

The National Renewable Energy Centre of Spain -CENER- is a technology centre specialized in applied research and development as well as the promotion of renewable energies. CENER is divided into six departments: Wind Energy, Photovoltaic Solar Energy, Solar Thermal Energy, Biomass Energy, Bioclimatic Architecture and Renewable Energy Grid Integration.

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CALIBRATION OF FIELD PYRANOMETERS BY COMPARISON TO A REFERENCE PYRANOMETER



Accurate and precise measurements of global (hemispherical) solar radiation are required in a lot of applications such as the testing of solar collectors, meteorological and resource assessment measurements, assessment of the direct versus diffuse solar components for energy budget analysis, geographic mapping of solar energy, and also can help in the determination of the concentration of aerosol and particulate pollution effects of water vapor .

A pyranometer with a well-known response and calibration is required to achieve accurate and precise measurements. CENER Solar Thermal Testing Laboratory is the first and only one in Spain to be accredited for calibration of field pyranometers by comparison to a reference pyranometer according to the International Standard **ISO 9847:1992**.



CALIBRATION FACILITIES

The calibration tests are performed outdoors on a horizontal mounting position, suitable for meteorological and resource measurement equipment. The test measurements are performed at the CENER BSRN radiometric station located in Sarriguren (Navarra).

Well-maintained secondary standard pyranometers are used as reference pyranometers, with high long-term stability and well-characterized dependence of its responsively on temperature, irradiance tilt and angles of incidence.

Reference pyranometers are traceable to the World Radiometric Reference (WRR) at the World Radiation Center (PMOD-WRC, Davos-Suiza).



CENER Pyranometer calibration facilities

STANDARD ISO 9847:1992

According to the ISO 9847:1992, there are 3 possible meteorological conditions for the horizontal calibration of field pyranometers by comparison to a reference pyranometer : stable cloudless sky conditions, unstable sky conditions with some cloud, and cloud sky conditions. Each of these typologies has different features for the measurements: minimum number of days and series.

Once enough was data acquired during the calibration period, the data processing consists of reading, filtering, data correction, and finally averaging calculation of calibration factor and its corresponding uncertainty. The calibration factor and its associated uncertainty, and weather conditions in which the calibration has been performed, is reflected in the corresponding calibration certificate.



CENER BSRN radiometric station

APPLICATIONS

Among the main applications currently pyranometers be highlighted:

- Evaluation studies of solar radiation for its energy use. The current situation both domestically and internationally to promote solar power plants, either photovoltaic or thermoelectric, has promoted a significant increase in demand for this type of sensors.
- Testing installations and laboratories. In many centers and test facilities that perform activities related to solar radiation, thermal or photovoltaic use.
- Automatic weather stations for agrometeorological networks or related crops. There is a significant relationship between solar radiation and plant growth. This variable also has an important effect on evapotranspiration and thus soil in irrigation systems.

In cases where the pyranometer are located in the open is recommended annual calibration of them. In some laboratory uses this calibration can be extended to a longer period of time depending on the actual use of the pyranometer.