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Solar Simulator to Test PVT Performance
Getting Smarter: New SHP1 Pyrheliometer

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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. - 2012

Solar Minded

It is amazing how fast time flies; its July already. Solar Energy is taking an increasingly important position in our company. We follow all the discussions in renewable energy on related costs, governmental policies, funding and feed-in tariffs.

Personally, I'm convinced that solar energy will become a very important source of energy and that technological development will, step by step, bring the efficiency to a highly competitive level. Of course there are mechanisms that might slow down the growth rate in the market; such as temporary lower fossil energy prices, but the trend is still up, as is the overall demand for energy.

Last June Kipp & Zonen attended Intersolar in Munich, the world's most visited conference and exhibition for solar energy. We had two real novelties to show to the public, a new instrument and our corporate video. In 5 minutes the new video shows you all you need to know about us. The real essence of our 'Passion for Precision'. The video is also available on our website and YouTube channel: www.youtube.com/kippzonen.

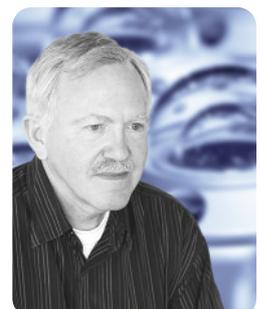
At Intersolar we introduced the next product in our expanding range for measuring solar radiation intelligently, the SHP1 Smart Pyrheliometer. Together with the SMP3 and SMP11 Smart Pyranometers we now offer a complete digital instrument set specifically tailored for the solar energy market. Please read the full story in this newsletter.

Other articles show different aspects of the application of our instruments in the solar energy market. It varies from testing photovoltaic modules via solar budget assessment to plant control and management. In this one newsletter we cover all aspects of the solar market.

I hope you enjoy reading the newsletter and that it will give inspiration for new applications and projects with our products.



Ben Dieterink, President
Kipp & Zonen B.V.



Four SOLYS 2 Sun Trackers at ACCIONA's Palma del Río I & II CSP Plants

Thanks to our Spanish distributor Dilus Instrumentación y Sistemas S.A. we had the unique opportunity to shoot part of our new corporate video at two Concentrating Solar Power Plants of ACCIONA Energy; Palma del Río I and II. The two are identical plants right next to each other. Together they have four of our SOLYS 2 sun trackers in operation to provide the control rooms with input of the real-time direct, global and diffuse solar radiation.



ACCIONA Energy is a leading company in the development of renewable energy sources. The company has installed 9,766 MW for clean energy generation of which it owns and operates 8,211 MW in 13 countries. The company works in a wide range of clean technologies; wind, hydro, CSP, photovoltaic, biomass, biodiesel and bioethanol.

ACCIONA Energy is one of the world's top firms in concentrating solar power, owning a total of 264 MW of capacity in four operational plants in Spain and one in Nevada (USA). With the opening of Orellana (Badajoz, Spain) this summer, a total capacity of 314 MW will be reached in 2012. That means more than one million mirrors and enough power to supply around 170,000 homes.

Located in the municipality of the same name in Cordoba province, Palma del Río I went into service in 2011, seven months after its 'twin' plant Palma del Río II, situated alongside it. The two Palma del Río plants generate renewable energy equivalent to the consumption of around 70,000 homes a year, avoiding the emission of approximately 220,000 metric tons of CO₂ into the atmosphere from conventional coal-fired power stations. Together, the plants have a solar field of 270 hectares with a potential of 100 MW.

Palma del Río I and II are based on parabolic trough technology. This consists of mirrors installed in rows that concentrate the sun's rays into pipes where a fluid is heated to around 400 degrees Celsius. This energy is then used to produce steam and drive a conventional turbine that, connected to a generator, produces electricity.

Like the plants, there are also 'twin' platforms, both with two of our SOLYS 2 sun trackers. In 2011 Dilus installed the platforms for weather and solar radiation monitoring at the power plants. On each platform there is one SOLYS 2 sun tracker with pyrheliometer for direct radiation, a pyranometer for global radiation and a shaded pyranometer for diffuse radiation. The second SOLYS 2 sun tracker functions as a back-up and only measures direct radiation with a pyrheliometer. The measurement data is stored and transferred to provide the control room with real-time inputs to monitor the yield of the CSP plant.



The result of filming two days at ACCIONA's CSP plants can be found on www.youtube.com/kippzonen and shows the greatness and beauty of it. Thank you ACCIONA Energy for your hospitality and thank you Dilus for all the assistance in preparation and during our stay at Palma del Río.

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For more information about Acciona Energy go to www.acciona.com and for Acciona Concentrating Solar Power (CSP) plants in Spain, http://www.acciona-energia.com/activity_areas/csp/installations/plantsinspain.aspx ■



Passion for Precision

Measuring Irradiation is Critical to PV Projects in Chile

By Patricia Pérez CEng, MEng, Senior Energy Analyst at Mainstream Renewable Power



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Chile is located in South America, between high mountain ranges and the coast. The geography of the country covers at least seven major climatic subtypes ranging from the driest desert in the world, the Atacama, to alpine tundra and glaciers in the south. In addition, the extreme topography of the country leads to the development of microclimates.



The Andes and the Atacama desert

The Andes reach over 6,900 m above sea level and the Chilean coastal range beyond 3,000 m. Though not an isolated case, a clear example of the effects produced by microclimates is the ‘Camanchaca’, a thick coastal fog that occurs in the morning at low altitudes near the coast in the

northern part of Chile. This fog helps to create places like the Fray Jorge Forest where, in a dry Mediterranean climate area, one can see the northernmost Valdivian temperate rainforest.

From the point of view of a solar and wind energy developer, this is challenging. Currently, the biggest source of uncertainty for large scale PV development comes from the input data. Chile has very few ground stations with high quality irradiance measurements. This forces many developers to use satellite data and solar models with very little validation. The satellite data and modelled data are typically validated via high quality ground stations. However, these are scarce in Chile and leads to high uncertainties in quantifying the long-term solar resource.

This means that planning and executing a high quality measurement campaign is essential for minimising uncertainties and giving investors comfort in the accuracy of the yield of the solar plant.



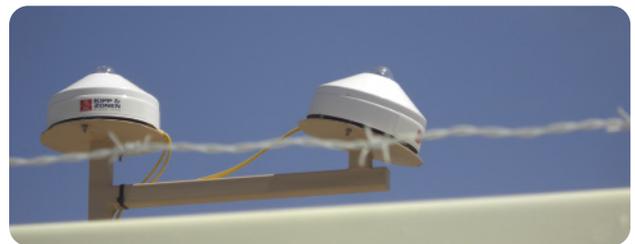
A typical Mainstream solar radiation measurement station

Mainstream is developing several PV projects in Chile, in total around 350 MW. It was clear from the start that the best way of addressing project risks was to carry out our own high quality solar radiation and meteorological measurements. This ensures that all our projects have high quality measured data that can be used with confidence in financial models.

Our measurement stations typically use two Kipp & Zonen CMP11 pyranometers to measure irradiation, both with CVF3 ventilation units. We use one pyranometer in the horizontal plane and another inclined in the same plane as the panels will be once they are installed. This adds some redundancy to the measurements and also allows us to reduce the uncertainties in the transposition models used. The CVF3's ensure that we minimise suspect data due to condensation and also reduce somewhat the need for pyranometer cleaning due to accumulated dust. We also measure other atmospheric parameters such as wind speed, wind direction, humidity and temperature.

We ensure that the equipment is regularly maintained and have local contractors servicing each station several times a week. They clean the domes of the pyranometers and the solar panel that powers the data logger and the ventilation units. They also check the silica gel desiccant in the pyranometers and the CVF3 inlet filters once a month, to monitor if they need replacements and in very remote areas they can download data to ensure we are able to carry out regular checks of the measurements.

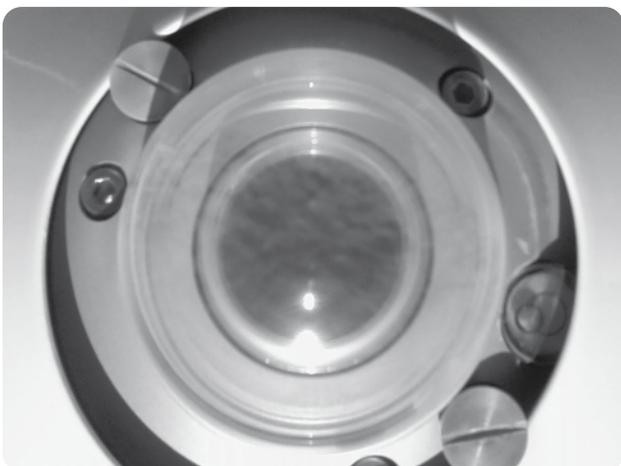
We are aware that most of the ground stations operated locally do not follow such strict standards regarding data quality and often do not have any form of a maintenance record log. As a result the consistency and accuracy of these datasets is often questionable and in addition there is higher uncertainty in the measurements. The pictures show the effect of not cleaning pyranometer domes regularly.



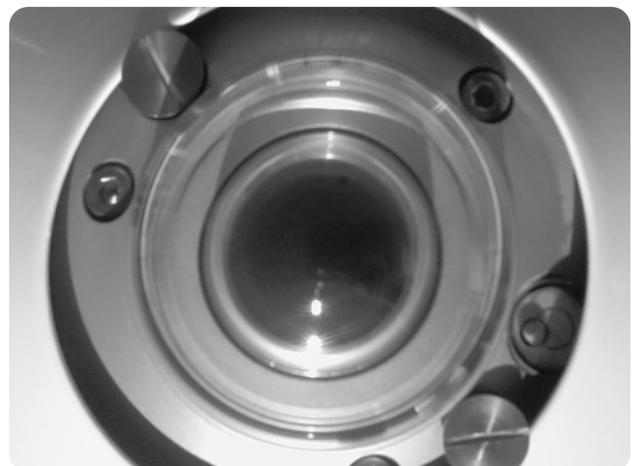
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By using equipment of the highest accuracy and regularly maintaining it, we are obtaining quality datasets with the very low uncertainty that is critical to successful solar project development.

Find out more about Mainstream Renewable Power at www.mainstreamrp.com and their projects in Chile at www.mainstreamrp.com/our-markets/onshore/chile ■



Pyranometer dome before cleaning



Pyranometer dome after cleaning

Passion for Precision

Solar Simulator to Test PVT Performance

In 2011 PSE AG of Freiburg, Germany, provided the Cologne Solar Energy Assessment Centre of TÜV Rheinland with a new steady state solar simulator. This test bench is to be used for measuring photovoltaic modules, thermal solar collectors and combinations of both technologies, known as PVT, for the first time in a sun simulator. The impressive new test bench includes a Kipp & Zonen CMP 11 pyranometer as the irradiance reference.

Under laboratory conditions a sun simulator provides photovoltaic modules or solar collectors with light from a sun-like source. This means that measurements can be performed and reproduced under precisely defined conditions which are independent of climate. The measured results help TÜV to find answers to the question of whether solar modules and sun collectors actually deliver on their promised performance and the service guarantees made by manufacturers.

The CMP 11 measures the incoming radiation at the same angle as the tested solar energy system. The data from the pyranometer is recorded and compared to the energy generated by the tested object. The CMP 11's flat spectral response and high quality ensure an accurate reading of all the incoming radiation.

In addition to the combined suitability for both solar thermal and photovoltaic modules, another special feature of this innovative test bench is the automatic shading facility. This facility means that TÜV Rheinland's experts can expose the photovoltaic modules to radiation for a specific period of time and determine the time constants of thermal collectors.

The 12 metal halide global (MHG) lamps provided by Atlas MTT GmbH have a controllable radiation power of up to 1,200 W/m². An "artificial sky" simulates natural long-wave radiation exchange so that the heat of the lamps does not affect the measured results.

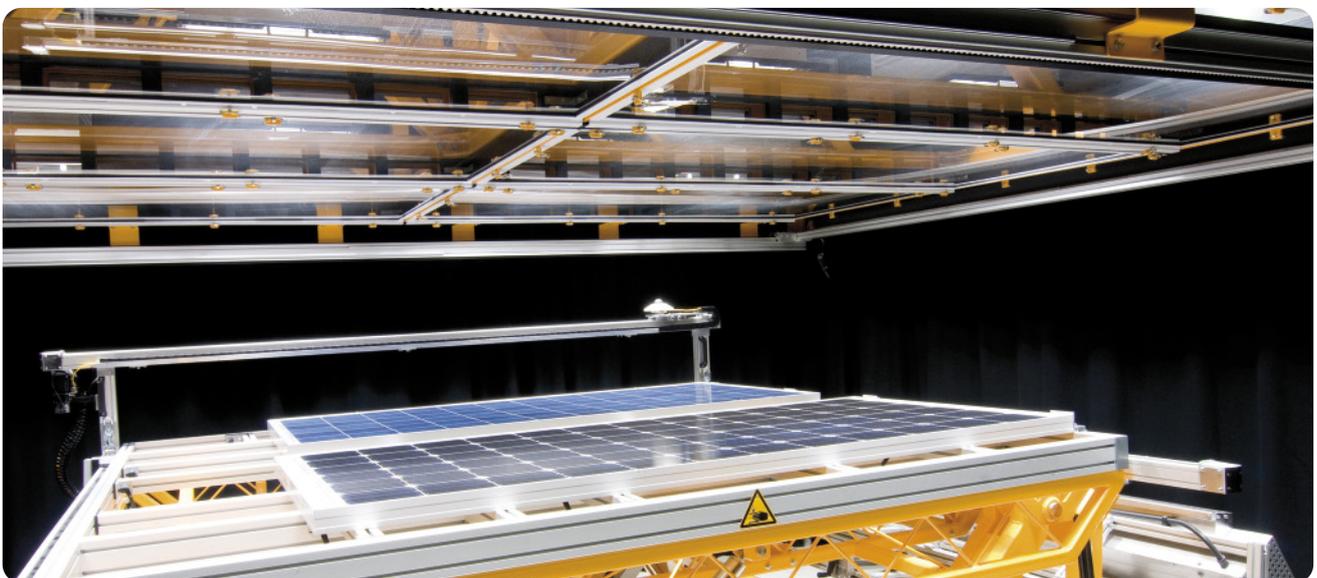
These high-performance radiation sources are integrated into a movable lamp holder. In conjunction with the test table that can be tilted, this allows the TÜV Rheinland inspectors to implement various test configurations, using angles between 0° and 45°. As the photovoltaic module and thermal collector test surfaces may require different alignments for the measurements, two independent test tables are needed.

TÜV Rheinland is a leading global independent test provider with a history stretching back 140 years. The Group maintains a presence at 500 locations in 65 countries with 16,000 employees. Their independent experts stand for quality and safety for people, the environment, and technology in nearly all aspects of life.

PSE AG provides solar test equipment and consulting services to international customers. PSE test benches are used by institutes and manufacturers for performance and quality testing as well as for certification in accordance with international standards. The company was founded in 1999 as a spin-off from the Fraunhofer Institute for Solar Energy Systems (ISE).

Find out more about the PSE at www.pse.de and TÜV Rheinland at www.tuv.com ■

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Getting Smarter: New SHP1 Pyrheliometer

Following the success of the smart SMP3 and SMP11 pyranometers, we proudly present the new SHP1 pyrheliometer. This radiometer for measuring Direct Normal Irradiance (DNI) is based on our well-known CHP 1 model, but improved and 'smarter'. The SHP1 has additional interfaces, faster response and improved temperature specifications.



Like the SMP series, the SHP1 pyrheliometer has an amplified analogue output and digital RS-485 interface with Modbus® protocol. All SHP1 pyrheliometers have the same calibrated output range, which makes it easy to exchange instruments. In addition to the irradiance value in W/m², temperature and power supply voltage are available over the serial bus. The analogue output can be either 0 to 1 Volt or 4 to 20 mA. The SHP1 requires very low power from a supply between 5 and 30 VDC and is protected against over voltage, reversed polarity and short circuiting.

Each SHP1 is temperature tested and the data is used to create an individual correction for the change in sensitivity with temperature over the range from -40 °C to +70 °C. A smart algorithm improves the response time to 2 seconds. The quartz window gives the SHP1 a spectral range from 200 nm to 4000 nm.

The SHP1 comes with PC software for setting the Modbus® parameters (such as the instrument address) and logging and visualising the data. The SHP1 is equipped with a rain shield and alignment aids. Like all pyrheliometers, an automatic sun tracker is required to point it accurately at the sun.

The new smart SHP1 pyrheliometer will be available to order from July 2012 ■

The APAC Office Reinforced by Lindy Toh



We welcome Lindy Toh to the Kipp & Zonen family! She is the new Sales Support Administrator at our Asia Pacific office in Singapore. Along with supporting all our customers and distributors in the APAC region, she will be assisting Gene Phay with the office administration, processing paperwork, phone calls and inquiries.

Lindy has built her expertise at Horiba Instruments over the past 14 years, where her responsibility was environmental instruments; including gas analysers, water quality testers and pollution. Now she is excited to learn all about a different environmental area, the field of solar radiation.

In May we had personnel from all our sales offices over in Delft to meet up, exchange experiences and to learn about future plans and projects. Lindy also joined us and met all her new colleagues at the headquarters. "I'm so happy to see the factory and meet everyone in person. This meeting will ensure a fruitful co-operation with the team and shortens the distance between our offices".

Lindy expects to make a great team together with Gene and looks forward to learning new things and travelling to the exhibitions we plan to attend in Asia Pacific this year. If you have the opportunity, Lindy will be glad to meet you there ■

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Fairs & Events

International Radiation Commission Berlin, Germany	5 - 12 August 2012
Asia Oceania Geosciences Society Conference Singapore	13 - 17 August 2012
12 th EMS Annual Meeting Lødz, Poland	10 - 14 September 2012
Meteorology Technology World Expo Brussels, Belgium	16 - 18 October 2012

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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