GREEN Grid

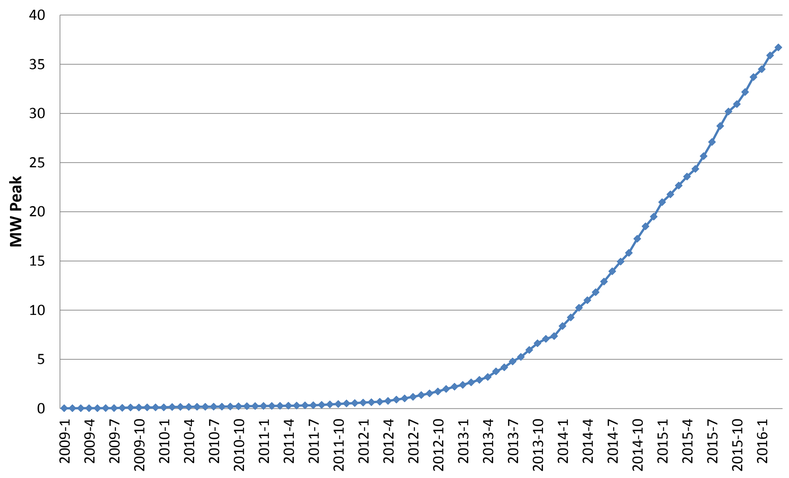
Future Proofing New Zealand's Electricity Supply

EEA consultation draft:
Guideline for the connection of small-scale inverter based distributed generation

Richard Strahan, Sharee McNab, Tim Crownshaw, Shreejan Pandey, Neville Watson, Scott Lemon, Alan Wood, and Allan Miller

Introduction

Small-scale distributed generation (DG) in New Zealand, particularly photovoltaic (PV) generation, has been growing steadily over the past few years. In the last year alone to 31 March 2016, installed PV generation of all capacities grew by a factor of about 1.6 to reach 37 MW. Approximately 90% (33 MW) of this installed PV capacity is made up of small-scale, single phase residential grid-tied systems with ratings below 10 kW. This corresponds, on average, to approximately 300-400 new PV systems being installed each month within low voltage (LV) distribution networks.



New Zealand PV uptake showing cumulative capacity

Issues to address

Traditionally, the flow of power in electricity distribution networks has been largely unidirectional. However, DG introduces reverse power flows into the LV network when the power produced by DG systems is greater than what can be consumed locally. The introduction of reverse power flows can negatively impact the electricity network, causing issues such as over-voltage, and overloading of conductors & transformers. As such, each DG connection application received by electricity distribution businesses (EDBs) presently needs to be carefully considered for its impact on the electricity network. The resourcing demand imposed by larger numbers of connection applications, and the difficulty of technical assessment, are likely to increase substantially as DG uptake intensifies.

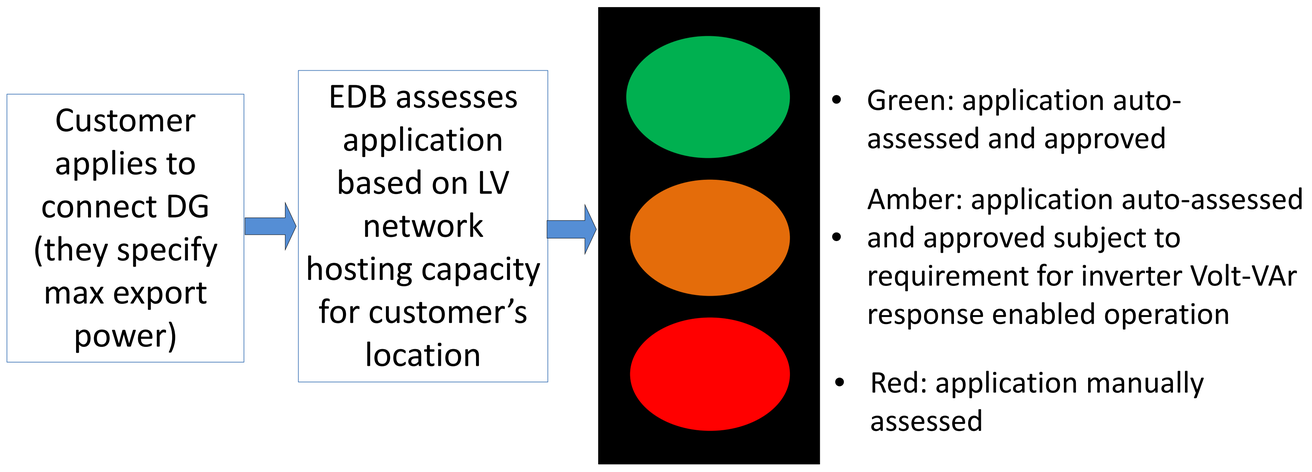
The Guideline project

These issues prompted the EPECentre via its GREEN Grid programme, with the assistance of the electricity industry based Network Analysis Group (NAG), to develop a small-scale inverter based DG connection guideline for New Zealand EDBs. This has been developed on behalf of the Electricity Engineers' Association specifically for the connection of inverter energy systems (IES) of 10 kW or less.

Guideline Contents

- ***Traffic light system* for streamlining DG connection applications**

  DG connection applications are categorized into a three tier *traffic light system*, which reflects the likely impact of the distributed generator exporting into the LV network. The tier which an application falls into is determined by looking at the DG *hosting capacity*. To determine hosting capacity (where full LV network information is not available) the EPECentre has developed an approximation method, which uses simplified inputs, called *DGHost.*

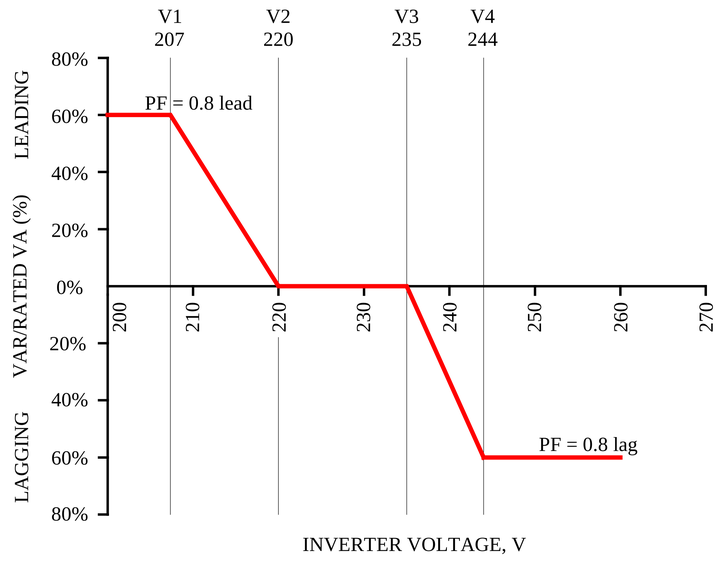


- **A simple method for evaluating LV network congestion**

  Enables the degree of export congestion for every network to be determined, allowing potentially congested networks to be flagged for closer inspection.

- **Technical requirements**

  Covers key requirements for installation and inverter, including safety & protection, and recommended inverter settings for NZ.



Curve for the NZ inverter Volt-VAr response mode designed by EPECentre/Network Analysis Group

- **Pro forma DG application form**

  For EDBs to adopt and adapt as they wish.

Acknowledgements

The in-kind support from organizations represented in the GREEN Grid Network Analysis Group has provided valuable input and reviews of the DG Connection Guideline. NAG members who have contributed to the development of the Guide include Glenn Coates (Orion), Wei Hao Zhou (WEL Networks), Murray Hendrickson (Network Tasman), Roger Miller & David Hume (Electricity Authority), Gari Bickers & Tim Crownshaw (Transpower), Tas Scott (Mitton Electronet), Russell Watson (Northpower), Marc Gulliksen (Unison), Wayne Stronach (Marlborough Lines), John Welch (Vector), Stuart Wilson (Mainpower), Abhishek Singh & Bernie Coster (Powerco), and Nirmal Nair (University of Auckland). Valuable input into the Guideline has also been provided by Steve Dawson (Enphase Energy), and Dennis Chapman & Sam Kivi (Enasolar).

Primary Funder

Ministry of Business, Innovation & Employment

Co-funders

TRANSPOWER

eea Electricity Engineers' Association

Research lead

EPECentre Electric Power Engineering Centre

UC University of Canterbury

Research partners

University of Otago

Centre for Sustainability Kā Rakahau o Te Ao Tūroa

The University of Auckland Faculty of Engineering Department of Electrical and Computer Engineering

In-kind supporters

WEL Networks

meridian

Vector

Orion

Fisher & Paykel appliances

Electricity Authority

POWERCO

Mitton ElectroNet

unison

www.epecentre.ac.nz