Submission: Draft Grid Planning Assumptions

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1. Introduction. This is a personal submission, from my sustainability perspective:

- preference for environmental sustainability, primarily the need to reduce greenhouse gas emissions; secondarily the impacts on biodiversity, recreation and aesthetic/ spiritual values of large-scale renewable electricity schemes;
- concern about the economic and social impacts of still-rising electricity prices;
- recognition of the importance of offering true consumer choice, to balance cost of energy services against convenience and security of supply
- recognition of the economic and social benefits of small-scale energy service businesses which compete with large-scale electricity supply.

The sustainability perspective is a primary requirement of the Electricity Commission's work, through the amended Electricity Act which sets out the Commission's principal objectives, which include ensuring electricity is generated and delivered to consumers in an environmentally sustainable manner, as well as being efficient, reliable, and fair to all classes of consumers.

2. Scenarios for grid planning:

I attended the workshop on grid planning assumptions on 29 February; many of the comments below arise from the discussion at that workshop.

The forecasting technique is, as in the past, entirely top-down. The methodology appears to be reasonably fair and unbiased, yet by ignoring significant changes in both demand and supply patterns, it risks capturing some of the trends that have already become apparent.

I mention just [two] trends here - changing recognition of the potential for extremely high carbon emissions prices, and trends in household space heating. Both of these have strong implications for peak demands in particular, and for generation that may be required to meet peaks.

The assumed carbon price range in the generation scenarios is quite out of step with recent experience; I believe the European price now is around $40 NZ per tonne CO2. Certainly cheaper "carbon credits" can be found on different carbon markets - as low as a few dollars per tonne - but the present New Zealand government's commitment to the Kyoto Protocol suggests we will be purchasing high quality credits at much higher prices than the scenarios' range of $20 to $50 NZ per tonne.

I note that the summary of a recent seminar held by Ministry of Social Development (Feb 29, hosted by Vic. University's Institute of Policy Studies), [1]on social impacts of the low-carbon society, "the current ETS (with a projected carbon price of $25 per tonne), may be a gross under-estimate of the eventual price for carbon."

[1] Soon to be posted on MSD website: "Thematic Summary sumposium 28 Feb08"

I therefore suggest that the "sustainable" scenario models a carbon price of $100 per tonne.

One effect of this might be that Huntly not close at all, but retain a couple of units as dry-year reserve, fuelled by biomass. Note that there are at least two technologies for pre-processing wood to grind them into the fine powdered required by the Huntly borders. These are "torrification", or pre-heating to a temperature that breaks down the fibrous structure of wood without volatilizing much of the energy content, and "cellulignin", or pre-treating chips with dilute acid, to the same end. At $100 or more per tonne, these seem likely to become economic.

Alternatively and almost certainly at lower cost, home wood burning for space and water heating could be increased in dry years, with electricity tariffs that encourage use of electricity in wet hydro years. This is further described in my presentation to a Victoria University seminar on low-carbon electricity, on Feb. 21 this year, attached.

At the workshop I remarked on the extensive use of open-cycle turbines on diesel as demand became more peaky, and asked whether assumptions included credible peak oil scenarios. This was answered in the negative. This appears to be confirmed by the costs given in slide 10 of the workshop's presentation on generation scenarios: the LRMC is given as $648/MWh, or about 65c/kWh, at 5% load factor. This appears to assume a SRMC similar to today's approximately 25c/kWh at Whirinaki, which is a diesel-powered peaker.

A peak oil scenario would drive far greater demand-side participation than appears to be presented in the "demand side" scenario. I suggest that early and high peak oil prices be written into this scenario.

3. Specific bottom-up considerations are crucial: household space heating

I raised at the workshop for the Interim SOO the issue of peak and energy increases if heat pumps take hold as a major space heating option. This has been confirmed by the survey carried out by BRANZ, when as I understand it was found that moves from wood burning to heat pumps increased energy demands by around 6%, and peak demands by around 65%. Air conditioning demand was not part of this survey - the cause is that people are encouraged to heat to higher temperatures for longer due to the convenience of the heat pump.

Coupled with understandable (and reasonable) consumer behaviour is the less reasonable promotion of cheap and inefficient heat pumps by appliance retailers: an urgent job is to find out whether thse have low power factors as well as low thermal efficiencies, and thus add problems to distribution networks. As I understand, about half of new houses have heat pump heating systems; the average new house is around 170 square meters, much bigger than older houses, and many are installing whole house heating systems.

For transmission planning, the peakiness of these heating systems is of greatest concern. But there's concern also from the low-income consumer perspective - issues that should be addressed by MED, EECA, and MFE (the latter charged with the household sustainability element of the Prime Minister's sustainability package of 2007). Never mind that these latter concerns are not directly part of the Electricity Commission's responsibility - to the extent that evolving Government policy is responding to the fuel poverty issue (which is also part of

the Electricity Market Review), the policies offered in response are bound to impact on the exercise to which this submission responds - the Grid Planning Assumptions.

Just a remark here, that sudden changes in home heating solutions are nothing new. In the 60s, electric heating became widespread due to its convenience and efficiency compared to open fires. A price freeze in the early 70s maintained that trend, and led to openly expressed concern at NZ Electricity Department that space heating was becoming so popular that they could never build power stations fast enough to meet the new demand. Muldoon famously increased the bulk tariff by 40%, followed shortly by another 60% increase - and demand growth slowed from 7.5% per year to 4% in 1977, or 2% after excluding the finish of the second potline at Comalco. And home electricity demand evidently dropped - in any case I recall a sudden disappearance of black maire trees in the Rangitikei - which were being sold into the Wellington market for firewood. Yes, market-driven energy choices are real!

Meanwhile the Department of Scientific and Industrial Research researched new "double burning" wood stoves, which rapidly penetrated the market and led to living spaces 2 degrees warmer on average than electrically heated houses (HEEP yr 10 report).

Third generation, efficient and low-pollution wood burners could well augment the heat pump fashion, to the benefit of renewable energy, and also energy costs.

Wood burners that use wood chip instead of pellets could form an increasing part of the home and especially commercial heating market, with a strong impact on scenarios and grid planning.

The Demand-side scenario should take full account of these new technologies, with the assumption that consumer-friendly advanced metering will make available tariffs that give consumers the proper rewards for using these less convenient but highly sustainable heating options.

4. conclusion

The discussion above shows the flawed nature of the Grid Planning Assumptions, in their structural rejection of demand-side solutions to electricity planning in a world economic system becoming rapidly constrained in its carbon emissions, and with oil prices reflecting a crossover of the demand-supply curve, exacerbated by the rapidly increasing energy cost of oil recovery from low-grade sources and/ or in very remote regions and deep ocean fields. Business is no longer as usual.

It will be important for the Electricity Commission's board to maintain stakeholder communications with those who fund the entire expansion of the grid, and the power stations it serves. Not only major electricity users, but representatives of domestic users, should be in all advisory groups.

Low-carbon household electricity through synergies with bioenergy

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Carbon-zero electricity requires renewable energy for peaking and dry year firming

- Household wood burning can do both
- Clean air policies driving household wood energy out; clean burning appliances unaffordable to many
- Policy responses: NZ needs –
  - Better understanding, health impacts of wood burning
  - support of clean wood burning commensurate with environmental gains
  - Tariffs that reward consumers for low-carbon actions
  - Better management of government conflicts of interest between electricity profits and carbon reduction actions

Dual fuel electricity/ wood systems are in common use now, and efficient

Peak demands: older wood burners often run hot on coldest days when electricity costs are highest

- Households could also offer much more interruptible load – e.g. fridges, E Vehicles could absorb wind intermittency
- Wood can be left to grow in wet hydro years, and burned in dry years providing reserve energy
- Wood is essential backup energy in case of blackout
- Wood should be major rural energy source if uneconomic rural lines closed down, and for carbon zero tourist lodges

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Home wood burning is declining

- Wood burning provided 8 PJ/year consumer energy in 2005
- HEEP study showed wood burning provided 45% of household space heating, electricity only 32%.
- HEEP sample had 1% of houses with heat pumps; now almost half of new houses have heat pumps,
- Whole-house heating uses 3-4 times energy of spot heating
- Replacing household wood burning with heat pumps increased kWh demand by 6%, peak demand by 60% (nationwide survey)

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Greenhouse emissions, household space heating

- H'hold GHG emissions = 11.4% of NZ energy emissions
- Marginal emissions are what counts – what actually happens when you switch the heater
- MED and MFE analyses of emissions ignore transmission losses, assume marginal generation mostly from gas; I consider it is is mostly from coal, and include losses.
- I conclude heat pumps have higher greenhouse emissions than gas heaters

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Household space heat source	emissions, kg CO2/kWh space heat
Electrical resistence heater	0.87
Heat pump COP 3, floor mount	0.36
Heat pump COP3, high wall mount	0.44
Flued natural gas	0.27
Flued LPG	0.33
Unflued LPG	0.23
Pellets or firelogs	0.04
Firewood transported 100 km	0.03
Firewood transported 25 km	0.01

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Health impacts of wood burning as described in HAPiNZ are controversial

- Fine particles (PM10) harm health, no question.
- Long term health impacts cause around ten times as many early deaths per "dose" of PM10 as short term impacts
- 90% of CH pollution in winter came from home wood burning in 2001; almost all summer pollution came from vehicles
- Summer (vehicle) pollution estimated to cause 4-5 times as many early deaths and illnesses per "dose" as winter (solid fuel) pollution
- HAPiNZ says the reason for summer-winter difference should be studied further : I agree!
- My hypothesis: wood smoke has large particles – visible like snowflakes - that don't get into lung but are broken into fine particles within measuring device

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Health and air pollution issues

- Cold houses a confounding factor, winter deaths + illness?
- Need to calibrate PM10 readings with measurement technique that cannot break up smoke particles
- Need to revisit cost benefit analysis of National Environmental Standard for Air Quality, which assumes zero resource consent cost, no power price increases, and is considered by some to use much too high a value for a "statistical life"
- Consider air quality standard based on annual cumulative emissions not number of daily exceedences of 50 microgram/ cubic metre of air

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New home wood burning technology is cleaner, more efficient and convenient

- Microprocessor combustion control, addition of combustion enhancers, central space/ water heat systems burning low-cost wood chip
- Chimney/ flue gases can be scrubbed, recycling heat and removing particles to any chosen level
- UK subsidises low-carbon technologies up to £2500 per house; London wants 10% renew'ble E in new subdivisions
- NZ beginning to use wood chip as well as pellets; appropriate for central heating and wood gasification for electricity, especially for tourist lodges, rest homes

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Wood fuel availability: the technology defines the resource

- Highly efficient burners use far less wood than old designs; "firelogs" can be stored to augment wood supply
- Pellets, mass-produced, will soon use geothermal drying
- Central heating and CHP systems being designed for chips
- Firm electricity from wood chip cheaper than wind: CHP from wood gasific. = $5,000/kWelect., firm wind = $10,000.
- NZ street trees could become "urban forests" – shady streets, sunny houses, native birds, firewood, compost, storm water management. Implement thru transition towns
- Biochar can be "harvested" from log fires, to sequester in urban gardens or for clean start of tomorrow's fire

Get the picture? A huge choice of low carbon options not being used! Why?

- Perceptions: wood burning on its way out; heat pumps convenient and "efficient" (but N. gas is lower carbon)
- Imperfect competition distorts markets for pellets.
- Regulations focused on appliances not outcomes
- Poor information on existing wood burners, installers
- No electricity tariffs that reward price-responsive demand using wood as dual fuel (or even load shedding, appliance
- Distributed energy needs regulatory & local body support

Generic causes for these barriers

- Clean air campaign outlived its usefulness
- Clean wood burning like other renewables is high capital cost, unaffordable to many householders
- Meagre government RE subsidies and research funding
- Gov't will not regulate retailers to deliver genuine benefits
- Gov't conflicted: carbon reduction vs fiscal effect of profits
- District & regional councils should support transition town movement - but cannot fund peak oil or GHG responses

Rationale for government intervention

- Recognise high social cost of restricting wood burning, as wood, at ~7c/kWh, is most affordable space heat
- Recognise home wood burning highly effective in reducing emissions, as displaces mostly peak electricity
- ETS will create ~ $1 billion/ yr windfall revenues for Gov't – recycling revenues highly appropriate here
- Fund development and deployment of least polluting wood burning in most sensitive airsheds as well as retrofits, transfer $$ to local bodies for transition town support
- Regulate to ensure cost reflective pricing options

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