Telecom PV Soiling in Saudi Arabia: When Should Cleaning Be Scheduled?

Schedule Saudi telecom PV cleaning using measured soiling, usable energy recovery and visit costs. Check rain effects before closing the maintenance work order.

PRODUCT KNOWLEDGE

Telecom PV Soiling in Saudi Arabia: When Should Cleaning Be Scheduled?

Use measured soiling, the station’s energy shortage and the actual cost of a visit to decide when PV cleaning is justified. Verify what rain and cleaning really restored before resetting the maintenance clock.

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Saudi PV maintenance decisions
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Schedule PV cleaning at a Saudi telecom site when a credible soiling measurement shows a recoverable loss that matters to the station’s supply margin or justifies the maintenance cost. Use a separate inspection route for concentrated contamination or suspected module damage. A weekly or monthly calendar alone cannot establish that either condition has been met.A cleaning decision for **telecom PV soiling** needs two records: what deposited dirt is taking away from the array, and what the station could actually do with the recovered energy. A dusty array supporting a battery that barely reaches its evening target deserves a different response from an equally dusty array already curtailed for much of the afternoon.

Separate dirty glass from low available sunlight

Dust on the module surface obstructs light entering the cells. Dust suspended in the atmosphere also reduces the sunlight reaching the array, but washing the glass does not remove that airborne dust. Low daily production during a dusty weather event is therefore a reason to investigate, rather than proof that cleaning will restore the missing kilowatt-hours.

Start with the affected period, not a comparison of two daily totals. Check contemporaneous irradiance, module temperature, controller state and equipment availability. If both the clean reference and the working array fall together, the available

solar resource may have changed. If the soiled device loses output relative to a trustworthy clean reference, surface contamination becomes a stronger explanation.

A third possibility is an operating limit. A controller may restrict PV production because of its output limit, temperature derating or a battery charge constraint. Recorded production is then below available array production for reasons that cleaning may not resolve. Investigate a disabled branch or electrical fault separately; this article does not replace the existing PV string and tower-shading design guide .

How should a Saudi telecom site measure PV soiling?

Compare a naturally soiled PV reference device with a maintained clean device under the same exposure, using a qualified measurement system with its calibration and temperature corrections. Check the reference result against representative array locations; one clean patch or an uncorrected before-and-after power reading cannot establish the whole station’s soiling loss.

For **soiling ratio** monitoring, the two devices should share the relevant tilt and orientation and have a documented clean-to-clean baseline. The measurement system may use power or short-circuit current; apply its specified method consistently rather than treating the two quantities as interchangeable. Maintain the clean device and irradiance sensor, and retain timestamps for both manual cleaning and natural cleaning events.

Soiling ratio, SR = corrected soiled-device output / expected clean-device output
Reference-device soiling loss = (1 − SR) × 100%

The expected clean output must account for the devices’ baseline mismatch and the chosen instrument method. A valid SR of 0.94 indicates an approximately 6% loss for the measured reference-device response. It does not automatically prove a 6% reduction in delivered station energy: uneven contamination, module mismatch and production limits can change the array-level result.

The September 2025 IEA PVPS soiling fact sheet describes paired PV-device measurements alongside optical approaches and emphasises site-specific mitigation. For a telecom operator, the practical addition is an operating-state record that identifies when the array can supply useful load or battery charging.

Place the reference assembly where it represents the working array, not where it is sheltered from local dirt. Examine exposed edges and areas near roads or construction separately. State measurement uncertainty and exclude unstable or unsuitable observations according to the instrument procedure. A threshold smaller than the

measurement uncertainty is a weak dispatch signal. Use purpose-built equipment and authorised personnel; do not improvise a short-circuit test on live PV wiring.

Saudi evidence does not give a national cleaning interval

A 2026 KFUPM-listed cleaning optimisation study used 2020–2024 data from the 300 MW Sakaka solar plant. Its abstract reports different modelled intervals for mechanised and manual cleaning, with further seasonal changes. Those are plant- and method-specific optimisation results, not instructions to clean every Saudi telecom array at the same interval.

A small remote station has different access costs, labour arrangements and uses for electricity from a utility plant selling production. Even within one region, nearby traffic, construction, humidity and particle sources can change accumulation. Record the station’s coordinates and exposure, then group sites only after measurements show sufficiently similar behaviour.

For a new Saudi site without a seasonal history, establish a provisional inspection and measurement plan approved by the operator. Review it after dust events, rain and documented cleaning. A short observation campaign can support an initial operating decision, but cannot prove a full-year loss rate or justify extrapolating a constant daily accumulation rate across seasons.

The dispatch rule: validity, urgency, then recoverable value

A useful work-order rule first asks whether the measurement is believable, then whether the station has a service-risk or module-condition concern, and finally whether routine cleaning has sufficient incremental value. Apply these gates in that order so an attractive savings estimate does not legitimise bad data.

Observed condition	Decision route	Evidence before release
Clean reference is dirty, drifting or unavailable	Restore measurement quality; use the operator’s fallback inspection plan	Maintenance timestamp, baseline check and valid reference readings
Concentrated contamination or suspected module damage	Request qualified inspection and a safe corrective method; do not wait solely for economic payback	Location-specific photographs, condition assessment and OEM instructions
Credible soiling coincides with inadequate battery recovery	Prioritise an energy-margin review and timely approved intervention	Usable recovery forecast, charging constraints and the operator’s reserve criterion
Credible soiling but no immediate supply-margin concern	Compare clean-now with the feasible next visit or verified natural reset	Recoverable-energy value, incremental visit cost and forecast uncertainty

The operator should define the trigger, persistence requirement and escalation authority for each route. A confirmed fall in soiling ratio might create an investigation task; an approved loss-and-reserve condition can release cleaning. Keep a maximum inspection interval as a fallback, rather than assuming that continuous measurement removes the need to inspect the physical array.

Rain or another dust event may change the value of dispatching today. A combined maintenance visit may change its marginal cost. Compare realistic alternatives at the same decision date; do not charge a full dedicated trip to one option and silently give another option free transport. Record why a work order was issued, deferred or escalated.

How much recoverable energy can a cleaning visit justify?

Estimate the extra PV energy available from cleaning over the period until the next credible reset, then subtract production constraints and conversion losses before valuing it. Compare that useful recovery with the incremental cleaning cost; additional PV kilowatt-hours are not automatically avoided grid purchases, avoided diesel consumption or additional battery autonomy.

The value of **recoverable PV energy** depends on when it becomes available. Extra morning energy may support a charge deficit, while extra midday energy may be curtailed because the battery is full. Use time-resolved load, battery and controller data where possible. The telecom energy-management source-control guide owns the wider source-priority and operating-mode decision.

Incremental available PV energy = Σ [Eclean,d × (Lwait,d − Lclean,d)]
Useful recovered energy = incremental available PV energy × usable fraction × delivery efficiency
Screening value = useful recovered energy × marginal energy value − incremental cleaning cost

Eclean,d is the forecast clean-array energy for day d, in kWh at the defined PV measurement boundary. Lwait,d and Lclean,d are fractional losses for waiting and cleaning now, including subsequent re-soiling. The usable fraction represents incremental production that can serve demand or be stored, rather than curtailed; delivery efficiency applies only losses downstream of that boundary. Do not apply the same loss twice.

Illustrative arithmetic, not a Saudi site benchmark

Assume a ten-day comparison window, ending at a scheduled maintenance visit. For

arithmetic only, the clean-array forecast is 40 kWh/day and the loss difference between the two options stays at five percentage points: 6% without today’s cleaning versus 1% after it. Assume 60% of the additional energy can be used, downstream delivery efficiency is 95%, marginal energy value is SAR 1.50/kWh and today’s incremental cleaning cost is SAR 120. These inputs are hypothetical, not local tariffs, quotations or measured performance.

- Additional available PV energy: 40 × (0.06 − 0.01) × 10 = 20 kWh.
- Useful recovered energy: 20 × 0.60 × 0.95 = 11.4 kWh.
- Gross energy value: 11.4 × 1.50 = SAR 17.10.
- Screening value after cleaning cost: 17.10 − 120 = −SAR 102.90.

On these assumptions, a dedicated visit is not justified by energy value alone. A service-risk concern could still require action, or a combined visit could lower the incremental cost. If the usable fraction were only 15%, useful recovery would fall to 2.85 kWh despite exactly the same assumed glass-soiling improvement.

Replace the constant-loss assumption with the measured accumulation and forecast profile before making a real decision. Test a lower recovery estimate, an earlier rain reset and higher visit costs. A small positive estimate that disappears within uncertainty is not robust payback. Value generator displacement through the actual operating regime and marginal fuel response; do not convert recovered kWh into litres using an assumed universal factor.

Does rain eliminate the need to clean a Saudi telecom PV array?

Rain can remove some deposits, but rainfall alone does not prove the array has returned to its clean baseline. Verify the post-rain soiling response and inspect representative modules before cancelling a cleaning task or resetting the site’s loss model.

The effect depends on the deposit and exposure. A rain gauge establishes an event, not the residual condition of each module. Check whether the measured soiling ratio improves and remains stable under valid comparison conditions. If the reference pair resets but an array section retains visible deposits, investigate that section rather than assuming the reference represents every row.

Treat a rain forecast as an uncertain alternative to dispatch, not guaranteed maintenance. When supply margin is tight, the cost of waiting includes the station’s operating consequence if rain fails to arrive or fails to clean effectively. Do not adopt a universal rainfall amount as a Saudi cleaning threshold. Retain the observed event and outcome so future scheduling uses the site’s own evidence.

Close the work order with a verified new baseline

Useful **PV cleaning records** connect the release decision to the method used and the condition left behind. An attendance signature proves a visit; it does not establish which modules were cleaned, whether their surfaces were damaged or whether the expected response was recovered.

1. Identify the cleaned rows, date, personnel and approved method. Record pre-existing defects and any areas excluded from the work.
2. Retain representative before-and-after photographs and the reference-device cleaning history, without presenting photographs as a calibrated energy measurement.
3. Compare valid normalised measurements before and after the work. Record residual contamination and operating limits that could mask improvement.
4. Track the subsequent energy and battery-recovery behaviour against a weather-adjusted baseline, including any concurrent settings or equipment changes.
5. Update the next inspection date, accumulated-loss model and unresolved exceptions. If performance does not recover as expected, reopen the diagnosis rather than assuming a second wash is the answer.

Use the actual module manufacturer’s current cleaning instructions and the site’s electrical safety procedure. Confirm tool compatibility, water quality, temperature conditions and any permitted pressure before work. Abrasive methods can damage surfaces; damaged glass or exposed wiring requires qualified assessment. PV modules can remain electrically active in daylight, so switching off downstream equipment is not proof that the array is safe to touch.

No module coating, cleaning machine or advertised dust resistance should remove the evidence requirement. Obtain model-specific compatibility and warranty information and verify the result at the site. The maintenance record should state both the recovered condition and the limitations of the measurement.

Review the maintenance inputs with the energy configuration

Provide Huijue with the Saudi site location, PV and controller configuration, measured soiling history, load profile, battery charge constraints and the operator’s maintenance arrangement. These inputs help define the monitoring and PV-to-cabinet interfaces for a project-specific telecom energy proposal. The cleaning method, dispatch authority and service agreement remain subject to the operator’s approval and the selected equipment instructions.

Discuss the Saudi site energy inputs

Related engineering resources

PV Module, String and Tower-Shading Design
Telecom Site Monitoring System Guide
Telecom Energy Monitoring KPIs
Telecom Solar Power System Architecture

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