

# Security of Supply Assessment Framework

Presentation to the EPOC Winter Workshop

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# Concept's Involvement with Security of Supply

- 2003 Winter Security Taskforce
- 2004 MED Security of Supply Modelling Team (on-going)
- 2005 Reserve Energy Assessment for MED / EC
- Currently assisting the EC in:
  - Developing Security of Supply Policy
  - Tendering for Reserve Energy
  - Developing Emergency Security of Supply Provisions

# Today's Focus

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- 2004 MED Security of Supply Modelling Team (on-going)
- 2005 Reserve Energy Assessment for MED / EC
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  - Developing Security of Supply Policy
  - Tendering for Reserve Energy
  - Developing Emergency Security of Supply Provisions

# Concept involvement with Energy Link

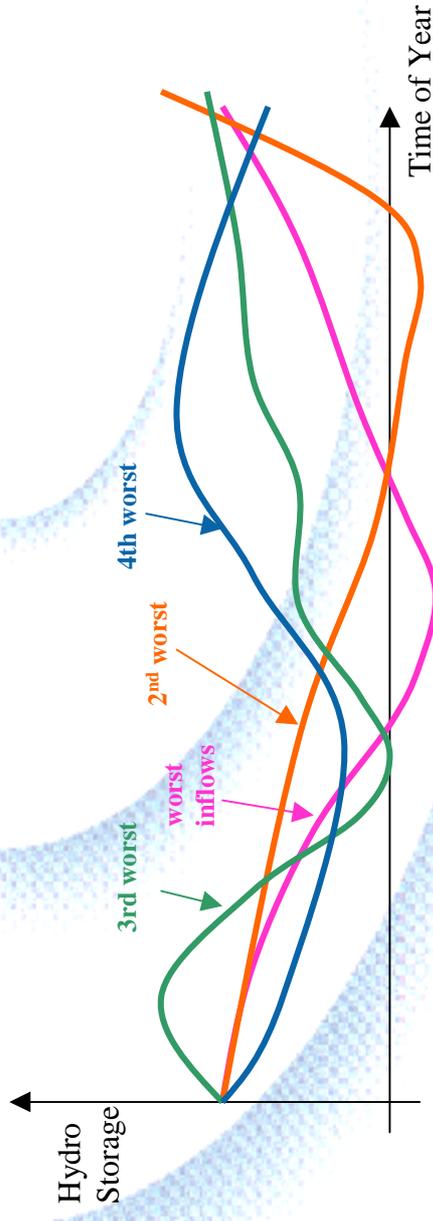
- Originally used E Market when modelling during Winter 2003
- MED has on-going relationship with Energy Link
- Concept originally asked to:
  - Assist with modifying minzone model originally developed for Winter 2003
  - Test / check assumptions used in Energy Link modelling
  - Check results for reasonableness
- Subsequent to Winter 2003, Concept and Energy Link have worked together on a number of projects for MED including:
  - 2004 Security of Supply Modelling Team
  - 2005 Reserve Energy Assessment

# Definition of Minzone

- The Minzone represents the minimum level of hydro storage required at any time of year to ensure that given a defined low flow event (looking forward only), forecast demand can still be met when all available thermal plant are run to capacity.
- Allowances are made for
  - Forced Plant Outages
  - Transmission Constraints
  - Minimum hydro flows
  - Instantaneous Reserve and Frequency Keeping requirements

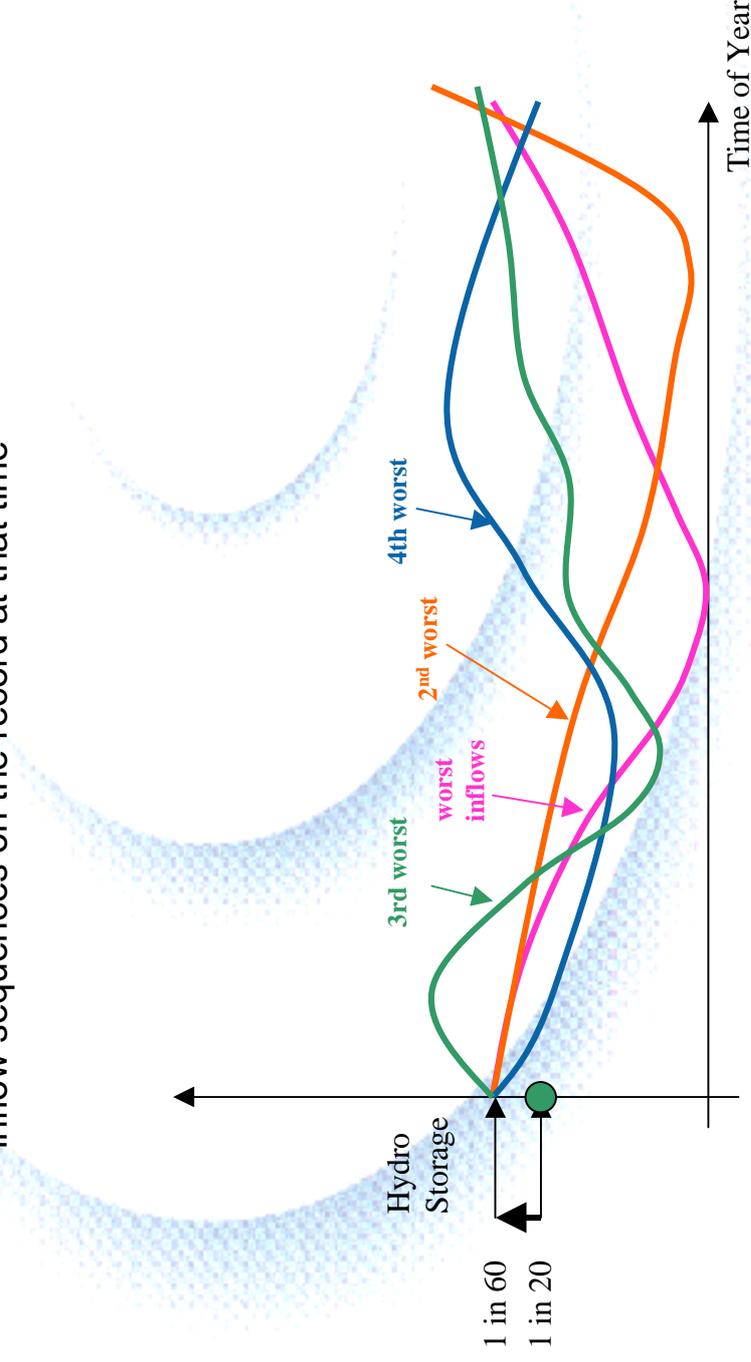
# Background on Minzone *Historical Perspective*

- Until 1992, the system was operated to 1:20 dry year standard
  - hydro storage maintained so that overall supply sufficient to meet forecast demand in 1:20 dry year event without rationing
  - in 1992, the hydrological record spanned 60 years
  - at any time of year, 3<sup>rd</sup> worst of 60 historical inflow sequences just covered



# Background on Minzone Historical Perspective (cont)

- After 1992 enquiry, interim 1:60 standard was adopted
  - Enquiry team considered one-off cost of raising security standard to be relatively small given system capacity at time
  - System operated to avoid forced supply restrictions under worst of 60 historical inflow sequences on the record at that time



# 2004 MED Security of Supply Modelling Team

- Focus was on a minzone approach to ensuring that 1:60 security of supply objective was being met
- Adapted model developed for Winter 2003 for this purpose
- Used modified E Market to produce minzone graphs
- Used standard E Market to produce “Current Storage” runs that give an indication as to chances of going into minzone from current storage.
- Tested minzone assumptions to see if a “Buffer” was required to allow for possible inaccuracies

**Supply Security 2004**

Home Overview Status Assessment Reserve Publications Links

**Welcome to the Supply Security 2004 Website**  
This site provides information on the outlook for electricity supply through 2004. The work is being coordinated by the Ministry of Economic Development with significant contribution of energy industry participants including energy users.

It is important to note that all information contained within this site is subject to change as new information becomes available. Given this, it is provided on an "as is" basis for the purposes of information sharing only, and is not intended to represent the views or potential actions of the Government, or others.

Should you have suggestions or queries on content please contact Roger Fairclough at [roger.fairclough@med.govt.nz](mailto:roger.fairclough@med.govt.nz) or Mob: 027 4729036. Further contact information can be found [here](#).

**Current Status as of 28/06/04:**  
**Riskmeter Status:** Low

**Aggregate Hydro Storage\***  
• 3,709,574 Wh (93% of full storage)  
\*Does not include Waitararua, Tongariro or minor storages.

**Thermal Plant Status:**  
• Fully Filled | [Previous Status](#)

**Upper South Island**  
• [Upper South Island Load Summaries](#)  
• [System Operator Website](#)

**Latest Updates:**

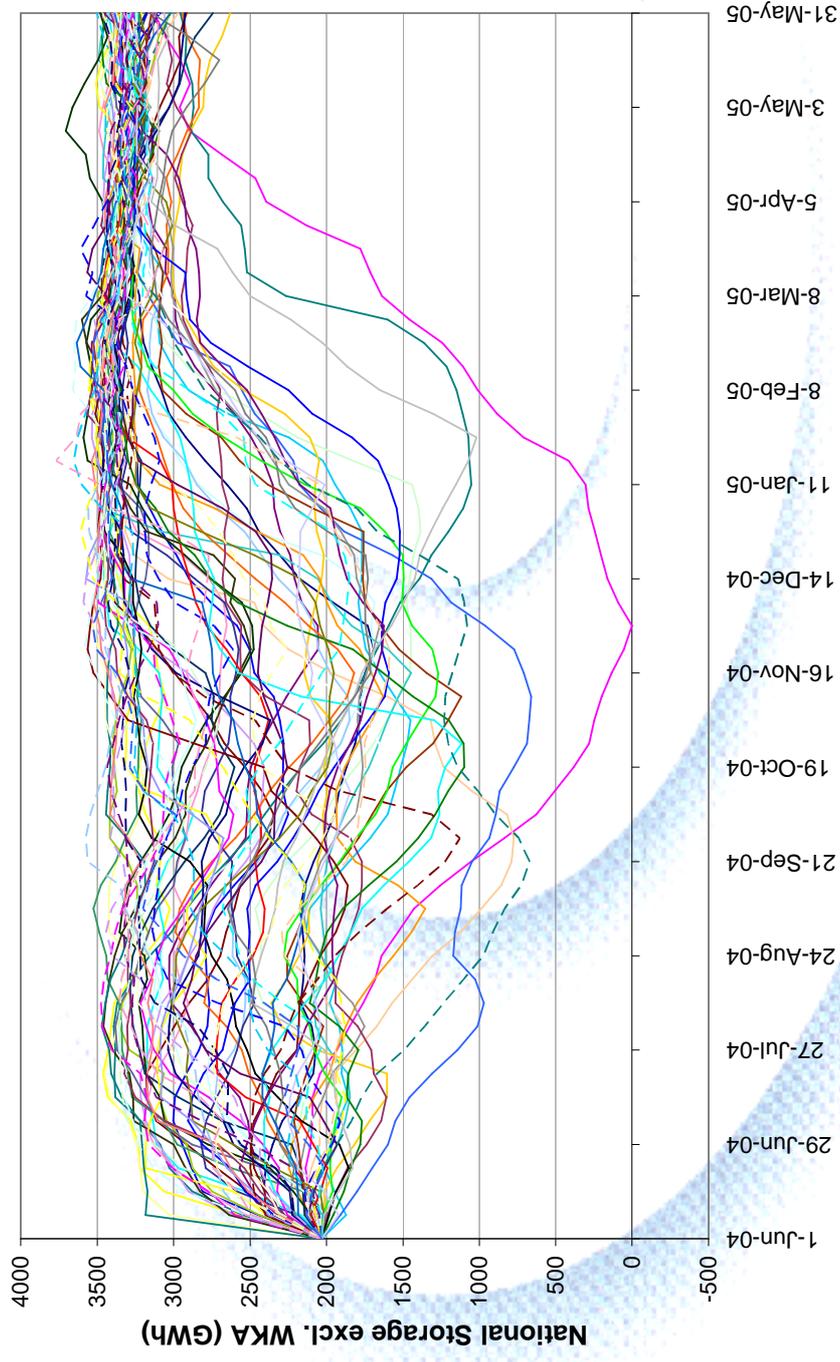
05/07/04	<a href="#">New Upper South Island Load Summary Available</a>
05/07/04	June Edition of NIWA's National Climate Centre: <a href="#">Climate Summary</a> now available on their website. See the <a href="#">Download</a> page also.
05/07/04	Electricity Commission has issued an Upper South Island Situation Report (as of 1st July 2004) on the front page of their website.

Site last updated on 05/07/2004 © 2004

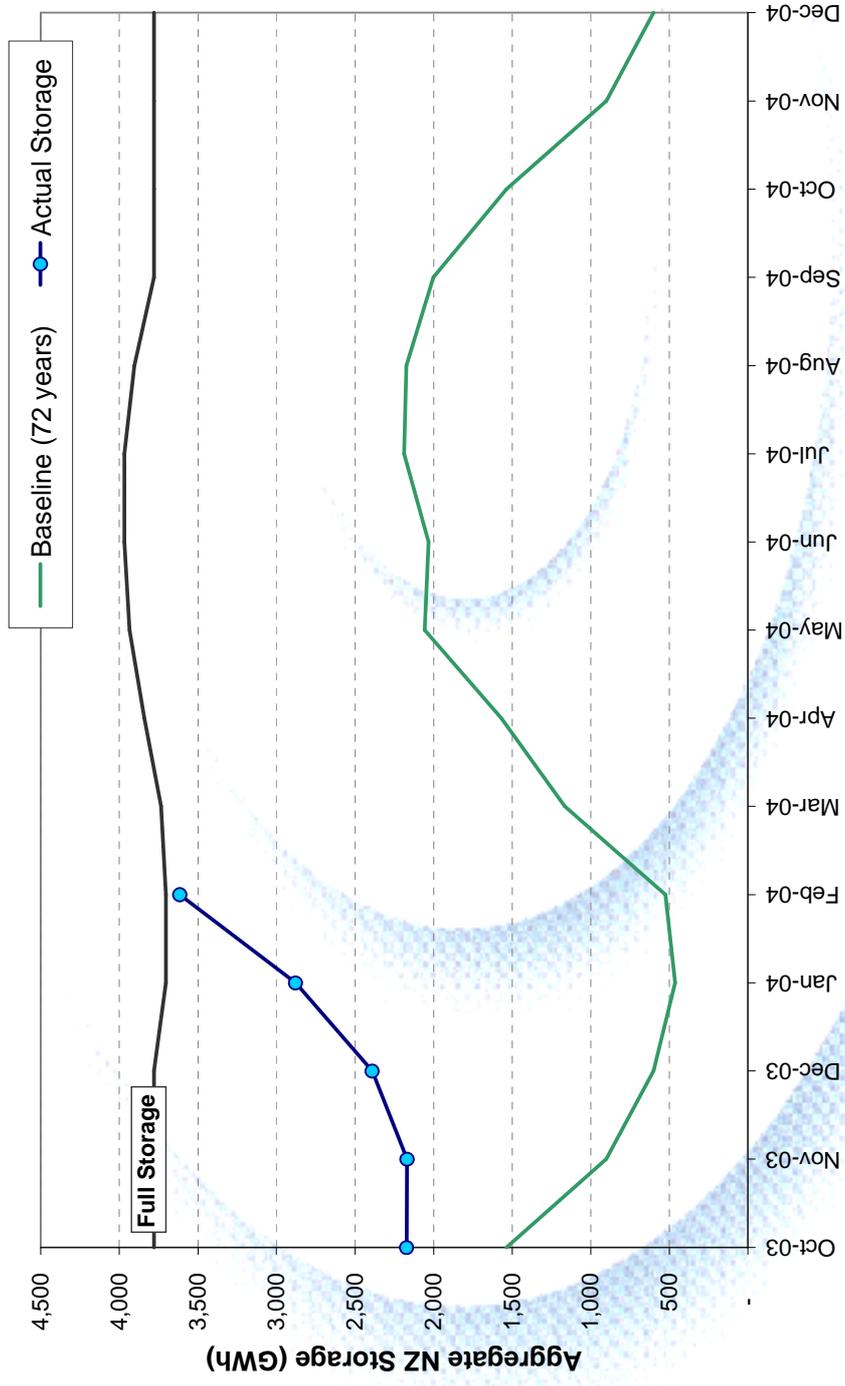
# Minzone Methodology

- The key steps are as follows
  - Storage projections are adjusted under the assumption that any non-supply would be met from storage (i.e. adjusted storage = storage – non-supply)
  - Start storage is adjusted such that the worst storage projection just reaches empty
  - This process is done on a monthly basis
- Adjusted storage projections are illustrated by the Minzone projection for June on the next slide
- The Minzone obtained from the monthly results is on the slide following this.

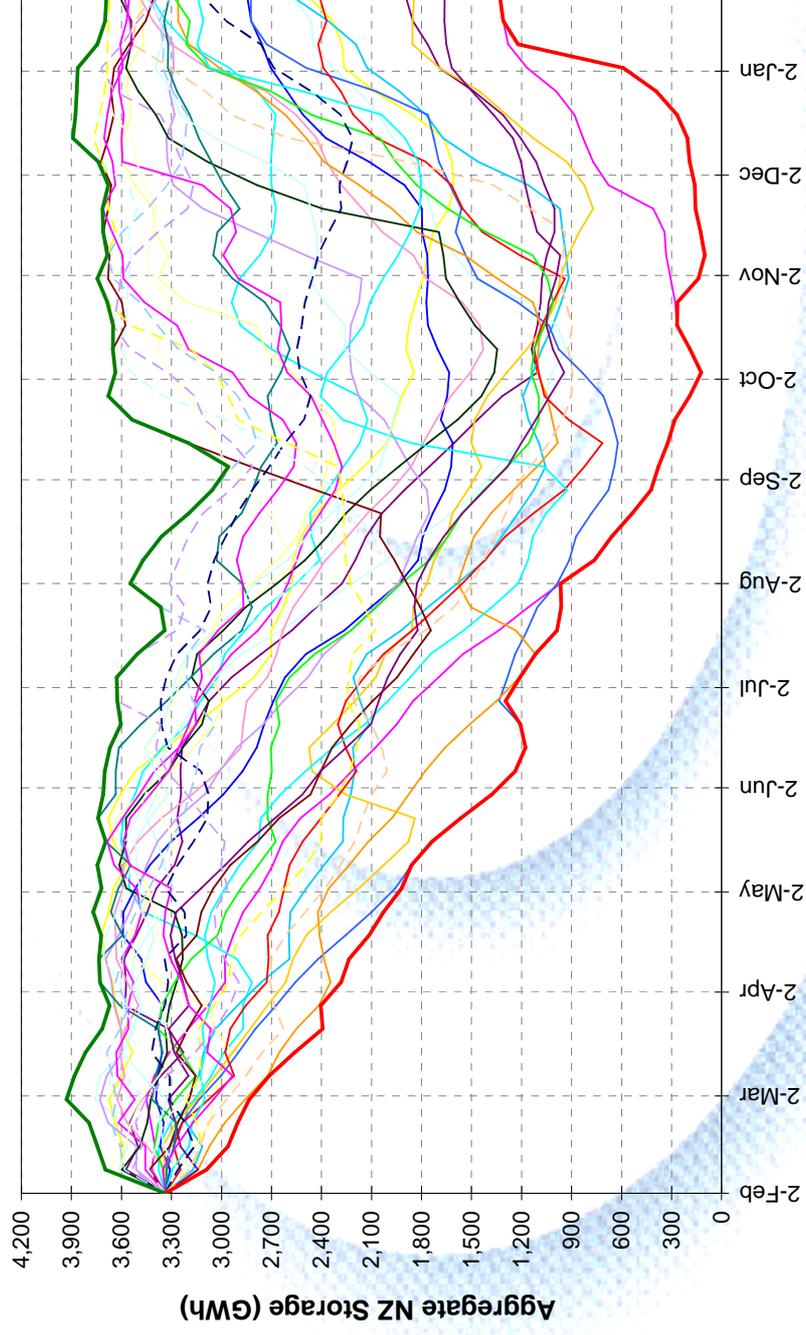
# Minzone Methodology (cont)



# Minzone Methodology (cont)



# Current Storage Projections

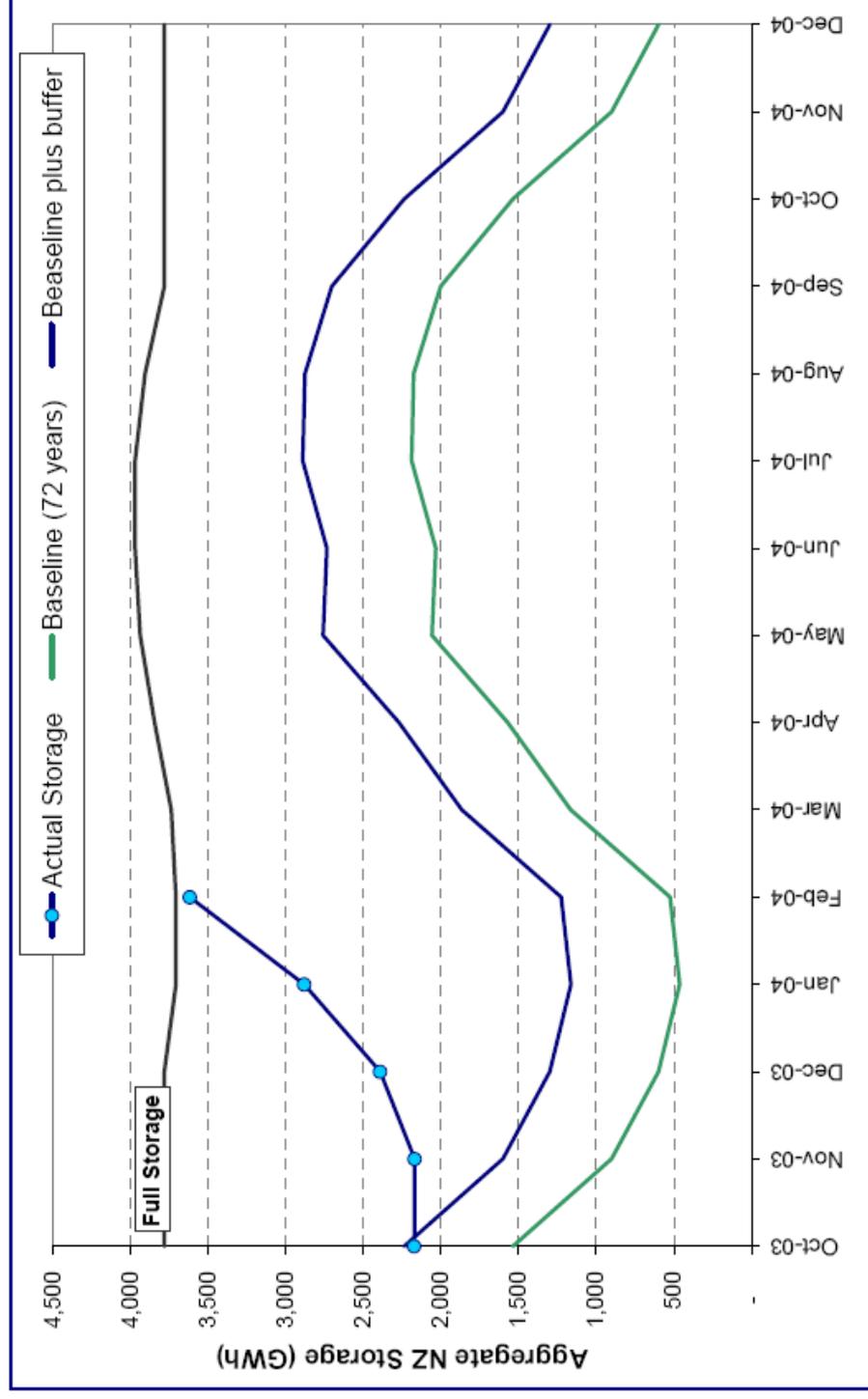


# Requirement for Buffers

- Minzone relies on analysing detailed supply and demand assumptions using Energy Link's EMarket model
  - Physical Assumptions
  - Modelling Approximations
- Historically, in the absence of being able to quantify all of these effects, a buffer zone has been adopted
- Concept Consulting was asked to review with the aim of quantifying what (if any) buffer was still required

# Requirement for Buffers (cont)

Figure 15: Baseline Minzone plus 700 GWh Buffer



# Requirement for Buffers (cont)

## *Physical Assumptions*

- Demand
  - Demand variation illustrated as plus / minus in Minzone
- Plant Performance
  - Major Plant Contingency shown on Minzone
- Fuel Delivery
- Transmission Availability
- Reserve Allocation and Frequency Keeping
- Hydro Running

# Requirement for Buffers (cont)

## *Modelling Approximations*

- Use of WODN version of EMarket
- Simplistic reservoir modelling
- Modelling of Waikaremoana and Tongariro
- Transmission Constraints

# Requirement for Buffers (cont)

## Summary

- Sensitivities relating to demand and an extended thermal forced outage have been modelled and depicted as storage ranges within the Minzone framework
- Other sensitivities do not appear to be significant
- Full details available on website [www.supplysecurity.org.nz](http://www.supplysecurity.org.nz)

# 2005 Reserve Energy Assessment for MED / Electricity Commission

- MED initiated assessment of possible 2005 reserve energy requirements in advance of Commission
  - Commission will be able to procure extra reserves, if needed, once EGIB passed into legislation later this year
  - MED concerned about lead time to procure any additional reserve energy needed for 2005
  - Work not intended to compromise Commission's approach to security of supply
- We have therefore had to consider, without compromising or pre-empting the Commission's approach:
  - How to interpret the Government's 1:60 dry year security of supply objective?
  - What is security of supply outlook for 2005 relative to a 1:60 standard?
  - Is any additional reserve energy needed to extend security of supply risk to 1:60 level in 2005?

# Overall Approach

## *How to Interpret 1 in 60 Objective?*

### Government Policy Statement:

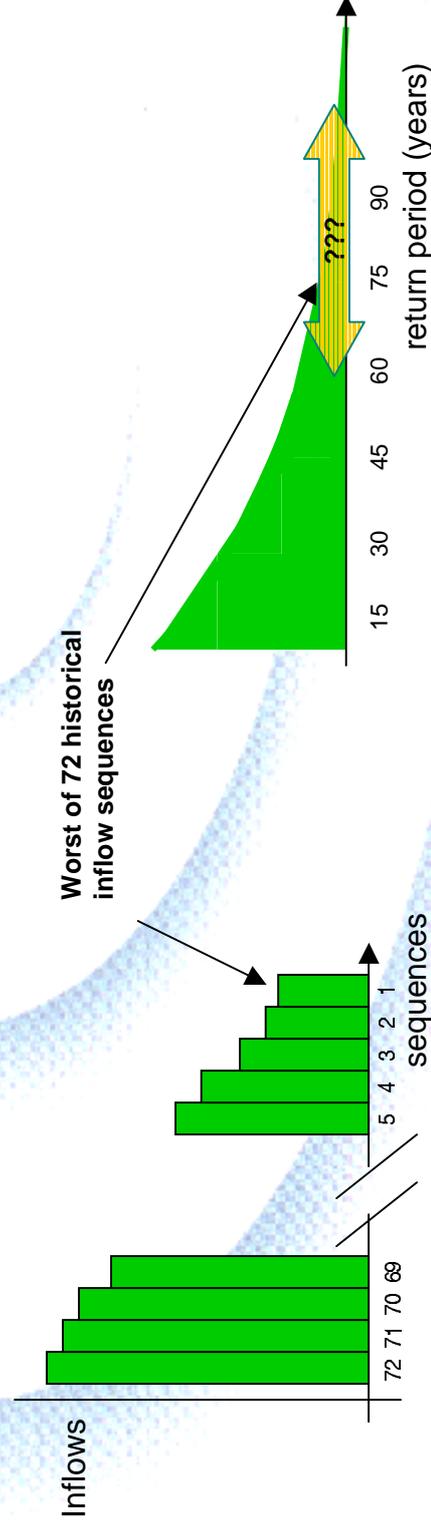
- Core objective that demand can be met in a 1 in 60 dry year without demand conservation campaigns
- Emergency conservation measures contemplated for extreme rare dry year events
  - ie worst historical inflow sequences not necessarily covered as intended with interim approach following 1992 enquiry
- Commission will need to decide how to interpret 1:60 objective
  - eg statistical techniques to define inflow event return periods, synthesise 1:n inflow sequences, combine with thermal outages
- For now, we have adopted a conservative approach based on covering the worst of 72 historical inflow sequences

# Overall Approach

## How to Interpret 1 in 60 Objective? (cont'd)

### Implications of our approach:

- Assumes that all inflow sequences on record have equal probability
  - in practice, 72 year record is likely to include low flow events with return periods exceeding 72 years
  - covering the worst of 72 historical inflow sequences at any time means that security of supply could exceed a 1:72 dry year
  - some inflow events in 72 year record could have return period greater than 60 years



# Overall Approach

## *Implementation Issues*

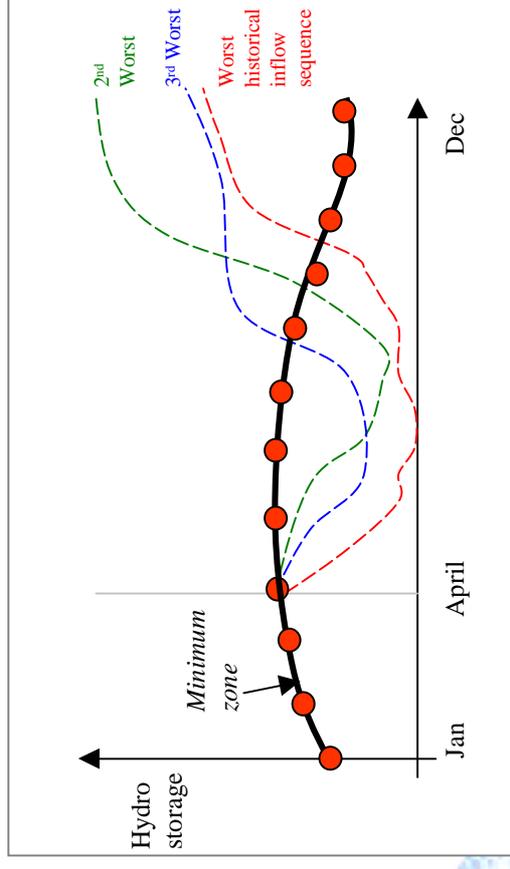
- Commission will need to develop a means of assessing and managing security operationally
  - In the interim, we have applied a minimum storage zone technique
    - Origins post 1992, new systems developed for 2003 Winter Task Force project, used in MED assessments of 2004 security
    - Commission should consider alternative or supplementary approaches (GPS refers to minzone as an option)
  - GPS indicates reserve energy to be triggered if 20c/kWh spot price or security guidelines set by Commission reached
    - In interim, we have assumed trigger for reserve energy (eg Whirinaki) could reflect a minimum zone approach

# Analysis Framework

## Minzone Modelling

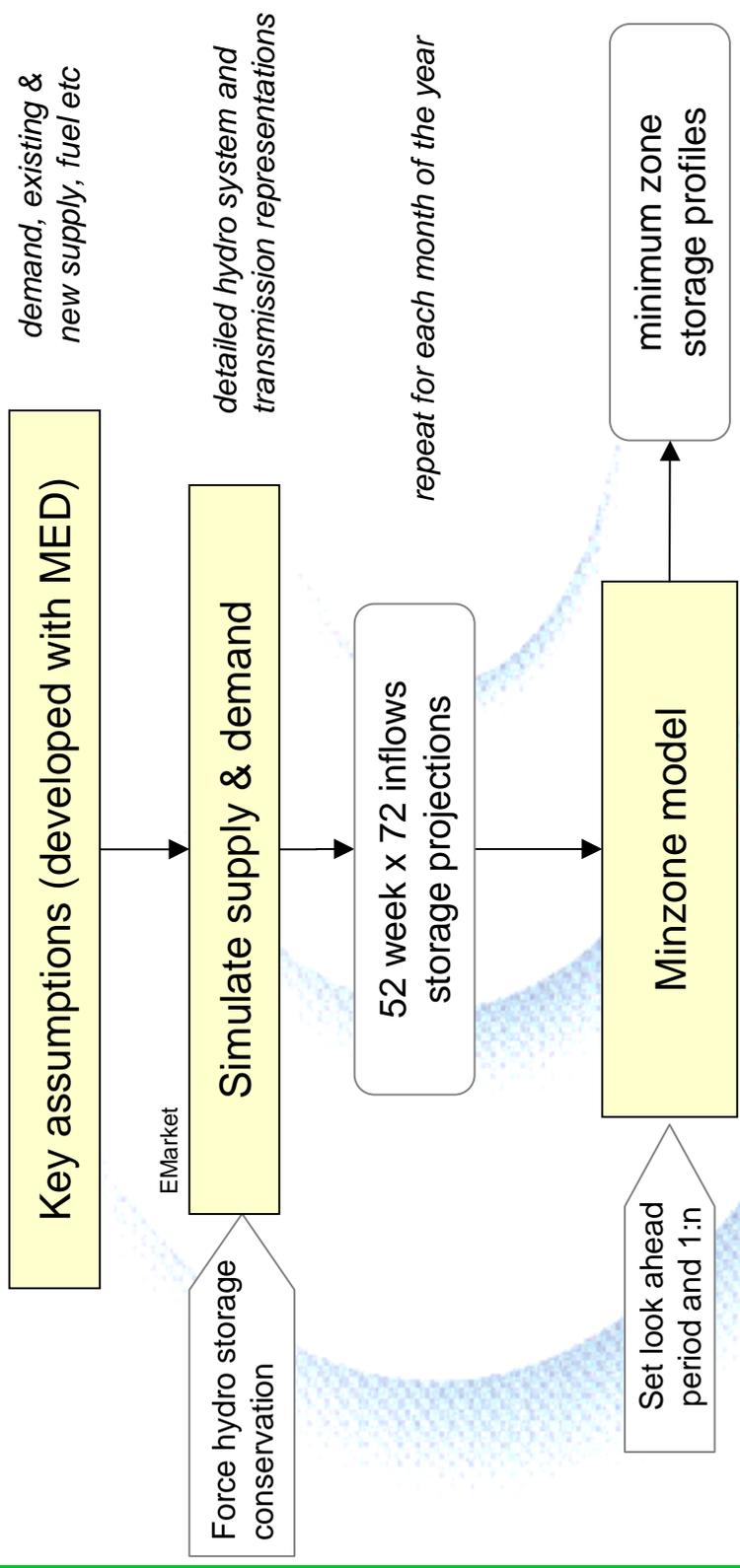
### Minimum Zone (Minzone):

- Minimum hydro storage profile that needs to be maintained to ensure that there is sufficient supply to meet projected demand
- Assumes non hydro supply operates at capability to conserve hydro storage
- Depends on:
  - look ahead period
  - severity of inflows to be covered
- Minzone envelope reflects technical supply capability of system for selected low inflow events



*Conservative approach:* – we have assumed worst 52 week inflow sequence to be covered at any time of the year

# Analysis Framework Establishing Minzone

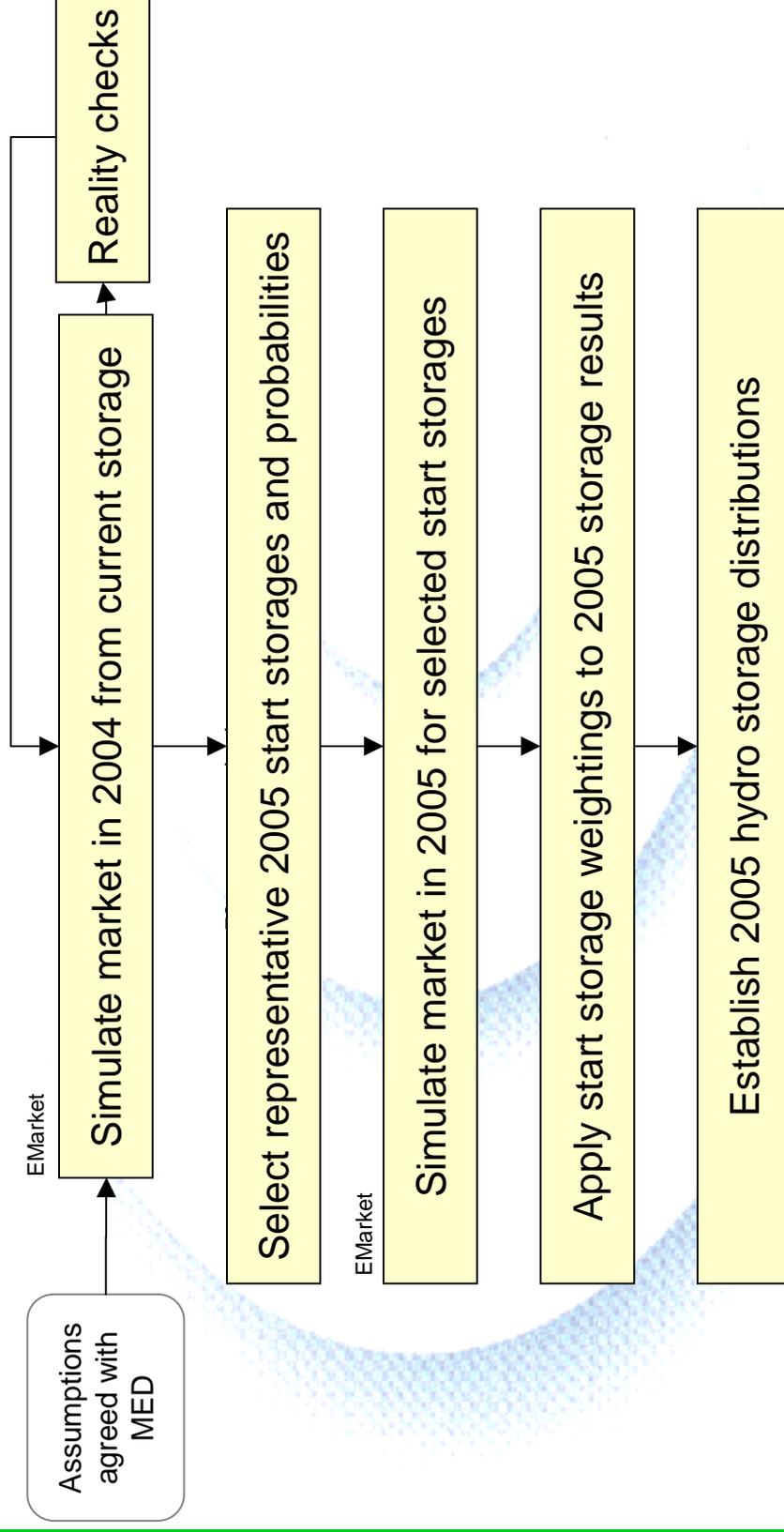


Note: Energy Link retained by MED. Concept oversaw Energy Link modelling, developed Minzone model.

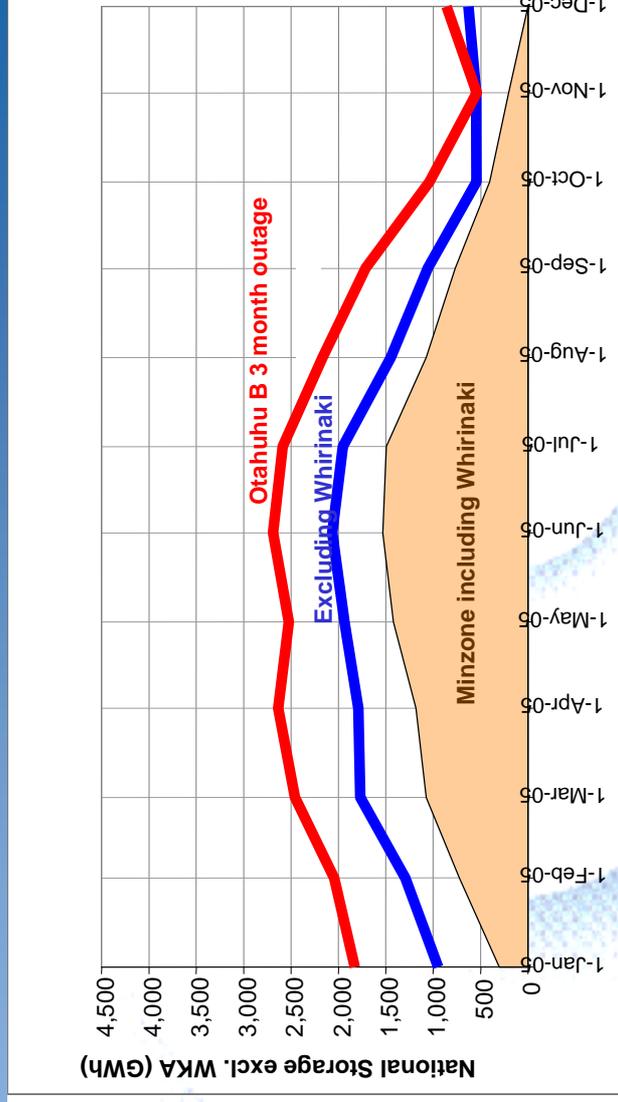
# Analysis Framework Reserves Assessment

- Minzone reflects technical supply system capability in a dry year
  - Used 52 week look ahead & worst historical inflow sequences
  - Ignored any demand response to spot prices
  - Assessed minzone with and without Whirinaki and for 3 month Otahuhu B outage
- At Minzone storage level, the risk of non supply is 1 in 72
  - But what is prospect of storage reaching minzone levels?
  - Detailed market simulations offer insights into this
- Chances of minzone being reached indicate potential need for reserves

# Analysis Framework *Market Simulations*



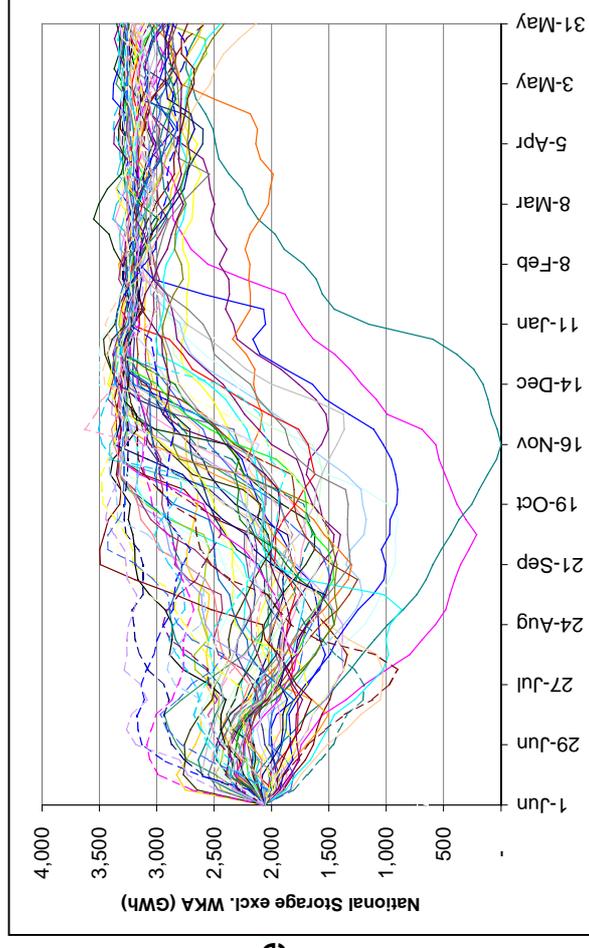
# Assessment 2005 Minzone



- Role of reserve is to extend security to 1 in 60 level
- Therefore assume Whirinaki will come on if storage falls to minzone including Whirinaki (probably triggered earlier due to spot price reaching 20c/kWh)
- Combined risk of 3 month Otahuhu B outage & worst inflows clearly worse than 1 in 60 year risk but prudent to adjust minzone should such a contingency occur
- It would also be prudent to assess the risk of combined contingencies further

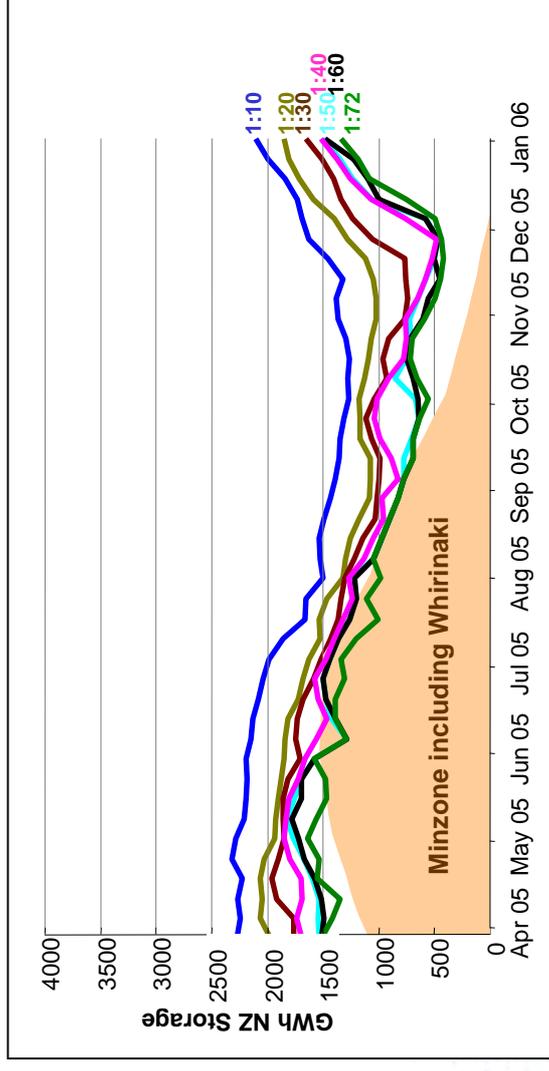
# Assessment Minzone Storage Projections

- Chart shows storage trajectories from June 2005 Minzone storage
- Two worst inflow sequences drive June minzone storage
- Under most historical inflow scenarios, storage does not fall below 1,000GWh before recovering
- For the two worst historical inflow sequences from June, storage falls over approximately 3 to 4 months
- For the two worst historical inflow sequences from June, storage falls to around 500GWh over 3 to 4 months suggesting significant time to intervene (Whirinaki excluded from the above simulations)



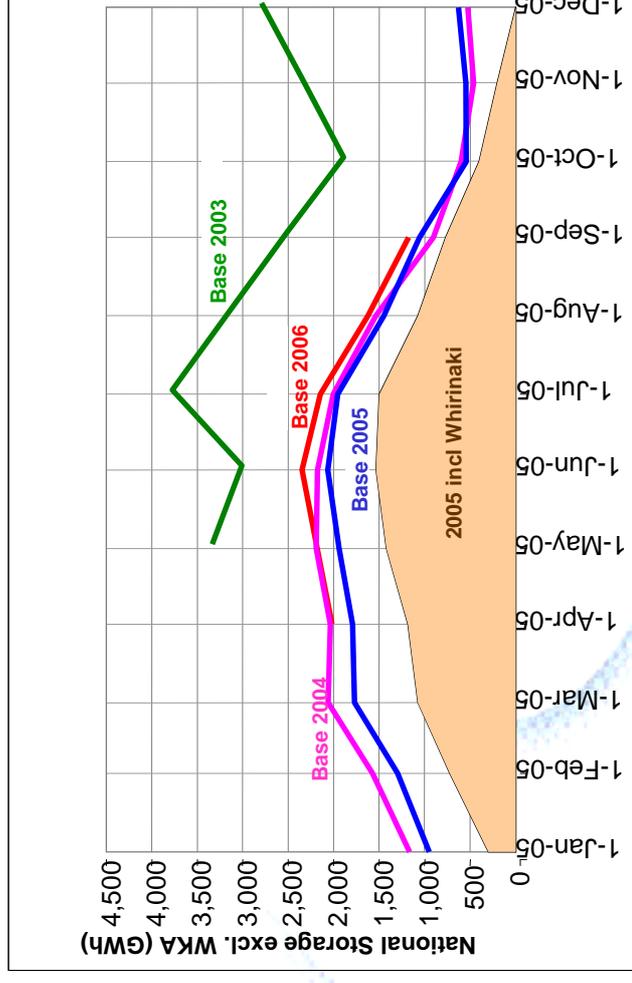
# Assessment 2005 Storage Distribution vs Minzone

- Market simulations broadly consistent with minzone
- Thermals operating near to capacity at minzone levels
- Low probability of storage falling to minzone level in 2005
- If storage does fall to minzone, all plant operating to assumed capability would just avert shortage under worst inflows
- Subject to assumptions holding, analysis is conservative (eg 1:72 minzone vs 1 in 60 dry year , no demand response to spot price etc)



# Assessment 2003 in Perspective

- In 2003, the minzone was considerably higher than current estimates
- Thermal fuel supplies were constrained
- 2003 minzone shown here was calculated in late April 2003
  - included some demand response and emergency supply options (inc extra fuel)



- Significant industry response to MED briefing on security risks in early March 2003 suggests closing information gaps about thermal fuels is important

# Assessment *Transmission Issues*

- Risk of transmission constraints limiting southward transfers
  - thermal supply can be constrained overnight (especially if Waikato not particularly dry)
  - risk of Whirinaki not being able to operate at full capacity
  - could cover thermal outages though
  - when e3p comes on line in 2007, situation may be worse depending on status of New Plymouth and Huntly fuel stocks
  - if additional reserves are to be procured, transmission issues and type , location and duration of reserve energy contracts need careful consideration

# Assessment

## Overall Conclusions

- 2005 & 2006 security concerns should be demonstrably less than 2003
  - our analysis is conservative to the extent that thermal assumptions can be relied on
  - eg no market demand response to spot price, 1 in 72 assessment, 52 week look ahead etc
- Prospect of e3p in 2007 suggests security risks could reduce significantly
- Potential transmission constraints warrant scrutiny to confirm Whirinaki status
- Key issues for the Commission in considering extra reserve energy for 2005 would appear to be:
  - The extent to which the fully fuelled assumptions can be relied on
  - The level of comfort that all non hydro generation will be fully committed when a minimum storage threshold is reached
  - Whether it wishes to insure against other risks such as the combination of a dry year and plant failure

The screenshot shows the Electricity Commission website in an Internet Explorer browser window. The browser title is "Electricity Commission - Security of Supply - Microsoft Internet Explorer". The address bar shows "http://www.electricitycommission.govt.nz/develop/supply/index.html". The website header features the "Electricity Commission" logo with the Māori name "Te Komihana Hiko" below it. A navigation menu on the left includes links for "About the Commission", "Industry governance", "Industry operations", "Industry development", "Work plans", "Wholesale", "Retail", "Transmission", "Common quality/system operation", "Security of supply", "Advisory Groups", "News", "Publications", "Links", "Contacts", and "Glossary". The "Security of Supply" section contains a globe graphic and text explaining the Commission's role in meeting system security. It includes a link to a "New Zealand Government's concern" and a "Submission on Need for Reserve Energy for 2005". A paragraph states that the Commission will be responsible for managing the electricity sector so that electricity demand can be met in a 1-in-60 dry year, without the need for emergency conservation campaigns. It also mentions that this is a result of the "New Zealand Government's concern" that there was not adequate incentive under previous market arrangements for generators to provide for sufficient supply security in very dry years. A final paragraph notes that the Commission's activities will include forecasting supply and demand, developing and publishing minimum hydro levels for security of supply, contracting for reserve energy, and improving the ability of consumers to manage price risks in the market. The footer of the page provides contact information for the Electricity Commission, Level 7, ASB Tower, 2 Hunter Street, P O Box 10041, Wellington, New Zealand.