

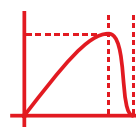


Thermal assessment in the photovoltaic industry

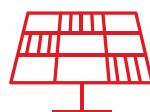
DuPont consultants can address solar panel degradation due to hot spots

Summary

Though solar panels are expected to function for 25 years or more, all panels will degrade predictably over time. Hot spots can speed up the degradation process, contributing to thousands of kilowatt-hours of unexpected energy loss every year. DuPont PV Consulting Services can find and assess underperforming panels and can help photovoltaic plants take preventive and reparative action to defend against further loss of power and consequent loss of investment returns.



Current-voltage (I-V) and thermal (IR) measurements



Degraded panel materials can compromise the safety and efficiency of solar plants



DuPont PV Consulting Services can provide a holistic assessment of your plant and recommend actions to prevent and rectify degradation and energy loss

Hot spots in panel performance

Hot spots are a key contributor to accelerated degradation and reduced reliability of solar panels. In photovoltaics (PV), hot spots are areas of localised elevated temperature created by a loss of efficiency in the affected area. The less efficient cell(s) creates a bottleneck for the circulation of electricity, which in turn leads to energy dissipation in the form of heat. This will result in a lower power output and accelerated aging of materials subjected to the high temperature.



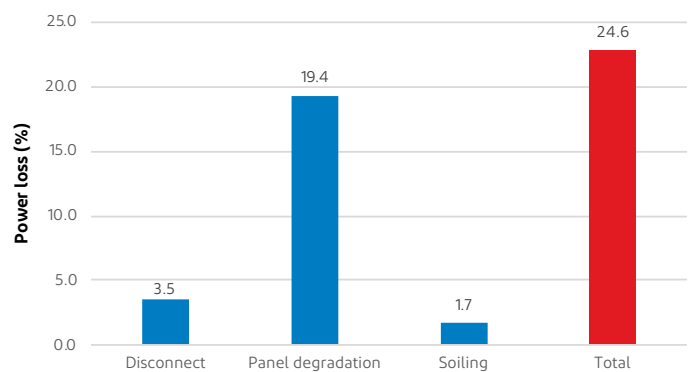
Thermal analysis reveals extensive signs of hot spots across the plant.

Any number of environmental factors can lead to hot spots. Panels may suffer increased partial shading during the winter, particularly from rooftops, vegetation and other tall features. Panels can also be soiled due to dust, dirt, sand and other contaminants.

Hot spots can also be the result of mechanical damage resulting from broken glass or bent frames, as well as invisible internal panel failures such as broken cells, increased contact resistance or other cell defects that can occur during the production process and/or the lifetime of the product.

Powering the future

A 3MW ground-mounted system was built in the Mediterranean region. After eight years of operation, a significant power drop that far surpassed the anticipated year-on-year degradation was noticed. The plant owners engaged DuPont PV Consulting Services to conduct a full-scale power investigation of the plant. The DuPont consultants discovered extensive signs of hot spots across the plant covering more than 20% of the panels and they found that 43% of the affected panels displayed temperatures 15 °C above the normal operating temperature. This resulted in a 19.4% power loss when the soiling was discounted from the pattern of degradation. Damaged cells were determined to be the main cause of the hot spots and of the energy loss.



The PV plant experienced a total power loss of 24.6% due to panel disconnects and degradation.

To stem the power loss, the DuPont consultants recommended an immediate replacement of all the panels affected by hot spots, as well as all panels presenting cell microcracks (as evidenced by snail trails in the absence of hot spots and triggered bypass diodes) which are susceptible to further damage.

As a preventive action, DuPont also recommended annual infrared thermography to detect further evolution of PV cell degradation such as cracking, which results in uneven temperature distribution.

Conclusion

Hot spot conditions are never desirable in a PV plant; therefore, it is important to identify and remedy them whenever possible. DuPont, backed by decades of experience in the solar industry, can offer a multimodal approach to PV plant issue investigations. DuPont consultants can help you to understand and mitigate risks now and in the future with the aim to preserve energy production and protect financial returns.



DuPont Photovoltaic Solutions
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