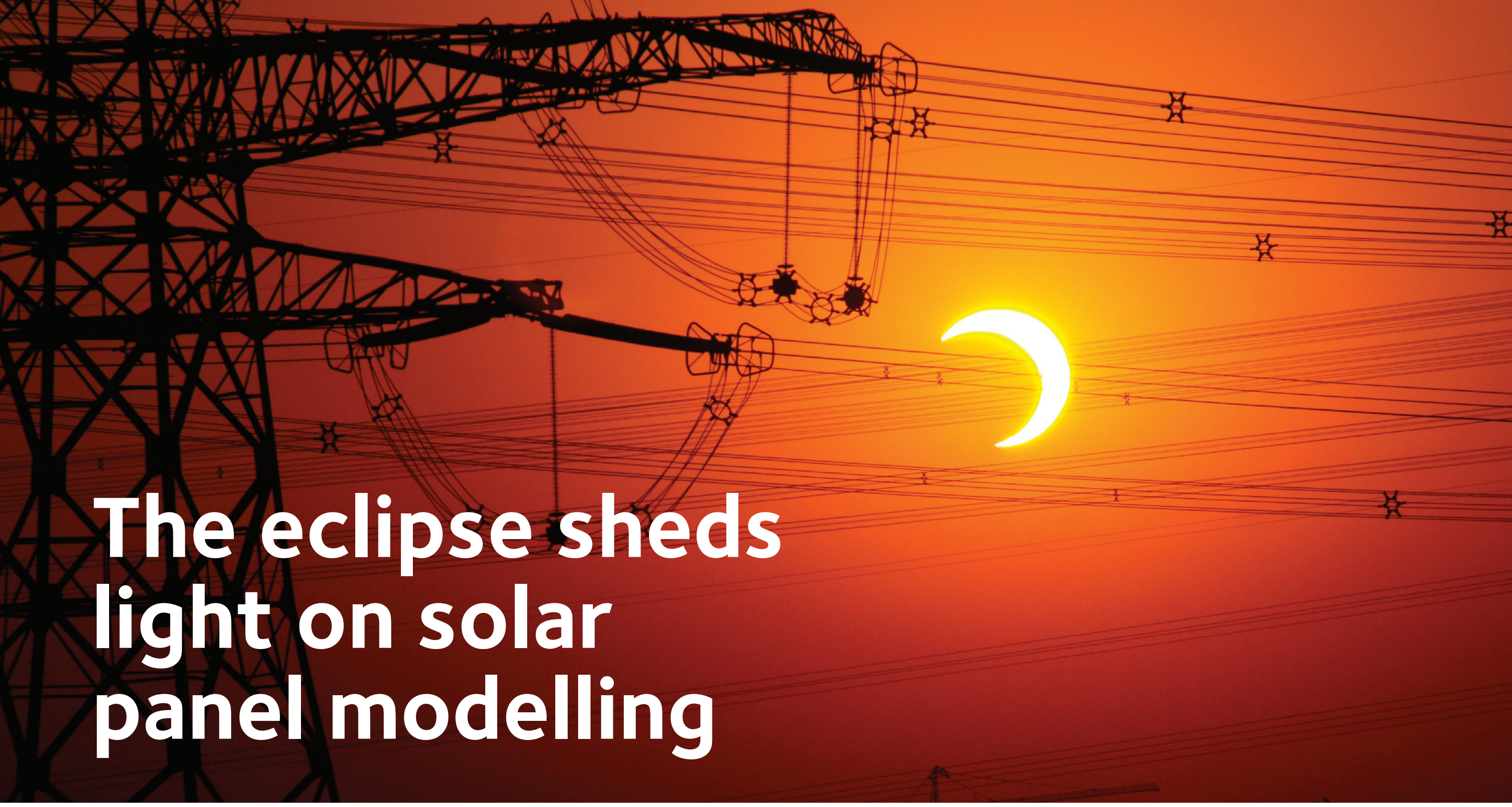

The eclipse sheds light on solar panel modelling

Mathematical models being developed at the Department of Computer Science to help predict the behaviour of renewable energy sources are going to be tested with data gathered from the partial solar eclipse. Professor Alessandro Abate, who is leading the work, describes how such models should result in a more robust and reliable electricity grid.

As the sun was disguised by the moon on 20 March, it led hundreds of thousands of solar panels to tune down as they experienced sudden partial darkness, and then jointly and rapidly turn on again as sunlight fully returned. Data from how solar panels reacted during the eclipse will inform mathematical models, which are developed to help ensure the stability of the power grid when energy sources don't perform steadily.

Solar panels now feed substantial amounts of electricity into the power grids of countries including Germany, Italy, and France: in the summer up to 40% of Germany's electricity comes from its solar farms. Whilst reducing greenhouse gas emissions, renewable energy sources, such as solar and wind, introduce uncertainty into power grids because of the oscillation in power production levels due to local weather variations.

The last European solar eclipse was in 1999, before the pervasive proliferation of solar energy sources feeding into grids. It was therefore not known what impact an eclipse, and the subsequent synchronised behaviour of large populations of solar panels, would have on the stability of European power grids, which were engineered in the pre-renewable era. Abrupt events such as a solar eclipse are thus relevant to the study of less infrequent grid instabilities, such as those related to local power failures, which can potentially result in a cascade of blackouts.

This eclipse provided a rare opportunity to challenge in a worst-case scenario the mathematical models developed to predict the behaviour of large populations of solar panels. With very many solar panels of different types, brands, and set-ups sited in different locations, current models have to cope with a lot of variables: the team in the Department of Computer Science believes that new, simpler, yet precise, models can be obtained to reliably predict the overall behaviour and its likely impact on the stability of the power grid. In the longer term, the quantitative prediction of the behaviour of populations of solar panels could enable the mitigation of grid instability.

The team hopes to contribute to helping design strategies to ensure that power grids are more predictable, robust, and reliable. The models under study are not only relevant to solar power, but should also be useful for predicting the behaviour of other renewable energy sources such as wind power. As we move towards ever more interconnected grids in which renewables are providing more and more power, there is a great need to understand how these variable energy sources can engage with electricity grids that are improved to fully accommodate them.