CASE STUDY
comparative analysis

PHOTON Labs, Germany
Power Optimizers Survey

OVERVIEW

Study Conducted by:
Photon Labs, Photon Magazine

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Location: Aachen, Germany

SolarEdge System:

PB250 Add-on power optimizers

Competing System:
6 power optimizers models by 4 power optimizer vendors

String Layout:
Two strings of 7 x 180W modules, one string of 14 x 180W modules.

Figure 1: *Photon's advanced test lab with sun simulator and shading elements*
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Introduction

The Photon Photovoltaics Lab has dedicated several months of testing and simulations during 2010 to the independent comparative performance analysis of SolarEdge power optimizers vs. six different power optimizer models offered by 4 vendors. The following case study presents the highlights of that analysis, which has been published by the international edition of Photon Magazine in February 2011.

The SolarEdge power optimizers have increased the energy across a wide range of real-life shaded and unshaded cases, by up to 32%.

Photon concludes: *"The system appears to be well-designed, produces increased yield, and is one of the least expensive solutions."*

SolarEdge power optimizers were among the only two power optimizers that *"Could be configured without any problem and worked properly right from the start."*

Setup

A comprehensive test setup was designed by Photon Laboratory for side by side power optimizer comparison, using a sun simulator, and with a 2.5 kWp installation consisting of 14 modules. The modules were exposed to 1,100 W/m^2 irradiance under reproducible conditions, generated by 44 halogen lamps, as shown in the above image (Figure 1). To simulate shading patterns typical of various real-world conditions, four shading elements were used (Figure 2):

- Mast (pole)
- Dormer (chimney-like structure that projects vertically from a sloping roof),
- Horizontal shading,
- Semi-transparent material simulating partial module soiling by dust or pollen.

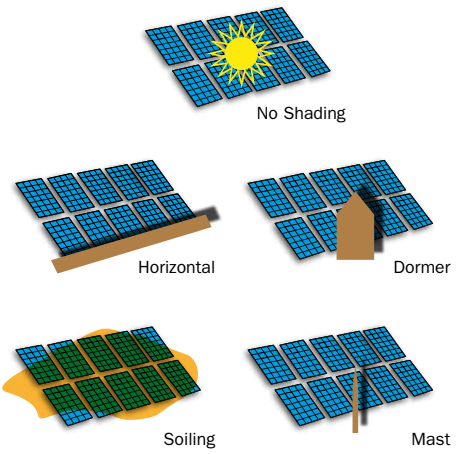

Figure 2: shading elements

Shading fluctuations were produced by applying different levels of solar irradiance. Accurate output measurements lasted several hours each day, and went on for a number of months. A comparison of the energy and power output of the array with and without power optimizers connected to the modules was performed under the same irradiance and shading conditions. The comparisons were conducted for a 14 module string, and for 2 parallel shorter strings of 7 modules each.

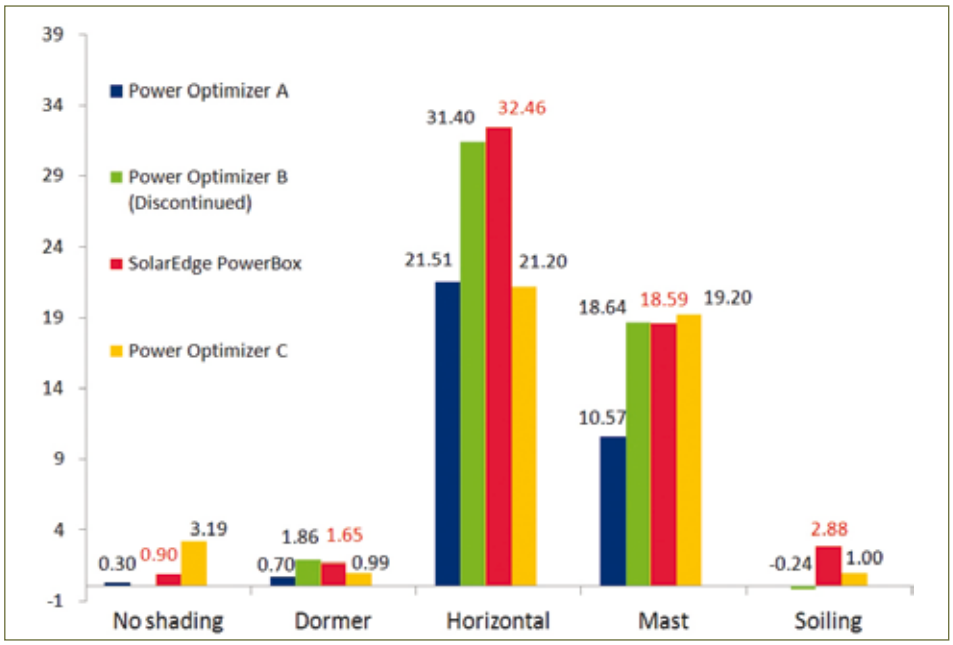

Figure 3: energy gain (%) measured for each optimizer

Results

In both long string layout and short strings layout, the scenario with maximum energy gain was achieved by the SolarEdge power optimizers.

Long string layout – top performer

According to Photon, *"When testing over an extended period, the greatest output gain was achieved when facing horizontal shading. The PowerBox from SolarEdge improves the output of the system by almost a third"* (32%).

Horizontal shading is often cast by an adjacent row of modules, or even by neighboring buildings at certain times of the day. "*SolarEdge took the top spot in this category.*"

Short strings layout – top performer

With short strings, the highest output gain, 15.5%, was measured for mast shading – *"The test winner here was SolarEdge."*

SolarEdge boosted energy output by 1.7% – 15.5%, in all short-strings shading scenarios, despite being tested outside of the product usage specifications (8-25 modules per string connected to a single phase inverter, or 15-55 modules per string connected to a three phase inverter).

Notably, when operated according to its specifications, SolarEdge increased energy gain by nearly 1% even when the modules were not exposed to any shading. The added energy in this case may be attributed to prevention of loss due to module mismatch.

Partial shading due to soiling

Photon analyzed whether power optimizers are beneficial when modules have varying amounts of dirt on them caused by pollen, leaves or other debris. As expected, power optimizers are useful under these conditions as well. The SolarEdge system led this category, ramping up power output by roughly 3%, about twice as much as the next best device.

Conclusion

In a broader perspective of the comprehensive advantages of some power optimizers, Photon asserts that when power optimizers with active communication systems like SolarEdge are used, *"faulty modules can be discovered very quickly."* Moreover, according to Photon: **"Power optimizers are likely to find a future market for quite a different reason as well: they enable PV systems to be monitored and controlled at the module level. Thus, they can shut down a PV installation immediately in the event of a fire."**