

An Indian-Australian research partnership



Industry sponsored project by CSIRO

Project title: Stochastic Network Design – Mathematical Programming Models for Electricity Grids with Storage

Project number: IMURA0175

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Research Academy theme/s

List only the research academy theme/s that is relevant to the project

1. Advanced computational engineering, simulation and manufacture
3. Clean energy

The research problem

The increased penetration of renewable forms of energy generation which involve large degrees of variability is placing increasing strains on the electricity grid, particularly in places such as Australia where the network is generally quite sparse. The network needs to deal with both fluctuations in supply and demand and extreme peaks in both that generally occur quite infrequently. For example in Australia peaks in demand tend to be driven by air-conditioning load on very hot days. This can be dealt with by building more network infrastructure (more/larger transmission links) or by using short term energy storage facilities to smooth out the stochastic variability. This project will look at developing Mathematical Programming models and algorithms for determining the optimal network design for dealing with the expected variability using a combination of energy storage and new links. The objective is to develop models and algorithms that can deal with the combinatorial complexity of such large network design problems without necessarily accurately capturing all of the power engineering considerations that have to be taken into account in an electricity grid.

Expected outcomes

This project will deliver new models and algorithms that give an indication of the feasibility of solving network design optimisation problems of this kind. In addition it is expected that the results will give a high level indication as to the trade-off between using energy storage and transmission network infrastructure.

Specific Milestones and Deliverables

1. Literature review
2. Development of abstract Network Design model
3. Research into electricity grid and generator characteristics to determine appropriate parameters and data for use in the model.
4. Exact solution algorithm design & implementation
5. Heuristic solution algorithm design & implementation
6. Investigation of model extensions and adaptation of algorithms to these.

Project Inputs

While working at CSIRO the student may be provided with access to confidential data sets in order to determine appropriate parameters for some of the models to be developed as part of the project. While the data sets have to remain confidential, the parameters derived from the analysis of these data sets can be published and used by the student elsewhere.