Draft 2008 Grid Planning Assumptions

Commentary on submissions

Prepared by the Electricity Commission

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Introduction and background

1. As part of its responsibilities to consider and make decisions regarding transmission investments the Commission is required under rule 9 of section III of Part F of the Electricity Governance Rules (Rules) to publish a Statement of Opportunities (SOO). The purpose of a SOO is to provide information to the electricity sector to enable the identification of potential opportunities for efficient management of the grid, including investment in upgrades and investment in transmission alternatives.

2. The Commission's Initial SOO was published in May 2005. In its Statement of Intent 2007 – 2010, and in line with the Government's expectations as set out in the October 2006 Government Policy Statement on Electricity Governance (GPS), the Commission has undertaken to publish a SOO every two years. In May 2007, the Commission delayed the publication of the next SOO until the New Zealand Energy Strategy (NZES) and the GPS were finalised. These documents have now been completed and reflect the Government's high-level aspirations for the energy (and electricity) sector.

3. A SOO is developed by bringing together three key bodies of work:

   (a) a context description - in the form of a reasonable range of credible forecasts and scenarios (Grid Planning Assumptions - GPAs);

   (b) the criteria - in the form of defined grid performance standards (Grid Reliability Statements - GRSs); and

   (c) the analysis - in the form of an analysis of network performance (Power Systems Analysis – PSA),

4. The Commission's "Initial" 2005 SOO informed the development of Transpower's Grip Uprgade Plan (GUP) in 2005. Together with a set of revised demand forecasts and generation scenarios that were developed released after consultation, in September 2006, the Initial 2005 SOO also provided context for Transpower's second GUP in 2007.

5. The Commission intends to publish the 2008 SOO in August 2008.

6. On 21 February 2008 the Commission published the draft 2008 GPAs for consultation. Part of the consultation included a workshop, held on 29 February 2008. The workshop was well attended by industry participants.

7. The consultation period closed on 13 March 2008. Nine written submissions were received from the following parties[1]:

   (a) Contact Energy;

   (b) Meridian;

   (c) Transpower;

   (d) Molly Melhuish;

   (e) Genesis Energy;

   (f) Major Electricity Users Group (**MEUG**);

   (g) New Zealand Wind Energy Association (**NZWEA**);

   (h) Vector; and

   (i) Mighty River Power (**MRP**).

Submissions received

8. The types of issues covered within the submissions can be grouped into two main categories:

   (a) high-level issues of principle regarding the purpose of the GPAs with respect to a SOO, the application of the grid investment test (**GIT**) in schedule F4 of section III of part F of the Rules, and the approach to scenario formulation and application; and

   (b) detailed comments on:

      (i) the links between the current GPAs process and other related workstreams the Commission is working on (principally the HVDC investment proposal, and the transmission to enable renewables project); and

      (ii) specific modelling assumptions and methodologies.

[1] Submissions are available at: http://www.electricitycommission.govt.nz/submissions/SubmissionsGPA08

9. The points raised in the submissions (summarised in Appendix 1 below) have been incorporated, wherever possible, into the Commission's programme of ongoing development of the key components and processes relating to each SOO.

Use of SOO scenarios in the GIT

10. The development of the GPAs and their subsequent application within a SOO and the GIT is reasonably tightly prescribed by the Rules. A SOO must set out the GPAs.[2] And, the Rules require GPAs to cover a reasonable range of credible forecasts and scenarios; to have a length of outlook commensurate with consideration of future investment in long-life transmission assets; to be as accurate as possible; and be developed with a rigour that is commensurate with the economic significance of the decisions to be made on the basis of them.[3]

11. The GPAs should therefore include committed projects; a reasonable range of credible demand forecasts by region or grid exit point; and a reasonable range of credible future, high-level generation scenarios.[4]

12. With respect to the use of SOO scenarios in the application of the GIT, it is the Commission's view that an 'a priori' scenario approach will not always be the best means of evaluating a transmission investment.

13. In constructing scenarios for a SOO, there are many 'degrees of freedom' in selecting assumptions and modelled plant to which, at the time of the scenario preparation, the Commission is indifferent. When the GIT is subsequently applied to a particular transmission investment, some of these arbitrary assumptions may be highly significant. In such cases, in accordance with clause 6.1 of the GIT, the Commission may determine the most appropriate market development scenarios to use.

The purpose of the GPAs with respect to SOO and GIT processes

14. Several parties considered there was a tension between the use of the GPAs as inputs to a SOO process, and their role in the GIT process.

15. A number of parties suggested that, in respect of the purpose of a SOO (to provide information to participants to help identify opportunities), a SOO should

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2 Rule 9.1.1.2 of section III of part F of the Rules.

3 Rule 10.2 of section III of part F of the Rules.

4 Rule 10.3 of section III of part F of the Rules.

have a medium-term (<10 years) focus, and be based predominantly on existing or committed projects. Reference was made to similar such approaches in the United Kingdom and Australia.

16. However, in respect to the GIT process, parties acknowledged that it was appropriate to focus over a longer period (20-25 years). In addition, concerns were expressed about the process being too specific in modelling particular projects, rather than a more generic examination of future drivers.

As stated in paragraphs 10 and 11 above, the development of the GPAs and their subsequent application within a SOO and the GIT is reasonably tightly prescribed by the Rules and the Commission's approach is consistent with that. However, the Commission continues to work on development of generation scenarios as the Commission further improves its modelling capability to ensure such scenarios are internally consistent.

17.

Appropriate approach to scenario formulation and application

18. Several parties felt that the scenarios were 'story boarded' to achieve certain end outcomes (principally varying the end % share of renewables) rather than varying the key underlying drivers in an internally consistent fashion to see what end outcomes resulted. Transpower commented on the limited number of generation scenarios produced and requested further detail around the Commission's follow-on suggestion that Transpower could use additional scenarios with lower weighting if it considered that to be more appropriate.

19. In relation to the 'story-board' comment, the scenarios selected were chosen to represent a reasonable range of possible futures. The modelling approach was not output-driven, but rather used an internally consistent model which dynamically scheduled generation build based on underlying input assumptions.

20. Input assumptions for each scenario were chosen to map out a reasonable boundary for future events, and internally consistent scenarios were then created. The proportion of renewable generation was then measured for each of the resulting scenarios. In the draft 2008 scenarios, these proportions formed a linear continuum, but this may not be the case in the final SOO scenarios – changes to the input assumptions based on submitter feedback may lead to a different distribution of renewable percentages.

21. The key drivers that differentiated between scenarios were:

(a) the future price of carbon;

(b) the future status of the Government's renewables preference ('moratorium on baseload thermal generation');

(c) the price of gas for electricity generation;

(d) the availability of various renewable resources;

(e) the fate of the coal-fired units at Huntly;

(f) the fate of the HVDC link;

(g) the extent of penetration of plug-in electric vehicles; and

(h) the extent of demand-side penetration.

Fulfilling the purpose of the GIT

22. With respect to the use of SOO scenarios in the application of the GIT, it is the Commission's view that an 'a priori' scenario approach will not always be the best means of evaluating a transmission investment.

23. As noted earlier, in constructing scenarios for a SOO, there are many 'degrees of freedom' in selecting assumptions and modelled plant to which, at the time of scenario preparation, the Commission is indifferent. When the GIT is then applied to a particular transmission investment, some of these arbitrary assumptions may be highly significant. For example, for no particular reason, all of the SOO scenarios may have substantial amounts of new generation in a region that is to be served by a proposed transmission investment.

24. In that case, in accordance with clause 6.1 of the GIT, the Commission may determine that market development scenarios proposed by Transpower, the proponent of a transmission alternative, or the Commission are more appropriate. This enables the Commission to adopt alternative scenarios that

more reasonably reflect new knowledge, or then-current uncertainty about the future.[5]

25. The Rules also permit real options benefits to be calculated, as an alternative method to explicitly evaluating the merit of decisions in the face of future uncertainty [clause 13 of the GIT]. Current practice for evaluating real options value for transmission investments is to employ a Monte Carlo simulation of many possible futures (many thousands to millions). To make this problem numerically feasible, many simplifications must be made to modelled interactions (for example to avoid the need for power flow analysis within each Monte Carlo draw). A hybrid approach, utilising both scenarios and Monte Carlo real options analysis was developed for the analysis of Transpower's North Island Grid Update Proposal decision.

26. Therefore there is considerable flexibility within the Rules, particularly in respect of large investments, to vary scenarios and, where merited, use state of the art analysis techniques. In other cases, a simple application of the existing scenarios will be appropriate. It is the Commission's view that this approach of publishing the starting point for GIT applications in a SOO, coupled with wide scope for greater flexibility where required, best balances the need to provide a flexible environment within which Transpower can undertake the cost benefit analysis of the GIT, against the need for a transparent and regulated framework for transmission investment decision-making.

Generation scenarios

27. This section discusses the main issues relating to the generation scenarios that have arisen from submissions. The focus is on the content of the scenarios rather than the way they are to be used. Topics covered are:

    (a) gas and diesel fuels (prices, availability and flexibility);

    (b) carbon prices;

    (c) the future of the Rio Tinto aluminium smelter at Tiwai;

    (d) the future of the HVDC link;

    (e) the future of New Zealand's major existing thermal power stations; and

[5] Any alternative scenarios adopted by the Commission must comply with clause 28 of the GIT, which defines "market development scenarios". The number of scenarios adopted must also be the same number as the number of scenarios set out in the SOO.

(f) generation projects likely to be commissioned in the next few years.

Gas and diesel fuels

28. The issue of flexibility of thermal fuel supplies was raised at the GPAs workshop in February 2008. A participant asked if the scenarios model the use of natural gas as a 'swing fuel' in the electricity market (i.e. increased production from gas-fired generators in dry years), and if the Commission had considered whether this was realistic.

29. Thermal generation is used for dry-year swing in the draft GPA scenarios.The Commission has reviewed the relevant assumptions and is working on several modifications to improve their credibility.

Carbon prices

30. Several submitters commented on the assumptions about carbon prices, which are a key driver of the scenarios:

    (a) NZWEA commented that a charge of $20/t CO2-equiv (in the High Gas Discovery scenario) is too low;

    (b) Contact requested carbon price sensitivities of +/- $10/t for each scenario;

    (c) Transpower submitted that more scenarios should have significant emissions reduction and carbon prices should be higher in the long term;

    (d) MRP commented that at least one scenario should have no price on carbon; and

    (e) MEUG and Molly Melhuish both commented that the upper bound of carbon prices should be above the current $50/t.

31. The nature of domestic and international carbon trading is not conducive to long-term forecasting of the price of carbon. All carbon price projections in the GPAs are therefore based on “best guess” estimates, rather than on modelling and empirical evidence.

32. However, the Commission believes that the low end of the range of assumed carbon prices ($20/t) is appropriate. Furthermore, using a lower carbon price, or no cost of carbon at all, would not be consistent with Government policy.

33. However, it is possible that the top end of the range ($50/t) may be too low, as was suggested by several submitters. A higher assumed carbon price would

lead to scenarios in which it would be uneconomic to keep existing thermal plant in service or even to build new peaking thermal plant. Instead New Zealand could develop demand-side response, peaking renewable generation and/or overbuild of baseload renewables. The Commission acknowledges that this scenario is plausible but is reluctant to attempt to model it at this stage, because it differs so greatly from experience to date. In the Commission's view, it would be better to carry out more development work first (e.g. on the economics of peaking renewable generation).

34. The Commission considers that Contact's suggestion of carrying out sensitivity analysis on the carbon price has merit, and will aim to do this before the publication of the 2008 SOO if time permits.

The Tiwai smelter

35. Several submitters commented on the assumed fate of the Rio Tinto aluminium smelter at Tiwai (i.e. remaining in steady operation in all scenarios except 'Sustainable Path', where it is assumed to decommission in the mid-2020s).[6]

36. Some submitters stated that, since Meridian Energy has now signed a contract with Rio Tinto to supply electricity until 2030, the smelter closure should not be assumed to occur before 2030, or even to occur at all. However, the Commission considers that the smelter could still potentially close before 2030 depending on aluminium prices, imported bauxite prices and prices in other electricity markets. This outcome would have a major impact on the New Zealand transmission system and should be modelled in at least one scenario.

[6] To some extent, these comments are the result of a table in the GPA consultation material, which mistakenly implied that the smelter would decommission around 2020 in the Sustainable Path scenario. Submitters therefore received the impression that a 2020 decommissioning was assumed. In fact the assumption was that it would phase out of operation between 2022 and 2027.

37. Other submitters commented that the association of the smelter decommissioning with the Sustainable Path scenario seemed to imply that the Government's 90% renewables target could only be achieved by closing the smelter. It was not intended that the scenarios should give this message, and the Commission considers that the 90% renewables target can potentially be met while the smelter remains in operation. To avoid this association, the smelter closure will be shifted to a different scenario (probably 'Medium Renewables') in the new set of scenarios.

The HVDC link

38. The future of Pole 1 of the Benmore-Haywards HVDC link is an important parameter in the scenarios. It affects the balance of new build generation between the North and South Islands.

39. Transpower has recently advised that it intends to keep half of Pole 1 in standby operation until 2012 (which will require Transpower to resolve outstanding insurance issues). The Commission suggests that, as previously, three out of five of the scenarios should follow this course. Of the remaining two, one should assume that the half Pole returns to full operation, and the other should assume that the half Pole is decommissioned entirely in the near future. On balance, this set of assumptions is consistent with Transpower's position, but allows for the possibility that new information about the serviceability of the Pole 1 equipment may become available in future.

40. The draft scenarios for consultation assumed that an HVDC upgrade to 1200 MW of northward capacity would occur in 2012, followed by a further upgrade to 1400 MW in 2018. Several submitters suggested that different assumptions could be made here. However, without prejudice to the Commission’s decision making in Transpower’s HVDC investment proposal, the Commission plans to retain this assumption for the time being.

New Zealand's major existing thermal power stations

41. A key part of the scenarios is the assumed future of the dual-fuelled units at Huntly Power Station. If and when these units are withdrawn from service, new generation and transmission will need to be built to replace them. Submitters did not offer much comment on this (perhaps because of confidentiality, in some cases) but the Commission has reviewed the issue anyway.

42. On reflection, the Commission considers that the previous draft scenarios place too much weight on an early (2010s) decommissioning of Huntly. An assessment of the cost of running Huntly, in relation to the cost of building new renewables or CCGTs, suggests that continuing to run Huntly in dry years will remain economic unless carbon prices reach a very high level.

43. The revised scenarios therefore assume that:

    (a) (Sustainable Path) Huntly units 1-4 will be decommissioned in the 2010s (as previously);

    (b) (SI Surplus) two Huntly units will be decommissioned in the 2010s; the other two will shift to dry-year reserve operation and will remain in that mode until 2030 (in the previous scenarios they were decommissioned entirely in the 2020s);

    (c) (Primary Renewables) all four Huntly units will be shifted into dry-year reserve operation in the 2020s and will remain in that mode until about 2030 (in the previous scenarios only two units were retained beyond 2020, and these were decommissioned in the 2020s);

    (d) (Demand Side Participation) Huntly units 1-4 will remain in full service until around 2030 (as previously); and

    (e) (High Gas Discovery) two Huntly units will be decommissioned in the 2010s and replaced with a lower-emitting CCGT (as previously). However, the other two dual-fuelled units will remain in operation until 2030 (previously they were assumed to be closed in 2022).

44. The new scenarios also attempt to model the displacement of existing CCGTs by new plant (either more efficient new CCGTs or renewables). In some scenarios, one CCGT (nominally Stratford, which is the least efficient of the three major existing CCGTs) is reduced to a winter-only operating regime in the 2020s and eventually decommissioned entirely. (At this stage, there is no facility to make these decisions endogenously within the GEM model.)

Generation projects before 2012

45. Several submitters commented on the Commission's assumptions around new generation that is planned to be built in the next few years. The Commission has reviewed these assumptions and the revised data is shown below.

46. The data is based on publicly available information only. There is no access to data provided under confidentiality by generators for this purpose.

Table 1 Assumptions about generation projects before 2012

Project	Developer	Location	Capacity	Likely timing
Thermal peaker	??	??	150 MW	Possible in 2009
Gas peaker	Contact Energy	Stratford	200 MW	Possible in 2010
Ngawha 2 geothermal	Top Energy	Northland	15 MW	Certain in 2009
Kawerau geothermal	Mighty River Power	Central NI	90 MW	Certain in 2009
Rotokawa 2 geothermal	Mighty River Power	Central NI	130 MW	Certain in 2010-2011
Te Mihi geothermal	Contact Energy	Central NI	Net increase of 60 MW	Certain in 2011
Deep Stream hydro	TrustPower	Otago	5 MW	Certain in 2008
Hawea Control Gate retrofit	Contact Energy	Otago	17 MW	Probable in 2010-2012
Wairau hydro	TrustPower	Marlborough	73 MW	Probable in 2011-2013
Te Waka wind	Unison	Hawkes Bay	102 MW	Likely in 2010-2012
Titiokura wind	Unison	Hawkes Bay	45 MW	Likely in 2010-2012
Te Rere Hau wind	NZ Windfarms	Manawatu	49 MW	Certain in 2009-2011
West Wind	Meridian Energy	Makara	143 MW	Certain in 2009-2010

Methodological work in progress

47. The Commission has been developing the GEM and working to improve the input data in parallel with the consultation process. Changes that will be ready in time for inclusion in the new scenarios include:

(a) modelling the need to meet winter peak via the GEM load duration curve (adding a narrow 'spike block' of a few dozen peak periods, where demand must be met by peaking generation and/or demand-side response);

(b) modelling the need to balance variable wind output via the GEM load duration curve (dividing load blocks into 'high wind' and 'low wind' sub-blocks, where demand in 'low wind' periods must be met by peaking generation, pumped storage, etc);

(c) using hydro and geothermal cost curves from the Transmission to Enable Renewables (**TTER**) project; and

(d) further work on revenue adequacy assessment – recalibrating the statistical forecast of wholesale price, and implementing a calculation of the level of prices required to produce revenue adequacy.

48. Modelling techniques to co-optimise transmission with generation are still under development. The Commission's view is that this analysis is targeted at achieving a set of internally consistent scenarios and that none of these is any sort of central plan for the electricity supply system as some submitters suggest.

Demand side scenarios

49. In the draft 2008 GPAs the Commission's approach to demand scenarios was quite limited. The main factor considered was the decommissioning of the Tiwai Point aluminium smelter. Apart from that, underlying electricity demand is assumed to be the same in every scenario. However in the draft 2008 GPAs, two scenarios include very high uptake rates for electric vehicles.

50. The rate of demand growth due to electric vehicles is modelled to be high since it is based on an assumption that from around 2015, electric vehicles rapidly increase their market share due to consumer preference. Effectively the vehicles are assumed to be lower cost and higher performance than conventional vehicles, and also that they are able to be supplied in sufficient quantity to meet New Zealand vehicle demand.

51. Commission modelling suggests this is possible, provided international targets for battery cost are achieved, and additionally, that the international market settles on a series hybrid design (a small battery of limited range with an on-board generator set).

52. Other scenarios for disruptive change on the demand side will require additional studies by the Commission. Of interest at the moment is the effect of heat pumps displacing solid fuel and resistive heaters, and a move to higher efficiency LED lighting (half the energy consumption of Compact Fluorescent Lamps (**CFL**)).

53. The Commission has proposed a joint work program with Meridian Energy to consider the impact of heat pumps on demand for energy and peak demand. LED lighting will be investigated using the KEMA model, and in conjunction with the Electricity Efficiency Workstream.

54. It is unlikely that these two pieces of work can be completed in time for the 2008 SOO. However, if material, they could be considered as a variation or sensitivity to the SOO scenarios when applying the GIT to future investment proposals submitted by Transpower.

55. A problem with demand side scenarios is how to incorporate them into the supply side scenarios in an internally consistent way. This is very difficult to do at the moment, as the only connection that could be modelled would be the weak demand elasticity to price. However, price cannot be used as a variable in in a GEM type model (that would make the model non-linear and intractable).

56. Technically, it may be possible to run some sort of partial equilibrium model, such as the MED's SADEM, to understand how future econometric drivers may affect demand. However, on the whole, the Commission is of the view that the increase in complexity of modelling to create internally consistent demand and supply side scenarios is not, on balance, worthwhile, given the other manifest uncertainties over the next thirty years.

57. By keeping demand and supply side scenarios separate, each piece of analysis is feasible, relatively transparent and repeatable. Given the low elasticity of demand, any internal inconsistency is likely to small. Thus five demand-side scenarios could be combined with five supply-side scenarios to give twenty five combinations.

58. This large number of combinations, if published as SOO scenarios, would not be practicable, and would place a significant burden on Transpower when applying the GIT to investment proposals. It is suggested instead that demand side scenarios are treated as sensitivities to the SOO scenarios.

59. As the Commission completes work on demand side scenarios, they are published in subsequent SOOs and whether published in the SOO or not, provided to Transpower to use in the sensitivity analysis when applying the GIT to investment proposals. Some demand scenarios may be 'mainstreamed' into the core SOO scenarios, as is proposed for the aluminium smelter decommissioning, and electric vehicle modelling.

Demand forecast

60. There was limited feedback on the demand forecasts. Two submitters expressed concern at the North Island/ South Island demand growth balance published in previously released versions of the demand forecasts. Most comments were seeking clarification of the assumptions and methodology used for forecasting. There were also a number of comments suggesting areas of analysis that could be further developed in the future. These are outlined in the attached summary of submissions.

61. The draft forecast review document made note of the potential impact of recent changes in consumption by major loads on the regional forecasts. This was also raised by participants during consultation.

62. In most cases historical changes in consumption by large loads have been relatively minor compared to the existing regional loads. However in the case of the Tiwai Point aluminium smelter, recent expansions have had a significant impact relative to the size of the rest of the load within Otago/Southland. This affects the projected trend used as an input to forecast short-to-medium term growth.

63. It is therefore proposed that the forecast be adjusted to exclude the impact of Tiwai's growth from Otago/Southland's short term forecast in order to ensure consistency with the assumption that Tiwai's future load remains constant.

64. The impact of this change is to reduce Otago/Southland's energy forecast in the short to medium term, while the long term energy forecast remains unchanged. The impact on peak demand is slightly counter-intuitive. While the short to medium term Otago/Southland peak forecast is also reduced, the long term peak forecast increases slightly because of the way that the medium to long term annual growth rates affect the prudent peak forecasts.

65. The regional forecasts are based on an allocation of national demand to regions. The reduction in the short to medium term Otago/Southland energy

forecast results in a small increase in the energy forecast for the other regions. There is also a corresponding impact on regional forecast peak demand.

66. Further discussion and tables showing the impact of the revision can be found in Appendix 1.

SOO timeline

67. The Commission's 07/10 Statement of Intent (**SOI**) has a performance measure to publish the next SOO by the end of June 2008.

68. The Commission, in February 2008, the Commission wrote to the Minister of Energy seeking his endorsement to the next SOO being released by the end of August 2008. In March 2008, the Minister of Energy accepted the revised timeline for publication of the 2008 SOO.

Conclusions

69. The Commission considers that the updated draft 2008 scenarios will represent credible views of the future and will be appropriate for use as GPAs.

70. The intention is for the draft GPAs to be used to complete the PSA and for inclusion in the 2008 SOO.

71. In parallel, the Commission will continue to develop the modelling approach.

Attachments

72. The following items is attached to this paper:

    (a) Appendix 1: Summary of submissions;

Appendix 1 Summary of submissions

Issue	Detailed submitter position	Commission response
High-level issues of principle		
Role of SOO & GPAs		
Genesis: Risk that SOO & GPA process becomes self-fulfilling centrally-planned gen. dev't regime. The Commission should focus on *purpose* of SOO (identifying opportunities) and not get distracted by secondary use (as input to the GIT). Use near-term forecasts based only on *committed* generation projects. GIT input should be based on a range of high-level market development scenarios over longer timeframe.	SOO has a market information function (especially around transmission alternatives), but is also a component part of the transmission investment ex-ante approval regime. The SOO needs to balance these purposes, while avoiding inadvertently crowding out the role of competition in the generation development market. The process risks becoming a contest of world views, played out as a set of arguments regarding cost, quantity and location of exploitable resources. This risk is heightened to the extent that the GPA process focuses on very long timeframes, takes transmission as following generation, and trends towards an increasingly completist approach to modelling. At some point, the SOO could ultimately begin to resemble the core of a centrally-planned generation development regime. To fulfil purpose (identifying opportunities) ... SOO needs to focus on projected regional energy and capacity supply/demand imbalances over the near term. Would require near-term demand forecasting, power systems analysis, and *committed* [generation] projects that would proceed without transmission augmentation, but need *not* require any forecasting of generation or demand-side participation developments.	Rule 9.1.2 of section III of part F of the Rules states: *The purpose of the **statements of opportunities** is to enable identification of potential opportunities for efficient management of the **grid** including investment in upgrades and investment in **transmission alternatives**.* The SOO provides a picture of the expected performance of the grid under a range of credible forecasts and scenarios. The scenarios are based on existing and committed generation, but do not prescribe an intended state of the grid at a future time. Proposals for investment, while developed in light of a SOO and applicable GPAs, are assessed according to the GIT. Although the GIT includes market development scenarios based on SOO scenarios or alternatives agreed by the Commission, it is nonetheless based on the market benefits and costs of proposed investments and alternative projects. The application of the GIT therefore requires market benefits and costs of a proposed investment or alternative project to be compared with market benefits and costs of the base case (the situation without that investment or alternative project). The development of the GPAs and their subsequent application within a SOO and the GIT is prescribed by the Rules. The Commission believes that the approach taken in the draft

Issue	Detailed submitter position	Commission response
High-level issues of principle		
Role of SOO & GPAs		
	Forecasting period would depend on when regional constraints are projected to arise, but could reasonably be limited to <10 years. (Note that NEMMCO use 10 years for its 'supply-demand balance' SOO, and 13 years for its 'annual national transmission statement' SOO. To support TP's GIT analysis, need longer-term high-level market dev't scenarios of <(20-25) . Could include anticipated and modelled [generation] projects, but it is not clear that a sophisticated generation expansion model need be central to the market development scenario work. Because of the secondary place of gen. dev't modelling, and the inherent uncertainties in long-term forecasting, generation expansion analysis should be kept to a generic level as far as possible.	GPAs is consistent with the Rules. There may be scope to publish a document other than a SOO, for the information of participants, which includes scenarios that only contain committed generation and transmission augmentations. The Commission considers that the level of sophistication in the generation expansion modelling is not excessive, but note Genesis's concerns in this regard.
Mighty River: The SOO / GPA process risks promoting the Commission's views on future gen. & Tx development to point where it no longer becomes a genuine process to identify opportunities, but a "Statement of	The Commission appears to have decided that the SOO is more important as a delivery mechanism of their own views, than it is as a document to enable identification of potential opportunities, as highlighted by the Commission's statement: *"In practice, the SOO also has a wider role to play in informing stakeholders about the EC's views of possible future developments in the power system"* E.g. Wairau project is included in all 5 scenarios, and always is 2011. This is the equivalent of stating this project is a certainty, and ... reduce or eliminate need for	See above comments regarding approach taken for a SOO. The intention is that no generation project should be common to all scenarios unless it is expected to be constructed with a high degree of certainty. The Commission agrees that the Wairau

Issue	Detailed submitter position	Commission response
High-level issues of principle		
Role of SOO & GPAs		
Solutions”	further transmission circuits into Christchurch.	project is not certain to proceed by 2011, and has modified the scenarios accordingly.
Only committed gen. projects & transmission upgrades should be included in SOO. This base then assessed against possible states of gen. scenarios.	The Commission should disregard the generation scenarios when identifying “potential opportunities for efficient management of the grid including investment in upgrades and investment in transmission alternatives” [rule 9.1.2 of Rules] instead using base case of committed generation and transmission upgrades. The Commission should take note of all comments through GPA consultation to construct a set of GPAs for evaluating efficient grid investment. Approach taken should be similar to TP Annual Planning Report – i.e. identify a problem (potential transmission issues), then outline possible solutions: different options assessed against full range of generation scenarios.	See above comments regarding approach taken for a SOO.
Transpower: Current SOO modelling approach is too long-term and too specific about particular futures.	Transpower believes that to achieve stated purpose of the SOO “*to enable the identification of potential opportunities for efficient management of the grid*” [Commission’s 2008 GPA consultation material on draft generation scenarios] requires a focus on the shorter term. Overseas SOOs are typically focussed on medium-term identification of looming power system issues for all	See above comments regarding approach for a SOO. The Commission considers thatthe SOO scenarios need to cover the GIT modelling horizon, which may extend beyond 2030.

Issue	Detailed submitter position	Commission response
High-level issues of principle		
Role of SOO & GPAs		
	proponents to address. (E.g. 10 years in Australia, 7 years in GB). They do not generally present a regulator's long-term view of specific transmission and generation investment paths.	
For opportunities identification, modelling should be medium term and cover full range of possible outcomes.	For medium-term identification of opportunities, the 'optimal' scenarios should less far sighted, and be numerous enough to cover *less* likely events *as well as* likely futures. This would provide the best possible range of when, where and how often investments may be needed.	See above comments regarding chosen approach for a SOO.
For GIT, modelling should be based on varying key future drivers	With respect to the use of the SOO as an input to the GIT, the Market Development Scenarios (MDSs) should not include specific generation types, siting and commissioning dates. Rather the MDSs 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.	The Commission plans to publish scenarios as build schedules (lists of projects with commissioning dates). However, this is not restrictive, since Transpower can propose a new set of generation scenarios when applying the GIT. One way to produce these scenarios is to run GEM or a similar model with the same inputs (investment drivers) that were used to produce the SOO scenarios. The Commission will make these inputs and the GEM model available. Hence, it could be said that the drivers of investments are already of primary importance.
Genesis: Process risks parties 'talking up' their prospects to influence GIT process.	Process creates tension between commercial sensitivity, and need to lobby for transmission.	Noted
A structured	Because of RMA processes, all committed and many	The Commission would appreciate any suggestions from Genesis

Issue	Detailed submitter position	Commission response
High-level issues of principle		
Role of SOO & GPAs		
approach to soliciting information is required	'anticipated' projects should be in the public domain → A structure approach to collating information on these projects should be straightforward. Genesis would be happy to engage with the the Commission on how to solicit information on the many other beyond the public-domain projects in a structured way that adds value to the GPA process, but preserves confidentiality.	as to how to obtain the best available information while preserving confidentiality.
Genesis: Overly complex modelling approach risks losing sight of bigger picture	The GPA process and SOO process ends up becoming so caught up in the complexities of modelling, that focus on the purpose of the SOO is lost... which is to identify opportunities.	See above comments regarding chosen approach for a SOO.
Transpower:	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, 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 GIT should be applied.	Noted. This point will be addressed in the 2008 SOO. The timing of transmission economic investments should be based on maximising expected value, using an NPV criterion. Basing project timing on a deterministic analysis using the prudent demand forecast may not lead to a least-cost decision (either because of overly high reliability costs, if the prudent forecast date is too late, or through overly high project costs, if the prudent forecast date is too soon).

Issue	Detailed submitter submission	Commission response
High level issues of principles		
Scenario framework and approach		
Mighty River: Scenarios are manipulated to deliver predetermined outcomes	Scenarios appear to have been fitted and manipulated to sit along a nicely linear spectrum of % renewables outcomes by 2025. Akin to using a 'goal seek' strategy to solve for the set of generation scenarios: completely opposite to what is appropriate. By predetermining the output, the Commission has already to some extent decided what type of outcome it wants evaluated as a scenario in the GPAs. This has no credibility, as to reach outputs, in many cases the Commission has to manipulate the inputs. E.g. Closure of Tiwai smelter is inconsistent with recent Meridian: Rio Tinto contract. Its inclusion in "sustainable path" scenario appear solely to achieve desired 90% renewables target by 2025.	The Commission's process is intended to be input-driven. Input assumptions for each scenario were chosen to map out a reasonable boundary for future events, and internally consistent scenarios were then created. The key drivers that differentiated between scenarios were: - the future price of carbon; - the future status of the Government's renewables preference ('moratorium on baseload thermal generation'); - the price of gas for electricity generation; - the availability of various renewable resources; - the fate of the coal-fired units at Huntly; - the fate of the HVDC link; - the extent of penetration of plug-in electric vehicles; and - the extent of demand-side penetration.
Solution: Move to approach where scenarios are driven by changes in fundamental input drivers	Move to approach where the only changes between scenarios are to the fundamental drivers that would be reason for change within the scenarios. With different fundamental drivers, there would be significant differences in the amount and location of wind, hydro, thermal & geothermal. Consider that the three greatest drivers to generation development are: • ***Access to fuel***, at its most fundamental level. i.e. fossil and renewable (wind, water, geothermal) resource, including ability to consent project • ***Technology cost***. Global supply: demand	In the draft 2008 scenarios, the proportions of renewable generation formed a roughly evenly spaced continuum, but this may not be the case in the final SOO scenarios. Changes to the input assumptions based on submitter feedback will likely lead to a different distribution of renewable percentages. With regard to the Tiwai smelter, the Commission considers that the 90% renewables target *can* potentially be met while the smelter remains in operation. To avoid the implication that the smelter closure is necessary to achieve the target, the Tiwai

Issue	Detailed submitter submission	Commission response
High level issues of principles		
Scenario framework and approach		
	(influencing cost & delivery times), technology development, and NZ$ foreign exchange. • **Carbon cost.** Has huge uncertainties. At least one scenario should eliminate the cost of carbon.	decommissioning will be shifted to a different scenario (probably 'Medium Renewables') in the new set of scenarios.
MEUG: Including scenarios not on the boundary of credible outcomes will skew the SOO. Solution: Construct alternative set of boundary scenarios based on 2 main uncertainties (carbon, NZ thermal)	The purpose of high-level generation scenarios should be to find the boundary or limits of credible scenarios. A scenario where a [change in assumption leads to a] shift in any direction leads to another credible [within-boundary] scenario is not a boundary scenario. Including such a scenario in the suite of scenarios will skew the SOO. Medium Renewables is not on the boundary and therefore is redundant. An alternative set of generation scenarios should be based on 2 main uncertainties: • Extent of global Carbon constraint. Reflected in assumptions regarding carbon prices • NZ's thermal options. Driven by extent of NZ's gas reserves, and carbon capture technology (which will influence coal-fired gen. dev't) DSP is not a generation scenario. It should instead by considered as part of "*a range of credible demand forecasts*" [rule 10.3.1.2 of section III of part F of the Rules]. Likewise uptake of electric vehicles.	Noted that the Medium Renewables scenario in the draft GPAs was essentially 'within the boundary' set by the other scenarios. It does not necessarily follow, however, that its transmission requirements would also be within the boundary of the other scenarios. In any event, the inclusion of the Tiwai smelter decommissioning in this scenario will help to differentiate it from the others. See above comments regarding choice of key drivers. The current intention is to retain the 'Demand Side Participation' scenario and to continue to include high EV uptake in two of the five scenarios.
Transpower: Forecasts appear to have been selected to achieve desired	Scenarios appear to be too focussed on renewables without clear relationships to key drivers. TP does not agree with the defined scenarios being weighted equally, and considers the decision may have	See above comments regarding input-driven nature of scenarios.

Issue	Detailed submitter submission	Commission response
High level issues of principles		
Scenario framework and approach		
endpoints (driven around future renewables %), rather than by varying key future drivers.	been partly due to the need to incorporate variations in key assumptions within a limited number of scenarios (five). TP would like further detail on the Commission's follow-on suggestion that TP could use additional scenarios with lower weighting if TP considered that to be more appropriate. Transpower note that the Market Development Scenarios used in the GIT do not have to be those of the SOO if the Commission Board determines (at the time of applying the GIT) that other scenarios are more appropriate.	The Commission will determine a set of scenario weightings, taking into account feedback from submitters, and publish these in the 2008 SOO. Transpower has the ability under the Rules to propose new scenarios, provided that they propose the same number of scenarios as contained in the relevant SOO. With respect to the use of the SOO scenarios in the application of the GIT, it is the view of the Commission that an 'a priori' scenario approach will not always be the best means of evaluating a transmission investment. The approach taken to the selection of the scenarios in a SOO, and their subsequent application in the GIT, is described in the body of this document.
Wind energy association: Scenario weightings should be consistent with likely future government policy	Both current Government & National party support increased carbon reduction. Accordingly the High Gas Discovery scenario which shows emissions nearly tripling by 2040 appears entirely inconsistent with expected policies, and should be accorded a much lower weighting in its application in the GIT.	See above comments regarding scenario weightings.
Transpower: Only one scenario meets current policy objectives	With respect to % of renewables and CO2 emissions, only the Sustainable scenario meets current policy objectives. Transpower is of the view that [this] NZES scenario be given a higher weighting, even with Tiwai still in operation.	See above comments regarding scenario weightings.

Issue	Detailed submitter submission	Commission response
High level issues of principles		
Co-optimisation of generation and transmission		
Mighty River: Co-optimisation of generation and Transmission is a fundamental change that risks increased central planning outcomes Solution: Consultation	The Commission's stated intention of developing a method of co-optimisation of generation and transmission that will be used for the SOO scenarios is a material change to the underlying process of scenario creation, and conflicts with an earlier statement made in same consultation document that "[GEM] is not intended to be used as a tool to centrally plan the electricity system. Such a change should not be undertaken without a full period of consultation.	Modelling techniques to co-optimise transmission with generation are still under development. It is not yet clear whether this will be included in the 2008 SOO. The use of co-optimisation is targeted at producing scenarios which are internally consistent, and which take connection costs into account when ranking generation projects. There is no intention that GEM be used as a tool to centrally plan the electricity system.

Issue	Detailed submitter submission	Commission response
High level issues of principles		
GPA consultation process & link with other Commission's workstreams		
Meridian: Too many planning consultations at once	Multiple sets of planning assumptions all being worked on in parallel (HVDC GUP; Tx to enable renewables (TTER); information for 2008 SOO; and Grid Planning Assumptions(GPAs)) [Meridian does] not have the resources to effectively participate in all these processes. It is focussed on HVDC and TTER...[therefore] will not be making substantive comments on this [GPAs] consultation	Unavoidably, the generation scenarios used in in-progress GUPs will not always be the same as those under consideration for the 2008 SOO. Redoing the HVDC GUP or TTER work with the 2008 draft GPA assumptions, or vice versa, would cause delays which could slow grid development.
Meridian: Inconsistencies in scenarios between work streams	Disappointed that the Commission is using different generation scenarios in the above work streams. The Commission should use a common set of Generation scenarios in all its work...in particular, the scenarios developed by Transpower. A more integrated approach should be undertaken to consulting on this work. It is disappointing that the information provided in the TTER process have not been incorporated into this [GPA] work"	To the extent possible, the Commission is ensuring that the data are consistent between all processes, although notes that where data is updated for once process, it will not necessarily retrospectively update data for a process that has largely completed. Some outputs from the TTER process have already been incorporated into the draft scenarios, or will be incorporated into the next set of scenarios. Others are not considered suitably rigorous for inclusion in the GPAs process at this stage (given that they have not been consulted on).
Genesis: GPA work should be 'joined up' with other Commission's work	Work on economics of peaking plant should be incorporated within GPA processes and integrated with work on: wind integration, the 90% renewables target in the NZES, and the market design review project. Market development scenarios should reflect the outcomes of the Commission analysis in these areas, but not drive it.	The Commission intends that these workstreams be integrated as much as is practicable and appropriate.
Wind Energy Association:	To-date Transmission to Enable Renewables (TTER) process has only presented preliminary information.	See comments on use of TTER data above.

Issue	Detailed submitter submission	Commission response
High level issues of principles		
GPA consultation process & link with other Commission's workstreams		
Need co-ordination with TTER process	Accordingly, input from the TTER process should be reviewed by industry before inclusion in SOO The anticipated further modelling w.r.t. co-optimisation of generation and transmission should also be linked to the TTER process.	
Meridian: Process prejudges HVDC GUP statutory processes	Concerned that in each of Commission's scenarios it assumes the HVDC upgrade has been approved and is operational 2012 Concerned this prejudges outcome of statutory processes that require Transpower to consult.	The GPA process does not impact on the HVDC GUP process.
Meridian: Concerned Board may not accept information from generators without verification	Information from generators is the most accurate and meaningful data available In fact, under rule 3.2, section 3, Part F, generators are required to provide accurate information to the Commission.	Noted.
MEUG: Disappointed SOO delayed due external political driver (NZES)	Delaying SOO pending finalisation of NZES is disappointing. Political views and targets will always be changing. Delaying publication of SOO each time there is a political change will undermine the value of the SOO as being up-to-date and politically independent view of credible futures. A rule change should be introduced to specify a pre-defined SOO timetable (e.g. every 2 years).	The Commission intends to define a regular two yearly SOO publication cycle in the GUIRP to ensure effective coordination with Transpower's grid planning processes.
Transpower: Independent auditing of the models is required	Because the models used to derive the GPAs are effectively software, some evidence of independent testing and review is required to give a degree of comfort. User guides and manuals would also be helpful.	The Commission is seeking to develop more information to facilitate stakeholders' understanding along these lines. Independent testing and review has been undertaken and is anticipated from time to time in future.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Scenario composition		
Meridian: HVDC upgrade may be delayed or even not go ahead	At least one scenario should consider the HVDC upgrade not going ahead, and another where the HVDC is delayed until 2014.	The draft scenarios for consultation assumed that an HVDC upgrade to 1200 MW of northward capacity would occur in 2012, followed by a further upgrade to 1400 MW in 2018. The Commission notes Meridian's suggestion that different assumptions could be made here. However, without prejudice to the decision making of the Board on Transpower's HVDC investment proposal, it is planned that this assumption be retained for the time being.
Contact: Sensitivities around HVDC pole 1 need to be considered	There needs to be further analysis around the requirements for Pole 1 with the different scenarios as it is unlikely that a Pole 1 replacement would be required in the next 10 years given the forecast load growth in the SI apart from an unlikely SI lead hydro and wind generation development scenario	See above comments.
Meridian: The impact of altering HVDC pricing on SI generators should be considered	If HVDC pricing is changed such that SI generators do not carry the full burden of HVDC charges ... will provide a strong incentive for additional renewable development in the SI. The Commission should consider this scenario.	The Commission has chosen not to consider this scenario in the GPAs as it regards transmission pricing as settled at this stage.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Scenario composition		
Contact: A NI led renewable scenario with delayed HVDC Pole 1 should be considered	Extensive NI wind and geothermal developments is more likely in the medium term as they have lower relative LRMC than SI renewables. This scenario will have a follow-on benefit of delaying need for HVDC Pole 1 replacement.	Agree that extensive NI renewables development is likely. All the draft scenarios include at least some NI wind and geothermal developments, and the majority of scenarios include a very significant amount of new geothermal development in the 2010s.

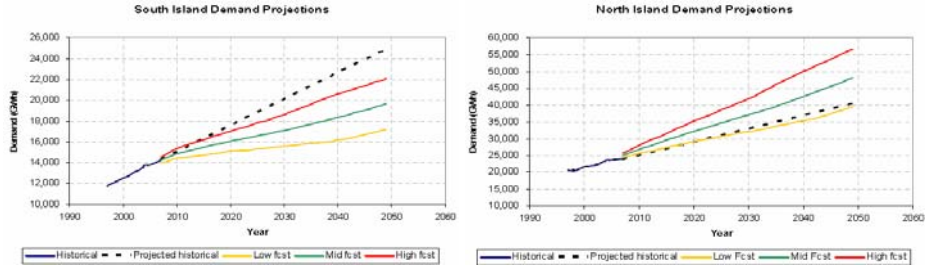
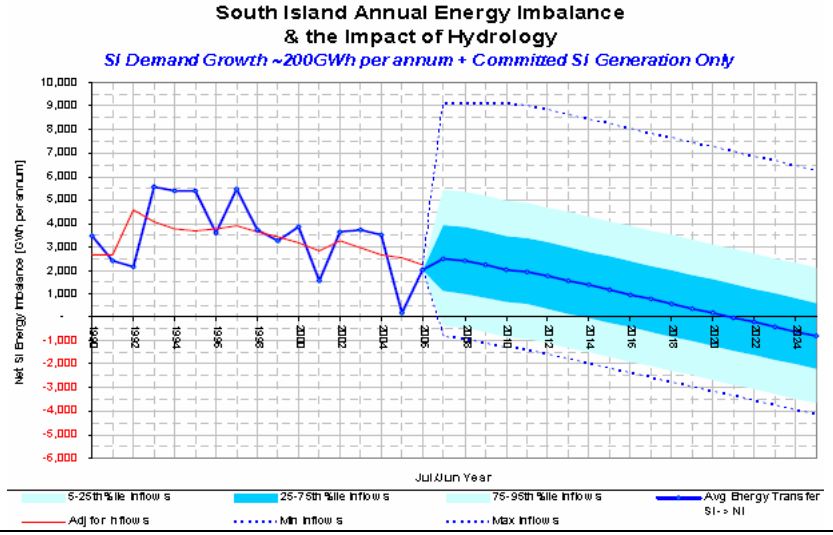
Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Scenario composition		
Transpower: Only one pre-2012 HVDC assumption should be used	Table 2 of the consultation indicates a range of possible existing HVDC Pole 1 fates has been used. Given that the issue has now been clarified, only the "Half pole on standby until replacement in 2012" fate should be used. 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 GPAs.	The future of Pole 1 of the Benmore-Haywards HVDC link is an important parameter in the scenarios. It affects the balance of new build generation between the North and South Islands. Transpower has recently advised that it intends to keep half Pole 1 in standby operation until 2012 (which will require Transpower to resolve outstanding insurance issues). The Commission suggests, as previously, that three out of five of the scenarios should follow this course. Of the remaining two, one should assume that the half Pole returns to full operation, and the other should assume that the half Pole is decommissioned entirely in the near future. On balance, this set of assumptions is consistent with Transpower's position, but it allows for the possibility that new information about the serviceability of the Pole 1 equipment may become available in future.

<table>
<tr><th>Issue</th><th>Detailed submitter position</th><th>Commission response</th></tr>
<tr><td colspan="3">Detailed commentary on modelling approach and input assumptions</td></tr>
<tr><td>Scenario composition</td><td></td><td></td></tr>
<tr><td>Genesis: Scenario weighting for wind is overally optimistic – especially relative to geothermal</td><td>As shown in the table below, the number of scenarios in which a particular future pattern of renewable development is included gives it effective weighting (given that all are weighted equally).
<table>
<tr><td>Amount of dev't</td><td>Wind</td><td>Geothermal</td><td>Hydro</td></tr>
<tr><td>'Extensive'</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td>'Moderate'</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td>'Limited'</td><td>-</td><td>-</td><td>1</td></tr>
</table>
Wind is overly optimistic because of: price escalation in the turbine market, the poor economics of standalone wind farms (versus hydro-wind portfolio developments), RMA issues, cost of connection, and the costs that wind potentially loads onto other parts of the market (reserves, frequency, voltage etc.)
A stronger weighting should be given to NI baseload geothermal.</td><td>Some clarification is needed about the treatment of available renewable generation. In four out of five scenarios, a large amount of wind generation is considered to be available (consentable, etc) – but it may not be economic. Cost factors lead to two of these scenarios having relatively little wind development before 2020.
By contrast, two out of five scenarios limit the amount of geothermal generation available to some extent, modelling resource consent or exploration issues – but even in these scenarios, the total capacity of geothermal generation (existing and new) is nearly 1000 MW by 2020. In the other three scenarios, there is 1000 MW of geothermal generation as soon as 2016-2018, and the final figure is as high as 1500 MW by 2025-2030.
The weighting given to NI baseload geothermal, therefore, is already relatively high.</td></tr>
</table>

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Scenario composition		
Meridian, Contact & Mighty River: Tiwai closure is not realistic	Tiwai closure is inconsistent with recent Meridian: Rio Tinto contract renewal. Tiwai closure should not be considered until information gained after contract is next renewed (2017).	Disagree. The Commission considers that the smelter could still potentially close before 2030 if this was economic – which would depend on aluminium prices, imported bauxite prices, and prices in other electricity markets. This outcome would have a major impact on the New Zealand transmission system and should be modelled in at least one scenario.
Meridian: Impact of GEM peak capacity constraint	One specific GEM scenario (preferably the 90% renewables) should be run with the capacity constraint removed... and allow GEM to schedule generation priced at a VoLL of $3,000/MWh.	Noted. The Commission will aim to carry out this work when time permits.
Contact: Carbon sensitivity needs developing	A +/- $10 CO2 cost band for each scenario should be produced so that sensitivity can be gauged.	Noted. The Commission will aim to carry out this work when time permits.
Mighty River: Need to consider carbon charge being eliminated	Considering that the New Zealand energy industry has never actually had a carbon charge, and still does not have an enforced charge, it seems aggressive to assume that all future scenarios have such a charge. At least one scenario should eliminate carbon charging.	Disagree. Using a lower carbon price, or no cost of carbon at all, would not be consistent with Government policy.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Scenario composition		
MEUG, NZWEA, Transpower & Molly Melhuish: Upper carbon charge limit is too low	At the 11 March 2008 petroleum conference, the Minister of Energy presented a slide illustrating predictions from $30 up to US$80/tonne in 2030. Thus NZ$50/t CO2-e is too low. MM suggests modelling a $100/t price in the Sustainable Path scenario, with Huntly retained as dry-year reserve fuelled by biomass.	Noted. It is possible that the top end of the range ($50/t) may be too low. If the carbon price was high enough, then it would become uneconomic to keep existing thermal plant in service or even to build new peaking thermal plant. Instead New Zealand could develop demand-side response, peaking renewable generation and/or overbuild of baseload renewables. The Commission acknowledges that this scenario is plausible, but is reluctant to attempt to model it at this stage, because it differs so greatly from experience to date. It would be better to carry out more development work first (e.g. on the economics of peaking renewable generation). The possibility of fuelling Huntly with biomass would need further investigation. Any comment from Genesis Energy on this issue would be welcomed.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Scenario composition		
Mighty River: Increased gas price *and* carbon charge is unlikely	Because NZ has a finite quantity of gas (its reserves), an increase in the cost of carbon will result in demand for gas as a fuel to drop, yet supply will remain unchanged. Therefore the price of gas will have to drop to the point it is again desirable to maintain equilibrium.	There are various dynamics interrelating the price of gas and the price of carbon. For instance, a higher carbon price would reduce the demand for gas and hence the incentive for gas exploration, thus potentially increasing gas prices. A combination of high gas prices and high carbon charges therefore seems possible.
NZWEA: Gas prices too low	Consultation suggests gas prices (excluding carbon charge and transport North of Huntly) of around $5.50 - $5.75 / GJ today rising to $6.50/GJ in 2010 and between $8.00 - $13.00/GJ depending on scenario by 2025. This compares with Contact's recent forecast of $8.75 delivered gas prices by 2010/11.	The Contact price forecast to 2010/2011 is of interest, but would need to be independently verified before it could be used in the GPAs. In any case, the Commission expects that the sensitivity of the scenarios to the assumed gas price around 2010 is not high. Prices from 2015 on are probably more critical.
Genesis: Thermal moratorium needs modelling consistently	Modelling the thermal moratorium extending beyond 2018 in two of the five scenarios effectively model a change in government policy. If such scenarios are considered, then it is equally plausible to include a scenario where the moratorium does not exist (or is removed prematurely).	The next set of scenarios will not model the extension of the moratorium beyond 2018 in the South Island Surplus scenario (though it will still be included in Sustainable Path, where it could be thought of as either a Government policy or a societal preference). There is currently no plan to include a scenario where the moratorium does not exist.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Demand forecasting		
Meridian: South Island demand growth forecasts are much too low (and North Island too high), resulting in • much higher South → North HVDC transfers than would likely occur; and • over-valuation of the HVDC upgrade The Commission is relying too heavily on population growth being the main driver of demand growth rather than increased industrial activity	Meridian notes that the Commission's GPA assumptions are similar to Transpower's for the HVDC GUP (although not underestimating SI demand growth to the extent that Transpower has). They attach a letter they sent to Transpower highlighting that Transpower's growth projections are inconsistent with the historic 10 yr average:  This is resulting in projected South → North transfers that are inconsistent with, and much greater than, the long-term trend: 	The issue of the balance of growth between the North Island and South Island has been largely addressed through the revision of the approach used to transition between the short term regional trends and the long term driver driven forecasts. The Commission believes that population and GDP are valid indicators for long term forecast growth within each region, but acknowledges that there are industry driven changes in demand that should be considered in the short to medium term. The regional forecasting methodology is designed to balance both. Observation of historical South Island growth should also consider the impact of recent growth in consumption at the Tiwai aluminium smelter given the forecast assumption that there will be no further growth in Tiwai load in the future.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Demand forecasting		
	This systematic demand forecast bias will ... over inflate the HVDC GIT valuation. The SI demand forecast is too low because of relying too heavily on population growth rather than looking at the cause of recent strong SI demand growth much of it driven by increased industrial activity rather than population growth.	
MEUG: Peak demand forecast should take account of new TPM	The introduction of regional coincident peak pricing creates strong commercial incentives on TOU consumers to respond. Accordingly forecast regional peak demand forecasts need to be dampened.	The potential impact on peak is acknowledged but needs to be considered in light of other drivers of change in peak behaviour. Further investigation on the response of peaks to various drivers is planned.
Vector: Explicit MW capacity forecasting should be developed rather than be derived from GWh energy forecasts	The current approach is to forecast energy (GWh) from which capacity MW forecasts are then derived. However GWh energy use has less relevance to development of Tx & Dx assets which are driven by peak MW demand. Forecasts should therefore by primarily based on peak demand.	For long term forecasting, Gwh growth is considered to be a conservative indicator of long term peak growth (i.e. produce forecasts that err on the high side) when considering demand at a regional level. Generally peak grows more slowly than total energy demand as the underlying load becomes more diversified. This may not hold for smaller areas due to the greater relative impact of new loads, or over the short term due to the impact of technology changes (heat pumps, air conditioning). The risk of higher short term peak growth is considered as part of the prudent peak forecasting process.
Vector: GDP & population growth are overly	GDP and population are overly simplistic and are effectively independent with energy demand. The most appropriate drivers to consider are demand elasticity, relative cost of energy types to consumers (driven by technological	The Commission believes that population and GDP are valid indicators for long term forecast growth within each region, but

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Demand forecasting		
simplistic drivers of future demand growth	development, costs of generation etc.), and consumers' ability to pay (driven by disposable income). E.g. assumptions about carbon prices could deliver significant switches in consumption behaviour that would not register via macro GDP or population measures.	acknowledges that there are short-term industry driven changes in demand that should be considered in the short to medium term. The approach used for long term forecasting also needs to consider the availability of indicators that themselves can be forecast with some degree of structure. Disposable income (GDP per person) and electricity prices are currently considered as part of the national modelling.
Transpower: Disagreement with aspects of prudent and expected peak demand forecast methodology	Earlier critical comments on aspects of the prudent and expected peak demand forecast methodology are reiterated.	The Commission acknowledges Transpower's comments and note that Transpower holds different views on some points. The Commission does not consider that these disputed points have major impacts on the forecast.
Transpower: Use of load probability curves should be considered more carefully before their use in the GIT	While LPCs have an advantage in reflecting a variety of demand forecasts, they have a disadvantage in that no high/low demand sensitivity analysis can be undertaken. If the Commission intends that LPCs are used in applying the GIT, this should be dealt with as a separate consultation.	Noted. In the 2008 SOO, the LPC forecasts will be provided on a 'for information only' basis. It may sometimes be appropriate for them to be used in the GIT; the 2008 SOO will provide some guidance on when this could be the case. The Commission notes Transpower's comments about sensitivity analysis. Probably the best way to carry out high/low

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Demand forecasting		
		demand sensitivity analysis is to use high- and low-growth load duration curve (LDC) projections rather than LPCs. The Commission can readily produce these LDC projections if they are required.
Vector: Probability of exceedence (PoE) is too low	Vector agrees with a planning for prudent peak approach, but believes that exceeding the prudent forecast on year in ten (PoE = 10%) is not appropriate. A PoE of 5% or lower is what the consumer expects.	Noted
Vector: Treatment of historic load step changes needs to be consistent with forecasts	Forecasting based on historic datasets will already include an element of historic load step changes, which will be reflected in the inter-year statistical variance. Any adjustment to a forecast needs to ensure that this will not be inconsistent with the inherent statistical variances of the dataset.	The methodology has been adjusted to exclude significant changes in recent growth associated with large loads. Currently this is limited to the Tiwai smelter.
Genesis: One-off demand increments	Genesis supports the approach of treating one-off demand increments as permanent offsets at a regional level.	The additional of significant new loads is currently treated as a permanent offset. Higher regional growth associated with short to medium term industry driven intensification is not treated as having a permanent impact relative to long term GDP and population driven growth.
Genesis: Electric vehicles assumptions too optimistic	Assumptions around electric vehicle uptake in the DSP and Sustainable scenarios are exceedingly optimistic.	Noted. The Commission is currently reviewing the assumptions about electric vehicle uptake, and may use lower EV demand projections in the 2008 SOO.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Demand forecasting		
Transpower: Welcomes inclusion of electric vehicles, but expects further analysis of their peak impact		Noted
Molly Melhuish: Moves to domestic heat pumps not properly considered	Recent BRANZ survey found that moving from wood burning to heat pumps increased GWh energy demand by 6% and peak MW electricity demands by 65%. However, concerned that the scenarios don't properly accommodate the consequences of sudden and widespread uptake of heat pumps. The Demand-side scenario should model better uptake of modern wood burners driven by advanced metering highlighting their relative benefits to heat pumps in relation to costs on the system.	The potential impact on peak is acknowledged but needs to be considered in light of other drivers of change in peak behaviour. Further investigation on the response of peaks to heat pump demand is planned.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Generation assumptions		
Meridian: Renewable LRMCs are too high	Table 5 suggests best NI & SI resources have LRMC of $80-85/MWh and $85-90/MWh, respectively. Meridian's present models for Mill Creek (NI) and Hayes stage I (SI) suggest <$80/MWh for both	The Commission notes Meridian's position that low-cost wind generation is available. As a point of procedure, the Commission would prefer that feedback on generation costs not be provided in LRMC terms. As noted in the consultation document: "Differences in assumed project life, depreciation rate, treatment of tax, discount rate, load factor and/or types of cost considered can make a very substantial difference to calculated LRMCs (easily $20/MWh or more)." It is more useful for costs to be expressed in terms of basic components.
Contact : Potential for NI geothermal is understated	In Table 5, NI geothermal generation should have a lower LRMC than other renewables, and the MW capacity could be somewhat greater than the 250 – 350 MW assumed for Best resources and the ≈400 MW for Next resources. E.g. Contact alone has 470MW od new geothermal generation in advanced stages of development. The NZES graph showing LRMCs for new build gen supports this view.	Noted. Even in the two draft scenarios where geothermal development is constrained, the total capacity of geothermal generation (existing and new) is nearly 1000 MW by 2020. In the other three scenarios, there is 1000 MW of geothermal generation as soon as 2016-2018, and the final figure is as high as 1500 MW by 2025-2030. The weighting given to NI baseload geothermal, therefore, is already relatively high.

Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Generation assumptions		
Meridian: Other assumptions	The Pukaki & Te Anau control gate retrofits are not occurring relatively soon (as modelled). They should be pushed out to 2020. Dependent on TTER project and Environment Court, Meridian may commit to all Hayes windfarm turbine positions, delivering full power output (up to 630MW) by 2013.	Noted, will remove these projects from the scenarios. The Commission will treat Project Hayes as committed in generation scenarios when Meridian has committed it.
Vector: Modelled CCGT load factor too low	Applying load factors of only 50% and 70% is well below the typical plant availability of 90-95%, and potentially misrepresents CCGTs in LRMC analysis.	Agree. This change will be made in the 2008 SOO document.
Mighty River: Cost of diesel is too low	GPA's assume a delivered price of $25/GJ, c.f. recent Whirinaki derived cost of $33/GJ. This is main reason why no generator would make such an investment decision. Also note that diesel is only fuel directly linked to the world price, and that long run oil prices are only going to trend upwards.	See discussion of oil prices following numbered bullet point 28.
NZWEA: Too much diesel generation forecast, and not enough DSM	Diesel is shown to have a higher LRMC than gas peakers. Therefore surprising that so much diesel is forecast to be built (between 600-1,200 MW by 2025) relative to gas peakers. Further, despite such large quantities of MW being built, their GWh energy contribution is forecast to be negligible. Difficult to reconcile such outcomes. The price at which demand-side response would be undertaken does not appear to be stated, but it might be expected to be less than the $500-600/MWh required to justify such peaking investments.	Noted. This point is being addressed by the Commission. It is expected that the next set of scenarios will include more use of gas and less use of diesel in peaking generation, and a higher GWh energy contribution from peakers. All scenarios already include some demand-side response, though the likely cost and extent of demand-side participation is still uncertain.
Molly Melhuish: Diesel builds don't take into account credible peak oil scenarios	LRMCs for diesels don't take account of any peak oil scenarios. A peak oil scenario would drive far greater demand-side participation than appears to be presented in the 'demand side' scenario. MM suggests that early and high peak oil prices be written into this scenario.	The price paths used for oil and LNG are based on advice from the Ministry of Economic Development. MED recommends keeping the current assumptions as a base case, but have suggested that the

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Issue	Detailed submitter position	Commission response
Detailed commentary on modelling approach and input assumptions		
Generation assumptions		
		Commission may wish to consider a higher oil price path as a sensitivity. The Commission will model the effects of higher oil prices (up to $35/GJ) in at least one of the SOO scenarios.
NZWEA: Inconsistent scenario outcomes	A number of apparent inconsistencies between scenarios make it difficult to understand the main drivers that are dictating the generation build schedules. E.g.: • Project Hayes makes it into the SI Surplus scenario but not the Sustainable scenario • Trustpower's Mahinerangi project is built in 2013 in SI Surplus, but not till 2037 in the Sustainable Scenario	To some extent this is due to the GEM feature of between-scenario variation in project costs, which will be described in more detail in the 2008 SOO. It is actively desirable that scenarios should vary in terms of what projects are built and when – this 'spatial diversity' helps to represent the uncertainties faced when making transmission decisions.
NZWEA: Data errors	High Gas Discovery scenario does not have Te Rere Hau wind farm despite this project already being under construction. Para 42 & Table 2 state opposite outcomes in terms of whether in period to 2012 HVDC remains as monopole or return to full service.	Noted, will be addressed
Transpower: CCGTs with CCS	CCGT generators with CCS should be included among the modelled projects.	Noted, will be addressed