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Vitalize Your Solar Panels



CLEANING FOR PERFORMANCE

Why all solar parks need regular cleaning

A brief introduction to minimizing energy loss and protecting your solar park

THE OVERLOOKED FACTOR IN SOLAR EFFICIENCY

As the global energy landscape pivots toward renewables, solar power has emerged as a cornerstone of sustainable growth. Solar parks, ranging from utility-scale farms to expansive commercial installations, are multiplying across continents, driven by falling costs and climate commitments.

Yet, amid this momentum, one critical factor often goes unnoticed: **the performance-degrading impact of soiling**. Dust, pollen, bird droppings, and pollution accumulate invisibly on panel surfaces. Unlike a cracked module or a malfunctioning inverter, soiling doesn't sound alarms, but it quietly diminishes energy output, day after day.

> "Solar panels don't need to be broken to stop performing—just dirty."
>
> ***Bas Moeskops*** *Product Manager Lumiforte*

This whitepaper explores the hidden impact of dirty panels, presents global benchmarks on energy losses due to soiling, and discusses cleaning strategies that are practical, scalable, and sustainable. It is written for solar park owners, asset managers, O&M teams, and cleaning contractors—anyone responsible for optimizing solar performance.



QUANTIFYING THE LOSS

Energy loss due to soiling is not anecdotal—it is quantifiable, measurable, and regionally specific. Multiple studies across Europe, North America, and arid regions paint a consistent picture: soiling significantly reduces solar output.

What the data really shows

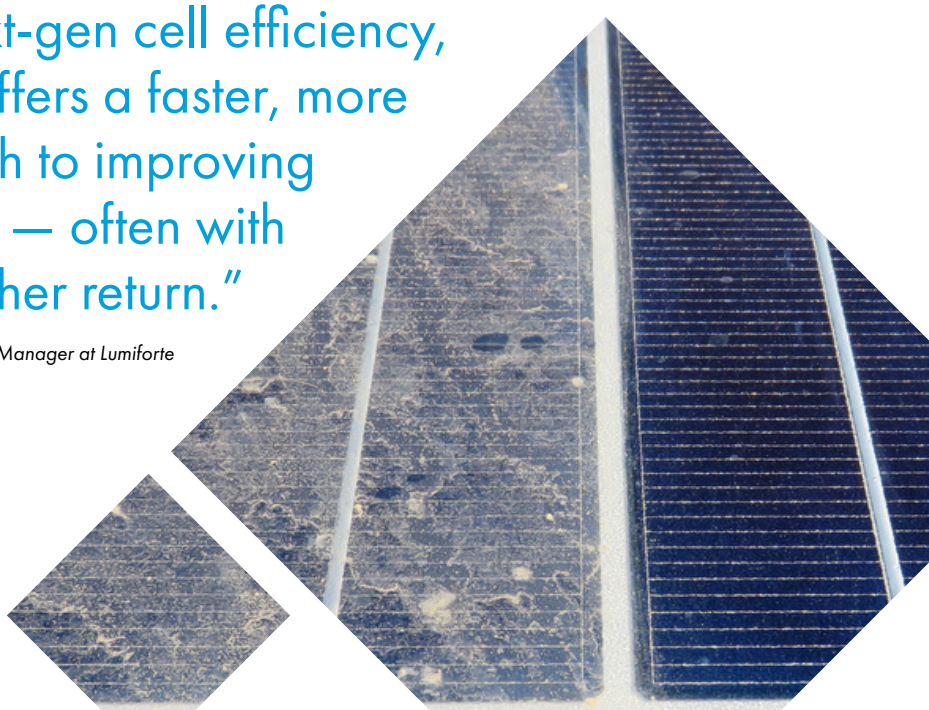
In Europe, an extensive study found **average losses of 5.3%**, with figures climbing as high as **14% in Spain**. Even in rainier countries like Norway, losses of around 2% were observed. This analysis accounted for natural rainfall cleaning, which in many cases only removes about 10% of accumulated soiling.

In semi-arid zones, such as parts of the Middle East or North Africa, **losses regularly reach 15–30%**, exacerbated by wind-blown dust and the absence of regular rainfall. Similarly, the U.S. Department of Energy's National Renewable Energy Laboratory reports that in certain parts of the U.S., **annual energy losses from soiling can reach 7%**.

Beyond geography, key variables influencing soiling rates include panel tilt angle, proximity to agriculture or roads, local humidity, and seasonal changes such as pollen bursts.

"Even a small gain in light transmission can lead to a significant increase in energy output. While the solar industry often focuses on next-gen cell efficiency, regular cleaning offers a faster, more accessible path to improving performance — often with a much higher return."

Mathieu Fiore *R&D Manager at Lumiforte*

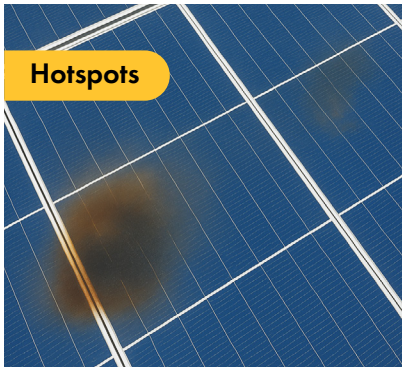


BEYOND OUTPUT

While energy yield loss is the most visible consequence of dirty panels, the long-term physical impact on the panels themselves can be even more damaging.

The hidden cost of neglect

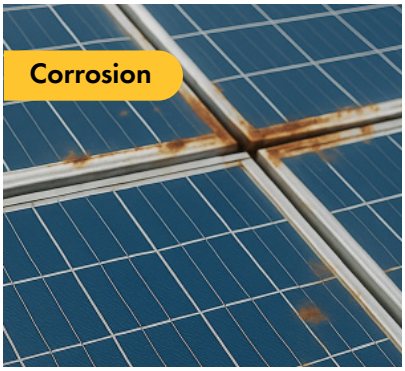
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When dirt builds up unevenly on the surface, it causes shading. This shading forces unsoiled parts of the panel to work harder, creating local overheating known as **hotspots**. Over time, this thermal stress can permanently degrade the cells and surrounding materials.



Soiling also traps moisture, particularly in humid or coastal regions. This accelerates **delamination**, where the protective layers of the panel separate and fail



In polluted or salty environments, the combination of particles and moisture can trigger **corrosion**—damaging the glass, frame, and electrical contacts.

These effects not only shorten panel lifespan but may void warranties that require adherence to proper maintenance schedules.

"What starts as dust can end in damage. Maintaining cleanliness is about more than optics, it's about protecting performance and asset value."

Martijn Koerts *Business Unit Manager Solar Lumiforte*

CLEANING METHODS

Cleaning solar panels is no longer a niche concern. It's an essential part of operational planning. The ideal cleaning method depends on the size, location, contamination type, and layout of the solar installation.

Choosing the right approach for your site
Selecting a cleaning strategy starts with understanding the site's specific challenges, such as dust, pollen, bird droppings, or residue. Climate and accessibility determine how often panels should be cleaned and which method offers the best long-term performance with minimal environmental impact.



Manual cleaning, using water-fed poles or brushes, remains common—particularly for smaller arrays or when precision is required. It allows direct inspection and can tackle stubborn dirt, but is labor-intensive and less scalable.

Robotic systems are increasingly used in flat, utility-scale parks. These machines automate brushing and rinsing, ensuring consistency while reducing labor needs. Initial investment is higher, but payback comes through efficiency and reduced downtime.





Tractor-mounted brushes strike a balance between speed and coverage, especially on large, accessible sites. The rotating systems can be combined with water dosing for effective, controlled cleaning.

For hard-to-reach or sprawling installations, aerial spraying by drones or helicopters offers an efficient alternative. In these cases, no brushing is involved—the cleaner is sprayed in anticipation of rainfall that acts as a natural rinse. This method is fast, contactless, and ideal for frequent maintenance.



The most effective cleaning strategies match method to site and frequency to contamination levels.

CLEANING AGENT

Cleaning matters more than you think! Choosing the right cleaning agent is just as important as selecting the right application method. Harsh chemicals or high-pressure water can damage sensitive anti-reflective (AR) coatings, corrode metal frames, or harm surrounding ecosystems.

A proper solar panel cleaner must be non-corrosive and safe for AR coatings. There are dirt-specific cleaners and cleaners that are effective against multiple, common contaminants like bird droppings, dust, and pollen.

There are several options on the market tailored for solar applications:

- **Vitapanel Clean ECO** is certified ECODETERGENT by ECOCERT, biobased, biodegradable cleaner designed for professional use. It is safe for coatings and frames, and 10 L can clean up to 1,700 m² at 1:20 dilution or 1,100 m² at 1:10 for drone delivery.
- **Huchem Solar Clean** is a non-corrosive formula that can be diluted up to 1:50, requires no rinsing, and restores full panel output.
- From Kärcher, the **RM 99 PressurePro Solar Cleaner** supports compatible iSolar brush systems and maintains streak-free, residue-free results.
- **Chemitek Solar Wash Protect (SWP)** offers a pH neutral, biodegradable cleaner with built-in antistatic protection to reduce soiling and cut future cleaning effort and water usage.

Ultimately, selecting the right cleaner ensures solar systems perform optimally while aligning with sustainability goals and environmental regulations.

By selecting the right cleaner, operators can ensure optimal results while meeting environmental and regulatory standards.



FINAL THOUGHTS

Too often, solar maintenance is reactive. Cleaning is only triggered when visible grime accumulates or output noticeably dips. But by then, losses have already occurred.

Cleaning as a performance strategy
Shifting to a proactive cleaning strategy means optimizing not just for uptime, but for long-term return on investment. Clean panels generate more electricity, age more slowly, and maintain manufacturer warranties.

The right frequency depends on the environment: monthly in desert regions, quarterly in semi-industrial areas, biannually in temperate climates. With the right tools and agents, regular cleaning becomes a low-cost way to reclaim lost power and protect infrastructure.

THE TOOLS ARE READY

THE DATA IS CLEAR

THE GAINS ARE REAL

For those operating solar assets, it's time to move cleaning from an afterthought to a strategic advantage.



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Vitalize your solar panels

As the world transitions to renewable energy, the energy industry is experiencing increased demand for solar energy. Solar panels, being a critical component of this transition, require regular maintenance to ensure optimal performance and longevity. Vitapanel will provide advanced coatings and cleaners specifically designed for solar panels, addressing the need for effective, safe and sustainable solutions.

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