Computer models are helping the National Grid to address the safety and transmission problems created by the rise in domestic solar generation.

Solar power is set to surge onto the National Grid over the next two decades. To meet government ambitions the UK must generate 20 GW – around one third of the nation’s energy – from solar by 2030.

**But is the technology ready to meet the needs of the network?**

“The anticipated uptake of solar energy brings key challenges to the grid,” says Dr Roger Shuttleworth, a member of the Power Conversion research group. “Solar panels produce electricity as direct current (DC) but the grid only transmits alternating current (AC). To transform DC to AC solar panels have devices called inverters.”

However inverters offer network operators little control over fluctuations in the voltage due to the power that PV panels produce. As PV becomes more popular network operators may need better control over voltage variations, notes Dr. Shuttleworth. He thinks the answer may lie in reactive power, which is associated with the electric and magnetic fields created by the AC voltage.

Of further concern to the development of solar power is whether micro inverters will live up to manufacturer’s claims of long lifespans.

Dr. Shuttleworth will be working to tackle both problems at once. He hopes to increase the lifespan and efficiency of inverters whilst permitting them to control grid reactive power to offer control over voltage variations. Novel inverter technologies such as circuit topologies, control strategies and semiconductor materials - including Silicon Carbide or Gallium Nitride – may make this possible.

Investigations have already started. Dr Shuttleworth says combining advanced inverter designs with novel PV materials may boost the popularity of PV panels.

Advances in solar technology may facilitate a large scale uptake of solar energy, but how will the network cope with this transformation?
The research project ‘Whole system impacts and socio-economics of wide scale photovoltaic integration’ (WISE PV) uses computer models to look into the future. Researchers want to explore different scenarios to forecast how widespread solar generation could affect the safety and stability of the National Grid, and the management and operation of local distribution networks.

Dr Joseph Mutale and colleagues of the WISE PV project are building forecasts on thousands of simulations run using a range of different variables and event probabilities. He wants to calculate the potential power output of photovoltaic (PV) solar panels and assess the extent to which PV could replace traditional power sources.

“Unlike traditional fossil fuels it will not produce a constant quantity of energy,” explains Dr Mutale. “In fact, about the only thing we can count on is that solar generation will be variable!”

Knowing the potential power output will enable the WISE PV researchers to plan how to integrate solar power into the grid. Will it need more substations, cables or general investment in infrastructure? To find the answers, the researchers are developing spatial and temporal models to predict how PV will stress the grid.

**Project:** Whole System Impacts and Socio-economics of wide scale PV integration (WISE PV)

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