A TOOL FOR THE PERFORMANCE EVALUATION AND FAILURE DETECTION OF AMARELEJA PV PLANT (ACCIONA) FROM SCADA

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ABSTRACT

- The increasing size of PV plants all over the world has made their O&M tasks much more complex.
- The use of SCADA systems is now required to collect the relevant information from the PV field, PV inverters, etc. and also the meteorological data in order to properly evaluate the performance of those installations
- The great amount of data provided for most of those SCADA systems requires the development of new procedures.
- **This poster presents a new tool developed for the performance evaluation and failure detection.**
- It has been implemented in a 45 MWp PV plant installed by the company Acciona in Amareleja (Portugal).

OBJECTIVES

- Development of an analysis tool featuring the following functions:
  - Monitoring system for data visualization in order to help with operation and maintenance tasks.
  - Selection of relevant information and development of analysis procedures that provide the whole PV plant behavior from the available information.
  - Detection of long-term trends in PV generators, degradations in the systems and possible hidden problems.

AMARELEJA 45 MWp PV PLANT

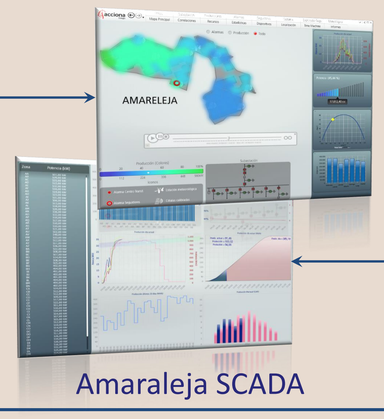
PV Plant

- Size and Power: 250 Ha and 45MWp.
- Tracking: 250 Trackers/Plant. 104 Modules/Tracker.
- Generator: 36 Trackers/Inverter. 70 Inverters/Plant.
- MT Line: 5MT lines/Plant. 14 Inverters/MT Lines.
- Substation: 1 Substation/Plant.

Monitoring System (SCADA)

Meteorological variables display

- From reference modules: G_m, T_m
- From meteorological station: G_0, D_0, T_a, W_s



Amaraleja SCADA

Electrical variables display

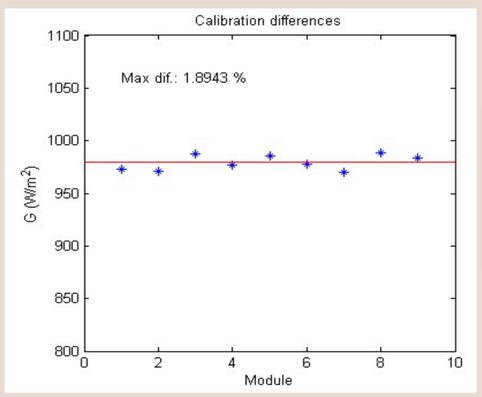
- Trackers: I_{string}, T_m
- Inverter: P_{AC_inv}, V_{AC_inv}, I_{AC_inv}, E_{AC_inv}, V_{DC_inv}
- Substation: P_{20kV} & P_{60kV}, Q_{20kV} & Q_{60kV}, V_{20kV} & V_{60kV}, I_{20kV} & I_{60kV}

ALARMS

TOOL FEATURES

1-Checking of data coherence

Compare all reference modules' irradiance measurements during clear sky moments



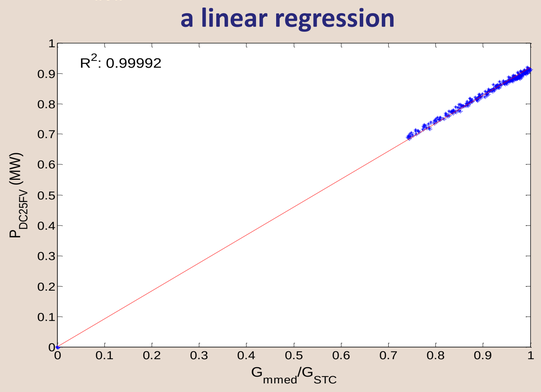
Reference modules' calibration differences

USEFUL FOR:

- Knowing if measurements are being taken correctly.

2-Calculation of the Power under Standard Test Conditions (P_{STC})

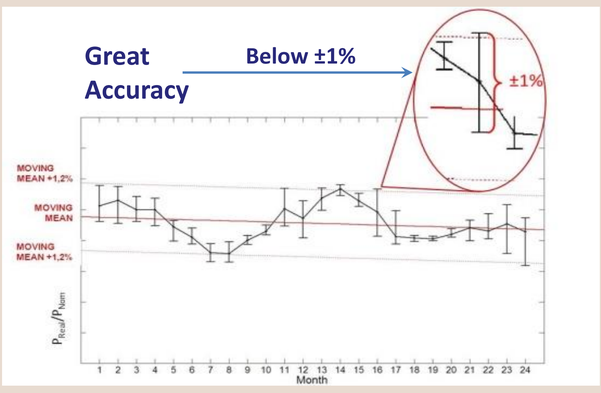
P_{STC} calculation procedure based on a linear regression



Linear regression to calculate P_{STC} plant

USEFUL FOR:

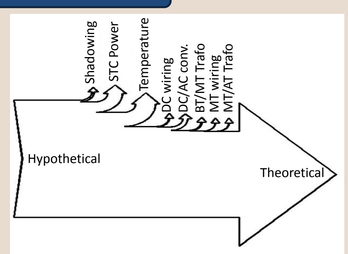
- Checking the PV degradation evolution.
- Developing analysis procedures.
- Detecting hidden problems.



PSTC evolution in the whole plant throughout two years

3-Theoretical production and losses calculation

- Theoretical production is the production that the plant could deliver if there were no technical problems.
- Only normal losses are taken into account

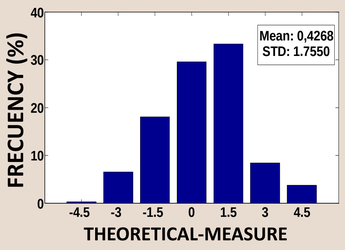


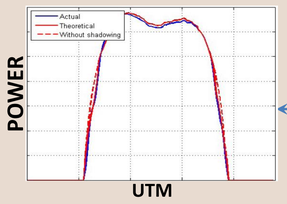
Sankey diagram

USEFUL FOR:

- Checking the PV plant performance.
- Detecting different problems.
- Checking cleanliness effects.

Procedure accuracy

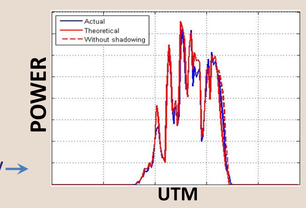




Examples days

Sunny day

Cloudy day



4-Technical availability analysis

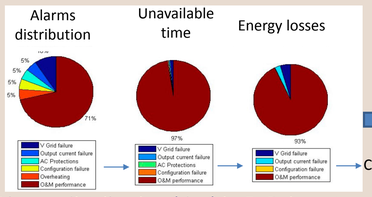
- Technical availability analysis determines the incidents identified by alarms.
- Statisticians:

$$TAF_{EoP} = \frac{(1-\sum Ti\_EoP)}{Ti_{ref\_EoP}}$$

$$EAF_{EoP} = \frac{(1-\sum E_{EoP})}{E_{ref\_EoP}}$$

Element of the plant	Time Availability Factor	Energy Availability Factor
EoP	**TAF (%)**	**EAF (%)**
Grid	100	100
Substation	100	100
20 kV Lines	100	100
AASS	100	100
Transformers	100	100
Inverters	100	100
Trackers	97,4	99,8
DC Lines	-	99,9
PV Arrays	99,9	100
TOTAL	**98,9**	**99,8**

Total losses due to unavailability: 0,189%

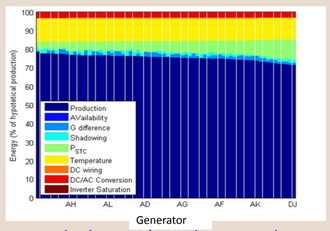


Alarms distribution (day) in EoP: inverters

- Identify, organize quantify and show alarms by cause, stop time, number of events and energy loss by EoP.

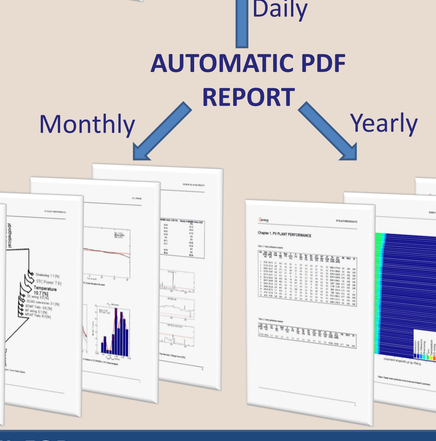
USEFUL FOR:

- Checking the technical PV plant performance
- Identifying and quantifying alarms cause, number of events, stop time and energy loss by EoP.
- Developing alarms statistical analysis.



Energy balance (production+losses) in each generator

5- Information management



USEFUL FOR:

- Organizing and visualizing all information obtained thanks to developed software.

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