



ATA Insights Webinar

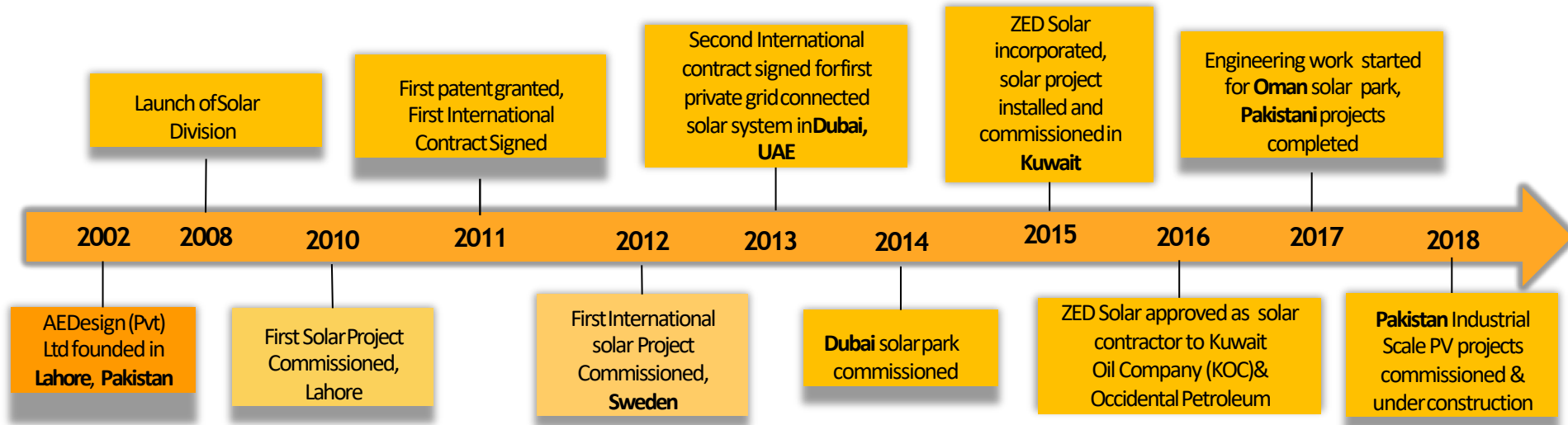
*O&M for PV Series: The
latest on cleaning
technologies*

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Company Overview



Awards, recognition and publications



- Finalists for Platts Global Energy Awards 2016 “Breakthrough Solution of the Year”, New York City, USA
- Finalist for “CSP Technology Innovation for MENA 2016”, Dubai, UAE
- Winner of “CSP Technology and Supplier Award 2015”, Seville, Spain
- Finalist for "Most Innovative Green Technology" Kuwait Sustainable Energy Conference 2015, Kuwait City, Kuwait

Technical papers presented at SolarPACES 2015, 2016 & 2017 and published by American Institute of Physics.



HH Sheikh Mohammed, Ruler of Dubai

Importance of proper cleaning of PV solar plants



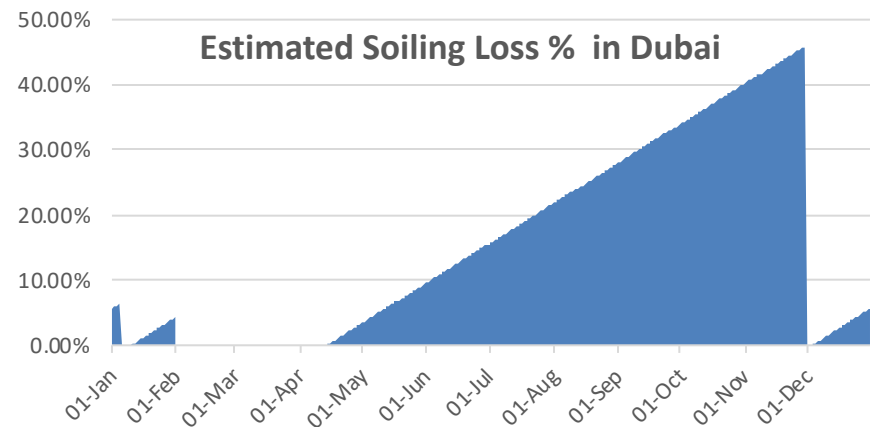
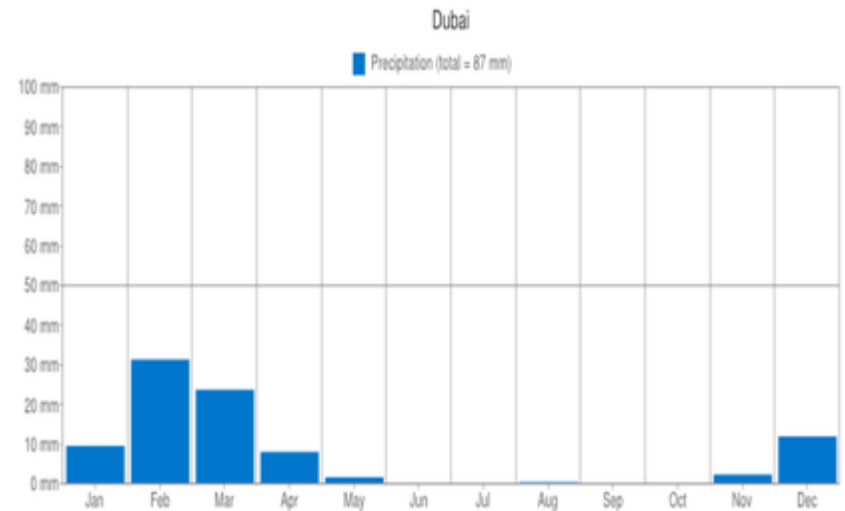
- PV Solar parks have minimal O&M requirements apart from ensuring that the panels are regularly and properly cleaned.
- If left unclean, PV solar parks suffer an annual power loss of between 16% and 40%
- Cleaning has generally been reliant on manual methods which are time & water and cost intensive
- Large quantities of fresh water is required for manual cleaning processes
- With a robotic cleaning system, it is possible to easily, safely and economically keep PV panels clean, thereby ensuring that optimum power generation is maintained
- This allows the end user to gain the most possible benefit from their solar system and achieve the best financial return.

Power loss due to soiling without cleaning

UAE case study



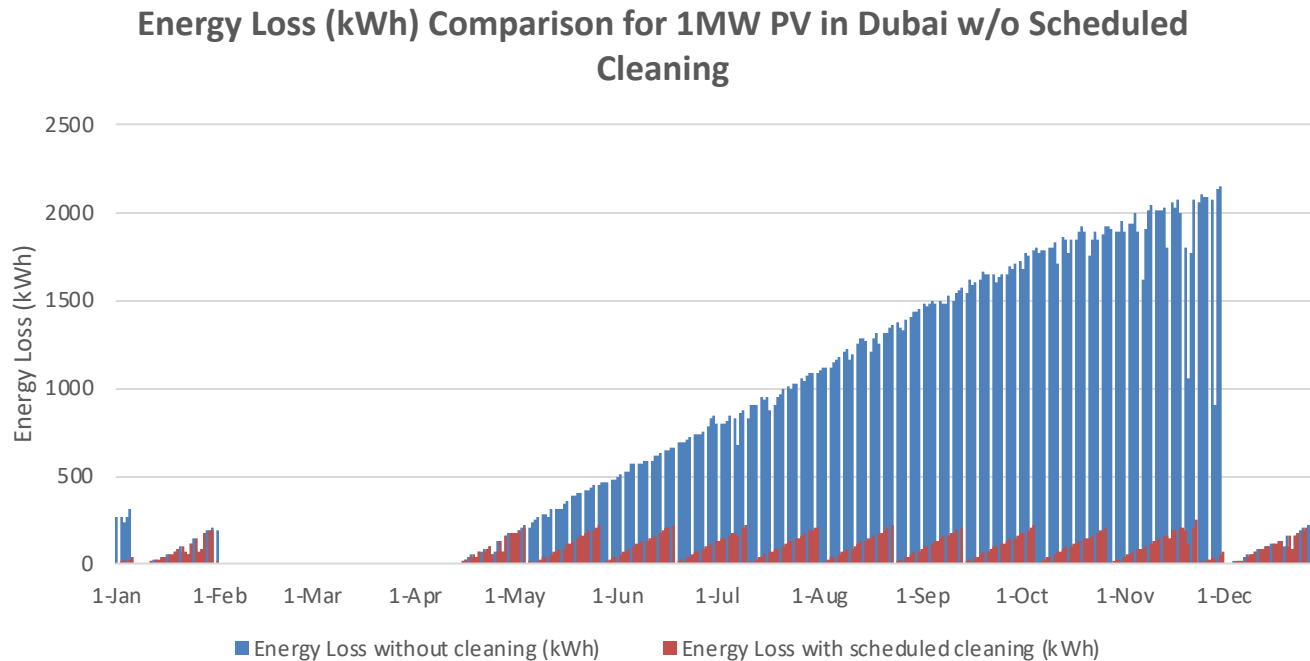
- According to available precipitation data for Dubai, UAE there is a long dry weather spell from April to December with no considerable rain
- With Average daily soiling rate of 0.2%/day, without cleaning the daily energy loss reaches up to 45%



Scheduled Auto Cleaning of PV Park in Dubai of 1MW Park



- With Scheduled Cleaning there will be 16% increase in production and hence additional revenue
- Net revenue gain by scheduled automatic cleaning will be 11,950 USD/year (5 US Cents per kWh)



Various manual cleaning methods



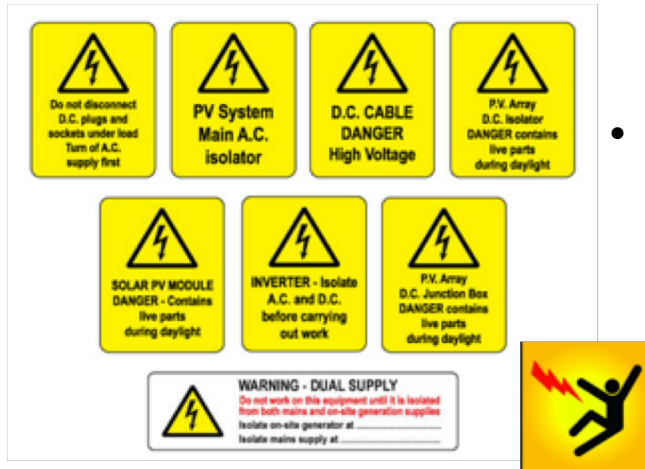
Hazards to human safety and property damage avoided with water efficient automated cleaning



- Working on rooftops poses hazards including tripping or fall down from the building



- Risk of severe electrocution in case of any fault in the earthing system of the solar installation



- Roof water ponding, due to excess water used for cleaning can lead to premature water seepage and damage to the roof



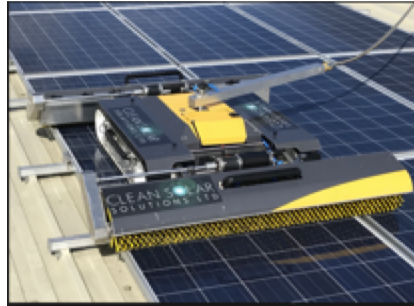
Why is automated cleaning the best solution?



- Cleaning can be scheduled over night and out of operation hours to avoid power production loss
- Cleaning in hours of low or no solar production minimizes thermal shock to panels and also potential issues from partial shading of panels
- Due to drastically lower cost and time required for cleaning, cleaning can be carried out on a frequent basis, thereby ensuring optimal power production
- Robotic cleaning process are much more reliable and consistent, ensuring that each panel is fully cleaned each time.



Automated and semi-automated cleaning methods



Comparison of automated cleaning solutions



Cleaning method	Water consumption	Energy consumption	Cleaning efficiency	Cost of acquisition	Maintenance cost	Effectiveness in high salinity environments	Total Score
Dry rotating brush scrubbing	5	3	2	4	3	2	19
Rotating brush with air pressure	5	1	2	2	2	2	14
Electrostatic cleaning	5	1	2	1	4	1	14
Water spray systems	1	3	1	4	5	2	16
Wash and wipe	3	5	3	3	3	4	21
Wash and scrub	1	3	2	3	4	3	16
Wash, scrub & wipe	4	5	5	3	3	5	25

*A higher score indicates a better rating

ZED Solar Robotic cleaning system



- Ensures optimum energy production while drastically reducing O&M costs
- Uses over **90% less water** than manual cleaning
- Cleaning options include dry scrubbing only or scrubbing & wiping with water
- Fully automated or Semi automated versions available
- Perfect for challenging rooftops as well as medium-large ground installations
- 3 year warranty



Effective and Water Efficient cleaning robot;

Annual water saving of 222,500 litres per MW



Solar Panel Cleaning Robot

Robot type/cleaning mode

Washing, scrubbing and wiping

Robot Operation

Automatic cleaning with semi-automatic inter row shifting

Water consumption

125ml per panel

Cleaning time

12 seconds per panel



Annual Water consumption of approximately **242,500 Litres** with manual cleaning for 1MW (**1.5 litre per panel**, 52 cleans per year) compares with approximately **20,000 Litres** with robotic cleaning for 1MW (**0.125 litre per panel**, 52 cleans per year)

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