Abstract

Evaluating the Potential for Residential Solar PV and Battery Systems during Extended Grid Outages in Austin, Texas

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Changing weather patterns and electrical grid security have become a major concern in the Electric Reliability Council of Texas (ERCOT) area. The trigger for these concerns was winter storm "Uri" that devastated Texas in February 2021 and left thousands of ERCOT customers without power or heat, causing billions of dollars in damage, and costing hundreds of lives.

This thesis evaluates the potential for residential solar photovoltaic systems coupled with battery storage in Austin, Texas by simulating outage scenarios with various solar PV and battery storage system sizes in the National Renewable Energy Laboratory's (NREL) System Advisor Model (SAM). Austin weather data and residential household load data are used to simulate five winter and five summer outage scenarios with 5 different system setups, ranging from 5kW to 15 kW solar PV and 13.5kWh and 26kWh Battery Storage. The outputs are analyzed in terms of the installed systems meeting critical load during multi-day outages and compared for each system during the winter and the summer seasons. Furthermore, the total electricity consumed and saved

by the household by including a solar PV and battery storage system is compared to upfront costs and payback periods based on first-year utility bill savings using Austin Energy Utility prices. Out of the five solar PV and Battery systems, the combination of 10kW+26kWh battery and 15kW+26kWh battery system performs the best, serving most of the critical load used for heating in the winter and all of the critical cooling load during the summer during a continuous outage of approximately 100 hours and are therefore the most advantageous during an extended grid outage. Upfront prices are approximately $30,000 for the smallest and up to approximately $85,000 for the largest evaluated system, which makes payback periods for all systems exceed the 25-year expected lifespan of each system. Although these systems are not yet financially practical for the average customer, they increase electricity security and independence for the owner and create more renewable energy in Austin, which benefits emission reductions and climate change goals and increases in residential battery storage installations show that customers value security and are willing to pay for it.

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