



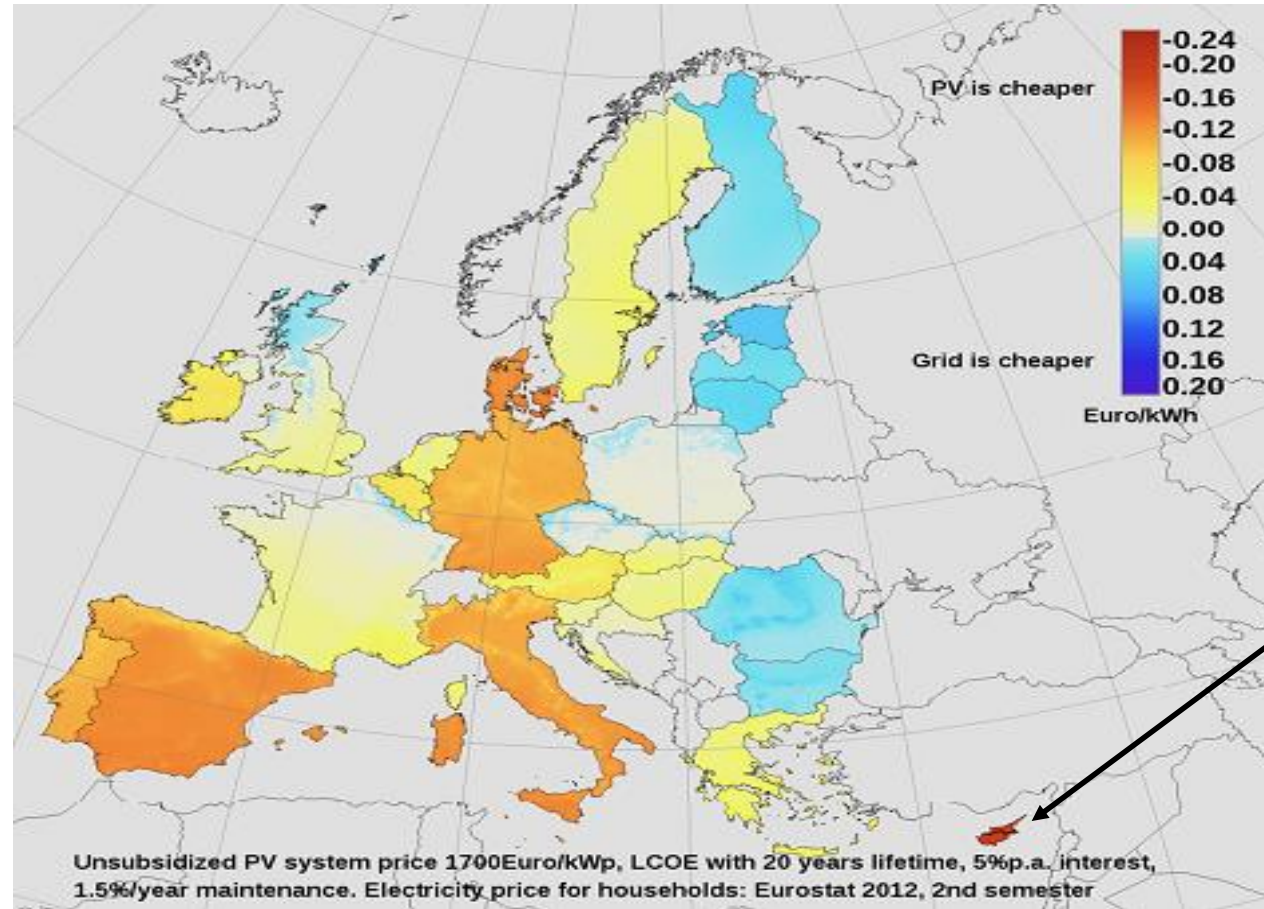
Condition monitoring platform for proactive and reactive operation and maintenance (O&M) with enhanced data analytic functionalities

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Cyprus

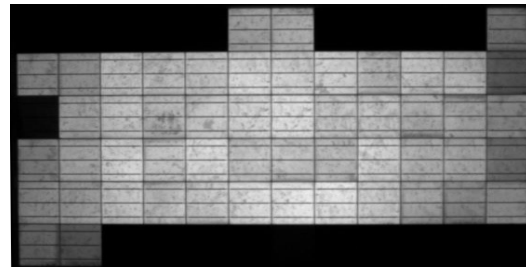
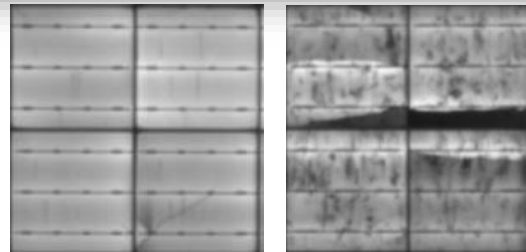


We are here!

Highlights of the PV Technology Laboratory



Indoor/outdoor testing



Testing site

Official testing site for over 40 different manufacturers:

Honeywell

Q CELLS
Engineered in Germany



CONERCON
ENERGY SOLUTIONS

tsmc solar

SunTechnics

oerlikon



REC
Solar

SCHOTT
solar

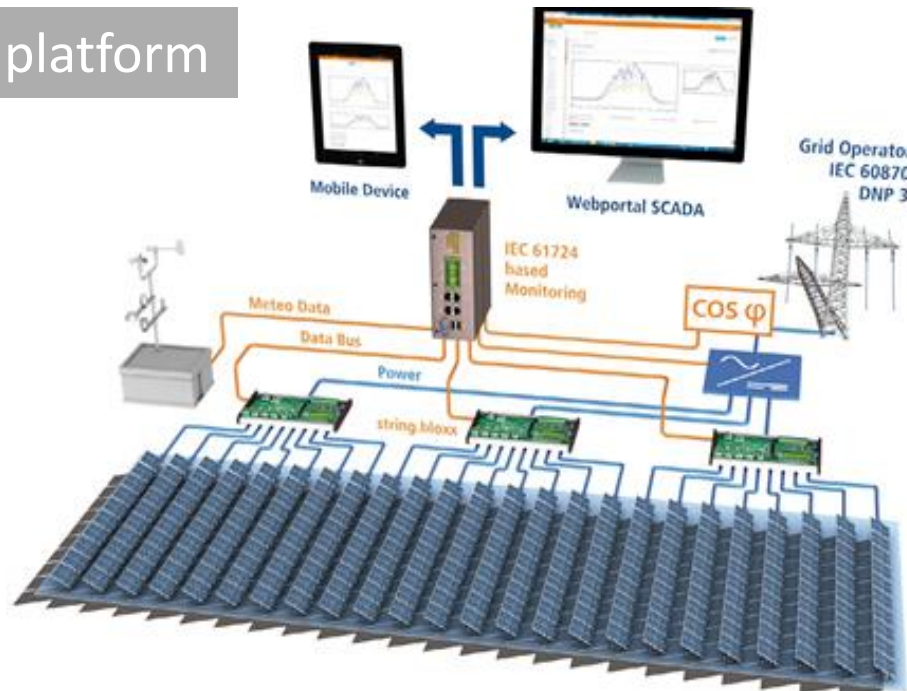


SOLARWORLD

Introduction

- Key factor for future PV uptake is to reduce Levelized Cost of Electricity (LCoE)
- Increasing performance and reducing operating costs (advanced monitoring)

Condition monitoring platform



Data quality and sanity

System health state

Failure detection and classification

Added Value Services:
Performance loss quantification
Degradation rate estimation

Background & Objective

Specific Objective: Development of an innovative condition monitoring platform for proactive and reactive O&M with enhanced data analytic functionalities

Advanced baseline condition monitoring solution to ensure operational quality and optimise energy production

 **Ipermon**

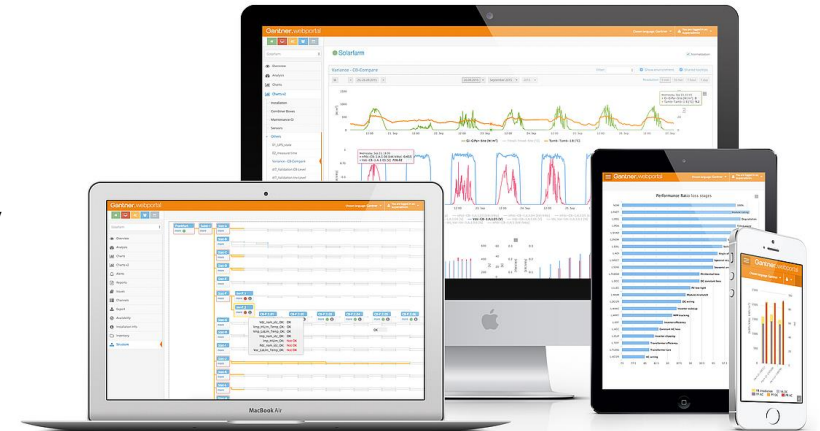
Partners: GI and UCY

Project: Innovative **Performance Monitoring System** for Improved Reliability and Optimized Levelized Cost of Electricity
IPERMON [Solar-ERA.net project]

Budget: €400,000

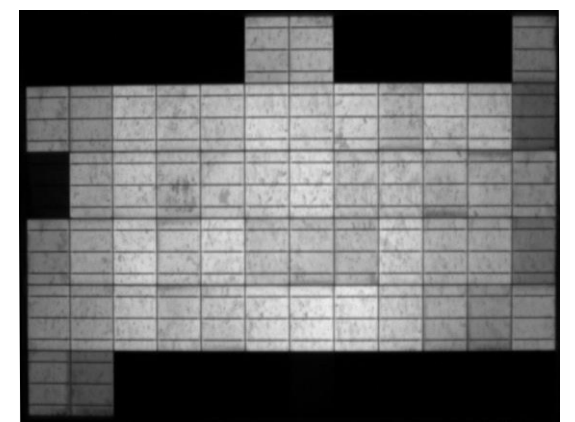
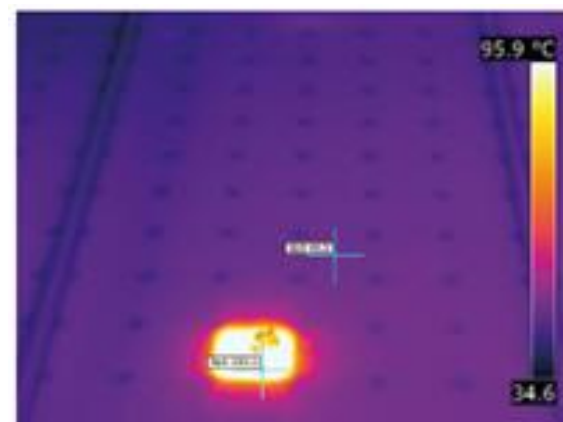
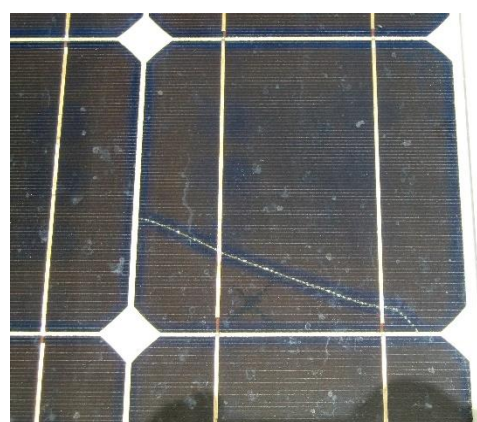
Duration: 36 Months

Weblink: <http://www.pvtechnology.ucy.ac.cy/projects/ipermon/>



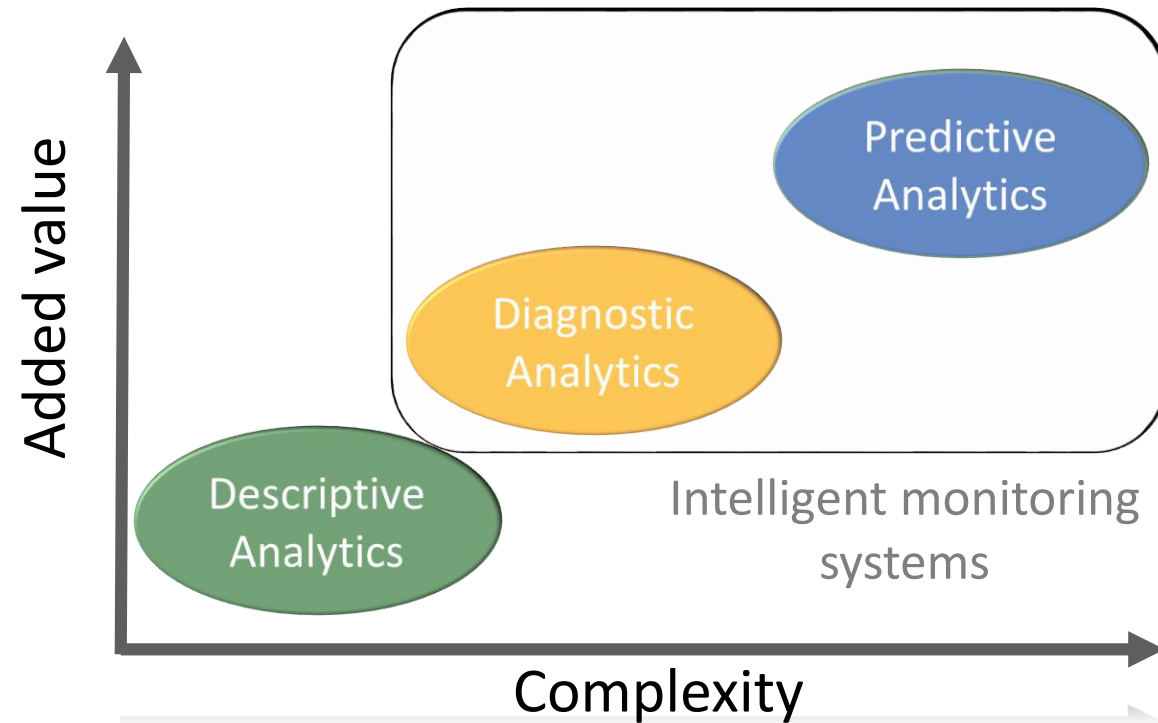
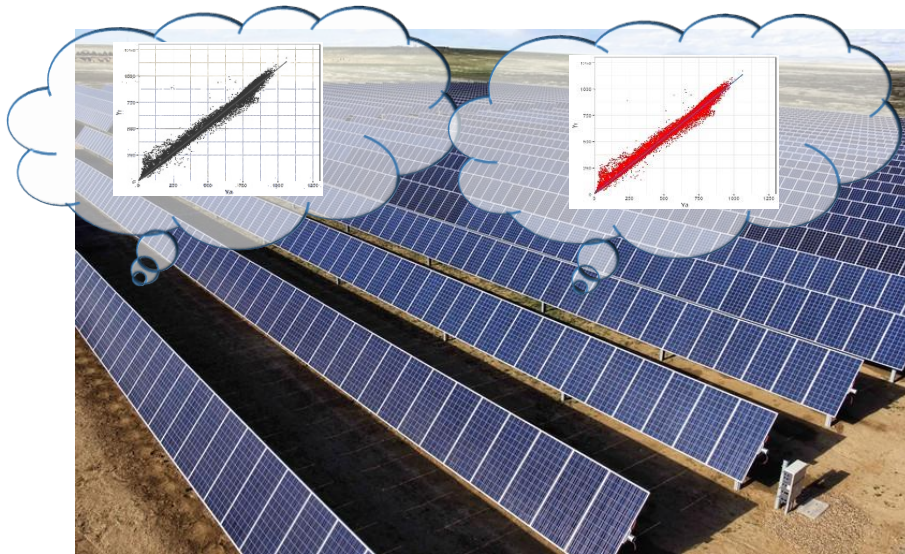
State-of-the-art

- Visual inspection is the simplest method to detect visible failures
- The most popular technique for failure diagnosis is image analysis
- Methods based on advanced data analysis of electrical parameters are becoming increasingly popular



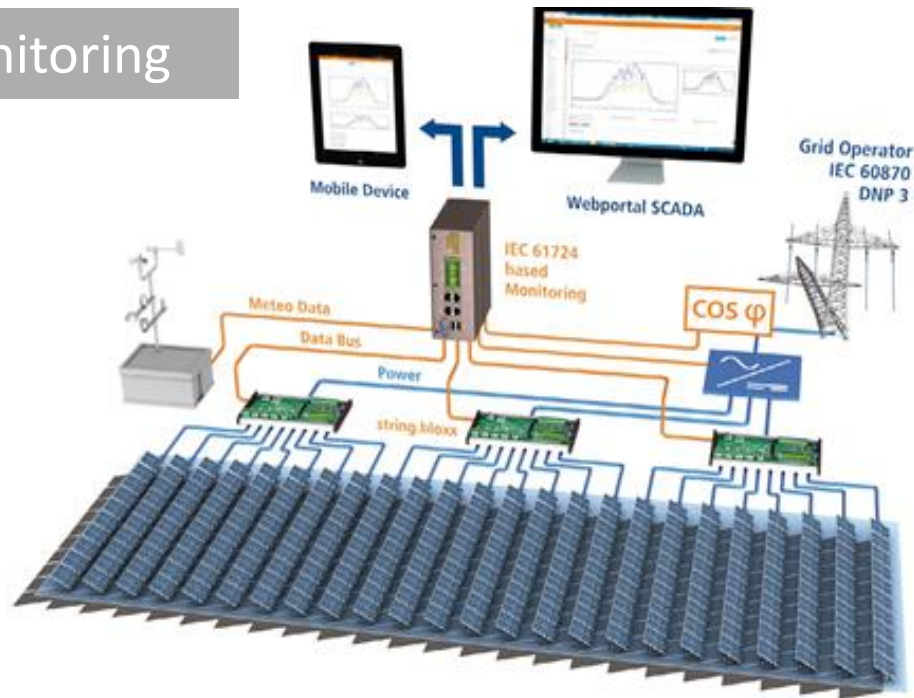
Performance monitoring and data analytics

- Change from Descriptive analytics to Diagnostic/Predictive Analytics

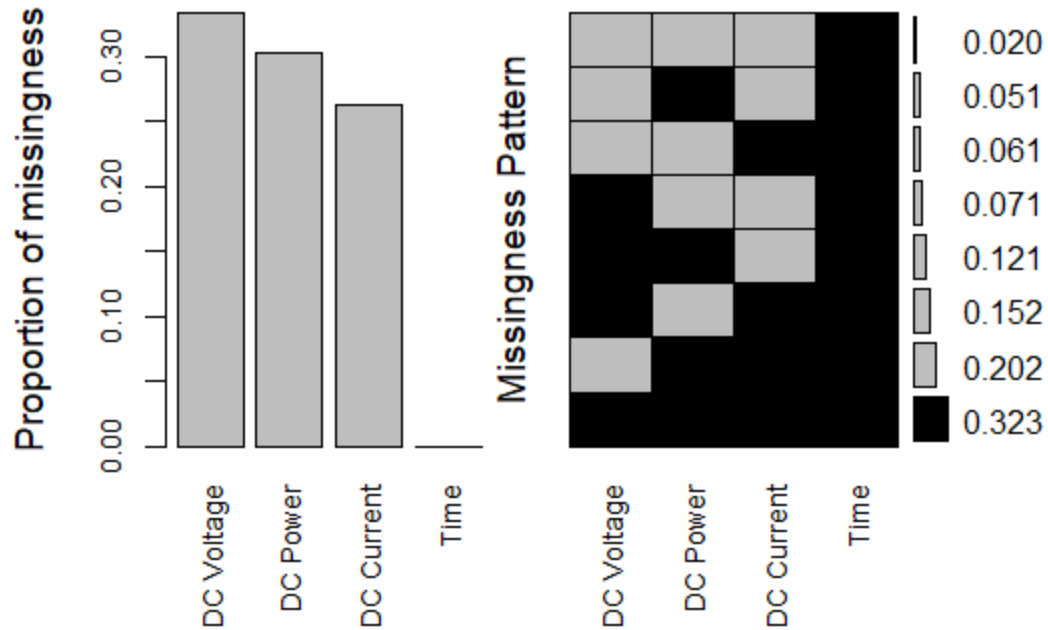


Intelligent data analytic features

Roust performance monitoring

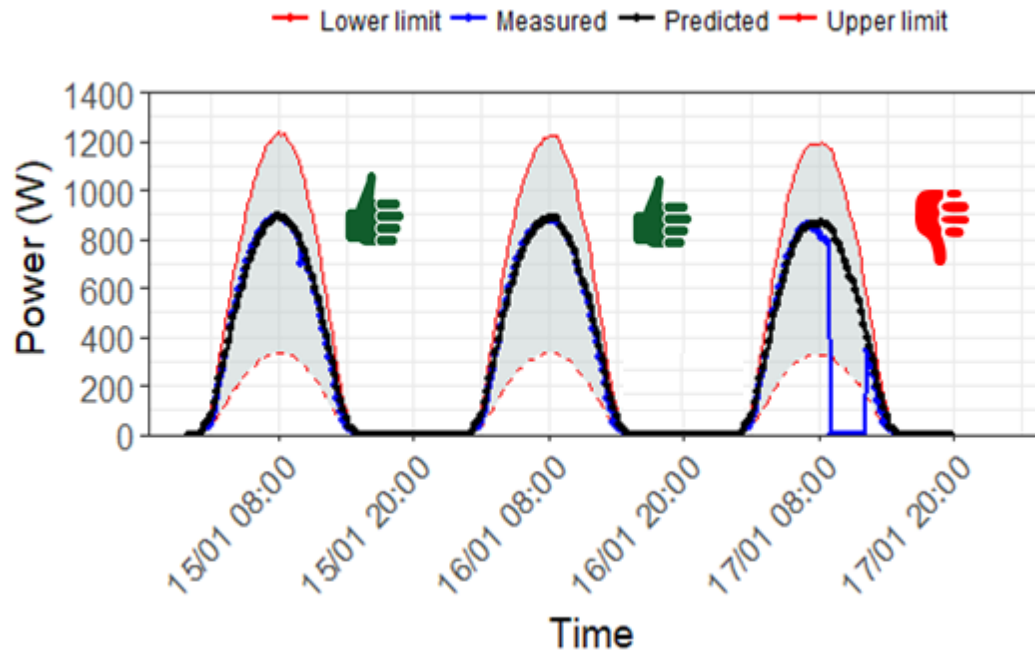


Intelligent data analytic features



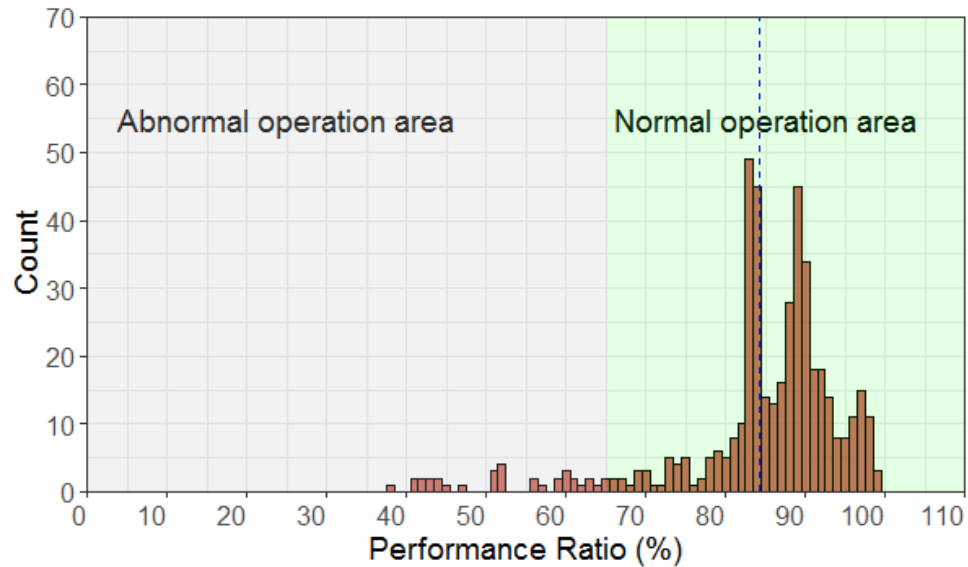
Data quality and sanity

Intelligent data analytic features

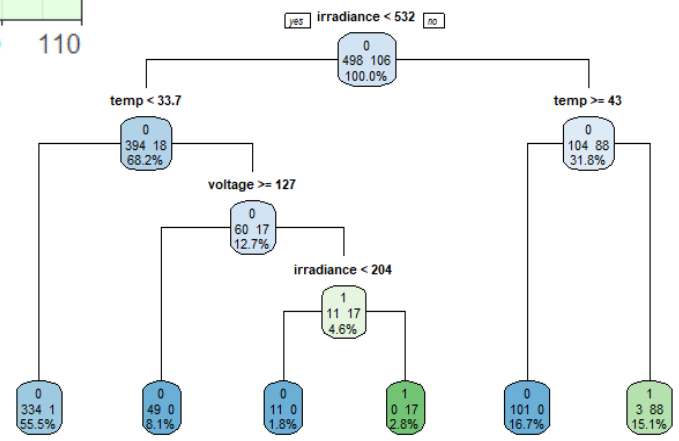


System health state

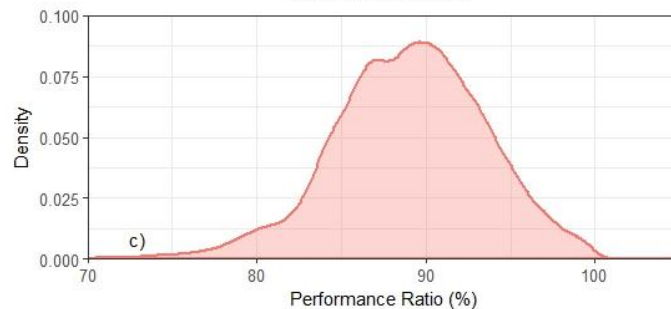
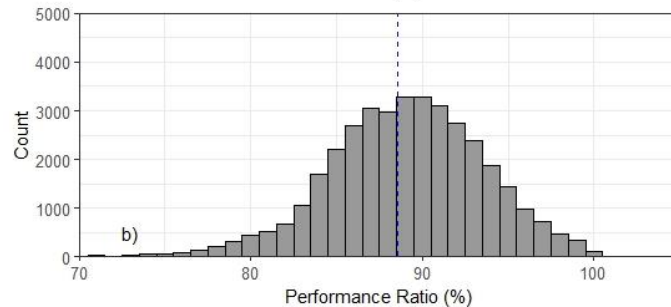
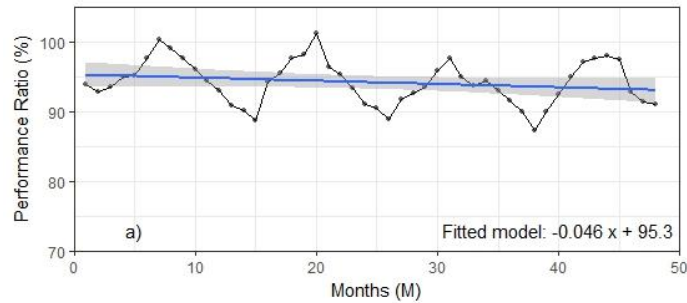
Intelligent data analytic features



Failure detection and classification



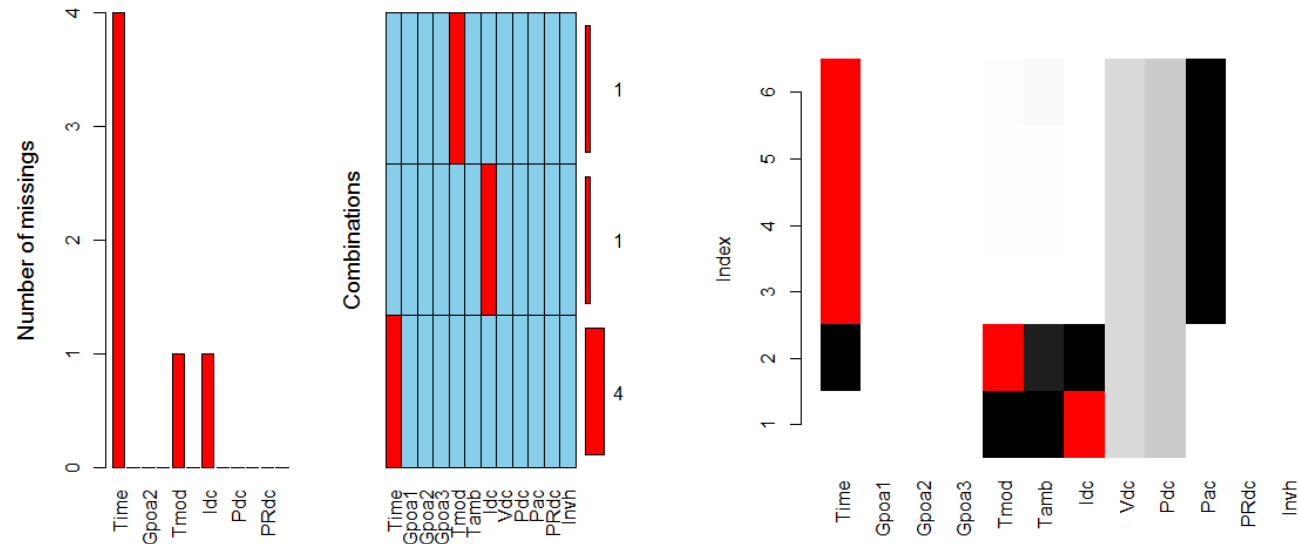
Intelligent data analytic features



Added Values Services:
Performance loss quantification
Degradation rate estimation

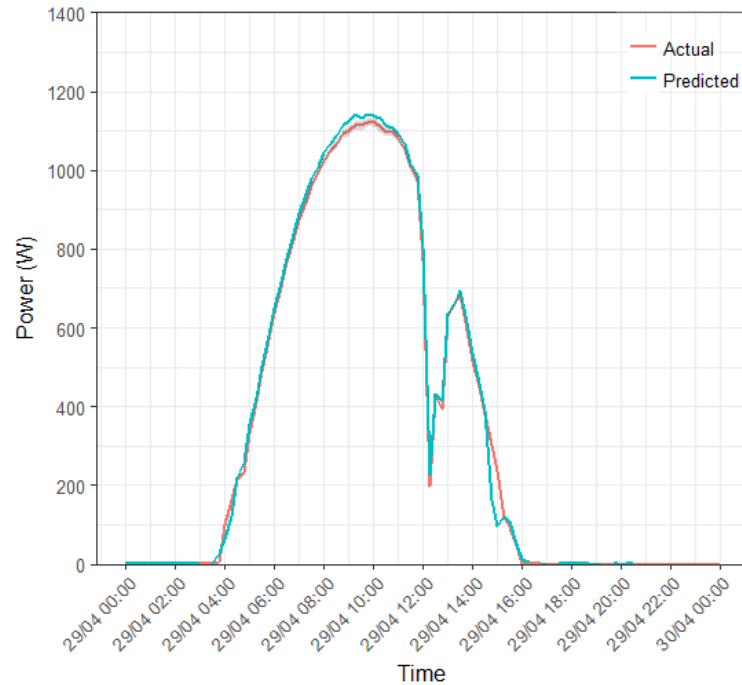
Platform functionalities – Data quality routines (DQRs)

- Identify missing and erroneous data
- Estimate system availability and sensor deviations
- Correct data through data imputation techniques (LOCF and linear interpolation)

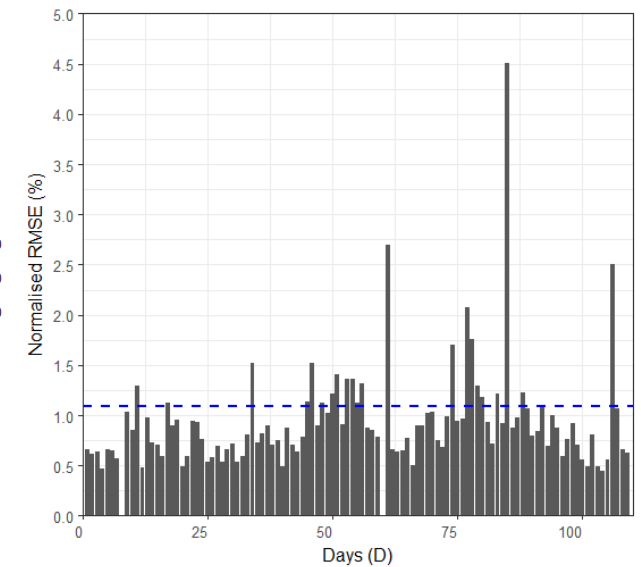
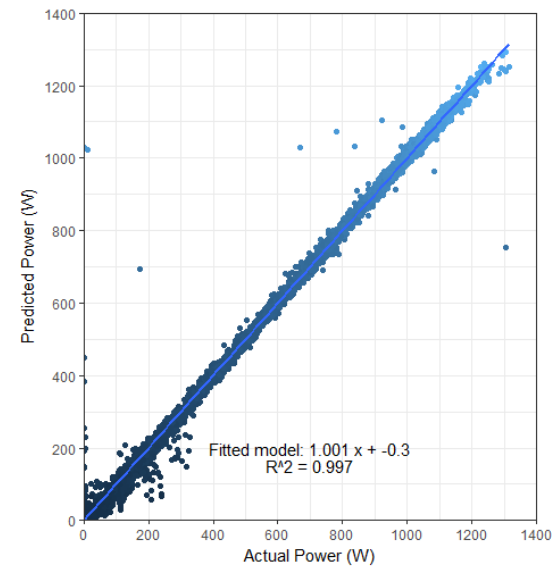


Platform functionalities – PV system model prediction

- Parametric and machine learning simulation models

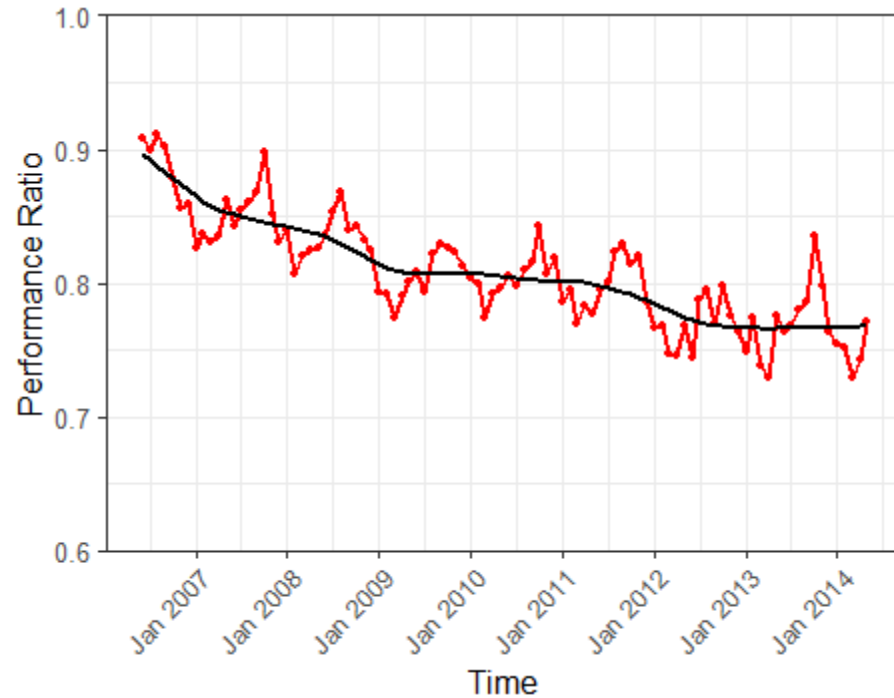
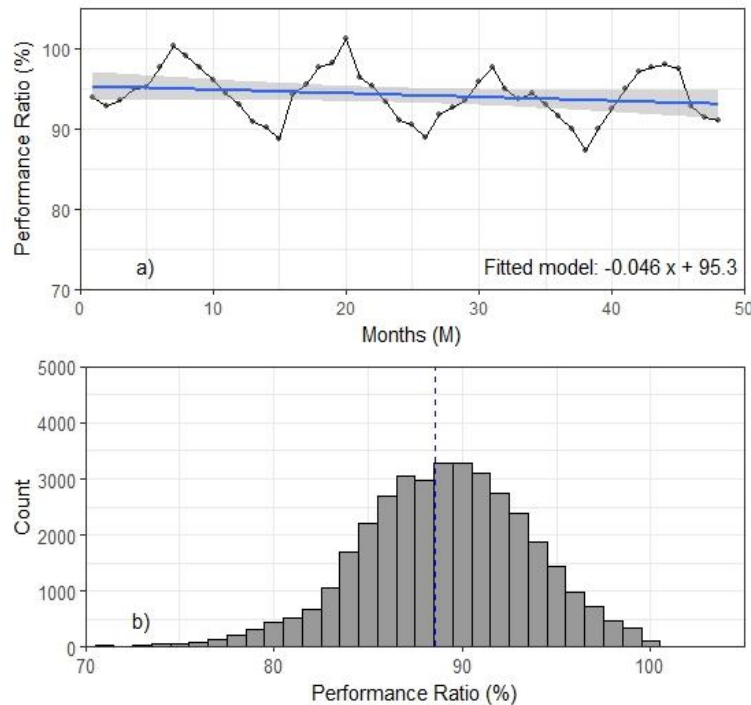


Highest prediction accuracy - FFNN



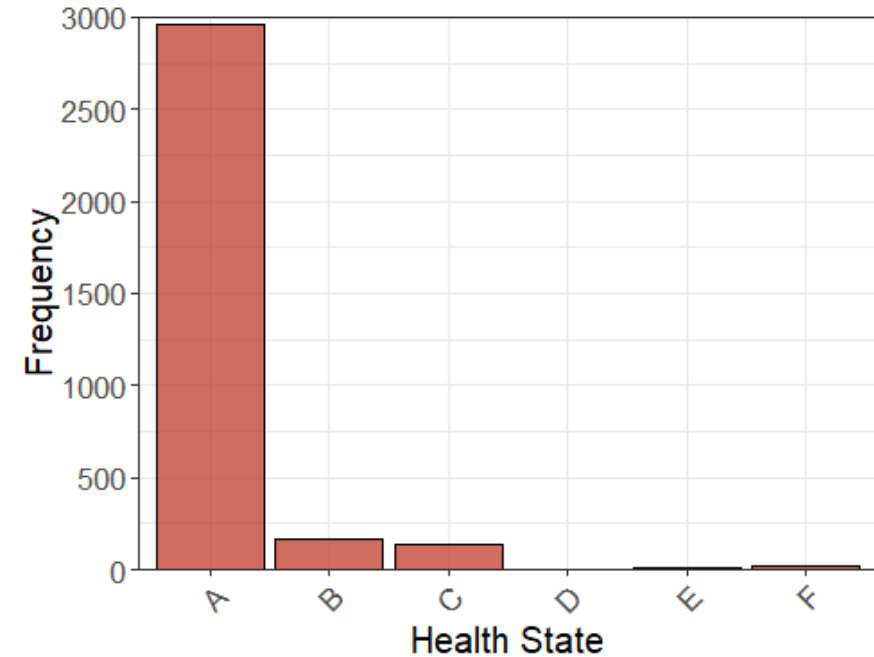
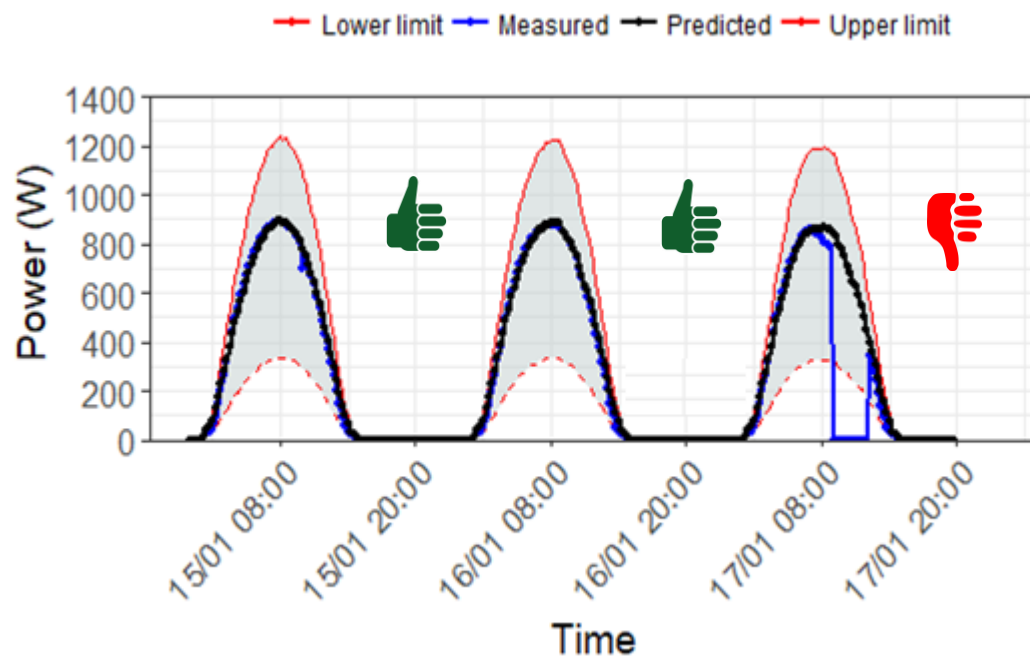
Platform functionalities – Degradation Rate

- Statistical and comparative techniques for trend extraction and estimation of the degradation rate



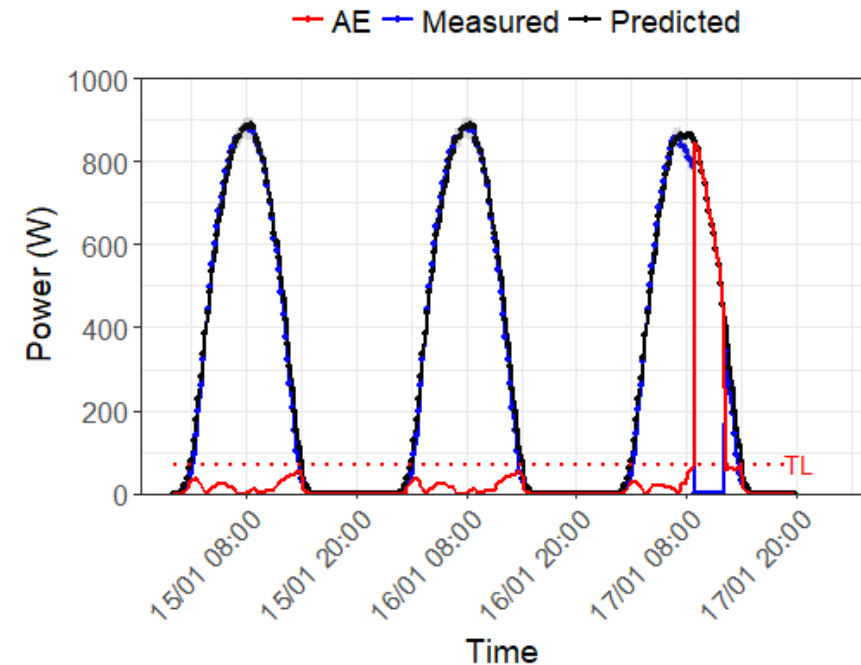
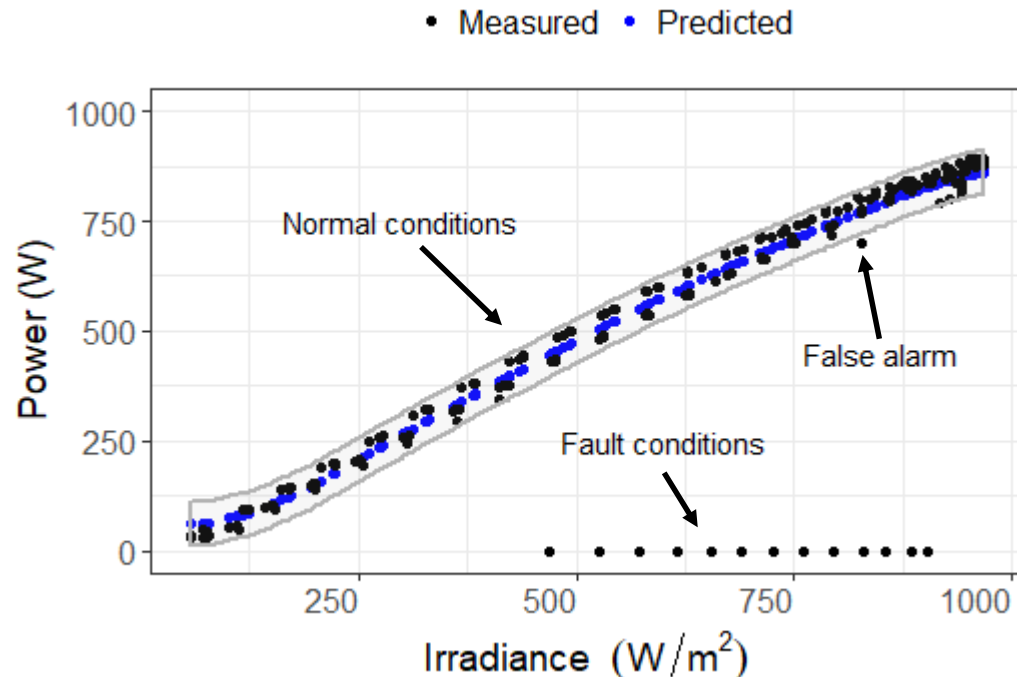
Platform functionalities – System Health State

- Comparative assessment between measured and predicted daily PV performance
- Classification of the relative error in ranked categories



Platform functionalities – Failure detection

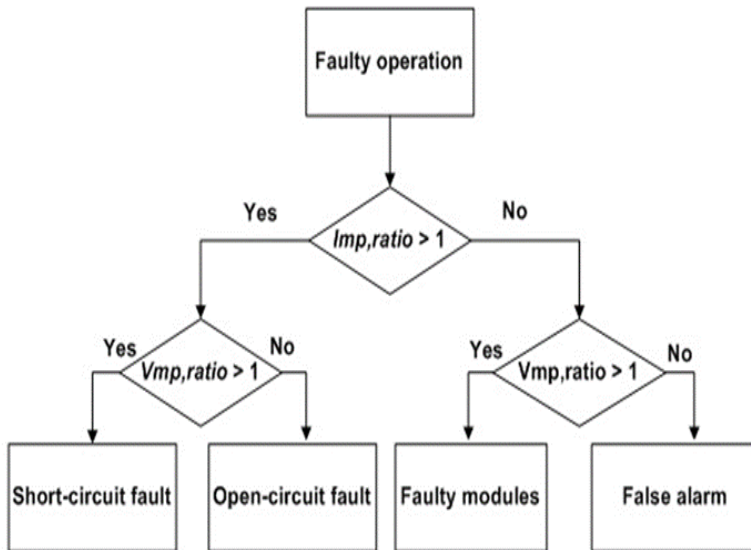
- Comparative assessment between measured and predicted measurements against set threshold levels (TL)
- Statistical outlier detection rules



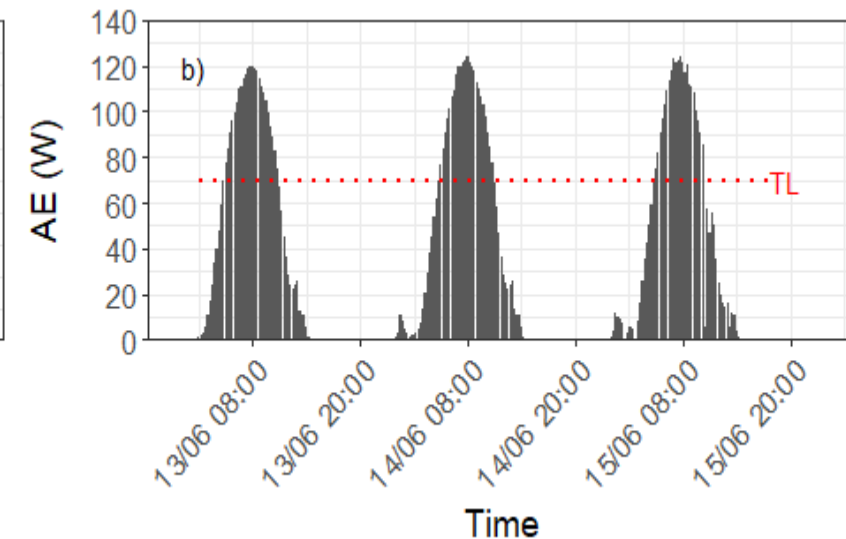
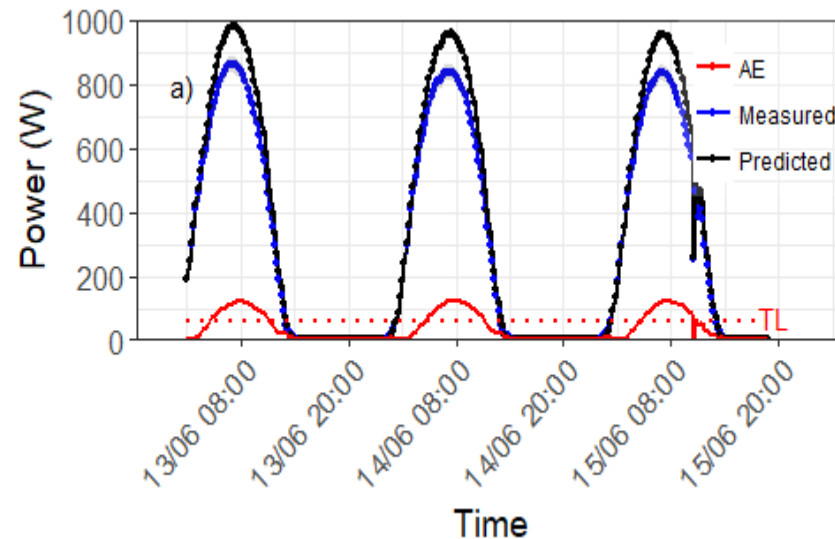
Platform functionalities – Failure classification

- Unsupervised procedures (voltage/current/power ratio and fuzzy logic rules)
- Supervised procedures (k-NN, SVM, Decision and Regression Tress)
- Failure patterns

Current and voltage indicators

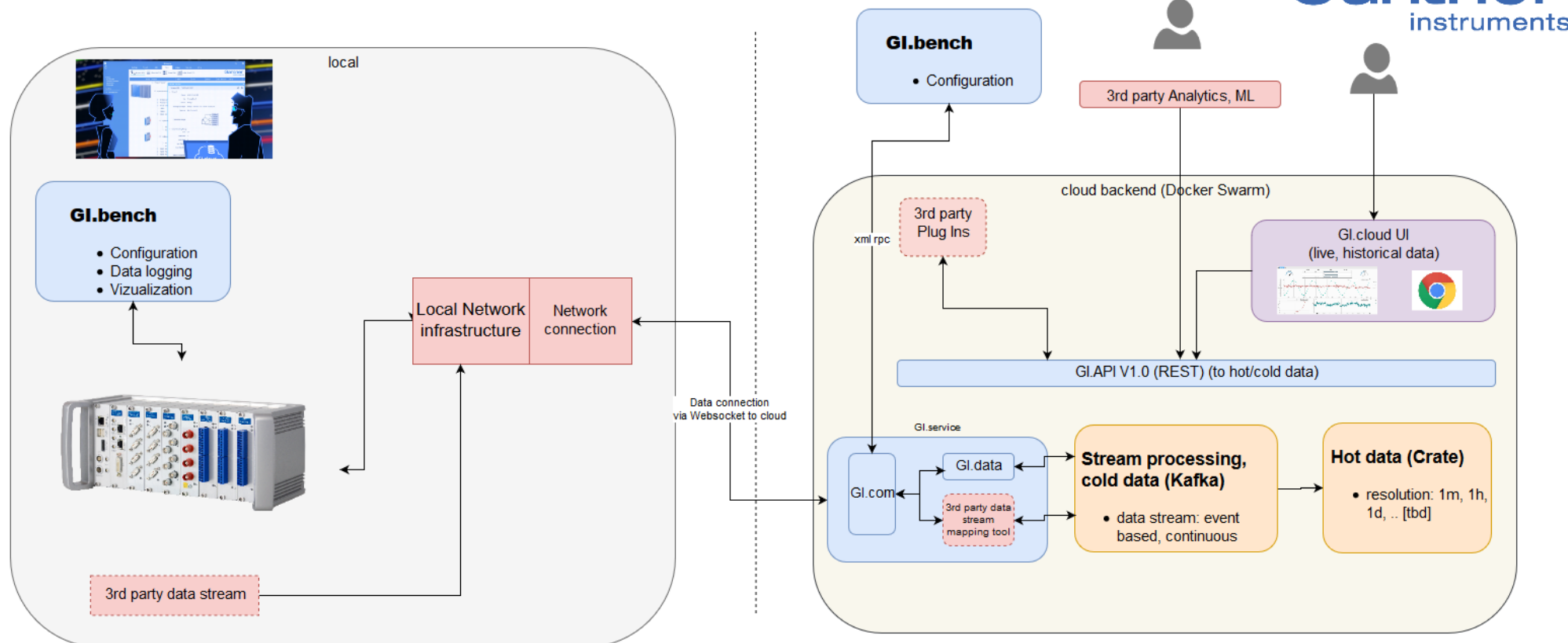


Bypass diode pattern



Online Platform

GI.cloud backend (appliance use case)

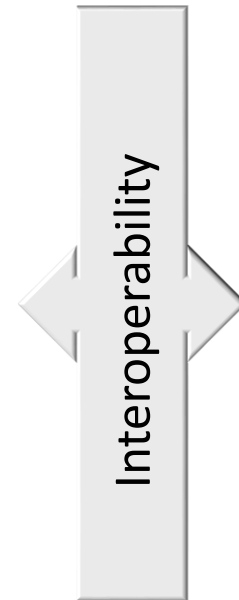


Future...

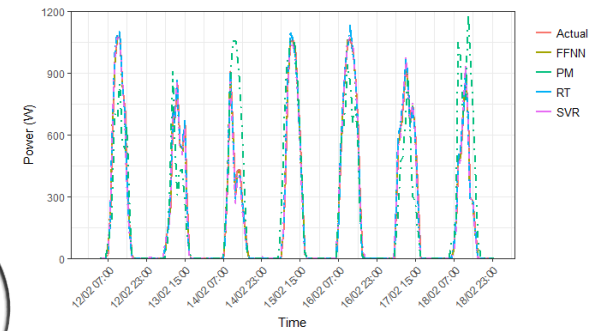
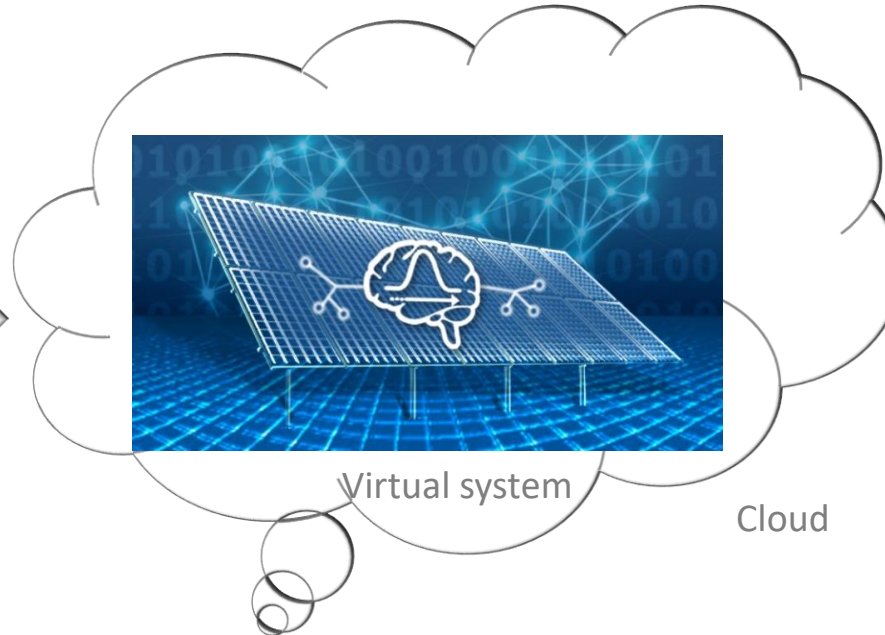
- Digital Performance Architectures (Digital Twin Concepts)



Physical systems



IoT



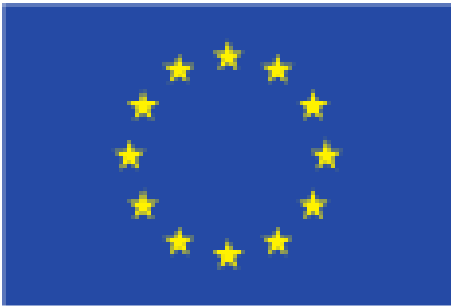
Added services
Grid control
Performance analysis
Forecasting

Summary

- PV performance measurements and analytical techniques are required to ensure optimal lifetime performance and to reduce LCoE
- Performance monitoring platforms consist of the:
 - Sensor network
 - Data acquisition (DAQ) device
 - Visualizations portal – Descriptive analysis
- Required accuracy and complexity depends on the PV system size and user objectives
- Future grid modernisation is the driver for advanced performance architectures

Acknowledgement

Stimulating scientific excellence through twinning in the quest for sustainable energy (TwinPV).

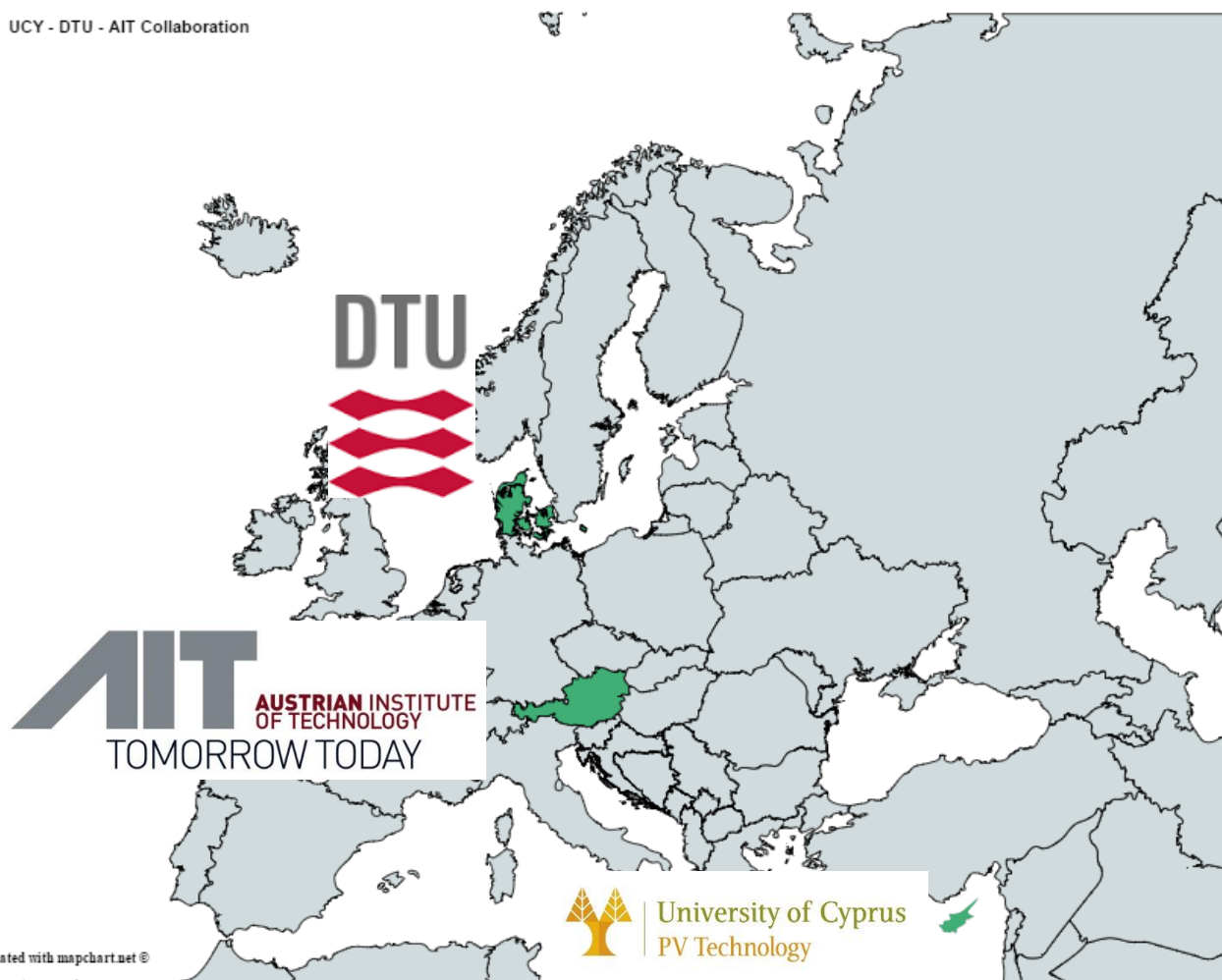


This project has received funding from the European Union's Horizon 2020 research and innovation programme under the agreement No. 692031



Together we do more for PV and Smart Grids

UCY - DTU - AIT Collaboration



Team

- 3 countries
- Over 100 Expert Researchers, Trainers
- One stop shop (cells to modules to Grid)
- Training, Testing, Research

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European Commission

Horizon 2020
European Union funding
for Research & Innovation



energies

IMPACT
FACTOR
2.676

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Photovoltaics Lifetime Output
Improvement: Advanced Monitoring,
Failure Detection and Classification and
Energy Forecasting

Guest Editors

Prof. George E. Georghiou, Dr. George Makrides, Dr. Marios Theristis

Deadline

15 March 2019

Special Issue

Invitation to submit

Thank you for your attention

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More information...

Websites: www.pvtechnology.ucy.ac.cy


<https://www.gi-cloud.io>



Highlights

-  Mediterranean Smart Grid Technology Platform formation.
[Read more...](#)
-  European award at the 29th EU-PVSEC conference.
[Read more...](#)
-  Conercon - UCY strengthen their collaboration.
[Read more...](#)

Upcoming Event

-  PV-NET Final Conference - 8 May 2015
[Provisional Agenda](#)

Latest News

-  DERlab Presents its Activity Report 2014/2015.
-  National Technical University of Athens and FOSS sign research collaboration agreement.
-  FOSS and Alfa Mediterranean Enterprises Ltd join forces.
-  Pilot Smart Meters with DSM and PV generation under way in Cyprus.
-  Smart meters and EMF.

