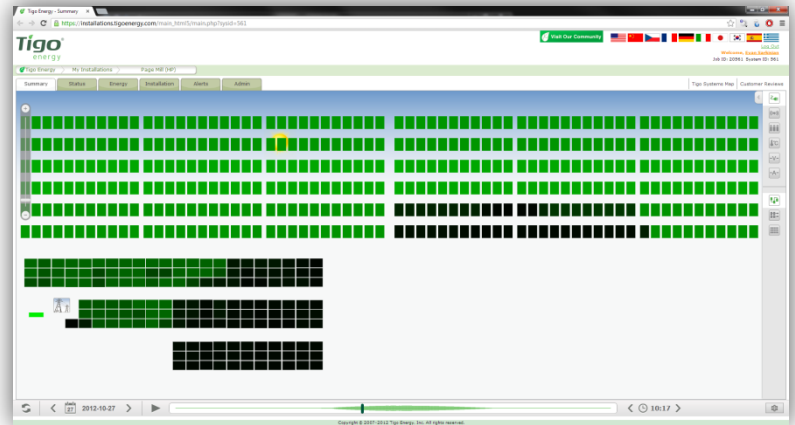




# Benefits of Module-Level Monitoring

Module-level monitoring facilitates the establishment of a range of advanced preventative and condition-based maintenance capabilities. These advanced maintenance capabilities utilize detailed performance monitoring information to conduct remote, real-time diagnostics, dynamically evaluate maintenance trips, and expedite initial commissioning and recommissioning processes.



## Solar Monitoring Benefits and Drawbacks

	Inverter	String	Module
Benefits	<ul style="list-style-type: none"> <li>- Convenience</li> <li>- Low Cost</li> <li>- Track Inverter condition and efficiency</li> </ul>	<ul style="list-style-type: none"> <li>- Moderate resolution and precision</li> <li>- Identify root cause of problem to the string</li> </ul>	<ul style="list-style-type: none"> <li>- Highest resolution and precision</li> <li>- Identify root cause of the problems to the module</li> <li>- Monitor individual panels</li> <li>- Efficiency benefits*</li> <li>- Improved inverter reliability**</li> </ul>
Drawbacks	<ul style="list-style-type: none"> <li>- Poor resolution</li> <li>- Inability to identify string or module problems</li> </ul>	<ul style="list-style-type: none"> <li>- Analytics required</li> <li>- Cost</li> <li>- Increased points of failure</li> </ul>	<ul style="list-style-type: none"> <li>- Analytics required</li> <li>- Cost</li> <li>- Increased points of failure</li> </ul>

\* When combined with DC power optimizer

\*\*Only for DC power conditioner

## Operating Capabilities Enabled by Module-level Monitoring

Additional Operating Capabilities	Definition
<b>Performance Risk Management</b>	Increased assurance that a system will deliver expected power production. Better management of system performance and third party O&M crews.
<b>System Reliability and Safety Management</b>	Identify and isolate ground and arc faults, which can jeopardize the safety of a system. Identify and prevent system problems before they take a system down.
<b>Warranty Management and Enforcement</b>	Better enforce warranties with more accurate tracking of component failures.
<b>Module Degradation Tracking</b>	Track module-level degradation over the life of a system.

### SAVINGS

Over the lifetime of a system, the value of incremental losses accumulates. A recent analysis by Ray Burgess of Solar Power Technologies suggested that replacing faulty panels at routine visits for a 100 kW system could save **\$14,900** in lost energy production over the life of a system.