



CEMENT REMOVAL AGENT REMEDIATION OF PROBLEMS & EVALUATION OF GAINS

ASSET OWNER	SirajPower
O&M COMPANY	SirajPower
LOCATION	United Arab Emirates, Dubai

PV PLANT	n/a
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CAPACITY	n/a
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Goal of the **CASE STUDY**

Assess the operational and efficiency gains associated with the use of the contaminant removal agent, **Cement Removal Agent** from ChemiTek:

- Removal capacity of the cured cement dust.
- Solar power generation improvement.



Characterization **OF THE PLANT**

SOILING TYPE

Harsh soiling caused by cement dust cured on glass.

CLEANING

Every 2 weeks with water and rotative brush,t without any success in removing the cement contamination.



Test PARAMETERS

The test was run over a period of 35 days (May 1st to June 5th) on 288 panels.

The inverter 6 was cleaned using the Cement Removal Agent and the inverter 7 was used as reference since it was not contaminated with cement, being only cleaned with water. Before the use of the CRA, the inverter 6 was losing almost 7% of the energy output when compared with the inverter 7.

As the existing problem on the solar plant was harsh, the manufacturer ChemiTek recommended to dilute the concentrated product with water at a dilution ratio of 1:2. Each 5 liters of CRA product was diluted in 10 liters of water.

Application of the CEMENT REMOVAL AGENT

As the existing problem on the solar plant was harsh, the concentrated product was mixed with water at a dilution ratio of 1:2. Each 5 liters of CRA product was diluted in 10 liters of water.

The total number of solar modules cleaned with the solution was 288, using as cleaning method the application of the product, then rinsing it off with a rotative brush and water, making sure that the modules did not dry since this can be the failure in the whole cleaning process.

The application method used was a sprayer, then brushing and rinsing with water, using the Karcher machine after a few seconds. With this procedure product did not dry quickly on the panels, and therefore the efficiency of the solution was kept.

As recommended by ChemiTek to the client, the amount of solution to be used per panel was between 500 to 800mL, due to the state of the contamination of the panels. Within this ratio the problem was solved.



Overall Results

During the cleaning, the O&M team reported:

- The CRA was successful in breaking the bond of the cement to the glass and emulsifying the particles.
- The product must not be let to dry on the module otherwise the cleaning process needs to restart.
- The experience in using the product made the process become more efficient throughout time.



Energy OUTPUTS GAINS

The energy output of each string was controlled at the inverter level and compared with the average energy generated.

In this test, the temperature of the panels had no influence in the results since all panels were subject to the same solar irradiation and ambient temperature.

Energy comparison table

BEFORE CLEANING			
Date	Daily Energy Produced Inverter 6	Daily Energy Produced Inverter 7	Comparison
27 May 2022	658,25	703,98	-6,50%
28 May 2022	657,9	703,98	-6,55%
29 May 2022	633,92	672,34	-5,71%
30 May 2022	707,06	761,15	-7,11%
31 May 2022	674,01	725,4	-7,08%
AVERAGE	666,228	713,37	-6,59%
AFTER CLEANING			
Date	Daily Energy Produced Inverter 6	Daily Energy Produced Inverter 7	Comparison
1 June 2022	682,18	691,43	-1,34%
2 June 2022	730,75	750,04	-2,57%
3 June 2022	761,04	781,82	-2,66%
4 June 2022	767,37	783,8	-2,10%
5 June 2022	747,86	760,46	-1,66%
AVERAGE	737,84	753,51	-2,06%

Performance Comparison Table

	Date	Daily Performance Inverter 6	Daily Performance Inverter 7	Comparison	
	1 May 2022	73,07%	77,19%	-5,33%	
	2 May 2022	71,11%	75,53%	-5,85%	
	3 May 2022	72,53%	77,31%	-6,19%	
	4 May 2022	71,56%	76,68%	-6,67%	
	5 May 2022	70,26%	74,41%	-5,58%	
	6 May 2022	68,49%	72,91%	-6,07%	
	7 May 2022	65,20%	69,75%	-6,52%	
	8 May 2022	63,78%	68,92%	-7,45%	
	9 May 2022	65,50%	70,90%	-7,62%	
	10 May 2022	66,01%	71,30%	-7,41%	
Both inverters cleaned cleaning cycle 34	11 May 2022	71,13%	76,88%	-7,47%	The daily average comparison percentage after the cleaning cycle 34 is -6.77%
	12 May 2022	71,83%	76,45%	-6,04%	
	13 May 2022	71,26%	76,30%	-6,61%	
	14 May 2022	72,45%	77,80%	-6,87%	
	15 May 2022	70,04%	74,95%	-6,55%	
	16 May 2022	67,88%	72,93%	-6,93%	
	17 May 2022	68,21%	73,36%	-7,02%	
	18 May 2022	64,86%	70,00%	-7,34%	
	19 May 2022	64,01%	68,81%	-6,99%	
	20 May 2022	62,26%	66,93%	-6,98%	
	21 May 2022	61,74%	67,16%	-8,07%	
	22 May 2022	60,26%	66,41%	-9,27%	
	23 May 2022	59,78%	65,56%	-8,82%	
Both inverters cleaned cleaning cycle 35	24 May 2022	63,05%	70,24%	-10,24%	The daily average comparison percentage after the cleaning cycle 35 is -6.68%
	25 May 2022	69,83%	75,36%	-7,34%	
	26 May 2022	70,29%	75,16%	-6,48%	
	27 May 2022	69,21%	74,01%	-6,50%	
	28 May 2022	67,84%	72,60%	-6,55%	
	29 May 2022	66,76%	70,80%	-5,71%	
	30 May 2022	68,93%	74,20%	-7,11%	
	31 May 2022	67,87%	73,05%	-7,08%	
Day of product cleaning	01 June 2022	70,21%	71,16%	-1,34%	The daily average comparison performance percentage after using the product is -2.06% which shows substantial improvement
	02 June 2022	75,37%	77,36%	-2,57%	
	03 June 2022	76,04%	78,12%	-2,66%	
	04 June 2022	75,60%	77,22%	-2,10%	
	05 June 2022	74,05%	75,29%	-1,66%	

CONCLUSIONS

The test was considered a success and the O&M team decided to move forward with the use of CRA – Cement Removal Agent – for the whole plant contaminated with cement dust. After the cleaning, the inverter 6 had recovered almost 5% of energy output.

As a preventive maintenance measure, in order to avoid the need of the recurrent use of the CRA, the plants will be protected with the antistatic and anti-adherent coating provided by ChemiTek: Solar Wash Protect or Antistatic Solar Amor. This will reduce the adhesion of the cement to the modules, thus making their cleaning much easier.

Annex 1

Framework of Cleaning Solutions in the Solar Industry

CLEANING SOLUTIONS IN THE SOLAR INDUSTRY

The preventive maintenance in the **Solar Industry** is more and more a concern of solar assets owners from the residential scale to the utility scale. Part of that preventive maintenance, and one of the most important tasks, is keeping the solar panels clean. Keeping the solar plants clean has an immediate impact on the energy production but will also prevent damages to the panels such as the appearance of hot spots.

The common practice of using just water to clean solar panels can present several issues. The quantity of water used and efficiency of the cleaning are the most important aspects.

On installations with harsh soiling, the amount of water used for cleaning will naturally increase. When cleaning manually more scrubbing will be required, when using a robot several passes might be required and when using a brush assembled on a tractor the speed of tractor will probably need to be lower.

All these cleaning processes use a continuous flow of water so any additional time spent cleaning equals to more water used.

The cleaning solutions present the capacity of reducing the quantity of water used and the time spent cleaning by enhancing the efficiency of the cleaning. The use of cleaning solutions has its own set of rules that need to be followed such as being pH neutral, non-abrasive to the glass and frame, safe for the sealing silicone, free of any harsh chemicals, and not lower the light transmission to the panel.

With the maturing of the market, O&M teams are now also looking into solutions to keep the solar panels cleaner between cleanings.

CHEMITEK'S CEMENT REMOVAL AGENT

The Cement Removal Agent (CRA) was developed specifically for solar panels. It is a biodegradable product that reacts with the cement and emulsifies it, making it easy to remove.

The product cleans efficiently harsh soiling, such as cement dust, stone dust, gypsum, and other alkali contaminants that are cured on the surface of the glass of solar modules, and thus reducing the cleaning time and the quantity of water of used.

This product is designed to be as delicate as possible with the components of the solar module (ARC, silicone, and aluminium frame), meaning it will not damage nor scratch it. CRA reacts chemically only with the contaminants and emulsions the particles so that they can be rinsed off easily.

Adjust the dilution of the product according to the harshness of the problem. Do a test in a small area to check which dilution is best for your case. It is preferable to leave the product on the module longer than to use a lower dilution.

Start with a dilution of 1 to 2 (1kg of CRA in 2L of water) and check the behaviour. If it is not strong enough to remove the cement with ease, then reduce the dilution ratio to 1kg of CRA in 1L of water, or even 1kg of CRA in 0,5L of water. **Lower dilutions should only be considered in very extreme cases.**

After diluting the product in the right amount of water, spray the diluted agent on the problematic areas making sure that all surface is covered. Wait a couple of minutes, let the product react with the cement. Then, rinse thoroughly with clean water making sure that all excess product and cement particles are removed from the panel. Make sure that the modules are dry and avoid cleaning them when they are hot. This will make the product dry very quickly and thus reduce its efficiency.

CRA is a remediation product and should be used as such. To avoid a recurring issue please act preventively and protect your modules with an antistatic coating, such as *Antistatic Solar Armor from ChemiTek*. This will prevent the particles from adhering directly on the glass, thus making them easy to remove during normal cleaning operations.



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