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Data analysis for effective monitoring of partially shaded photovoltaic systems

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Motivation

Over 2GW of solar PV capacity is installed in The Netherlands, with average system capacity 3.5kW. The majority is monitored through simple Pac meter and without any further (solar) equipment [1].

70% of these PV systems **are placed on rooftops**

Research Target

An algorithm that:

- Detects the energy loss due to an expected shadow
- Distincts it from any additional energy loss and alets the owner for the real faults.

• Use only Pac - the most common data

Systems of Presented example^[3]

Power measurements from 2 systems:

- Partially shaded PV panel (P_{shade})
- Non shaded PV panel (P_{Ref})
- Same panels & Power Optimizers
- Pole placed in front of the studied PV system

[2], where different objects might obstruct the irradiance reaching the PV modules and affects their energy output.

The algorithm returns the shadow story of the system:
Date vs Time plot

Points' color based on: Error = $|P_{ref} - P_{shade}|$

some days of the year, shades it in the morning.

- Rooftop shades Reference PV in the afternoon
- In last plot, DHI used for verification.



Conclusions

•The proposed method is offering a low cost monitoring solution, since it needs only a simple Pac data logger, to small residential PV systems, since it requires only P_{AC} of two neighboring PV systems, with similar tilt and orientation.

•DHI measurements used to prove that shadow not detected in all expected hours because of high DHI. •For smaller time periods steps 1&2 are sufficient. For larger DBSCAN is required.

 In current form is perfect for malfunction detecting and performance analysis of systems with power optimizers and micro inverters

Referenses

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