

Application Note – Monitoring Portal Performance Ratio Calculation

Introduction

The performance ratio (PR) of a PV installation is the ratio between the actual energy yield of a site (production energy), and the expected energy of the site, based on the module type and environmental sensor measurements. The PR value ranges between 0 and 1 and is used to evaluate the PV system performance: A high PR indicates a properly operating site. You can use the PR to compare the performance of several systems located at different locations, to monitor a site's performance over time and to check if a site is meeting its energy production targets.

To allow displaying the PR in the dashboard of the site, the following is required:

- A direct irradiance sensor installed at the site and connected to the monitoring portal¹. The sensor orientation and tilt have to be the same as that of the PV modules so that the sensor is exposed to the same solar irradiation. Use a Control and Communication Gateway (CCG) to connect the sensor to the SolarEdge monitoring portal. To use sensors, the CCG firmware version must be 2.07XX and later (refer to *Software Compatibility Check and Upgrade* on page 2).
- Setting the PR information in the monitoring portal (refer to *Setting up the PR Display in the Monitoring Portal Dashboard* on page 2).
- Optionally, installing a module temperature sensor in addition to the irradiance sensor increases the accuracy of the PR calculation. This is not mandatory for calculating the PR.

This application note describes how the PR is calculated and how to set the monitoring portal to display the PR. For information about connection of the sensors to the CCG and their configuration, refer to the *SolarEdge Control and Communication Installation Guide* available on the SolarEdge website at <http://www.solaredge.com/files/pdfs/solaredge-gateway-installation-guide.pdf>.

PR Calculation

The ratio between the actual and the expected energy is stated as a percentage and is calculated using the following formulas:

- For a PV system with a single orientation:

$$PR = \frac{\text{Production energy}}{\text{Expected energy}} = \frac{\text{Production energy [Wh]}}{\sum_t \left[\text{Irradiance} \left[\frac{W}{m^2} \right] \times \frac{\text{Peak power [W]}}{1000 W/m^2} \right]}$$

- The production energy is the measurement of the site output in kWh
- The expected energy is calculated by multiplying the sensor readings by the peak power (the nominal site output at STC).
- For a PV system with multiple orientations, you may connect an irradiance sensor (and a CCG) on each facet. In this case, the PR calculation is as follows:

$$PR = \frac{\text{Production energy}}{\text{Expected energy}} = \frac{\text{Production energy [Wh]}}{\sum_t \left\{ \left[\text{Irradiance} \left[\frac{W}{m^2} \right] \times \frac{\text{Peak power [W]}}{1000 W/m^2} \right]_1 + \left[\text{Irradiance} \left[\frac{W}{m^2} \right] \times \frac{\text{Peak power [W]}}{1000 W/m^2} \right]_2 \right\} \dots}$$

- If you use a module temperature sensor to improve the accuracy of the PR calculation, the PR is calculated as follows:

$$PR = \frac{\text{Production energy}}{\text{Expected energy}} = \frac{\text{Production energy}}{\sum_t \left[\text{Irradiance} \left[\frac{W}{m^2} \right] \times \frac{\text{Peak power [W]}}{1000 W/m^2} \right] \times \left[1 + (\text{Temp } [^{\circ}\text{C}] - 25^{\circ}\text{C}) \times \text{Temp Coefficient} \left[\frac{\%}{^{\circ}\text{C}} \right] \right]}$$

- Temp is the module temperature sensor measurement, in °C
- Temp Coefficient is the module's Pmpp temperature coefficient, taken from the module datasheet, and is always a negative value in %P/°C (or %P/°K)

¹ Sensors are available from SolarEdge – refer to http://www.solaredge.com/files/pdfs/products/inverters/se_sensor_datasheet.pdf

Software Compatibility Check and Upgrade

To use sensors, the CCG firmware version must be 2.07XX and later.

▶ To check the CPU version:

1 Press the Enter button until reaching the following screen:

```

ID : ##### #
DSP 1 / 2 : x . x x x x / x . x x x x
CPU : 0 0 0 2 . 0 7 0 0
C o u n t r y : X X X X X
    
```

2 SolarEdge devices with earlier firmware versions can be upgraded locally. Contact the SolarEdge support team to obtain the upgrade files and instructions.

Setting up the PR Display in the Monitoring Portal Dashboard

When the sensor(s) is installed, connected to the CCG and configured, you can edit the sensor(s) settings in the monitoring portal in order to display the PR in the site dashboard.

- 1 Log in to the monitoring portal (monitoring.solaredge.com) using your user name and password.
- 2 Click on a site to access its dashboard.
- 3 Click the **Admin** icon and select the **Logical** Layout tab. If a sensor is installed, the **Sensors** option is displayed in the component list in the left pane.
- 4 Select **Sensors** (see Figure 1). If an irradiance sensor is installed at the site, the Performance Ratio Administration is displayed, showing:
 - The site peak power
 - The associated peak power, which is the power of the array in which the sensors are installed. This number will be used to calculate the PR and is displayed after the sensor settings are edited as described below. For multi-orientation sites, the associated peak power is the sum of powers of all arrays that have a sensor installed (see Figure 2).



NOTE

The site peak power is taken from the the site details. The sum of associated peak power values of the CCGs should equal the site peak power value.

- Gateway (CCG) name and sensors information
- 5 To enable PR calculation using the sensor(s) readings, select the **Gateway** check-box. The sensor settings are displayed and can be edited in this section.

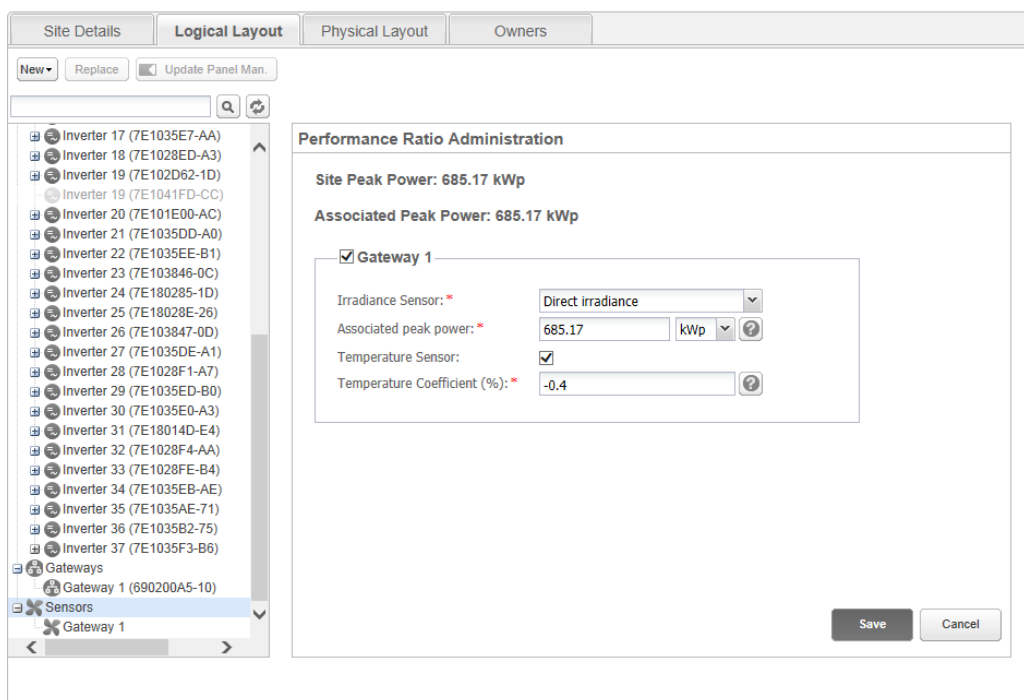


Figure 1: Performance Ratio Administration – single gateway

- 6 Edit the sensor(s) settings:
- 7 Verify that the **Irradiance Sensor** configuration is the same as appears in the CCG.
- 8 Enter the **Associated peak power** value and select the units (Wp, kWp or MWp). This value will be displayed in the Associated Peak Power header.
- 9 If a module temperature sensor is installed at the site and you want the PR calculation to use its readings, select the **Temperature Sensor** check-box. The Temperature Coefficient field is displayed.
- 10 Enter the module's power **Temperature Coefficient** (in %P/°C). This value must be negative. In case you do not have the module datasheet you may use -0.4 as a default number.
- 11 In case of multiple orientations, thus more than one CCG, repeat steps 5-6 for each of the CCGs whose sensor measurements you want to include in the PR calculation.

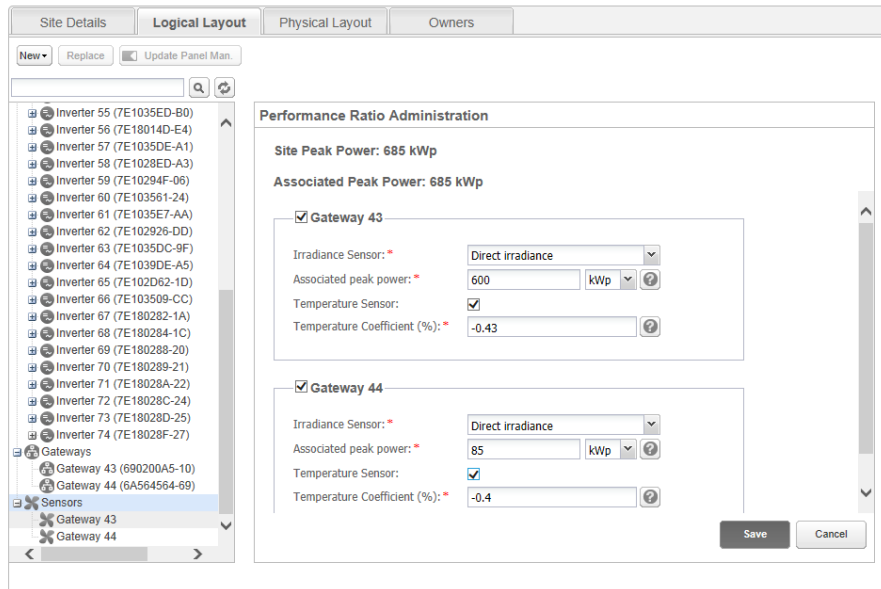


Figure 2: Performance Ratio Administration – multiple gateways



NOTE

Gateway names may be modified in the gateway details form to have more meaningful names.

12 Click **Save**.

Viewing PR

- To view the PR of sites in the site list, you can add PR columns to the display: Click **Choose Columns** and select one or more of the PR columns: **Last Year PR**, **Last Month PR**, or **Current Year PR**.

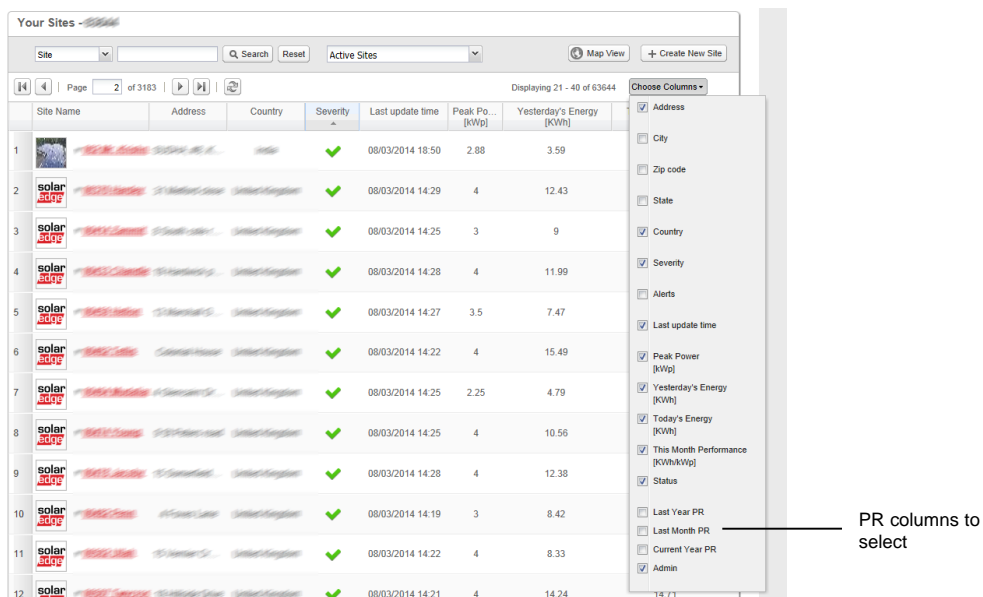


Figure 3: Selecting PR columns

- To view the PR in the site dashboard, click the **Dashboard** icon, and scroll down to the last graph - Performance Ratio. You can toggle between Daily/Monthly/Yearly views and compare the performance results. In the monthly and yearly views you can also compare to past performance.

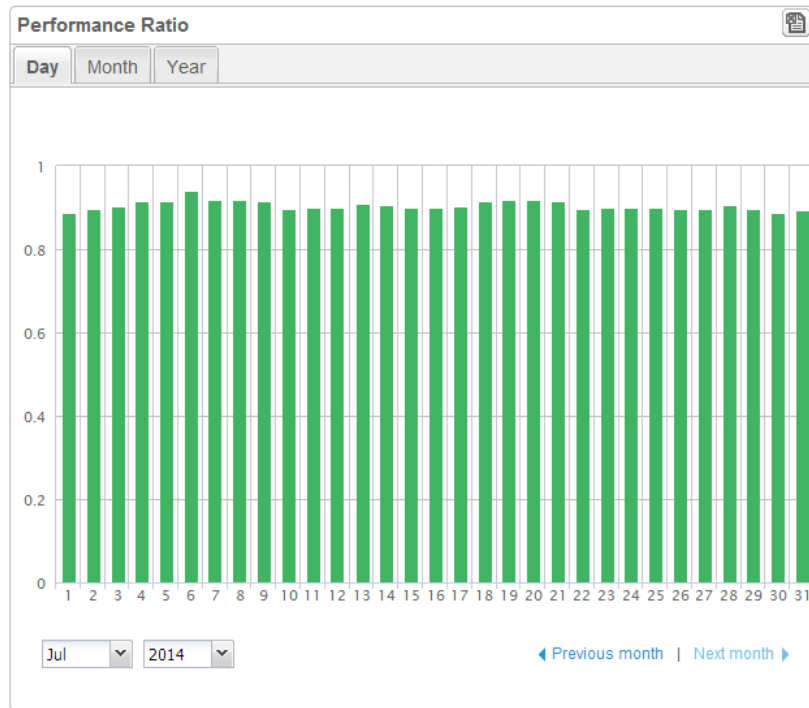


Figure 3: Performance Ratio displayed in the site dashboard