



The Business of
Marine Energy

Oceania Room | Te Papa Tongarewa | Wellington

Integrating new forms of generation

Graeme Ancell

Planning and Development
Manager, Transpower

TRANSPOWER



Transpower: Owner and operator of national grid

- Owner
 - Asset management
 - Connect new generation and load
 - Reinforce core grid
- Operator
 - Schedule and dispatch generation to meet demand
 - Schedule planned outages
 - Restore security after unplanned outages

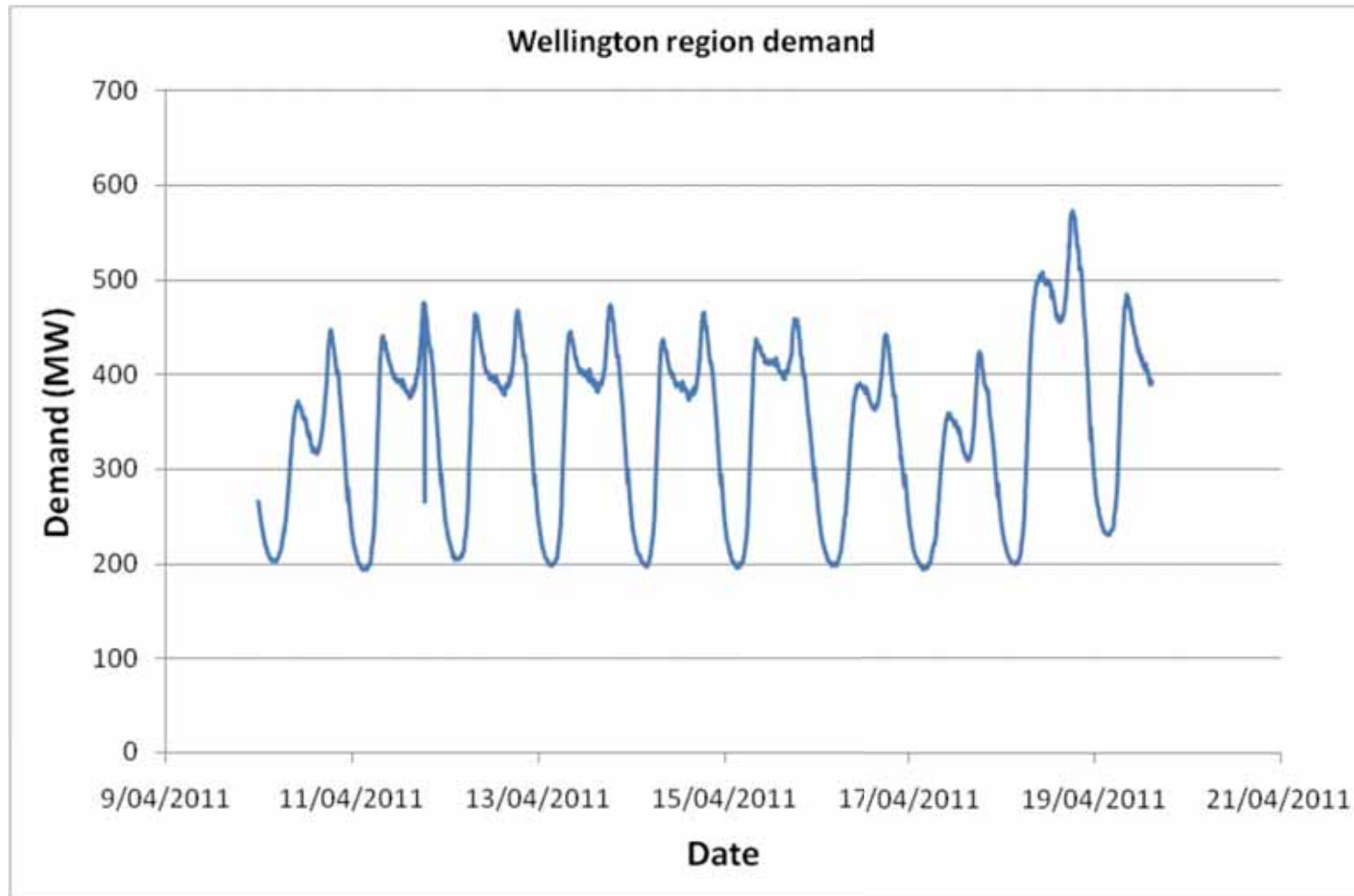


Transmission implications for new forms of generation

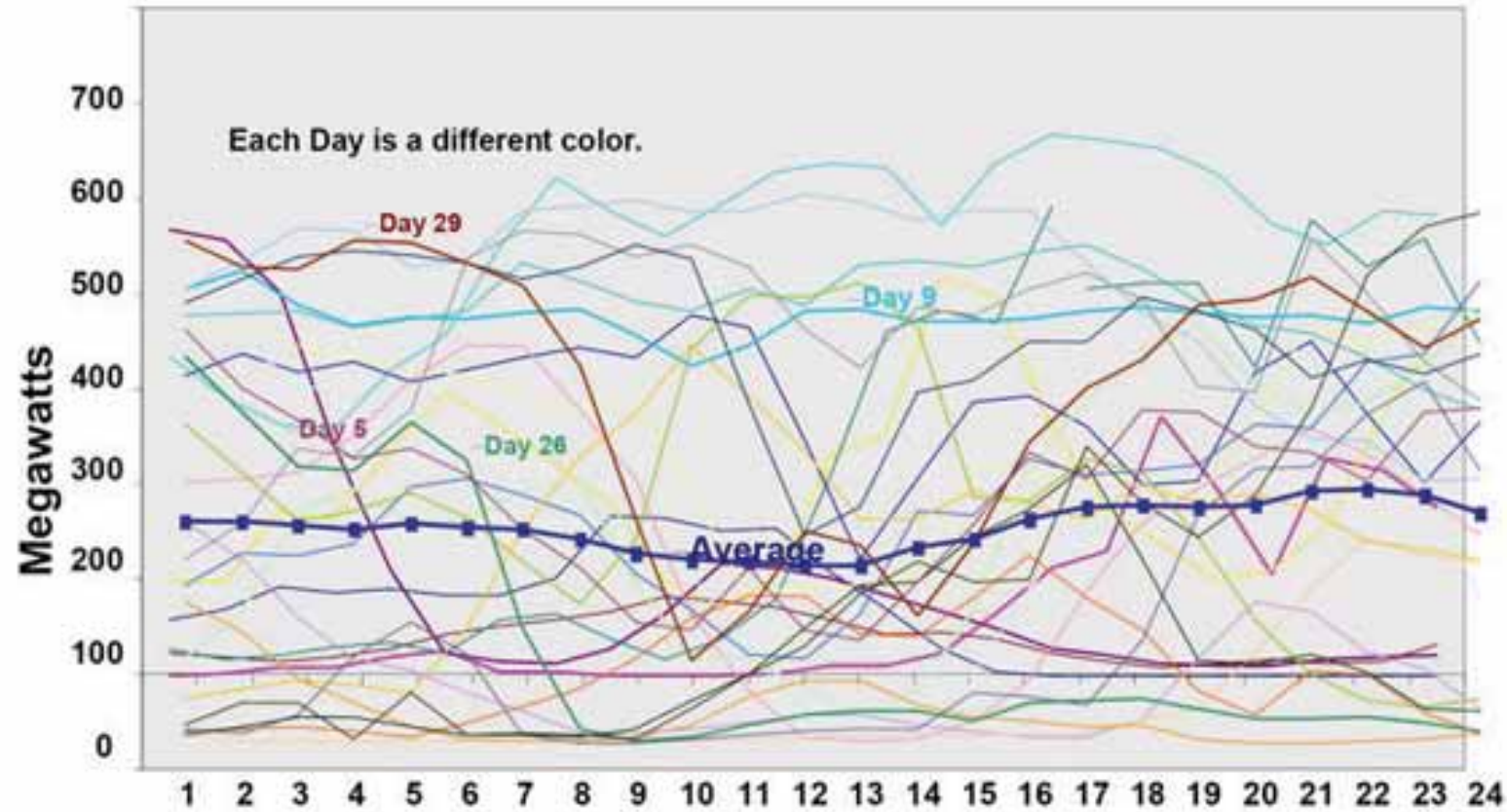
- Intermittent output
 - Variability (how fast does output change)
 - Predictability (can future output be forecast)
- Technical performance
 - System support
 - Voltage
 - Frequency
 - System Stability
 - Ride through disturbances



Load variability



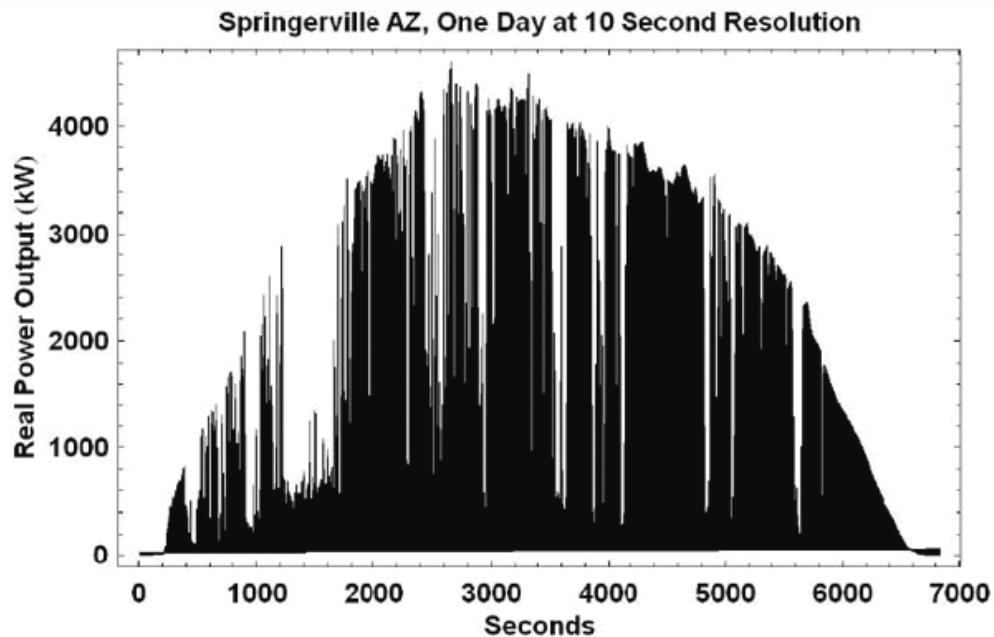
Wind generation variability



<http://www.megawattsf.com/gridstorage/gridstorage.htm>



Solar generation Variability



<http://www.solarserver.com/solar-magazine/solar-news/current/kw35/acc-approves-97mw-of-pv-and-cpv-ppas-for-tuscon-electric-power.html>

<http://www.megawattsf.com/gridstorage/gridstorage.htm>

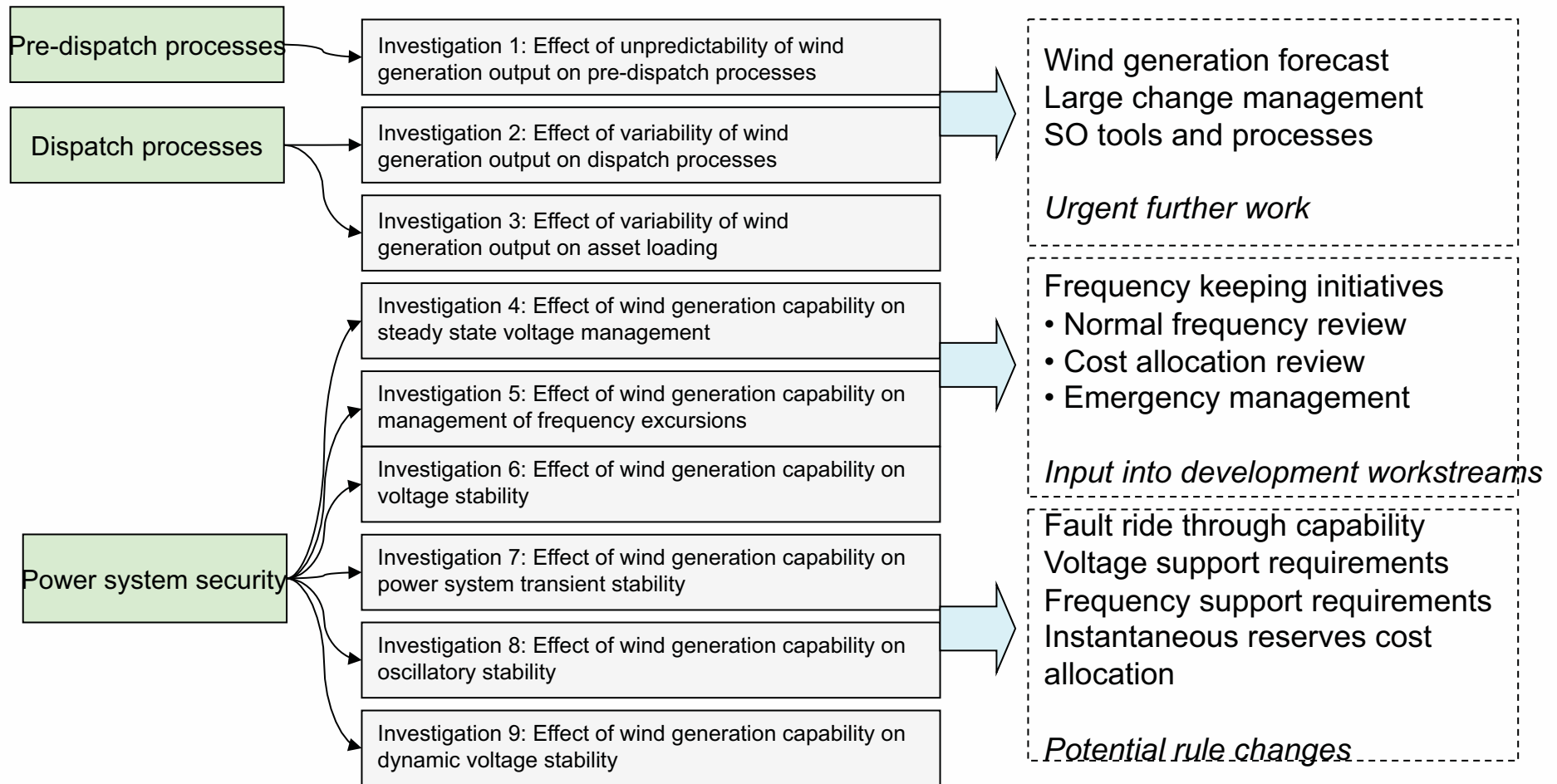


The Wind Generation Investigation Project 2005-2008

- System Operator concerns over large amounts of proposed wind generation
- Electricity Commission starts an investigation
- Project Team
 - Wind energy consultancy
 - Transpower
 - Regulation consultancy
- Objectives
 - Identify and quantify the technical and electricity market impacts of wind generation
 - Recommend amendments to standards/operating codes; and
 - Recommend an implementation plan for proposed changes.



Work arising from Investigations' outcomes



International studies

Many wind and solar integration studies have been carried out in US, Europe, UK in last decade

Some conclusions

- Upgrades or additions to transmission facilities needed
- Well-functioning hour-ahead and day-ahead markets best manage variability
- Energy imbalance charges should be based on actual costs
- Wind turbine output limits or ramp rates needed.



Integration of marine energy into the NZ power system

- What scale of marine energy is envisaged?
 - 5kW to 10 MW+
- What type of connection?
 - Distribution network
 - Grid
- What type of connection interface to the network



Integration questions

- What is output variability of marine energy?
- How does the technology perform during power system disturbances?
 - Faults
 - Frequency disturbances
 - Voltage disturbances



The future?

- “Primary hurdle facing renewable developers stems from limitations to the existing transmission grid”
<http://www.renewableenergyworld.com/rea/news/article/2011/04/no-grid-no-gain-untangling-the-transmission-tie-up>
- “I think baseload capacity is going to become an anachronism. Baseload capacity really used to only mean in an economic dispatch, which you dispatch first, what would be the cheapest thing to do.” Jon Wellinghoff Chairman FERC 2009





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