A model capable of simulating power fluctuations in large grids of photovoltaic power stations is patented

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Iñigo de la Parra Laita, an industrial engineer of the NUP/UPNA-Public University of Navarre, has focused his PhD thesis on the grid integration of large photovoltaic power stations. Among the contributions of his research, he has developed a model that has been patented and which is capable of simulating fluctuations in photovoltaic power. As he explains, "just by knowing the irradiance recorded in one spot, the number of grouped power stations and the average surface area they occupy, we can simulate what fluctuations may take place in photovoltaic power".

Right now, one of the problems the operator is facing is the impossibility of knowing the power variations that may take place in different points of the system in which various photovoltaic power stations converge. "To find out this information one could fit power loggers at all the stations, but that is a very costly solution and, what is more, difficult because the power stations tend to have different owners".

The PhD thesis is entitled "Grid integration of large-scale PV plants". It was supervised by the lecturers Javier Marcos-Álvarez and Miguel García-Solano of the Department of Electrical Engineering and Electronics of the NUP/UPNA.

This research is part of the European "PVCROPS" project (PhotoVoltaic cost reduction, Reliability, Operational performance, Prediction and Simulation), in which institutions of 7 countries are

collaborating; the aim is twofold: to increase the quota of photovoltaic energy in Europe by up to 30% and to increase the energy efficiency of photovoltaic systems by 9% in order to cut the price of the kilowatt hour (kWh) of this origin.

Cost and profitability

Although photovoltaic facilities have traditionally been small and dispersed, today the tendency is to build large photovoltaic plants. This has also meant adopting new criteria for action (grid codes) that involve, for example, fixing the maximum variation in the power that a photovoltaic power station can inject into the power grid within a period of time.

The work by Iñigo de la Parra seeks to provide a solution for this scenario in which numerous companies are considering what they need to set up a photovoltaic plant in a place where compliance with these codes is required. "Firstly, it is clear that a storage system needs to be installed, and this thesis has quantified what these energy requirements are, in terms of both power and energy," he pointed out.

Adding a storage system to a photovoltaic plant makes the total cost (photovoltaic power station plus storage system) considerably higher, so the economic return for the investor will be slower. "That is why the smaller the required storage system is, the lower the total cost and the higher the profitability of the power station will be. The thesis shows what the minimum energy requirements are to comply with a specific grid code for any type and size of photovoltaic power station and for different control strategies". In this respect, a ramp control strategy has also been patented; it enables these new grid codes to be complied with by using the minimum energy requirements of the storage system.

Finally, another of the contributions of the thesis is to quantify the

savings of the storage system in energy terms. "The quantification is carried out bearing in mind the grouping of photovoltaic power stations, treating each one as a whole and locating the storage system at one node of the electricity grid rather than a storage system in each power station."

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