2035/2050 VISION FOR GAS

FOR NEW ZEALAND

PURPOSE OF THE REPORT

The New Zealand Government has set a net zero emissions target by 2050 and is exploring policy choices for the gas sector. It will publish a Gas Transition Plan (GTP) by the end of 2023 to inform a National Energy Strategy, to be published in 2024.

Castalia was commissioned by Energy Resources Aotearoa, Gas New Zealand, and Major Gas Users Group to provide an independent analysis of gas demand under plausible pathways for transitioning the gas sector and to evaluate the trade-offs involved.

This Report at a Glance provides a brief overview of the key findings of Castalia's 2035/2050 Vision for Gas report.

Climate change is a major policy challenge that requires a serious policy response

Castalia's 2035/2050 Vision for Gas report identified seven plausible pathways that reflect possible outcomes for the GTP. The pathways show key trade-offs.

The future is uncertain – modelling shows where choices have impact

Castalia modelled gas demand, gross emissions, and energy costs of the seven pathways between 2022 and 2035. The pathways modelled are not predictions about the future. Instead, the pathways show where key choices will have the most impact on emissions, energy demand, and energy costs.

KEY RECOMMENDATIONS FOR GAS TRANSITION PLAN TO 2035

Natural gas is a key part of the energy system and transition. Achieving 98 percent renewable electricity is more cost-efficient with support from gas and offsets. Natural gas can provide energy for dispatchable generation, with emissions that can and should be offset. Policies should support investment confidence because gas will be important to underpin the energy transition, especially in electricity generation.

CCUS significantly reduces emissions relatively cost-effectively. Investment in carbon capture, usage, and storage (CCUS) technologies and adoption should be prioritised for some industrial users and electricity generation, so the government should ensure the regulatory regime is supportive. This aligns with IPCC recommendations to meet climate targets.

Utilise a robust ETS with a binding cap and support carbon offset opportunities. The ETS can incentivise gross emissions reductions across the economy, including in the gas sector.

Deterministic direct interventions should be avoided due to high risks and high costs. Deterministic interventions can rapidly become out of date or cause unintended outcomes. Direct interventions risk imposing significant energy and economic costs without reducing overall emissions.

Renewable gas potential and pricing should be monitored. Certificates should be explored and targets used if prices fall. Integrating renewable gases could provide options for New Zealand's gas networks and gas consumers, and also provide energy choices to consumers, while achieving emissions reductions.

Retain LPG for some users and explore use of renewable LPG. LPG will remain an important energy source for commercial and residential, agriculture, and transport sectors into the future because switching to alternative energy sources is likely to be costlier than retaining LPG.

NET ZERO EMISSIONS 205

ADDITIONAL IMPACTS FROM PATHWAYS BEYOND 2035 to 2050

After 2035, most natural gas demand is likely to come from industrial users and for electricity generation. Typically, these large-scale users emit from concentrated point sources. This strengthens the case for CCUS in the absence of other decarbonisation options.

Path dependencies matter beyond 2035. Commodity production from gas and key infrastructure could create options for future decarbonisation.

Choices made in the medium term may prevent future options. Key industries and infrastructure may enable future decarbonisation options, such as clean methanol production or availability of transmission and distribution infrastructure. Policymakers should take care not to lock in path dependencies too early.

Emissions leakage from industry is possible if domestic production stops, but global demand remains. If gas-using New Zealand firms stop production due to policy changes, but overseas firms continue to meet global demand and are not subject to equivalent policies, global emissions will not reduce (and could increase).

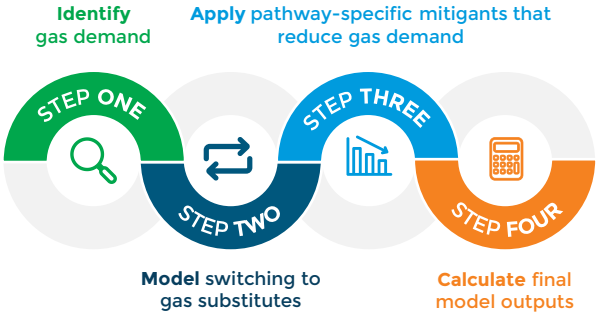
2035/2050 VISION FOR GAS

FOR NEW ZEALAND

MODELLING APPROACH ESTIMATES GAS DEMAND, COSTS, AND EMISSIONS

Castalia built the **Gas 2035 model** to predict gas demand, gross emissions from gas and LPG use, and energy costs for current and predicted future users of gas. It is an economic model that predicts future gas demand based on the relative costs of alternative energy sources.

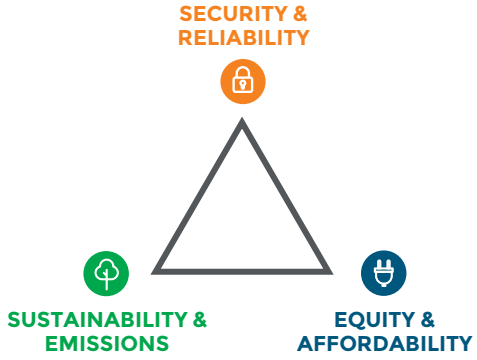
The model starts with 2022 gas demand. It models switching from natural gas and LPG to alternative energy sources for each major gas-consuming sector and for specific major users over time. The outputs of the model are set out in the figures that follow. Major assumptions and the modelling approach are described in the Report.



PATHWAYS WERE EVALUATED USING THE ENERGY TRILEMMA

ADJUSTED FOR RELIABILITY

We assessed the pathways using the energy trilemma, a well-understood framework for assessing energy systems and used in the GTP terms of reference. The interpretation of these three elements follows:



Sustainability is measured by the amount of greenhouse gas (GHG) emissions associated with gas use in New Zealand from 2022 to 2035 under each pathway. GHG emissions are expressed as carbon dioxide equivalent (CO_2e).

Affordability refers to the total cost of energy for current and predicted future gas users. This includes the total cost of all energy sources, any cost of matching energy reliability to the current level, renewable gas blending costs, and any carbon capture, utilisation, and storage (CCUS) costs.

Reliability refers to the ability of New Zealanders to access energy at the same rate, for the same purposes, and at the same level of reliability as they currently enjoy. **Reliability is normalised** across all pathways. Where substitutes for a current energy source are used, the full costs of maintaining the same level of reliability are incurred.

SEVEN PATHWAYS MODELLED ILLUSTRATE KEY POLICY CHOICES

Reference Pathway = policy as usual. This was developed through extensive engagement workshops with the gas sector to identify where gas demand would change due to investments and initiatives, changes in the cost of carbon, and relative costs of alternative energy sources.

Six other pathways test how gas demand responds to changes in key variables. We developed six additional pathways that each model changes in assumptions about policy, technology availability, and prices. The pathways illustrate major policy choices but are not determinative; the future could include a combination of many aspects of these pathways. Each pathway was normalised for reliability, so the analysis is isolated to sustainability and affordability.

Reference Pathway	CCC Demonstration Pathway	100% Renewable Electricity by 2030 Pathway	Direct Interventions Pathway	High Carbon Price Pathway	Renewable Gas Pathway	CCUS Pathway
Current and expected policy and carbon prices ($160 per tCO_2e by 2035)	Climate Change Commission's 2021 'demonstration path', only updated to reflect actual gas demand in 2020 and 2021	NZ transitions to 100% renewable electricity and investments are made to improve reliability	Gas use stops across low-medium heat processes, new commercial and residential sites, and in aspects of methanol and urea production	Impact of the carbon price rising to $300 per tCO_2e by 2035	Blending of hydrogen, biogas, bioLPG, and DME into natural gas networks and LPG distribution	Impact of CCUS technologies being available for large gas users from 2026

2035/2050 VISION FOR GAS

FOR NEW ZEALAND

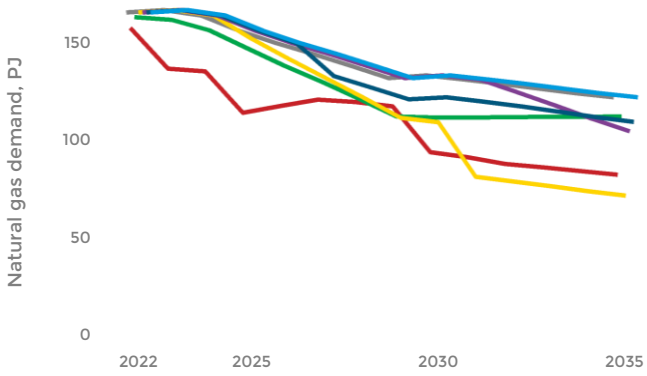
NATURAL GAS DEMAND DECLINES UNDER ALL PATHWAYS

The Reference Pathway shows a steady decline in natural gas demand. The CCUS Pathway holds natural gas demand at similar (declining) levels, albeit with lower emissions..

Natural gas demand is lower in the other five pathways, compared to the Reference Pathway:

- The 100% Renewable Electricity by 2030 Pathway, the CCC Demonstration Pathway, and the Direct Interventions Pathway result in the largest reductions in gas demand due to specific policies stopping gas use
- The High Carbon Price Pathway sees gas demand fall after the carbon price passes $200 per tCO_2e around 2031
- The Renewable Gas Pathway sees gas demand fall as higher-cost renewable gases are blended (despite a fall in renewable gas prices).

Natural gas demand across pathways from 2022 to 2035



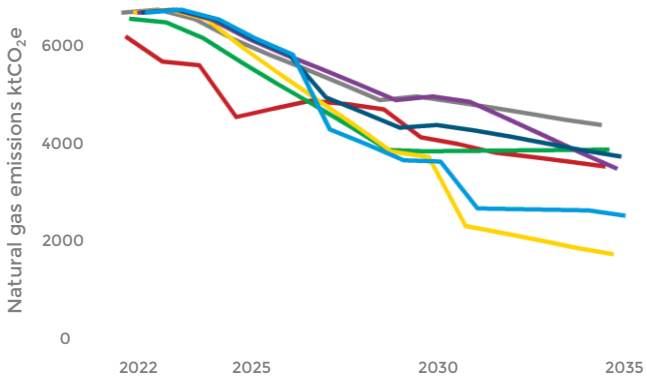
SUSTAINABILITY: EMISSIONS DECLINE WITH ALL POLICY CHOICES

The Reference Pathway shows a decline in emissions as natural gas demand declines.

Emissions from natural gas are lower in the other six pathways, compared to the Reference Pathway:

- The Direct Interventions Pathway and the CCUS Pathway result in the largest emissions reduction
- The CCC Demonstration Pathway has earlier emissions reductions potential, which is marginally better for mitigating the impact of emissions (earlier reductions have a greater climate impact)
- The 100% Renewable Electricity by 2030 Pathway results in less emissions from electricity generation, but possibly higher national net emissions
- The High Carbon Price Pathway and the Renewable Gas Pathway show more modest emissions reductions.

Natural gas emissions across pathways from 2022 to 2035



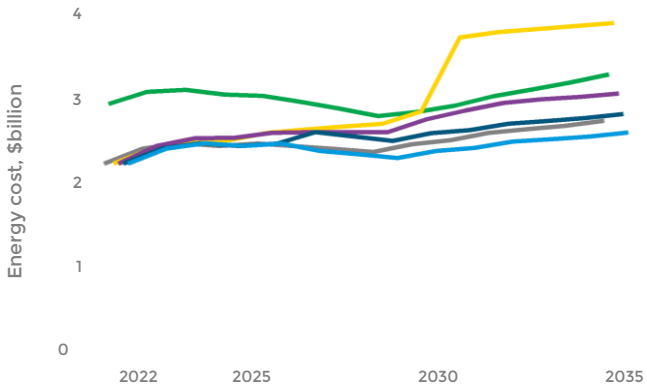
AFFORDABILITY: ENERGY AND ECONOMIC COSTS WILL BE HIGHEST IF DIRECT INTERVENTIONS ARE USED

Total energy costs under the Reference Pathway are $34.5 billion from 2022 to 2035, with the annual cost increasing as the carbon price rises.

Energy costs vary across the other six pathways compared to the Reference Pathway, when specific policy choices are modelled:

- The CCUS Pathway has lower energy costs, as the cost of technology is less than paying the carbon price for large emitters
- The Renewable Gas Pathway is only 3% more expensive, but costs are predominantly absorbed by industrial users
- The Direct Interventions Pathway and the High Carbon Price Pathway result in high energy costs that could lead to lower economic outputs
- The 100% Renewable Electricity by 2030 Pathway also has high energy costs, as a reliability adjustment is needed
- Due to a lack of disclosed data, the CCC Demonstration Pathway energy costs could not be modelled but are likely higher than most pathways.

Energy costs across pathways from 2022 to 2035



KEY: Reference | CCC | 100% RE | Direct Interventions | High Carbon Price | Renewable Gas | CCUS

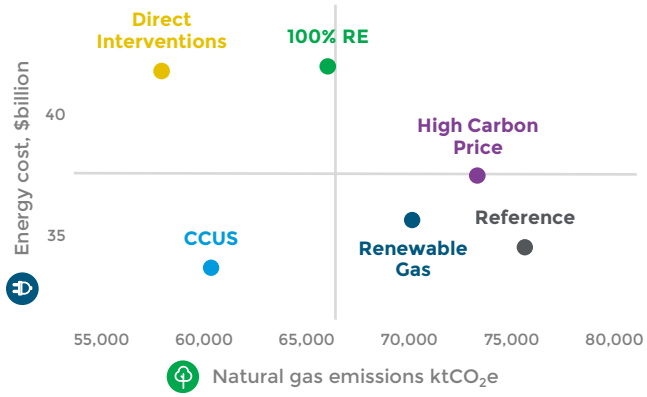
2035/2050 VISION FOR GAS

FOR NEW ZEALAND

CCUS WOULD DELIVER GREATEST EMISSIONS REDUCTIONS FOR LEAST COST

Evaluating the pathways by energy costs and emissions suggests CCUS would deliver the greatest emissions reduction for the least cost, assuming CCUS is implemented for large, point-source emitters in a timely way. While other pathways would reduce emissions, these are higher cost and present risks.

Total energy costs and emissions across pathways



WASHINGTON, DC
1747 Pennsylvania Avenue NW, Suite 1200
Washington, DC 20006
United States of America
+1 (202) 466-6790

SYDNEY
Suite 19.01, Level 19, 227 Elizabeth Street
Sydney NSW 2000
Australia
+61 (2) 9231 6862

AUCKLAND
3 Glenside Crescent, Eden Terrace
Auckland 1010
New Zealand
+64 (4) 913 2800

WELLINGTON
Level 2, 88 The Terrace
Wellington 6011
New Zealand
+64 (4) 913 2800

BOGOTA
Calle 81 #11-08
Piso 5, Oficina 5-121
Bogotá
Colombia
+57 (1) 508 5794

enquiries@castalia-advisors.com
castalia-advisors.com