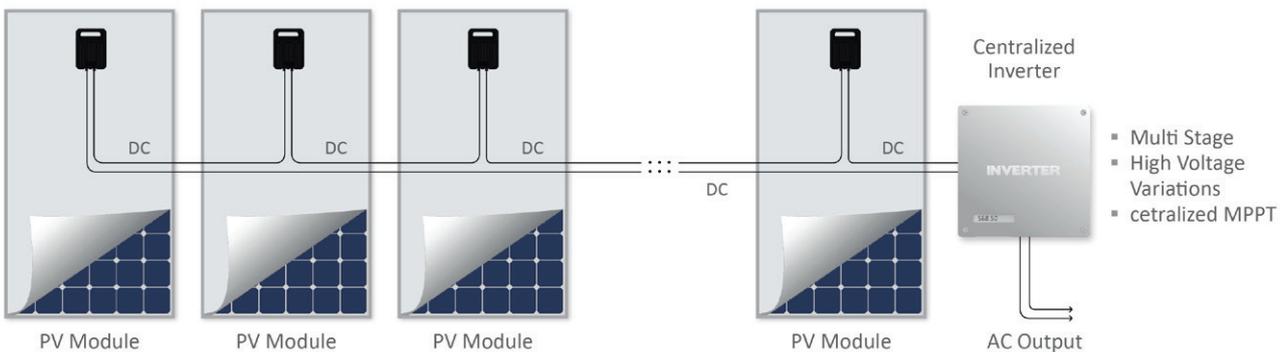


Introduction to SolarEdge



- Up to 25% increase in output power (34.6% recorded during the Photon Magazine laboratory tests - October 2011).
- Higher efficiency (99.5%) - peak performance both in shaded and unshaded conditions.
- Flexible system design for maximum space utilization.
- Next generation maintenance with module level monitoring.
- Superior safety for installers and firefighters.

Challenges inherent to traditional PV systems

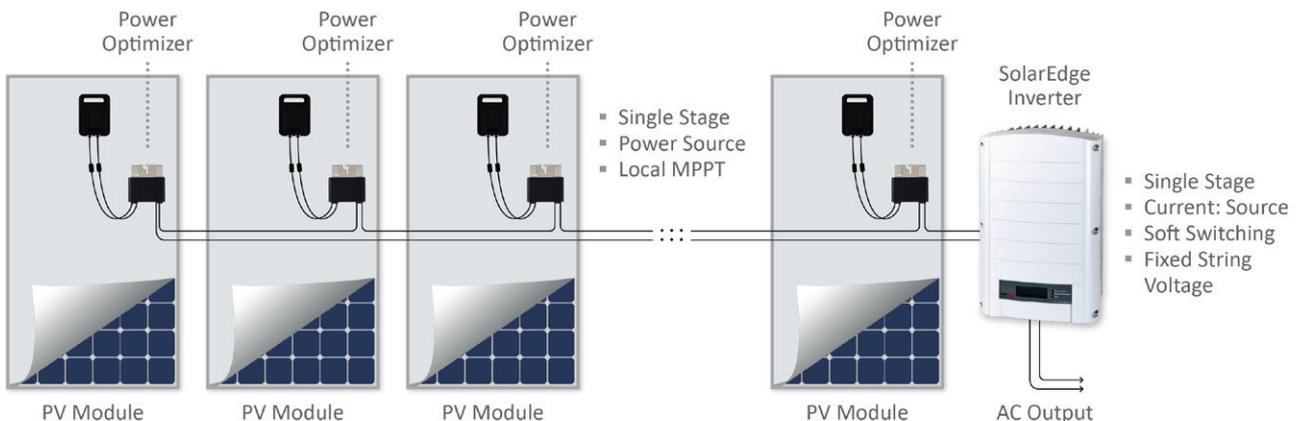


- All strings must consist of the same number of PV modules.
- PV modules must all be of the same manufacturer and same nominal power.
- Even though PV modules leaving the production line are not identical, their power mismatch ranges between 3% and 5% and energy is lost.
- Partial shading on one module or part of the string can lead to a disproportional loss of energy for the entire string. 10% of shade on one PV module can eliminate 90-100% of its produced energy. This is also true for dust, bird droppings and any type of dirt accumulating on the module.
- PV modules must all have the same orientation.
- Changes in temperature and solar irradiance lead to significant voltage fluctuations at the module output and even more at the inverter input. This has a highly negative effect on the efficiency of the central inverter which is likely to be different from the documented nominal efficiency measured in the lab under optimal voltage.

- When calculating the right string length, installers must take into account:
 - > That the minimum length will not generate under-voltage on the hottest and cloudiest days of the year as this could stop the inverter and result in energy loss during the whole period the inverter is shutdown.
 - > That the maximum length will not generate over-voltage on the coldest and sunniest days of the year as this could damage the inverter and result in costly repairs or inverter replacement.
- Dynamic MPPT losses:
 - > Whenever conditions such as temperature or solar irradiance change, the central MPPT algorithm must find the new Maximum Power Point (MPP). Due to the large amount of power connected to the inverter, MPP tracking occurs rather slowly. This slow reactivity translates in energy losses called «dynamic MPPT losses».
 - > Safety problems: At any point during the installation, a high DC voltage at the end of the string presents a dangerous hazard for installers, maintenance workers or firefighters.
 - > Neither feedback on installation nor easier ways to locate faults exist.

Decentralized DC Architecture – The SolarEdge Innovation

The solution to all the above problems cannot come from a “better” inverter. These system level problems can only be solved with a different system approach. SolarEdge decentralized what needed to be decentralized (MPPT) and kept centralized what was needed (DC to AC inversion). The SolarEdge solution consists of three important components (see below figure):





SolarEdge Power Optimizer

Performs local MPPT at PV module level and makes sure the module is maximum powered at all times, with a yield of 99.5%. This results in:

- Zero module mismatch losses.
- Zero partial shading losses.
- One can install any module of any make or rated power in the same string, thus eliminating the need for sorting modules. A module can be replaced by any other PV module available.



SolarEdge Inverter

No matter the number of modules in the string, the temperature outside, the solar radiation, the dirt on the panel, the partial shading or dirt on the modules, the SolarEdge architecture maintains a constant string voltage which has the following huge advantages:

- Not only is the inverter much simpler as it only converts DC to AC, but it works at a constant voltage which has been selected to be optimal for DC to AC conversion. Therefore, the SolarEdge inverter is always performing at maximum efficiency, 100% of the time.
- The SolarEdge inverter is very reliable because it has less electronics (no MPPT), and all its components are rated for small voltage range (fixed string voltage).
- There is no more limitation in the number of panels that can be connected in a string (up to 25 modules for the single phase inverter and up to 50 modules for the three phases). This allows the system owner a better roof utilization without the need to redesign the system and savings in wiring and junction boxes
- There is no more influence of temperature, solar radiation, dirt on the string voltage and therefore all string calculations are irrelevant and all inverters faults are eliminated. Uptime has been maximized.

We now have PV modules that are maximum powered all the time and an inverter that is optimum all the time. This is why a SolarEdge powered system can yield between 2% to 25% more energy on an annual basis.



SolarEdge Monitoring Server

Each SolarEdge power optimizer is monitoring enabled. Every few minutes, the power optimizers transmit Power, Voltage, Current and Temperature over the DC lines to the inverter. The inverter has a receiver that collects and a buffer that stores this data (for periods when the internet is not available) and communicates this data to the SolarEdge monitoring server over the internet. The SolarEdge monitoring server not only monitors and displays real time data at the level of each PV module but also analyzes the data and sends alerts (email or text) whenever an important event occurs which must be notified to the owner or the operator of the PV plant. The server software is based on a rules engine and pre-defined rules that have been entered in the system. Admin users will have the ability to define their own rules and therefore capture corporate knowledge about the way the PV plant and all its components perform over time (failure, degradations, best performing modules, effect of dust or temperature, recommended time to clean the modules, etc).

Safety

At any time during installation, there is a high DC voltage at the end of a string, which represents a serious danger to installers, maintenance workers or firefighters. During installation and until the power optimizers are not connected to the inverter and the inverter is not connected to the grid, all power optimizers maintain a safe low voltage of 1 volt, making the system secure. Similarly at system shutdown, as soon as the AC power is disconnected, the inverter disconnects and shuts down, making all the power optimizers decrease immediately to their safety voltage of 1V. For extra precaution, particularly in the case of the inability to cut the AC power (unknown location, connector on fire, etc.), the modules and the inverter are switched off whenever the temperature exceeds a predefined value, thus eliminating complex procedures before any intervention with a fire.



To learn more about SolarEdge and succeed in your projects

SolarEdge and its partners assist you with the evaluation and implementation of your projects.

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