MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

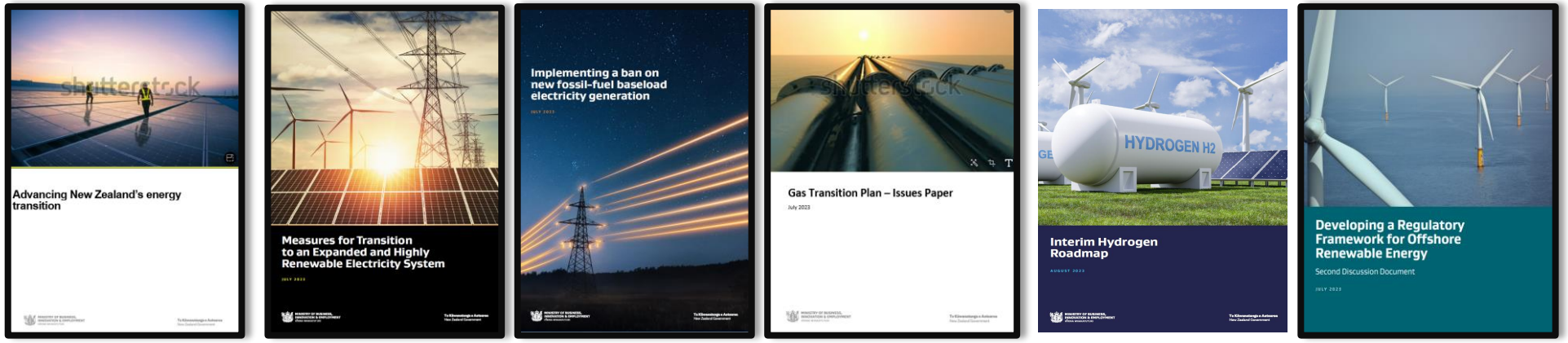
Interim Hydrogen Roadmap

Launch Webinar: 31 August 2023

New Zealand Government

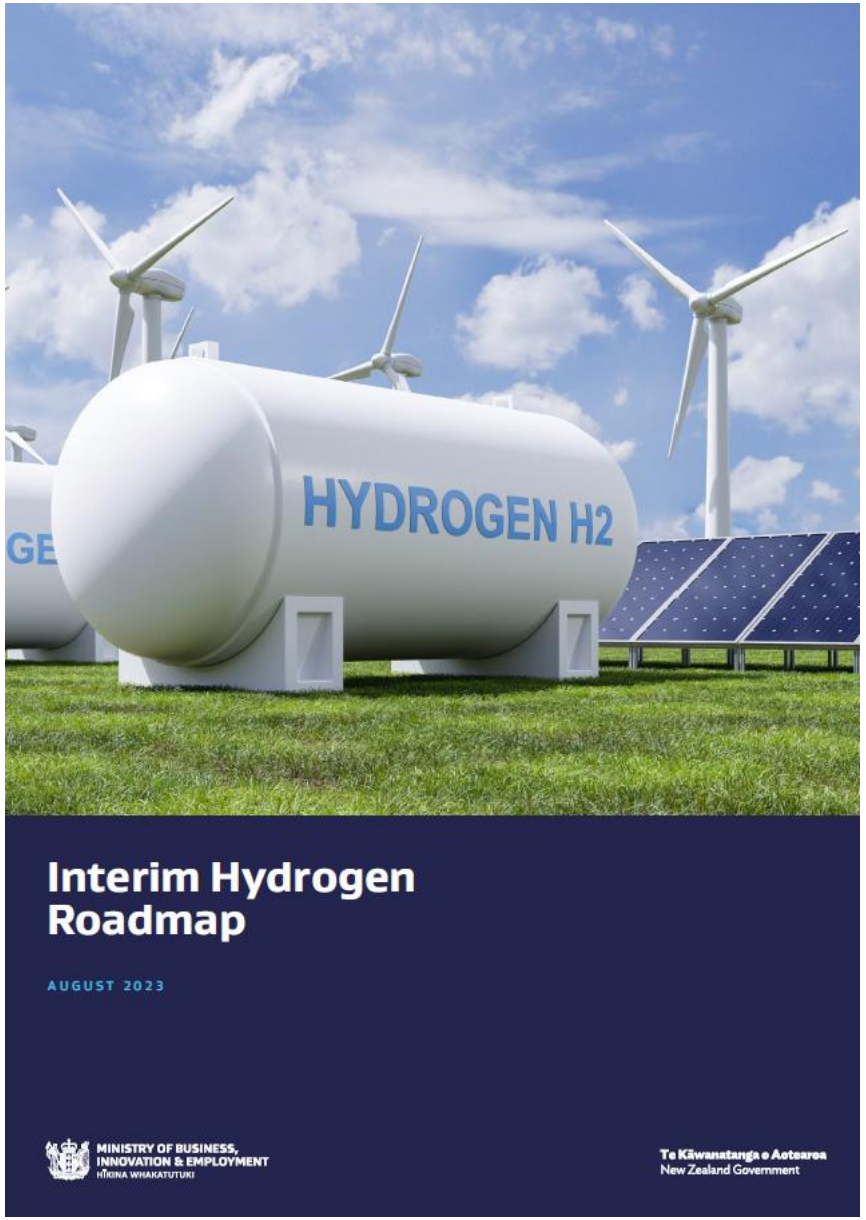
MBIE’s energy transition work programme

- We are currently consulting on five documents covering different aspects of our energy transition.
- Consultation is open until **5pm on 2 November 2023.**



Overview

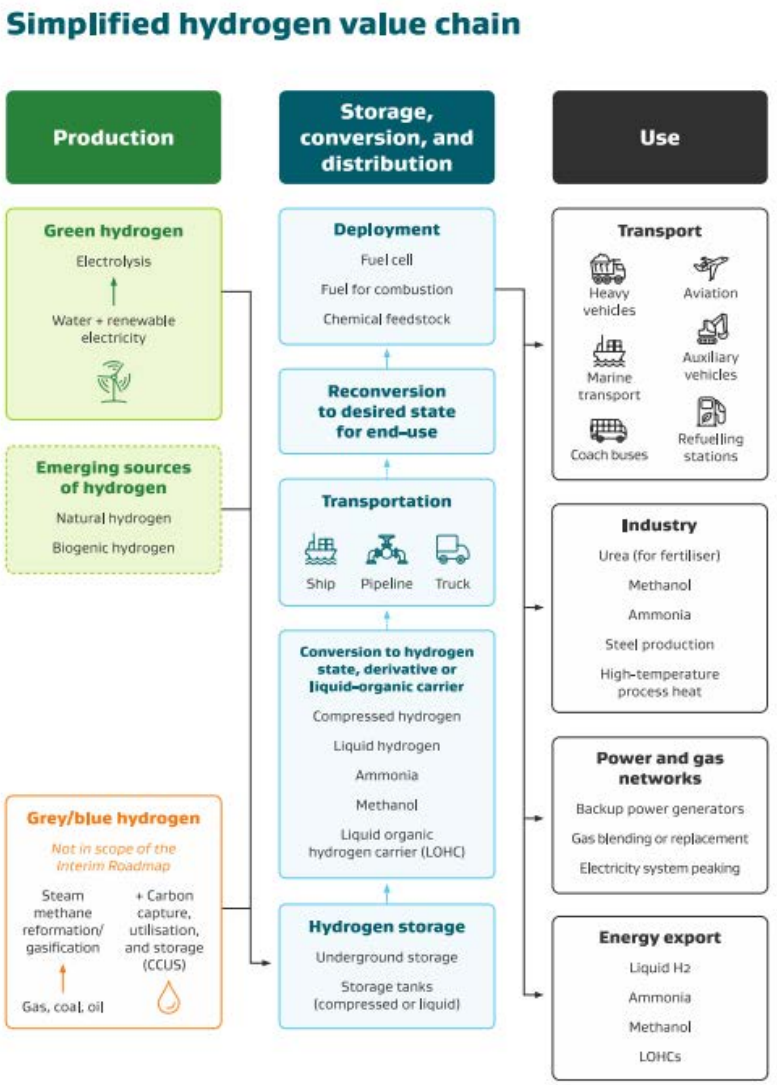
- MBIE's energy transition work programme
- What is green hydrogen?
- Background to MBIE ERM's hydrogen work programme
- Overview of the Interim Hydrogen Roadmap
  - The hydrogen landscape
  - The role of hydrogen in New Zealand's energy system
    - The Pathway to 2050
    - Initial Government views on the role for hydrogen in New Zealand's energy transition
  - Actions we are taking to support hydrogen deployment, in line with these views
    - Other areas we are considering further.
- What are our next steps?
- Questions



You can find the Interim Hydrogen Roadmap here.

What is green hydrogen?

- Hydrogen is a versatile energy carrier that can be produced in renewable ways and used as a chemical precursor, combustible gas for heat and energy and used in a fuel cell to produce electricity.
- Green hydrogen generally refers to hydrogen that is produced in ways that produce no greenhouse emissions
- The Interim Hydrogen Roadmap signals that ‘green’ hydrogen is the Government’s primary interest.
- There is future potential for other low or zero emissions sources such as naturally occurring hydrogen and biogenic hydrogen.



Background to MBIE ERM's hydrogen work programme

A Vision for Hydrogen in New Zealand Green Paper (2019)

- Broad scope, first government-initiated public input on hydrogen

Hydrogen Regulatory Settings Project (2021 – Current)

- New Zealand's hydrogen regulatory pathway
- Regulatory Settings Working Group

New Zealand Hydrogen Scenarios (2021-2022)

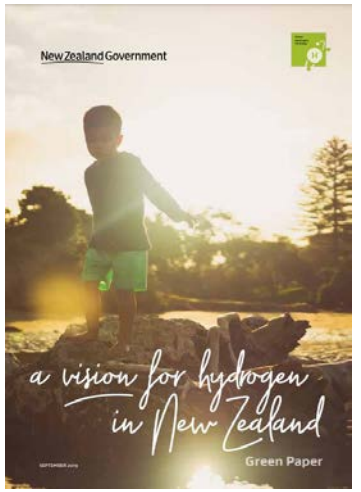
- Model of potential hydrogen supply and demand. BAU scenario to 2050.

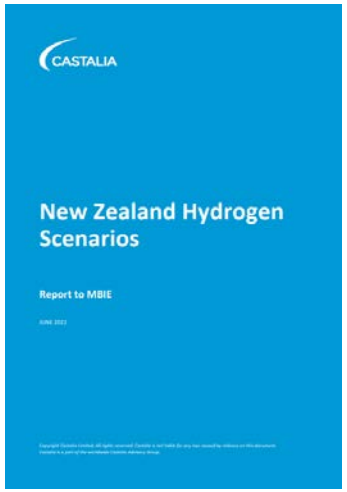
International

- Hydrogen cooperation arrangements, Japan (2018), Singapore (2021)
- CEM Hydrogen Initiative
- Hydrogen Ministerial Group
- COP Breakthrough Agenda

Hydrogen roadmap

- Included as an action in the Emissions Reduction Plan

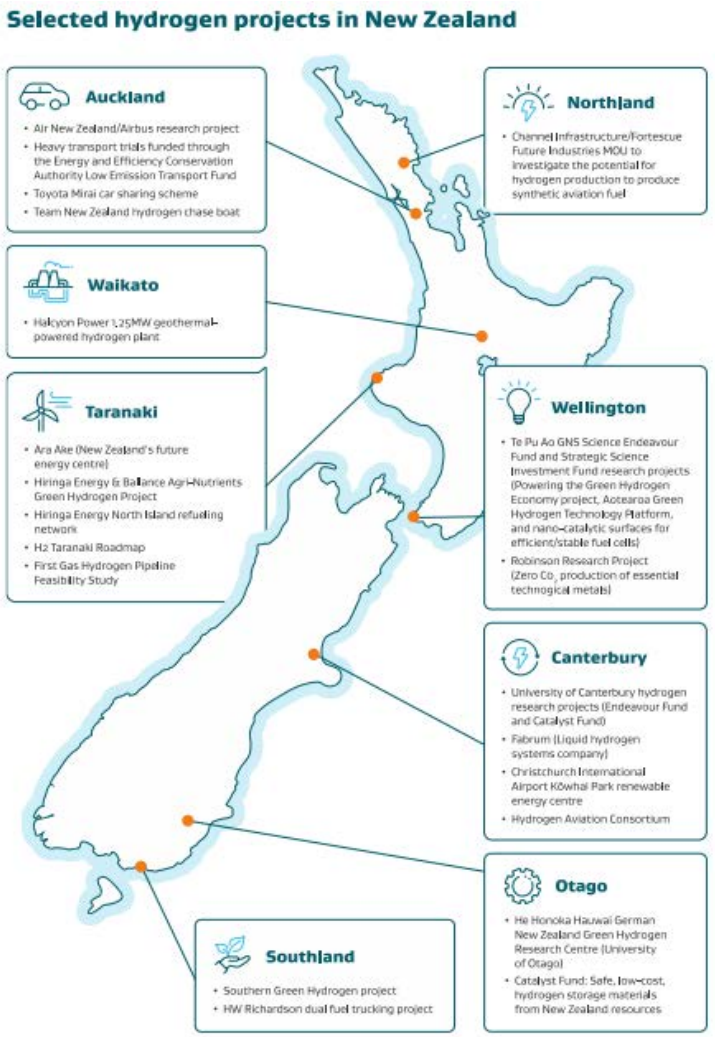




Overview of the Interim Hydrogen Roadmap

Section 1: Hydrogen is emerging as an important part of the future global energy system

- Many countries are preparing strategies and taking action to support the deployment of hydrogen as part of the clean energy transition.
- Hydrogen activity in New Zealand
  - There is already an emerging sector, with activity across the country.
  - Government has financially supported many of these projects
    - $88 million in government funding and financing for hydrogen-focused projects to date (pre-Budget 23)
      - $35m to support capital investment in key supply chain focused projects
      - $45.5m in research and development
      - $7.5m in trial and demonstration projects



Overview of the Interim Hydrogen Roadmap

Section 2: The role for hydrogen in New Zealand's energy system

- What are the opportunities and challenges to deploying hydrogen?
  - Opportunities
    - Reducing emissions
    - Economic development opportunities
    - Contributing to NZ's energy security and resilience
  - Challenges
    - High costs
    - Technical challenges
    - Missing market
    - Regulatory barriers
- What should the role of Government be in this space?

Key question:

- What are the key challenges for achieving **commercial viability**, and what role should the government play?

Overview of the Interim Hydrogen Roadmap

Section 2: The role for hydrogen in New Zealand's energy system

- Where do we see the most promising roles for hydrogen in New Zealand's energy transition?
  - New Zealand's energy system, context and challenges, linked to critical activities that support our economy
  - Most of the emissions reductions we need can be met through electrification. Hydrogen appears to have the most promise in hard to abate activities that are impractical or challenging to electrify:
    - Industrial feedstocks (ammonia, methanol, steel production)
    - Some heavy road transport (FCEVs, dual fuel hydrogen-diesel combustion)
    - Marine (ammonia or methanol bunkering)
    - Some high temperature process heat
    - Aviation (eSAFs, fuel cell, combustion)
    - Potential for other, more niche applications like remote/offroad/specialty vehicles, power backup, green peaking, rail

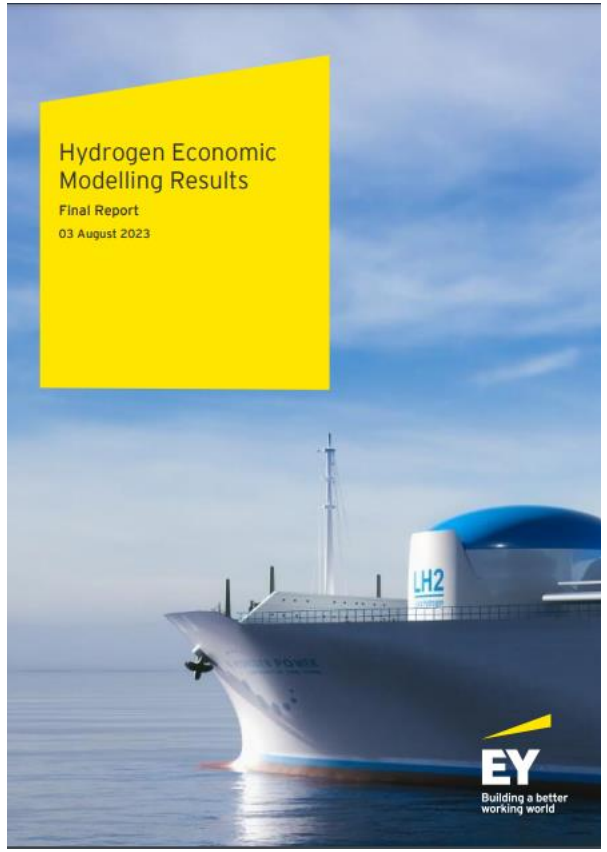
Key question:

- Do you agree that hydrogen has the most potential for New Zealand in **decarbonising hard-to-abate applications** such as chemicals, fertiliser and heavy transport (including heavy long-haul freight, aviation and marine)?

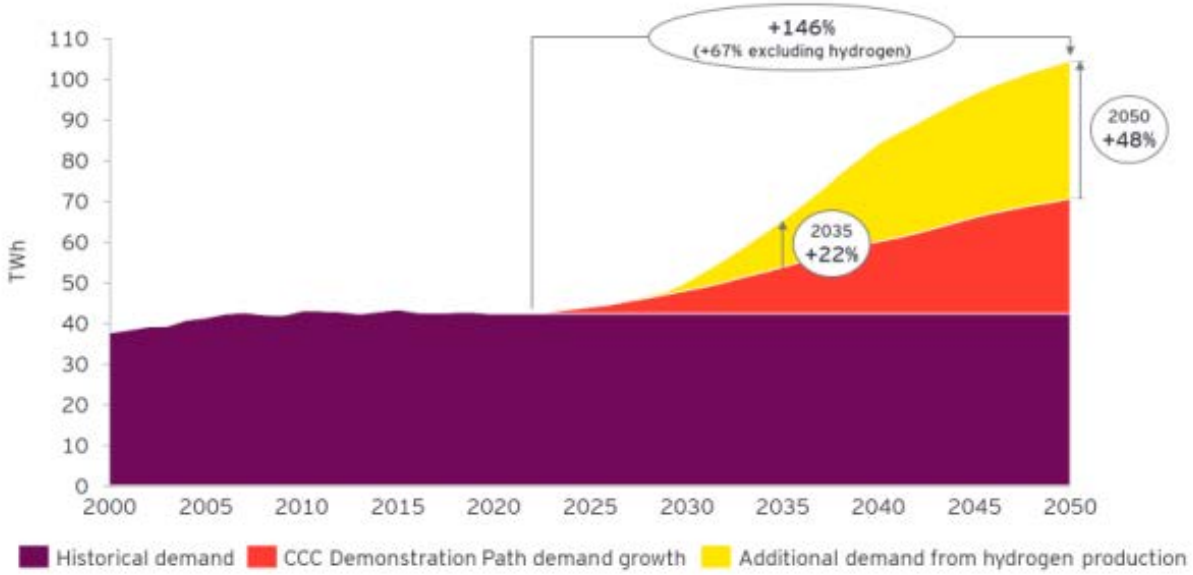
Overview of the Interim Hydrogen Roadmap

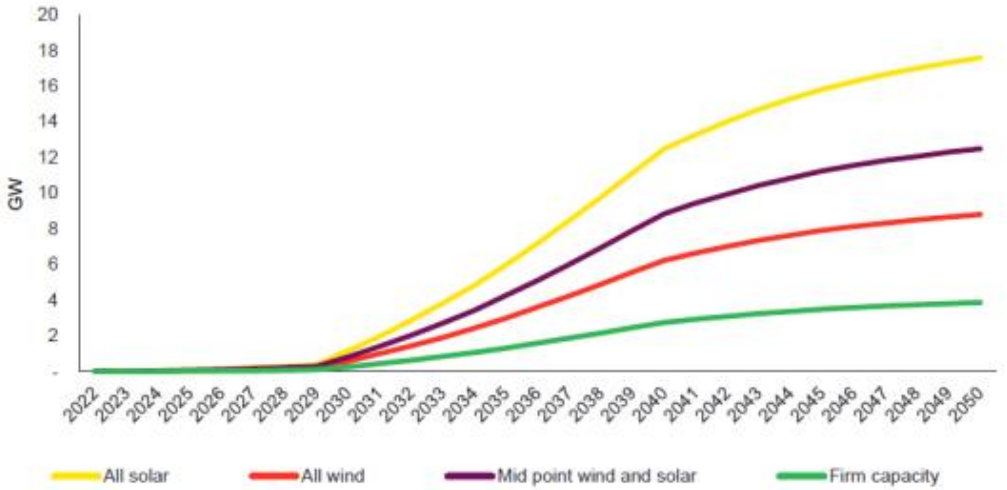
Section 2: The role for hydrogen in New Zealand's energy system

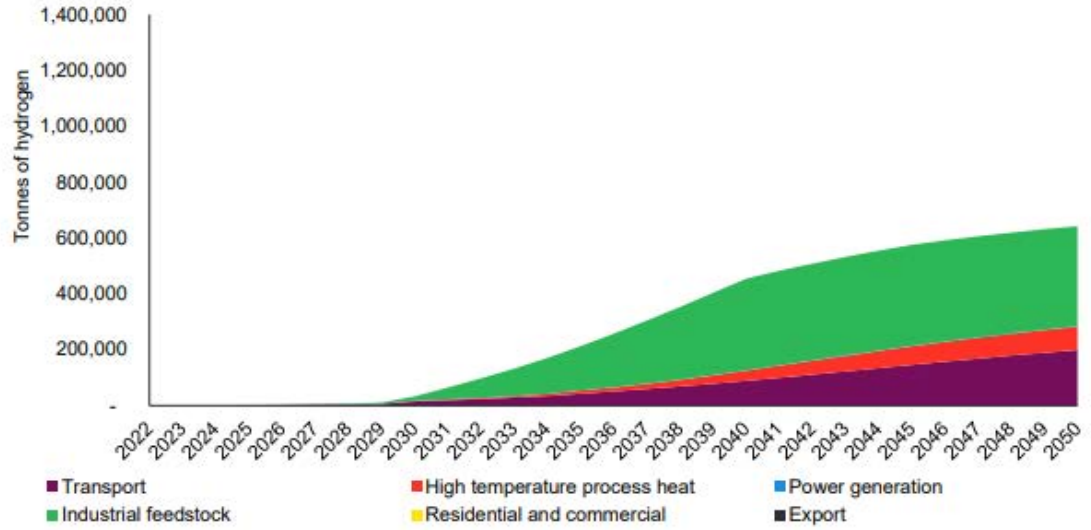
- We commissioned scenario modelling to inform the Interim Hydrogen Roadmap.
- Five scenarios to test possible hydrogen futures against our three high level objectives:
  - Base case
  - Accelerated uptake
  - Energy security and resilience
  - Export
  - Export + value add
- For each of these scenarios, the modelling estimated out to 2050:
  - Supply/demand volumes across key use cases
  - Renewable generation capacity and electricity demand
  - Electrolyser capacity
  - Emissions reduction potential
  - Economic impacts (value-add activity and employment supported)
  - Energy security and resilience outcomes:
    - Displaced fossil fuel imports
    - Demand response potential



Read the report here.


+146%
(+67% excluding hydrogen)
2050
+48%
2035
+22%
TWh
Historical demand
CCC Demonstration Path demand growth
Additional demand from hydrogen production


GW
All solar
All wind
Mid point wind and solar
Firm capacity


Tonnes of hydrogen
Transport
High temperature process heat
Power generation
Industrial feedstock
Residential and commercial
Export

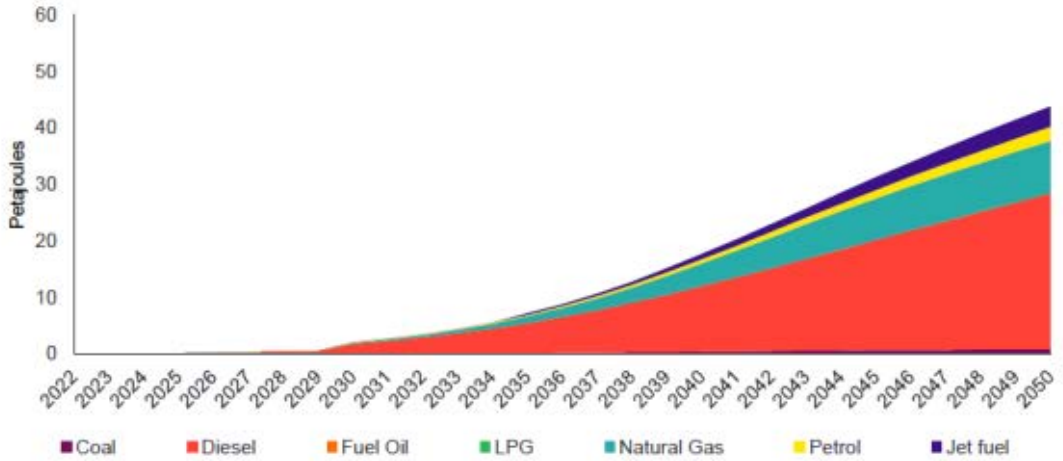

Petajoules
Coal
Diesel
Fuel Oil
LPG
Natural Gas
Petrol
Jet fuel

Table 1: Modelled scenarios and key differences relative to base case

	Base case	Accelerated uptake	Energy security and resilience	Export market	Value-add export
Hydrogen demand					
	► Driven mostly by industrial feedstock and heavy transport	► Uptake across domestic demand sectors higher and faster	► Uptake across domestic demand sectors higher	► Increased demand from export	► Increased demand from export and industrial feedstock (value-add commodities)
Total hydrogen demand					
2035	0.18 Mt H_2	0.60 Mt H_2	0.20 Mt H_2	0.47 Mt H_2	0.50 Mt H_2
2050	0.56 Mt H_2	0.91 Mt H_2	0.61 Mt H_2	1.05 Mt H_2	1.21 Mt H_2
Hydrogen supply					
	► Production focused in decentralised plants ► Some centralised production	► Production focused in decentralised plants ► Some centralised production	► Production focused in decentralised plants ► Some centralised production	► Production focused in centralised plants ► Some decentralised production	► Production focused in centralised plants ► Some decentralised production
Total installed electrolyser capacity					
2035	1.5 GW	6.0 GW	3.6 GW	3.8 GW	5.4 GW
2050	4.5 GW	8.0 GW	6.4 GW	8.5 GW	9.8 GW
Total electricity demand for hydrogen production					
2035	11.5 TWh	44.9 TWh	25.8 TWh	28.4 TWh	40.7 TWh
2050	33.9 TWh	60.1 TWh	45.1 TWh	63.6 TWh	73.4 TWh

Table 2: Summary of scenario performance against outcomes

	Base case	Accelerated uptake	Energy security and resilience	Export market	Value-add export
Decarbonisation					
Energy sector emissions reductions enabled by 2050[4]					
	2.6 Mt CO2	3.9 Mt H_2	3.5Mt H_2	2.6 Mt H_2	2.6 Mt H_2
Contribution to total final energy consumption by 2050 (energy supplied by hydrogen and additional electricity required for hydrogen production for industrial feedstock)					
	12.2 GWh H_2 +21.8 GWh electricity	18.6 GWh H_2 +41.6 GWh elec.	16.4 GWh H_2 + 28.7 GWh elec.	12.1 GWh H_2 + 51.4 GWh elec.	12.1 GWh H_2 + 61.3 GWh elec.
Economic development					
Total gross value add by 2050 (as an indicator for GDP)					
	$2.3 b	$4.1 b	$3.2 b	$4.4 b	$5.1 b
Total supported employment by 2050 (full-time equivalent, FTE)					
	11,900 FTE	21,800 FTE	16,700 FTE	23,300 FTE	27,000 FTE
Energy security and resilience					
New electricity generation incentivised by 2050					
	12.5 GW	22.1 GW	16.6 GW	23.4 GW	27.0 GW
Potential annual demand response capacity by 2050					
	3.8 TWh	6.7 TWh	8.0 TWh	7.1 TWh	8.2 TWh
Liquid fossil fuel volume displaced annually by 2050					
	0.87 BL	1.36 BL	1.26 BL	0.87 BL	0.87 BL

Figure 42: Electricity input cost impact on incremental centralised LCOGH

Figure 43: Electricity input cost impact on incremental decentralised LCOGH

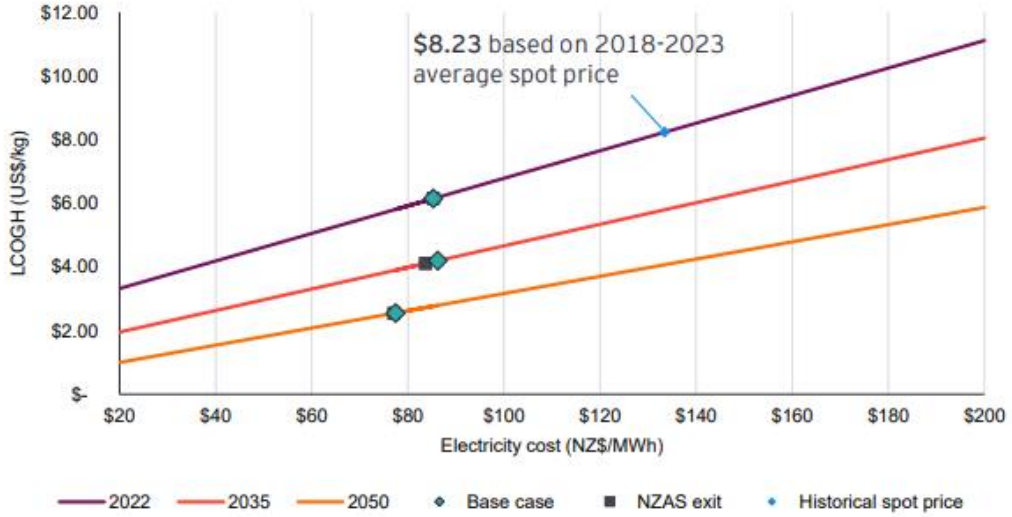
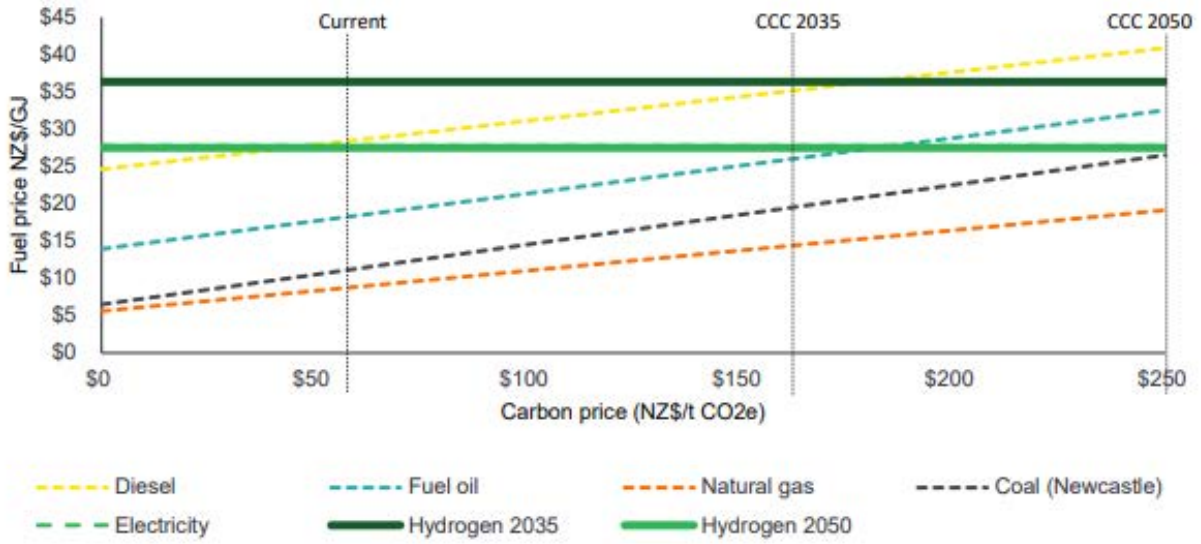


Figure 45: Comparison of modelled incremental LCOGH to other fuel types, carbon price and the Climate Change Commission's modelled future carbon price



Overview of the Interim Hydrogen Roadmap

Section 3: Government positions and actions

Our policy objectives for hydrogen deployment as part of the energy transition:

- Ensure supply can scale up, including hydrogen production that is matched to electricity and other inputs
- Enable the safe use of hydrogen and facilitate early projects that enable the sector to develop.
- Bring forward and support early demand for hydrogen, linked to the most viable use cases within New Zealand's energy system, and aligned with other priorities including economic development and supporting just transitions for key affected communities.
- Monitor outcomes and progress over time.

What about export?

- We welcome private activity in New Zealand to progress the development of hydrogen production for export. However, government support is focused on domestic deployment at this time.
- We want to further understand the electricity system implications of large-scale hydrogen production for export.

Key question:

- Significant **additional renewable electricity generation** will be needed to develop large scale hydrogen production, especially if New Zealand becomes a green hydrogen exporter. How do you think we should approach this challenge and manage any risks?

Overview of the Interim Hydrogen Roadmap

Section 3: Government positions and actions

- Actions outlined in the Interim Hydrogen Roadmap include:
  - establishing a government and sector coordination body. Possible workstreams could include collaboratively developing views on:
    - Regulatory matters
    - Workforce needs
    - Infrastructure requirements
  - progressing a regulatory work programme, prioritising common infrastructure and near-term use cases like heavy road transport.
  - the Regional Hydrogen Transition consumption rebate (up to $100 million over ten years)
  - the Clean Heavy Vehicles Grant scheme (Budget 2023 - $30 million over three years)
  - considering any gaps in our RD&D support system and national research priorities to support hydrogen deployment
  - considering certification, emissions intensity standards and guarantee of origin for hydrogen production
  - continuing our work on:
    - international cooperation and engagement
    - supporting public awareness and profile for hydrogen.

Overview of the Interim Hydrogen Roadmap

Section 4: Next steps

- Implementation and progression of actions we have committed to in the Interim Hydrogen Roadmap.
- Areas for further consideration:
  - Refining the expected scale of hydrogen supply/demand, taking a whole-of-energy-system approach within related key work, such as the New Zealand Energy Strategy
  - Further understanding:
    - electricity system implications and opportunities
    - the commercial viability gap to the hydrogen use cases that appear to make the most sense for New Zealand.

Next steps

- We want to hear from you – consultation is open until 5pm on 2 November 2023.
  - How to submit:
    - Complete the online survey
    - Submit a written submission via email or post using the submission template.
- We are speaking at the H2 2 Zero conference next week (Sep 7th)
- We are also planning 1:1 stakeholder sessions to have detailed discussions about the Interim Hydrogen Roadmap, and our signalled areas for further consideration.
- Following the consultation period, we will:
  - Analyse responses
  - Produce and publish a summary of submissions.
- Feedback received will inform our work to prepare the final Hydrogen Roadmap alongside the New Zealand Energy Strategy.

Next steps contd.

- Our key areas of focus for phase 2:
  - Further understanding and developing positions on the areas signalled:
    - Hydrogen within the broader energy system
    - Electricity system integration implications and opportunities (incl. for export)
    - Commercial viability across hydrogen use cases and potential gaps

Questions?

Links

- Find out more about our energy transition consultation here.
- Read more about our hydrogen work programme here.

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