# Transmission 2040
## (Grid Development Strategy)

# Feedback from Stakeholder Workshops held in November 2008

**Auckland – 3 November**
**Wellington – 5 November**
**Christchurch – 6 November**

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# 1. Introduction

Transpower held a series of stakeholder workshops in Auckland (3 November 2008), Wellington (5 November 2008) and Christchurch (6 November 2008) to obtain stakeholder input into key assumptions for the Transmission 2040 project.

This document summarises the feedback received from those workshops. For some work packages, participants were split into focus groups to discuss the work packages. Notes taken at these workshops are provided in the appendices.

The introduction, keynote speeches and presentations[1] are available on the "Work Package Documents" link at http://www.gridnewzealand.co.nz/grid-development-strategy.

# 2. Scenarios (Work Package 1)

The scenario work package was discussed during the morning session of the workshops. Firstly, an overview presentation of the draft scenarios that had been developed was given followed by two or three presentations by external parties who had reviewed the work. This was followed by some general discussion.

The consultation document, the scenario overview presentation and most of the presentations given by the reviewers are available by clicking on the "Work Package Documents" link on Transpower's website: http://www.gridnewzealand.co.nz/grid-development-strategy

A summary of the points raised by the reviews and details on the following discussion can be found in Appendix A. The main points are listed in the following sections.

## 2.1 Scenario purpose and design

Most feedback supported the scenario dimensions, but there were some adjustments suggested:

- It should be clarified whether electricity demand referred to energy demand or peak demand. If energy demand, Transpower could consider using peak demand instead or adding peak demand as a third dimension.
- One participant suggested using dimensions that Transpower couldn't control such as climate change – which would be a true external event.

The four scenario stories that had been developed were discussed. Some potential inconsistencies were identified and alternative stories and/or scenario names suggested.

## 2.2 General assumptions

It was pointed out that the consultation report missed important information about the future market and regulatory settings including the nature of the Transmission Pricing Methodology. These aspects are considered part of Work Package 9. An updated list of those assumptions based on feedback at the workshops can be found in section 3 and Appendix C of this document. The final scenarios will be based on those assumptions and the accompanying report will include an overview of them.

[1] Where similar presentations were presented at all three workshops, the latest (Christchurch) version is available on the web site.

## 2.3 Demand

Several participants pointed out that peak and energy growth rates were likely to differ in the future. Transpower accepts this is likely to be the case and will analyse this further.

Demand Side Participation (DSP) is likely to play a larger role in the future and more work will be done in assessing the impacts. This is one of the aspects that can lead to lower peak demand growth compared to energy growth.

Demand levels were only presented at a national level. Regional trends may differ, also between scenarios. Also, many participants were better able to comment on regional growth rates than national growth rates.

Further to this, several participants suggested a bottom-up approach for the demand forecast, starting at a regional level rather than (or in addition to) the top-down approach currently used.

The potential for direct use of gas or bio-fuels for heating (process or space heating) was pointed out.

The report did not state whether one global carbon price was assumed. This assumption is important to assess whether there will be a relocation of industry between countries, which could affect demand significantly.

## 2.4 Supply

Several participants pointed out that distributed (or embedded) generation could be significantly more important in the future. Some participants indicated the preference for assessing this distributed generation using a bottom-up approach.

There were also some warnings for Transpower not to rely on distributed generation happening.

More focus on biomass as a fuel option for electricity generation was suggested.

It was pointed out that technological development may differ between scenarios, e.g. as innovation would differ as GDP assumption differed.

Exchange rate may differ between scenarios resulting in different capital costs of new generation (assuming most of the costs are related to imported parts).

## 2.5 Quantification

The importance of including a demand/supply feedback loop during the quantification was pointed out.

The use of the Electricity Commission regional GEM model with co-optimisation of transmission and generation was suggested.

# 3. Planning Assumptions (Work Packages 2, 7 and 9)

## 3.1 Security, Reliability, Capacity

Participants agreed that it is important to have a secure electricity supply. Some participants noted that they did not want “just in time” investment and that grid capacity should be developed four to five years ahead of the need date. The grid should also be designed with the capability to increase its capacity as required, for example, by staging investments.

Participants generally accepted that using an n-1 security criterion would be an appropriate first cut, considering the long planning period. Security levels can then be adjusted where appropriate to provide a final solution. Some participants noted that their existing end customers already require security levels greater than n-1 and were against applying n-1 across the board.

Transpower needs to select an appropriate security criteria mix to provide the right level of investment in the grid (i.e. not over-investment).

Participants agreed that the grid should be designed with sufficient capacity to allow equipment to be taken out of service for regular maintenance. Loading on the transmission grid is increasing to the extent that there are only limited "windows" of time where equipment can be taken out of service for maintenance. In some parts of the network, these are getting shorter and may be limited to specific times of the year or day. Participants discussed the risks of not being able to carry out maintenance or having to restrict maintenance to very short windows of time.

Transpower was requested to clarify what it means by "non-distortionary" transmission pricing.

## 3.2 Definition of 'the grid"

Participants agreed that the Transmission 2040 project should assess the interconnected grid as defined by the System Operator. Transmission 2040 does not consider Grid Exit Points and spur lines issues in detail – this was a concern to participants as they felt the complete grid should be included. Local issues will be covered in detail in the "Annual Planning Report".

Participants also noted that there may be some merit in including generation spur lines in the scope of the Transmission 2040 project to facilitate integration of the Transpower's grid development strategy with its customers.

## 3.3 Planning guidelines

### 3.3.1 Asset ratings

Participants agreed with the use of existing asset rating assumptions.

Participants generally noted that within the 40 year planning period, there will be a move away from the traditional summer/winter ratings. A number of participants were of the opinion that full dynamic line ratings will be implemented within that time frame.

## 3.4 Long list of options

Participants generally agreed that pre-event load management requests or use of special protection schemes for enhancing transmission capacity are only short-term fixes.

Participants generally agreed with Transpower's generic long list of options with the inclusion of the following:

- Reconductoring existing transmission lines with higher temperature conductor

## 3.5 Option Short Listing Criteria

The option short-listing criteria were not discussed in any detail at these workshops as participants focussed their comments on the main inputs to the planning process. Participants requested that Transpower make the short listing criteria transparent.

Some participants noted that in designing the future transmission grid, it should:

- be developed to support future growth of New Zealand, both economically and socially; and
- recognise that some trade-offs must be made between price and reliability/quality.

## 3.6 Property, Easements, Designations, RMA

Participants requested Transpower to include a new issue in the draft consultation document for work package 9 as follows:

| Issue | Discussion | Assumption |
|---|---|---|
| Transmission Corridors | Long lead time and being able to implement quickly | Routes have been designated and planned to facilitate timely investments. |

Some participants noted that for property, the assumption should be changed to include requiring property rights for transmission line upgrades in addition to building new transmission lines.

Participants expressed an interest in seeing more coordination between Transpower and other infrastructure development. Some participants suggested Transpower consider building future transmission lines along roads as doing so would not require easements.

Some participants requested Transpower also consider undergrounding transmission lines in areas of national significance.

Some participants requested Transpower define liability issues in relation to Transpower assets on private land and remove the potential liability of landowners of up to $20m.

It was suggested that Transpower indicate its intentions regarding designation of transmission line routes

# 4. Asset Performance (Work Package 3)

## 4.1 Outcomes from Consultation

The discussions raised a number of valuable and interesting issues which Transpower will follow up. However, the consultation did not provide specific targets or levels of service that would be appropriate for Transpower to implement.

In general, the participants agreed that the electricity system would face increasing reliability expectations from end consumers. A further theme was that end consumers in general, and major industrial consumers in particular, were placing increasing importance on quality of supply, i.e. momentary interruptions, voltage dips and spikes, voltage imbalance, harmonics, etc.

In addition, there was a general recognition that there is also an economic element to this and some trade-offs must be made between price and reliability/quality. In essence, there is no simple answer to the questions raised around asset and system performance; a number of factors, including customer expectations, security of supply and cost, must be considered.

A number of participants expressed an interest in gaining more insight into issues around emergency preparedness / response to events, risk management and security of supply, as well as analysis and monitoring undertaken by Transpower to manage its assets.

Overall, participants seemed satisfied with the current design standards around return periods for extreme events such as localised floods, earthquakes and similar natural disasters.

### 4.2 Future Development

Transpower advised that it will continue the current work plan to fully understand the factors impacting historic asset and system performance, and from this, develop expected reliability performance for the future grid. The existing performance measures will continue to be calculated and reported. However, Transpower will work with stakeholders to develop new performance measures (particularly in the areas of security and quality), and improve communications around emergency preparedness and risk management.

## 5. Technology (Work Package 6)

### 5.1 Information Co-ordination with customers

Participants generally agreed that there needs to be improved co-ordination and information sharing between Transpower and its customers. Developments in technology will facilitate better co-ordination between companies. This will enable:

- better co-ordination of strategic development plans;
- improved outage planning information;
- integration of protection and control functions between organisations
- roll out of demand side management to smaller customers.

Transpower noted that to enable this to happen, organisations need to move towards investing in similar technology and implementing common standards and protocols, or implement a common interface between different technologies. Participants also agreed that this requires a strong communication backbone.

### 5.2 Sharing information

Participants considered that in the future, technology developments would enable Transpower to provide/share more timely information to its customers such as:

- power quality;
- elements of the grid that are potentially at risk; and
- information on outages, restoration times and causes.

This would require some form of security protocol to control the information exchange.

Currently it can take several months and thousands of dollars to gain access to a few real-time grid measurements. Scaling to enable information driven Smart Grid initiatives - particularly those involving the demand side, will require lower cost solutions.

## 6. General

### 6.1 Consultation

Participants expected that all affected parties will be engaged early for any planned generation and grid investment. They also expected to review any preferred solution prior to commitment.

## 6.2 Resources, Staffing, Skills

Participants were generally concerned about retaining appropriate resources and skills going forward. Skilled resources are scarce due to an ageing workforce, which is compounded by emigration of skilled resources due to better employment prospects overseas.

Participants also acknowledged that there will be a need for resources to develop new skills to adapt to changing technology. Options going forward could include:

- developing and implementing industry standards via an industry led body (such as EEA); and
- organisations implementing appropriate training and/or partnership schemes.

## 6.3 Other

Participants noted that the current moratorium on thermal base load generation may dictate what and where investments are made.

# Appendix A Scenarios

## A.1 Points raised by reviewers during the workshops

### Auckland

**Vector – by Peter Yeung:**

- General agreed with approach and design
- Not seen regional demand and generation - only NZ to date.
- Suggested a bottom up approach for demand rather than top-down
- Look at energy vs. peak load growth
- Assumption about peak vs. energy growth an issue
- Demand side missing – distributed generation and load shaping chapters
- Other considerations: transmission pricing, transmission security, transmission constraints.

**Energy Centre – by Bart van Campen:**

- Missing information on regulatory environment
- Worldwide carbon market assumptions missing
- No information on regional demand differences in the scenarios. There could be regional demand changes such as close of Tiwai Point or surge in Canterbury dairy
- Lead time of generation vs. transmission not discussed
- Questioned some of the scenario story logics (other assumptions would be more plausible – e.g. high oil and carbon prices might not coincide)
- Impact from DSP on peak demand growth
- More focus on biomass fuels, the coal/lignite resource and impact of GTL/CTL
- Focus on the regional location of fuels/generation options
- Scenario use: suggested to establish mid-points/milestones and stories leading there

### Wellington

**DEUN – by Molly Melhuish:**

- We should do a cost benefit analysis of wood-based energy
- Suggested new scenario stories
- Suggested that scenario stories also should describe who is to decide (small players or big players), whether “economics of scale vs. economics of scope” is considered and whether the scenarios are based on proactive planning or reactive responses.
- Pointed out areas where the draft scenario stories were inconsistent/wrong.

**MEUG – by Ralph Matthes:**

- Supported process
- Choice of drivers ok
- Exchange rate variations in scenarios
- Innovation will be different for different GDP scenarios
- Missing information on regulatory environment

**Victoria University – by Geoff Bertram:**

- The objective is not clear
- Important to include supply-demand interaction. Simple feedback loop as proposed may not be enough.
- Suggested other scenario dimensions with the world carbon price on the vertical axis and the bias of global technical progress (towards small scale/distributed versus large scale/remote generation) along the horizontal axis. The rationale is that both the world carbon price and the direction of technology are exogenous to Transpower's decisions and therefore provide a fixed background for the scenarios.
- The current report is missing dealing with the two most important aspects of future: distributed generation and demand side participation.
- Can ban on thermals be sustained?
- Impacts of fuel switching important.

### Christchurch

**Centre for Advanced Engineering – by Ken Mitchell:**

- One scenario will eventually be closer to the actual direction. At what point do we need to modify the other scenarios to bring them in line?
- Change cannot happen overnight
- The system should not hinder future paths from happening, such as one with electric vehicles

**New Zealand Windfarms – by Chris Freear:**

- Pointed out that it was not very clear if electricity demand dimension was energy or peak demand.
- Suggested peak demand as extra dimension as they should be decoupled.

## A.2 General discussion on scenarios for Transmission 2040

### Auckland

**General discussion:**

- The potential for gas substitution (direct use of gas) was raised. Transpower answered that it had considered the issue but it didn't fit within the current scenario stories.
- The importance of creating corridors even if not needed in the shorter term was pointed out and that synergies if coordinating with motorways, railways, etc. could be found. Transmission 2040 as a long term plan could help to facilitate integrated planning of infrastructure.
- It was asked how the generation expansion modelling would be done. Transpower responded that it was likely to use the 18-node version of GEM developed by the Electricity Commission, though it may not be workable for the problem this size.
- How the scenarios differ from those in the Electricity Commission SoO was raised as well. It was explained that scenarios have to be tailor-made to the problem being analysed and the problem Transmission 2040 analyses is very different from that of the SoO.
- Regional/local demand and generation data needed for local stakeholders (network companies, regional councils) to verify. It was suggested a bottom up approach for demand in addition to the top-down approach.

- Scenario documentation is potentially very useful. Encourage Transpower to keep going and to move to a regional basis.

## Wellington

**General discussion:**

There was little time for discussion in Auckland as result of having three reviews given. However, a few points were discussion, namely:

- which scenario stories that were most relevant; and
- whether the scenarios would be weighted was raised as well. Transpower responded that these scenarios are for estimating the boundaries of the future need for transmission, for which no weighting is needed.

## Christchurch

**General discussion in Christchurch:**

- Opportunity to install transmission lines along other existing infrastructure corridors like rail, roads etc (co-ordination of infrastructure development)
- It was mentioned that Transpower should continue to consider all energy options
- The possibility of creating a 5th scenario was discussed - combining parts of all 4 scenarios into a most likely scenario
- Suggestion of creating a three dimensional matrix of scenario design adding peak demand to the list (in addition to energy demand and remoteness of generation)

# Appendix B Updated summary of key assumptions (work package 9 consultation document)

This table is an updated summary of the key assumptions described in the consultation document for work package 9, based on workshop discussions.

| Issue | Discussion | Assumption |
|---|---|---|
| Market Structure and Competition | The market will evolve over time but the expectation is that it will deliver capacity, energy and security. | It is assumed that a competitive market will remain. |
| Co-ordination of Generation and Transmission Investment | The chicken and egg issue exists but for TRANSMISSION 2040 the high-level expectation is that decisions on investment will be made with the full knowledge of each others plans. | It is assumed that transmission and generation will have limited knowledge of each others investments. |
| Transmission Pricing | The pricing methodology will evolve over time. Expectation that either a locational or non-distortional pricing regime will be used. | It is assumed that the pricing methodology will be based on the non-distortionary principle. |
| Asset Planning Boundary | Three options considered for defining the Grid for this study. GRS definition, Pricing definition and System Operations definition. | It is assumed that the interconnected grid as defined by the System Operator will be used plus an inclusion to allow for additional generation likely to be committed. |
| Technology | Technology will evolve over time with Smart Grid products under development. Transpower will be a fast follower of technology once they are proven. | No technology path is assumed. However the outcomes of WP3 will be used |
| Transmission Corridors | There is a discrepancy between the long lead times for transmission investment and ability to react in a timely manner to generation connections. Ability for Transpower to designate routes of corridors for future lines. | Routes have been planned and designated to facilitate timely investments. |
| Environment | Difficult to establish an assumption. Work package 10 will consider issue in more detail | No environment assumptions are assumed. Wait for the outcome of WP10, which will include the issue of under-grounding policy. |
| Property | Transpower is required to acquire property rights for new lines and for existing lines where significant change is required. | It is assumed that all new lines and significant changes to existing lines will require property rights. |

The undergrounding issue was removed at the suggestion of some focus groups in the workshops

# Appendix C Notes from workshop focus groups

The following notes record comments made in different focus groups and on different days so in some cases the comments may be in conflict or even express opposite views.

## C.1 Key Assumptions – Work Package 9

### Auckland

- Do not need easements if we build transmission lines along roads – can Transpower factor this into their plans?
- Undergrounding
  - Use 40 year urban boundary
  - Areas of national significance?
- Do not include a future for reactive power
- What process will Transpower use to trigger the designation of routes?
  - Timing? – early is costly but may give certainty
- N-1 – for a long term plan, use of n-1 is appropriate, given the uncertainties

### Wellington

- Market structure and competition
  - Thermal ban may dictate investments
  - Assume that there will be a capacity market (subject to thermal ban)
  - Change assumption to “It is assumed that a competitive market will remain”
  - Does market drive change?
    - Market signals
    - Single NZED?
  - 20 years ago markets were not in place
  - How does market impact on studies?
  - Will Transpower own spur assets in the future?
  - Is important
  - Regulation for competition by small consumers and generators which will drive the nature of the grid
- Coordination of Generation and Transmission Investment
  - Assume that there will be information transfer between generators and transmission owners
  - Change assumption “that transmission and generation will have good knowledge of each others investments” to “It is assumed that transmission and generation will have limited knowledge of each others investments”
  - Early engagement with **all** potentially affected parties for generation and grid investment
  - Look to protect a corridor to identified resource?
    - Develop transmission system to enable generation
    - Look to make strategic investment first
  - Build in capability to upgrade
  - Assumption requires better definition to allow generator comment

- Investment Coordination unlikely
- Need to reduce planning and transmission line construction timeframes
- TP has no property rights for future investment
- Generators need certainty of transmission before committing to build & vice versa

- Transmission pricing
  - The focus group accepted that assuming non-distortionary pricing is appropriate for modelling purposes. This will not be the case in reality.
  - Assumption on Transmission pricing methodology will impact on investment requirements
  - Location is important
  - Price/Quality trade-off
  - Transpower in private hands?
  - If distortion, then this would create opportunity for bypass
- Asset Planning Boundaries
  - Use the System Operator grid
  - At present Transpower scope is 375 kV – 11 kV = core grid as defined by SO i.e. through flows
  - excludes spurs and GXP upgrades
  - includes interconnecting transformers
  - New generation spurs are therefore excluded but need to be included somehow
- Technology
  - Transpower aspires to be fast follower
  - Smart Grids
  - Dynamic line rating will be included
- Undergrounding
  - Transpower propose from 40 year urban boundary
  - This should be included as one of the aspects under Economic & environmental issue not a stand alone issue – therefore drop
- Environmental
  - NIMBY
  - Importance will continue to Increase
- Property
  - Upgrades as well as new build
  - Transpower needs to position itself to increase its responsiveness
  - Buy property in anticipation of future projects – i.e. transmission corridors
  - Development of options which are 'ready to go'
- Transmission Corridors
  - Add new issue – Transmission corridors
    - Discussion – "Long lead time and being able to implement quickly"
    - Assumption – "Routes have been designated and planned to facilitate timely investments"

### Christchurch

- Market structure and competition
  - Assume a market will remain – may not be competitive

- Split of generators and retailers?
- Unclear as to how any such changes would influence Transpower investment
- Who values the water storage? i.e. value of 'spill'

- Coordination of Generation and Transmission Investment
- Transmission pricing
  - Clarify what is meant by non-distortionary principle
  - Remain non-discretionary
- Asset Planning Boundaries
  - Use the System Operator grid
  - GO - SO core grid definitions
  - Could include generation spurs
  - Not GXP, LV, generation spurs
  - Need to integrate TP vision and plans with the lines companies
- Technology
  - Fast follower – how long before adoption?
  - Earth fault protection on neutral earth wire? (noted not likely to be extended for HV)
  - Assume TP will not become a telecoms provider
- Undergrounding
  - Super conducting DC systems could change cable costs and drive undergrounding
- Environmental
  - Transpower should work at national level, not at level of local councils and other territorial bodies
- Property
  - Upgrades as well as new build
  - Need to define liability of TP assets on private land and remove capped liability of <20M and increase cap when capability of assets is enhanced
  - TP needs to own easements for access to existing assets on private land – and pay the going rate
  - Need to allow costs to obtain appropriate property rights to be included in EC approval project costs
  - Try to obtain transmission corridors prior to building – these could also double as bus and cycle ways

## C.2 Grid Planning Guidelines – Work Package 2

### Auckland

- Disturbances to the network are important (power quality, under voltage, under frequency etc);
- Synergies with lines companies – strategic plans;
- Big shifts - new generation or industrial load
- Group scenarios;
- Voltage level of supply
  - Distribution voltage
  - Tap changes
    - Volt range

    - Progressive change of transformer fleet
    - Difference in +/- volt tap range
- Distribution level fault level stays constant
- Look at Asset Management Plans of distribution companies - 10 year view and some companies will have 25 year views
- Regional – bottom up approach to explore synergies
- Councils interact with local lines companies - but can be reactive rather than proactive - use a bottom up approach with councils and lines companies involved
- Harmonics – something better than NZECP36
    - More PV (non-linear) loads
- Voltage step change (tap range)
- Fault levels may not be appropriate 16kA ring main units will continue to be on roadside - need individual input from distributors
- Designated status is only valid for 5 years - how to recover costs
- Designated transmission corridors for future use? - RMA seen as long winded and expensive process
- Consider generation and transmission together (do not have one driving the other)

### Wellington

- What event/driver would cause us to go beyond n-1?
- Trend towards probabilistic methods
- Need to be able to manage outages (maintenance outages)
- Do not see drive towards higher levels of security (greater than n-1)
    - It is hard to change underlying standards
- Use n-1 safety net and tailor security levels where appropriate
- Assume some sort of EGR's will be in place
- Use current line rating assumptions
- Clarification of fixed line GO rating (used by GO) and 15 minute off load (used by SO)
- GRS & GIT – should allow for staged investment

### Christchurch

- N-1 security level
    - n-1 – one size fits all – not suitable as it may cause inequality provincially
    - some end customer security requirements
        - some end customers require n-2, n-3 …
        - impact on end business process
    - security level should be set on:
        - demand basis, e.g. CBD use n-2?
        - dependent on number of customers
        - importance of load
        - "political" impact
    - With n-2, having equipment out for maintenance still gives n-1
    - Power quality
    - Problems getting the grid out in future

- Line ratings
  - In 40 years time there will be dynamic line ratings instead of just summer/winter ratings.

## C.3 Planning Studies – Work Package 7

### Auckland

- Auckland wants a reliable transmission system
- Need to ensure transmission capacity allows for remote generation
- Do not want "just in time" solutions. Capacity should be developed 4-5 years ahead of need
- Criteria for transmission development:
  - Will support future growth of New Zealand
  - Cost/benefit trade-off
- In the long term, need to consider transmission corridors

### Wellington

- General agreement that core grid is 220 kV
- Large generation issues important, including regional issues
- Review "preferred solution" before committing
- Keep criteria of long/short listing transparent
- Current short-listing criteria can be split. First two (reliability and diversity) for whole network and other four at project level.
- Need to cover for generation from renewable sources not operating
- Consider generation and demand as one?
- Environmental impact to be considered in criteria
- Special protection schemes ok as a short term fix
  - Risk vs. investment deferment
  - Only as contingency
- Annual planning boundary?
  - 220 kV / 110 kV / others?
- Suggest add "mass use of bio fuel technology could be included; acknowledged that this would require 'Regulation of Renewables'" to long list of options
- Suggest add "Upgradeability opportunities" to short list criteria

### Christchurch

- Lower priority on special protection schemes
- Re-conductoring with higher temperature conductors
- Relocation of load to be considered

## C.4 Grid performance – Work Package 3

### Auckland

- Distribution companies – quality as well as reliability is important
- Old asset base (distribution) – time to change
- Councils – planned certainty is important

- Future outage planning
  - Renewables lead to more costly outages (cost of constraints)
  - Customers seek more flexibility
    - Better consultation
  - .00005%??
- Evidence of
  - Root cause analysis/learnings from failure
  - Emergency preparedness
  - Managing risk exposure (security)
- 99.999 % overall reliability of supply
- Outage planning
  - Will there be "pre-event" load management requests or use special protection scheme etc to avoid (especially 3 circuit scenario)
- Future plans must consider maintenance and maintenance outages

| Return Period | Continuity Maintained? | Restoration | |
|---|---|---|---|
| | | Extent? | Time? |
| 50 | Yes | | |
| 100 | Yes | | |
| 300 | No | 50% | 2 days |
| 1000 | No | 50% | Months |
| 2500 | | 100% | Years |

## Wellington

- Frequency of outages
- Time of day?
- Duration of outage when it occurs
- Advice on how to protect devices (e.g. knowledge on surge protection)
  - Quality
- "Brownouts" – autoreclose are  big issues for customers
- Forward risk assessment
  - Identification of implications
  - Transparency
- Maintain current security (n-1) – provide more data on performance including quality?
- Ultimately
  - Root cause of fault
  - What is being done to mitigate repeat?
- Domestic users:
  - Want to know about restoration times
  - Voltage disturbances cause more damage than outage => provide advice for mitigation
  - frequency of outages is more critical than duration
- Industrial users:

- momentary interruptions can be an issue e.g. auto re-close needs to be reported
- overview of cause of LOS report within 1 month is sufficient

- In future, Transpower should identify higher risks of equipment failure and consequences of any failures and communicate these directly to customer or/and connected party

### Christchurch

- Reliability requirements will increase
- Quality is of more concern at present and will increase
  - Industrial
  - Pumps
- Electricity energy penetration will increase as oil use decreases
- Duration is not such an issue – 0.2 seconds to 30 minutes same impact
- Security of supply linked to architecture (SLD)
  - N-1 is too high a level
- High impact event planning
- Emergency preparedness i.e. double transformer failures do happen – 100 days loss of supply
- Interconnectedness can provide resilience
- Natural disasters resilience for 1 in 50 years event?
  - Small township vs. urban centre
  - Loss of grid infrastructure
  - Design return periods
    - Storm
      - Line companies design to 1:100
      - National grid 1:300
    - Earthquake
      - Equipment 1:1000
      - Buildings 1:2500
- Impact of reduced security
  - How to report?
  - Balance of local equipment vs. grid trip
  - Financial compensation for reduced security? Compared with standard level
  - Risk of "fault" from no maintenance vs. time shifting
  - Reduces security issue for key industries
- Power quality
  - Need to report on quality
    - Dips
    - Harmonics
    - Brownouts
    - Motor negative sequence
  - Develop set of indices
- Where/how access quality information?
  - OS technology from firmer grids
  - Forum with customers

- Quality and performance planning
- Quality performance reviews – ok?
- Power Quality
  - Establish standards
    - Harmonics
  - Current performance?
  - Tolerance of outages is reducing
  - Customer communications
  - Source of performance information
  - Availability is better than theoretical – less tolerance
  - Impacted equipment designed for “firmer” grids
  - Capability and experience gap increasing
    - Identify “sensitive” customers, e.g. information on surge arresters
- Reduced security
  - Very high security of supply
  - Some information from local lines companies
  - Notice of windows
  - Niche, specialised industries
- N-1 transformer bank outage of unit
  - Need spare, near to site, in service (hot)
  - Worse for 3-phase compared with 1-phase
  - Could be out for months
- Lines and towers – time to return – days
- Emergency preparedness
  - High risk / sensitive issues
- Natural events
  - Design guidelines?
  - Storms
    - No damage for 1:50 years and 1:100 years
    - Design to 1:300 years
  - Earthquakes
    - Supply what survives
    - Substation 1:1000 years
    - Lines could be lower
    - Buildings are category 4 - $\geq$ 2500 years
- Spare equipment
  - Storage
  - Staff
  - Temporary bypass
  - Borrow from elsewhere
- Greater Transpower industry engagement

## C.5 Grid Communications, Control and Protection Technology – Work Package 6

### Auckland

- Security and reliability of information/data
- Technology and functionality driving 'life"
- Skills for new technology – changing
- Other organisations investing in similar technology
- Disturbances - frequency, voltage
- Relay downloads – faults
- Information on web site – frequency, voltage
- Exchange of information (from distribution companies)
- Dynamic line rating? – summer/winter vs. dynamic line rating
- Storage of data
- Reliance on new "unproved" technology – Phasing in
- Single point of failure?
- Uncertain trends/technology – rate of change
- Communication backbone requited
- Fits into customer plans
- Fully automated system?
- Two way information
- Locate fault without need for line patrol (location)
- Disturbance information
- Line metering information (relevant to Transmission Pricing Methodology)
- Accessibility / security / reliability
- Skills / phasing?

### Wellington

- Common standards/information/language at all levels
- Impact on lines companies and end users?
  - Radial systems
  - Better information on outages (in real time)
- Aggregation, smart meters, smart tariffs
  - Demand side management out to smaller consumers
- Improved outage planning information
  - Short term co-ordinated
  - Potential opportunities?
  - Better co-ordination
- Information on outages/disturbances in real time
  - Cause (not root cause)
  - Estimated restoration time
  - Website? – unless you have no power
- Regulatory issues
- Need to stick to common standards/language over time (consistency)
  - Mandate? – e.g. US (SO etc)
  - Self regulate

    - Transpower to lead?
    - Industry groups
    - Consumer representation
- Skills gap
    - ageing workforce
    - overseas drain
    - establish centre of excellence
    - contractors
- Information and Control
    - Information and control sharing there but not elegant – easily broken - hard to set up (3 months, $10k)
    - Special protection schemes means we need to know more about the grid
    - Trend – include issue version management (configuration)
- Everyone wants to be in control
- Maintaining older kit getting harder
- Widespread use of deployment of common information model (CIM) protocol is predicted by TP – most were unaware
- Enable demand side control via smart meters and tariff, area aggregators (such as recently announced collaboration between Google and GE)
- Dynamic line rating should result in improved outage planning
- Common information model (CIM) allows short, medium and long term planning – less impact on generators than distributors, especially for embedded generation
- Greater communication with domestic users especially there is a LOS; key issue is duration (Transpower needs to communicate better with lines companies communication about estimated service restoration times)
- Smart Grid promises to speed up restoration – automatic?
- Gradual penetration of CIM capable equipment
- CIM mandated in US, Europe
- Consistent guidelines are required across the industry by cooperation (or regulation) via industry groups
- Skills gap and aging workforce especially in smaller rural areas likely to worsen; this could lead to line company consolidation initially through cooperation and use of shared resources (e.g. control room)

### Christchurch

- Technology
    - Information on fault
    - Estimated restoration time
    - Power quality
    - Need for consistent standards/protocol
    - Establish existing technology
    - Sharing information
        - increased transparency (relevant data)
        - allow more informed instigation steps to be taken
    - Security
        - Control of information exchange
        - Centralised control centre

- Drivers
  - Advantages?
- Don't make it more complicated than is required
- Manufacturing driving change – stop making old units
- Change over time
- Fibre base
- Allow for interface between organisations technology
- Transparency of meter points
- Dynamic load ratings
- Two way information flow (as market allows)
- Improve performance of networks
- Need to stick to industry standards via industry lead body (e.g. EEA)
- Integration of protection functions between companies
- Inform consumers/customers of action
- Staffing
  - Lifestyle expectations
  - Training/partnerships
  - Resource drain – overseas?
  - Surviving on left over from NZED?
- Is the existing use of multiple information models sustainable and will it enable information driven Smart Grids initiatives? Yes

## C.6 Other/Keynote Speeches

### Auckland

- Transpower will send out emails to all registered parties to let them know when changes are made to the Transmission 2040 website *[ed note – this facility will be available in early December]*
- New Zealand living off invested capacity for some time and inadequate investment is seen as the single biggest factor to address the issue.
- How does electricity investment stack up against other infrastructure investment such as water and transport?
- The 40 year transmission study could be for nothing if other infrastructure is given priority. Any decision to invest or not invest could have an impact on other infrastructure investment decisions.
- Major users worried about over-investment as they have to pay. However they have no worries about the right level of investment
- Councils need signals about where investments may be required so that they can make decisions about where else other investments may be required - potential creation/use of corridors
- Investment in transmission is required for generation as generators support investment in the grid
- What is Transpower's obligation to the country? Transpower does not have an obligation to keep the lights on, but probably as duty of care should do so. Transpower is obligated to build a transmission system, but not mandated to do so.
- Electricity Commission has obligation to ensure there is sufficient generation to meet demand. The market should provide signals for transmission.
- Transpower is looking at the issues as Grid Owner and not as System Operator.

- Milestones on 40 year timeline.
- Use of land - as far as possible.
- Draft lines on maps would be good.
- Bottom up approach for regional issues.
- Reconciliation of Transpower and industry planning - better alignment and agreement for direction of future.
- Transmission pricing will provide drivers for behaviours - but is a big political issue.
- HVDC as core grid.
- If TP tailor investment, this may adversely affect other investment (eg generation)

### Wellington

- Investment should be driven by cost benefit analysis not cost of investment
- How to accommodate uncertainty of distributed generation?
- Discussion around simulating possibilities instead of using scenarios?
- Transpower is neutral – promote competition in market – transmission planning has major impact on industry participants
- Christchurch
- Grid must meet customer needs.
- Perception that we are not doing a good job.
- Big cost of failure - political and indirect costs.
- Transpower's problem is really everyone's problem.
- Talk to customers and stakeholders in a language they understand - for example N-1 does not mean anything outside the industry.
- Use of existing corridors for transmission - for example rail corridors for transmission assets.

# Appendix D List of workshop attendees

## D.1 Heritage Hotel, Auckland – 3 November 2008

| Name | Company |
|---|---|
| Aaron Webb | Vector |
| Bart van Campen | The Energy Centre, Auckland University |
| Bill Burrill | Auckland City Council |
| Bill Howse | Powerhowse Electric |
| Blair Dickie | Environment Waikato |
| Bob Brown | Hamilton City Council |
| Bob Lack | Counties Power |
| Bruce Forbes | Arc Government |
| Des Hughes | Auckland City Council |
| Dick Whitelaw | New Zealand Steel |
| Doug Watson | Fonterra |
| Gavrilo Kovacevic | Electrix |
| Grant Johnson | Electrix |
| Ian Ferguson | Vector |
| Jaun Park | Unison |
| Jeremy Wyatt | North shore city |
| Keith Gilby | Top Energy |
| Maurice Hoskins | Counties Power |
| Murray Parrish | Carter Holt Harvey |
| Paul Coster | Mighty River Power |
| Peter Yeung | Vector |
| Raj Singh | North Power |
| Ranjit Manak | Electrix |
| Roger Foy | Transfield Services |
| Roshanth Sivanathan | Unison |
| Rowan Maxwell | Genesis Energy |
| Russell Watson | North Power |
| Stephen Selwood | NZ Council for Infrastructure Development |
| Teng C. Ang | Mighty River Power |
| Terry Shutt | Top Energy |

## D.2 Westpac Stadium, Wellington – 5 November 2008

| Name | Company |
|---|---|
| Aliga Buozkowska | Ministry for the Environment New Zealand |
| Ajay Anand | Horizon Energy |
| Bill Heaps | Strata Energy |
| Bill Wasley | Wasley Knell |
| Brent Thomas | Contact Energy |
| Brian Bull | Electricity Commission |
| Fraser Clark | NZWEA |
| Geoff Bertram | School of Economics and Finance, Victoria University |
| Glenn Wigley | Ministry for the Environment New Zealand |
| John Huckerby | AWATEA |
| John van Brink | Wel Networks |
| Lyndon Haugh | Carter Holt Harvey |
| Mark Dean | MED |
| Mark Walkington | MED |
| Mickey Cave | MED |
| Molly Melhuish | Domestic Energy Users Network (DEUN) |
| Prof Lewis Evans | School of Economics and Finance, Victoria University |
| Ralph Matthes | Major Electricity Users Group |
| Ray Brown | Meridian Energy |
| Richard Harrison | Industry Capability Network |
| Richard Spearman | Trustpower |
| Ross Parry | Genesis Energy |
| Stephen Gale | Castalia |
| Tim Davin | IPENZ |
| Tony Appleyard | Ministry for the Environment New Zealand |
| Tony Baldwin | |
| Tristan Maunsell | Todd Energy |
| Warwick Glendenning | Power Systems Consultants |
| Ralph Samuelson | MED |

## D.3 Chateau on the Park, Christchurch – 6 November 2008

| Name | Company |
|---|---|
| Andrew Parkyn | Crighton Anderson |
| Chris Freear | NZ Windfarms |
| David Moore | Landowner |
| David Waters | Marlborough Lines |
| Frank Arthur | Alpine Energy |
| Glenn Coates | Oriongroup |
| Graham Darby | TLJ Switchgear |
| Ian McWha | Lincoln University |
| John Coursey | Oriongroup |
| Ken Mitchell | Network Waitaki |
| Pat Bodger | Electrical and Computer Engineering, University of Canterbury |
| Pete Simpson | Solid Energy |
| Peter Weir | NZ Forest Owners Association |
| Rodney Lewis | MainPower |
| Roger Paterson | PowerNet |
| Roger Sutton | Oriongroup |
| Sonia Voldseth | Federated Farmers |
| Stephen Hirsch | Oriongroup |
| Terry Jones | PowerNet |
| Tim Fulton | NZ Farmers Weekly |
| Tom Henderson | Landowner |