EU COST Action PEARL-PV:

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

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Introduction The EU COST Action PEARL-PV was initiated at the end of 2017. The 4-year research and work plan is presented 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". The Action entails the formation of an inclusive network of PV researchers/experts and the **largest-ever agglomeration of PV systems performance data in Europe** that will be analyzed in order to include more-nuanced evidence-based reliability of PV system evaluation methods, simulation and design tools.

Aims PEARL-PV aims to increase performance and hence, lower costs of electricity produced by 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 long-term PV performance data with a focus on understanding defects and failures of PV systems installed across Europe. These will fall in the context of PV grid integration where the impact of regional climate characteristics on the generation of PV energy will also be investigated.

Data analysis The 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) interaction with the grid, (vi) geographic location and (vii) weather and climate conditions on the (a) performance degradation over time and (b) failure modes as they affect (1) economic viability, (2) securing project investment, (3) environmental sustainability, (4) security and predictability of electricity supply and (5) diversity and distribution of electricity supply in order 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 of 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, simulation tools and models in order to analyze and compare these data. 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***.

Summary 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***.

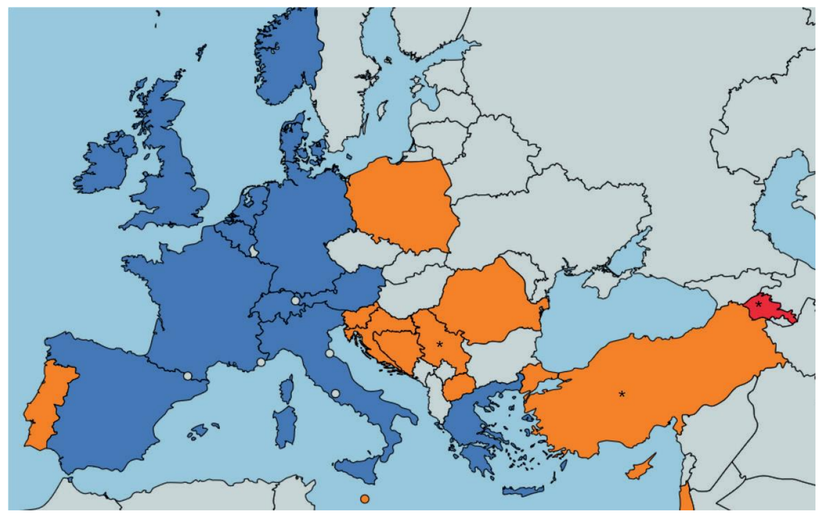

Figure 1: 26 countries take part in this COST Action PEARL-PV by 20 February 2018.

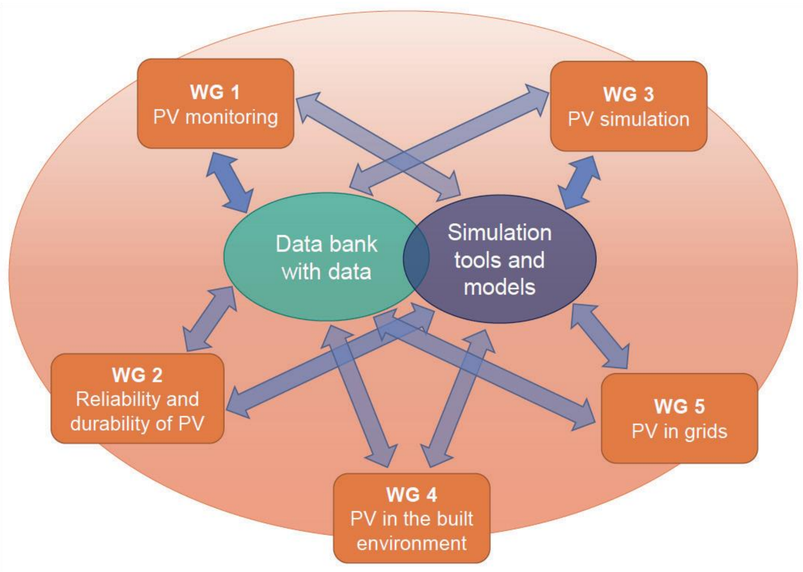

Figure 2: The 5 Working Groups of COST Action PEARL-PV in relation to a shared data bank and simulation tools.

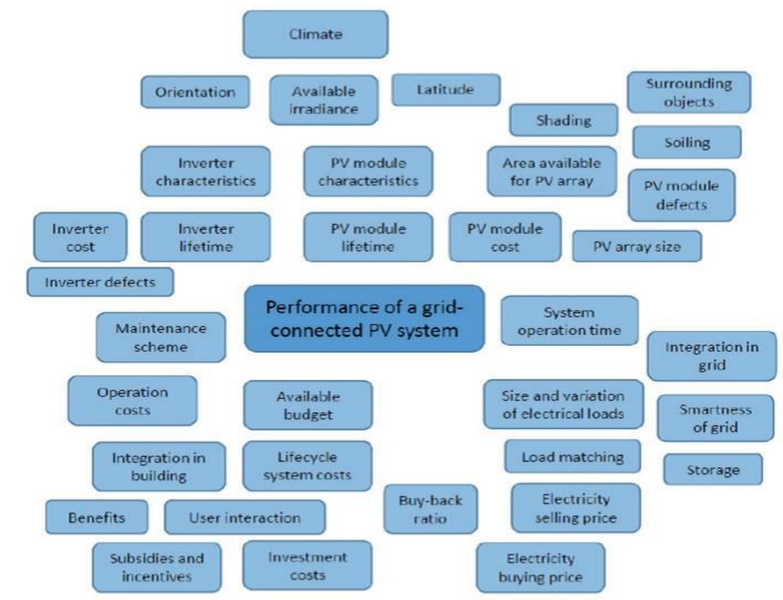

Figure 3: Key factors that determine the optimal performance of PV systems.

Acknowledgements

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