



From wellhead to burner - *The New Zealand Gas Story*

September 2015

Who are we – and why are we here

- We're the industry body and co-regulator for the downstream gas sector
- We're telling the wider Gas Story because:
 - the industry has changed, there are more players, and the story is getting fragmented and lost
 - the industry asked us to stitch the story together and to tell it.
 - it fits with our obligation to report to the Minister on the state and performance of the gas industry.
- and, because gas has a long pedigree and makes a valuable contribution to New Zealand, it's a great story worth telling...

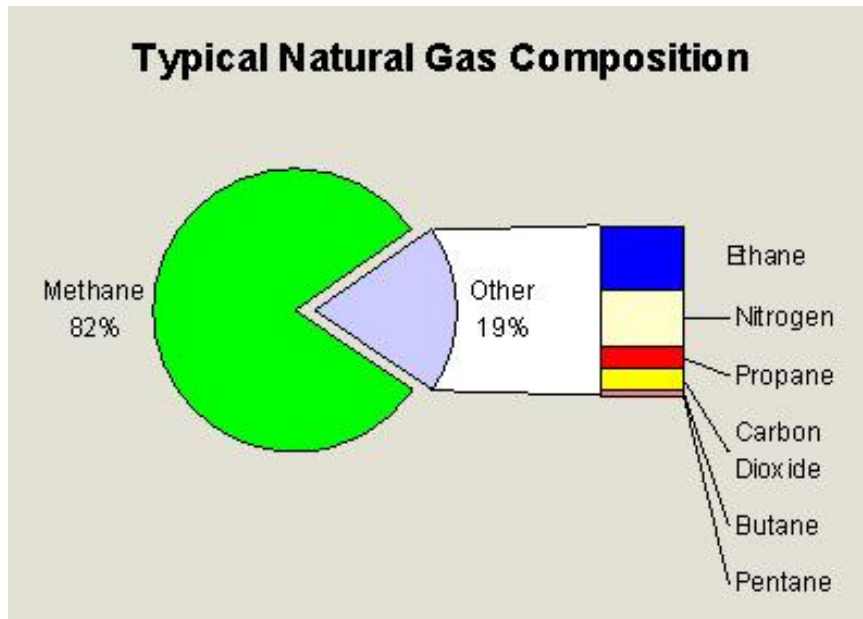


What we'll cover...

- History and development
- The contribution of gas to New Zealand's energy supply
- How gas used
- Industry structure and the players
- Gas policy evolution and the regulatory framework
- A look at each key element:
 - exploration & production
 - processing ← we'll take a short break here
 - transmission
 - distribution
 - wholesale and retail markets
 - metering
 - pricing
 - safety
- Gas in a carbon-conscious world
- What the future for gas may look like



What is natural gas?



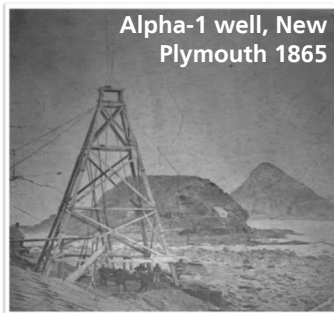
Some terms we'll be using:

- Petajoule (PJ) – Measure of gas volume. 1PJ = 40,000 households or approximate annual gas use of Wanganui.
- Gigajoule (GJ) – Also a measure of gas volume. There are one million GJs in a PJ. The average household use is around 25GJ per year.
- LPG – Liquefied Petroleum Gas. Comprising propane and butane components of the gas stream
- LNG – Liquefied Natural Gas. Natural gas that is chilled to minus 162C for bulk transport storage in the international market

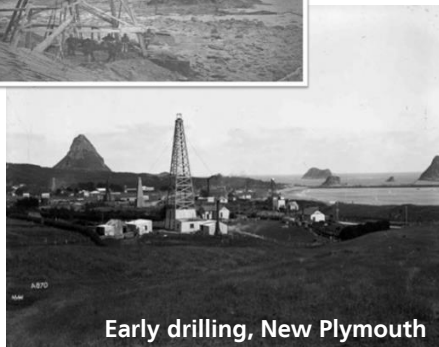
Gas has a long history



Oil seep, Kotuku, West Coast, South Island



Alpha-1 well, New Plymouth 1865



Early drilling, New Plymouth

Oil seeps have been observed in NZ since Maori settlement.

The search for oil has been going on since 1865.

The Petroleum Act 1937 sought to spur oil exploration before and during WWII – no discoveries.

The modern natural gas era began when a drilling rig struck gas at 4,000m at Kapuni in 1959 and began flowing in 1970....

...and received a major boost with the offshore Maui field discovery in 1969.

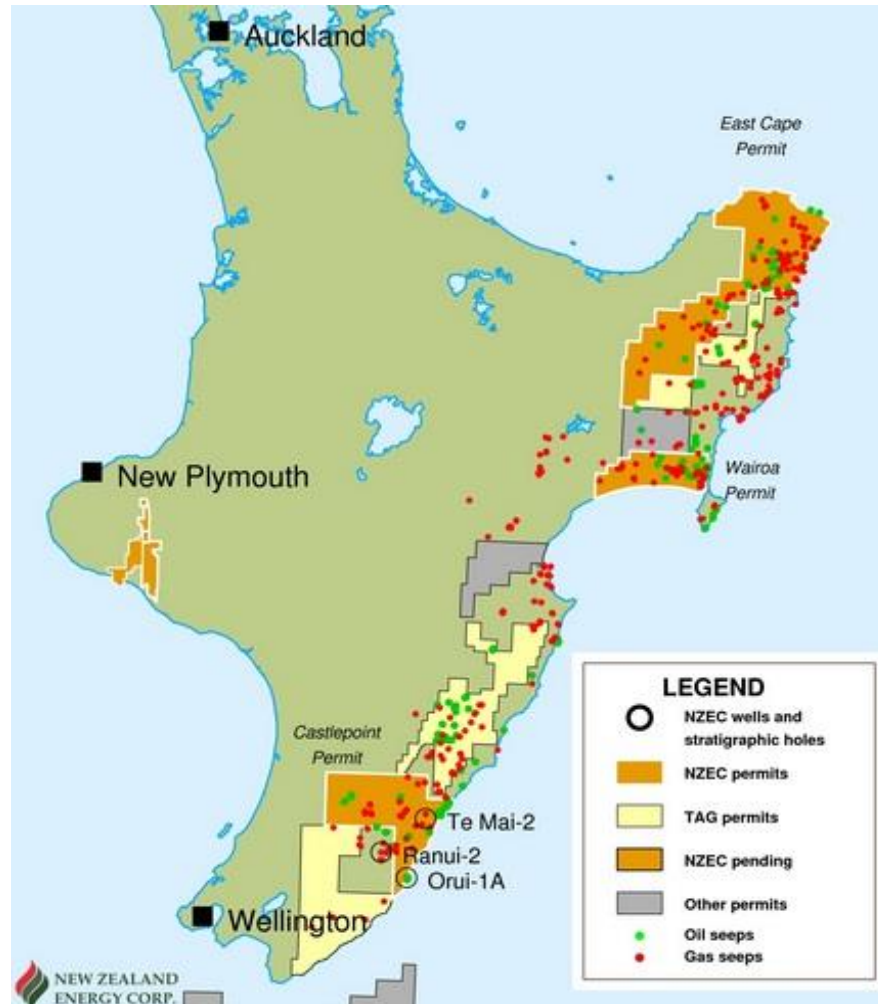


Kapuni field discovery

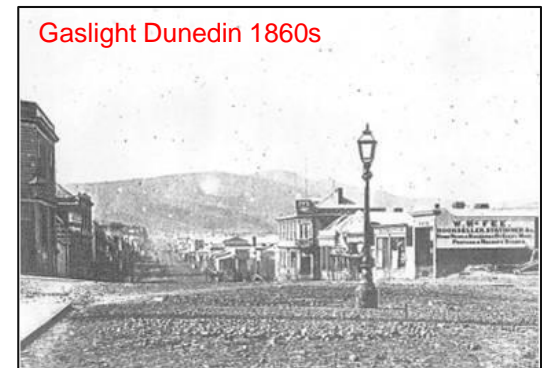
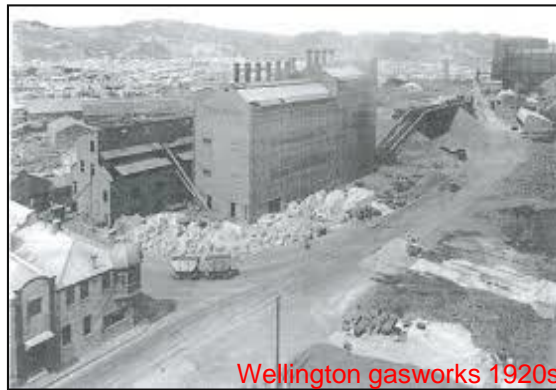
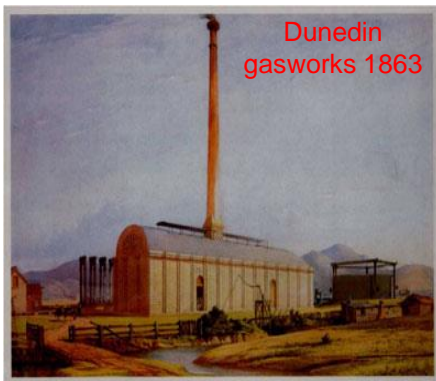


Maui field offshore platform construction

Seepages still abound



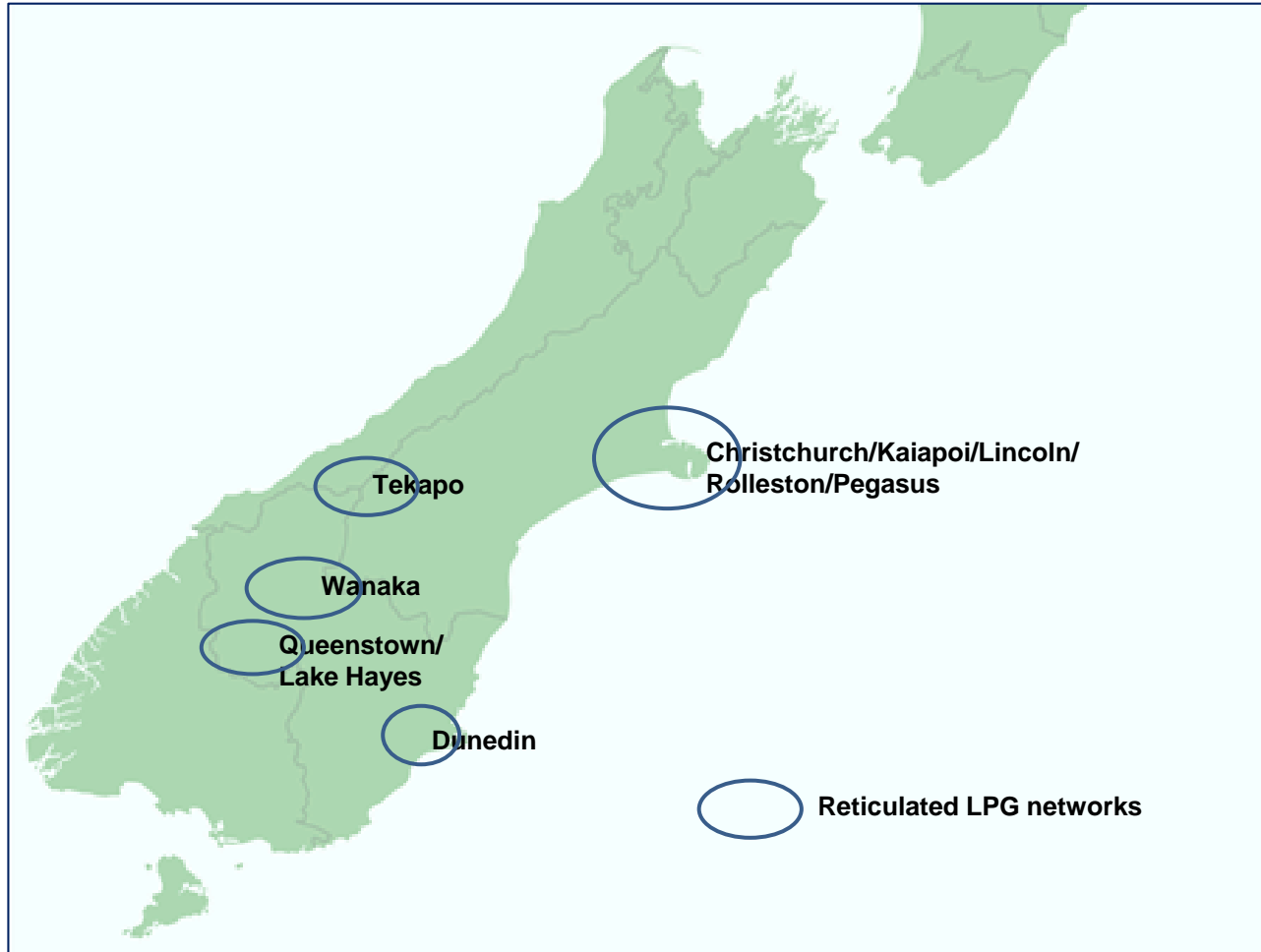
Before 'natural gas' coal gas plants supplied New Zealand from 1863



Kapuni and Maui brought natural gas for the first time, and to more people...



No natural gas in the South Island, but LPG provides energy choice for Mainlanders

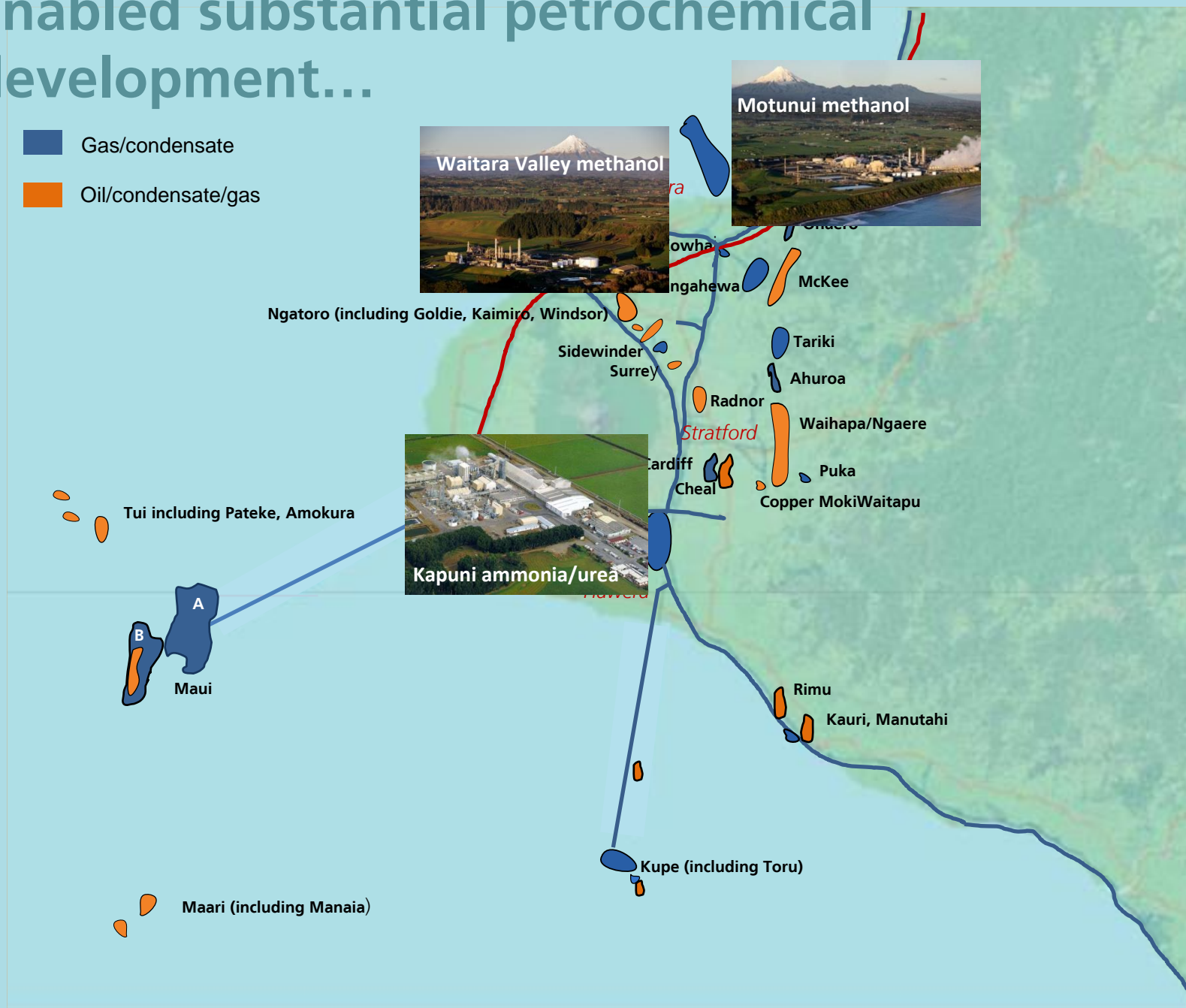


Abundant natural gas underpinned electricity supply security...



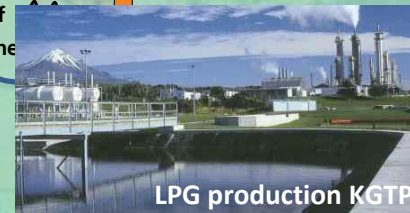
enabled substantial petrochemical development...

- Gas/condensate
- Oil/condensate/gas



and established a domestic LPG industry.

- Gas/condensate
- Oil/condensate



...that services the whole country with LPG



LPG depot, New Plymouth



LPG depot Auckland



LPG depot Christchurch



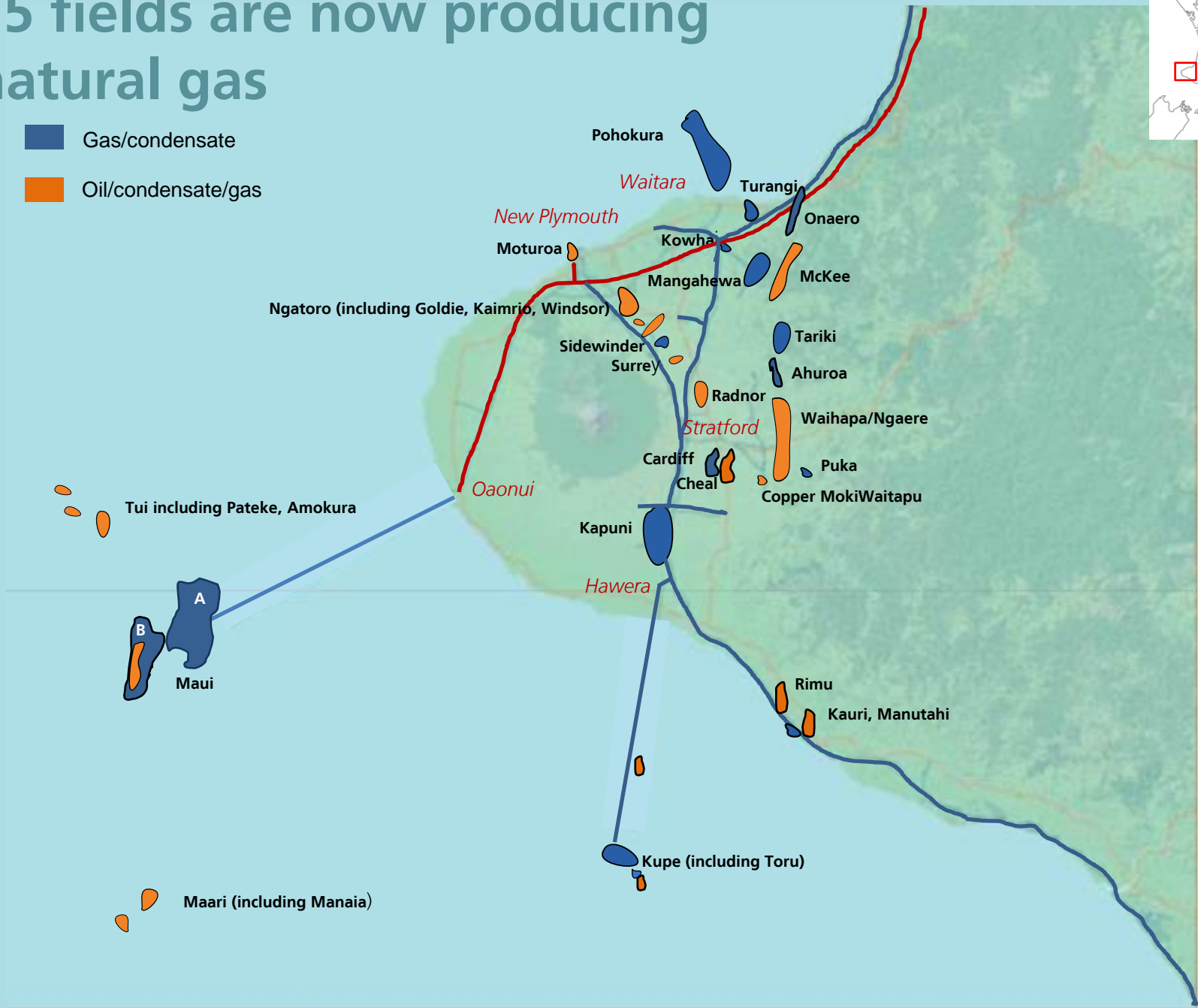
LPG depot Dunedin



15 fields are now producing natural gas



- Gas/condensate
- Oil/condensate/gas



Pohokura

Waitara

Turangi

Onaero

New Plymouth

Moturoa

Kowhai

Mangahewa

McKee

Ngatoro (including Goldie, Kaimiro, Windsor)

Sidewinder

Surrey

Tariki

Ahuroa

Radnor

Stratford

Waihapa/Ngaere

Cardiff

Cheal

Puka

Copper Moki Waitapu

Tui including Pateke, Amokura

Oaonui

Kapuni

Hawera

Maui

Rimu

Kauri, Manutahi

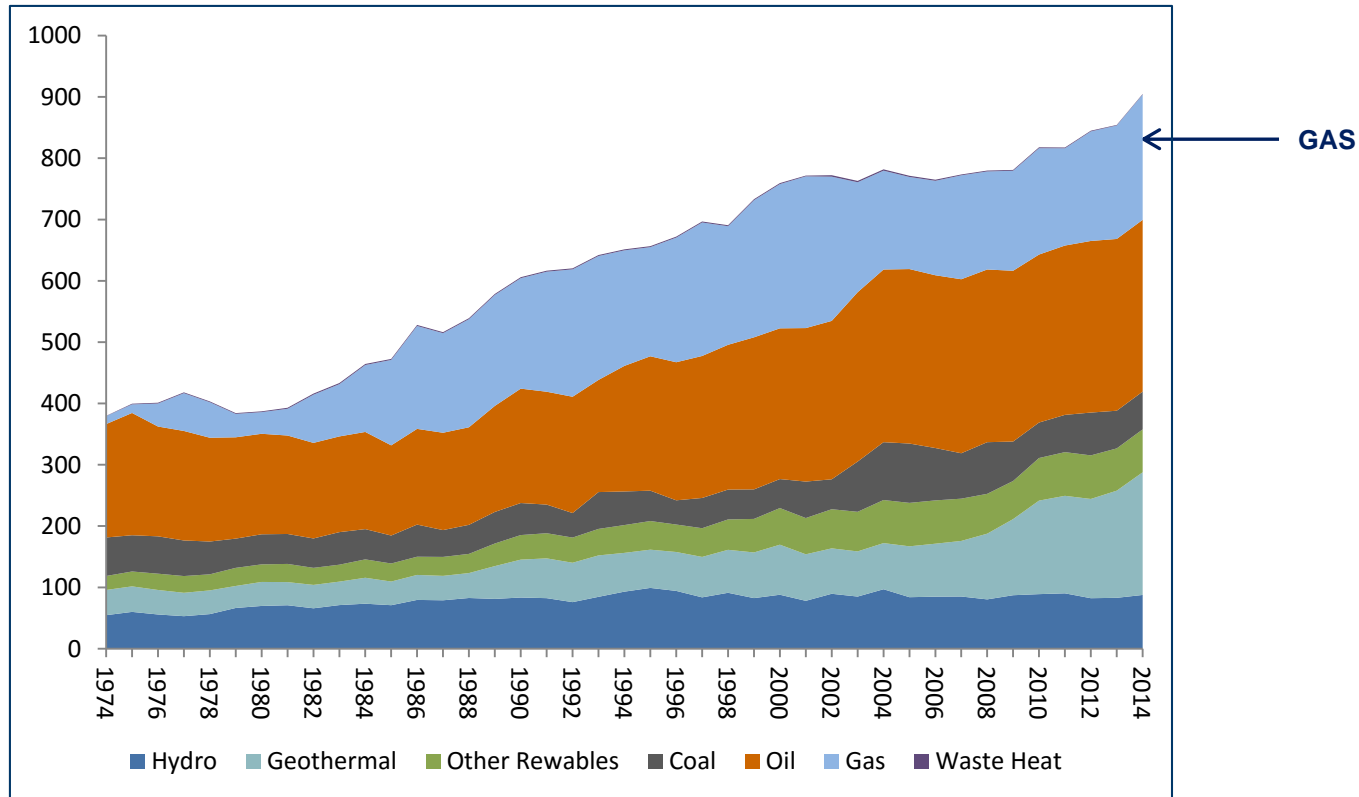
Kupe (including Toru)

Maari (including Manaia)

Gas contribution to New Zealand's energy

... gas has made a consistently solid contribution to primary energy over three decades

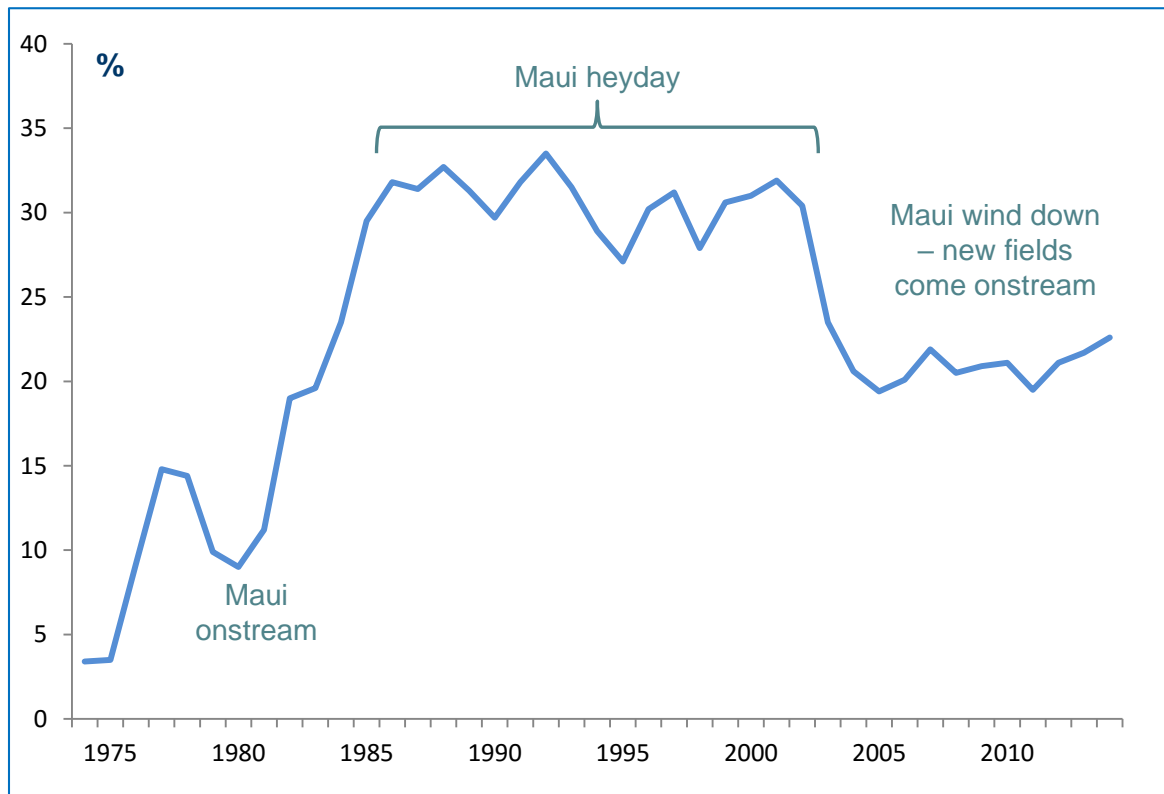
Primary Energy Composition 1974-2014



Source: 2015 Energy in New Zealand

Since 1990, gas contribution to primary energy supply has been 20-33%

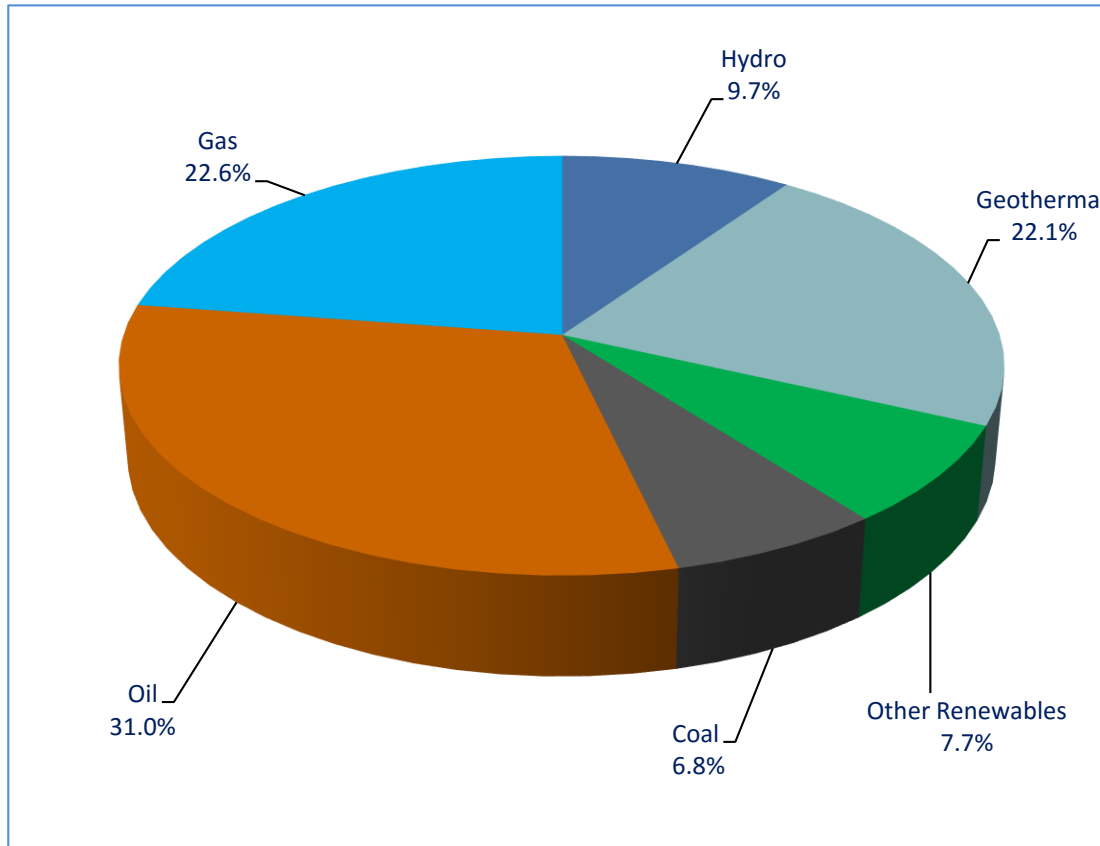
Gas Contribution to Primary Energy Supply 1974-2014



Source: 2015 Energy in New Zealand

Today gas provides 23% of primary energy

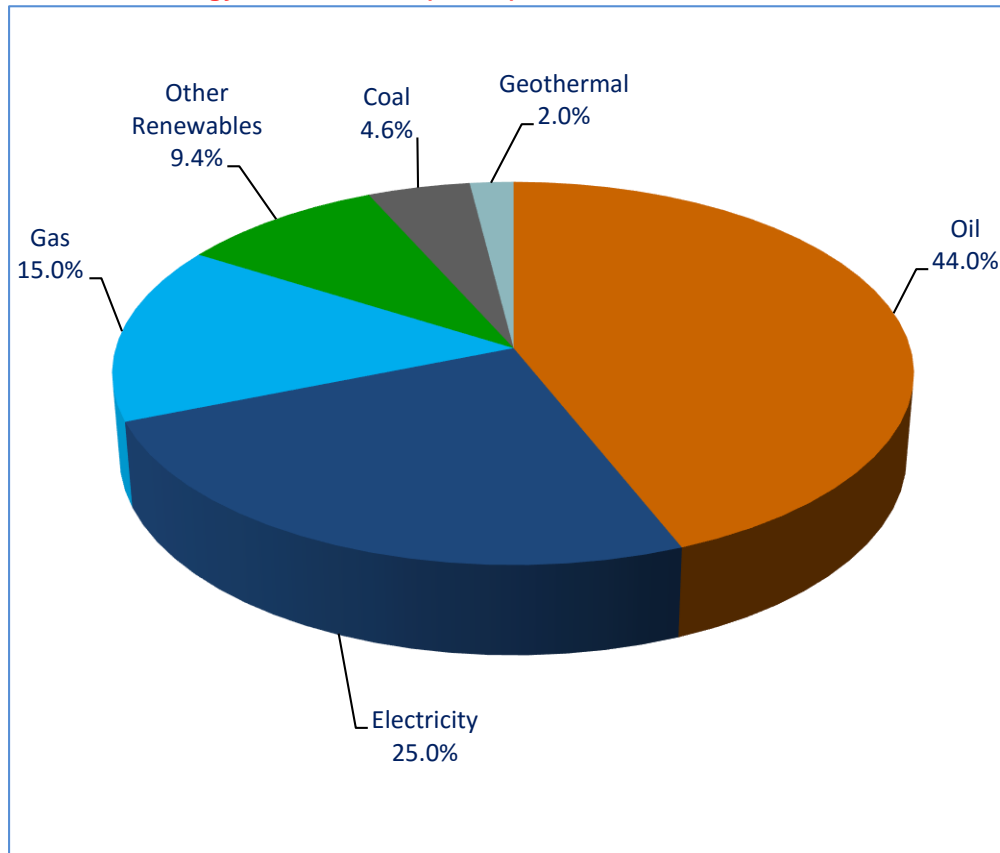
Primary Energy Supply 2014 (905PJ)



Source: 2015 Energy in New Zealand

...while accounting for 15% of consumer energy use

Consumer Energy Demand 2014 (573PJ)

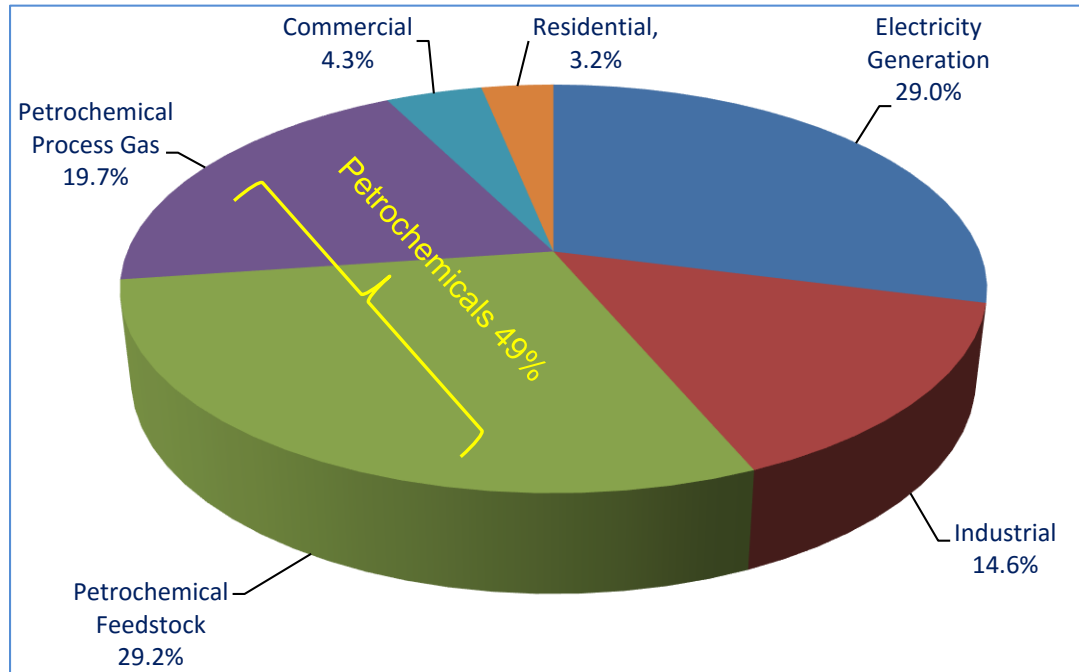


Source: 2015 Energy in New Zealand

How gas is used

78% of gas is used as a transition energy for electricity/petrochemicals. 249,000 households use just 3.2%

Consumer Gas Use 2014 (203PJ)



Source: 2015 Energy in New Zealand
Petrochemical usage accounts for 48.9% of total

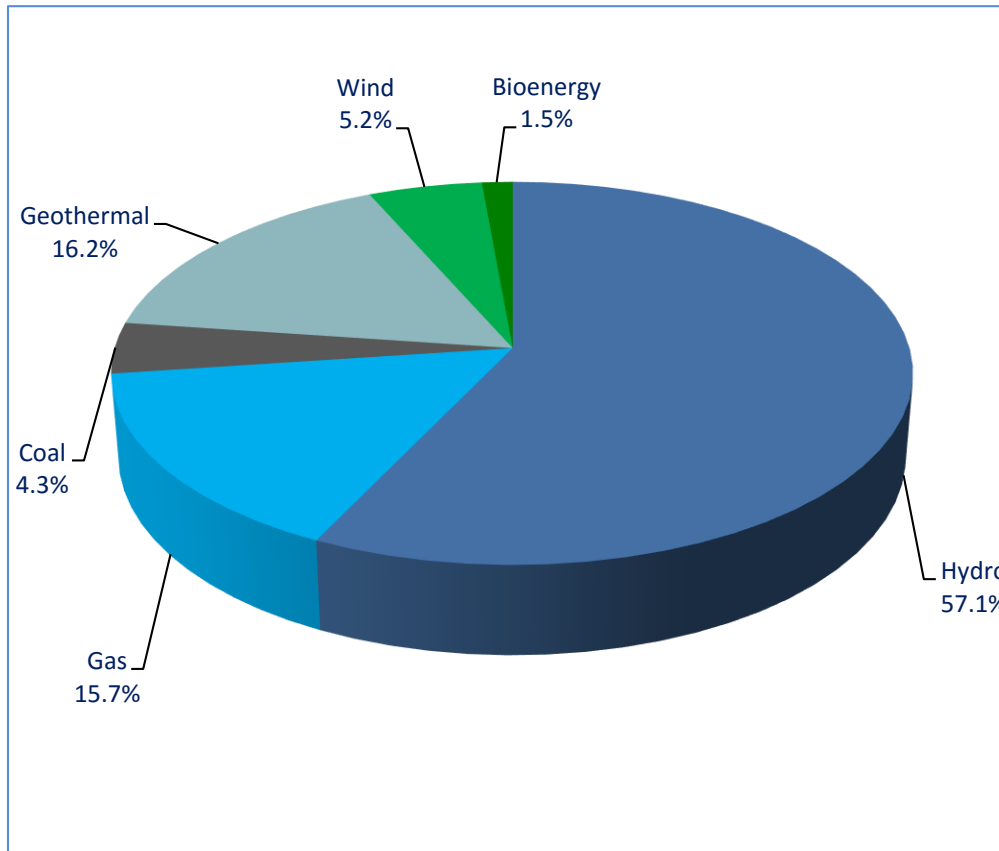
Large users represent less than 1% of gas consumers, but 90% of consumption

In Victoria, residential use is over a third of total consumption

In densely populated UK, most gas is used in the residential and commercial sectors

Gas accounts for 16% of electricity generation

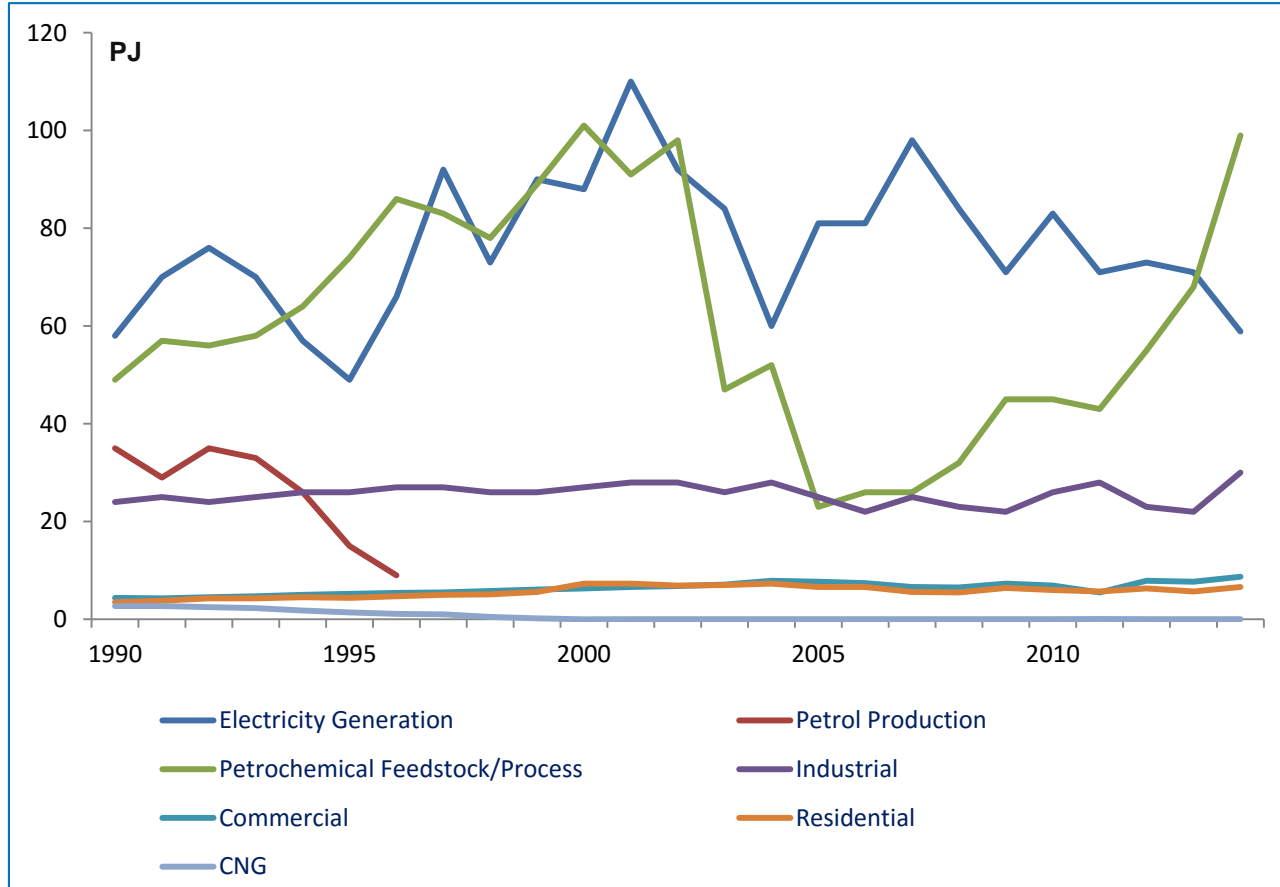
Electricity Generation by Energy Type 2014 (42,231 GWh –152PJ)



Source: 2015 Energy in New Zealand

Gas use trends are changing over time

Gas Use by Consumer Group 1990-2014



Source: 2015 Energy in New Zealand

Gas fuels all major North Island regions

Auckland

Consumers	94,100
Volume TJ	31,531
Total volume share %	18.4

Waikato

Consumers	35,900
Volume TJ	34,807
Total volume share %	20.4

Taranaki

Consumers	17,900
Volume TJ	87,572
Total volume share %	51.2

Manawatu/Whanganui

Consumers	30,700
Volume TJ	3,316
Total volume share %	1.9

Wellington

Consumers	62,800
Volume TJ	3,863
Total volume share %	2.3

Northland

Consumers	1,200
Volume TJ	3,817
Total volume share %	2.2

Bay of Plenty

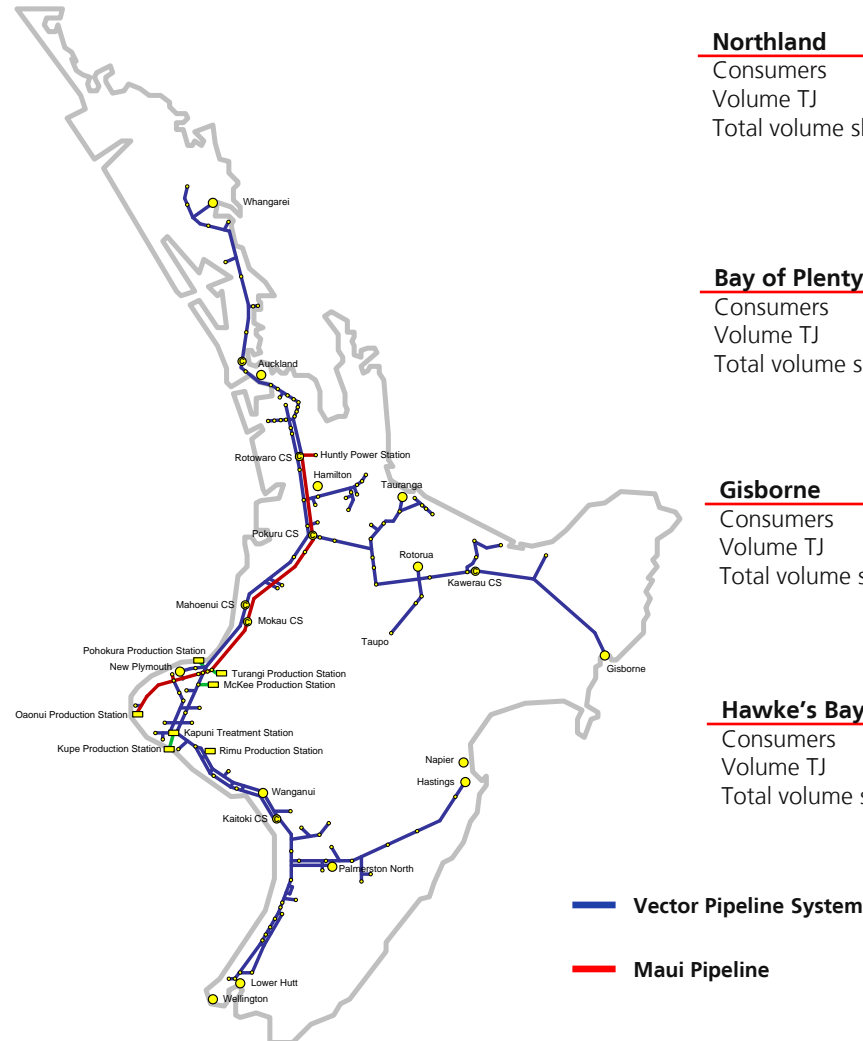
Consumers	14,00
Volume TJ	3,816
Total volume share %	2.3

Gisborne

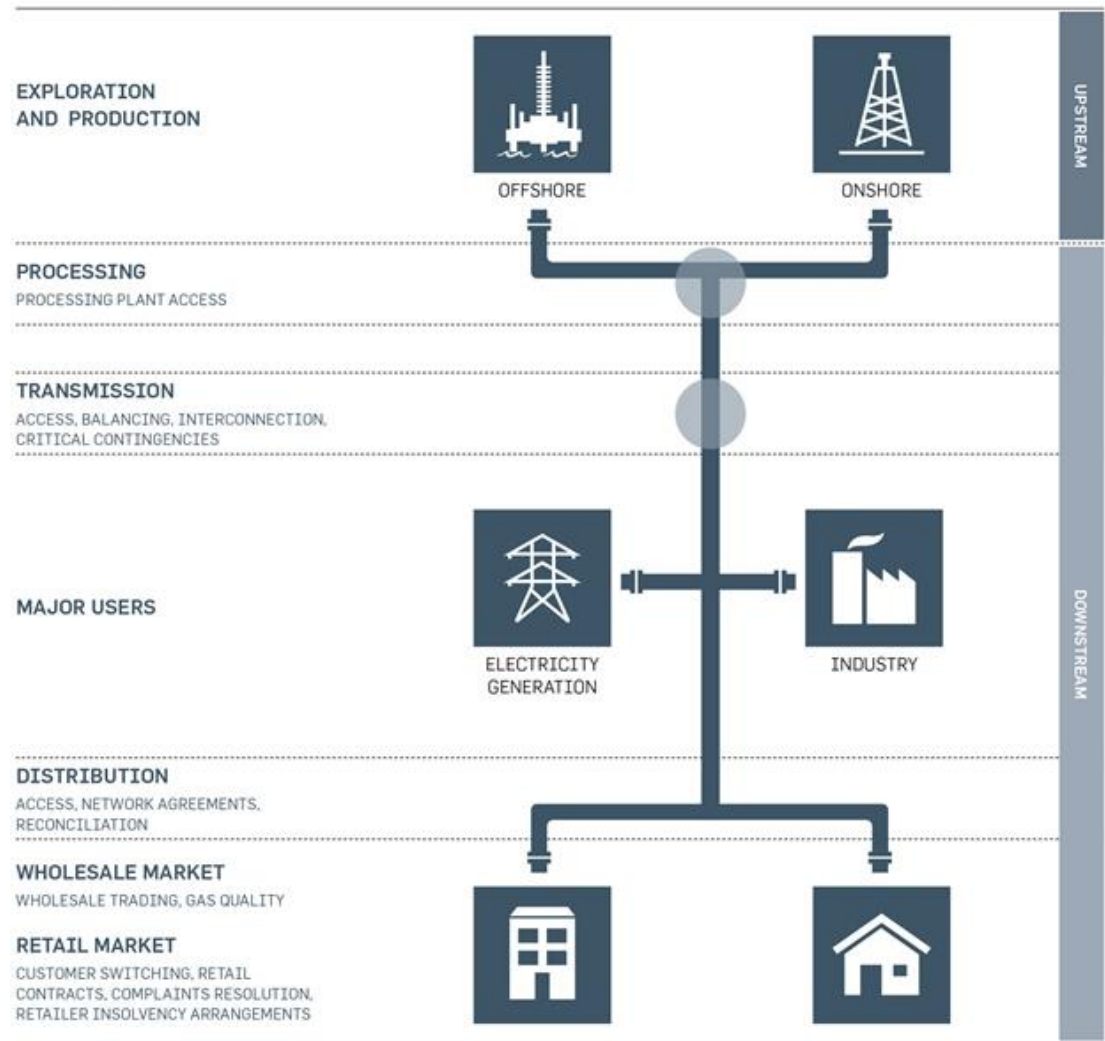
Consumers	3,300
Volume TJ	408
Total volume share %	0.2

Hawke's Bay

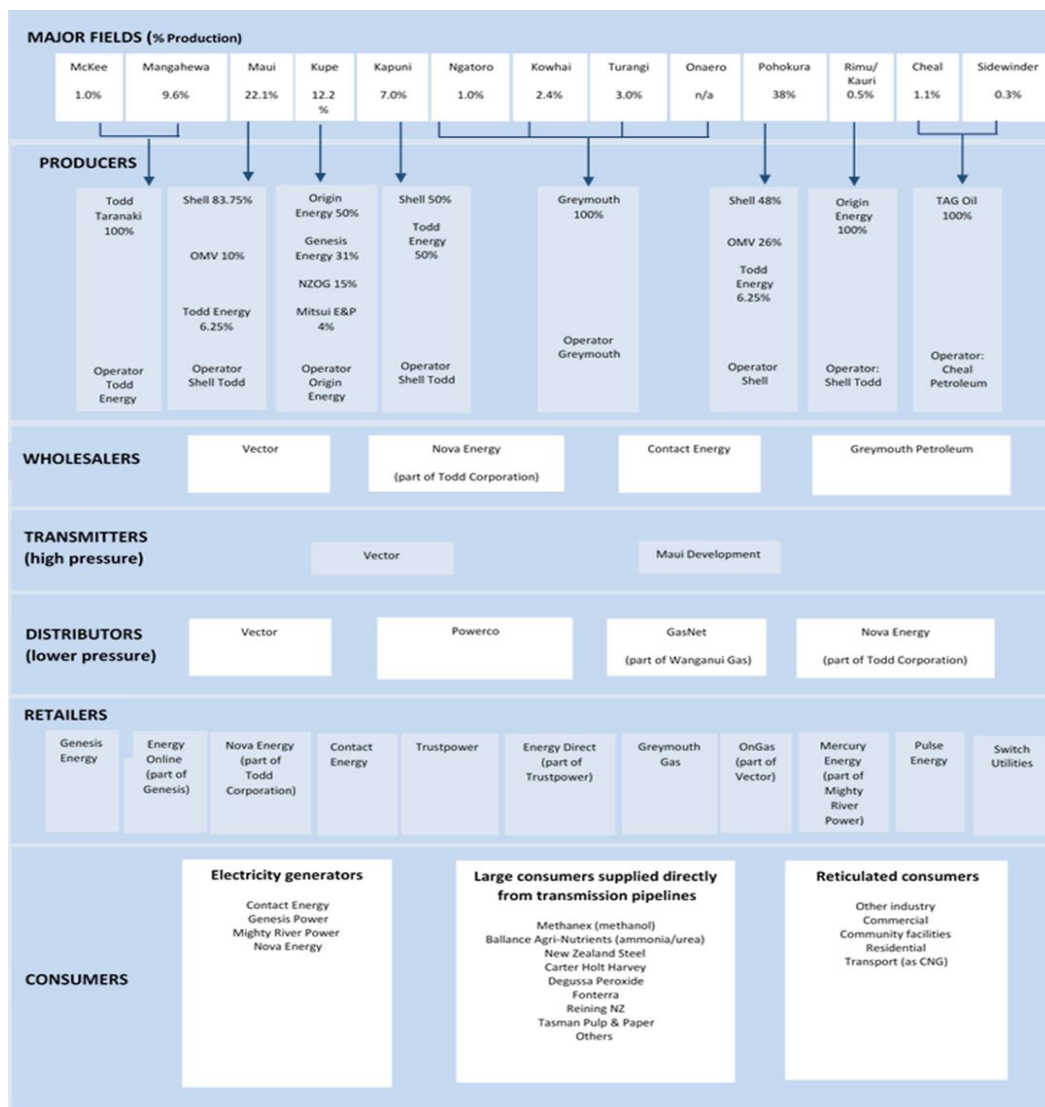
Consumers	4,400
Volume TJ	1,709
Total volume share %	1.0



Industry Structure



More participants, but industry is concentrated



Examples of multiple interests:

- Todd – explorer/producer, wholesaler, distributor, retailer and consumer (generation)
- Vector – processor, transmitter, distributor, wholesaler, retailer
- Genesis – production interests, retailer, consumer
- Contact – wholesaler, retailer, consumer (generation)
- Greymouth – explorer/producer, wholesaler, retailer

Policy evolution

Policies apply across the industry

The gas industry is subject to a wide range of Government policies designed to:

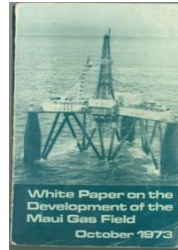
- Find and develop petroleum resources in a sustainable manner for the benefit of all New Zealanders.
- Ensure gas is delivered in a safe, efficient, reliable and environmentally sustainable manner.
- Ensure resilient infrastructure.
- Oversee natural monopoly activities.
- Protect consumer interests.



Crown involvement – from direct ownership to divestment...



- Kapuni discovery sees Government ownership of energy assets/contracts:
 - strategic policy to use natural gas as a premium fuel to replace coal gas plants
 - 1969: Formation of state-owned Natural Gas Corporation (NGC)



- Maui discovery offers more gas than NZ needs. Government becomes half owner of Maui and buyer of all gas under 30-year take-or-pay contract:
 - coincides with global oil crisis
 - initial intention to build gas-fired electricity generation abandoned
 - Gas diverted into Think Big projects and policy to extend gas availability



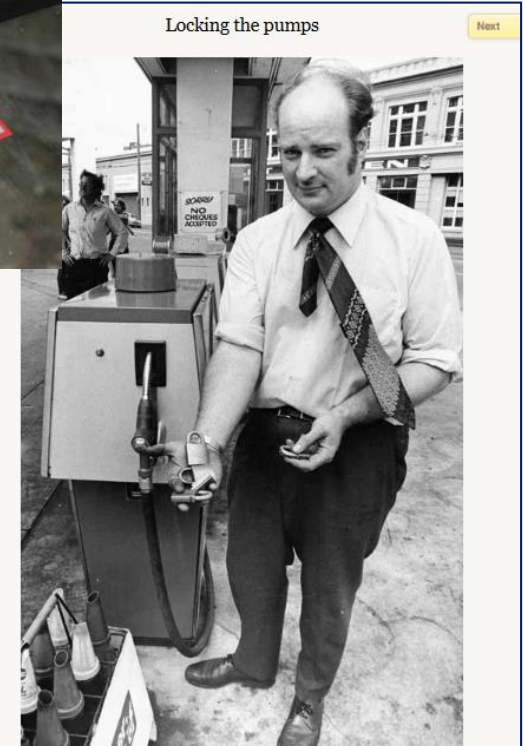
- 1978: Formation of state-owned Petroleum Corporation of NZ (Petrocorp) to hold Crown's direct interests in the oil and gas industry:
 - NGC, Offshore Mining, Exploration & Production, Petrochem (ammonia/urea plant), 51% of Petralgas (Waitara Valley chemical methanol plant)



- Privatisation of Government's energy interests:
 - 1987: Sale of Petrocorp to Fletcher Challenge
 - 1990: Sale of NZ Liquid Fuels Investments Ltd (NZLFI – vehicle for Crown's investment in the synthetic petrol plant) to Fletcher Challenge

The '70s oil shocks brought a change in approach

- 1970s international oil price shocks severely impacted New Zealand's balance of payments (NZ's imported oil bill 1973: \$19 million; 1981: \$1,500 million).
- Maui gas presented solution through direct use and import substitution....
- leading to wider gas availability, transport fuel diversification CNG/LPG, and controversial 'Think Big' developments:
 - synthetic petrol
 - methanol
 - Urea
 - Marsden Pt refinery expansion
- Between 1975 and 1995 total energy self-sufficiency rose from 43% to 83%; liquid fuels from 4% to 56%.



Locking the pumps

A Wellington garage manager locks up his pumps in February 1974 during the first oil shock. As a result of the Yom Kippur Arab-Israeli war in October 1973, the Organization of the Petroleum Exporting Countries (OPEC) restricted the supply of oil. This increased the price over four-fold and created uncertainty about supply. New Zealand was faced with a massive impact on the balance of trade and the balance of payments, since oil was a significant portion of the country's imports. Restrictions were placed on the sale of petrol and permits were required to buy it at the weekend.

Policy framework today – key elements

Policy	Aim	What it says generally	What it says about gas
Business Growth Agenda	To support business growth, job creation and improved living standards	Focus on six main economic sectors, including natural resources	Published in-depth sector reports so far include petroleum and minerals
New Zealand Energy Strategy 2011-2021	To make the most of its petroleum resources through balanced development of energy resources for a higher economic growth lower emissions future	There is a need to develop a mix of renewable and non-renewable energy options – and a balance between protecting the environment and economic development	Has an important role to play in NZ's overall energy mix
National Infrastructure Plan 2015	Set a marker for New Zealand's long-term infrastructure journey and the progress achieved	By 2045 New Zealand's infrastructure is resilient and coordinated and contributes to a strong economy and high living standards	Gas transmission capacity is generally sufficient for short to medium term supply and demand scenarios
Petroleum Action Plan 2009	To assist development of NZ's petroleum resources and maximise gains from their responsible development	Builds on prior work for managing the Crown's petroleum estate and maintain NZ as an attractive global destination for petroleum explorers/producers	Focus on 'petroleum' which incorporates gas; specific work relating to gas hydrates resources

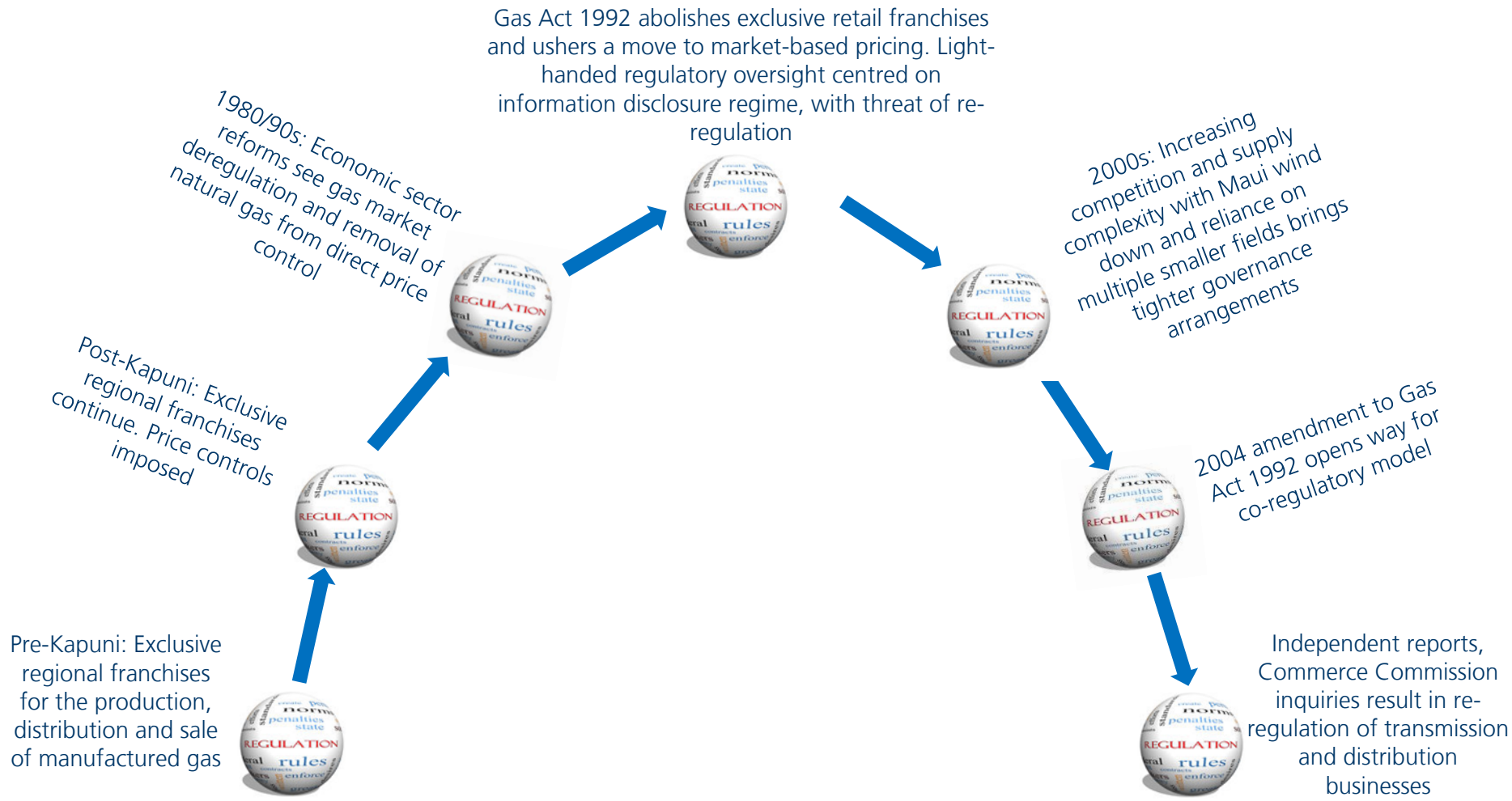
Regulatory framework for gas

Gas markets liberalised; infrastructure regulated

- Following deregulation in 1992, the gas markets have become open and liberalised.
- Government divestment has seen infrastructure transition into private ownership.
- The regulatory focus has fallen more heavily on natural monopoly infrastructure...
- Safety and environmental management of operations...
- ...and governing commercial behaviour, particularly at the consumer end.
- A number of regulatory bodies have an interest in the gas sector.



From regulation to deregulation and back again



Cornerstones of gas regulation - upstream

Legislation	What it does	Main aims	What else
Crown Minerals Act 1991	<p>Sets the broad legislative arrangements for petroleum prospecting, exploration and mining</p> <p>Governs the allocation of rights to, and management of all Crown-owned petroleum and minerals in their natural state</p>	<p>Manage the Crowns petroleum and minerals estate</p> <p>Ensure a world-leading petroleum/minerals regime that balances economic benefits with safety/environmental considerations</p> <p>these resources are found and developed in a sustainable manner for the benefit of all New Zealanders</p>	<ul style="list-style-type: none">• Substantially amended in 2013 following a review to accommodate emerging technologies/resources, improve clarity for participants and transparency for then public• Associated regulations relating to permitting, reporting, royalties, fees etc...

Cornerstones of gas regulation- downstream

Legislation	What it does	Main aims	What else
Gas Act 1992	<p>Repealed Gas Act 1982. Removes exclusive retail franchises and price controls, places a focus on open, competitive markets and established co-regulatory regime</p> <p>More generally sets out roles and responsibilities of MBIE, grants rights of entry, mandates gas safety requirements, has broad regulation-making powers, establishes offences</p>	<p>Regulate the supply and use of gas</p> <p>Regulate the gas industry</p> <p>Protect the health and safety of the public in connection with gas supply and use</p> <p>Prevent damage to property in connection with gas supply and use</p>	<ul style="list-style-type: none"> • Objective for gas to be delivered to existing and new customers in a safe, efficient and reliable manner • Facilitate the promotion of the ongoing supply of gas to meet NZ's energy needs by providing access to essential infrastructure and competitive markets • Minimise barriers to competition • Incentives for investments are maintained/enhanced • Delivered gas costs are subject to sustained downward pressure • Security of supply risks are properly and efficiently managed • Consistency with the gas safety regime

...and flow-on considerations

Legislation	What it does	Main aims	What else
Government Policy Statement of Gas Governance (2008)	<p>A mechanism under the Gas Act enabling the Minister to require the industry body to have regard to additional matters when recommending rules or recommendations for the gas industry</p> <p>Adds 'fair' and 'environmentally sustainable' to the Gas Act's overarching policy objective</p>	<p>Provides Minister with a mechanism to require other factors to be taken into account in gas governance arrangements.</p> <p>Particular focus on consumer outcomes and retail arrangements, gas wholesaling, infrastructure access, contingency management and compliance</p>	<ul style="list-style-type: none"> • Energy and other resources used to deliver gas to customers are used efficiently • Competition is facilitated in upstream and downstream markets by minimising barriers to access to essential infrastructure • The full costs of producing and transporting gas are signalled to consumers • Infrastructure • Gas sector contributes to achieving climate change objectives • Sound arrangements for the management of critical gas contingencies • Various expectations for consumer benefits, including a complaints process • Retailers' contractual arrangements adequately protect rights of small consumers

Cornerstones of gas regulation – economic control and consumer protection

Legislation	What it does	Main aim	What else
Commerce Act 1986	<p>Enables regulation of price and quality of goods and services in markets where there is little/no competition (control under Part 4)</p> <p>Enabled price control over gas transmission and distribution business owners in various forms since 2005, culminating in new price-quality paths in 2013</p> <p>Enabled economic control over other natural monopoly services (electricity lines, airports...)</p>	<p>Ensure suppliers of natural monopoly services have similar incentives and pressures as they would if operating in a competitive market</p> <p>Protect consumers against inappropriate exercise of market power and price fixing (restrictive trade practices)</p>	<ul style="list-style-type: none">• Monopoly businesses keep prices down• Limits ability to extract excessive profits• Incentivises natural monopoly businesses to innovate and invest, improve efficiency and provide goods/services at a quality that reflects consumer demands

and a host of other controls...

Hazardous Substances and New Organisms Act 1996

Gas (Downstream Reconciliation) Rules 2008

Health & Safety in Employment Act 1992

Crown Minerals (Royalties for Petroleum) Regulations 2013

Emissions Trading Scheme

Resource Management Act 1991

Electricity and Gas Complaints Commissioner Scheme

Gas Governance (Critical Contingency Management) Regulations 2008

Crown Minerals (Petroleum Fees) Regulations 2006

Gas (Switching Arrangements) Rules 2008

Gas (Safety and Measurement Regulations) 2010

Gas (Statistics) Regulations 1997

Consumer Guarantees Act 1993

New Zealand Standards

Health & Safety in Employment (Pipelines) Regulations 1999

Petroleum Programme 2013

Exclusive Economic Zone and Continental Shelf
(Environmental Effects) Act 2012

Gas Governance (Compliance) Regulations 2008

Submarine Cables and Pipelines Protection Act 1996

Fair Trading Act 1986

Health & Safety in Employment (Petroleum Exploration and Extraction) Regulations 2013

Crown Minerals (Petroleum) Amendment Regulations 2013

Plumbers Gasfitters and Drainlayers Act 2006

■ Environmental

■ Consumer

■ Upstream

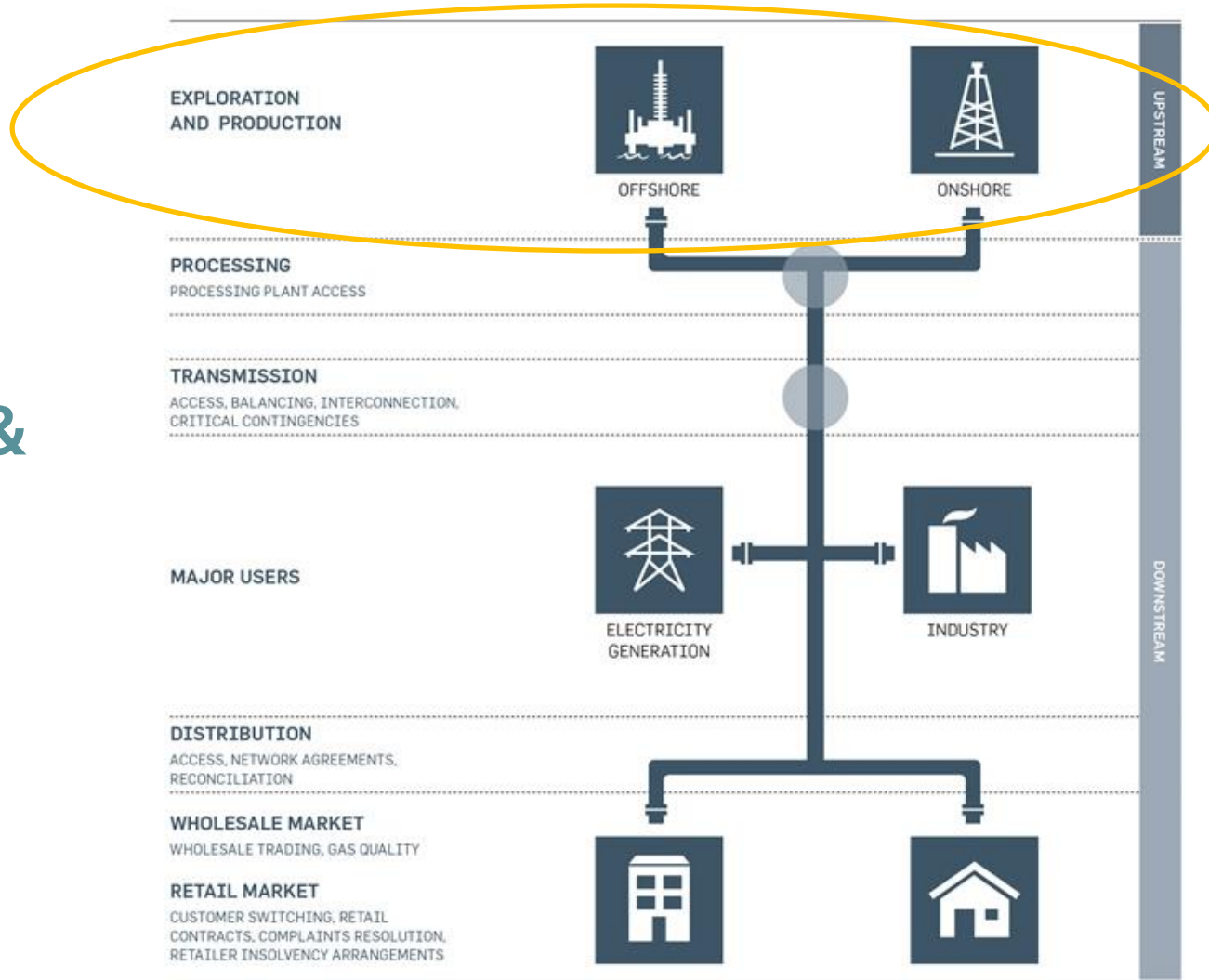
■ Downstream

■ Safety

... involving a range of regulatory bodies

Regulatory Body	Role
Minister of Energy & Resources	Various statutory powers to make gas governance rules or to recommend regulations
MBIE	Advises Government for petroleum/gas policy. Administers key legislation including Crown Minerals Act, Gas Act..
Gas Industry Co	Industry body under Part 4 of the Gas Act. Administers co-regulatory model. Recommends regulations/industry arrangements to Minister
Commerce Commission	Competition regulatory agency
Electricity and Gas Complaints Commissioner	Independent complaints scheme for small electricity and gas consumers
Standards New Zealand	Develops/administers specifications for products, processes, services and performance, including for the gas industry
Ministry for the Environment	Advises Government on environmental policies, including advice on RMA.
Department of Conservation	Oversight of pipelines running through conservation estate
Parliamentary Commissioner for the Environment	Advises Parliament on environmental issues
Environmental Protection Agency	Various regulatory environmental management functions including consenting under RMA, Emissions Trading Scheme, hazardous substances, EEC activity consenting
Energy Efficiency and Conservation Authority	Promotes energy efficiency, conservation and renewable energy use
WorkSafe New Zealand	Crown Agency responsible for workplace safety, High Hazards Unit and industry specific safety functions
Local/regional authorities	Local planning and day-to-day management of the RMA

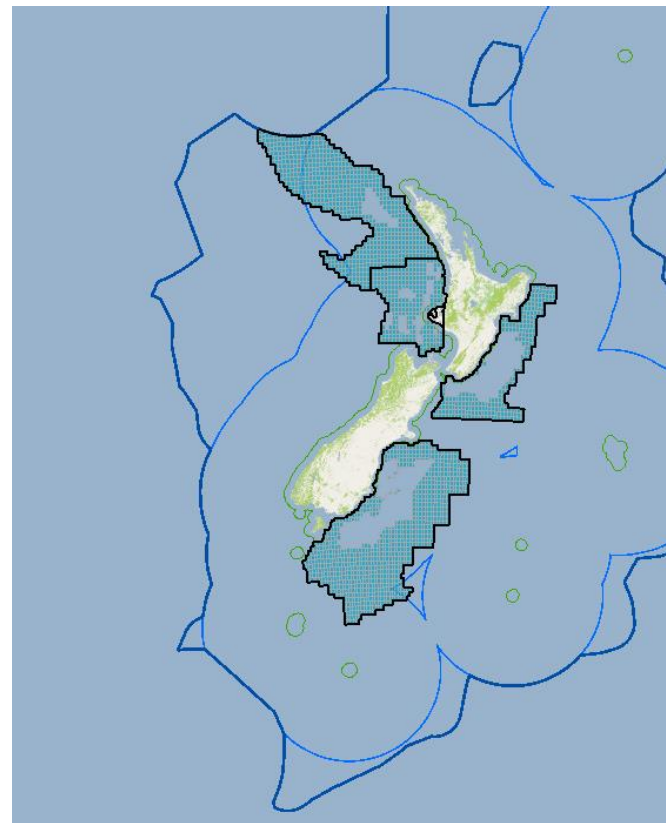
Exploration & Production



Exploration and production has eased

- Emerging from an intensive exploration programme involving over 100 wells in the past 2 years.
- Big new gas has proved elusive.
- International oil price drop is affecting upstream investment – main focus is on oil.
- New Zealand still attracting major players through annual Block Offer regime introduced in 2012.
- Since then, 35 explorations permits have been issued
- Focus of latest Block Offers are the Taranaki, Reinga-Northland, Pegasus, Great South Basins.
- Major players to join the search from the 2014 Block Offer include:
 - Chevron (US)
 - Statoil (Netherlands)
 - ONGC Videsh, India
- 2015 Block Offer outcome known in December. Consultation started on 2016 Block Offer.

2015 & 2016 Block Offer regions



And a lot has been happening on existing fields

- Life-extending developments to increase gas and condensate recovery from Maui and Kapuni.
- Mangahewa field expansion to supply Methanex.
- New technology unlocking small/difficult gas pockets bypassed in conventional drilling.
- Advanced production technologies turning previously non-commercial finds into viable producers.
- Ahuroa gas storage facility adds new dimension to supply/demand management and flexibility.
- Unconventional gas – primarily shale and coal seam gas – has potential in New Zealand, but development in its infancy.

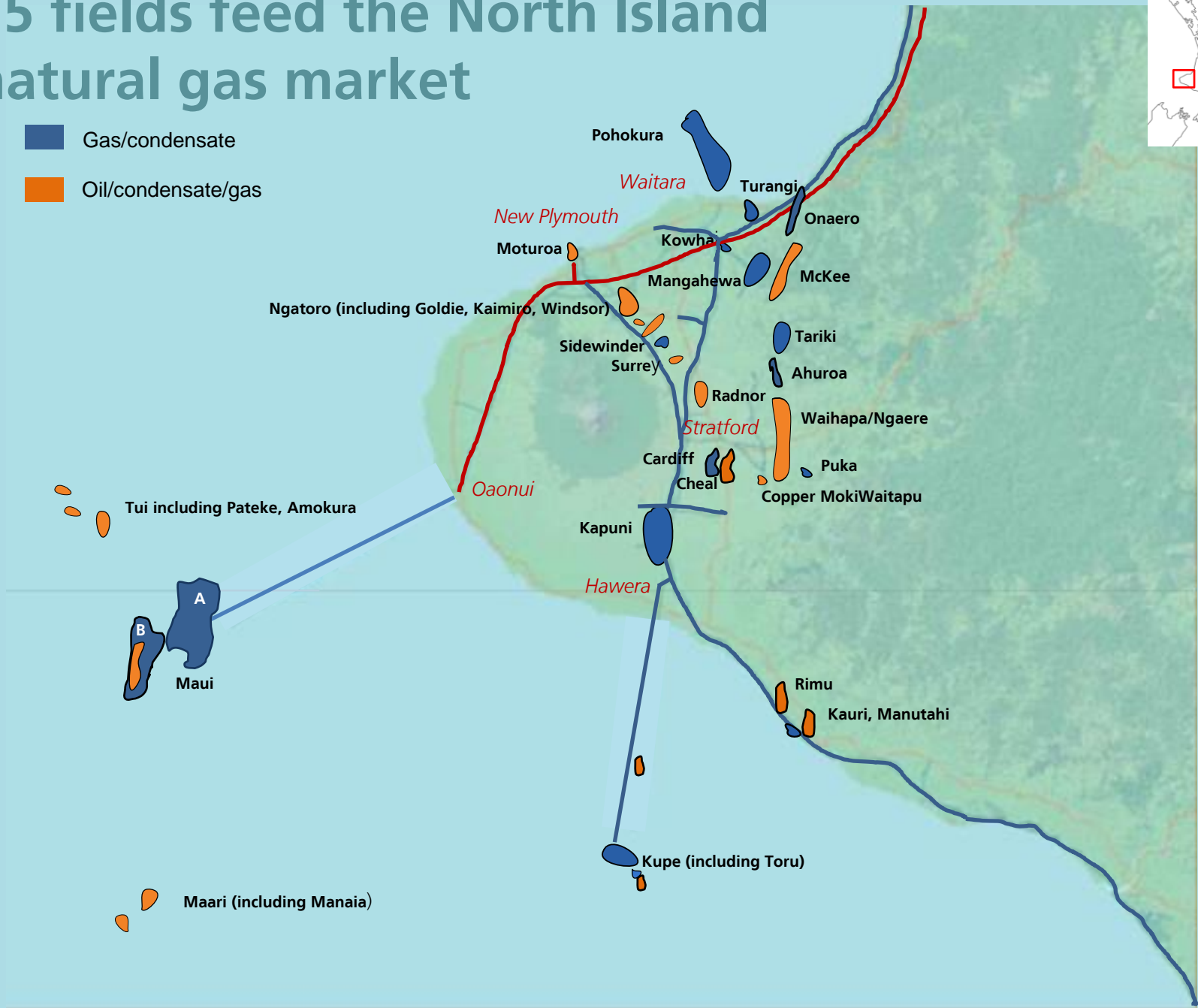


15 fields feed the North Island natural gas market



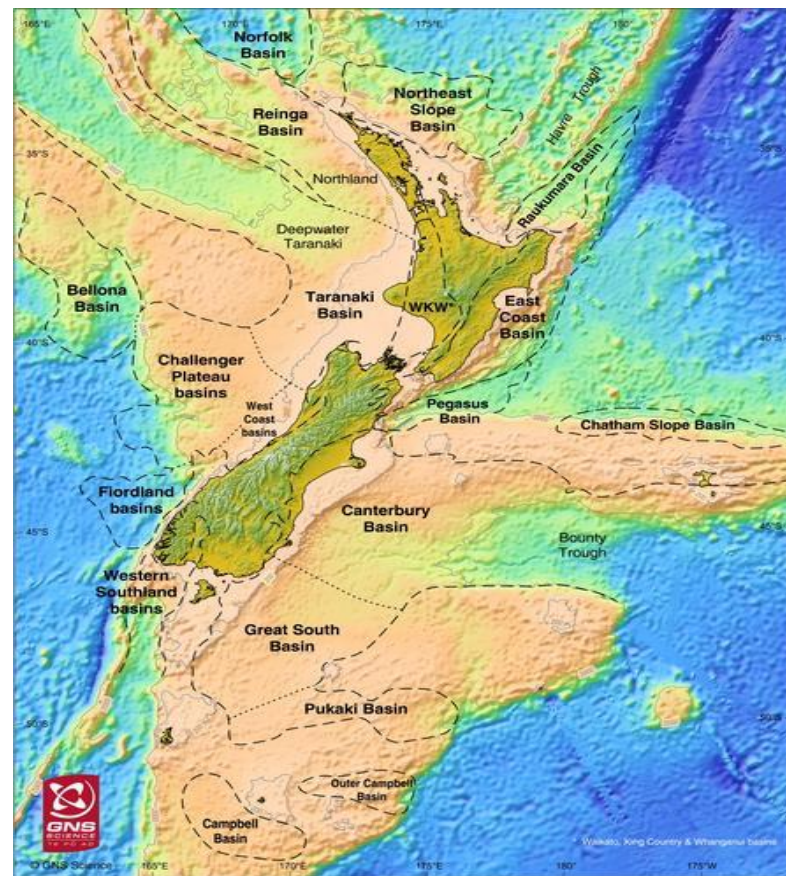
■ Gas/condensate

■ Oil/condensate/gas



New Zealand is still under-explored

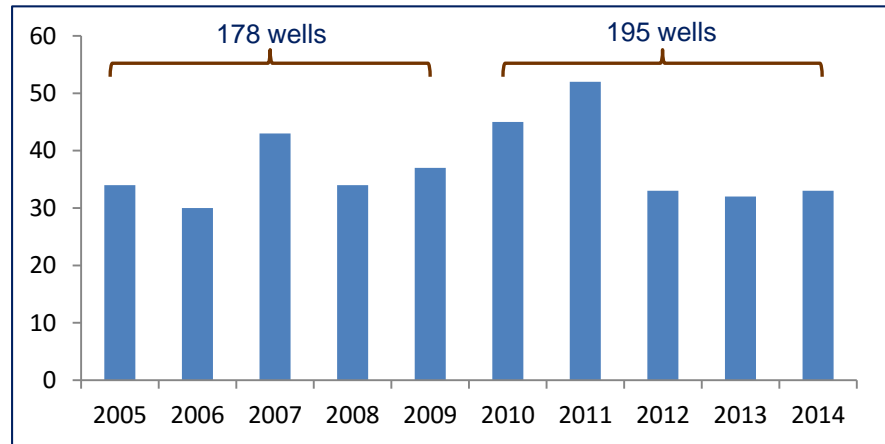
- 18 sedimentary basins in New Zealand's extensive Exclusive Economic Zone (EEZ).
- All – including the currently sole producing region Taranaki – are considered to be under-explored.
- Others – East Coast, Great South, Canterbury – have produced hydrocarbons, but not in commercial quantity.
- No exploration at all in some Basins.
- Variety of geological formations – from porous sandstones to cracked limestone.
- Range of hydrocarbon-bearing zones from 200m to more than 5,000m.
- Fraser Institute, Canada, ranks New Zealand 17th most attractive jurisdiction for oil/gas investment worldwide – and most attractive in the Oceania region.



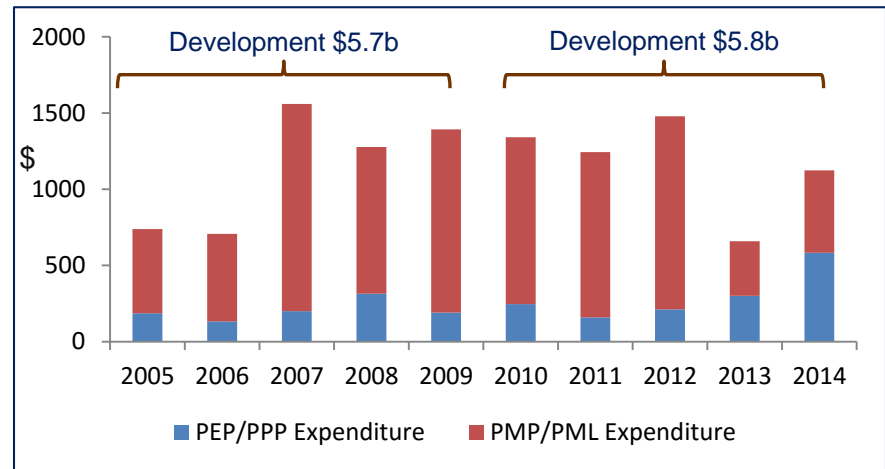
Despite the challenges, there has been sustained investment in search & development

- High seismic survey activity - important precursor to drilling – 290,000km of new and reprocessed data in past decade.
- Seismic data pool boosted by Government-funded surveys and data acquisition.
- Information from data reprocessing by GNS Science provided free of charge.

Wells drilled 2005-2014



Exploration/production Expenditure 2005-2014



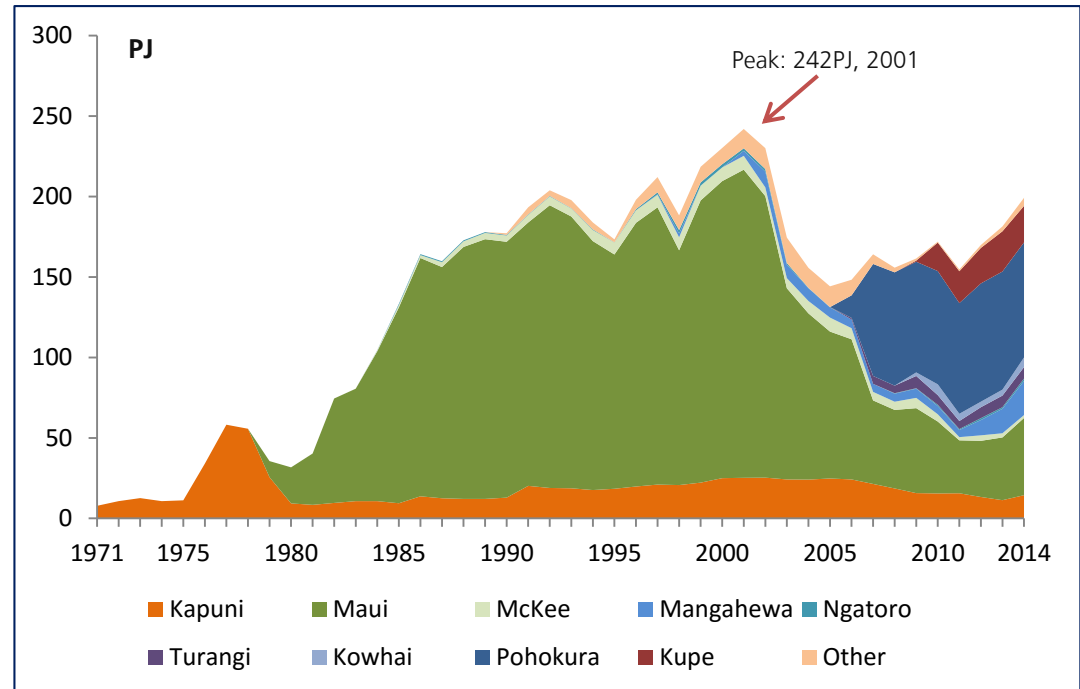
Source: 2015 Energy in New Zealand

Annual production fluctuates

Influenced by:

- Field production capabilities.
- Demand for thermal electricity generation and the level of petrochemical production.
- As Maui declined and before new fields commissioned petrochemical feedstock demand dropped from 62PJ in 2000 to 13PJ in 2005.
- Total market now over 200PJ/year.

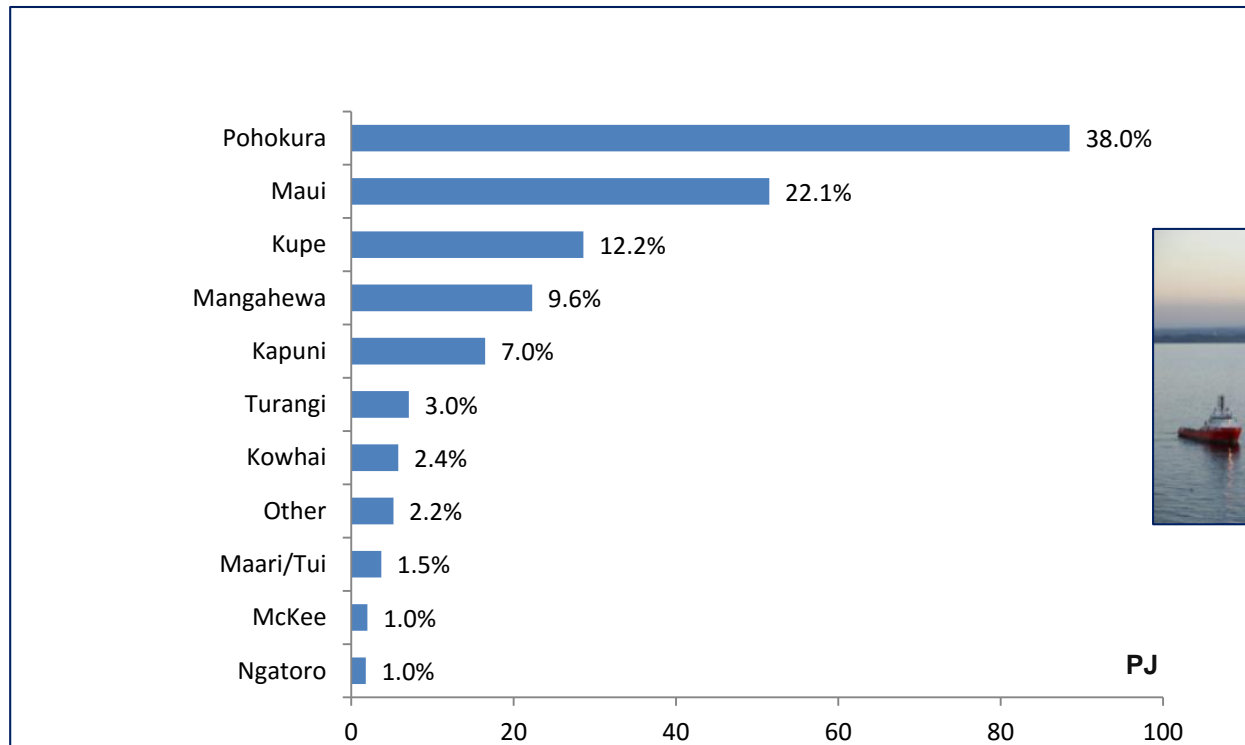
Natural Gas Net Production by Field 1971-2014



Source: 2015 Energy in New Zealand
Other includes Cheal, Sidewinder, Rimu

Pohokura is today's biggest producer

Natural Gas Production by Field 2014

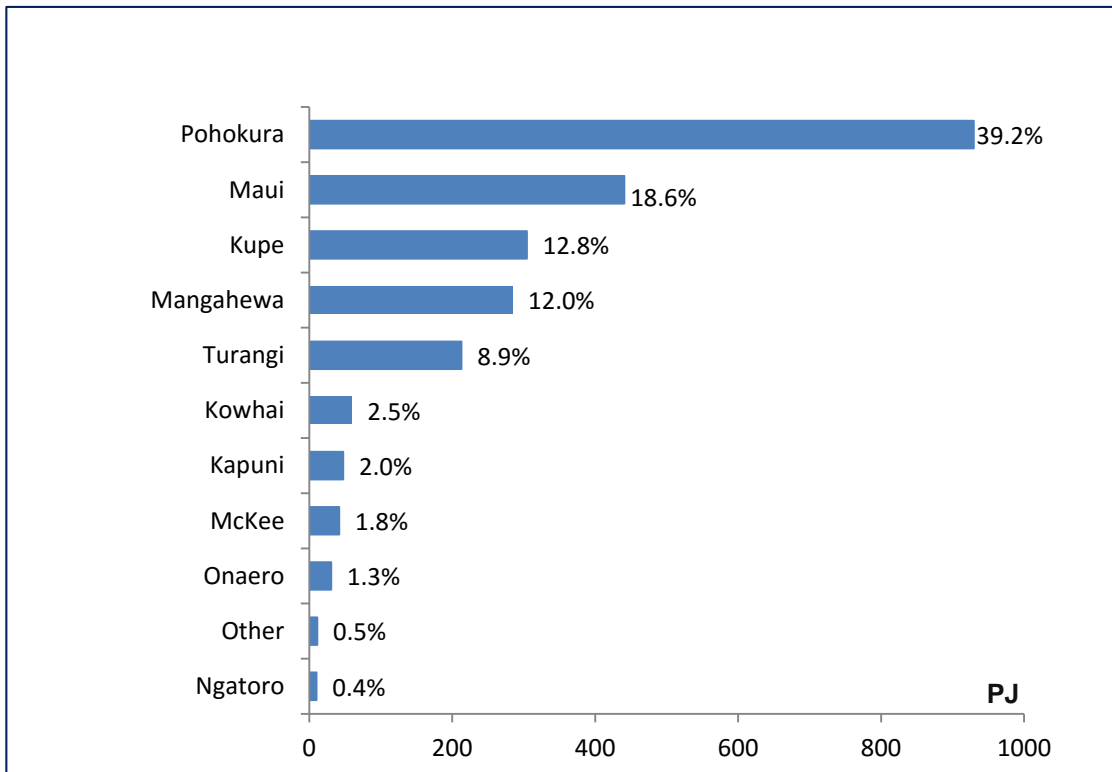


Source: 2015 Energy in New Zealand

- Includes gas reinjected (17.7PJ), LPG extracted (8.9PJ), and gas flared (2.9PJ). Net Production, excluding production losses and own use=197.7PJ
- Gas produced from the Maari and Tui fields is flared or used for operational purpose.
- Ngatoro includes production from the Goldie field. Gas from the Moturoa wells is used for operational purposes.
- Other includes Cheal, Copper Moki, Rimu, Sidewinder, Surrey and Waihapa wells.

Gas reserves have declined in the past year

Remaining P50 Gas Reserves by Field



Source: 2015 Energy in New Zealand

- Includes LPG
- Other includes Ngatoro, Kauri, Onaero, Waihapa/Ngaere, Cheal, Sidewinder, Coppermoki, Puka

- Remaining gas reserves of 2,373PJ down 10% on the 2,642PJ as at 1 January 2014. Decreases:

- Pohokura (929PJ vs 1,017PJ)
- Maui (440PJ vs 466PJ)
- Mangahewa (284PJ vs 368PJ)
- Kapuni (47PJ vs 102PJ)
- McKee 42PJ vs 81PJ)
- Kauri (1.4PJ vs 11PJ)

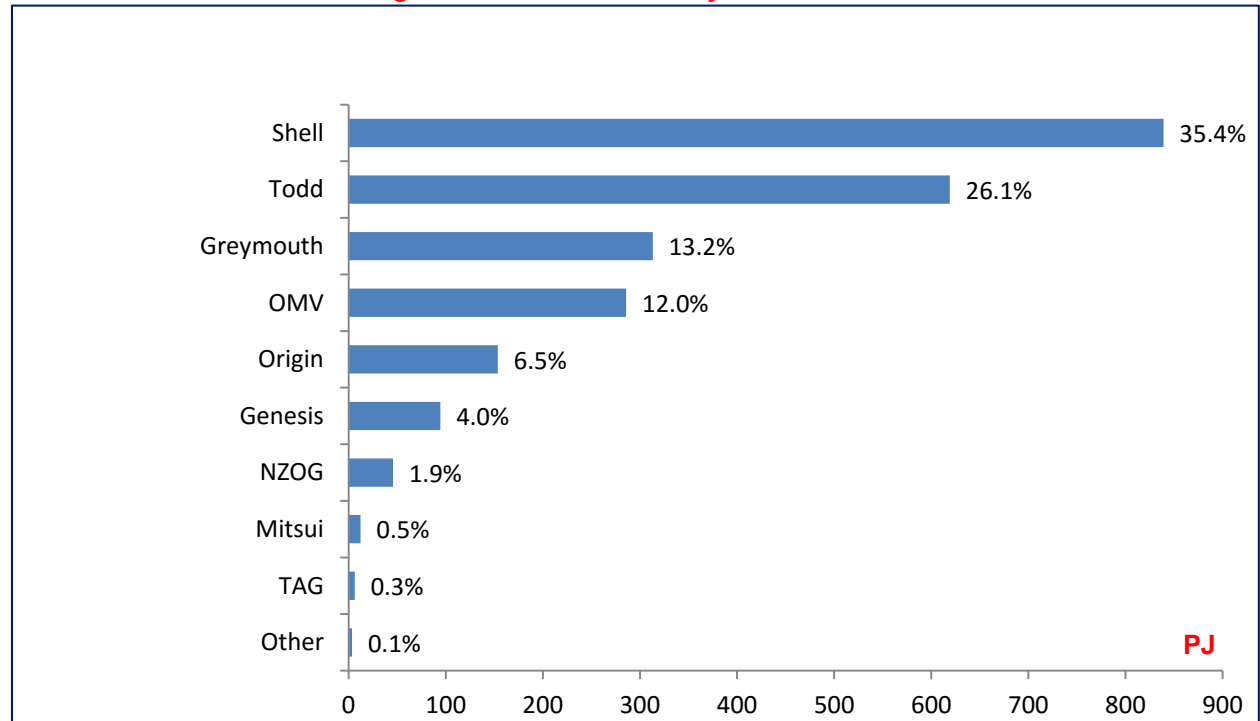
Partly offset by some increases:

- Kupe (304PJ vs 299PJ)
- Turangi (213PJ vs 195PJ)
- Onaero (31PJ vs 10PJ)

who owns them...

- The transition to multi-field supply has seen some dilution of historical concentration of gas reserves ownership in a small number of large producers. Newcomers are establishing a strengthening foothold.

Producers' Share of Remaining Gas Reserves 1 January 2014

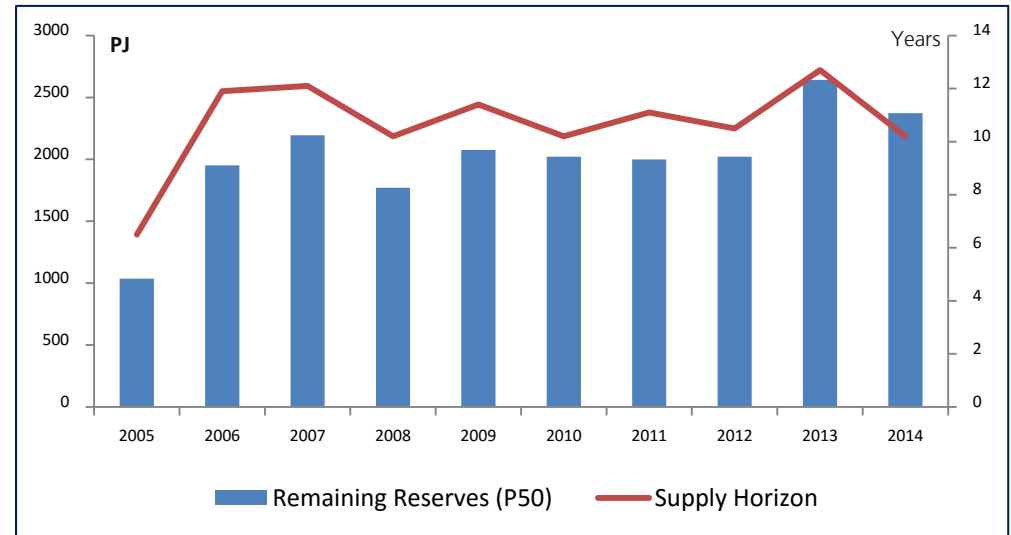


GIC calculated : Source: 2015 Energy in New Zealand

Gas reserves are relatively stable...

- Since 2005, remaining gas reserves have ranged between 1,036PJ (2005) to 2,642PJ (2013)
- Reserves/production ratio to 2015 consistently in 10-12 year horizon, recovering from a low of around 6 years in 2005
- Current supply horizon = 10.2 years
- Gas reinjection increased from 11PJ to 17PJ in 2014 (mainly Pohokura)
- Unconventional gas reserves are not firm enough to be included in New Zealand's formal gas reserves position

Remaining P50 Reserves/Supply Horizon 2005-2014

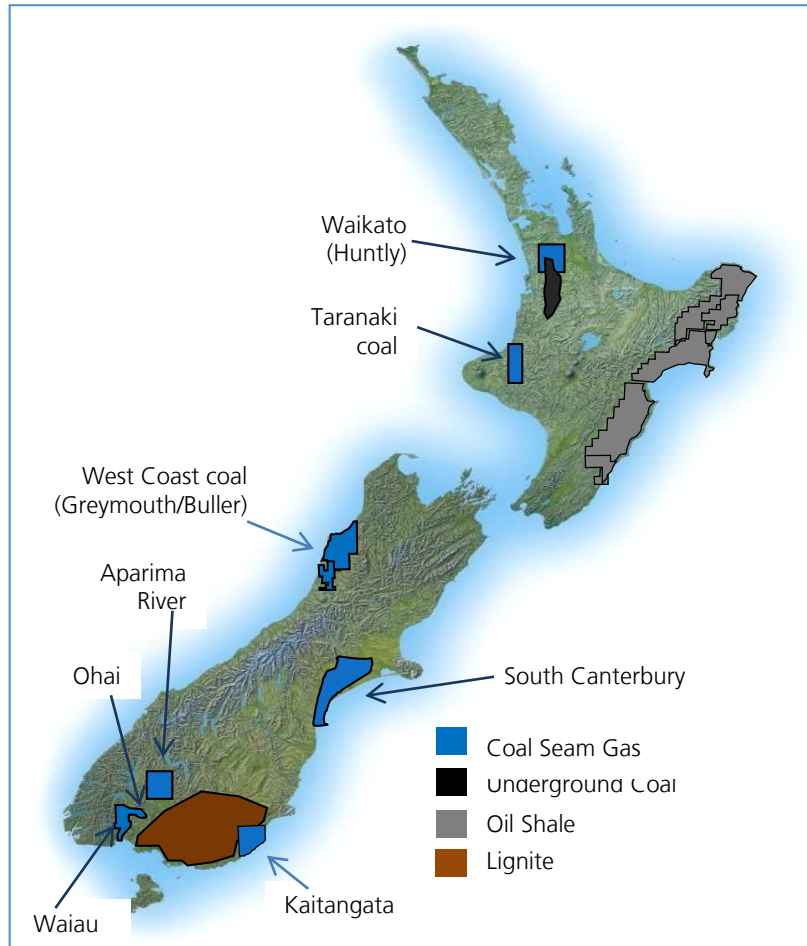


Source: 2015 Energy in New Zealand

Supply Horizon = annual reserves/gross production ratio. Gross production includes gas flared, gas injected, gas used for operational purposes, losses, and LPG extraction

Unconventional gas is in its infancy in NZ

Unconventional gas - Areas of Interest



Source: Petroleum Exploration and Production Association (PEPANZ)

Coal gas

- Much of New Zealand's ~ 15 billion tonnes of in-ground coal could yield CSG.
- Limited activity reflects abundant conventional gas, under-explored Basins.
- Activity largely exploratory/experimental, but suggests potential for:
 - 900PJ Taranaki
 - 200PJ Huntly
 - 240PJ West Coast
 - 270PJ Ohai

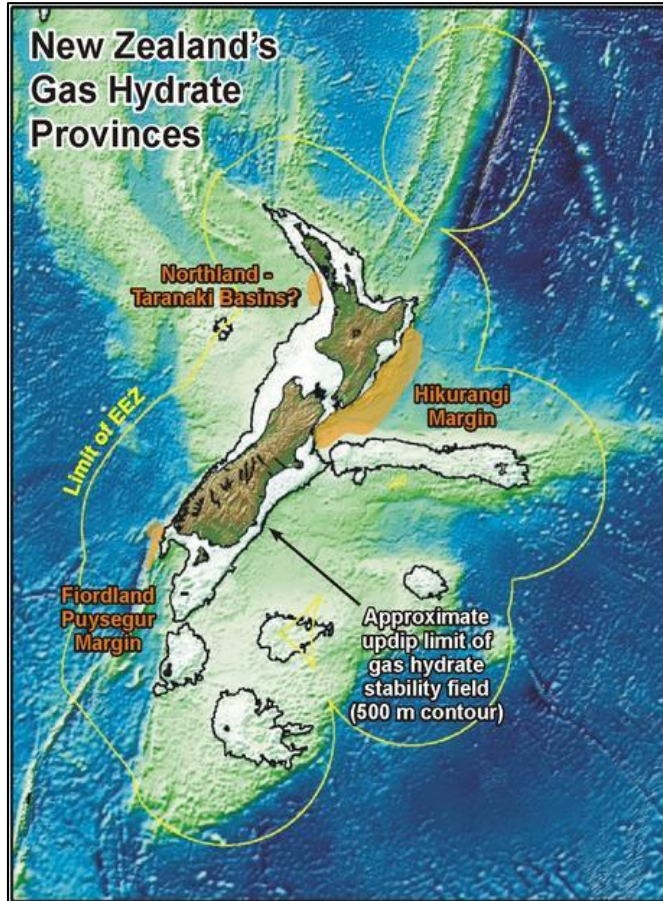
Shale

- East Coast oil shale deposits targeted as conventional and unconventional prospects.

- 'Unconventional' gas is in tight, low permeability formations that are difficult to access – CSG, shale rock coal gasification
- Massive reserves globally, but requires advanced extraction techniques and raises major issues

And then there's 'ice gas'..

Gas Hydrates- Areas of Interest



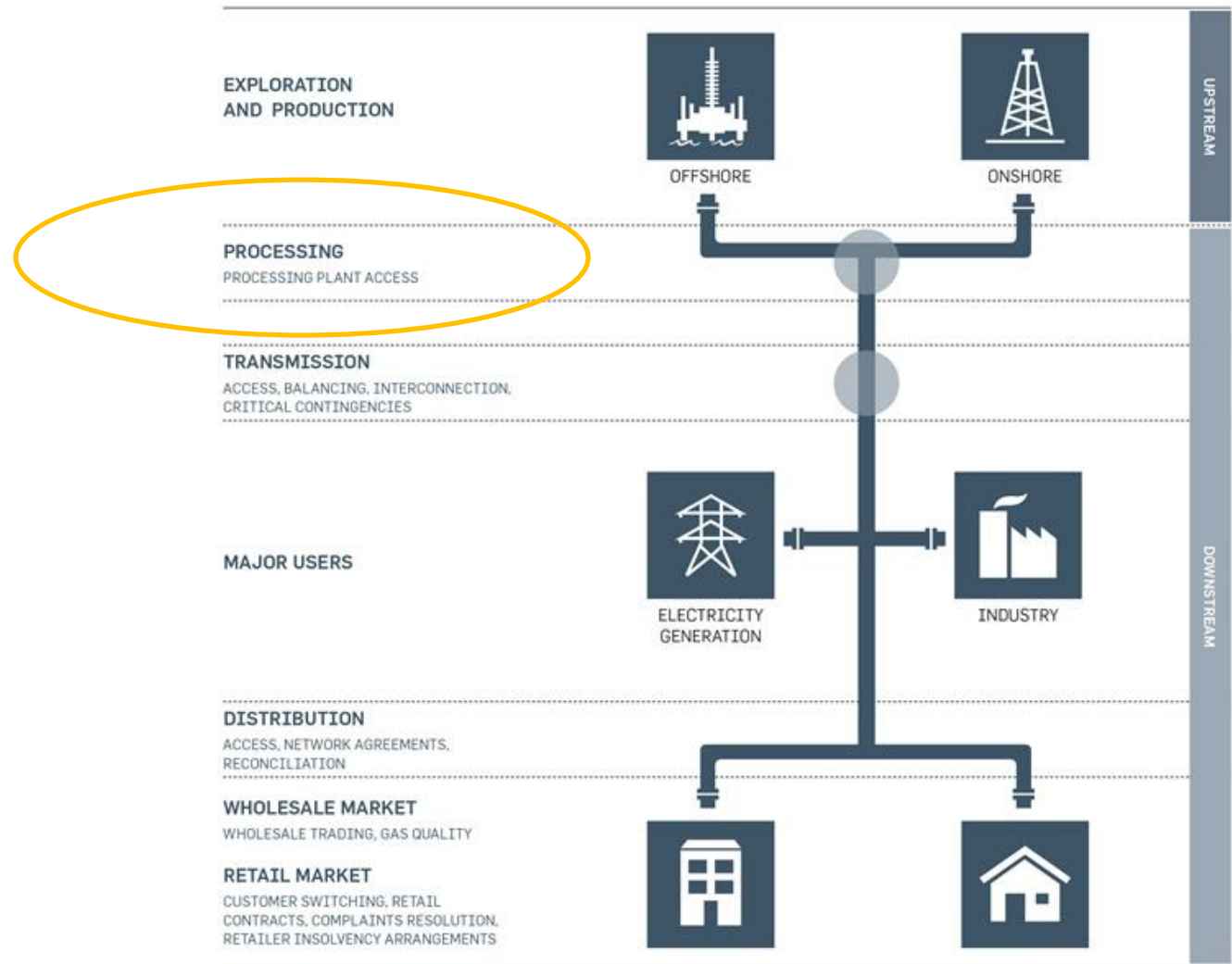
Source: GNS Science

- New Zealand has been researching methane hydrates since 1993. Observed in the Hikurangi Margin, deep-water Taranaki and Northland Basins, and off the South Island.
- The Hikurangi Margin covers 50,000sq km. Initial methane hydrate estimates: 20,000PJ

- Ice gas occurs under high pressure and very low temperatures – found under Arctic permafrost and beneath the sea floor in deep water continental margins. Exists as a highly compressed crystalline solid encased within ice. When liberated, the methane volume expands 160 times.
- Several research programmes but access/production technology is developmental. Japan has extracted ice gas but not yet commercial.
- Enormous potential– estimated 400 billion PJ (currently known world gas resources = 5 million PJ).



Gas Processing

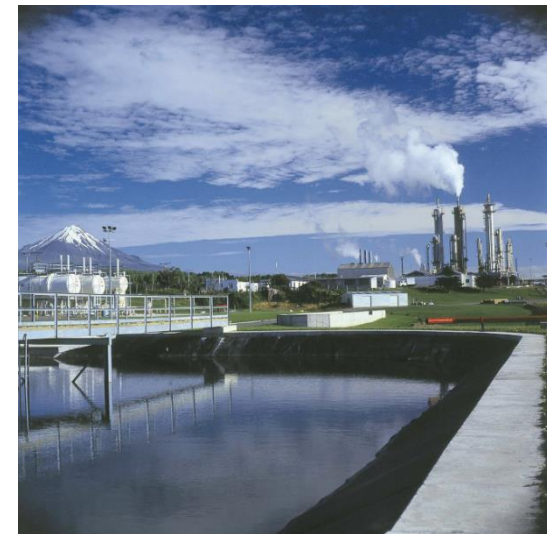


Gas needs to be processed before use

- 'Raw' gas is used by a small number of large users (Methanex), but specification gas is needed for the rest of the market.
- The industry is well served with gas processing facilities, which remove/reduce water, carbon dioxide and other contaminants.
- Propane and butane are extracted as LPGs for domestic market use or export. Carbon dioxide can be further processed for a range of other uses, including putting froth on beer.
- Processing plants tend to be built in conjunction with a new field development and tailored to:
 - reserves
 - wellstream composition
 - field production characteristics
- They can range from simple, skid-mounted facilities to large, complex production/treatment plants.

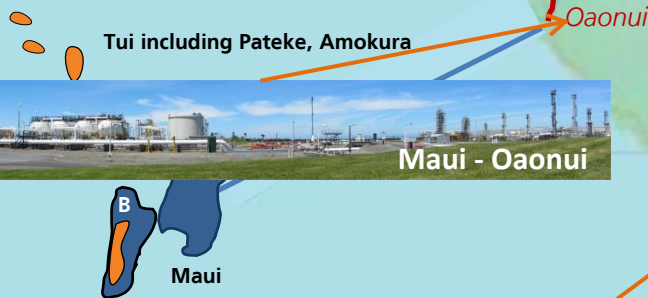
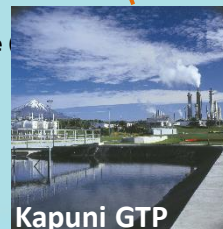
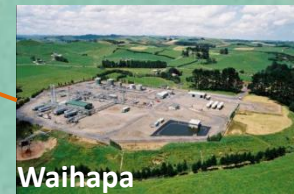


Kupe Production Station



Kapuni Gas Treatment Plant

There are 12 processing plants



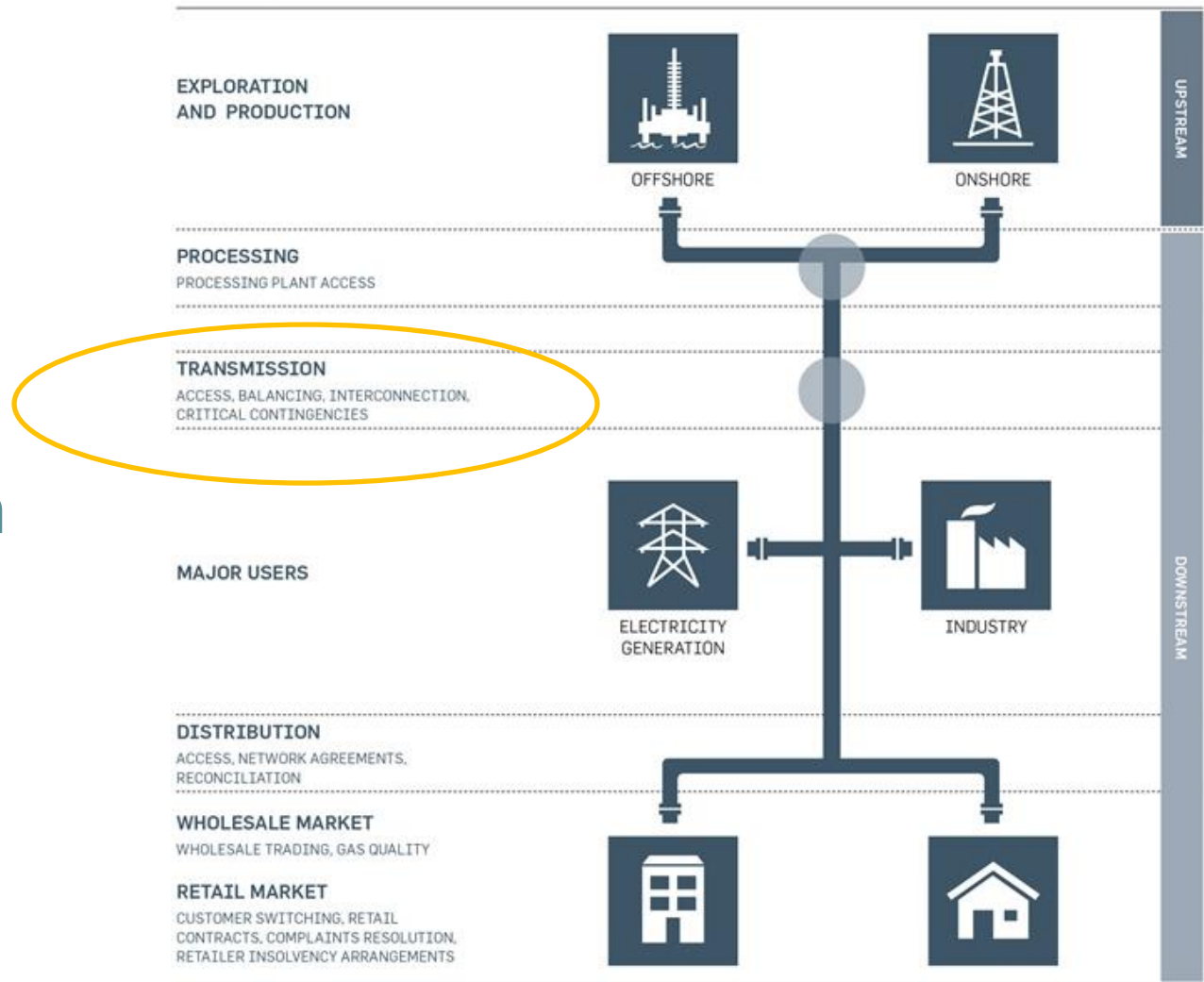




From wellhead to burner - *The New Zealand Gas Story*

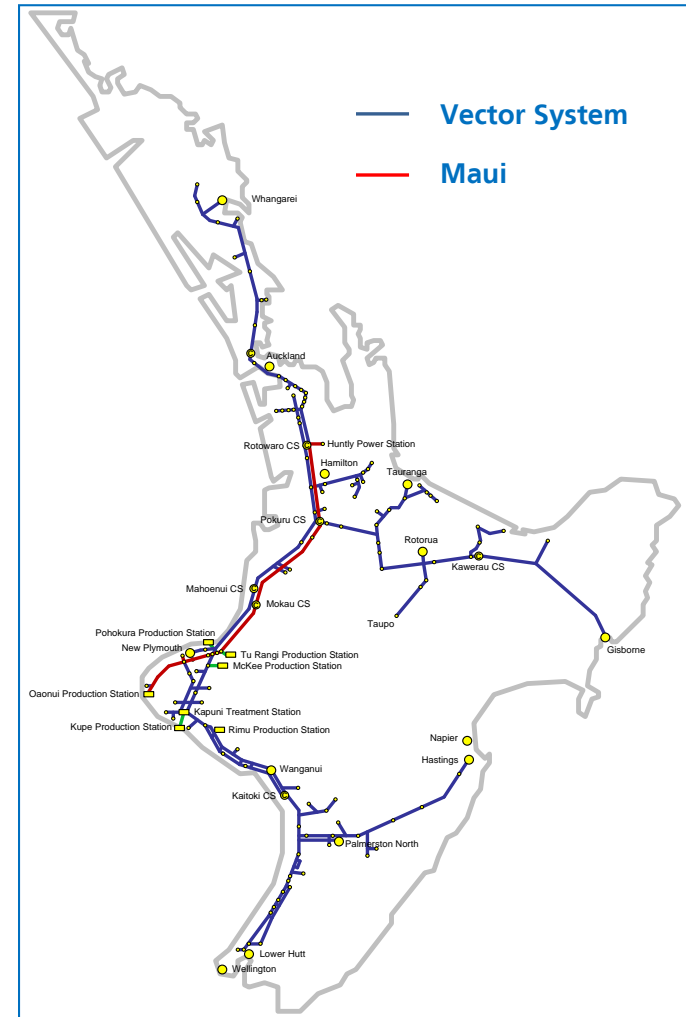
Part Two – the story continues

Gas Transmission



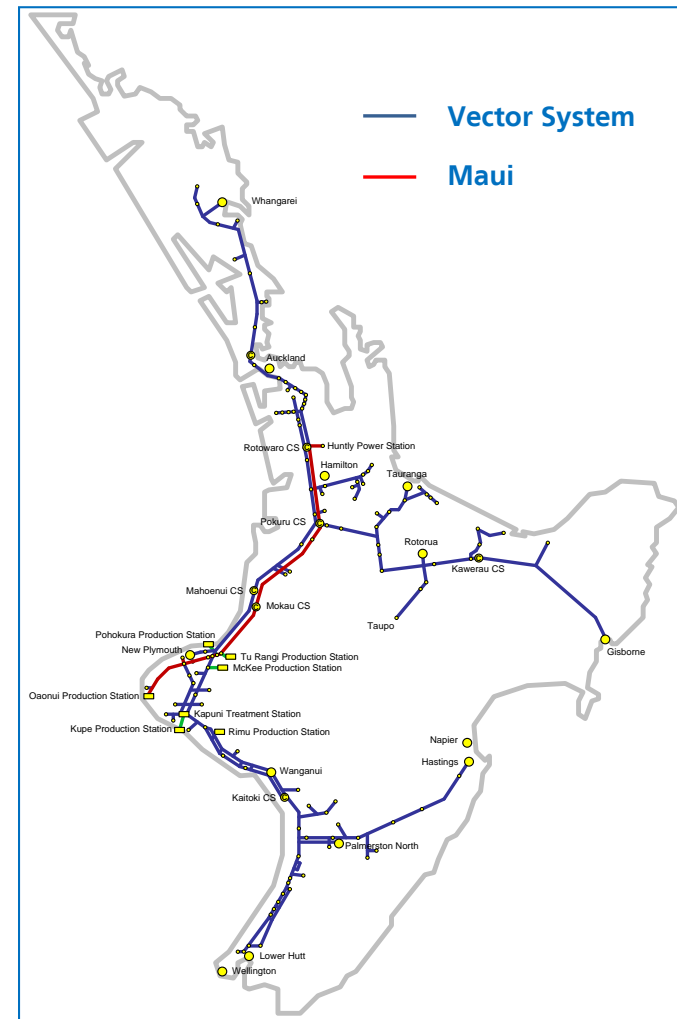
Transmission pipelines - high pressure arteries

- Two 'open access' pipeline systems:
 - 308km Maui pipeline
 - 2,211km Vector system
- Supply distribution networks and some large users.
- 'Open access' transmission access governance is built on fit-for-purpose codes and contracts rather than formal regulations.
- Other transmission requirements:
 - gas specification/quality
 - balancing arrangements
 - interconnection arrangements
 - emergency management processes
- Regulatory focus on access, efficiency, pricing, investment, security of supply.
- Volumes sensitive to electricity generation, general economy, gas substitution, efficiency.



Transmission has undergone major reforms

- Previously Government-owned pipelines transferred to private ownership (Vector).
- Declining Maui production and move towards multi-field supply created need to open Maui pipeline to other gas sources.
- Shift from long-term contracts based on Maui gas to more varied, short-term supply arrangements from new, smaller fields.
- Transmission services market more complex – access, interconnection, balancing, critical contingency management.
- Last decade marked by debate over monopoly nature of transmission assets. Economic regulation of Maui and Vector transmission pipelines.



The transmission players

- Pipeline owners /operators.
- System operators (physical and commercial).
- Interconnected (welded) parties physically connected to the transmission system and transferring gas into, or out of, the pipeline. They operate under an Interconnection Agreement (ICA).
- Shippers – buyers of transmission services to transport their gas for consumption or onsale in the downstream wholesale and retail market. There are three categories:
 - electricity generators
 - petrochemical manufacturers
 - retailers



Transmission services and wholesale gas trading are interlinked – gas trading must be accompanied by an ability to transport the gas from a field to the end user.

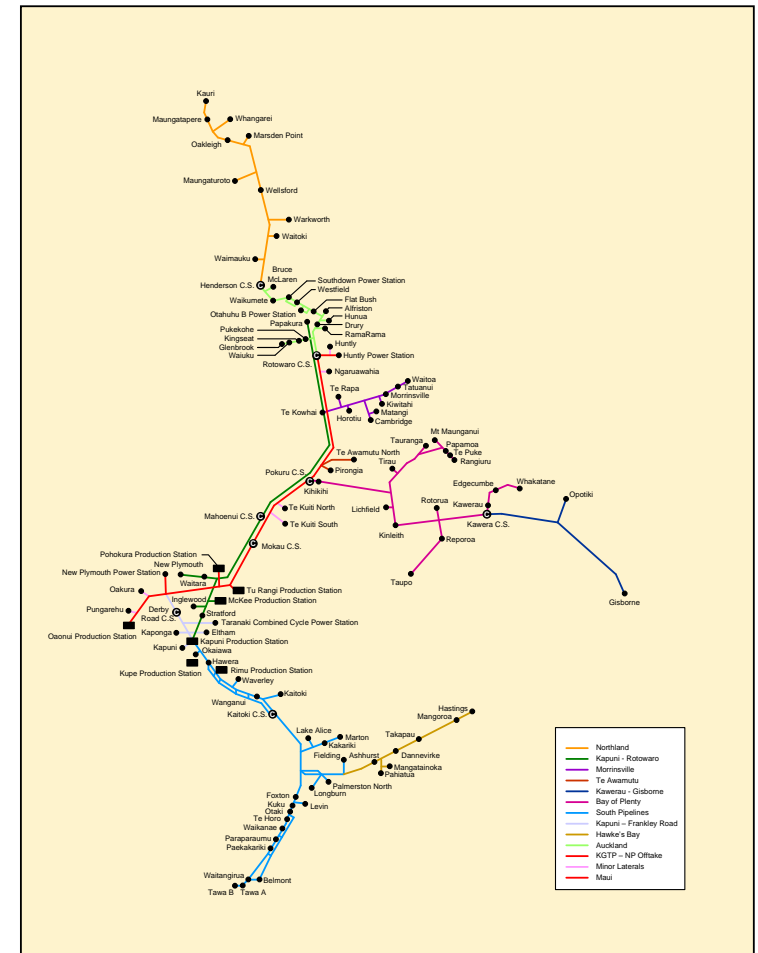
70% of gas goes through the larger Maui line

- Oaonui-Huntly. 750mm-850mm diameter pipe.
- Owners: Shell (83.75%), OMV (10%), Todd 6.25%). Maui Development Ltd (MDL) contracts with parties.
- Commissioned 1979. Dedicated to transporting Maui gas until becoming open access in 2005. Maui gas now accounts for 30% of throughput.
- Common carriage transportation with no specific rights to capacity.
- Shippers (12) sign up to Maui Pipeline Operating Code (MPOC) which sets out terms and conditions.
- 6 producers inject gas; 3 consumers receive gas.
- Maui line generally feeds gas into the Vector pipelines at 13 interconnection points.
- 18PJ transported in first year. Maui transports $\approx 130\text{PJ}/\text{year}$ - over 70% of total gas transported.



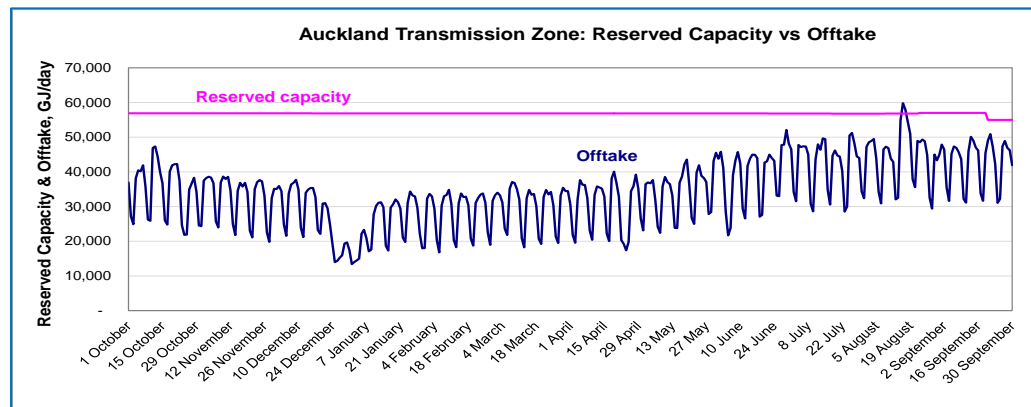
The Vector system takes the further around the North Island

- Transports over 80PJ of high pressure gas to most North Island cities and towns. 138 offtake and connection points.
- Kapuni to Auckland and Wellington commissioned 1970. Major expansion during the 1980s.
- Non-discriminatory open access arrangements since the mid 1990s.
- Bilateral contracts replaced in 2007 with the Vector Transmission Code (VTC), which sets out terms and conditions.
- Shippers sign a Transmission Services Agreement (TSA). Supplementary Agreements available for special needs, including long-term arrangements for electricity generation.
- Standard offering includes firm service; annual block of point-to-point capacity with grandfathering rights.



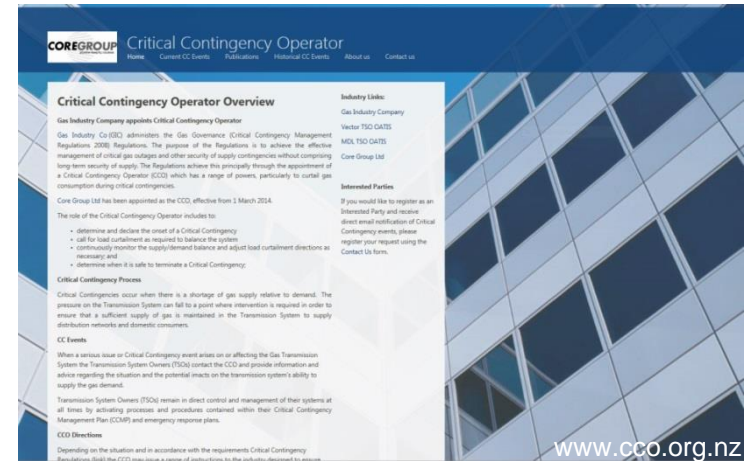
Transmission capacity has been in the spotlight

- 2009 announcement that Vector can't sell any more reserved capacity on the North Pipeline.
- Retirement of Auckland power stations (Otahuhu B, Southdown, releases significant spare capacity (up to 60%).
- Auckland load becoming more 'peaky'.
- Existing capacity appears adequate for foreseeable future, but industry needs to plan to avoid a potential capacity constraint recurrence.
- The focus is on determining optimum access/pricing arrangements to achieve best utilisation of existing pipelines, and developing investment signals.



Robust processes for emergency management

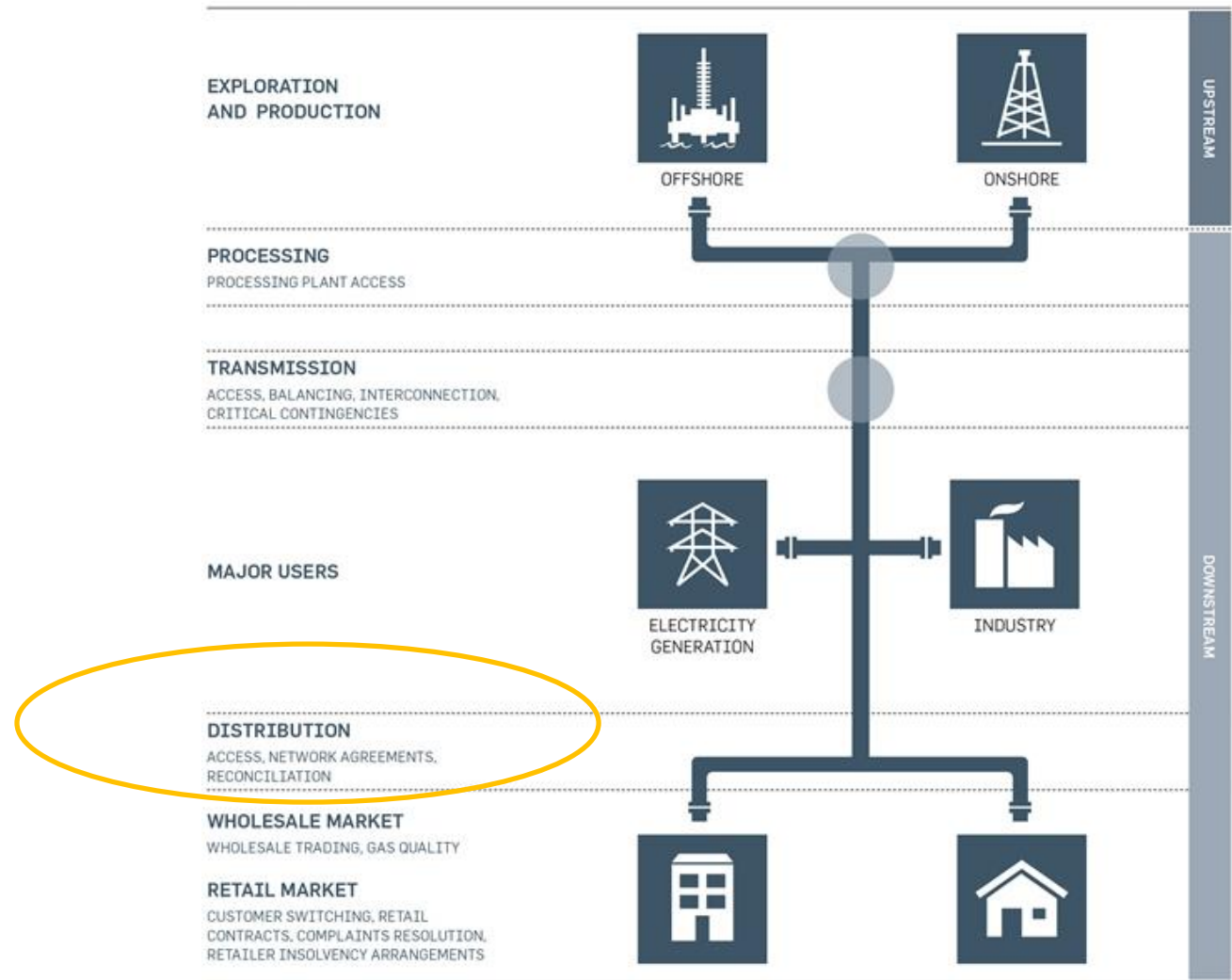
- Transmission systems cross rugged terrain but have a long history of reliability.
- Outages can arise from failure of:
 - major production facilities
 - transmission pipelines
- Formal critical contingency management regulations replaced a voluntary industry arrangement in 2008.
- CCM focus is on:
 - maintaining safe transmission pipeline operating pressures for as long as possible
 - allocating available gas to priority consumers
- CC management led by the Critical Contingency Operator (CCO).
- Key tools are curtailing consumption to reduce demand, and maximise gas from other sources where possible.
- Consumers need to be prepared for loss of utility services and have a contingency plan.



Available gas is preserved gas for priority users

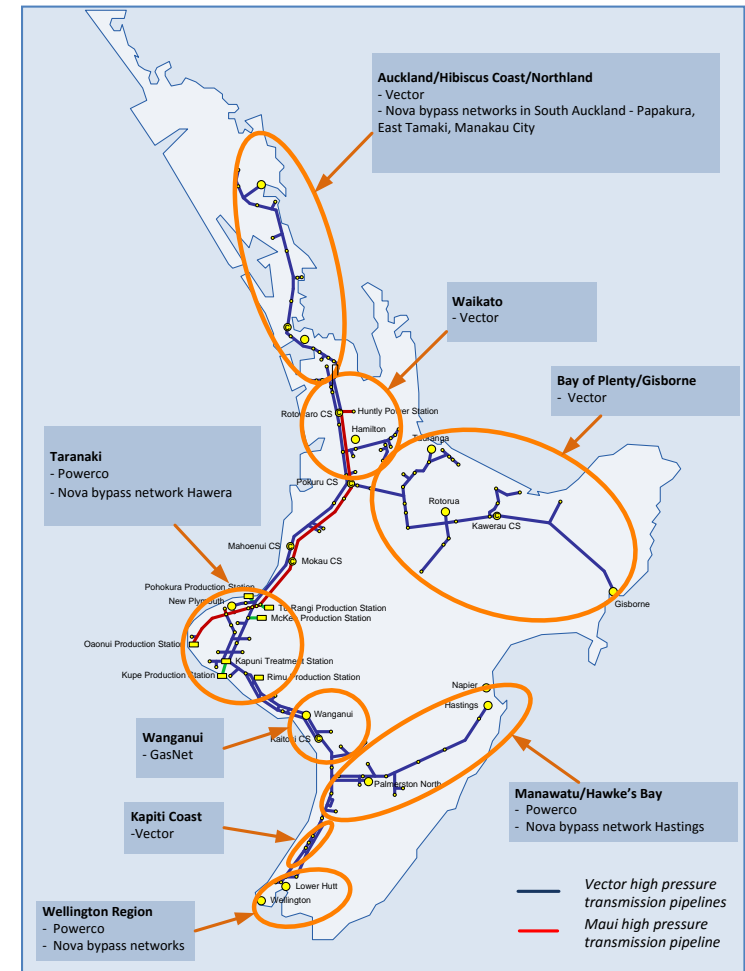
Curtailment Band	Consumption	Description	Previous Curtailment Band
0		Gas storage.	0
1	>15 TJ/day	Consumers with alternative fuel capability	1a
2	>15 TJ/day	Consumers without an alternative fuel capability.	1b
3	>10 TJ/annum	Industrial and commercial consumers	2 (without alternative fuel) 3 (with alternative fuel)
4	>250 GJ/annum	Medium-sized industrial and commercial consumers	4 (> 2 TJ/annum)
5	>2 TJ/annum	Essential services designated consumers	5
6	< 250 GJ/annum	Small commercial customers	6 (< 2 TJ/annum)
7	any	Critical care designated consumers	

Gas Distribution



Distribution networks get gas to the vast majority of consumers

- Three 'open access' networks – Vector, Powerco, GasNet – and one non-open access distributor (Nova).
- Regulatory focus on access, efficiency, pricing, investment, reliability.
- Open access distribution services are also subject to economic regulation.
- The networks generally have a high level of reliability.



What distributors do

- Provide gas distribution services to retailers under Network Services Agreements (NSAs) – also referred to as Use of System Agreements (UoSAs).
- Receive gas from transmission pipelines at gas gates and transport it through lower pressure networks to industrial, commercial and residential consumers.
- Support associated processes including:
 - customer switching
 - gas reconciliation
 - reducing of unaccounted-for gas (UFG)
 - disconnections and reconnections.



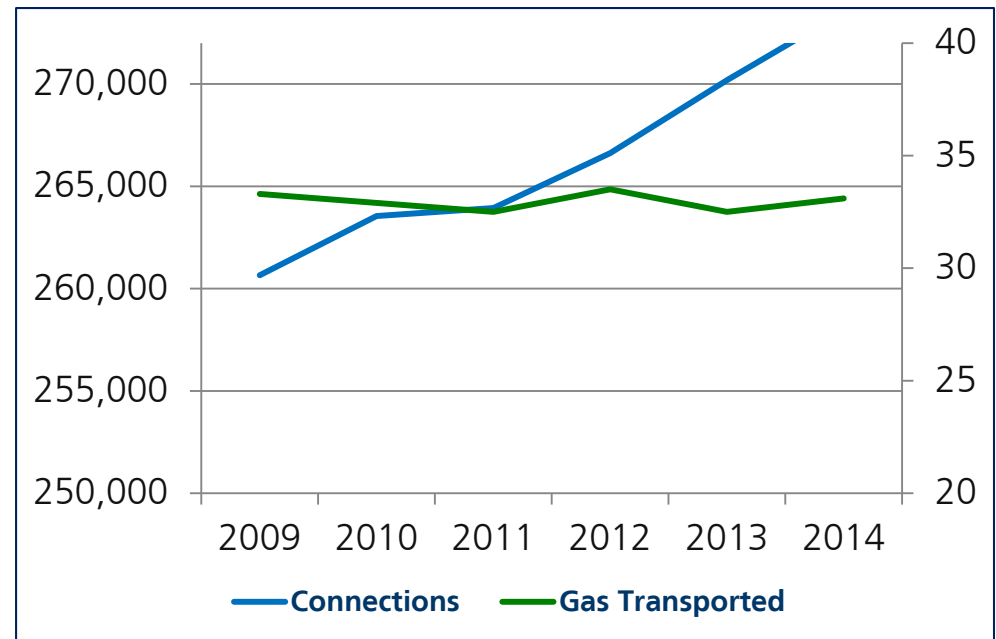
Gas gate station



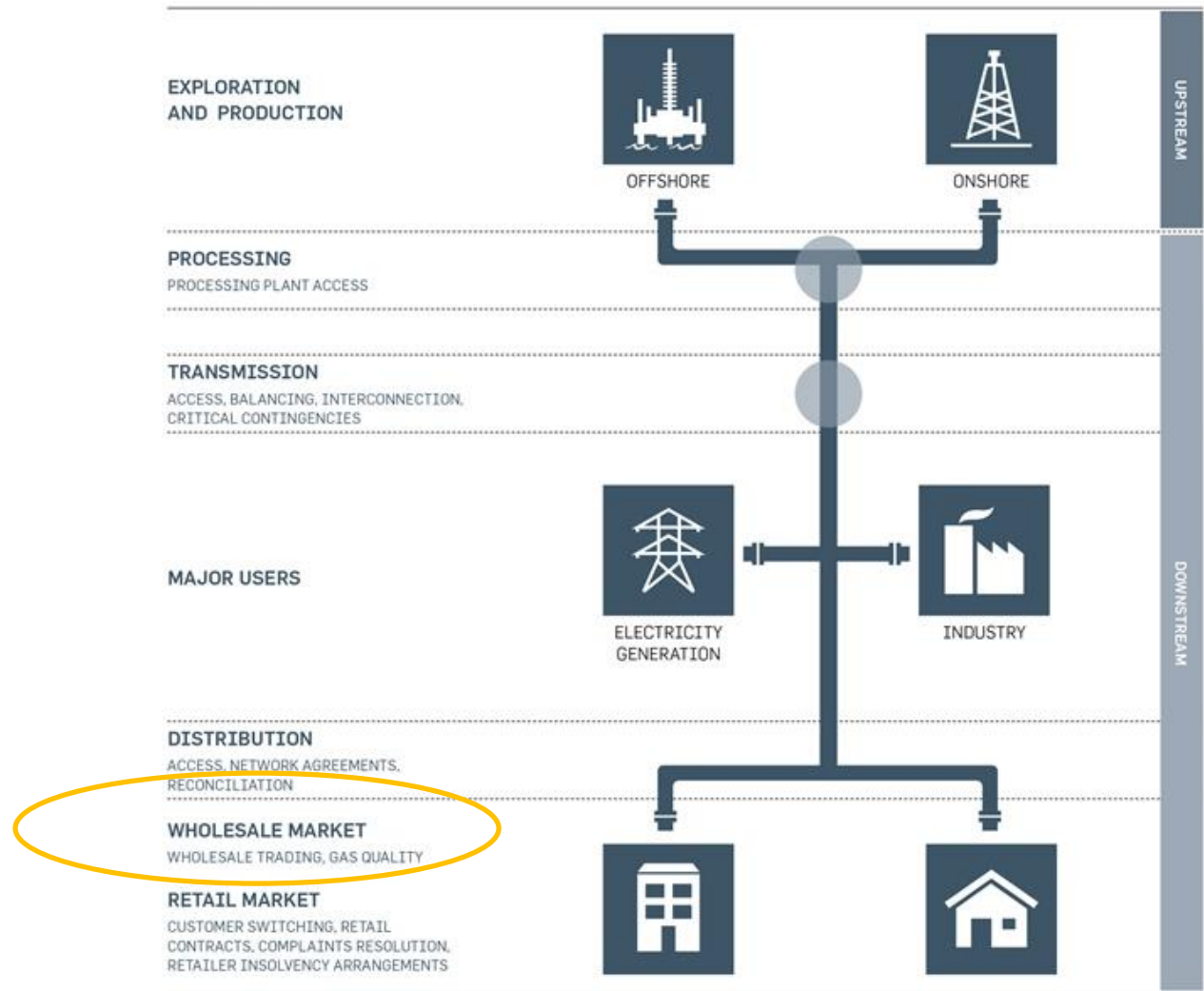
Distribution networks are growing, but throughput is static

In the past five years:

- Total network length has grown 850km to 17,559km primarily on Vector and Powerco networks.
- Consumer connections up almost 10,000 to 273,500.
- 33PJ sent through distribution networks in 2014 – static volumes.
- Average customer density of 15.6 consumers/km of pipe - low by international comparison (eastern/southern Australia 49.32 consumers/km).



Wholesale Gas Market



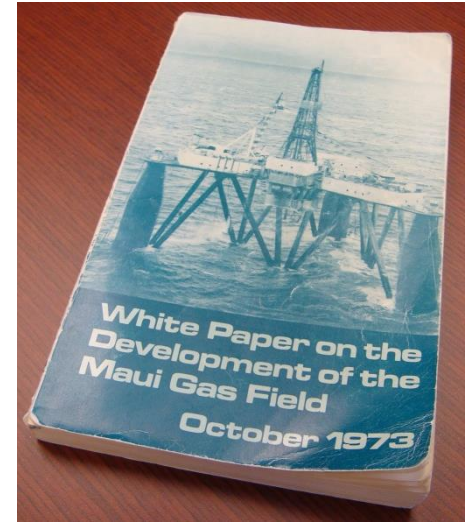
The wholesale market was opaque, but is getting clearer

- Wholesalers buy gas from producers for onsale to retailers and large users. Producers also sell directly to large consumers and, where vertically integrated, to their own retail arms
- The wholesale market is small and relatively concentrated. There are four main wholesalers – Vector, Nova, Contact, Greymouth
- Competitive tendering for gas supply occurs, but primary and secondary trading generally through bilateral contracts
- No specific concerns about buying or selling gas as a commodity, but little transparency of wholesale trades, prices, volumes, frequency
- emsTradepoint wholesale trading platform established in October 2013



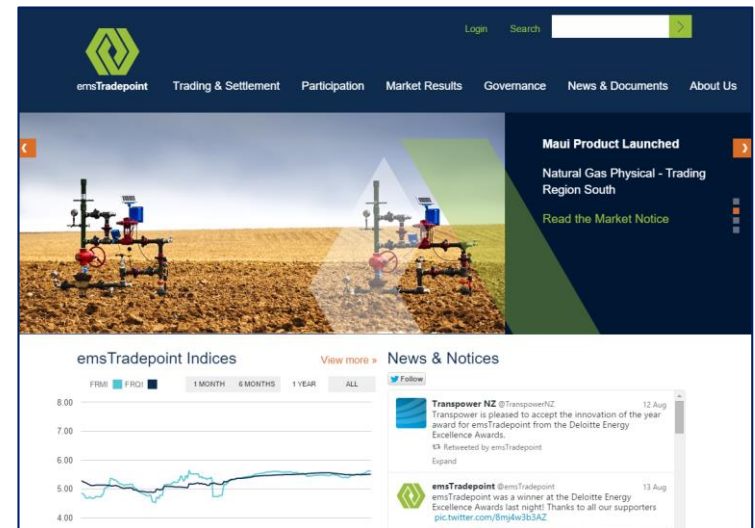
With Maui, there was no need for a wholesale market

- Maui shaped exploration/production and the wholesale market for 30 years and represented an effective price cap.
- Diminishing Maui production brought fundamental change to the wholesale market - from abundant, cheap gas and a single dominant field, gas supply shortened, prices increased, and the market became more complex with supply from multiple fields:



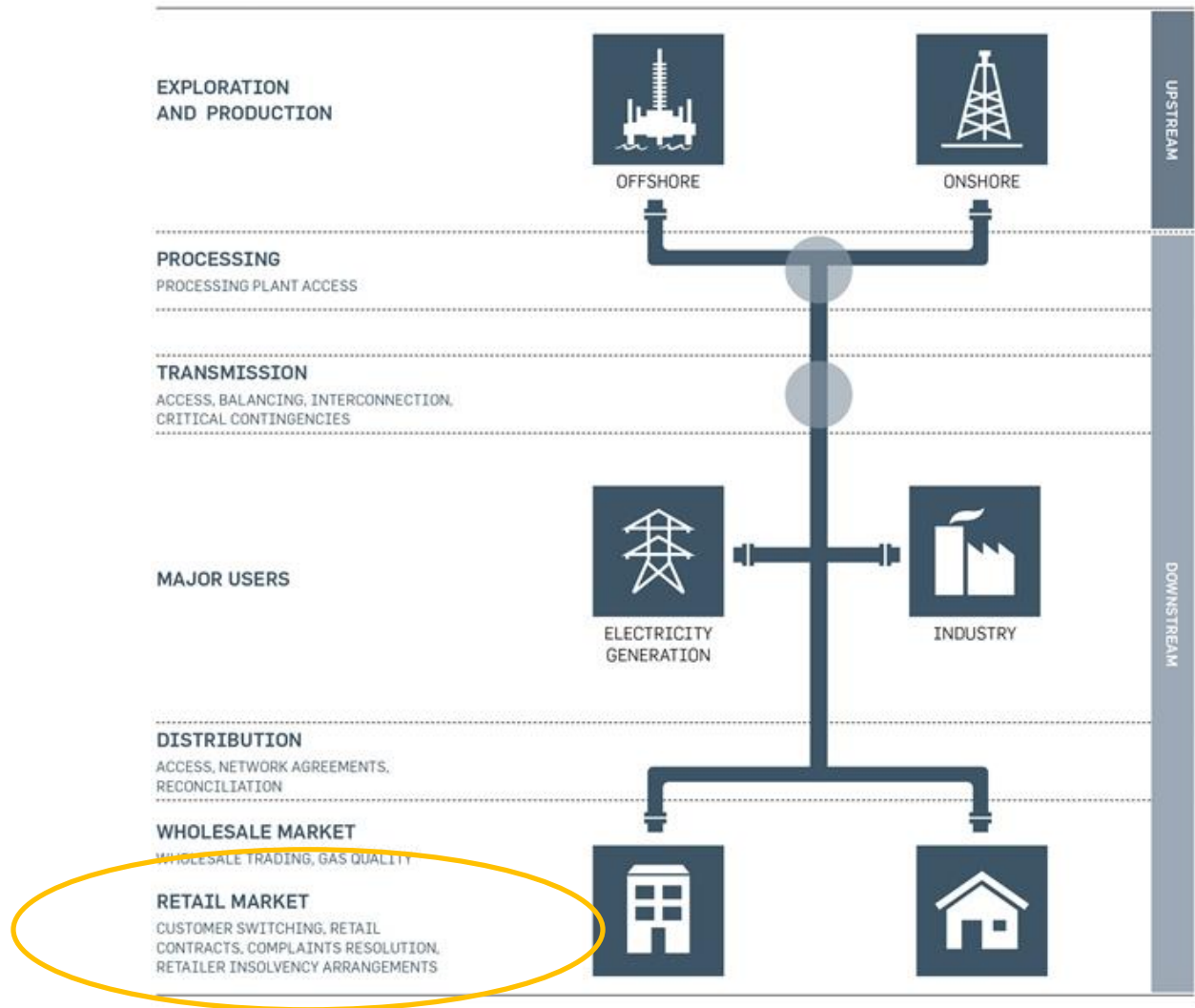
New market platform is providing improved transparency

- emsTradepoint (Transpower) wholesale gas spot market is providing a transparent price benchmark for the whole industry.
- Trades of 1.4PJ totalling \$7.6 million (as at 30 June 2015).
- Commenced trading transmission balancing gas on 1 October.
- emsTradepoint/Australian Stock Exchange (ASX) - New Zealand Gas Futures contract launched on ASX in April 2015.



www.emstradepoint.co.nz

Retail Gas Market



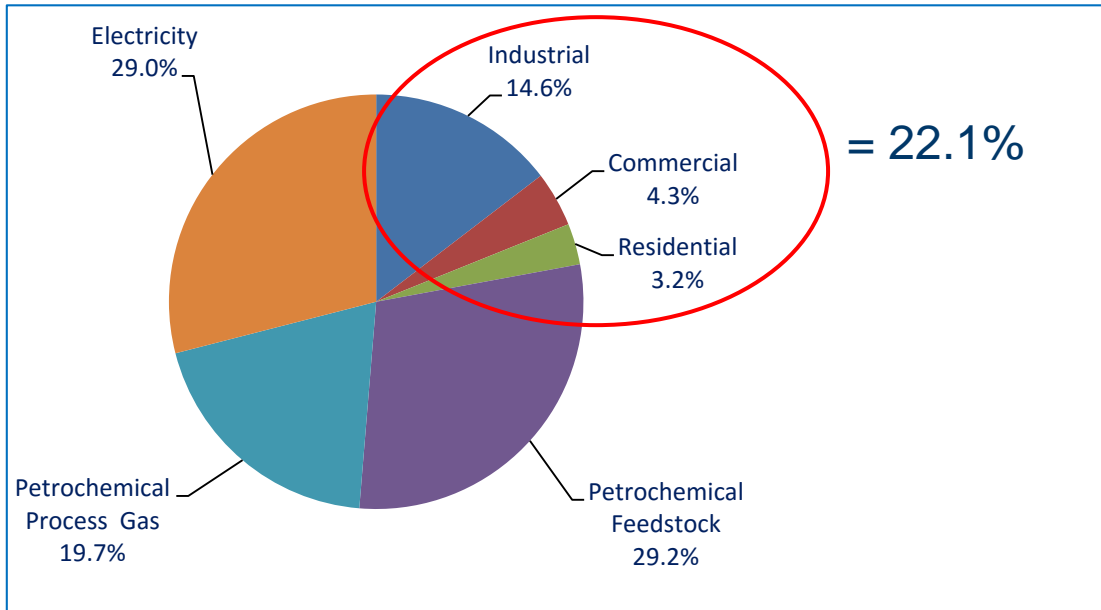
The retail gas market is constantly growing

- 6,000 new consumers in the past five years.
- 11 retailer brands:
 - Contact
 - Genesis
 - Energy Online (Genesis subsidiary)
 - Greymouth Gas
 - Mercury (part of Mighty River Power)
 - Nova Gas (part of Todd Corporation)
 - OnGas (part of Vector)
 - Trustpower
 - Energy Direct (part of Trustpower)
 - Pulse Energy
 - Switch Utilities
- Stronger retail competition and market contestability
- Suite of measures to protect small consumers:
 - customer switching
 - consumer complaints scheme
 - retail contract benchmarks



Retail accounts for 22% of the gas market

Gas use 2014



Source: 2015 Energy in New Zealand

Consumer characteristics

Industrial

1,500 consumers (29.6PJ)

- large users
- internal energy management expertise
- 1:1 relationship with energy supplier

Commercial

14,000 consumers (8.7PJ)

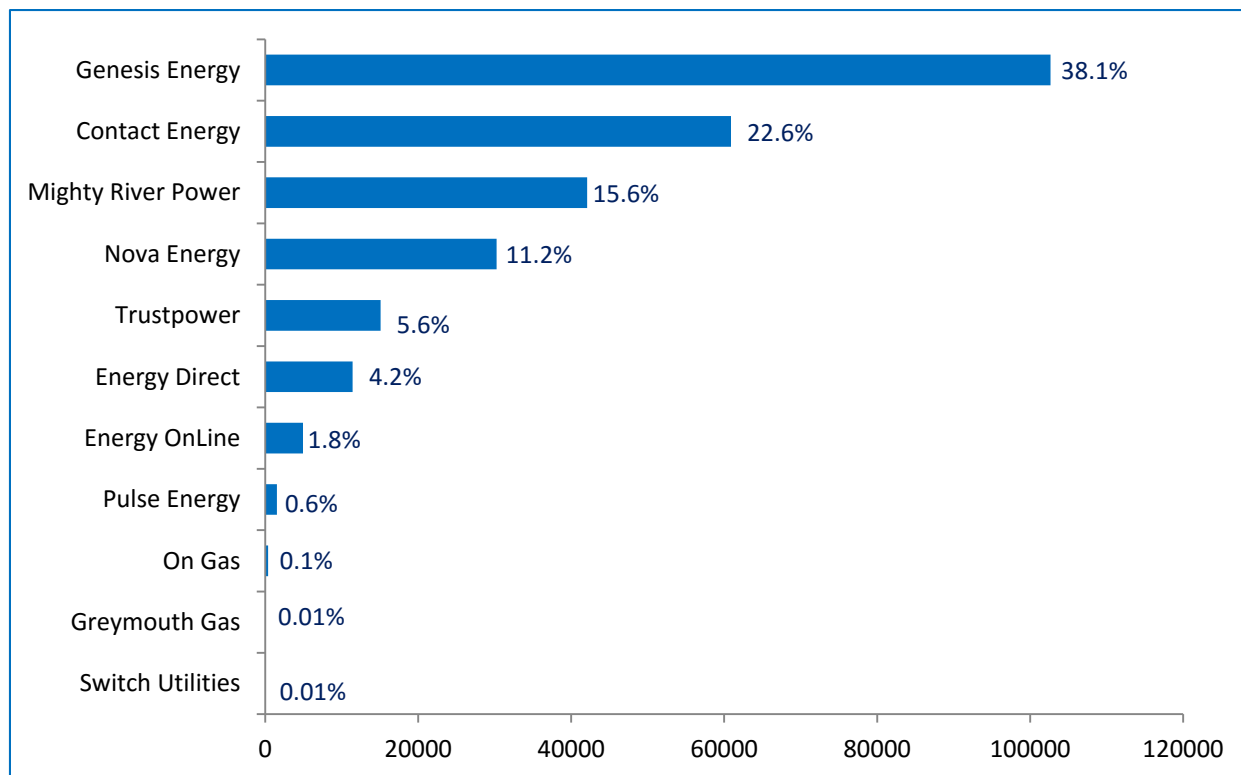
- range of business/community users
- direct account management relationship

Residential

249,000 consumers (6.6PJ)

- households (mass market)
- little contact with retailer apart from connect/disconnect, monthly bill, complaints/issues

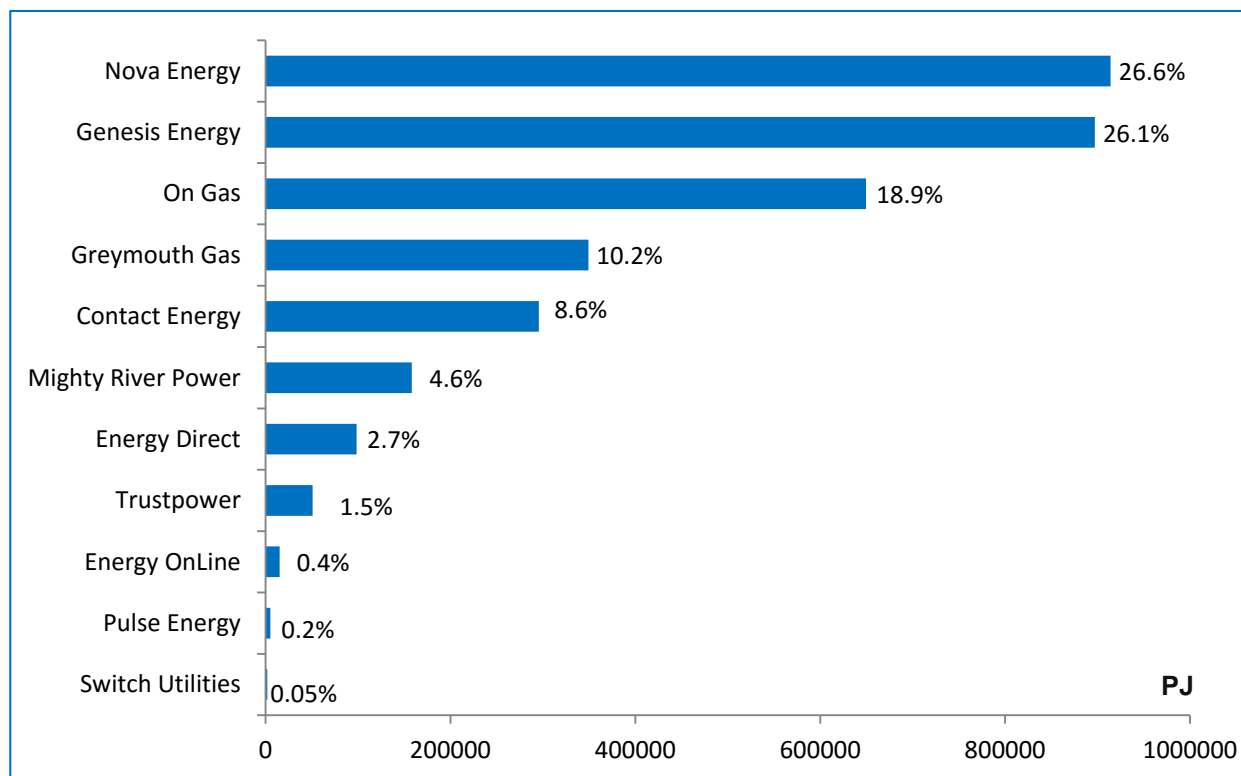
Retailers' market share by consumers



Source: Gas Registry Statistics -% of Active ICPs August 2015

OnGas and Greymouth Gas supply large consumers only. Switch commenced gas retailing in 2015

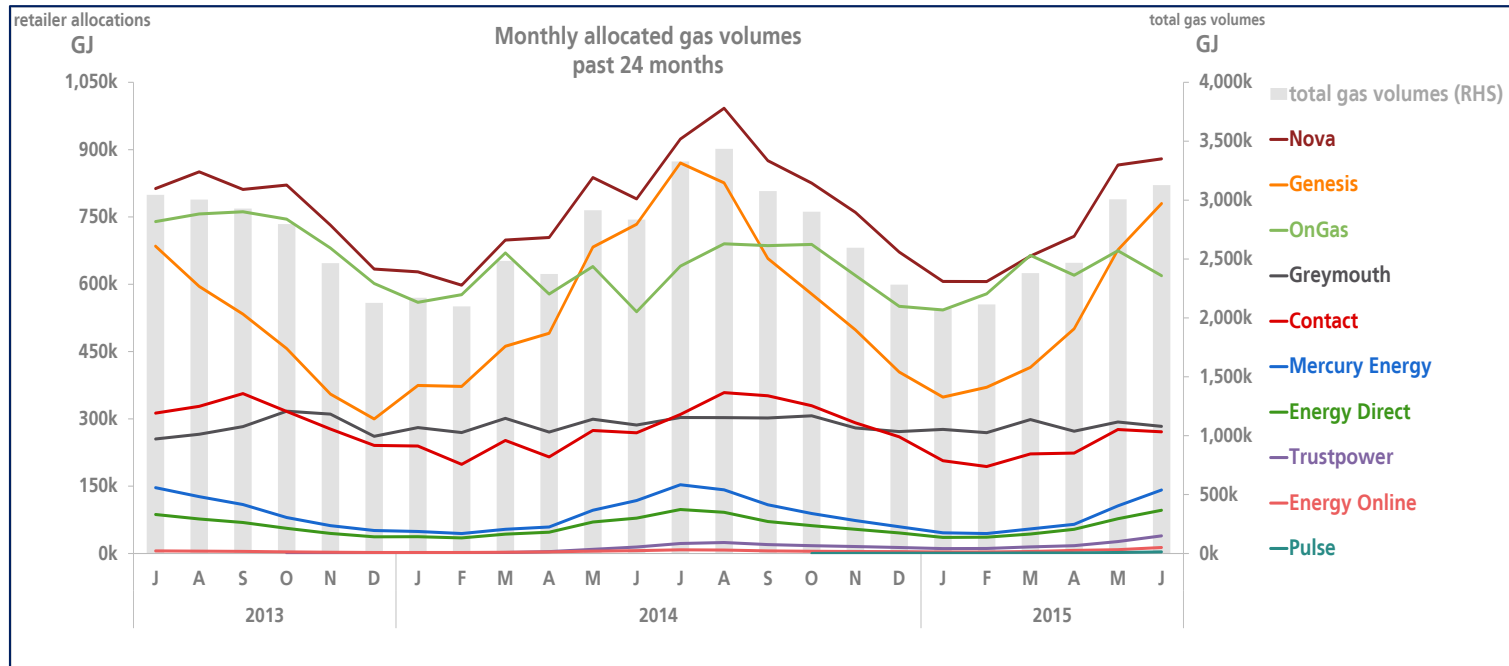
Retailers' market share by allocated volume



Source: Gas Registry June 2014

Volumes are at shared gates (ie: connected to a network supplying multiple customers). Volumes include gas consumed by industrial, commercial and residential consumers, but exclude gas from gas gates that supply a single customer directly from the transmission system, such as thermal power stations, the oil refinery, petrochemical plants and pulp and paper facilities.

Volumes generally track seasonal demand



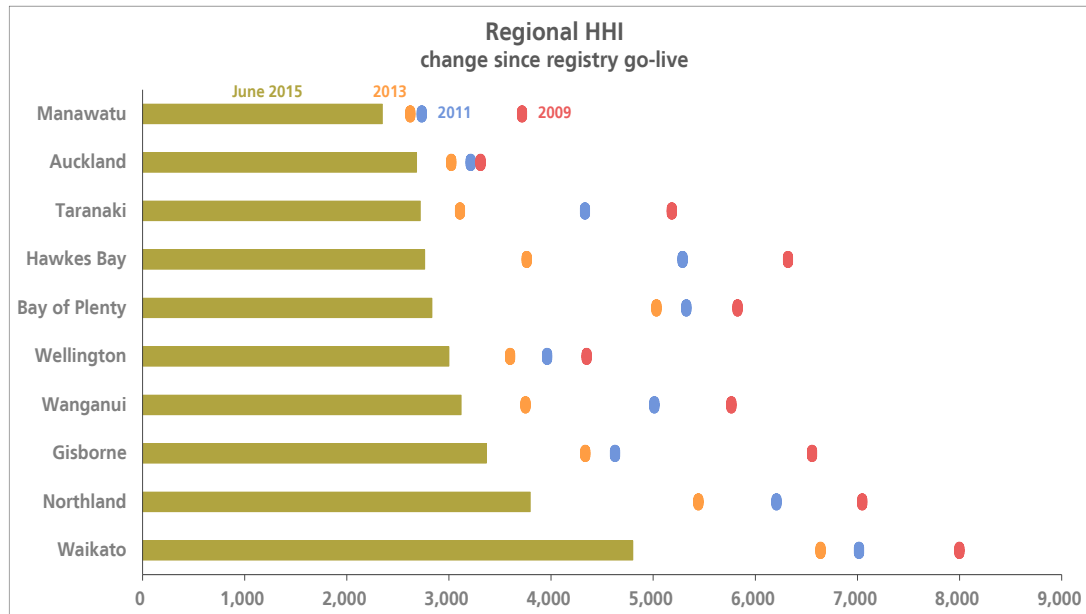
Source: Gas Industry Co June 2015 Quarterly Report

Volumes are at shared gates (ie: connected to a network supplying multiple customers). Includes gas consumed by industrial, commercial and residential consumers, but exclude gas from gas gates that supply a single customer directly from the transmission system, such as thermal power stations, the oil refinery, petrochemical plants and pulp and paper facilities

- Most retailers experience gas consumption seasonality - higher in winter, lower in summer; volume patterns are more stable for retailers supplying industrial loads.

Market concentration has diminished

Herfindahl-Hirschman Index (HHI)



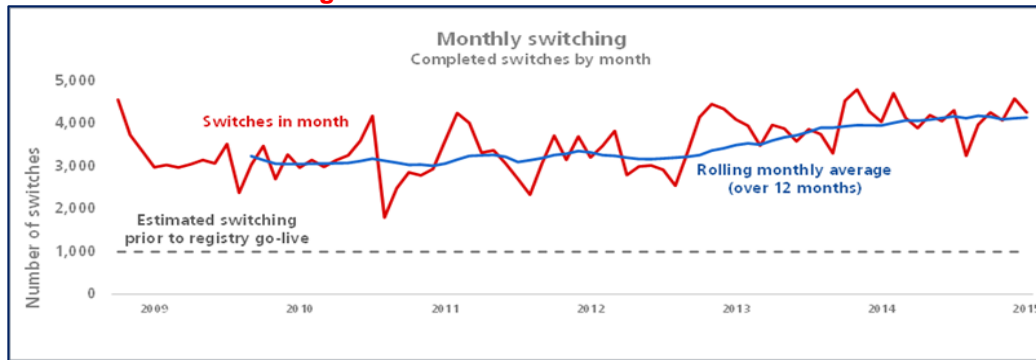
Source: GIC Quarterly Report June 2015

The Herfindahl–Hirschman Index is one way of measuring market concentration by using size and number of competing firms. The index ranges from 0 to 10,000, with a low score indicating a low level of market concentration.

- Nationally, the HHI is 2,423. It was 3,033 when the Gas Registry began in February 2009.
- HHI decrease in all regions indicates the retail market has become less concentrated across the board.
- The more retailers at a gas gate, the greater potential for competition.
- 99% of gas customers are connected to a gas gate where at least 7 retailers trade.

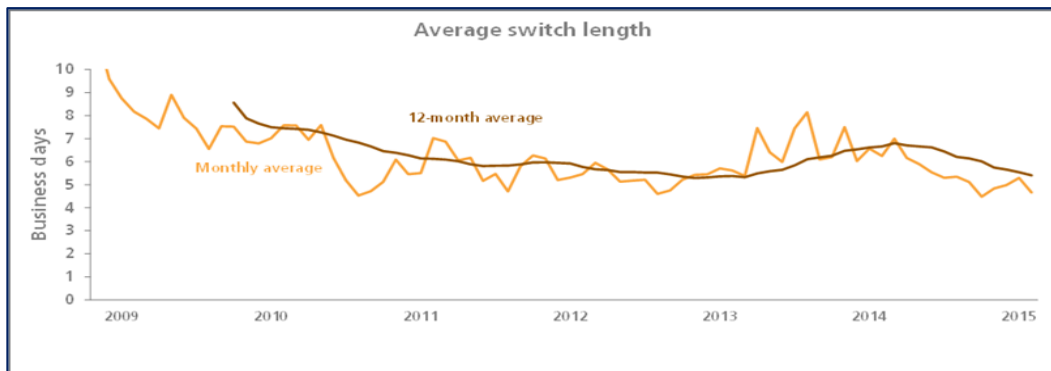
Consumers are embracing their ability to switch retailer

Gas Consumer Switching 2009-2015



- Gas Registry provides a central ICP data base. Switching regime details the process and timeframes.
- Switching rate of 3,000-4,600 a month (18%) vs around 1,000/month pre-2009.
- 54% residential
- 65% small commercial
- 73% large commercial
- 46% large industrial
- ... customers have switched retailer at least once in the past 5 years.

Consumer Switch Time 2009-2015



Source: GIC Quarterly Report June 2015

- Average switching time is around seven days vs weeks/months previously.

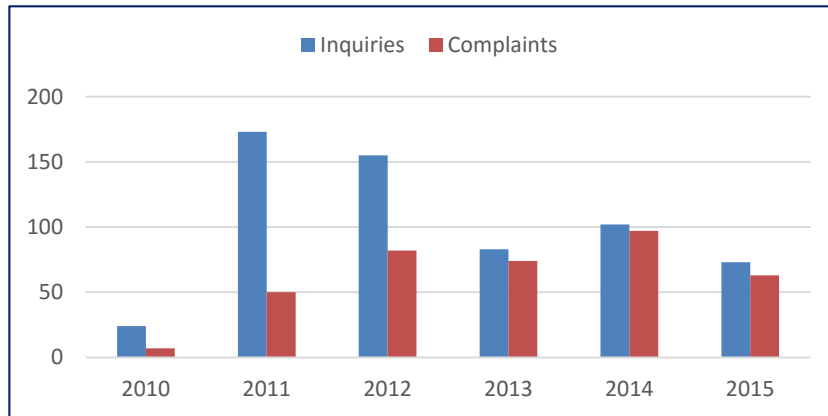
EGCC provides a complaints resolution scheme



- Since 2010 small gas consumers have had access to a free, independent complaints resolution system provided by the Electricity and Gas Complaints Commission (EGCC).
- EGCC scheme recently expanded to include reticulated LPG.
- Covers gas complaints for amounts less than \$20,000, or up to \$50,000 with agreement of the company involved.

The number of gas complaints is relatively low

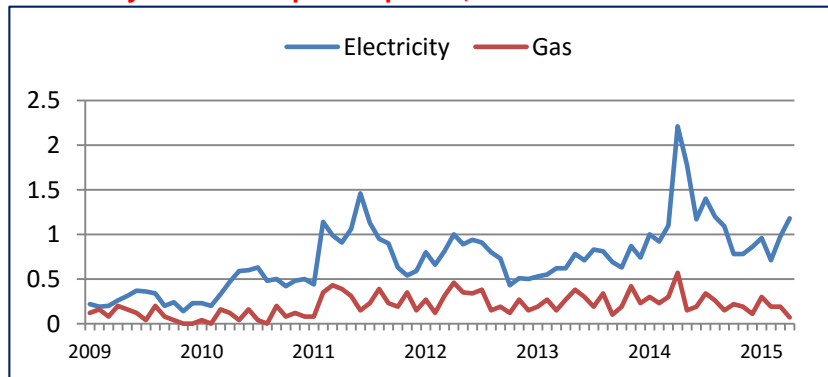
Gas-related Inquiries & Complaints



2015

- Gas complaints/inquiries 136 (2013: 199).
- Dual fuel (electricity and gas) inquiries/complaints 139 (2014: 104).
- Most common complaints are billing (almost half), customer service, metering, supply and lines issues.

Electricity & Gas Complaints per 10,000 ICPs

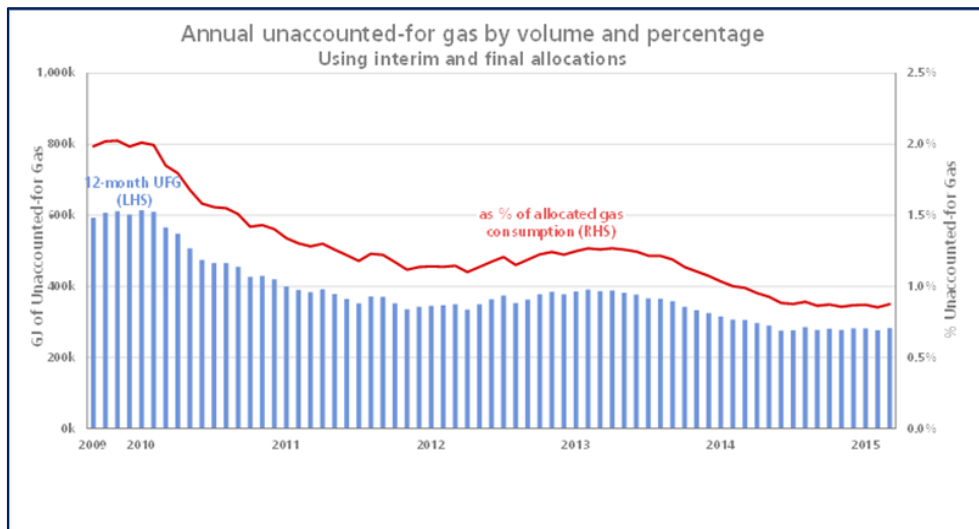


Source: EGCC

- Complaints per 10,000 ICPs: Gas is doing better than electricity (average 0.2/month vs 1.07/month).

Downstream reconciliation is carefully managed

Unaccounted-for Gas 2009-2015



Source: GIC Quarterly Report June 2015

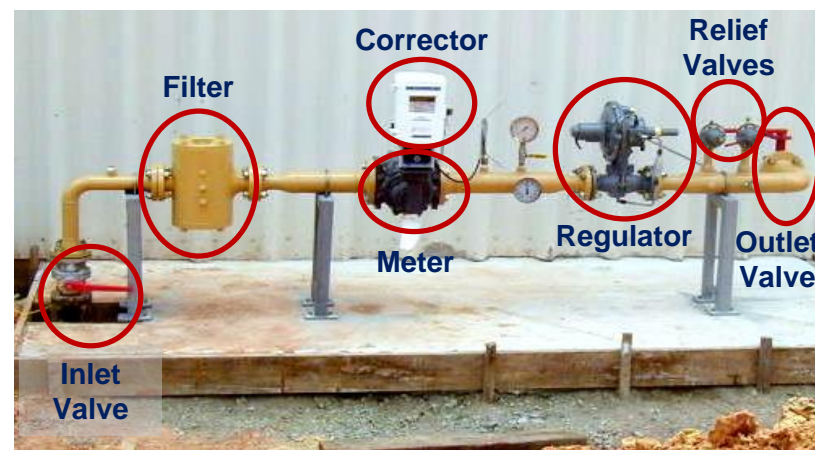
UFG is the difference between gas leaving the transmission system at a gate and the volume consumed by retailers' customers. It imposes an unnecessary cost on the market as it is gas that retailers pay for, but can't sell.

- Volumes of gas consumed are allocated to the responsible retailers.
- An audit regime examines retailers' data management, consumption validation and information provided.
- This process is instrumental in identifying erroneous reporting by retailers and led to uncovering serious misreporting by E-Gas in 2010.
- Process for calculating and allocating unaccounted-for gas (UFG) on a 'socialised' basis
- The move to a rules-based regime has seen UFG halved from 600,000 - 300,000GJ - or from 2% to 1% of gas consumed.
- Ongoing cost savings of \$2.5m/year.

Gas Metering

Metering is critical to accurate billing

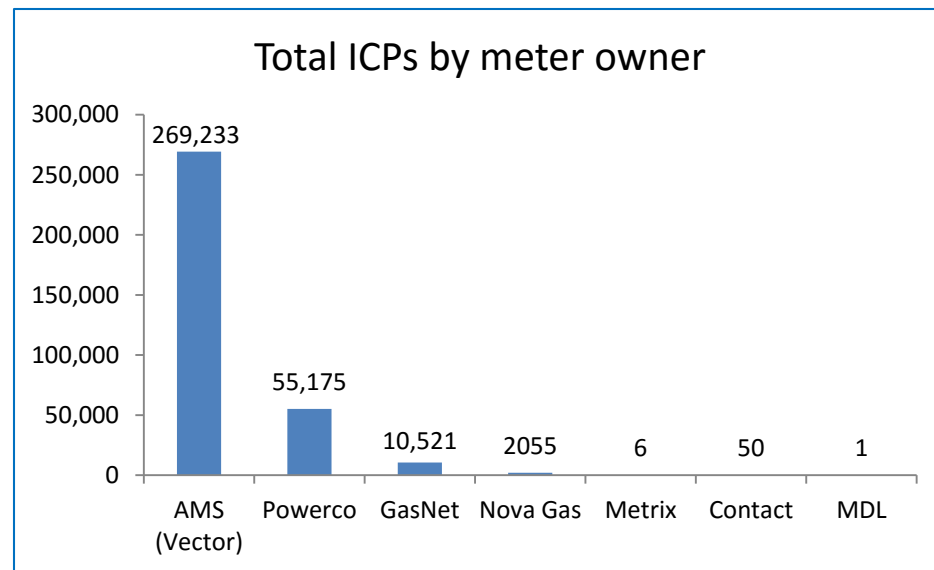
- Gas delivered to a consumer is measured by a meter at the consumer's premises.
- Gas meters are a component of gas measurement systems – (GMS) and are central to accurate billing and system reconciliation.
- GMS are more complex, more expensive than other energy metering systems.
- Meters differ in size/technical complexity depending on amount of gas use at the ICP. Range from standard meters for small consumers (around 95%), to Time of Use (ToU) meters for larger users. Some with telemetry.
- Safety management systems for GMS required since 2013.



Industrial/Commercial Gas Measurement System (GMS)

Metering ownership and regulation

- 7 suppliers – primarily AMS (Vector) which acquired Contact Energy's gas metering business in 2013.
- Gas metering subject to technical regulation (NZS 5259), Gas Act, Gas (Safety & Measurement) Regulations, and reflected in the Reconciliation Rules, industry contracts.
- Commerce Commission has described gas metering services competition as 'limited' and is considering an inquiry into whether they should be regulated.



Source: Gas Registry Statistics. Excludes ICPs where there is Meter Owner assigned, but the registry indicates that no physical meter is in place

Gas meters are getting smarter

- Technology for smart gas meters exists – but not yet rolled out to the same extent as smart electricity meters.
- Installations in New Zealand involve a small number of large ToU consumers.
- Trials of remote reader units fitted to latest technology residential meters. Potential for general roll-out to small gas consumers.
- Main issues for smart gas meters:
 - cost
 - complexity in balancing safety with need to connect to a power source – gas meters subject to an ignition source exclusion zone
 - battery equipment ok but also needs certification and life span limited



Gas Pricing

Gas prices generally reflect market forces

- Competitive forces are at work in the gas market.
- Pricing generally reflects the cost of production and transportation.
- Prices subject to 'sustained downward pressure' arising from:
 - new entrants
 - new fields/production enhancements have increased short-term gas supply
 - consumers able to compare retail prices and switch supplier easily and quickly between multiple retailers
 - transmission and distribution prices constrained by regulation – subject to Comcom price/quality regime from 2013



In search of pricing information – a lot is in the open

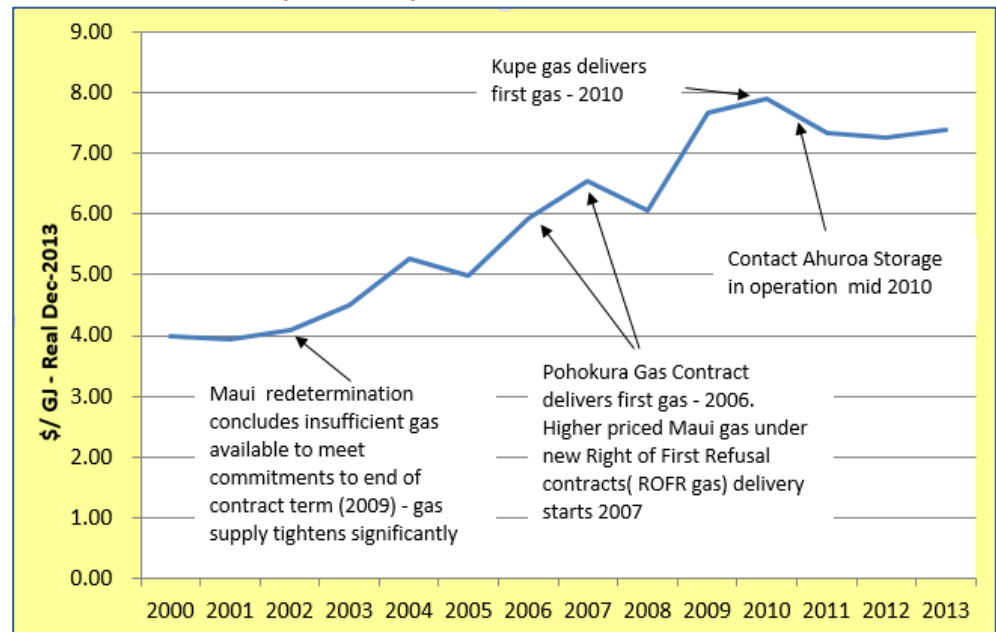


- Variety of public reference points for gas prices.
- MBIE surveys retailers quarterly and publishes price series for:
 - wholesale (GST inclusive)
 - industrial (GST exclusive)
 - commercial (GST exclusive)
 - residential (GST inclusive)
- Other sources of information:
 - posted transmission and distribution tariffs
 - (emsTradepoint) wholesale trades
 - published retail tariffs
 - statutory financial disclosures for regulated companies (transmission/distribution)
 - listed company annual reports
- These aren't comprehensive, and given competitive confidentiality there's no broad visibility of retailers' costs of service and margins.
- Gas price analysis and constructing price bundles necessarily requires assumptions.

There's a variety of influences on the wholesale price

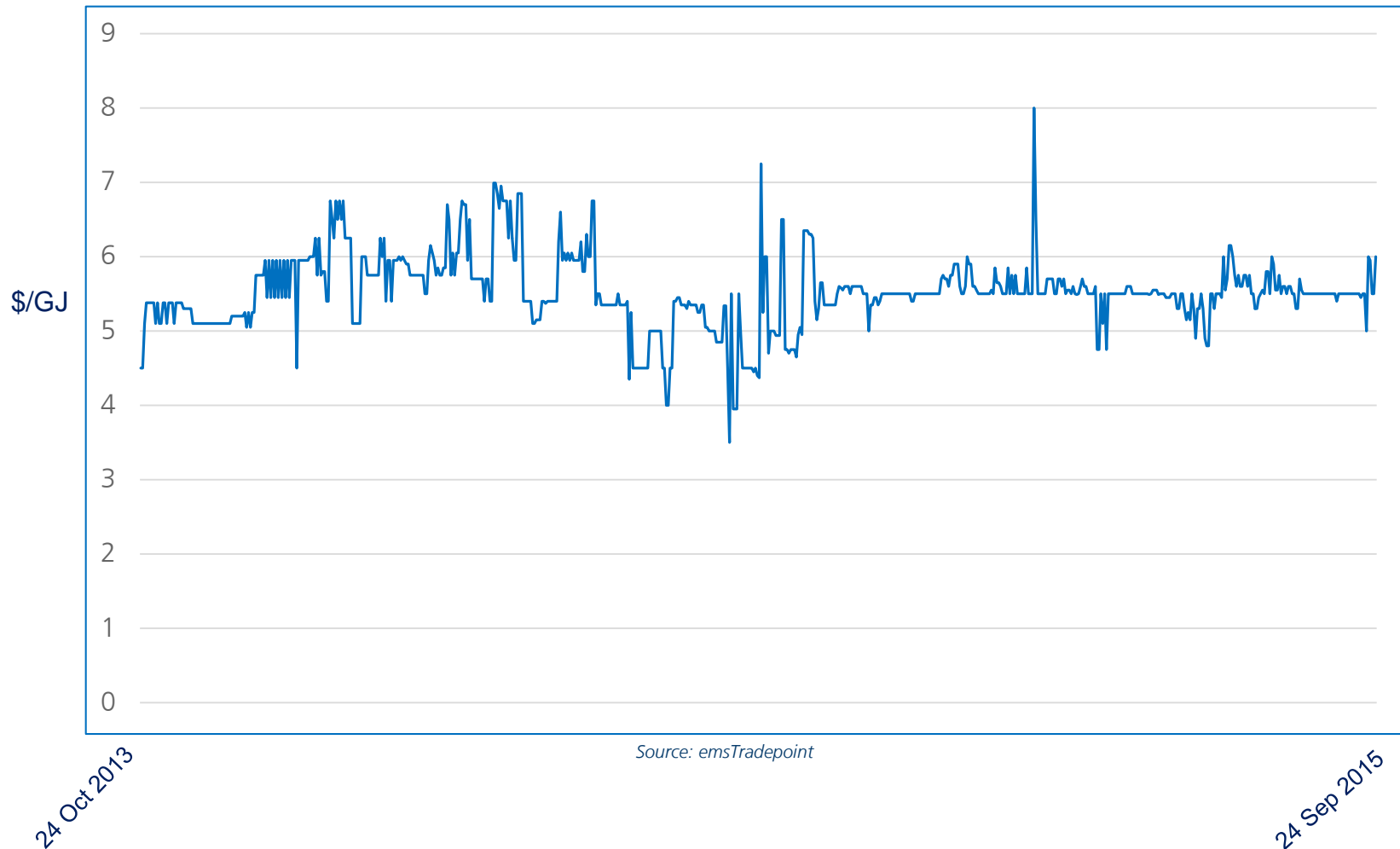
- Producer/buyer Gas Sale Agreements non- standard. Tailored bilateral contracts reflect:
 - supply availability
 - field production characteristics
 - drivers on the seller
 - drivers on the buyer
 - relative negotiating leverage of the parties
 - characteristics of the deal – term, supply security, delivery guarantees, pricing formula, risk-sharing.
- Doesn't include delivery charges.
- MBIE wholesale gas price includes direct sales between producers and wholesalers/retailers, but not potentially significant quantities sold directly to some industrial/ petrochemical users.

Wholesale Gas Price (Real 2013)



Source: Arete Consulting Ltd

emsTradepoint trades have ranged from \$3.50 to \$8.00/GJ – VWAP of \$5.50



And retail price factors are complex



GST



Retail margin



Retail costs



Industry levies



Government levies/charges



Metering



Distribution



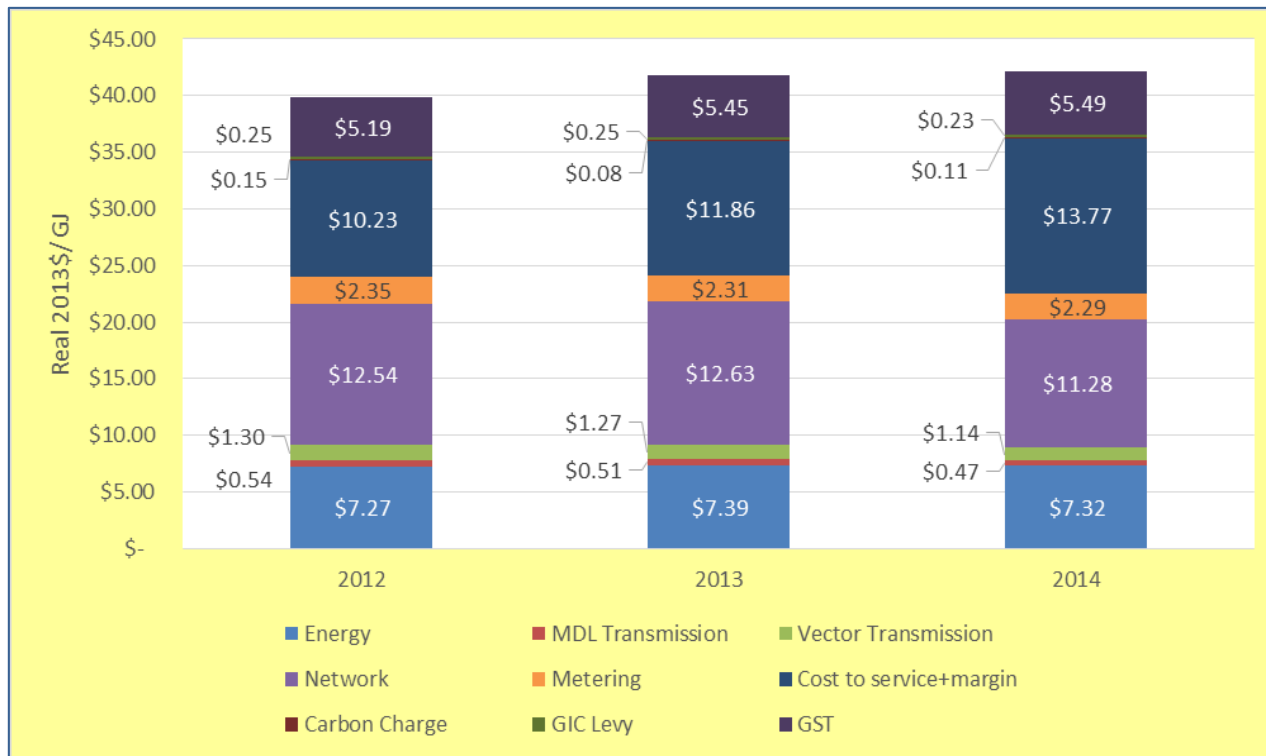
Transmission



Wholesale gas

- Distance pricing element in transmission.
- Consumer segmentation:
 - home
 - business
 - small to medium
 - large
 - industrial
 - rural
- Networks segmentation by load ($\text{sm}^3/\text{h}^{-1}$) – also adopted by retailers.
- Distribution differentials:
 - Vector has five distribution price plans (down from 16)
 - Powerco looking to reduce five pricing regions to two
 - GasNet aims to reduce 11 standard load groups to five
- Retailer discounts (prompt payment, dual fuel, online billing).
- No 'typical' customer in any sector.

A typical residential price stack may look something like this

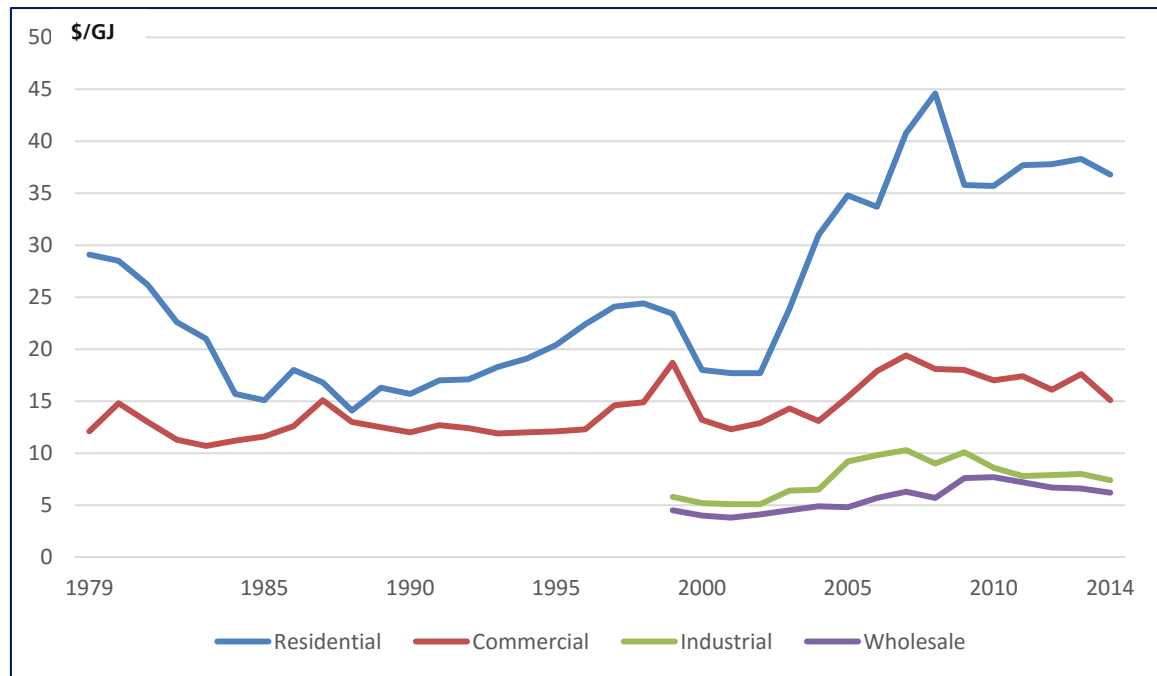


Source: Arete Consulting Ltd

Multiple sourcing and 'cost of supply' have influenced gas price trends

- Prices eased with advent of low-cost Maui gas from 1979
- Pronounced increase from 2002, especially for residential users, as supply moved to multiple sourcing and prices reflect cost of supply (no cross-subsidisation)

Average Natural Gas Cost by Customer Type (Real 2014)

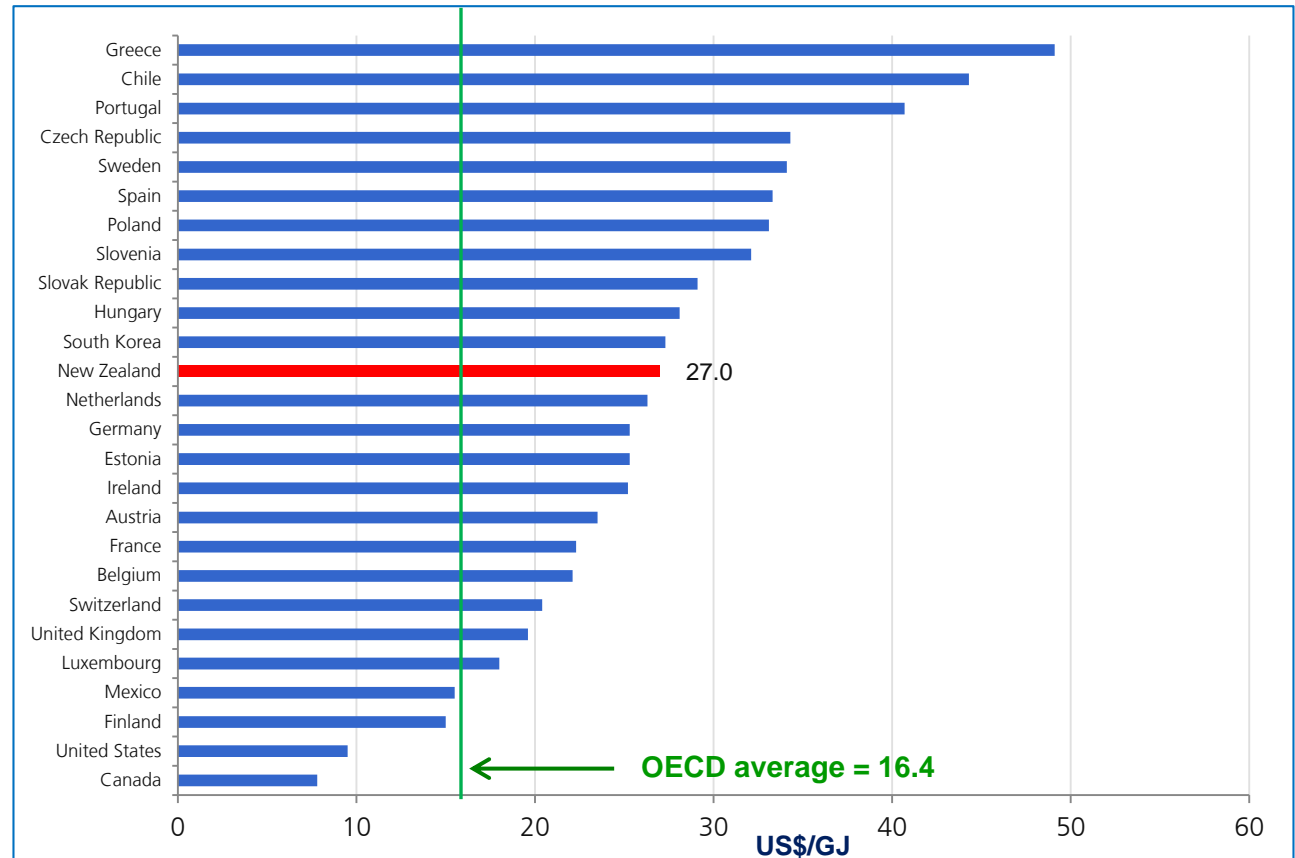


Source: Energy in New Zealand 2015

Where NZ gas pricing sits in the world

- New Zealand's residential gas price is at the higher end of the price range - 15th out of 26 in this list of developed countries

International Comparison in OECD Countries - Residential Natural Gas Price



Source: *Energy in New Zealand*

Data based on energy prices and taxes published by the International Energy Agency (IEA). Product specifications, statistical methodology and information availability can differ between countries. Price for some countries listed as 'not available', including Australia, Italy, Japan and Turkey

Gas Safety

Safety is at the heart of gas industry activity

- Gas is a highly combustible hydrocarbon
- Safety and supply reliability are interdependent
- Key aspects of a safe, reliable gas supply:
 - gas quality to maintain composition and burning characteristics within specification and restricting contaminants
 - odourisation so gas leaks are detectable
 - supply pressure within contracted limits
 - avoiding supply interruptions, particularly through third party damage
 - installation and appliance integrity
- Safety regime previously administered by MBIE (including former DoL) has generally transferred to the new Crown agency, WorkSafe New Zealand
- Industry looking at gas quality arrangements



The safety requirements are comprehensive

- A range of safety/quality requirements apply across the gas supply chain
- Many recently updated and strengthened through generic workplace and industry-specific legislation:
 - establishment of WorkSafe, absorbing Energy Safety, High Hazards Unit, pipeline safety, general HSE
 - HSE regime under EEZ legislation includes offshore oil/gas exploration
 - HSE (Petroleum Exploration & Extraction) Regulations 2013
 - Gas Safety & Measurement Regulations 2010
 - requirements for safety management systems
 - changes to PGD certification regimes in 2013
- Other legislation includes:
 - HSE (Pipelines) Regulations 1999
 - Plumbers, Gasfitters and Drainlayers Act 2006
- Standards
- Pipeline easement and network management practices



Standards play a key role by incorporation

- Technical in nature and cover numerous, detailed operating and network requirements.
- Standards don't carry the force of law – they are applied through mechanisms such as contracts, statutes or regulations specifically requiring compliance with a standard.
 - eg: Gas (Safety and Measurement) Regulations 2010 cites over 20 different standards
- Variety of official standards relevant to the gas industry. Some key ones are:
 - NZS5442: specification for reticulated natural gas
 - AS/NZS 4645: Gas distribution networks
 - AS/NZS 5601: Gas installations
 - NZS 5255: Safety verification existing installations
 - NZS 5259: Gas measurement
 - NZS 5266: Gas Appliance safety
 - NZS 5266: gas detection and odorisation
 - NZS 790: safety management systems for electricity and gas industries



Special safety requirements for high pressure pipelines...

- Transmission pipelines must have current Certificate of Fitness – renewable every five years.
- Specifically required to appoint pipeline operations managers to supervise health and safety.
- Duties in relation to land occupiers and controlling authorities.
- Provisions for emergency procedures.



... and for gas appliances

- New Zealand/Australia safety regime for appliances harmonised in 2002 – part of Trans-Tasman Mutual Recognition Agreement (seamless market).
- Common New Zealand/Australian gas appliance approval mark – the 'Gas Tick' agreed in 2009, with the compliance mark required on appliances since 2012.
- Formal declaration from appliance suppliers that their appliances meet safety requirements.
- Approved appliances listed on Energy Safety website – retailers/gasfitters must confirm the appliances they sell/install are listed.



When used for gas product, this label/mark is called the Gas Safety Compliance Label. When used for gas installation work it is called the Gas Authentication Mark.

Gas quality is important to supply reliability

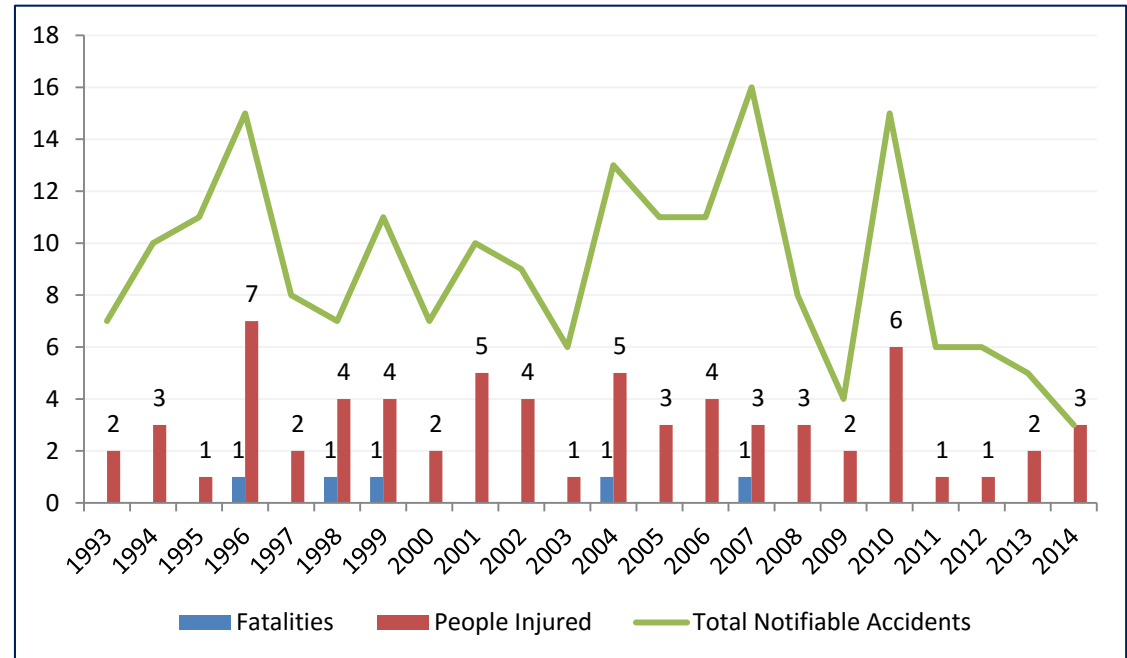
- Quality important to combustion performance, safety, supply reliability and long-term pipeline integrity.
- Prospects of serious quality-related incident are small, but consequences severe.
- Pipelines are a 'common use' facility involving multiple parties. Transparency of quality management important for all users.
- No evidence that quality is not being managed properly throughout supply chain – but not that visible (commonly in contract provisions).
- Main concerns:
 - ability for parties with the legislative responsibility for complying with the specification (wholesalers & retailers) to demonstrate compliance while not physically controlling gas quality.
 - costs associated with a quality-related outage may not be borne by the party that caused it.
- Industry *Gas Quality and Procedures* document sets out legal requirements and industry procedures for managing gas quality.



There's no obvious trend in natural gas safety incidents

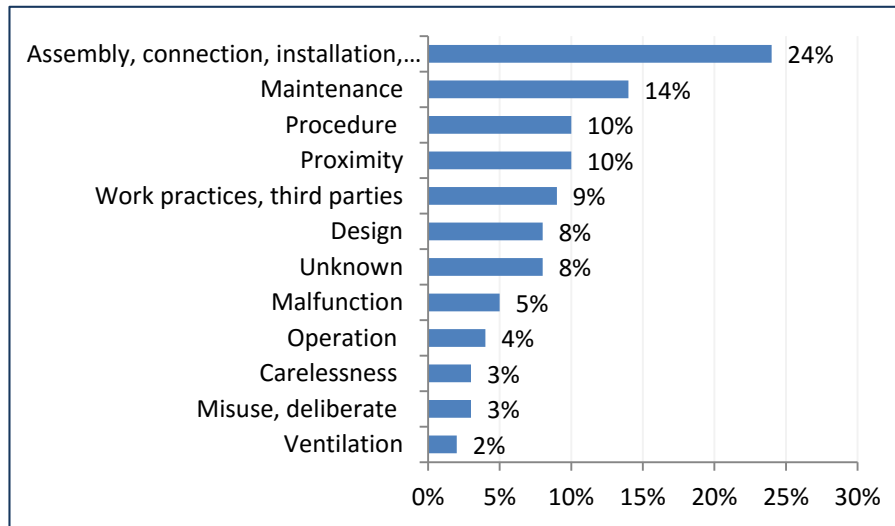
- 198 notifiable natural gas accidents in 22 years to 2014.
- Five fatalities, and 55 events injuring 68 people.
- Given the small number, there's no discernible trend, although 3 fatalities involved fixed space heaters and the other two a cooker and a water heater.

Notifiable Natural Gas Accidents 1993-2014

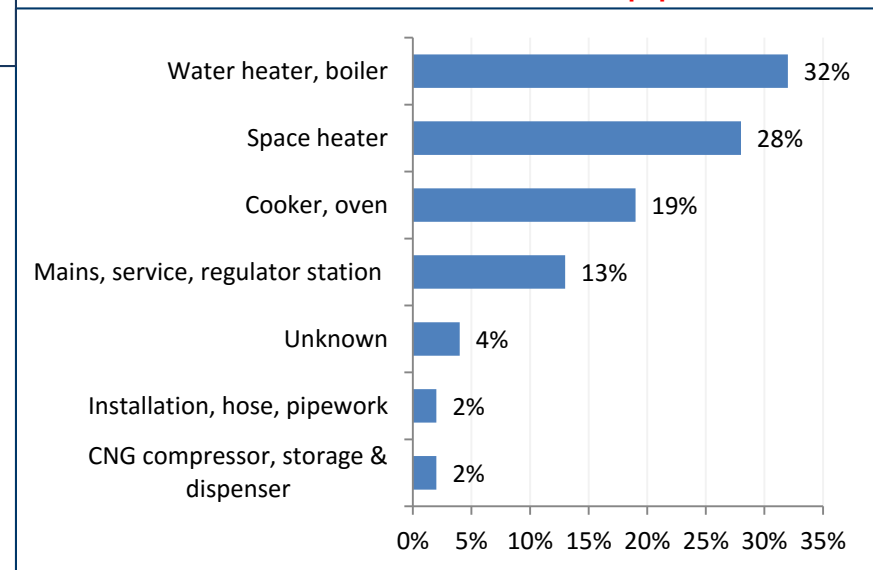


But incidents are tracked by cause and equipment

Causes 1993-2014



Equipment 1993-2014



Gas in a carbon-conscious world

Gas has a voice in the greening economy debate

- Gas is part of the global debate on climate change and the drive for greener economies.
- Internationally, gas has an important role in environmental sustainability:
 - cleanest burning among fossil fuels
 - for many countries it is a bridge to a greener future by replacing more harmful energy forms (coal, oil)
- Opportunities for gas substitution in NZ fewer than in other countries (US, Australia) because we already have a high level of renewable energy:
 - 40% of primary energy
 - 80% electricity generation; 90% target by 2025
- Direct gas use and efficient technologies can lower energy emissions.



‘Making the most of the country’s abundant energy potential for the benefit of all New Zealanders’ through.. ‘the environmentally responsible development and efficient use of the country’s diverse energy resources’ – New Zealand Energy Strategy

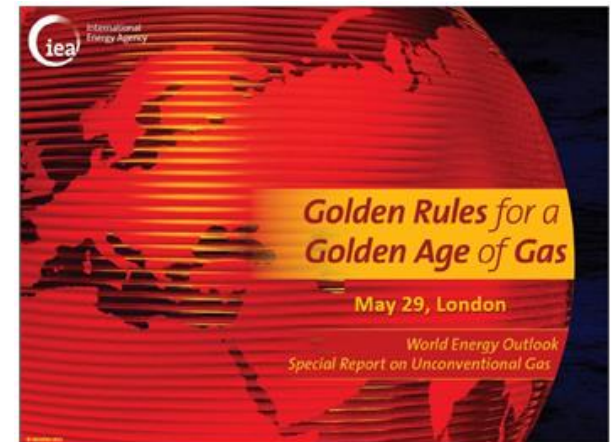
Gas is growing and could change the nature of the debate

- IEA predicts 70% increase in world electricity demand by 2035 – underpinned by doubling of gas-fired generation.
- Context of mounting worries about energy security, climate change, nuclear power.
- US leading the way in unconventional gas. Shale gas is driving down prices and coal-fired generation:
- Australia has 15% gas-fired generation, but heavily reliant on coal (75%).
- Australian gas production has soared – CSG contribution up from 2% to 13% in 10 years. Much is for export.



But there are concerns and calls for caution

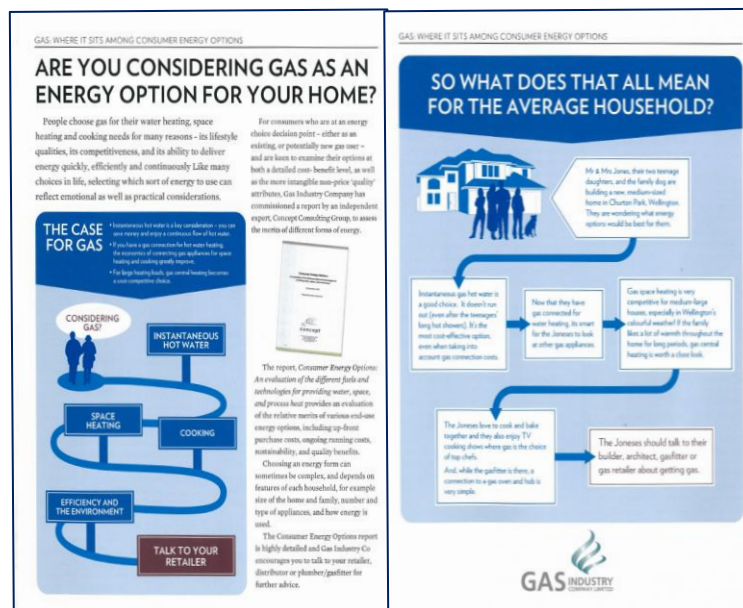
- Environmental impacts of tracking and natural gas leaks.
- Cheap gas may deter alternative energy developments.
- IEA 'golden rules' – principles that should be followed or risk set back/halt to unconventional gas 'revolution'.
- New Zealand Parliamentary Commissioner for the Environment 2012 report on fracking - regulators 'scrambling to catch up'.
- PCE's final report (2014) - regulation in New Zealand not adequate for managing oil and gas drilling environmental risks. Calls for
 - national policy statement on unconventional oil and gas
 - better well design
 - improved rules in regional council plans
 - greater action on climate change risks



Looking ahead

Gas remains strongly competitive...

- Instant gas hot water most cost-effective even if the home doesn't have an existing gas connection
- Gas best option for new industrial boilers

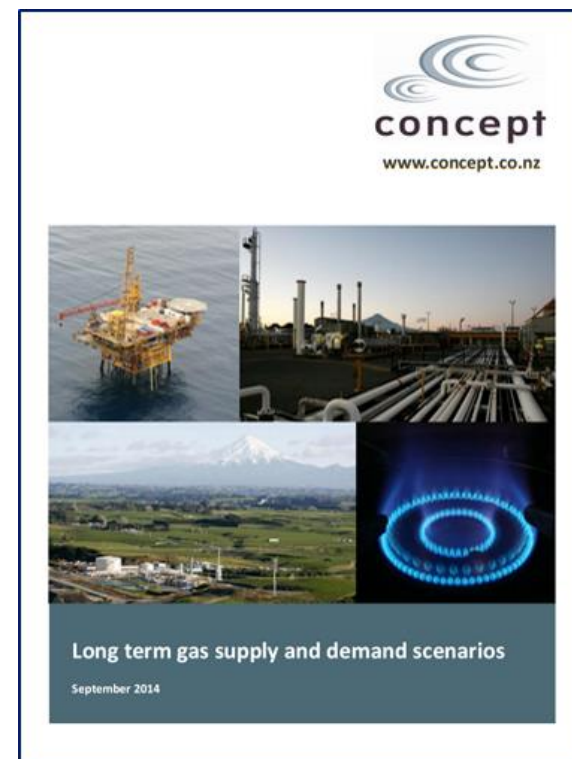


- Space heating options vary depending on house size, insulation, and preferences. Gas competitive with heat pumps if already a connection for water heating
- The carbon footprint of gas-fired space and water heating is less than some electric heating options and similar to high efficiency electric heat pumps

Supply & demand scenarios

Gas discoveries are sporadic and all have different characteristics. Three scenarios reflect possible futures for New Zealand...

- **Plentiful supply** – where the discovery exceeds the market's ability to absorb it
 - lower prices
 - new petrochemical or other demand increases
- **Moderate supply** – where the discovery closely matches demand over time
 - upstream replaces 200PJ used each year
 - existing methanol plants act to balance demand with supply
 - prices influenced by economics of producing methanol in New Zealand
- **Tight supply** – where insufficient gas is found to meet demand
 - methanol plant demand declines to match supply, or ceases
 - reduced consumption by other large users – electricity generation, urea, industrial process heat
- **What's likely?** – New Zealand will cycle between these scenarios, rather than move to just one. Market will find equilibrium



Commercialisation options...

Two reports on the opportunities and challenges presented by a major new gas discovery:

Report 1: Woodward Partners (John Kidd)

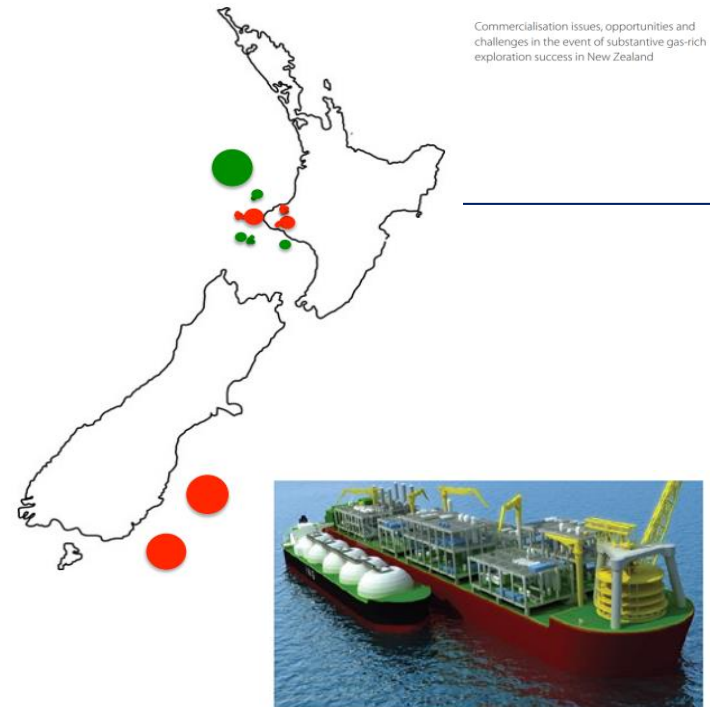
Written at a time of unprecedented exploration activity – high level view of challenges and opportunities associated with a significant new gas find

Report 2: Concept Consulting (Simon Coates)

More detailed assessment of what New Zealand might actually do with such a find

Report 1 – how exploration success might unfold

- North and South Islands are different worlds
- South Island a blank slate
 - no natural gas
 - no infrastructure
 - transformational market development opportunities
- North Island market is mature
 - infrastructure well established, highly reliable
 - substantial recent demand growth attributable to one player (Methanex)
 - but market concentration, reduced demand.
- Possible LNG exports vs overall benefits to NZ. Floating production technologies may mean gas won't land in NZ
- LNG carries price shock risk through move to export price parity



Report 2 – demand options for new gas discoveries

- New gas discoveries may exceed the current domestic market to absorb them
- But there are options for growing the market to absorb surplus production
- Feasibility depends on a variety of external factors
 - world energy prices
 - currency exchange rates



Option – LNG export

- LNG exports for discoveries 3,000-4,000PJ and over
- LNG sale into Asia is potentially one of the most valuable options for a large new gas discovery in New Zealand, even allowing for processing and shipping costs
- Lower shipping costs to Asia compared with, eg US Gulf Coast
- Higher liquefaction costs in New Zealand offset by floating liquefaction developments



Option - petrochemicals

- Methanol, ammonia/urea manufacture for fields not large enough to warrant LNG development
- These are mature technologies with products sold into well-developed international markets
- New Zealand still importing some of its urea requirements



Option- transport fuel

- Emerging technologies for natural gas use as heavy duty haulage transport fuel potentially offer lower fuel prices
- 'micro' production technologies enabling pipeline gas to produce LNG and establish refuelling bases
- Scale of likely New Zealand demand insufficient to underwrite a new gas discovery on its own
- Fuel blend possibilities –eg: methanol/traditional fuels



Duel diesel/LNG powered train - USA



LNG-powered truck



Shell LNG refuelling station - Canada

Option – electricity generation

- Electricity generation historically important to commercialising gas finds
- Opportunities for developing new baseload gas-fired generation are constrained by electricity demand growth and rising competitiveness/use of renewables – particularly geothermal and wind
- Gas is the most competitive energy for peaking generation, but the quantities of gas involved are relatively small
- Continuing developments in electricity generation fuel mix



Nova Energy – McKee Power Station

Option – retail market

- Direct gas use in the residential, commercial and industrial sectors is a steady, but relatively small demand source
- Most significant opportunities to switch to gas in the North Island have already been taken up
- In the South Island, any find not justifying LNG export could displace existing coal applications – but challenges include scale limitations and pipeline development costs



Fonterra Dairy factory - Whareroa

Report 2 conclusions...

‘Taken together, these options mean there should be a ready source of demand for significant New Zealand gas discoveries...’

‘As such, New Zealand should not be disadvantaged for exploration investment relative to other locations around the world which are distant from the core oil and gas markets of the US, Europe and Asia.’



Overall - there are some head winds for the NZ Gas Story ...

- Gas in strong competition with electricity and other fuels
- Gas networks affected by new distributed generation
- Energy demand is flat
- Dealing with the carbon challenge
- Big new gas find is proving elusive
- Oil price downturn affecting investment



but the gas sector remains in good health...

- Gas still making a major contribution to the New Zealand economy and energy mix
- It is providing consumers with a competitive energy choice
- Its role is changing, but it is still a good story
- New Zealand is still an attractive exploration destination.
- Homes will be found for new gas



Discussion