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## Advantages of MLPE in O&M for Commercial Systems

PV asset management refers to the financial and administrative activities that are completed in order to translate energy production into revenue. This is work that is typically done in an office. While O&M is the physical, labor-intensive, technical work in the field that is conducted in order to ensure a system's uptime. Part of what is contributing to the blurring of the lines of these separate activities is the advent of module-level power electronics (MLPE). With remote monitoring and troubleshooting, MLPE is helping to transition some of the O&M activities into PV asset management.

There has been a lot of talk recently in the industry about operation and maintenance (O&M) and PV asset management as part of the system's long-term financial planning. Effective O&M and PV asset management can both help improve a system's financials. However, these terms are often used interchangeably in the PV industry even though they have very different roles. PV asset management refers to the financial and administrative activities that are completed in order to translate energy production into revenue. This is work that is typically done in an office. While O&M is the physical, labor-intensive, technical work in the field that is conducted in order to ensure a system's uptime. Part of what is contributing to the blurring of the lines of these separate activities is the advent of module-level power electronics (MLPE). With remote monitoring and troubleshooting, MLPE is helping to transition some of the O&M activities into PV asset management.

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There are two different types of O&M activities that have been improved as a direct result of the monitoring benefits provided by MLPE - preventative and corrective maintenance. Preventative maintenance is intended to maintain the PV system at its highest working condition and limit system downtime. Corrective maintenance is conducted after an issue has been discovered and

includes the actual repair process. MLPE impacts each of these differently and actually helps shift some corrective maintenance tasks into preventative maintenance, and can even eliminate some preventative and corrective maintenance activities altogether.

A significant aspect of preventative maintenance is the annual site visit during which a thorough evaluation of all PV system components is conducted. This is a mandatory measure for commercial systems in order to check system health. With traditional inverter systems, each module needs to be inspected to ensure proper functioning. This is both a costly and a time-consuming procedure, not to mention the safety concerns that arise from working at heights and with high voltages. During these preventative maintenance activities, latent problems causing decreased energy production are often uncovered.

However, with monitoring offered by MLPE, this corrective maintenance can

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Pinpointed alerts show the specific fault location, fault description and fault status

now be performed without needing a specific site visit to identify the problem. Module-level monitoring provides pinpointed alerts, fault detection, and remote troubleshooting that reduces trips to and time spent at PV sites. This is because module-level monitoring enables O&M service providers to perform many of the preventative maintenance activities from the comfort of an office. For example, if a module has a failed diode, then an automatic alert will notify the O&M provider. The module can be easily identified, pinpointed to its specific location, and a screen shot can be provided by the O&M provider to the module manufacturer for a warranty claim. This means that during the annual site visit for preventative maintenance, the O&M provider is actually replacing the module instead of doing so during the follow up visit. Both preventative and corrective maintenance can now occur simultaneously.

The highly detailed resolution that module-level monitoring offers is especially important for commercial

systems as it significantly decreases the resources needed to maintain such large projects. Combining module-level monitoring with other performance monitoring tools, such as fleet management, inter-site and multi-site comparisons, pre-scheduled performance and status reports of multiple sites, and executive reporting, is key for O&M providers to be able to offer performance guarantees and a high-performance ratio for system lifetime. The transition of O&M activities from a labor-and time-intensive task to being one that requires a few simple clicks, is happening at the same time that new challenges are arising in the maturing PV market. For instance, aging systems require more maintenance, and with installations being geographically spread out, O&M teams are faced with an even greater burden in reaching these installations in a time-effective manner. This is where solutions with module-level monitoring, real-time detection, automatic alerts, and remote troubleshooting can be leveraged as

strategic PV asset management tools in order to provide post installation services. These solutions enable O&M providers to become more effective by front loading many of their activities in the office. This not only helps improve the response time, but frequently saves costs for the O&M provider. In fact, these types of strategic tools can actually enable 15-25% savings on annual O&M costs.

While the new demands on O&M providers could potentially be overly onerous, module-level power electronics help these providers rise to the challenge. Access to site information, including automatic alerts displayed on smart phones and tablets, enables a small team of technical experts to efficiently manage multiple PV systems in an expansive geographical region. In fact, O&M providers can use module-level monitoring and remote troubleshooting in order to streamline their businesses and create new revenue streams through tailored O&M services.