NEW ZEALAND WIND ENERGY ASSOCIATION

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Transpower New Zealand Ltd.
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Sent by email only to: gdsproject@transpower.co.nz

Attention: Magnus Hindsberger

GDS – WP1 submission

Dear Magnus

Thank you for your invitation to attend your recent industry workshop considering transmission scenarios through to 2050 as part of your Grid Development Strategy. The New Zealand Wind Energy Association ('NZWEA') welcomes opportunities to take part in this type of strategic activity, which could potentially influence the future uptake of wind energy in New Zealand.

The recently released 'Request for Information – Long-term electricity industry scenarios' seeks feedback on drivers and trends that might be expected to influence the NZ power system. Some comments from NZWEA follow below. We do not have any detailed analysis of our own to refer to and accordingly our thoughts on future scenarios are relatively general in nature.

Carbon price	The ETS is now set to become law, and the Opposition have indicated that they will modify but not repeal the legislation if they are elected. Electricity generation is expected to enter the scheme from 1st January 2010 regardless of who is in Government. With the Australians also developing a scheme, an ETS already operating in the EU and both political parties in the USA proposing an ETS we anticipate that a global market for carbon will emerge over time. The time taken for this global market (and price) to emerge will be influenced by global negotiations for a post-2012 agreement (and to a lesser extent by ongoing research into the likely impact of climate change, i.e. what level of emissions reduction is required). NZ's specific legislation will have some impact on the price of carbon faced by NZ's emitters (i.e. all existing and new fossil fuel generators and, to a lesser extent, geothermal). The price of carbon is expected to be passed on to consumers through higher prices for electricity generated from these sources. While NZ carbon prices can be expected to trend towards international prices (especially post-2012) there appears to be a high level of uncertainty as to what those prices might eventually be.

Carbon price (cont.)	The carbon price is likely to impact first on older, less efficient plant. It is conceivable for instance that Genesis Energy might choose to remove Huntly from operation sooner than might have been expected if carbon pricing reduces its viability. There could be short term ramifications (i.e. 1-2 years) from this if replacement dry year reserve energy is not operational at that time.
Gas supply	Current forecasts appear to show a constrained gas supply in the mid-2010's, with prices expected to rise accordingly (see Figure 1 below). This may then have a greater impact on the future use of this resource than the current debate around the moratorium on new baseload gas generation (and the security of supply provisions of that legislation could mean that it would not ultimately prevent new development in any case). Current supply constraints, together with the high value of the liquids extracted with the gas, are leading to the increased use of 'take-or-pay' supply contracts and a less-flexible gas supply. Future gas finds can reasonably be expected to be either smaller than existing fields or in more difficult locations. High global demand for infrastructure such as drilling rigs will also influence exploration and development costs. We expect gas costs to rise accordingly, possibly to global commodity levels. The explorers of the Deep South Basin have already indicated that they will only develop the field if there is a lot of gas, and if there is a lot of gas that they will look to process it for export as LNG. The NZ price for this gas would then be set at the global price level. Gas will become increasingly valuable as a source of peaking or reserve due to its flexibility and ability to be stored. It would seem more reasonable that local gas is more readily utilised for this role than imported diesel (especially when carbon costs are factored in). The amount of peaking plant required will be influenced by the ability of energy sources such as wind and geothermal to substitute for hydro (allowing greater flexibility for it to be used as a source of capacity) and the level of variability in electricity demand (and eventually wind generation).
Exchange rate	The majority of new generation technology (i.e. wind, steam and gas turbines and transformers) is imported from overseas. The costs for this technology will increase if the NZ dollar reduces in value against foreign currencies and this would then be reflected in electricity prices. All technologies would be affected in a similar manner so this would seem to be unlikely to lead to a preference for one form of generation over another. If there is a large gas or oil find that is developed for export (see above) the resulting improvement to our balance of payments could see our exchange rate improve, reducing the cost of imported technology (i.e. gain global market prices for hydrocarbons while utilising lower cost indigenous fuel here in NZ).

Commodity prices	The cost of all new generation technology is affected by the cost of materials such as steel, copper, etc. Even if new electricity demand growth slows the need to retire or replace existing generation (either through age, lack of fuel supply or operating costs – including carbon) may keep these material costs relatively high. The impact may be similar to that of exchange rate (i.e. increase electricity prices while not preferring one technology over another).
Technology development	The need for efficiency gains should see ongoing improvement in the performance of all existing technologies, though we are not aware of any big 'step change' improvements being on the horizon. **Wind energy:** • For wind energy our expectation is that the current R&D focus on the reduction of operating costs (through both performance optimisation and improved uptime) will reduce its LRMC (see figures 2 & 3 below). • Performance gains for turbines for low-wind speed conditions will also likely increase the range of sites that might be viable here in NZ beyond the existing focus on the highest wind speed sites. • The rapid growth in wind turbine production in China might eventually see lower cost turbines enter the market but due to the size of the Chinese market this may take several years and will also be influenced by commodity prices. • The ongoing development of turbine power electronics should see an increase in the role that wind energy plays in the ancillary services market (i.e. reactive power, frequency keeping, etc,). • International studies and experience continue to show that large amounts of wind energy can be accommodated on electricity systems without significant cost impacts. Largely islanded networks such as Ireland, Spain and Portugal (where the level of interconnection is well below typical demand levels) are already achieving average wind penetrations of around 10%, with Spain reporting shorter term penetrations of around 25%. All of these countries are also continuing to expand their installed wind generation capacity and so these penetration levels can be expected to continue in the future. Here in New Zealand modelling and research conducted for Meridian Energy by Imperial College London suggest that a penetration level of around 10-15% can be achieved at relatively low cost. Accordingly we do not expect that wind penetration will be a constraining factor on the NZ electricity system within the timeframe of your scenario modelling. The existing development focus on marine technologies should conceivably see these enter use in NZ during the scenario period, though others are better placed to discuss the timing than we are.

Technology development (cont.)	The use of any clean coal technology would seem likely to be most greatly constrained by the size and location of any potential geo-sequestration sites and their location relative to the fuel source and the electricity system (but again others are better placed to discuss this than we are). The technology has also yet to enter the commercial development phase and there may also be challenges around economies of scale and the risk and related liabilities associated with storing carbon underground (i.e. who pays if there is a leak or failure?). We consider that the overall infrastructure costs, the use of an imported fuel and waste disposal challenges will continue to make nuclear energy a non-viable energy source over the scenario period. We consider that further developments are likely in the area of storage technologies. In particular the potential for electric vehicles as a technology that can be used for distributed storage, load-shaping and ancillary services would seem to be high, particularly when weighed along the benefit of reducing the demand for imported petrol. It would seem likely with the roll-out of smart metering technology and successful demand-response trials that demand side activities will have a greater influence on demand and demand profiles.
Regulatory factors	The availability of a strong and robust transmission network is essential for the operation of the electricity market. The existing regulatory focus on demand-driven transmission investment may need to be relaxed to enable greater supply-driven investment. We expect that the electricity supply and price path scenarios will be quite different if your modelling is constrained to the use of existing assets and routes (which may push prices higher), compared to those where the network is broadened to enable the potential connection of a greater diversity of generation resources. New generation and transmission projects will continue to face consenting challenges, although it appears (for wind generation at least) as though consent will eventually be granted. Ongoing issues with supply constraints might eventually see either the public attitude to new investment or the regulatory barriers relaxed. The operation of the electricity market will likely require regular review and adaptation to accommodate an increasingly diverse generation mix (with a higher degree of variability) and more variable demand.

Recommended additions to your reference list:

The study 'The system impacts and costs of integrating wind power in New Zealand' conducted by Imperial College London with Meridian Energy.
A report and presentation (by Grant Telfar of Meridian) are available at
http://www.esc.auckland.ac.nz/Epoc/workshop2008.html

NZWEA would be happy to discuss this submission with you further if desired. We are also happy to discuss with you related matters such as the status of the New Zealand and global wind industry, technology and technology developments, etc.

Yours sincerely,

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Figure 1 - Contact Energy's forecast of natural gas prices
From Contact Energy's presentation of its Annual Financial Report for the year ended 30 June 2008, available at www.contact-energy.co.nz.

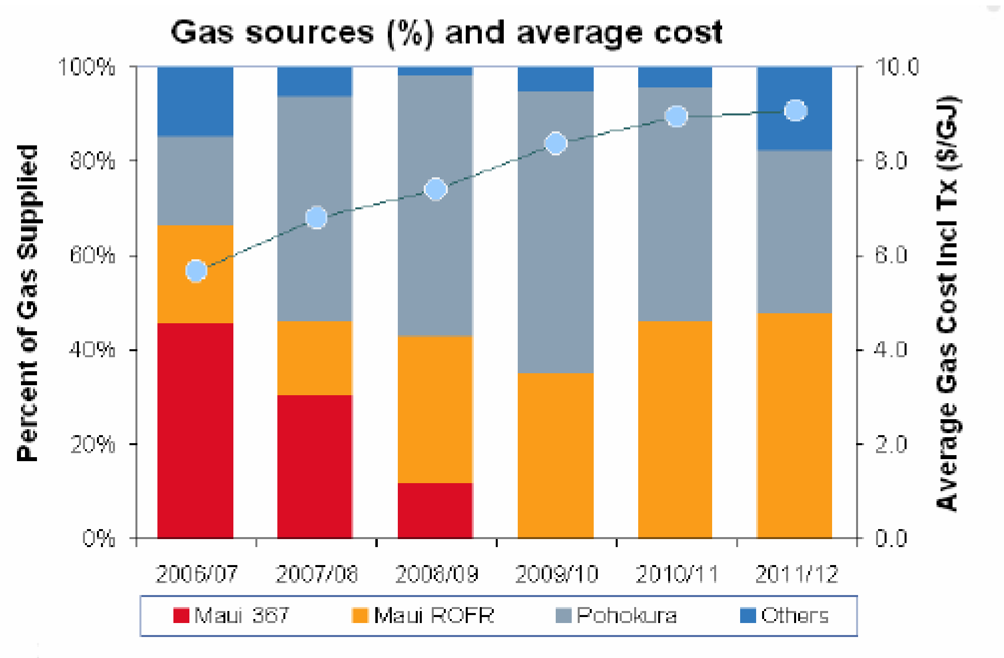


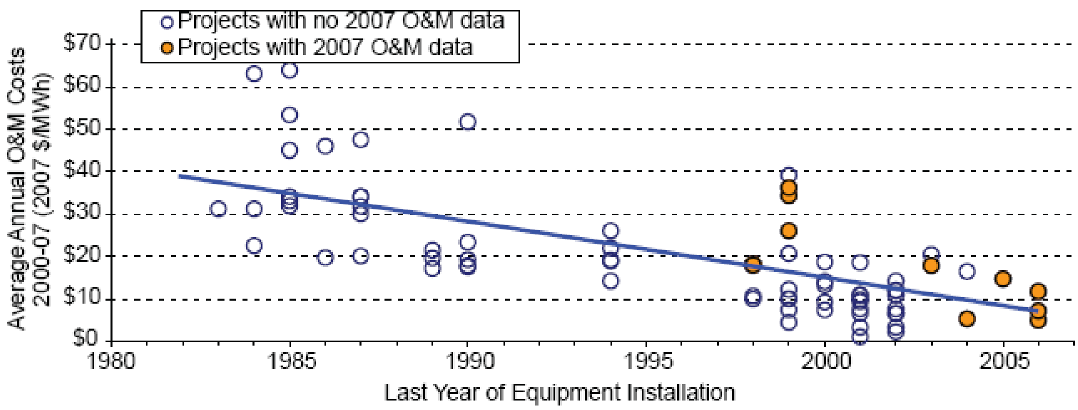
Figure 2 - Potential wind energy technology improvements
Taken from '20% Wind Energy by 2030 – Increasing Wind Energy's Contribution to U.S. Electricity Supply', US Department of Energy, May 2008.
(Available from http://www1.eere.energy.gov/windandhydro/).

Table 2-1. Areas of potential technology improvement

Technical Area	Potential Advances	Performance and Cost Increments (Best/Expected/Least Percentages)	
		Annual Energy Production	Turbine Capital Cost
Advanced Tower Concepts	* Taller towers in difficult locations * New materials and/or processes * Advanced structures/foundations * Self-erecting, initial, or for service	+11/+11/+11	+8/+12/+20
Advanced (Enlarged) Rotors	* Advanced materials * Improved structural-aero design * Active controls * Passive controls * Higher tip speed/lower acoustics	+35/+25/+10	-6/-3/+3
Reduced Energy Losses and Improved Availability	* Reduced blade soiling losses * Damage-tolerant sensors * Robust control systems * Prognostic maintenance	+7/+5/0	0/0/0
Drivetrain (Gearboxes and Generators and Power Electronics)	* Fewer gear stages or direct-drive * Medium/low speed generators * Distributed gearbox topologies * Permanent-magnet generators * Medium-voltage equipment * Advanced gear tooth profiles * New circuit topologies * New semiconductor devices * New materials (gallium arsenide [GaAs], SiC)	+8/+4/0	-11/-6/+1
Manufacturing and Learning Curve*	* Sustained, incremental design and process improvements * Large-scale manufacturing * Reduced design loads	0/0/0	-27/-13/-3
Totals		+61/+45/+21	-36/-10/+21

*The learning curve results from the NREL report (Cohen and Schweizer et al 2008) are adjusted from 3.0 doublings in the reference to the 4.6 doublings in the 20% Wind Scenario.

Figure 3 - Declining wind energy O&M costs
From 'Annual Report on U.S. Wind Power Installation, Cost and Performance Trends:2007', US Department of Energy, May 2008.
(Also available from http://www1.eere.energy.gov/windandhydro/)



Source: Berkeley Lab database; five data points suppressed to protect confidentiality.

Figure 28. Average O&M Costs for Available Data Years from 2000-2007, by Last Year of Equipment Installation

Figure 4 - Wind integration costs identified in studies conducted in the USA
Taken from the US DoE Annual Report referred to in Figure 2, above.

Table 8. Key Results from Major Wind Integration Studies Completed 2003-2007

Date	Study	Wind Capacity Penetration	Cost ($/MWh)				
			Regulation	Load Following	Unit Commitment	Gas Supply	TOTAL
2003	Xcel-UWIG	3.5%	0	0.41	1.44	na	1.85
2003	We Energies	29%	1.02	0.15	1.75	na	2.92
2004	Xcel-MNDOC	15%	0.23	na	4.37	na	4.60
2005	PacifiCorp	20%	0	1.60	3.00	na	4.60
2006	CA RPS (multi-year)*	4%	0.45	trace	trace	na	0.45
2006	Xcel-PSCo	15%	0.20	na	3.32	1.45	4.97
2006	MN-MISO**	31%	na	na	na	na	4.41
2007	Puget Sound Energy	10%	na	na	na	na	5.50
2007	Arizona Public Service	15%	0.37	2.65	1.06	na	4.08
2007	Avista Utilities***	30%	1.43	4.40	3.00	na	8.84
2007	Idaho Power	20%	na	na	na	na	7.92

** regulation costs represent 3-year average*
*** highest over 3-year evaluation period*
**** unit commitment includes cost of wind forecast error*

Source: Berkeley Lab based, in part, on data from NREL.