

MISG 2008

TRANSPOWER



Project Title

A methodology for determining the optimal response characteristics for “Grid Friendly” devices in small power systems

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[Back to top](#)



Company Background

Transpower is New Zealand’s national grid company. A State-owned enterprise, Transpower New Zealand Ltd is owner and system operator of New Zealand’s high-voltage electricity transmission grid - linking generators to distribution companies and major industrial users.



As System Operator, Transpower is responsible for the central role of real-time operation of the New Zealand power system. The core services of the System Operator are power system security management, energy scheduling and dispatch and ancillary services management.

This project relates to Transpower’s system operator function.

See www.transpower.co.nz for more information.

Problem Summary

A methodology for determining the optimal response characteristics for “Grid Friendly” devices in small power systems

International consensus identifies an urgent need for major improvements in the electric power grids of most western nations. Beyond merely providing transport of electricity a fully modern grid needs meet increasingly higher standards for reliability, security, cost of service, power quality, efficiency, environmental impact and safety.

A significant contributor to these necessary enhancements will be “Grid Friendly” devices. Electrical devices are Grid Friendly if they operate in a manner that supports power grid reliability or security.

Grid Friendly devices will incorporate passive or active control features that allow the devices to respond to power system conditions. Simple devices will respond autonomously to changes in power system conditions such as frequency. More sophisticated devices may alter their operating profile based on the current market price for electricity, reducing load when prices are at a peak. Grid Friendly devices can include domestic appliances such as fridges, freezers, water heaters, air conditioners and heat pumps. The commercial and light industrial sector also provides many opportunities for Grid Friendly devices such as commercial building systems [HVAC](#), cool stores, lighting and heating systems and processes.

The advantage of Grid Friendly frequency response is that frequency is ubiquitous on an electric system. When a generator shuts down in one part of the system, all the loads everywhere in the system can simultaneously detect the change and respond instantly and appropriately without the need for a control system to detect the problem, a control center to make a decision, or communications network to deliver commands to millions of devices.

Research has considered the response characteristics for Grid Friendly devices. On the whole this has focussed on large power systems such as continental USA and European systems where the aggregate behaviour of Grid Friendly devices can be considered as only beneficial. For small power systems such as New Zealand’s and potentially even larger systems such as Australia’s interconnected power system there are other considerations.

The New Zealand power system is relatively small. An installed capacity is of 8500MW with a peak demand of 6900MW and a minimum demand of 2400MW. It is a credible scenario that sufficient Grid Friendly devices could be installed on the New Zealand power system such that the aggregated response of these devices will significantly alter the dynamic response of the system. Transpower NZ Ltd proposes that the MISG consider as an initial approach to the issues raised by the employment of Grid Friendly devices the following question:

What methodology should be used to determine an optimal characteristic for Grid Friendly devices connected to a relatively small power system? Such methodology should consider both passive and adaptive response characteristics.

Transpower proposes to provide details of the dynamic response required of the system and data for the dynamic response of the system when disturbed under various system loading conditions as a starting point for this study.

References

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