Technology

Renewable Generation:

- A strong core grid is required to facilitate renewable generation investment. Future generation investment locations may be uncertain but a strong core grid will allow for fast and easy development of generation connections.
- Increased renewable generation requires a more cohesive strategy for the long term future of various network components e.g. 110 kV. Generators face increased uncertainty in planning if clear connection policies are not implemented.
- Wind generation is likely to create volatile spot prices that will affect both generation investment planning and consumer prices.

Nuclear:

- Current perception is that nuclear will not be a viable technology for New Zealand for both political and technological reasons.
    - Technologically: Large nuclear units are not viable in NZ due to the reserve requirements that must be satisfied in order to ensure N-1 security is maintained. Small units e.g. 400MW are becoming available and may be more suitable for the NZ system but are not considered a cost effective generation technology at this time.
    - Politically: The NZ public is not currently in favour of nuclear generation and this stance is not envisaged to change in the near future. This viewpoint may change over time if Australia were to invest in nuclear technology.

Investment Costs:

- If the cheapest generation technology results in generation located distant from load centres then timely transmission development is vitally important.

Developing Technologies:

- Photovoltaic (PV): This technology has a lot of potential in enabling consumers to reduce their demand levels but must be developed further to reduce manufacturing, installation and maintenance costs. Large scale production will introduce economies of scale and reduce manufacturing prices but as demand rises resource costs will also rise potentially cancelling the savings made.
- Marine: Is seen as a potential generation source with significant wave resources in NZ, particularly on the west coast of the country. Currently the technology is considered expensive with design and manufacturing in early development stages. The current state of marine generation can be compared with wind generation in the early 1990's.
    - The transmission grid will need to be planned differently for marine generation as currently the NZ grid does not usually run near the coast.

- FACTS, superconductors, higher voltages, smart metering: Have the potential to allow greater diversity of usage of the grid but will require much greater knowledge and skill in planning transmission investment.

Consumer

Energy Efficiency:

- Heat pumps/ ecobulbs/ smart metering have only a small impact on reducing demand. Their greatest attraction, from a transmission and generation investment perspective, is their ability to delay investment although that investment will still be required albeit at a later date.
- People move house every 4 years, on average, making it difficult to encourage initial investment in energy efficiency technologies such as insulation, solar hot water etc.
- Some consider it unlikely that significant numbers of wind turbines will be installed in the residential sector as it will still be cheaper to buy off the grid, even with price increases.

Transport:

- Fuel substitution and the introduction of electric cars will increase demand but will have both benefits and drawbacks:
    - Benefits include:
        - Facilitates connection of greater amounts of wind generation as electric cars can be used as an energy storage medium.
        - Smoother demand peaks
    - Drawbacks:
        - Increased demand
        - Uncertainty about who controls the storage aspect of vehicle/grid technology.
        - Grid may need upgrading to facilitate gird/vehicle control technology
- Fossil fuel availability and exploration is affected by the existence of and uncertainty surrounding carbon prices.

Customers/Retail:

- The historically low levels of elasticity in the residential sector may change as prices rise. The commercial and industrial sectors see electricity as an operating cost and are likely to pass increased costs through to the consumer resulting in continuing inelasticity in demand.
- Is electricity too cheap? Do we need a crisis to make people take more notice and become more aware of electricity issues?
- Demand Side Participation: will it influence peak or baseload demand? It tends to delay rather than remove the need for investment.
- Need for change in retailer approach with different tariff structures to incentivise changes in energy usage.

- Increasingly do not want transmission lines near their properties (NIMBY). This drive generation closer to the load and makes obtaining consents for investment difficult.

Environment

Climate Change/Carbon Price:

- The introduction of a carbon price will drive technology development but will increase price uncertainty and volatility.
- Carbon prices are seen as more uncertain than fuel price**.**
- All parties in government have the concerns of climate change so all governments are likely to try and effect climate change legislation. The form of the legislation will change depending on the government but not that certainty that there will be legislation.

Water Rights/Water Access

- Restrictions on water availability and allocation will slow rural development that in turn affects regional demand growth. Some consider this a inconsequential issue over a 40+ year time horizon particularly once all land has been developed and/or all water has been allocated
- Water rights and allocation time frames (e.g. 35 years) significantly increase uncertainty for hydro investment as hydro plant has a life time of greater than the water allocation time frame.

Land Use:

- What happens if dairying crashes? Other industries such as forestry may become dominant resulting in need for a very different energy supply and transmission system.

Regulation and Policy

Government Energy Strategy:

- Energy Efficiency:
  - Will only provide a small reduction in demand growth and doesn't provide a complete solution, the network will still need to be augmented.

- Renewable Energy:
  - Regardless of outcome of coming election renewables will still be high on the political agenda.
  - As thermal generation costs rise, renewables will become more cost competitive.
  - Small scale installations (residential) are likely to increase in number. This has implications for network control (passive vs active networks). The viability of these installations is related to the economics of storage of generated energy. In poor generation conditions the grid will still be required to provide security of supply

Regulatory:

- Producing a long term transmission plan implies that transmission exists to allow the market to operate rather than transmission following a market lead. To enable such a long term plan to be useful strong leadership from Transpower, industry and government is required.
    - Partnership between transmission and generation can be problematic due to generation investment often being commercially sensitive. Where transmission proposals are notified publicly, it is unlikely that a partnered generation investment will want sensitive information in the public arena.
    - The government must provide direction and leadership to facilitate investment rather than the complex EC/Commerce Commission/Financing hurdles that currently exist.
    - Resource planning/consent is likely to become more difficult and complex in the future. This may lead to small scale and lower impact investment proposals being favoured. Greater levels of small scale generation could require a grid or distribution centre level of control rather than market driven control and dispatch.
    - All planning is undertaken with the assumption that the regulatory environment doesn't change. This is probably an unrealistic assumption over a 40 year time frame.
    - RMA must change if 90% renewables target is to be achieved. Consenting times are very long e.g. 2 years for a 15MW hydro.
    - If RMA costs are reduced then smaller projects will result. There are economies of scale with RMA costs, large and small projects cost the same to consent.
    - Difficulties of consenting with the RMA drive generation investments to easy to consent regions.

Society:

- Politicians will change when people demand it but generally society is not knowledgeable of the electricity/energy industry.

Pricing Methodology:

- Transmission pricing methodology can deter a generator from being the first generator in an area, even if the transmission system has specifically been designed to facilitate generation investment because the first generator is hit with all the connection costs.

Planning

Quality and Security of Supply:

- Supply is perceived as insecure due to recent dry year events. Whether this insecurity is perception or reality is irrelevant as it is our image of having an insecure supply that influences both domestic and international investment.
- Where is the balance between price and security? Who should chose this balance? Consumers or grid owner/operator?
- There appears to be an assumption of general trend towards more involved consumers through smart metering, distributed generation etc. This results in increased complexity and the need for increased flexibility in operating the system. It is uncertain how this flexibility may be implemented in the current market structure.

Flexibility/Optionality:

- Planning for more capacity is better than planning for too little, or just enough.
- Flexibility in mid term investment is important as the uncertainties of the future can change and unfold rapidly.
- There is a need to work out how to make efficient investments now while still retaining flexibility for future investment and development requirements.
- The near horizon (10 years) needs also to be 'solved' as well as the long term. Present grid needs to be brought to more reliable and robust standards to deal with the short term issues and to provide a base on which to plan for the next 40 years.

Wild Cards:

- There are wild cards that may affect planning such as Tiwai closing and global instability.

Miscellaneous

- Where investors are pushing the boundaries of technologies and investment practices the level of risk in the system increases. Historically the industry couldn't rely on intelligence so overbuilt as compensation. With increased knowledge, skills and intelligence systems can now be pushed harder resulting in different planning assumptions.

- International investment particularly in agricultural development is affected by the security of supply (or the perception of security of supply) and competition for resources in adjoining regions. NZ cannot afford to lose international investment.

- There is expectation of incremental change rather than large fast moving change. The underlying physics of electricity restrict the potential for sweeping changes and developments.

- The next development of consequence is expected to be improvements in design, availability and affordability of energy storage options.

- There is likely to be increased competition for skills and labour but this is not seen as the largest difficulty as investors/market participants will always pay to attract people.

- It seems uncertain as to how the NZ population will flatten out or decline when the global population is forecast to reach 9 billion and NZ is a desirable place to live.