Meeting Date: 21 October 2021

GAS RELIABILITY AND RESILIENCE

SECURITY AND RELIABILITY COUNCIL

This paper introduces presentations from gas participants involved in production, transmission and distribution, and storage as well as a presentation from the gas regulator. The first paper is a scene setter from independent research and advisor, Enerlytica. These presentations form part of the SRC's theme of gas reliability and resilience, given gas' continued importance to the New Zealand power system.

Gas reliability and resilience

1.1.1 As part of its theme of gas reliability and resilience, the SRC has sought input from gas participants involved in production, transmission and distribution, and storage.

1.1.2 The secretariat has arranged presentations from:

- Enerlytica
- The Gas Industry Co (GIC)
- OMV
- Todd
- First Gas

1.1.3 Representatives from these organisations have provided a paper, which they will present, and be available to take questions from the SRC.

1.1.4 The aim of these presentations and discussion is to:

a) assist the SRC to provide advice about the resilience of the gas industry against impacts of disruption on the longer-term outlook for security and reliability

b) ensure the SRC receives relevant information from and about the gas industry to increase its overall knowledge of the sector and support its advice to the Authority

c) give the SRC the opportunity to give feedback to the Authority on gas-related initiatives and their application to security and reliability in the electricity industry

d) give the SRC the opportunity to hear from and ask questions of gas participants relevant to the SRC's purpose

1.1.5 The SRC brought this paper forward in its work programme, due to the heightened impact of gas on security and reliability of the power system during dry years.

Questions for the SRC to consider

The SRC may wish to consider the following questions.

Q1. What further information, if any, does the SRC wish to have provided to it by the secretariat?

Q2. What advice, if any, does the SRC wish to provide to the Authority?

Appendix A: Presentation from Enerlytica

Appendix B: Presentation from the Gas Industry Co

Appendix C: Presentation from OMV

Appendix D: Presentation from Todd Corporation

Appendix E: Presentation from First Gas

enerlytica

NZ Gas

October 2021

Electricity Authority SRC

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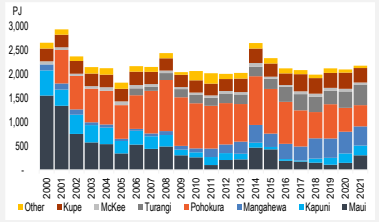
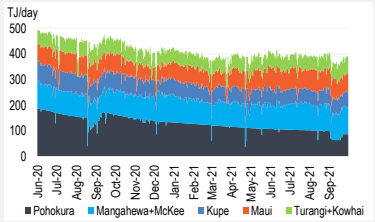
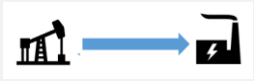
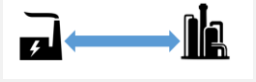
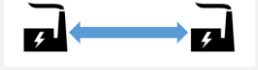
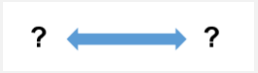
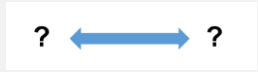
Energy supply first principles

"The five Cs"

	ASSET		SYSTEM
			5. Coherency
UPSTREAM	1. Commodity	Raw fuel into the energy system as either molecules (water, steam, gas, coal, LPG) or electrons (solar, wind).	The ability of aggregate market supply to meet aggregate market demand.
MIDSTREAM	2. Carriage	The transmission and distribution of energy from its point of production to its point of consumption.	
	3. Containment	Storing fuel and/or energy for the purpose of moving one or both through time.	
DOWNSTREAM	4. Carbon	The impost involved with drawing on fuels that carry an emissions footprint	

Gas supply first principles

Contracted supply is what matters … which is always a subset of physical supply

	PHYSICAL	CONTRACTUAL	
COMMODITY	**Reserves-backed ACQs**  **Dynamic deliverability** 	**Bilateral** GSAs  Operator time swaps  Generator tolling 	**Anonymous** Spot trading  On-market time swaps 
CONTAINMENT	**Underground gas storage**  **Huntly coal stockpile** 		

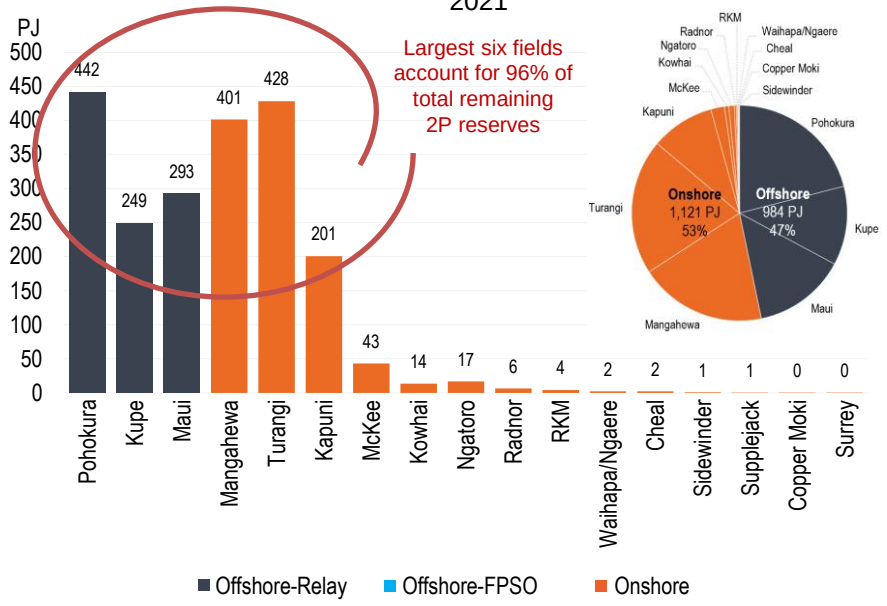
Source: Enerlytica

Reserves

2021 upgrade, but supply-side concentration remains a dominant feature

Gas (only) remaining 2P

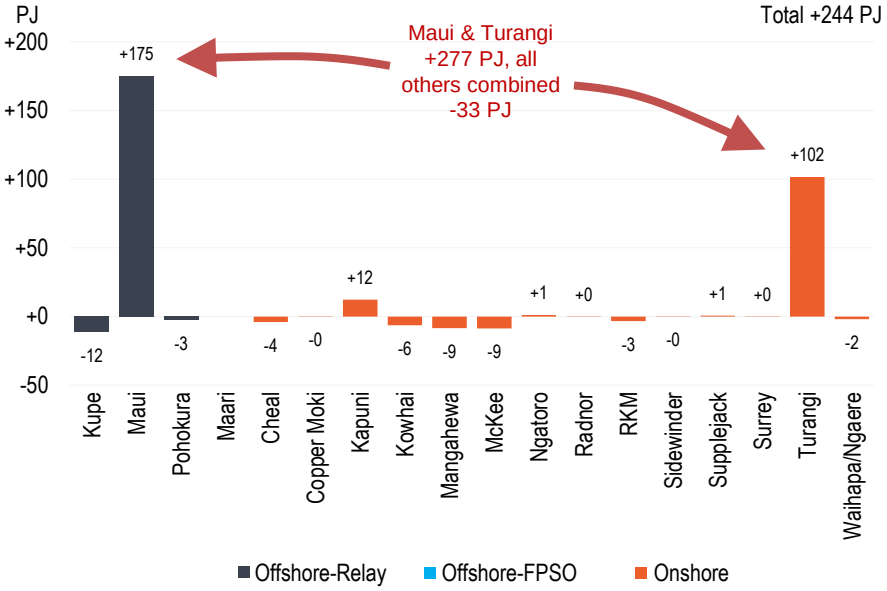
2021



Source: Enerlytica

Gas (only) remaining 2P

2020→2021 net change



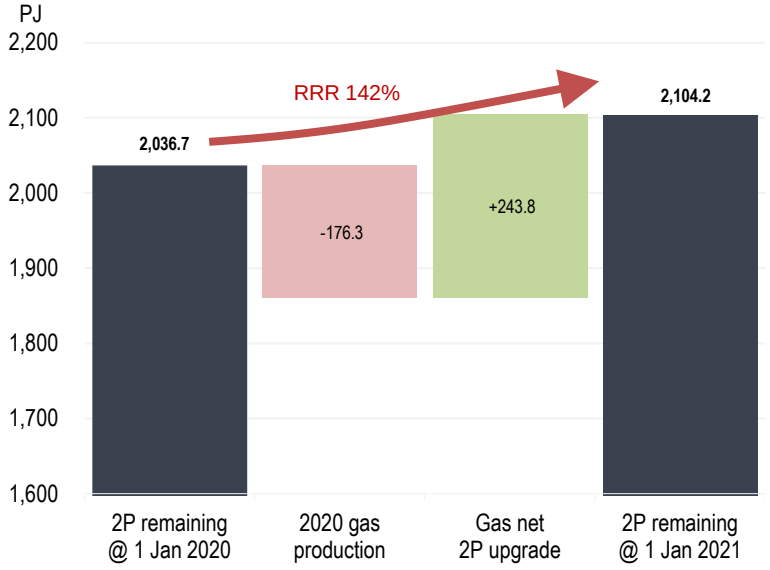
Source: Enerlytica

Reserves

Continuing to perform at better than production replacement

Gas 2P reserve change constituents

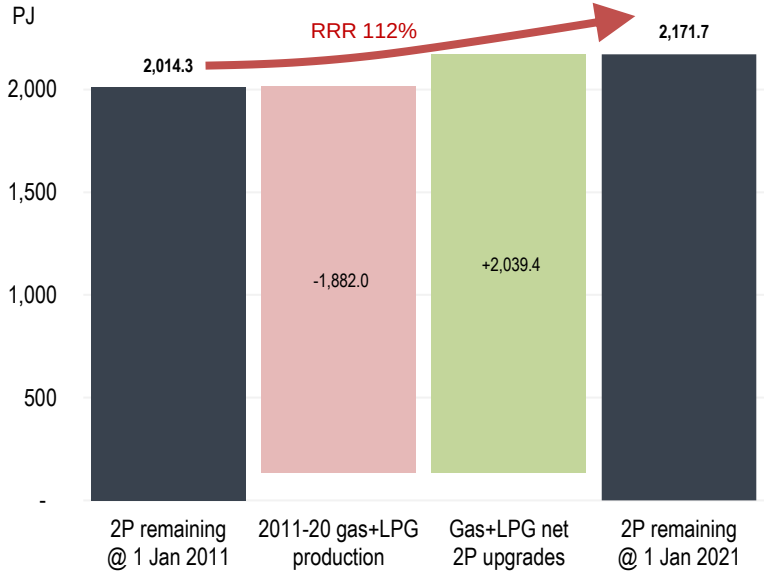
1-year 2020→2021



Source: Enerlytica

Gas 2P reserve change constituents

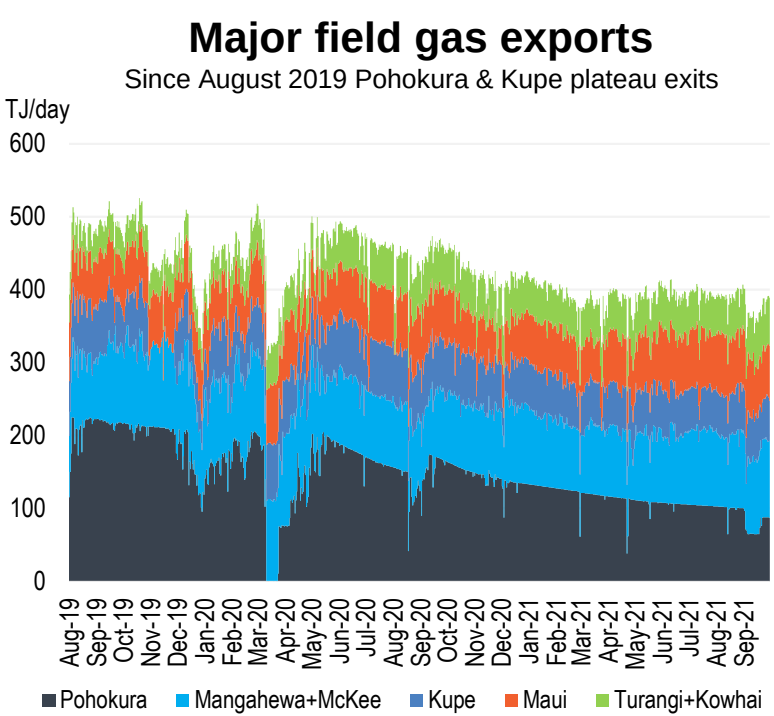
10-years 2011→2021



Source: Enerlytica

Deliverability

Pohokura masked systemic deliverability decline 2019-2021



Source: Enerlytica

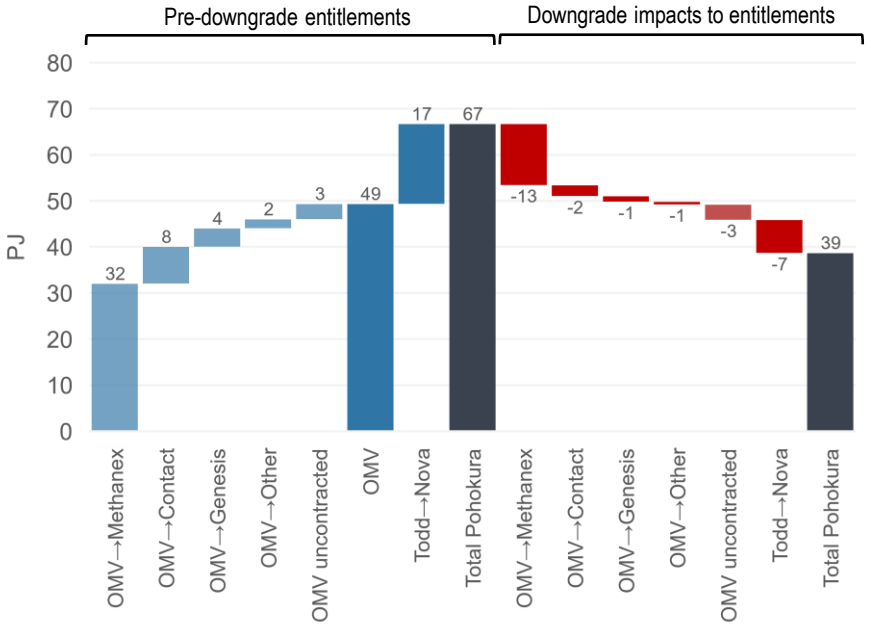
- Pohokura and Kupe each exited plateau within days of each other in 2019, but have since followed two very different decline paths:
  - Pohokura far steeper than modelled pre-decline
  - Kupe in-line with pre-decline forecast
- Inlet compression projects at each field brought very different outcomes
- Other fields also off-plateau, but have recently recovered and been providing increasing cushion

Deliverability

Demand-side absorption of supply-side decline

Pohokura 2021 downrates

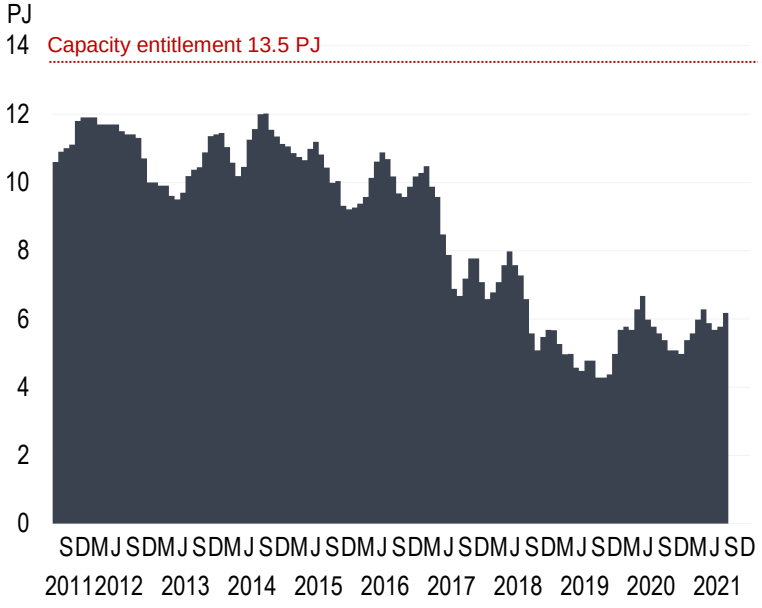
Pre- and post-downgrade entitlements



Source: Enerlytica

Contact Energy gas storage

Working gas inventory

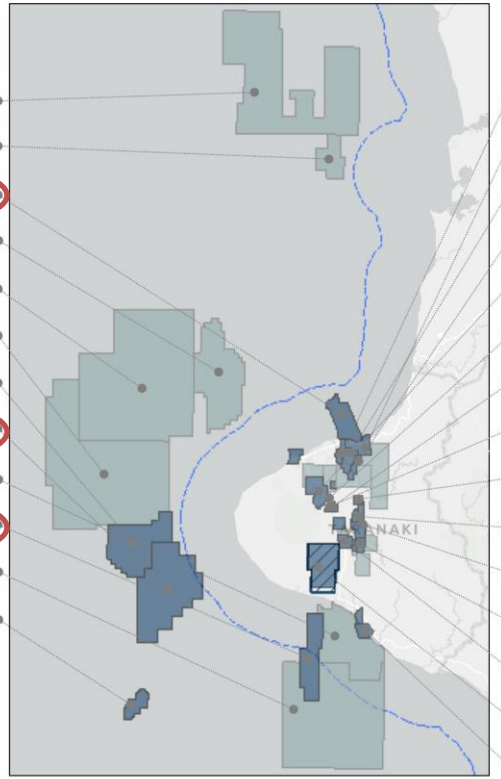


Source: Enerlytica

E&P work programmes

OFFSHORE

INVESTORS		PERMITS	
OPERATOR	CO-VENTURERS	EXPL'N	PRD'N
TODD		Nimitz PEP 57080	
TODD		Karewa PEP 38602	
OMV	TODD		Pohokura PMP 38154
OMV	sapura	Cloudy Bay PEP 57075	
OMV	sapura	Ridgeline PEP 60092	
OMV	sapura	Toutouwai PEP 60093	
			Tui PMP 38158
OMV			Maui PML 381012
WestSide		Kaheru PEP 60402	
beach	genesis, NEW ZEALAND OIL & GAS		Kupe PML 38146
TODD		Sth Basin B. PEP 60094	
OMV	Horizon Oil, cue		Maari PMP 38160



ONSHORE

INVESTORS		PERMITS
OPERATOR	CO-VENTURERS	PRD'N
GREYMOUTH PETROLEUM		Kowhai PMP 51378
GREYMOUTH PETROLEUM		Turangi PMP 38161
TODD		Mangahewa PMP 38161
TODD		McKee PML 38086
GREYMOUTH PETROLEUM		Ngatoro PMP 38148
TAMARIND		Sidewinder PMP 53803
GREYMOUTH PETROLEUM		Surrey PMP 38159
GREYMOUTH PETROLEUM		Radnor PMP 38157
NEW ZEALAND ENERGY CORP.	New Dawn Energy	Tariki PML 38138
Flexgas		Ahuroa PMP 52278
NEW ZEALAND ENERGY CORP.	New Dawn Energy	Ngaere PML 38141
NEW ZEALAND ENERGY CORP.	New Dawn Energy	Waihapa PML 38140
TAMARIND		Cheal PMP 38156
TODD		Kapuni PML 38839
WestSide		Rimu+Kauri PMP 38151 & 55

Source: Enerlytica

E&P work programmes

Kupe

Kupe inlet compressor

- $70m build
- commissioned Sept 2021 at Kupe production station
- has returned field production to plateau 77 TJ/day, adding +15-20 TJ/day
- expected to support plateau extension to 2023-24

Kupe production station

Drilling

- new wells likely to be drilled as part of Phase 2 development programme ahead of extended plateau exit
- jack-up rig required to cantilever over Kupe platform
- Beach has indicated late 2022 / early 2023 timing for drilling of at least one production and a potential appraisal well targeting an area to the South of the central field area

Kupe platform

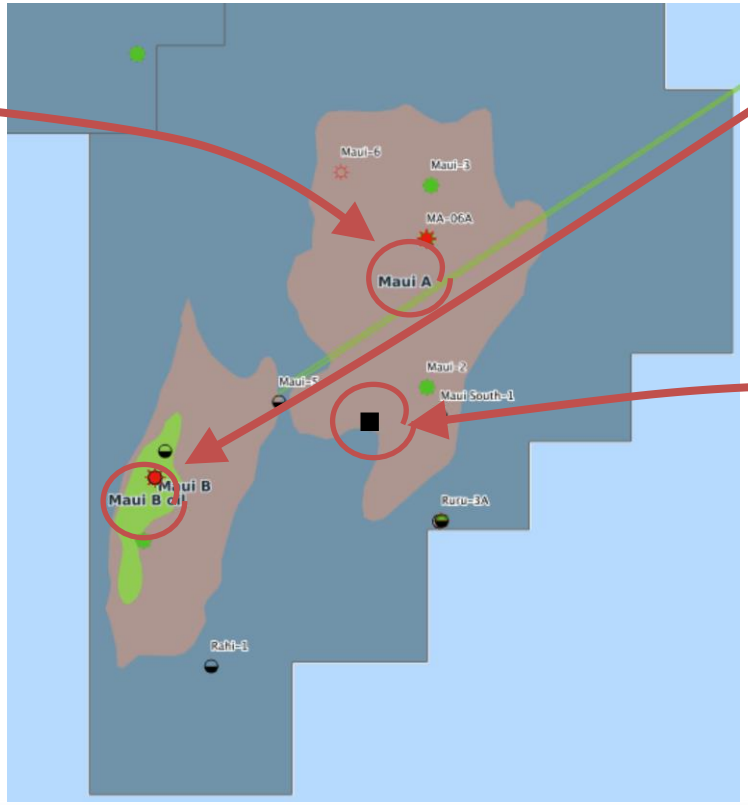
E&P work programmes

Maui

Maui-A CI programme

- infill drilling programme targeting by-passed gas
- Archer Emerald modular rig installed on Maui-A WHP
- 5 firm (11 months) + 2 contingent (5 months) sidetrack wells
- operations commenced Oct 2020, first production Dec 2020, likely to extend into 1Q 2022

Archer Emerald atop Maui-A WHP



Maui-B IRF programme

- targeting by-passed gas by re-entering existing shut-in wells
- 6 sidetracks
- Valaris JU-249 contracted for 400+ day charter
- 4Q 2021 mobilisation, late 4Q 2021 commencement

Maui-8

- exploration well targeting liquids-rich satellite accumulation for tie-on to existing Maui infrastructure
- P_C ~33%

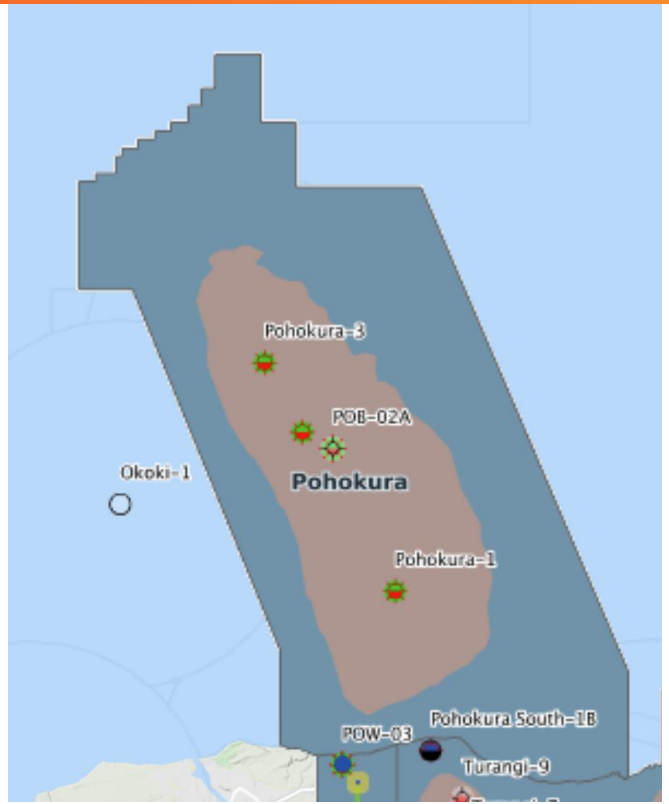
Valaris JU-249

E&P work programmes

Pohokura

Pohokura development

- offshore and onshore intervention campaigns completed during 2020 achieved limited success
- new development wells are required with both offshore and onshore options feasible
- OMV has indicated that contracting Todd Energy's Big Ben land rig is an option to drill a new development well once it has completed its current deployment at Kapuni. Drilling would comprise a deviated extended reach onshore→offshore well in 1Q 2022.
- likely future offshore programme but not before at least 2023 and unlikely with Valaris rig

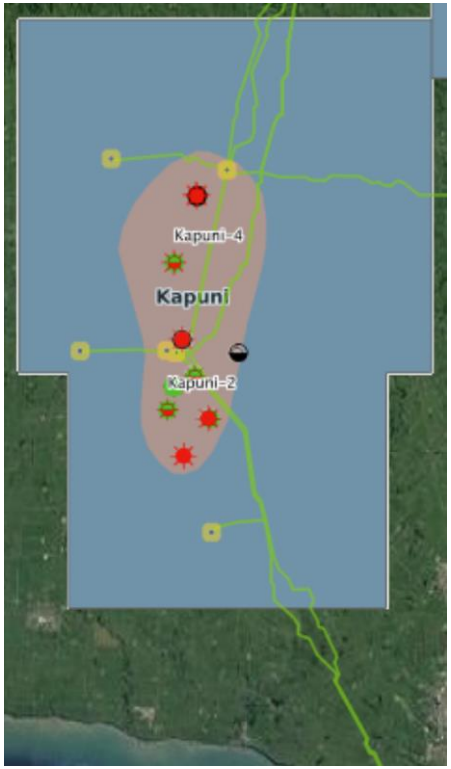


E&P work programmes

Kapuni

Kapuni development

- Todd Energy's Big Ben land rig now onsite at the newly-commissioned Kapuni-J wellsite
- 4 new appraisal/development wells to be drilled during 2H 2021 ahead of likely long-term development programme
- With potential commitments at each of Pohokura and Mangahewa, unlikely that Big Ben would be available to return to Kapuni until 2023-24



Kapuni-1 wellsite, 1959

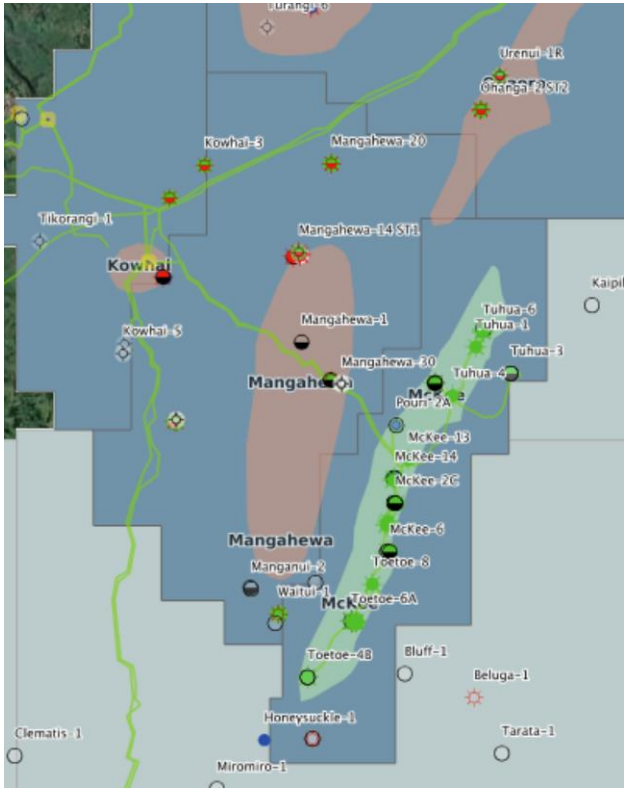

Kapuni-J wellsite, 2021

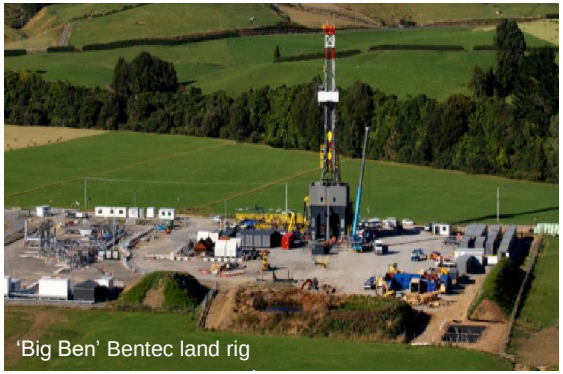
E&P work programmes

Mangahewa

Mangahewa development

- MHW31 & MHW32 development wells drilled & completed 1H 2021 from Mangahewa-G pad, now on continuous production.
- 26 wells now drilled since 2011 in the first stage of the Mangahewa development programme.
- Todd has said that it is planning to drill a further 24 wells at its –C and –D pads over the next 10 years under the second stage of the Mangahewa development programme
- Big Ben rig likely to return to Mangahewa 1H 2022 after likely Pohokura drilling




'Big Ben' Bentec land rig


Mangahewa-G pad stimulation & well testing operations

E&P work programmes

Tariki

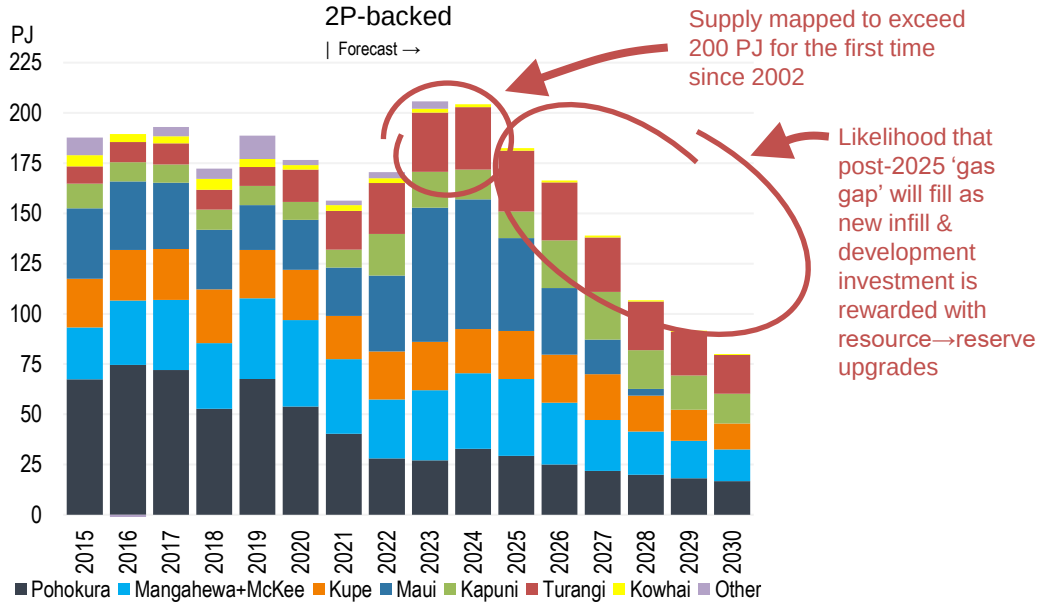
Tariki underground gas storage

- Operator New Zealand Energy Corp scoping potential conversion of depleted Tariki field into new UGS facility
- Existing wells and some above-ground compression to limit capex to ~$100m
- Genesis has said it is seeking gas storage to replace the Huntly coal stockpile, seeking 20 PJ storage with cycling of +/- 55 TJ/day, with Tariki its likely target
- NZEC has said Tariki could provide up to +/- 90 TJ/day of cycling capacity therefore inferring up to +/- 35 TJ/day could be made available to other market participants
- potential mid-2022 FID for commissioning possibly as early as late 2023

Outlook

2021 operator reportings support sizeable improvement in supply outlook

Forecast aggregate gas production

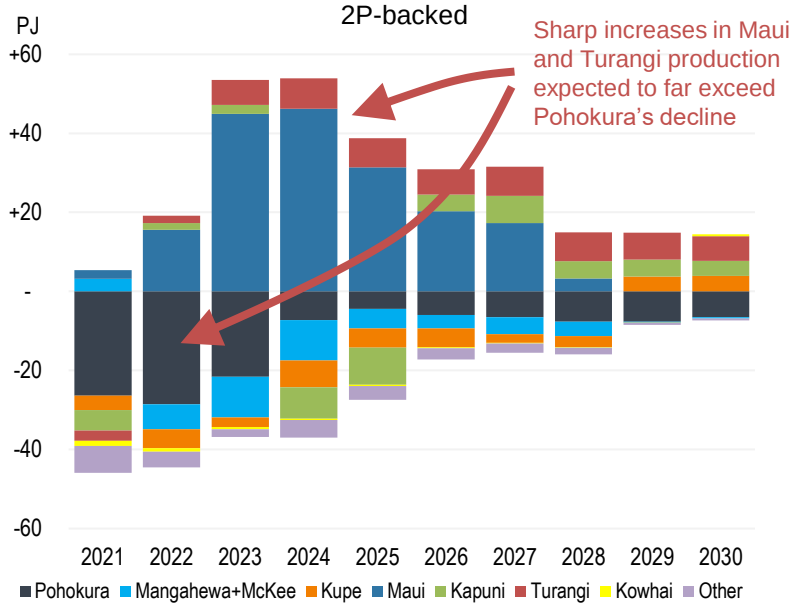


Supply mapped to exceed 200 PJ for the first time since 2002

Likelihood that post-2025 'gas gap' will fill as new infill & development investment is rewarded with resource→reserve upgrades

Source: Enerlytica

2020 vs 2021 gas production forecasts



Sharp increases in Maui and Turangi production expected to far exceed Pohokura's decline

Source: Enerlytica

Key conclusions

2021-22 tension to abate ahead of likely strong 2022-23 recovery

- **Maui dominates near-term outlook** – MACI and Maui-B IRF fillips, if delivered, underpin a strong supply-side recovery from 2023. Pohokura 1Q 2022 onshore well will serve as key to informing post-2022 work programme. Other fields including Kupe, Mangahewa, Turangi and Kapuni to provide important additional support to post-2023 supply.

- **2022 likely to remain tense** – Maui scheduled outage in April 2022 likely to see inventory levels remain suppressed into winter 2022. Kupe's return to 77 TJ/day plateau, MACI and Maui-B IRF with potential support from a new Pohokura production well should offset this.

- **No free lunch** – Capex of $2-3 bln required during the 2020s alone to maintain continuity. Policy direction since 2018 has made winning this capital from international investors now far more challenging. It is the retention of Methanex that will continue to underwrite the flow of this investment, with other users including powergen as beneficiaries.

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Briefing for Security and Reliability Council

Date: October 2021

Author: Gas Industry Co

Gas Industry Co.

Today's main topics

- 2021 security of supply: What happened?
- Gas supply outlook
- Gas Industry Co Gas Market Settings Investigation
- Update on our work.

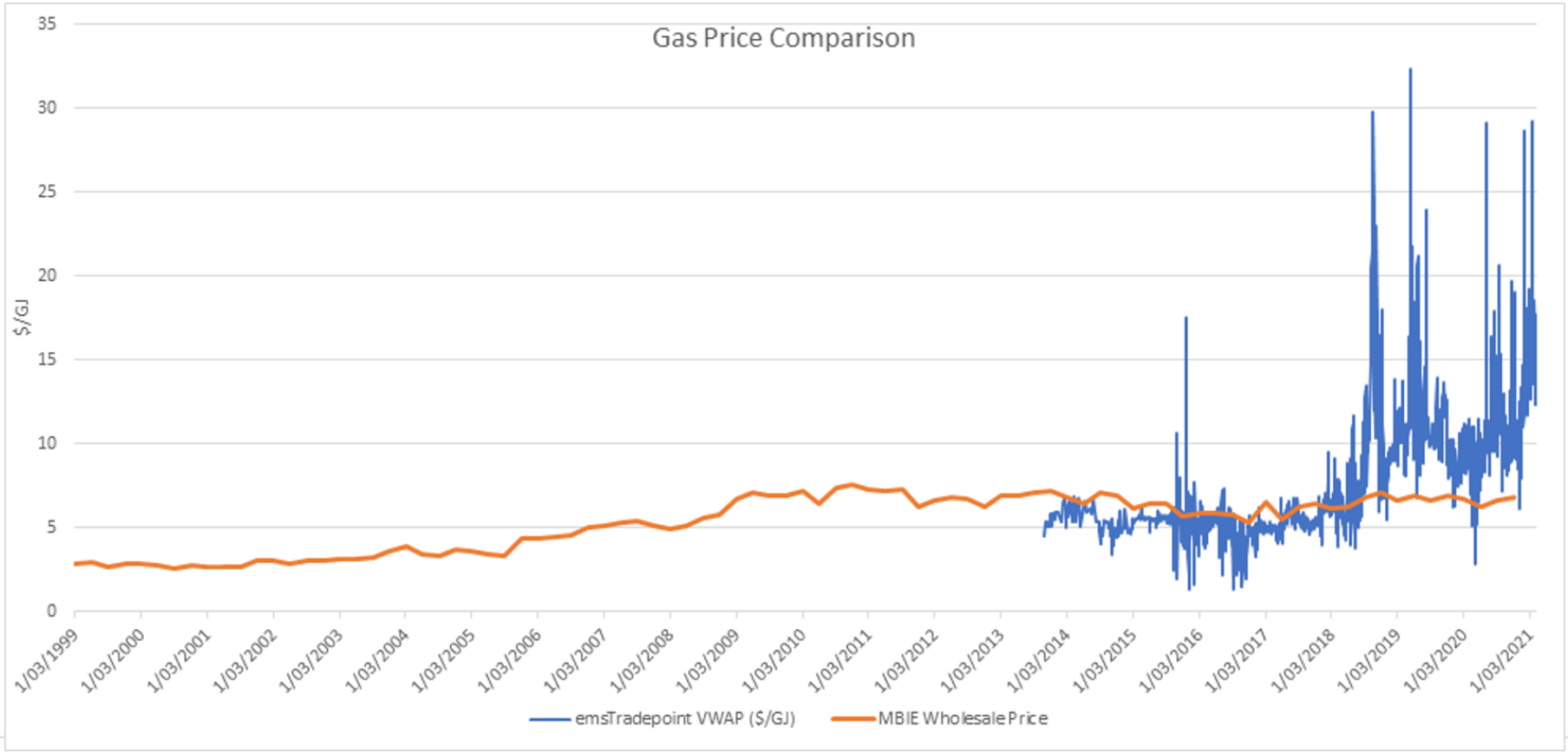
Exceptionally tight conditions in 2021

- Pohokura production dropped from 200+TJ/day, to 100.
- New supply delayed (partly due to covid-19 stalling work).
- Gas storage not full.

Outcomes

- Methanex closed Waitara plant.
- Significant idling at some major plants.
- High prices for customers off contract.

Spot prices increases with supply shortages …but most gas is sold on long term contract



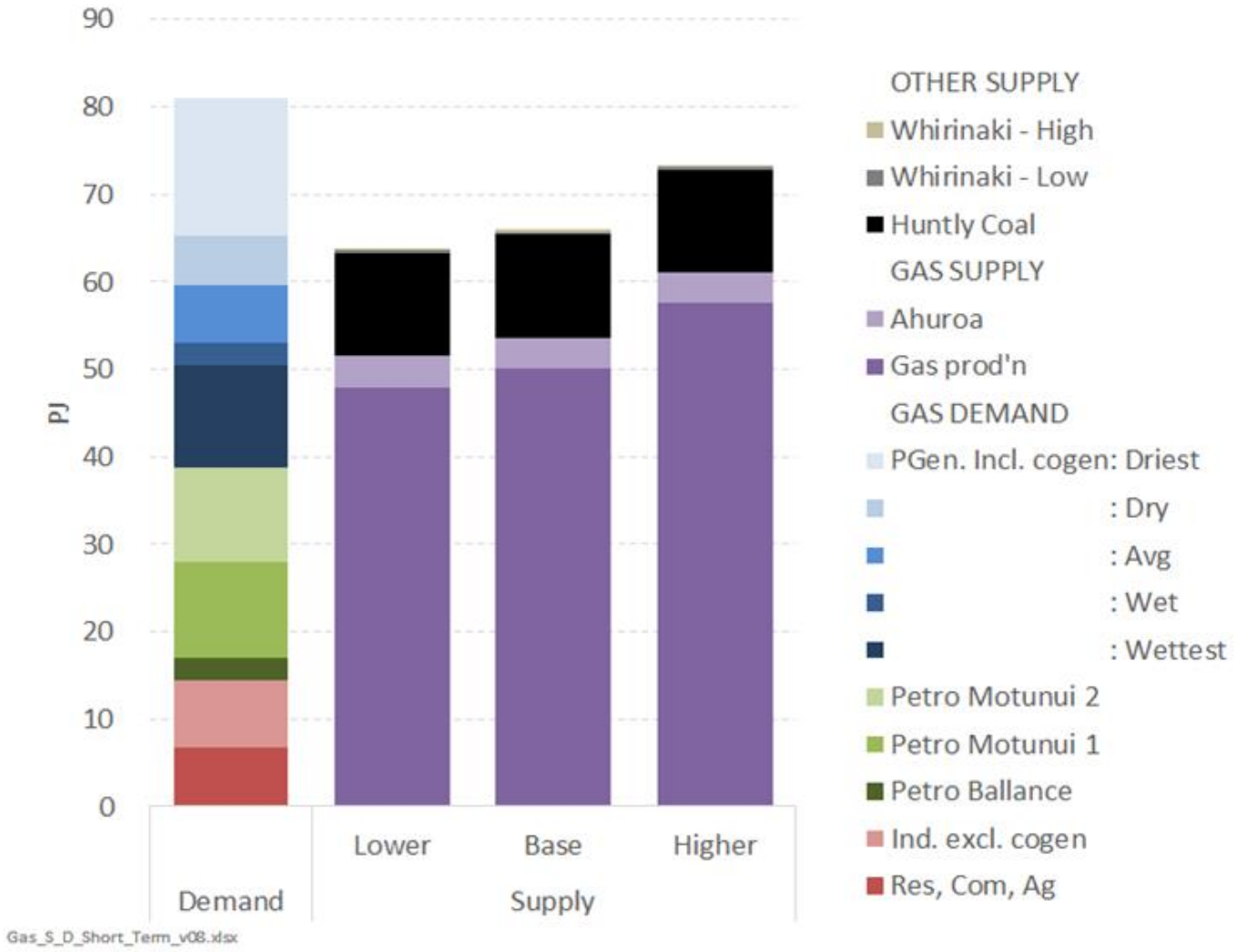
Outlook

Next year may also be very tight

- More confidence about 2023-24.
- Work at Kapuni, Kupe, Mangahewa, Maui, and Turangi is expected to make more supply available.

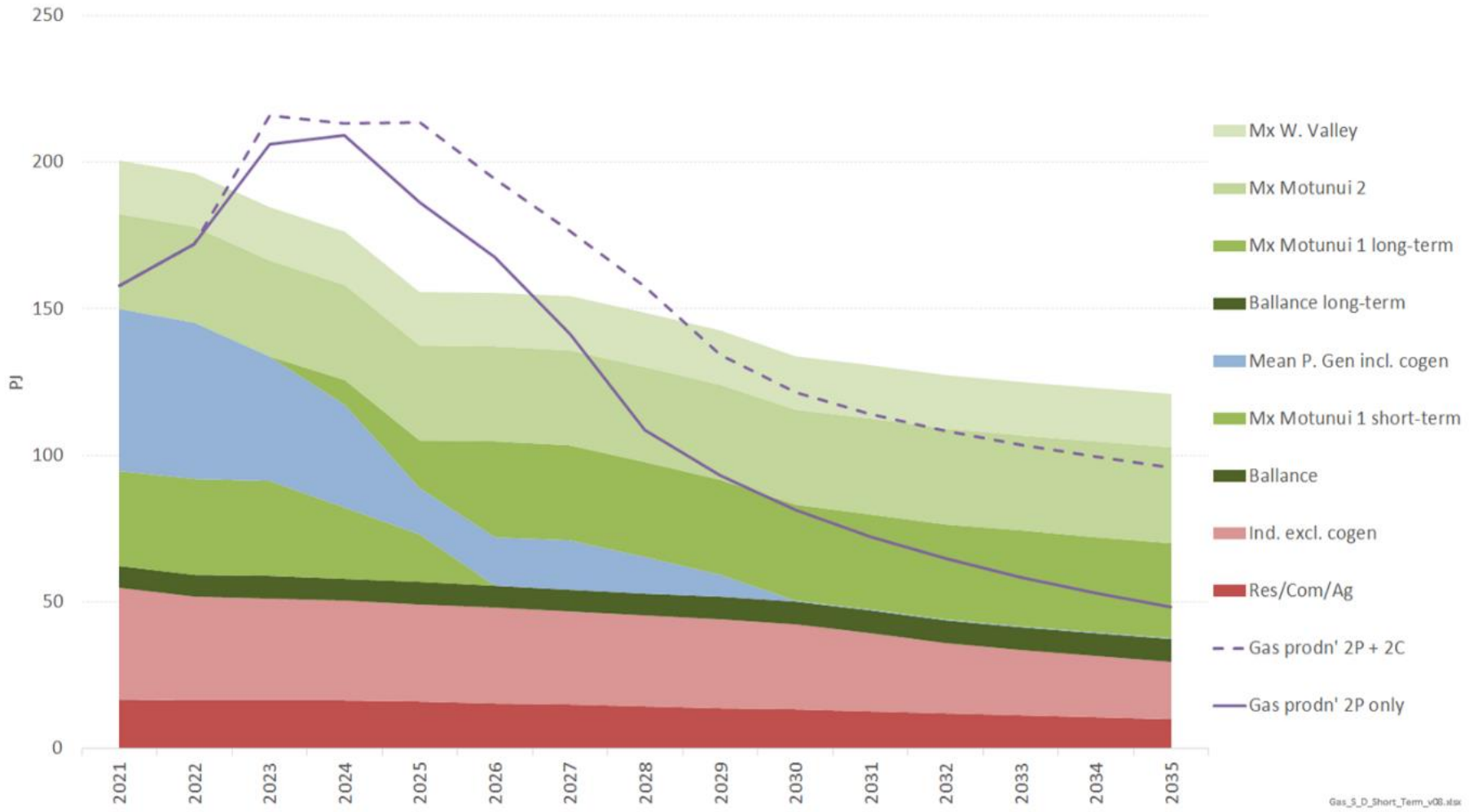
Winter 2022

Projected demand and supply expected to be tight.

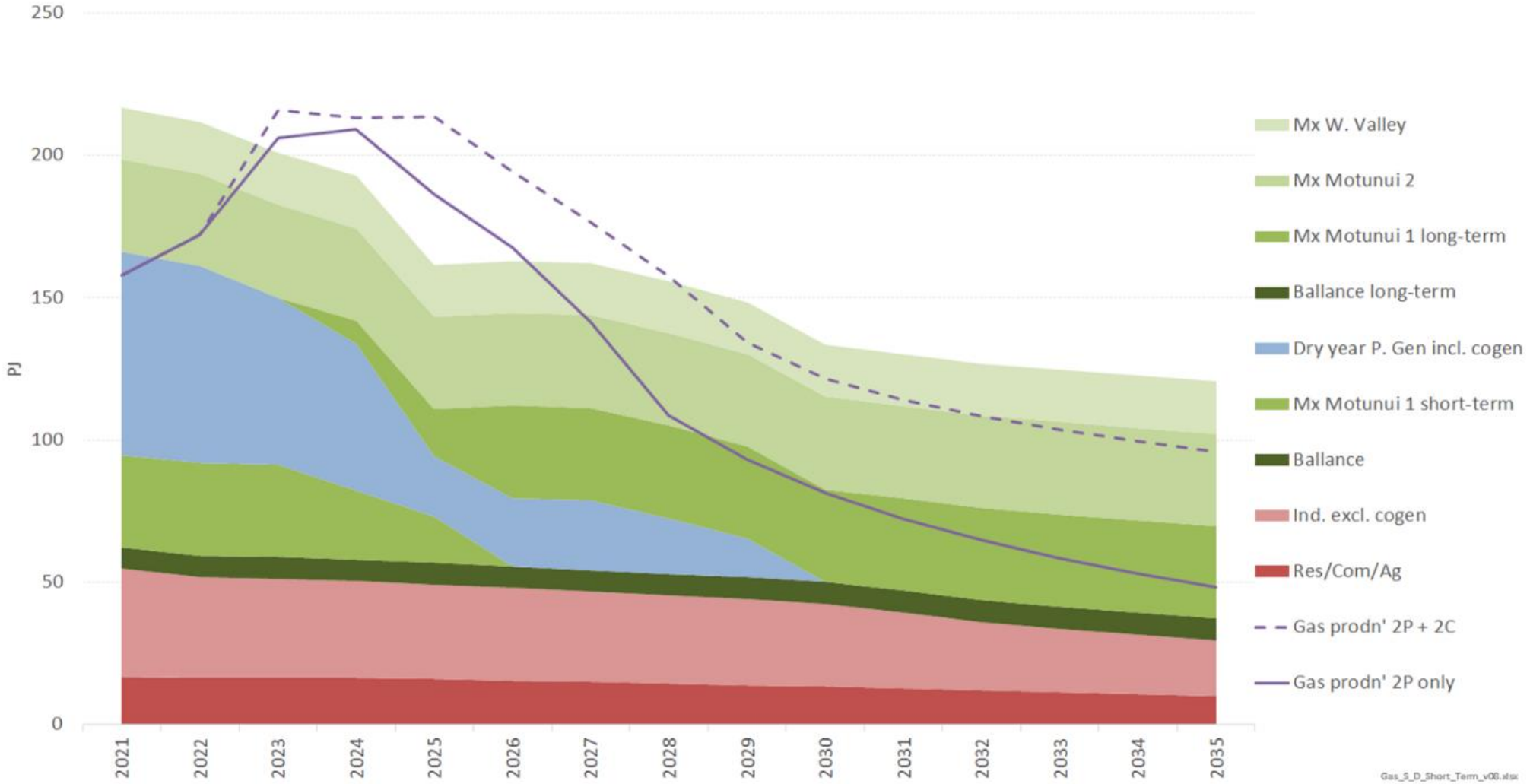


Base case supply with **mean** hydrology

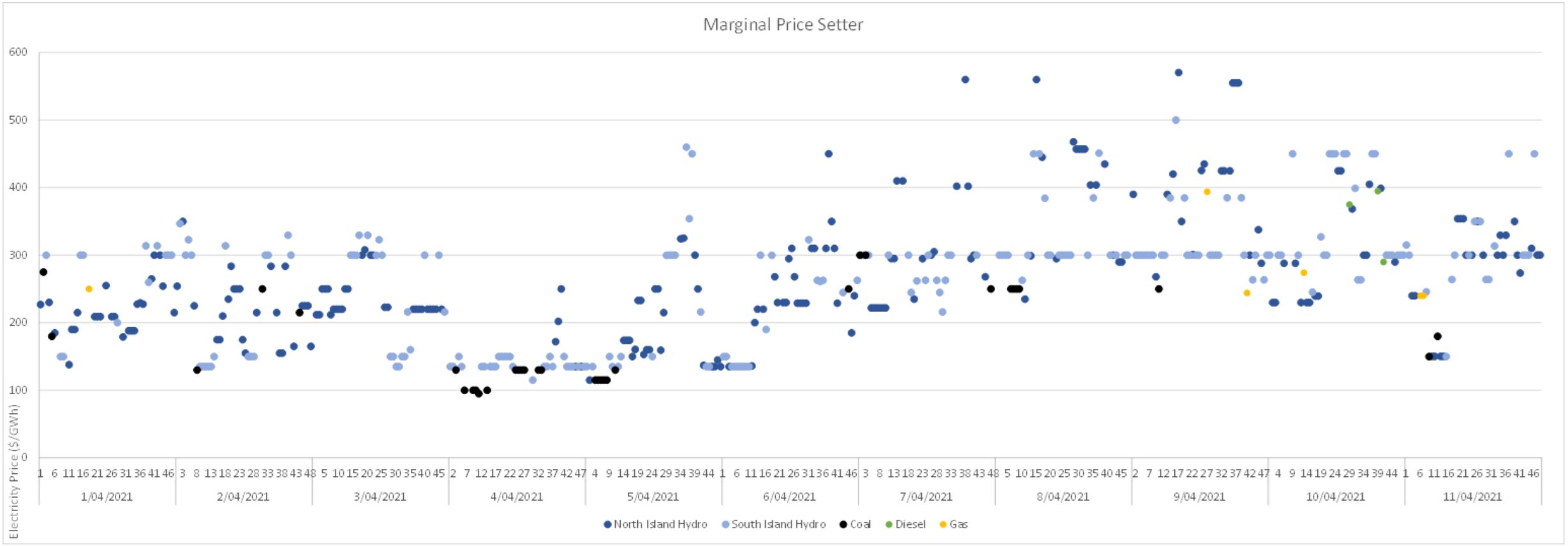
Investment needed to meet demand beyond late 20s



Base case supply with **dry** hydrology



Marginal electricity price is not set by gas



Climate Change Commission
Projected gas demand

Gas Market Settings Investigation

Looked at settings in the natural gas market and whether they are fit for purpose for New Zealand's transition to 100 per cent renewable electricity by 2030.

Our report published 12 October 2021

- notes what a fit-for-purpose natural gas sector would look like;
- considers the outlook for natural gas in New Zealand;
- recommends potential solutions and a work programme.

Gas Market Settings Investigation

Sufficient gas in the ground

- "There are sufficient reserves in the ground to meet New Zealand's gas demand."

Investment needed to develop fields

- "Without ongoing investment (well in advance of when the gas is needed), there is a real risk that not enough gas will be able to be delivered to major gas users, including electricity generators, during the transition out to 2030 and beyond."

Commercial arrangements for gas to support electricity in dry years

"There are insufficient commercial arrangements for gas supply dedicated in advance for electricity security of supply during sustained dry periods. Current committed arrangements do not appear to be sufficient to cover the large volume of thermal fuel support required for dry winters over the transition period."

Gas transition pathway

- We recommend a workstream to develop a Gas Transition Pathway.
- Its purpose would be to provide the granular direction needed to support improved investment confidence.
- Could be jointly managed by Gas Industry Co & MBIE.

3 proposed workstreams to improve commercial arrangements

Arrangements are needed specifically for the electricity generation sector (rather than other major users) because generators need flexible thermal fuel supply to counteract intermittent renewables.

1. Supply Side
2. Planned demand response
3. Reviews of electricity market

1. Supply-side workstream

- More regular gas supply and demand studies
- Assessing the likely costs and availability of gas-related options (storage, demand response, and unplanned demand diversion).
- Facilitating arrangements between industry participants where necessary.

2. Planned demand response

Planned demand response by Methanex is likely to be readily available and at large enough volumes to enable the flexibility in the system needed.

- Discussion needed about Methanex's decisions whether to remain operating in New Zealand. Focus on commercial arrangements to underpin planned demand response
- **Who pays?**

3. Reviews of electricity market & competition

- EA expected to thermal fuel availability for electricity generation in its reviews of 2021 dry hydro sequence and the events of 9 August 2021 (the Phase 2 review), and electricity wholesale market competition.
- Includes current limitations to backup fuel supply for sustained dry periods.

Other workstreams

- **Information availability** to help enable participants plan
- Regulatory framework for gas **pipelines**.
- Potentially accelerated development of **hydrogen and biofuels**
- How to avoid and **reduce emissions** for those who need to use gas
- Exploring the viability of **emissions capture and storage** in New Zealand.
- Considering **additional mechanisms** to ensure gas is available to industrial users in unexpected tight situations.

Gas Industry Co commencing consultation

- Now beginning engagement with industry on our future workstreams.

NZ gas in the context of electricity security and reliability

Security & Reliability Council

Wellington, October 21 2021

The energy for a better life.

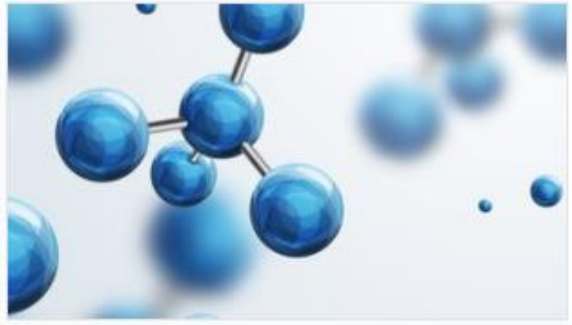
Agenda

1. Introduction to OMV in NZ
2. Gas Market & Electricity Security of Supply
3. Outlook

OMV is an international Oil & Gas, Refining and Chemicals business based in Vienna, Austria

Exploration & Production

Refining & Marketing



Chemicals & Materials

OMV is playing its role in the global energy transition

Gas

Hydrogen

Biofuels

Circular Economy

Strong track record of investment and operations in New Zealand

20 Year History in NZ

Extensive Operations

Significant Investor

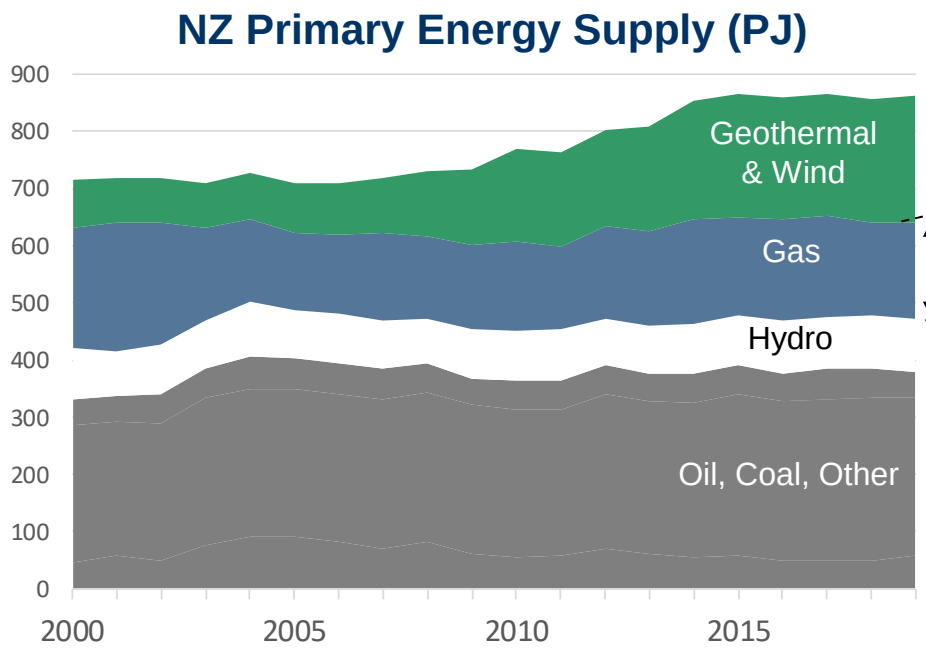
Valuable Contributor

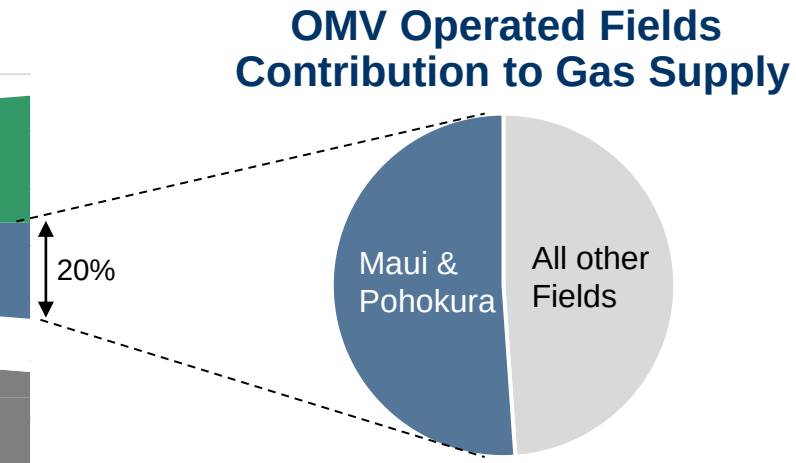
300 Skilled Local Staff

Agenda

1. Introduction to OMV in NZ
2. **Gas Market & Electricity Security of Supply**
3. Outlook

OMV operated gas meets approximately 10% of NZ's primary energy needs

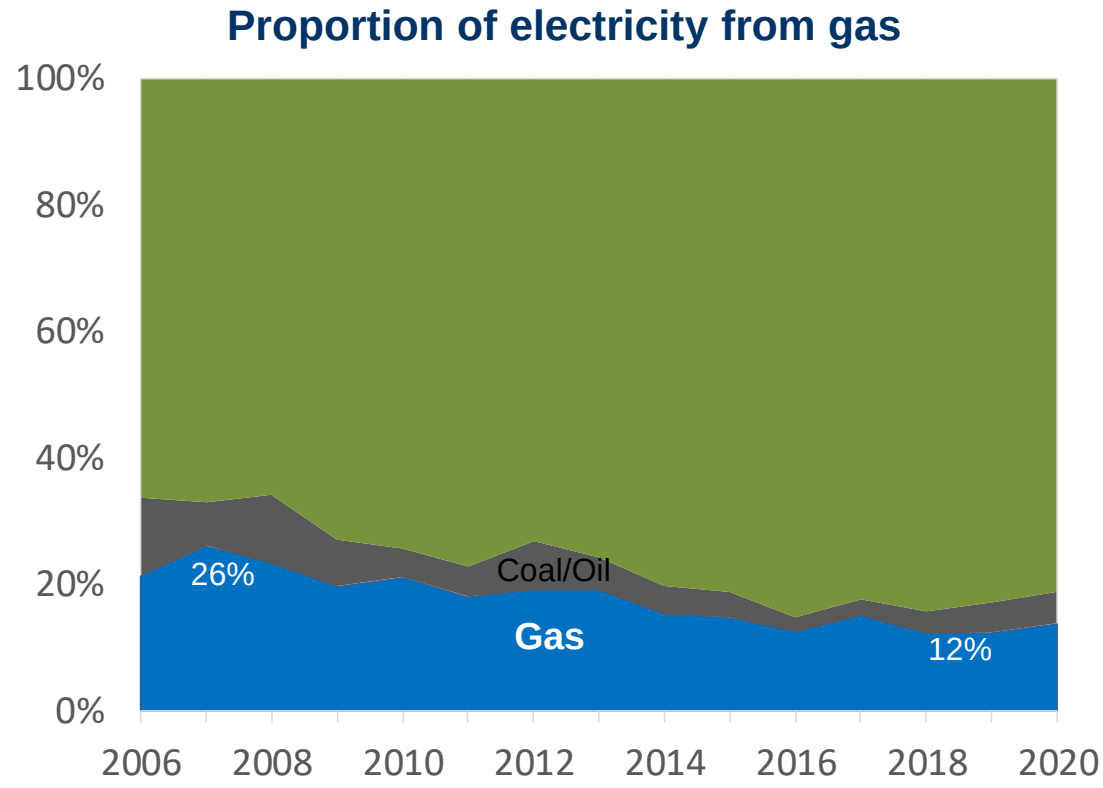




Source Data
Historic Data: IEA
Pie Chart: MBIE Gas data table (2016 to 2020 average)

Gas still plays a key role in electricity generation

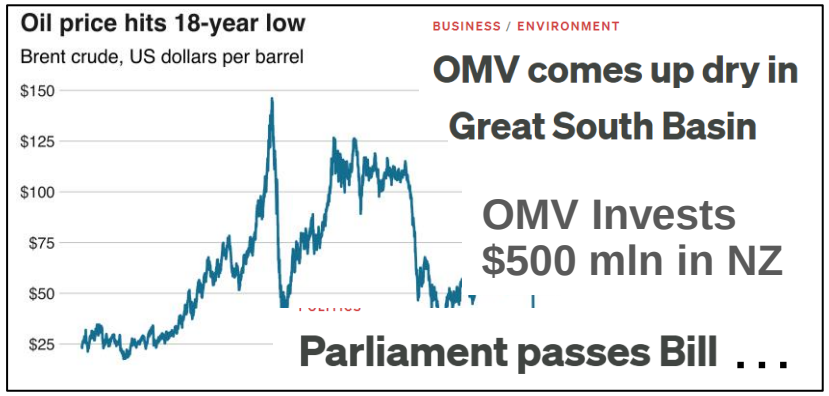
- Base Load Generation ->> Winter Firming
- Peaking
- Coal displacement



Source Data
MBIE Energy in New Zealand Data Tables

Continued investment is required to maintain production

Significant Investment & Risk



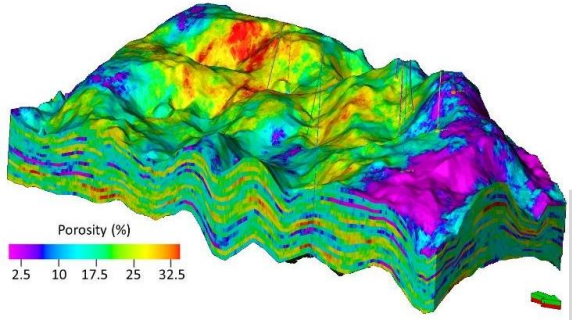
Long Investment Cycles

Long Term Contracts

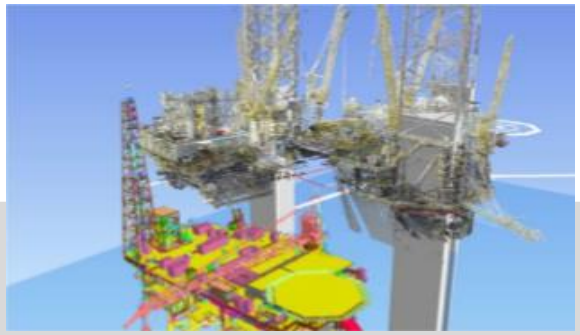
Maximize Production

Case Study: Maui B infill drilling campaign

Seismic acquired in 2018

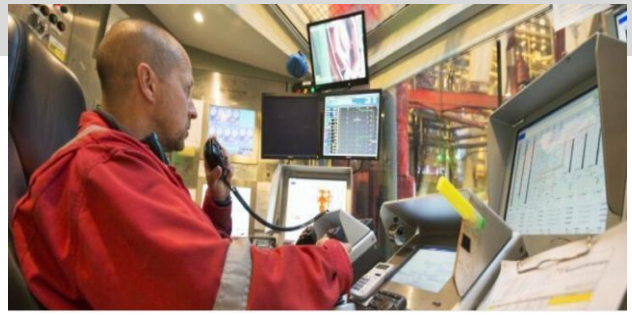


Rig secured mid 2021



2019/20 Project Maturation

Drilling from early 2022

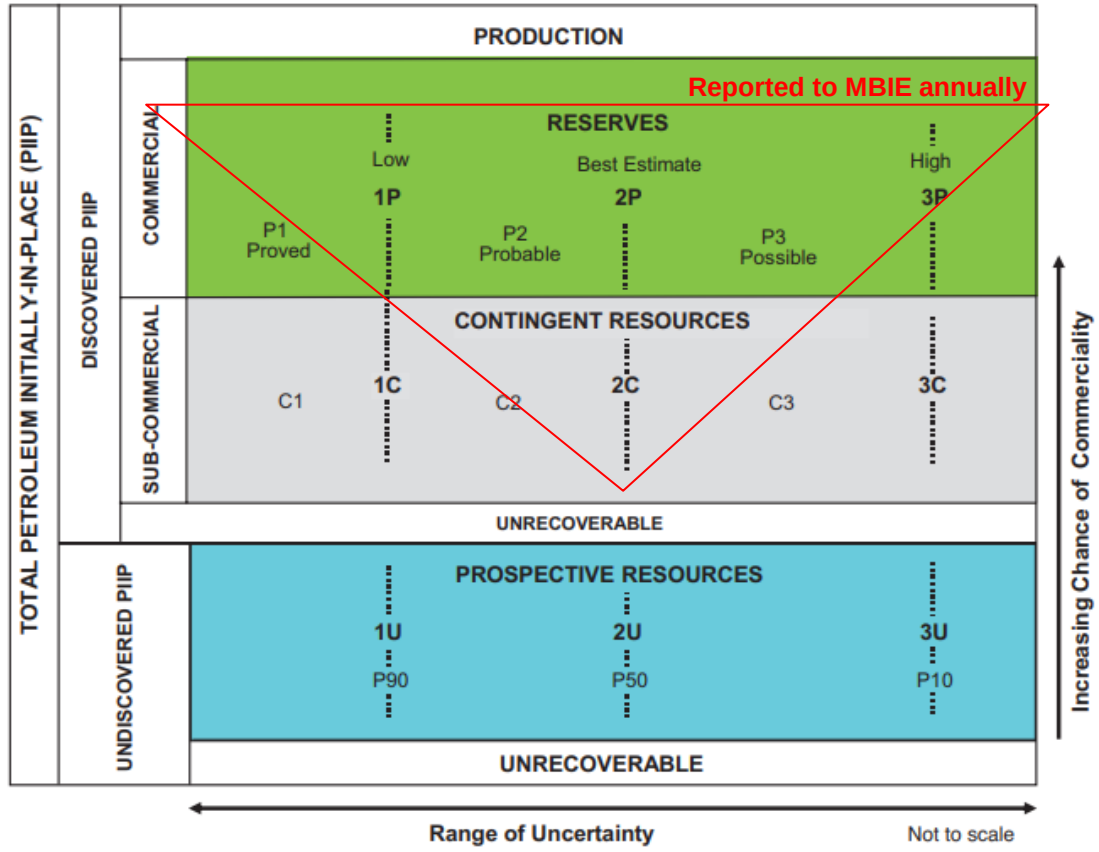


Gas to Market

Continued maturation of resources to production allows uncertainty to be managed

- Volume uncertainty reduces with time and volume maturation
- Contingent resources converted to reserves and production with investment
- Opportunity funnel replenished with data collection, study and innovation

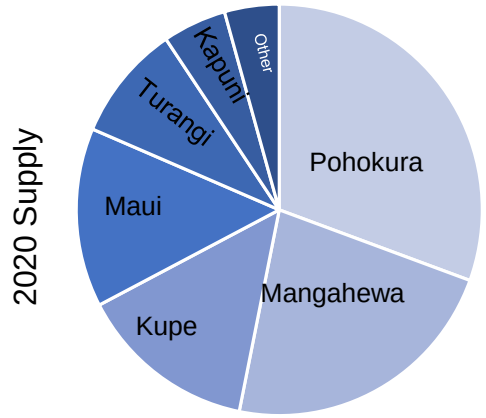
Investment moves resources from: Prospective to Contingent to Reserves to Production



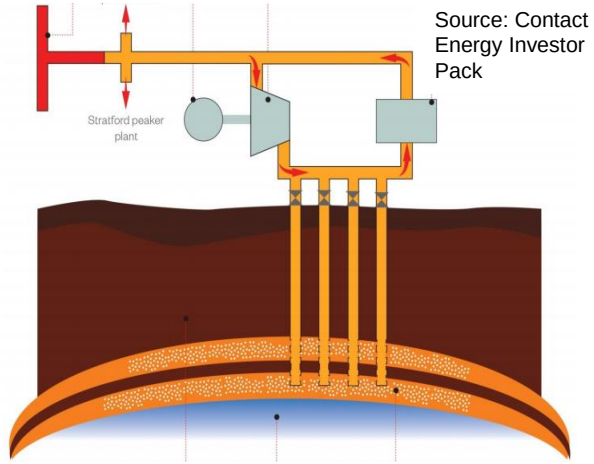
Source: SPE Petroleum Resource Management System (2018)

NZ gas: electricity security of supply strengths

Diversified supply



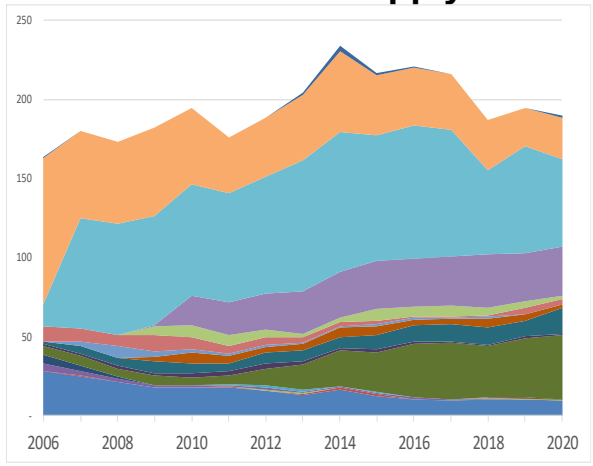
Ahuroa



Source: Contact Energy Investor Pack

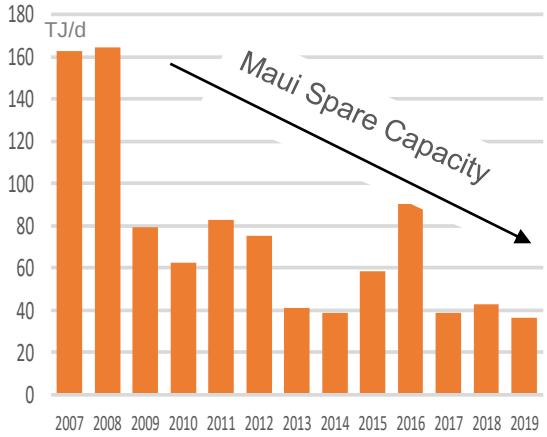
Methanex

Predictable Supply

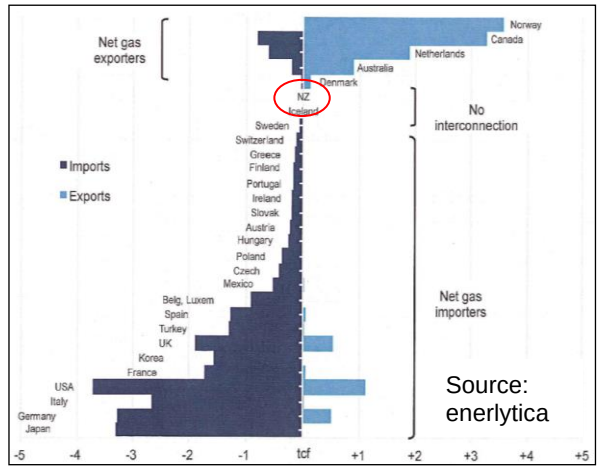


NZ gas: electricity security of supply challenges

Limited Spare Capacity

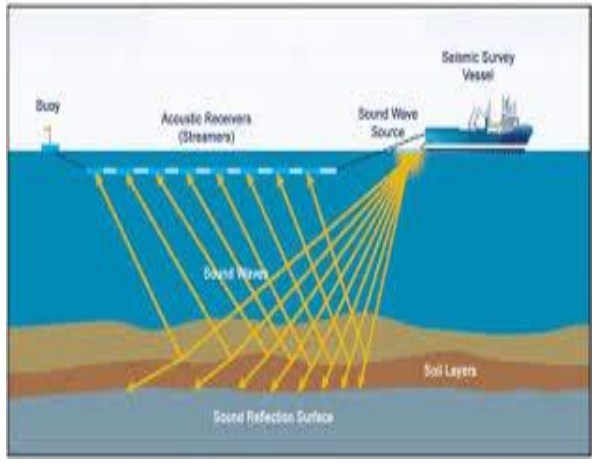


Isolated Market



2030 deadline

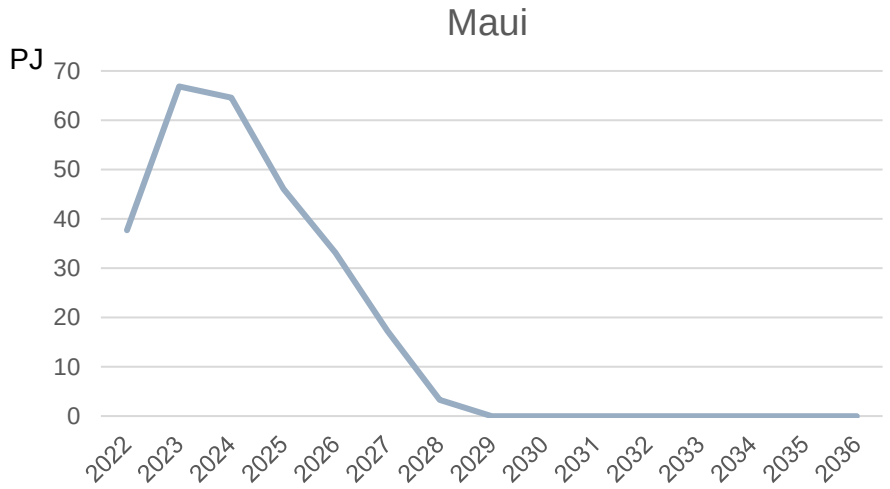
Exploration Curtailed

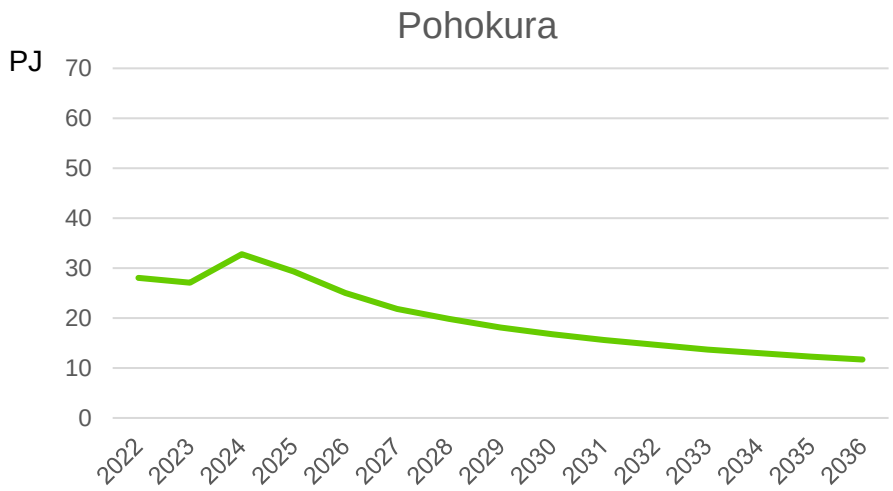


Agenda

1. Introduction to OMV in NZ
2. Gas Market & Electricity Security of Supply
3. Outlook

Ongoing investments secure production for the next 3-5 years, beyond that new investment is needed





- Investment accelerated since data submitted, additional production onstream in 2022
- Subsequent projects being worked, but are not mature
- 3–4-week outage planned at Maui in April 2022
- Production rate is well-constrained

Source: MBIE reserves data 2021

OMV is supportive of NZ meeting its climate change objectives

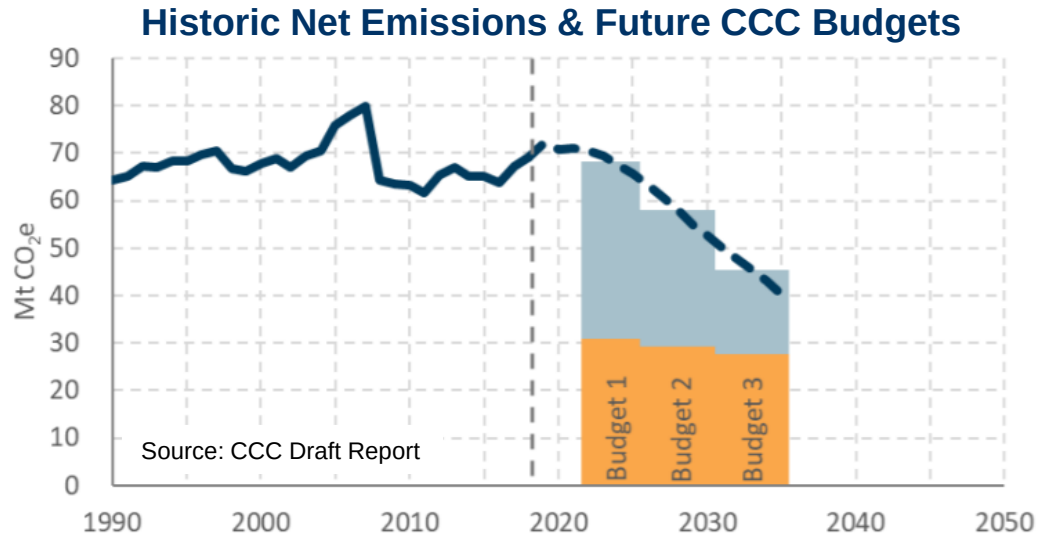
Carbon Reduction Pathway

- Gas has an ongoing role out to 2050+ and is a transition enabler
- Key issues:
  - Regulatory stability is important
  - ETS could do more “heavy lifting”
  - It is important to retain optionality
  - Emissions leakage risk is real

Gas Market Settings review

- Correctly identified key challenges around gas storage and flexibility
- Increased visibility of the role of Methanex
- Ongoing focus on information disclosure

New investment needs secure demand and regulatory certainty



Summary

Gas plays an important role

- Significant source of primary energy for NZ
- In electricity generation: Winter firming, peaking and displacing coal (reduced emissions)

Ongoing investment is required

- Risky, Long-Lead Times, secure demand, maximise offtake
- Continued investment is key to mitigating production risk

…and OMV is investing

- Upcoming investments should secure production for next 3 to 5 years, thereafter more investment will be needed
- Regulatory risks are mounting for the next phase of investment

Gas is well positioned to serve electricity market needs:

- Diversified Supply
- Ahuroa
- Methanex
- Predictable supply

….and challenged in others

- Limited spare capacity
- Isolated market
- 2030 deadline
- Exploration curtailed

The energy for a better life.

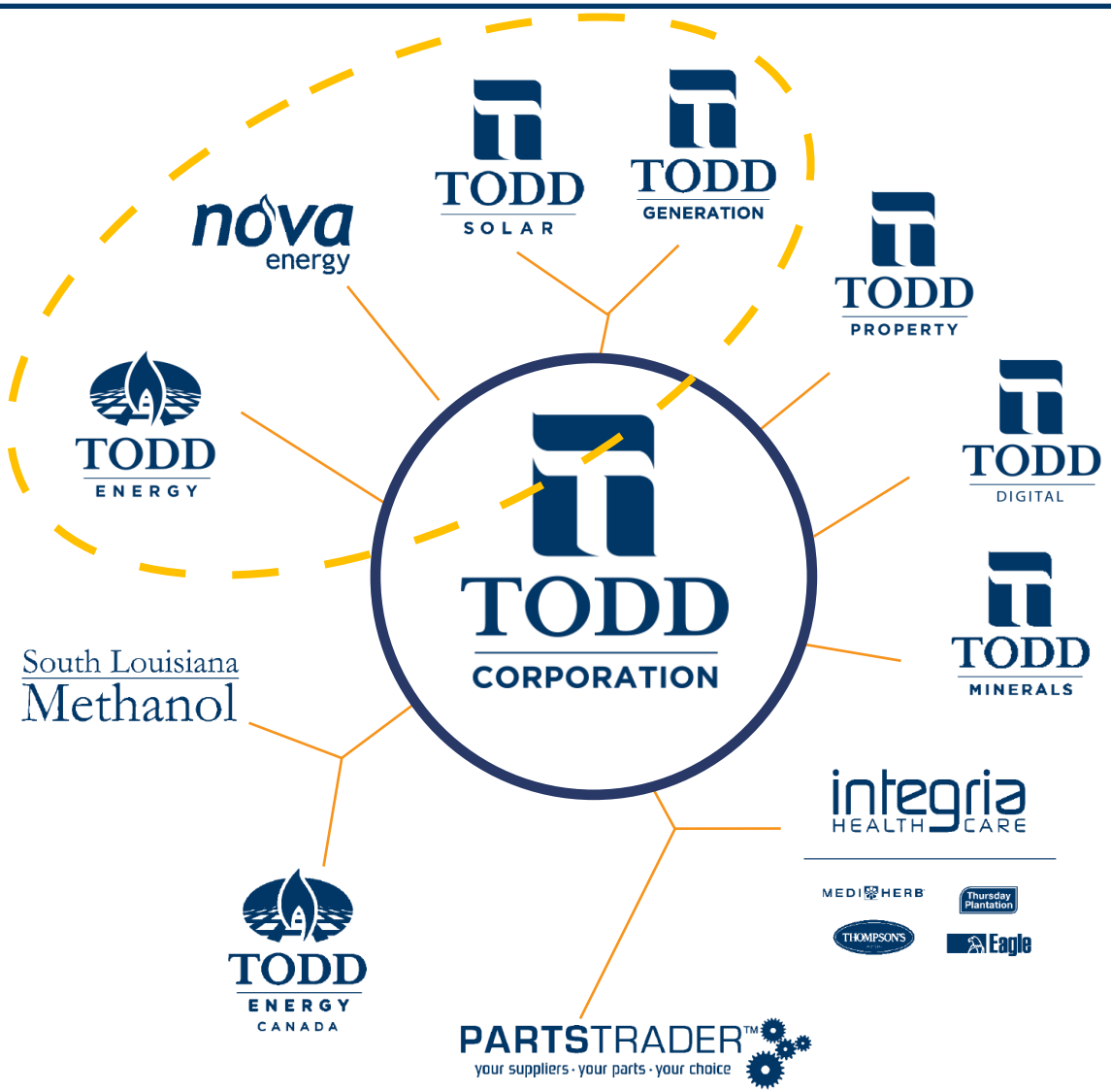
Security and Reliability Council

October 2021

Security Reliability Council

- Gas supply forecasts for 2022
- Security of supply for 2022 and contribution from gas fired thermal plant
- Gas sector contribution to long term energy security of supply
- Government policy re:
  - 100% renewable energy
  - Net zero emissions target by 2050

Todd Group of Companies



Todd natural gas supply 2022

McKee and Mangahewa fields

- Drilled 2 wells during 2021 that lifted production capacity to >100 TJ/day
- Production will decline slowly to around 80TJ/day by the end of 2022
- Next drilling at M&M planned for 2023

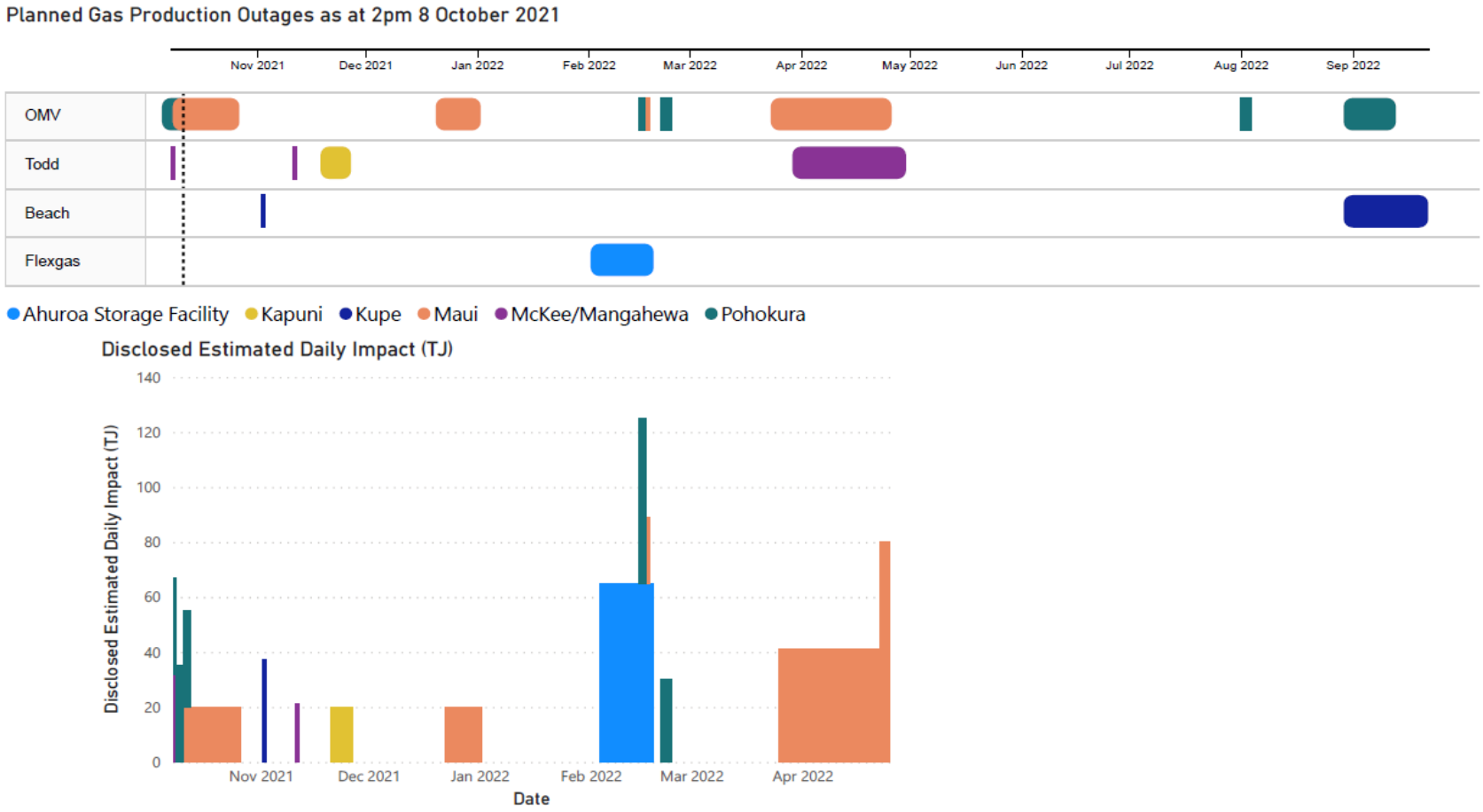
Kapuni field

- Kapuni 3D Seismic study in 2016-17 identified contingent reserves
- Currently drilling at Kapuni J site 4 wells that potentially will see Kapuni return to production rates of 55-60TJ/day from mid 2022 (currently ~20-25 TJ/day).
- Further drilling indicatively planned for 2024

Pohokura

- OMV operated
- Infill well planned for Q2/Q3 2022 that is expected to reinstate some of the 2021-22 lost production

Todd gas field planned outages



- M&M statutory inspections in April for ~1 month. Final dates and impact on production to be confirmed. Indicatively 20-30 TJs per day offset by increased production as new Kapuni production comes on-line.
- Methanex train turn-around anticipated for 30-60 days during Q2/Q3 2022

Natural gas supply 2022

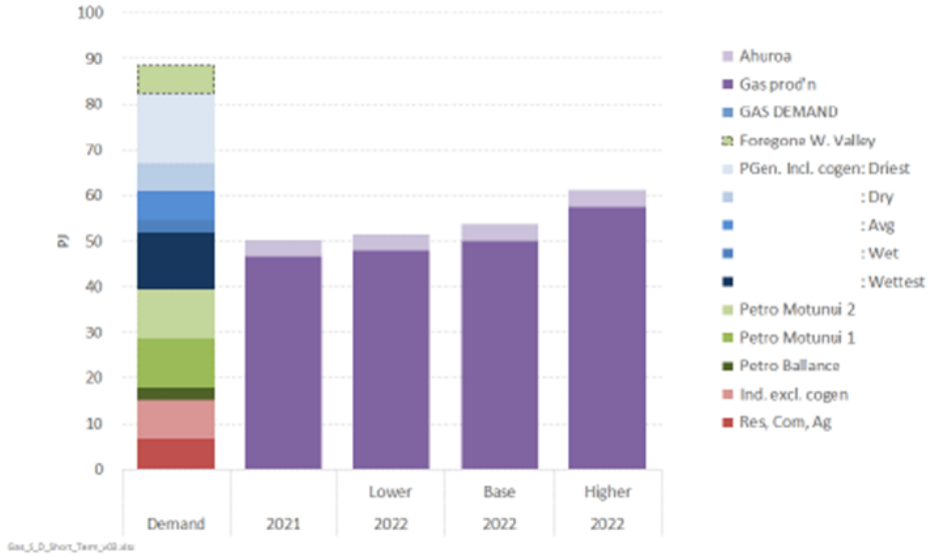
Our observations regarding 2022 in general

- Todd supply expected to be at similar levels across the year for 2022 compared to 2021
- Peaker plants should have a similar level of gas available for next year as 2021
- Key risks include:
  - Kapuni drilling outcomes
  - Pohokura infill well outcomes
- Positive signs of improved gas supply production:
  - Maui successful drilling lifting daily production to ~100 TJ/day
  - Kupe recompression progression increasing production back to 77 TJ/day
- Return to a normal hydrological inflow and storage situation
- New generation coming on at Turitea
- Supply position will be tight in gas and electricity markets if renewable output is down. Coal still required to fill the gap in a dry year

Projected fuel position for Todd peaking plants?

Scenario: Expected gas supply (P50) as % of available generation capacity	Next week	Next 4 weeks	Next 3 months	Beyond 3 months
Peak periods (<30%)				
Daytime (>30%, <70%)				
Baseload (>70%)				

Figure 18: Winter 2022 – projected gas demand and supply



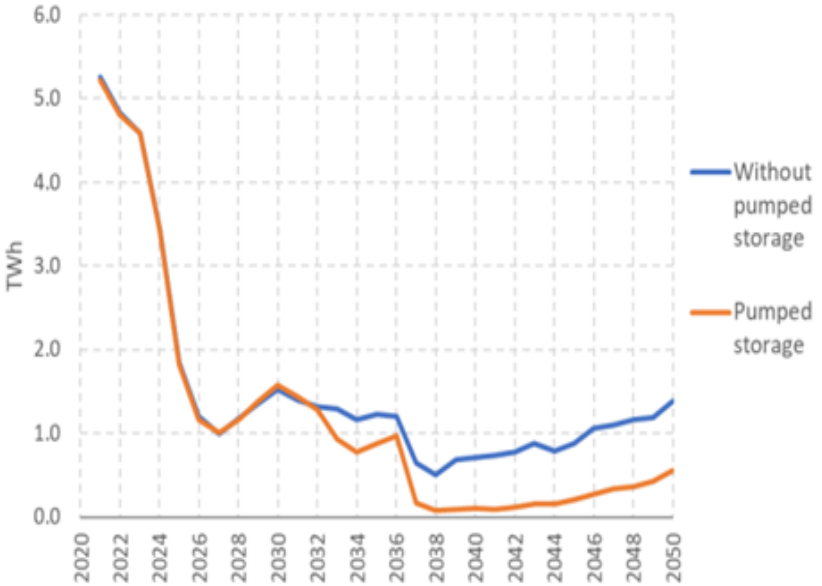
Source: Concept analysis

Importance of natural gas peaking over next 5-10 years and beyond

- New Zealand's dry year risk needs to be managed if electrification of the economy is to be the cornerstone of the decarbonisation pathway
  - Ensuring electricity is secure and affordable is key
- Current winter and dry year risk well understood and managed by thermal peaking capacity
- As NZ transitions to a low emissions future, increased reliance on intermittent renewables will cause increasing winter energy shortfall, requiring additional peaking capacity
  - At the same time, thermal generation capacity is expected to decline as thermal baseload is decommissioned
- Transpower 2020 modelling showed dry year shortfalls as early as 2027, if no new generation built
  - As such, it modelled, by 2035, 400 MW of baseload gas generation being retired and replaced by 4 x 100 MW gas-fired peaker plants
- Natural gas-fired peaking will still be needed for the foreseeable future as insurance against winter peak shortfalls and dry year risk

A variety of peaking / storage options will be needed in the future irrespective of Lake Onslow

CCC Electricity Market Modelling Results



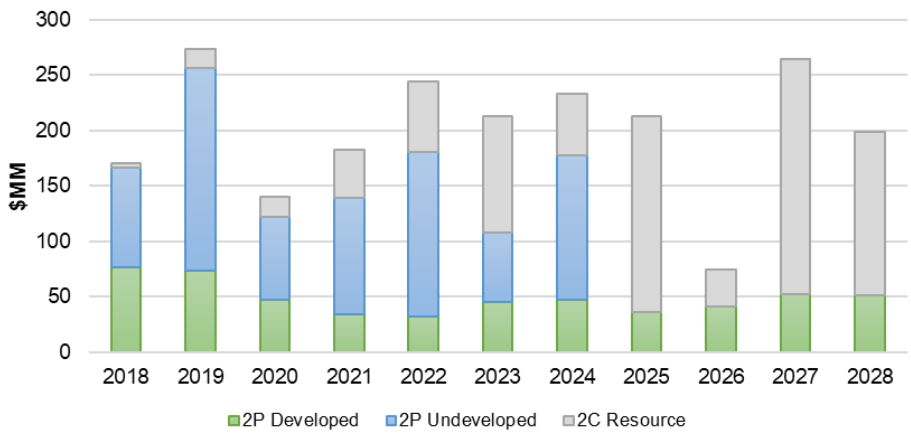
Durable and predictable policy and regulatory settings key to investment

- Significant capital expenditure needed:
  - Peaker plants – to maintain/upgrade existing plants and storage facilities and to build new plants
    - Transpower models 4 new peaker plants before 2035 (replacing older plants)
    - CCC models 6 new plants between 2035 and 2045
  - Production – to bring gas to market (GIC/Enerlytica: ~$2 bn during 2020s to maintain current production levels)
- This investment will provide insurance against energy shortfalls, market volatility, higher prices and a risk of slowing down electrification and decarbonisation of the economy
- Market already supporting transition:
  - decreasing renewable costs – renewable generation expected to peak at 94%
  - increasing ETS costs – companies factoring in rising carbon costs into investment decisions
- Clarity that natural gas peaking has a role to play is key for investment to occur

CCC electricity modelling

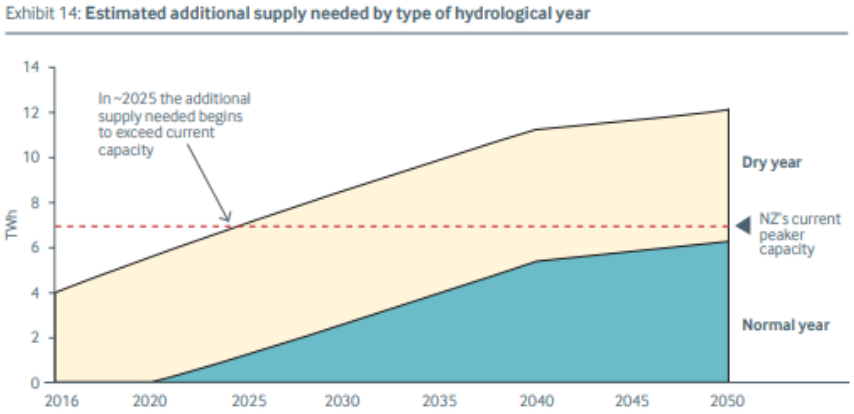
Tailwinds demand profile build schedule							
	2020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050	2050-2055
Total projects	6	4	17	24	15	12	6
Wind	4	3	14	13	8	4	1
Solar	0	1	2	6	2	0	0
Geothermal	2	0	0	1	4	5	1
Peaker	0	0	1	4	1	0	0
Hydro	0	0	0	0	0	3	4

$2 bn capital investment



Clarity needed that natural gas peaking has long-term role

- As NZ economy electrifies and share of intermittent renewables increases:
  - risk of winter and dry year shortfall will grow
  - peaking and storage will play critical role beyond 2030 and need to significantly increase between 2030 and 2050 irrespective of Lake Onslow
- Government policy statements send strong signals that there is no role for natural gas peaker plants beyond 2029
- Unless there is positive acknowledgement of a long-term role of natural gas fired peaking the 9 August power shortage should be seen as a window into the future, as with the volatility of renewables there will be:
  - brown-outs
  - more burning of coal
  - market volatility and price spikes
  - lower energy reliability and higher costs for residential and business consumers, impacting on jobs and health, especially vulnerable communities
  - slowing down of electrification and decarbonisation of the economy



Estimated additional supply needed by type of hydrological year

Page 30 of Transpower Energy Futures - Te Mauri Hiko 11 June 2018

2020 update - gap of 9 TWh in 2050

Gas Transmission Security and Reliability

Iwan Bridge
Chief Operating Officer
Firstgas Group

Firstgas Group

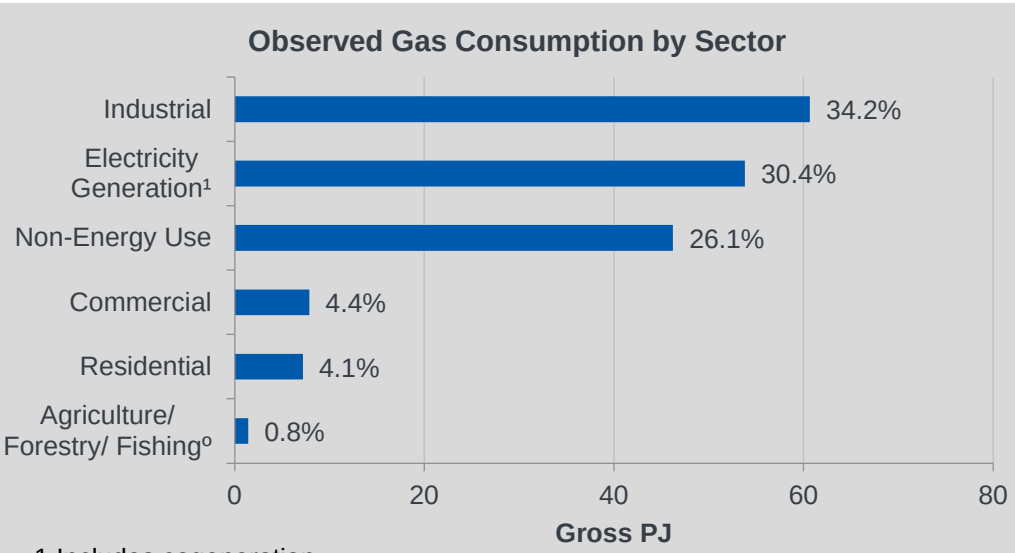
12 October 2021

Purpose of presentation

- Describe how security of supply risks are managed on the gas transmission system
- Increase awareness of specific risks and steps taken to manage those risks
- Explain Firstgas emergency response capability
- Describe the role of Ahuroa Gas Storage

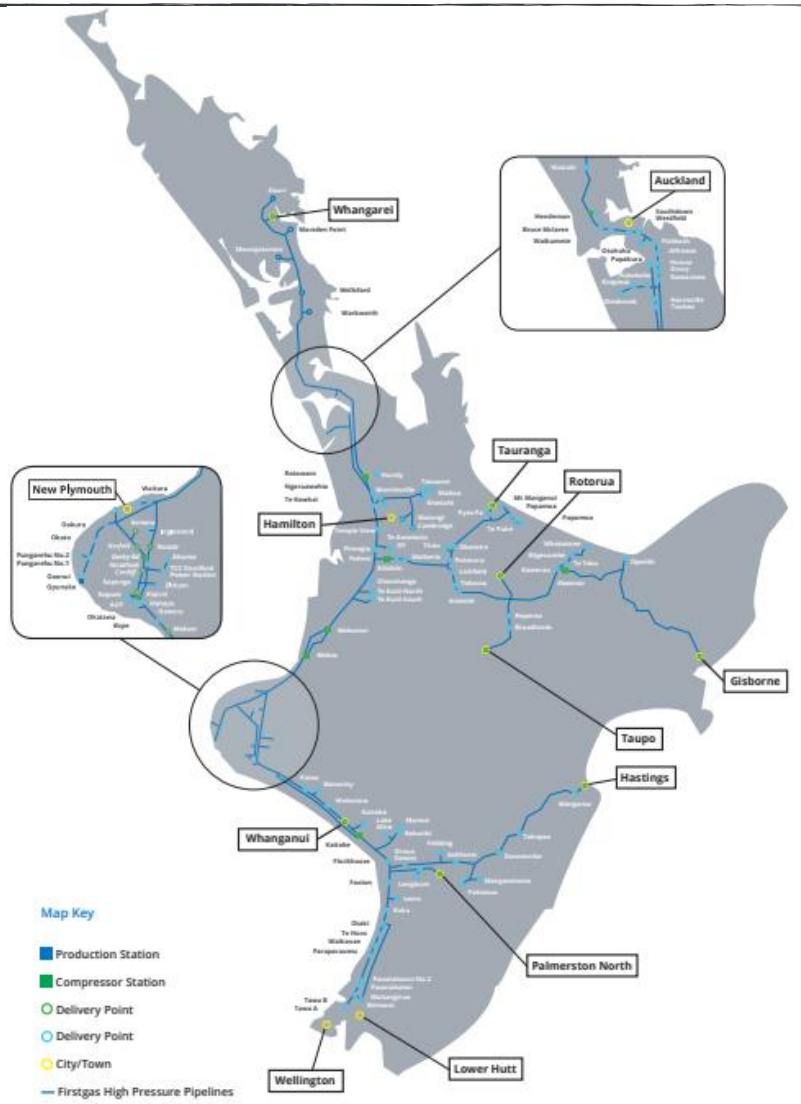
Gas transmission overview

Feature	Value
System length (km)	2,517
No. of Compressor Stations	9
No. of Compressors	20
No. of Delivery Points	131



1 Includes cogeneration
2 Includes transport

Source: Ministry of Business, Innovation and Employment



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Two dimensions to pipeline security of supply

Two areas to consider:

- Reliable operation of above ground assets, such as compressor stations and delivery points
- Effective mitigation of external threats to integrity, such as landslides and third-party activity

Reliable operation:

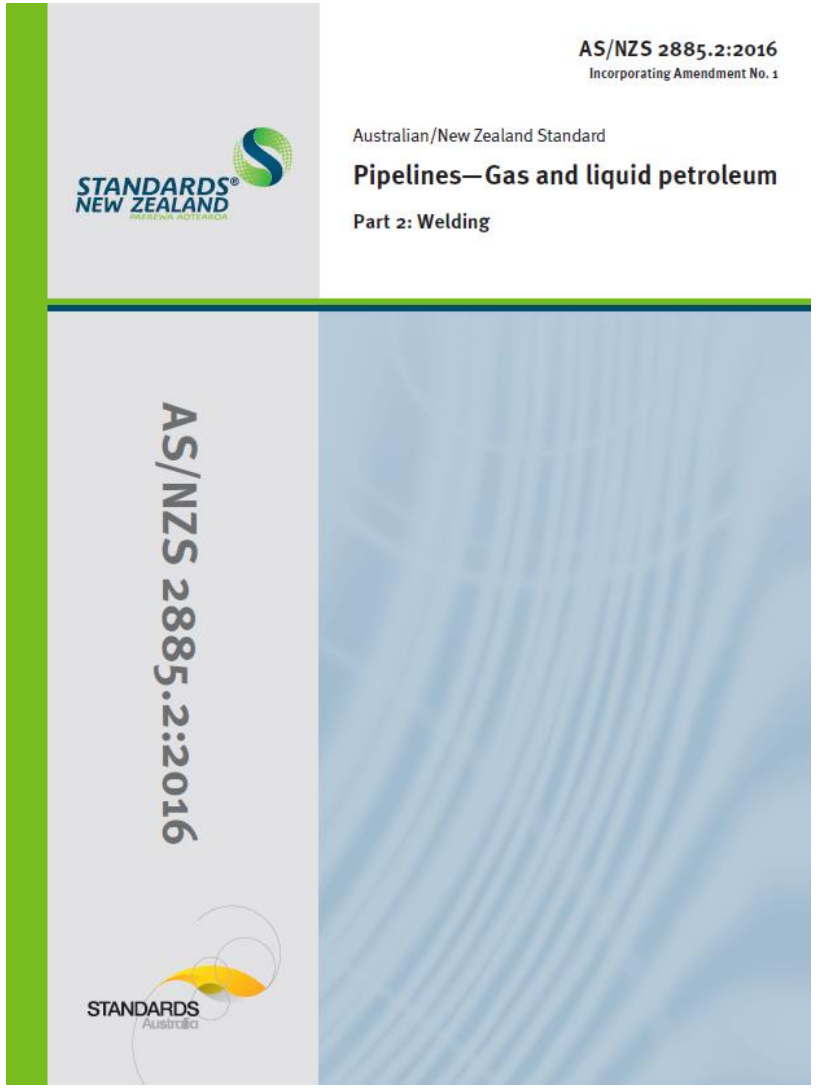
- Set under the terms of the Firstgas System Security Standard
- Conventional maintenance optimisation and reliability practices and equipment redundancy for:
  - Compression
  - Pressure regulation at delivery points where peak demand > 20GJ/day
- System flexibility provides additional resilience (e.g., compressor stations at Mokau and Rotowaro)

Mitigation of external threats:

- The integrity and safe operation maintained in accordance with approved pipeline management system set out in a recognised standard: AS / NZS 2885: Pipelines – gas and liquid petroleum

AS/NZS 2885: Summary of requirements

- AS/NZS 2885 sets out the requirements for the safe management of a pipeline throughout the asset life (http://www.apga.org.au/issues/australian-standards/)
- A pipeline is to be designed and constructed to withstand all design loads to which it may be subjected during construction, testing and operation. This design is to be reviewed, assessed and approved
- All threats to a pipeline are to be identified and either controlled or the associated risks shall be evaluated and managed to an acceptable level
  - Documented in a Safety Management Study (SMS). Every 5 years or when significant changes occur
  - Mitigation of SMS risks executed through a Pipeline Integrity Management Plan (PIMP)



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Principal risks to integrity

There are three principal threats to pipeline integrity:

- Corrosion
- Third party damage
- Geohazards (earthquakes, erosion, flooding, slips etc)

Geohazards

Routine surveillance is carried out to identify areas susceptible to natural events (which may be gradual or episodic)

- Surveillance identifies both the presence of features that may pose a risk and includes monitoring of features identified for change in risk profile
- Methods of surveillance vary from foot patrol along pipeline route to use of drone for detailed land feature mapping

Mitigation of risks from natural events involves modification to the design of the pipeline itself or modifying the landscape (such as by installing additional drainage)

Depending on the issues identified, these can lead to significant projects

Currently two significant risk areas identified:

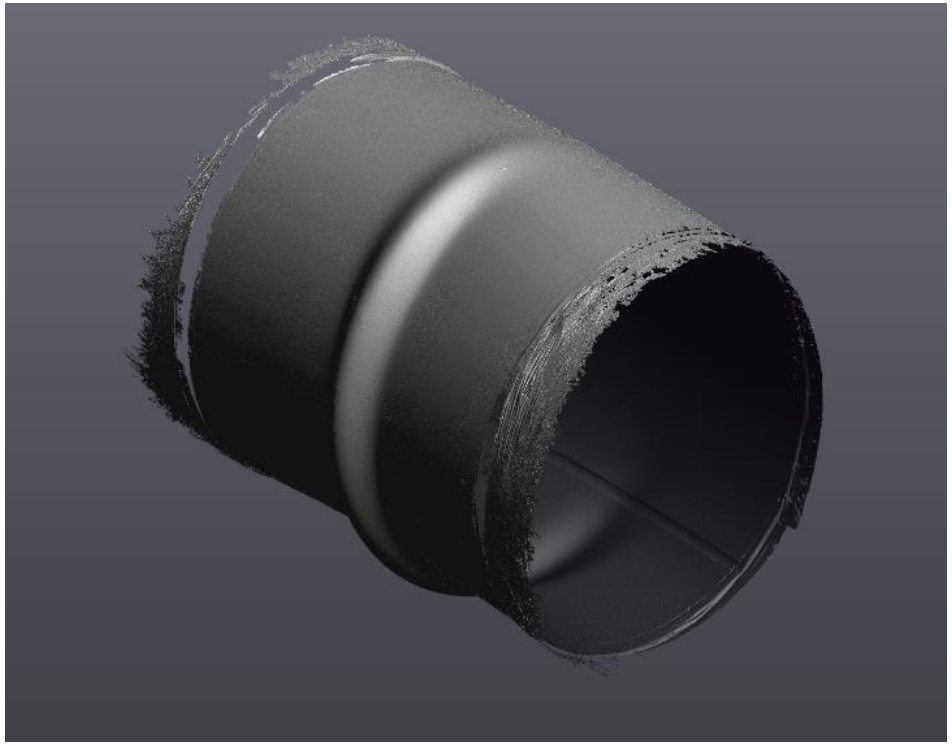
- Maui Pipeline at Gilbert Stream
- Maui Pipeline at Pariroa

Gilbert Stream

Firstgas Group

Pariroa

Pariroa

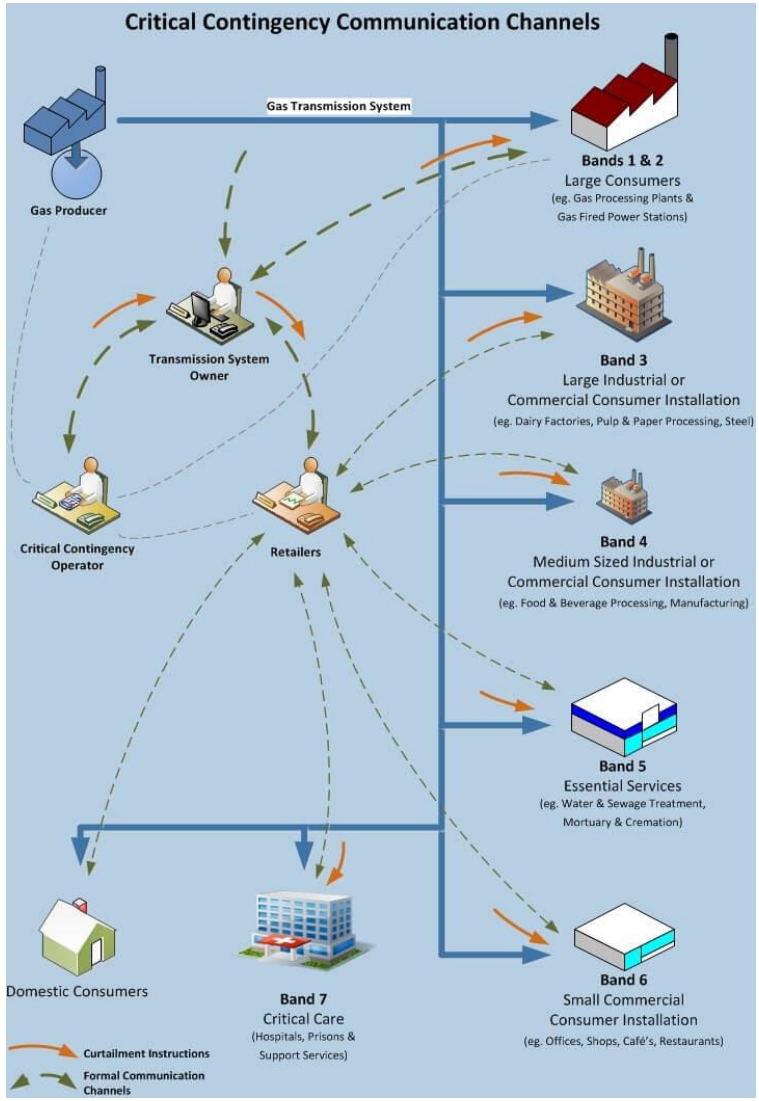


Pipeline Emergency Preparedness

- Emergency response preparation is required under AS/NZS 2885
- First Gas has the appropriate plans, trained and experienced people, equipment and spares to respond to an emergency repair on Gas Transmission pipelines and stations. This includes the following:
  - Full range of hot tapping and stoppling equipment, including a recent investment in an additional $5M of equipment in this area
  - Spare line pipe for emergency which is stored in a warehouse near the main operational base
  - Undertaking annual emergency response exercises
  - Training and competency assessment of staff, including skills and tasks involved in emergency repairs
  - Procedures and strategies for managing the emergency response, engineering of repairs, and detailed repair plans
  - Experienced staff who have been involved in previous urgent repairs
  - Dedicated emergency control room adjacent to the pipeline control centre

Critical Contingency Management

- The Gas Industry Company administers the Gas Governance (Critical Contingency Management Regulations 2008) Regulations.
- The purpose of the Regulations is to achieve the effective management of critical gas outages and other security of supply contingencies
- The Regulations achieve this principally through the appointment of a Critical Contingency Operator (CCO) which has a range of powers, particularly to curtail gas consumption during critical contingencies.
- The role of the Critical Contingency Operator is to:
  - determine & declare the onset of a Critical Contingency
  - call for load curtailment as required to balance the system
  - monitor the supply/demand balance and adjust load curtailment directions as necessary, and
  - determine when it is safe to terminate a Critical Contingency.
- The Transmission System Owner (TSO) remains in direct control and management of the transmission system at all times.



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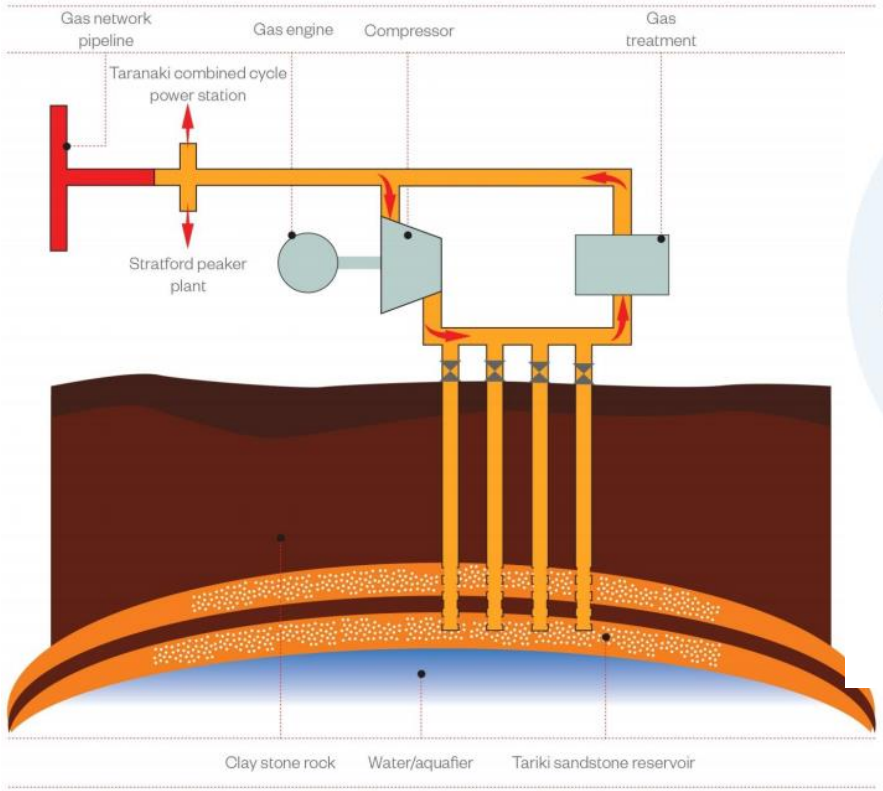
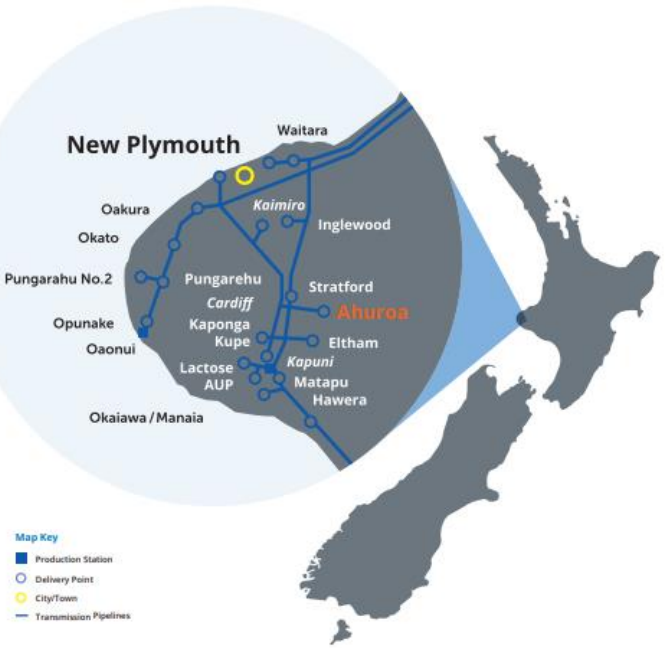
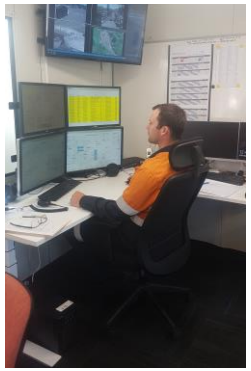
Ahuroa Gas Storage

Flexgas
A First Gas Affiliate

- The Ahuroa Gas Storage Facility (AGS) is an underground natural gas storage facility located 10km north of Stratford
- It is connected, via a dedicated pipeline, to Contact's thermal generation at the Stratford Power Station and is connected to the transmission system there.
- Main use is storage for peak generation (can supply 3 x 100MW Thermal Peakers Plants with 10min start).
- The site has 4 production wells (2A, 3, 4 & 5ST1)
- An Expansion Project was completed in 2020 which allows injection or extraction from storage of 65TJ/day







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Key takeaways for SRC

- Security of supply is a key consideration in the design and operation of the Gas Transmission System
- While security of supply risks are effectively managed, residual risks remain
- Principle risk areas are corrosion, third party damage and geohazards.
- Comprehensive emergency procedures and assets are in place should an event occur
- Ahuroa Gas Storage plays a significant supporting role in maintaining security of supply