

Get More When Shopping for Solar



**CREATIVE
ENERGIES**

Located in Santa Clara, Utah, the first Harmons grocery store to go solar strives to derive 40% of its energy from the sun. The 700kWp system deploys 16x SE33.3KUS inverters and over 2,100x 72-cell 320Watt Canadian Solar modules optimized by over 1,000x P700 power optimizers connected by only 48 PV strings.



STRONGER TOGETHER.

“The goal of this system was to place as much PV on the rooftop as possible. To accomplish this, we installed modules in an East/West orientation and we leveraged the flexibility of SolarEdge’s Optimized Inverters.”

> Phil Schneider, System Designer, Creative Energies



No two installations are the same and even the same installation rarely goes without some changes. For this project, Creative Energies faced a tight timeline and a rooftop with many visible obstructions. Plus, to meet the customers financial and production goals, they needed to place as much PV on the rooftop as possible. “When we saw the requirements for the project and compared them to the rooftop layout, we knew that we wanted to use SolarEdge for this job,” said Toby Schmidt, Director of Installation for Creative Energies. “We used SolarEdge before on smaller commercial projects and recognized the design flexibility offered by the optimized inverter technology.”



Looking Both Ways

To maximize the amount of PV on the rooftop, Creative Energies chose an East/West racking system and the SolarEdge SE33.3KUS optimized inverter. These racking systems use modules on 2 sides to reduce ballast, eliminate wind shields and to eliminate shade spacing. “With no wind shields or offset to account for shading, we were able to build an array 30% larger than possible with standard racking systems,” said Toby Schmidt.

When installing an East/West racking system, SolarEdge has a number of advantages over traditional string inverters. The SolarEdge inverter greatly simplifies rooftop wiring and offers string level shade tolerance and more options with regard to string length. With the SolarEdge inverter, Creative Energies stated that it was able to increase the system size by another 10% utilizing the rooftop to its fullest, simplify the wiring layout, speed up the installation timing with less homerun cables and verify connections safely with SafeDC™ technology.

“With SolarEdge, we are able to install about 10% more PV and fully maximize the energy from on the rooftop.”
- Phil Schneider, System Designer Creative Energies

Seeing Double

SolarEdge SE33.3KUS inverters offer a unique advantage when compared to traditional string inverters. The SE33.3KUS facilitates 15 kW of power on each string which

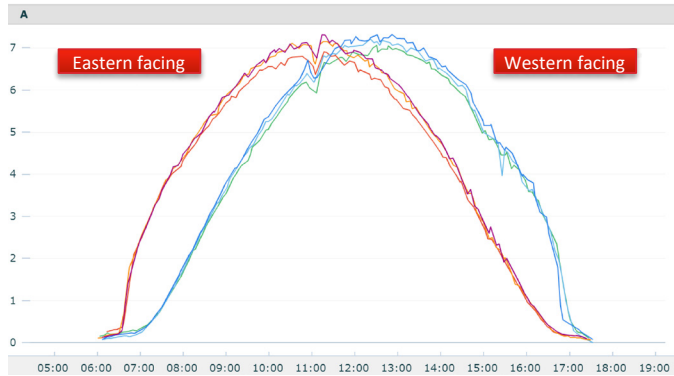
which represents an improvement in string length by about 2.5x. For a traditional inverter to reach this string length, it would need to operate at around 2500 Volts. But, because SolarEdge’s inverter operates on a fixed string voltage, SolarEdge inverters are able to achieve much longer strings and stay under the 1,000 Volt limit. In addition, the SE33.3KUS inverter ships with an integrated combiner box that supports 6 fused inputs for 3 PV strings. At 15kW per string, installers only require 3 strings to reach the maximum of 45kWdc of solar modules at the recommended 135% DC/AC ratio. With 320Watt modules, this results in 46 modules per string and simplifies wiring on projects like Harmons. “Longer strings represent a substantial savings and saves a considerable amount of time overall,” said Toby Schmidt.

Energy Optimization

East/West racking increases the system size on the rooftop but with some loss of specific yield (kWh/kWp) versus southern facing systems. Creative Energies estimate that for this installation, the loss is about 8%. But, because of some of the design choices made during the installation, these losses may be recovered.

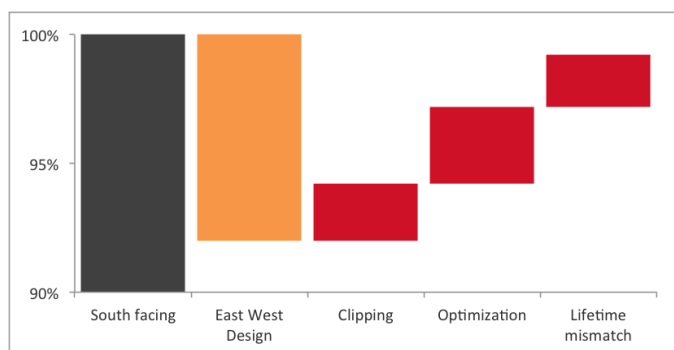
For the three strings design, Creative Energies combines both east and west strings into a single inverter. For example, an inverter might contain 2 east and 1 west string. This helps to avoid clipping of production during the day as the inverter will always have at least one string not facing the direct sun.

At an oversizing of 135%, systems that are arranged due south in high production regions could expect to see 2-3% clipping. With east / west system, installers have the ability to combine strings with offsetting production levels to minimize the clipping potential. By using this technique, systems are able to minimize clipping and regain the 2-3% that would have been lost from clipping.



Graph 1: You can see the east / west module production clearly in the SolarEdge monitoring portal

In addition, SolarEdge offers MPP tracking at the module level for increased energy output. Even under ideal conditions, modules connected in series and in parallel can experience mismatch losses. Localized temperatures, soiling, and shading can further increase the issue. These losses caused by mismatch can be recovered with module level MPP tracking. SolarEdge estimates that on many commercial sites, power optimizers can recover approximately 3% more energy in year one. As modules age, this mismatch continues to increase leading to an additional 2% potential recovery for systems optimized by SolarEdge.



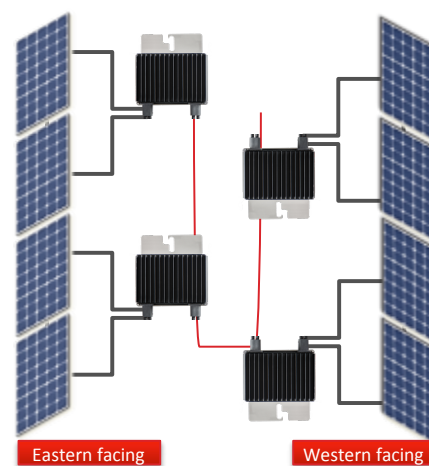
Graph 2: The specific yield losses from the east west orientation combined with the gains from the design of the system mostly cancel one another out leading to very attractive modeled production levels in the array.

Connecting Power Optimizers

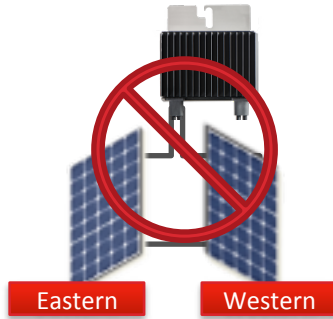
For this installation, Creative Energies chose the P700 power optimizer that connects to 2 72-cell modules. These power optimizers combine the 2 modules in series doubling the voltage but keeping the current of a single module. Since these modules are connected in series, they should be designed using the same module part numbers and power levels. The 2 modules should also be installed as if they were one 'super' module - having the same tilt and azimuth. This will maximize energy production on site and prevent mismatch losses within the pair. Creative Energies uses this rule often when designing this array, leading to many best practices.

Best Practices

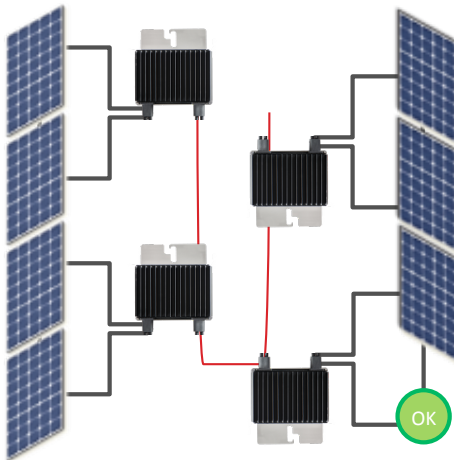
✓ Creative Energies mixed eastern module pairs with western module pairs onto the same string. This is possible because, even though module production will vary during the day, and neighboring module pairs will vary in output, the power optimizers manage their current output and can match currents within the string. So, a group of power optimizers supporting module pairs that face west can be combined in a string with a group of power optimizers supporting module pairs that face east.



Note: While it may be tempting to install one eastern module and one western module onto the same power optimizer, this will create 2 modules with different current levels throughout the day. Because these modules are connected in series, the module pair will experience higher than expected mismatch losses. This type of configuration is not authorized by SolarEdge.



✓ Creative Energies installed one module on a P700 when not able to fit both modules in the same location. SolarEdge P700 power optimizers can work in 2:1 configuration or 1:1 configuration within the same string. For example, some strings may support 45 modules and not the full 46. Rather than eliminating a module from that string to arrive at an even 44 modules (and 22 power optimizers), installers place the 45th module on its own power optimizer (23 total power optimizers).



✓ Power optimizers require equipment grounding. This can be accomplished with a simple grounding plate installed between the power optimizers and the racking. In this case, the racking base rail provides the mounting and grounding point for the power optimizers. Creative Energies installed the power optimizers with an optional MLPE mounting kit combined with a standard grounding plate.



✓ In addition, with no cross racking, Creative Energies relied on module frames for cable management. Toby Schmidt claimed that “by using industrial, nylon coated steel ties, Creative Energies ensured that the cable management would last the full system lifetime of 25 years.”



✓ With large installations, there are often many cables and connectors. SolarEdge inverters not only reduce cables on the rooftop with longer PV strings but also make verification easier. With SolarEdge’s SafeDC™, when power optimizers connect to PV modules, they each output 1 Volt DC until the inverter tells them to turn on. This can help installers check their connections in the field. For example, if there are 25 power optimizers installed in the string, installers should be able to measure around 25volts. Creative Energies uses this SafeDC™ check to verify that all wiring and connections are done accurately.



✓ To maximize space utilization on the rooftop, Creative Energies chose to install the inverters in a central location running DC lines to the inverter bank. SolarEdge inverters are smaller and lighter than many inverters in the same power class. The SE33.3KUS weighs only 106 lbs. and can be installed vertical or tilted to a maximum of 10 degrees. This gives designers the flexibility in placing the inverter around or within the PV array.

