Monitoring Platform Mismatch Analysis Report, Application Note

Version History

Initial release- July 2017

Version 1 - March 2018 – replaced the generate report window and deleted the generate the periodic energy report window

Introduction

The SolarEdge monitoring platform provides reports that help analyzing site performance and comparing different sites and inverters. This document describes the Mismatch Analysis report. For other monitoring platform reports, refer to https://www.solaredge.com/sites/default/files/monitoring_portal_reports.pdf.
In a PV system, differences between PV modules (or module mismatch), are unavoidable. They are mainly caused by manufacturing tolerance mismatch, soiling and shading of the modules, uneven module aging, and different orientation (tilt and azimuth).

In a SolarEdge system, the power optimizers perform module-level maximum power point tracking (MPPT), eliminating power losses due to mismatch. However, high mismatch between modules may indicate underperforming modules. Identifying such modules allows troubleshooting or replacing modules, thus increasing system production. Since high mismatch may also be attributed to specific site characteristics, such as partial shading of some modules, it is important to consider these characteristics when analyzing a site's mismatch.

The Mismatch Analysis report provides the necessary data for detecting modules that may be underperforming, by comparing each module's peak power and energy production to the average of all modules in the site, and presenting each module's mismatch as a percentage above/below the average.

NOTE

To account for mismatch due to multiple orientations, every group of modules with the same tilt and azimuth is averaged separately. The orientation details are taken from the site's physical layout as configured in the monitoring platform.

This document describes how to generate a mismatch report and how to analyze the data.

Generating a Module Mismatch Report

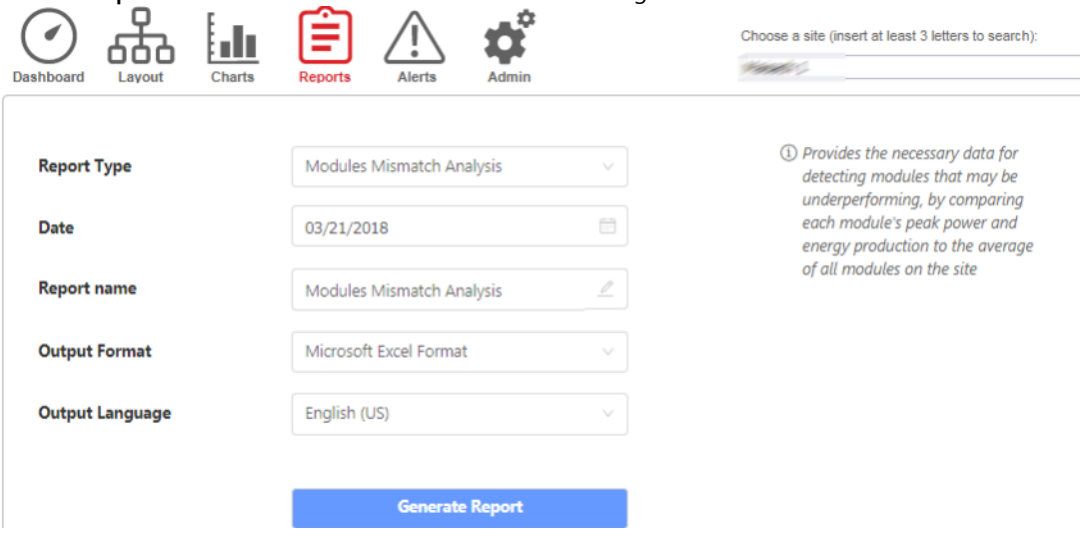
NOTE

To provide valuable data, the following is required to generate the report:

1. The site physical layout must be created

2. At least 30 days of data

1. Select the site for which to generate the report.
2. Click the **Reports** icon in the site window and do the following:



a. Select the report type, in this procedure Modules Mismatch Analysis
b. Use the Period calendars to define the report dates
c. Enter a name for the report
d. Select the report's output format
e. Select the report's output language
f. Click Generate Report. The report is generated and downloaded to your browser when complete.

The Mismatch Data

The report provides power and energy mismatch data for all modules in the site and presents it in three levels:

- **Site Modules Mismatch** – by calculating the average mismatch of all modules in the site, it indicates how close all module mismatch values are to the average
- **Inverter Modules Mismatch** - by calculating the average mismatch of all modules connected to each inverter, it indicates how close all module mismatch values are to the average
- **Modules Mismatch** – mismatch of each module in the site

The per-module mismatch is calculated as follows:

$$Power\ mismatch = \frac{Module,max}{Average_{Module,max}} - 1 \qquad Energy\ mismatch = \frac{Module,average}{Average_{Module,average}} - 1$$

Where:

- Module,max = Module max power in the last 30 days
- Module,average = Module average energy in the last 30 days
- Average = Average of all modules with the same orientation

Analyzing the Data

Module Power Mismatch

Power mismatch is an indicator of module quality. A certain mismatch can be expected even in new sites due to manufacturing and measurement tolerances, and is expected to grow yearly due to module aging. The following values should be considered when evaluating whether the mismatch is at an acceptable level:

- Manufacturing tolerance: ±3%
- Measurement tolerance: ±3%
- Aging: 0.2-0.5% per year

Based on these numbers, a mismatch of up to 6% and down to -6% can be attributed to manufacturing tolerance (+3% or -3%) and measuring tolerance (additional +3% or -3%).

A mismatch that is higher than ±6%, or a sudden increase in mismatch, may indicate an underperforming module, for example due to PID (potential induced degradation), diode failure, accelerated degradation, etc.

Module Energy Mismatch

Energy mismatch is an indicator of site or installation quality. In an unshaded site, energy mismatch should be similar to power mismatch. Different values can indicate shading or soiling of modules, or other temporary differences in the conditions to which the modules are exposed.

Inverter and Site Mismatch

Inverter or site level mismatch provides a general indication of the mismatch of all modules connected to the same inverter or in the site. A low value indicates there is none or few (relative to the inverter or site size) modules with high mismatch.

Further Analysis

If the Mismatch Report indicates large mismatch that cannot be explained by the site characteristics, it is recommended to use other monitoring platform tools to further analyze the relevant modules (e.g. the energy or power charts).

Examples

The following examples show various mismatch values and their analysis.

Example 1 – Site Mismatch

Module energy mismatch: 6%
Module power mismatch: 5%

These values indicate there are no or few modules with high mismatch. The module mismatch values can be examined if further information is required.

Example 2 – Site Mismatch

Module energy mismatch: 7%
Module power mismatch: 8%

Based on the site characteristics, these values may or may not indicate underperforming modules. Consider the age of the system, and compare these values to previous months' reports.

Example 3 – Module Mismatch

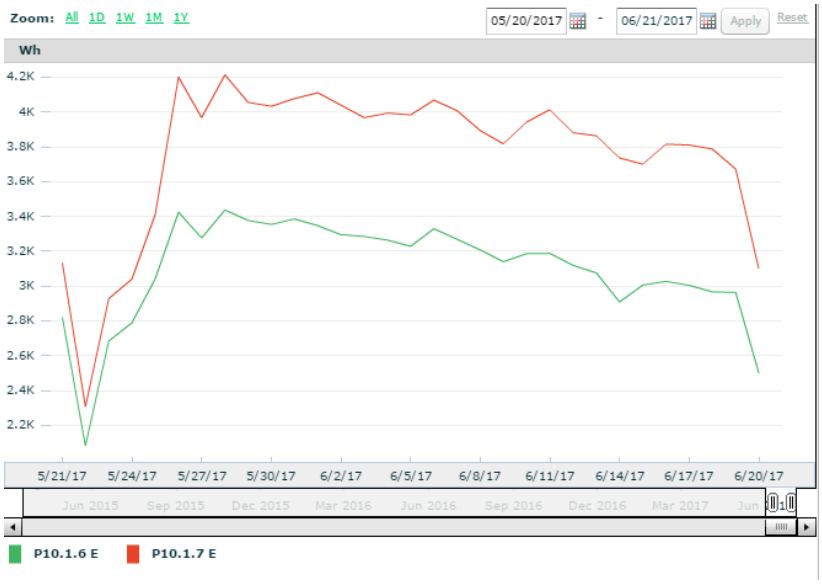
Module energy mismatch: -29%
Module power mismatch: -26%

The power mismatch strongly suggests that the module is faulty. Further investigation using the charts to compare the voltage of the suspect module to several other modules clearly shows a voltage drop of 1/6, indicating one of the diodes is burned and a complete sub-string is not producing (the chart below corresponds to an optimizer with two modules).

Example 4 – Module Mismatch

Module energy mismatch: -12%
Module power mismatch: 4%

The low power mismatch together with the high-energy mismatch suggest that the module is partially shaded. Further investigation using the charts to compare the energy of the suspect module to several other modules supports this assumption.


Zoom: All 1D 1W 1M 1Y
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Jun 2015 Sep 2015 Dec 2015 Mar 2016 Jun 2016 Sep 2016 Dec 2016 Mar 2017
P10.1.6 E
P10.1.7 E