Different Orientations

Optimization enables modules to be placed in the same string on different orientations/azimuths, or pitches/elevations.
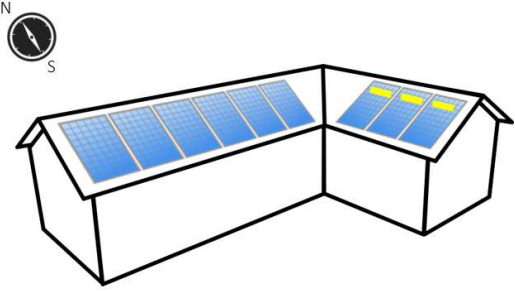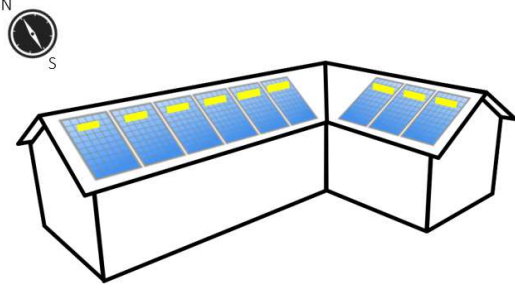
Ensure panels in different major orientations can generate enough voltage on a string to start up the inverter:
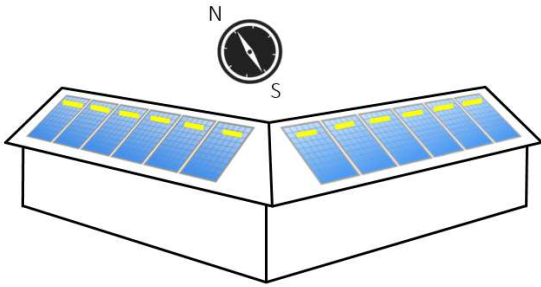
> 🖉 On strings with split orientations, such as East facing and West facing, each major orientation needs to have the minimum Mppt voltage. In another words, when not in the direct sun, PV modules should not be considered to be contributing to the string voltage to the inverter. PV modules must maintain string voltage within the inverter's Mppt operating voltage range. The higher the string voltage, not exceeding Mppt voltage maximum, the better.

When using TS4 O or L which optimize for shading conditions, partial/**selective installation is possible in a few cases listed below.** When using gen. 1 Smart Modules (non-TS4) ES or 2ES add-on optimizers; always deploy on 100% of an MPPT to enable the different combinations. Assume the residential systems described below are built with 240V SMA Sunny Boy 3800TL-US inverters (datasheet available here) and Trinasmart 270W modules (datasheet available here)

- Cases with most panels facing the same direction, and a small portion, which can't generate high enough voltage to start up the inverter, facing a different direction. For example, with 9 panels on a string with 6 of them facing south, and the remaining 3 panels facing west:
  - The SMA inverter's startup voltage = 150V, and the Trinasmart modules in direct sunlight contribute 30.9V each (assume 30V for the sake of simple calculations)
  - The 6 south-facing modules alone will start up the inverter, (6 modules * 30V = 180V > 150V) and the 3 west-facing modules will not (3 modules * 30V = 90V < 150V)
  - Conclusion: Deploy TS4-O only on the 3 panels that are facing west

TS4-O or TS4-L: Selective deployment	Non-TS4: 100% deployment

- Cases where each orientation is able to produce <u>enough voltage on a single string</u> for the inverter to <u>start up</u>. For example; a string of 12 panels with 6 panels facing south, 6 panels facing west.
  - Assume the inverter's startup voltage = 150V, and that modules in direct sunlight contribute 30V each
  - Each orientation will have enough voltage to keep the inverter on (6 modules * 30V = 180V > 150V)
  - Conclusion: Deploy 100% optimization to ensure that the array voltage is high enough keep the inverter on throughout the day. This is especially important for systems with half an array facing east, and half an array facing west.

In this single string example, each orientation is able to produce enough voltage for the inverter to start and stay ON. Deploy 100% optimization

- Note that there's no limit on how different the azimuths are, as long as voltages of the inverters are met.
- On multiple parallel strings, follow the same voltage guidelines, and deploy 100% optimization (TS4-O, TS4-L, gen.1 Smart Modules and/or 2ES).