Subject 5.2 PV System Reliability and Availability

Automatic detection of PV systems failures from monitoring validated on 10,000 BIPV systems in Europe

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ABSTRACT

The installers and owners show a growing interest in the follow-up of the performance of their photovoltaic (PV) systems. The owners are requesting reliable sources of information to ensure that their system is functioning properly, and the installers are actively looking for efficient ways of providing them the most useful possible information from the data available. Policy makers are becoming increasingly interested in the knowledge of the real performance of PV systems and the most frequent sources of problems that they suffer to be able to target the identified challenges properly. The scientific and industrial PV community is also requiring an access to massive operational data to pursue the technological improvements further.

A review of the performance of more than 10,000 residential PV systems in France and Belgium, based on their monthly energy production has identified and quantified the main sources of energy losses and has drawn a general picture of the state of the art of commercial PV systems[1,2,3,4].

The existing approaches for analyzing monitoring data are based on ratios between the power of a PV system and the solar radiation that it receives at a given moment. Many of the possible causes of failures or performance problems that can provoke energy losses are not possible to detect from this kind of approaches. In the present work, we present procedures for the automatic detection of PV systems failures from the monitoring of their energy production that make extensive use of spatial and temporal correlations between PV systems. These procedures have been developped and validated on the basis of the data monitored on 10,000 BIPV systems in Europe with a temporal resolution of 10 minutes. These analyses extract information from the evolution of the performance of the PV systems over time, and use cross-relations between its components, such as inverter and PV modules. These analyses have allowed for detecting and quantifying the energetic impact of the most relevant causes of PV systems failures, such as grid-inverter interface problems (figure 1), excessive soiling (figure 2), early degradation (figure 3), shadings (figure 4), underperforming components (see refs 1-4), or poor system design or installation (see refs 1-4).

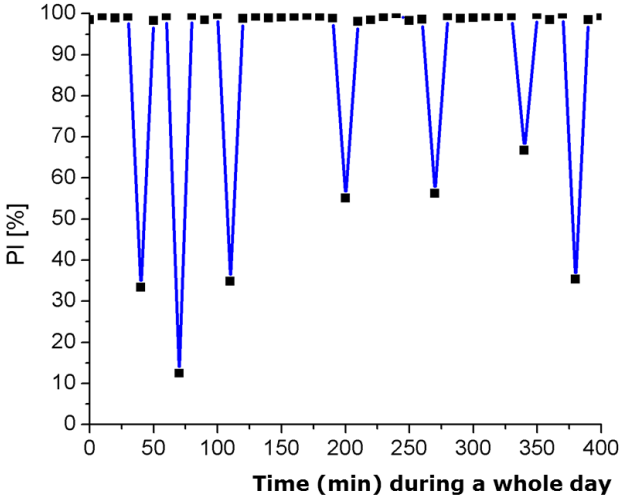

Figure 1: Frequent disconnections of the inverter from the electrical grid

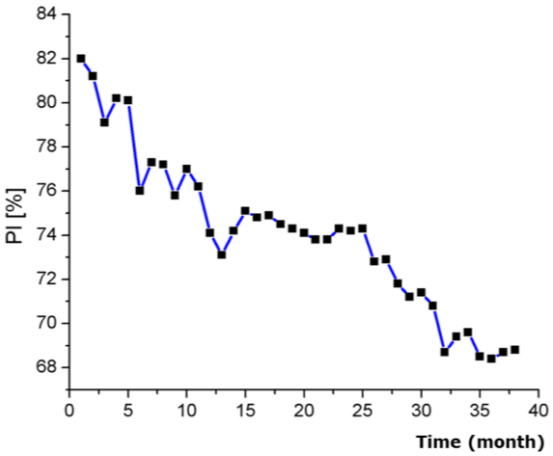

Figure 2: Early degradation of PV modules

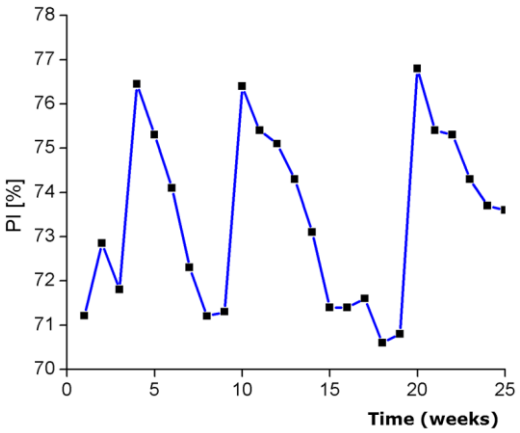

Figure 3: Rain-cleaning and dirt accumulation episodes

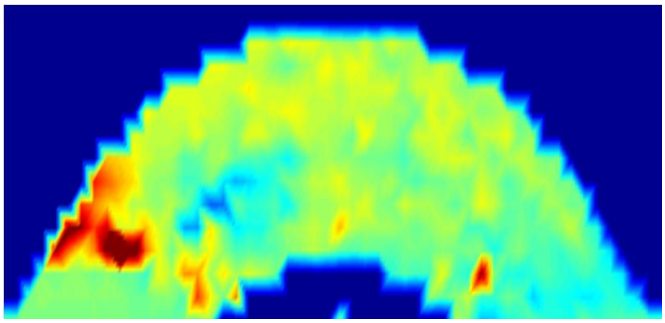

Figure 3: Detection of shading from lower performance associated to some particular solar angles

REFERENCES (click on the links to download the references)

[1] J. Leloux et al., Performance analysis of 10,000 residential PV systems in France and Belgium, 26th PVSEC, 2011 (Proceedings)
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