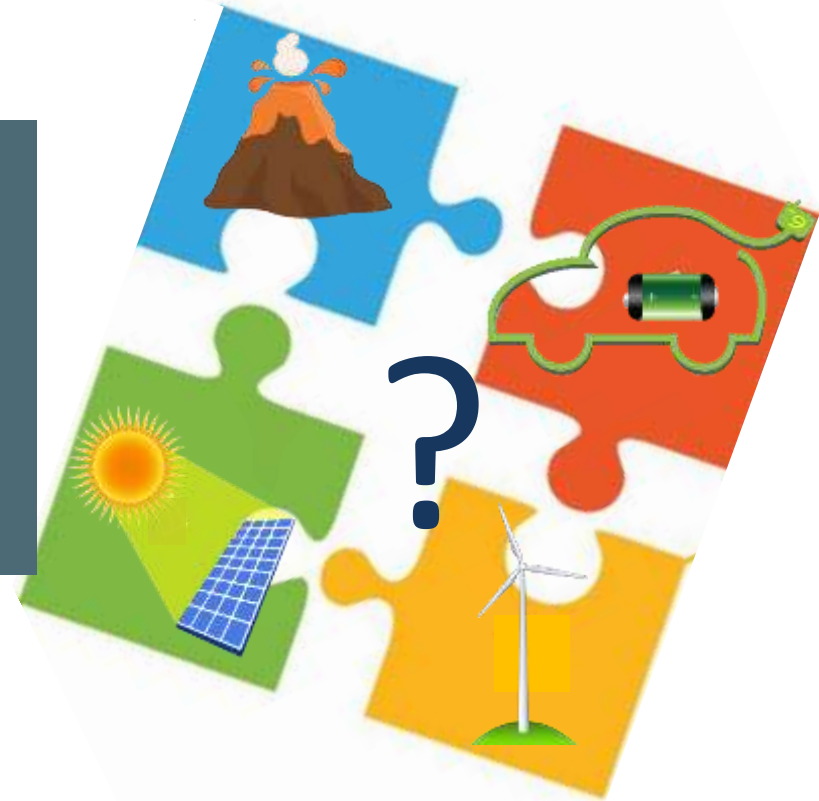




# Where does wind fit in NZ's energy technology mix?

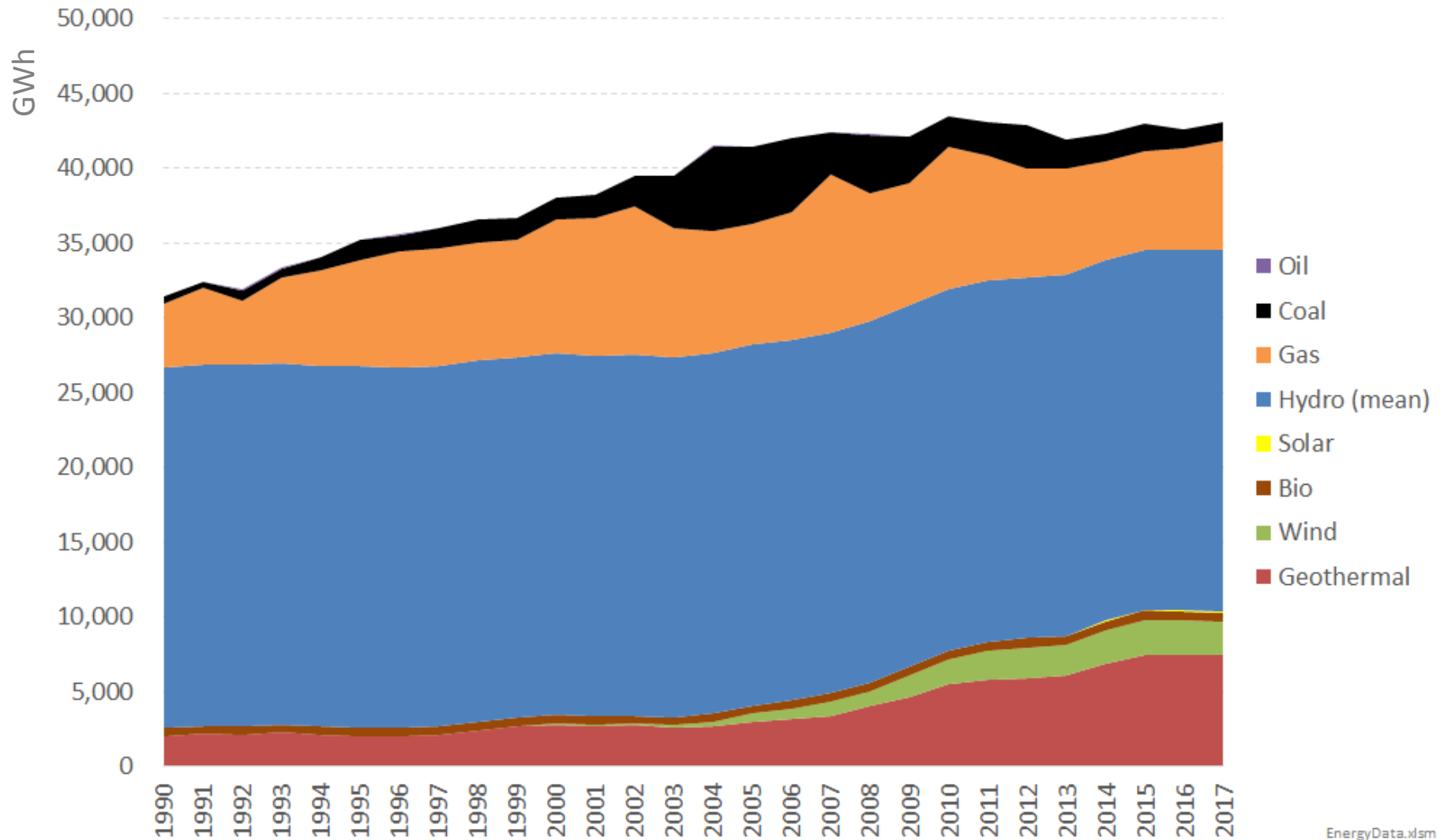
**Simon Coates**  
**Concept Consulting**  
**2 May 2018**



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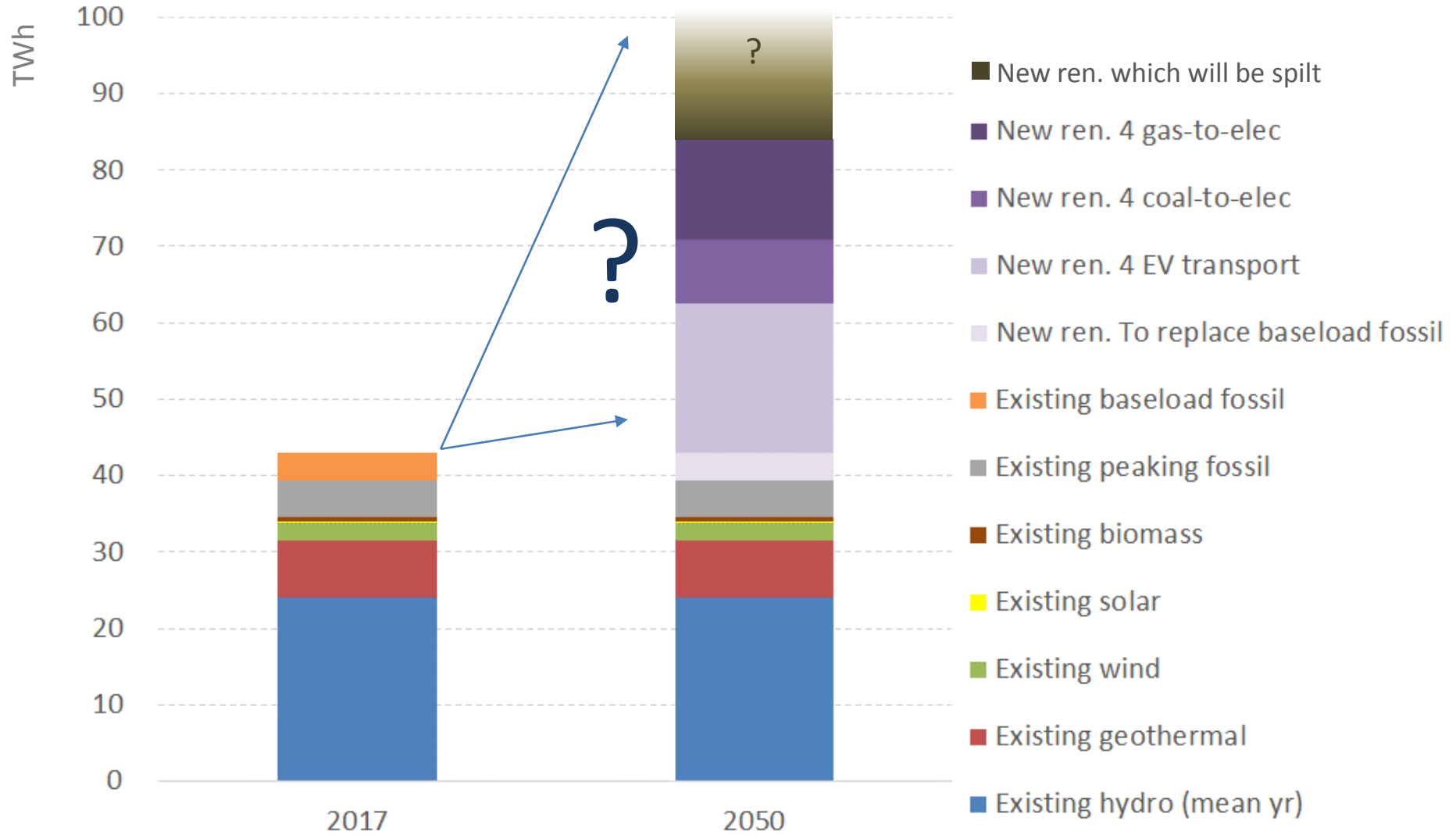
- Where we have come from?
- Where we need to get to?
  - What does de-carbonisation of our economy mean for electricity generation?
- How do we get there?
  - Renewables policy
  - Managing the surplus / scarcity dynamic of variable renewables

# Where have we come from?

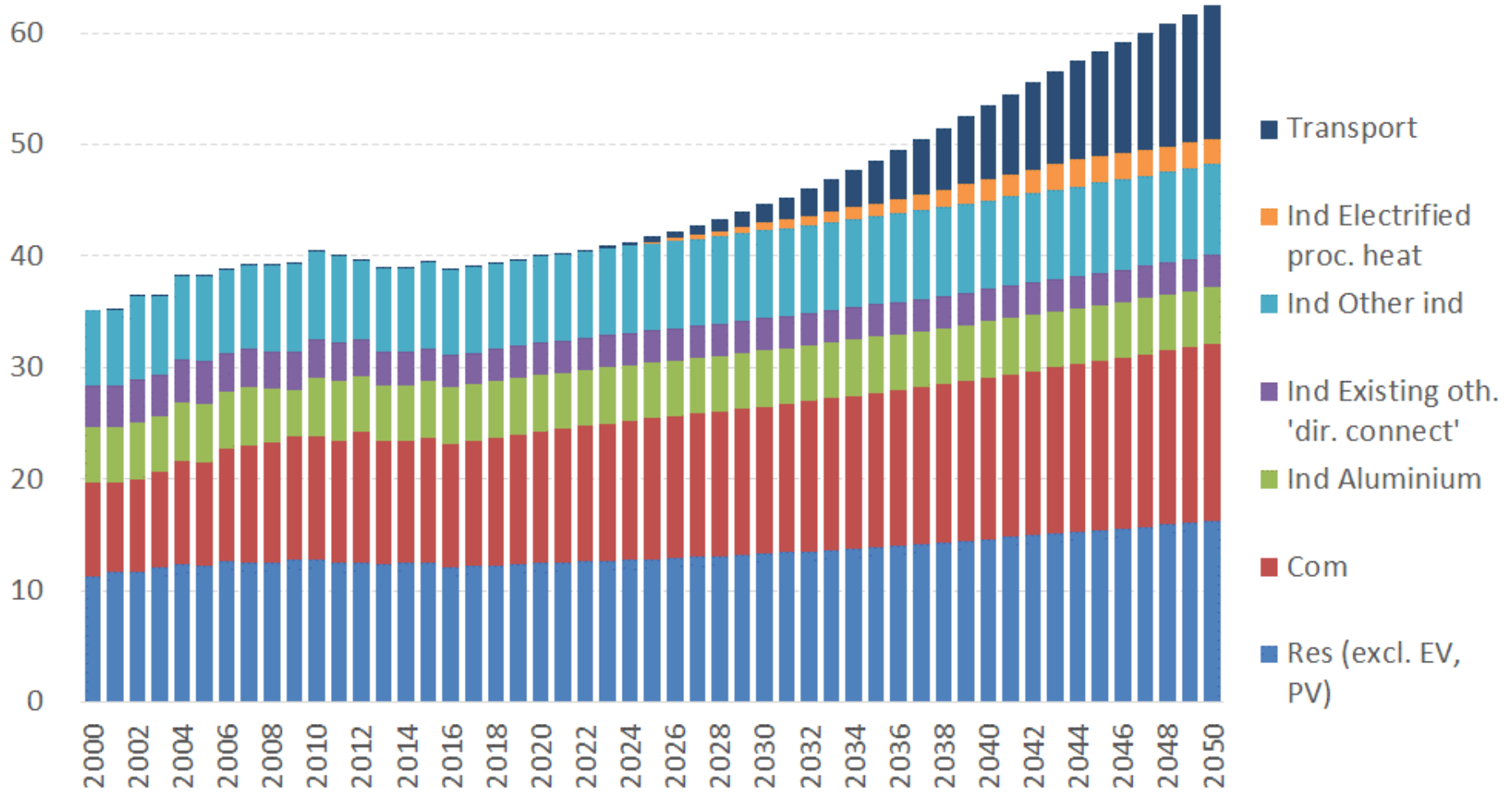


EnergyData.xlsm

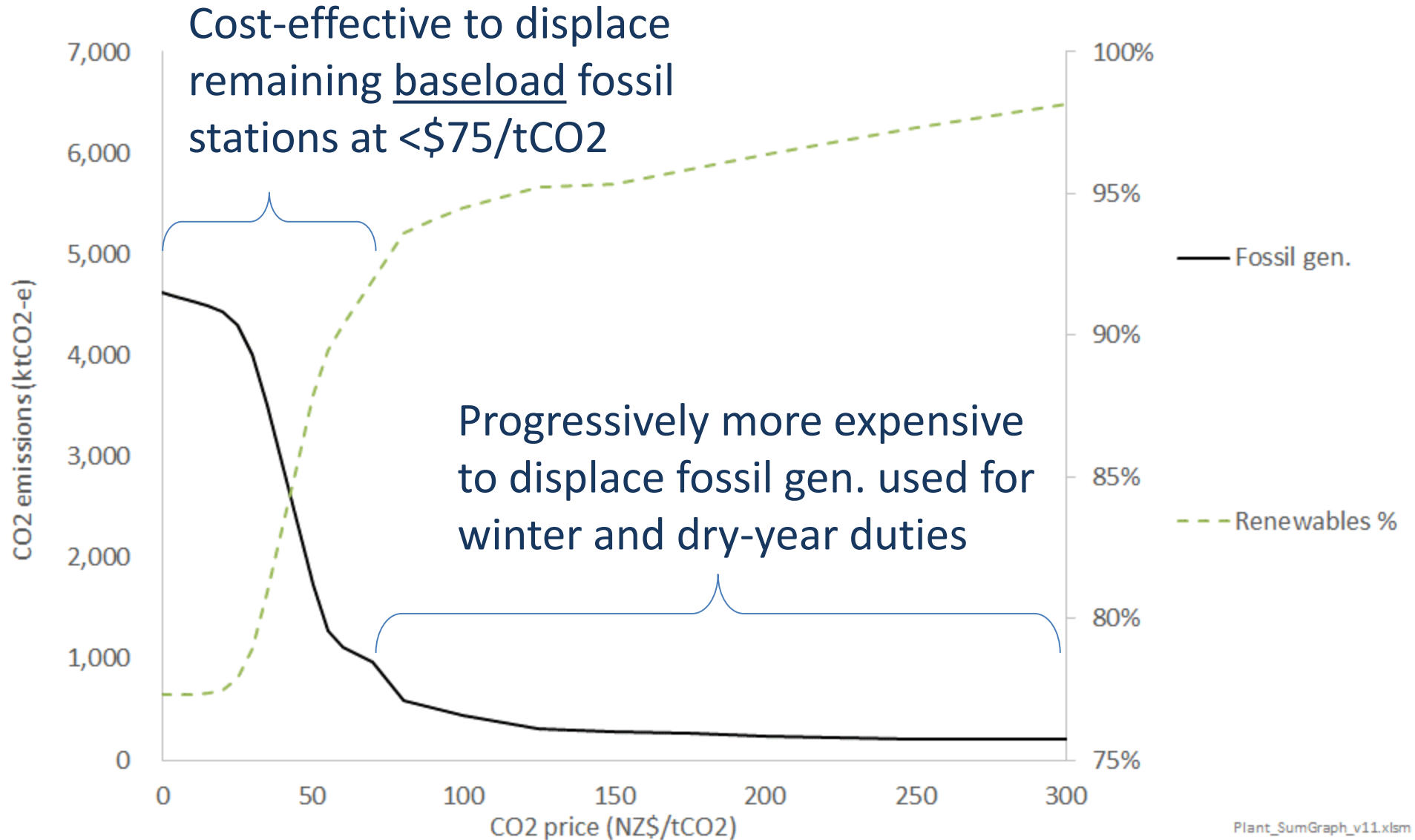
# Where do we need to get to?



# Our net-zero-for-2050 projections prioritise what is cost-effective

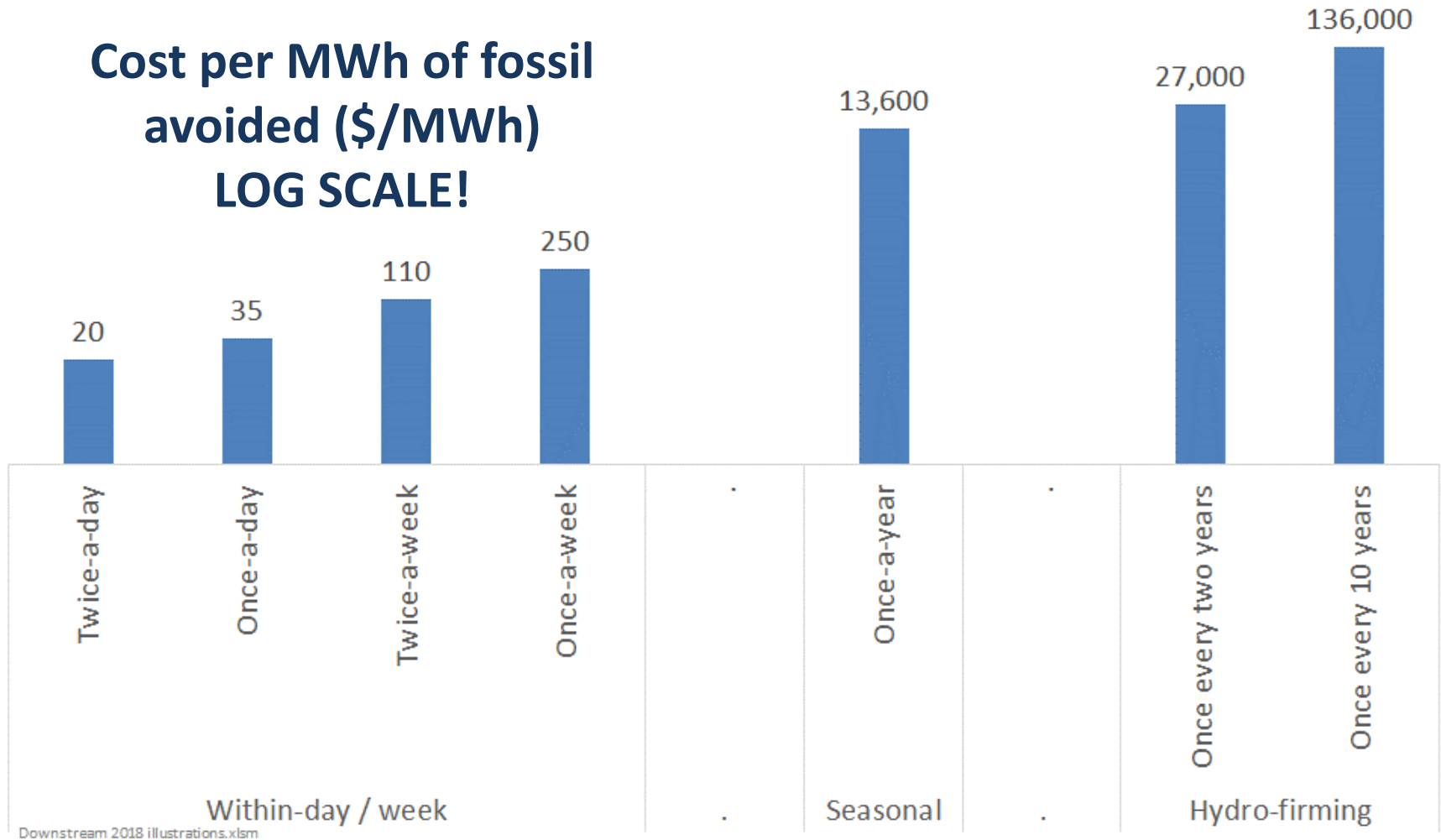


# What about moving to 100% renewables?



# But won't batteries change things?

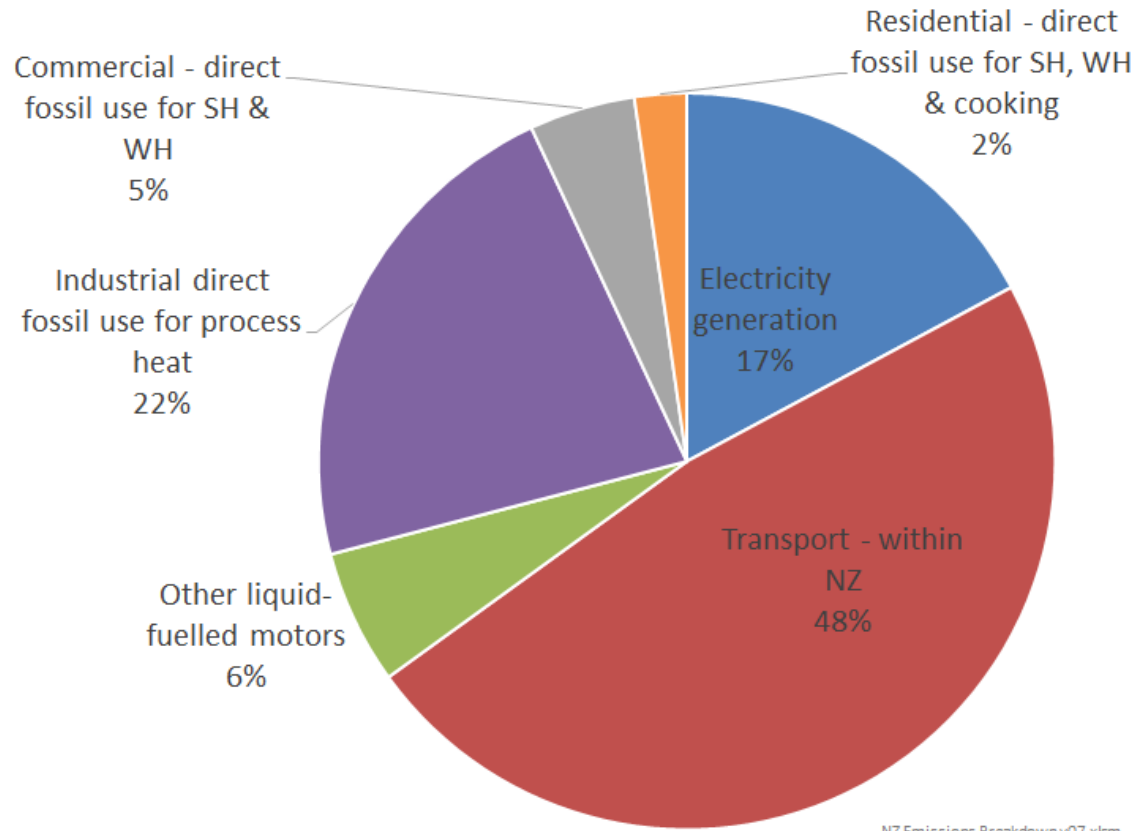
- How much would it cost to use a battery costing \$100/kWh (of storage capacity) to avoid fossil generation?



# Aiming for 100% renewable electricity may lead to more emissions for NZ as a whole

- Electrification is key technology for transport and process heat

New Zealand's 2015 energy-related greenhouse emissions

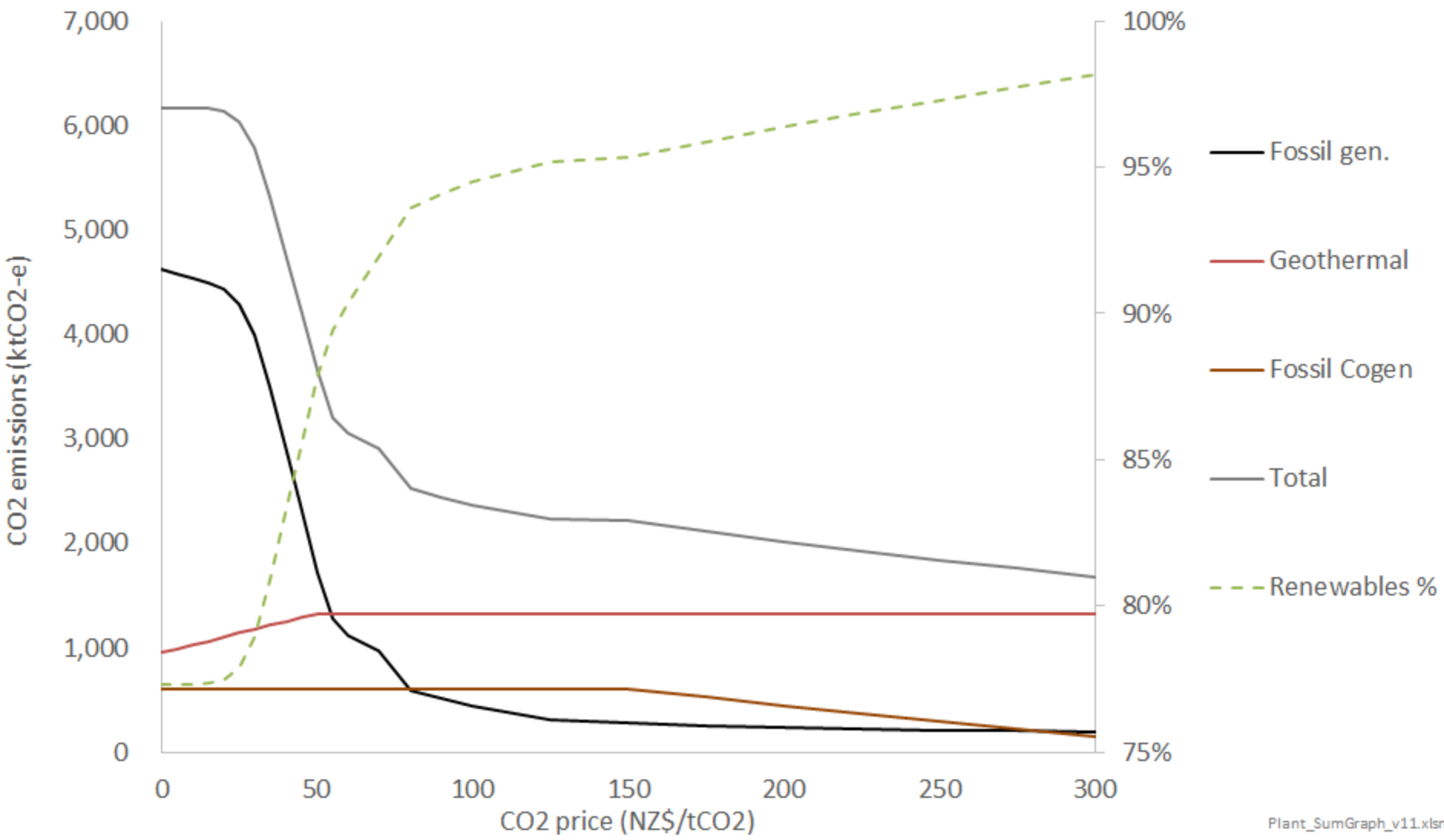


NZ Emissions Breakdown v07.xlsm

- Making electricity more expensive may frustrate the bigger de-carbonisation prize



# Plus, why only focus on fossil generators when geothermal and fossil cogen emissions will become a bigger problem?



Plant\_SumGraph\_v11.xlsm

- Fundamentally uneconomic to provide seasonal and dry-year electricity from over-building renewables and batteries
- Forcing electricity outcomes risks worse whole-of-economy GHG outcomes
- Introducing capacity mechanisms won't change the underlying physics / economics
  - Indeed, risk of other poor outcomes, e.g. dulling ability for consumer tech. (e.g. EVs) to participate and reduce peak system costs
- Let CO2 prices do the heavy lifting!

# Which renewable technologies could / should drive the de-carbonisation of our economies?

## Pros

- Already competitive
- Firm generation



## Cons

- Emits CO<sub>2</sub>
- Finite additional resource

- Costs declining rapidly
- Large theoretical resource



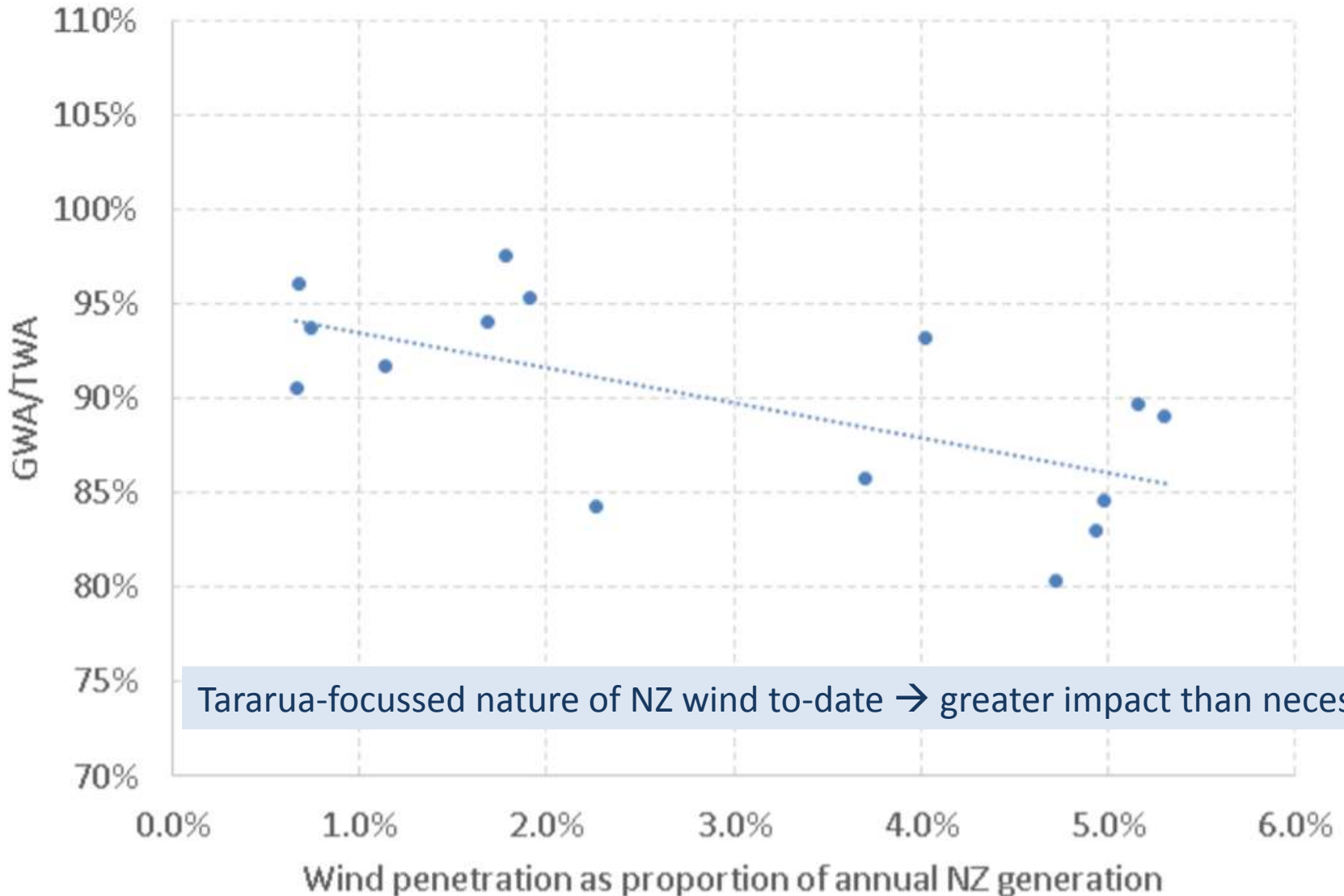
- High cost at moment
- Variable with very low capacity factor

- Already competitive
- Costs continuing to decline
- Large theoretical resource



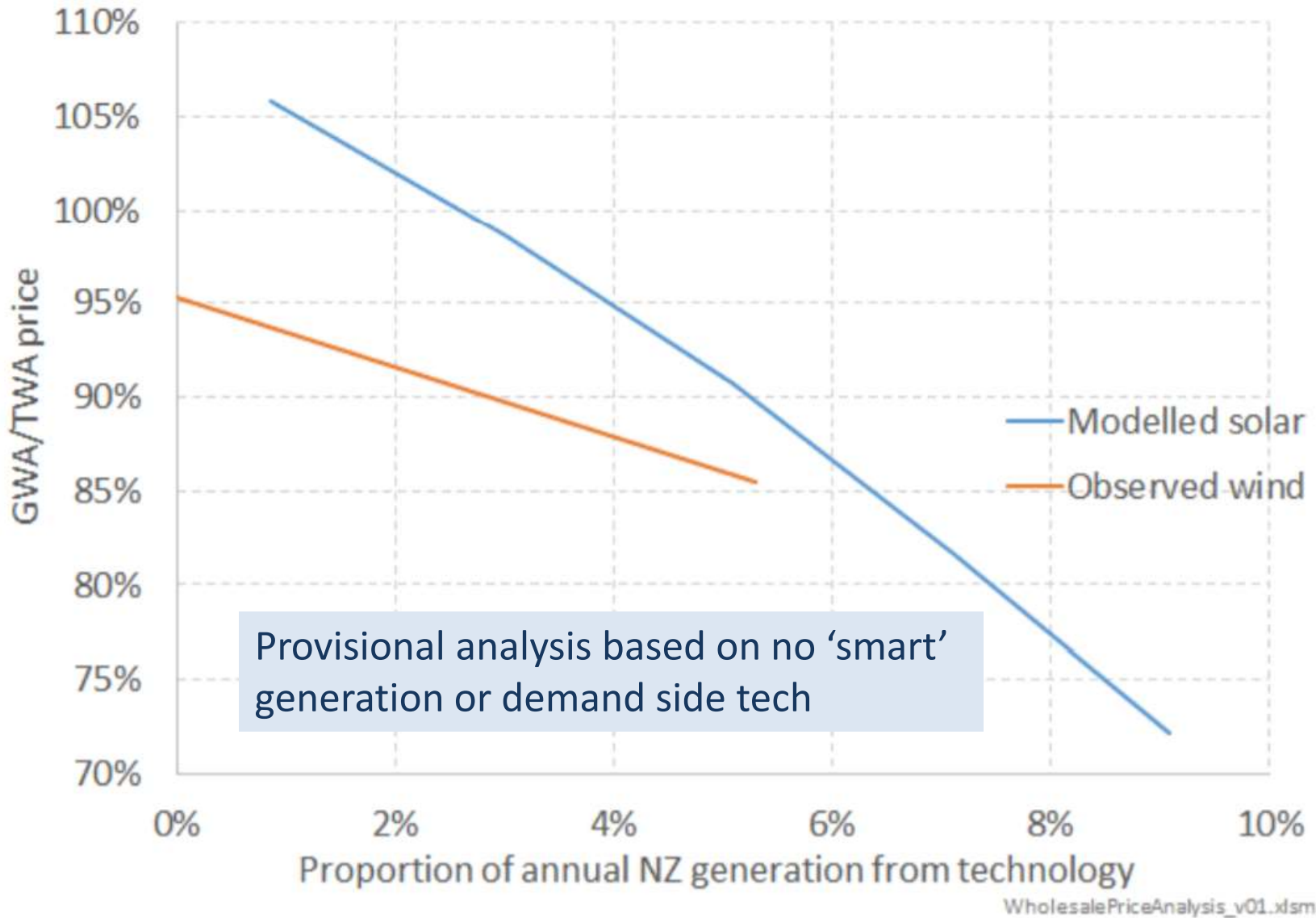
- Variable

# Falling achieved earnings with increased wind penetration illustrates the challenge of variable generation



Wind\_generation\_factor\_v01.xlsx

# The more concentrated nature of solar generation makes this even more of a challenge



# How do we manage this variability?

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- Smarter generation developments
  - Geographically diverse variable renewable generation
  - Smarter solar developments → higher capacity factors
    - Single axis tracking
    - Winter-focussed angling
    - ‘Over-sizing’ arrays
  - Diversity of generation technologies
- Increased demand-side interaction
  - Varying demand-side with changing surplus / scarcity situation
  - Smart EV charging will be critical
  - Potentially H<sub>2</sub> production at times of surplus?

# Which renewable technologies could / should drive the de-carbonisation of our economies?



## • All of them!



- Developing arrangements to facilitate a dynamic demand-side (particularly EVs) will be key to uptake of variable renewables
  - Network tariff reform will be critical to this



**Thank you!**



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## About Concept

- Concept is a specialist energy and economics consultancy that provides services to clients in New Zealand, Australia and the wider Asia-Pacific region.
- Concept provides advice on energy sector policy, business analysis, restructuring, market design, regulatory issues, energy modelling, market analysis, and technical issues.
- Combining economic rigour, leading modelling & analytical skills, and practical backgrounds in the energy sector, Concept consultants are able to provide practical solutions to client problems based on robust analysis.
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