

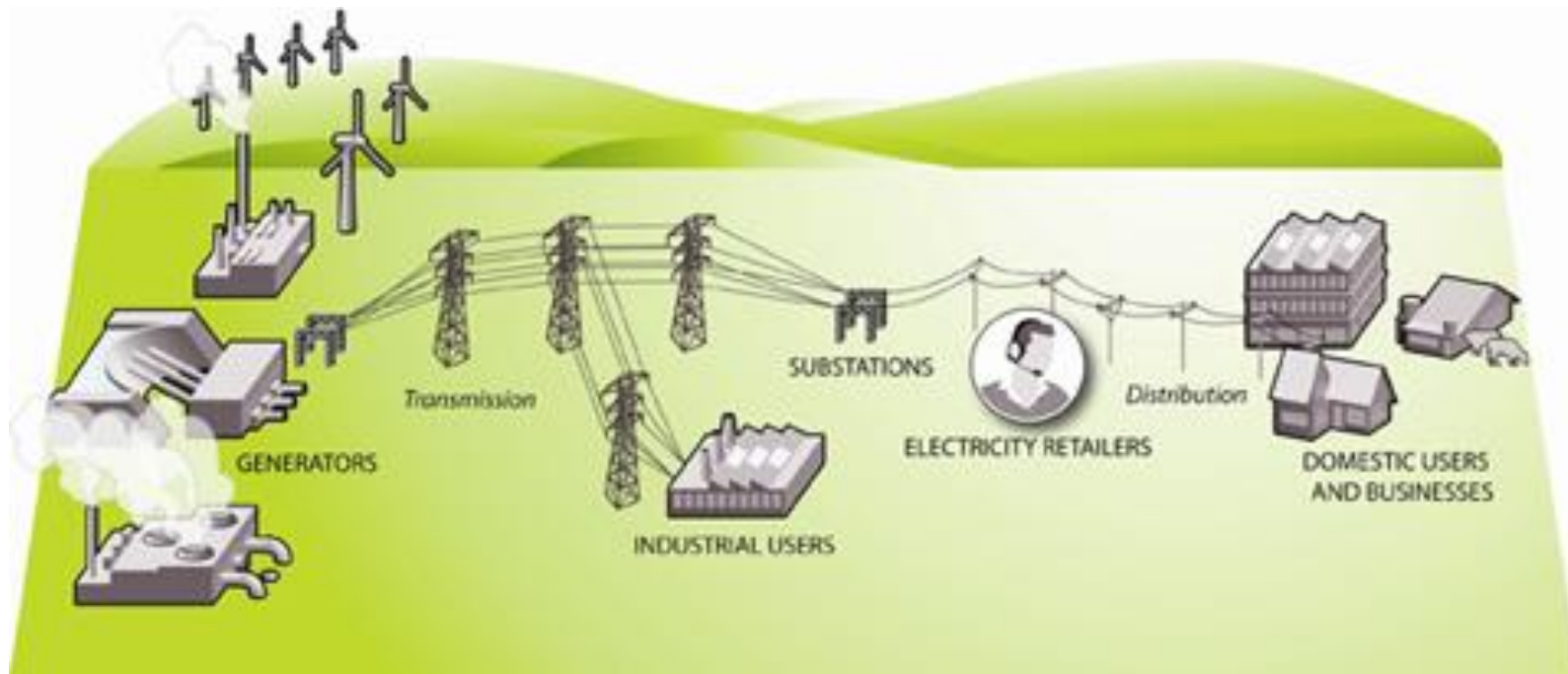
# NAVIGATING A NEW WORLD: WORKING FOR MIGHTY RIVER POWER AS AN ACTUARY

Clinton Freeman

21 May 2014

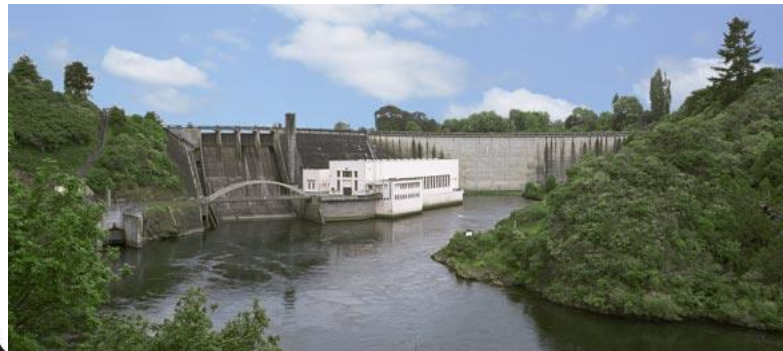
# INTRO TO NZ ELECTRICITY INDUSTRY

# NZ ELECTRICITY INDUSTRY: THE VALUE CHAIN



[www.med.govt.nz](http://www.med.govt.nz)

# NZ ELECTRICITY INDUSTRY: GENERATION



# NZ ELECTRICITY INDUSTRY: THE NATIONAL GRID



[www.mfe.govt.nz](http://www.mfe.govt.nz)

# NZ ELECTRICITY INDUSTRY: THE NATIONAL GRID

**T R A N S P O W E R**



## TWO MAIN FUNCTIONS:

- ◉ Owner of transmission infrastructure connecting generation and substations.
- ◉ System Operator - real-time operation of grid and electricity market

# NZ ELECTRICITY INDUSTRY: LARGE INDUSTRIALS



# NZ ELECTRICITY INDUSTRY: RETAILERS





# NZ ELECTRICITY INDUSTRY: LINES COMPANIES



# NZ ELECTRICITY INDUSTRY: CONSUMERS

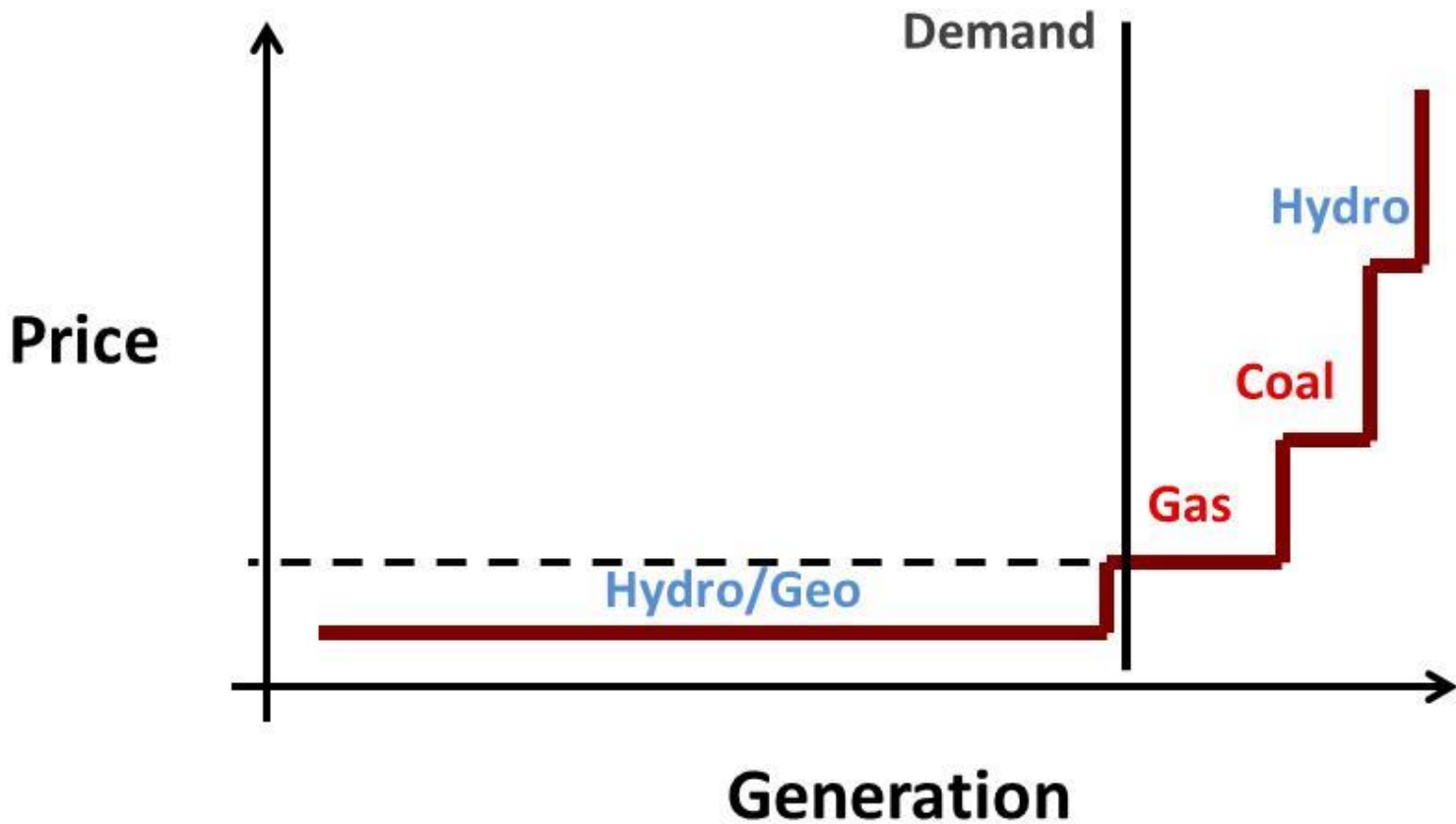
- ◉ Residential
- ◉ Commercial
- ◉ Industrial
  
- ◉ Flat demand
- ◉ Economic growth versus energy efficiency
- ◉ Shift to service-economy

# WHOLESALE ELECTRICITY MARKET

# BUYING AND SELLING ELECTRICITY ON THE *WHOLESALE* MARKET

- ◉ Generators sell into market
- ◉ Retailers (and large industrials) buy from market
- ◉ ‘Internal hedge’ if generation=retail
  
- ◉ Circa 285 nodes across country
- ◉ Half-hourly trading (48 per day)
  
- ◉ Offers made up to two hours in advance
- ◉ ‘Supply and Demand’ in action

# MARGINAL PRICING



# WHOLESALE PRICES - FACTORS

- ◉ Electricity generally increases in price the further from generation
- ◉ Prices increase with demand (morning and evening peaks)
- ◉ Winter versus summer
- ◉ Droughts
- ◉ Outages - stations
- ◉ Outages - transmission
  - HVDC - market separation of NI and SI
- ◉ Reserves market

# DATA DATA DATA

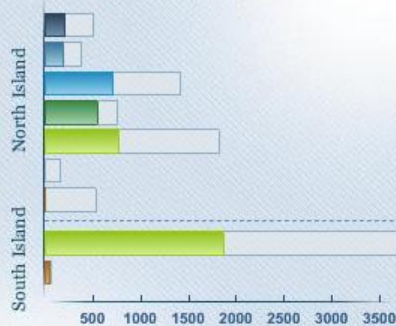


## Electricity Market Overview

LAST UPDATED

04.20pm FRI 16 MAY 2014

### Current Generation (MW)



16/05/14 15:30

### Inter Island Flow



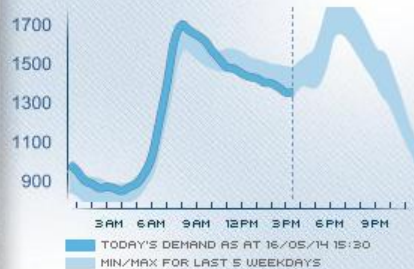
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### Regional Price (\$/MWh)

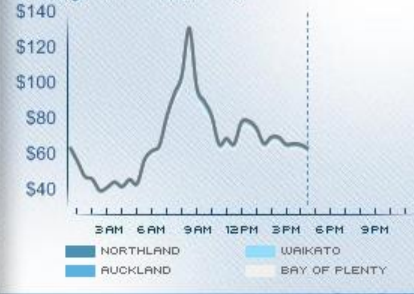


16/05/14 16:30

### Today's Demand (MW)

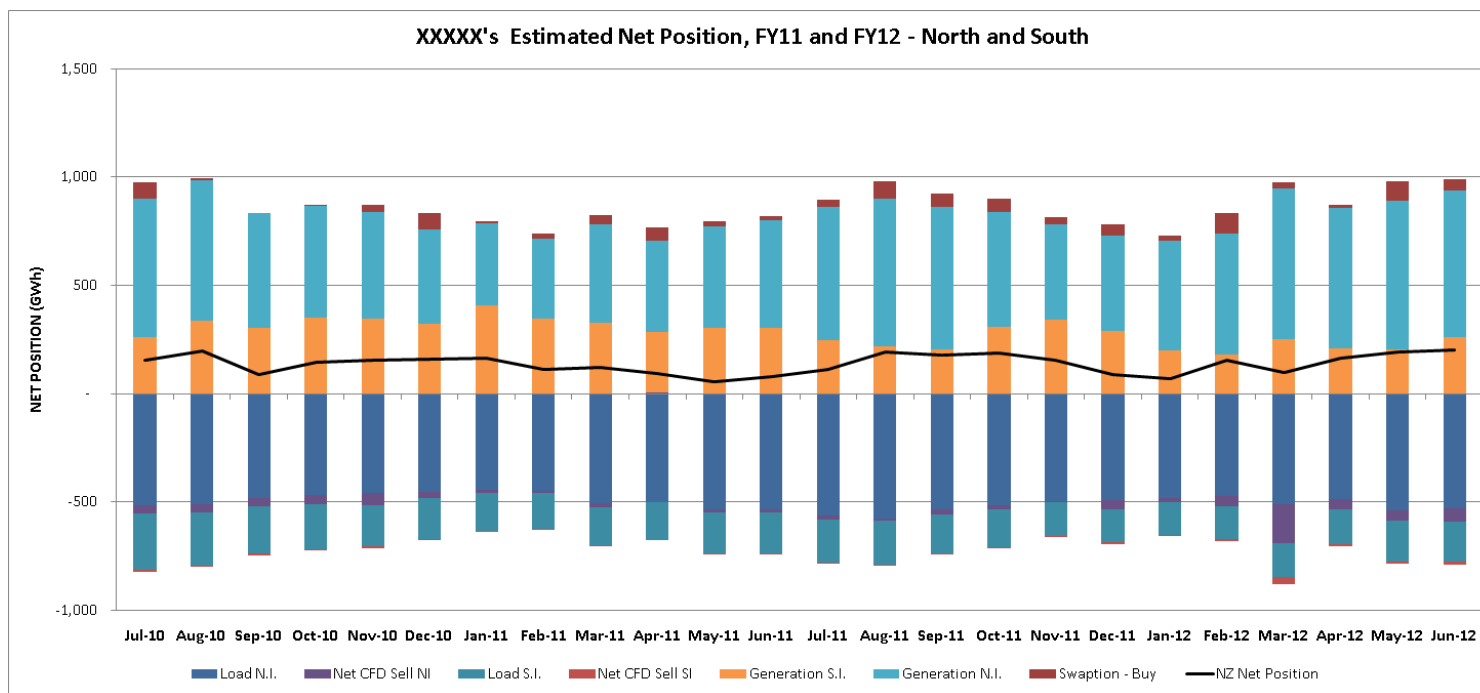


### Today's Price (\$/MWh)



# COMPETITOR ANALYTICS

- Net position
- Long or short generation?
- Plenty of publicly-available data...but not enough





# HEDGING

## ○ Contracts for Difference

- Derivative
- No physical supply of electricity
- Large industrial buys CFD - still buys electricity at prevailing wholesale price but is reimbursed (or pays out) difference between wholesale price and strike price

# MODELLING ENERGY MARGIN

- Current analysis is deterministic
- Shift to Bayesian Networks to provide range of possible outcomes
- Back-casting - what were the main drivers (and by how much) for the deviation from budget?
- Delivery of results with those 'promised' in IPO document

# PRICE FORECASTING

- ◉ Statistical approach
- ◉ Fundamental approach
  
- ◉ No year is ever the same
  - Hydrology
  - New generation/decommissioning
  - Competitor behaviour
  - Grid upgrades

# ANALYTICAL OPPORTUNITIES FOR ACTUARIES

- ◉ Wholesale price forecasting
- ◉ Solutions to weather-dependence, eg weather derivatives
- ◉ Big data analytics with smart meter data
- ◉ Insurance and risk management
- ◉ Hedging
- ◉ Treasury

# ROAD TRIP

