

Improved quality and efficiency for PV production

As the market for PV grows and production ramps up with it, keeping productivity levels high is important, yet not without its challenges. PES discussed the common issues and how they can best be overcome, with Jyry Hyvärinen, Sales Manager at Endeas.

PES: A very warm welcome to PES Jyry, it's lovely to speak with you. Perhaps you could begin with a little bit of background to Endeas and what you do?

Jyry Hyvärinen: We are a Finland based company developing and delivering extensive photovoltaic module testing solutions for the needs of the PV industry. Our product line extends from manually operated laboratory and R&D systems to highly automated solutions designed for mass production. Endeas Oy was founded some 20 years ago and we have used all that experience to design testing stations to meet the needs of the industry.

In the early years we provided only flash testers to perform I-V measurements. Since then, the requirements have changed a lot and our products have undergone drastic changes. We have learned to integrate the most important PV module backend tests in a single machine

and in recent years the level of automation has gone up.

Personally, I joined Endeas sales team roughly a year ago and since then I have been taking on more and more responsibility in the discussions with our customers.

PES: The PV industry is evolving quickly as the demand for solar grows isn't it? What are some of the biggest changes you have been witnessing over the last few years or so?

JH: There is no denying that the solar industry is a fast growing and quickly evolving industry and this development is only expected to speed up in the future. Besides the fact that PV technology has been for years a competitive way to produce energy, the green transition and decarbonization goals around the globe are accelerating development even further.

The biggest changes in recent years have been the announced ambitious plans to ramp-up local production, for example in Europe, US, and India, to become more self-sufficient and have more control in the PV manufacturing process. It is understandable that these plans and their success is essential to reach the goals in the reduction of CO₂ emission of energy production.

It has also been good to notice how widely PV has been adopted in different fields and applications. Regarding BIPV products, we have seen interesting solutions in how PV and thermal solar power are combined in an efficient and compact way.

But personally, I find a more fascinating example in the automotive industry. Many vehicle manufacturers already have PV integrated into their electric vehicles and it seems the rest are planning to follow this trend. Of course, this poses some challenges, since these modules are curved and there are no standards yet to follow. Nevertheless, we have been able to provide customized high class solar simulators with integrated EL options for the testing of curved PV modules used in electric vehicles.

PES: Cost is a big story, with many forecasts marking solar the cheapest of the technologies in the near future, what are your thoughts on this?

JH: 15 years ago, photovoltaics was by far the most expensive technology for energy production. Since then, LCoE has decreased radically and in the last couple of years it has been the cheapest. This is of course great news since this development encourages major investments in PV development and manufacturing. Among PV manufacturers the competition for the lowest offered LCoE



Manually operated QuickSun 650Lab offers same extensive testing capabilities as QuickSun 650 for laboratories and R&D

is also on-going, which I think will decrease the costs even further.

PES: With this no doubt resulting in even more demand, is the industry moving towards growing module sizes and new technologies as a way of keeping up?

JH: Over the last few years we have seen cell and module sizes growing and new cell technologies such as HJT, IBC and TOPCon being more widely adopted, not forgetting the trend towards bifacial products. These changes are the result of the pursuit towards even lower LCoE and enable higher power throughput the operation, while also decreasing production unit costs.

PES: Do these changes come at a cost to the manufacturer, not to mention other challenges too?

JH: To keep up with the development, manufacturers need to invest in costly upgrades and accommodate their production lines to be able to stay in the competition. Cost is of course one aspect which needs to be considered, but when upgrading an existing plant one important factor to consider is how to fit production equipment into current facilities. There is no doubt that floorspace is valuable and as module sizes grow, production lines get bigger as the equipment requires more space.

PES: So with the help of Endeas, are these changes easier to accommodate?

JH: All our products are compatible with space saving All-in-One technology. The main idea behind All-in-One is that it integrates all key backend tests in a single machine. When tests such as I-V measurement, electroluminescence imaging and analysis, electrical safety tests, bypass diode test, automatic visual inspection are performed in a single station without additional module movement, we are able to offer compact and cost-efficient solutions to save floorspace in production facilities.

PES: Is there an opportunity here for manufacturers to improve quality and perhaps overall efficiency of their

production lines too?

JH: New systems with new features and capabilities definitely help manufacturers to improve quality, as all of our standard solutions comply with A+A+A+ requirements according to the latest IEC 60904-9 Ed.3 standard. Besides meeting the renewed requirements of the updated standard, our solutions are equipped with proprietary Capacitance Compensation (CAC) method, which ensures accurate and reliable I-V measurement results for modern high efficiency modules with single optimized pulse length. This method has been confirmed by a published independent study to be the most accurate method for measuring high-efficiency modules.

In terms of efficiency and testing capacity, our latest All-in-One testing station for mass production, the QuickSun 650, offers extensive backend testing capabilities for module sizes up to 140 cm x 270 cm, with throughput of 150 modules/hour. This means that QuickSun 650 performs I-V measurements, EL imaging and analysis, electrical safety tests, bypass diode test and automatic visual analysis within 24 seconds. Of course, if all tests are not required, the overall throughput is even higher. For example, with I-V measurement and EL image recording it is possible to reach a testing rate of over 200 modules/h, including module movement and contacting.

In regard to improving manual labour efficiency, the machine has inbuilt maintenance features to reduce manual labour. These include automatic irradiance non-uniformity measurement and control, automatic camera focus control and automated calibration procedure with silver modules.

PES: Do you think there are more challenges to come and new technologies possible to deal with these?

JH: Perovskite tandem PV products are surely an interesting upcoming technology on which research and development is ongoing and encouraging results are published regularly. We are carefully following the development and plan to be



Jyry Hyvärinen

ready when perovskite products show stronger signals of becoming the mainstream, as manufacturers start to implement needed changes on their mass production lines and need perovskite compatible testing equipment.

PES: And for Endeas, are there any new ideas in the pipeline?

JH: We aim to develop our testing solutions to be even more cost effective for our clients. A great example of this is our direct junction box contacting without the use of contact adapters. This solution eliminates one manual labour intensive step in the otherwise highly automated production. Besides reducing the involved manual labour costs, this solution increases safety, since there is no need for operators to work in the proximity of moving objects.

Our goal is also to further increase the lifetime of our Endeas Xenon flash lamps in our module sized testing stations. Recently we increased the life to over one million flashes, which is roughly the annual testing capacity of the QuickSun 650. The results of the verification tests were so encouraging that we expect to reach a lifetime of nearly two million flashes in the future.

PES: How do you see your company evolving this year and in the future?

JH: This year we have been focusing on improving our delivery and manufacturing capabilities. Despite the challenging and volatile situation in the component market, our supply chain and engineering teams have done a tremendous job and already we have been able to ramp-up our capabilities to be ready to participate in even bigger manufacturing plant projects around the world.

In the near future we aim to continue the previously mentioned strengthening without compromising the high quality of co-operation and solutions we offer our customers.

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Fully automated QuickSun 650 brings together I-V measurement, EL imaging, electrical safety tests, bypass diode test and visual inspection in single machine