

Newsletter **40**

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If you have a news item for the newsletter or want to share your experiences with Kipp & Zonen applications and contribute to our next issues, please e-mail the editor: kelly.dalu@kippzonen.com

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Kipp & Zonen B.V. - 2017

Solar-Tech innovations inspired by rice fields

In emerging economies provision of electricity at a local level is a major problem. How to reduce the expensive import or transport of fossil fuels? How to provide energy locally, in an environmentally clean and sustainable manner? How to do that based on a cost-effective distribution network?

These are examples of the issues that can be resolved by installing solar generating plants as a source of energy. Just imagine a remote village, way off the grid and with limited transport connections, that is in need of affordable power. Suddenly, these philosophical issues become real.

I recently visited such a place in Thailand, where a remote rural community growing rice in paddy fields was equipped with a solar energy power plant. The beautiful setting is illustrated in the picture!

However, as in many rural environments, rice farming poses soiling problems for PV panels. Traditionally, in Southeast Asia the rice stubble is burned each year, between February and the April rains, to prepare the land for the next crop. This produces enormous air quality issues and leaves layers of ash on the PV panels, severely reducing their performance. In drought periods, dust storms can cover everything, posing another problem to both energy consumers and investors.

While Kipp & Zonen products are widely known for their quality and reliability in measuring the potential output of a solar power plant, it became clear to me that users could benefit from new, smarter, instruments - solar-tech innovations that will inform operators and investors accurately about actual and potential performance loss. The paddy fields thus provided insights into new ways that Kipp & Zonen could improve its solar irradiation monitoring systems into even better and more relevant solutions.

I invite everybody to visit us at Intersolar in Munich from 31st May to 2nd June to see how we transferred paddy field problems into new product solutions. Register at www.kippzonen.com/intersolar to make sure you don't miss an exclusive preview.



Erik Valks
CEO Kipp & Zonen

The Deutscher Wetterdienst reviews the RaZON⁺

Reliable high-quality measurements and observations are essential for weather forecasting, and for the climate and environmental services of the Deutsche Wetterdienst (DWD). DWD performs research in these areas to continuously improve its operational measurement systems and networks according to the state-of-the-art in science and technology. Therefore it came as no surprise that DWD was one of the first customers to purchase our new RaZON⁺ all-in-one solar monitoring system.



Klaus Behrens oversees the Radiation Processes Group at the main DWD research site, Meteorologisches Observatorium Lindenberg - Richard Aßmann-Observatorium (MOL-RAO), which has been at the leading edge of meteorological research since 1905. Lindenberg is one of the earliest Baseline Surface Radiation Network (BSRN) sites and is also a member of the European Skynet Radiometers Network (ESR) with the POM-02 and hosts at least one of the DWD Brewer spectrophotometers.

Lindenberg carries out inter-comparisons of many types of instruments, including UV radiometers and scintillimeters. The observatory is equipped with many scientific instruments to study and characterize physical processes in the atmosphere, and one of the most important measurements at the observatory is the measurement of solar, atmospheric and terrestrial radiation. The energy balance between the Earth, the sun and space is monitored by Kipp & Zonen instruments at the BSRN station.

Associated with Lindenberg is the Meteorological Observatory Hohenpeissenberg, which is the world's oldest mountain observatory, dating back to 1781. Situated 80 km southwest of Munich in the foothills of the Alps, the Observatory is a major Global Station of the Global Atmospheric Watch programme and also has Brewer instruments to monitor the health of the atmosphere.

Now, the Lindenberg Observatory is evaluating our latest innovation - the RaZON⁺. Mr. Behrens says; "It is a completely new and interesting approach to solar radiation measurement, with new instruments. It uses a concept of data acquisition and distribution that is still not so commonly used in the field of radiation measurements.

When the RaZON⁺ was delivered in December the winter was not yet in full effect, which allowed us to mount the system to the platform immediately and start making measurements. I'm happy that we were able to gather experiences about the system during winter with harsh conditions and low sun, up to the summer period. This helps us to test this new measurement approach, and its features, and to compare it with the more traditional equipment; such as our BSRN station with both ZAP and SOLYS2 sun trackers.

The installation of the RaZON⁺ was that easy that we did not even use the manual! We just fixed it to the platform, switched it on and it was ready to go. We did have some difficulties setting the RaZON⁺ up in our network infrastructure but quickly found a workaround to read the data from the network. The fact that it has an integrated data logger inside was very convenient.

It is too preliminary to make any judgements yet about the measurement data because we are still emerging from winter-time, however we can say that the global radiation information given by the RaZON⁺ is in good agreement with the data received from the CM22 we use in our BSRN routine. We look forward to evaluating the RaZON⁺ performance when the sun shows more of itself."

More information about the observatory can be found (in German) at www.dwd.de/mol.

We thank Mr. Behrens for his review and look forward to learning more about the DWD RaZON⁺ measurements in the summer ■



Passion for Precision

Everything a technical advisor wants to know about RaZON⁺

My name is Patricia Darez; I am a Director of 350renewables, which is a consultancy that specialises in providing technical and commercial advice to investors, operators and developers of renewable energy projects from the early stages through to full operation. Our main offices are currently in Chile, since we have a strong presence in the Latin American market. I recently interviewed Marc Korevaar, Physicist at Kipp & Zonen, about the new product RaZON⁺ that was launched last year.



Patricia Darez, www.350renewables.com

Congratulations on the new product, I haven't had a chance yet to test it out in the field but I already like the name (in Spanish it translates as 'Reason'). Could you introduce the RaZON⁺ and tell us a bit about how it works?



Marc Korevaar, Kipp & Zonen

The RaZON⁺ is an ALL-IN-ONE Solar Monitoring System that was developed and engineered by a dedicated team at Kipp & Zonen. Apart from the Spanish meaning we also chose the name because ZON means sun in the Dutch language.

The system gives the three components of solar radiation; direct, diffuse and global. Direct and diffuse are measured and global is calculated, using the time and location data from the integrated GPS receiver. The on-board microcontroller performs the calculations and logs the data. It also allows for communication through four-wire RS-485, Ethernet or the optional Wi-Fi.

The RaZON⁺ is more resistant to soiling than traditional systems, mainly because of the way the PH1 pyrheliometer is designed. The PH1 and the PR1 pyranometer are Smart instruments with a fast response that can follow rapidly changing levels of irradiance. However, there is also the option to go for even higher performance, using a SHP1 first class pyrheliometer and a SMP10 secondary standard pyranometer (with an adapter kit).

Sometimes, there is a divide between pre-construction and operational measurements. For which type of customers and in what situations would you recommend to use RaZON⁺?

We would advise using the RaZON⁺ as an accurate and cost-efficient solution for solar energy and meteorology applications. For solar energy we expect it to be deployed on both prospecting and operational sites, where the low maintenance and ease of use are an added benefit. For prospecting, the possible absence of a logger infrastructure is no problem for the RaZON⁺ as it comes with an on-board data storage that does not need any additional setup.

RaZON⁺ also gives you all of the three components of solar irradiance which enables you to find the best installation angle for your panels depending upon the typical sky conditions. For overcast conditions there is only diffuse radiation and horizontally positioned panels are optimal; whereas, for clear skies, panels normal to the direct sun are ideal.

For operational sites the option to connect the RaZON⁺ directly to the SCADA system, either through Modbus[®] RS-485 or Ethernet, is attractive. An auxiliary Modbus[®] input enables the connection of compatible plane-of-array pyranometers, PV panel temperature sensors and all-in-one weather stations.

I like the idea of a system that comes with an integrated data logger. If this arrangement is flexible enough and takes care of the customer requirements, it is a very effective way of minimising interface problems within the system (they can often take a lot more time than one budgeted for!). What are the main improvements when compared with a 'more traditional' measurement approach?

The main improvements are easy connectivity during installation and operation. During installation there are less cables involved, just serial data and 24 VDC power. For operation it is because the system can be remotely accessed to check data and status.



Patricia Darez inspecting modules and soiling patterns in the Atacama Desert

There is also the possibility for a more sophisticated interaction between the Smart instruments and the Smart sun tracker in future versions of the system.

Are there any drawbacks?

A drawback could be in transferring from the old type of infrastructure, with analogue signals and a separate data logger, to an all-digital new one.

In the Atacama Desert, we often work with stations that do not have regular maintenance due to their remote location, How do you ensure that the soiling is minimised, and how much maintenance does the system require?

The unique design of the PH1 pyrliometer has no front window for the collimation tube and a diffuser in front of the thermopile radiation sensor. This reduces sensitivity to soiling and has been demonstrated in testing. In addition, the detector assembly is easily removed from the collimation tube without tools, for cleaning the diffuser.

Because the shaded PR1 pyranometer does not see the direct beam from the sun, and measures diffuse light from all directions, it is less susceptible to soiling particles blocking part of the light through the dome. PR1 has a similar diffuser and thermopile sensor to the PH1.

There is no need to change any desiccant as both instruments are sealed. The expected maintenance interval is much longer than with traditional systems.

One of the main issues to consider with measurements is the quality of the data and the uncertainties related to the measurements. For the technical advisors like us (or even technical departments within a company) it is often clear what the best ways of measuring are, but the reality of corporate life is that it is difficult to justify spending money if the investment does not reflect a reduction of uncertainty which makes the project more valuable. What sort of studies have you done to help with such decisions?

One of the main reasons RaZON⁺ can be interesting is that it offers a very simple and cost-effective way to get good quality measurements. Additionally, the system offers an output of the sun position that can be used for other applications, such as to control PV panel trackers or solar concentrators, which can reduce costs.

We have also introduced our Suncertainty mobile app that calculates the uncertainty of global irradiance measurements by different Kipp & Zonen pyranometers under varying measurement conditions. This includes the RaZON⁺ and you can see that, due to the calculation of global from the measurement of direct and diffuse, the directional error is a lot smaller. This reduces the uncertainty under clear sky conditions when the sun is closer to the horizon. Suncertainty shows that a RaZON⁺ can lower the uncertainty of the whole solar measurement chain.

The Suncertainty app is a free download from the App Store and Google Play ■

Ventilation case study in Finland

By Mikko Pitkänen, Research Scientist at the Finnish Meteorological Institute and Clive Lee, Technical Sales & Service Manager at Kipp & Zonen

FMI has an Atmospheric Research Centre in Kuopio, a city in the lakes region of Eastern Finland. On the roof of the building is a solar radiation measurement site and, at ground level, an automatic weather station (the station name is Kuopio Savilahti). You can find out more about the Centre at en.ilmatieteenlaitos.fi/atmospheric-research-centre-of-eastern-finland.

Kipp & Zonen radiometers were used for a case study on the effects of different types of ventilation units on keeping pyranometers clean, especially in the winter conditions of snow and rain showers, freezing rain, frost and other situations.

Three CM11 pyranometers were each fitted with a different ventilation unit, Kipp & Zonen CVF3 and CVF4 models and a custom-made design; all of which were continuously heated. A fourth CM11 was not ventilated and served as a control for the comparison.

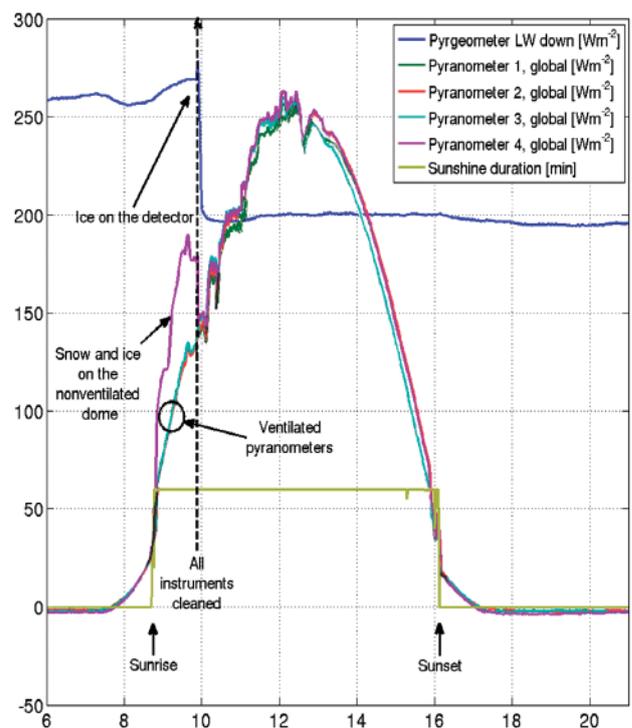


CM11 without ventilation, 2nd February 2017

All the ventilation units performed well in keeping the domes clean and preventing the main effects of bad weather on the radiation measurements. There was an example in February of frozen sleet when all ventilation units successfully evaporated the accumulated sleet on the domes.

In this case, the unventilated CM11 was reading high by up to 38% before it was cleaned (see photo).

In the graph, Pyranometer 4 is the unventilated CM11. Additionally shown are CM11 + CVF4 (Pyranometer 1), CM11 + CVF3 (Pyranometer 2) and CM11 + custom ventilator (Pyranometer 3). The pyrgeometer is an unventilated CGR3 and the effect of ice on the window is shown.



This initial review of the case study results demonstrates the necessity of using a ventilation unit and heating with pyranometers in Finnish winter conditions ■



CVF4 Ventilation Unit

Hands-on experience with the RaZON⁺ in Italy

By Antony Giles, Marketing and Technical Support at Eurelettronica Icas Srl, Italy - When Kipp & Zonen launched RaZON⁺ last year we knew right away that we wanted to present it at the Festival Meteorologia in Rovereto in November 2016. This is a unique event, organized by the University of Trento, which gathers together all the Italian stakeholders in Meteorology. It was the perfect opportunity to show the new all-in-one solar monitoring system to our meteorological customers.

At the festival we were able to demonstrate the instrument in a dedicated area, with a simulated test installation. The setup was surprisingly fast and very straightforward. Following the instruction manual, the system was collecting data within one hour of opening the box. Connecting to the RaZON⁺ via smartphone was easy and convenient, and enabled us to check the device status and complete the configuration without making cable connections. Customers also appreciated the Wi-Fi connection that was used for the initial setup before connecting the device to a PC.



RaZON⁺ is the perfect choice in the solar energy industry for the evaluation of the performance and reliability of PV modules and when there is the need for a reliable system, to provide accurate data for DNI, GHI and DHI. RaZON⁺ features low maintenance requirements and the pyrhelimeter design will maximise the intervals between cleaning at an unmanned site.

The first RaZON⁺ sold in Italy is to EURAC, the European Academy of Bolzano, and it will be installed in 2017. EURAC has been using Kipp & Zonen solar monitoring equipment for several years. We expect that the RaZON⁺ will be most appreciated for educational purposes and we look forward to working more with RaZON⁺ systems in Italy.

Please visit www.eurac.edu to find out more ■



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Eurelettronica Icas was founded in 1961 to introduce innovative technologies in the fields of oceanography and meteorology. The company has competencies in project management, integration, sales, installation, technical support and training; for a range of applications. Eurelettronica has been the Italian distributor of Kipp & Zonen products for many years and is the Representative and Certified Service Partner of Vaisala; with installations ranging from synoptic sites for meteorological services, to airports, motorways and solar energy.

Please visit www.eurelettronicaicas.com

Fairs & Events

SNEC 2017 PV POWER EXPO • Shanghai • China	19 - 21 April
Intersolar Europe • Munich • Germany	31 May - 2 June
ASEAN Sustainable Energy Week • Bangkok • Thailand	07 - 10 June
Weather Climate Water Earth Observations Green Economy • St. Petersburg • Russia	14 - 15 June
ICEM • Bari • Italy	27 - 29 June

Passion for Precision

Passion for Precision

Kipp & Zonen is the leading company in measuring solar radiation and atmospheric properties. Our passion for precision has led to the development of a large range of high quality instruments, from all weather radiometers to complete measurement systems.

We promise our customers guaranteed performance and quality in; Meteorology, Climatology, Hydrology, Industry, Renewable Energy, Agriculture and Public Health.

We hope you will join our passion for precision.

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