Introducing ‘PEARL-PV’:

Performance and Reliability of Photovoltaic Systems: Evaluations of Large-Scale Monitoring Data

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Introduction This poster will introduce an at the end of 2017 initiated COST Action entitled PEARL-PV. It show its 4-year research and work plan with the aim to create exposure, receive feedback from various stakeholders and involve new participants to this research network. PEARL-PV is the abbreviation for ‘Performance and Reliability of Photovoltaic Systems: Evaluations of Large-Scale Monitoring Data’. Namely the PEARL-PV project aims at the formation of an inclusive network of PV system researchers, data resources that will be analyzed by researchers and experts that can include more-nuanced evidence-based reliability in PV system evaluation methods and simulation and design tools.

Aims PEARL-PV aims to increase performance and lower costs of electricity produced by photovoltaic (PV) solar electricity systems in Europe via:
(i) obtaining higher energy yields,
(ii) achieving longer operational life time (beyond the 20 years usually guaranteed by manufacturers) and
(iii) lowering the perceived investment risk in PV projects.

Data These objectives will be achieved by a cooperative European COST Action partnership, see ***Figure 1***, collating and analyzing a very large aggregated set of monitored long-term PV System operational performance data, with a focus on understanding defect and failure of PV systems installed across Europe, in the context of integration of PVs facilities into grids, and the impact of regional climate characteristics on the generation of PV energy.

Data analysis This data will be used to determine quantitatively: - the absolute influences of (i) components’ rated performance, (ii) system design, (iii) installation type, (iv) operation and maintenance practice, (v) interactions with grids, (vi) geographic location and (vii) weather and climate conditions; - on (i) performance degradation over time and (ii) failure modes as they affect (i) economic viability, (ii) securing project investment, (iii) environmental sustainwability (iv) security and predictability of electricity supply and (v) diversity and distribution of electricity supply; - to (i) improve the electrical design of PV systems, (ii) achieve optimal sizing via the use of simulation models, (iii) enhance expected system efficiency, (iv) ease maintenance, (v) achieve high reliability and (vi) demonstrate excellent durability.

Method To execute the research proposed, 5 Working Groups have been set up that will conduct research using a shared data bank and shared simulation tools and models to analyze and compare these data that are collected in this data bank. The 5 Working Groups are focused on (WG1) PV monitoring, (WG2) PV simulation, (WG3) Reliability and durability of PV, (WG4) PV in the built environment and (WG5) PV in grids, see ***Figure 2***.

Conclusions Whilst the highest efficiencies for small PV cells in laboratory contexts are near 32%, commercial PV modules have a maximum rated efficiency of close to 22%. In operational PV installations these efficiencies decline further to be in the range of 13 to 17%, because a PV system is exposed to variable solar irradiation intensity and spectra, and because of various system losses. Key factors determining the optimal performance of a PV system are shown in ***Figure 3***.

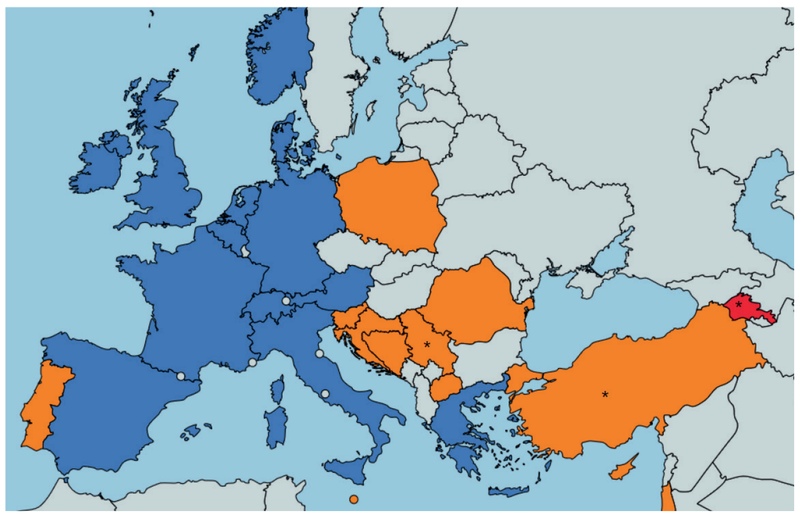

Figure 1: Countries that take part in this COST Action PEARL-PV by 22 January 2018

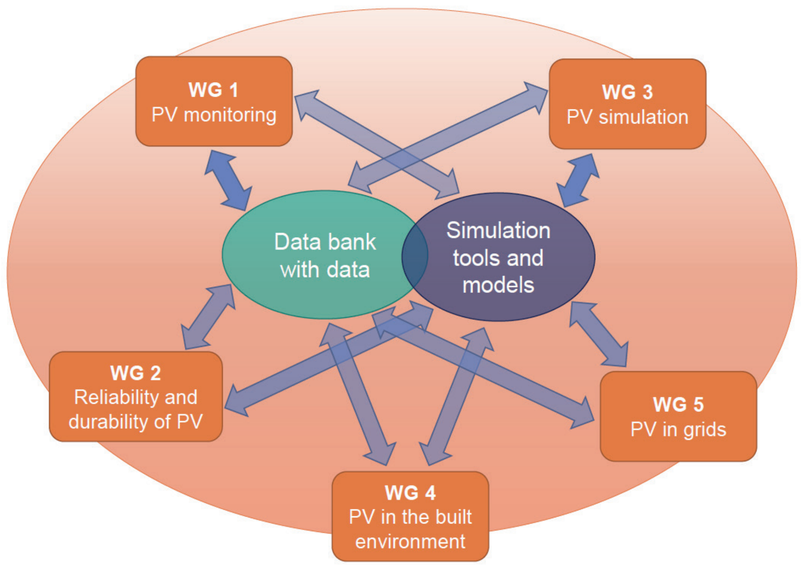

Figure 2: The 5 Working Groups of COST Action PEARL-PV in relation to a shared data bank and simulation tools.

Figure 3: Key factors that determine the optimal performance of PV systems.

Acknowledgements

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