

PVgnosis DiaGNOSIS, maintenance and operation of PV plants

Project duration: from 12.2020 to 07.2023

Report submitted: 09.2023

Publishable Summary

The main objective of PVgnosis is to create an advanced operation and maintenance framework for photovoltaic (PV) systems. At PV plant level, an Information and Communication Technology (ICT) platform and associated tools needed were developed for delivering advanced diagnosis, predictive maintenance and intelligent visual inspection on installed PV plants. More particular, real-time information is provided to the PV plant operator in terms of individual panel operation, shading and thermal strain from sensory equipment on-site via heterogeneous sources and image processing and machine learning-based pattern recognition techniques was used to create automated decision-making mechanisms for optimizing the operation and maintenance of PV systems. Through the advanced data processing, early signs of problems can be revealed, such as solar cell potential induced degradation, which can lead to power losses of up to 50% and may be difficult to spot at very early stages within traditional operations and maintenance schedules. On the inverter-side, an advanced model-based fault detection and accommodation scheme was introduced for detecting and isolating faults that affect the PV inverter while a temperature control scheme was introduced to extend the inverter lifetime when provisioning ancillary services. Additionally, the inverter functionalities were enriched with novel control modules to achieve new operational capabilities, such as flexible active and reactive power management functionalities, novel fault ride through support strategies, phase balancing compensation services. The multi-functional operation of the novel inverter enables the provisioning of key ancillary services to support the grid operation under high PV penetration. The developed control and fault diagnosis schemes have been embedded into an actual inverter-controller and feed-in relevant information to the central platform as required, though the development of proper application programming interfaces (APIs). As such, PVgnosis is expected to deliver a holistic, end-to-end operation and management solution for established and new PV plants worldwide.

All the activities of the project were according to the implementation plan and significant results have been achieved. The fact that the transnational PVgnosis project is separated into three national sub-projects (Greek, Cypriot and Swedish) and each of this sub-project had a different start and end date created some obstacles on the smooth implementation of the project objectives. However, the consortium made a significant effort to follow the timeline of the leader of each task in order to minimize any possible delays due to the non-common timeline for the project. At the end of the project (July 2023) all activities were successfully completed.

Project consortium

Coordinator and all contact details:

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|---------------------------------------|---|
| Full name of organisation | Centre for Research and Technology Hellas |
| First and family name of coordinator: | Dimitrios Tzouvaras |
| Full address: | CHARILAOU THERMI ROAD 6 KM, 57001 Thermi, Thessaloniki, Greece |
| E-mail: | dimitrios.tzouvaras@iti.gr |

Participating countries and financing:

| Country | Number of organisations involved | Project costs in EUR | Public funding in EUR |
|--------------|----------------------------------|----------------------|-----------------------|
| Greece | 2 | 268 238 | 141 268 |
| Cyprus | 1 | 169 303 | 169 303 |
| Sweden | 1 | 303 007 | 136 358 |
| <i>Total</i> | <i>4</i> | <i>740 547</i> | <i>446 929</i> |

Funding agencies involved and contracts

| Funding Agency | Contract N° and Title |
|--|---|
| General Secretariat for Research and Innovation (GSRT) | PVgnosis/5075007 |
| Cyprus Research and Innovation Foundation (RIF) | P2P/SOLAR/0818/0007 |
| Swedish Energy Agency | 2019-004730 PVgnosis – DiaGNOSIS: drift och underhåll för solcellsanläggningar |