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Opportunity

To accelerate the adoption of the battery energy storage controller through co-development or licensing, contact:

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Battery energy storage controller

Improved control for household photovoltaic battery systems

The technology

- A controller for battery energy storage systems uses smart charging and discharging to manage the export of surplus energy from solar photovoltaic (PV) systems to the electricity network.

Market need

- Exporting surplus energy from multiple households may cause power spikes, surges and congestion, necessitating expensive and time-consuming network upgrades. Current methods to control battery energy storage systems are ineffective.

Technology status

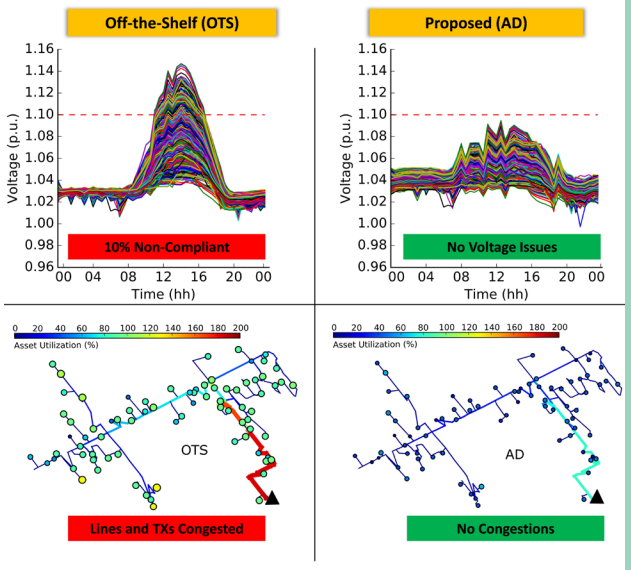
- Proof of concept through simulation-based studies using real distribution network and smart meter data demonstrates the controller's ability to reduce exports of surplus PV energy.

Market need

Household battery systems for storing energy operate for the sole benefit of the customer: they are programmed to reduce the amount of electricity imported from the network. However, this approach can be inefficient from a network perspective. If battery systems are not discharged fully overnight, they will reach their full state of charge before the peak PV generation period on the following day – causing surplus energy to be exported to the network during times of high PV generation.

The export of surplus PV energy from multiple households may cause power spikes, surges and congestion, triggering the need for expensive and time-consuming upgrades to increase network capacity.

As the number of solar PV installations continues to grow, significant investment may be required to upgrade the network. The 2017 Open Energy Networks Consultation Paper estimates that over $1.4 billion will be needed to augment electricity networks in Australia if no other solution is found.



Comparison of voltage performance and network congestion between commercially available (OTS) and proposed battery energy storage controller (AD). Picture: Andreas Procopiou

Solution

Battery systems are controllable via software, providing an opportunity to implement smart control strategies that aim to reduce household power exports and the burden on the network.

University of Melbourne researchers, led by Prof. Luis (Nando) Ochoa, have developed an improved controller for battery energy storage systems connected to household PV systems.

Optimized using data from 350 smart meters, the controller manages the rate of power charge and discharge throughout the day based on local measurements such as clear-sky irradiance, PV energy generation, electricity demand, and state of charge.

The controller can be coded directly in the management unit of the battery system or in an external control device.

Technology and IP status

Proof of concept has been successfully demonstrated through simulation-based studies on a real distribution network with more than 4500 residential customers. The findings show that use of the battery controller mitigates power spikes, surges and congestion while maintaining similar levels of energy self-sufficiency for customers.

A provisional patent application, which was filed on 21 November 2018, describes the method for controlling the battery energy storage system.

Tech name and number:	**2018-031 Energy storage controller**
Researchers:	Professor Luis (Nando) Ochoa, Dr Andreas T. Procopiou, Mr Kyriacos Petrou
Publications:	Procopiou AT, Petrou K, Ochoa LF, Langstaff T, Theunissen J. 2018. Adaptive decentralized control of residential storage in PV-rich MV-LV networks. *IEEE Transactions on Power Systems,* doi: 10.1109/TPWRS.2018.2889843
Patents:	AU2018904434 filed on 21 November 2018
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