

Mobile revolution

Testing | The past two years have seen a boom in the deployment of mobile PV testing laboratories. Sara ver Bruggen reports on how technological advances are helping investors and developers in new and emerging solar markets get the best from their assets



Mobile module testing equipment is seeing booming demand in PV markets worldwide

The notion of being able to test PV modules in the field can be traced back to the last decade, when the PV market really began to take off and a flood of cheap modules from China first sparked concerns over quality. But it is really in the past 18 months that the concept has taken off.

Several companies – mainly European – now offer mobile PV testing services. And it looks like an area that is set to grow still further, fuelled by a combination of ongoing pressure to ensure quality and the increasingly stringent demands of plant owners and operators to maximise the value of PV assets in the field. Add to that the burgeoning demand for solar in emerging markets worldwide, where developers are keen to avoid the mistakes made in pioneer markets, and it looks as though this is an idea whose time has come.

"Quality assurance monitoring of PV panels, from production to installation,

will always be a key factor determining a PV plant's overall performance," says Erik Lohse, managing director of mobile testing specialist MBJ Services. "Testing of panels in a stationary lab has been the traditional method. Mobile testing, thanks to improvements in technology, is becoming more popular. It provides banks and insurers with assurances that PV modules, which comprise 30-40% of a plant's total cost, installed at site, are without flaw.

"With the increase of the installed base, keeping all the gigawatts of PV operational at the optimal performance is and will be a major challenge for O&M and this is where mobile testing will be deployed more widely in the coming years."

It's the tech

One key factor that has helped the mobile testing concept take off and will likely underpin its further expansion is the improvement in mobile testing technology. Advances in the sophistica-

tion of equipment used for testing in a mobile environment means the quality and standard of testing is on par with diagnostics undertaken by independent testing and quality monitoring firms and agencies, such as Fraunhofer ISE and TÜV Rheinland.

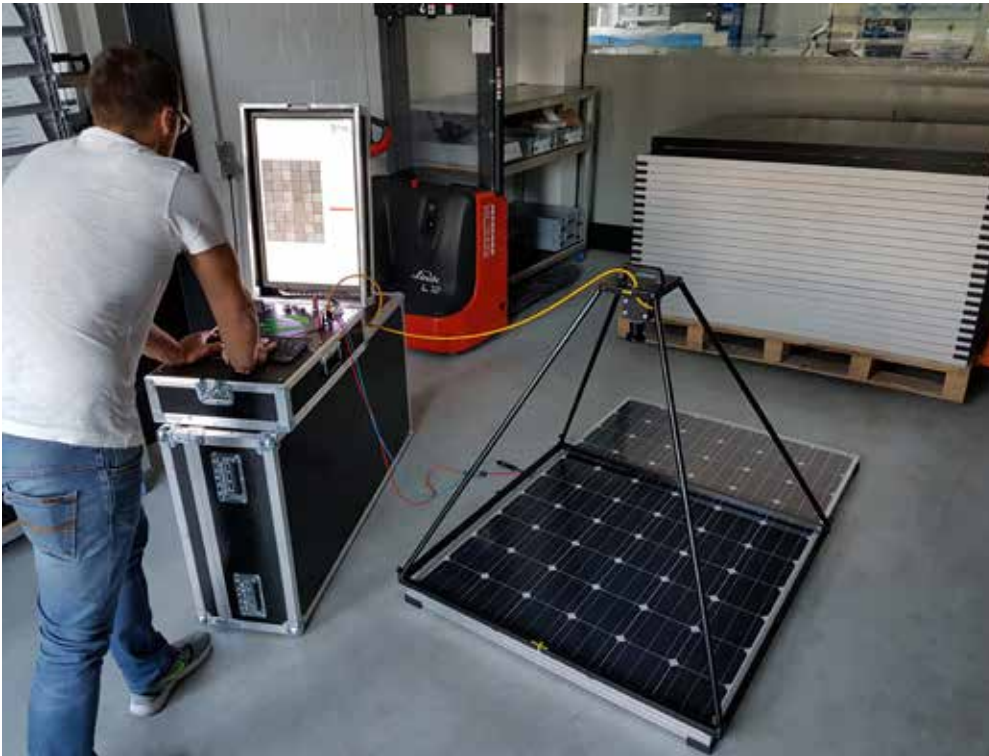
When Hamburg-based MBJ Services launched its second-generation mobile PV testing lab, an initial customer was independent quality assurance services provider Intertek. In 2015 Intertek, in partnership with the Center for the Evaluation of Clean Energy Technology (CECET), launched a mobile platform for testing modules in situ. The Mobile PV Testcenter complements Intertek's wider range of quality assurance services for solar products and installations usually carried out at fixed laboratories on the US east and west coasts. The lab is used to identify underperforming modules.

MBJ Solutions, a leading producer of electroluminescent (EL) inspection equipment for PV module factory lines, set up MBJ Services as a subsidiary five years ago. The first generation of mobile testing labs commercialised by MBJ Services was based on a simple light emitting diode (LED) flasher, for sunlight simulation, as well as EL technology.

"We saw that a certified lab-level flasher was needed for greater accuracy and to provide testing in the field equivalent to PV testing in stationary labs," says Lohse.

Xenon flash lamp technology, widely used at the time in stationary PV labs and production lines, was deemed insufficiently robust for use in the field. MBJ Services started developing an LED flasher, the basis of its second-generation lab, which the company is now commercialising.

"As the spectrum range of LED lamps has improved LED flash lamps are today at least as accurate as xenon," says Lohse. "More widely across the industry LED flash lamps are replacing xenon flash lamps and sun simulators because the technology is as accurate, but is more robust and compact."



Credit: MBJ Services

Driving up quality

The biggest impact that mobile module testing has had to date is in driving up module manufacturing standards.

“In the past, before mobile testing was possible, many manufacturers did not care about quality because nobody knew what was going on,” says Thomas Hemmenstädt, head of service at Kirchner Solar Group, which operates a subsidiary business for testing PV modules in situ, called PV Mobilab.

Lohse adds: “Mobile testing gives our customers the means to be able to scrutinise what module suppliers claim they are producing. The growth in mobile PV testing has forced module manufacturers to improve quality.”

In 2012 Kirchner Solar Group launched its PV Mobilab. The lab offers IV curve measurement at class A+A+A, real standard test conditions (STC), electroluminescence testing, thermography inspection of the entire system, identification of hot spots and inactive modules, and on-site random sampling and documentation of issues and faults found. The range of testing that can be administered means mobile PV testing can be used during several stages of the PV panel’s lifecycle.

“It is critical to carry out in situ testing but as part of a wider quality control programme, which starts at the module factory, and even during module supply contract negotiations,” says Álvaro Velasco, global business development

MBJ Services’ mobile electro-luminescence testing in operation

executive at renewable energy consultancy, Enertis, in Spain.

Mobile PV testing can be deployed in various downstream stages to ensure quality, identify faults or damage and protect investments in PV plant assets, from pre-shipment inspection of PV panels after leaving the factory, to post-shipment inspection of modules at the harbour, before customs, to when the panels are unloaded from the delivery truck at the project site. Post installation, it can be used to verify the final status of the PV panels as part of plant-level inspections, as well as during the plant’s

operational lifetime to identify or estimate degradation.

“This provides the entire picture of what may have happened to panels, and can help settle warranty disputes and apportion responsibility correctly,” says Velasco.

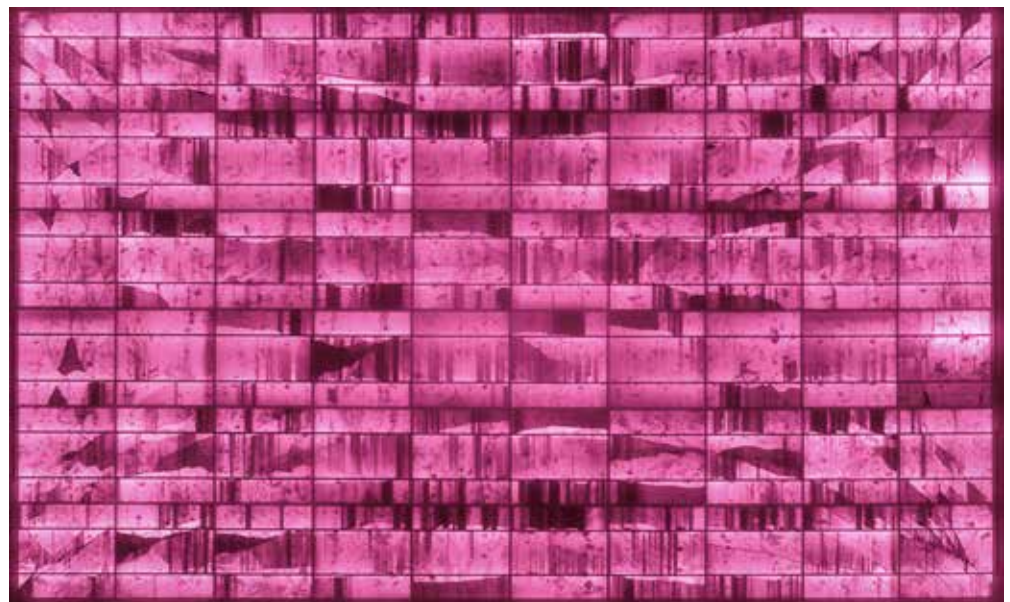
Enertis provides a full range of PV testing. “We provide services covering the full cycle of the project, based on our own laboratory capabilities, as opposed to being just a supplier of mobile PV testing laboratories,” says Velasco.

Markets

The company’s third and latest mobile PV testing laboratory is expected to be deployed by December in the northern part of Chile, where much of the country’s installed solar capacity is based. Enertis opened a local operation in Chile two years ago. All three generations of the mobile PV testing labs include A+A+A LED solar simulators.

Enertis launched its first mobile PV testing lab in Europe in late 2012 and it remains one of the first mobile labs still used in the industry. Over the past four years it has been transported around Europe’s main PV markets, including Spain, France, Italy, Germany, the Netherlands and the UK.

The growth in demand for utility-scale PV means the lab has been widely deployed in the UK over the past two years. Due to the significant role investment funds play in the UK PV market, there is demand for Enertis’ quality control services and those provided by the mobile lab in the operational phases, as



EL imaging from mobile testing highlights inactive cell areas in modules in the field

Credit: PI Berlin

Intertek

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Mobile PV Testcenter

well as in the installation phases of plants.

Valesco says: "The secondary PV market in the UK is evolved, where there is a high level of activity transferring assets from one owner to a new owner. On the one hand, the existing owner of the plant wants to be able to check how the asset is operating with the view to selling these on, but the buyers of assets also want our services to be able to do due diligence on PV plants they are seeking to purchase."

Enertis deployed its second mobile lab in the US two years ago in New Jersey and in San Francisco.

"In the US, we have to focus on where the lab can be deployed. Though there is demand at all stages, including the construction of PV plants, where we are seeing growing demand is for the operational stages of PV farms. Typically, we might deploy it when a plant's output or yield is impacted and we can test modules in the field and identify degradation causes, such as potential-induced degradation (PID), hotspots and so on. The US is a highly competitive and mature market, so plant operators and owners want to be able to quickly identify any problems that impact a plant's output and, therefore, its earnings," says Velasco.

Enertis' mobile lab can test up to several dozen panels in a day, though actual quantities tested per customer depend on the size of the PV farm itself. In some cases the company has tested 50 modules in a PV farm, but in others the requirement has been up to a thousand.

"It does not make economic sense to test every panel, so we use a sampling approach, which is standard practice of PV module testing in the industry," Velasco says.

According to Lohse, certification bodies such as TÜV Rheinland and Fraunhofer ISE will use mobile testing as part of PV plant testing and certification services, particularly in emerging markets where it does not make economic sense to have panels shipped over to Germany for testing.

MBJ Services has several partners in local markets around the world, including five in Japan and one in the US. The company is qualifying its first local partner in South Africa, which is also looking to provide mobile PV testing services throughout the African continent.

"This approach makes sense as the mobile testing lab can cost in the region of €200,000, whereas investing in the setting up of a stationary testing lab costs at least €1 million," says Lohse.

The local partner must not only have access to the local PV market but must also employ lab engineers. While the operation of the mobile lab can be done by technicians with training, the interpretation of the results has to be done by properly qualified solar PV engineers.

"The South African partner was already operating a mobile service for calibrating sensors for PV modules installed in the field, so expanding its service to include inspection of PV panels was a logical step," Lohse says.

Other partners include Adler Solar, a Bremen-based provider of independent technical services for the entire lifetime of a PV plant, including operation and maintenance services on behalf of operators, and which also has a subsidiary in Japan.


To date MJB Services has sold 20 mobile labs. Six of these are the company's second-generation version, which is the version Intertek is using. It uses a certified A+A+A LED flasher. The first-generation labs, which use simple LED flashers only, are still being used, though they cannot carry out certified PV lab-level inspections.

Emerging solar markets

This year MJB Services has refined the lab further by building a containerised version, which is smaller and more compact, and is also air conditioned. Lohse says: "It is more suitable for shipment by truck and plane, which makes it ideal for emerging markets, such as Africa and Latin America."

In line with growth in utility-scale solar PV, MJB Services expects more demand for its labs to come from emerging markets.

"This is not because local investors and developers are requesting this



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How mobile PV testing is being deployed in the field

Back when production of PV modules boomed and panels started shipping to Europe, failures were thought to be due to damage during shipping and transportation.

In one case, a PV module producer supplying panels to Europe had issues with 50-80MW-worth of panels shipped. Initially problems were found when MJB Services' mobile testing equipment was used by a customer – an investor – and revealed a high rate of cracked panels after the journey from China to Europe. The issue was traced to the panels being too sensitive to mechanical loads.

In the end, however, the PV module producer also employed MJB Services' equipment to test panels at various ports in Europe and the producer was able to track back through the production process to the root cause of the problems and the producer was able to adjust and modify its production processes accordingly.

"Investor-owners are most interested in using mobile testing, as opposed to developers, as investors want to ensure that any risks are minimised by good quality control. Sometimes investors procure panels directly for a project," says Erik Lohse, managing director of MJB Services.

However, some developers will also use mobile PV testing for quality control, especially if they plan to sell the asset once operational. "Here, developers want to minimise the risk in knowing the status of the panels they will use," he says.



Suncycle is now offering its mobile testing services through an O&M partnership with Cobalt Energy in the UK

Three years ago Kirchner Solar Group's PV Mobilab tested modules at a solar farm comprising 36,000 modules, following a thunder and hail storm. About 120 modules were damaged by hail. Broken glass was visible, however the tests picked up broken cells that the naked eye could not detect.

"It depends on the transport costs and what price the customer is willing to pay. But we can test around 500 modules per day," says Thomas Hemmenstädt, head of service at Kirchner Solar Group.

Meanwhile, Cobalt Energy has joined forces with German solar firm Suncycle, which offers a mobile test lab, to launch a joint venture bolstering its operations and maintenance service to UK customers. The addition of the German company's operations to the UK arm, known as Suncycle Ltd, means clients will now be offered advanced O&M techniques such as mobile electroluminescence, flash testing and aerial thermography analysis as well as standard maintenance services.

John Davies, managing director of Suncycle Ltd, says: "By combining Suncycle's extensive experience across Europe in testing and servicing with Cobalt Energy's well established solar operation and maintenance service, we will be able to offer unique professional and technical expertise and services."

Following the reduction in government support in the form of cuts to feed-in tariffs and ROCs, Suncycle believes the UK market is transitioning towards an O&M market following a highly active period of construction. This is further supported by the fact that many solar PV installations are soon to come to the end of their warranty periods.

type of testing, but because where European and North American investors and developer partners are involved, they are educating partners in new markets because they want to see the earlier mistakes in Europe – when the absence of mobile testing made it hard to pick up faults from PV installed in the field – avoided," Lohse says.

Today, he says most demand for mobile PV testing is for the pre-operational stage of the project. Stationary PV labs will always be required but it is likely that in future their services will be deployed for certifying new types of panels. The individual testing of panels which are checked by testing and certification agencies on behalf of investors and PV plant owners will be done in the field, as will any testing as part of O&M activities. "It makes no sense to ship hundreds of panels from one country such as South Africa to a lab in Germany due to the risk of damage and the logistical cost," says Lohse.

Future demand

But as global PV markets continue to mature, the O&M side of the industry is evolving in order to be able to adequately service the growing quantity of operational PV assets. That's where providers of mobile PV testing labs and associated services see growth opportunities.

Enertis, which provides a whole suite of PV quality control services, wants to work with third-party O&M service providers, as well as engineering, procurement and construction firms, owners and asset managers on a collaborative basis, as opposed to selling its PV mobile testing labs to customers such as independent testing and service providers.

"Operators are in a tough position as they have to take responsibility for an asset they didn't build or specify components for. We can offer comfort, because our testing service can identify the root of the problem, such as whether it was due to faulty or poor quality modules in the first place."

Whether through partnering with firms like Enertis, or leasing or purchasing mobile PV testing labs, O&M service providers are able to offer their clients, the owner-investors, peace of mind that the PV asset will operate profitably over its lifetime. The ability to provide lab-level testing could be a valid differentiator for independent service providers as the O&M market grows. ■