

Role of gas infrastructure in a low carbon economy

First Gas and Powerco
for
The Gas NZ Industry Forum 2018

Firstgas

POWERCO



From Kapiti to Kaitaia, New Plymouth to Tauranga.
First in delivering gas to the North Island.

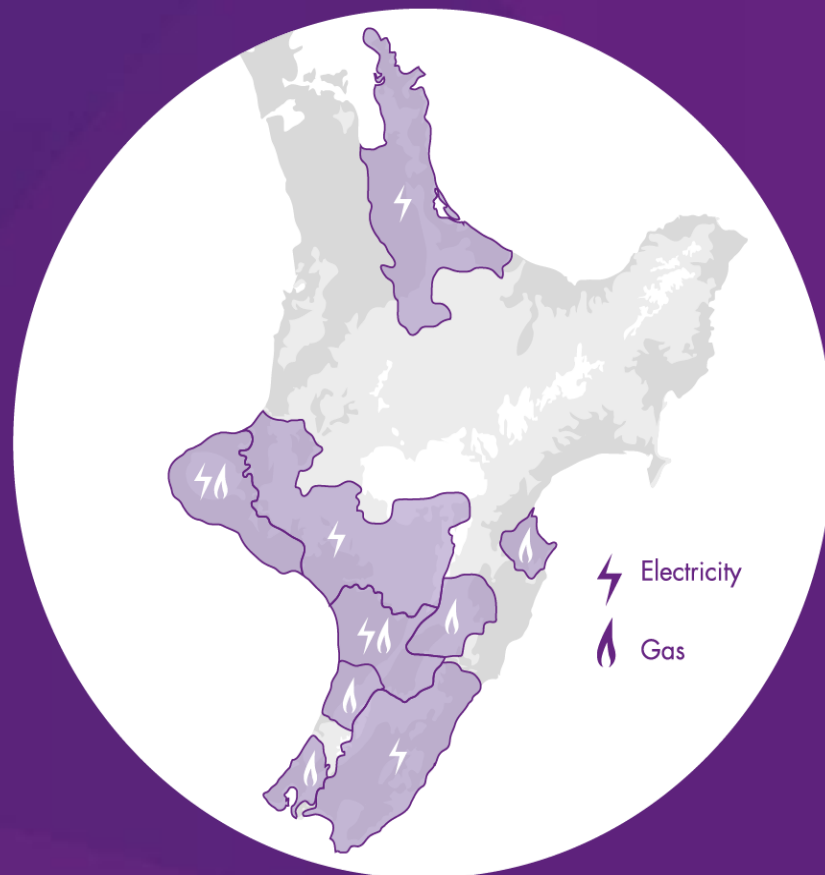
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Powerco is your reliable partner, delivering New Zealand's energy future.

The company distributes electricity and gas
across parts of the central and lower North Island.

We have around 435,000 customers connected
to our networks.



Powerco network area

Scope

: vivid economics

Objectives

To build a shared understanding of options for the role of gas pipeline infrastructure in a net zero emissions New Zealand

Scenarios

Identify future scenarios and quantify the impacts for New Zealand on energy consumption, emissions and costs

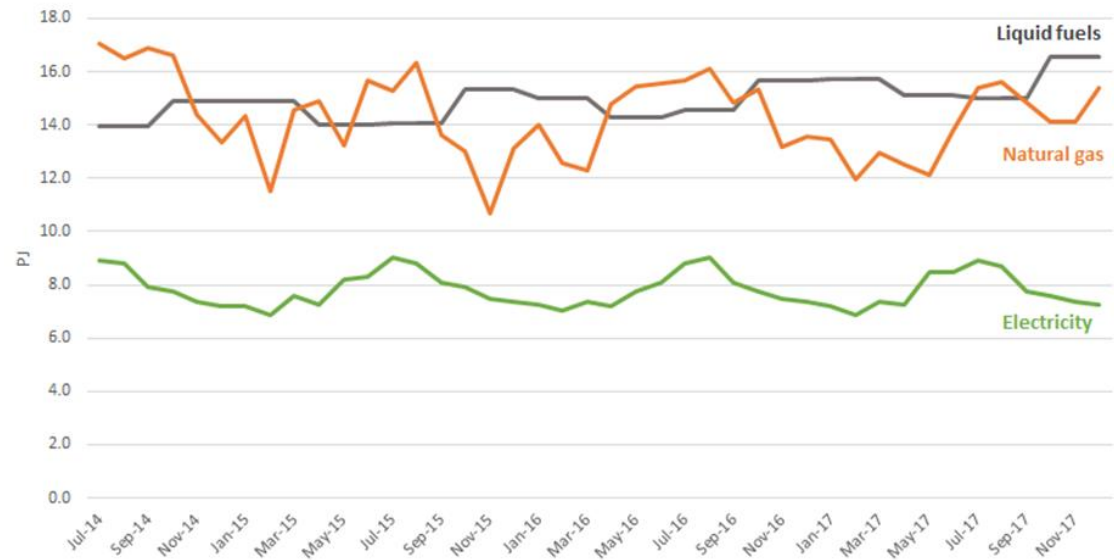
Strategic implications

To identify risks and trade offs of these scenarios, strategic implications and key decisions faced by New Zealand

Why?

- We know lower carbon will drive significant energy sector change
- Intuitively gas infrastructure has an important role to play
- But current lack of evidence and tendency towards over-simplification focused on electricity

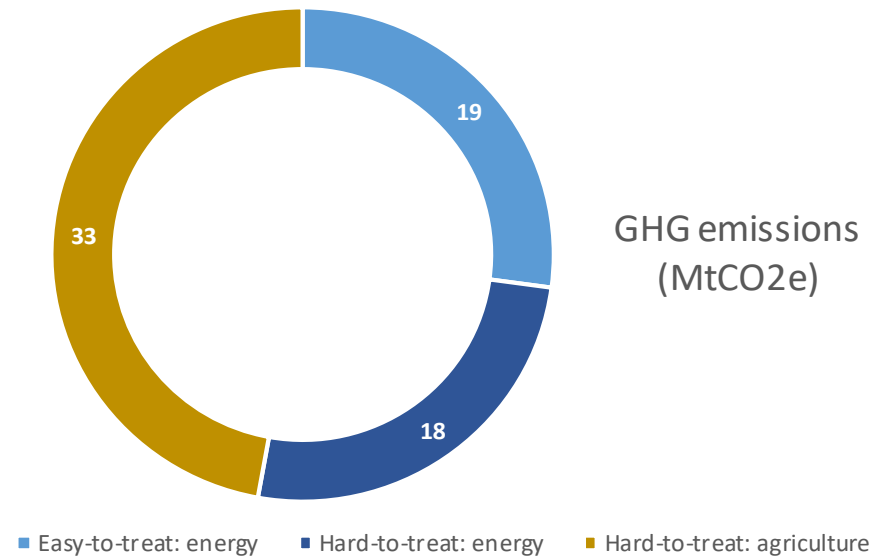
Monthly North Island energy demand



Unique contribution #1: hard to treat emissions

Easy to treat

- Off-peak electricity generation
- Passenger vehicles
- Commercial space and water heating



Hard to treat

- Winter peaking electricity
- Intermediate-and high-temperature industrial heat
- Dry year reserve for electricity generation
- Residential space and water heating
- Heavy vehicles
- Agriculture (out of scope)

Unique contribution #2: cost it out

- Affordability matters
- But future costs are unknown
- Provides broad estimates to assess likely impacts
- Helps to build understanding of trade-offs



Policy context

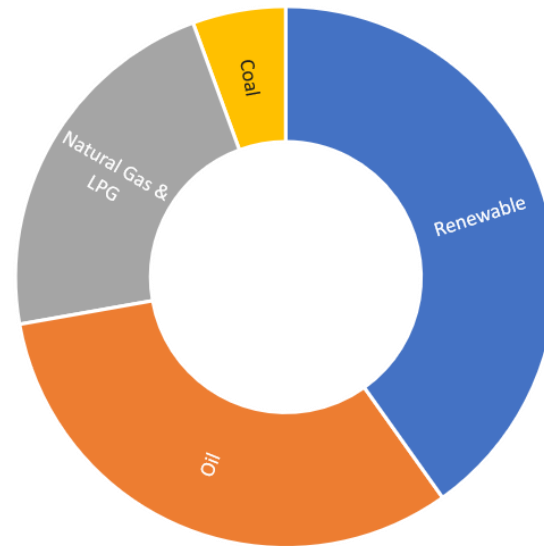
- Net Zero Bill
- Climate Change Commission (and interim)
- ETS Review
- CMA
- EPR



Energy System Context

- Gas is currently ~25% of the primary energy in NZ
- Despite a high level of renewable electricity, only ~40% renewable energy

Total Primary Energy Source, 2017



Defining the scenarios

- Critical uncertainties in how to reduce hard to treat emissions:
 - Ability of forestry to offset emissions – slope of the forestry supply curve, maximum abatement potential
 - Rate of technological development – batteries, hydrogen, CCS, etc
- Other critical uncertainty: willingness to pay to reduce carbon



Scenarios defined
by critical
uncertainties



Diversified mix

Emissions reductions achieved through electrification and land use

Forestry: Unconstrained

Technological development: moderate



Green gas

Gas grid substantially retained, innovation and gasification technologies develop to allow a high penetration of hydrogen and/or biogas in the gas grid

Forestry: constrained

Technological development: hydrogen (or biogas)



All electric

Emissions reductions achieved through electrification and minimised fossil use across electricity and industry

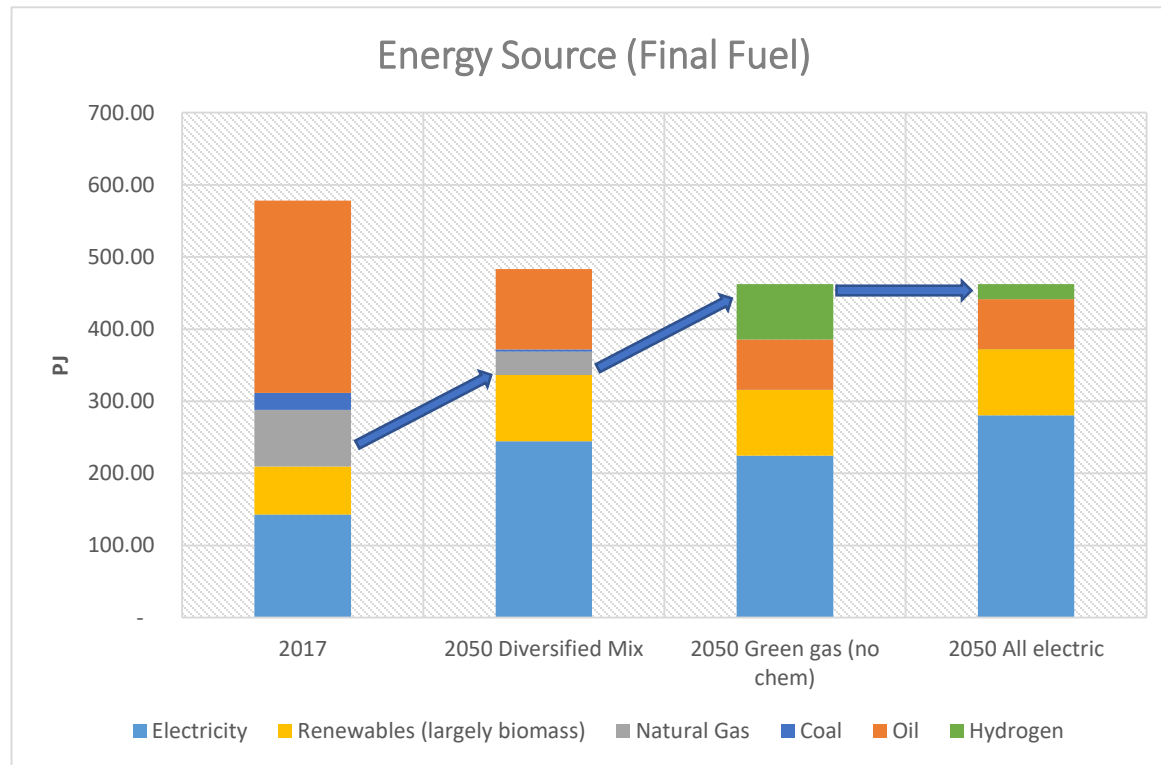
Forestry: Constrained

Technological development: electric focused

Energy mix will change, regardless of which scenario eventuates

Key facts

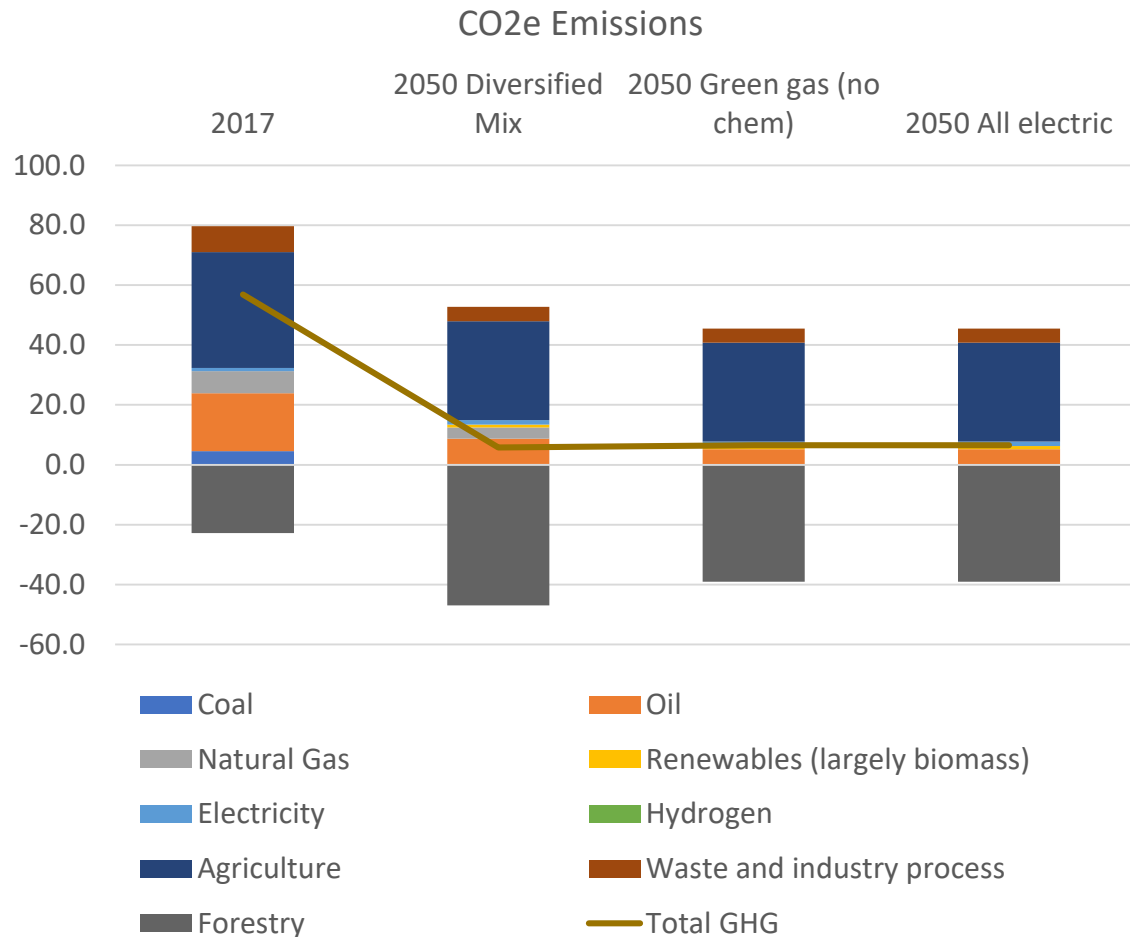
- All scenarios have huge increases in electricity consumption
- Natural gas demand lower but remains important in 'diversified mix'
- Total energy consumed drops (driven by petrochemicals)

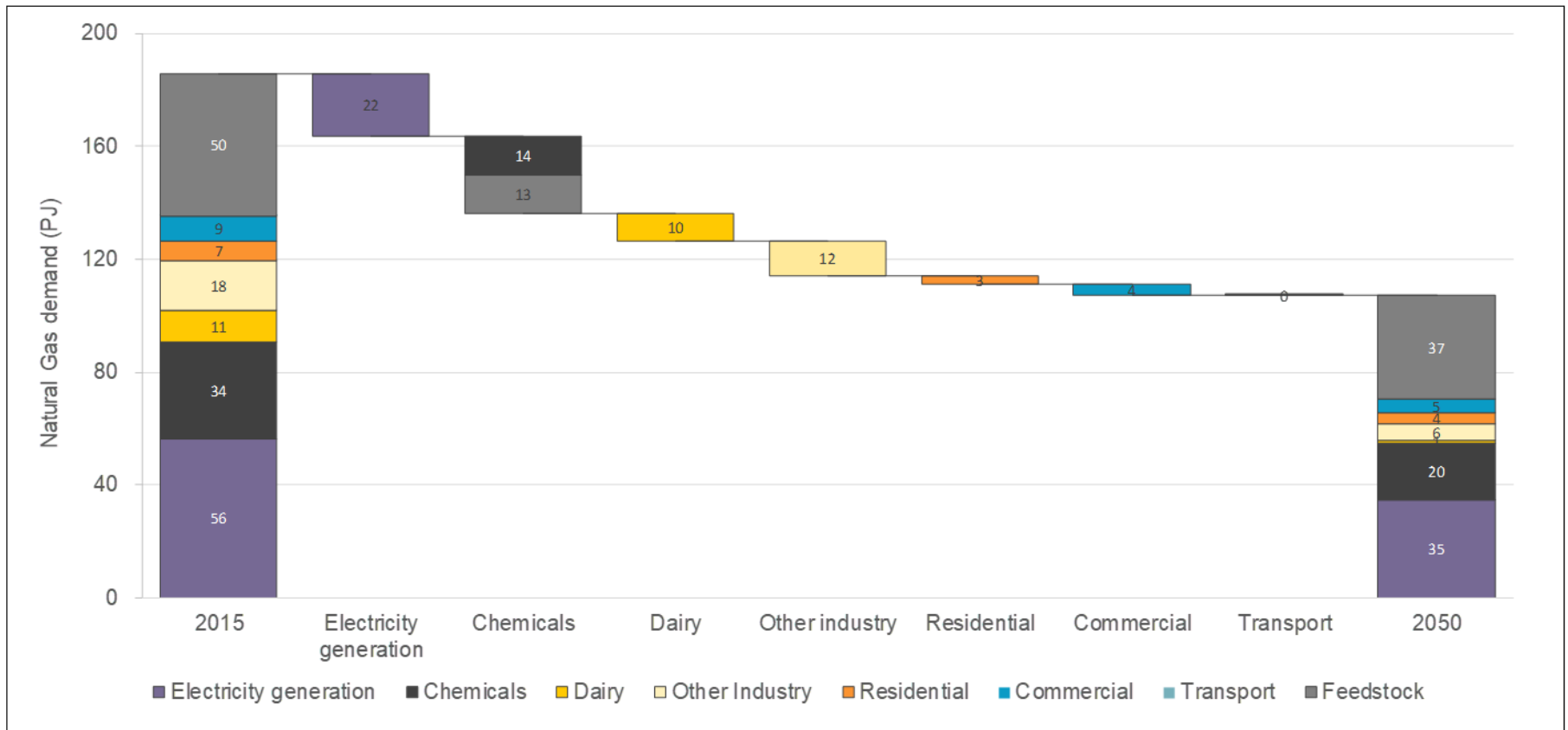


While energy use falls, it's forestry that gets us to net zero

Key facts

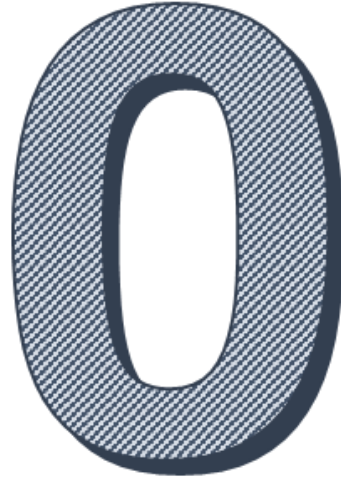
- Scenarios have (almost) net zero emissions
- Agriculture dominates emissions
- All scenarios require large scale afforestation





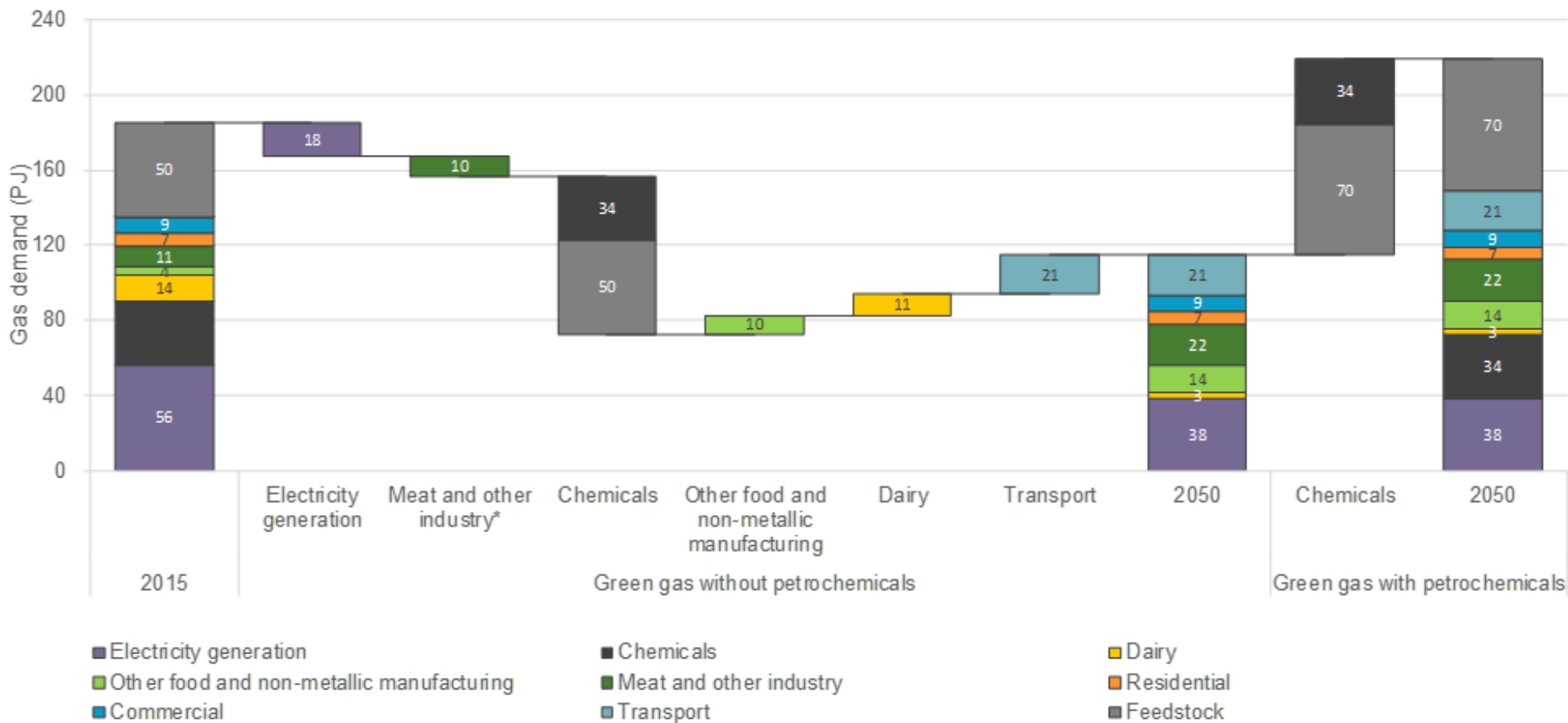
Key results:
diversified mix

- Gas reduces substantially, but retained by many for residential/commercial heat loads
- Gas used for hard-to-treat sectors
 - electricity peaks
 - Industrial heat
- Remaining emissions offset through forests (0.3 Mha larger than other scenarios)



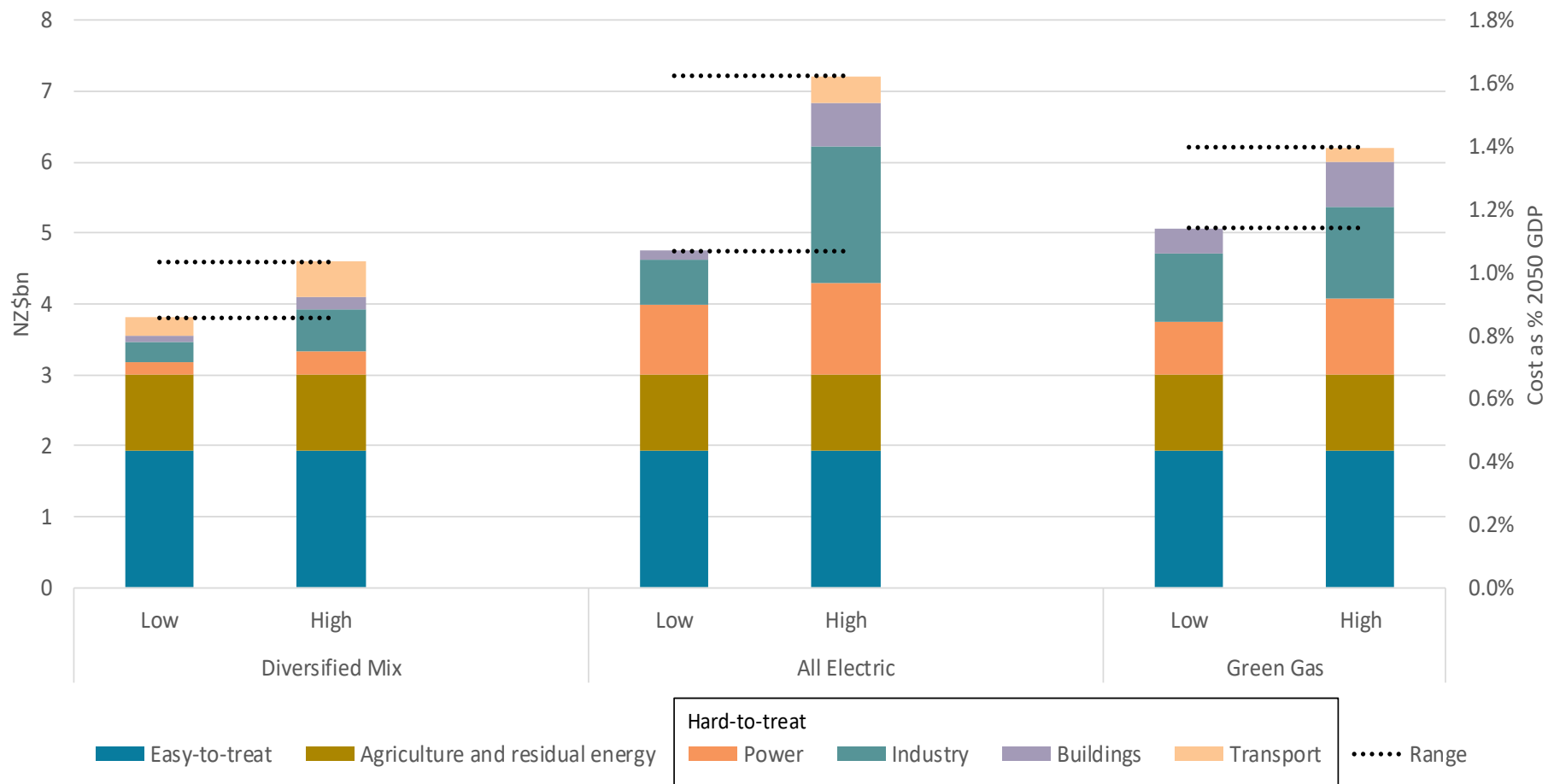
Key results:
all electric

- No gas
- Substantial overbuild of renewable generation (>10x as many wind turbines?)
- Challenging to meet dry-year demand
- Under-utilised assets



Key results: green gas

- Maximises gas infrastructure utilisation
- Addresses hard-to-treat sectors – heavy transport, dairy, other process applications
- Hydrogen production is high cost - modelled at \$4.10-\$5.30 per kg, assuming cost of \$70-90 to produce electricity from wind
- Hydrogen production via SMR with CCS could cost as little as US\$1.7 (NZ\$2.6) per kg (IEA, 2017)

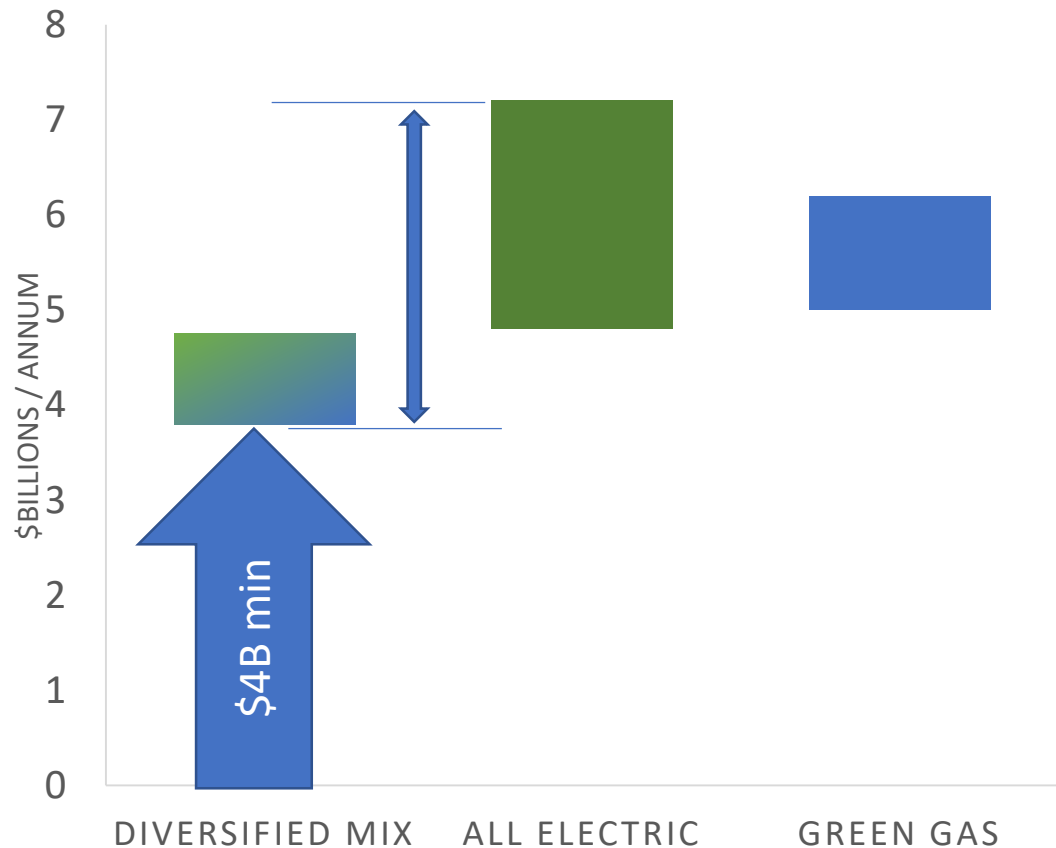


Scenario cost and GDP impact

- Hard to treat energy demand drives the uncertainty
- GDP impact of 1 – 1.7%

Affordability impact on New Zealand

- The future is more expensive!
- And has a lot of uncertainty
- Backing the wrong horse could cost 0.5% of GDP - \$2-3 billion extra each year (**\$1,500 per household**)*
- Significant impact on energy costs, especially vulnerable households
- Nearly a third of all households struggle to pay their power bills or spend a large part of their income on power



**Note: this assumes population of 5 million and average household size of 2.5 inhabitants*

The future is uncertain...



Climate action

- How fast will other countries act?
- How ambitious will domestic legislation be?
- What will be the scope for carbon offsets?

Land use

- How much land can be converted to new forest?
- How will global demand affect the value of dairy and meat production?

Economy

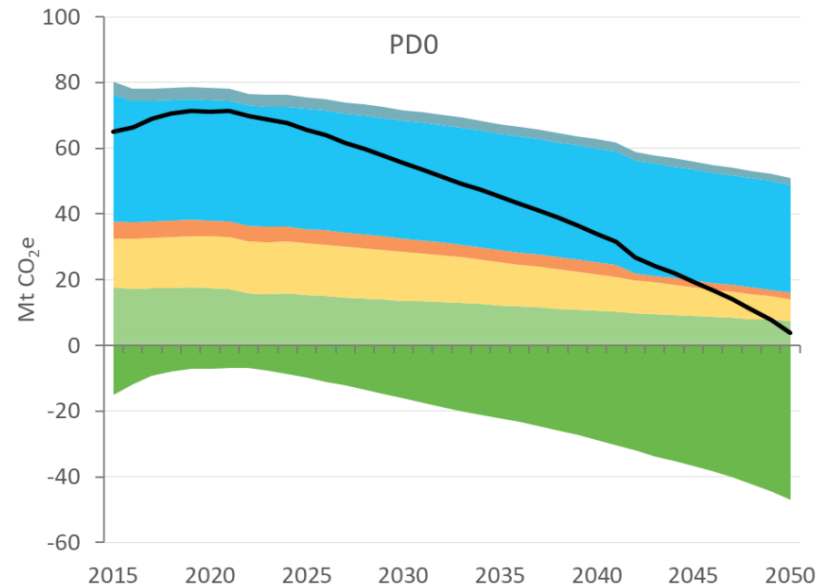
- How will economic growth drive energy demand?
- How will NZ industry evolve?
- What is the willingness to pay to reduce emissions?

Technology

- How will global climate action drive innovation?
- How fast will electric vehicles take off in NZ?
- How far can energy efficiency reduce demand?
- Is carbon capture and storage (CCS) viable in NZ?
- Will hydrogen technologies be commercialised?
- Will it be viable to electrify industrial heat?

Summary of analysis

1. All options need huge growth in forestry to offset emissions
2. In some sectors, such as passenger transport, electrification is the best emissions reduction strategy
3. In other **hard-to-reduce sectors**, it is too early to exclude potential solutions
4. Affordability differs between scenarios – reducing options risk unnecessary costs



Source: Concept, Motu, Vivid Economics

Summary of analysis

5. Natural gas and gas infrastructure could have high option value to address hard-to-treat sectors in a net zero New Zealand
6. Strategic to keep these options open until the best decision can be made




Key takeaways

- Action today can focus on no-regrets moves:
 - Accelerate electrification of light vehicles
 - Reduction in coal use
 - Planting trees
- In parallel, Policy makers and the industry need to understand how we will address the hard to treat emissions:
 - What are the economic, environmental and social impacts of large scale afforestation?
 - What potential does hydrogen have?
 - What can we realistically obtain from electrification?
 - How quickly will technology reduce costs and find new solutions?
- The global challenge and approach will continue to evolve and New Zealand will need to respond to these changes

There is immense value in maintaining options to best achieve energy policy objectives





First Gas and
Powerco will
release the Vivid
report in November

details to be confirmed

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