

### Project outline

Distribution System State Estimation (DSSE) is an algorithm which combines knowledge of the physical network with time-series measurement data and average loading patterns to form an estimate of the electrical state of the network at a point in time. With increasing levels of Distributed Energy Resources (DER) in the form of rooftop photovoltaics (PV) connected to the grid at low voltage (LV), it is important that distribution networks develop methods to more comprehensively understand how the LV network is performing. A better understanding of the impacts of DER on the network will allow for improved design and planning process and more targeted and innovative solutions to problems. A real-time view of the performance of the LV network may one day support a future where DER is managed dynamically dependent on network conditions or even as part of a DER energy market with individual customers or aggregators buying and selling energy across thousands of connected DER systems, all orchestrated within the physical limits of the network.

It has historically been challenging to implement DSSE on LV networks due to their 4-wire, unbalanced nature and lack of monitoring. The LV State Estimation project sought to test the application of a novel DSSE engine to determine if it could overcome these challenges and achieve visibility of LV networks.

The project scope covered the implementation of DSSE on a single LV network in Energex. The estimator was executed in near real-time within the Operational Technology Environment.

Project partners and funding organisations: Australian Research Council, The University of Queensland.

### Project outcomes / findings

Key project findings are:

- DSSE was successfully implemented on the trial LV network handling deficiencies in network model accuracy and the limited data inputs available at LV.
- The algorithm solved sufficiently quickly on the trial LV network (<1 second) demonstrating the viability of near real-time state estimation on distribution networks.
- The accuracy of estimates varied depending on the density and source of measurement data. Voltages estimated at customer premises ranged from  $\pm 0.5V$  to up to  $\pm 5V$  depending on the extent of network and customer monitors available to the estimator.

### Next steps

Energex and Ergon Energy Network are pursuing a broader implementation of the DSSE as developed in the Solar Enablement Initiative (refer to separate case study). This work is being undertaken through the Expanded Network Visibility Initiative and seeks to improve visibility of the network at both medium and low voltages. Rights to commercialise the state estimator developed through the Solar Enablement Initiative have been granted to GridQube.

### More information

- For more information on the LV State Estimation project contact Terese Milford, [terese.milford@energyq.com.au](mailto:terese.milford@energyq.com.au)
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