SolarEdge - Single string design guidelines - Application note – North America

This application note establishes guidelines for implementing the single string design topology in North America. It applies to residential P-series and S-series Power Optimizers.

Revision history

- Version 1.1, July 2024 – Added definitions and examples of clipped and excess power.
- Version 1.0, February 2024 – Initial release.

Design Guidelines

NOTES:

- In case of a conflict between these guidelines and local regulations, local regulations shall prevail.
- When using a single string design on multi-facet roofs, yield losses greater than 2% can be recovered by installing higher output voltage Power Optimizers or multiple strings where possible.

When the inverter AC nameplate is lower or equal to the maximum usable power delivered per string for the connected inverter (as mentioned in the Power Optimizer's datasheet), all Power Optimizers can be connected in a single string if the following conditions are met:

- The connected string power does not exceed the total allowed inverter DC/AC oversizing ratio as mentioned in the inverter's datasheet.
- The maximum allowed number of Power Optimizers per string does not exceed 25 Power Optimizers for a single-phase inverter.

Systems that include batteries

Below are some guidelines to help design an efficient system.

Oversizing is a cost-effective way to maximize a solar energy system's production by increasing the total capacity of the DC power so that it is higher than the capacity of the inverter. While energy will be lost at peak production, more energy is harvested throughout the day.

For more clarity, we need to define clipped and excess power.

Clipped power

This occurs when the installed string DC power is higher than the maximum usable power delivered. In single-phase systems, the maximum usable power delivered per string is 5700W. For example, in a single string of 6000W installed DC power using an SE6000H inverter, the string reaches its maximum usable power delivered (5700W) so 300W is clipped.

Excess power

This refers to the case where the string power is higher than the inverter's rated power. This excess power can be used for battery charging. For example, in a single string system of 5700W DC installed power using an SE3800H inverter and connected battery, the excess power of 1900W is used for battery charging.

Inverters rated less than 5700W

If a single string is connected and its power is **higher than** the inverter rating, the battery is charged from excess PV power.

Inverters rated at 5700W

If a single string is connected to an SE5700H inverter, there is no excess power available for battery charging since the string maximum usable power delivered is 5700W. In case of string oversizing, the energy is clipped at the peak production of 5700W. To avoid this and to ensure that all generated energy is used, we recommend a two-string design. Alternatively, if a single string design is necessary, the mySolarEdge app allows configuring manual charge schedules to prioritize energy storage in the battery.

Inverters rated above 5700W

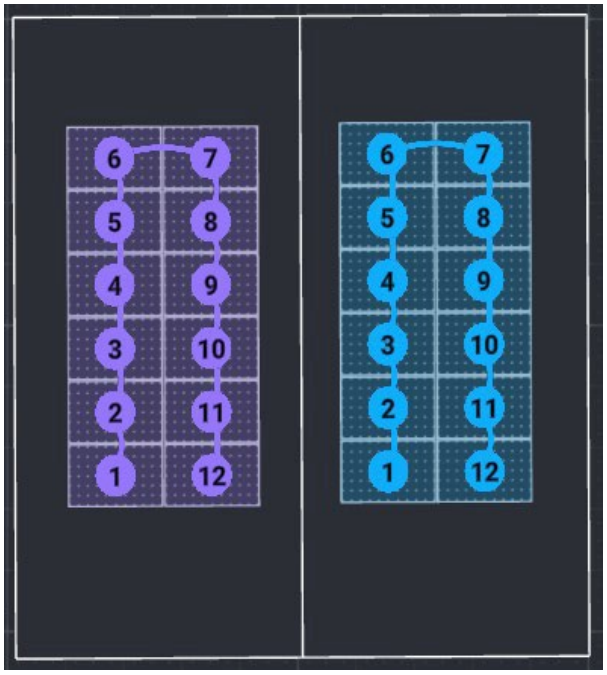
SolarEdge recommends avoiding string oversizing to reduce the potential for string-level clipping since clipped string PV power occurs at 5700W.It is better to install two strings even if all the rules are met. This allows for maximizing battery charging and inverter production. For inverter oversizing information, please refer to the Home Hub inverter's datasheet.

Example one – single-phase inverters – valid use

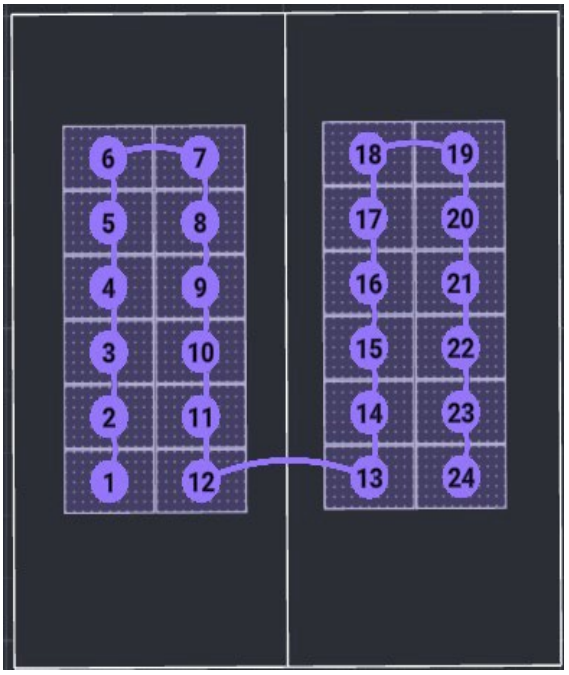
The AC nameplate for a single-phase SE5700H Home Hub inverter is 5.7kW$_{AC}$. This rating is equal to the maximum usable power delivered per string of 5.7kW (15A x 380V) for S440 Power Optimizers with a single-phase Home Hub inverter. Installing 24 x 400W modules connected to S440 Power Optimizers provides an installed DC capacity of 9.6kW (STC).

This is possible since 200% DC/AC oversizing (up to 11.52kW in this case) is allowed. In addition, 24 Power Optimizers is permissible according to the maximum number of Power Optimizers allowed per string with a single-phase inverter. The inverter nameplate limit ensures that the maximum usable power delivered per string is not exceeded.

Regular Design



Single String Design

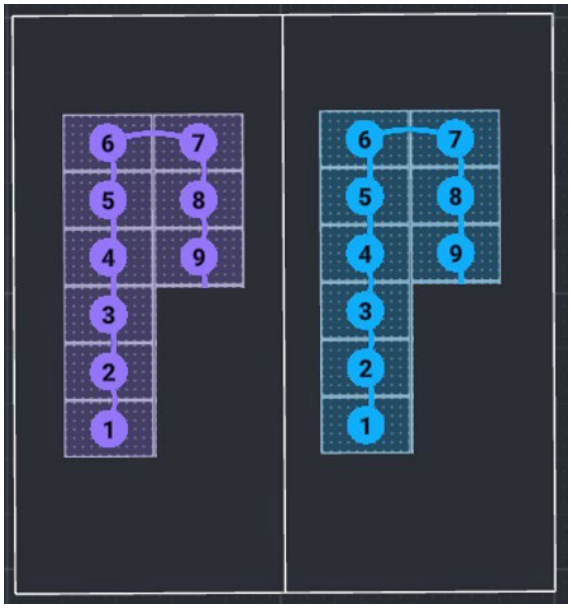


Example two – single-phase inverters – valid use

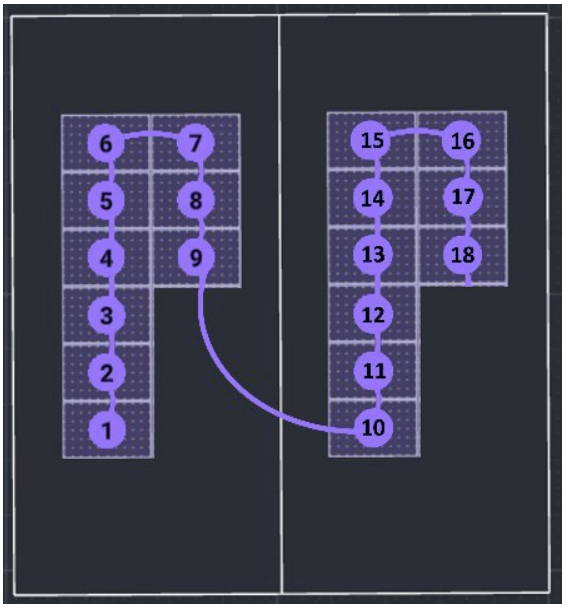
The AC nameplate for a single-phase SE5000H Home Wave inverter is 5kWAC. This rating is lower than the maximum usable power delivered per string of 5.7kW (15A x 380V) for S440 Power Optimizers with a single-phase Home Wave inverter. Installing 18 x 400W modules connected to S440 Power Optimizers provides an installed DC capacity of 7.2kW (STC).

This is possible since 155% DC/AC oversizing (up to 7.75kW in this case) is allowed. In addition, 18 Power Optimizers is permissible according to the maximum number of Power Optimizers allowed per string with a single-phase inverter. The inverter nameplate limit ensures that the maximum usable power delivered per string is not exceeded.

Regular Design



Single String Design



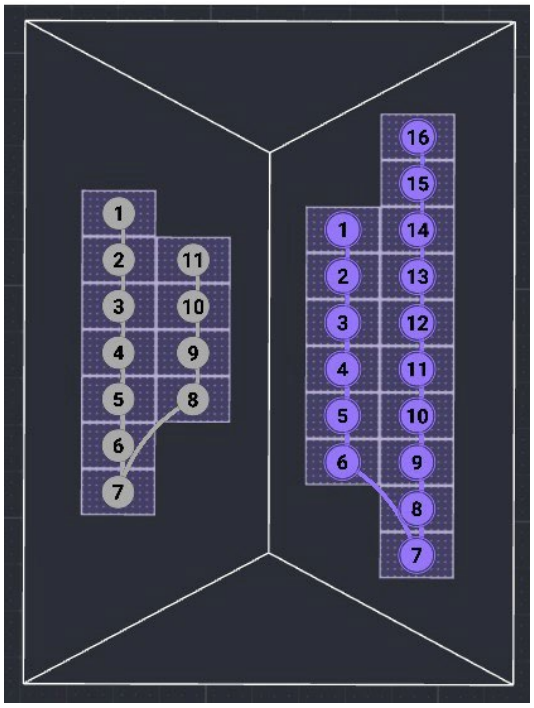
Example three – single-phase inverters – invalid use

In a system with a single-phase SE5700H Home Hub inverter installed, the inverter AC nameplate is 5.7kW$_{AC}$. This rating is equal to or lower than the maximum usable power delivered per string of 5.7kW (15A x 380V) for S440 Power Optimizers with a single-phase Home Hub inverter.

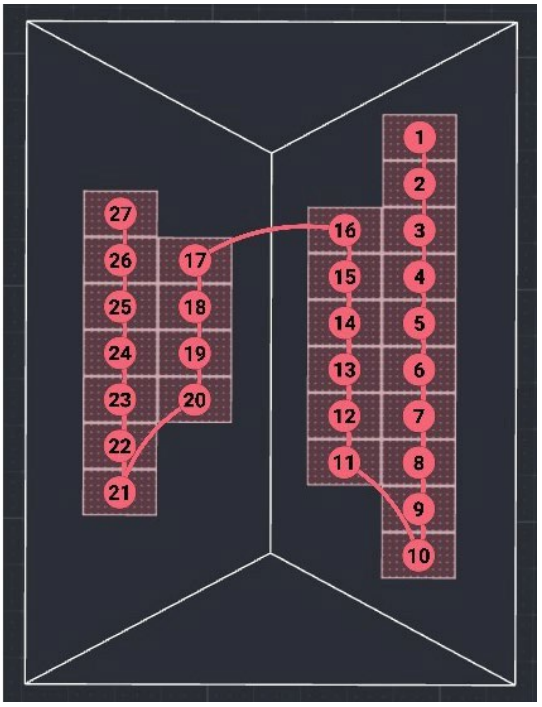
Installing 27 x 370W modules connected to S440 Power Optimizers provides an installed DC capacity of 9.99kW (STC). This is possible since 200% DC/AC oversizing (up to 11.52kW in this case) is allowed.

However, the number of Power Optimizers (27) exceeds the maximum number of Power Optimizers allowed per string (25) with a single-phase inverter and therefore the DC capacity of 9.99kW STC must be installed **in two strings**.

Regular Design - Valid



Single String Design - Invalid



Applicable inverters

These guidelines apply to the following SolarEdge inverters:

- Single-phase Home Wave inverters SE5700 and lower.
- Single-phase Home Hub inverters SE5700 and lower.