# India Solar O&M and Performance Optimisation 2026: PR, Soiling, SCADA and Degradation

By Sudarshan Karweer · 25 August 2026 · growthifye.com

*A 2026 practitioner guide to solar O&M in India: PR, soiling losses, SCADA, degradation, warranties, repowering and lender checks.*

India's utility-scale and C&I solar market in 2026 is no longer just about winning EPC on the lowest CAPEX. For asset owners, lenders and offtakers, the bigger commercial question is what happens after commissioning: whether the plant sustains performance ratio, controls degradation, minimises inverter downtime, and converts irradiation into billable units with disciplined O&M.

That shift matters because many Indian projects commissioned in 2018-2023 are now old enough to show clear divergence between nameplate expectations and actual operating performance. Two plants with similar modules, inverters and trackers can differ by 3-6% in annual generation simply because one owner invested in better SCADA architecture, spare strategy, cleaning optimisation, thermography, string-level analytics and claims management. At current C&I replacement tariffs and open-access economics, that performance gap can materially alter project IRR, DSCR and refinancing outcomes.

For a 10 MW AC ground-mount solar plant in India, a 1% generation gain can easily be worth several lakhs to over Rs 20 lakh per year depending on CUF, tariff, wheeling losses, settlement mechanism and state-level banking rules. For a 100 MW asset, the value is obviously much larger. This is why 2026 conversations have moved beyond EPC handover checklists to long-term performance engineering.

This article focuses on a different topic from module, inverter, EPC-cost and solar+BESS guides: how to optimise post-commissioning solar performance in India through O&M strategy, PR management, soiling control, SCADA data quality, degradation tracking, and contractual governance.

## Why solar O&M is now a board-level issue in India

India's solar fleet is operating in a more demanding environment than the market assumed a few years ago.

- DISCOM payment discipline remains uneven in some states, increasing pressure on plant availability and cash conversion.
- Open-access consumers are scrutinising every delivered unit because banking restrictions, CSS/AS changes and time-of-day structures affect realised savings.
- Lenders are more forensic during operational due diligence, especially for refinancing and portfolio acquisitions.
- ALMM-linked procurement decisions made during construction have created variation in module binning, low-light performance, warranty backstops and field quality.
- High DC/AC ratios, tighter clipping assumptions and aggressive commissioning schedules have exposed weak points in earthing, cable termination, combiner-box reliability and tracker controls.

As a result, owners are asking harder questions:

- Is my PR drop due to weather normalisation, soiling, clipping or equipment faults?
- Are cleaning cycles economically optimised or just operationally convenient?
- Is the SCADA trustworthy enough for warranty claims and lender reporting?

- Are module failures random, batch-linked or installation-induced?
- When should I replace inverters, retrofit communication systems or repower sections of the plant?

These are not theoretical questions. They directly affect cash flow, contract enforcement and valuation.

## PR, CUF and specific yield: what owners should actually monitor

Many Indian operating teams still over-focus on CUF because it is easy to communicate. But CUF alone is a weak operational KPI unless it is paired with irradiation context, clipping logic and grid availability. In 2026, better-run portfolios monitor a hierarchy of metrics.

First is specific yield, typically measured in kWh/kWp or kWh/kW AC, depending on reporting convention. Ground-mount projects in India often see annual yields ranging roughly from 1,450 to 1,900 kWh/kWp depending on irradiation, technology stack, module orientation, DC/AC ratio and outages. Rooftop and C&I portfolios may differ significantly because of shading, export constraints and operational shutdown windows.

Second is performance ratio. For well-designed Indian projects, annual PR may often fall broadly in the 76-84% range, though this varies with technology, climate, auxiliary load treatment and metering methodology. A PR number by itself is not enough; owners must segment losses into:

- Soiling loss
- Temperature loss
- Inverter conversion loss
- DC ohmic loss
- AC ohmic loss
- Mismatch loss
- Clipping loss
- Curtailment/grid outage loss
- Availability loss due to equipment failure
- Auxiliary consumption

Third is availability, which should be reported separately for plant, inverter, tracker and grid. A plant can show high equipment availability but still underperform due to poor MPPT behaviour, calibration drift in weather sensors or chronic communication loss masking string outages.

Fourth is degradation-adjusted performance. If a module warranty says first-year degradation of up to around 1% and then 0.4-0.55% per annum, the owner should not blindly accept field underperformance as “normal ageing.” Degradation must be distinguished from dirt, delamination, hotspot growth, PID, snail trails, cracked backsheets, connector heating and bypass diode failures.

The practical recommendation is to maintain a loss-tree dashboard at plant and feeder level, refreshed monthly and reviewed quarterly with management, O&M contractors and lenders where relevant.

## Soiling, cleaning strategy and water economics in Indian conditions

Soiling remains one of the most underestimated revenue leakages in Indian solar. In arid and semi-arid states such as Rajasthan, Gujarat and parts of Maharashtra, soiling losses can build rapidly, especially near roads, quarries, cement clusters, mining zones and dry agricultural belts. In coastal areas, salt deposition creates a different cleaning challenge. In industrial C&I sites, process dust may dominate.

Typical annual soiling losses in India can range from below 2% in well-managed low-dust sites to more than 6-8% in difficult conditions if cleaning frequency is suboptimal. In extreme periods, short-term losses can build much faster.

The correct cleaning strategy is not “clean as often as possible.” It is to clean when the incremental generation value exceeds the cost and operational burden.

Owners should compare:

- Water-based manual or semi-mechanised cleaning
- Robotic dry cleaning, especially in water-stressed regions
- Hybrid seasonal approaches
- Daytime vs night-time cleaning windows
- Cleaning by row criticality using soiling station data

A robust 2026 O&M programme should use site-specific soiling measurement rather than static schedules. Soiling stations, reference modules and SCADA-linked alerts can help estimate actual accumulation rates. If cleaning is triggered by data, not habit, many plants can improve both water productivity and generation yield.

Key checks include:

- Water TDS quality, because poor water can leave deposits and reduce transmittance
- Brush material and pressure, to avoid micro-scratches on glass
- Cleaning contractor training, especially on module edges, clamps and cable handling
- Seasonal planning before dust storms and low-rainfall periods
- Safety controls for rooftop cleaning at C&I sites

For lenders and insurers, documented cleaning strategy increasingly matters because repeated mechanical damage from poor cleaning can create long-tail warranty disputes.

## SCADA, data integrity and digital diagnostics: the real foundation of performance claims

An uncomfortable truth in Indian solar is that many underperforming assets do not lack data; they lack reliable data. Plants often have SCADA systems that look functional on a dashboard but are weak where it matters: sensor calibration, timestamp alignment, granularity, string-level visibility, event classification and historical retention.

In 2026, minimum good practice for serious asset owners should include:

- Revenue meter reconciliation with SCADA export data
- Pyranometer and reference-cell cross-checks with documented calibration intervals
- Inverter-wise and string-wise fault tagging
- Event logs mapped to loss categories for PR analysis
- Remote access with cyber controls and role-based permissions
- High-resolution data storage adequate for claims and analytics
- Alarm rationalisation so teams do not ignore frequent nuisance alerts

Poor data quality has direct commercial consequences. If irradiation sensors are drifting, PR calculations become unreliable. If string-level data is absent, low-performing circuits remain hidden until annual generation shortfall becomes too large. If event logs are not archived properly, warranty claims against inverter OEMs or EPC contractors weaken.

Advanced portfolios are now using analytics for:

- Detecting underperforming strings relative to peer groups
- Identifying tracker misalignment or stow failures
- Spotting inverter clipping or derating patterns during high-irradiance windows
- Correlating transformer temperature, harmonics and nuisance trips
- Estimating module degradation after weather normalisation
- Distinguishing curtailment from equipment outage

For C&I clients, digital performance also affects settlement credibility. When a captive or open-access consumer challenges delivered energy, the owner needs auditable, time-stamped evidence.

## Degradation, failures and warranty recovery: where many owners lose money

By 2026, a meaningful share of India's operating fleet has enough runtime to reveal medium-term reliability trends. Not every shortfall is degradation, and not every degradation case is bankable for warranty recovery. Owners need disciplined field evidence.

Common field issues include:

- Hotspots due to cell cracks, poor soldering or localised shading
- PID in susceptible site and system conditions
- Junction box and connector failures
- Backsheet cracking or chalking in harsh UV environments
- Glass breakage linked to handling, cleaning or wind events
- Tracker driveline and actuator failures
- Inverter fan, capacitor, IGBT or control-board failures
- Combiner-box fuse and SPD problems

A practical investigation stack typically includes:

- Drone thermography
- IV curve tracing
- Electroluminescence on sampled modules where feasible
- Insulation resistance testing
- String current comparison under matched conditions
- Weather-normalised performance benchmarking

Owners should not wait until annual underperformance becomes obvious. A quarterly exception-based review often catches problems early enough to avoid cumulative losses.

On warranties, the key challenge is documentation. Module OEMs, inverter suppliers and EPC contractors will typically ask for evidence on operating conditions, installation quality, maintenance history and failure incidence. If commissioning records, torque logs, serial-number mapping, electroluminescence baselines and

SCADA archives are incomplete, claims become slower and weaker.

This is particularly important for projects that changed hands through secondary transactions. Acquirers should verify whether warranty assignment was completed and whether O&M practices complied with OEM conditions. Many portfolios discover too late that paper warranties exist but practical recoverability is poor.

## Repowering, inverter replacement and life-extension economics in 2026

A growing number of Indian plants are entering the stage where selective repowering or mid-life refurbishment can make more sense than passive maintenance. The case is especially relevant for projects with older central inverters, chronic communication issues, obsolete spares or recurring DC-side faults.

Repowering does not always mean replacing modules. It can include:

- Inverter replacement with higher-efficiency modern units
- DC cable and connector remediation
- SCADA and communication system overhaul
- Tracker controller retrofit
- Transformer and switchyard protection upgrades
- Selective module replacement in degraded blocks

The investment decision should be based on discounted incremental generation and avoided downtime, not on OEM sales claims. For example, if replacing repeatedly failing inverters improves availability by 1.5-2.5% and reduces O&M burden, the payback may be attractive in high-tariff C&I plants. In utility-scale projects with lower tariffs, the economics may be tighter unless downtime has become severe.

Owners should also review whether repowering affects:

- Grid compliance and protection settings
- CEIG approvals and amendment requirements
- Warranty continuity on surviving equipment
- Insurance disclosures
- PPA constraints and declared capacity conditions
- CFA-linked obligations where applicable in certain segments

For rooftop and C&I systems, repowering often intersects with sanctioned load, net-metering or gross-metering rules, and DISCOM approvals can become the real bottleneck. Planning should therefore integrate technical and regulatory workstreams.

## What lenders, acquirers and developers should include in operational due diligence

Operational due diligence in 2026 should be more granular than simple annual-generation comparison against P50. Whether for refinancing, acquisition, or internal portfolio review, the checklist should include:

- Plant-level and block-level PR trend over at least 24-36 months
- Grid outage and curtailment separation from equipment downtime
- Soiling and cleaning records linked to generation patterns
- Sensor calibration and SCADA data quality audit
- Inverter failure history and spare philosophy

- Module serial mapping, failure clustering and warranty status
- Thermography and IR test records
- Earthing, insulation resistance and protection-system health
- Tracker availability and wind-stow event analysis where relevant
- O&M SLA compliance and liquidated damages enforcement history

Lenders increasingly want confidence that reported generation shortfall is understood, measurable and recoverable where possible. Developers seeking capital must therefore present an evidence-based operational narrative, not just a high-level MIS deck.

For utilities and policymakers, the lesson is similar: national capacity addition numbers matter, but realised energy and plant reliability matter more. As India scales solar deeper into the grid, post-commissioning quality and performance discipline will increasingly shape actual system value.

## The 2026 bottom line for Indian solar owners

The easy gains in Indian solar are mostly gone. Winning on tariff or EPC cost is no longer enough if post-COD performance governance is weak. In 2026, the strongest solar portfolios are those that treat O&M as an engineering-and-data function tied directly to cash flow.

Owners should focus on five priorities:

- Build a trustworthy loss-tree using calibrated SCADA and meter reconciliation
- Optimise cleaning based on measured soiling and water economics
- Track degradation scientifically, not anecdotally
- Prepare documentation for warranty recovery before failures become large claims
- Evaluate selective repowering where repeated downtime is eroding project value

For C&I consumers, developers and lenders alike, the difference between a satisfactory plant and a high-performing one is often just a few percentage points of energy. In today’s policy and tariff environment, those few points are worth serious money.

If you are evaluating solar asset performance, O&M strategy, repowering options, SCADA upgrades or technical due diligence in India, contact Growthifye’s advisory desk for a project-specific review.

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