



FAQ – Can I install more than the recommended solar power for a VarioTrack?

The dimensioning of the solar generator is crucial for having enough energy to charge the battery and supply energy to the loads. The configuration of the solar array must be done according to the voltage and current limits of the VarioTrack (VT).

To get the optimum solar voltage the PV modules should be connected in series to form a string with the desired voltage. The optimum operating voltage of the string (V_{mpp}) should always be above the battery voltage. The maximum operating voltage must always be lower than 145Vdc, under any temperature and irradiation condition. This value should be calculated according to the modules open circuit voltage with the temperature correction for the lowest temperature expected for the installation.

For example, if we are working with a 60 cells PV module with the following characteristics:

- Open circuit voltage, $V_{oc} = 39,1V_{dc}$ (at STC, 25°C)
- Thermal coefficient for V_{oc} , $\beta_{V_{oc}} = -0.33 \%/^{\circ}C$

For this module the open circuit voltage at -10°C (lowest temperature of your installation) will increase by 11.55% up to 45.16V_{dc}. Therefore, it is possible to install up to 3 of these modules in series for this installation, in order to respect the maximum of 145Vdc of the VT-80.

Thus, we have a maximum of 3 standard modules (60 cells) per string in our typical configuration for 24 and 48V batteries.

U Battery	36 cell module Voc < 25V		60 cell module Voc < 42V		72 cell module Voc < 50V		96 cell module Voc < 67V		Thin film module Voc > 75V	Number of modules per string
	max.	opt.	max.	opt.	max.	opt.	max.	opt.	--	
12V	3	2	1	1	1	1	1	1	0	
24V	5	3	3	2	2	2	2	1	1	
48V	5	5	3	3	2	2	2	2	1	

Possible arrangement in series for common PV panels according to the number of cells and type

The voltage calculation is critical, as a potential voltage above 145V will damage the device and may cause fatal defects in the installation.

In terms of power, several strings are usually connected in parallel. Each string connected in parallel should be composed of the same number of modules of the same type. The number of strings connected in parallel will determine the solar charging current. The VT has a current limit: 65 Amps for VT-65 and 80 Amps for VT-80. This will be the maximum current that the VT is able to take from the solar array towards the battery. If the number of strings in parallel is increased, the VT will reach its maximum charging current quicker and even when solar irradiation is lower. This will also mean that there would be a bigger potential of energy that will not be used when the solar irradiation is high. As

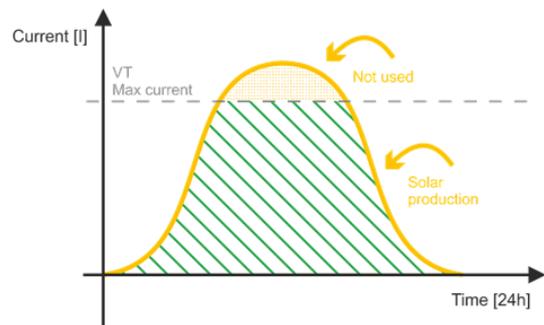
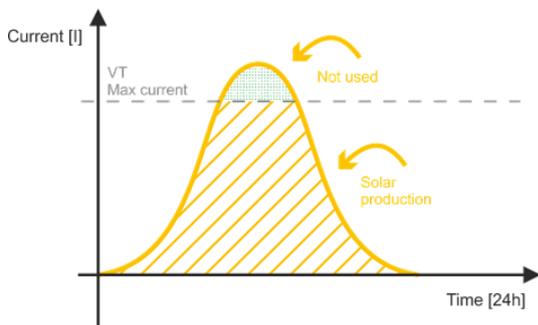
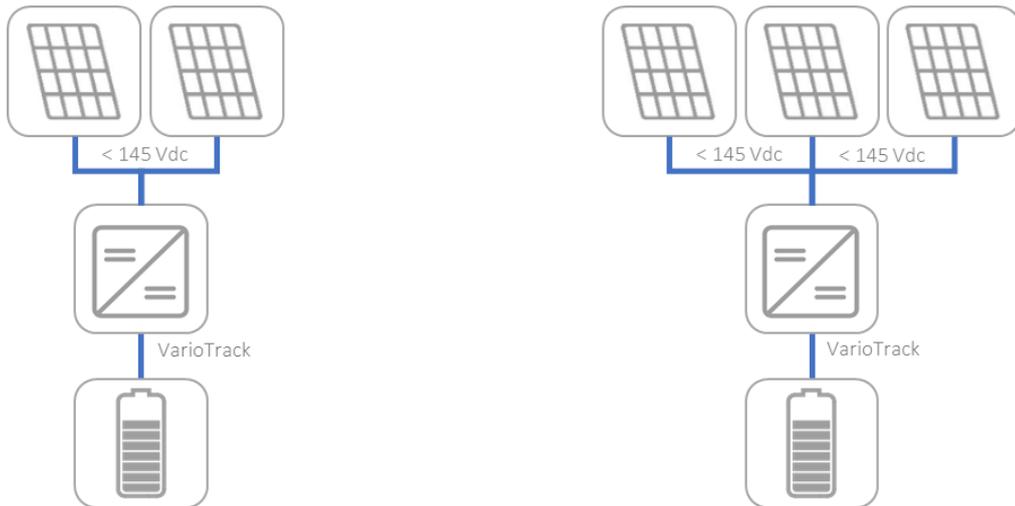
Maximum recommended power for the solar generator

Battery	VT-65	VT-80
12V	1000W	1250W
24V	2000W	2500W
48V	4000W	5000W



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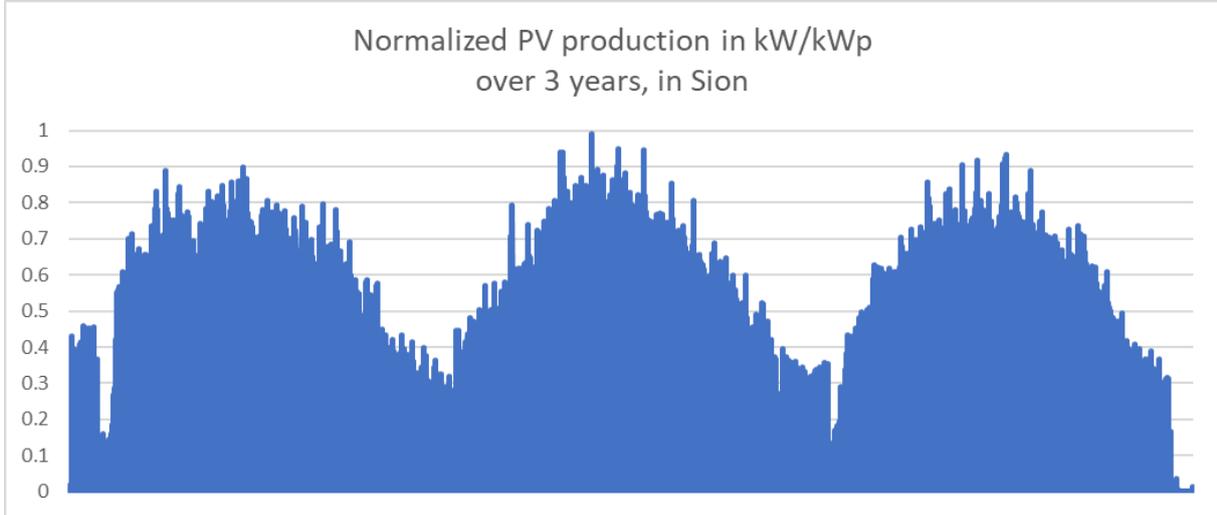
soon as the voltage limit is respected, the solar power to be installed depends on the dimensioning of the installation. Thus, it is possible to oversize the solar power to maximize the solar production, even if this means an increase of potential solar energy not used.



In terms of irradiance this could be relevant, for example in European countries, during most of the year the solar production is lower than the nominal power because of low irradiation (winter, clouds, etc.). If we take the example of our factory in Switzerland, we could have a 10% over dimensioning in solar power, which will represent a very little excess of solar (solar not used) during summer, but a 10% increase in the production all over the rest of the year:



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In addition, there are other weather and context conditions that could drastically influence your solar production and that you should consider (such as dust, air particles, pollution, snow, shadows, etc.). For example, in countries where there is snow during the winter, the dimensioning should consider the reflexion (albedo) can be quite high and the irradiance on the solar modules can be higher than the standard test value of 1000W/m², influencing the Voc and Isc values of the modules in winter.