Pyranometer innovators

Kees van den Bos, Director of Hukseflux Thermal Sensors, dropped in to PES to tell us about the latest developments in solar radiation sensors and the quest to take measurement to the next level. We started off by talking about how it all started...

Kees van den Bos

PES: Welcome to PES Solar/PV magazine. It's great to talk with you. Would you like to begin by explaining a little about the background of your organisation and how you currently serve the solar/PV industry?

Kees van den Bos: Hukseflux Thermal Sensors is a leading manufacturer of solar radiation sensors. We have one core purpose: to take measurement to the next level. Hukseflux was founded in 1993. It started with the idea that there is a need for sensor specialists. The founder Eric Hoeksema is an industrial designer and I have a background in physics. We started off making heat flux sensors for meteorology and building physics. The company organically grew in terms of both products and personnel. We now employ around 40 people.

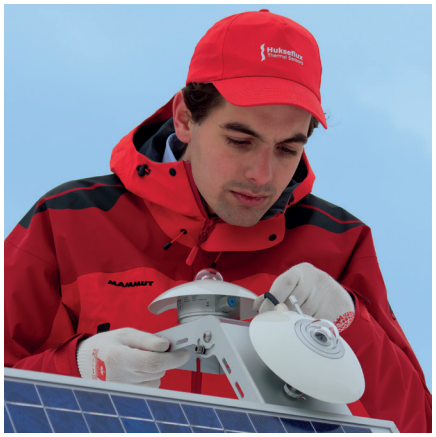
KvdB: In 2007 we came out with a relatively simple solar radiation sensor, a pyranometer, aiming for the meteorological market. Soon parties from the PV industry started to approach us; this took us somewhat by surprise and we didn't then have the high-grade instruments necessary for good PV system performance monitoring. Since 2010 the PV market has dominated our R&D efforts. Now we are the technology leader in pyranometers and the fastest growing company in this market. Most of our pyranometers end up in monitoring systems, in PV power plants bigger than 1 MW.

PES: You are active in a number of industry sectors. How important is the solar/PV business to Hukseflux?

KvdB: The PV sector now contributes around 30 % to our turnover.

PES: Is solar/PV a growing business area for you? How are you capitalising on this growth?

KvdB: Over the last 2 years the PV industry has been the largest contributor to Hukseflux' growth. This growth allows us to invest further in product development. At the same time, the increasing numbers make it possible to attain a better level of quality at a lower cost. We believe the PV market will develop even more and that the need for monitoring will increase. The customer will get higher performance for less money. This growth also means that we can invest in expanding our worldwide calibration and servicing organisation.



PV system performance monitoring with Hukseflux pyranometers, measuring GHI and POA

"PV monitoring is an essential building block of the industry, which will become ever more accurate and at the same time more affordable. This is not a contradiction"

Kees van den Bos

PES: Can you tell us about the importance of sensors for solar radiation measurement and the technology used for this?

KvdB: The basic principle is very simple: with pyranometers you measure the incoming radiation. Installed in Plane of Array, POA is the maximum attainable yield of the PV system in Watts per installed square meter. This is a good point of reference for the analysis of system efficiency. Installed horizontally you measure Global Horizontal Irradiance, GHI. This is a good point of reference for comparison with the local met office or national weather service, with satellite data or data from other PV plants.

System efficiency monitoring serves several purposes. An obvious example: if efficiency suddenly drops from one day to the next, you can take action to analyse what's going on. But also the long-term record of system efficiency serves as one of the indicators determining the PV systems' worth. We see that asset managers push for higher accuracy. Our main growth is in high-accuracy, secondary standard class, pyranometers. Instruments made according to this standard are individually tested, for example, for their temperature and directional responses during manufacturing. If you want to measure long-term system degradation in the range of 1 to 2 % per year, you need instruments to be more accurate and stable. Secondary standard pyranometers are, in our opinion, the only ones meeting that requirement.

Another example: the GHI measurement may be used to compare your total yearly irradiance with historical records of the national weather service to see how the total solar radiation that year compared to others.

For practical reasons pyranometers are preferred to the competing technology of PV reference cells; they are suitable for both POA and GHI measurement and also the exact model that you use is independent of the PV cell type and glass coating employed in the PV plant. Reference cells are not suitable for GHI measurement and need to "match" the exact cell type, including glass reflective coating, of the PV plant.

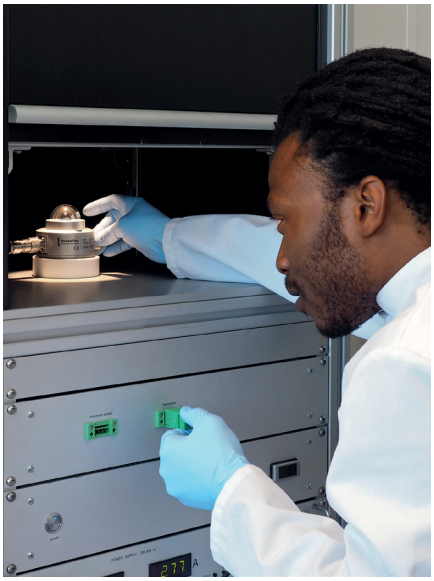
PES: We believe there are to be new standards for solar radiation measurement and PV monitoring, how will this affect you and also the end user?

KvdB: Some 10 years ago solar radiation measurement was primarily used by meteorologists and the scientific community. Also use of PV was not truly money-driven. Now PV has rapidly become an integral part of the power industry and it is treated like a commercial investment. We see that asset managers increasingly insist that the PV system monitoring is done by independent parties, not those involved in the daily operation. The power industry and asset managers are pushing for standardisation at all levels. The ISO and ASTM are working on new standards for uncertainly evaluation of solar radiation measurement. IEC is revising its 61724 standard on PV monitoring. Above all the new standards will offer more clarity on what class of instruments to use and how to estimate measurement uncertainty. Hukseflux is an active member of the ASTM working group that is addressing evaluation of measurement uncertainty.

PES: Currently what part does maintenance and calibration play in our market?

KvdB: Part of the new IEC standardisation will be a recommendation for the calibration interval. The calibration of pyranometers, basically a verification of the measurement instrument accuracy, is not easy for users. Contrary to most system components that you can check on-site, you have to send the pyranometer away from the power plant: time consuming and relatively costly. At present, many organisations do not recalibrate within the recommended 2 year time interval. Pressure from the IEC and asset managers will change this.

It is interesting to see that the USA, where we are the market leader with our instruments for monitoring large PV power plants, is taking the lead in this respect. In our opinion, the US market is truly the most professional now. US asset managers realise that the instrument costs over their lifetime will be dominated by calibration costs. They prefer our product because when you purchase a Hukseflux pyranometer you also gain access to an efficient calibration and servicing organisation. We have calibration support in the larger economies: USA, China, Japan, EU, India and Brazil. Plus we work with partners in many of the smaller economies.



An efficient worldwide calibration organisation

"Over the last years our main markets have been the USA and the EU. We are now seeing a rise in demand in India and China"

Pyranometer application example: indoor solar exposure testing

Hukseflux Thermal Sensors headquarters in Delft, the Netherlands

PES: Is data availability important in solar radiation measurement, please can you expand on this and your solutions?

KvdB: Talking of measurement uncertainty in an outdoor environment, there are situations when the instrument does not work within its rated operating conditions. For example, a regular pyranometer with dew deposition on its dome will not correctly measure the solar radiation. There is no standard vocabulary for this situation, but we at Hukseflux say that there is no data availability then. You might also say that its uncertainty is very large or mark it as "unreliable". The traditional standardised operating practices say that ventilation of a pyranometer is a good solution. What these standards do not mention is that this ventilation is effective only if the air is dust-free, and that you have to regularly clean and change filters. For traditional pyranometer users, in science and meteorological institutes, this is no problem, but for the cost-over-lifetime-conscious PV industry we think it is not a good enough solution. We therefore developed heated instruments, which is effective both against dew and frost but at a lot lower power consumption and without the need to change filters. Having said that, instrument cleaning remains necessary at fixed intervals, certainly in environments with dust and snow.

PES: Geographically speaking, where are the key markets for Hukseflux and do you have any plans for expansion into other areas?

KvdB: Hukseflux is already active worldwide. Our main customers are specialised monitoring companies. These companies might order from the EU or the USA, but the instruments end up all over the world. Over the last years our main markets have been the USA and the EU. We are now seeing a rise in demand in India and China.

PES: Which aspect of the industry provides the most satisfaction for you right now?

KvdB: What I like is that the industry really "pulls", that it asks for innovation, new product features, new services.

PES: And conversely, what presents you with the biggest challenges?

KvdB: We have invested a lot in making products with better data availability, easier to calibrate and service and also in our worldwide calibration and servicing organisation. We sometimes find it difficult to convince all involved parties to put cost over lifetime and data availability on the agenda. The purchasing is not always in the hands of the party that operates the PV system. Our challenge is to convince the purchaser to take these benefits into account.

PES: You said that you invested in your calibration and servicing department. Is there any news on your product portfolio?

KvdB: Yes, certainly. We released the SR05 pyranometer earlier this year, an affordable sensor that is easy to install in small PV systems. Now we will launch a new secondary standard pyranometer: SR30. Our engineers have succeeded in giving SR30 unique features to attain the highest measurement accuracy and data availability, whilst having a surprisingly small footprint. It adheres to the upcoming standards. We are very excited about these next level pyranometers.

PES: What are your thoughts about prospects for the rest of 2016 with regard to your organisation and the solar/PV industry in general?

KvdB: We keep a close eye on the worldwide PV markets and find it very unpredictable, mostly depending on local tax policies that often only receive last-minute confirmation. Hukseflux believes in the usefulness and long-term growth of PV monitoring. It is an essential industry building block, which will become ever more accurate and at the same time more affordable. This is not a contradiction. We, the Hukseflux organisation, do our best to make this possible. ■

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