Application Note: Design Requirements for
Yaskawa Solectria Solar Inverters and Bifacial Modules
November 2, 2020. Rev 3.

Bifacial photovoltaic (PV) modules introduce an attractive value proposition for PV installers due to their ability to produce energy from both the front and back sides of the module. This results in greater power output potential than conventional mono-facial modules. The added backside production, often referred to as "boost" or "bifacial gain," can vary significantly and depend on a number of different conditions including but not limited to system design, installation methods, project location, and site albedo. Currently there is a lack of standardization on how bifacial modules are rated. Some module datasheets have the front side STC rating with backside gain specified in another section. Some include the backside gain in their STC ratings. In all cases the backside production is provided as a range, with values depending upon the specific enhancement expected at the site.

When designing with bifacial modules and Yaskawa Solectria Solar inverters, it is important to keep in mind that the expected bifacial gain should be added to the front panel STC module ratings if not already provided on the datasheet. A good way to calculate expected bifacial gain is to use production software such as PVSyst or Helioscope with accurate annual weather data for the site. 10% bifacial gain or the final bifacial gain calculated shall be used, whichever is greater. Additionally, the bifacial gain affects some key system elements that should be included in the design process of a robust system.

DC-to-AC loading ratio – This is the ratio determined by taking the total DC power "rating" expected (front plus backside power) and dividing that by the inverter's AC real power rating. With bifacial modules it is important to consider the bifacial boost when calculating the total DC power, as in the equation below.

$$\boldsymbol{DC:AC\ loading\ ratio} = \frac{[(module\ frontside\ STC\ power\ rating) + (expected\ backside\ power\ boost)]}{(inverter\ rated\ AC\ real\ power)}$$

The DC-to-AC loading ratio limits for Yaskawa Solectria Solar inverter models are as follows:

Inverter Model	Max DC-to-AC ratio
XGI 1500-125/125, XGI1500-125/150	2.6
XGI 1500-150/166	2.2
XGI 1500-166/166	2.0
XGI 1000 (all models)	1.5
PVI 25TL-208, PVI 50TL	1.8
PVI 25TL-480, PVI 36TL, PVI 60TL,	1.5
PVI 14TL, PVI 23TL, PVI 28TL	1.35

Maximum PV Current (I_{sc} x 1.25) – With bifacial modules the Short Circuit Current (I_{sc}) used in this equation shall be the sum of the expected bifacial gain I_{sc} and the rated frontside I_{sc}. The inverter's Maximum Available PV Current can be found on the inverter's datasheet.

$$\boldsymbol{Maximum\ PV\ Current} \geq [(frontside\ rated\ Isc) + (\ backside\ Isc\ gain)] * 1.25$$

DC Fuse Rating – Designers shall ensure that the DC fuse is sized appropriately and is based on the Maximum PV Current calculation as described above. Please refer to the installation and operation manual of the specific Yaskawa Solectria Solar inverter for its maximum acceptable DC fuse size.

The system designer is responsible for ensuring that the Maximum PV Current, the system DC/AC overloading ratio and the DC Fuse Rating are compliant with the inverter's specified requirements when using bifacial modules. If there is a question about the possible backside gain for a bifacial PV module, please consult the module manufacturer.

The use of bifacial modules will not affect the Yaskawa Solectria Solar inverter warranty as long as the actual bifacial gain is properly included in the design and the inverter's limits are not exceeded. Please contact Yaskawa Solectria Solar (978-683-9700) with any further questions.