



Microinverter Analysis

How Microinverters compare to
Tigo DC-DC Optimizers

<http://www.tigoenergy.com>

DO I WANT TO DESIGN WITH A MICROINVERTER?

Module Level Power Electronics (MLPE) offer some very attractive features, for designers, installers and system owners:

1. Ease of Design
2. Shade tolerance and maximum energy harvest
3. Rooftop Safety
4. Module-level Monitoring plus Advanced System and Fleet Management tools

However, when looking at microinverters, one must consider the compromises: additional costs, reliability issues of having inverters on the roof, and lower conversion efficiencies. But this is not necessary ... Tigo is the path to gaining all the value of a Microinverter without the downsides.

A Microinverter design takes all the functionality and components of a string/central inverter and puts it on **every** module. There are a few downsides for this architecture:

1. It puts a lot of redundant electronics in a harsh environment: underneath the PV modules temperatures are high, and airflow in many cases is limited.
2. There's far greater complexity and higher prices for services associated with roof maintenance vs. ground-based maintenance, where a typical inverter is housed.
3. More electronics on the roof means more heat exposure, less effective cooling, and therefore lower reliability and shorter lifetime.
4. Last, to connect microinverters to each other special cables and connectors are needed. These are often proprietary, and therefore again – can and do create service issues down the line.

Tigo takes a very different approach to offering the same features mentioned above, by putting the least amount of electronics at the PV module. This semi-distributed approach puts only critical sensing, communications, and power control at the module, but leaves MPP calculation and inversion centralized at the inverter.



Figure 1 - Thermal image of microinverter indicating excessive heating of PV cells. It damages performance and longevity of the solar module, in addition to stressing the Microinverter components.

TIGO DELIVERS...

1. **Ease of Design** – Tigo's [Predictive IV](#) algorithm allows system designers great freedom in configuring and placing modules and strings.
 - Tigo's technology enables modules to be placed in multiple orientations in the same string – East, West and South facing roof surfaces can be fully utilized.
 - System designers have complete freedom to choose practically any inverter, charge controller or battery backup system.
 - Tigo optimizers are attached directly onto the module frame, eliminating the need for special mounting hardware, additional grounding, or rooftop labor. They are also strung together in series, exactly like standard PV modules would, eliminating the need for expensive proprietary BoS (Balance of System) components.
 - System designers can address any size system, any modules in any worldwide geographic location by selecting an inverter that fits the project needs the best.
 - Tigo's unique TS4 technology provides the ultimate in modularity and flexibility, allowing system designers to selectively deploy just the features they need. Microinverters are one-size-fits-all, limiting design choices that would be more efficient and save money.
2. **Efficiency** –Tigo's TS4 offers module-level optimization with DC conversion efficiencies exceeding 99.5%. When used with the industry's leading inverters, total system DC to AC conversion efficiency can exceed 98%. System owners can achieve shade tolerance equal to that of a microinverter while enjoying 2-4% more energy than the leading microinverter due to a more efficient DC to AC conversion at the system level.

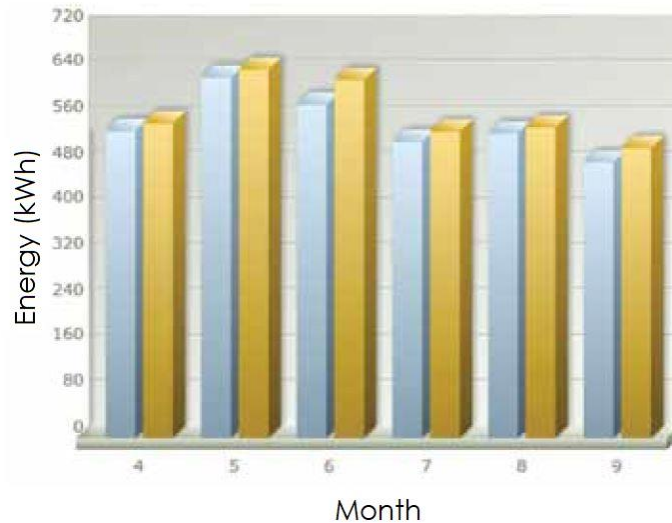


Figure 2 - Tigo system performance (yellow) compared to that of leading microinverter in independent monthly testing as recorded during a side by side test

- 3. Module-level monitoring plus advanced system and fleet management** – The Tigo optimizers report the performance of an individual module. Tigo provides functionality well beyond simple inverter-direct monitoring. Tigo samples each panel in the array simultaneously every two seconds, and presents the information on a 1-minute basis – the most granular in the industry! The module level data at the granularity provided by Tigo allows unprecedented intelligence of the system, including sophisticated alerts, which can pinpoint costly problems. The Tigo software tools can offer significant cost reductions in commissioning, operations and maintenance of a PV plant.
- 4. Cost Effective for Systems of All Sizes** –The approach of having central functions done at the inverter takes advantage of traditional economies of scale providing a cost-effective solution for both large and small installations. Microinverters have a fixed cost per watt (the same at 10 modules or 1000 modules), limiting cost-effective deployment to very small residential systems. The Tigo solution enables the use of transformerless string/central inverters and with TS4-L, considerable elimination of other BOS costs (string wiring, fuses, combiner boxes, data loggers, etc.).

CONCLUSION

Tigo provides a **better path** to module level features for systems of all sizes.

For more information about Tigo products, contact training@tigoenergy.com or your solar distribution partner. Learn more at www.tigoenergy.com.