Technical Note: Oversizing of SolarEdge Inverters

Revision History

- Version 1.1, October 2023; minimum sizing of inverters does not apply to Japan.
- Version 1.0, March 2023; Content update.

PV inverters are designed so that the generated module output power does not exceed the rated maximum inverter AC power. Oversizing implies having more DC power than AC power. This increases power output in low light conditions. You can install a smaller inverter for a given DC array size, or you can install more PV modules for a given inverter. However, too much oversizing of the inverter may have a negative impact on the total energy produced and on the inverter lifetime.

This document provides information for oversizing inverters and presents the maximum allowed DC/AC ratio for SolarEdge inverters.

Introduction

PV modules do not consistently perform at their nominal output rating. The module output power is affected by the weather, the sun's position during the day and in different seasons, local site conditions, and array orientation. In addition, module output power might decrease due to aging, soiling, and shade.

For an inverter with maximum AC power output $P_{AC(max)}$ connected to a PV array with STC power $P_{DC(STC)}$ the inverter is oversized if:

$$P_{DC(STC)} > P_{AC(max)}$$

DC/AC oversizing is defined as the ratio between the array STC power and the inverter AC power.

$$\text{DC/AC oversizing (\%)} = \frac{P_{DC(STC)}}{P_{AC(max)}} \times 100\%$$

The maximum AC power output of the inverter P_{ACmax} is the rated or nominal power of the inverter[1].

DC/AC Oversizing Considerations

The main reason for oversizing an inverter is to drive it to its full capacity more often. Oversizing the inverter is not a requirement. An experienced PV designer might choose to oversize the inverter to maximize power production because of:

- Actual PV module power vs. module nominal power
- Financial considerations

Excessive oversizing can negatively affect the inverter's power production. Inverters are designed to generate AC output power up to a defined maximum which cannot be exceeded. The inverter limits or clips the power output when the actual produced DC power is higher than the inverter's allowed maximum output. This results in a loss of energy.

Oversizing the inverter can cause the inverter to operate at high power for longer periods, thus affecting its lifetime. Operating at high power increases inverter internal heating and might heat its surroundings. Inverters reduce their peak power generation when overheating[2].

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[1] As specified in the inverter datasheet.

[2] Refer to the Inverter Power Derating appendix in the installation manual for details on how temperature affects inverter power generation.

Maximum Oversizing of SolarEdge Inverters

SolarEdge allows DC/AC oversizing depending on the inverter model.

> **⋯ NOTE**
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> In all cases, refer to the applicable inverter data sheet to determine the allowed DC/AC oversizing ratio.
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> For all limits, the rated STC power of the modules must be used regardless of the module location, tilt, or orientation.
>
> When using SolarEdge Designer, DC/AC oversizing is based on the maximum achieved DC power, given the site location and PV array tilt and azimuth. This allows connection of more modules in a string than possible when only using the STC specifications.
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> In Germany, utilities might require limiting the AC power to 70% of the DC power according to EEG 2012.

Minimum sizing of SolarEdge Inverters

When using Single phase or Three phase inverters in combination with 1:1 Power Optimizers, the DC/AC sizing ratio must be at least 60%.

When using Three phase inverters with 2:1 Power Optimizers, the minimum DC power must be 11kW and the DC/AC sizing ratio must be at least 73%.

> **⋯ NOTE**
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> This rule does not apply in Japan. Three-phase inverters with 2:1 Power Optimizers can have DC power less than 11 kW, and the DC/AC sizing ratio can be less than 73%

Oversizing of power optimizers is not allowed. The PV module STC as listed in the module datasheet must not exceed the Power Optimizer rated input DC power. PV modules with up to +5% tolerance are allowed.

Some countries and grid operators prohibit inverter oversizing or limit oversizing to a lower value than the maximum allowed by SolarEdge. In these cases, always comply with local regulations.