SOCIÉTÉ DE L'EAU AÉRIENNE SUISSE

WHITE PAPER

INCREASING SOLAR FIELD PRODUCTIVITY

WITH SEAS SYSTEMS

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EXECUTIVE SUMMARY

Solar photovoltaic (PV) fields are critical to the transition toward renewable energy, yet their efficiency is significantly hindered by soiling-accumulation of dust and airborne particles-which can reduce energy output by up to 50% in some regions. Regular cleaning is essential, and using demineralized (distilled) water is widely recognized as the optimal approach. However, traditional water sources for cleaning are increasingly scarce, expensive, or environmentally unsustainable.

SEAS Air-to-Water Generator (AWG) technology offers a novel, sustainable solution by producing high-purity distilled water on-site from atmospheric humidity. This white paper outlines how SEAS distilled water can increase both production and productivity in solar field operations, drawing on research and a real-world case study.

THE CHALLENGE: Soiling & Water Scarcity in Solar Operations

Impact of Soiling on PV Performance

- Soiling can cause energy production and productivity losses ranging from 3% to 50%, depending on location and environmental conditions.
- Losses are particularly severe in arid and dusty regions, which are often ideal for solar installations due to high solar irradiance.

Limitations of Traditional Cleaning Water Sources

- Conventional cleaning often uses local freshwater, which is increasingly scarce and subject to price volatility.
- Reverse osmosis and desalination can provide demineralized water but are resource-intensive, produce waste brine, and may leave residues harmful to PV panels and electrical systems.
- In many high-irradiance regions, water scarcity is acute, making reliance on traditional sources unsustainable and potentially contentious.

THE SOLUTION: SEAS SYSTEMS
Air-to-Water Generator (AWG) Technology

How SEAS AWG Works

- SEAS AWG units extract water vapor from ambient air by condensing it into high purity distilled water.
- The process is independent of local water infrastructure and can be powered by energy created by the solar field being serviced, aligning with the sustainability goals of solar operators.
- The distilled water produced is naturally low in minerals and contaminants, requiring only mild disinfection (e.g., UV treatment) before use.

Advantages Over Other Water Sources

SOURCE	WATER PURITY	ENVIRONMENTAL IMPACT	OPERATIONAL INDEPENDENCE	SUITABILITY FOR PV CLEANING
LOCAL FRESHWATER	Variable	Depletes resources	Low	Good (if available)
DESALINATED SEAWATER	Medium	Produces Brine Waste	Low	Poor (salt & other particles)
SEAS SYSTEMS	Very high	Minimal	High	Excellent

AWG water avoids brine disposal issues, salinity, and chemical residues, which can degrade PV panel surfaces and cleaning equipment over time.

PRODUCTIVITY & PRODUCTION GAINS

Enhanced Cleaning Efficiency

- Regular cleaning with distilled water prevents mineral and chemical buildup, maintaining optimal panel transparency and electrical integrity.
- Manufacturers of cleaning robots recommend demineralized water to prevent nozzle clogging and equipment wear.

Quantative Impact

- Case studies show that deploying AWG-produced distilled water for cleaning can prevent substantial energy loss due to soiling, compared to unoptimized or irregular cleaning schedules.
- Optimizing cleaning frequency using AWG water allows operators to balance energy and water costs, maximizing net energy production.

Operational Flexibility & Resilience

- AWG systems enable solar fields to operate independently of external water supplies, crucial in remote or drought-prone regions.
- This independence enhances operational resilience, especially during water shortages or emergencies, and reduces potential conflicts over water use.

CASE STUDY: Application of SEAS AWG in PV Field Cleaning

A **study** led by SEAS R&D Manager Lucia Cattani, Ph.D., applied a cleaning optimization method to a real-world solar field with 560,000 solar panels, which were cleaned by distilled water produced by a SEAS System. The cost of providing the SEAS distilled water provided a significant savings compared to incumbent water sources. SEAS distilled water did not require additives such as expensive and environmentally polluting detergents. In such a scenario, even a modest increase in electrical production and efficiency can provide almost immediate payback on the SEAS System.

Sustainability & Future Outlook

- AWG technology supports sustainable water use and reduces the environmental footprint of solar operations.
- As climate change increases the frequency of water-related disruptions, on-site water generation will become increasingly valuable for solar asset owners.
- The integration of AWG systems with solar fields exemplifies circular resource use, where renewable energy powers the production of a critical input (distilled water) for maintaining that very energy infrastructure.

CONCLUSION

SEAS AWG technology provides a reliable, sustainable, and high-quality source of distilled water for PV panel cleaning.

By enabling optimal cleaning schedules and reducing dependence on traditional water sources, AWG systems can significantly increase both the productivity and resilience of solar field operations.

The result is higher energy yields, lower operational risks, and a more sustainable approach to large-scale solar deployment.