



Global measuring and testing systems

PES had a very interesting conversation with Dirk Tegtmeier, one of the founders of Ingenieurbüro Mencke & Tegtmeier GmbH. Quality, customisation, a real interest in the technology and continually striving to reach the next level, along with staff driven by the same aim, is what keeps this successful company at the top.

PES: Welcome back to PES Solar/PV magazine, Dirk. It's great to talk with you again. For the benefit of our new readers would you like to begin by explaining a little about the background of Ingenieurbüro Mencke & Tegtmeier GmbH (IMT) and the importance of the Solar/PV industry to you?

Dirk Tegtmeier: We started in July 1993 as the first spin-off from the Institut für Solarenergieforschung (ISFH, Institute for Solar Energy Research) the founders, myself and Detlef Mencke, wanted to bring our master thesis on silicon irradiance sensor with internal temperature compensation of the irradiance signal, steady-state sun simulators and I-V curve

analyzers for PV, to the market.

The first IMT expansion was in 1999, when we got our first employee, Nikolai Maris, who now is also an associate. Until 2011 we were continuously growing, but this slowed down a little bit in 2012 and 2013 because of the German politics on renewables.

Since then we have increased our export quota massively and therefore stabilized and this year it seems, that we will get back to the size we were in 2011. Since the beginning we have extended our product portfolio to all kinds of sun simulation, like flash-light and LED based simulators, as well as steady-state simulators for solar thermal collectors and specific PV modules, which have a higher response time due to

their material e.g. thin film.

We produce our own temperature sensors for ambient and module temperature measurement and optimized the uncertainty of our Si sensors by more than twice what it was.

All big monitoring companies worldwide use our silicon irradiance sensors. We install complete measuring systems for research institutes and industry. We also have experiences in planning PV systems, especially customized building integrated PV generators, but this part of business is decreasing, because these installations are very few today in Germany.

PES: Is this a growing market for you?



Automatic I-V curve measuring system for up to 12 PV modules (IMT)

DT: Of course, the PV market worldwide is increasing and therefore it is also a growing market for IMT. It's a great feeling: renewable energies can compete with the old energy monopoly, and hopefully make the world a better place. Renewable energies, not the components, are mostly produced locally, so that the people have the direct advantage within their region.

At IMT we all love the rise in PV solar systems and the more independence we are gaining from oil and gas. At the very least we have a part in all the PV systems built with monitoring systems, by supplying our irradiance and temperature sensors.

PES: We see you supply measuring systems to a variety of industries; we would like to know more about these solutions and the role they play.

DT: Some years ago, many of our installations were to test complete PV systems, which means we built the complete system with AC and DC measurement transducers, data loggers and data transition. Additionally, we also helped research institutes like SERIS, in

Singapore, to build up their own systems by guiding them in the use of the best transducers and how to combine them in their own data logging system. This is more an interest, which gives us extra satisfied customers. And having satisfied customers has always been the most important thing for us at IMT. These customers bring us new ones from all over the world.

Over the last years the production of automatic PV I-V curve analyzing solutions (multiplexers) has become a big part of our portfolio. These MUX systems are able to test several different PV modules automatically, under natural sunlight, complying with international standards. With these test stands, which are totally plug and play, you can get the realistic yearly energy output of PV modules under specific weather conditions.

PES: Please tell us about your calibrated silicon irradiance sensor and how it benefits the client and the end user.

DT: We have been creating silicon irradiance sensors now for 25 years and have made several improvements. During the last decade we improved the mechanics and robustness, as well as the electronics and measuring uncertainty to $\pm 2.5\%$ of reading $\pm 5 \text{ W/m}^2$.

We use reference cells, that are yearly recalibrated at PTB (the National Metrology Institute of Germany) to do the inhouse calibration for our Si sensors. We have developed all types of Si sensors, analogue and digital outputs, because they were asked for by our customers. So, if there is a specific need for a monitoring company to use irradiance sensors, we are able to help.

PES: How important is a customized system and what are the cost

implications to the client?

DT: For some research institutes and module manufacturers it is very important to get a measuring system that meets the specific needs of the engineers and scientists completely. So, the cost really depends on the requirements of the customer. Our PV-KLA I-V curve analyzing unit is built in modules, so it can be adapted to many requirements without increasing the price too much.

PES: How and when is the I-V curve measurement used?

DT: Our I-V curve analyzers are not built for use in the field for testing high-voltage strings, but for testing single modules. This is the only measurement which accurately shows misbehaviour or power loss in PV module. Measuring a complete string only helps check whether the modules are working or not.

Therefore, most of our I-V curve analyzer customers are research institutes or developing divisions, in PV manufacturers, for whom we build customized systems to get best use out of the modules.

PES: We are curious to know if your systems are easy to use or if specific training is needed?

DT: We always try to keep an eye on the easiness of our products, but in our experience every product needs a service, because not all customers have even a basic knowledge.

For the technician, installing a monitoring system with an irradiance sensor for the first time, there are several issues, of course the solutions can be found in our manual, but most of the time it's easier to

call us directly by phone, or send an e-mail to get the short answer, rather than read through 20 pages of the manual. Therefore, most of our customers only need assistance within 1 to 12 hours.

For our test stands we nearly always have customers experienced, for example, in measuring PV module I-V curves. For the first explanation and set-up we are also able to help the customer by remote control, which was made for USA, as well as Bangladesh or India. This is very easy and the customer is able to watch what we do within the software.

Our test stand hardware is tested for at least one week, in our workshop, for an endurance run. Only if this test is successful, do we deliver the test stand.

PES: Do you have any new products in the pipeline, if so we would like to hear about them?

DT: We are currently working on two research projects, together with solar institutes and the quality industry, on really exciting new products, but we can't tell you about these before 2019 or 2020. But on successful completion, both products will bring monitoring and maintenance of PV systems to a new quality level.



One of the calibrated mini modules of a UniformSun module (ISFH)

PES: What makes IMT systems stand out from the competition and why should customers choose you?

DT: We work hard on every project to satisfy all our customers. This gives us a better reputation in the market and more customers as a result, because they hear about us from other customers. This has been our policy since the start of our business and it has helped us flourish. I think, many successful companies worldwide have had the same experience, and it is not just an outstanding trademark of IMT, but it certainly helps a lot. For instance, IMT's temperature compensated silicon irradiance sensors are a unique feature on the global market.

PES: Quality is something you strive for; how do you manage this and ensure you always produce the best products you can?



Detail of the 60 cell UniformSun homogeneity measurement module (ISFH)

DT: We are not quality certified by any international standard, but we have our own quality processes. For instance, our silicon irradiance sensors get complete quality management from the PV cell laminate (electroluminescence tests for every laminate), the housing (every part of every case), the calibration and the final test before packaging.

All these quality steps are done by different people, so every time there is more than one pair of eyes on the job. Every year we recalibrate all of our production and reference equipment through DaKKs certified labs: such as PTB or ISFH.

This means there is no uncertainty for us about the quality level of our sensors over the complete temperature range from -40 to 85°C.

Additionally, we have highly motivated employees, who always are thinking about how to improve things and bring production quality to a new level. All of our engineers, especially our associate, Nikolai Maris, uses every working day to search for new ideas and optimized technical data of our products. And we take care for our customers, who also have ideas for pushing products to the next level.

PES: Where do you operate and where are the key markets for IMT and are there any areas, geographically speaking, that you would like to break in to?

DT: Since our worst year (2012), when throughout the year our turnover dropped down by 50%, because of the killing of the German PV industry and market, we have found new markets to take over the German industry and installation. Beginning with France, UK and USA, then East Europe, Israel, India, Singapore, Bangladesh and China. We do not export directly to China, but one of our largest customers in the monitoring industry, was bought by a Chinese company some years ago, so these monitoring systems, together with our

silicon irradiance sensors, are exported to China by them.

PES: What is the single biggest challenge facing the market today?

DT: One of the biggest challenges will be to integrate the fluctuating PV energy and also wind energy, into the systems without causing problems for the end user. Therefore, more decentralized storage has to be implemented within European countries for example. Having discrete storage will help us to minimize the additional grid installations and also help us to keep the existing grid in good condition.

Small systems also can help the people in rural regions to get energy for: light, medics, cooling and also fresh water without harming the environment with exhaust fumes. And perhaps we no longer need to suppress foreign countries in order to obtain their oil and gas.

PES: Looking ahead to the end of 2018 and beyond, what trends and/or changes are you anticipating in the market and why?

DT: I personally would be happy, if building PV integration would become a larger part of the worldwide installed systems, because then PV would be available to many people.

It will also be interesting to see at which price level PV modules will stabilise this year, after China, the largest market for PV installations, has limited the installation to 35 GWp for 2018. The production lines globally have a much higher capacity than the probable installation for 2018. PV will become even more reasonable in price, the quality of modules, inverters and installation will be of highest interest to get sustainable energy production. Storage systems especially will help PV to stabilise the electrical grid and get solar power to higher levels of stability and availability.

www.ib-mut.de