



Solar optimizer performance – takeaways from 12 years of field data

Author: Sarah Ozga, Product Manager

The problem: energy loss from mismatch

All PV systems are affected by some level of mismatch. PV modules are wired in series, and therefore, each of the modules affected by mismatch, reduces the performance of all other modules on the string and can reduce performance for the entire array. A slight mismatch – let's say only 1% – even on one PV module will be magnified by 20 in a string of 20 panels, reducing the total energy by as much as 19%.

Mismatch can be caused by a variety of factors and affects all PV systems. Commonly, shade from trees or objects causes mismatch, but so does snow, leaves, soiling, natural aging of PV Modules as well as small variation in the manufacturing process.

The solution: optimizers

Tigo's TS4 optimizers are designed with patented technology, able to address even the smallest mismatch impact created by manufacturing process as well as the significant impact created by shade, in all cases, improving the PV system performance. Tigo optimizers constantly measure several parameters, at a very high speed, of the PV modules they're connected to and quickly adjusts its behavior to extract the maximum energy from the PV Module. This capability allows each of the panels to add the maximum energy to the string while eliminating the negative impact of the underperforming PV Modules on the stronger partners in the string.

Tigo's confidence in its product performance, and the value created, is exposing the energy extracted from each PV Module and shares the additional energy generated due to the TS4 mismatch mitigation actions in the form of Reclaimed Energy on Tigo Energy Intelligence monitoring.

Validation: Reclaimed Energy

System owners can view the total kilowatt-hours of Reclaimed Energy that was archived by the Tigo Optimizers from within the Tigo Energy Intelligence monitoring portal. Tigo Energy Intelligence shows each 15 minutes (Free) or 1-minute (Premium) interval of energy generated as well as Reclaimed Energy so that customers and installers can quantify the payback of the PV system and of the optimizers in isolation. Only Tigo provides Reclaimed Energy data to customers.

Optimization in action

In the residential example shown, the homeowner has 2 strings of 9x 216 W modules and a single-phase inverter. Each of the modules has Tigo optimizers installed to minimize the impacts of mismatch created by shade. The Tigo Energy Intelligence portal indicates the real-time Energy Reclaim amount for each module, shown on each module in watts.

String A is being shaded by a tree and utility pole, resulting in lower output. The optimizers are able to reclaim some energy, indicated in Watts on the dark green modules.

Module B5 on String B is being shaded by the chimney, and as a result, Tigo optimizers are optimizing the remaining modules on the string. Energy Reclaim totals 33-37 W per module, shown on the bright green modules.

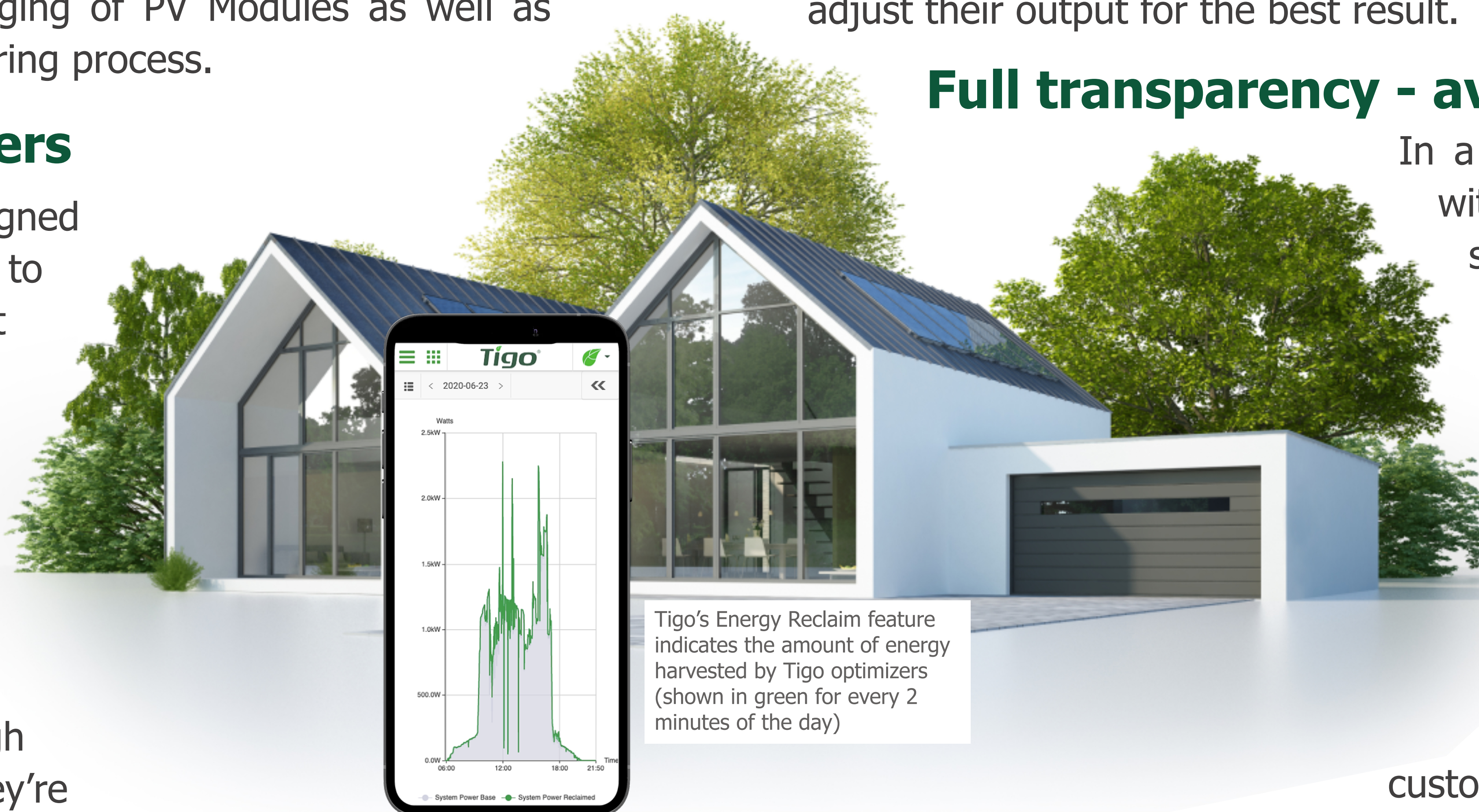
Without optimization, the inverter would choose a lower operating point for the string and the unshaded modules would contribute less than they can produce under the site conditions. Instead, the best performing modules stay at the maximum power point set by the inverter and the optimizers adjust their output for the best result.

Full transparency - available anytime

In a survey of more than 18,000 sites with Tigo optimizers installed, 25% of sites averaged yields greater than 10%, and 76% gained between 3-15% more energy as a result of optimization.

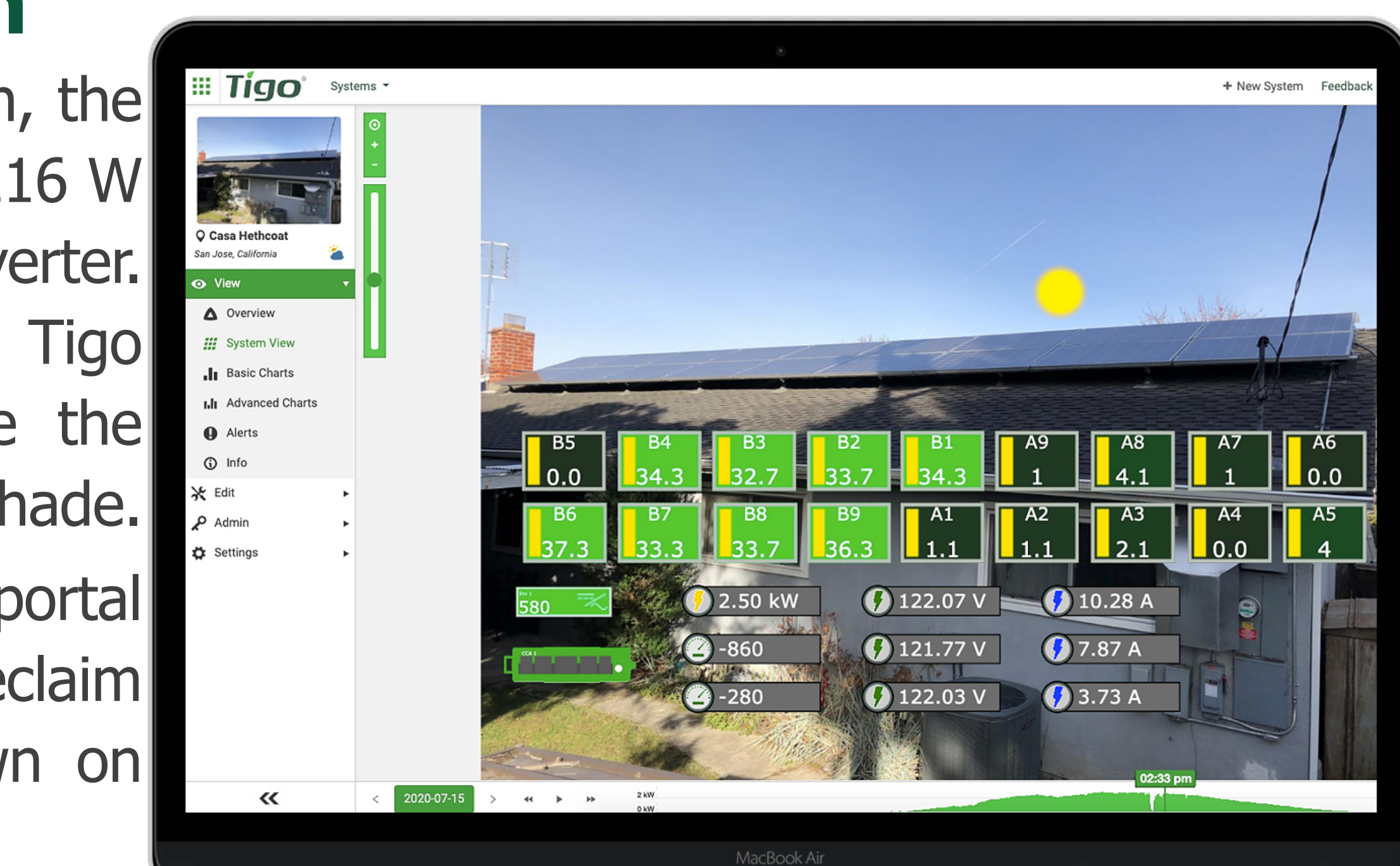
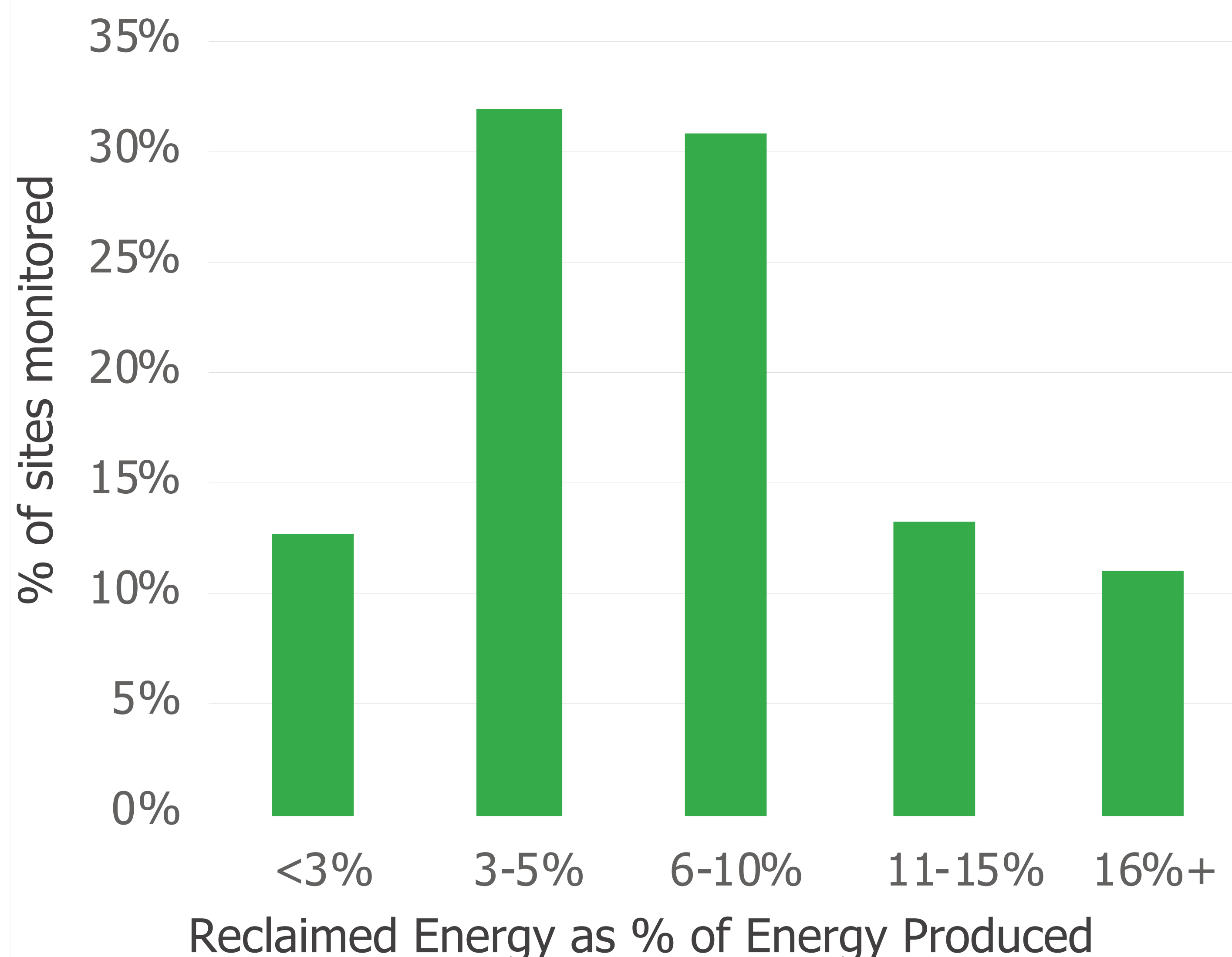
Tigo's TS4 optimizers provide the maximum energy harvest and the monitoring portal enables a unique level of visibility into system energy production. Only Tigo lets customers visualize lifetime system energy production with Reclaimed Energy as a way to quantify the return on investment optimization brings to your PV system.

Discover how your installation can benefit from optimization and Reclaimed Energy. Visit our website for more information, downloads, and a monitoring demo: www.tigoenergy.com



Reclaimed Energy

From Tigo's Optimized & Monitored Sites Worldwide



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