

Solar farms should prepare for bushfire effects, which can reduce output by 70%

UNSW research has found that smoke from major bushfires can sharply reduce solar electricity generation, even from more than 150 kilometres away.

SYDNEY, NSW, AUSTRALIA, October 28, 2026 /EINPresswire.com/ -- Smoke from major bushfires can significantly reduce the amount of electricity generated by solar farms, even when the fires are burning many kilometres away.

Now, UNSW Sydney researchers say better forecasting of smoke movements, more frequent panel inspections and cleaning, and changes to how solar panels operate could help solar farm operators prepare for these events and protect their equipment.

The recommendations follow a study examining the effects of two major Australian bushfires – the 2019-2020 Black Summer fires and Victoria's 2009 Black Saturday fires. Using historical weather and satellite data, the researchers modelled how smoke and airborne particles affected solar electricity generation and panel temperatures across south-eastern Australia.

The [findings have now been published](#) in the Solar Energy journal, with [Dr Shukla Poddar](#) as the corresponding author, alongside Professor Bram Hoex and Associate Professor Merlinde Kay from UNSW's [School of Photovoltaic and Renewable Energy Engineering](#).

Dr Poddar says the research highlights the need to look beyond solar farms immediately surrounding a fire and consider where smoke is likely to travel.

"We should start looking into things like trajectory modelling of the smoke and how long and far those smoke particles can be transported," she says.

"Extreme bushfires are becoming more frequent and intense in several regions, including Australia, California and southern Europe. Their impacts are not confined to the areas where fires burn: smoke from California's 2020 wildfires reached Europe, while smoke from Spain's 2025 fires travelled as far as the UK and northwestern Europe.

"Although this particular study is based on two extreme bushfires in Australia, the same method and analysis can be done for other parts of the world."

Solar panels generate electricity by converting sunlight into electrical energy. Smoke and

airborne particles can reduce the sunlight reaching the panels, lowering the amount of electricity they produce.

The UNSW study found that the impacts can extend well beyond the immediate fire zone.

During the Black Summer bushfires, the researchers estimated that electricity generation fell by as much as 70% at locations within about 50 kilometres of fire hotspots during several consecutive days. In regions more than 150 kilometres from hotspots, the study estimated there were still losses of up to 30%.

“Even at a radius of 150 kilometres away from the hotspots, there was around 30% reduction on those bushfire days, or just after the bushfire days, because a lot of the wind had transported the smoke inland across New South Wales,” Dr Poddar says.

The effects varied with the severity of the fires and the weather. During the 2009 Black Saturday bushfires, the study estimated lower reductions of generated power of around 18% near fire hotspots and up to 10% in more distant regions.

These figures are modelled estimates rather than measurements from individual solar farms. The researchers were unable to separate smoke-related losses from other factors, such as electricity generation being deliberately limited when the grid did not need all the power available.

One of the researchers’ key recommendations is to combine bushfire information, wind patterns and smoke-trajectory modelling to help predict which solar farms are likely to be affected.

Weather forecasts already help operators anticipate conditions such as high temperatures and strong winds. A similar system for smoke could give them advance warning that airborne particles are heading towards their facilities.

That warning could allow operators to plan inspections, schedule cleaning or adjust the position of panels before smoke arrives.

Poddar says historical wind patterns could also help operators understand which areas are more likely to be affected during bushfire conditions.

The study also highlights the importance of panel maintenance, particularly during bushfire periods.

Smoke particles can settle on solar panels, reducing the sunlight reaching their surfaces. If deposits accumulate unevenly, they may also create localised hot spots, where parts of a panel become much hotter than others. Over time, these hot spots can damage cells and reduce their performance.

The study did not model this localised damage directly, so further work is needed to establish how frequently it occurs during bushfires and how much generation it can cost.

Dr Poddar recommends more frequent cleaning when smoke is likely to affect a solar farm, alongside regular thermal inspections to identify unusually hot panels or electrical components.

The paper also recommends better remote monitoring and electrical fault detection, allowing operators to identify temperature anomalies and quickly isolate affected parts of a system. Managing grass and shrubs beneath panels, maintaining firebreaks and preparing bushfire management plans can help reduce the risk of fires starting or spreading within solar farms.

Many large solar farms use tracking systems that move panels to follow the Sun throughout the day. Dr Poddar suggests operators could consider temporarily adjusting those angles during particularly hot periods, such as when bushfires are occurring, rather than always positioning panels for maximum sunlight.

The aim would be to reduce heat exposure and potentially help loose particles move off panel surfaces. Such adjustments would involve a trade-off since panels may produce less electricity while turned slightly away from the Sun.

The research findings could also inform decisions about where to build future solar farms. Developers could assess the history of nearby bushfires and examine prevailing wind directions and likely smoke pathways before investing in a site.

“This framework can be combined to understand the frequent bushfire hotspots and air trajectory pathways as a pre-feasibility assessment for site selection of new solar farms,” the paper says.

“This is also beneficial for understanding optimal operational and management strategies for current operational solar farms that are in proximity to bushfire hotspots or can be affected due to aerosol dispersion and travel.

“Importantly, this approach is transferable to other bushfire prone regions globally, including California, southern Europe, and parts of South America, where recurring bushfire activity and atmospheric transport pose similar risks to solar energy generation and asset management.”

“If operators got an alert that their solar farm might be impacted, they could potentially adapt some mitigation strategies, such as adjusting the panel angle where appropriate or being aware that additional cleaning may be required,” she says.

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