CASE STUDY

Photo by HD-Solar — The Netherlands

Analysing panel damage after a hailstorm

PV installers and system owners can face the challenge of identifying internal panel damage caused by extreme weather, such as a severe hailstorm. Large, fast-moving hailstones can cause considerable impairment to a solar panel's inner cells, without creating any visible signs of damage to its exterior. This is known as micro cracking, and it can degrade a PV system's output.

Even though panels are designed and certified (IEC 61215) to withstand the impact of hailstones 25mm in diameter, traveling at a maximum speed of 83 km/hour, real-world weather conditions can exceed the limits used in a panel testing environment. Consequently, after a severe hailstorm has struck, the system owner may consider Electroluminescence (EL) testing in order to detect possible micro cracking. During EL testing, all panels, including those that appear undamaged, are removed from the roof and closely examined in a mobile testing trailer. The cost and burden of checking for post-hailstorm system impairment can be high. Using the SolarEdge monitoring platform to analyse and identify underperforming panels can help minimise testing costs and labor.

How to use the SolarEdge monitoring platform to detect non-visible panel damage

- The SolarEdge monitoring platform provides complete visibility of a PV system's total energy output, as well as individual panel yields. By comparing data from before and after the hailstorm, the monitoring platform can assist in identifying which panels may be failing due to micro cracks.

- Another useful tool for detecting system degradation is the monitoring platform's panel mismatch analysis. This report compares each panel's peak power and energy production with the average of all solar panels on the PV site. Panel mismatch is presented as a percentage above or below the average, and any significant discrepancies in the array which cannot be explained by the PV site's characteristics, could indicate panel-level production problems caused by micro cracks.

- Unusual dips in system output after a hailstorm should not be ignored, as micro cracking can worsen with time due to thermal cycling, leading to significant degradation, or even a complete failure of the PV system.

Hailstorm in the Netherlands

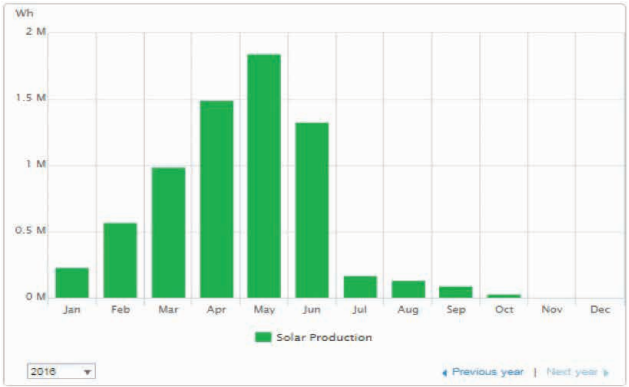
A severe hailstorm that caused serious damage to several PV solar systems passed over the southeastern region of the Netherlands on June 23, 2016. The consequences of this storm were clearly identified via the SolarEdge monitoring platform for the affected PV sites.

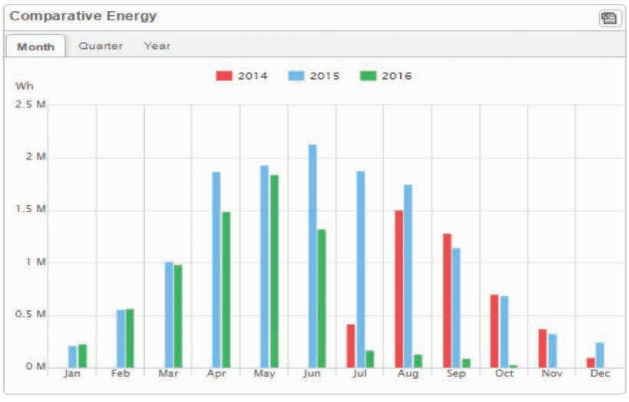
Site 1

By analysing and comparing the performance of three panels in a PV system, a noticeable decrease in production for two of the panels can be seen beginning on June 24, 2016, one day after the hailstorm.

The graph for Site 1 shows failing panels **P1.0.25 P**, **P1.0.1 P** compared to reference panel **P1.0.26 P**.

By analysing the total system output of the affected site over a longer period of time, there is a marked dip in system energy production starting in June, which continues to decrease over the months that follow.

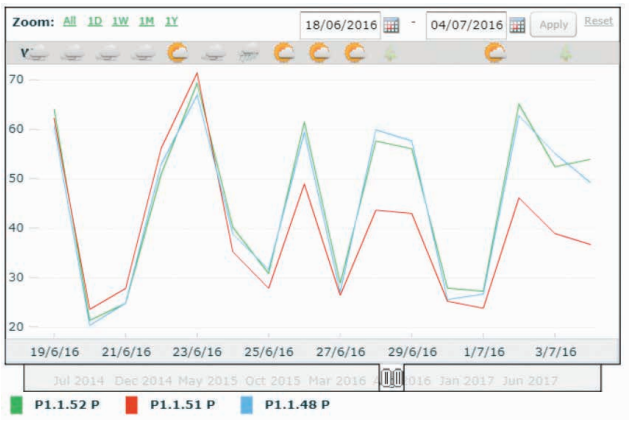




The graphs for Site 1 show the difference in monthly energy production.

Site 2

The graph below compares the power production of three panels over a seven-day period before and after the hailstorm. The chart shows normal production up to and including June 23, 2016. A marked decrease in panel 1.1.51 P's output (red curve) compared with the adjacent panels' output (green and blue curves) beginning on June 25, demonstrates the damaging effects caused by the hailstorm.



The graph for Site 2 shows failing panel **P1.1.51 P** compared to reference panels **P1.1.48 P** and **P1.1.52 P.**

The tables below show panel mismatch reports from before and after the hailstorm, confirming low performance for one panel.

Name	Serial Number	Inverter	Energy Mismatch	Power Mismatch
Panel 1.1.48	10109AC6-80	1	-3%	2%
Panel 1.1.51	1010B7B0-87	1	6%	4%
Panel 1.1.52	101028D3-1B	1	-1%	-5%

Mismatch analysis report screen capture shows panel mismatch performance averages for 1 month prior to the hailstorm on June 22 for Site 2.

Name	Serial Number	Inverter	Energy Mismatch	Power Mismatch
Panel 1.1.48	10109AC6-80	1	2%	-4%
Panel 1.1.51	1010B7B0-87	1	-29%	-32%
Panel 1.1.52	101028D3-1B	1	1%	-3%

Mismatch analysis report screen capture shows panel mismatch performance averages for 1 month after the hailstorm for Site 2, demonstrating that panel 1.1.51 was damaged during the storm.

Conclusion

The SolarEdge monitoring platform can help identify damage caused by a severe hailstorm, both at the panel and system level. Panel-level monitoring and mismatch analysis are essential for maximising lifetime energy yields, and reducing operation and maintenance costs, such as post-hailstorm testing. The SolarEdge monitoring platform pinpoints system failure and underperforming panels, while reducing the need to remove panels from the roof for individual testing. This helps system owners respond proactively in order to achieve maximum energy production.