



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

August 2014

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# Who are we – and why are we here

- We're the industry body and co-regulator
- We're telling the 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...

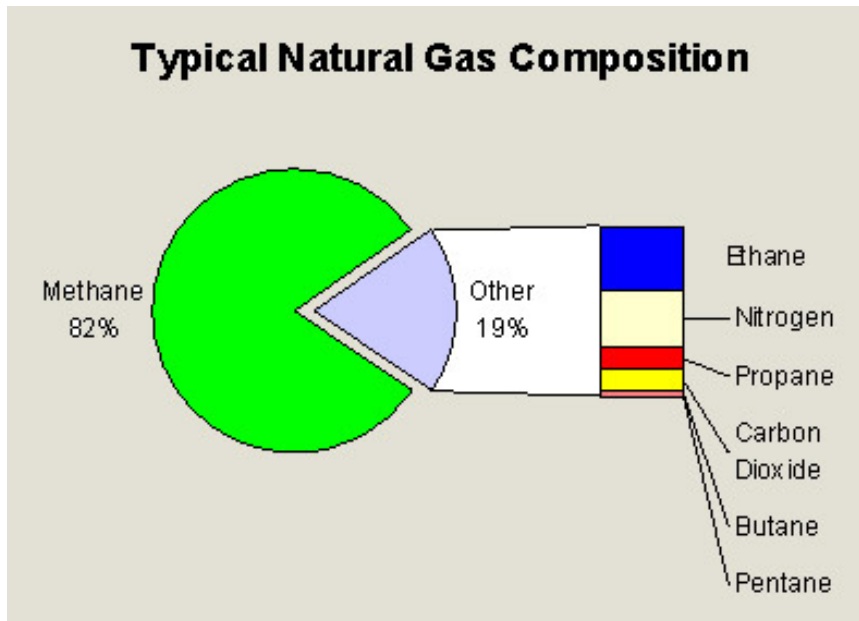


# What we'll cover...

- 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
  - transmission ← we'll take a short break here
  - 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
- Condensate – a light oil

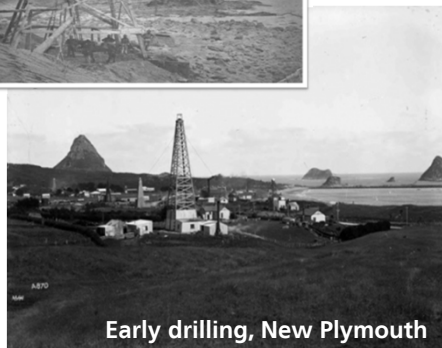
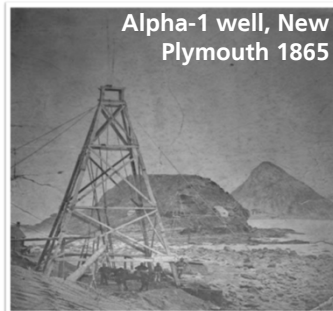
# Gas has a long history



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.

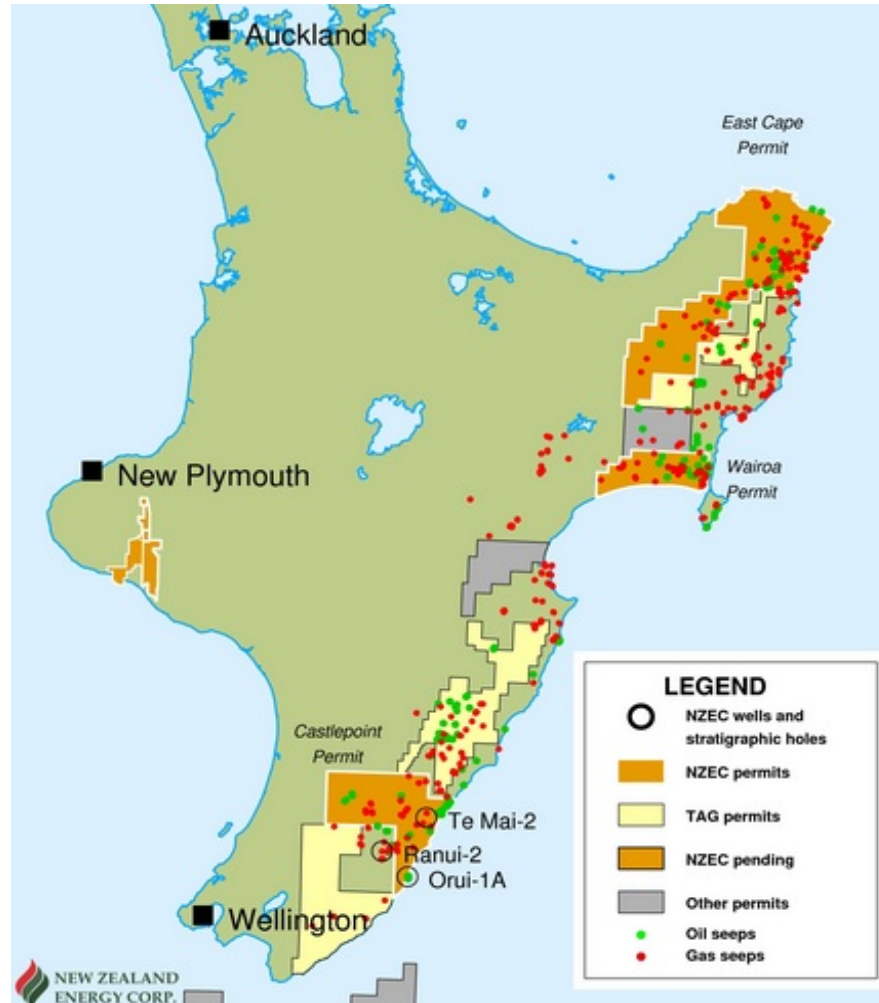


The modern natural gas era began when a drilling rig struck gas at 4,000m at Kapuni in 1959 and began flowing in 1970....

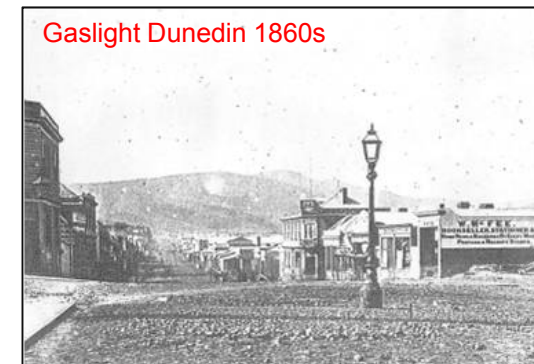
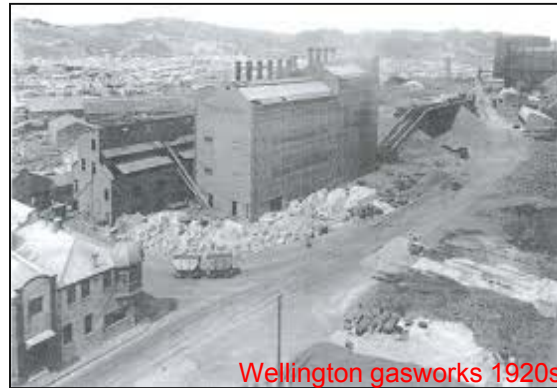
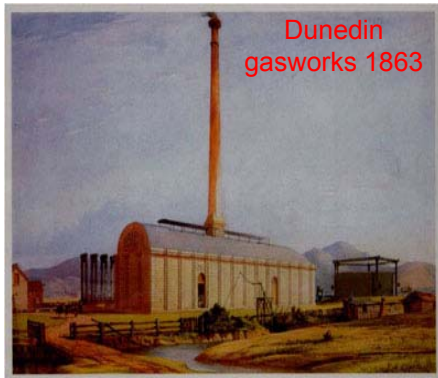
...and received a major boost with the offshore Maui field discovery in 1969.



# Seepages still abound – like on the East Coast



# 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...





# they underpinned electricity supply security...



# enabled substantial petrochemical development...



# and established a domestic LPG industry...



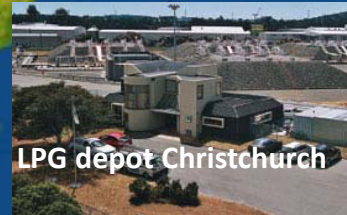
# ...that services the whole country with LPG



LPG depot Auckland



LPG depot, New Plymouth

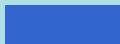



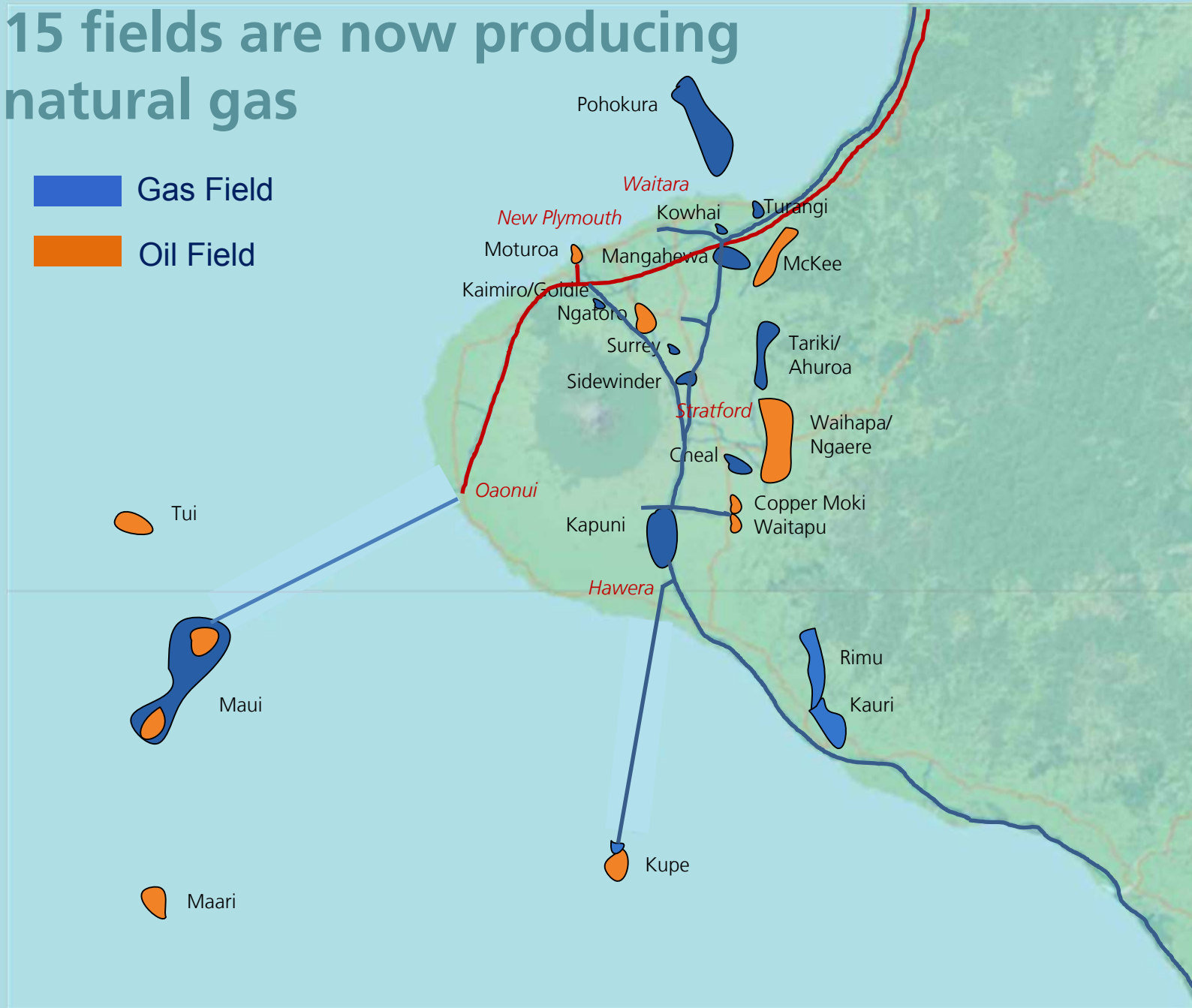
LPG depot Christchurch



LPG depot Dunedin

# 15 fields are now producing natural gas

-  Gas Field
-  Oil Field

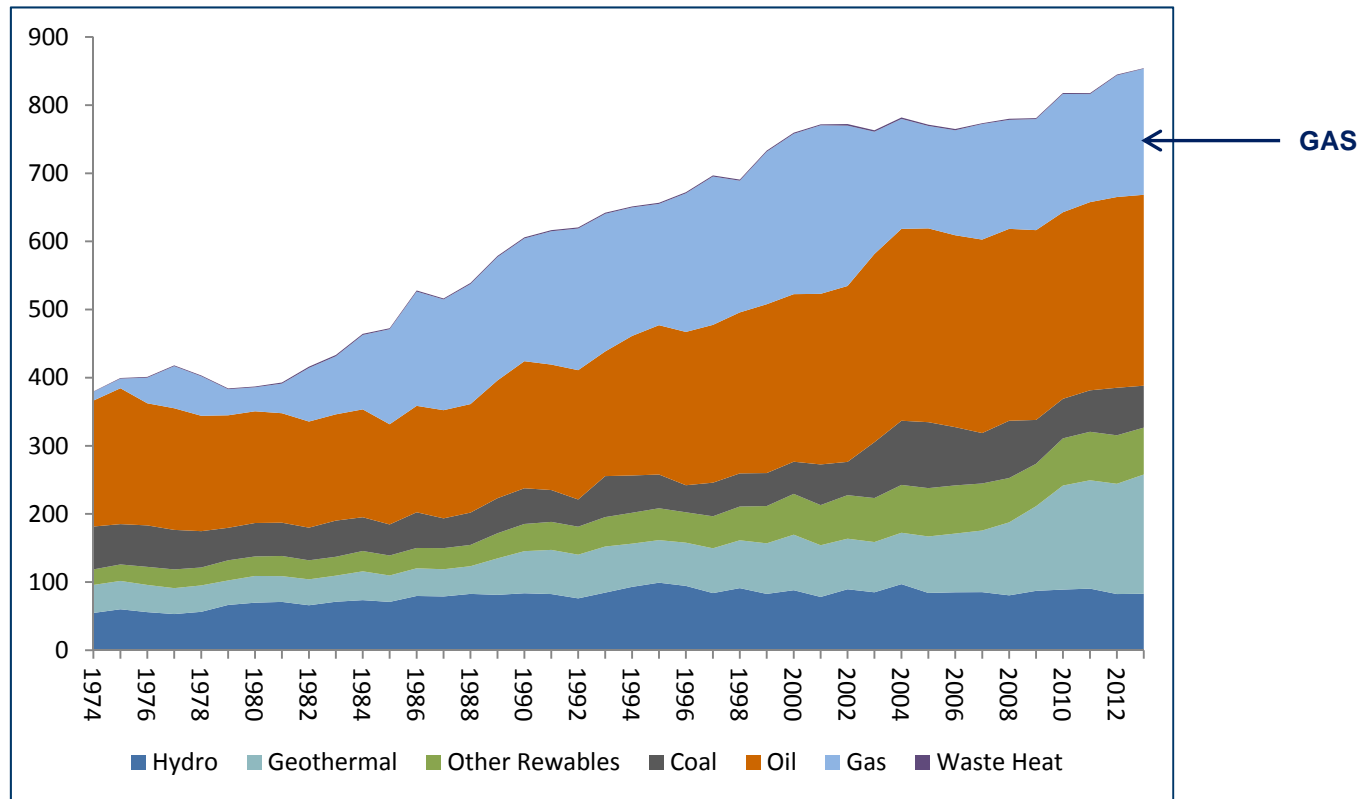


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# Gas contribution to New Zealand's energy

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

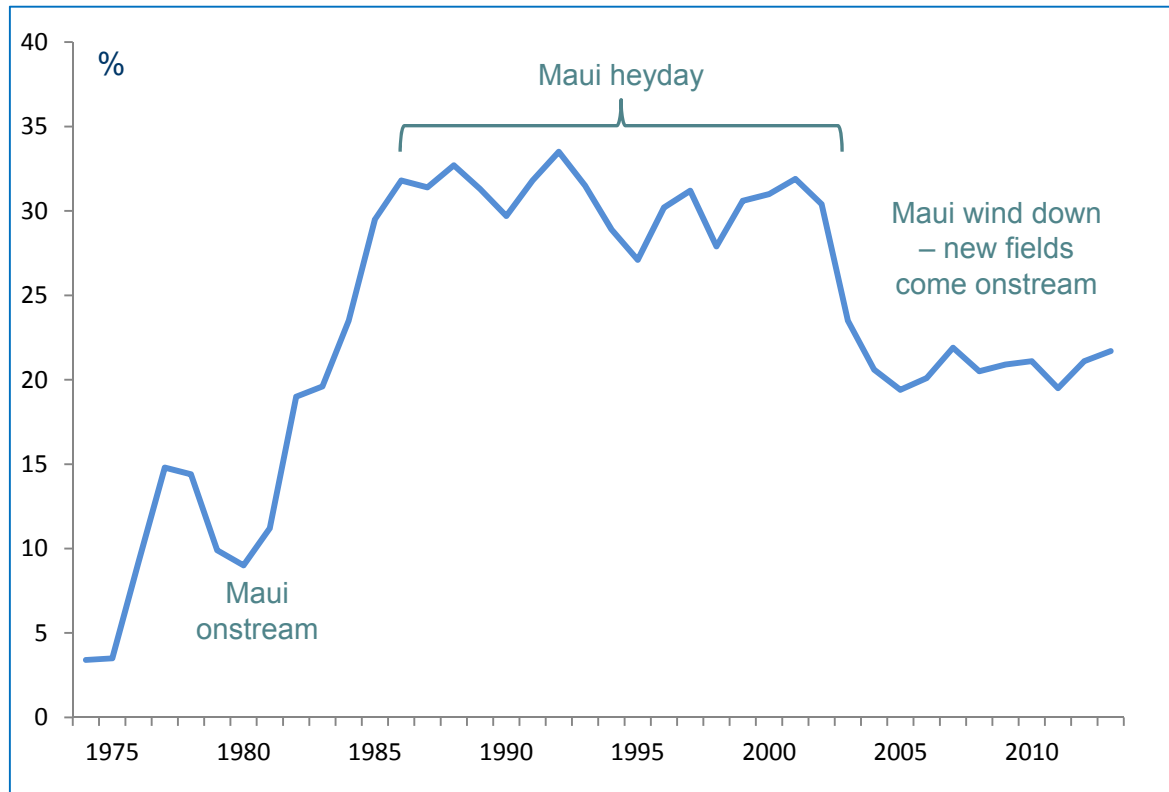
Primary Energy Composition 1974-2013



Source: 2014 Energy in New Zealand

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

Gas Contribution to Primary Energy Supply 1974-2013

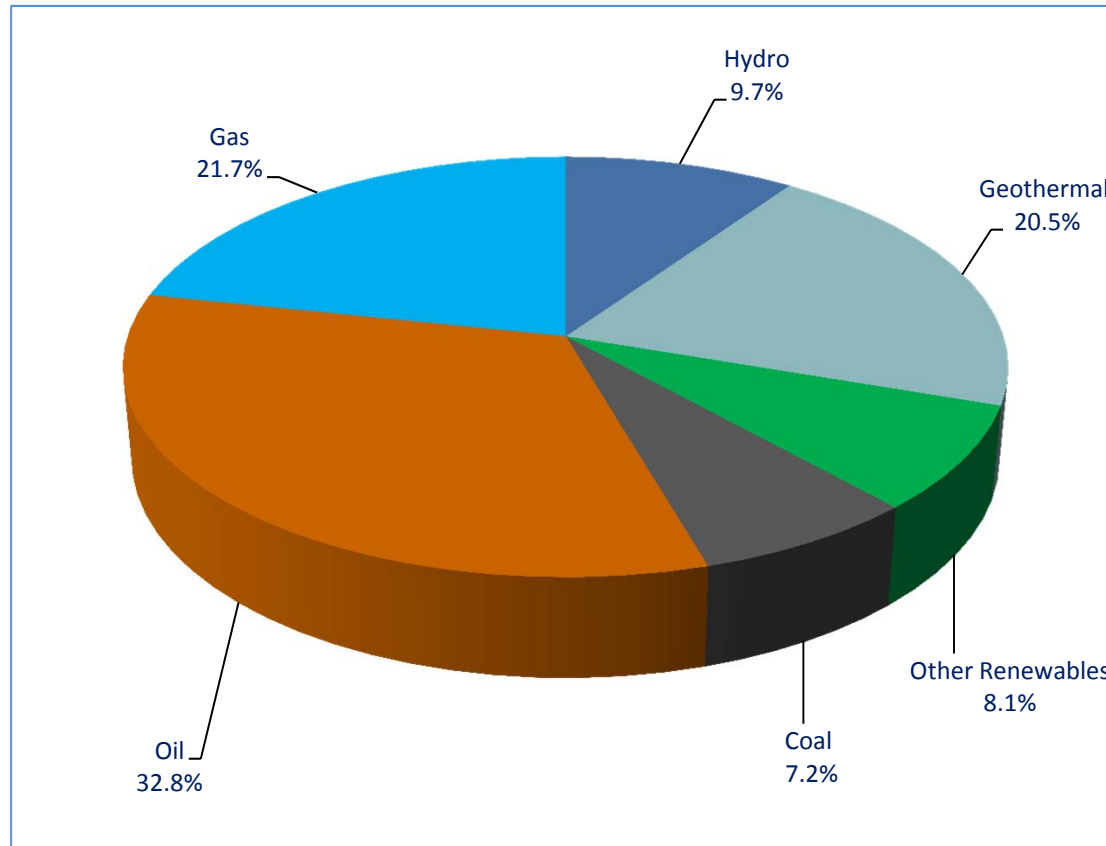


Source: 2014 Energy in New Zealand



# Today gas provides over 21% of primary energy

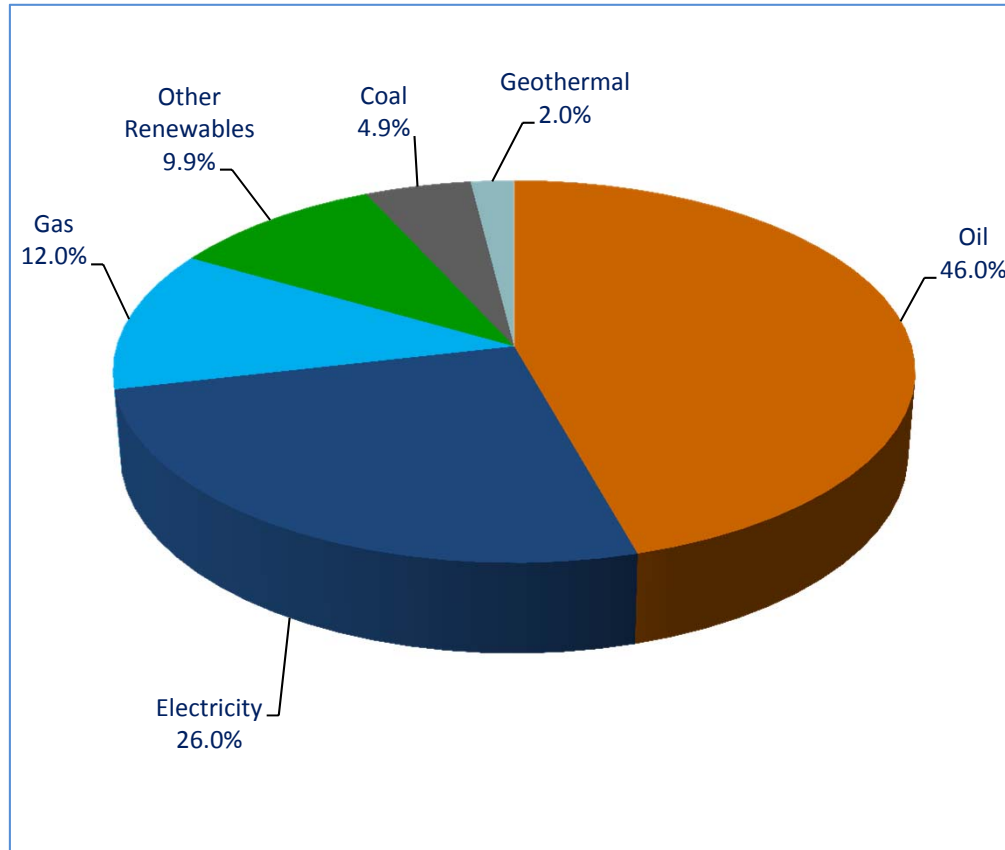
Primary Energy Supply 2013 (854PJ)



Source: 2014 Energy in New Zealand

# ...while accounting for 12% of consumer energy use

Consumer Energy Demand 2013 (544PJ)



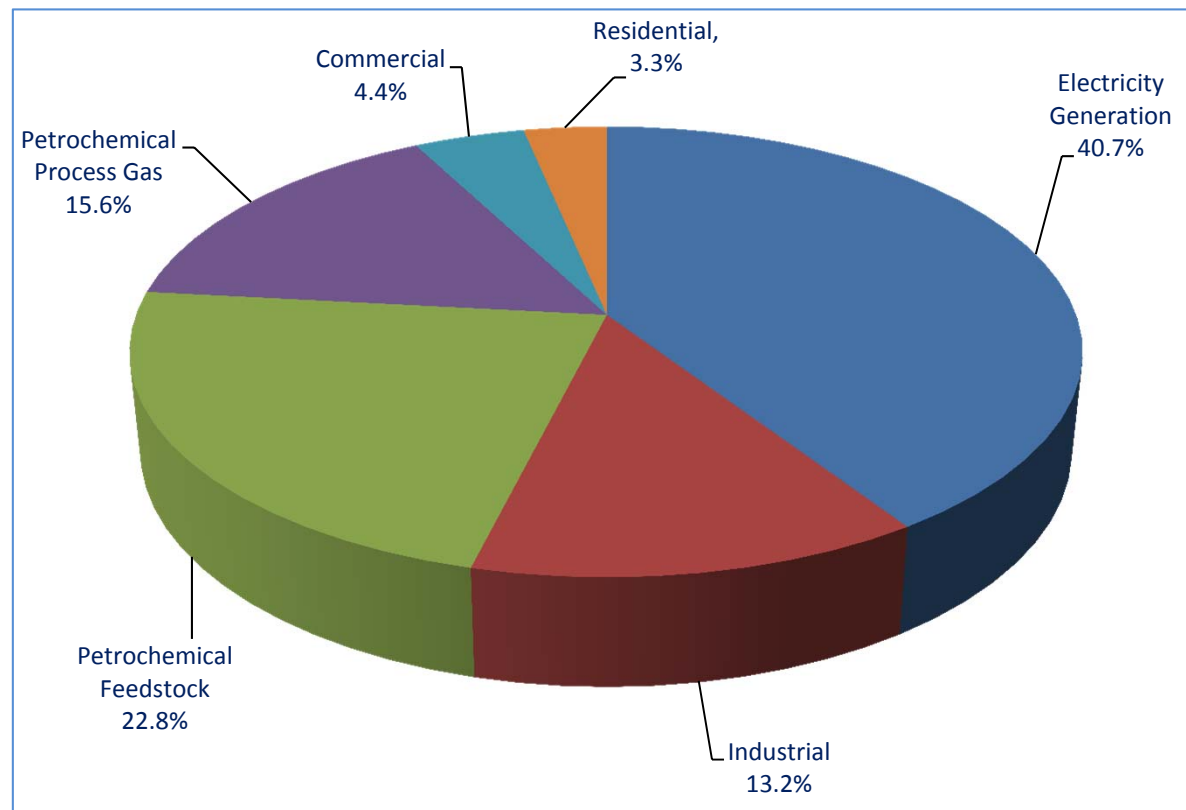
Source: 2013 Energy in New Zealand

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# How gas is used

# Up to 80% of gas is used as a transition energy for electricity/petrochemicals. 248,000 households use just 3.3%

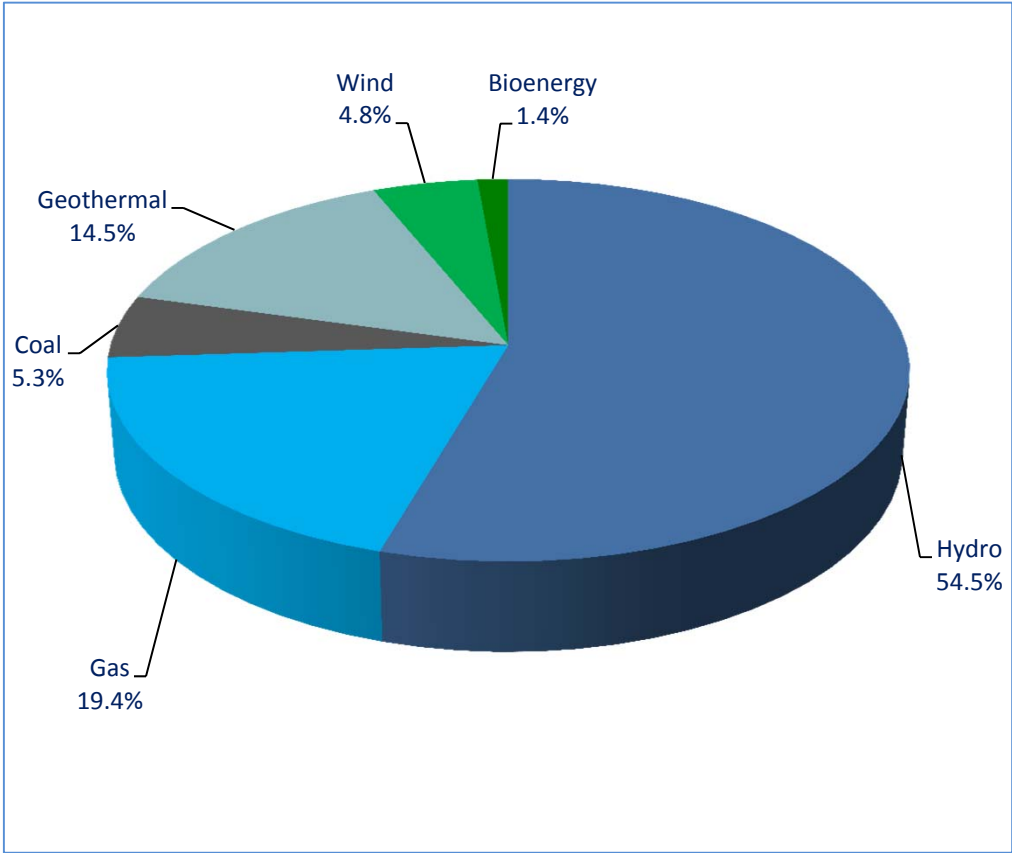
Consumer Gas Use 2013 (174PJ)



Source: 2014 Energy in New Zealand  
Petrochemical usage accounts for 38.4% of total

# Gas accounts for 19% of electricity generation

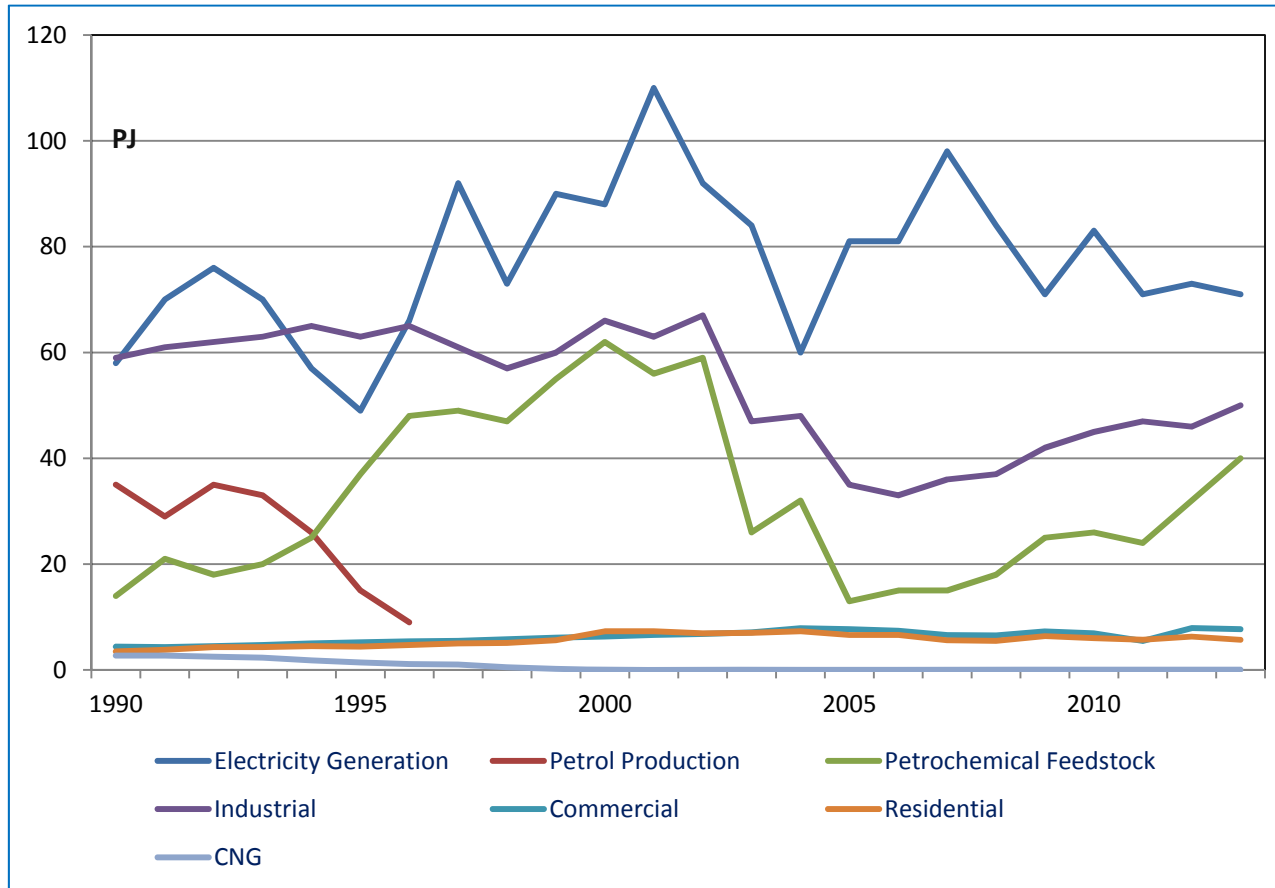
Electricity Generation by Energy Type 2013 (41,876 GWh –151PJ)



Source: 2014 Energy in New Zealand

# Gas use trends changed over time

Gas Use by Consumer Group 1990-2013



Source: 2014 Energy in New Zealand  
Industrial includes 27PJ petrochemical process gas

# 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

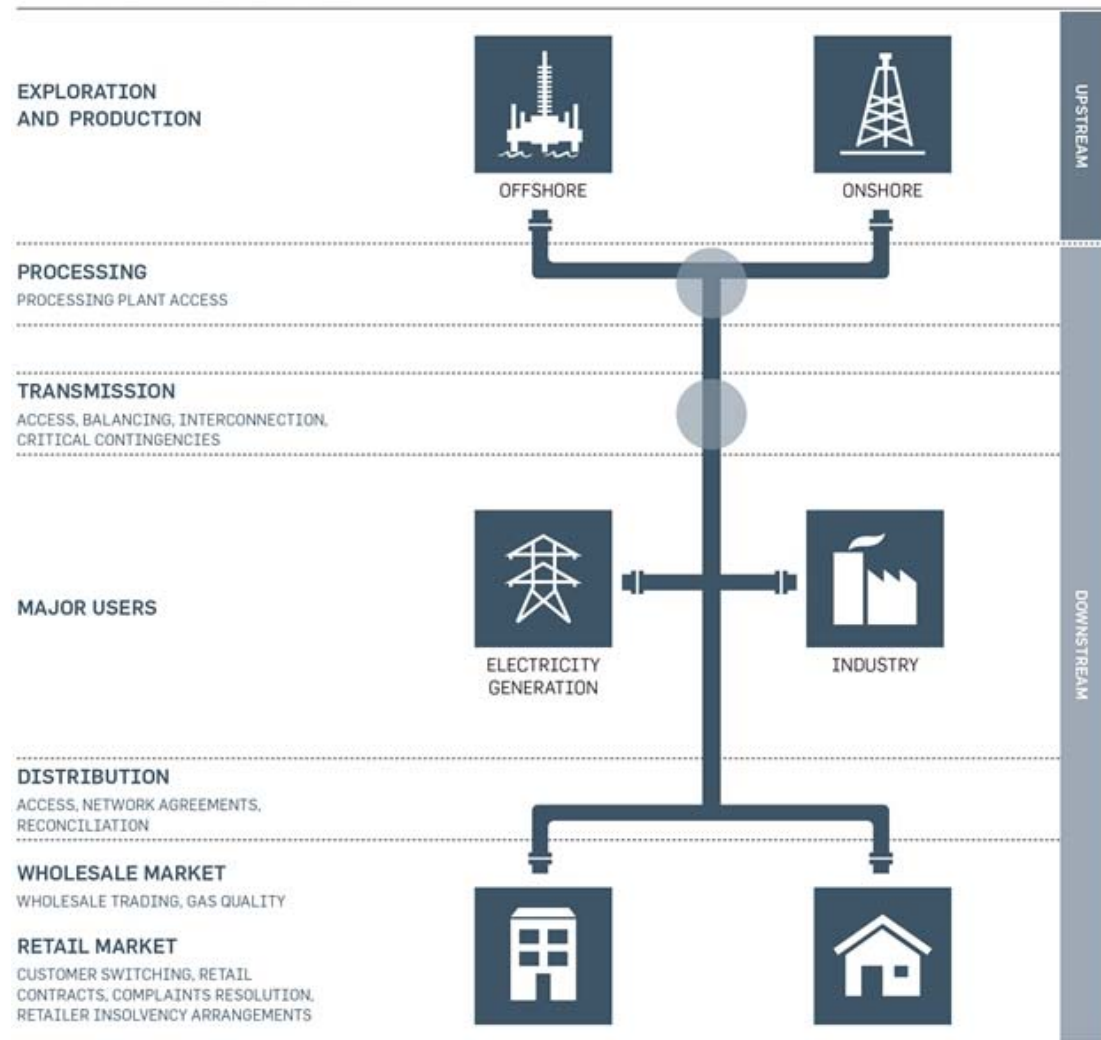
Consumers 4,400  
Volume TJ 1,709  
Total volume share % 1.0



— Vector Pipeline System

— Maui Pipeline

# Industry Structure





# More participants, but industry is concentrated

Major Fields % Net Production	McKee 1.6%	Mangahewa 7.7%	Maui 20.2%	Kupe 14.7%	Kapuni 6.2%	Ngatoro 1.0%	Kowhai 1.9%	Turangi 3.5%	Pohokura 39.5%	Rimu/Kauri 0.2%	Cheal <sup>1</sup> 0.0%	Sidewinder 0.8%
<b>Producers</b>	Todd Taranaki		Shell 83.75% OMV 10% Todd Energy 6.25%	Origin Energy 50% Genesis Energy 31% NZOG 15% Mitsui E&P 4%	Shell 50% Todd Energy 50%	Greymouth Petroleum 100%			Shell 48% Todd Energy 26% OMV 26%	Origin Energy 100%	TAG Oil 100%	
	Operator Todd Energy		Operator Shell Todd	Operator Origin	Operator or Shell Todd	Operator Greymouth			Operator Shell	Operator Origin	Operator TAG	
<b>Wholesalers</b>	Vector			Nova Energy (part of Todd Corporation)			Contact Energy			Greymouth Petroleum		
<b>Transmitters</b>	Vector						Maui Development					
<b>Distributors</b>	Vector			Powerco			GasNet (part of Wanganui Gas)			Nova (part of Todd Corporation)		
<b>Retailers</b>	Genesis Energy	Energy Online (Part of Genesis)	Nova Energy (part of Todd Corporation)	Contact Energy	Trustpower	Energy Direct NZ (part of Trustpower)	Greymouth Gas	OnGas (part of Vector)		Mercury Energy (part of Mighty River Power)		
<b>Consumers</b>	<b>Electricity generators:</b> Contact Energy Genesis Power Mighty River Power				<b>Direct supply large consumers, including:</b> Methanex (methanol) Ballance Agri-Nutrients (ammonia/urea) New Zealand Steel Carter Holt Harvey Degussa Peroxide Fonterra Refining NZ Tasman Pulp and Paper						<b>Reticulated consumers:</b> Other industrial Commercial Community amenities Residential Transport (as CNG)	

Examples of multiple interests:

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

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# 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



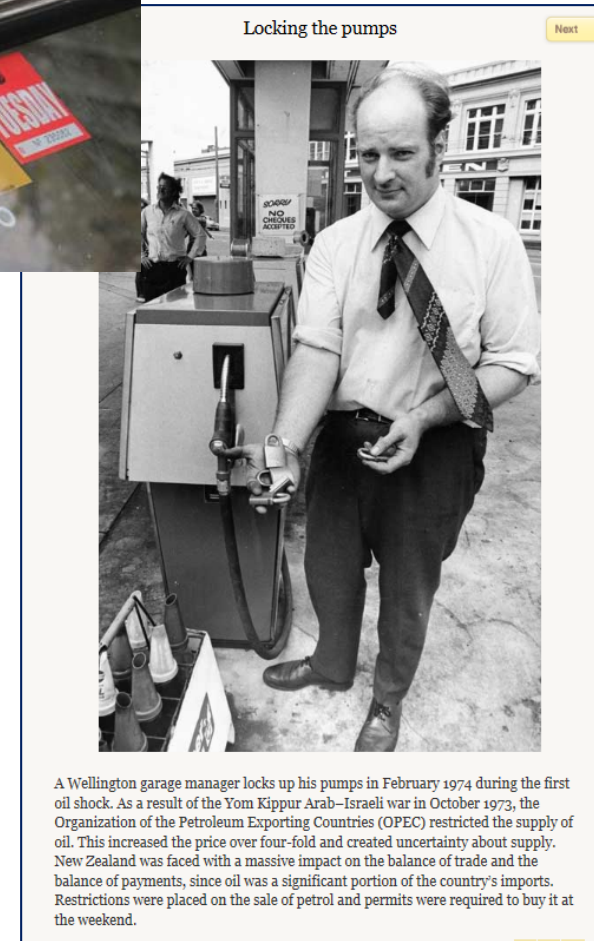
- 1978: Formation of state-owned Petroleum Corporation of NZ (Petrocorp) to hold Crown's direct interests in the oil and gas industry:
  - NGC, Offshore Mining, Exploration & Production, Petrochem (ammonia/urea plant), 51% of Petralgas (Waitara Valley chemical methanol plant)



- 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%.



# Policy framework today – key elements

Policy	Aim	What it says generally	What it says about gas
<b>New Zealand Energy Strategy 2011-2021</b>	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
<b>National Infrastructure Plan 2011</b>	To reduce uncertainty by outlining intentions for infrastructure development over the next 20 years	By 2030 NZ's infrastructure will be resilient, co-ordinated and contributing to economic growth and a better quality of life	Energy infrastructure overall is performing well, with progress in areas needing improvement. Specifically notes private nature of investment in gas infrastructure
<b>Petroleum Action Plan 2009</b>	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
<b>Business Growth Agenda</b>	To support business growth, job creation and improved living standards	Focus on six main economic sectors, including natural resources	Published sector reports so far include an in-depth on petroleum and minerals

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# Regulatory framework for gas

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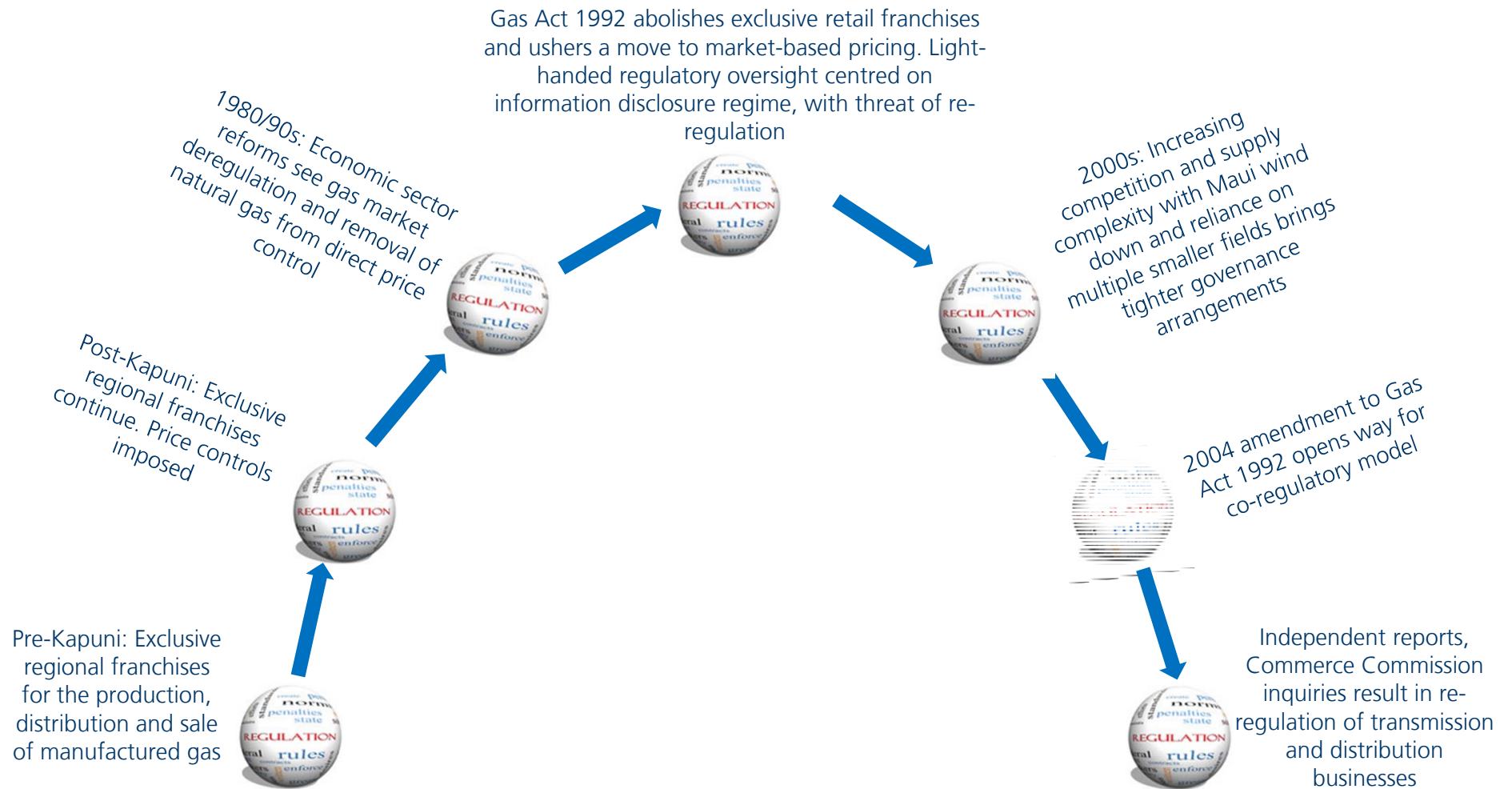
# Gas markets liberalised; infrastructure regulated

- 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
<b>Crown Minerals Act 1991</b>	<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"> <li>Substantially amended in 2013 following a review to accommodate emerging technologies/resources, improve clarity for participants and transparency for then public</li> <li>Associated regulations relating to permitting, reporting, royalties, fees etc...</li> </ul>

# Cornerstones of gas regulation- downstream

Legislation	What it does	Main aims	What else
<b>Gas Act 1992</b>	<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"> <li>• Objective for gas to be delivered to existing and new customers in a safe, efficient and reliable manner</li> <li>• Facilitate the promotion of the ongoing supply of gas to meet NZ's energy needs by providing access to essential infrastructure and competitive markets</li> <li>• Minimise barriers to competition</li> <li>• Incentives for investments are maintained/enhanced</li> <li>• Delivered gas costs are subject to sustained downward pressure</li> <li>• Security of supply risks are properly and efficiently managed</li> <li>• Consistency with the gas safety regime</li> </ul>

## ...and flow-on considerations

Legislation	What it does	Main aims	What else
<b>Government Policy Statement of Gas Governance (2008)</b>	<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"> <li>• Energy and other resources used to deliver gas to customers are used efficiently</li> <li>• Competition is facilitated in upstream and downstream markets by minimising barriers to access to essential infrastructure</li> <li>• The full costs of producing and transporting gas are signalled to consumers</li> <li>• Infrastructure</li> <li>• Gas sector contributes to achieving climate change objectives</li> <li>• Sound arrangements for the management of critical gas contingencies</li> <li>• Various expectations for consumer benefits, including a complaints process</li> <li>• Retailers' contractual arrangements adequately protect rights of small consumers</li> </ul>

# Cornerstones of gas regulation – economic control and consumer protection

Legislation	What it does	Main aim	What else
<b>Commerce Act 1986</b>	<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"> <li>• Monopoly businesses keep prices down</li> <li>• Limits ability to extract excessive profits</li> <li>• Incentivises natural monopoly businesses to innovate and invest, improve efficiency and provide goods/services at a quality that reflects consumer demands</li> </ul>

# and a host of other statutory 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

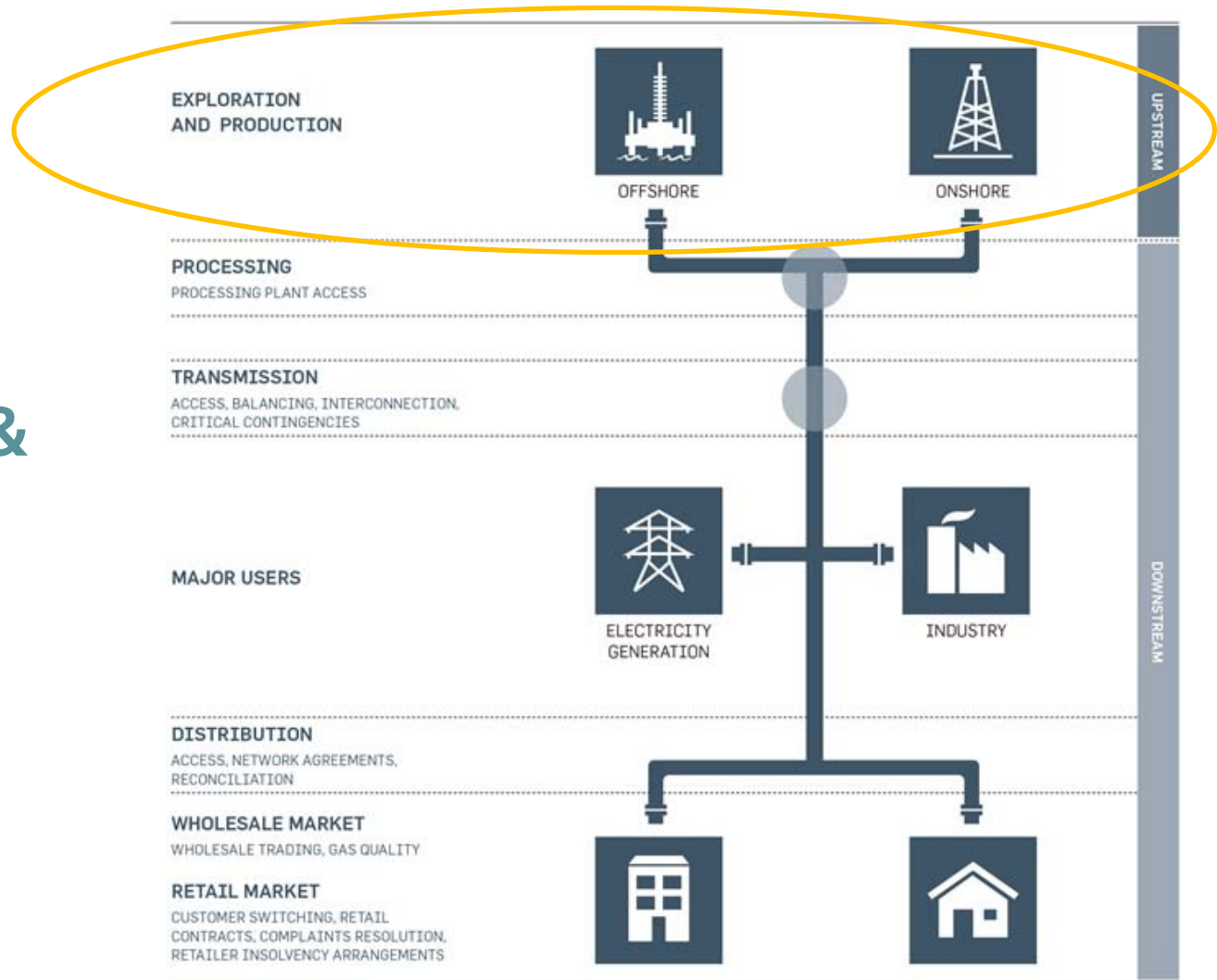
■ Downstream

■ 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



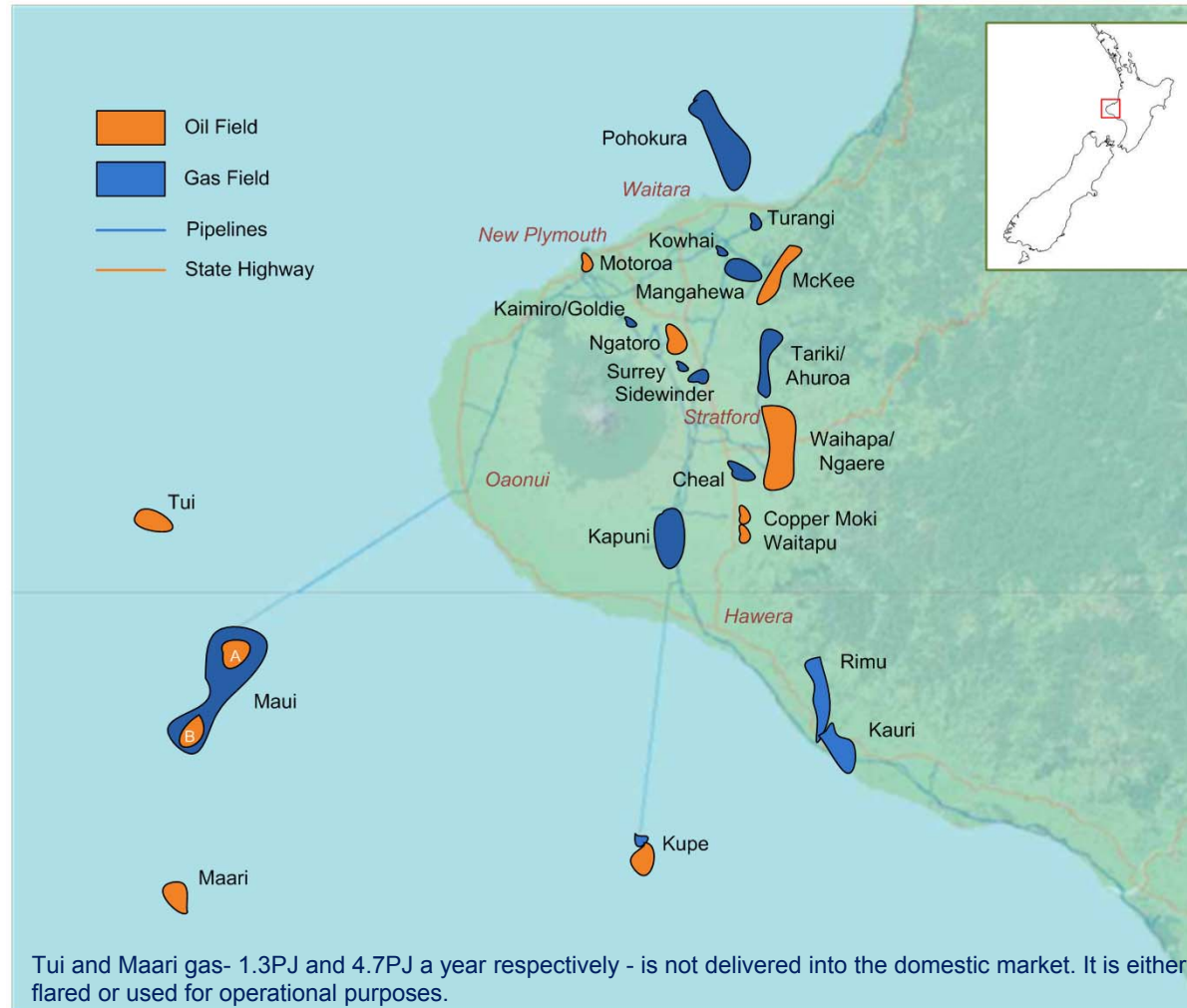


# Exploration and production activity is high

- Petroleum exploration activity is at its highest for many years
- Main focus is on oil; discoveries to date primarily gas/condensate
- Gas supply horizon improves from six years (2002) to 11 years
- Life-extending development to increase gas and condensate recovery from Maui and Kapuni
- Major Mangahewa field expansion to supply Methanex
- Advanced production technologies are turning previously non-commercial finds into viable producers
- Ahuroa gas storage facility adds a 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
- Government policies continue to encouraging petroleum exploration and development

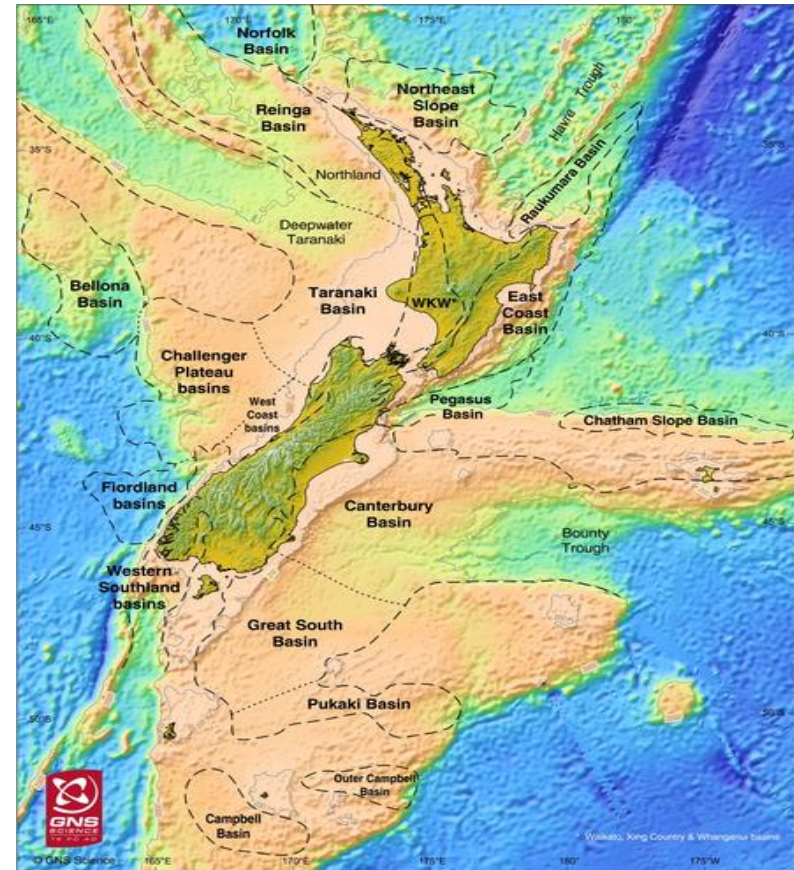


# 15 fields feed the North Island natural gas market



# New Zealand is still under-explored

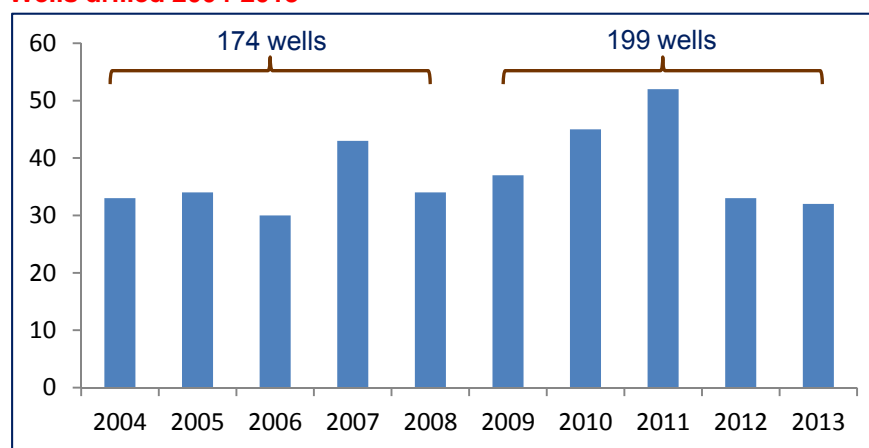
- 18 sedimentary basins in New Zealand's extensive Exclusive Economic Zone (EEZ).
- All – including the currently sole producing region Taranaki – are considered to be under-explored.
- Others – East Coast, Great South, Canterbury – have produced hydrocarbons, but not in commercial quantity.
- No exploration 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 20<sup>th</sup> most attractive jurisdiction for oil/gas investment worldwide – and most attractive in the Oceania region.



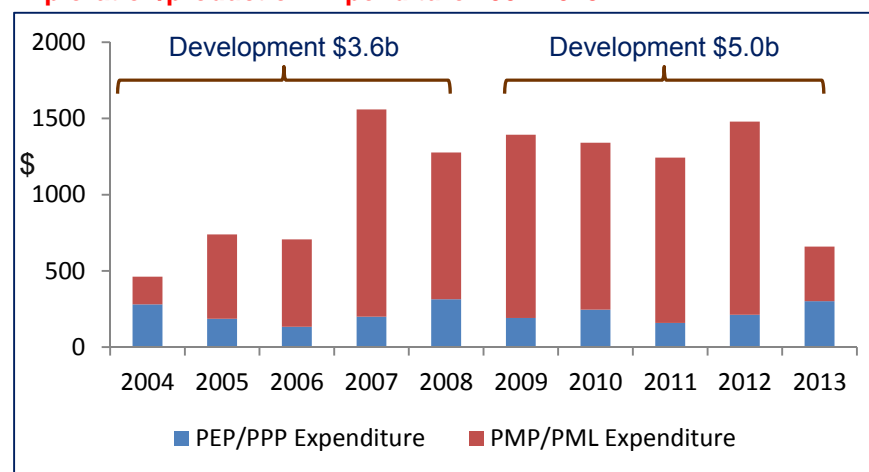
# Huge investment in search and development

- Extensive programmes involving international players.
- Heavy upstream investment in the past five years and \$2 billion committed/signalled.
- Around 100 wells are scheduled to be drilled in the next 18 months.
- Some targeting high-impact gas prospects.
- 2-3 of genuine international scale.
- Success so far has proved to be elusive.
- High seismic survey activity - important precursor to drilling – 290,000km of new and reprocessed data in past decade.
- Seismic data pool boosted by Government-backed \$15 million surveys in East Coast and Great South Basins, and 8,000 data reprocessing by GNS Science. Information provided free of charge.

Wells drilled 2004-2013



Exploration/production Expenditure 2004-2013



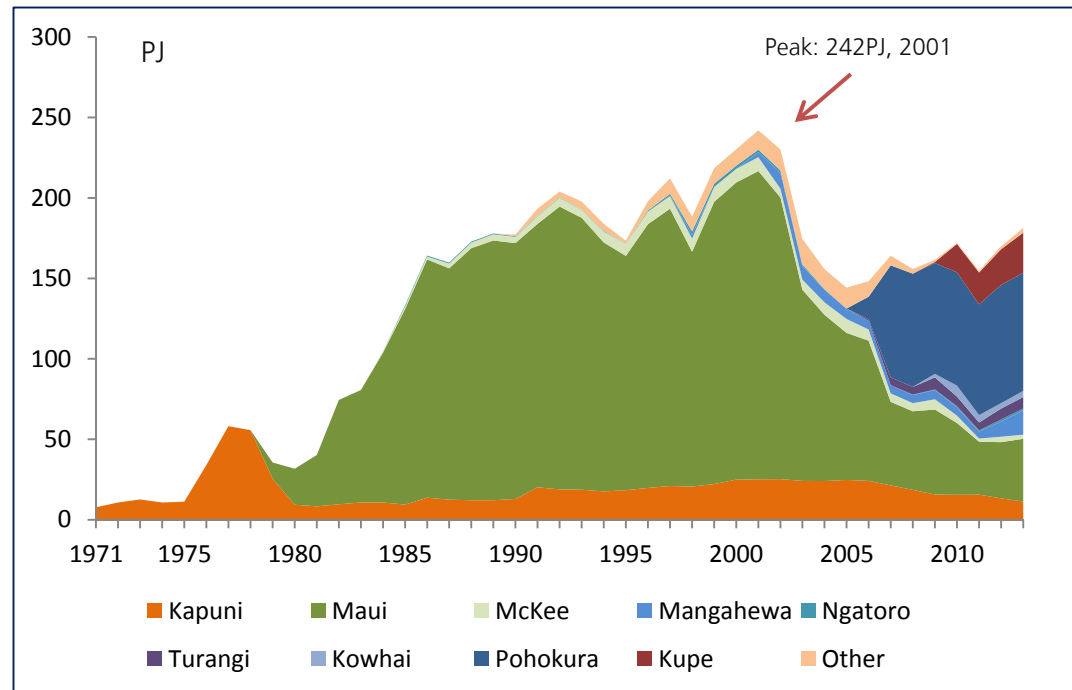
Source: 2014 Energy in New Zealand

# 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.
- Market now returning to over 200PJ/year.

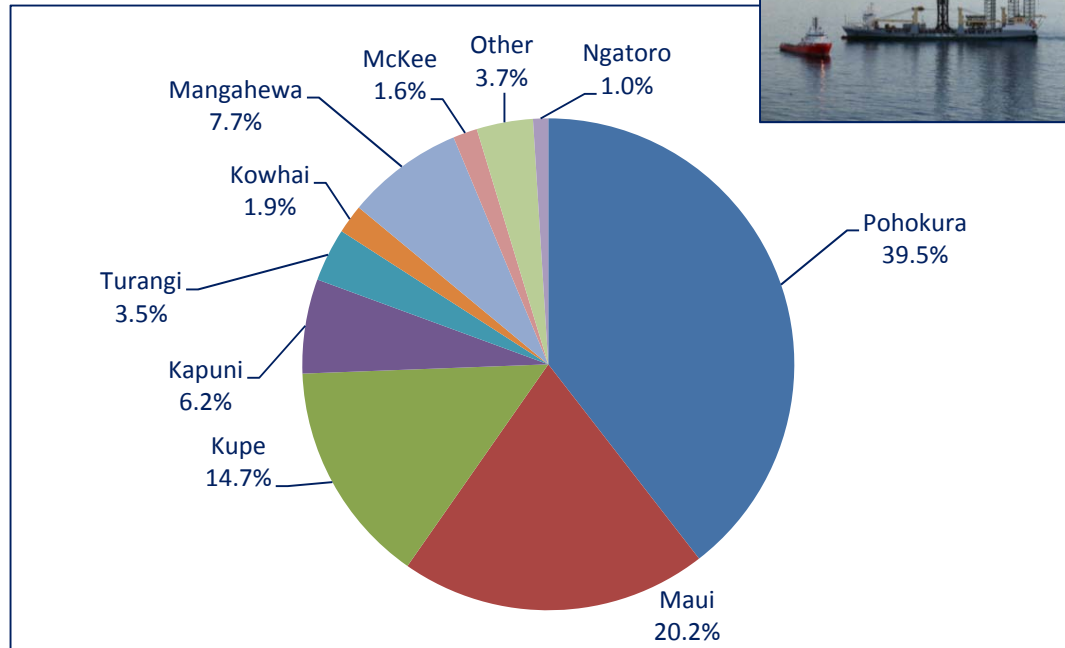
**Natural Gas Production by Field 1971-2013**



Source: 2014 Energy in New Zealand  
Other includes Cheal, Sidewinder, Rimu

# Pohokura is today's biggest producer

Net Natural Gas Production by Field 2013 – 181PJ



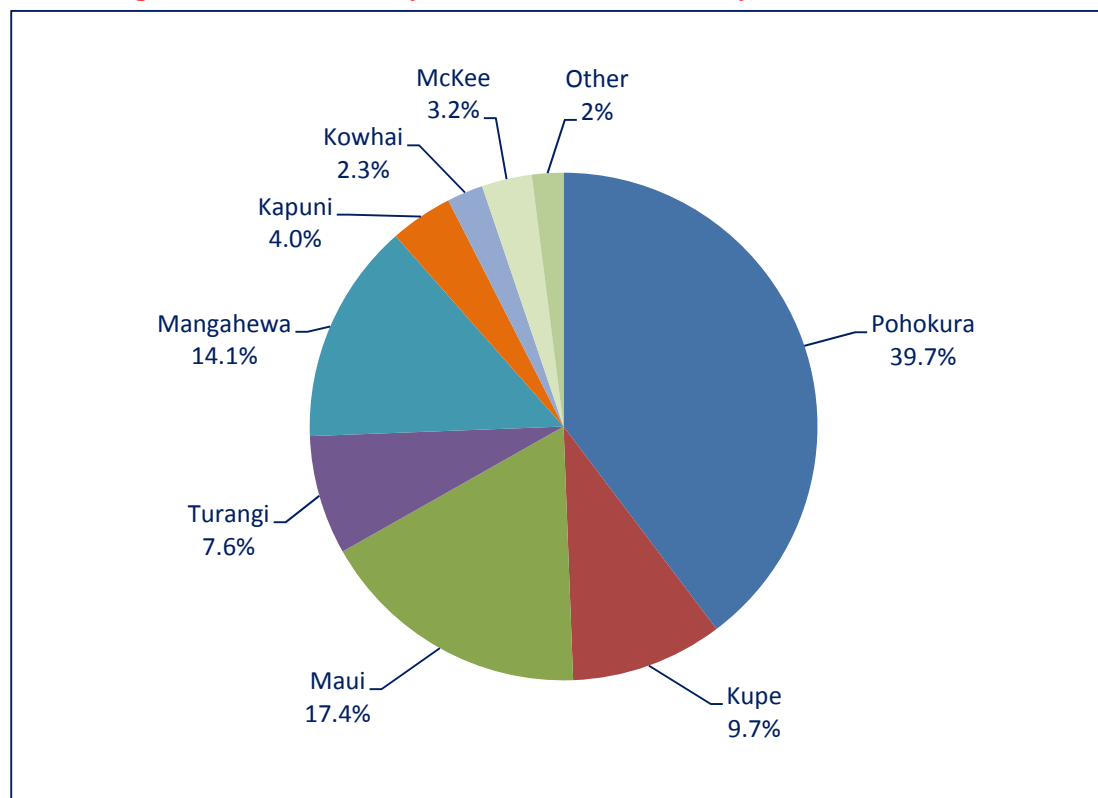
Source: 2014 Energy in New Zealand  
Other includes Cheal, Sidewinder, Rimu



- Pohokura: Discovered 2000 and commenced gas/condensate production 2006.
- Largest discovery since Maui in 1969.
- Maui still makes second largest contribution to gas supply.
- Maui and Kapuni undergoing further development to tap tight gas. New technology unlocking small/difficult gas pockets bypassed in conventional drilling.
- Major development of Mangahewa field to service Methanex supply contract.

# Gas reserves increased 31% in the past year

Remaining P50 Gas Reserves by Field – 2,560PJ 1 January 2014



- Remaining gas reserves of 2,560PJ were up 31% on the 2,021PJ as at 1 January 2013 due to increases reported at:
  - Pohokura (1,017PJ vs 783PJ)
  - Maui (445PJ vs 219PJ)
  - Mangahewa (362PJ vs 250PJ)

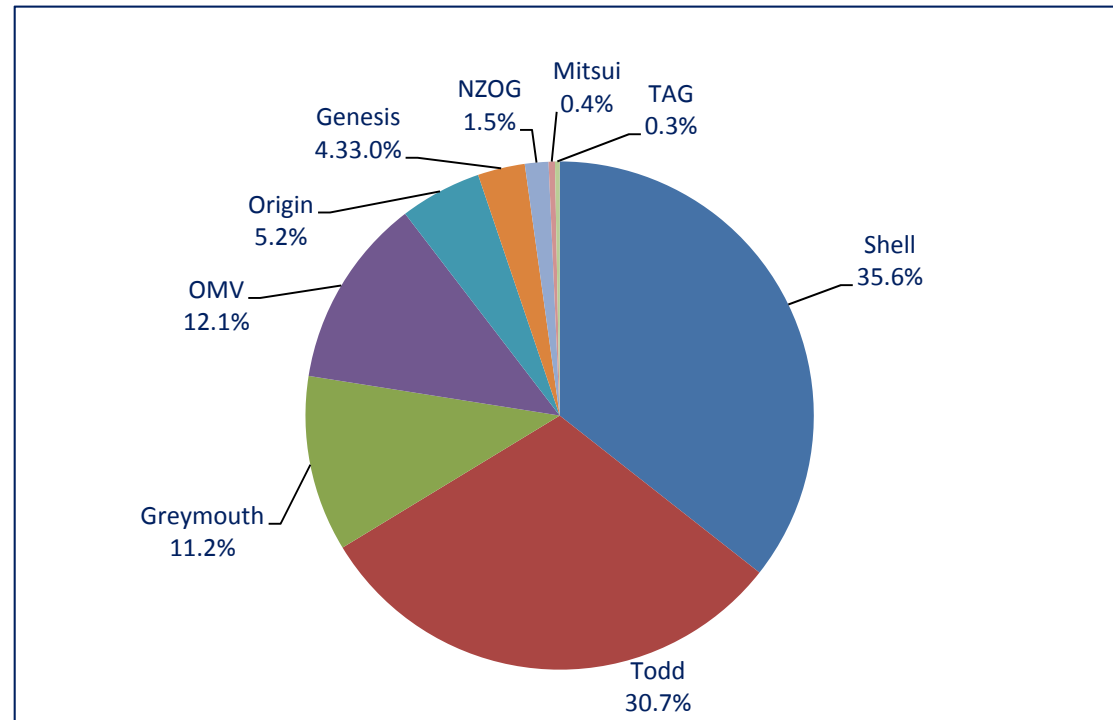
Source: 2014 Energy in New Zealand

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

## 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



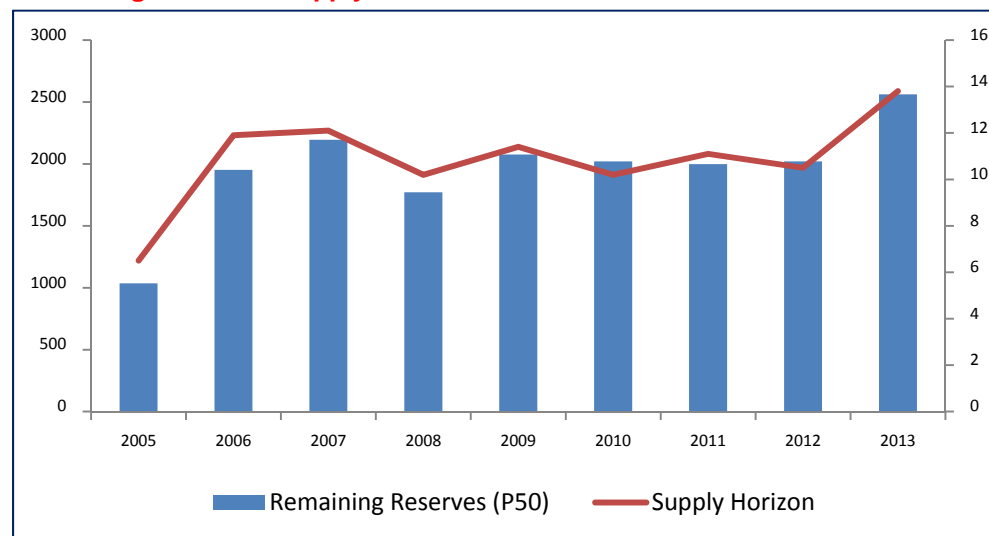
GIC calculated : Source: 2014 Energy in New Zealand



## Supply longevity is relatively stable...

- Since 2005, remaining reserves have ranged between 1,036PJ (2005) to 2,560 (2013).
- The reserves/production ratio to 2012 has been consistently in a 10-12 year horizon, recovering from a low of around 6 years in 2005.
- The supply horizon has risen to 13.8 years.
- The reserves position reflects production levels, and reserves replacement through new discoveries and production enhancement at existing fields.
- Unconventional gas reserves are not firm enough to be included in New Zealand formal gas reserves position.

Remaining Reserves/Supply Horizon 2005-2013



Source: 2014 Energy in New Zealand

Supply Horizon = annual reserves/gross production ratio. Gross production (185PJ) includes gas flared, gas injected, gas used for operational purposes, losses, and LPG extraction

# Unconventional gas... some background



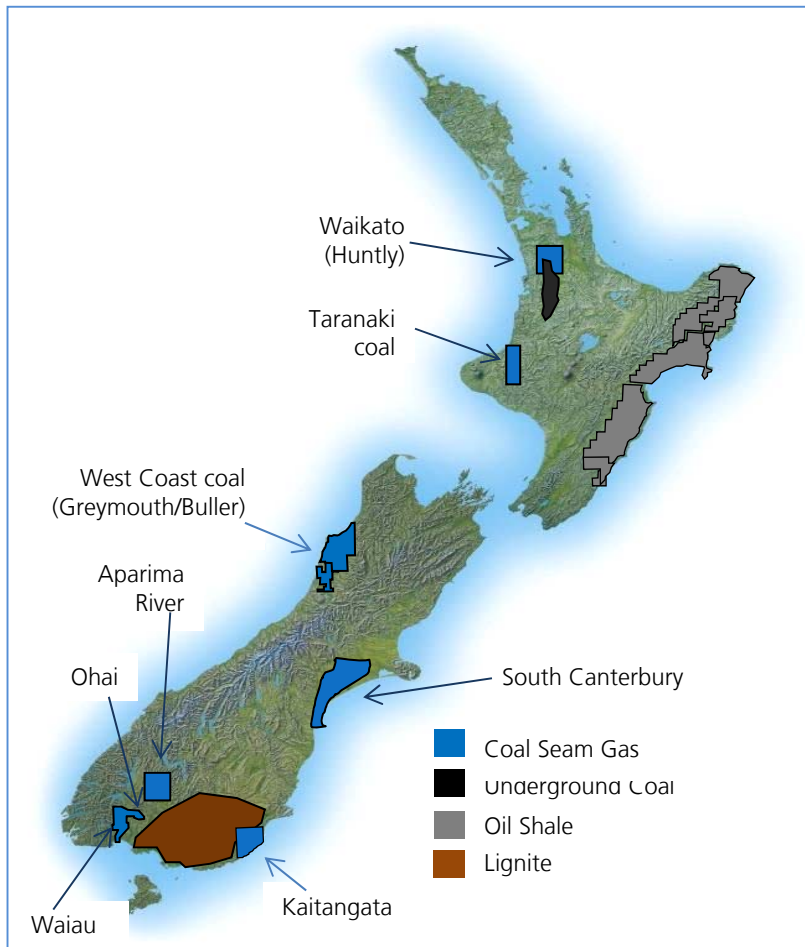
*Coal seam gas wells, Australia*

- ‘Unconventional’ gas is contained in tight, low permeability formation that is difficult to access. It includes:
  - coal bed methane (aka coal seam gas - CSG)
  - shale gas from mature source rock
  - coal gasification
- Advanced extraction techniques - horizontal drilling and hydraulic ‘fracking’ - are needed to produce it.
- Potentially massive reserves, but with some issues:
  - extent and cost of extraction
  - environmental impacts
  - supply saturation and price impact including possible economic effect on LNG investments
  - population density and land access

‘Unconventional’ gas is seen as a global energy game changer. It is a supply bonanza that is underpinning what the IEA is calling the ‘golden age of gas’. The charge is being led by the USA where it is transforming the energy economy.

# 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.
- NZEC describes the East Coast Basin as an 'unexplored area of vast resources potential' with shale beds up to 600 metres thick.

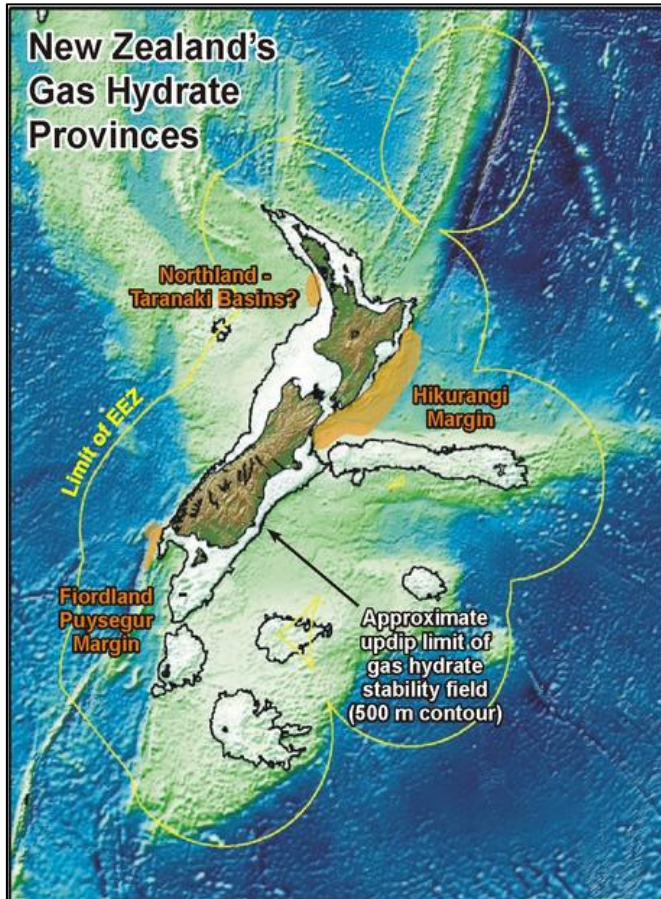
# And then there's methane hydrates - 'ice gas'

- Unconventional methane 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 – Japan, US – but access/production technology is developmental. There has been no commercialisation.
- The potential is enormous – estimated 400 billion PJ (currently known world gas resources = 5 million PJ).
- For some, its not urgent as cheaper gas is available. Others with few indigenous resources are looking at it more closely.
- In 2013, Japan became the first to extract ice gas from the Nankai Trough. That discovery alone could equal 11 years of Japan's gas imports.



# New Zealand has quite a bit of it

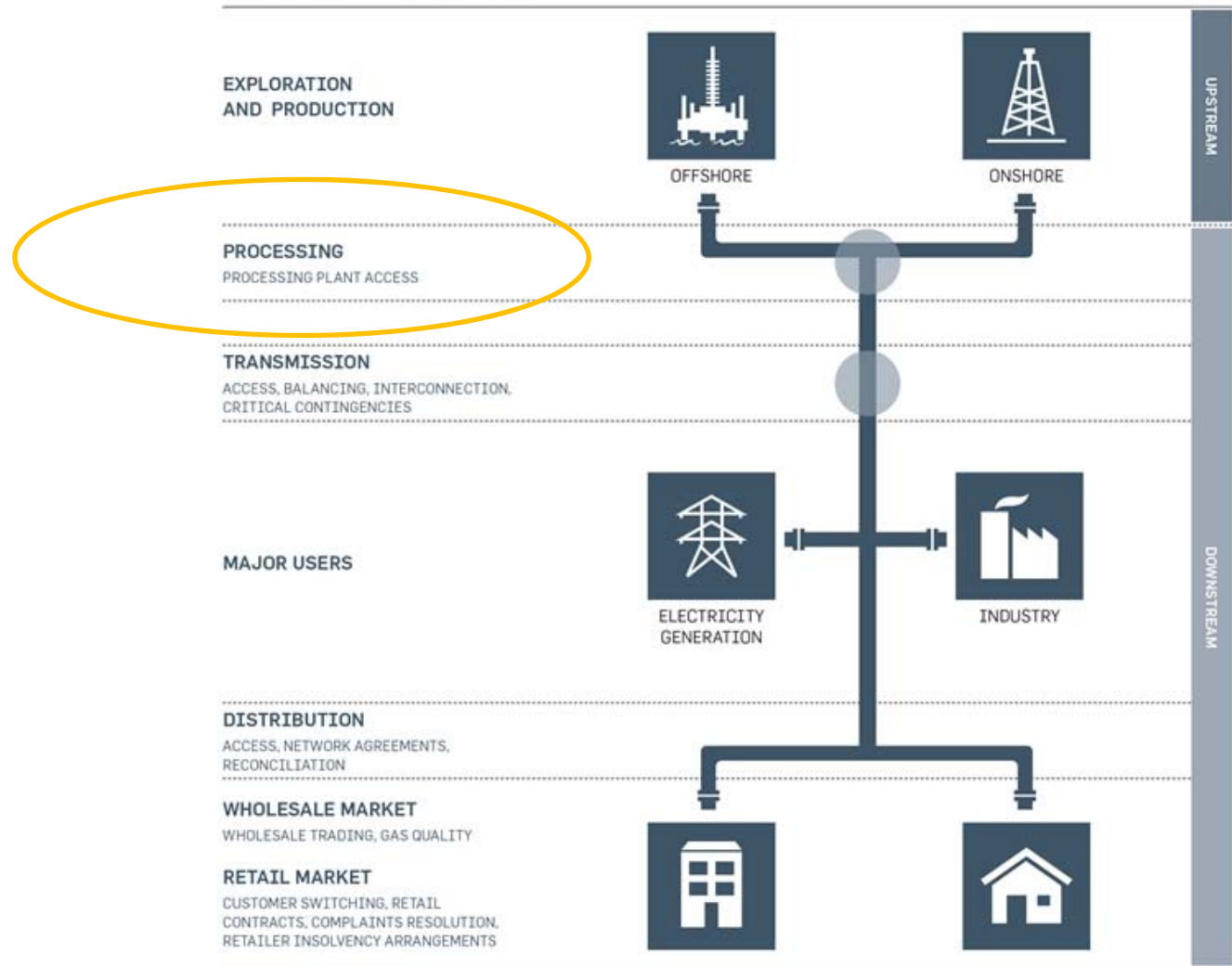
## Gas Hydrates- Areas of Interest



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.
- In 2012, GNS Sciences completed a 2-year gas hydrates programme, focused on the Hikurangi Margin.
- The Hikurangi Margin covers 50,000sq km.
- Initial methane hydrate estimates: 20,000PJ

# 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.
- They tend to be built in conjunction with 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.
- A short-term information disclosure regime for processing facility owners to assess if permanent regulations are needed did not find natural monopoly characteristics, and expired in June 2014.



*Kupe Production Station*



*Cheal Production Station*

# What processing plants do

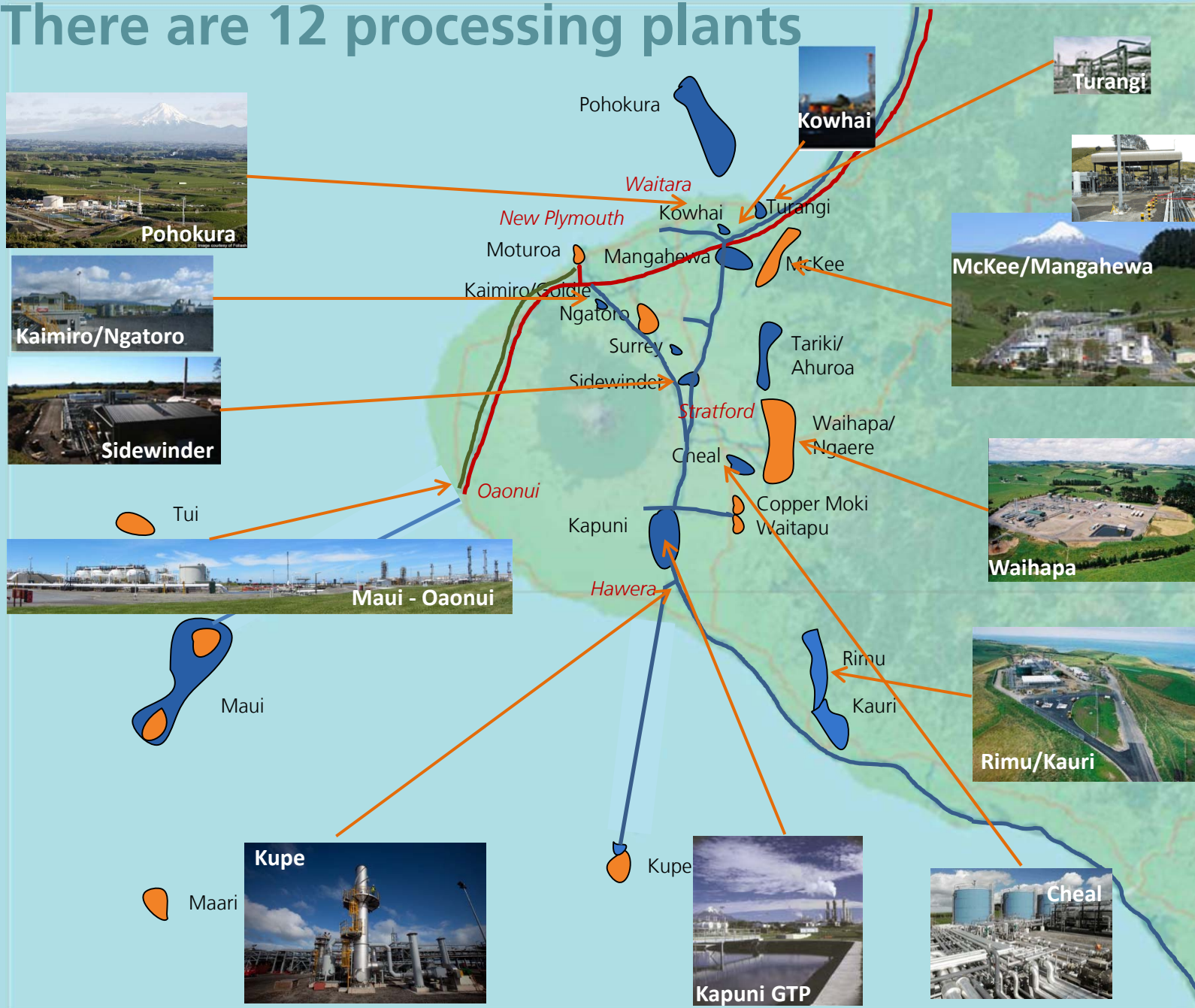
- In underground reservoirs natural gas exists in association with oil, condensate, water and other compounds and impurities.
- This 'cocktail' is brought to the surface and processed to separate the oil and other hydrocarbon liquids (condensate, natural gasoline), and remove water.
- A resulting 'raw' gas stream comprises mainly methane, with heavier hydrocarbons (propane, butane, ethane), carbon dioxide and other unwanted components.
- This raw stream is processed to achieve technical gas specifications for transmission and general market use by removing or reducing heavier hydrocarbons, carbon dioxide etc....
- Propane and butane are extracted as LPGs for domestic market use or export. Carbon dioxide has many other uses, including putting froth on a Guinness.



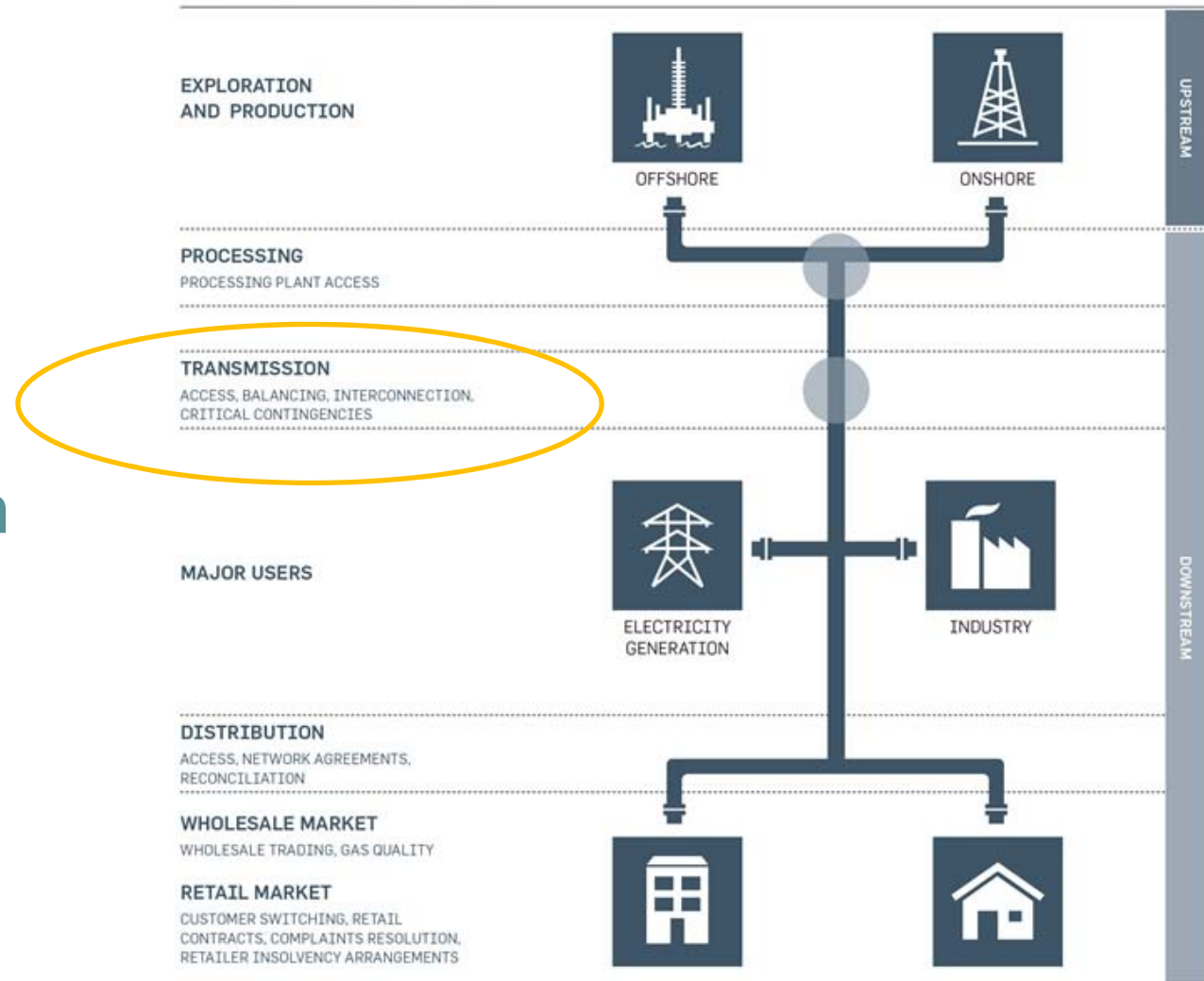
*Kapuni Gas Treatment Plant*



# There are 12 processing plants

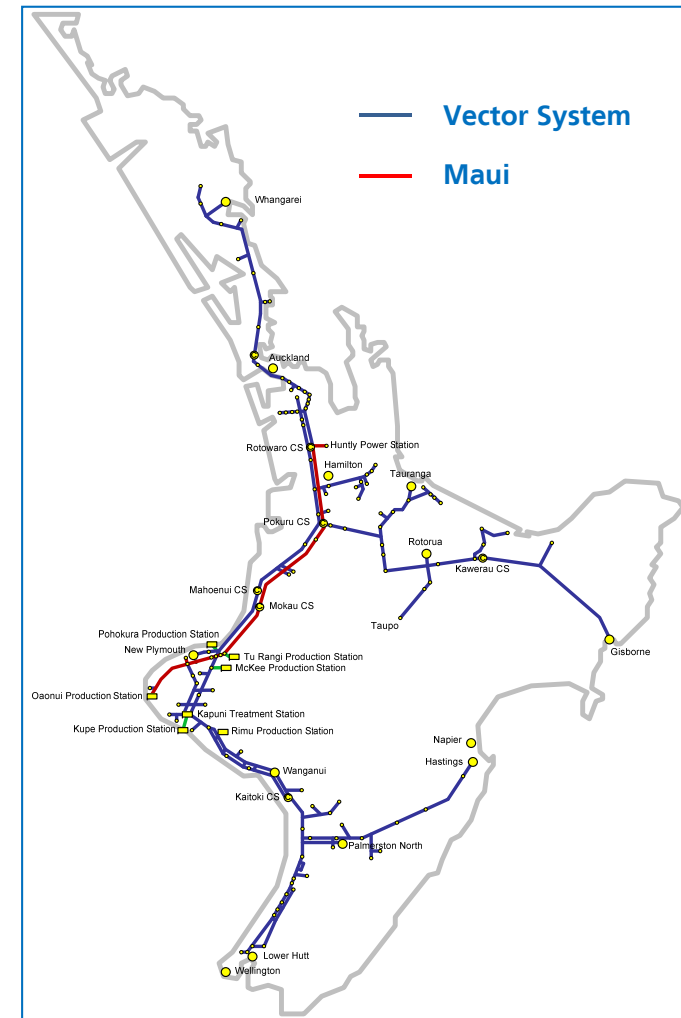


# Gas Transmission



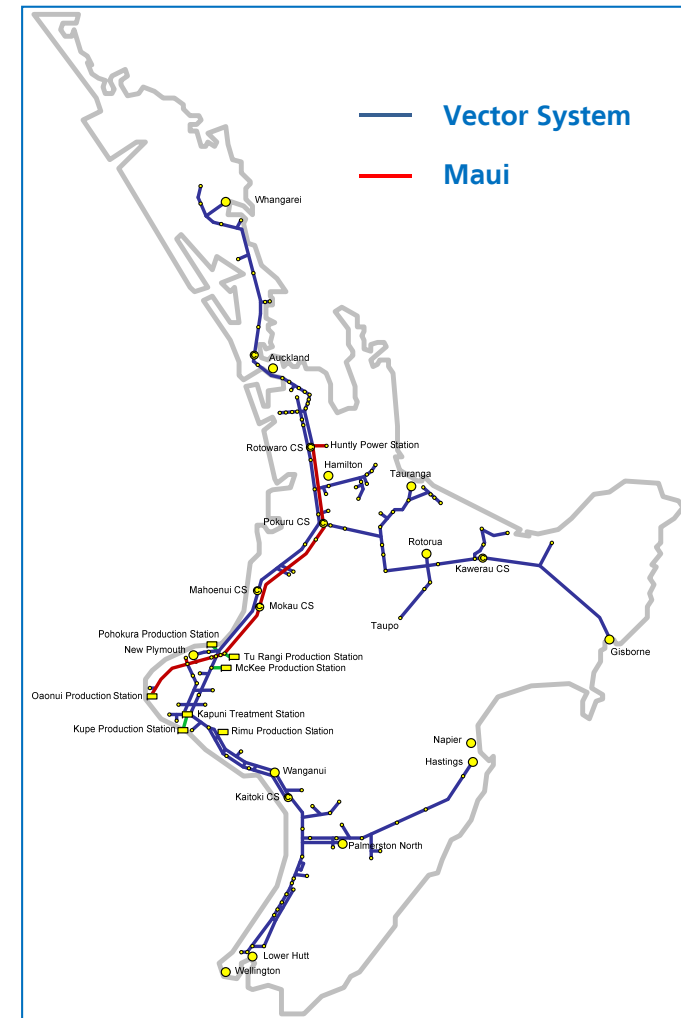
# Transmission pipelines - high pressure arteries

- 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 creates 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.
- Adequacy of current arrangements under the spotlight:
  - legacy of two transmission systems with different access regimes



# 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

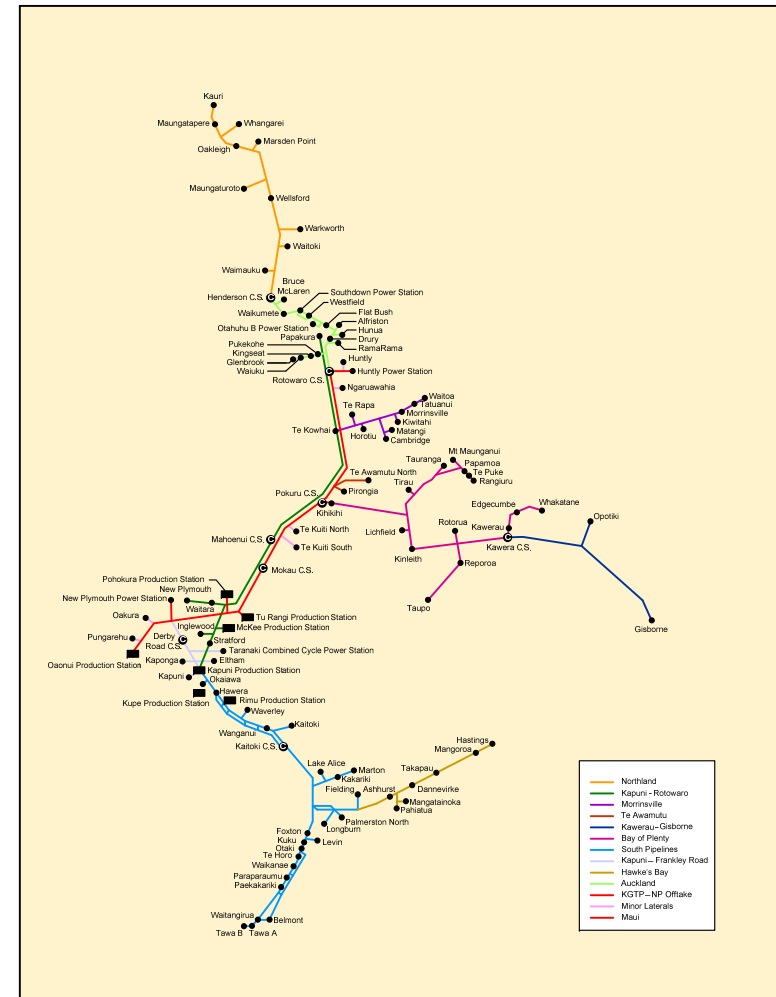


Transmission services and wholesale gas trading are interlinked – gas trading must be accompanied by an ability to transport the gas from a field to the end user.



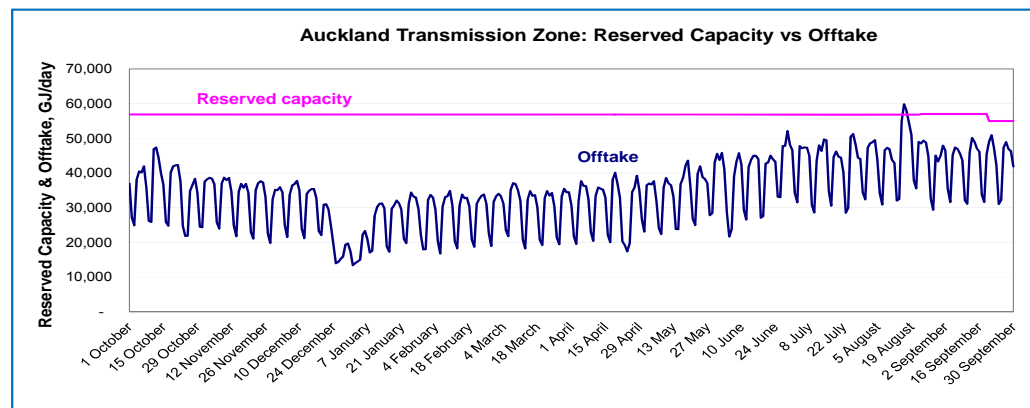
# The Vector system takes the further around the North Island

- Transports high pressure gas to most North Island cities and towns. 138 offtake/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
- Transports over 90PJ/year



# Transmission capacity is in the spotlight

- 2009 announcement that Vector can't sell any more reserved capacity on the North Pipeline
- Auckland load becoming more 'peaky'
- Non-code (supplementary agreements) account for 60% of North Pipeline capacity
- Physical capacity scarcity events are rare, limited to a few days and not necessarily annual. Greater potential for contractual congestion
- Industry focus on determining optimum access/pricing arrangements to achieve maximum utilisation of existing pipelines, and developing investment signals
- Existing capacity appears adequate for foreseeable future, but industry needs to plan





# Robust processes for emergency management

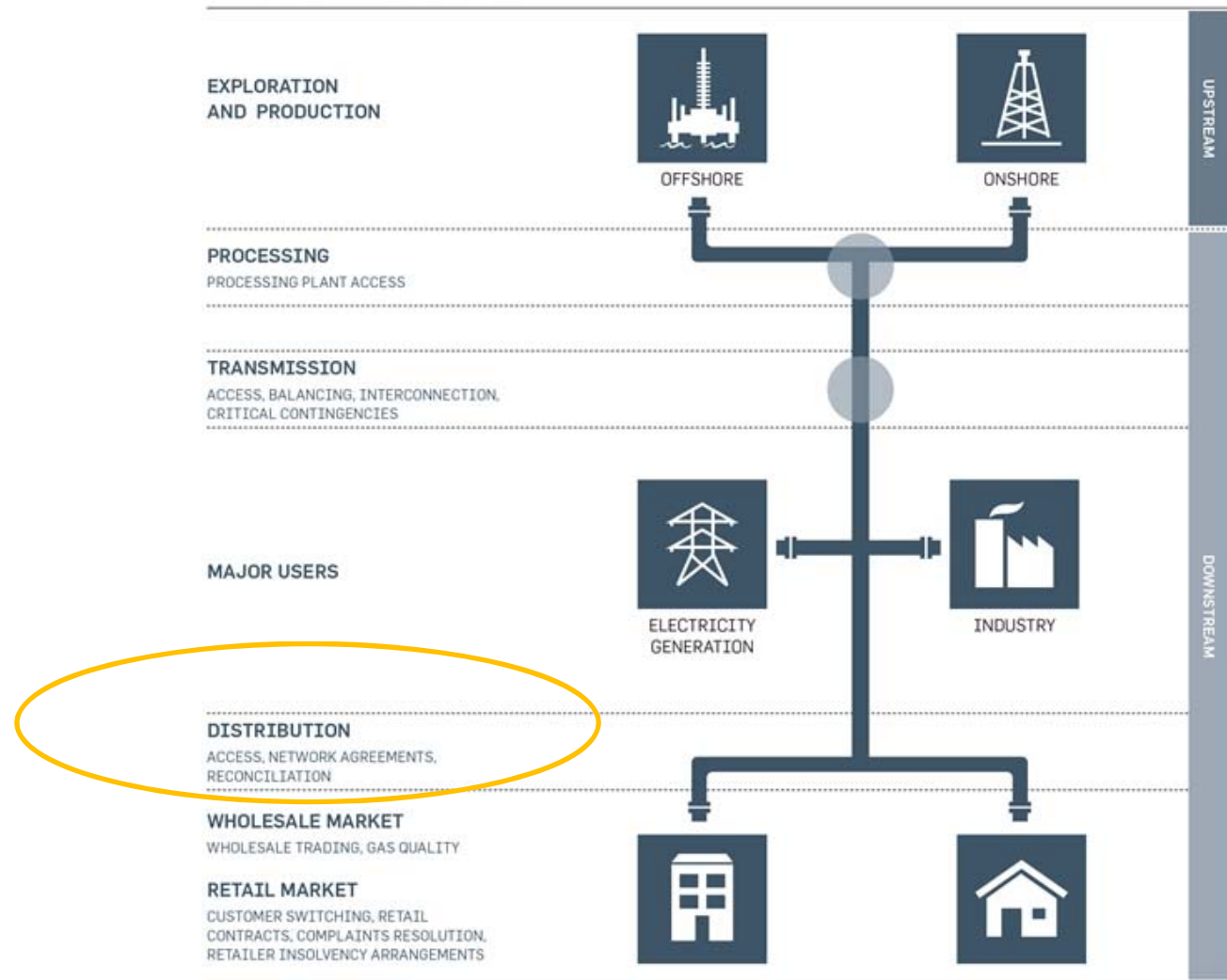
- Transmission systems cross rugged terrain but have a long history of reliability
- Outages can arise from failure of:
  - major production facilities
  - transmission pipelines
- Formal critical contingency management regulations replaced a voluntary industry arrangement in 2008
- CCM focus is on:
  - 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

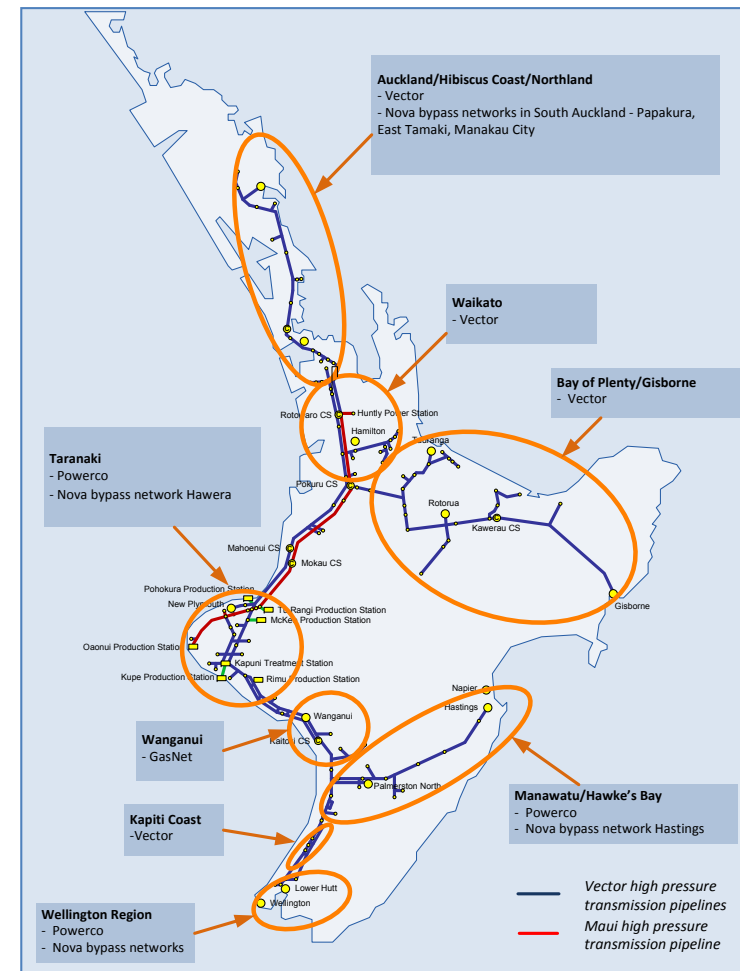
Curtailment Band	Consumption	Description	Previous Curtailment Band
<b>0</b>		Gas storage.	0
<b>1</b>	<b>&gt;15 TJ/day</b>	Consumers with alternative fuel capability	1a
<b>2</b>	<b>&gt;15 TJ/day</b>	Consumers without an alternative fuel capability.	1b
<b>3</b>	<b>&gt;10 TJ/annum</b>	Industrial and commercial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



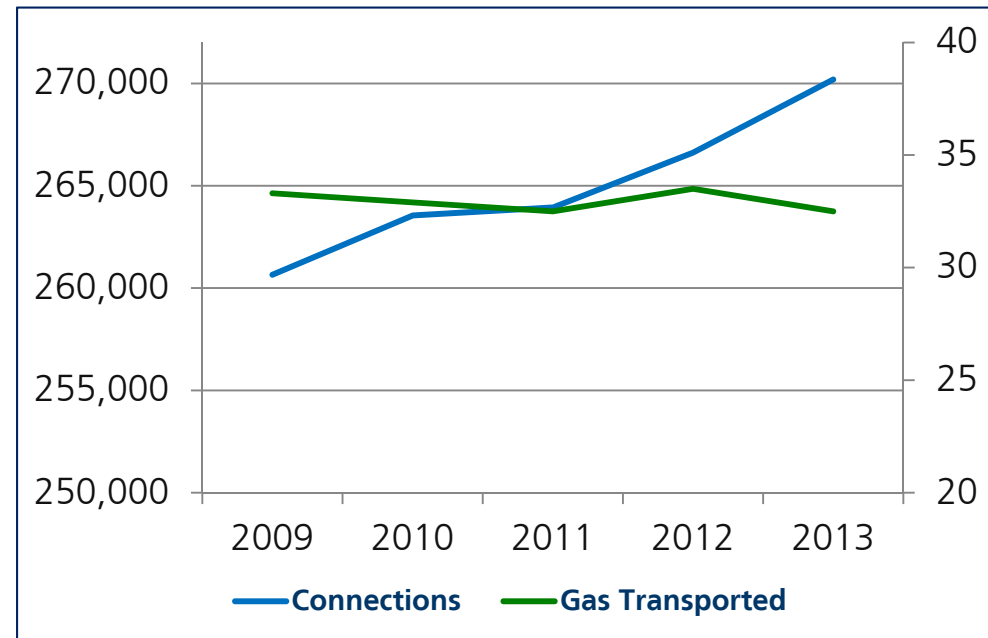
*Gas gate station*



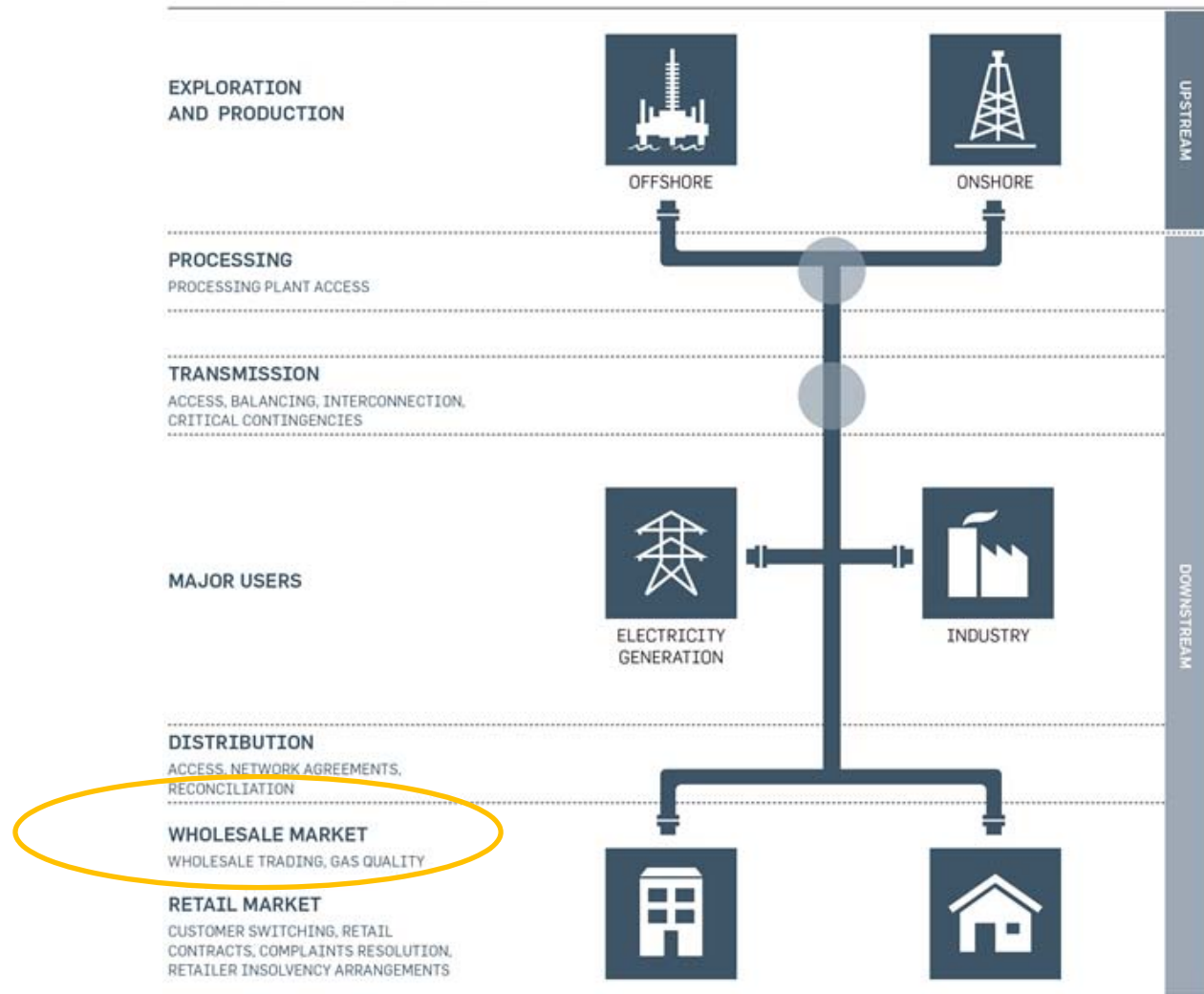
# Distribution networks are growing, but throughput is easing

In the past five years:

- Total network length has grown by 1,000km to 17,342km primarily on Vector and Powerco networks.
- Consumer connections up almost 10,000 to 270,000.
- 32.5PJ sent through distribution networks in 2013 – around 800,000TJ (0.8PJ) down on 2009.
- Average customer density static at around 15.7 consumers/km of pipe - low by international comparison (eastern/southern Australia 49.32 consumers/km).



# Wholesale Gas Market



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## The wholesale market is opaque, but some light is filtering in

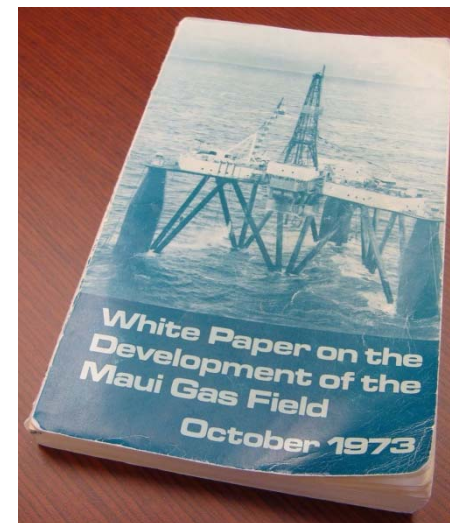
- Wholesalers buy gas from producers for onsale to retailers and large users. Producers also sell directly to large consumers and, where vertically integrated, to their own retail arms
- The wholesale market is small and relatively concentrated. There are four main wholesalers – Vector, Nova, Contact, 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
- Two commercial trading platforms established in November 2013 – only one has seen active trading to date
- MDL operates a Balancing Gas Exchange (BGX) for gas balancing purposes – but not open to everyone





# With Maui, who needed a wholesale market?

- Maui shaped exploration/production and the wholesale market for 30 years:
  - long term agreements with high annual take-or-pay commitments
  - diminishing price in real terms – escalator being the greater of either 50% of inflation, or inflation less 3%
  - bundled gas prices
  - buyers' ability to store prepaid gas
  - Maui able to act as a swing producer to meet demand on the day
- Effective price cap on the gas market, led to:
  - suppressed incentives to explore, develop and produce gas from other fields
  - restricted ability of other fuels to compete on price with Maui gas
- High investment in gas utilisation by large users taking advantage of low prices and plentiful supply.
- Cheaper electricity due to abundance of low-cost gas resources.



## ..and then it all changed

- Diminishing Maui production brought fundamental change to the wholesale market
- From abundant, cheap gas and a single dominant field, gas supply shortened and prices increased, resulting in:
  - some large users restricting or ceasing operations due to an inability to source gas at competitive prices
  - switching to other fuels, including geothermal, and biomass
  - increased exploration activity and improved financial viability of previously uneconomic fields– eg: Kupe, Turangi, Cheal
  - Government withdrawal from gas wholesaling
- Transition to supply from multiple fields:
  - more complex, less flexible unbundled contract arrangements



# But the market still has challenges

- Debate over what sort of wholesale market New Zealand needs :
  - few sellers
  - commitment of large-field production to long-term contracts
  - limited demand-side density. Most demand from a small number of large users
  - New Zealand's gas self-dependence (no cross border pipelines or LNG imports)
  - relatively small size of New Zealand's economy, population and population spread
- The wholesale gas market doesn't need to be as complex as the electricity market...
- But there's a strong case for an efficient, open trading mechanism to improve transparency and provide price/demand investment signals

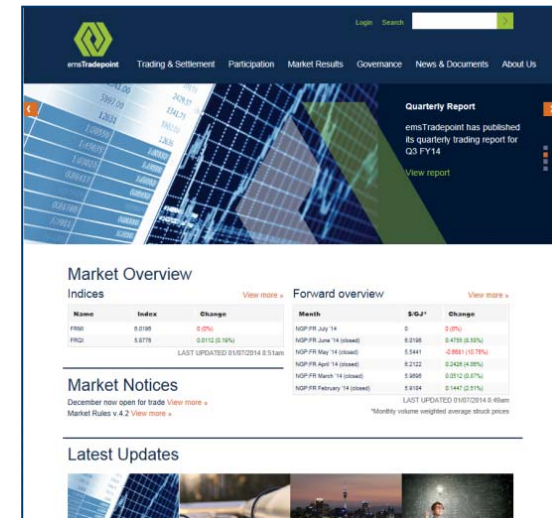
In 2012, large users represented just 0.6% of gas consumers, but 90% of consumption

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

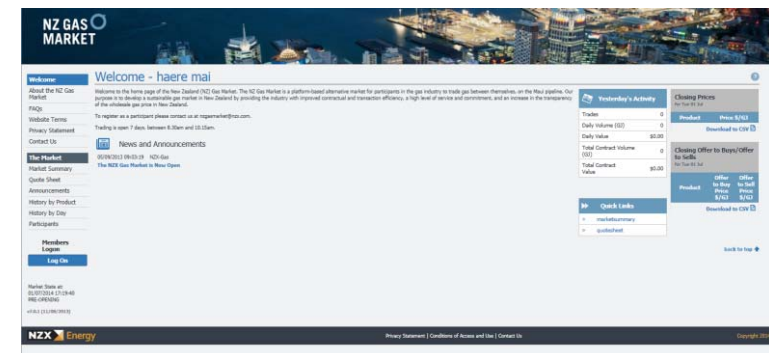
In densely populated UK, most gas is used in the residential and commercial sectors

# New market platform is shining a torch on wholesale trading

- emsTradepoint (Transpower) and NZ Gas Market (NZX) both established September 2013
- Fledgling markets with potential to fill the market efficiency/information transparency gaps
- Trades so far only on emsTradepoint - 190 trades, 242,200GJ, \$1.4 million (as at 31 March 2014)
- emsTradepoint and ASX developing a New Zealand Gas Futures contract based on the emsTradepoint market

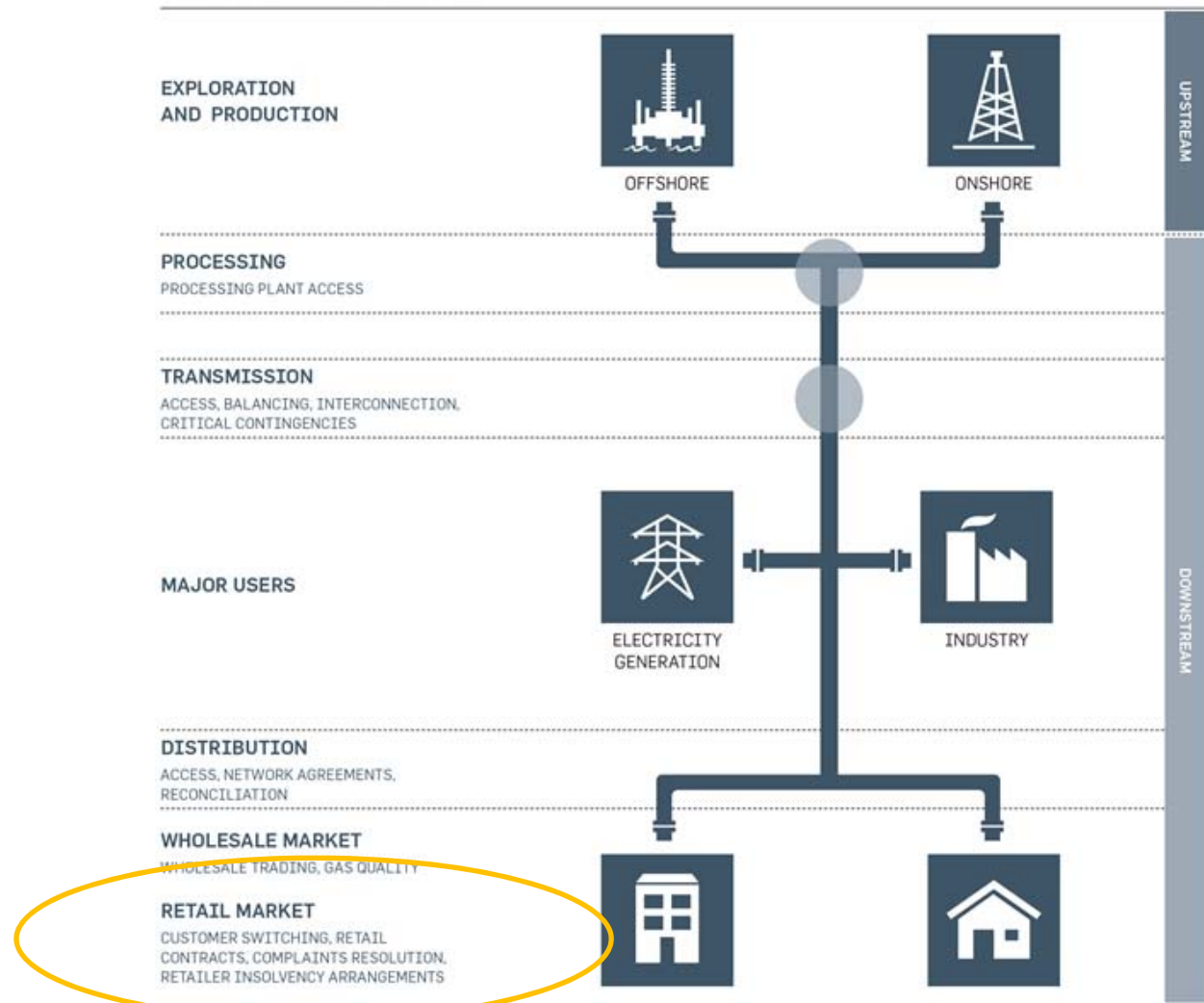


[www.emstradepoint.co.nz](http://www.emstradepoint.co.nz)



[http://gas.nzx.com/nzgasPublic/nzgas\\_mt\\_public.home](http://gas.nzx.com/nzgasPublic/nzgas_mt_public.home)

# Retail Gas Market



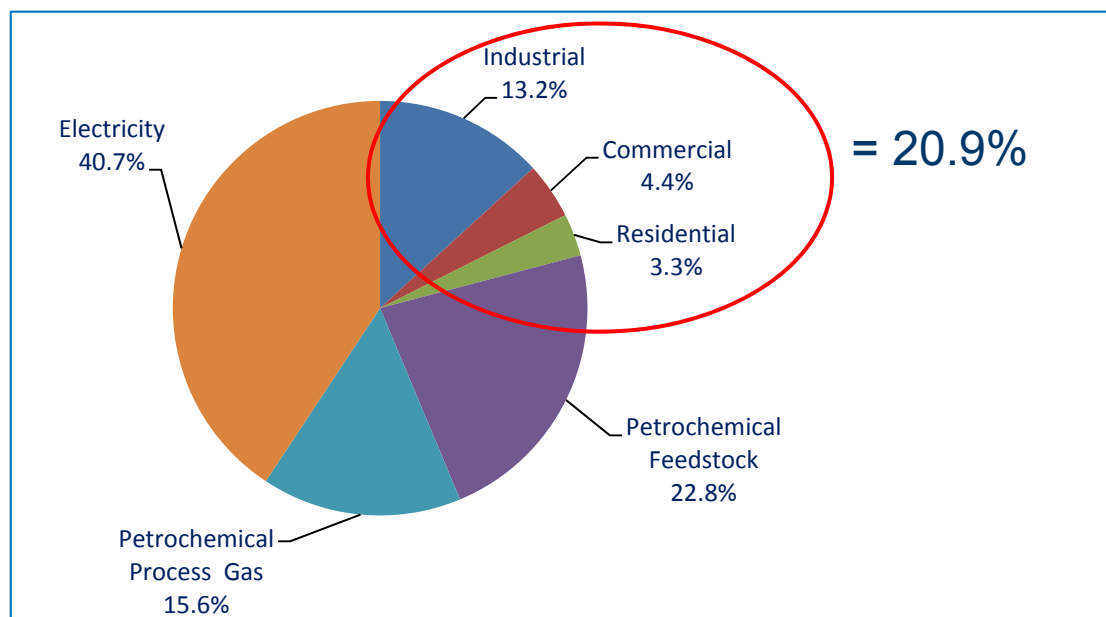
# The retail gas market is constantly growing

- ≈ 12,000 new consumers in the past five years.
- Nine retailers:
  - 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 (since November 2013)
  - Energy Direct (part of Trustpower)
- Retail competition and market contestability has strengthened . Consumers have choice of retailer at over 100 gas gates.
- Suite of measures to protect small consumers:
  - customer switching
  - consumer complaints scheme
  - retail contract benchmarks



# Retail accounts for 21% of the gas market

## Gas use 2013



Source: 2014 Energy in New Zealand

## Consumer characteristics

### Industrial

1,500 consumers (22.9PJ)

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

### Commercial

14,000 consumers (7.7PJ)

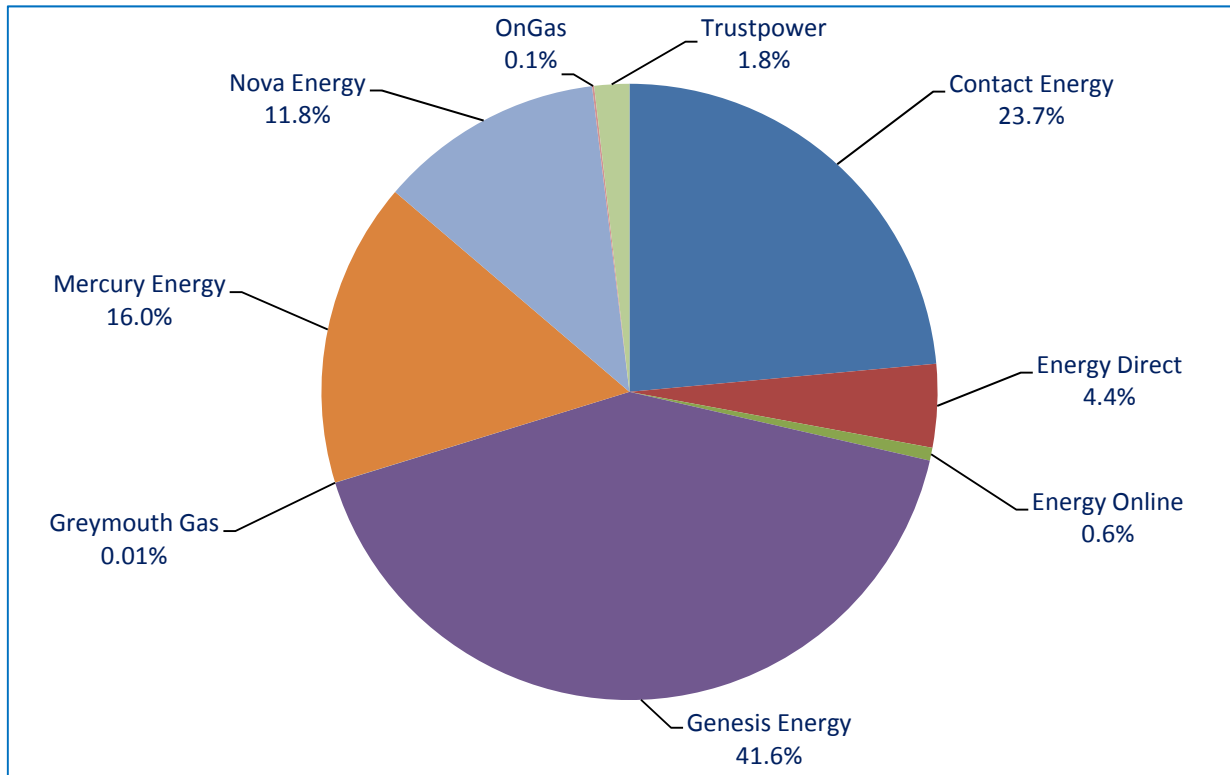
- range of business/community users
- direct account management relationship

### Residential

248,000 consumers (5.7PJ)

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

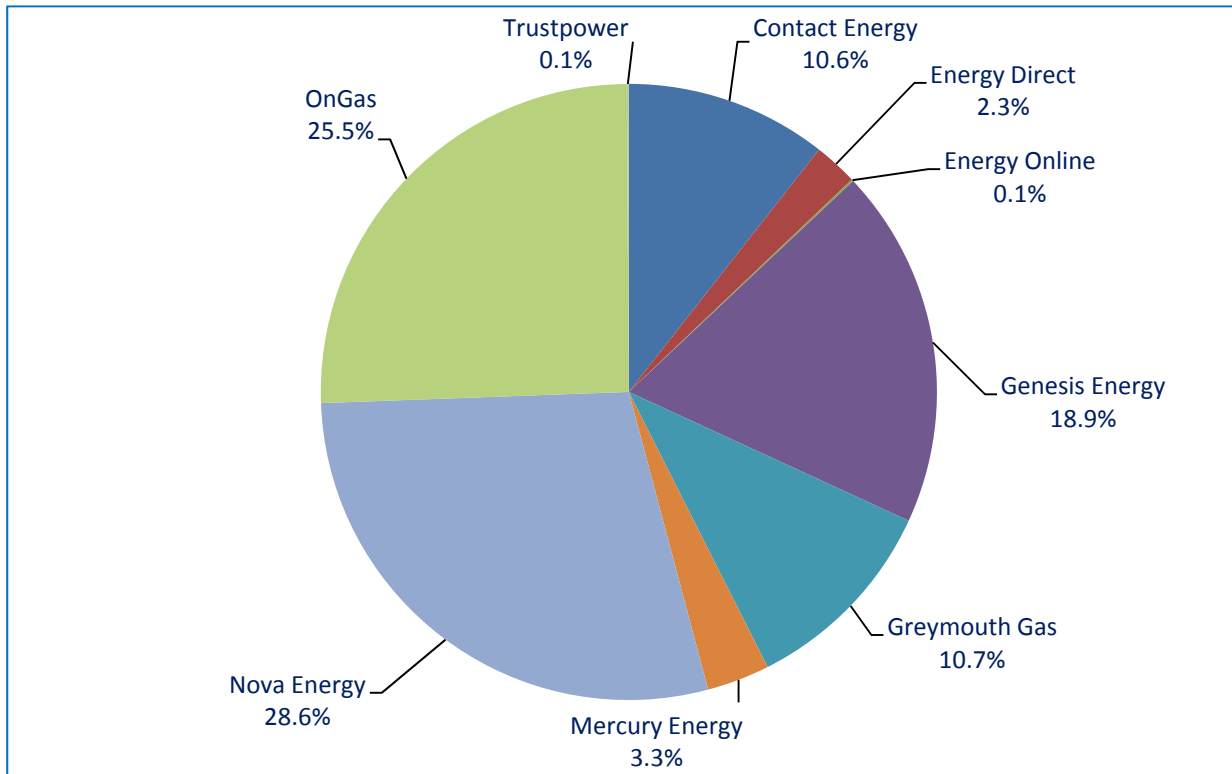
# Retailers' market share by consumers



Source: Gas Registry Statistics June 2014  
OnGas and Greymouth Gas supply large consumers only



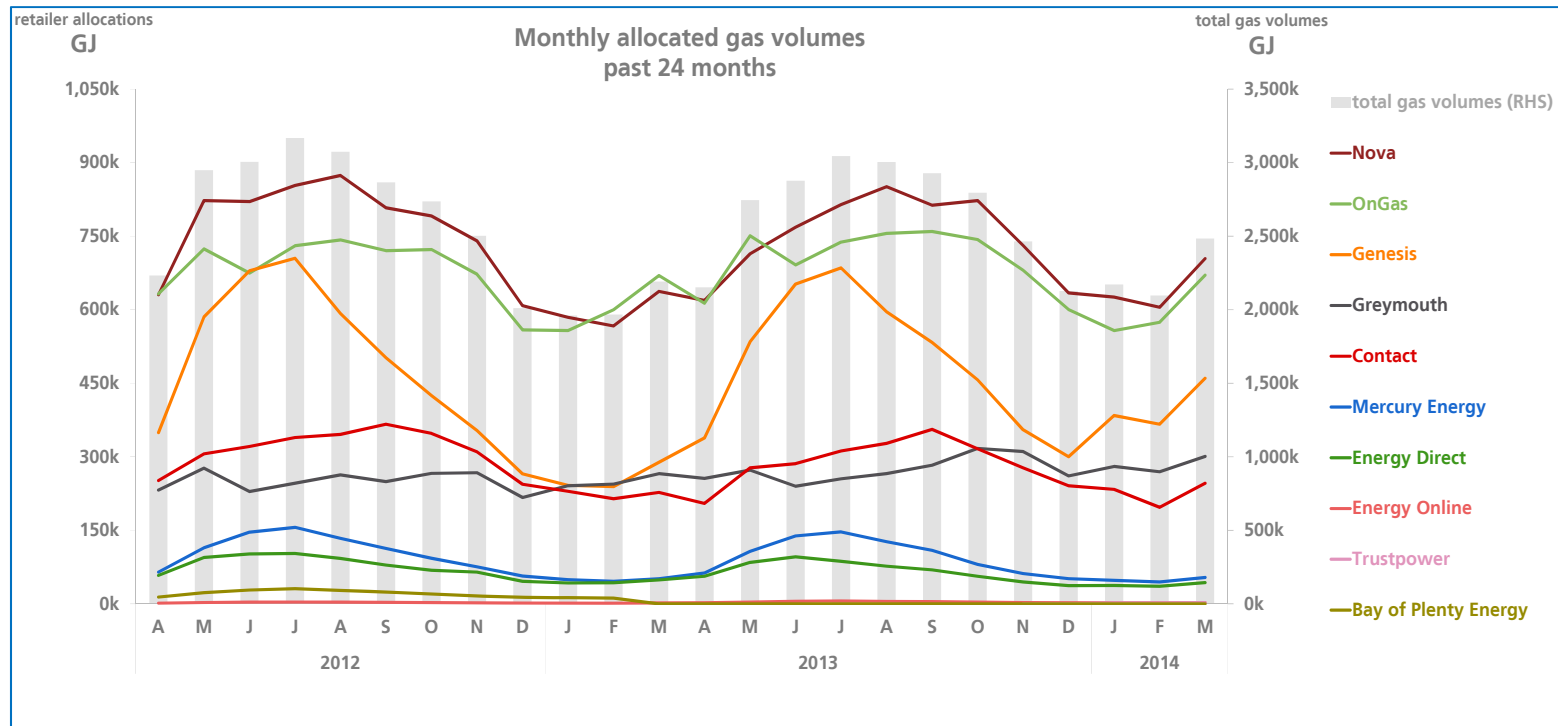
# Retailers' market share by allocated volume



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



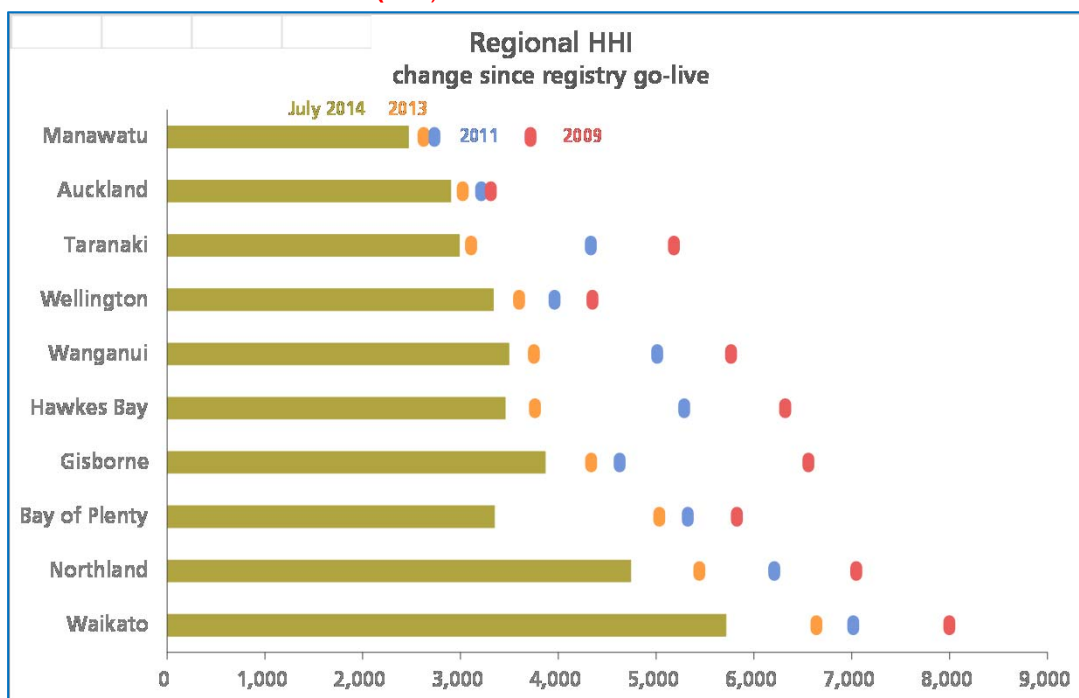
Source: Gas Industry Co March 2014 Quarterly Report

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)



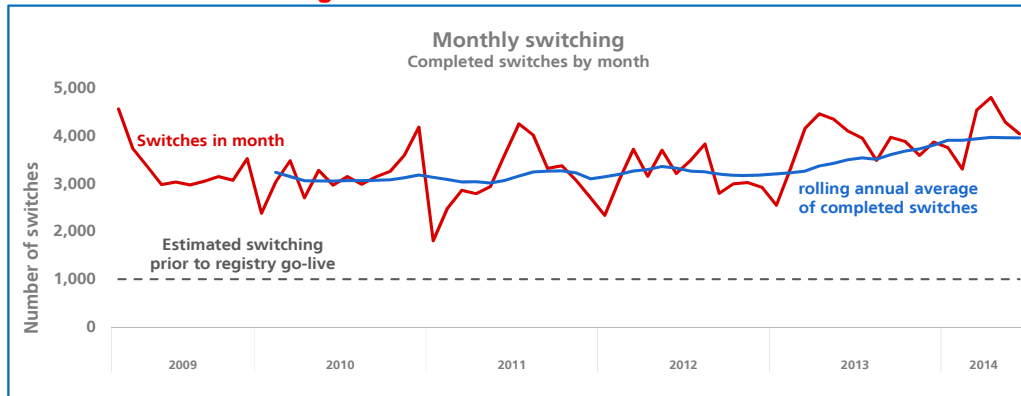
Source: GIC Quarterly Report June 2014

- HHI decrease in all regions indicates the retail market has become less concentrated since 2009.
- The more retailers at a gas gate, the greater potential for competition.
- Over 98% of gas customers are connected to a gas gate where at least 6 retailers trade.

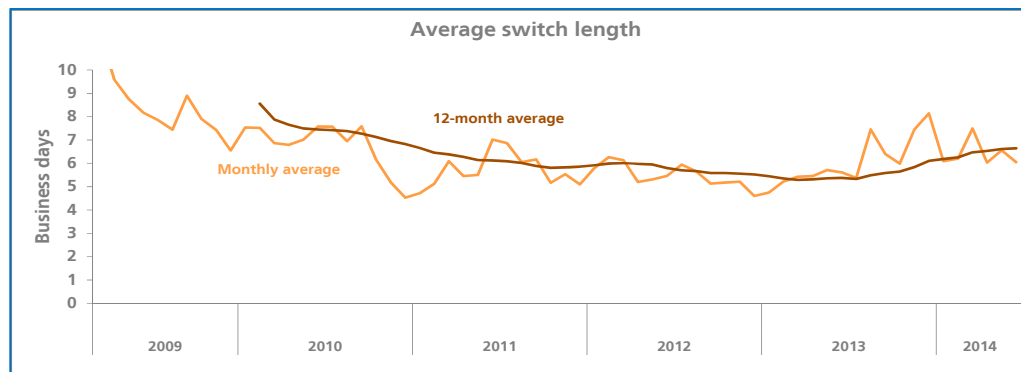
The Herfindahl–Hirschman Index is one way of measuring market concentration by using size and number of competing firms. The index ranges from 0 to 10,000, with a low score indicating a low level of market concentration.

# Consumers are embracing their ability to switch retailer

**Gas Consumer Switching 2009-2014**



**Consumer Switch Time 2009-2013**



Source: GIC Quarterly Report June 2014

- Gas Registry provides a central ICP data base. Switching regime details the process and timeframes.
- Switching rate of 3,000-4,000 a month (17%) vs around 1,000/month pre-2009.
- 46% residential customers have switched retailer at least once in the past 5 years.
- 62% of small commercial, and 70% of large commercial sites have switched at least once.
- Average switching time is around seven days vs weeks/months previously.

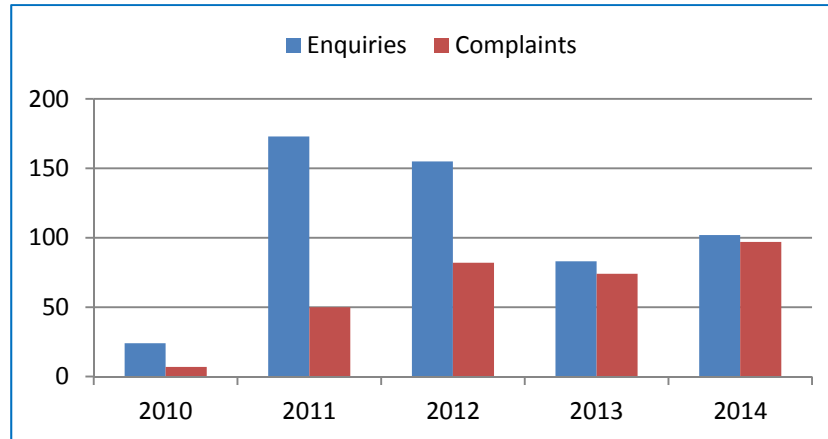
# EGCC provides a complaints resolution scheme



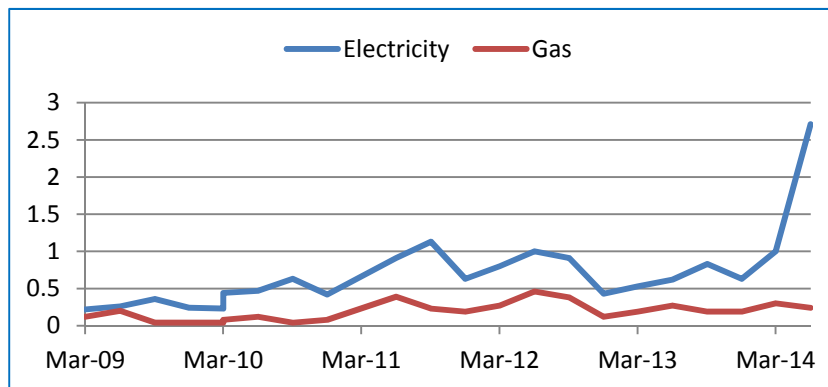
- Since 2010 small gas consumers have had access to a free, independent complaints resolution system provided by the Electricity and Gas Complaints Commission (EGCC).
- EGCC scheme recently expanded to include reticulated LPG.
- Covers gas complaints for amounts less than \$20,000, or up to \$50,000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

# The number of gas complaints is relatively low

## Gas-related Inquiries & Complaints



## Electricity & Gas Complaints per 10,000 ICPs



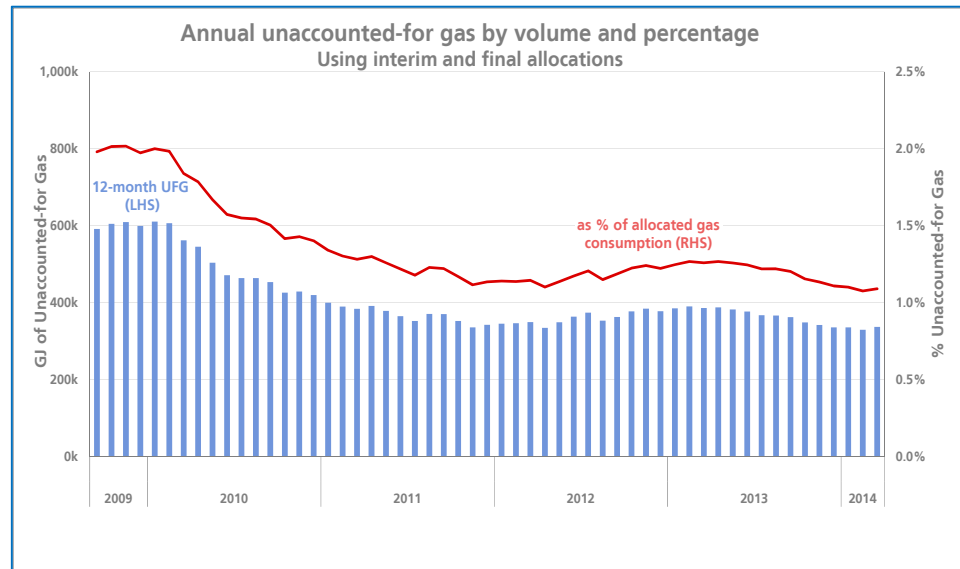
Source: EGCC

## 2014

- Gas complaints/inquiries 199 (2013: 157)
- Dual fuel (electricity and gas) inquiries/complaints 104 (2013: 89).
- Most common complaints are billing (almost half), customer service, disconnection, metering, debt issues.
- Complaints per 10,000 ICPs: Gas is doing better than electricity (average 0.27/month vs 0.98/month).

# Downstream reconciliation is carefully managed

## Unaccounted-for Gas 2009-2014



Source: GIC Quarterly Report June 2014

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 reduce from 2% to 1.1% of gas consumed and ongoing cost savings of \$2.5m/year.

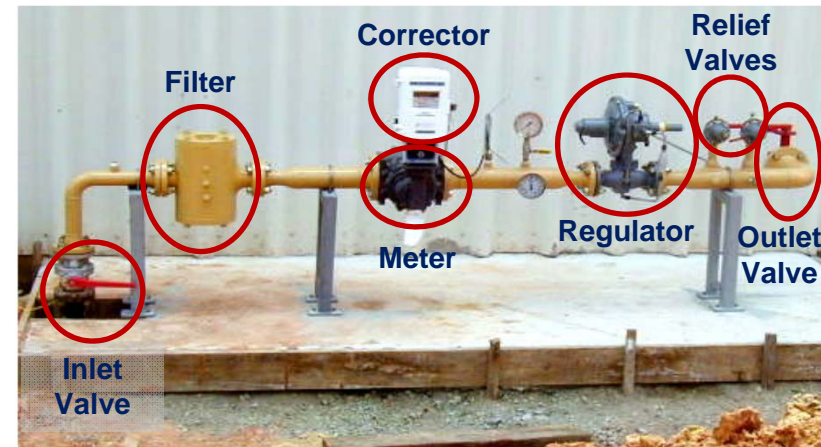
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# Gas Metering



# Metering is critical to accurate billing

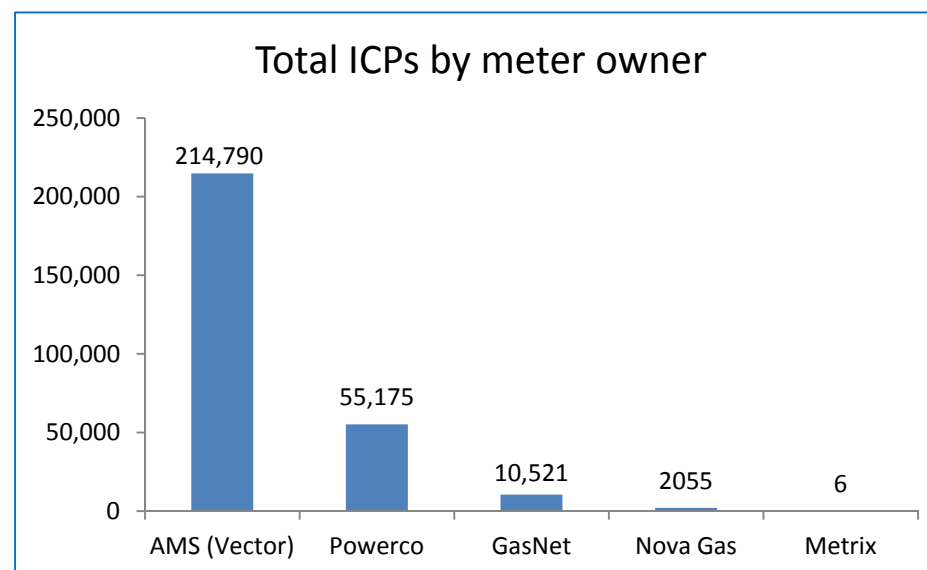
- Gas delivered to a consumer is measured by a meter at the consumer's premises.
- Gas meters are a component of gas measurement systems – (GMS) and are central to accurate billing and system reconciliation.
- GMS are more complex, more expensive than other energy metering systems.
- Meters differ in 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 market is considered 'limited'

- Five gas metering services suppliers:
  - Advanced Metering Services (AMS - subsidiary of Vector)
  - Powerco
  - GasNet
  - Nova Energy
  - Metrix (subsidiary of Mighty River Power)
- \* AMS acquired Contact Energy's gas metering business in 2013
- Gas metering subject to NZS 5259 standard, 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 smart, but yet to be rolled out in great numbers

- 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.
- 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
- Trials of remote reader units fitted to latest technology residential meters. Potential for general roll-out to small gas consumers.



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# 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 open, some lies hidden

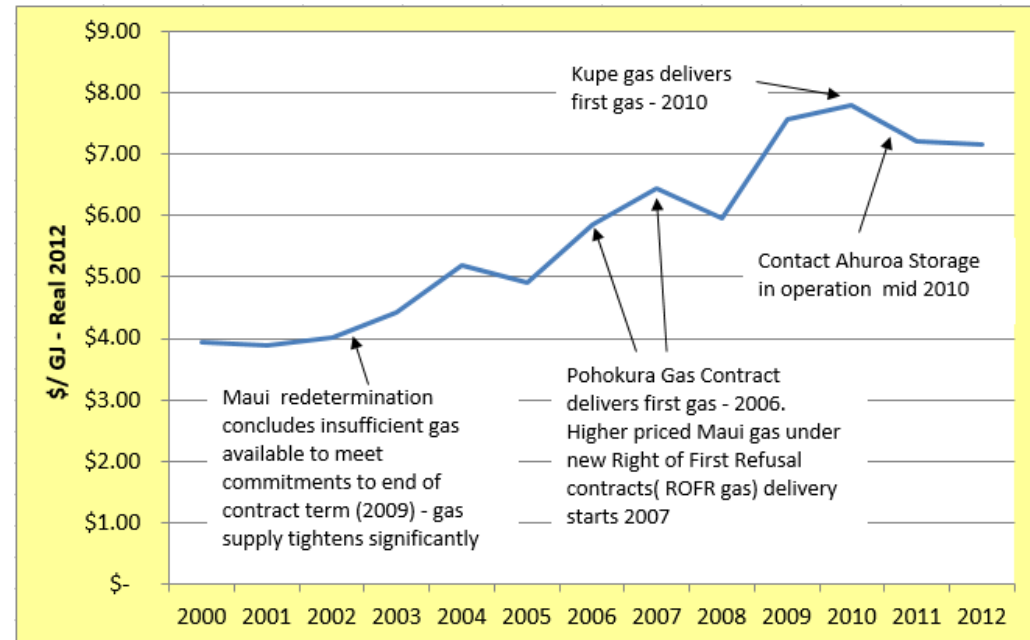


- Variety of public reference points for gas prices.
- MBIE surveys retailers quarterly and publishes price series for:
  - wholesale (GST inclusive)
  - industrial (GST exclusive)
  - commercial (GST exclusive)
  - residential (GST inclusive)
- Other sources of information:
  - posted transmission and 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 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 2012)



Source: Arete Consulting Ltd  
emsTradepoint trading has ranged from \$4.50/GJ to \$6.75/GJ

# And retail price factors are complex

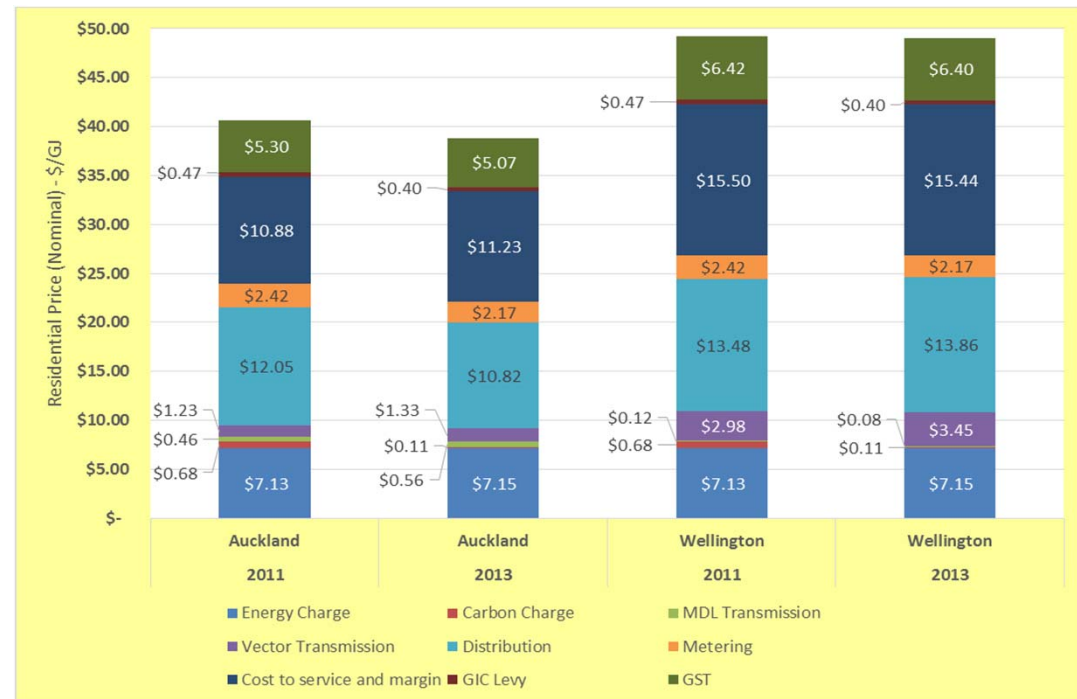


- Distance pricing element in transmission.
- Consumer segmentation:
  - home
  - business
  - small to medium
  - large
  - industrial
  - rural
- Networks segmentation by load ( $\text{sm}^3/\text{h}^{-1}$ ) – also adopted by retailers.
- Distribution differentials:
  - Vector has five distribution 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

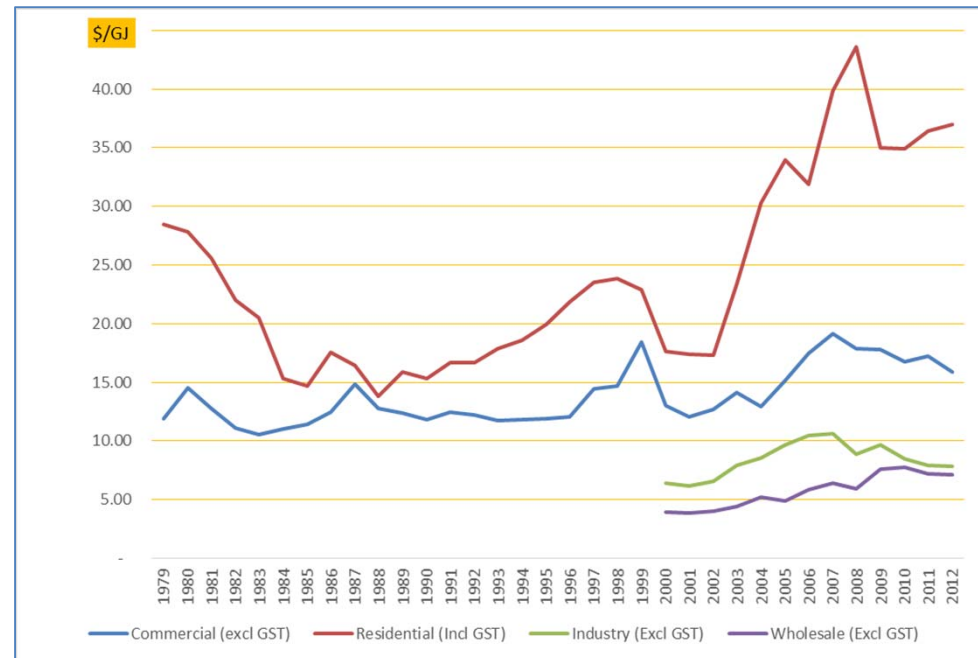
- Auckland - Wellington price difference reflects higher cost to service, margin, network costs, transmission charges – all of which drive a higher GST.
- Prices relatively stable over the period.
- Transportation charges (transmission/distribution) are the biggest cost, reflecting infrastructure investment and lower volume gas use by average residential customer.
- Second highest is retailer cost to service (excluding prompt payment discount) and retailer margin .



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)

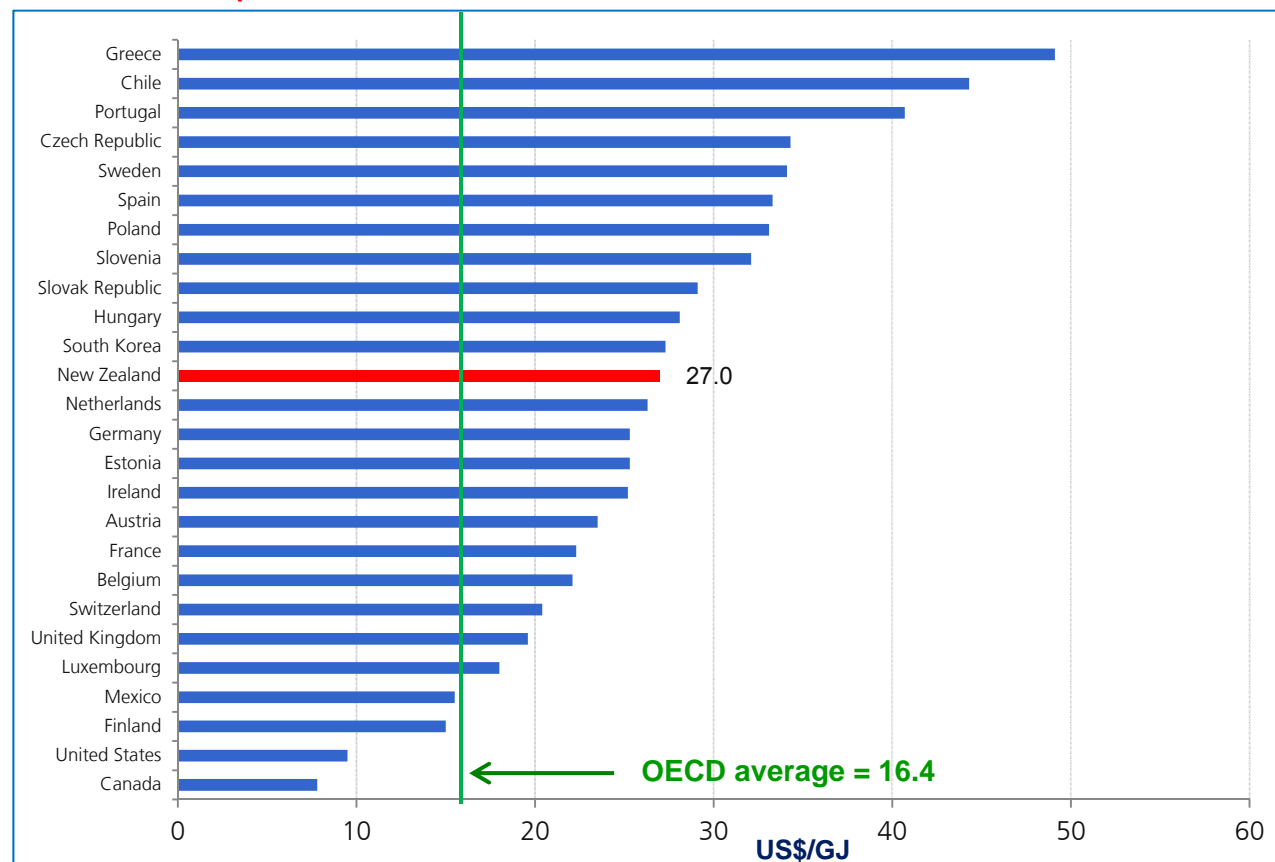


Source: Energy in New Zealand 2013

# Where NZ gas pricing sits in the world

- New Zealand's residential gas price is at the higher end of the price range - 15<sup>th</sup> 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

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# 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.

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# Gas quality is important to supply reliability

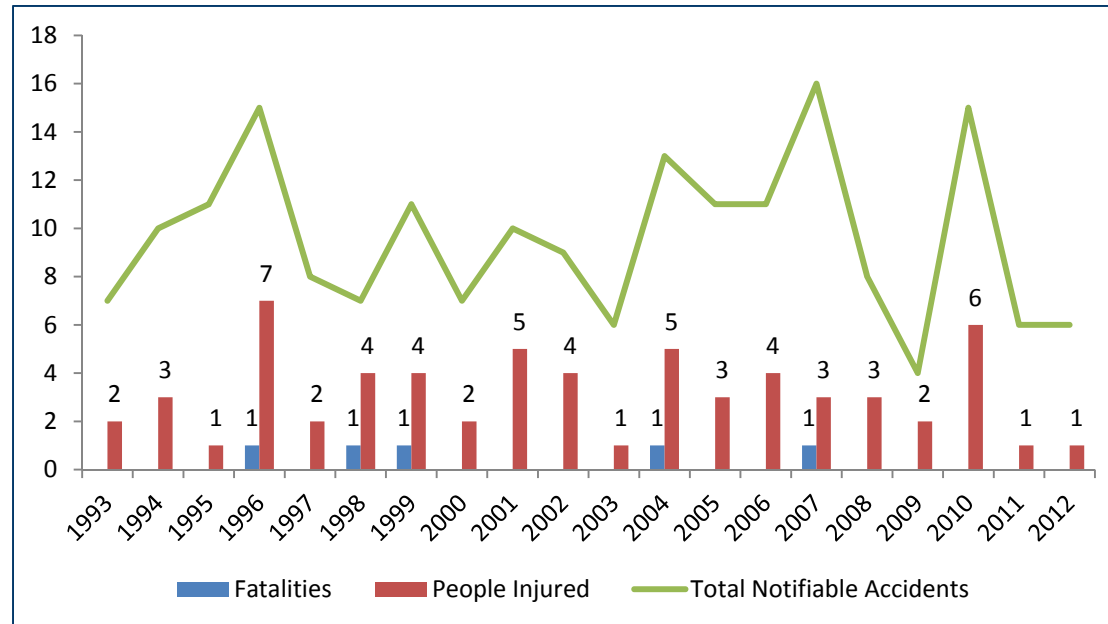
- Quality important to combustion performance, safety, supply reliability and long-term pipeline integrity.
- Prospects of a serious quality-related incident are small, but could have severe consequences.
- No evidence that quality is not being managed properly throughout the physical supply chain – but not that visible (commonly in contract provisions).
- Pipelines are a ‘common use’ facility involving multiple parties. Transparency of quality management important for all users.
- Industry developing protocol to address concerns around quality arrangements, including:
  - 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.



# There's no obvious trend in natural gas safety incidents

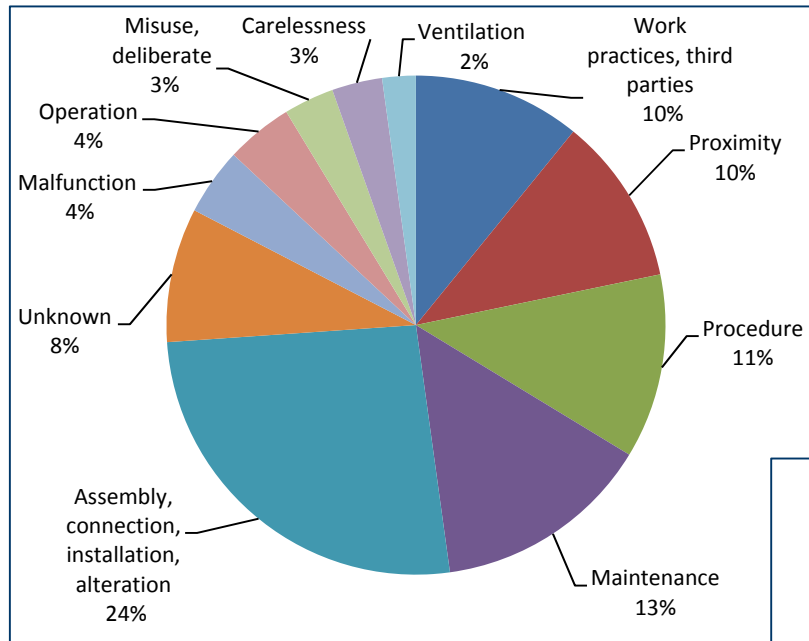
- 191 notifiable natural gas accidents in 20 years to 2012.
- Five fatalities, and 51 events injuring a total of 63 people.
- Given the relatively small number, Energy Safety finds no discernible trend, although 3 fatalities involved fixed space heaters and the other two a cooker and a water heater.

Notifiable Natural Gas Accidents 1993-2012

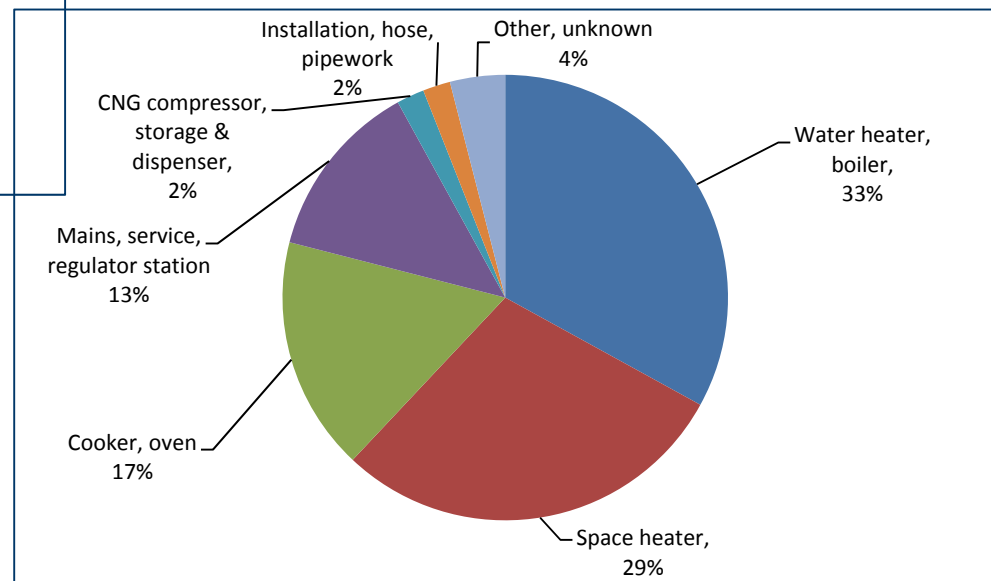


# But incidents are tracked by cause and equipment

**Causes 1993-2012**



**Equipment 1993-2012**



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# 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:
  - 37% of primary energy
  - 75% 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

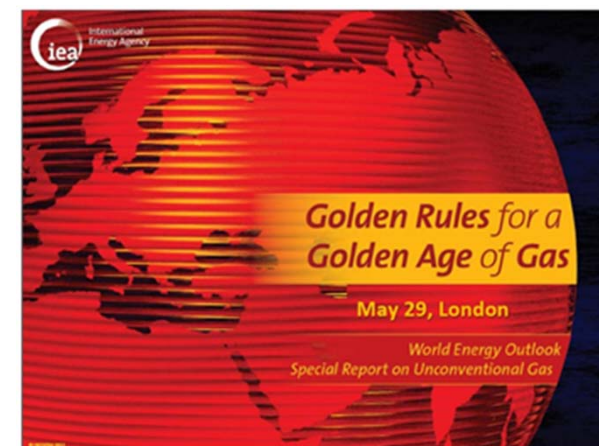
# Gas is growing and could change the nature of the debate

- 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:
  - US natural gas production up 56% by 2040
  - gas-fired electricity generation will overtake coal by 2035
  - US already achieved 70% of CO<sup>2</sup> emissions reduction target
  - US to become a net exporter again by 2020
- 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:
  - \$200b new-build LNG capacity nearing completion
  - \$65b on three CSG-to-LNG projects



## But there are concerns and calls for caution

- In addition to concerns over the environmental impacts of tracking and natural gas leaks, environmentalists fear cheap gas may deter alternative energy developments.
- The IEA has published a set of 'golden rules' – principles it says governments and stakeholders should follow or risk a set back or halt to the unconventional gas 'revolution'.
- Regulators 'scrambling to catch up' with unconventional gas developments pointed out by New Zealand Parliamentary Commissioner for the Environment in 2012 report on fracking.
- PCE's final report 2014 notes regulation in New Zealand not adequate for managing oil and gas drilling environmental risks and 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



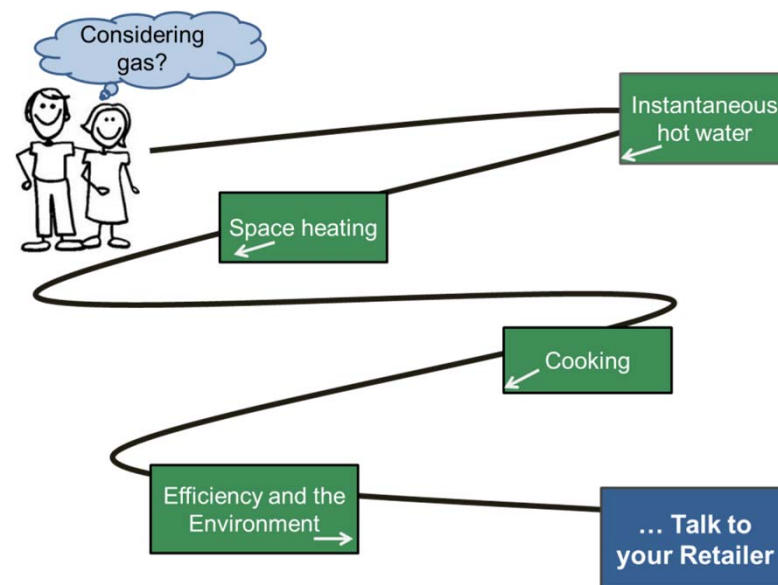


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# Looking ahead

# Gas holds its own in the highly competitive energy market

- Gas is strongly positioned as an efficient, cost-competitive option for home energy and industrial heat.
- Because of its lower capital cost and energy price (compared with electricity) instant/continuous gas water heating is often the most cost-effective option - even if a home doesn't already have a gas connection.
- Space heating options vary significantly depending on house size, insulation, geographic location and consumers' heating preferences. Gas is highly competitive with heat pumps, especially if gas is already connected for water heating.
- Gas-fired industrial boilers are cheaper than coal and biomass options.



Text and image from the report: *Consumer Energy Options: An Evaluation of the Different Fuels and Technologies for Providing Water, Space and Process Heat*, Concept Consulting, November 2012.

# Lumpy discoveries blur the crystal ball – there's a range of supply/demand futures...

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 facility to pick up slack
- return to a state of moderate supply

**Moderate supply** – where the discovery closely matches demand over time:

- 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:

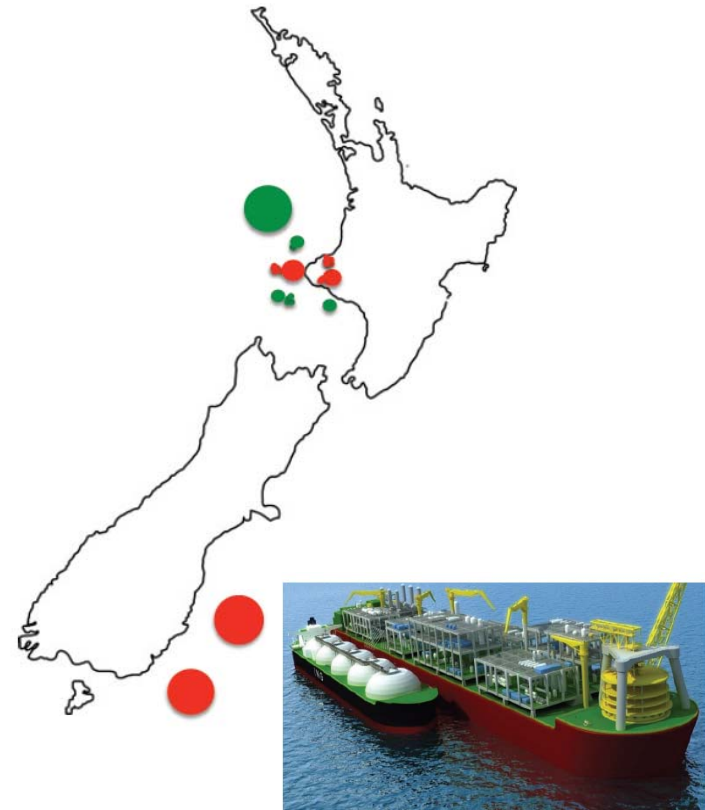
- methanol plant demand declines to match supply, or ceases
- reduced consumption by other large users – electricity generation, urea, industrial process heat

**What's likely?** – New Zealand will cycle between these scenarios, rather than move to just one.



# Is NZ ready for the next big gas find?

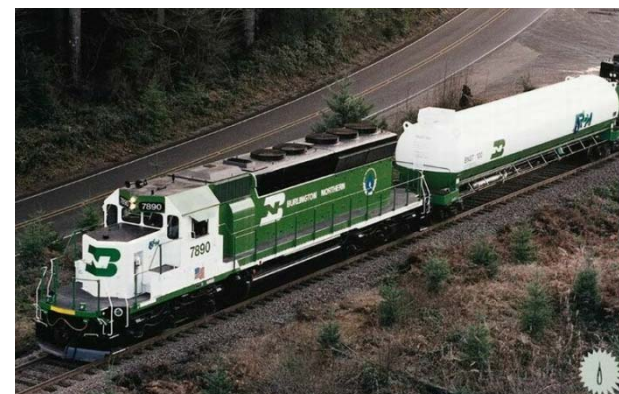
- A major new gas find will throw up substantial commercialisation and public policy opportunities and challenges.
- North and South Islands are different worlds.
- South Island is a blank slate:
  - no natural gas
  - no infrastructure
  - market development opportunities
- North Island market is mature:
  - infrastructure well established, highly reliable
  - substantial recent demand growth attributable to one player (Methanex)
  - concerns of market concentration, reduced demand.
- Possibility of LNG exports vs overall benefits to NZ.
- LNG carries a risk of price shock through a move to export market parity (see Australia).



Source: *Commercialisation Issues, Opportunities and Challenges in the Event of Substantive Gas-Rich Exploration Success in New Zealand*, John Kidd, Woodward Partners May 2014

# Are there opportunities to grow the NZ gas market?

- Gas will continue to perform its current role:
  - supporting electricity security of supply
  - providing consumers with energy choice
  - helping warm New Zealand homes
- Gas could deliver a transformational mix of economic and social benefits to the South Island and add an environmentally friendlier layer to existing coal, liquid fuels-intensive energy use.
- Traditional markets can be further developed:
  - industrial heat
  - electricity generation (South Island)
  - reticulation
  - fertiliser
- Innovative developments may translate to NZ, depending on cost/scale:
  - micro technology enabling direct LNG consumption
  - developments for gas as a transport fuel
- A lot depends on the delivered gas cost!



Duel diesel/LNG powered train - USA



LNG-powered truck



Shell LNG refuelling station - Canada

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# Discussion