Fronius
SHIFTING THE LIMITS

# INVERTER SELECTION FOR COMPLEX PV SYSTEMS

## 1. PV systems with different orientations[1]

The installation of an inverter with a single MPP Tracker (MPPT) in PV systems with different orientations (e.g. East/West or South/West) makes sense if one considers the following rules*:

/ Shading within each orientation must be avoided
/ Within a single string, the inclination angle and orientation of the solar modules must be identical
/ The number of solar modules must be identical in all strings**

*Investigations have shown that with such installation variant mismatching losses occur. As expected, these losses are very small (~1%). In contrast to minimal yield losses the following costs can be reduced: firstly, the nominal power of the inverter can be up to 35% smaller than the installed module power and secondly the installation costs can be minimized.
**Note: The number of strings of the sub-arrays can be different (e.g. installation of one string on the east roof and two strings on the west roof).

## 2. Shaded PV systems – Shading through near objects (e.g. chimney)[2]

Basically it's recommended to avoid shading. If it's not possible to achieve that – because the total roof area must be used - then the system configuration must be planned well. Firstly you should differentiate between a monostring system and a polystring system. If it's possible to build up a monostring system then the use of an inverter with multiple MPPT has no advantages compared to an inverter with a single MPPT. If a monostring configuration is not possible then the use of an inverter with multiple MPPT could result in higher energy yield compared to an inverter with a single MPPT. The highest energy yield can be achieved with module optimizers because with this solution every PV module operates at its MPP.

## 3. Shaded PV systems – Shading through distant objects (e.g. tree)[2]

In the case of shading through trees the use of module optimizers leads to the best results. In this case also an inverter with multiple MPPT can generate mostly a higher yield compared to an inverter with a single MPPT.

## 4. Different string length[3]

The MPP Tracking algorithm of Fronius inverters is best suited for paralleling strings of the same module type and equal numbers of modules per string. Even if it's not recommended in some cases it is possible to connect unequal string length in parallel to the inverter without having any negative impact on the PV system. Such configuration would make sense in a system where the full power of the inverter shall be utilized, but the number of modules doesn't allow a configuration of equal strings. This often leads to one module more or one module less in one string.

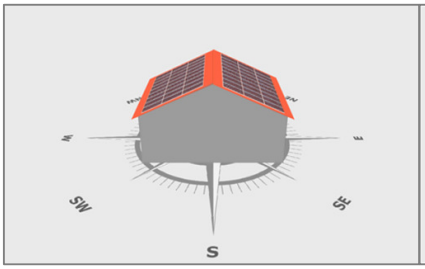
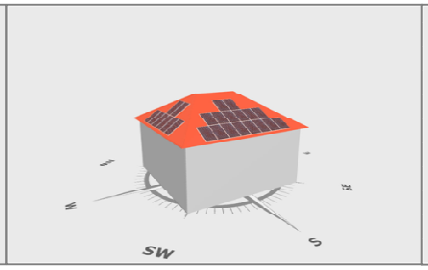
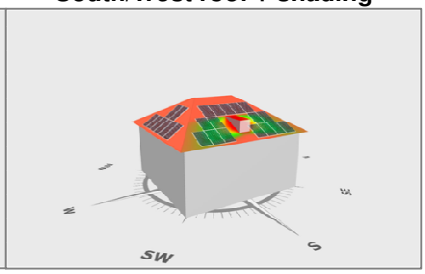
/ One longer string: system configuration is possible, no matter how many strings are in parallel. However, only a part of the additional installed power (one module) can be utilized.

/ One shorter string: system configuration is also possible. But in that case the effect on the power-output of the PV system depends on the number of parallel strings when using an inverter with a single MPPT. The use of an inverter with multiple MPPT or module optimizers is recommended at this point.

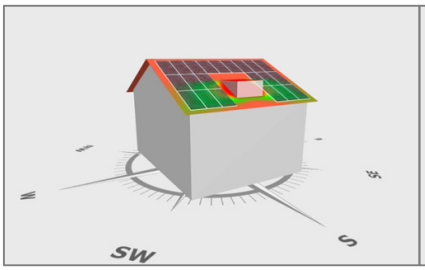
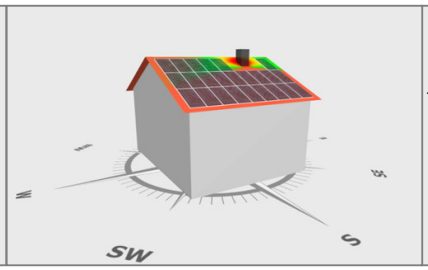
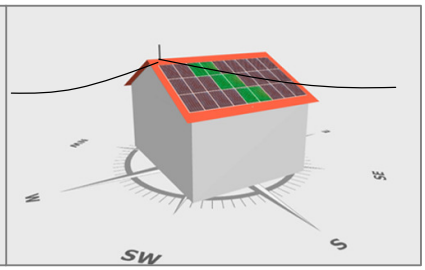
/ Different string length: such system configuration makes no sense with an inverter with a single MPPT. A detailed analysis is necessary when using an inverter with multiple MPPT or module optimizers.

[1] *Fronius article: "Efficient East/West orientated PV systems with one MPP Tracker"*
[2] *Fronius article: "Monostring vs. Polystring"*
[3] *Fronius article: "Dissimilar strings in parallel"*

## 1. PV systems with different orientations

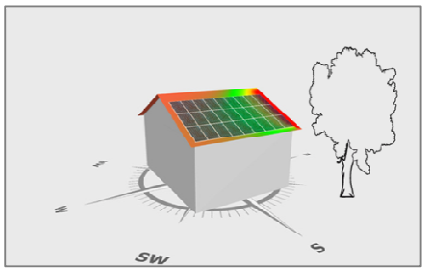
| East/West roof | | South/West roof | | South/West roof + shading | |
|---|---|---|---|---|---|
|  | |  | |  | |
| Single MPPT | ✓ | Single MPPT | ✓ | Single MPPT | x |
| Module Optimizers | o | Module Optimizers | o | Module Optimizers | o |
| Multiple MPPT | o | Multiple MPPT | o | Multiple MPPT | o |

## 2. Shaded PV systems – Shading through near objects (e.g. dormer window)

| Shading through dormer window | Shading through chimney | Shading through power line |
|---|---|---|
|  |  |  |

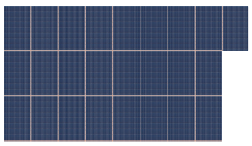
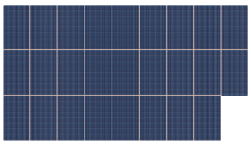
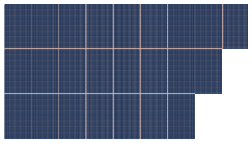
| Monostring (refers to all three examples) | | Polystring (refers to all three examples) | |
|---|---|---|---|
| Single MPPT | ✓ | Single MPPT | o |
| Module Optimizers | ✓ | Module Optimizers | ✓ |
| Multiple MPPT | ✓ | Multiple MPPT | o |

## 3. Shaded PV systems – Shading through distant objects (e.g. tree)



| | |
|---|---|
| Single MPPT | o |
| Module Optimizers | ✓ |
| Multiple MPPT | o |

## 4. Different string length

| One longer string | | One shorter string | | Different string length | |
|---|---|---|---|---|---|
|  | |  | |  | |
| Single MPPT | o | Single MPPT | o | Single MPPT | x |
| Module Optimizers | ✓ | Module Optimizers | ✓ | Module Optimizers | o |
| Multiple MPPT | ✓ | Multiple MPPT | ✓ | Multiple MPPT | o |

✓ ***Recommended*** o ***Detailed analysis of the PV system necessary*** x ***Not recommended***