

Performance Ratio Calculation and Activation in the Monitoring Platform - Application Note

Revision History

- Version 3.0, April 2024: Updated text and images
- Version 2.1, Apr. 2018: Correction in formulas
- Version 2.0, Dec. 2017: Addition of satellite-based service for PR% calculations

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Overview

This application note describes how to edit settings in the SolarEdge Monitoring platform to display the Performance Ratio (PR) value. The PR value is a critical metric used to assess the efficiency and overall performance of a solar photovoltaic (PV) system. It provides insight into how effective the system is in converting sunlight into electricity. It is expressed as a percentage and calculated by comparing the actual energy output of the PV system to the theoretical energy output that is generated under ideal conditions.

The following table provides the terminology for calculating the PR value:

Terminology	Description
Energy Output	The actual amount of electricity generated by a solar PV system, measured in kilowatt-hours (kWh).
Peak Power	The maximum rated power output of a solar PV system under standard test conditions, measured in kilowatts (kW).
Solar Irradiance	The amount of solar energy hitting the surface of the solar modules per unit area, measured in kilowatts per square meter (kW/m ²).

The PR value represents loss due to inefficiencies in the system, such as temperature variations, shading, dust, dirt, and so on.

The following table describes the measurements required to calculate the PR value:

Measurements	Description
Energy Output	This can be measured using a utility meter that tracks the electricity generated by the solar PV system. SolarEdge smart inverters provide data on the energy output.
Peak Power	The peak power rating of the solar PV system is provided by the manufacturer and can be found on the specification sheet, or nameplate of the solar modules.
Solar Irradiance	Solar irradiance data can be obtained from local weather stations, sensors, and solar monitoring systems. Data can also be obtained from online satellite weather providers who supply current and historical data and can forecast solar radiation data for your location.
Compute Interpretation	A higher PR indicates better performance and efficiency of the solar PV system. A PR value close to 100% means the system is operating efficiently, while a lower PR indicates efficiency loss due to various factors.

It's important to note that the PR value is a dynamic metric and can change over time due to environmental conditions, maintenance practices, and system upgrades. Regular monitoring and calculation of the PR value can help identify performance issues and guide maintenance to optimize a solar PV system's efficiency.

A satellite-based service, which provides PR calculations based on irradiance information from satellites is only available in some regions and can be purchased whether sensors are installed at the site, or not.

**NOTE**

SolarEdge is no longer selling satellite-based services.

**NOTE**

For information about connecting sensors to the Commercial Gateway (CCG) and configuring the system, refer to the [SolarEdge Control & Communication Gateway Installation Guide](#).

Set up the PR display in the Monitoring platform

To set up PR calculations in the Monitoring platform:

1. Log in to the [Monitoring Platform](#).
2. To access your site, click the **Site Name**.
3. Click the **Admin** view.
4. From the **Admin** menu, click **Performance**.

**NOTE**

If a sensor is installed, or if a satellite-based PR service was purchased, **Performance Ratio** is displayed.

5. Select **Performance Ratio**.

Sensors as data source

When sensors are installed, connected to the CCG, and configured, you can edit their

settings in the Monitoring platform to display the PR value in the site dashboard. To enable sensors, the CCG firmware version must be 2.07XX or later. For information about software compatibility and upgrade refer to [Appendix B: Software Compatibility Check and Upgrade](#).

To set up PR using sensors:

1. From the **Data Source** dropdown list, select **On-Site Sensors**.

The **On-Site Sensors** information is displayed:

- **Site's peak DC power:** taken from the site details
- **Associated peak power:** displays the power of the array in which the sensors are installed



NOTE

This number will be used to calculate the PR value and is displayed after the sensor settings are edited. For multi-orientation sites, the associated peak power is the sum of the power of all arrays that have a sensor installed.

- Gateway (CCG) name and sensor information

2. To enable PR calculations using the sensor's readings, select the **Gateway** checkbox.

The sensor's settings are displayed and can be reconfigured.

SolarEdge Site

Site Details
Site Access
Logical Layout
Remote Settings
Energy Manager
Revenue
Performance
Inverter kWh/kWp
Estimated Energy
Performance Ratio

Performance Ratio

Data Source
On-Site Sensors

Site Peak Power: 443.8 kWp
Associated Peak Power: 421.8 kWp

Gateway 1

Irradiance Sensor
Direct irradiance

Associated Peak Power ⓘ
421.8 kWp

Temperature Coefficient ⓘ
-0.4 %

3. In the **Irradiance Sensor** field, verify that the Irradiance Sensor configuration is the same as it appears in the gateway.
4. In the **Associated Peak Power** field, enter the Associated Peak Power value and select the unit (Wp, kWp or MWp).

This value is now displayed in the **Associated Peak Power** field.



NOTE

The sum of the associated peak power values of the gateways should equal the site's peak power value.

5. If a module temperature sensor is installed on site and you want the PR calculation to apply its readings, enter the module's power Temperature Coefficient (%P/°C) in the Temperature Coefficient field.

**NOTE**

The Temperature Coefficient value must be negative. If you do not have the module datasheet you can use -0.4 as the default number.

6. Click **Save**.
Your sensor's settings are configured.
7. For multiple orientations, such as more than one gateway, repeat all steps for each gateway, to include the sensor measurements in the PR calculation.

Satellite PR as a Data Source

If you purchased a satellite-based PR service, use it to calculate the PR value.

To edit the Satellite Data:

1. From the **Data Source** dropdown list, select **Satellite data**.

The **Satellite Data** information is displayed:

- **Site's peak DC power:** Taken from the site details
- **Modules peak power:** This is the power of all installed modules

**NOTE**

This number will be used to calculate the PR and is displayed after the module settings are edited. For multi-orientation sites, the total peak power is the sum of all the powers.

**NOTE**

The sum of the modules' peak power values should equal the site's peak power value.

2. In the **Start Date** field, select a start date from which to display the performance ratio.
3. From the **Installation Type** dropdown list, select your installation type:

- **Freestanding:** structure with modules on land
- **Building-integrated:** modules directly integrated into a roof or facade
- **Roof-mounted:** modules mounted on roofs at certain angles

A table displays the module details including the number of modules, Power Optimizers, azimuth, tilt, and power output for each module type.

SolarEdge Site

Site Details
Site Access
Logical Layout
Remote Settings
Energy Manager
Revenue
Performance
Inverter kWh/kWp
Estimated Energy
Performance Ratio

Performance Ratio

Data Source: Satellite data

Start Date: 03/07/2023

Installation Type: Roof Mounted

Module Details	Module	Optimizers	Azimuth	Tilt	Power (kWp)
CS Wismar GmbH, Excellent Glass/Glass 260M48 brilliant Crystalline Silicon, 260W	847	430	135	17	241.5
REC Solar AS, REC 245PE ECO Crystalline Silicon, 245W	500	250	315	37	142.5
Total	1,347	680			383

Site Peak DC Power: 383 kWp DC
Modules Peak Power: 383 kWp

Cancel Save

4. To edit the **Module Details**, click .

The **Edit Module Details** pop-up is displayed:

Edit Module Details

Manufacturer: CS Wismar GmbH

Technology: Crystalline Silicon

Model Name: Excellent Glass/Glass 260M48 brilliant

Temperature Coefficient: -0.39%

Maximum Power: 260 W

Cancel Update


5. In the field options, type the information you want to edit and click **Update**.
6. Click **Save**.

The Performance Ratio chart will be available on your site's dashboard within one business day.




NOTE

To use the Satellite PR feature, verify your site has a published physical layout:

- To edit the physical layout, select the **Layout** tab and click .
- If a physical layout does not exist, click [Using the Site Layout Editor in the Monitoring Platform Application Note](#).

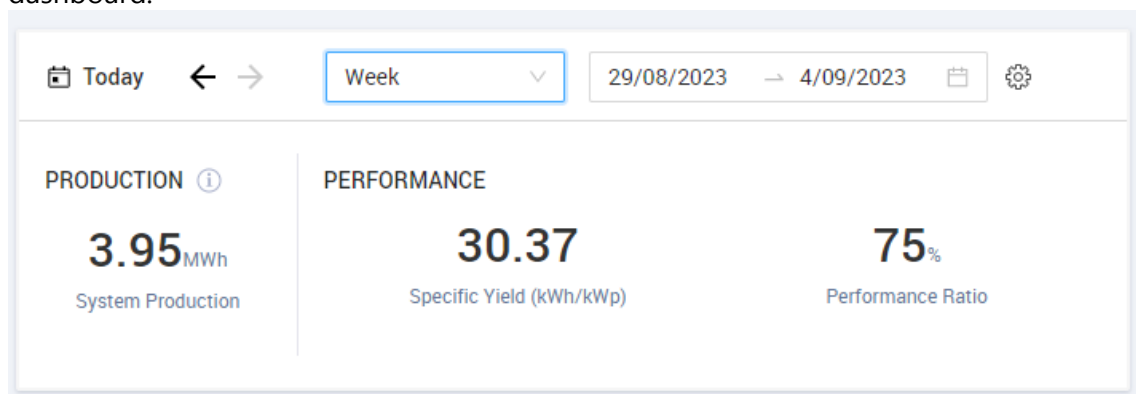
View PR

To view your site's PR on the site list:

1. On the **Sites List**, click  .
2. Select one or more of the **Performance Ratio** checkboxes.
The Performance Ratio columns are automatically displayed in the sites list.

To view PR on the site dashboard:

1. Click the **Site Name**.
The **Site Dashboard** is displayed. The PR value automatically displays on the mini dashboard.



2. Select the duration of time you want to display.
By default, the dashboard displays information for the current day and automatically updates after you modify the time.

Appendix A: PR calculation

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

- For a PV system with a single orientation:

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

- 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:

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

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

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

- 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)

Appendix B: Software compatibility check and upgrade

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

To check the CPU version:

Press the **Enter** button on the screen until the following screen is enabled:

```
ID: ##### #
DSP1/2: x.xxxx/x.xxxx
CPU :0002.0700
Country:XXXXX
```



NOTE

SolarEdge devices with earlier firmware versions can be upgraded. Contact [SolarEdge Support](#) to obtain the upgrade files and instructions.