

Solar Volte-Face

Solar photovoltaic (PV) systems can prove to be either very good or bad for the electric grid. To understand how PV systems can be very good, it is important to understand how they might jeopardize the grid – turning the PV deployment around from a complicating grid liability to supportive asset. The functional face that PV presents to the grid, depends on those responsible for its planning and operation. Thinking that a PV grid integration plan might not matter much, for low to moderate levels of grid penetration, is fraught with risk.

PV systems can pose a voltage (V) stability risk, even by a handful of solar rooftops connected to the low-voltage (LV) network of an AC grid. The weaker the network connections, characterised by short-circuit ratio and short-circuit angle parameters, the greater the risk. V fluctuations from the LV connection of a solar rooftop can move upward and propagate across the medium-voltage (MV) distribution grid network. A small reverse power flow, and or transients (dV/dt), can be magnified by the high reactive impedance of a weak grid (high X/R ratio) to wider grid instability. The V stability issues are

exacerbated for electric power networks spread over longer geographic distances.

PV inverters drive a small V rise to push active power into the grid. Short-term weather fluctuations can lead to dV/dt fluctuations at multiple points, V surges, sags, and oscillations. These fluctuations can happen too rapidly for a weak network with a high short-circuit angle and inadequate protective devices for it.

Fortunately, PV systems have the capability to take care of such problems – provided the system inverters are correctly programmed for the purpose. Not only can PV take care of itself, but also quench V instabilities from other power generation sources and loads connected to the grid. V control, unlike grid frequency a global grid control parameter, is fundamentally a local physical phenomenon. The greater the number of PV systems, spatially distributed across the grid, the wider the capability of local V control for a more resilient and stable network. PV does a volte-face from a grid liability to a highly valuable V support asset. In our guide, “Managing Solar Energy”, we explain the PV methods for fast, dynamic grid voltage support.