

MODULES (FRONT SIDE)

Modules are installed at a consistent tilt angle in the expected configuration. No sign of soiling.

MODULES (BACK SIDE)

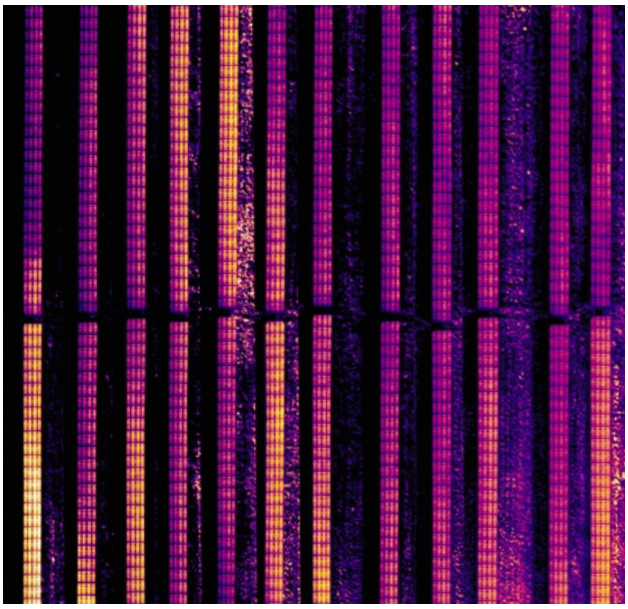
Modules are clearly labelled, and DC cabling is in line with expectations.

DRONE INSPECTIONS: A VIABLE ALTERNATIVE?

Using drones is becoming more common in the solar industry, as a drone can provide an easy and practical solution for inspecting solar farms. A drone equipped with a thermal camera can scan a solar farm for module defects that a simple visual inspection could not detect. This method is much faster than using a thermal camera on the ground. O&M contractors already widely use this method for regular inspections during a project's operational stage. Markets like the US already use drones for takeover inspections, and we expect this to become more popular in the European market over the coming months and years. Using a drone during the acceptance process can offer a range of advantages:

- Drones can clearly see incomplete sections of the array.
- It provides an aerial image of the entire site. These can be easily compared to the as built and planning drawings to identify discrepancies.
- Any major defects such as damages to modules (cracks, hotspots, diode failures) can be identified from thermal imagery.
- Dust and soiling accumulation can be identified.
- Shadows on the PV arrays can be identified.
- It saves time and money, particularly for larger sites.
- It allows for social distancing between the drone operator and construction staff.

The image below is taken from a recent thermal drone survey Natural Power undertook in Texas, USA.



Natural Power drone survey 100ft above ground

CONTINUING TO SUPPORT CLIENTS

Covid-19 has affected the renewables industry in many ways, such as supply chain disruptions and power price uncertainty. As technical advisors, we have felt the impact in our ability to support our clients with site inspections due to the travel restrictions and social distancing measures in place.

To help a client finalise the takeover of a solar farm despite the lockdown, we recently carried out a remote site inspection. We used pictures and videos to verify the quality of the installation.

There were many challenging aspects to this type of remote inspection. In particular, ensuring that the EPC contractor provided a representative sample of pictures so that we could check all items that are normally covered during a physical inspection.

The solar industry is increasingly making use of drones to carry out aerial surveys. This method may gain further popularity while social distancing measures are in place as it minimises contact between the inspector and on-site staff. Drone surveys are a cost-effective way of assessing the completeness and compliance of solar farms, as well as identifying module defects through thermal imagery.

For more information on Natural Power's experience with acceptance testing at solar facilities around the world, see our white paper here: **https://www.naturalpower.com/xhr/downloadRequest.php?id=23**

Or, for more information on Natural Power's solar PV and drone inspections services, please contact:

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