

# Pricing 100% Renewables

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# Pricing 100% Renewables

- This presentation is not about:
  - ICCC modelling
  - the technical feasibility of 100% renewable electricity
- This presentation is about:
  - how electricity prices might behave as we get closer and closer to 100% renewables
  - what this could mean for energy management

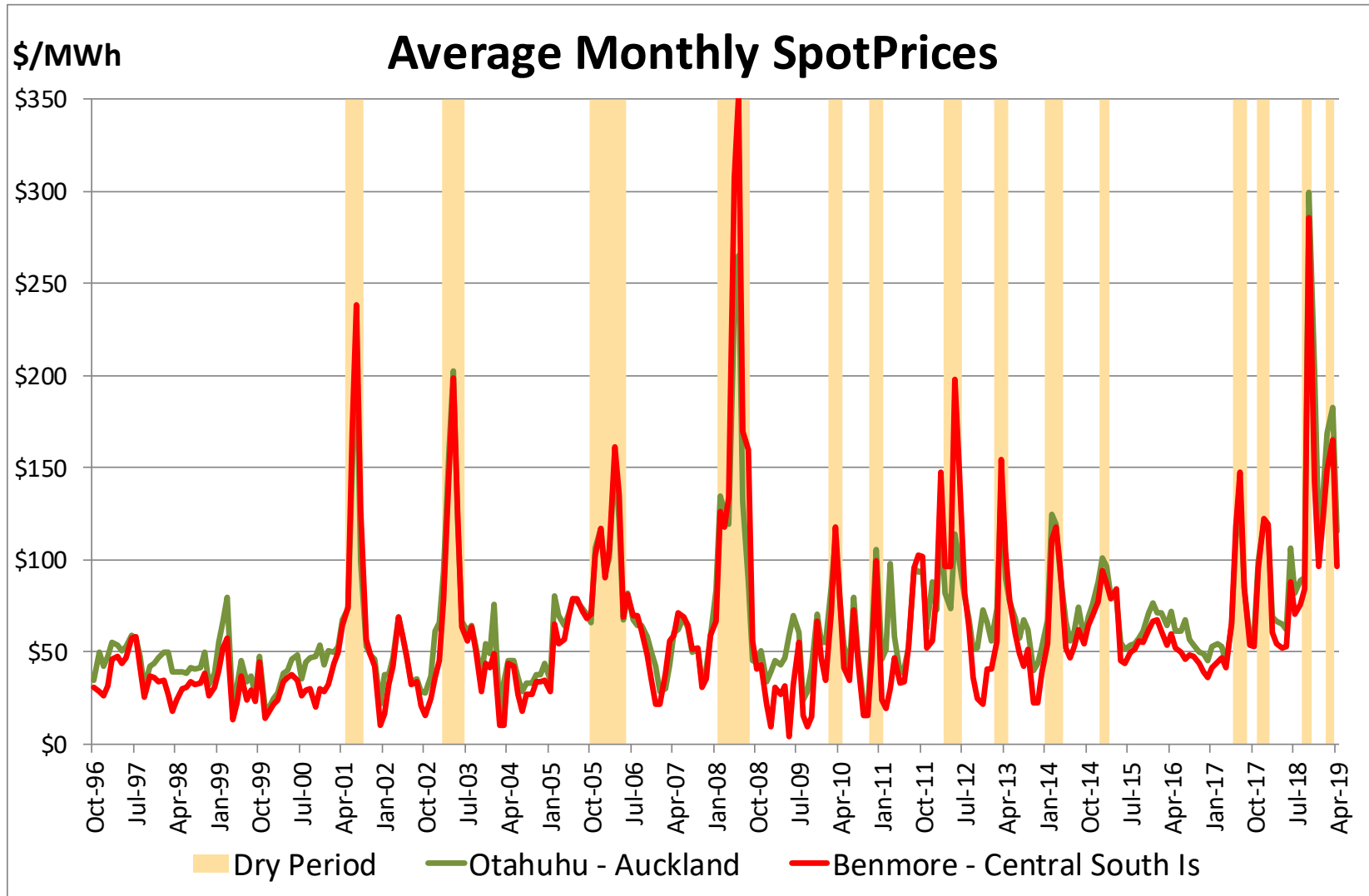
# Timeframe

**Sometime before 2050,  
based on current knowledge**

# The Basics of Electricity Pricing

- We'll focus on spot prices because ~100% of all electricity generated is sold through the spot market, so expectations of future spot prices tend to drive fixed prices paid by consumers
- Spot prices are currently mainly driven by:
  - demand
  - availability & retirements of plant ("TCC", "Huntly" sometime in the 2020s)
  - the total cost of building, owning and running plant
  - the price of natural gas for thermal generation
  - inflows: wet and dry periods
  - wind farm output

# Historical Prices by Month



**We already understand that a high percentage of renewables leads to volatility in prices**

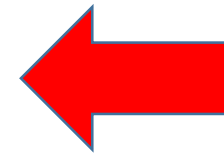
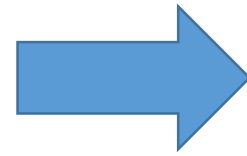
**\$10/MWh = 1 c/kWh**

# Impact of Natural Gas Prices

Hydro ~55% of market



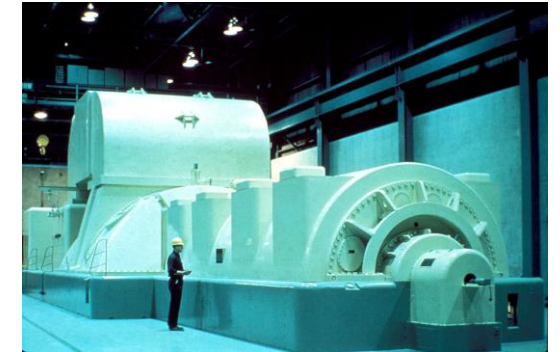
Minimal variable costs



Lowest offers dispatched first

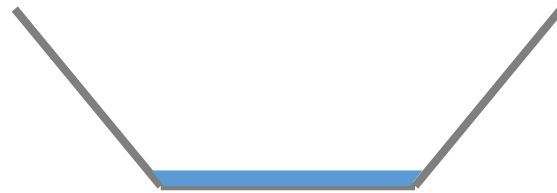
Offers to generate at variable costs starting at \$65/MWh

Gas ~17% of market



Significant variable costs under long term contract

Offers to generate at less than \$65/MWh



Less gas burned, resulting in shortage!

Offers to generate at more than \$65/MWh



More gas burned, excess spill

**Hydro storage is priced to “shadow” thermal offer prices**

# Increasing Renewables



**Dry  
periods**



**Dry, calm, cloudy  
periods**

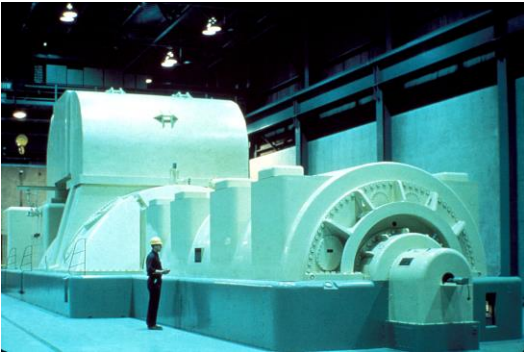
**Wet  
periods**



**Wet, windy, sunny  
periods**

**And everything in between:  
correlations become more important**

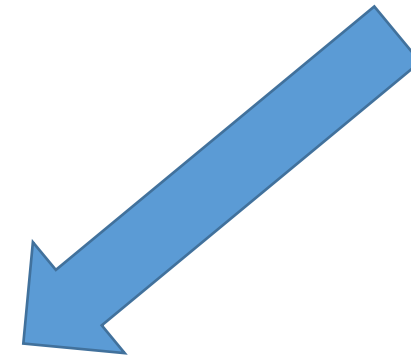
# Reducing Thermals => “Peaking” Role



**Low Renewables**  
Running more



**High Renewables**  
Running less

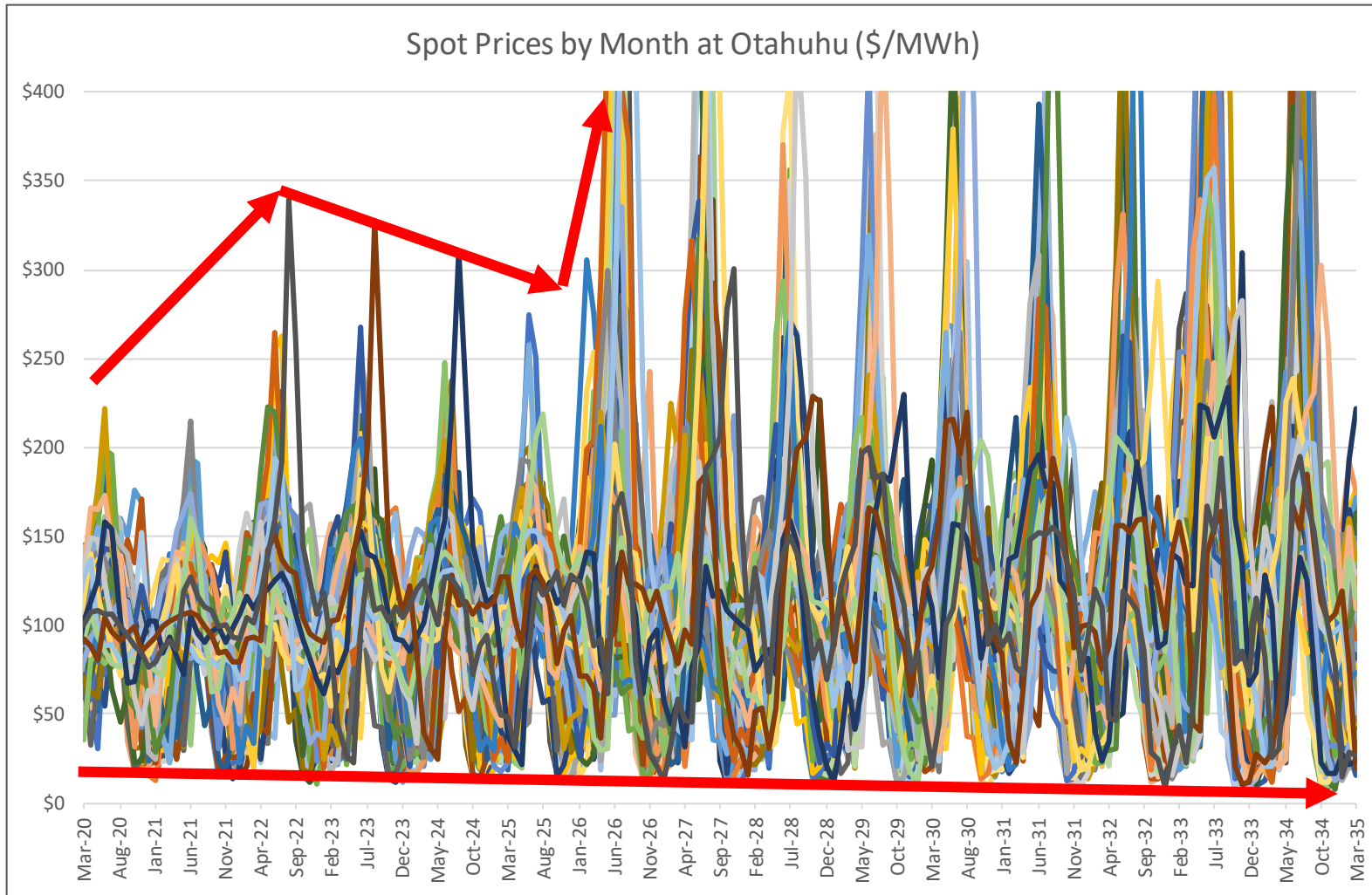


- ❑ Higher price when it does run, to recover fixed costs
- ❑ Influence on hydro pricing falls off near 100% renewables



# Greater Volatility – 96% Renewables Study

- This all adds up to:
  - spot prices become more volatile
  - winter prices higher relative to summer prices
- (Fixed) prices paid by consumers may fluctuate during the transition to 100% renewables



**TCC retires 2021, Huntly 2025**

# 100% Renewables

- Wind & solar “over-build” to cover dry years
  - BUT: winter still hard to meet peak demand on calm winter mornings & nights
  - total cost of supply rises substantially (due to over-building)
  
- Renewables offer into the spot market at low prices
  - with no gas-fired generation, there is a risk that spot prices will not be high enough to support investment in new generating plant

# Some Solutions at 100% Renewables?

- We have a shortage price of \$10,000 - \$20,000/MWh
- The literature suggests that prices during shortages may need to rise by a factor of eight \$80,000+/MWh in New Zealand
  - average prices high enough to support new investment
- Consumers will have greater price incentives to avoid shortages
  - because prices during shortage could be extremely high
  - implications for the monitoring and control of exposure to spot prices

# Some Solutions at 100% Renewables?

- May even need to introduce new market mechanisms such as a “capacity market” or “peaking ancillary service”
- There may be new opportunities to provide ancillary services or capacity
  - for example, getting paid to provide batteries, demand response, on-site generation, vehicle-to-grid discharging by EVs

