PERFORMANCE ANALYSIS OF FIELDED SYSTEMS FOR IDENTIFICATION AND MODELLING OF SYSTEM LIFE TIME ENERGY YIELD

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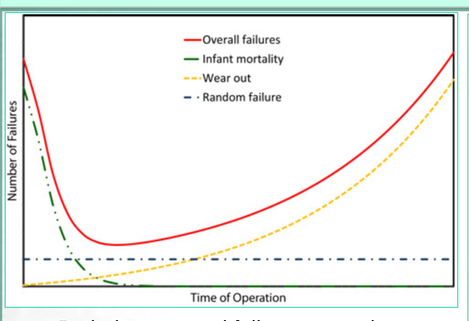
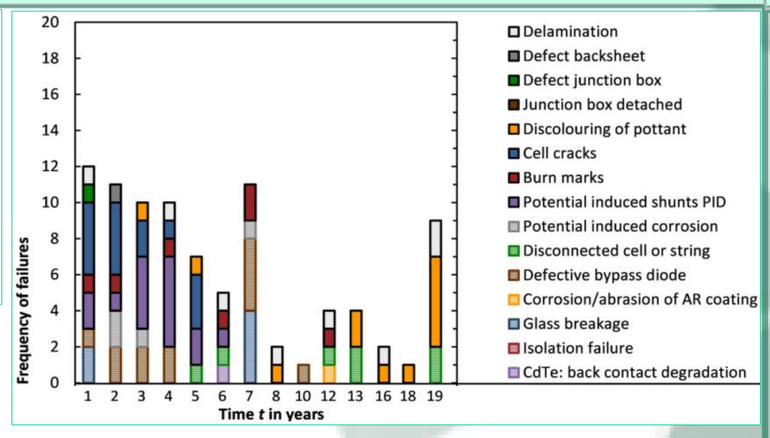
Abstract

This poster provides an overview of the context, targets and objectives of the three-year research project on statistical analysis of reliability and durability of fielded systems started in 2017. The research aims to identify system failures, improve condition monitoring and system quality assurance, model reliability and durability and assess financial implications. The initial literature review is presented here, identifying key system failure modes. The path towards automated identification of key failure modes is presented. The next steps in the research project elaborated.

Failures do happen



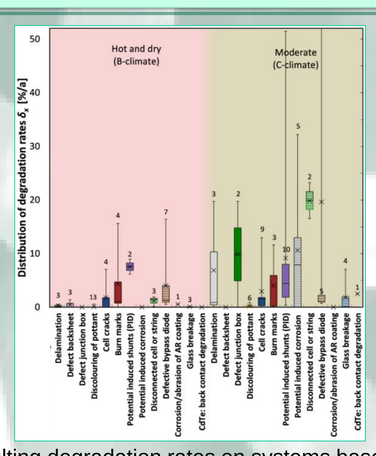
Bathub curve and failure categories



Frequency of degrading failures showing power losses (adapted from Köntges et al., 2017)

From failure classification…

Understanding failures impact on PV systems



Resulting degradation rates on systems based on component degradation (adapted from Köntges et al., 2017)

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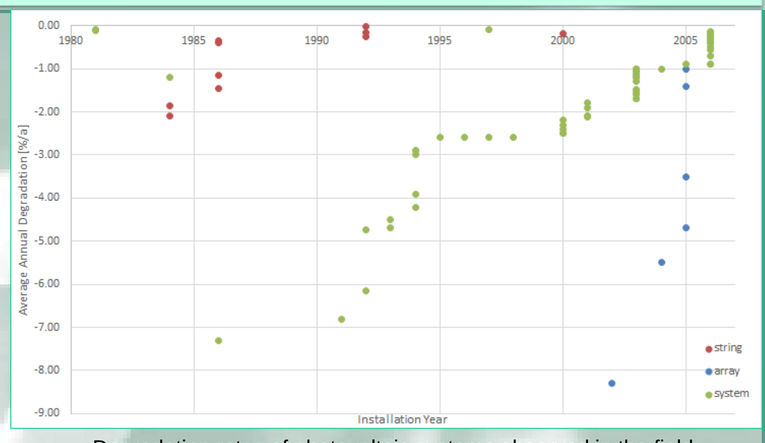


Degradation rates of photovoltaic systems observed in the field

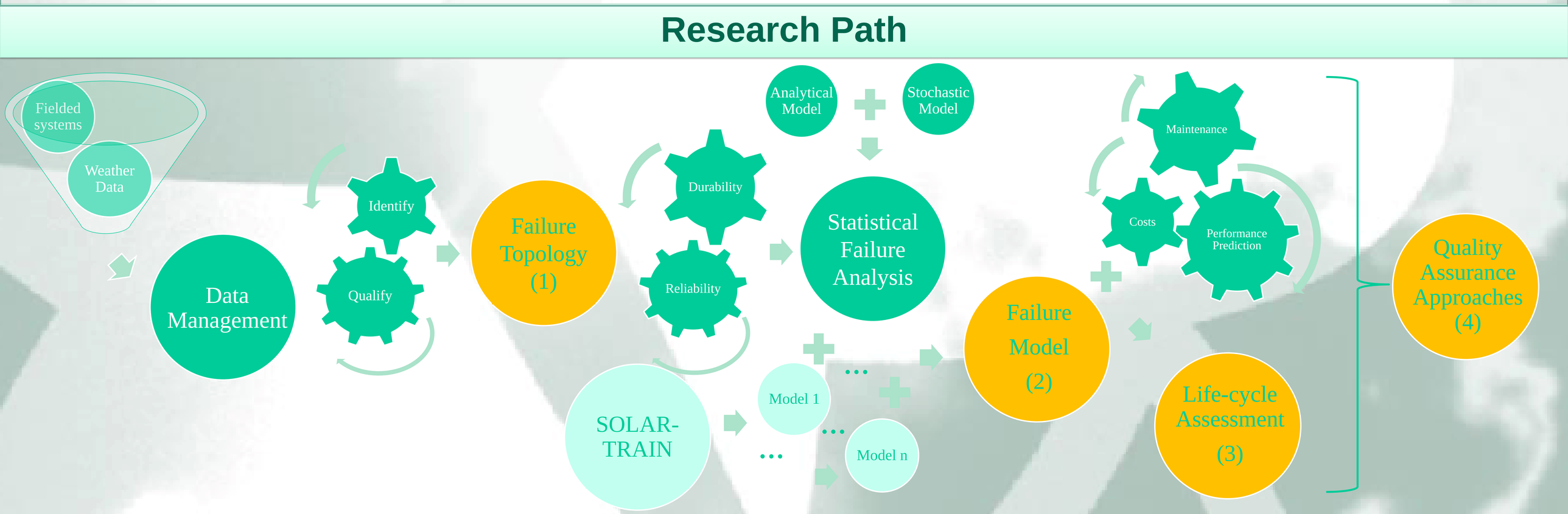
… to reduced uncertainty

Research Objectives

1) identification and quantification of field-relevant failures in several climatic zones;
2) a statistical model including durability issues and able to identify system failures from well-monitored data;
3) a demonstration of financial implications of durability issue;
4) optimised quality assurance approaches for different real systems.

Interesting targets: large commercial PV systems (or grid-interactive PV systems from large domestic programs)

Research Path



Data Management

Direct measurements of electrical parameters from fielded systems in several climate zones. Automatic data quality processes (Python) on systems and related meteorological data (e.g. irradiance).

Failure Topology (1)

Identification and quantification of most critical system failures based on two different reference yields (strings performance comparison and predicted PR).

Statistical Failure Analysis

Modelling of reliability and durability patterns in PV systems through an hybrid model. Fault Tree Analysis assisted by Monte Carlo Simulation or Markov Model.

Failure Model (2)

Development of the statistical system scale model with the option to integrate detail models from other SOLAR-TRAIN researchers.

Life-cycle Assessment (3)

Integration of reliability and durability predictions with performance, maintenance and cost data. Site-dependent analysis of energy and financial implications.

Quality Assurance Approaches (4)

Knowledge share between research outcomes and QA initiatives (IEC, IEC-IECRE, PVQAT).

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