

# Why Systematic Optimisation Is Essential for Operational Solar Assets

As solar portfolios mature and the global energy transition accelerates, asset owners face a new reality: building solar capacity is no longer the primary challenge; operating it efficiently is. With new connections at a premium and the demand for renewable energy increasing, optimising existing assets moves away from being a nice-to-have and becomes a strategic imperative.

This article explores why systematic optimisation matters for operational solar assets, how it works, and the value it delivers across performance, reliability, and long-term sustainability.

## 1. The Growing Need for Systematic Optimisation

Modern solar plants are no longer simple arrays of modules and inverters. They are integrated systems involving advanced inverters, grid-support functions, hybrid with storage alongside evolving regulatory and grid-compliance requirements.

The industry is now characterised by increasing technological complexity and operational challenges. Without systematic optimisation, this complexity leads to inefficiencies, underperformance, and escalating O&M costs.

Operations and maintenance represent the single largest cost category for utility-scale solar assets after commissioning. As pressure mounts to deliver higher returns, asset owners are increasingly turning to structured optimisation strategies to extract more value from existing infrastructure.

## 2. What Systematic Optimisation Means in Solar

Systematic optimisation is a continuous, data-driven process of analysing performance, identifying losses, and implementing targeted improvements across the entire solar asset. It is not just reactive troubleshooting. It is a structured approach integrating traditional asset management and O&M practices with advancing performance analytics, component-level diagnostics and financial and risk modelling.

This systematic approach ensures that improvements are not isolated fixes but part of a coordinated strategy, relevant to the environmental and operational context, that enhances the entire asset's performance throughout its lifetime.

### **3. Why Systematic Optimisation Matters**

Lost MWh are lost revenue. Data-driven optimisation can recover substantial generation losses. Case studies show that AI-enhanced performance analytics can recover thousands of MWh by identifying hidden inefficiencies and failure patterns.

Losses can include, but aren't limited to: inverter underperformance, soiling and cleaning inefficiencies, shading changes over time, string-level faults and grid-related curtailment patterns

Systematic optimisation ensures these issues are detected early and addressed holistically.

#### **3.1 Improving O&M efficiency**

Strategic O&M practices, better use of technology, improved processes, and smarter resource allocation can significantly boost efficiency. Systematic optimisation supports this with impact-based priorities for maintenance, facilitating predictive maintenance ahead of reactive and keeping O&M actions aligned to financial priorities.

#### **3.2 Reducing operational risk**

Solar assets face risks from component failures to grid instability, and weather to regulatory impacts. Systematic optimisation reduces risk through identifying early-stage component degradation, boosting inverter uptime, ensuring compliance with grid codes; stabilising export profiles, reducing volatility in generation.

A more predictable asset is a stronger, more dependable asset. Less risk, more value.

#### **3.3 Enhancing long-term asset value**

Optimised solar assets work harder for longer. They don't degrade as fast, they stay online when they're needed, deliver steadier generation, and demand fewer major interventions across their lifecycle. The result is simple: stronger performance and better lifetime ROI.

And in a sector where consistency and predictability drive portfolio returns, systematic optimisation isn't just good practice, it's a competitive advantage.

### **4. The Role of Data and Technology**

#### **4.1 Data intelligence as a performance driver**

Modern solar plants generate an enormous amount of operational data, but data doesn't improve performance on its own. The real gains come when it is turned into actionable insight to inform decisions that sharpen performance. AI-driven tools now make that

possible on a far larger scale, converting raw signals into clear, actionable insights that save time, energy, and money.

Technologies such as AI-based fault detection, predictive maintenance algorithms, digital twins, advanced SCADA analytics, automated benchmarking, and string- or module-level anomaly detection give operators a clearer view of what's happening on site. With that visibility, teams can shift from reacting to issues to staying ahead of them.

#### **4.2 Machine learning and optimisation trends**

Machine learning is becoming central to how high-performing solar assets are run. It strengthens forecasting, improves fault detection, and supports smarter system-level optimisation. In practice, these tools help operators predict failures before they occur, refine cleaning schedules, improve inverter loading, reduce clipping losses, and maintain stronger grid compliance.

### **5. Key Areas Where Systematic Optimisation Delivers Value**

Systematic optimisation pushes performance ratio (PR) up and running costs down. Improvements compound with systematic optimisation, capturing gains in PR while lowering overhead costs.

Even small gains in performance ratio compound into meaningful financial returns over the life of a solar asset. Systematic optimisation uncovers and resolves the issues that quietly erode PR: from thermal derating and mismatch losses to DC/AC ratio inefficiencies and inverter setpoint errors.

A more predictable asset is a more cost-efficient asset. Optimisation reduces both direct and indirect costs by cutting emergency repairs, minimising downtime, improving spare-parts planning, and focusing labour where it can have the greatest impact.

Optimised assets generate more clean energy, interact more smoothly with the grid, and deliver steadier export profiles. They also extend component life, reducing waste and improving the sustainability profile of the entire portfolio. As the grid becomes more dynamic, stable and predictable solar assets carry even greater strategic value.

### **Conclusion**

Systematic optimisation unlocks higher performance, reduces costs, mitigates operational risk, and strengthens long-term asset value. As the solar sector becomes more complex and more competitive, asset owners who adopt structured, data-driven optimisation will be best positioned to maximise returns and operate with confidence.

With rising expectations from investors, regulators, and grid operators, systematic optimisation is no longer an enhancement. It's a core requirement of modern solar asset management.

GreenEnco offer pvAPM, our solution designed to help you implement systematic optimisation. pvAPM utilises our in-house experience and AI-enhanced tools, to help you identify the best solution for your asset. Every implementation is bespoke, giving you a tailored optimisation strategy shaped around the realities of your asset.

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