
Estimating Energy in PVWatts - Application Note

PVWatts¹ is a widely popular online tool for estimating the energy output of photovoltaic systems, developed by NREL (National Renewable Energy Laboratory). PVWatts enables quick and accurate estimation of PV performance using a list of derating factors, which together with the system location determine the energy output of the PV system.

This application note explains what derating factors should be used when simulating a SolarEdge system in PV Watts.

Simulating SolarEdge in PV Watts

PVWatts default values reflect the behavior of traditional inverters and require adjustment to account for the added energy of the SolarEdge system. Specifically, several of the derating factors which together result in the “DC to AC Derate Factor” need to be adjusted (the remaining factors that are not detailed here can be left with their default values or adjusted according to the specific site characteristics).

1. Inverter and Transformer – This is the efficiency of the system. Use CEC values for both traditional and SolarEdge systems.
2. Mismatch – This needs to be set to the maximum value. Traditional systems have mismatch energy loss due to manufacturing tolerances, uneven soiling, thermal differences and more. Module-level MPPT eliminates all mismatch energy losses.
3. System availability – Due to module-level optimization, the SolarEdge system is not exposed to the vulnerability of a single point of failure. In addition module-level monitoring enables fast fault troubleshooting. Both these features increase the system availability compared to that of a traditional inverter. This is reflected in a GTM Research report² that says module-level power electronics can increase system availability by 1-2%.
4. Shading – Shading Percentage (Shade%) is determined by a site audit (for example with a Solmetric SunEye). Recent studies³ by NREL and PVEL have quantified the advantage of a SolarEdge system over a traditional system under shaded conditions, in the form of a Shade Mitigation Factor (SMF). The SolarEdge SMF is 24.8%, meaning a SolarEdge system will recover approximately 25% of energy lost by a traditional system due to shading. This factor can be used to determine the shading derate factor that should be used in PVWatts, as demonstrated below.

¹ http://gisatnrel.nrel.gov/PVWatts_View/index.html

² <http://www.greentechmedia.com/articles/read/Reliability-Testing-Front-and-Center-in-Solar-Module-Electronics>

³ <http://www.nrel.gov/docs/fy12osti/54876.pdf>

How to Change the Derating Factors for a SolarEdge Simulation

STEP 1 In the following PVWatts screen, press the “Derate Factor Help” button:

PV System Specifications:

DC Rating (kW):

DC to AC Derate Factor: **7**

Array Type:

1

This will open the full list of derating factors shown below. Change the following factors:

STEP 2 “Inverter and Transformer”: Inverter CEC efficiency X Optimizer CEC efficiency. For example:

Single Phase (240 Vac): $97.5\% \times 98.8\% = 96.3\%$; enter 0.963

3-phase (480 Vac): $98.0\% \times 98.8\% = 96.8\%$; enter 0.968

STEP 3 “Mismatch”: Change to 0.995

STEP 4 “Availability”: Change to 0.995

STEP 5 “Shading”: Shade% is determined by a site audit, and is used together with the SMF to determine the Shading derate, according to the following formula:

$$\text{Shading derate} = 100\% - [\text{Shade}\% \times (1 - \text{SMF})]$$

Example: Shade% = 12% (determined by site audit)

$$\text{Shading derate} = 100\% - [12\% \times (1 - 24.8\%)] = 100\% - [12\% \times (75.2\%)] = 91\% = 0.91$$

STEP 6 Press the “Calculate Derate Factor” button.

STEP 7 Enter the result in the “DC to AC Derate Factor” field shown above.

| Component Derate Factors | Component Derate Values | Range of Acceptable Values |
|--------------------------------|---|----------------------------|
| PV module nameplate DC rating | <input type="text" value="0.95"/> | 0.80 - 1.05 |
| Inverter and Transformer | 2 <input type="text" value="0.963"/> | 0.88 - 0.98 |
| Mismatch | 3 <input type="text" value="0.995"/> | 0.97 - 0.995 |
| Diodes and connections | <input type="text" value="0.995"/> | 0.99 - 0.997 |
| DC wiring | <input type="text" value="0.98"/> | 0.97 - 0.99 |
| AC wiring | <input type="text" value="0.99"/> | 0.98 - 0.993 |
| Soiling | <input type="text" value="0.95"/> | 0.30 - 0.995 |
| System availability | 4 <input type="text" value="0.995"/> | 0.00 - 0.995 |
| Shading | 5 <input type="text" value="1"/> | 0.00 - 1.00 |
| Sun-tracking | <input type="text" value="1"/> | 0.95 - 1.00 |
| Age | <input type="text" value="1"/> | 0.70 - 1.00 |
| Overall DC to AC derate factor | 0.83 | |

6