European Metrology Research Programme

Delivering Impact

New standards for solar power

Europe aims to generate at least 32% of energy from renewables by 2030 and solar power will significantly contribute to meeting this target. It has been estimated however that for each percentage point of uncertainty between the predicted to actual energy yield by photovoltaics equates to a financial uncertainty worth €500 M a year globally. Decreasing this will reduce financial risks for investors and stimulate uptake of this technology.

Europe's National Measurement Institutes working together

The European Metrology Research Programme (EMRP) brings together National Measurement Institutes in 23 countries to address key measurement challenges at a European level. It supports collaborative research to ensure that measurement science meets the future needs of industry and wider society.

Challenge

The EU's renewable energy directive sets a binding target that at least 32 % of energy consumed in Europe comes renewable sources by 2030.

Electricity generated from solar cells, also known as photovoltaics (PV), will have a vital role but will require an increased uptake of PV technologies. Operators of solar parks need accurate forecasts of the energy likely to be generated from PV modules and since the 1980s such estimations were based on the claim of a module's peak power output, as measured under Standard Test Conditions (STC).

However, STC measurements are based on single, fixed values for module temperature, solar irradiance and solar spectrum characteristics. These affect the energy output from a cell but do not reflect the actual operating conditions in Europe where a range of climates are present.

This can result in a module generating less electricity than has been predicted under STC measurements which can lead to uncertainty when installed in solar parks. This mismatch has financial implications and it has been estimated that each percentage point of uncertainty between the predicted and actual power output equates to a financial uncertainty worth €500 M a year globally.

Incorporating improved measurements for PV performance, that better reflect the energy a module produces during its lifetime, are needed to reduce this economic burden.

Solution

The EMRP project *Towards an energy-based parameter for photovoltaic classification* (PhotoClass) set out to develop a new metric for PV devices more representative of real-world operating conditions.

The project examined various factors effecting the energy output of PVs including the angle of light striking the cell and module temperature. The spectral response over a wide range of irradiances was examined, suitable for PVs that incorporate non-silicon technologies. New measurement facilities were then developed, and the data was validated with robust links to the SI. Based on ground and satellite information the effects of climate at various latitudes around Europe on PV output was assessed - allowing the creation of a Climate Specific Energy Rating (CSER) for solar cells. These new measurement methods, combining device properties, tabulated irradiance and environment data, generated a new energy rating based on standardized energy yields for different climate zones, rather than unrealistic peak power output for PV devices.

Impact

The International Electrotechnical Commission (IEC), that develops international standards for electrical and related technologies incorporated data from the project into three new standards of the IEC 61853 series for PV modules. These three standards, the development of which was led by members of the EMRP project PhotoClass, establish the specifications for determining PV performance, energy rating and CSER and are applicable to all PV technologies. Adherence to International standards constitutes one of the important bases for the removal of technical barriers to trade and the adherence to them is recommended by the World Trade Organisation.

Solar module manufacturers throughout the world are now beginning to produce their products using these additional measurement requirements. These new PV ratings will allow investors the ability to more closely match a module's performance to the conditions of the location under which it will be deployed, reducing financial uncertainty and stimulating the uptake of new and existing PV technologies.

New energy classifications for solar cells

The EMRP project *Towards an energy-based parameter for photovoltaic classification* (PhotoClass) measured the energy output of Photovoltaic cells (PVs) under a range of environmental parameters such as different module temperatures, solar intensities and performance at different climate zones across Europe. This allowed the development of a new model of PV rating based on energy output rather than peak power under fixed conditions. From this, new calibration devices and facilities were developed to provide improved measurement services for PV modules along with three new practice guides. Members of the project led the development of three new international standards in the IEC 61853 series. These new PV ratings, which more closely match a cells performance to the conditions under which it will be deployed, will decrease financial risk for investors, increase confidence and aid in the competitiveness of this technology.

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