TRANSPOWER NEW ZEALAND LIMITED

Submission to the Electricity Commission on The 2008 Grid Planning Assumptions

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TRANSPOWER

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Contents

1. Introduction

1.1 Purpose of this document

This is Transpower's submission in response to the Electricity Commission's consultation on the draft 2008 grid planning assumptions.

2. Executive summary

2.1 Content

Transpower thanks the Electricity Commission for the opportunity to submit feedback on its draft 2008 grid planning assumptions (GPAs).

Given that the Commission has not posed specific consultation questions, Transpower is providing feedback by way of directly addressing specific sections in the GPA material provided.

2.2 Key Points

Transpower seeks some assurance from the Commission that the software models it has provided in support of the GPAs are robust and fit for purpose. This could be provided by way of a clear functional specification and independent testing and peer review.

Transpower supports the use of an econometric model used to derive the national energy forecast but is of the view that the regional allocation methodology could be improved and that further investigation into the drivers behind the regional allocation be undertaken to ensure that recent increases in energy intensity in some areas is accurately reflected in the forecasts.

Transpower supports the use of prudent peak demand forecasts in its planning activities. However, Transpower does have some concerns with the arbitrariness of some of the assumptions used in the Commission's prudent peak demand forecasts.

Transpower is of the view that statements of opportunity should be focussed on medium-term identification of looming power system issues for transmission, generation and demand-side proponents to. To this end, it questions the requirement for the Commission to produce long term Market Development Scenarios (MDS) of specific generation types, sitings and commissioning dates. Rather, the MDS should be defined as future paths of the *drivers* of such investments, e.g. capital and operating (including fuel) building block assumptions for use in generation expansion modelling.

3. Discussion

3.1 Software Models

The Commission has provided several software models which it uses to derive the GPAs. These models are central to creating robust forecasts and MDS and Transpower seeks assurances from the Commission that they are robust and fit for purpose.

Given that these models are effectively software, some evidence of independent testing and review would give Transpower and other interested parties (and indeed the Commission) a degree of comfort that the models are doing what they are intended to do. It would also be helpful to provide user guides and manuals.

3.2 Electricity Demand Forecast Review February 2008

Transpower supports the use of an econometric model to derive electricity demand forecasts. However, given the changes made to the model, and the subsequent demand forecast, since the 2005 SOO was published, it would be useful if the Commission could provide a summary of the key changes that have been made to the model and its inputs over the last three years, and the subsequent impact of those changes.

Section 3.3.9 details the technique used by the Commission to estimate the modelling error of the residential sector energy model. Transpower questions the need for this estimation given that the model statistics are reported and include the value of the *adjusted* R^2. This value is a measure of the how well the models fits the data. Given this, a preferable approach to estimating the upper and lower limits of the uncertainty would be to sample from a synthetic distribution that is artificially created and has the same characteristics as the distribution of the existing model errors.

Section 3.5 details the treatment of the Tiwai aluminum smelter in the Commission's forecasts. Forecast demand is assumed to remain constant, however, historically there has been some variation in demand and there may be some merit in including this variability. It would be relatively straightforward to model some variability as follows:

$$\text{Tiwai}_t = \text{Mean}(\text{Tiwai}) + \varepsilon_t$$

where ε_t is the model error term.

Section 3.7.7 details how variation has been introduced into the population forecast variable. This has been done by "applying a factor drawn from a distribution based on the various Statistics New Zealand Population scenarios".[1] Transpower questions whether it is useful or indeed necessary to add a layer of variation and complexity by introducing an artificial variation to the population forecast. Year on year percentage changes to the population are very small, i.e. although the population does vary, year-on-year the variation is quite small. It is unclear what value the variation to the population forecast variable adds.

[1] Refer section 3.7.7, page 21.

Section 4.2.2. For each region, "an alternative final population forecast is calculated for each Electric Power Board (EPB) area using a proportion selected from a normal distribution (i.e. 100% of the current final forecast ± x% where x is drawn from a normal distribution)." Rather than using a proportion selected from a normal distribution, one alternative is to select a proportion from a uniform distribution. It is unclear why a normal distribution has been chosen and so it would be helpful for the rationale underlying the choice of the distribution to be provided.

Section 4.2.3. The Commission states that "regional GDP projections are also scaled to maintain consistency with the population changes within the region". The implicit assumption is that GDP is correlated with population. Unfortunately, on a regional basis, this assumption breaks down, especially in regions that are rural in nature yet have energy intensive industries.

In section 4.3, the Commission outlines its rationale for weighting the re-allocation of regional growth to reflect recent regional demand growth. Transpower accepts that the allocation of national demand to regions based on the standard population and regional GDP forecasts will not capture recent changes in energy intensity. However, the weightings that have been applied appear to be arbitrary and are not supported by any analysis into the exact drivers of increased demand growth is some areas compared to others.

It is possible that increased energy use in areas such as South Canterbury will not be captured by the regional GDP and population forecasts and the question as to whether or not this is the case should be asked of the GDP forecast providers, NZIER.

Transpower welcomes the inclusion of known step loads as outlined in section 4.4. However, Transpower does not agree with the process used to accommodate these step load changes, in as much as these step load increases at GXPs are proportionally subtracted off the other GXPs in the region to ensure the national energy total remains constant. In the case of a small region like the West Coast which has significant forecast step load forecast, this method will result in extreme low or negative forecast growth at the GXPs which do not have step load changes.

Transpower suggests the Commission ascertains whether the high increases in industrial load, in the regions where there are significant step load increases, are captured in the regional GDP forecasts. If not, the step loads should be treated as additions to the total energy demand, not included within it.

Section 5.1.2. A range of peak demand forecasts (100,000) are produced for use in GIT analysis. Transpower seeks clarification that the mean and prudent ADMD forecasts correlate to the 50^{th} and 90^{th} percentile of the forecast range. Transpower also requests that the Commission publish files containing the 100,000 national and regional demand forecasts for use in Grid Investment Test analysis. This would save parties who wish to apply the Grid Investment Test considerable time and would ensure a consistent result. Currently, Transpower generates its own set of 100,000 demand paths as required. Of course, smaller investment proposals may use a commensurately simpler approach to the number of demand forecasts.

Section 5.2.3. In computing the prudent peak forecasts, for each region, an exponential curve is fitted to the historical data. No discussion has been provided to explain the rationale for choosing to fit an exponential curve. It could be argued that a trend through the historical data would be adequate. Similarly a polynomial of degree two or higher could be argued as being adequate. It seems that the exponential curve had been chosen for its behaviour at the right end point thereby predetermining the desired forecasting outcome. Therefore, a discussion on the choice of the exponential curve would be useful.

Peak forecast distributions have been created in part by using "an estimated 20% chance of exceptional growth (1.0% per annum higher) over a five year period." A discussion would be useful behind the reason that 1.0% per annum higher was chosen rather than any other percentage value. In addition, Transpower questions the need to include such a concept. The modelling is attempting to capture the uncertainty in underlying growth. The prudent peak is capturing those cases where the value is not exceeded 90% of the time. Thus the prudent peak is designed not to capture exceptional growth. It seems inconsistent to design a model not to capture exceptional growth and then cater for exceptional growth in the variability.

Transpower seeks clarification of the starting point for projected peak load at each GXP as detailed in section 5.3.1. Does the Commission use the 50 peak average from one year, and if so, which year?

Given Transpower's reliance on GXP forecasts for its transmission planning, it would welcome the provision of more detail around the individual GXP base demand data produced by the Commission. For instance, what type of events does the Commission consider as "significant disruption or variations in the peak"[2]? This could be provided in a form of a spreadsheet with notes as to what adjustments have been made to the base data and the reasons behind the changes.

Transpower believes that the GXP forecasts could be improved considerably by incorporating customer feedback as part of the demand forecasting process. Transpower is in regular contact with its customers and has strong incentives to ensure GXP forecasts are reasonable. It may be worth considering a process whereby the Commission produce national and regional demand forecasts and Transpower produces the GXP forecasts. Processes would need to be developed to satisfactorily marry the Commission's top down forecasts with Transpower's bottom-up feedback, as received from customers, but the end result should be better GXP forecasts for transmission planning. Transpower currently includes some customer information in the prudent peak demand forecasts it uses for its Annual Planning Report and looks forward to further discussions with the Commission on this matter.

Section 5.4.2. Regional and island diversities for new industrial loads have been assumed to take the value one. This assumption is based on the premise that the new industrial load is operating 24/7. A more conservative approach is to assume a diversity factor of 0.975 until data is collected and an actual diversity factor is calculated.

[2] Section 5.3.2.

The adjustments made to allow for embedded generation detailed in section 5.7 are sensible and it would be useful to have more detail supplied with regard to which GXPs have been grossed up and by how much so this can be articulated in a transparent fashion when applying the GIT to specific upgrades that are affected by embedded generation.

Transpower agrees that the prudent forecast should revert to mean growth rates after a period of time as detailed in section 5.9.3 but would welcome the Commission's rationale for choosing a 5 year period.

The regional peak forecasts in Appendix 3 do not match those in section 3.1 of the *Regional Peak Demand Forecast from 2007* report. For instance, the North Island peak demand in Appendix 3 is 4624 MW in 2008, whereas it is 4431 (expected) and 4555 (prudent) in section 3.1 of the *Regional Peak Demand Forecast from 2007* report.

It would be useful to have the historical data included in the tables in Appendix 2 and 3.

3.3 Regional Peak Demand Forecast

In February 2007, Transpower raised its concerns with the prudent peak methodology directly with the Commission. The Commission responded to Transpower's concerns but it would have been useful to have had the output of these discussions incorporated in the revised version of the report[3] issued as part of the 2008 GPA consultation. Given that it was not included, Transpower raises many of the same concerns in this submission.

Transpower supports the use of prudent forecasts for its transmission planning.

Transpower does not agree with the Commission's interpretation of how to use the prudent forecast in determining the timing of transmission investments. Whilst the application of the GIT will take into account the full range of modelled demand possibilities, from 0-100%, the actual timing of an investment is determined by the prudent demand forecast. For example, if a prudent demand forecast shows a thermal capacity of a line being exceeded by 2013, with unserved energy forecast to occur after that time, then 2013 is the target year for investment. In any case, the GPA document is not the appropriate vehicle for discussing how the Commission considers the Grid Investment Test should be applied. This is commented on further below.

As indicated previously, Transpower does not agree with the weighted least squares approach which fits an exponential curve to historical data – section 2.3. This implies that the later data points hold more information that earlier ones, which whilst true for a lengthy time series holding in excess of 100 data points, does not hold for relatively short time series of 10 annual data points where the variation is more important than the trend. In the absence of any analysis or discussion to support this view, a linear fit would be preferable since it would not create any bias either way.

Whilst Transpower accepts that the 2003 peak was likely to have been affected by a demand savings campaign, it is of the view that the 2001 peak was unlikely to have been affected given the fact that the demand savings campaign did not

[3] Regional Peak Demand Forecast from 2007 dated November 2007.

start until the beginning of August[4]. The National Winter Group which is made up of industry participants also agree that the 2001 peak should be included in deriving its forecast of demand for 2008.

The use of arbitrary assumptions in deriving the prudent peak forecast has been covered in the previous section.

Given the importance of the prudent peak demand forecast, Transpower is of the opinion that the prudent peak demand forecasting methodology would benefit from peer review and comment by an independent expert.

3.4 Draft Generation Scenarios

The following comments refer to the document "2008 Grid Planning Assumptions: Consultation material on draft generation scenarios."

Paragraph 6. This states that the purpose of the SOO "is to enable the identification of potential opportunities for efficient management of the grid, including investment in upgrades and transmission alternatives". Transpower views this as a focus on the shorter term: statements of opportunity are typically focused on medium-term identification of looming power system issues for transmission, generation and demand-side proponents to address (e.g. ten years ahead in Australia, seven years in England and Wales). They do not generally present a regulator's long-term view of specific transmission and generation investment paths.

Paragraph 7**.** It is Transpower's view that the scenarios should be designed to accommodate the analysis for which they are intended. Assuming the shorter term horizon is the one in focus, the "optimal" scenarios should be less far sighted, but numerous enough to cover less likely events as well as the likely future. Transpower is of the view that this would provide the best possible range of when, where and how often investments may be needed.

However, if the market development scenarios are to be used as the basis for the Grid Investment Test (GIT), where a longer horizon and fewer scenarios are desirable, there is a possible tension, which could result in a lower quality SOO and GIT compared with a situation where two different sets of scenarios were to be used.

It is Transpower's view that the component of the SOO labelled as the Market Development Scenarios (to which the GIT refers) should not include specific generation types, sitings and commissioning dates. Rather, the Market Development Scenarios should be defined as future paths of the *drivers* of such investments, e.g. capital and operating (including fuel) building block assumptions for use in generation expansion modelling. This will allow the Market Development Scenarios to fulfil their role as inputs to generation expansion modelling in developing specific transmission investment proposals. The SOO can still include 'story lines' of specific generation types, sitings and commissioning dates for industry information.

Paragraph 17. Transpower agrees with the three key steps adopted for the scenario development process, but is of the view that there is a lack of detailed information provided in the consultation documentation around the input data

[4] Of the last 11 years of peak data, 2 occurred in May, 5 in June, 2 in July and 2 in August.

assumptions. It would be useful to include clear references to the sources behind fuel prices, carbon prices and other major drivers. In addition, it would be useful to articulate the reasoning that leads from the forecast data to the formation of the scenarios stories.

Paragraph 18. The iterative refinement process appears to be focused on a range of scenarios with different amounts of renewables without considering whether this is a likely result of the various forecasts. To this end it appears that forecast points have been selected to arrive at desirable end points, i.e. the iterations have been around this rather than verifying the scenarios against current or likely future policy objective.

Paragraph 31. As stated earlier, it would be useful to articulate clearly reasoning behind the scenarios, i.e. with reference to forecasts. Without that information, it is difficult to justify the weightings which will be applied to the scenarios.

Paragraph 32. Transpower does not agree with the equal weighting of the defined scenarios. See further comment around Table 2 and Figures 4 and 5.

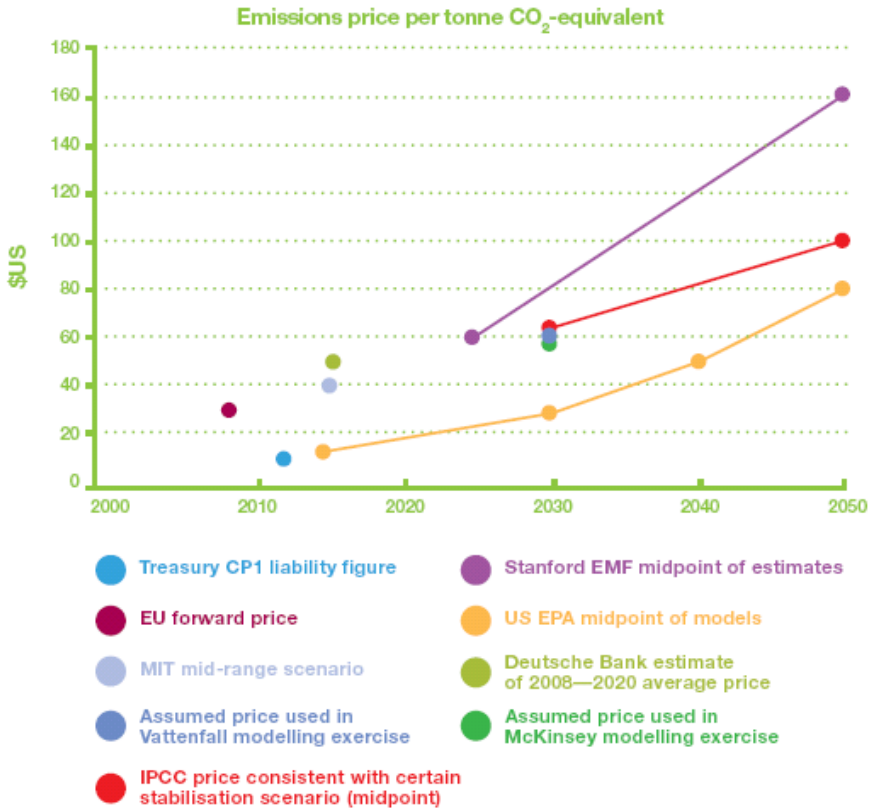
Table 2 – Key drivers of the draft generation scenarios. Transpower questions the inclusion of Tiwai smelter closure in the only scenario that achieves the New Zealand Energy Strategy (NZES) target of 90% renewables by 2025. Transpower acknowledges that achieving the 90% renewables objective is going to be challenging, however the assumption that the smelter will close makes the scenario significantly less challenging. Transpower notes that the direction indicated by the NZES for maintaining security of supply in electricity in meeting the target noted requirements for generation, fuel, transmission and energy efficiency, but not for major plant closures. As all other scenarios are more carbon intensive, the result is five scenarios, none of which meet current policy goals. Transpower is of the view that a higher weighting should be given to the NZES scenario even with Tiwai still in operation.

Transpower is of the view that the generation expansion modelling should not have regard to the closure of Tiwai until such time when confirmation of this would be obtained, i.e around 2017 when the contract is up for renewal. To do otherwise could impact on assumed investment decisions in the years leading up to that time.

At the GPA workshop, the Commission noted that they had incorporated several "orphaned" effects into the 5 generation scenarios they had identified. The Tiwai smelter closure, discussed above, was one of those effects. When questioned why the Commission were producing only 5 generation scenarios, rather than a larger number which may individually reflect these effects, the Commission responded that 5 were produced to keep Grid Investment Test analysis tractable. Whilst that is laudable, the Commission went on to suggest that Transpower could use additional scenarios, with lower weightings, if it considered that to be more appropriate. It would be helpful if the Commission could provide further detail with regard to this point.

Transpower notes that Table 2 indicates that a range of possible existing HVDC Pole 1 fates have been used. Whilst this was a reasonable approach at the time these draft generation scenarios were prepared, that issue has now been clarified and hence only the "Half pole on standby until replacement in 2012" fate should be used in compiling the final generation scenarios.

The following figure is taken from the New Zealand Energy Strategy to 2050 page 30. While it shows that the range of carbon prices in the draft SOO scenarios for 2012 till around 2025 is well in line with these, the draft SOO scenarios fail to pick up the increasing longer-term trend in the forecasts.



Source: Ministry for the Environment

Paragraph 39. Transpower welcomes the inclusion of a forecast in the uptake of electric vehicles in the demand forecasts. Transpower encourages the Commission to continue to study this and its likely implications on the demand for electricity in the long term. Transpower notes previous Commission statements to the effect that high electric car penetration will not increase peak demand as re-charging can be off-peak, and indeed batteries can be used at peak to reduce net demand. Transpower questions the practicality of this, and expects the Commission to include a reasonable analysis of the effects of electric car penetration on peak demands.

Paragraph 42. Transpower anticipates that Pole 1 will be used for emergency coverage prior to its replacement, but will not be able to be used in full service. Therefore, only 700MW should be used in the grid planning assumptions.

Paragraph 45. Transpower notes that the projects should include CCGTs with carbon capture and storage equipment as well.

Table 3. It is unclear that whether the assumed gas price is the same for gas-fired OCGTs as for base load CCGTs.

Table 4. Transpower notes that the column headings in this table should read SRMC rather than LRMC.

Figure 4. Transpower notes that this chart shows only one scenario (which includes the decommissioning of Tiwai) meets the current policy objective while the rest fall short. See comments on Table 2 above.

Figure 5. This chart shows the forecast carbon emissions from the five scenarios. Transpower notes that New Zealand's Kyoto obligation is to reduce its emissions to 1990 level on average over the period 2008-2012. This is across all sectors, but reductions from other sectors are generally expected to be more costly and hence there is an expectation that the electricity sector's reductions will have to be met within, if not sooner, than the available timeframes.

The 1990 emission level was around 3.5 Mt CO2e[5]. Only one of the Commission's scenarios delivers carbon reductions to this level, 10 years after the Kyoto target date and with Tiwai decommissioned.

3.5 Regional load probability curve forecasts from 2007

Section 1 of the document states that load probability curves "are to be included in subsequent SOOs for use in applications of the Grid Investment Test (GIT). They would be used to determine the timing of major investments under the GRS and to calculate expected unserved energy." Transpower notes also that the Market Development Scenarios used in the GIT do not have to be those of the SOO if the Board of the Commission determines (at the time of applying the GIT) that other Market Development Scenarios "proposed by Transpower, the proponent of a transmission alternative or the Board are more appropriate". This and other language in the GPAs should conform to the rules requirements that the SOO provides only one source of information for the GIT, albeit an important one.

Transpower is of the view that while LPCs have an advantage in that they reflect a variety of demand forecasts, they also have a disadvantage in that no sensitivity analysis of demand forecasts can be undertaken. In some studies valuable information can be obtained about a project by considering how the results differ between high, medium and low demand forecasts. However, as an LPC implicitly considers a range of demand forecasts no such sensitivity analysis can be undertaken.

If it is the intention of the Commission that LPCs are used in applying the GIT, then Transpower suggests that this will need to be dealt with as a separate consultation and not as a part of the SOO process.

Section 2.2. The Commission's paper presents a range of regional LPCs broken down into three load blocks: extreme summer, summer and winter. Regional forecasts may not be helpful for considering some grid upgrades that are dependent on load at a particular GXP or group of GXPs within a region. In some studies it may even be beneficial to consider additional load blocks, such as weekdays and weekends. If LPCs are to be used some method of generating GXP specific LPCs, over a range of load blocks, will need to be developed that is consistent with a regional LPC. Transpower notes that any analysis using LPCs, at a GXP or regional level, is complicated by the fact that LPCs at different GXPs, or in different regions, cannot be simply added to define the LPC for the new region.

[5] Refer page 36 of the New Zealand Energy Strategy.

Section 2.3. The steepness value is defined as the ratio, (max-P_1)/(max-mean), where max is the maximum value of the half-hourly load duration curve, P_1 is the first percentile of the load duration curve, and mean the mean. While Transpower acknowledges that the use of a random steepness value in the derivation of the LPC allows the LPC to consider variation in the shape of the base load duration curve used in the derivation, the definition of the steepness value is arbitrary and use of alternative definitions may yield different curves. An explanation of the rationale behind this assumption would be useful.