PV MODULE LIFE TIME FORECAST AND EVALUATION

Causes of Degradation and Performance Improvement in a Complete PV System for O&M Activities

G. Oviedo Hernandez[1], P. V. Chiantore[1]

[1] BayWa r.e. Operation Services S.r.l. / Rome, Italy / +39 3461175310 / guillermo.hernandez@baywa-re.it

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About SOLAR-TRAIN

- SOLAR-TRAIN is a Marie Sklodowska-Curie (MSCA) Innovative Training Network (ITN) that brings together 14 international, multi-disciplinary early stage researchers (ESR) to work towards the common goal of «Photovoltaic Life Time Forecast and Evaluation»
- ESRs are hosted by a consortium of eight research institutions, universities and companies with the support of 10 partner organizations in Austria, France, Germany, Italy, Spain, Slovenia and the UK.
- More information on the project: www.solar-train.eu

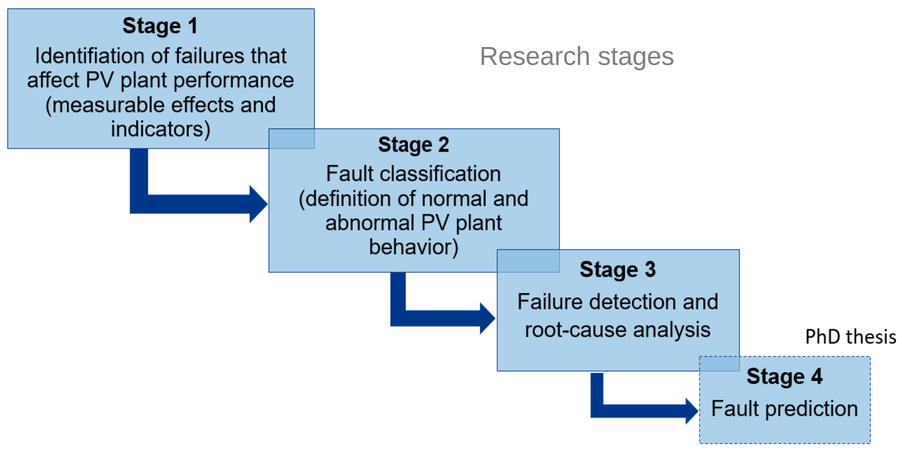
Introduction

- Reliability assessments are not considered crucial for the PV industry.
- Focus has been largely on producing cheaper modules and increasing efficiencies to reduce initial system costs.
- PV modules are engineered to meet an estimated lifetime of 25-30 years, but it has been shown that the biggest uncertainty in the cost of energy generated from PV is the system degradation.
- Today, it is not possible to predict with accuracy neither aging rates nor lifetime.
- The need for tracking down the source of failures once the PV plant is running becomes vital. For that reason, more specialized and proactive O&M approaches are being investigated to improve the performance of PV plants.

Investigating new O&M approaches for PV plants. Source: BayWa r.e.

Objectives

- Remote calculation of key performance indicators
- Optimization of on-site technical inspections for PV module quality assessment
- Solar economics (technical risks and impact of degradation in O&M strategies)
- Advanced data analysis for automated detection and diagnosis of failures
- Predictive maintenance (fault prediction with machine learning)



Assessment of the economic impact of technical risks

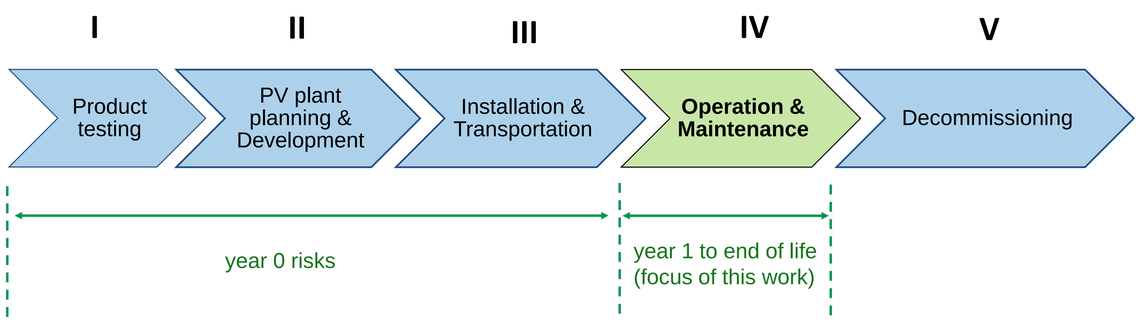
- Optimization of the cost priority number (CPN) methodology to the needs of a large O&M operator.

The CPN methodology was developed in the Solar Bankability project (www.solarbankability.org), in which the risk assessment connected to investments in PV projects was studied. The methodology helps to classify technical risks and to assign a cost for preventive and corrective measures, which lower the impact on the availability and performance of a PV plant.

This methodology is an implementation of a cost-based Failure Modes and Effects Analysis (FMEA) to the PV sector and defines an estimation of the economic losses due to system downtime and the substitution/repair of components:

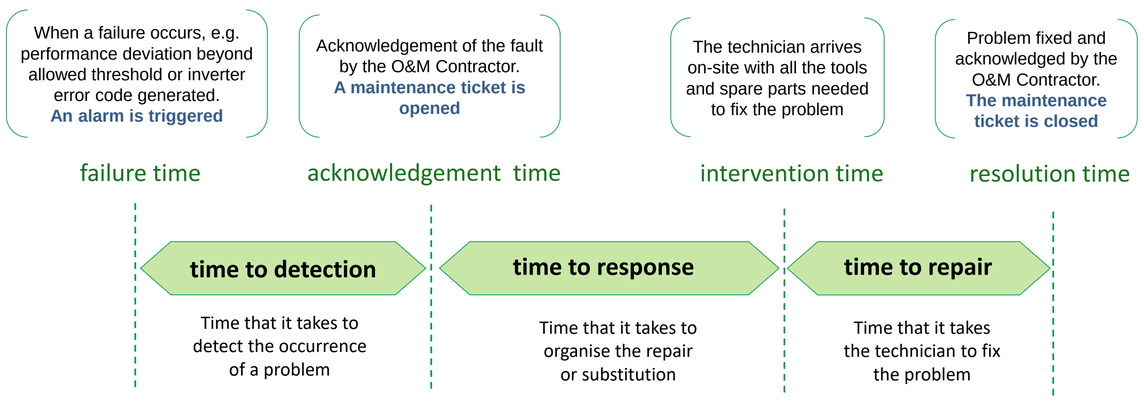
$$CPN = C_{down} + C_{fix} \quad [€/kWp/year]$$

The methodology was originally applied by developing theoretical scenarios which took into account all the phases of a PV plant life cycle. The current work is now focused only on phase IV, O&M, using real PV system data of a large operator, BayWa r.e. Operation Services S.r.l.



For this purpose, well monitored systems were selected and the recorded list of maintenance tickets is being used to apply the methodology and create a benchmark between PV plants. This will help standardize the methodology further and to acquire more useful results.

Later on, the study will be expanded to a portfolio of 127 PV plants, which combine 150 MW of installed power, in order to collect a statistically relevant distribution in terms of occurrence and impact of technical risks. The methodology mainly uses, as input, O&M KPIs which are calculated based on the information extracted from the maintenance tickets and the monitoring systems:



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