Meeting future peak energy demand – what are the options?

What will peak demand be?

What are the options?

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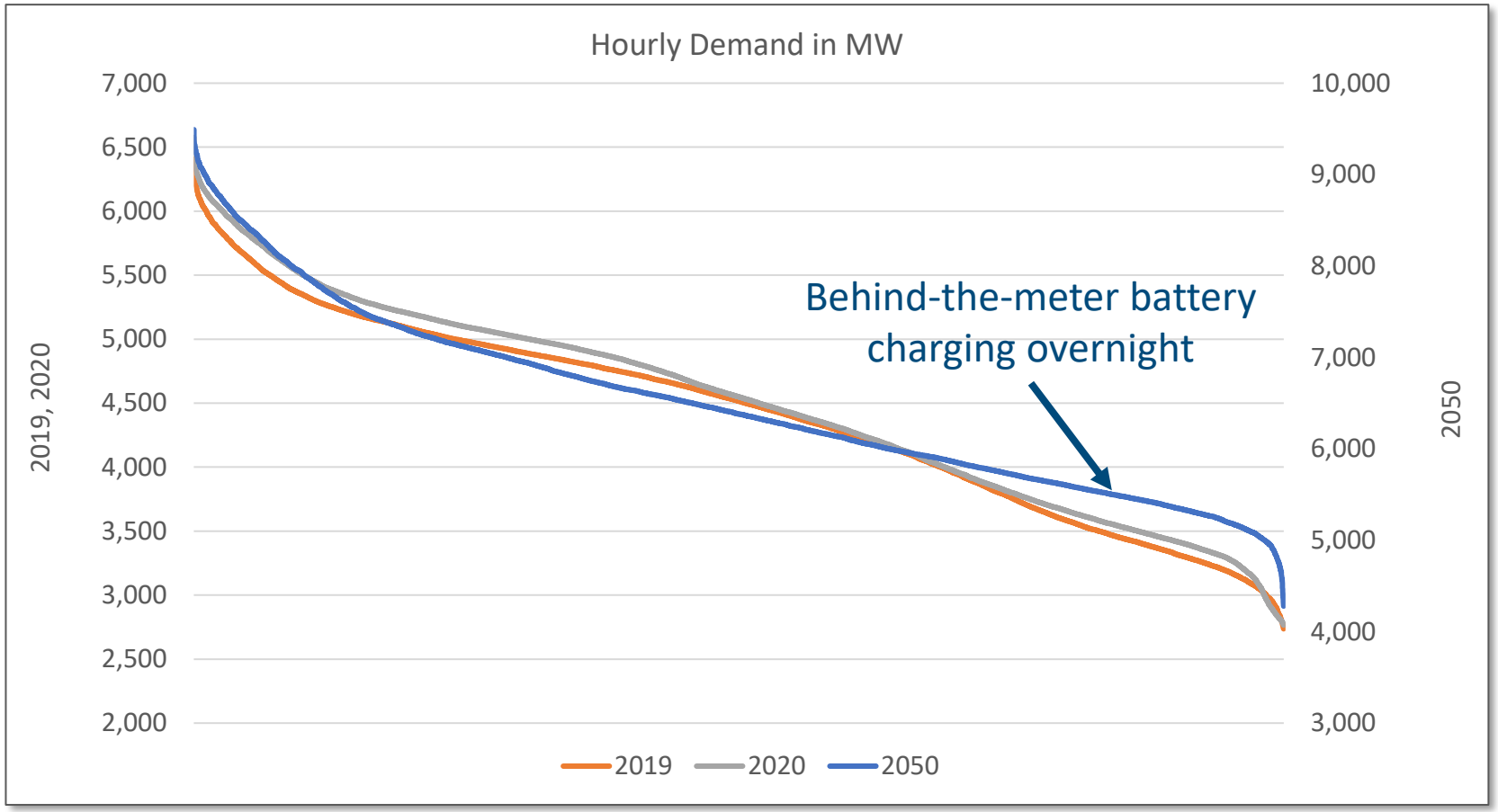
What will peak (electricity) demand be in future?

2050

- The context is 2050
- 100% renewables
- Modelled demand around 60 TWh p.a.
  - 40% higher than it is today (and after Tiwai has closed, taking 5 TWh p.a. out of the market)
- If you think you know how we'll get to 100% renewables, you don't understand how different 100% renewables will be. [to paraphrase Richard Feynman, Nobel laureate Physics]

Demand Duration Curves



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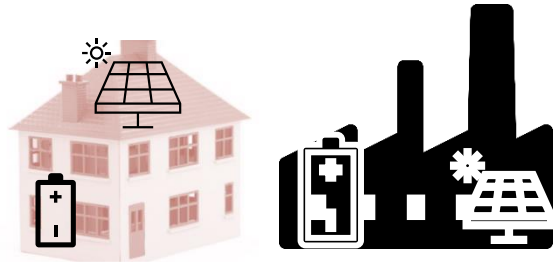
The Demand Mix

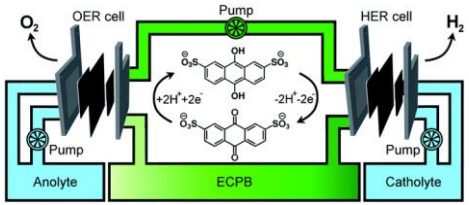
Organic growth
(population driven)



Batteries behind the meter

Batteries are net energy consumers

Millions of EVs



Green hydrogen +40 TWh?

Industrial heat pumps and electrode boilers

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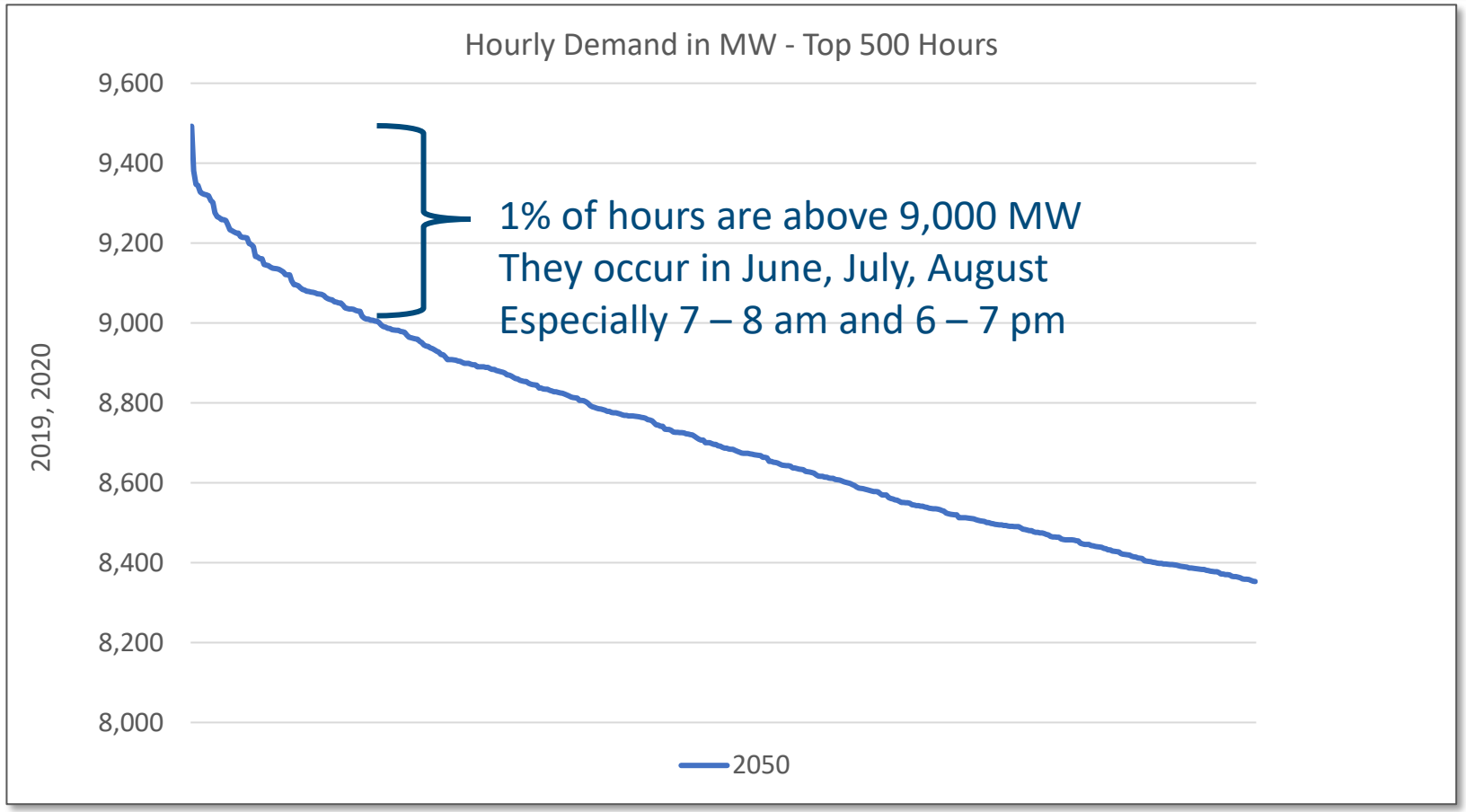
Peak Demand – what's driving it?



What do we (think we) know about peak demand in 2050?

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EVs – when will they charge?

2021

Majority of charging is at home, overnight at ≤ 3 kW

2050

- Privately owned? rented? autonomous?
- Charging overnight may remain convenient for privately owned vehicles. What about cars parked on the street?
- Fast charges for ranges of 500+ km will require 500+ kW chargers, at specialised charging stations: rush hour?
- Autonomous vehicles may charge at their base at moderate to high rates, depending on demand (for cars) e.g. time of day

Will this re-shape the daily demand profile?

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Options – Demand-side response

- Price signals: best if they are strong and consistent
  - e.g. Electric Kiwi's 'free hour of power'
  - paid demand-side response programs including battery-to-grid

- Automation: home and business networks that reduce non-essential consumption

- Efficiency: permanently reduce demand

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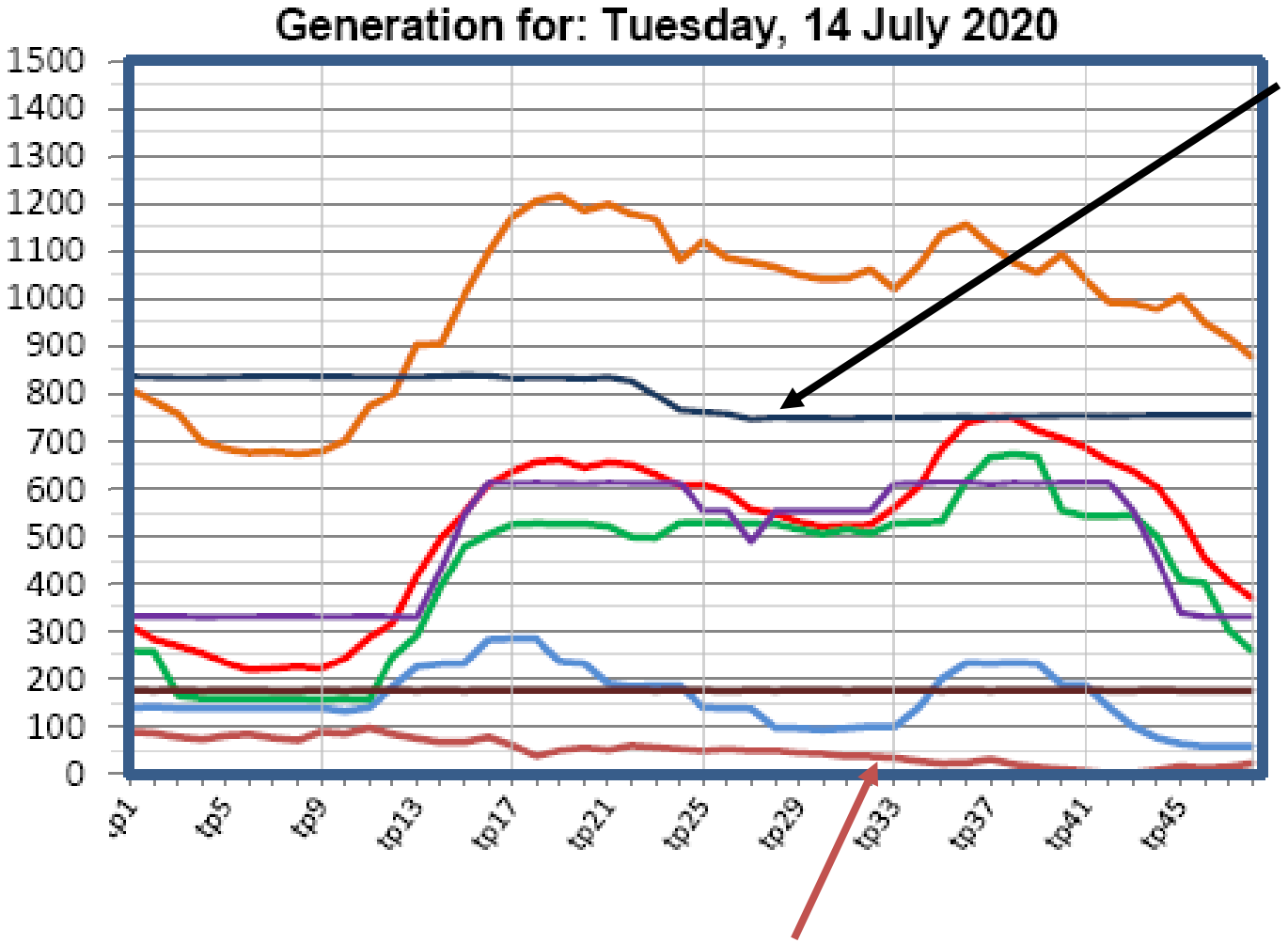
Options – renewable generation

Solar output is zero before 7 am and by 6 pm in winter



Geothermal is predictable, but not easy to turn up and down

Biofuels

Total wind generation can drop to ~zero

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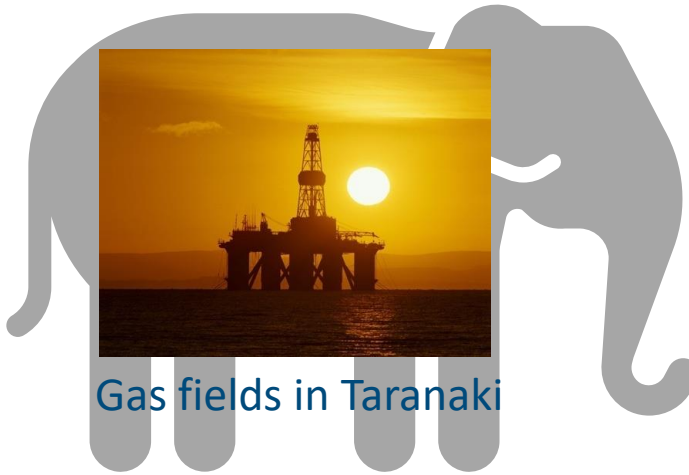
Options - storage

We have massive & diverse storage today

Hydro lakes

Coal stockpile at Huntly



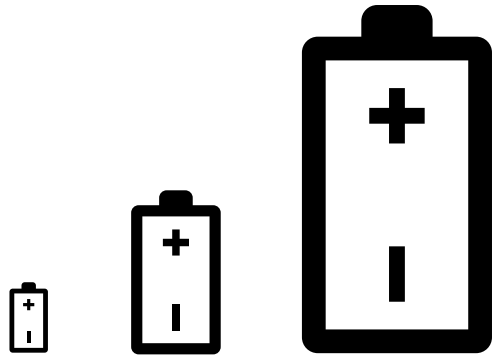
Gas fields in Taranaki

We will need massive & diverse storage in 2050

Hydro lakes

Pumped storage

Green hydrogen



Chemical batteries of all sizes

and more…

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2050 Peak Demand

Secure electricity systems, that consistently meet peak demand, will require a mix of supply, demand-side response, and storage options, along with reliable interconnection (lines)

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Thank you for listening

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