

Solar grid-connected inverter power outage at night





Overview

Areas with sparse transmission lines are common in regions with high solar energy potential and need voltage support. This may require installing expensive voltage compensators, such as static synchronous compensators (STATCOMs). This expense can increase the cost and decrease the acceptance of large-scale adoption of solar power. Unlike current photovoltaic (PV) inverter controllers, which provide voltage support only during the day, commercially available augmented voltage controllers can provide voltage support at night. We examine whether PV inverters improve nighttime voltage on the grid and how much such an operation would cost compared to a STATCOM. We ran grid contingency analyses on a model for West Texas within the Electric Reliability Council of Texas (ERCOT) jurisdiction under spring and summer conditions.

- Using PV at night for voltage support saves millions of dollars in grid costs.
- We present the first economic analysis of nighttime voltage support from solar.
- Solar owners accept a 1-year lifetime reduction to provide daytime voltage support.
- Voltage support at night reduces solar inverter lifetimes by one additional year.

Photovoltaic solar generation economics
Reactive power cost
Inverter STATCOM
Voltage support at night
ERCOT policies.

Loosely connected transmission systems are susceptible to voltage excursions due to the system's inability to meet their reactive power demand (Obadina and Berg, 1990). Voltage support is provided by reactive power, the result of a difference in phase between current and voltage, stated in units of volt-ampere reactive (VAR). Reactive power is needed for generators, motors, and transformers, and to compensate for reactive power losses on transmission lines. Typically, expensive voltage compensators are installed to maintain grid stability and system voltage at proper levels, especially in areas such as West Texas where transmission is sparse and voltage support is needed 24 h a day (ERCOT, 2019). Many regions with excellent utility-scale solar resources have similar issues. Inverter-based resources.

To assess the feasibility and cost of using PV inverters for voltage support at night, we ran a power systems voltage analysis of an ERCOT model, simulated



a grid-connected PV generator (in MATLAB/Simulink) to compute the lifetime of an inverter, and did a cost comparison between inverters that do and do not provide voltage support at night. We ran.

Can a grid-connected PV inverter control overvoltage and undervoltage?

Generally, a grid-connected PV inverter can be programmed to inject and absorb the reactive power. Hence, both the overvoltage and undervoltage conditions can be regulated using the reactive power control ability. The dq components theory, which will be described in Section 2, can be used to perform the controlling mechanism efficiently .

How do grid-tied inverters work during a power outage?

During a power outage, grid-tied inverters can continue to operate using power from the solar panels. This is made possible through innovative inverter technology that allows the system to function independently of the grid. By leveraging this advancement, you can liberate yourself from the constraints of grid dynamics during outages.

Why do PV inverters stay idle at night?

For photovoltaic (PV) inverters, solar energy must be there to generate active power. Otherwise, the inverter will remain idle during the night. The idle behaviour reduces the efficiency of the PV inverter. However, if there is a mechanism to use such inverters in a different way at night, its efficiency can be increased.

Can a solar inverter keep your power on in a blackout?

To keep your power on in a blackout, you need a solar inverter that can remove your home from the grid, along with a generator or battery for longer-term energy needs. By creating your own little “island” of a home with solar panels and batteries, you can run essential appliances for days during a power outage.



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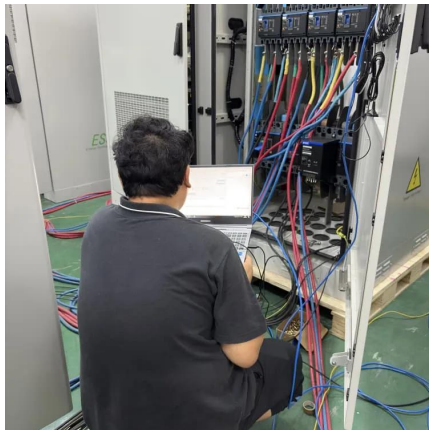
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