ENERGETICS

Edison S.p.A. - Advanced analyses for the performance characterisation of photovoltaic systems with innovative technologies in outdoor conditions

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Context of the research activity	The continuous decrease in the cost of photovoltaic modules generates so low levelized costs of energy as to become the cheapest technology for electricity production in many regions. The accurate and long term measurements of conversion efficiency and improved mathematical models are required to test the most promising semiconductor materials for solar cells, as for example mono-crystalline silicon hetero-junction with amorphous silicon, all back contact cells, bifacial cells, perovskite cells.

Objectives	This doctoral research is in an industrial collaboration with company Edison S.P.A. aiming to conduct an advanced characterisation of the performance of photovoltaic generators based on unconventional technologies, with particular reference to commercial and prototype photovoltaic modules based on innovative materials and new cell architectures. The research activity will include the development of advanced methodologies for analysing the performance of photovoltaic modules and will use software tools implemented in the Python environment. In addition, the study will be based on experimental data acquired in long-term campaigns both in the field and in outdoor experimental measurement stations. The candidate will adopt numerical optimisation methods and/or unconventional statistical approaches to determine the main performance parameters of photovoltaic modules. In particular, the candidate will focus mainly on the application of advanced methodologies for the comparative analysis of different crystalline silicon photovoltaic technologies installed in multi-MW plants in operation, in terms of energy yield, equivalent hours, thermal performance, bifacial performance, non-linearity under low irradiance conditions and, possibly, degradation. The candidate will be able to compare the results obtained with estimates produced by commercial software for calculating energy productivity. In addition, the candidate will determine the performance parameters of the modules in other areas of application, such as residential installations with conventional monitoring equipment and outdoor experimental measuring stations with high-accuracy measuring systems.

	The study will focus on, but is not limited to, innovative crystalline silicon modules and prototype perovskite devices. Test protocols may be developed in collaboration with partners within the company's scientific network.
Skills and competencies for the development of the activity	Background in energy or electrical engineering, with expertise in photovoltaic technology. In particular, documented knowledge or experience with methods of processing and/or analysing data from photovoltaic fields or experimental measurement activities is appreciated. The candidate must be able to interact and collaborate with national and international companies. Programming skills are required, with added value in the Python environment.