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Ask the Experts: PV String Sizing

By **Jeff Clearwater**
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Introductory Level

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PV String Sizing

How do I decide how many modules to wire in series for a batteryless, grid-tie inverter? It all seems very complicated—is there any way to simplify my design decision?

John Worth • Plainview, Texas

String sizing for grid-tie inverters involves optimizing several—often conflicting—performance and safety design factors. I can't fully explore all the issues involved in just a few paragraphs, though I can identify the issues and steer you to the right tools. But first I'm obliged to mention that DC voltage in the 100 to 600 V range is dangerous stuff and best left to a professional.

It boils down to choosing a string size that meets three very important parameters, while trying to optimize a few more. You must satisfy a voltage window that, on the high end, is limited by the maximum open-circuit voltage that the inverter can handle before you harm its electronics and, on the low end, is limited by two factors—the minimum MPPT voltage that the inverter can operate at and the minimum start-up voltage the inverter needs. While doing that, you also have to feed the inverter enough wattage to ensure you are using the inverter efficiently while not feeding so much that you overpower it. You also have to stay within the inverter's amperage limits while keeping voltage drop to a minimum.

All these parameters are moving targets because PV module output is inherently temperature dependent, with cold and hot weather performance varying greatly. So you see that you were right—it is complicated! However, there are two tools I would recommend you use.

The first tool is a string-sizing calculator or chart that inverter manufacturers make available on their Web sites. Start with the inverter model, module make and type, and the critical inputs of the average highest temperature at your site and historical absolute lowest temperature the array will ever experience under sunlit conditions. The calculator results will show the allowable and ideal string-sizing combinations.

The second tool is a solar professional. Though the string-sizing tools are good, they can't make all of the critical decisions that go into good solar-electric system design. The safety issues are just too important, so at the very least, you should have a pro evaluate your intended design, and then seriously consider having a pro install your system too.

Jeff Clearwater • Village Power Design

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