

THE NEW ZEALAND GAS

FIFTH EDITION | DECEMBER 2016



Message from the Chief Executive

Gas Industry Co is pleased to publish this fifth edition of the *New Zealand Gas Story*. It includes developments in the policy, regulatory and operational framework of the industry since the previous edition was published in July 2016.

The New Zealand gas industry continues to change. In the past year we have seen a quantum shift in the world response to climate change. New energy technologies are transforming the sector. Although these are mostly electricity technologies, impacts on gas's contribution to the sector are inevitable.

On the home front, suppressed upstream exploration investment due to low international oil prices is changing the supply/demand dynamics of the domestic market. At the same time, after a history of separate ownership of the two open access high pressure pipeline systems, the new owner, First Gas, is progressing the development of a single access code that is widely expected to bring improved efficiencies to transmission access and pricing arrangements.

Gas remains an essential component of New Zealand's energy supply, but the developments referred to above on both the international and local stages are creating some significant uncertainties.

The latest gas supply/demand assessment¹ commissioned by Gas industry Co foreshadows a tightening of supply, and potentially higher gas prices, in the next four or five years in the absence of significant reserves increases from new or existing resources.

Specific uncertainties for New Zealand's energy markets include:

- future oil prices and the consequent extent of exploration effort;
- future CO₂ prices, and the consequent impact on gas demand – particularly the extent to which coal- and gas-fired power stations are displaced by renewables;
- the future of the electricity-intensive Tiwai aluminium smelter, and the consequent impact on power generation demand, and therefore the level of thermal support, should the smelter close;
- future international gas and petrochemical prices, as well as New Zealand's gas reserves position, and the bearing these have on the extent of future methanol production in New Zealand; and
- population and GDP growth.

The Paris COP-21 Agreement on Climate Change is unprecedented in focusing international attention on climate change management and committing nations, including New Zealand, to establish targets and implement programmes to limit the world temperature rise to below 2°C (if possible, below 1.5°C), and to achieve net zero carbon emissions by 2100. This international pact will require significant changes to how countries manage their economies. Energy use will attract much attention and there is no doubt that future energy markets will be substantially different to those of today. In the longer term, we can expect to see diminishing fossil fuel use and greater uptake of renewable energy.

The New Zealand energy supply position, comprising an already high level of renewable resources, particularly in electricity generation, is very different to that of other countries. For many nations, gas

¹ [Long-Term Gas Supply and Demand Scenarios – 2016 Update](#), Concept Consulting

will continue to play its demonstrably effective role in helping the transition towards greener economies by replacing more harmful fossil fuels, such as coal.

Such substitution opportunities for gas are far more limited in the New Zealand context. And as gas itself accounts for only about 9 percent of New Zealand's greenhouse gas emissions, it can be only a corresponding part of solutions. Transport and agriculture are far larger sources of environmental emissions. As the world transitions to a 'low carbon future', gas has an important ongoing role in New Zealand's electricity supply security, general energy sufficiency and economic stability for the foreseeable future. In particular:

- supporting a predominantly renewable electricity system;
- industries that use gas as a feedstock to convert into other products (methanol/urea);
- other energy-intensive industries that have no better option at present;
- businesses that could use alternatives, such as electricity, but to do so would likely increase their effective carbon footprint; and
- households where the direct use of gas is more efficient and/or has a lower carbon footprint than alternatives.

Over time, the wider energy sector in New Zealand and globally will be progressively transformed by a combination of energy use policies, carbon pricing and new technologies. Consumers will drive technology utilisation and gas will have to earn its place, much as it does now in the New Zealand electricity generation stack.

The wider *New Zealand Gas Story* traversed in this document has some unique features – not the least being that, apart from some importing and exporting of LPG, it is an isolated natural gas market unconnected to international trade via LNG or cross-border pipelines. And, with the currently good supply of gas from conventional sources, including contingency gas reserves, New Zealand has barely scratched the surface of the development of 'unconventional gas', which is the focus of much development overseas.

With the retirement of two baseload gas-fired electricity generation plants in Auckland in late 2015, gas infrastructure is expected to carry the industry forward in the foreseeable future. But, while the risks around transmission capacity constraints that arose in 2009 have eased, improvements to transmission capacity access and pricing arrangements remain a priority focus area for the industry. A programme to this end is being led by First Gas.

From a governance perspective, a solid platform of fit-for-purpose arrangements tailored to the particular characteristics New Zealand industry has been put in place following the introduction of a co-regulatory regime for the downstream gas sector in 2004. These are regularly reviewed for their ongoing effectiveness and, in conjunction with industry stakeholders, amended where improvements are identified. Remaining downstream issues are being proactively addressed.

We trust that this latest edition of the *New Zealand Gas Story* continues to be of value to all interested in the industry.

Steve Bielby
Chief Executive, Gas Industry Company

About the New Zealand Gas Story

The *New Zealand Gas Story* was first published in February 2013. It has two purposes - one legislative; the other market-based.

As the 'industry body' under Part 4A of the Gas Act 1992, Gas Industry Co is required to report to the Minister² on the state and performance of the gas industry. In the past, Gas Industry Co and the Government have issued occasional substantive reviews by external consultants³. In the era of websites and e-communication, Gas Industry Co publishes regular updates on market performance⁴. With *The New Zealand Gas Story*, we have developed a web-based report, which can be readily updated and added to over time. This is useful for keeping abreast of an industry that is constantly evolving, and where disclosure requirements introduced in 2013 sees staged releases of information during the year.

The second, market-based driver for this Report was a request from industry participants for Gas Industry Co to 'stitch together' the full story of gas in New Zealand, to assist knowledge and understanding of gas and its role in the New Zealand economy and society. This has become a formal part of Gas Industry Co's strategy.

The industry is complex and multi-faceted, from the time in which investors enter the upstream exploration market through to where gas is used by one of over 265,000 consumers. This Report is intended to provide a reference for industry stakeholders who may only be familiar with the parts of the gas story that are closest to them. Gas Industry Co also hopes the Report will help inform stakeholders' planning and decision-making processes.

While the Report is produced by Gas Industry Co, it is not about Gas Industry Co and its work. Rather, it is a discussion of the broad gas industry in New Zealand, and as such:

- extends beyond Gas Industry Co's formal jurisdiction, which essentially covers industry governance arrangements from the point at which gas is processed and injected into the transmission system. There is a range of other private and public players participating in or reporting on the industry.
- provides signposts to work being undertaken separately by other parties. Readers should follow those for the inevitably changing detail of that work.
- has scope to update, expand and improve its contents iteratively over time. Gas Industry Co welcomes ongoing feedback. The report benefits from drafting and review by a range of external stakeholders, but Gas Industry Co retains authorship responsibility and reserves the right to moderate and/or edit any contributions.

Disclaimer: In preparing this Report, Gas Industry Co has relied on information it holds, or has accessed through publicly available sources. While Gas Industry Co has endeavoured to provide accurate information and reliable analysis, it will not be liable for any claim by any party acting on such information.

² The Minister is defined in the Gas Act as the Minister with responsibility for administration of the Gas Act. As at the date of this report, the ministerial warrant for Gas Industry Co was held by the Minister of Energy and Resources. On occasion, decisions in respect of the gas industry have been made under delegation by the Associate Minister of Energy and the Acting Minister of Energy.

³ ACIL Consulting: *Review of the New Zealand Gas Sector. A Report to the Ministry of Economic Development*, October 2001; Allen Consulting Group: *The New Zealand Gas Industry in 2006. Review of its state and performance – Final Report to the Gas Industry Company*, 15 November 2006

⁴ www.gasindustry.co.nz

Executive Summary

Gas makes a large and important contribution to New Zealand's energy supply - as a direct fuel source, supporting electricity supply security and providing energy choice for consumers.

With a current contribution of 190 petajoules (PJ) natural gas accounts for 21.0 percent of New Zealand's total primary energy needs. It fuels around 15 percent of electricity generation, and meets 14 percent of consumer energy use. In 2014 the total gas market surpassed 200PJ/year for the first time since 2002 following the return to full, three-train methanol production capability by Methanex in 2013. Mechanical problems in 2015 saw reduced methanol production which contributed largely to an overall decline in gas use to 190PJ.

Available only in the North Island, natural gas is used by 268,800⁵ industrial, commercial, community and residential consumers and is supplied from 15 fields. Natural gas is no longer materially represented in the transport sector, with the compressed natural gas (CNG) market and its associated refuelling network essentially disappearing following the removal of subsidies in the mid-1980s.

Most of New Zealand's natural gas is used to generate the high heat required for electricity generation and industrial processes. A significant amount is also used for conversion into petrochemical products. Gas is delivered through 2,520km of high pressure gas transmission pipelines and 17,560km of regional gas distribution networks.

In the past decade, the gas industry in New Zealand has undergone substantial change, transitioning from a substantial reliance on the large Maui field, to drawing supplies from multiple smaller fields. While this change has seen the emergence of new participants, industry activity remains concentrated in a relatively small number of players.

Greater market complexity has been accompanied by commensurately tighter industry governance arrangements. The upstream sector has undergone a programme of change in recent years under the Government's Petroleum Action Plan and through review of the Crown Minerals Act. Arrangements for the mid and downstream sectors seek to establish a fit-for-purpose regime, balancing the need for efficient and competitive markets, while avoiding unnecessary hurdles in the development of what is a discretionary⁶ fuel option for most consumers (compared with electricity).

Gas continues to be an attractive energy choice for consumers and it is expected to maintain a significant role in New Zealand's energy mix well into the future.

⁵ 2016 Energy in New Zealand. Includes LPG

⁶ With the possible exception of petrochemical producers and some other large end-users, gas is an 'optional' fuel for consumers at the time they make their energy choice/investment. While gas is generally substitutable in many residential, commercial and industrial applications, it is often seen as the best or only choice on the basis of cost and efficiency. Once an investment is made, the consumer is usually committed to the chosen form of energy for the economic life of the plant

Gas Industry – Key Statistics

	2014	2015	Change
Annual natural gas supply (PJ) ¹	198	182	-8.0%
Consumers	264,500	268,800	+1.6%
Natural gas consumed ²	203	185	-8.9%
Wells drilled	33	10	-23%
Producing fields ³	15	15	--
Remaining gas reserves (2P)(PJ)	2,328	2,116	-9.1%
Total PEPs/PPPs ('granted' status)	59	51	-8
Total PMPs/PMLs ('granted' status)	25	25	--
PEP/PPP ⁶ expenditure (\$m)	\$ 449	\$166	-63.0%
PMP/PML ⁷ expenditure (\$m)	\$6,161	\$888	-45.0%
Gas processing facilities (operating)	12	12	--
Total transmission pipeline (km)	2,520	2,520	--
Total distribution networks (km)	17,559	17,744	+185km

¹ Annual natural gas supply is derived from total gross production (2015:216.PJ; 2014: 233PJ), less gas reinjection (2015: 13.1PJ; 2014: 17.7PJ); LPG extracted (215: 8.1PJ; 2014: 8.9PJ); gas flared (2015:7.0PJ; 2014: 2.9PJ) and production losses/own use (2015: 5.7PJ; 2014: 5.7PJ).

² Excludes transmission/distribution losses (2015: 0.8PJ; 2014: 0.8PJ)

³ Excludes gas produced at the offshore Tui (commissioned 2007) and Maari (commissioned 2009) fields, which is not delivered into the consumer market.

⁴ PEPs - Petroleum Exploration Permits; PPPs - Petroleum Prospecting Permits

⁵ PMPs – Petroleum Mining Permits; PMLs – Petroleum Mining Licences

Policy and Governance Framework

The gas industry is subject to a range of Government policy and governance measures, which are designed to ensure New Zealand's petroleum resources are found and developed, and that gas is delivered to consumers in a safe, efficient, fair, reliable and environmentally sustainable manner. Programmes are in train to address outstanding policy and industry operations issues.

All aspects of the industry, from drilling exploratory wells to its production, transportation, sale and the installation of gas appliances in the home, are subject to a form of regulatory oversight. The governance regime involves a variety of regulatory bodies and continues to evolve. Identified issues in the mid-to-downstream gas sector are addressed through regulated and non-regulated solutions. A price-quality regime for gas transmission and distribution businesses, overseen by the economic regulator, the Commerce Commission, was introduced on 1 July 2013.

Gas Industry Governance – Significant Policy, Regulatory and Industry Arrangements

Arrangement	Year	Purpose
Crown Minerals Act	1991	Sets policy for prospecting, exploration and mining of minerals and petroleum ¹ . This Act was substantially amended in May 2013 ² .
Gas Act	1992	Repeals the previous legislation (Gas Act 1982), removes exclusive retail franchises and price controls, places a focus on open, competitive markets. Establishes co-regulatory regime.
Gas (Information Disclosure) Regulations ³	1997	Introduced pursuant to the Gas Act 1992 to create information transparency as part of the light-handed regime.
Maui Pipeline Operating Code (MPOC)	2005	Ushers in open access on the Maui pipeline.
Vector Transmission Code ⁴	2007	Code-based regime that standardises transmission services by incorporating common contract terms.
Commerce Act 1986 Amendment	2008	Part 4 amendments include the economic regulation of gas distribution and transmission.
Government Policy Statement on Gas Governance (GPS)	2008	Updates 2004 GPS (which in turn updated the 2003 GPS). Sets out policy objectives additional to those in the Gas Act 1992.
Gas (Switching Arrangements) Rules	2008	Facilitate customer switching between retailers.
Gas (Downstream Reconciliation) Rules	2008	Prescribe a process for volumes of gas consumed to be attributed to retailers responsible for them.
Gas Governance (Critical Contingency Management) Regulations	2008	Process for industry participants to plan for, respond to and manage a serious incident affecting gas supply.
Gas (Processing Facilities Information Disclosure) Rules ⁵	2008	Require information to be provided by owners of gas processing facilities.
Gas Governance (Compliance) Regulations	2008	Determine and settle alleged breaches of the rules and regulations.
Utilities Disputes ⁶	2010	Provides a free and independent complaints resolution process for gas consumers.
Retail Gas Contracts Oversight Scheme	2010	Ensure retailers' supply contracts with small consumers are in the long-term best interests of those consumers.
Gas (Safety and Measurement) Regulations	2010	Prescribe rules and requirements for gas safety and measurement.
Gas Distribution Contracts Oversight Scheme	2012	Principles for contract arrangements between gas distributors and retailers.
Health and Safety at Work Act 2015	2015	Replaces the Health and Safety in Employment Act 1992. Promotes the prevention of harm in or near workplaces. Took in April 2016 following the development of supporting regulations (regulations include gas pipelines and petroleum exploration/extraction).

¹ Natural gas is covered by the definition of 'Petroleum'

² Crown Minerals Amendment Act 2013

³ Superseded from 1 October 2012 by new information disclosure requirements under Part 4 of the Commerce Act 1986

⁴ Vector's transmission system was acquired by First Gas in 2016

⁵ These Rules expired on 27 June 2014

⁶ Formerly Electricity and Gas Complaints Commission

Environmental Sustainability

As a fossil fuel, gas is part of the global debate on climate change, environmental sustainability and New Zealand's drive towards a greener economy.

The December 2015 Paris Agreement on Climate Change (COP-21) has given considerable impetus to global climate change management, with major implications for the future use of all fossil fuels, including gas, and how nations manage their economies.

Gas is the cleanest burning of fossil fuels, and is being widely used internationally to replace more harmful fossil fuels and help drive the transition to an environmentally sustainable future.

As it accounts for approximately 9 percent of New Zealand's total greenhouse gas (GHG) emissions, with transport and agriculture having a much greater environmental impact, gas can be only a corresponding part of the solutions.

With its already high level, and growing, renewable energy use, particularly in electricity generation, New Zealand has far fewer opportunities for gas to displace more harmful fuels. But for the foreseeable future, gas has an important ongoing role in New Zealand, in particular for:

- supporting a predominantly renewable electricity system.
- industries that use gas as a feedstock to convert into other products (methanol/urea).
- other energy-intensive industries that have no better option at present.
- businesses that could use alternatives, such as electricity, but to do so would likely increase their effective carbon footprint.
- households where the direct use of gas is more efficient and/or has a lower carbon footprint than alternatives.

Ultimately, gas will need to justify its place in a low carbon future.

Exploration and Production

After almost a decade of high levels of upstream exploration and development that stimulated demand, especially for petrochemical manufacture, and enhanced New Zealand's gas reserves position, upstream investment over the past two years has softened dramatically due to a slump in international oil prices. An intensive drilling programme two years ago involving plays in major offshore basins were unsuccessful in finding new gas resources, and in the current environment a number of permit holders have sought to defer their work programmes.

In the absence of an improved gas inventory from new discoveries or further development of existing fields, New Zealand faces a tightening gas supply in the medium to long-term. The current reserves/production ratio provides a supply horizon of approximately 10 years, at current production rates.

Interest in New Zealand's unconventional gas resources, that elsewhere are making a substantial impact on global gas reserves, has waned in recent years due to low oil prices and the withdrawal of some companies from these activities.

Government policies under the New Zealand Energy Strategy and Petroleum Action Plan are aimed at encouraging the search for, and sustainable development of, New Zealand's petroleum resources.

The commissioning in 2011 of New Zealand's first underground gas storage facility at the Ahuroa field by Contact Energy added a new dimension to supply/demand management and flexibility.

Gas Processing

The industry is well serviced with gas processing facilities, which tend to be built in conjunction with the development of new fields, and tailored to the reserves, wellstream composition and production characteristics of the particular field. Third party access, when required, is governed by commercial contracts. A finite term information disclosure regime for gas processing facility owners that ended in June 2014 did not identify competition or entry barrier issues and no need was seen for regulated access.

Gas Transmission

The main gas transmission pipelines are available to gas shippers under non-discriminatory, open access arrangements, and interconnection arrangements are in place to receive gas from new fields, or deliver gas to users. Accordingly, no significant barriers to entry have been identified.

Potential capacity issues on the transmission system have eased since 2009 when periods of congestion on the transmission North Pipeline affected the ability of then owner, Vector, to offer new capacity contracts on that section of the pipeline, prompting competition concerns. Capacity availability increased particularly with the retirement of two gas-fired power stations in Auckland - together accounting for about 60 percent of the North Pipeline capacity - in the second half of 2015.

Although transmission system capacity is considered adequate for the foreseeable future, the industry is continuing a programme to improve transmission access and pricing arrangements following the 2009 constraints. This programme is now being led by the new (single) owner of both pipeline systems, First Gas, and involves the development of a proposed single access code to replace the currently separate access arrangements - akin to common carriage on the Maui line, and contract carriage on the former Vector system.

While under single ownership, the transmission systems are currently separately regulated under a Commerce Commission price-quality regime introduced in 2013. The Commission is in the process of resetting transmission price/quality paths to take effect in 2017.

The transmission infrastructure is generally reliable and fit for purpose. A serious Maui pipeline outage in October 2011, affecting a large number of consumers in the upper North Island, provided a reminder of the industry's reliance on these assets and prompted a review of gas supply emergency response arrangements. Changes were implemented in 2014.

Gas Distribution

The gas distribution market is well established, with four open network services providers, and one non-open access network owner. No efficiency or competition issues have been identified around open access gas distribution networks.

The networks were founded in the early days of local manufactured gas operations, or constructed as new towns and cities became serviced with natural gas following the development of the Kapuni and Maui fields. Distributors have continued to invest in network expansion. There is more pipe in the ground, increasing consumer connections, and the market for reticulated gas is seeing improved throughput following a period of relatively static volumes.

The distribution networks generally operate to a high level of reliability and a formal downstream gas reconciliation regime is providing an efficient process for allocating to retailers the portion of gas on a

distribution network used by their customers. Levels of unaccounted-for gas have declined substantially.

Wholesale Market

The New Zealand wholesale market is small and relatively concentrated. Competitive tendering for gas supply occurs, and no specific concerns have been raised by industry participants about buying or selling gas as a commodity. There are a number of producers and wholesalers active in the market. Some producers sell gas directly to end-users. Secondary trading has traditionally been arranged bilaterally between parties. However, for both primary and secondary trading, there has historically been no transparency of terms that enable discovery of prices or other information, such as trading frequency – although these are understood to be occasional only.

A commercial trading platform established in 2013 has also become a platform for balancing transactions associated with a new market-based transmission pipeline balancing regime. This platform is providing improved transparency of prices and volumes, and assists in fulfilling Government policy objectives for 'efficient arrangements for the short-term trading gas'.

Retail Market

The retail gas market continues to grow, with around 10,500 new consumers in the past five years. Market contestability has strengthened, and over 99 percent of gas consumers have a choice of seven or more retailers. Customer switching between retailers has increased markedly to 19 percent. Stronger retail competition is also evidenced by reduced market concentration, reflecting new retailers entering the market and smaller retailers increasing their market share.

The industry is performing well against Government policy objectives for the retail market and the protection of small consumer interests. A retail contract evaluation scheme introduced in 2010 has seen a major improvement in the clarity and detail of retailers' supply arrangements with small consumers. A suite of other market enhancements benefitting small consumers has included a switching regime to enable consumers to efficiently change their retail supplier, and the implementation of a formal consumer complaints scheme through Utilities Disputes Limited (formerly the Office of the Electricity and Gas Complaints Commissioner).

Gas Pricing

The availability of multiple retailers and significant customer switching indicate competitive forces are at work in the retail market. Pricing generally signals the full cost of producing and transporting gas.

In a number of respects, delivered gas costs and prices are subject to 'sustained downward pressure', as sought by Government policy objectives. Gas Supply Agreements (GSAs) are reflecting increased competition following the initial post Maui 'reset', and new entrants, together with new sources of gas have increased short-term gas supply availability with a positive impact on gas price trends. Mechanisms have been put in place to enable consumers to readily compare retailer prices and to switch supplier easily and quickly. Transmission and distribution prices are constrained by regulation in the form of a price-quality control regime that took effect on 1 July 2013.

Gas Metering

Gas metering is joining the international movement towards 'smart' metering technologies and is working its way through particular challenges applying to the gas sector. Gas metering is subject to technical regulation, which is reflected in the Reconciliation Rules and industry contracts. Metering

services are excluded from the definition of gas pipeline services under Part 4 of the Commerce Act. While the Commerce Commission has described competition in gas metering services as 'limited', it has decided not to make an inquiry at this time to ascertain if these services should be regulated.

Gas Safety

Natural gas safety requirements have been strengthened in recent years, through both generic and industry-specific health and safety regulation. This was primarily the responsibility of the Ministry of Business, Innovation and Employment prior to the creation in 2013 of a new Crown Agency, WorkSafe New Zealand. In addition to national workplace health and safety performance, a health, safety and environmental management regime has been developed under EEZ legislation, which includes offshore oil and gas exploration.

While the prospects of a serious gas quality-related incident are considered small, concerns over gas quality arrangements have led to the production of a *Gas Quality: Requirements and Procedures* document for the industry.

Contents

1	Gas Industry and Policy Evolution	1
1.1	Industry Development	1
1.2	Policy Development	2

2	Gas Contribution to Energy Supply	6
2.1	Energy Supply and Demand	6
2.2	Gas Use by Sector	8
2.3	Electricity Generation	9
2.4	Gas Industry Structure	11
2.5	Regional Consumption	14
2.6	An Ongoing Role for Gas	14
2.7	Gas Supply and Demand	15

3	Government Policy Framework	23
3.1	New Zealand Energy Strategy	23
3.2	National Infrastructure Plan	24
3.3	Petroleum Action Plan	25
3.4	Business Growth Agenda	25
3.5	Gas Act and Government Policy Statement on Gas Governance 2008 (GPS)	25
3.6	Commerce Commission – Economic Regulation	26

4	Regulatory Framework	30
4.1	Evolution of Regulatory Frameworks	30
4.2	Entities Overseeing Gas Industry Arrangements	31
4.3	Regulatory Arrangements	34

5	Environmental Sustainability	44
5.1	Background	44
5.2	Electricity Generation	46
5.3	Industry and Commerce	46
5.4	In the Home	47

5.5	What People are Saying about Climate Change	47
5.6	What Countries are Doing	49
5.7	Other Environmental Considerations	50
5.8	Regulatory Performance	50
<hr/>		
6	Exploration and Production	51
6.1	Background	51
6.2	Post Kapuni/Maui Developments	52
6.3	Government Policy Initiatives to Encourage Gas Exploration	55
6.4	Current State of Exploration and Production	57
6.5	Exploration Activity	60
6.6	Gas Production	62
6.7	Gas Reserves	64
6.8	Reserves Ownership	68
6.9	Unconventional Gas	70
6.10	Unconventional Gas Developments in New Zealand	70
6.11	International Developments in Unconventional Gas	73
6.12	Gas Hydrates	77
<hr/>		
7	Gas Processing	80
7.1	Background	80
7.2	Current State of the Gas Processing Market	80
7.3	Gas Processing Facilities	81
7.4	Reliability	83
7.5	Regulatory Performance	83
7.6	International Gas Processing Access Practices	84
<hr/>		
8	Gas Transmission	86
8.1	Background	86
8.2	Current State of the Transmission Market	87
8.3	Maui Pipeline	92
8.4	First Gas System	95
8.5	Other Transmission Pipelines	98
8.6	Transmission Capacity Services	98
8.7	Transmission Capacity Access	99

8.8	Gas Balancing	103
8.9	Interconnection with Transmission Pipelines	105
8.10	Transmission Pipeline Integrity	105
8.11	Critical Contingency Management	108
8.12	Regulatory Performance	109
8.13	International Transmission Market Practices	111
<hr/>		
9	Gas Distribution	114
9.1	Background	114
9.2	Current State of the Distribution Market	115
9.3	Gas Distribution Market in New Zealand	117
9.4	Regulatory Performance	126
9.5	International Distribution Market Practices	127
<hr/>		
10	Wholesale Market	129
10.1	Background	129
10.2	Current State of the Wholesale Market	130
10.3	International Wholesale Gas Market Practices	131
10.4	Wholesale Market Needs in New Zealand	133
10.5	Spot Market Developments	135
10.6	Regulatory Performance	136
<hr/>		
11	Retail Market	137
11.1	Background	137
11.2	Current State of the Retail Market	137
11.3	Retail Market Trends	138
11.4	Retailers	139
11.5	Customer Choice	141
11.6	Customer Switching	143
11.7	Retailer Market Share	144
11.8	Switching Rules Breaches	145
11.9	Downstream Reconciliation and UFG	146
11.10	Reconciliation Rules Breaches	147
11.11	Reconciliation Rules Audits	148
11.12	Insolvent Retailer Arrangements	148

11.13	Retail Contracts	149
11.14	Consumer Complaints Process	150
11.15	Raising Awareness	152
11.16	Regulatory Performance	152
11.17	International Retail Market Practices	154
<hr/>		
12	Natural Gas Pricing	156
12.1	Background	156
12.2	Wholesale Gas Price	159
12.3	Retail Gas Price	168
12.4	Residential Market	171
12.5	Industrial Gas Price	179
12.6	Commercial Gas Price	181
12.7	Regulatory Performance	184
<hr/>		
13	Gas Metering	185
13.1	Background	185
13.2	Current State of the Gas Metering Market	186
13.3	Meter and Energy Conversion Accuracy	188
13.4	Smart Meters	189
13.5	Regulatory Performance	190
13.6	International Metering Market Practices	191
<hr/>		
14	Gas Safety	193
14.1	Background	193
14.2	Standards	194
14.3	High Pressure Pipelines	195
14.4	Gas Appliances	195
14.5	Current State of Gas Safety	195
14.6	Gas Quality	196
14.7	International Gas Quality Practices	197
14.8	Gas Safety Incidents	198
14.9	Regulatory Performance	200

1 Gas Industry and Policy Evolution

1.1 Industry Development

Natural gas is a substantial component of New Zealand's energy supply make-up. It provides consumers with a direct energy choice, supports electricity supply security and makes an economic contribution in a way that recognises the country's environmental sustainability goals.

Gas is used by 268,800⁷ industrial, commercial and residential consumers. It accounts for 21.0 percent of total primary energy supply and 14 percent of total consumer energy use.

The energy supply and economic importance of natural gas has grown rapidly since the first commercial discovery at Kapuni in 1959. That discovery led to increased exploration activity and further major gas finds.

The commencement of natural gas deliveries from the onshore Kapuni field in 1970 enabled the replacement of aging town gas works that produced gas from coal. The cleaner, more efficient natural gas was initially distributed through local gas networks in nine communities serviced by a transmission pipeline running north from Kapuni to Auckland, and south to Wellington⁸.

Gas supplies were substantially expanded in 1969 with the discovery of the much larger offshore Maui gas/condensate field. Maui gas deliveries began in 1979, and at their peak accounted for over 85 percent of total gas supply.

The development of the Maui field and the construction of a 309km pipeline from Oaonui to the Huntly power station heralded an era of rapid expansion of the high pressure gas transmission system during the 1980s to Northland, the Bay of Plenty and Hawke's Bay, extending the reach of natural gas into all major populated centres of the North Island. No significant transmission pipeline extensions have been built since the construction burst in the 1980s. The 2,520km of transmission pipelines feed the lower pressure local distribution networks, and directly supply some large users.

The advent of plentiful natural gas enabled existing distribution networks to be upgraded and expanded, and for new networks to be constructed as the high pressure transmission pipeline reached other towns and cities for the first time. Distribution networks in North Island cities and towns now total over 17,700km.

Today, natural gas has a wide range of applications - fuelling thermal electricity generation plants and large industries (including in the key export sectors of meat, dairy and timber processing, and steel manufacture), and providing feedstock and process gas for petrochemical (methanol and ammonia/urea) production. Gas is also used directly in a wide range of small to medium commercial enterprises, in community amenities such as schools, hospitals and public swimming pools, and for space and water heating and cooking in homes.

⁷ 2016 *Energy In New Zealand*

⁸ The original 'Kapuni 9' retailers were Wellington Gas Company, Hutt Valley Electricity and Gas Board, Levin Borough Council Gas Department, Wanganui City Council Gas Department, Palmerston North City Council Gas Department, Hawera Gas Limited, New Plymouth City Council Gas Department, Hamilton City Council Gas Department, and Auckland Gas Limited. They were subsequently joined by East Gas Limited (Hawkes Bay) and, as the transmission system was extended to reach new urban areas, NGC.

In the past decade, as Maui gas reserves have diminished, the gas industry has transitioned from a dependence on that field to drawing on multiple fields for gas supplies. Market demand of over 185PJ a year is currently being met from 15 different fields.

While there has been exploration activity in many onshore and offshore regions of New Zealand, all gas production so far has been from onshore and offshore Taranaki, on the west coast of the North Island. Natural gas is not available in the South Island. However, LPG (liquefied petroleum gas), a mix of propane and butane extracted from the petroleum wellstream, is available throughout the North and South Islands.

1.2 Policy Development

Prior to the discovery of the Kapuni field, New Zealand communities since 1862 had been supplied by 'town gas' plants that manufactured gas from coal and, later, other feedstock such as naphtha. The manufactured gas was transported to consumers through small community-based networks. These operations were owned by the local government authority or a local private business.

With the discovery of the Kapuni gas/condensate field, the Government made a strategic policy decision to use the gas as a premium fuel to replace some of the aging and uneconomic coal gas plants in the North Island. It established the Natural Gas Corporation of New Zealand Limited (NGC) as a state-owned company to buy the high carbon dioxide-content Kapuni gas from the joint venture producers (then Shell, BP and Todd), process it to a specification suitable for the retail market (primarily by removing the CO₂), transport it to market, and wholesale it to existing gas utilities. By 1969 a pipeline had been constructed from Kapuni north to Auckland and south to Wellington and gas supply began with the completion of the Kapuni gas treatment plant in 1970.

Kapuni gas was originally supplied under long-term contracts between NGC and nine gas utility companies, each of which held a Government-sanctioned retail franchise monopoly in the population centre in which it previously manufactured and sold town gas. The supply contracts were for 'delivered gas' and did not separately account for transportation services.

The much larger Maui discovery offered far more gas than New Zealand needed for the then size of the domestic market. The development of the Maui field proceeded with the Government (Crown) in 1973 becoming a half owner (through an investment vehicle Offshore Mining Company Limited), meeting half the development costs and agreeing to purchase all Maui gas under take-or-pay arrangements. The contract was to run for 30 years, expiring in June 2009, and the intention was to supply new and proposed gas-fired electricity generators.

However, these proposals represented more electricity generation than the country needed. Coincidentally, a substantial change in world oil market dynamics – a series of economically damaging price increases known as the 1970s 'oil shocks' – drove a significant change in the Government's thinking.

A new strategy, to use Maui gas to achieve economic growth and to reduce New Zealand's dependence on imported oil, spawned a programme of Government-sponsored 'Think Big' construction projects. They included a number of large gas-based developments - an ammonia-urea plant at Kapuni, a synthetic petrol (or gas-to-gasoline) plant at Motunui (synfuel plant), and a chemical methanol plant in the Waitara Valley (Petrageas plant).

Other initiatives included encouraging the direct use of gas in large industries, businesses and homes by making gas more widely available, strengthening petroleum exploration activity, expanding the Marsden Point oil refinery, and using gas directly as a transport fuel – as CNG and LPG.

In 1978, the Government consolidated all of its then increasing direct interests in the oil and gas sector into a new state-owned company, the Petroleum Corporation of New Zealand Limited (Petrocorp). These interests included NGC, Offshore Mining Company, and an exploration and production activity carried out under the then Department of Mines. Petrocorp subsequently expanded its interests to include ownership of the Kapuni ammonia/urea plant through a subsidiary, Petrochemical Corporation of New Zealand Limited (Petrochem), and a majority ownership interest in Petralgas Limited, which owned and operated the Petralgas plant.

As the gas industry expanded and matured, the Government commenced a process of reducing its direct commercial involvement. In 1987, the Government sold 30 percent of its interest in Petrocorp through the issue of new shares, resulting in Petrocorp briefly becoming listed on the New Zealand Stock Exchange (NZX). Of the total shares issued, 15 percent were sold by tender to Fletcher Challenge Limited (FCL), with the rest offered to the public via a share float. The following year, the Government effectively privatised its energy industry interests by selling its remaining 70 percent shareholding of Petrocorp by tender to FCL. FCL also acquired the shares held by the minority shareholders⁹.

The changing energy scene was also reflected in the evolution of the Crown's Maui contract arrangements. With the change in gas utilisation policy, after it became apparent that the forecasts for electricity demand were overstated and the Crown faced a substantial annual take-or-pay deficit, the Crown committed its Maui gas entitlements to the development of the domestic market and to supplying the petrochemical plants. Gas for the ammonia/urea plant was bought by NGC (then a subsidiary of Petrocorp); and Petralgas - a joint venture between Petrocorp (51 percent) and Canadian-based Petralgas Corporation (49 percent) - bought gas directly from the Crown. The Synfuel plant did not buy gas; rather the Crown became a 75 percent owner of the company that owned and operated the plant, which processed the Crown's gas into gasoline on a tolling fee basis.

During this period, about 40 percent of the Crown's Maui gas was being burned in thermal power stations directly owned by the Crown and, from 1987, by a state-owned enterprise, the Electricity Corporation of New Zealand (ECNZ). The contractual arrangements with ECNZ were informal until 1990, when the Crown restructured its contracts, and onsold its rights to Maui gas in a series of six contracts. After industry consolidation and sales, three companies held the six 1990 contracts:

- NGC¹⁰ (27.47 percent)
- New Zealand Liquid Fuels Investments Limited (NZLFI)¹¹ (29.74 percent)
- ECNZ¹² (42.79 percent)

⁹ NGC operated as part of FCL until 1992, when FCL floated off two-thirds of NGC, a third to Sydney-based Australian Gas Light Company (AGL), and a third to the public via the NZX. In 1999, AGL acquired FCL's one-third interest to become a two-thirds majority shareholder of NGC. In 2004/05 Vector limited acquired AGL's shareholding in NGC, and subsequently moved to 100 percent ownership through the acquisition of the minority interests.

¹⁰ Subsequently acquired by Vector.

¹¹ NZLFI was previously the Crown's vehicle for investing in the New Zealand Synthetic Fuels Corporation, and acquired part of the Crown's Maui gas for processing at the Synfuel plant. As part of the 1990 transactions, Fletcher Challenge Limited (FCL) acquired the Crown's interest in NZLFI. NZLFI subsequently assigned its gas purchase rights to Methanex, which purchased FCL's methanol operations, including the Synfuel plant, in 1993.

¹² Subsequently assigned to Contact Energy, which was separated from ECNZ in 1996.

These contracts were further revised in 2004 as a result of a redetermination of Maui reserves. The Maui Mining Companies (Shell, Todd and OMV), the Crown and the parties that held the final delivery rights to Maui gas (Vector, Methanex, and Contact) agreed to amend the terms of the contract, limiting the remaining amount of gas to be delivered under the contract price – which at the time was significantly below the market price for gas – to 367PJ. This was the volume of remaining Maui gas that an independent expert determined to be 'economically recoverable' from the Maui field. Any gas to be recovered in excess of this volume would be sold by Maui Development Limited (MDL) at the market price, thereby providing an incentive for further development of the field. Of any further gas recovered from the field, 40PJ was reserved for Methanex. Vector and Contact had a right of first refusal for the remaining additional gas (referred to as 'ROFR gas').

Natural gas supply was the last activity to be removed from direct price control as part of New Zealand's economic reforms of the late 1980s/early 1990s. An in-depth review of the gas industry in the early 1990s¹³ led to the development of new policies for fundamental gas sector reforms that were translated into the Gas Act 1992. These reforms deregulated the market through the abolition of the exclusive retail franchise areas and a move from price control to market-based pricing. At the same time it introduced a light-handed regulatory regime centred on information disclosure, but retained the threat of re-regulation. Government policy thinking at the time was also influenced by infrastructure and competitive markets policy developments in Australia¹⁴.

With these developments, NGC negotiated new contracts with the gas utility companies, which unbundled the previous delivered gas arrangements into separate gas supply and transport elements. While there was no mandatory separation of gas retailing and distribution functions – as applied to electricity sector companies under the 1998/99 electricity reforms¹⁵ – some gas utilities chose to separate their retail and network businesses, retaining one or the other, and adding to widespread buying and selling of energy businesses.

The new transport arrangements also introduced open access to NGC's transmission pipelines in 1996 and the development of an industry Pipeline Code in 1998. The Maui pipeline remained dedicated to the delivery of Maui gas until 2005 when it was opened for the transportation of gas from other fields, which were coming onstream as Maui output declined.

The Government continued to periodically review the gas sector, which has fed further policy development. In 2001, the Minister of Energy released a discussion paper prepared by ACIL Consulting¹⁶ that considered whether the gas sector was meeting the Government's objective for natural gas to be delivered to users in an efficient, fair, reliable and sustainable manner.

In a subsequent Policy Statement on Gas Governance in March 2003, the Government stated that, consistent with a self-regulation approach, it favoured industry-led solutions where possible, but that it was prepared to use regulatory solutions if necessary.

A Gas Industry Steering Group (GISG), formed to respond to the Policy Statement, advised that the industry would require some form of regulatory backing to achieve the Government's objectives and outcomes. The Government agreed, and the Gas Act was changed in 2004 to give effect to a co-

¹³ *Review of the Regulation of the Natural Gas Industry: Report to the State Sector Committee*, March 1991.

¹⁴ Professor Frederick G. Hilmer: *National Competition Policy Review*, 25 August 1993 (Hilmer Report).

¹⁵ The 'Bradford' reforms, introduced by then Energy Minister Hon Max Bradford.

¹⁶ ACIL Consulting: *Review of the New Zealand Gas Sector. A Report to the Ministry of Economic Development, October 2001*. This report includes details of historic contractual arrangements relating to Maui and Kapuni gas sales and purchases.

regulatory model of governance. Gas Industry Co was established as the industry body and co-regulator.

In relation to gas pipelines, the ACIL report pointed to monopoly pricing and access issues in gas transmission and distribution. As a result of these findings, in early 2003 the Minister of Energy asked the Commerce Commission to conduct an inquiry into gas pipeline services under Part 4 of the Commerce Act. In late 2004, the Commission recommended to the Minister that Powerco's pipelines and Vector's distribution networks in Auckland should be subject to regulatory control, and that other gas pipelines (except those of Nova Gas and 'gas gathering' pipelines in Taranaki), be subject to a thresholds regime similar to the provisions of the Part 4A regime for electricity lines. On 27 July 2005, the Minister of Energy announced the decision to declare control over the gas distribution services of Powerco and the distribution services of Vector in Auckland¹⁷.

In 2008, Part 4 of the Commerce Act was amended¹⁸ and all suppliers of open access gas pipeline services became subject to new information disclosure and price-quality regulation. The Commerce Commission set information disclosure requirements for gas pipelines on 1 October 2012, and new price-quality control arrangements for all open access transmission and distribution pipeline services took effect on 1 July 2013.

Since the 2001 ACIL report, the Allan Consulting Group in 2006¹⁹ released an industry review commissioned by Gas Industry Co, and in 2011 the industry was reviewed by Professor Stanford L. Levin on behalf of the New Zealand Institute for the Study of Competition and Regulation (ISCR)²⁰.

¹⁷ Commerce (Control of Natural Gas Services) Amendment Order 2005

¹⁸ Commerce Amendment Act 2008

¹⁹ *The New Zealand gas industry in 2006. Review of its state and performance – Final Report to the Gas Industry Company*, 15 November 2006.

²⁰ ISCR: *Policy Considerations for the New Zealand Natural Gas Industry*, Stanford L. Levin and Alfred J.M. Duncan, July 2011

2 Gas Contribution to Energy Supply

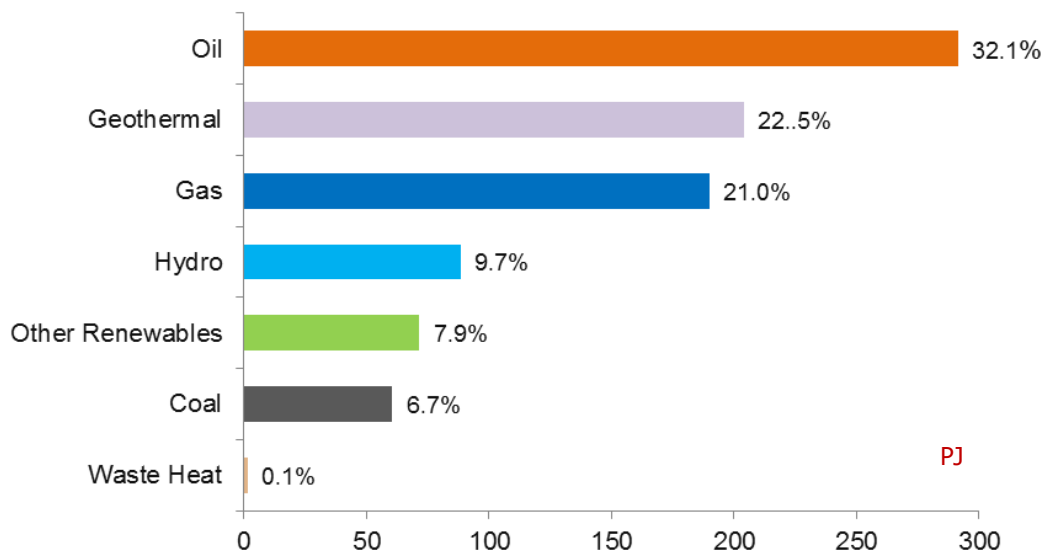
2.1 Energy Supply and Demand

New Zealand's primary energy demand amounts to over 900PJ a year²¹. In 2014, gas contributed 190PJ²², or 21.06 percent of the country's primary energy needs. In volume terms, the contribution of gas was 6.8 percent down on the 204PJ in the previous year, reflecting mainly reductions in gas use for methanol production and for electricity generation.

The composition of New Zealand's primary energy supply is shown in Figure 1. New Zealand produced a record 40 percent of its primary energy needs from renewable sources in 2015 (up from 39 percent in the previous year), with an additional 9.3PJ of renewable energy supplied – mainly from increased geothermal generation. Internationally, New Zealand continues to have the third highest percentage contribution of renewable energy behind Iceland and Norway. Since 2000, the contribution of renewables to primary energy has grown from around 30 percent, reflecting in particular increased geothermal generation, and reduced coal and gas-fired generation. Geothermal overtook hydro as the single largest renewable energy source in 2006.

Through renewables and other indigenous energy reserves, including oil, gas and coal, New Zealand was 81 percent energy self-sufficient in 2015. Energy self-sufficiency peaked at 92 percent in 2010 when there was a historically high combined oil, gas and coal production. Since then the self-sufficiency level has trended downwards.

Figure 1: Primary Energy Supply 2015 (907PJ)



Source: 2016 Energy in New Zealand

- Gas includes LPG

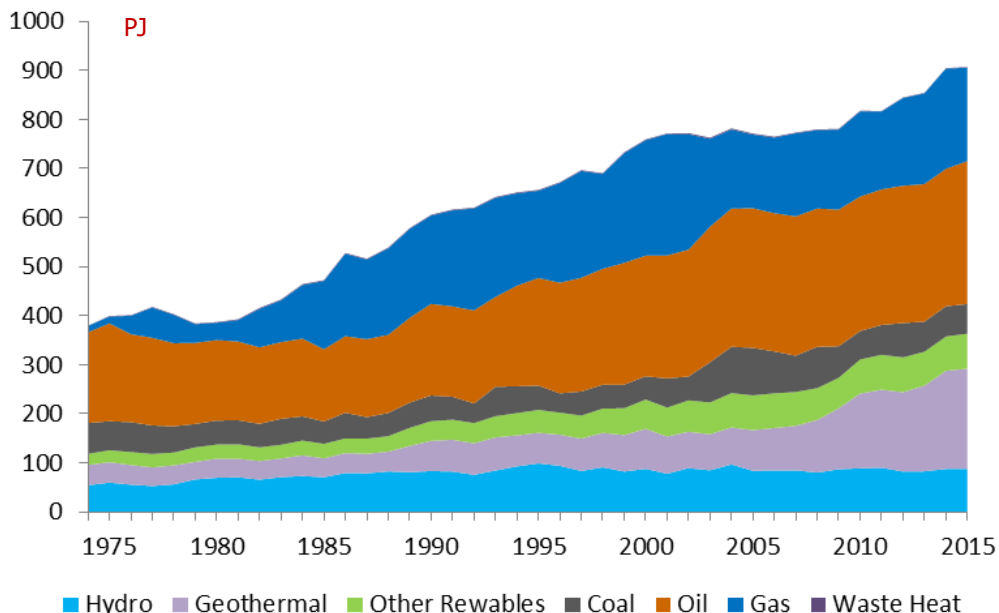
- Other Renewables include wind, solar, biomass, and biogas

²¹ 2016 Energy in New Zealand. Total primary energy supply in 2015 was 907PJ.

²² Includes LPG production

Figure 2 shows historic changes in the composition of total primary energy supply in New Zealand since 1974, and Figure 3 plots the percentage contribution of gas to primary energy over the same period.

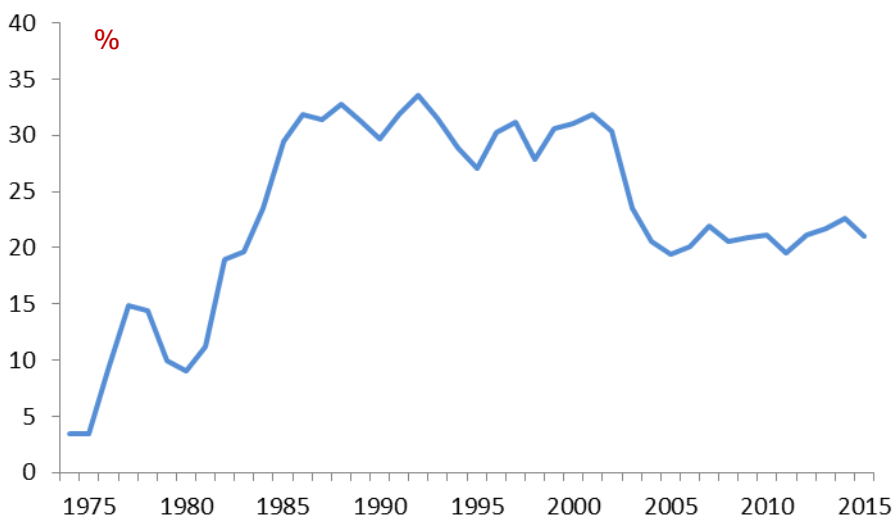
Figure 2: Composition of Primary Energy 1974-2015



Source: 2016 Energy in New Zealand

The contribution of gas grew quickly following the commencement of Maui gas supplies in 1979. The increase in gas use in 1976 reflects the conversion of the New Plymouth power station from oil to generation from Kapuni gas, before it was transitioned to run on Maui gas. Between 1974 and 2014, total primary energy supply has increased by approximately 140 percent from 380PJ to 907PJ. The contribution of gas peaked at 33.5 percent in 1992. Gas production volume reached a peak of 247PJ in 2001.

Figure 3: Percentage Contribution of Gas to Primary Energy Supply 1974-2015



Source: 2016 Energy in New Zealand

2.2 Gas Use by Sector

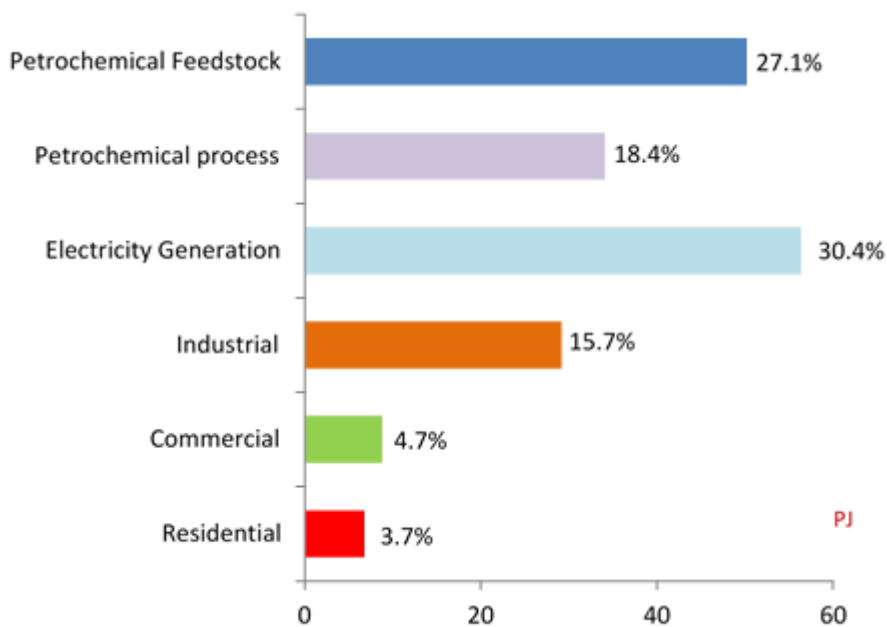
Natural gas is used by approximately 268,800 consumers, with consumer demand in 2015 totalling 185PJ. As is characteristic of the New Zealand market, most of the gas is used to generate the high heat required for electricity generation and industrial processes, and a significant volume is used for conversion into petrochemical products. As a result large users, representing less than 1 percent of total consumers, account for over 90 percent of gas consumption. In contrast with more densely populated markets, for example Victoria, Australia, where residential use is over a third of total consumption, in New Zealand the 253,000 residential consumers account for just 3.7 percent of total use.

The industrial sector comprises around 1,800 consumers who used 29.2PJ of gas in 2015. Feedstock and process gas requirements for petrochemical use have risen steadily from 43PJ in 2011 as Methanex progressively recommissioned previously mothballed units and returned to full three-train methanol production capability at its Motunui and Waitara Valley plants.

The 84.3PJ²³ used by the petrochemical sector in 2015 was 15 percent down on the 99PJ in 2014, due mainly to methanol plant mechanical issues, which have since been rectified. Methanol production in 2015 was down 15 percent to 1.9 million tonnes, or 79 percent of Methanex' New Zealand capacity.²⁴

Commercial and residential consumer groups respectively account for 8.8PJ and 6.8PJ of gas consumption annually. Commercial sector consumers number about 14,000. In addition to a myriad of business consumers – ranging from restaurants and hotels to horticultural greenhouses and dry cleaners - they include community amenities like hospitals, public swimming pools and schools.

Figure 4: Gas Use by Consumer Group 2015 (185PJ)



Source: 2016 Energy in New Zealand

Together, petrochemical feedstock and process gas use amounts to 84.3PJ, or 45.5 percent of total gas use.

²³ Comprising feedstock gas of 50.2PJ and process gas of 34.1PJ

²⁴ Methanex Corporation 2015 Annual Report

2.3 Electricity Generation

Gas use for electricity generation commenced in 1976 when the New Plymouth power station, originally built to run on fuel oil, was converted to dual oil/Kapuni gas operations. It was further converted in 1979 to run on Maui gas. The New Plymouth station was decommissioned in 2007. During 2015 the main gas-fired generators were Contact Energy (Otahuhu B, Taranaki Combined Cycle, and Stratford peaker plant), Genesis Power Limited (Huntly, including the e3p combined cycle plant), Mercury²⁵ (Southdown), and Nova Energy, through a newly-constructed peaker plant associated with parent company Todd's McKee field.

Two of these plants have since been retired. Contact Energy closed the Otahuhu B power station in October 2015²⁶, and Mercury's Southdown power station, in Auckland, was closed in December 2015²⁷. Mercury and Contact cited increasing use of renewable generation and comparably higher running costs of the thermal plants as reasons for the retirements.

Together, the two power plants accounted for 13-20 PJ/year of demand. Depending on electricity market requirements, this potential gas load reduction could be offset by increased output from Contact's Taranaki combined cycle (TCC) and Stratford peaker plants, Nova's McKee peaker plant, or Genesis Energy's e3p gas-fired unit at its Huntly power station.

Further offsetting could arise should Nova proceed with two further open cycle gas turbine peaker plants - one near New Plymouth, Taranaki, and the other near Otorohanga in Waikato.

Nova has lodged resource consent applications for its proposed Otorohanga power station, which would initially generate up to 120MW of electricity. This first phase could be commissioned before 2020. It is envisaged that proposed further stages will expand the plant's capacity to 360MW over time.

Nova has resource consents for its proposed 100MW plant near New Plymouth and has completed some preliminary engineering work. Development timeframes for this project will be considered once the resource consent process for the Otorohanga plant is completed.

As well, the Oji Fibre Solutions²⁸ Penrose mill, which had been using excess steam from the Southdown power station for manufacturing corrugated paper from recycled paper, will take an additional 490 terajoules (TJ) of gas to fuel its own boiler.

In the context of these electricity generation changes, it is noteworthy that Genesis Energy has extended until December 2022 its intended closure of the two coal/gas Rankin Units at the Huntly power station. Genesis initially announced its intention to permanently withdraw these units in 2018²⁹, having earlier retired its two other coal/gas units at that location. However in a subsequent announcement³⁰ Genesis commented that market changes, the time required to develop new generation, continued uncertainty over the future of the electricity-intensive smelter at Tiwai Point, and

²⁵ Formerly known as Mighty River Power. Mighty River Power Limited has been renamed Mercury NZ Limited with a progressive rebranding of Mighty River Power and the Mercury Energy retail business to 'Mercury' during 2016 – Mighty River Power media Release: *Mighty River Power moving to single brand – Mercury*, 2 May 2016.

²⁶ Contact Energy media Release – *Contact to close Otahuhu power station as NZ moves to greater share of renewable electricity generation*, 17 August 2015.

²⁷ MRP media release – *Renewables growth behind closure of Southdown thermal station*, 24 March 2015

²⁸ Formerly Carter Holt Harvey

²⁹ Media Release – Genesis Energy: *Genesis Energy Limited (GNE) announces timetable to end coal-fired generation in New Zealand*, 6 August 2015

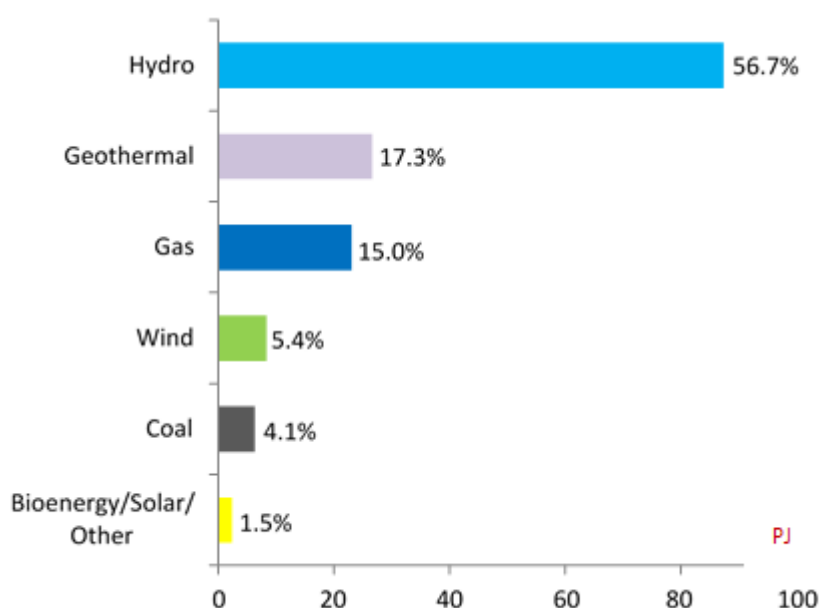
³⁰ Media Release – Genesis Energy: *Rankine units operational life extended*, 28 April 2016

increased dry year risk resulting from other thermal plant retirements indicated that a longer transition period that originally expected is required.

At 42,876GWh (154PJ) electricity generation was 1.6 percent higher than the 42,231GWh (152PJ) in 2014.

In 2015, electricity generation demand accounted for approximately 56PJ (30.4 percent) of total gas use. In turn, 15 percent of total electricity generation was from gas-fired power plants (Figure 5). This was only slightly lower than the 15.6 percent contribution of gas to electricity generation in 2014, but considerably less than the 19 percent contribution to electricity generation in 2013. The reflects increased generation from renewable sources, with the full effects of the gas-fired power station closures yet to be seen,

Figure 5: Electricity Generation by Energy Type 2015 (42,876 GWh –154PJ)



*Source: 2016 Energy in New Zealand
Other includes oil and waste heat*

Renewable electricity generation increased from 79.9 percent in 2014 to 80.8 percent in 2015 due to higher hydro and geothermal generation. This was the highest annual share of renewable generation since 1995 and was led by record levels of geothermal production, which increased by 8.2 percent to 7,411GWh. Wind generation increased by 6.4 percent to 2,333GWh and consistent water inflows enabled a small increase in hydro generation.

Geothermal replaced gas as the second highest primary energy source for electricity generation in 2014 and, in the same year, wind generation exceeded coal generation for the first time.

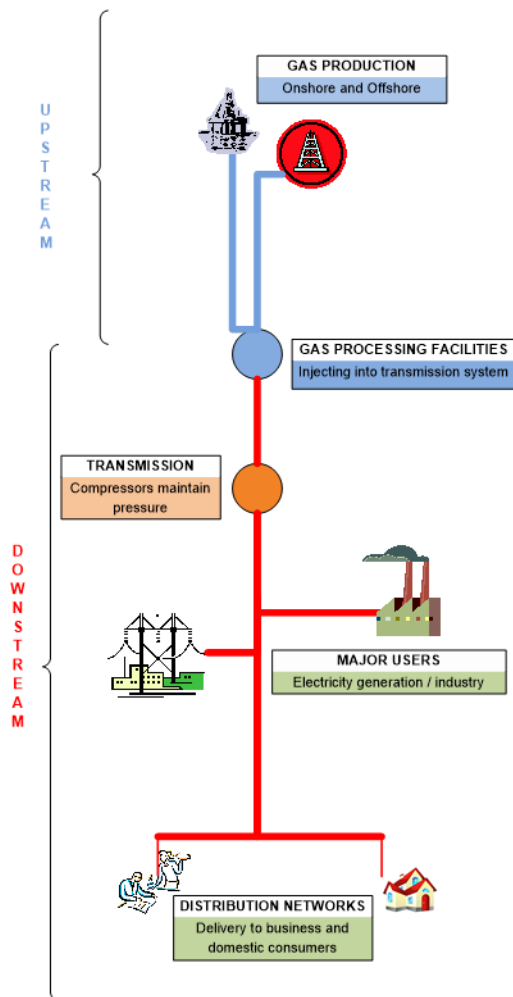
Future electricity demand is uncertain as conventional electricity consumption levels are influenced by more efficient appliances, greater price sensitivity of consumers and 'disruptive' technologies – in which consumers are increasingly embracing self-sufficiency technologies such as off-grid solar photovoltaic installations. The downward effect of these trends on consumption levels could be offset by growing uptake of electric vehicles and expectations that energy networks will ultimately need to meet high demand for overnight recharging.

2.4 Gas Industry Structure

New Zealand has a conventional gas industry structure (Figure 6), with an upstream exploration and production sector, and a downstream sector comprising high pressure (transmission) and lower pressure (distribution) transportation, and wholesale and retail markets. Some large users, notably power stations, petrochemical producers, dairy factories and timber processing plants, are supplied directly from the high pressure transmission pipelines.

Relatively small by international standards – but nonetheless significant in the New Zealand energy market context – the gas industry in New Zealand has a concentration of participants, many of them with interests at more than one level of the value chain.

Figure 6: Industry Structure



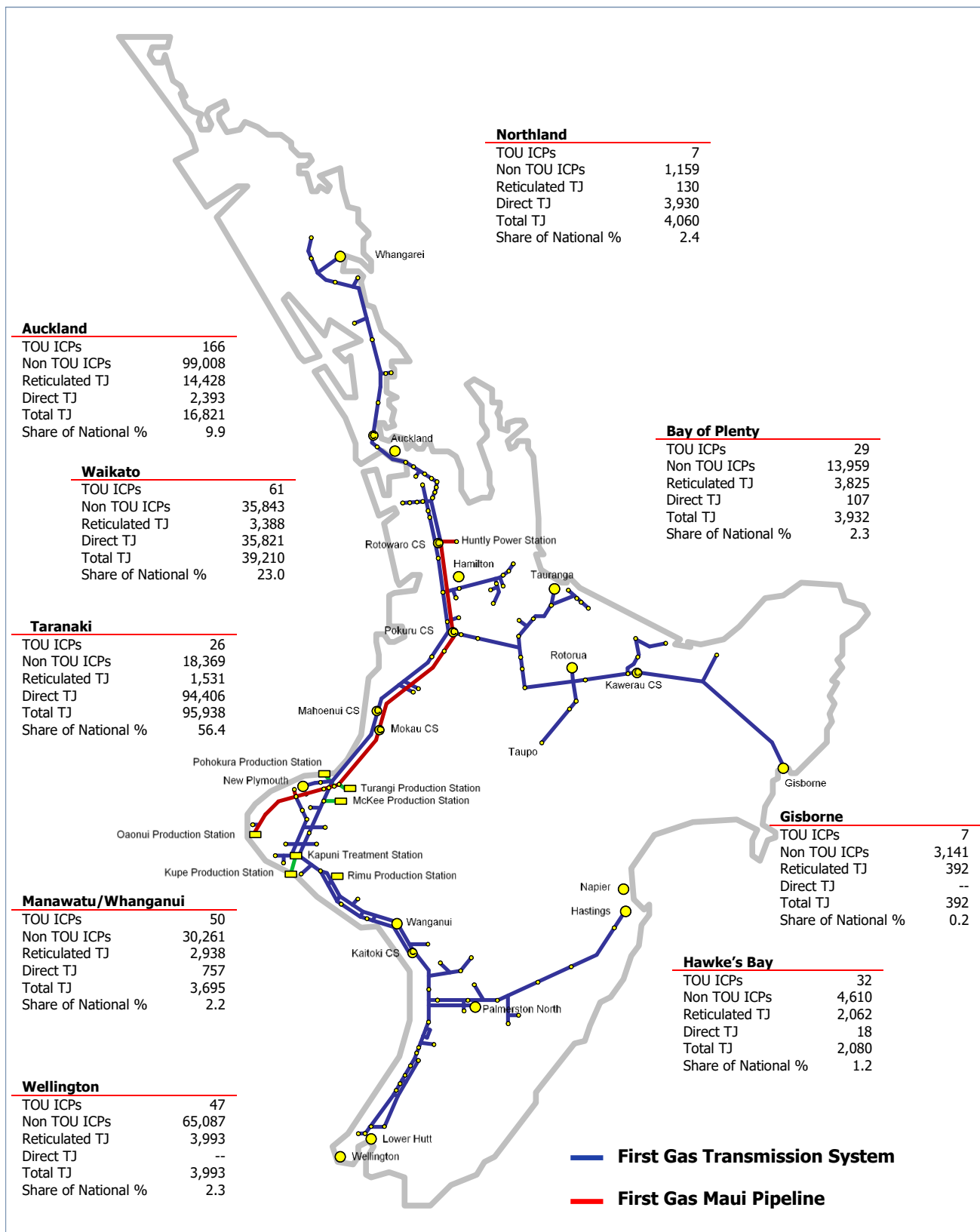
Industry participants and their operational interests are set out in Figure 7.

Figure 7: Industry Participants

MAJOR FIELDS % Production	McKee 1.0%		Mangahewa 11.6%	Maui 17.5%	Kupe 13.8%	Kapuni 5.8%	Ngatoro 1.0%	Kowhai 2.6%	Turangi 4.1%	Radn or 0.0	Pohokura 36.8%	Rimu/ Kauri 0.3%	Cheal 0.4%	Sidewinder 0.1%
PRODUCERS *Operator	Todd Taranaki (100%) *Todd Energy			Shell 83.75% OMV 10% Todd Energy 6.25% *Shell Todd	Origin Energy 50% Genesis Energy 31% NZOG 15% Mitsui 4% *Origin	Shell 50% Todd Energy 50% *Shell Todd	Greymouth 100% *Greymouth				Shell 48% OMV 26% Todd Energy 26% *Shell Todd	Origin Energy 100% *Origin	TAG Oil 100% *Cheal Petroleum	
WHOLESALERS	Vector					Nova Energy (part of Todd Corporation)		Contact Energy				Greymouth Petroleum		
TRNANSMITTERS (high pressure)	First Gas													
DISTRIBUTORS (lower pressure)	Vector			First Gas			Powerco		GasNet		Nova Energy (part of Todd Corporation)			
RETAILERS	Genesis Energy	Energy Online (part of Genesis)	Nova Energy (part of Todd Corporation)		Contact Energy	Trustpower	OnGas (part of Vector)	Mercury	Greymouth Gas	Pulse Energy	Switch Utilities			
CONSUMERS	Electricity Generators Contact Energy Genesis power Nova Energy				Large Consumers supplied directly from transmission pipelines Methanex (methanol) Ballance Agri-Nutrients (ammonia/urea) New Zealand Steel Oji Fibre Solutions (pulp & paper) Fonterra Degussa Peroxide Tasman Pulp & Paper				Reticulated consumers Other industry Commercial businesses Community facilities Households Transport (as CNG)					

Note: On 16 November 2016 Genesis Energy acquired NZOG's 15 percent interest in the Kupe field, subject to approval by NZOG's shareholders – Genesis Energy announcement 16 November 2016.

Figure 8: Gas Use by Region



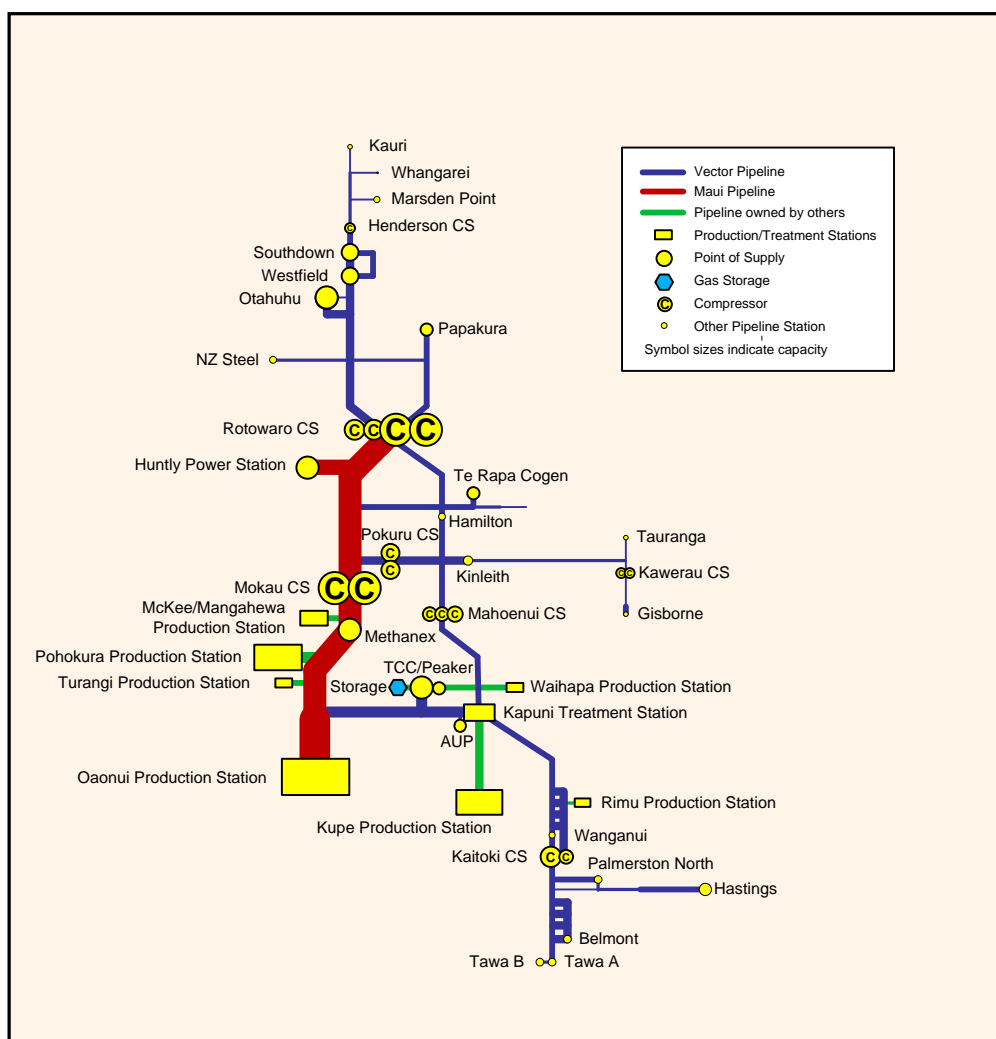
Source: Gas Registry

2.5 Regional Consumption

By region (Figure 8), Taranaki has the highest gas consumption, by virtue of hosting the large gas-based petrochemical plants – Methanex and Ballance Agri-Nutrients – gas fired power plants and a substantial dairy factory near Hawera. Large industrial loads are also located in Waikato (Huntly power station, Te Rapa cogeneration plant, dairy processing), Bay of Plenty (dairy and timber processing), Auckland (Glenbrook steel plant) and Northland (dairy processing and the Marsden Point oil refinery).

An abstract schematic of onshore gas injection, transmission and major offtake points is shown in Figure 9.

Figure 9: Gas System Abstract



Note: Vector pipeline is now owned by First Gas

2.6 An Ongoing Role for Gas

Gas is seen as having a continuing and important role in New Zealand's energy mix for the foreseeable future.

However, this role will be shaped by a number of factors, many of them uncertain at this time. An important influence will be the energy policies and technologies expected to emerge as the world

focuses more intensely on climate change management. This is discussed in more detail in **Section 5.0, Environmental Sustainability, Page 44**.

A 2016 study³¹ commissioned by the gas industry body, Gas Industry Co, confirms that, as a direct use fuel, gas continues to provide a competitive energy choice for home energy and industrial heat applications. Its main findings are that:

- instant (or continuous) gas water heating is the most cost-effective energy option in the majority of cases, even if a home doesn't already have a gas connection, because of its low capital cost, and cheaper energy price (compared with electricity).
- while the best space heating options vary significantly depending on house size, insulation, geographic location and consumers' heating preferences, gas is highly competitive with log burners and heat pumps, especially if gas is already connected for water heating or cooking.
- for new industrial boiler requirements, gas units are significantly cheaper than coal and biomass options. An investment in gas boilers is unlikely to become uneconomic unless there is a substantial shift in relative coal and gas prices.

LPG provides the same quality advantages as natural gas. Although generally not as cost-effective as natural gas in many North Island centres, it offers a competitive alternative in the South Island and parts of the North Island where there is no natural gas reticulation.

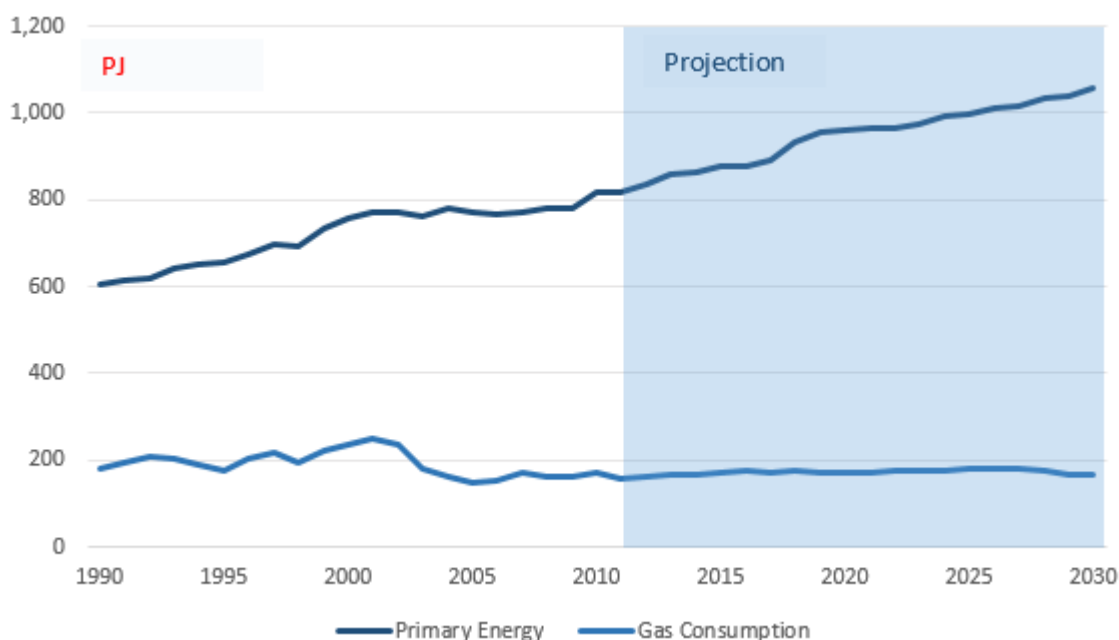
The study also finds that the carbon-intensity of electricity heating options is very similar to that of gas heating options. This is because the type of generation that will meet an increase in residential heating demand is relatively fossil-heavy compared with the average type of generator to meet demand in general.

2.7 An Ongoing Role for Gas

As globally, continued energy demand growth is expected in New Zealand. However, *the New Zealand Energy Supply Outlook 2011* base case scenario envisages little change to the current gas market size out to 2030 (Figure 10).

³¹ Concept Consulting: *Consumer Energy Options: 2016 Update*. This updates and expands *Consumer Energy Options: An Evaluation of the Different Fuels and Technologies for providing Water, Space and Process Heat*, 12 November 2012. Both are available at www.gasindustry.co.nz

Figure 10: Base Case Scenario - Future Energy and Gas Demand



Source: New Zealand's Energy Outlook (reference scenario)

Beyond this base case, a number of broad factors will define the actual role gas will play in New Zealand's energy future. They include:

- New Zealand's gas reserves position and outlook.
- future oil prices and the consequent extent of exploration effort.
- future CO₂ prices, and the consequent impact on gas demand – particularly the extent to which coal- and gas-fired power stations are displaced by renewables.
- the future of the electricity-intensive Tiwai aluminium smelter, and the consequent impact on thermal power generation demand should the smelter cease operations.
- future international gas and petrochemical prices, as well as New Zealand's gas reserves position, and the bearing these have on the extent of future methanol production in New Zealand.
- population and GDP growth.

The New Zealand gas market is isolated and, while gas is transported between international markets in other parts of the world by pipe or as LNG (liquefied natural gas), New Zealand does not have a natural gas importation capability - although it is able to import (and export) LPG.

On the supply side, New Zealand's gas reserves-to-production ratio strengthened until two years ago, but has declined to under 10 years due to the low international oil price suppressing upstream investment. The supply horizon however, remains considerably better than the low of around six years in the early 2000s.

Gas use trends (Figure 11) have been largely influenced by the varying requirements of the predominant demand sources – electricity generation and petrochemical production. In particular,

methanol production (Methanex) has historically acted as a swing user, lowering or increasing output during times of reserves reduction or growth, and responding to such other influences as the New Zealand gas price compared with other countries with competing methanol facilities, and the international methanol price itself.

Feedstock gas for methanol production has consequently fluctuated significantly in the past decade. In 2004, the two production trains at Methanex's Motunui methanol plant were shut down, and the company produced only from its Waitara Valley plant. Four years later, Methanex recommissioned one of those trains and closed its Waitara Valley plant. This period of reduced feedstock gas uptake also impacted on the volume of gas – recorded as industrial usage – that these plants separately use for their operational processes.

With an improving reserves outlook and a favourable New Zealand gas price, Methanex reached a 10-year supply agreement with Todd Energy in 2012, under which Todd developed and expanded its Mangahewa field gas production capability, and Methanex restarted the second Motunui production train in 2012. In October 2013, it recommissioned the Waitara Valley plant, returning to full production. The increase in Methanex's demand has attracted some comment about its possible impact on the industry, including whether it could displace other uses for the gas. However, there is no question that the presence of Methanex enhances the domestic market attraction to explorers and – as demonstrated by the arrangement with Todd Energy – it has been successful in unlocking a prospect in a way that others have not been able to achieve. Given the costs of field development, Methanex represents a load that can underpin the market and assist Government objectives to incentivise upstream exploration and development investment.

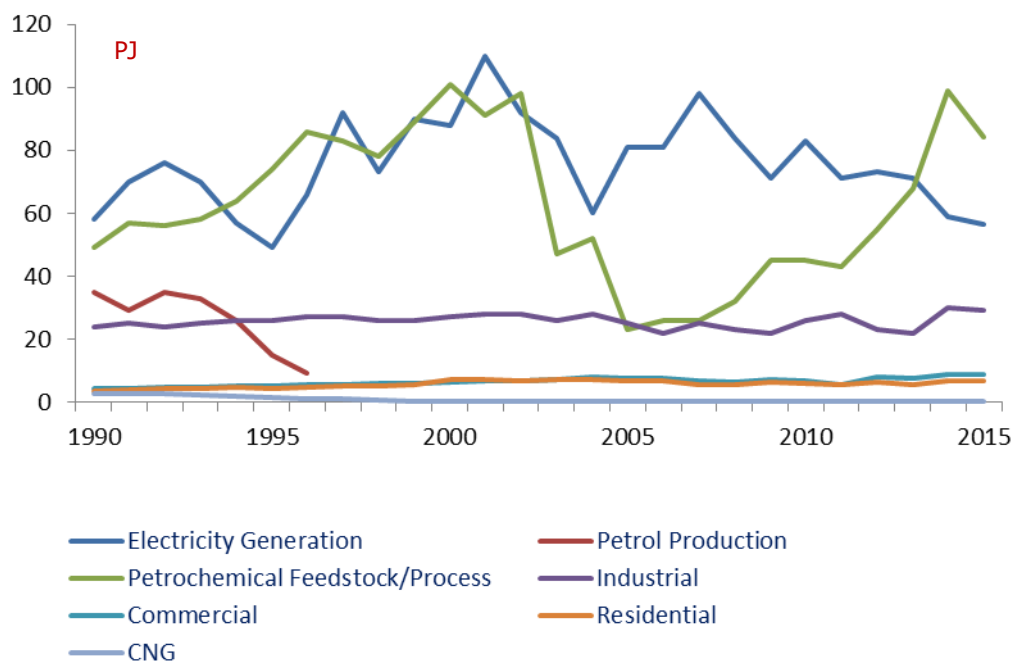
The other major petrochemical producer, the Ballance Agri-Nutrients ammonia/urea plant at Kapuni, consumes around 7PJ/year of gas. Production from the site, which began in 1982, may be expanded with a call by Ballance during 2015 for tenders for the possible redevelopment of the site. This may involve building a new plant to replace the existing facility³².

These developments, and the trend towards a peaking rather than baseload function for gas-fired electricity generation, have seen methanol production, in particular, moving from a swing to market-setting role.

CNG, which reached a demand peak of 5.8PJ in 1985 as an alternative transport fuel to reduce New Zealand's reliance on imported oil, now barely registers on the usage scale at only 0.03PJ/year. The North-Island wide refuelling network, comprising over 200 outlets, disappeared as CNG use rapidly declined with the removal of subsidies in 1986.

³² Reported – Taranaki Daily News: *Ballance Agri-Nutrients calls for tenders on South Taranaki urea plant*, 10 July 2015

Figure 11: Gas Use by Consumer Group 1990-2015



Source: 2016 Energy in New Zealand

Significant events affecting the gas use trends:

- 1996 Southdown power station commissioned
- 1996 Methanex Motunui plant, originally designed to convert crude methanol into petrol, reconfigured to produce chemical grade methanol. Petrol production ceases.
- 1999 Te Rapa cogeneration plant commissioned
- 2000 Otahuhu B power station commissioned
- 2004 (March) First Motunui methanol train shut down.
- 2004 (November) Second Motunui methanol train shut down
- 2007 Southdown power station expanded with third gas turbine
- 2008 Second Motunui methanol train restarted (first train remains shutdown)
- 2008 Waitara Valley methanol plant shut down
- 2011 Contact Energy Stratford peaker plant commissioned
- 2012 Nova McKee peaker plant commissioned
- 2012 Methanex resumes two-train operations
- 2013 Methanex resumes three-train operations
- 2015 Otahuhu B and Southdown power stations closed in the second half of 2015

Supply/Demand Study

In 2016, Gas Industry Co further updated its gas supply and demand assessment, commissioned from Concept Consulting, with a renewed look at the main drivers for price and demand outcomes, and the factors likely to influence future outcomes. *Long Term Gas Supply and Demand Scenarios – 2016 Update*³³ takes a specific look at the implications of a low oil price/low exploration future for New Zealand, outcomes for future high CO₂ prices, and the implications of major changes in the electricity generation sector. It accordingly makes an assessment of the potential exit of the Tiwai aluminium smelter and the associated likely retirement of gas-fired generation, as well as the potential retirement of the Huntly power station Rankine units and the associated implications for upstream gas

³³ <http://gasindustry.co.nz/work-programmes/gas-supply-and-demand/current-arrangements/> It follows the initial 2012/13 study, *Gas Supply and Demand Scenarios 2012-2027*, and the 2014 update, *Long-Term Gas Supply and Demand Scenarios*

deliverability, including to manage dry year risk. It is intended to assist industry participants and consumers with their energy investment decisions.

Like the earlier studies, it constructs three broad supply scenarios and considers demand projections for them. The scenarios are:

- **Plentiful** – representing a future where gas exploration and development brings significant new supply from existing and/or new fields. This is more likely in a scenario of sustained high future oil prices, which generally encourage active upstream exploration and development.
- **Scarce** – representing a future where no major new supply sources are developed, and future development is largely around firming up incremental gas supply from existing fields. This is more likely in a scenario of sustained low future oil prices. Prices in this scenario are likely to be capped in the long-term at the level where it starts to become economic to import LNG – although this outcome may be relatively unlikely as it is probably more economic to develop New Zealand’s reported contingent resources at prices below this LNG import parity level.
- **Central** – representing a situation between these two extremes.

It finds the Central scenario is the most likely outcome in the next 4-5 years, with a continuation of gas prices at around existing levels. It also finds, however, that following the period of high oil prices and associated exploration effort that provided a relative gas surplus, New Zealand looks to be heading towards a tightening supply position. In the medium-to-long-term, and absent a resumption of major exploration and development effort, this is likely to result in a contraction in demand from the petrochemical and electricity generation sectors, and an allocation of gas towards higher value users. The main conclusions of the updated report are:

Gas Supply

The significant drop in oil prices and exploration effort, coupled with the disappointing results from recent exploration efforts, point to a tightening of New Zealand’s gas inventory. The analysis indicates that by 1 January 2017 the P50 (or 2P) reserves-to-production ratio will be close to 9 years – down from the 1 January 2014 figure of almost 14 years - and to approximately 5 years’ of cover by 2022 if total demand continues at current levels, and no additional reserves are booked.

Renewed upstream development effort will be needed to replenish gas inventories in the medium-to-long term. A key driver will be the outlook for oil prices. Exploration and development activity is expected to remain at reduced levels until there is a strengthening in the outlook for oil prices, but it is not known if recent oil price weakness is an aberration, or a sign of the future. An oil price recovery will support upstream activity and assist in rebuilding gas inventories. Conversely, a weak outlook will subdue upstream activity, putting upward pressure on gas prices. At some point that will trigger a significant scaling back of demand from petrochemicals and, to a lesser extent, power generation. In doing so, it will conserve supply for higher value gas users.

The report also notes that the supply outlook is primarily an economic rather than physical issue, and that, in physical terms, there are multiple sources available to replenish reserves and/or meet future gas demand. In this regard, some known resources – recorded as contingent gas reserves – have not yet been developed as prices have not been high enough to justify their development. These could come into play should gas prices increase to the point that they become viable (also see **Section 6.7 Gas Reserves, Page 64**).

The report notes that its discussion focuses on New Zealand's existing gas market, with production located entirely from fields in Taranaki, and transmission networks radiating out from Taranaki to the main North Island load centres.

It acknowledges that New Zealand has a number of other prospective sedimentary basins – including several in the South Island (particularly the Canterbury, and Great South basins) and other locations in the North Island (including Eastland, and the Far North).

The report concludes a discovery or development in these other locations is likely to have minimal impact on New Zealand's existing Taranaki-based gas market because of the likely prohibitive cost of the gas transmission pipelines necessary to 'join' these new markets to the existing market. It would likely be more economic to develop new sources of gas demand close to these new locations.

The main options for new large scale demand are LNG, methanol or urea for sale overseas, although a find in the South Island could potentially also be used to displace existing coal-fired process heat in the dairy processing sector.

Which of the LNG, methanol or urea options would be most economic would depend on the extent to which each of the three commodities was in a situation of relative global production over- or under-capacity, and the extent of any regional dynamics relating to demand and competing marginal international sources of supply – for example, shipping cost differentials can materially impact the relative economics of producing these commodities.

An extremely large find would more likely be developed for LNG production, whereas a smaller find may be better suited to petrochemical production.

Demand

Gas demand is split into three main segments:

Petrochemicals

- Gas demand for methanol, and to a lesser extent urea fertiliser production, tends to rise or fall in response to changes in the domestic supply/demand outlook as this affects the relative international competitiveness of the New Zealand production plants.
- Given the history of Methanex scaling back production during the tighter supply ratio, it is potentially the case that relatively high petrochemical demand will continue until around 2022. At that point, absent new reserves coming to hand, the reserves/production horizon will reach the same point as in 2002 and a substantial reduction in methanol production could be expected. It is unlikely that urea production would similarly shut down at this point.
- In this situation, it is unlikely the methanol plants would be permanently retired, but mothballed in anticipation of production resumption if and when a significant new gas field were developed.

Power generation

- Gas demand for power generation is likely to be the most sensitive to variations in CO₂ pricing; rising New Zealand CO₂ prices would likely result in some displacement of gas-fired generation by renewables.
- The future of the Tiwai aluminium smelter also has an important influence on the outlook for gas demand, as this would decline significantly if the smelter were to close or cut production. The bulk of reduced power requirements would likely come from curtailment of gas-fired generation.
- The Central projection (under mean hydrology) is for gas demand for power generation to rebound modestly in the near term, and then remain relatively flat before gradually declining in the very long

term. This rebound occurs because near-term growth in power demand is projected to be met mainly from spare capacity at existing gas-fired stations, with further ongoing power demand growth coming mainly from new renewable sources. Irrespective of the average level of gas demand for power generation, this sector will require significant gas swing – both on a seasonal basis to address increased winter electricity demand, and on a year-to-year basis to address significant variations in hydro output due to dry/wet years. While the seasonal swing can be largely met by the Ahuroa gas storage facility, it is likely that the year-to-year variation will require swinging of upstream production. At present, this year-to-year flex requirement is around 20-25PJ – but could rise to 35-40PJ if the Huntly power station were to retire.

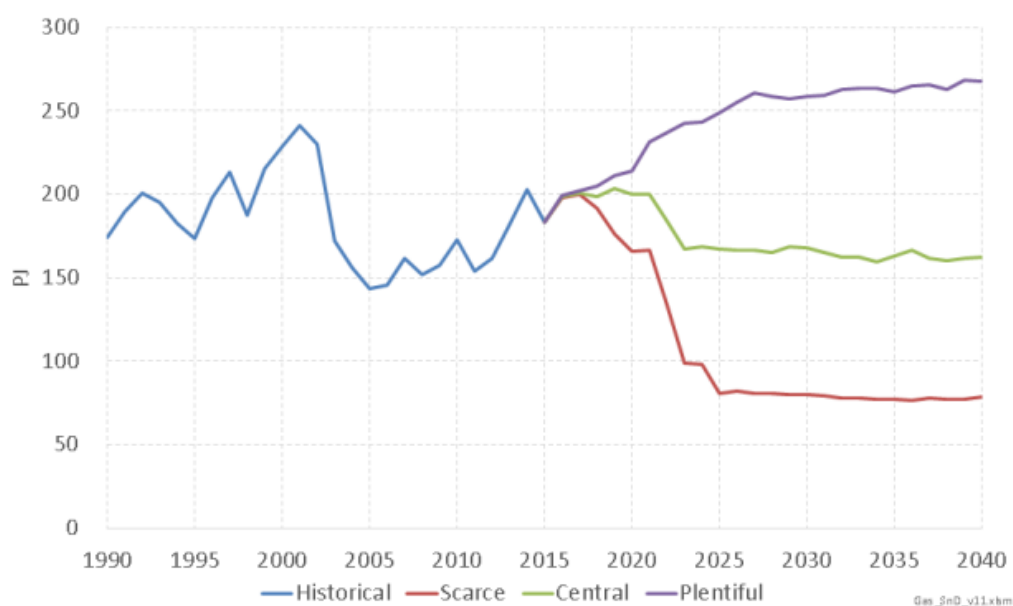
- The need for flexible power generation that can operate at lower capacity factors tends to place a ceiling on the proportion of power that can be economically met from renewable sources. For example, it is relatively expensive to build a wind farm which would only operate in winter, whereas the lower capital intensity of thermal power stations makes them more economic for such duties.
- From the perspective of New Zealand's overall gas supply/demand balance, the power generation sector has historically played a role similar to that of petrochemicals, and is likely to continue to do so in the future. Modelling indicates that there could be a significant degree of long-term demand variation from the power generation sector in response to higher or lower gas prices. However, unlike the petrochemical sector, which can quickly reduce/increase demand in response to a changing supply position, the change in demand from the power generation sector would be much slower, as it relies on changing investment in renewable generation.
- It is unlikely that gas prices will fall to a level which would justify building new baseload combined-cycle gas-fired turbines (CCGTs), particularly in an environment where CO₂ prices rise and the cost of renewables is likely to continue to fall. New CCGTs would also be inconsistent with the Government's current target of 90 percent renewable generation by 2025.
- It becomes progressively more expensive to build renewables to displace existing thermals from ever lower-capacity-factor duties. Accordingly, even at very high gas prices, it will still be economic to have some peaker plants to provide low-capacity factor duties.

Direct use of gas

- Around 268,000 industrial, commercial and residential consumers use gas as an energy source for heating purposes (space and water heating, and industrial process heat).
- This group is the most stable segment of demand, with future demand variations predominantly driven by population and economic growth, rather than in response to New Zealand's changing gas supply/demand position. This reflects the fact that, for most direct-use consumers, wholesale gas prices will generally need to rise very significantly in order for gas to become more expensive than alternatives. This is because most alternative fuels suffer from some combination of:
 - high appliance capital costs that would be incurred from a fuel switch
 - high wholesale fuel costs (in the case of biomass, diesel, and LPG)
 - high transport costs
- Further, unlike for the petrochemical sector, energy costs generally comprise a relatively small proportion of consumers' total inputs. This means that, apart from some industrial consumers in sectors suffering an economic downturn, a rise in wholesale gas prices would be unlikely to cause most consumers to exit gas use completely.

- However, in the long-term it is expected a tightening gas supply position and associated rise in prices would depress demand relative to what it would otherwise be, and vice versa for a position of relative surplus. The rate of change would be very slow, with fuel-switching decisions by consumers predominantly coinciding with times when they need to make an appliance capital decision – both for new consumers, or where an existing appliance has reached the end of its useful life.
- The Central case sees a gradual increase in direct use gas demand, driven mainly by population and economic growth. The Low case projects a gradual decline in direct use gas demand, whereas the High case projects a gradual increase.

Figure 12: Gas Demand: Historic and Future Scenarios



Source: Concept Consulting: Long-Term Gas Supply and Demand Scenarios -2016 Update

The march of technology

Considerable broader energy sector attention is turning to emerging technologies; how they can be used and, particularly with disruptive applications (solar, wind turbines, batteries) allowing isolation from supply grids, their impact on conventional networks. Many of these developments relate directly to electricity, but gas industry players are reflecting on the role gas will play in this rapidly evolving environment. Gas networks are part of a developed North Island infrastructure, are reliable and secure, have unused capacity and hold utility scale storage in the form of linepack. They are seen as having an important place in integrated smart infrastructure networks of the future, through:

- providing gas back-up for off-grid residential and community energy when the sun doesn't shine, the wind doesn't blow and batteries are insufficient (for example, Powerco is trialling solar with gas back-up).
- meeting high energy intensity needs.
- delivering biogas or synthetic gas.
- distributed generation via fuel cells and cogeneration.
- Potentially fuelling vehicles and micro LNG installations.

3 Government Policy Framework

The gas industry is subject to a range of Government policy measures, which are designed to ensure the development and delivery of gas in a safe, efficient, fair, reliable and environmentally sustainable manner. Programmes are in train to address outstanding policy and industry market issues.

All aspects of the industry, from drilling exploratory wells to production, gas transportation and the installation of gas appliances in the home, are subject to a form of regulatory oversight. The governance regime involves a variety of regulatory bodies and continues to evolve. Identified issues in the mid-to-downstream sector are addressed through regulated and non-regulated solutions. A price-quality regime for gas transmission and distribution pipeline businesses, overseen by the economic regulator, the Commerce Commission, was introduced on 1 July 2013.

In the past four decades, the policy approach of various Governments to the oil and gas sector has transitioned from direct financial involvement, to divestment of those interests and, ultimately, oversight of the now privately-owned industry through policy directives and regulation. **Section 4.0, Regulatory Framework, Page 30** sets out the regulations and the regulatory bodies governing the industry.

Key policies and objectives for the upstream and downstream sectors of the gas industry are contained in the:

- New Zealand Energy Strategy
- National Infrastructure Plan
- Petroleum Action Plan
- Business Growth Agenda
- Gas Act 1992 and the 2008 Government Policy Statement on Gas Governance (GPS)
- Part 4 of the Commerce Act

3.1 New Zealand Energy Strategy

The New Zealand Energy Strategy 2011-2021 (NZES)³⁴ details the Government's overall policy aims for the energy sector, and confirms the development of New Zealand's petroleum and minerals resources as a key element in wider economic growth objectives. The policy aim is for 'New Zealand to make the most of its abundant energy potential through the environmentally responsible development and efficient use of the country's diverse energy resources.' The NZES calls for balanced development of New Zealand's energy resources to best position New Zealand for a higher economic growth, lower-emissions future.

It establishes four priorities:

³⁴ <https://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-strategies/documents-image-library/nz-energy-strategy-lr.pdf>

- diverse resource development.
- environmental responsibility.
- efficient use of energy.
- secure and affordable energy.

On gas specifically, the NZES comments:

'Gas is an important feedstock for electricity generation. It is also an important direct source of energy in industry and homes. As the gas and LPG markets continue to develop, it is important to ensure reliable infrastructure and competitive markets as gas has an important role to play in New Zealand's overall energy mix.'

The NZES discusses the need to develop a mix of energy options, both renewable and non-renewable, to ensure delivery of New Zealand's broader economic development interests, and the need to strike a balance between protecting the environment and economic development.

Renewables, energy efficiency and reducing greenhouse gas emissions are fundamental to the strategy. A companion paper, the *New Zealand Energy Efficiency and Conservation Strategy 2011-2016*, which is incorporated into the NZES (*see link above*) is specifically focused on the promotion of energy efficiency, energy conservation and renewable energy. The Government is developing a new Energy and Conservation Strategy that will establish policies and actions to meet New Zealand's commitments under the Paris COP-21 climate change agreement.

While recognising the importance of the petroleum industry, and what is at stake if New Zealand should see a major reduction in a fuel that makes such a substantial contribution to its primary energy supply and economy, the NZES considers it vital that New Zealand has world-class environmental regulation for oil and gas exploration, production and transportation³⁵.

3.2 National Infrastructure Plan

The 2015 National Infrastructure Plan³⁶, the third produced by the National Infrastructure Unit³⁷, reaffirms the Government's long-term vision, set out in the original 2011 Plan, that New Zealand's infrastructure is resilient and co-ordinated, and contributes to a strong economy and high living standards. It looks out 30 years and seeks to provide a better understanding of future services requirements, improved information about and management of existing assets and ensuring New Zealand has the right settings to make better investment decisions.

The Plan notes that the New Zealand energy system is in sound overall condition with sufficient energy available and adequate management of resources. However there are challenges for electricity, gas, oil and coal networks, which contain interdependencies, and a need to better understand desired levels of customer service to strengthen system performance and resilience.

³⁵ The Government passed the Exclusive Economic Zone and Extended Continental Shelf Act in September 2012 to help achieve this.

³⁶ <http://www.infrastructure.govt.nz/plan/2015/nip-aug15.pdf>

³⁷ <http://www.infrastructure.govt.nz/>

On gas specifically, the Plan comments that gas transmission capacity, including into Auckland, is generally sufficient for short-to medium-term supply and demand scenarios, and that the next step-change in investment is likely to be from a significant new gas discovery.

The Government has directly funded infrastructure - for example, roads and broadband - but with energy infrastructure relies on a combination of private company investment and its own involvement through the state owned national electricity grid owner Transpower. The Government is indirectly involved through its majority interest in formerly 100 percent-owned 'gentailers'³⁸, which were partly privatised in 2013/14. No state-owned enterprise is involved with gas infrastructure, and the Plan does not envisage any direct Government investment in gas infrastructure.

The resulting reliance on private sector investment in turn raises the importance of having a clear and practical path of such investment and a regulatory regime that takes account of 'public benefit'. The rollout of the broadband project in New Zealand is an example of how the Government can intervene where these criteria are not met.

3.3 Petroleum Action Plan

The Government released its Petroleum Action Plan (<http://www.med.govt.nz/sectors-industries/natural-resources/oil-and-gas/petroleum-action-plan>) in 2009 to assist the development of New Zealand's petroleum resources and maximise the gains from the responsible development of New Zealand's petroleum resources. The Plan's actions build on prior work of the Government, ongoing management of the Crown's petroleum estate, and initiatives such as the Government's seismic data acquisition programme. It is discussed in more detail in **Section 6.3, Government Policy Initiatives to Encourage Gas Exploration, Page 55.**

3.4 Business Growth Agenda

The Business Growth Agenda³⁹ is a Government programme administered by MBIE to support New Zealand business growth, create jobs and improve living standards. It is aimed at delivering initiatives and policy reforms that will help create a more productive and competitive economy.

The programme focuses on six main areas – export markets, innovation, infrastructure, skilled and safe workplaces, natural resources and capital. It also involves the production of a series of sector reports, including an in-depth look at New Zealand's petroleum (oil and gas) and minerals sector⁴⁰.

3.5 Gas Act and Government Policy Statement on Gas Governance 2008 (GPS)

The Government's policy objectives for the gas sector are set out primarily in the Gas Act 1992 and the GPS⁴¹.

³⁸ Companies engaged in both electricity generation and energy retailing. In 2012 the Government embarked on a share sale process that reduced its ownership of Mighty River Power, Genesis Energy and Meridian Energy to a bare majority position.

³⁹ <http://www.mbie.govt.nz/info-services/business/business-growth-agenda/towards-2025>

⁴⁰ [*Petroleum and Minerals Report*](#)

⁴¹ The Government issued its first GPS in 2003. This was revised and updated in October 2004 to coincide with amendments to the Gas Act that provided for a co-regulatory model of gas governance and the establishment of an industry body to recommend improved gas industry arrangements. The GPS was again revised in 2008 to reflect policy directions set out in the 2007 New Zealand Energy Strategy.

Together, the Gas Act and GPS establish an umbrella policy objective for gas 'to be delivered in a safe, efficient, fair, reliable and environmentally sustainable manner'. Other policy objectives of the Gas Act⁴² include:

- the facilitation and promotion of the ongoing supply of gas meets New Zealand's energy needs, by providing access to essential infrastructure and competitive market arrangements.
- barriers to competition in the gas industry are minimised.
- incentives for investment in gas processing facilities, transmission and distribution, energy efficiency and demand-side management are maintained or enhanced.
- delivered gas costs and prices are subject to sustained downward pressure.
- risks relating to security of supply, including transport arrangements, are properly and efficiently managed by all parties.
- consistency with the Government's gas safety regime is maintained.

Further objectives and outcomes the Government wants to be taken into account in recommendations for rules or regulations, are established by the GPS, and include that:

- energy and other resources used to deliver gas to consumers are used efficiently.
- competition is facilitated in upstream and downstream gas markets by minimising barriers to access to essential infrastructure to the long-term benefit of end-users.
- the full costs of producing and transporting gas are signalled to consumers.
- the quality of gas services where those services include a trade-off between quality and price, as far as possible, reflect customers' preferences.
- the gas sector contributes to achieving the Government's climate change objectives as set out in the NZES, by minimising gas losses and promoting demand-side management and energy efficiency.

The GPS also notes the need for sound arrangements for the management of any critical gas contingencies and the Government's expectations for consumer benefits.

3.6 Commerce Commission – Economic Regulation

Commerce Act 1986 regulation of gas pipelines is designed to ensure that suppliers of natural monopoly services⁴³ have similar incentives and pressures as they would have if operating in a competitive market. The regulatory provisions of Part 4 of the Commerce Act 1986 aim to ensure that such businesses keep prices down and have limited ability to extract excessive profits, while also being incentivised to innovate and invest, improve efficiency, and provide goods or services at a quality that reflects consumer demands.

Some regulation of pipeline services under the Commerce Act has been in place since 2005 for Powerco and certain pipelines owned by Vector. Amendments made to the Commerce Act in 2008 extended the scope of the regulation to include all open access pipelines.

In July 2005 as a result of the Commerce (Control of Natural Gas Services) Amendment Order 2005, price control was imposed over the gas distribution pipelines of Powerco, and Vector's distribution

⁴² Section 43ZN

⁴³ Includes electricity lines, gas pipelines and airports. The regulatory regime for telecommunications is embodied in the Telecommunications Act 2001.

pipelines in Auckland, with significant impact on the distribution services market. For example, the first provisional authorisations required Powerco to ensure that its average price for controlled services as at 1 October 2005 was at least 9 percent lower than the average price charged at 30 June 2005. For Vector the average price as at 1 October 2005 had to be at least 9.5 percent lower than the average price charged at 30 June 2005. The authorisation also provided for the monitoring of service quality. A final authorisation, made on 30 October 2008 and expiring on 30 June 2012, required further price decreases of 11.1 percent for Powerco, and 3.7 percent for Vector.

At the time of issuing the 2005 Order, the Minister of Energy announced that a thresholds regime (similar to that under Part 4A of the Commerce Act for electricity lines businesses) would be introduced for all gas pipeline businesses. This occurred with the Commerce Amendment Act 2008 and resulted in significant changes to the scope and role of the Commission in regulating gas pipeline services. The 2008 regime applies to three gas distribution businesses - GasNet, Powerco and Vector - and two gas transmission businesses, Maui and Vector. The Commerce Amendment Act also made amendments to the regulation of electricity lines services and airport services.

The Commission's work in developing the regulatory framework for gas pipelines since 2008 involved setting input methodologies, information disclosure requirements, and default price-quality paths. It released various papers⁴⁴ discussing details of its Part 4 work.

In February 2013, the Commission released its final decision⁴⁵ on the first default price-quality paths for gas transmission and distribution businesses, setting the maximum prices and minimum standard of quality that gas pipeline businesses must comply with in the period 1 July 2013 to 30 September 2017. The overall initial price adjustments from 1 July 2013 were a 2 percent increase for GasNet's distribution business, a 4 percent increase for Powerco distribution, a 1.2 percent reduction for the Maui transmission pipeline, and reductions of 18 percent and 29.5 percent respectively for Vector's distribution and transmission services. The Commission limited price increases from 2014 to 2017 to no more than the rate of inflation.

In 2014, the Commission further reduced returns in a final decision that lowered the weighted average cost of capital (WAAC) margin for price-quality regulated businesses from the 75th percentile to the 67th percentile⁴⁶. For electricity lines businesses, the new WAAC margin took effect in April 2015, and for gas pipeline businesses from 2017. The Commission expects this decision will save consumers an estimated \$45 million a year by reducing the rate of return by 24-28 basis points per annum⁴⁷.

The Commission notes that in setting the price-quality paths it sought to achieve a balance between providing incentives for suppliers to invest in their infrastructure services, and ensuring that customers are charged prices that are better aligned with the cost of the services they receive.

Input Methodologies

The purpose of input methodologies is to promote certainty for suppliers and consumers in relation to the rules, requirements, and processes applying to the regulation. Input methodologies had to be applied to information disclosure and price-quality regulation, and they include matters such as the

⁴⁴ Available at www.comcom.govt.nz/initial-default-price-quality-path/

⁴⁵ *Commerce Commission sets prices and quality standards for gas pipeline services*, Media Release, 28 February 2013.

⁴⁶ Commerce Commission media release: *Commerce Commission reduces the margin that it applies to regulated businesses' cost of capital*, 30 October 2014

⁴⁷ The Commerce Commission's decision was in response to a High Court judgment in 2013 which questioned the WAAC margin. The High Court considered the use of the 75th percentile was not supported by sufficient evidence and might be at odds with the Part 4 objective to limit the ability of regulated suppliers to earn excessive profits.

valuation of pipeline assets, the allocation of costs, treatment of taxation, and cost of capital. They also set the rules and processes for customised price-quality paths.

The input methodologies were determined in December 2010 and were subsequently the subject of extensive litigation⁴⁸. As well as two judicial reviews, the input methodologies were subject to merits reviews that were heard in the High Court in February 2013. This series of litigation delayed final decisions on the default price-quality path settings⁴⁹. However, a Supreme Court Ruling on input methodologies in November 2012 confirming that the Commission is not required to determine a starting price input methodology for electricity distribution and gas pipeline services – in turn confirming a June 2012 decision by the Court of Appeal – enabled the Commission to complete aspects of the regulatory regime⁵⁰. In December 2013 the High Court dismissed the merits reviews appeal, finding in favour of the Commerce Commission on all but two relatively minor points out of around 58 matters that had been challenged⁵¹.

In keeping with a requirement for the input methodologies to be reviewed within seven years of publication, the Commerce Commission commenced a review process in June 2015⁵². The Commission expects to publish draft decisions in February 2017 and to reset the default price-quality paths applying to gas distribution and gas transmission businesses by 31 May 2017.

Price-Quality Regulation

Under Part 4 of the Commerce Act, all suppliers of gas pipeline services are subject to either a default price-quality path or a customised price-quality path. The 'default' path is the generic form of regulation, which applies to all gas pipelines over the regulatory period (four to five years).

If a gas pipeline business considers the 'default' path does not meet the needs of its business, it can apply for a customised path, which has the same key components as the default path, but uses information more specific to the particular pipeline business. Following the expiry of a customised path the business will move back to the default path, but may apply for a new customised path. One of the grounds of appeal against the Commerce Commission's methodologies accepted by the High Court in its December 2013 judgment is that the Commerce Commission should be able to revisit a default price path after a catastrophe or a major change in the industry.

Under this form of regulation each pipeline business is set a maximum price or revenue cap, which is only allowed to increase broadly in line with inflation over the regulatory period⁵³. There are substantial penalties⁵⁴ for non-compliance.

⁴⁸ In September 2012, as the result of a September 2011 High Court decision, the Commission redetermined the input methodologies to specify how asset valuation, tax and cost allocation apply to default price-quality paths.

⁴⁹ See *Commerce Commission v Vector Limited* [2012] NZCA 220 for the Court of Appeal decision. There was also an earlier High Court decision on the process for determining input methodologies. In each case the Commission has updated its processes in light of the Courts' decisions. For example, the Court of Appeal concluded the Commission was not required to determine a stand-alone starting price input methodology, which the High Court had directed the Commission to determine. The Court of Appeal finding in favour of the Commission was subsequently confirmed by the Supreme Court of New Zealand, see *Vector Limited v Commerce Commission* SC 46/2012 [2012] NZSC 99]

⁵⁰ Commerce Commission media release: *Commission welcomes Supreme Court ruling on input methodologies*, 15 November 2012

⁵¹ See *Wellington International Airport Ltd & Others v Commerce Commission* [2013] NZHC 3289 (The Input Methodology Appeals) 11 December 2013

⁵² Media Releases– Commerce Commission: *Commission begins industry and consumer engagement on IMs review*, 16 June 2015; and *Commission updates process for input methodologies review*, 30 October 2015. General information on the input methodologies is available at <http://www.comcom.govt.nz/regulated-industries/input-methodologies-2/>

⁵³ As well as an inflationary increase an adjustment based on the expected productivity of the industry as a whole is also factored into the annual rate of adjustment

⁵⁴ Part 6 of the Commerce Act

Key aspects of the price-quality regime relate to:

- maximum prices that transmission and distribution pipelines may charge for pipeline services.
- the maximum annual rate of change for those prices.
- minimum service standards that must be met.

Gas Information Disclosure

The Commission also developed new information disclosure requirements⁵⁵ under Part 4 of the Commerce Act to apply to regulated gas pipeline businesses⁵⁶. Effective from October 2012, the new regime replaced the Gas (Information Disclosure) Regulations 1997 administered by MBIE. The new requirements include improved information on network management, assets, expenditure, prices and quality. They also include, for the first time, disclosures by gas pipeline businesses on how they manage their networks, including the disclosure of asset management plans.

The first independent review of gas pipeline companies' response to the disclosure requirements, commissioned by the Commerce Commission in 2015, found the companies generally provided the information required, resulting in a high level of compliance overall⁵⁷.

While some information required under the previous regime has continued with the new information disclosure arrangements, in other respects the basis and nature of information required has changed and is therefore not comparable with previous disclosures.

Where information has continued, five-year performance and statistical trends are included in the body of the relevant sections - primarily the Transmission and Distribution chapters - of the *New Zealand Gas Story*. Other newly-required information is presented for the first time.

Where the information requirement has changed, performance and statistical tables compiled from disclosures under the previous regime are included as **Appendix A on Page 201** to give the reader an appreciation of industry performance and statistical trends in the five years prior to the changeover. This will be retained while data trends build up under the new regime in the next few years.

⁵⁵ Available at www.comcom.govt.nz/gas-information-disclosure/

⁵⁶ Maui Development Limited, Vector Limited, Powerco Limited and GasNet Limited.

⁵⁷ Media Release – Commerce Commission: *Gas companies respond well to new disclosure requirements*, 2 December 2015

4 Regulatory Framework

The gas industry has become increasingly regulated in the past decade. All aspects of the market, from wellhead to end-user installations, are subject to some form of regulatory oversight. This chapter provides a snapshot of the regulatory entities and key governance frameworks that apply to the industry.

4.1 Evolution of Regulatory Frameworks

Since 1990, the regulatory framework has turned full circle for gas transportation services. Significant changes implemented with the new Gas Act in 1992 ushered the industry away from price controls and protected retail franchises into a deregulated era and the opening of competitive gas markets.

Now, price controls have been re-imposed for open access pipeline businesses, although contestable gas wholesaling, retailing and metering services are not subject to price regulation.

The 1992 regime was billed as an age of 'light-handed' regulation, founded on transparency through information disclosure⁵⁸ and governed primarily by restrictions on anti-competitive practices (legislated in the Commerce Act), protections against misleading and deceptive conduct in trade (Fair Trading Act) and safety obligations in the Gas Act. The underlying policy assumption at the time was that commercial forces and market competition would ensure appropriate investment in the network and deliver positive outcomes for consumers. In addition, soon after this, a generally applicable piece of consumer protection legislation – the Consumer Guarantees Act – was passed to ensure that core warranties were provided to consumers.

Towards the end of the 1990s, as Maui gas reserves declined and the industry faced transition to a wider range of gas supply sources, it became increasingly apparent that additional governance measures were required. Moreover, as retail competition intensified, new issues – such as customers switching between retailers, and arrangements for managing supply outages – were also starting to emerge.

The industry took steps towards self-governance. An industry group – known as 'Gas House' – was formed in 1995 with voluntary membership from industry participants, including suppliers, pipeline owners and consumers. A key piece of work by the group was the development of the Pipeline Access Code in 1998, which set out the principal terms for pipeline access. The Pipeline Access Code later gave way to specific codes for the Maui and Vector transmission pipelines.

The industry also introduced a Reconciliation Code for allocating gas between the retailers trading on a given distribution network, and an industry protocol to manage serious supply disruptions⁵⁹.

The Commerce Commission found some merit in the arrangements, but it was not altogether happy. Its views⁶⁰ included:

- as a voluntary, non-binding arrangement, there was no legal compulsion of any person or body in the gas industry to formally support, or to abide by, the provisions of the Pipeline Access Code.

⁵⁸ The Gas (Information Disclosure) Regulations 1997. These were replaced by a new information disclosure regime implemented in October 2012 by the Commerce Commission.

⁵⁹ National Gas Outage Contingency Plan.

⁶⁰ Decision 387, NGC application to acquire TransAlta New Zealand, 17 March 2000.

- the Pipeline Access Code, the Reconciliation Code and the information disclosure requirements represented a basic framework that had the potential to facilitate the development of competition, but the Commission was not confident they were sufficient to ensure sustained competition in the residential market within a reasonable period.
- there were weaknesses in Network Services Agreements (NSAs), which governed access, including that their terms prevailed over information memoranda in the event the two were in conflict, or were inconsistent. The NSA applied for an indefinite term, and the dispute resolution process gave the network operator sole discretion to make final decisions in relation to the posted price.

Consequently, together with these industry initiatives, regulatory intervention progressively occurred as Government-sponsored reviews of the industry uncovered increasingly complex issues. In addition to gas-specific policies, the gas sector is also subject to a variety of industry agreements and a mix of general Government policies and regulatory frameworks that apply to all commercial entities.

Regulatory and other arrangements continue to be reviewed in the context of changing market dynamics.

4.2 Entities Overseeing Gas Industry Arrangements

A number of entities have an oversight role in respect of the gas industry. These are summarised as follows:

Minister of Energy and Resources

The Minister of Energy and Resources has various statutory powers to make a wide range of gas governance rules or to recommend regulations.

Ministry of Business, Innovation and Employment (MBIE)⁶¹

MBIE (www.mbie.govt.nz) has primary responsibility for advising the Minister (and the Government) on energy policy. In respect to gas, it is responsible for:

- all gas governance and industry arrangements
- the role of gas as a thermal fuel
- recommendations made by Gas Industry Co
- the Crown Minerals Act 1991
- the Gas Act 1992

MBIE has an ongoing role in policy development and maintenance of the legislation to ensure it remains fit for purpose⁶².

⁶¹ MBIE was established on 1 July 2012, as a new Ministry to assume the responsibilities and functions previously performed by the Ministry of Economic Development (MED), the Ministry of Science and Innovation, the Department of Labour, the Department of Building and Housing, and the Ministry of Consumer Affairs. Oil and gas-related information is also available at www.nzpam.govt.nz, an arm of MBIE.

⁶² Gas-relevant legislation administered by MBIE includes the Gas Act, Commerce Act, Fair Trading Act, Crown Minerals Act and Plumbers, Gasfitters and Drainlayers Act.

Gas Industry Co (Industry Body and co-regulator)

The co-regulatory model, in which gas industry governance arrangements are developed in a partnership between industry and the Government, was established in 2004 and is unique in New Zealand. It mirrors a co-regulatory gas body developed in New South Wales at the time, and was specifically requested by the industry, which argued for a 'right-sized' governance body for the smaller New Zealand gas industry, and a regime that recognised the 'challenger' nature of gas as a generally optional fuel in increasingly competitive consumer energy markets. It is innovative in that it tasks an industry body with performing much of the policy analysis that would usually be performed by a Ministry.

Essentially, the industry is given the opportunity to develop industry practices, with a back-up of the force of law through regulation and the ability of the Minister to step in to counter any hold-out behaviour, or an inability of participants to reach an appropriate, workable arrangement.

The co-regulatory model thus encourages the delivery of industry-led solutions for gas industry reform where practicable, and the recommendation of regulatory arrangements where appropriate. In a technically complex industry, the co-regulatory model allows the industry greater opportunity to be involved in the development of governance arrangements.

Its uniqueness was observed in a gas industry review conducted in 2011⁶³:

'The system of co-regulation, with the [Government] and the Gas Industry Company sharing regulatory oversight of the industry, is unique to New Zealand. It does, however, seem to be working. While there might be some fear that the Gas Industry Company becomes a trade association rather than a regulator, this does not seem to be the case and there does not appear to be any cause for concern along these lines.'

Appointed as the industry body under Part 4 of the Gas Act in 2004, Gas Industry Co (www.gasindustry.co.nz) is owned by industry shareholders and funded by industry via statutory levies. It is incorporated as a company under the Companies Act 1993 and governed by a Board of Directors, a majority of whom (including the Chair) are independent of the industry.

Gas Industry Co's regulatory oversight encompasses the wholesale and retail markets, processing facilities, and the transmission and distribution sectors of the industry. It specifically administers the Gas (Downstream Reconciliation) Rules 2008, the Gas (Switching Arrangements) Rules 2008, the Gas Governance (Critical Contingency Management) Regulations 2008, and the Gas Governance (Compliance) Regulations 2008.

Its jurisdiction also encompasses customer-facing aspects of the LPG sector⁶⁴. Gas Industry Co's assessment is that there are currently no substantial issues in these LPG markets that warrant regulatory intervention⁶⁵.

⁶³ New Zealand Institute for the Study of Competition and Regulation Inc: *Policy Considerations for the New Zealand Natural Gas Industry*, Stanford L. Levin and Alfred J.M. Duncan, July 2011.

⁶⁴ Gas Industry Co's jurisdiction covers the bottled LPG markets and gaseous LPG supplied via reticulated networks. It does not extend to the bottles themselves, the supply and bulk storage of LPG, or to pipelines carrying LPG in liquid form between transport depots and bulk storage facilities.

⁶⁵ Gas Industry Co: 2016 Annual Report.

Commerce Commission

As New Zealand's primary competition regulatory agency, the purpose of the Commerce Commission (www.comcom.govt.nz) is to achieve the best possible outcomes in competitive and regulated markets for the long-term benefit of New Zealanders.

The Commerce Commission is an independent Crown entity established under section 8 of the Commerce Act 1986, and is not subject to direction from the Government in carrying out its enforcement and regulatory control activities.

As the Commission and Gas Industry Co have some overlap of jurisdiction in respect of gas pipeline services, the two entities entered into a Memorandum of Understanding⁶⁶ (MoU) in August 2011 that sets out how they will coordinate their respective roles under the Gas Act and the Commerce Act.

Utilities Disputes (formerly Electricity and Gas Complaints Commissioner)⁶⁷

Utilities Disputes (<http://www.utilitiesdisputes.co.nz/>) provides a free and independent complaints resolution process for small gas consumers. Originally established as an unincorporated joint venture of a number of electricity retailers committed to a common dispute resolution scheme, the then Electricity and Gas Complaints Commissioner Scheme (EGCC) was approved by the Minister of Energy and Resources as the consumer complaints resolution scheme for the electricity and gas industries on 1 April 2010. This is an outcome of a GPS policy objective for all small gas consumers to have effective access to a free and independent complaints resolution system, and a Government expectation that consumers' best interests are served by a joint gas and electricity scheme. Further information on Utilities Disputes can be found under **in Section 11.14, Consumer Complaints Process, Page 150.**

Standards New Zealand⁶⁸

Standards New Zealand (www.standards.govt.nz) is the national standards organisation and is part of MBIE. Standards New Zealand publishes 'New Zealand Standards', which prescribe specifications for products, processes, services, and performance, including for the gas industry. Standards development is undertaken by a statutory officer within MBIE, using technical committees of industry experts for approval by an independent Standards Approval Board established under the Standards and Accreditation Act 2015

Environmental Agencies

There are a number of agencies with an environmental focus whose functions and operations impact on the gas sector. They include:

- Government departments which advise Government and implement Government policy:
 - Ministry for the Environment (MfE - <http://www.mfe.govt.nz/>), which advises on environmental laws, policies, standards and guidelines, including providing advice on the Resource Management Act 1991 (RMA).

⁶⁶ The MOU is available at <http://gasindustry.co.nz/search/?q=memorandum%20of%20understanding%20commerce%20commission>

⁶⁷ The EGCC changed its name to Utilities Disputes in November 2016 - media release: *Utilities Disputes Ltd replaces EGCC*, 1 November 2016.

⁶⁸ The Standards and Accreditation Act 2015, which came into effect on 1 March 2016, disestablished the previous Standards Council, an autonomous Crown entity established under the Standards Act 1988. Standards New Zealand had performed as the operating arm of the Standards Council which was found by a 2012 review to be financially unsustainable.

- Department of Conservation (<http://www.doc.govt.nz/>), which has an oversight and advisory role in respect of any pipelines running through the conservation estate.
- Statutory Crown Entities that perform regulatory functions, such as:
 - Energy Efficiency and Conservation Authority (EECA - www.eeca.govt.nz), established under the Energy Efficiency and Conservation Act 2000 and subject to the Crown Entities Act 2004. EECA encourages, promotes and supports energy efficiency, energy conservation and the use of renewable energy sources.
 - Environmental Protection Authority (EPA - www.epa.govt.nz), established as a Crown Agent under the Environmental Protection Authority Act 2011. It is responsible for various regulatory environmental management functions, including:
 - consenting under the RMA for major infrastructure projects of national significance.
 - management of the New Zealand Emissions Trading Scheme (ETS) and New Zealand Emission Unit Register.
 - regulation of hazardous substances, including gas (under the Hazardous Substances and New Organisms Act).
 - the consenting authority for activities in the Exclusive Economic Zone and Continental Shelf.
- Local authorities, including local, regional and unitary government bodies, which are responsible for the day-to-day management of the RMA, and whose district plans include provision for such utilities as gas pipelines.
- Parliamentary Commissioner for the Environment (PCE - www.pce.parliament.nz) an independent officer of Parliament, who reviews and provides advice to Parliament on environmental issues. The office was set up under the Environment Act 1986.

WorkSafe New Zealand

WorkSafe New Zealand (<http://www.worksafe.govt.nz/worksafe>) was established in 2013 as a stand-alone Crown Agent as part of Government reforms to the New Zealand workplace health and safety system. Its creation was a key recommendation of both the Royal Commission on the Pike River Coal Mine Tragedy, and the Independent Taskforce on Workplace Health and Safety. The new organisation absorbs general workplace health and safety, as well as the High Hazards Unit and industry-specific safety functions of MBIE, including those of Energy Safety.

4.3 Regulatory Arrangements

The regulation of the gas industry, as with other industries, includes general legislative requirements (for example, consumer protection, health and safety, and environmental management) as well as industry-specific regulation.

The following summary focuses on legislation of most relevance to the gas sector. It does not include very general legislation (such as tax legislation) that also has an impact on the industry and its participants. Aspects of the legislation are discussed in more detail in relevant sections of this report.

While key policy objectives are often similar to those in other countries, the regulatory arrangements in many respects differ from other international gas markets, reflecting that they have been developed specifically for the characteristics of the New Zealand market.

Gas Act 1992

As suggested by its title, the Gas Act⁶⁹ is the primary piece of legislation in respect of the regulation and use of gas in New Zealand. The purposes of the Gas Act are to:

- provide for the regulation, supply, and use of gas in New Zealand.
- protect the health and safety of members of the public in connection with the supply and use of gas.
- promote the prevention of damage to property in connection with the supply and use of gas.

Inter alia, it:

- sets out the roles and responsibilities of MBIE, including its powers to carry out enquiries, tests, audits or investigations to determine compliance with the Gas Act and to ensure the safe supply and use of gas.
- grants owners, operators and other relevant persons powers such as rights of entry and prescribes conditions in respect of the exercise of those powers.
- establishes duties, such as requirements to inform MBIE of key gas activities, especially in respect of gas operators and other owners of gas fittings.
- allows for the issuance of industry codes of practice.
- includes various arrangements in respect of the governance of the gas industry, including mandating the co-regulatory model.
- mandates various requirements in respect of gas safety, including a requirement for all owners or operators of gas supply systems to have a safety management system that addresses the prescribed requirements.
- includes broad regulation-making powers.
- establishes various offences for breaches of the Gas Act.

Specific policy objectives of the Gas Act are also discussed under **Government Policy Framework, Page 25**. In addition to the provisions in the Gas Act itself, there is a variety of regulations and rules which sit under the umbrella of the Gas Act. They include the following regulatory arrangements administered by MBIE or Gas Industry Co:

Gas (Statistics) Regulations 1997

MBIE prepares various energy data and modelling reports to keep track of and report on the New Zealand energy sector. Reports include the annual *Energy in New Zealand* publication (formerly the *New Zealand Energy Data File*), the *New Zealand Energy Quarterly*, and *New Zealand's Energy Outlook*. These Regulations⁷⁰ enable MBIE to collect quarterly gas statistics, and annual LPG statistics from participants to inform its energy data and modelling work.

Gas (Safety and Measurement) Regulations 2010

These Regulations⁷¹ set out responsibilities and obligations for the safe supply of gas and include:

⁶⁹ www.legislation.govt.nz/act/public/1992/0124/latest/DLM285412.html

⁷⁰ www.legislation.govt.nz/regulation/public/1997/0128/latest/DLM235059.html

⁷¹ www.legislation.govt.nz/regulation/public/2010/0076/latest/DLM2359501.html

- generic rules and requirements for safety.
- the point of supply for the delivery of gas.
- requirements for safety management systems (SMS).
- the third party certification regime for gas appliances.
- the joint New Zealand/Australian gas appliance label.
- offences.

Gas (Downstream Reconciliation) Rules 2008

These Rules⁷² superseded the Reconciliation Code and provide a set of uniform processes to enable the fair, efficient, and reliable allocation and reconciliation of downstream gas quantities. The Rules took effect from 2 October 2009, and allow for an Allocation Agent to:

- gather information about gas injection and consumption.
- allocate daily gas quantities to retailers at gas gates.
- reconcile downstream gas quantities.

Gas (Processing Facilities Information Disclosure) Rules 2008

These fixed-term Rules⁷³ expired in June 2014. They required information to be made publicly available about gas processing facilities' capability and capacity, and requests by third parties for access to processing facilities. After a review by Gas Industry Co found no competition issues associated with gas processing access, the Minister accepted Gas Industry Co's recommendations that no permanent regulations are needed.

Gas (Switching Arrangements) Rules 2008

These Rules⁷⁴ codified existing arrangements that enable consumers to choose, and alternate efficiently between competing retailers. They provide for a centralised Gas Registry that stores key information about every consumer installation, facilitates the switching process, and monitors switching timeframes from initiation through to completion.

Gas Governance (Critical Contingency Management) Regulations 2008

The purpose of these Regulations⁷⁵ is to achieve the effective management of critical gas outages and other security of supply contingencies without compromising long-term security of supply. They provide for the appointment of a Critical Contingency Operator (CCO), which is responsible for determining, managing, and terminating critical contingencies, as well as associated activities, such as training and conducting exercises.

⁷² <http://gasindustry.co.nz/work-programmes/downstream-reconciliation/policy-development/#the-rules>. These Rules are being reviewed by Gas Industry Co

⁷³ <http://www.gasindustry.co.nz/work-programmes/gas-processing-facilities-information-disclosure/>. In September 2013 the Minister accepted a Gas Industry Co recommendation that regulated access to processing facilities is not required and that these Rules be allowed to lapse upon their expiry on 27 June 2014.

⁷⁴ <http://gasindustry.co.nz/work-programmes/switching-and-registry/policy-development/#overview>

⁷⁵ <http://gasindustry.co.nz/work-programmes/critical-contingency-management/current-arrangements/>

Gas Governance (Compliance) Regulations 2008

These Regulations⁷⁶ establish a number of compliance processes and key compliance roles, including the Market Administrator, an Independent Investigator and a Rulings Panel, and allow for the following rules and regulations to be monitored and enforced to ensure the integrity of key markets:

- Gas (Switching Arrangements) Rules 2008
- Gas (Downstream Reconciliation) Rules 2008
- Gas Governance (Critical Contingency Management) Regulations 2008

The role of Market Administrator is performed by Gas Industry Co. The Independent Investigator function has a range of powers to investigate and report on allegations of breaches of the rules and regulations. The Rulings Panel, an independent body appointed by the Minister of Energy and Resources, approves or rejects settlements referred to it by the Investigator and determines breach allegations that are unable to be settled, or in respect of which a settlement has not been approved.

Gas (Levy of Industry Participants) Regulations 2013

These Regulations⁷⁷ allow Gas Industry Co to collect levies from gas industry participants to fund its work.

Gas Industry Co is required to consult annually on the development of a work programme and associated costs, and to publish an annual Statement of Intent (SOI)⁷⁸. Its costs are met through a combination of levies applied to wholesale and retail participants, and market fees associated with the ongoing administration of specified rules and regulations.

Commerce Act 1986⁷⁹

Restrictive trade practices

General provisions in the Commerce Act promote competition and protect against the inappropriate exercise of market power and price fixing.

Control under Part 4 of the Commerce Act

Provides for the regulation of the price and quality of goods or services in markets where there is little or no competition, and little or no likelihood of a substantial increase in competition.

Crown Minerals Act 1991⁸⁰

Since 1 January 1938, all petroleum resources in New Zealand have been owned by the Crown on behalf of all New Zealanders. Natural gas is covered by the definition of 'Petroleum' (as a naturally occurring hydrocarbon in a gaseous state) and thus covered by the Crown Minerals regime.

The Crown Minerals Act 1991 sets the broad legislative policy for prospecting, exploration and mining of Crown-owned minerals in New Zealand. It governs the allocation of rights to, and the management

⁷⁶ <http://gasindustry.co.nz/work-programmes/compliance/policy-development/>

⁷⁷ <http://gasindustry.co.nz/work-programmes/levies/overview/>

⁷⁸ The requirement to publish an SOI was introduced with Gas Act changes in 2013, and replaced a requirement to publish a strategic plan. The content requirements of the two documents were unchanged.

⁷⁹ www.legislation.govt.nz/act/public/1986/0005/latest/DLM87623.html

⁸⁰ <http://www.legislation.govt.nz/act/public/1991/0070/latest/DLM242536.html>

of, all Crown-owned minerals in their natural state. A person or company wanting to prospect, explore or mine Crown-owned minerals in New Zealand must obtain a permit from New Zealand Petroleum & Minerals.

Substantial changes to the regime were introduced with the Crown Minerals Amendment Act 2013⁸¹ and revisions to associated regulations on 24 May 2013 following a substantial review of the Crown Minerals Act during 2012/13. The review looked at how exploration and production rights are allocated, the management and oversight of exploration and production processes, and how the Crown shares the benefits of exploration success. It was part of the Government's objective to ensure that New Zealand has world-leading mineral and petroleum exploration and production systems that balance economic benefits with safety and environmental considerations. It also sought to accommodate emerging technologies and resources; and ensure greater clarity for participants, and greater public transparency, in the development of new petroleum and minerals opportunities.

It did not include, and the Government is not considering changes to, fundamental aspects of the Crown Minerals regime, such as:

- Crown ownership, on behalf of all New Zealanders, of petroleum, gold, silver and uranium.
- the right of the Government to be the ultimate decision-maker in allocating permits to develop Crown-owned petroleum and minerals.
- the right for the Crown to collect royalty payments from Crown-owned petroleum and minerals, Crown ownership of any royalty payments, and the right to use such funds in any way the Crown sees fit, on behalf of all New Zealanders.

Associated regulations and programmes include:

Petroleum Programme 2013⁸²

The Petroleum Programme establishes the policies, procedures, and provisions to be applied to petroleum under the Crown Minerals Act. It includes details of the permitting regime, operational aspects such as flaring and venting, and extends to unconventional (gas hydrates, coal seam gas) resources and underground gas storage. The Programme was revised on 1 January 2012, and further updated from 24 May 2013 as an outcome of the Crown Minerals Act review.

Crown Minerals (Petroleum) Amendment Regulations 2013⁸³

The Petroleum Regulations, made pursuant to s105(I) of the Crown Minerals Act, specify the requirements and procedures for explorers and developers. They include provisions relating to documents, permit applications, notices, mining operations, activity reporting, the provision of samples, and royalty statements and returns.

Crown Minerals (Royalties for Petroleum) Regulations 2013⁸⁴

These regulations detail the regime applying to oil and gas royalties, including cost definition, the timing and rates of royalty payments, and calculation instructions.

⁸¹ <http://www.legislation.govt.nz/act/public/2013/0014/latest/DLM4756113.html>

⁸² <http://www.nzpam.govt.nz/cms/documents/industry/regulations/petroleum-programme-2013.pdf>

⁸³ <http://www.legislation.govt.nz/regulation/public/2013/0127/latest/DLM5156501.html>

⁸⁴ <http://www.legislation.govt.nz/regulation/public/2013/0126/latest/DLM5156989.html>

Crown Minerals (Petroleum Fees) Regulations 2006⁸⁵

The Petroleum Fees Regulations, made pursuant to s105 (I)(i), (j), and (k) of the Crown Minerals Act, outline fees payable in respect of various matters specified under the Crown Minerals Act.

Plumbers Gasfitters and Drainlayers Act 2006⁸⁶

The Plumbers, Gasfitters and Drainlayers Act 2006 established a Plumbers, Gasfitters and Drainlayers Board (PGDB – www.pgdb.co.nz) and is aimed at protecting the health and safety of members of the public by ensuring the competency of persons engaged in the provision of sanitary plumbing, gasfitting, and drainlaying services, and regulating those persons. The Act, which came into full force on 1 April 2010, introduced significant changes to improve public health and safety.

New Zealand Standards

There is a variety of official standards relevant to the gas industry. They include

- AS/NZS 4645:2008, gas distribution networks.
- AS/NZS 5601:2010, gas installations (which in time will replace NZS 5428: 2006 in respect of LPG installations for non-propulsive purposes in caravans and boats; and 5261:2003, gas installations).
- NZS 5255:2014, safety verification of existing gas installations.
- NZS 5256: 2014, verification of the safety of gas appliances.
- NZS 5257.1:2004, gas industry audit protocol.
- NZS 5259:2015, gas measurement⁸⁷.
- NZS 5262:2003, gas appliance safety.
- NZS 5263:2003, gas detection and odourisation.
- NZS 5266:2014, safety of gas appliances.
- NZS 5442:2008, specification for reticulated natural gas.
- NZS 7901:2008, electricity and gas industries - safety management systems for public safety.

In general, standards do not themselves carry the force of law. This occurs through other mechanisms, such as when contracts, statutes or regulations specifically require compliance with a standard. For example, the Gas (Safety and Measurement) Regulations 2010 cites over 20 different standards.

Submarine Cables and Pipelines Protection Act 1996⁸⁸

Submarine cables and pipelines are protected under the Submarine Cables and Pipelines Protection Act 1996 and include pipelines used or intended to be used for the conveyance of gas, petroleum, or oil. The Act provides for the creation of protected areas for the pipelines and prohibits ships from fishing or

⁸⁵

www.legislation.co.nz/regulation/public/2006/0227/latest/DLM403197.html?search=ts_regulation_Crown+Minerals+Petroleum+Fees+Regulations+2006_resel&sr=1

⁸⁶ www.legislation.govt.nz/act/public/2006/0074/latest/DLM396778.html

⁸⁷ Revision of NZS 5259:2004, taking account of current national and international best practice, new technologies and generic developments, compliance costs. Performance requirements have been updated.

⁸⁸ www.legislation.govt.nz/act/public/1996/0022/latest/DLM375803.html

anchoring in those areas. It also defines the liability and offences for damage done to cables and pipelines. Protected areas are in place in respect of a few significant underwater gas pipelines⁸⁹.

Emissions Trading Scheme⁹⁰

The Climate Change Response Act 2002 was enacted in order for New Zealand to ratify the Kyoto Protocol and meet its obligations under the United Nations Framework Convention on Climate Change. In 2008, the Climate Change Response (Emissions Trading) Amendment Act 2008 amended the Climate Change Act to establish the New Zealand Emissions Trading Scheme (ETS) as the Government platform to assist New Zealand to meet its Kyoto Protocol obligations in respect of greenhouse gas emissions⁹¹.

In November 2012, the Government decided that, for the transition period 2013-2020, New Zealand would take the option of aligning its climate change efforts with the UN Framework Convention, rather than sign up to a Second Commitment Period (CP2) under the Kyoto Protocol. In December 2015, New Zealand participated in COP-21, a substantial climate change forum in Paris⁹² and has committed to reducing New Zealand's Greenhouse Gas (GHG) emissions to 11 percent below 1990 levels by 2030 – more than double its existing 5 percent reduction by 2020 Kyoto target. It also represents a 30 percent reduction on New Zealand's 2005 levels.⁹³ The Paris forum set out to reach a global emission reduction accord that is more ambitious than any previous negotiations have accomplished. See also **Section 5.0, Environmental Sustainability, Page 44**.

When fully implemented the ETS will be a national, all-sectors, all-greenhouse gases, uncapped internationally linked emissions trading scheme. However, full implementation will take a considerable period due to lengthy transitional arrangements.

Under the ETS, a participant is someone who carries out a greenhouse gas-producing activity listed in the Act. There are two types of participants: mandatory and voluntary. In respect of natural gas, each person that mines natural gas or imports more than 10,000 litres of natural gas a year is a mandatory participant. Industry participants who purchase more than 2PJ of natural gas in a year from one or more participants who mine natural gas are voluntary participants, but all requirements are mandatory if they opt into the Scheme.

All mandatory gas sector participants entered the scheme on 1 July 2010⁹⁴, although a transitional period operated for the gas sector from 1 July 2010 to 31 December 2012. During this period participants had the option of buying New Zealand Units at a fixed price with one unit able to be surrendered for two tonnes of carbon dioxide equivalent emissions, effectively setting a price ceiling for units in the transition period.

Natural gas default emission factors (DEFs) are specified in Regulations passed under the Climate Change Act and it is envisaged the factors will be reviewed for each reporting year, and updated as

⁸⁹ [Submarine Cables and Pipelines Protection Orders for the Kupe Gas Project \(2008\)](#), [Maori Development \(2008\)](#), and [Tui Area Development \(2007\)](#).

⁹⁰ <http://www.mfe.govt.nz/climate-change/reducing-greenhouse-gas-emissions/new-zealand-emissions-trading-scheme>

⁹¹ The legislation and regulations, particularly the transition provisions, are complex. Additional information is available on the Ministry for the Environment (www.mfe.govt.nz) and EPA (www.epa.govt.nz) websites.

⁹² Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). As the 21st COP meeting, the forum is known as 'COP21'.

⁹³ Media release: Hon Tim Groser, Minister for Climate Change Issues: *Climate change target announced, 7 July 2015*

⁹⁴ Different sectors of the economy have different 'entry dates', being the date when their obligations to report emissions and surrender emission units have effect. The last industry – agriculture – entered the scheme on 1 January 2015. The gas industry along with other stationary energy, industrial processes and liquid fossil fuel sectors entered the ETS on 1 July 2010.

necessary⁹⁵. In addition to the DEFs the Regulations establish field-specific factors, as well as a national average, which are used by participants when reporting their emissions. Reporting by gas miners is based on actual data for the current year.

Modifications to the ETS were made in 2012⁹⁶ to maintain the costs the ETS imposes on the economy at existing levels while New Zealand managed an economic recovery. The modifications also included changes to improve the operation of the ETS. The Government is now also moving to phase out the one-for-two subsidy implemented during the global financial crisis.

In November 2015, the Government began a further review of the ETS to assess its effectiveness to 2020 and beyond⁹⁷.

Fair Trading Act⁹⁸

The Fair Trading Act protects against misleading and deceptive conduct in trade, and promotes fair competition to contribute to the economic wellbeing of all New Zealanders. It prohibits certain conduct, provides for the disclosure of consumer information relating to the supply of goods and services, and promotes product safety. Consumer law reforms passed by Parliament in December 2013⁹⁹ include a number of amendments to the Fair Trading Act and the Consumer Guarantees Act. These include some exceptions that allow businesses to contract out of their obligations under the Act.

Consumer Guarantees Act¹⁰⁰

The Consumer Guarantees Act is a key piece of consumer protection legislation, providing consumer rights through a number of 'guarantees' that the seller automatically makes to a consumer when the consumer buys any goods or services purchased for personal use. While the Act applies regardless of who acquires the goods or services, it allows businesses to contract out of it. Most business and industry gas supply contracts exclude the Consumer Guarantees Act where permitted by law. The Act applies to 'goods and services'. The definition of 'good' expressly includes gas, and the definition of 'services' includes a contract for or in relation to the supply of gas.

The consumer law changes passed in December 2013 also include amendments to the Consumer Guarantees Act, some of which relate directly to the gas industry.

Health and Safety at Work Act 2015¹⁰¹

The Health and Safety at Work Act 2015 replaces the Health and Safety in Employment Act 1992 (HSE Act) and is part of the Government's 'Working Safer: a blueprint for health and safety at work' programme that substantially reforms New Zealand health and safety system. It follows the recommendations of an Independent taskforce on Workplace Health and Safety and took effect in April 2016 following the development of supporting regulations. Oil and gas sector - related regulations previously introduced under the HSE Act include the Health and Safety in Employment (Pipelines)

⁹⁵ Updates may have retrospective effect, to allow them to be applied for the reporting year in which the changes are made.

⁹⁶ [Climate Change Response \(Emissions Trading and Other Matters\) Amendment Act 2012](#).

⁹⁷ Media release: Hon Tim Groser, Minister for Climate Change Issues: *Government begins review of ETS*, 24 November 2015

⁹⁸ www.legislation.govt.nz/act/public/1986/0121/latest/DLM96439.html

⁹⁹ The Consumer Law Reform Bill, in the form of five separate amendment Acts and a replacement Act, passed its third reading in December 2013. A number of changes took effect from 18 December 2013; others applied from 17 June 2014. Detailed information is available at <https://www.consumerprotection.govt.nz/consumer-law-and-your-rights/>

¹⁰⁰ www.legislation.govt.nz/act/public/1993/0091/latest/DLM311053.html

¹⁰¹ <http://www.legislation.govt.nz/act/public/2015/0070/latest/whole.html>

Regulations 1999¹⁰² and the Health and Safety in Employment (Petroleum Exploration and Extraction) Regulations 2013¹⁰³.

Hazardous Substances and New Organisms Act 1996¹⁰⁴

The Hazardous Substances and New Organisms (HSNO) Act 1996 aims to protect the environment and the health and safety of communities, by preventing or managing the adverse effects of hazardous substances and new organisms¹⁰⁵. The provisions of the Act apply to gas, as a flammable and potentially hazardous substance, and dovetail with the safety requirements in the Gas Act¹⁰⁶.

Resource Management Act 1991¹⁰⁷

The Resource Management Act (RMA) is the main piece of legislation that protects New Zealand's environment. It is wide-reaching and at times controversial as it is seen by some as a costly impediment to timely project development. It is administered by the Ministry for the Environment, but a number of other agencies, including local and regional government bodies, are also responsible for considering environmental impacts under the RMA. The RMA is based on a principle of 'sustainable management', a purpose that directs all other policies, standards, plans and decision-making.

Virtually all significant uses of land, air, coastal, or water-related resources are regulated by provisions of the RMA, or by rules in regional or district plans, or by decisions on consent applications. Accordingly, any gas field production facility, and downstream infrastructure installation – such as processing plants and pipelines – require numerous RMA consents for their construction, and for their ongoing operations. Operational consents can include water abstraction, treatment and use, waste treatment and discharges, air emissions, landscaping requirements, noise levels, traffic movements and parking amenities.

A number of significant changes to the RMA are proposed in the Resource Legislation Amendment Bill introduced in Parliament in December 2015¹⁰⁸.

¹⁰² www.legislation.govt.nz/regulation/public/1999/0350/latest/DLM298848.html

¹⁰³ <http://www.legislation.govt.nz/regulation/public/2013/0208/15.0/DLM5203558.html> . The new regulations covering petroleum exploration and extraction, effective from June 2013, strengthen the management of oil wells over the life of the wells, including managing hazards that could cause a major accident, and minimising the likelihood of an uncontrolled release of oil and gas – Media release, Acting Minister of Labour: *Health and safety a priority in oil and gas production*, 27 November 2012.

¹⁰⁴ www.legislation.govt.nz/act/public/1996/0030/latest/DLM381222.html

¹⁰⁵ The HSNO Act is administered by the EPA, and MBIE ensures that the HSNO Act is complied with in places of work. MBIE carries out this role in conjunction with a number of other agencies, including Maritime New Zealand, Civil Aviation Authority, Land Transport Safety Authority and territorial authorities.

¹⁰⁶ s97 makes plain that the provisions of the HSNO Act are to be enforced in, on, at, or around any distribution system, gas installation, or gas appliance. The Gas Act provides for safety in the supply and use of fuel gases, such as natural gas and LPG, supplied to appliances from containers, installations or distribution systems. The Gas Act does not, however, control the safety of the containers themselves. The HSNO Act controls potentially harmful effects of flammable or toxic gases, including fuel gases. The HSNO Act requires Energy Safety to consult with the EPA on regulations under the Gas Act. Energy Safety, however, remains the regulatory authority responsible for administering controls over the safety and quality of fuel gases under the Gas Act.

¹⁰⁷ www.legislation.govt.nz/act/public/1991/0069/latest/DLM230265.html

¹⁰⁸ Media Release – Hon Nick Smith, Minister for the Environment: *Resource Managements Changes Pass First Reading*, 3 December 2015.

Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012¹⁰⁹

The Exclusive Economic Zone (EEZ) and Continental Shelf (CS) Act (the EEZ Act) 2012 manages the environmental effects and potential risks of activities in New Zealand's oceans, such as petroleum exploration, seabed mining, marine energy generation and carbon capture developments¹¹⁰.

It came into force in June 2013 after the Ministry for the Environment developed the associated regulations, which include seismic surveying and prospecting for petroleum and minerals amongst permitted activities. The EPA is the consenting authority for activities within the EEZ and undertakes the day-to-day operations of the legislation, including information management, decision-making, monitoring and enforcement¹¹¹.

Energy Efficiency and Conservation Act 2000¹¹²

The Energy Efficiency and Conservation Act 2000 (EEC Act) promotes energy efficiency, energy conservation and the use of renewable sources of energy in New Zealand. It is administered primarily by EECA and MBIE.

¹⁰⁹ www.legislation.govt.nz/act/public/2012/0072/latest/DLM3955428.html

¹¹⁰ The EEZ Act fills a perceived gap as the RMA only regulates natural resource management activities on land and in the territorial sea out to 12 nautical miles. It does not override existing controls over fishing and shipping.

¹¹¹ See also *Checks and Balances: Responsible development of petroleum and minerals in New Zealand*, New Zealand Petroleum and Minerals, which explains the decoupling of exploration/mining permit and marine consent decisions

¹¹² <http://www.legislation.govt.nz/act/public/2000/0014/latest/DLM54948.html>

5 Environmental Sustainability

As a fossil fuel, gas is part of the global debate on climate change, environmental sustainability and New Zealand's drive towards a greener economy.

The December 2015 Paris Agreement on Climate Change (COP-21) has given considerable impetus to global climate change management, with major implications for the future use of all fossil fuels, including gas, and how nations manage their economies.

Gas is the cleanest burning of fossil fuels, and is being widely used internationally to replace more harmful fossil fuels and help drive the transition to an environmentally sustainable future.

As it accounts for approximately 9 percent of New Zealand's total greenhouse gas (GHG) emissions, with transport and agriculture having a much greater environmental impact, gas can be only a corresponding part of the solutions.

With its already high level, and growing, renewable energy use, particularly in electricity generation, New Zealand has far fewer opportunities for gas to displace more harmful fuels. But for the foreseeable future, gas has an important ongoing role in New Zealand, in particular for:

- supporting a predominantly renewable electricity system.
- industries that use gas as a feedstock to convert into other products (methanol/urea).
- other energy-intensive industries that have no better option at present.
- businesses that could use alternatives, such as electricity, but to do so would likely increase their effective carbon footprint.
- households where the direct use of gas is more efficient and/or has a lower carbon footprint than alternatives.

Ultimately, gas will need to justify its place in a low carbon future.

5.1 Background

Natural gas is a fossil fuel that emits GHGs when released to atmosphere or burned. So, while making a significant contribution to New Zealand's energy mix, gas is part of the global debate on climate change, environmental sustainability and New Zealand's drive towards a greener economy.

The world is proactively grappling with climate change challenges. The COP-21 Paris Agreement, which has been ratified by New Zealand, targets limiting the future global temperature rise to 'well below' 2 degrees (1.5°C if possible) and achieving net-zero carbon emissions by the end of the century. It came into force in November 2016, having reached the threshold requiring 55 Parties representing at least 55 percent of global emissions to join it. At that point, 110 of the 197 parties had formally ratified the agreement, including the USA¹¹³, China, India and the EU.

¹¹³ US President-elect, Donald Trump, has indicated he will withdraw the US from the Agreement upon taking office.

The Paris Agreement departs from earlier international agreements in not seeking to set international climate change reduction targets. Rather, it requires each member country to set its own national targets to help achieve the Agreement goals, with obligations for members to prepare, communicate and maintain nationally determined contributions (NDCs) at least every five years.

Having made emissions reduction commitments under the Paris Agreement, countries, including New Zealand, are now developing plans to meet their obligations. The New Zealand Government has signalled significant changes and a desire to manage the economic implications of climate change are needed to meet these targets, and it sees particular opportunities with ongoing developments in energy and other technologies.

And, as the Government is reviewing national measures required to meet New Zealand's Paris commitments, other voices from across the spectrum are debating the best national initiatives to meet the country's emission reduction commitments and the climate challenge more widely.

New Zealand is currently generating around 80 percent of its electricity from renewable resources, and has a target of 90 percent of electricity generation from renewable sources by 2025 'providing this does not affect security of supply'. In the broader energy supply context, renewable energy made up 40 percent of New Zealand's total primary energy in 2015, meaning some 60 percent of New Zealand's supply came from carbon fuels, much of associated with transport.

Natural gas provides over 20 percent of New Zealand's primary energy, but as a GHG emitter its role will be affected by national and global climate change responses.

Although fuelling over 268,000 homes, community facilities and businesses, gas accounts for a relatively small 9 percent of New Zealand's greenhouse gas emissions and is only one part of the wider issues and solutions needed. Agriculture (49 percent), and transport (40) percent are the largest GHG contributors in New Zealand.

Gas emits around half the CO₂, one third of the nitrous oxides (NO_x) and 1 percent of sulphur oxides (SO_x) emissions of coal. Consequently, many countries more heavily reliant on coal and other 'dirtier' fuels are looking increasingly to cleaner-burning gas to replacing these more harmful fossil fuels and thereby reduce their environmental emissions.

An example of this trend is the United States, where the power sector accounts for 31 percent of US emissions, and where the development of shale gas deposits has seen gas overtake coal as the main source of electricity generation. The United States Energy Information Administration reports that switching from coal to natural gas accounted for 68 percent of a 12 percent total reduction in energy-related CO₂ emissions in the USA in the last decade.¹¹⁴

Gas consumption globally is therefore predicted to increase for some time, with corresponding global emissions reductions potential, as it performs this important transitional role towards a low carbon emissions world.

According to BP's *Statistical Review 2016*, world consumption of natural gas grew 1.9 percent in 2015; at the same time coal consumption declined by 1.8 percent for the first time since 1998 and the largest decline since the mid-1960s.

¹¹⁴ EIA *Today in Energy* Bulletin 9 May 2016, and IPAA *Energy in Depth* bulletin, 5 July 2016

And the International Energy Agency (IEA), in its latest world energy outlook¹¹⁵, predicts gas growth of 1.5 percent a year, or 50 percent by 2040, while growth in oil demand slows and coal use is 'hit hard by environmental concerns - after the rapid expansion of recent years, growth essentially grinds to a halt'. The IEA see an increase in nuclear output spurred mainly by deployment in China.

As is the case in New Zealand, internationally there are bigger issues with other GHG emissions sources than with gas - agriculture, other land uses and transportation being much larger GHG emission contributors.

Substitution opportunities for gas are far fewer in New Zealand. But gas has an important transitional role to play in New Zealand's energy supply, primarily in support of renewables-dominated electricity generation and fuelling some of the country's largest and most important industries that do not have an immediate large scale, practical and economic alternative.

Over time, gas will need to justify its place in a low carbon future; in an energy sector that is otherwise being transformed by new technologies and consumer demands; and in response to new policy requirements and energy technologies that are being developed nationally and internationally to meet the urgent targets set by the Paris Agreement.

5.2 Electricity generation

Gas's role in New Zealand has continued to change, notably as the country moves closer to its 90 percent renewable electricity generation target.

Gas use in electricity generation is declining as its role transitions from one of baseload to a peaking role though modern-technology peaker plants. Geothermal has overtaken gas as the second largest generation fuel. However, gas supports electricity supply security by generating the balance of New Zealand's power needs, while allowing maximum use of hydro generation by virtue of 'backing up' the system, including in dry years.

The alternative to gas would require building more wind and hydro that would not be needed much of the time. Water would be spilt more often and these generating sources would also be subject to the same climatic vagaries.

Until technology improves, it is unlikely that electricity generation in New Zealand can economically move much beyond the current position without significantly increasing costs to all electricity users.

5.3 Industry and commerce

Gas has been the preferred, and in many cases the only, economic fuel for New Zealand commercial and industrial energy consumers.

Energy-intensive plant such as timber processing, dairy and steel manufacture, would need a considerable change to technology to able them to stop using gas. Some, such as timber processors, are already maximising use of bio-fuels that are underpinned by a small amount of gas for stability and/or cold starts. The electricity system could not supply the raw energy in the quantities required by these plants. New Zealand therefore has a stark choice: Continue to use gas pending a technology change, or shut down some of New Zealand's most important industries, among them key exporters.

¹¹⁵ [World Energy Outlook 2016](#)

Less energy-intensive industries could potentially move their heating requirements from gas to electricity. However, if that was done now, carbon emissions would rise because the increased electricity needed would most likely come from gas-fired generation plant. The direct use of the same fuel at the end-user site would have lower GHG emissions.

5.4 In the home

Gas is used in 253,000 homes, often with a carbon footprint comparable to that of electricity.

The latest *Energy Options Report*¹¹⁶ finds that the carbon-intensity of electricity heating options is very similar to that of direct gas heating options. This is because the type of generation that will meet an increase in residential heating demand is relatively fossil-heavy compared with the average type of generator to meet demand in general.

Also, efficient gas heating installations are among desirable heating options listed by the Energy Efficiency and Conservation Authority (EECA).

5.5 What people are saying about climate change

International voices, including from the oil and gas industry, have been acknowledging for some time the need for transition to a low carbon emissions world, and that gas will need to justify its place in that world.

Intergovernmental Panel on Climate Change (November 2014) - *The world must end its reliance on fossil fuels such as coal, oil and gas by 2100 or the effects of climate change will be severe, pervasive and irreversible. The majority of the world's energy needs must be met by renewable sources by 2050. Currently some 30% of energy is generated by sustainable means. By 2050 that must rise to 80%, with nuclear power making up much of the shortfall.*

Peter Coleman, Managing Director, Woodside Petroleum (APPEA Conference 2016) - *The industry should start thinking to secure the place that gas, as the lowest emission fossil fuel, should 'rightfully' take in the future. There are opportunities but the future of gas is not guaranteed.*

New Zealand Prime Minister John Key (Radio NZ Morning Report, December 2015) - *The Paris climate change deal will require New Zealand to take significant steps to reduce greenhouse gas emissions, but [this] reduction will not involve cutting back on the mining of oil, gas and coal; The world's going to continue to consume some of these products and we can't stop that. The question is, can we get them to transition more rapidly to other forms of renewable energy? The answer is yes. But one of the fastest ways to do that is to stop the subsidisation of the consumption of fossil fuels and that's really what the fossil fuel subsidy reform's about; New Zealand will have to make significant changes, which could cost households \$100 a year, to reduce emissions. That would include increasing the country's use of renewable energy. You will see a push towards electric cars. I think you are going to have to see from New Zealand's point of view a scientific solution to our agriculture emissions and frankly more happening in the commercial sector. So there's a lot of changes there. They're all do-able but we'll just need to push hard on those.*

Energy and Resources Minister Simon Bridges (Downstream Energy Conference 2016) - *There is no doubt that our future energy markets will look very different to the ones we have today; We need to continue to build willingness to do things differently, and awareness that energy efficiency and*

¹¹⁶ [Consumer Energy Options in New Zealand – 2016 Update](#), Concept Consulting

increased use of our renewable potential are critical game-changers; We need to broaden our renewable energy use beyond electricity and increase its use in the transport and industrial heat sectors; The argument around non-renewables versus renewables is far too simplistic. We need to recognise that not all non-renewables are created equal and I believe gas will play an important role in transitioning to a lower carbon future. There is no doubt that a gas find off the Canterbury coast, for example, could shift the energy dynamic in the South Island and further afield.

Climate Change Minister Paula Bennett (media release and national statement, April 2016) - *New Zealand is absolutely committed to reducing our emissions and to achieving the ambitious target we set before Paris. We intend to do this within the context of economic growth, which remains a top priority for our Government; I am already thinking about what we have to do domestically to grow our economy with fewer emissions; The next step is for more of the operational details to be fleshed out so New Zealand can consider timing and the best way to ratify the agreement; Because of the importance of agriculture in our country, we are particularly focused on finding practical solutions to reduce emissions in that sector in a way that doesn't detrimentally affect our farmers, and as a consequence, our food supply.*

New Zealand Parliamentary Commissioner for the Environment, calling for bold leadership on climate change, also notes (media release, April 2016): *New Zealand has signed the Paris Agreement. Now we need to deliver; Ministers should consider the economic and financial risks of climate change, which threatens financial resilience and long-term prosperity; The Emissions Trading Scheme is not enough and needs to be strengthened; Many of New Zealand's laws and regulations were set up with a different world in mind, and now need to be scrutinised through a climate change lens; New Zealand cannot continue to ignore agricultural greenhouse gas emissions.*

Business NZ: *New Zealand business acknowledges the need for a transition to a low/no emissions world. According to Business NZ: businesses want a deeper, more mature conversation with Government, a more predictable environment that supports business to accelerate change, what New Zealand wants to achieve in relation climate change and how to achieve that aim; the challenge is to find faster solutions to reducing carbon emission from energy use while maintaining sustainable business; there are risks and opportunities associated with climate change; there is more awareness of the 'window' of opportunity and that makes good business sense and is good for the NZ-Inc brand; carbon pricing is just part of the sustainable business story - other relevant factors include changing consumer preferences; reductions in gross emissions will be difficult, but not impossible to achieve; and it will be businesses and their consumers who deliver on emissions reduction targets.*

IEA (World Energy Outlook 2016¹¹⁷): *Transformative change in the energy sector, the source of at least two-thirds of greenhouse gas emissions, is essential to reach the objectives of the [Paris] Agreement; The renewables-led transformation of the power sector has given focus to a new debate over power market design and electricity security, while traditional energy security concerns have not gone away; the 2°C pathway is very tough, but it can be achieved if policies to accelerate further low carbon technologies and energy efficiency are put in place across all sectors. The road to 1.5°C goes through uncharted territory; The collective signal sent by governments in their climate pledges is that fossil fuels, in particular natural gas and oil, will continue to be a bedrock of the global energy system for many decades to come, but the fossil fuel industry cannot afford to ignore the risks that might arise from a sharper transition; Renewables make very large strides in coming decades but their gains remain largely confined to electricity generation. The next frontier for the renewable story is to expand*

¹¹⁷ <https://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html>

their use in the industrial, building and transportation sectors where enormous potential for growth exists; We see clear winners for the next 25 years, natural gas but especially wind and solar; Natural gas continues to expand its role while the shares for coal and oil fall back; There is no single story about the future of global energy: in practice, government policies will determine where we go from here.

5.6 What countries are doing

New Zealand

Has committed to reducing the country's emissions to 30 percent below 2005 levels by 2030. It has signed and ratified the Paris Agreement, and is developing plans to meet the country's commitments.

The New Zealand Government also:

- supports the removal of fossil fuel subsidies and is a member of the 'Friends of Fossil Fuel Subsidy Reform'.
- supports the role of markets in reducing climate change and led the Ministerial Declaration on Carbon Markets.
- is reviewing the Emissions Trading Scheme (ETS) and over the next three years is phasing out the one-for-two subsidy, implemented during the global financial crisis. The Government says this is a step towards helping New Zealand meet its emissions target reduction and to grow a lower-emissions economy.
- has commenced a process to set new national energy targets, and to replace the *New Zealand Energy Efficiency and Conservation Strategy* (NZECS) that will set out policies and practical ways in which the energy targets will be met.
- established a new Energy Efficiency and Conservation Authority fund aimed at promoting uptake of electric and other low-emission vehicles.
- established the New Zealand Aviation Emissions Reduction Action Plan setting out measures to address aviation emissions.
- on 1 December 2015 announced it will ratify the Doha Amendment to the Kyoto Protocol, which creates a second commitment period from 1 January 2013 to 31 December 2020.
- supports and contributes to the United Nations Sustainable Development Goals Partnership 2030, adopted by the UN in September 2015. The 17 sustainable development goals include taking urgent action to combat climate change and its impacts.

Other countries are similarly planning to meet their respective Paris Agreement commitments. For example:

- Australia reduce emissions to 26 to 28 percent on 2005 levels by 2030.
- The United States has committed to reduce greenhouse gas emissions by 26-28 percent below the 2005 level in 2025, and to make 'best efforts' to reduce emissions by 28 percent.
- China will reduce CO₂ emissions intensity by 60 to 65 percent below 2005 levels by 2030.

- The EU has presented a low-carbon roadmap calling for a cut emissions to 80 percent below 1990 levels by 2050, with milestones towards this objective of 40 percent emissions cuts by 2030 and 60 percent by 2040.

5.7 Other environmental considerations

Beyond climate change management challenges arising from the Paris Agreement, the gas industry responds to environmental issues as part of statutory requirements and standard operating practices. These include:

- effective environmental management associated with gas plant developments and infrastructure operations. The Resource Management Act is central to this, requiring consenting of major activities; setting standards for environmental performance; and otherwise seeking to avoid, remedy or mitigate environmental effects.
- operational management codes and practices as part of the day-to-day operation of gas infrastructure, including avoiding/minimising gas escapes.
- legislation, including new Exclusive Economic Zone legislation, to address concerns about the environmental effects of offshore drilling.
- industry consideration of the best environmental options for decommissioning onshore and offshore oil and gas production facilities at the end of their operating lives.

5.8 Regulatory Performance

Gas safety policy objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> • Recommendations for rules, regulations or non-regulatory arrangements take account of environmental sustainability. • The gas sector contributes to achieving the Government's climate change objectives set out in the New Zealand Energy Strategy, or any other document the Minister of Energy and Resources may specify from time to time, by minimising gas losses and promoting demand-side management and energy efficiency. 	<p>Direct implementation of Government energy, environmental and conservation policies is the responsibility of various Government agencies. Environmental sustainability considerations are taken into account in the development of rules, regulations or voluntary arrangements for the gas industry including:</p> <ul style="list-style-type: none"> • relevant Government policies, particularly in relation to impacts of gas as a carbon fuel • gas use efficiency, including efficient space heating under the former Warm Homes programme • resource utilisation efficiency through direct gas use • best practice in environmental management for energy projects and infrastructure operations <p>The industry generally operates to environmental management codes and resource consent conditions, as well as operational and safety practices designed, inter alia, to avoid or minimise gas escapes.</p> <p>Gas utilisation technologies, as well as evolving smart metering, is enabling consumers to manage their consumption of gas.</p> <p>Exploration and mining permit conditions restrict gas flaring.</p>

6 Exploration and Production

After almost a decade of high levels of upstream exploration and development that stimulated demand, especially for petrochemical manufacture, and enhanced New Zealand's gas reserves position, upstream investment over the past two years has softened dramatically due to a slump in international oil prices. An intensive drilling programme two years ago involving plays in major offshore basins were unsuccessful in finding new gas resources, and in the current environment a number of permit holders have sought to defer their work programmes.

In the absence of an improved gas inventory from new discoveries or further development of existing fields, New Zealand faces a tightening gas supply in the medium to long-term. The current reserves/production ratio provides a supply horizon of approximately 10 years, at current production rates.

Interest in New Zealand's unconventional gas resources, that elsewhere are making a substantial impact on global gas reserves, has waned in recent years due to low oil prices and the withdrawal of some companies from these activities.

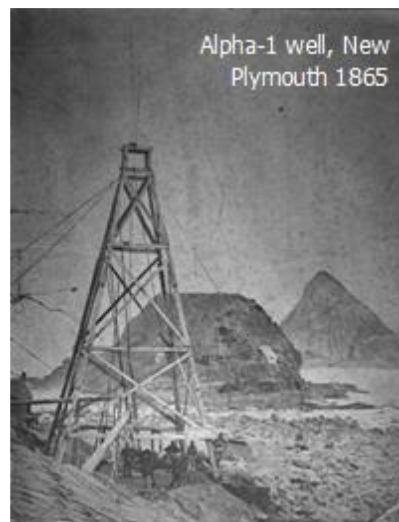
Government policies under the New Zealand Energy Strategy and Petroleum Action Plan are aimed at encouraging the search for, and sustainable development of, New Zealand's petroleum resources.

The commissioning in 2011 of New Zealand's first underground gas storage facility at the Ahuroa field by Contact Energy added a new dimension to supply/demand management and flexibility.

6.1 Background

Naturally occurring oil and gas seeps have testified to the presence of petroleum resources in New Zealand for centuries. Attempts to tap these resources began in 1865, when the Alpha 1 well, the first in the British Commonwealth, was drilled on the New Plymouth foreshore into what came to be called the Moturoa field. The Encyclopaedia of New Zealand¹¹⁸ records:

Seepages (places where oil seeps out of the ground) were the first sites that oil drillers targeted in New Zealand. Known seepages occur on the New Plymouth foreshore, Kotuku on the West Coast, and Waitangi, north of Gisborne. At New Plymouth, bubbles of gas were seen along the coast, and on calm days an oily sheen could be seen on the sea water. In early 1865, gunsmith Edward M. Smith collected samples of oil he found among boulders at Ngamotu Beach, on the New Plymouth foreshore. He sent them to Britain for analysis. Following this, the Taranaki provincial government offered £400 for the discovery of a commercial find of petroleum.



The Alpha-1 well struck shallow oil and gas but, although further wells were drilled, only a few barrels of oil were recovered in the early years. The arrival of the first steel drilling rig in 1904 provided an impetus to the search and greater success was achieved in 1906. By 1913, crude oil was being stored

¹¹⁸ Encyclopaedia of New Zealand: *Oil and Gas – Early petroleum exploration, 1865-1960* www.teara.govt.nz/en/oil-and-gas/4

in New Plymouth and a local refinery was built. However, this could not be sustained due to spasmodic field production. A second refinery built in the late 1920s was more successful. It produced locally-branded Peak Petrol (named after Mt Taranaki) and the local council used Taranaki diesel in its vehicles. The refinery operated until 1975 and the Moturoa field continues to produce small quantities of oil and gas today.

The Petroleum Act of 1937 was designed to encourage the search for oil and gas. Spurred by the need for oil during World War II, considerable exploration was conducted in various regions of the North Island and the West Coast of the South Island. No discoveries were made.

In 1951, government consultants, D'Arcy Exploration, declared New Zealand to be gas prone, with little chance of finding what explorers really wanted – oil. This impression persisted for several decades.

In 1954, the Todd Brothers company, having obtained government leases to explore large areas of the North Island, joined with two overseas oil companies, Shell and BP, for the work. The first large-scale seismic surveys, carried out in Taranaki farmland, revealed a promising underground structure near Kapuni. In 1959, a drilling rig struck gas at 4,000 metres, ushering in the modern era of natural gas supply in New Zealand.

The Maui field discovery in 1969 provided substantial momentum to the industry's development.

6.2 Post Kapuni/Maui Developments

In the past decade there has been a quantum shift from a reliance on Maui, to drawing supplies from a variety of fields. Significant developments have included:

Pohokura Field

The offshore North Taranaki Pohokura field is now the largest contributor to New Zealand's gas supply, in terms of remaining reserves and annual production.

Discovered in 2000, Pohokura commenced gas and condensate production in 2006. An unmanned, onshore production station processes the wellstream from an unmanned offshore platform, and treated gas is fed into the Maui pipeline for delivery into the gas market.

The largest petroleum discovery in New Zealand since Maui in 1969, Pohokura's ultimate recoverable gas reserves are estimated at 1,524PJ¹¹⁹ and the field currently accounts for 37 percent of New Zealand's annual gross gas production. In 2011 an additional compressor was installed at the production station to reinject gas and enhance liquids extraction.

Also in 2011, Pohokura joint venturer, Todd Energy, commissioned an LPG gas extraction plant at its McKee field in eastern Taranaki, to take gas from the Pohokura and Mangahewa fields for LPG removal.

Kupe Field

Production from the Kupe oil and gas field, located off the South Taranaki coast, commenced in December 2009, 22 years after its discovery in 1987. Field complexity, choosing the optimum development option, and market conditions all contributed to the development time lag. Kupe

¹¹⁹ 2016 *Energy in New Zealand*

infrastructure comprises an unmanned offshore platform, a 30km pipeline to shore, an onshore production station near Hawera, and oil storage facilities at New Plymouth.

The decision to proceed with the Kupe development was made in June 2006, and was based on a budget of \$980 million. The project scope was subsequently expanded and the final development cost was approximately \$1.3 billion¹²⁰. At the time of the investment decision, 2P gas reserves were estimated at 254PJ. A detailed reserves review in 2010 re-evaluated these to 273PJ and the field's ultimate recoverable 2P reserves are currently assessed at 391PJ. Kupe contributes 14 percent of annual gross gas production.

Development of Existing Fields

Further development of the Maui, Kapuni and Mangahewa fields is also adding to New Zealand's gas reserves position.

The life of the Maui field has been extended using new technologies and drilling techniques to tap areas where new modelling indicated the presence of natural gas pockets that had been bypassed in conventional extraction processes. The gas pockets are relatively small and difficult and costly to drill. Accessing the pockets began in 2011 by re-entering existing wells and horizontally drilling 'slim hole sidetracks' using precise geosteering techniques. The programme involved the drilling of 14 sidetrack wells, seven each from the Maui and Maui B platforms.

During 2015, the Maui operator, Shell Todd Oil Services, (STOS) was granted a 35-year marine consent from the EPA to continue to operate the Maui facilities off the Taranaki coast¹²¹. It was the first hearing under the EEZ legislation for re-consenting of an existing field. Initial consents for the Maui field were granted in 1973 and expired in June 2015.

A programme to extend the life of the Kapuni field by tapping 'tight' gas began in 2012. It involved the workover of an existing well, and the drilling of two new wells.

Following its gas supply agreement with Methanex, Todd Energy spent \$120 million doubling the size of its McKee/Mangahewa production station to process the gas from the Mangahewa field development. The Mangahewa expansion Train 2 was commissioned in 2014 and was part of an \$850 million five-year expansion that involved construction of a high pressure gas processing plant, the drilling and hook-up of 27 wells and construction of 9km of pipeline.

Turangi, Kowhai Discoveries

Since its formation in 2000 and its acquisition of the Kaimiro/Ngatoro field assets from Shell in 2002¹²², Greymouth Petroleum has emerged as a significant explorer/producer. Through further acquisitions and its own exploration efforts Greymouth has interests in 19.5 percent of remaining 2P gas reserves and accounts for 8.5 percent of annual gas sales.

Greymouth's exploration programme includes using new techniques and research to revisit existing, but undeveloped, gas discoveries previously considered too difficult to exploit¹²³. In 2011, Greymouth

¹²⁰ Kupe joint venture partner, NZ Oil & Gas www.nzog.com

¹²¹ Media Release – Environmental Protection Agency: *EPA grants marine consent for Shell Todd Oil Services for its Maui offshore facilities*, 5 June 2015.

¹²² Divestment by Shell of some oil and gas assets acquired from Fletcher Challenge – Commerce Commission decision 411, 17 November 2000

¹²³ Rob Brady, exploration general manager, ENEX oil and gas conference, New Plymouth 2011.

flowed gas and condensate from the Onaero-1 well, originally drilled more than 30 years previously by Petrocorp.

Turangi was declared a discovery in 2006 and a production facility, completed in 2007, is connected to the Maui pipeline.

In 2007, Greymouth acquired a majority shareholding in Bridge Petroleum Limited, which held interests in the Radnor mining permit and an adjacent exploration permit. The same year, it also acquired the Surrey and Windsor leases from Energy Corporation of America, operating in New Zealand as Westech Energy. In 2008, Greymouth acquired Swift Energy's 80 percent working interest in the Kowhai gas/condensate discovery located adjacent to Greymouth's Turangi mining permit, having earlier acquired Petrochem Limited, holder of the other 20 percent working interest.

Kowhai field production facilities, including an interconnection with the Maui pipeline, were completed in 2009. Ultimate recoverable gas reserves in the Turangi and Kowhai fields have been upgraded and are recorded at approximately 381PJ and 102PJ respectively¹²⁴, with Turangi now incorporating the Onaero wells which were recorded in 2014 as holding 36PJ of gas reserves¹²⁵.

Sidewinder Discovery and Cheal Development

In 2011, Canadian-based production and exploration company, TAG Oil, confirmed three Sidewinder wells as light oil and gas discoveries¹²⁶. Commercial production from the Sidewinder field began in September 2011 following the commissioning of production facilities and an interconnection with the Vector Frankley Road-Kapuni pipeline. TAG entered an agreement to sell 3.5PJ a year of Sidewinder gas to Vector until December 2014.

TAG is also improving oil and gas production through further development of the Cheal field, in central Taranaki, following its acquisition in 2009 of Austral Pacific's 69.5 percent stake for \$2 million. In April 2013, TAG commissioned a production station on the Cheal field, and gas is being flowed into the Vector transmission system.

Copper Moki Discovery

Canada-based New Zealand Energy Corporation (NZEC) was formed in 2010 and acquired interests in two South Taranaki permits. It has declared its Copper Moki wells to be commercial producers, and wells in the adjoining Waitapu field to be discoveries.

In 2012, NZEC reached agreement to buy the Waihapa production station and related assets, including four Petroleum Mining Licences, and gathering and export pipelines, from Origin Energy. NZEC formed a 50:50 joint venture with L&M Oil for the Tariki, Waihapa and Ngaere (TWN) licences and the acquisition of the Waihapa assets was completed in October 2013. A natural gas pipeline connecting the Copper Moki site with the Waihapa production station has been completed.

As a result of a private share placement in March 2015, industry investor Geoservices Limited acquired a 19.82 percent interest in NZEC. This could increase to over 20 percent if Geoservices exercises share purchase warrants issued by NZEC.

¹²⁴ 2016 Energy in New Zealand

¹²⁵ 2015 Energy in New Zealand

¹²⁶ TAG media release 5 April 2011.

Gas Storage

The first large-scale gas storage facility in New Zealand was commissioned in 2011. Developed by Contact Energy and using the depleted Ahuroa reservoir near Stratford, the facility supports Contact's nearby 200MW gas-fired electricity peaking plant, also completed in 2011 in a combined \$400 million investment, and the adjacent TCC plant. The underground gas storage facility provides Contact with flexibility in managing its gas portfolio, allowing it to take and store natural gas during off peak times, and using it when most needed. It is linked to Contact's Stratford power stations by a 9km pipeline commissioned in early 2013.

Contact acquired the rights to the Ahuroa field from Swift Energy in 2008. The underground storage facility has involved the installation of a large injection compressor and the drilling of three injection/extraction wells. It can hold up to 17PJ of gas.

6.3 Government Policy Initiatives to Encourage Gas Exploration

Since 2005, the Government has introduced a range of policy initiatives to encourage petroleum (including gas) exploration in New Zealand.

A package of measures effective from 1 January 2005 and applying to discoveries made between 30 June 2004 and 31 December 2009, included:

- reduced royalties.
- prospecting and exploration cost deductibility for calculating the Accounting Profit Royalty on a mining permit granted during the period.
- Government backing for a \$15 million seismic data acquisition project, involving approximately 3,000km of two-dimension (2-D) data over the central and northern parts of the East Coast Basin, and 3,160km of 2-D data over northern parts of the Great South Basin. A further 8,000km of existing 2-D data was reprocessed by the Institute of Geological and Nuclear Sciences (GNS Science). The data acquired, or reprocessed, was released to the industry free of charge.
- exemption from New Zealand tax levy income for non-resident offshore rig operators and seismic vessels carrying out exploration work in New Zealand.

The tax exemption was extended from 31 December 2009 to 31 December 2014. All of the other 2005 initiatives lapsed upon expiry.

Petroleum Action Plan

The Government's Petroleum Action Plan, introduced in November 2009, aims to help achieve its overarching strategic objective of ensuring the New Zealand is an attractive global destination for petroleum exploration and production investment so that the country is able to develop the full potential of its petroleum resources. Its core components are:

- a sustained communications strategy to raise the profile of the petroleum sector and signalling Government support for exploration and development activity.
- developing a co-ordinated investment strategy to improve knowledge of New Zealand's petroleum resources.
- a review of its own capability and resources to manage, and maximise the returns from, New Zealand's petroleum estate.

- improving the quality of information provided to the Government by industry participants of the Crown's petroleum resources, particularly to address oil and gas reserves data.
- reviewing the regulatory, royalty and taxation arrangements for petroleum.
- reviewing and, where necessary, amending the legislative framework of the petroleum sector, including existing permitting regimes.
- undertaking further work to develop a pathway for realising the potential of New Zealand's gas hydrates resources.
- a review of health, safety and environmental legislation for offshore petroleum operations.

Government-funded seismic data acquisition and reinterpretation

New Zealand Petroleum & Minerals (part of MBIE) maintains a collection of exploration reports on the results of all exploration carried out in New Zealand since the 1880s and provides information on New Zealand's prospects. The reports are available to interested parties via a free online database.

In May 2010, the Government initiated a two-year programme to further promote oil and gas exploration around New Zealand. NZPAM contracted with GNS Science to deliver a jointly-funded \$7.8 million Petroleum Exploration and Geosciences Initiative (PEGI). The PEGI, completed in April 2012, supplemented the Crown's seismic data acquisition programme and was aimed at improving knowledge of, and access to, information about New Zealand's oil and gas reserves. It involved 14 inter-related projects, comprising a range of evaluations and knowledge upgrades on the Taranaki and other key basins. Included also were eight existing GNS Science data products¹²⁷. Google Earth was used to display information about New Zealand's offshore geological, geophysical and geographical datasets to provide ready, freely available information.

In 2013 NZPAM released its first GIS-based compilation and interpretation of geological data, also targeted at improved understanding of the structure and distribution of New Zealand's sedimentary basins¹²⁸.

And in September 2014, the Government announced an \$8 million investment over four years in projects to provide better geological information for oil and gas exploration investors. Projects include aeromagnetic surveys, frontier and petroleum basin data using NIWA's research vessel, RV Tangaroa, and a national audit of well outcomes¹²⁹.

Allocation of exploration rights

In August 2011, the Government announced an overhaul of the way petroleum exploration permits are offered to oil and gas companies¹³⁰. Through exclusive use of the competitive Block Offer method – as used in other countries including Australia, Vietnam, India and Indonesia - it takes a more proactive and strategic management approach to the allocation of petroleum exploration rights, compared with the primarily reactive first-in, first-served 'priority in time' method it replaced from 2012.

¹²⁷ The projects and data products are described at <http://www.gns.cri.nz/Home/Our-Science/Energy-Resources/Oil-and-Gas/Products/PEGI>

¹²⁸ The New Zealand Extended Continental Shelf SEEBASE project™. NZPAM media release: *New GIS-based product informs understanding of New Zealand's sedimentary basins*, 22 May 2013.

¹²⁹ Media Release – Hon Simon Bridges, Minister of Energy and Resources: *Govt continuing to support data acquisition*, 4 December 2014

¹³⁰ Block offer and related information is available at <http://www.nzpam.govt.nz/cms/petroleum/block-offers>

The revised approach involves the offer by tender of a set number of specific exploration permits with applicants for each block selected on the strengths of their technical and financial capability, as well as their proposed work programme. It is also designed to add transparency to the process of granting permits by giving other stakeholders, including communities and iwi, the chance to comment on where and when acreage will be offered. Since its introduction in 2012, 44 exploration permits have been issued under the Block Offer regime.

Compared with the 'priority in time' system, which required any application to be processed by NZPAM, the new method gives the Government more control over where, when and to whom exploration rights are granted.

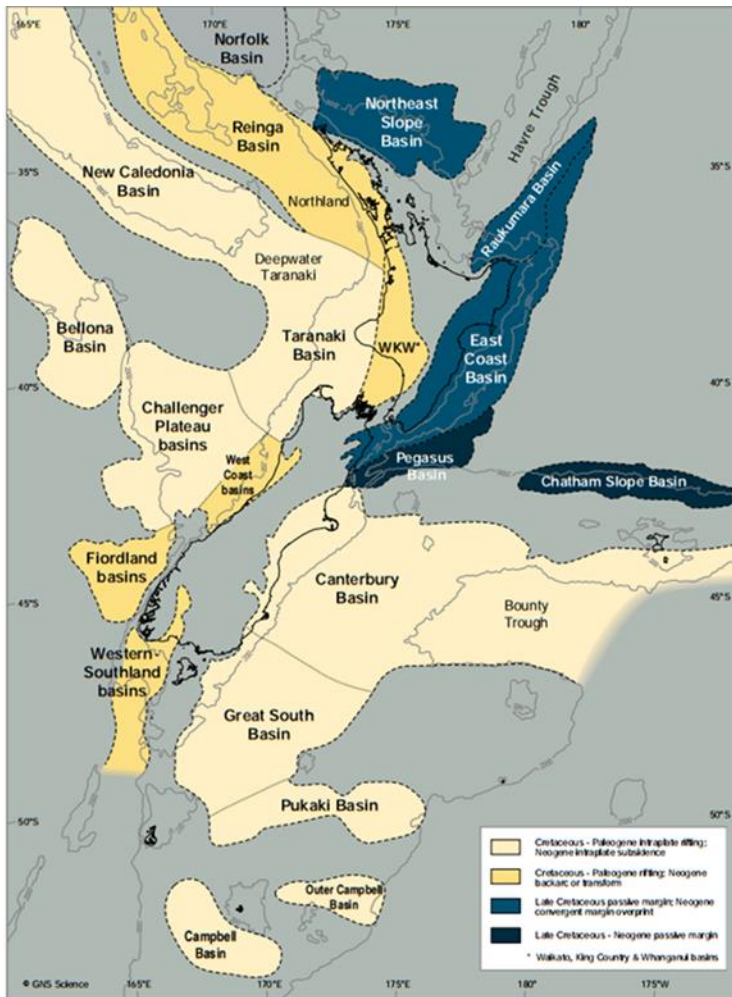
6.4 Current State of Exploration and Production

New Zealand relies on indigenous production for its natural gas needs. Buying natural gas from the international market is currently not an option. Although equipped to import LPG, New Zealand has no LNG importation capability and, as an isolated island nation, cannot tap into other countries' natural gas resources through cross-border pipelines.

Indigenous gas production has so far proved sufficient for the New Zealand market, albeit with Methanex taking a swing purchaser role.

The 18 sedimentary basins (Figure 13) in New Zealand's extensive EEZ, including the currently sole producing basin, Taranaki, are considered under-explored. Some have seen no exploration at all. Those that have exhibit a variety of geological formations, from porous sandstones to cracked limestone, and a range of hydrocarbon-bearing zones – some as shallow as 200 metres; others more than 5,000 metres deep.

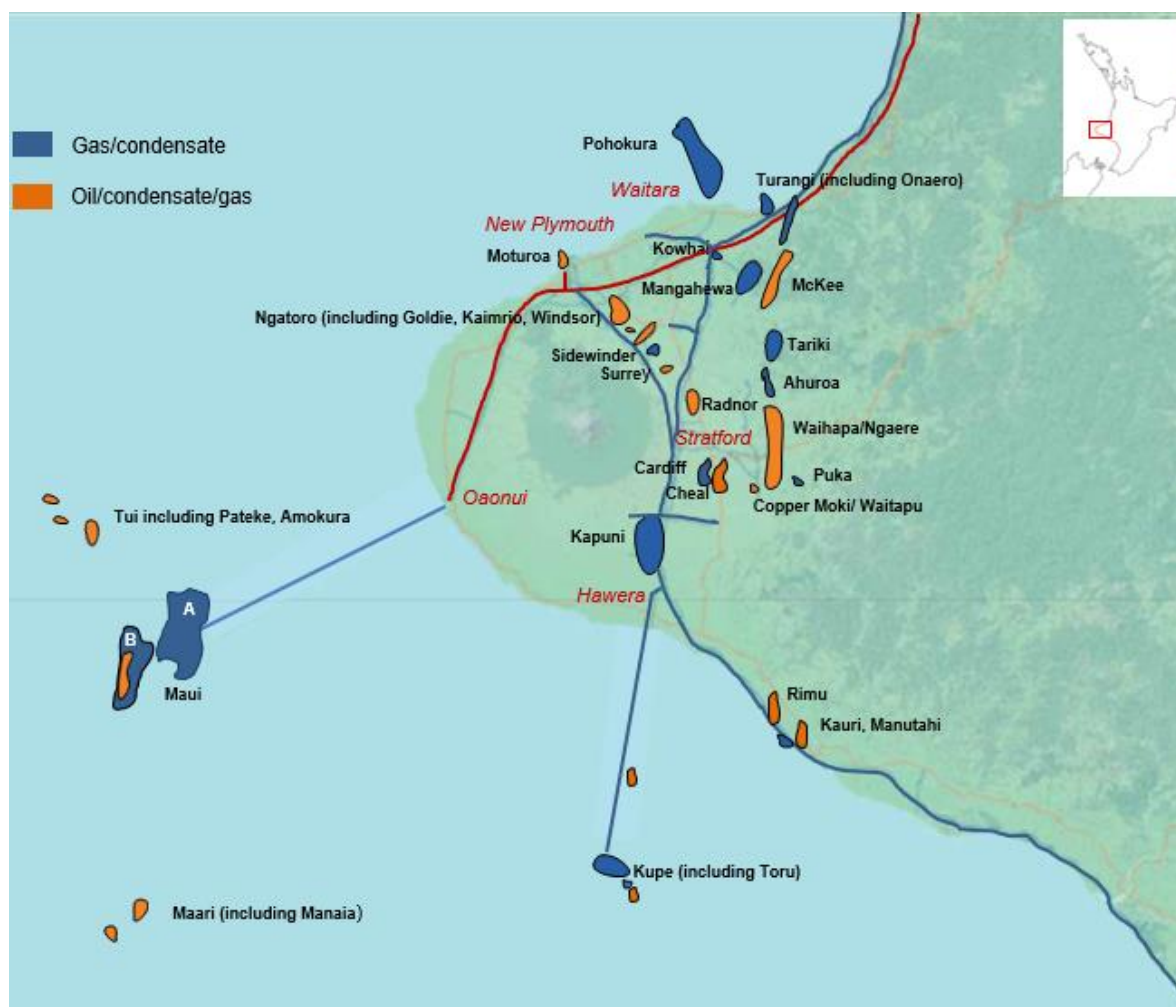
Figure 13: New Zealand's Sedimentary Basins



Source: NZ Petroleum & Minerals

The Taranaki region (Figure 14), with its production history and proven prospectivity remains the central focus for providing the country's gas reserves, through new exploration and reserves enhancement on existing fields. Gas is currently produced from 15 fields. Two offshore fields, Tui and Maari, are not connected to the domestic gas market and the gas they produce – approximately 1PJ and 2.7PJ a year respectively – is either flared or used for operational purposes.

Figure 14: Producing Oil and Gas Fields, Taranaki



Gas produced at the offshore Tui and Maari fields is flared or used for operational purposes. The fields are defined by their predominant product – oil or gas. Those shown as oil fields also produce gas, which is separated and processed for market consumption; those shown as gas also produce condensate.

Other sedimentary basins have produced hydrocarbons and, although yet to yield them in commercial quantities, continue to attract attention from explorers. In recent years, drilling has occurred onshore East Coast, Waikato, West Coast and Southland, and interest remains strong in the challenging offshore Great South Basin, the Canterbury Basin, deepwater Taranaki Basin and Pegasus Basin.

Although geographically remote, New Zealand is among the world's more desirable exploration destinations. The 2015 Global Petroleum Survey¹³¹, conducted by the Fraser Institute of Canada, ranked New Zealand as the 14th most attractive jurisdiction for petroleum investment among 126 jurisdictions worldwide (2014: 17th among 156 jurisdictions), and the second most attractive in the Oceania region¹³², behind South Australia (in 2014, New Zealand topped the Oceania region perception rankings).

¹³¹ <https://www.fraserinstitute.org/sites/default/files/global-petroleum-survey-2015-rev.pdf>

¹³² Jurisdictions are broken down by states in larger countries – for example, the top 20 jurisdictions worldwide include 11 US States and two Canadian provinces. Oceania consists of 15 jurisdictions, including New Zealand, seven Australian States, and Australian Offshore, Timor Gap Joint Petroleum Development Area, Brunei, Malaysia, the Philippines, PNG, and Indonesia.

The annual survey focuses on barriers to oil and gas investment, and is referenced by petroleum companies when deciding on investment locations.

The survey findings are echoed by NZEC, which sees the following advantages in New Zealand¹³³:

- proactive Government approach to exploration and development.
- favourable royalty and tax structure.
- Brent pricing¹³⁴ environment with top-tier netbacks.
- proven hydrocarbon systems with multi-zone potential.
- established infrastructure with capacity.
- significant in-country demand for both oil and gas.

In addition to the continuing presence of major explorer/producers such as Shell, Todd, OMV and Origin Energy, large international newcomers to the New Zealand petroleum exploration scene recently have included the US-based Anadarko Petroleum and Chevron Corporation, India's Oil & Natural Gas Corporation, and Norway's Statoil. Other large international players, Apache Corporation and Brazil's Petrobras, conducted initial work in New Zealand in 2012/13 but have since departed New Zealand.

Detailed planning in anticipation of a future major discovery has not been carried out because of the extreme variability of scenarios – in particular the location and size of such a find. These factors are important even with a find in Taranaki. The flaring, or limited operational use of gas produced at the offshore Tui and Maari discoveries fields demonstrates that field economics apply if the discovery is too small or remote to deliver the gas to market profitably.

From the perspective of regulatory arrangements, the framework is in place and no obvious issues are seen. Given the long lead times from discovery to development and delivery, there is sufficient time to fully assess regulatory and related requirements against the characteristics and needs of the discovery.

New Zealand's work on assessing and developing potential unconventional gas resources - including coal seam gas, shale gas and coal gasification - is in its infancy when compared with countries, notably Australia and the United States, where these sources are making a substantial contribution to gas supplies (see **Section 6.9, Unconventional Gas, Page 70**).

New Zealand is also looking into the possibility of tapping reportedly abundant methane hydrates on the ocean floor within its economic zone. Internationally, the economics of extracting hydrate resources are not yet known and the technology for doing so is commercially unproven, notwithstanding success by Japan in extracting natural gas from frozen methane (See **Section 6.12, Gas Hydrates, Page 77**).

6.5 Exploration Activity

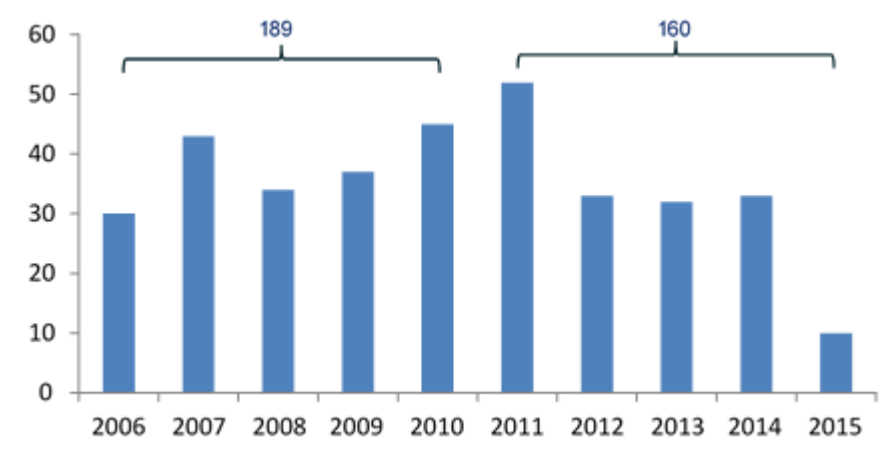
Exploration and field development activity has softened as New Zealand has not escaped the effects on upstream investment of the dramatic fall in global oil prices. The softening has occurred as this country emerged from a highly intensive period of drilling. Just 10 wells were drilled in New Zealand in 2015. Of these, five were development wells on existing discoveries, two were appraisal wells, and three were exploratory. The 33 wells (including 22 exploratory) drilled in 2014 were at a similar level to 2013 (32)

¹³³ NZEC Corporate Presentation 2012

¹³⁴ Brent Crude. A major oil trading classification and international oil pricing benchmark.

and 2012 (33), but considerably down on the 52 in 2011, itself the highest level of drilling in a decade, and 45 in 2010. Comparisons, taken over five years, show the 160 wells drilled in 2011-2015 reflect a slowing from the 189 wells drilled in the previous (2006-2010) five-year period (Figure 15).

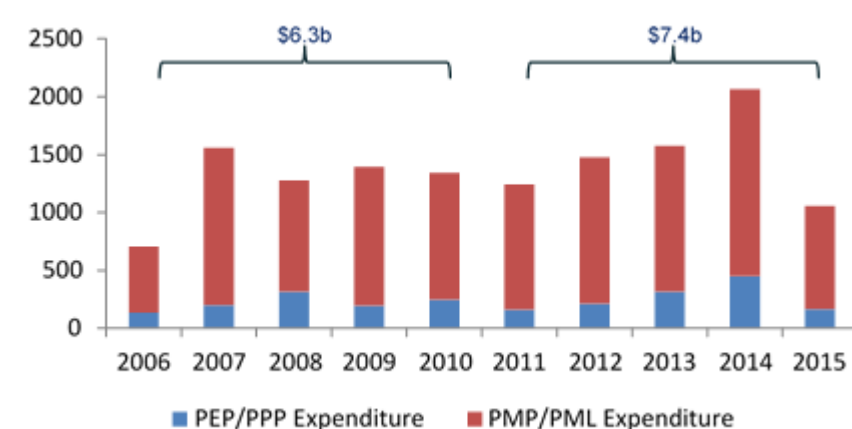
Figure 15: Wells drilled 2006-2015



Source: 2016 Energy in New Zealand

Until 2015, annual investment in exploration and prospecting activity had been relatively consistent, while mining permit development investment soared (Figure 16). Exploration investment declined from \$449 million in 2014 to \$166 million in 2015, and development expenditure dropped from \$1,616 million to \$888 million. The total spend of \$1,055 million for 2015 was 49 percent below the \$2,065 million in 2014, in turn the highest expenditure in 10 years. However, total expenditure over the five years from 2011-2015 of \$7.4 billion continued to track higher than the \$6.3 billion spent in the preceding five-year period. Of the \$7.4 billion in 2011-2015, \$6.1 billion – 82 percent – was applied to mining licence development.

Figure 16: Exploration and Development Expenditure 2006-2015 (\$ million)



Source: 2015 Energy in New Zealand

PEP = Petroleum Exploration Permits

PPP = Petroleum Prospecting Permits

PMP = Petroleum Mining Permits (production permits)

PML = Petroleum Mining Licences (production permits)

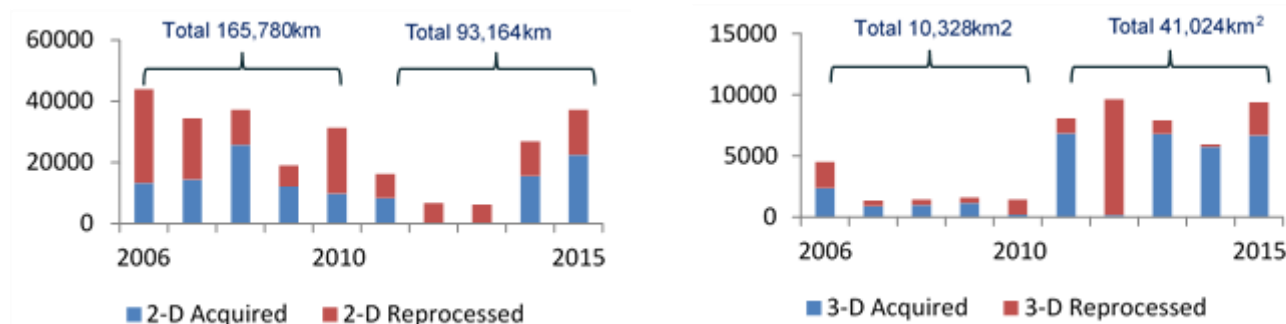
A decline of over 50 percent in international oil prices – from around US\$110 to US\$30 a barrel since mid 2014 – has seen a number of explorers, especially smaller companies, scale back their exploration and development plans, including the relinquishment or revocation of permits. NZOG, TAG, Kea Petroleum¹³⁵, NZEC, Comet Ridge, AWE and Canadian Offshore Petroleum are among the upstream players to have implemented or signalled curtailments, deferrals or reviews. In October 2016, oil prices had shown some signs of recovery towards US\$50 in the wake of an agreed cut in OPEC output.

In addition to the effects of the oil price downturn, other anticipated drilling by oil majors has been deferred for other reasons. In June 2015 Anadarko was granted a six-month extension for its Pegasus Basin permits and in December 2015 sought a 12-month extension for its 3D seismic commitment to address risks associated with the Basin's complex geology. For similar reasons, Shell has postponed seismic and drilling activity in the Great South Basin, citing the need for further geological interpretation.

Seismic data acquisition and reprocessing to identify potential hydrocarbon-bearing formations – an important precursor to drilling activity – has been helped in recent years by the Government-backed seismic acquisition projects described in **Section 6.3, Page 55**. In the period 2011-2015 new and reprocessed 2-D and 3-D seismic data covered 134,1886km, which was down on the 176,108km in the preceding five-year period when there was a particularly high level of 2-D seismic reprocessing (Figure 17).

Although exploration and development activity in 2015 was down on previous years, upstream companies applied greater attention to seismic data, acquiring or reprocessing a total of 37,238km of 2D data (2014: 26,823km) and 9,405km² of 3D data (2014: 5,955km²).

Figure 17: Seismic Data Acquisition 2006-2015



Source: 2016 Energy in New Zealand

6.6 Gas Production

Annual gas production fluctuates year-on-year, reflecting particularly thermal electricity generation requirements and the level of petrochemical production.

Figure 18 tracks gas production by field since 1971, the first year of Kapuni gas supply. Production accelerated with the commencement of Maui gas supply in 1979 and grew exponentially as transmission system expansion grew the market. The total annual production peak of 242PJ in 2001,

¹³⁵ Kea Petroleum is in liquidation following a voluntary winding-up. Market announcement – Kea Petroleum Plc: *Meetings of Members and Creditors in a Winding Up*, 19 November 2015; *New Zealand Gazette* notice of appointment of liquidators, 21 January 2016

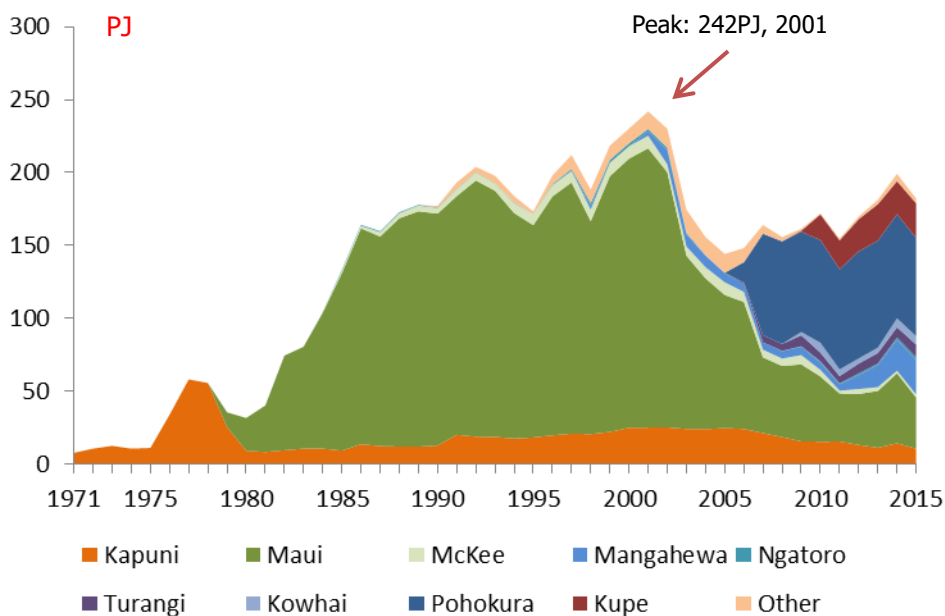
which coincided with the Maui production peak of 191PJ, was followed by a sharp fall-off. Since 2001, net gas production from Maui steadily declined to 33PJ in 2011, but has since improved due to production enhancement work on the field. In 2015, Maui gross gas production was 38PJ (2014: 51PJ) and after 36 years of production, Maui is still the second highest producer, with a contribution of 17.5 percent of total production (Figure 19).

The sharp drop in annual gas production in the decade to 2011 is mirrored in the substantial decline in petrochemical feedstock and associated process gas uptake evident in Figure 11 (Page 18). After reaching a peak of 62PJ in 2000, petrochemical feedstock demand dropped to 13PJ in 2005 (at least half of it for urea production) before the commissioning of new fields enabled a resumption of methanol production and a recovery of petrochemical volumes to around 25PJ/year from 2009. The trends illustrate the production 'absorber' role played by the methanol plants. With petrochemical feedstock gas amounting to 50PJ in 2015, together with the plants' higher process gas use (34PJ in 2015), the previous declining trend has been substantially reversed. The return to three-train methanol production capability in late 2013 lifted total market demand in 2014 to over 200PJ a year for the first time in more than a decade.

Total annual net production since the first full year of Pohokura gas production in 2007 has fluctuated in a range of 155PJ (2011) to 198PJ in 2014. Year-on-year changes primarily reflect thermal electricity generation and petrochemical requirements.

Gross natural gas production of 216PJ was down 7.3 percent from 233PJ in 2014. There was less gas reinjection in 2015 (13.1PJ compared with 17.7PJ in 2014, mainly at Pohokura).

Figure 18: Net Natural Gas Production by Field 1971-2014



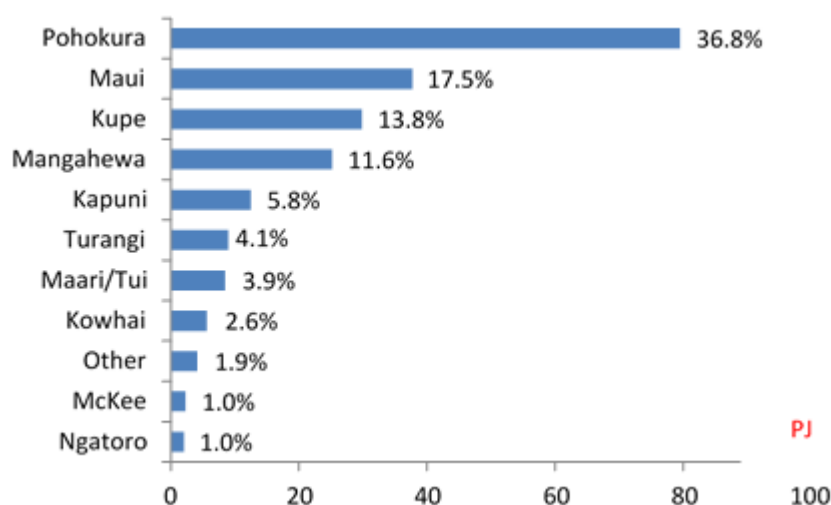
Source: 2016 Energy in New Zealand.

Ngatoro includes gas from the Goldie and Kaimiro wells. Gas from the Ngatoro field was flared from 1992-1998.

Other includes Tariki/Ahuroa, Waihapa/Ngaere, Rimu, Cheal, Copper Moki, Sidewinder, and Surrey wells.

Excludes Tui and Maari fields, where gas is flared or used for operational purposes.

Figure 19: Gross Natural Gas Production by Field 2015 (216 PJ)



Source: 2016 Energy in New Zealand

Includes gas reinjected (13.1PJ), LPG extracted (8.1PJ), gas flared (7.0PJ) and production losses/own use (5.7PJ). Net Production, excluding these factors=182.4PJ

Gas produced from the Maari and Tui fields is flared or used for operational purposes.

Ngatoro includes production from the Goldie field. Gas from the Moturoa wells is used for operational purposes.

Other includes Cheal, Copper Moki, Rimu, Sidewinder, and Waihapa wells.

6.7 Gas Reserves

Figure 20 sets out the current remaining gas reserves by field, while Figure 21 illustrates the remaining gas reserves, and supply longevity position, since 2005. Remaining gas reserves (2P) in producing fields have been comparatively stable in the period 2007-2016, fluctuating in a range of 1,952PJ (2007) and 2,642PJ (2014) and providing a consistent reserves/gross production ratio of between 10 and 13 years.

As at 1 January 2016, remaining 2P gas reserves amounted to 2,116PJ, comprising 2,062PJ of natural gas and 54PJ of LPG. These are 212PJ – or 9.1 percent – below the 2,328PJ of 2P remaining reserves recorded as at 1 January 2015.

With the absence of new exploration success in recent years, the forward supply horizon in 2015 was about 10 years (at 2015 production rates), compared with 13 years in 2014 when reserves increased following enhancement work at Pohokura, Maui and Mangahewa.

The current position reflects a number of significant movements in Ultimate Recoverable Reserves reported by producers, particularly positive assessments for Pohokura, Mangahewa, the Greymouth fields of Turangi, Kowhai and Ngatoro, and the inclusion for the first time of the Radnor field. These increases are partially offset by reductions in Ultimate Recoverable Reserves for Maui and Cheal. The reserves change for Turangi reflects the inclusion of Onaero, reported separately last year with Ultimate Recoverable Reserves of 38PJ. Onaero is not separately listed in the latest issue of MBIE's *Energy in New Zealand*, but the publication's oil and gas fields map includes for the first time a reference to 'Turangi (including Onaero)'.

No new gas discoveries were declared during 2015 and in the past year. However, In market announcements during 2015 two Kupe joint venturers, NZOG and Genesis Energy – upgraded their assessments of developed gas and condensate reserves in the Kupe field by over 33 percent¹³⁶. In April 2016 NZOG announced a further 15 percent increase in developed gas and condensate reserves at Kupe as a result of detailed reservoir simulation uncertainty modelling by the joint venture. It included an extra 3.6PJ of gas. Remaining 2P reserves reported for Kupe as at 1 January 2016 were 242PJ, compared with 273PJ as at a January 2015.

Table 1 sets out the significant changes in 2P Ultimate Recoverable Reserves reported as at 1 January 2015 and 2016.

Table 1: Ultimate Recoverable 2P Gas Reserves Movements (PJ)

	2015	2016	PJ Change	% Change
Increases				
Turangi	264	381	+117	+44.3
Mangahewa	397	457	+60	+15.1
Kowhai	83	102	+19	+23.2
Pohokura	1,509	1,524	+15	+1.0
Ngatoro	45	52	+7	+9.5
	2,298	2,516	+218	+9.5
Decreases				
Maui	4,466	4,309	-157	-3.5
Cheal	8	6	-2	-25.0
	4,474	4,315	159	-3.6
Additions				
Radnor	--	11	+11	--

Source: *Energy in New Zealand*

Table 2 sets out significant changes in Remaining 2P Reserves reported as at 1 January 2014 and 2015.

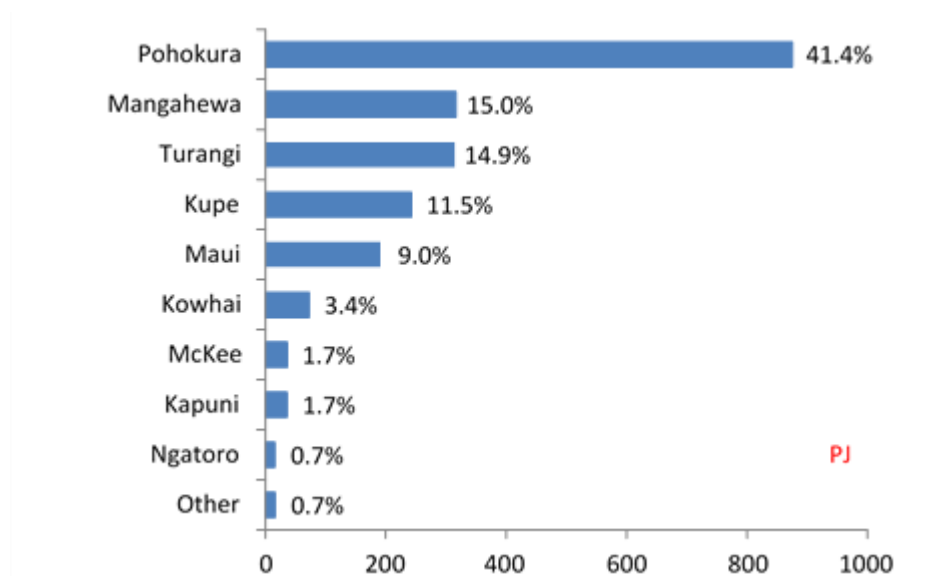
¹³⁶ Media Release – NZOG: *34.7% increase in Kupe Developed Reserves*, 28 October 2015; Market Announcement – Genesis Energy: *Genesis Energy increase in Kupe Developed Reserves*, 9 December 2015

Table 2: Remaining 2P Gas Reserves Movements (PJ)

	2015	2016	PJ Change	% Change
Increases				
Turangi	213.0	314.6	+101.6	+44.7
Mangahewa	281.1	316.7	+35.6	+12.7
Kowhai	59.3	72.6	+13.4	+22.4
Ngatoro	10.1	15.7	+5.6	+55.4
Decreases				
Maui	430.3	190.7	-239.6	-55.7
Pohokura	929.6	875.0	-54.6	-5.9
Kupe	273.4	242.4	-31.0	-11.3
Kapuni	47.6	36.0	-11.6	-24.4
McKee	41.9	36.4	-5.5	-13.1
Additions				
Radnor	--	11	+11	--

Source: Energy in New Zealand

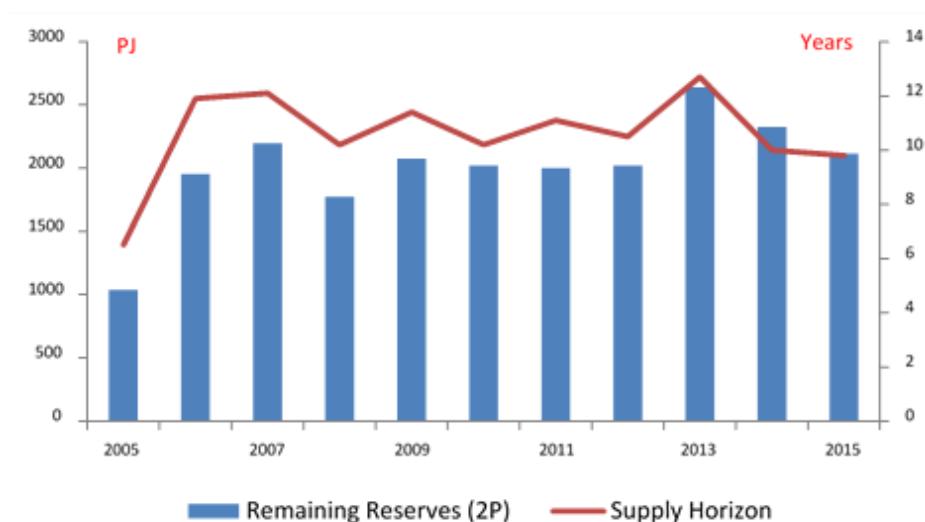
Figure 20: Remaining 2P Reserves by Field (2,116PJ as at 1 January 2016)



Source: 2016 Energy in New Zealand

- Includes LPG reserves. Total reserves comprise natural gas 2,062PJ and LPG 54PJ
- Other includes Radnor, Cheal, Waihapa/Ngaere, Copper Moki
- Tariki, Ahuroa, Kauri, Sidewinder, Rimu, Surrey and Moturoa reserves recorded as '0'

Figure 21: Remaining Reserves/Supply Horizon 2005-2015



Source: 2016 Energy in New Zealand

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

In addition to reported resources, contingent natural gas reserves¹³⁷ amount to 1,733PJ (2014: 2,114PJ), comprising Kapuni (901PJ), Maui (204PJ), Pohokura (250PJ), Mangahewa (173PJ), Turangi (110PJ), Kowhai (53PJ), Ngatoro (25PJ), Kauri (17PJ) and McKee (1PJ). Maui is reported also to have 155,000 tonnes of contingent LPG reserves. .

In 2014 the Kapuni Mining Companies (KMCs) initiated a process under the Kapuni Gas Contract with Vector to redetermine the Original Recoverable Gas Reserves (ORGR). The current ORGR of 1,010PJ was set by an agreed redetermination in 1999. Vector has rights to half of the remaining reserves, with the Kapuni Mining Companies, Shell and Todd, entitled to the other half. The KMCs have proposed a revised ORGR of 1,038, which is higher than the redetermined 1999 level, but lower than MBIE's published P50 ORGR of 1,078PJ as at 1 January 2014. Vector has rights to take 50 percent of remaining Kapuni gas as at 1 April 1997, and exhausted its share of the current ORGR in July 2013. It has been continuing to take Kapuni gas on the basis of a 2011 agreement with the KMCs that expects sufficient reserves are available to supply Vector a further 36PJ over five years¹³⁸. Aspects of an arbitration award in Vector's favour regarding applicable price and quantity are being challenged by Shell and Todd¹³⁹.

The quality of reserves reporting has improved following accuracy concerns that prompted MBIE to issue an options paper¹⁴⁰ in 2010. The paper commented on a perceived lack of confidence in the accuracy, precision and consistency of reserves information and, based on a review of reporting rules in Australia, the United States, the United Kingdom and Norway, proposed a number of options to reform the petroleum reporting and disclosure regime. Reporting improvement measures were introduced with changes to the Crown Minerals Act in 2013.

¹³⁷ Estimated quantities that are potentially recoverable from known accumulations but for which the applied project(s) are not yet considered mature enough for commercial development due to one or more contingencies.

¹³⁸ Vector market releases: *Kapuni Field Gas Redetermination*, 8 December 2014 and *Kapuni Field Gas Redetermination Update*, 24 December 2014

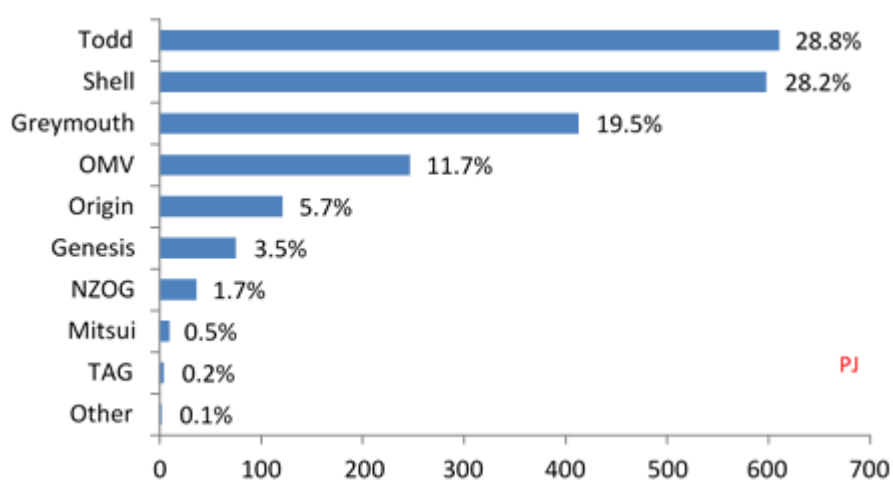
¹³⁹ Vector market announcements: *Kapuni Gas Arbitration Award*, 7 September 2015; *Kapuni Gas Arbitration Award*, 7 December 2015.

¹⁴⁰ *New Zealand Petroleum Reserves*, August 2010

6.8 Reserves Ownership

The transition to multi-field gas supplies has resulted in some dilution of a historical concentration of reserves ownership in a small number of large producers. While original Maui and Kapuni producers Shell and Todd, and their Maui and Pohokura partner OMV remain core investors in New Zealand's gas sector, more recent explorer/producers – among them Origin Energy and Greymouth Petroleum - have established a firm position through the discovery and development of new resources. Adjustments to reserves assessments noted above, in particular the reduction in remaining Maui gas reserves and increases for Greymouth-owned fields, have brought reserves ownership ranking changes, with Todd now holding the greatest interest in remaining reserves for the first time and Greymouth increasing its interests from 13.5 percent to 19.5 percent. Figure 22 sets out the ownership of remaining gas reserves as at 1 January 2016. A more detailed ownership breakdown is presented in Table 3.

Figure 22: Producers' Share of Remaining 2P Gas Reserves (as at 1 January 2016)



Source: Compiled from 2016 Energy in New Zealand.

Excludes Maari/Tui where gas is flared or used for operational purposes.

Note: On 16 November 2016 Genesis Energy acquired NZOG's 15 percent interest in the Kupe field, subject to approval by NZOG's shareholders – Genesis Energy announcement 16 November 2016.

Table 3: 2P Remaining Gas Reserves Ownership (as at 1 January 2016)

Company	Field	% Interest	Remaining 2P Reserves (PJ) - as at 1 January 2016	Reserves Ownership (PJ)	Ownership of total Reserves (%)
Todd	McKee	100	36.4	36.4	
	Maui	6.25	190.7	11.9	
	Kapuni	50	36.0	18.0	
	Mangahewa	100	316.7	316.7	
	Pohokura	26	875.0	227.5	
				610.5	28.8
Shell	Maui	83.7	190.7	159.7	
	Kapuni	50	36.0	18.0	
	Pohokura	48	875.0	420.0	
				597.7	28.2
Greymouth	Turangi	100	314.6	314.6	
	Kowhai	100	72.6	72.6	
	Ngatoro	100	15.7	15.7	
	Radnor	100	9.7	9.7	
				412.6	19.5
OMV	Maui	10	190.7	19.7	
	Pohokura	26	875.0	227.5	
				246.6	11.7
Origin	Kupe	50	242.4	121.2	5.7
Genesis	Kupe	31	242.4	75.1	3.5
NZOG	Kupe	15	242.4	36.4	1.7
Mitsui	Kupe	4	242.4	9.7	0.5
TAG	Cheal	100	3.3	3.3	
	Copper Moki	100	0.8	0.8	
				4.1	0.2

Source: Compiled from 2016 Energy in New Zealand

- Not shown: Radnor (9.7pj); NZEC and L&M Energy each with an interest in 1.05PJ from their 50 percent interest in Waihapa (2.1PJ)
- Excludes Maari and Tui fields where gas is flared or used for operational purposes.
- Remaining reserves in the Tariki/Ahuroa, Kauri, Sidewinder, Rimu, Surrey and Moturoa fields are recorded as zero.
- In September 2015 Origin Energy entered a conditional agreement to sell the Rimu/Kauri/Manutahi oil and gasfields to UK-based Mosman Oil and Gas for \$10 million. The assets became known as the South Taranaki Energy Project (STEP). However, the agreement was subsequently cancelled due to the oil price collapse, with Mosman noting also that it had not at that time received Government approvals for the acquisition.¹⁴¹
- On 16 November 2016 Genesis Energy acquired NZOG's 15 percent interest in the Kupe field, subject to approval by NZOG's shareholders – Genesis Energy announcement 16 November 2016.

¹⁴¹ Mosman Oil and Gas market announcement: *Corporate Update – STEP Acquisition and Murchison*, 1 February 2016

6.9 Unconventional Gas

What is it?

'Unconventional' gas is contained in tight, low permeability formations and is difficult to access. There are a number of forms of unconventional gas, but two common types are coal bed methane (primarily methane and also known as coal seam gas (CSG) or 'firedamp' to miners), and shale gas, derived from source rock that has matured. These tight formation gas deposits require advanced extraction techniques such as hydraulic fracturing – commonly referred to as 'fracking' - and horizontal drilling, to produce. Fracking involves pumping sand, chemicals and water at high pressure into the formation.

By contrast, 'conventional' gas deposits are contained in porous reservoirs, often limestone or sandstone, which have interconnected spaces that allow the gas to migrate to the well bore and to generally flow freely to the surface, often under the natural pressures of the reservoir.

'Unconventional' gas is producing a global supply bonanza, underpinning the so-called 'golden age of gas' and seen as a global energy market game-changer.

Australia and the United States are leading the way in the development and production of unconventional gas resources, and have reported substantial increases in their national gas reserves in the past five years as a result. By comparison, it is in its infancy in other parts of the world, including New Zealand.

6.10 Unconventional Gas Developments in New Zealand

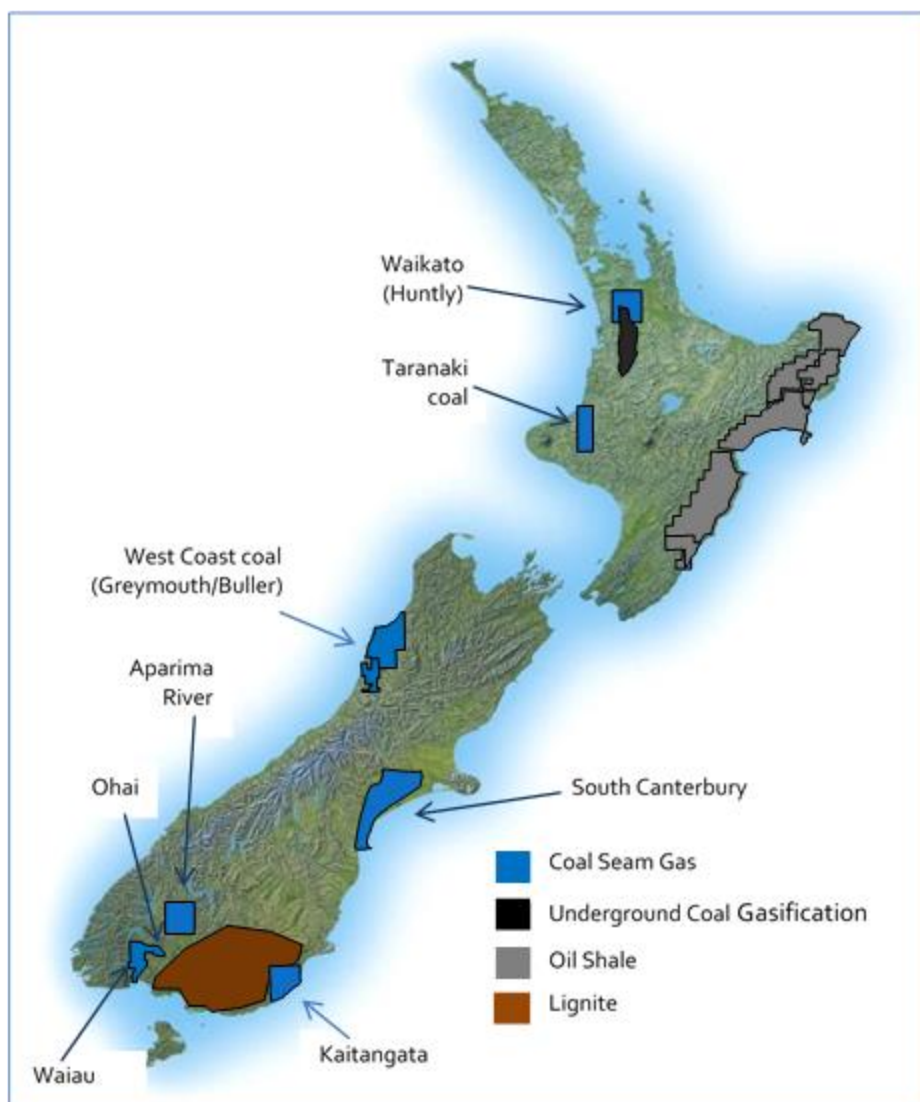
New Zealand has an estimated 15 billion tonnes of in-ground coal resource. Much, although not all, is thought to be conducive to CSG production¹⁴². Limited activity in CSG exploration and development to date is therefore considered to be more a reflection of the under-explored nature of New Zealand's petroleum and mineral basins and the abundance of conventional gas, rather than a perceived lack of resource.

Figure 23 shows the significant areas of interest in New Zealand for the main types of unconventional gas – CSG, fractured shale and coal gasification. It also shows a large area of lignite deposits in Southland, where interest has been more towards conversion into briquettes, fertiliser and possibly petroleum liquids¹⁴³.

¹⁴² Minister of Energy, address to the inaugural coal seam gas industry briefing, 30 June 2009.

¹⁴³ Solid Energy 2012 Annual Report. Solid Energy constructed a \$29 million briquette plant using lignite to produce higher-energy coal briquettes. It was also progressing feasibility work on preferred sites for a proposed coal-to-fertiliser plant and a new lignite mine to supply it. This work had been prioritised ahead of coal-to-liquids development. These Solid Energy projects have since been halted with the company entering voluntary administration in the wake of trading difficulties.

Figure 23: Unconventional Gas in New Zealand – Areas of Interest



Source: PEPANZ

While contingent reserves estimates, particularly for CSG, are reported by some companies, they are not sufficiently firm to be included in New Zealand's formal gas reserves position.

Following a period of relatively high activity to better understand and tap New Zealand's unconventional gas sources, this has since waned with the recent weakness in oil prices and little work is currently being undertaken.

Oil shales occur in various regions of New Zealand. Between 1899 and 1903, oil was extracted from shale at Orepuki, on the south coast of the South Island. Around 6,350 tonnes of oil shale were processed, yielding some 179 litres of oil per tonne. The operation ceased as the shale deposit was small, mining was costly, and a duty on imported oil products was removed¹⁴⁴.

¹⁴⁴ [Te Ara Encyclopaedia of New Zealand](#)

CSG exploration began in New Zealand in the early 1980s, when RC Macdonald Limited commenced projects in the Ohai coalfield and Greymouth coalfields. Neither project yielded commercial quantities of CSG, but both coalfields have continued to attract CSG interest by different parties.

Seismic and drilling activity associated with unconventional gas exploration increased substantially in 2009 to 2011. CSG accounted for 16 of the 52 petroleum wells drilled in 2011, 16 of 45 wells in 2010, and 19 of 37 wells in 2009. Solid Energy further established the potential of unconventional gas resources through a pilot project that produced gas from Waikato coal.

Initial work indicated that the North Huntly coalfield could contain between 25PJ and 200PJ of gas. In 2008, Solid Energy produced sufficient CSG from an exploratory project to power a 1 megawatt (MW) turbine. Four years later, in April 2012, Solid Energy¹⁴⁵ started up a \$22 million underground coal gasification (UCG) pilot plant near Huntly, which successfully produced synthesis gas (syngas)¹⁴⁶ from coal.

In May 2012, on the back of 'proving' the technology at its Huntly plant, Solid Energy announced a refocusing of its CSG development work on Taranaki, where its CSG acreage in the Tahora/Tangarakau area indicated contingent resources of more than 900PJ of gas, based on exploration results to 31 December 2011¹⁴⁷. In 2010 it had reported its contingent CSG resources at 190PJ. With its then focus on Taranaki, Solid Energy relinquished less prospective areas in the South Island and the Counties region of the North Island.

All of this work has since ceased. During 2012/13, in the face of deteriorating trading conditions and a challenging global coal market, Solid Energy began a restructuring to refocus on its core coal mining business and to divest non-core assets and activities. Noting that underground coal gasification and lignite conversion continued to have potential, Solid Energy reported that it 'is no longer in a position to be the lead sponsor of major capital projects and [is] looking to transition and divest these projects to entities which have the capital, experience and appetite to progress them.'¹⁴⁸. The position was reinforced with Solid Energy recording in its 2013 Annual Report that it had halted non revenue-generating activities, including the coal-to-fertiliser project and the Taranaki and Huntly coal gasification projects.

Earlier, it reported the underground coal gasification pilot plant had met its planned operational test programme objectives and had been shut down for completion of post-operational analysis and monitoring. This was the 'last remaining objective in the life cycle analysis of the pilot project.'

By 2015 deteriorating business conditions saw Solid Energy enter into voluntary administration and subsequently a Deed of Company Arrangement as it commenced a process of selling its economically viable assets.

Wellington-based L&M Energy has interests in conventional petroleum licence plays in Taranaki, as well as unconventional prospects with Ohai, Aparima River and Waiau (western Southland), Kaitangata (south Otago), and South Canterbury. It also has a permit over part of the Waikato coal deposits. L&M

¹⁴⁵ Via Coal Bed Methane Limited, a joint venture with US-based Resource Development Technology LLC.

¹⁴⁶ Syngas has several component gases, including hydrogen, carbon monoxide, methane, carbon dioxide and nitrogen. It is suitable for methanol and ammonia/urea production, but otherwise can be used only in equipment made specifically for syngas. By contrast, CSG typically comprises 95 percent or more methane and less than 2 percent carbon dioxide, and can be used more generally as a consumer energy. Solid Energy website www.solidenergy.co.nz

¹⁴⁷ Solid Energy media release: *Solid Energy to refocus coal seam gas development in Taranaki*, 30 May 2012.

¹⁴⁸ Solid Energy media release: *Solid Energy proposes further job cuts in refocused business*, 8 May 2013.

had conducted pilot production testing on the Ohai licence area which it reported had estimated contingent CSG reserves of about 270PJ¹⁴⁹.

Brisbane-based CSG specialist company, Comet Ridge Limited, has been active on the West Coast of the South Island, with work to date involving gathering and analysing data. The company, was granted a permit in 2007 for a period of 20 years. In 2013 Comet Ridge surrendered a portion of the area, and its latest approved work programme ended in July 2015. Comet Ridge has since applied to New Zealand Petroleum and Minerals to surrender the permit¹⁵⁰.

Oil shale deposits on the East Coast of the North Island, believed to be the source rocks for the basin's hydrocarbon system, provide unconventional as well as conventional prospects for explorers. In 2011, US-based Apache Corporation farmed into East Coast acreage held by TAG Oil to jointly explore and potentially develop oil and natural gas resources in this region in a three phase programme. Amongst projects by its reservoir engineers, Apache had listed an evaluation of potential well performance for an oil shale project in New Zealand. However, in January 2013 partner TAG Oil announced that Apache had decided to end its venture in New Zealand and would not undertake phase 2 of the programme.

New Zealand Energy Corporation (NZEC), describing the East Coast Basin where it formerly held permits, as an 'unexplored area of vast resource potential', referred to 'enormous shale beds up to 600 metres.

Notwithstanding the optimism around East Coast shale prospects, during 2015 both NZEC and TAG ceased activity in the region, citing the slump in global oil prices.

NZEC did not consider exploration in the East Coast permit to be viable 'in the current commodity price environment' and focused attention on its Taranaki Basin permits.

TAG, which held exploration permits over 7,000 sq km of onshore East Coast land and carried out some drilling, subsequently abandoned and plugged those wells, saying it has encountered extremely difficult drilling conditions. TAG also said it would concentrate its exploration and development efforts in Taranaki.¹⁵¹

Concept Consulting's *Long Term Gas Supply and Demand Scenarios – 2016 Update* also records: 'Some industry observers remain sceptical about the potential for commercialisation of East Coast shale resources, citing the extensive faults in the underlying structures, difficult terrain and relative distance to infrastructure.'

6.11 International Developments in Unconventional Gas

Around 45 percent of the world's recoverable natural-gas reserves are unconventional. The International Energy Agency (IEA) estimates that global gas demand will increase by more than half by 2035, and that unconventional gas will make up 32 percent of the total supply, up from the current level of about 14 percent. While Russia and the Middle East have the largest reserves of conventional gas, unconventional gas resources are spread across the world, including in countries such as China and America that are currently net importers.

¹⁴⁹ L&M Energy 2011 Annual Report; 2012 Annual General Meeting Managing Director's Presentation. In 2013 L&M Energy was acquired by New Dawn Energy and ceased being a publicly listed company and further information is not publicly available.

¹⁵⁰ Comet Ridge website information http://www.cometridge.com.au/Projects_NZ.htm

¹⁵¹ TAG media release: *TAG Oil announces abandonment plans at Waitangi valley-1 and return to drilling of core production assets in Taranaki, 16 September 2014*

The United States Energy Information Administration (EIA) current update of its 2013 assessment of shale gas resources outside the USA¹⁵² evaluated shale formations in 46 countries (previously 41 countries). It estimates the top 10 countries, including the US, have combined technically recoverable shale gas reserves of approximately 6 million PJ – or about 75 percent of the world total of 8 million PJ.

Table 4: Top 10 technically recoverable shale gas resources

Country	Trillion Cubic Feet (Tcf)	PJ
China	1,115	1,170,750
Argentina	802	842,100
Algeria	707	742,350
USA	623	654,150
Canada	573	601,650
Mexico	545	572,250
Australia	429	450,450
South Africa	390	409,500
Russia	285	299,250
Brazil	245	257,250
Top 10 total	5,714	5,999,700
World Total	7,577	7,955,895

Source: US Energy Information Administration
1 Tcf = 1.05 exajoule (EA) = 1,050PJ

In Australia, the contribution of CSG to annual gas production has increased from 2 percent in 2003 to 17 percent in 2015, when it accounted for around 410PJ of Australia's total annual gas production of 2,460PJ. Currently, most of Australia's CSG is produced in Queensland (99 percent), and the rest in NSW. CSG made up 49 percent of gas production in the eastern states of Queensland, NSW, Victoria and South Australia in 2015. CSG production is expected to continue to grow to support LNG exports from Australia's east coast where three CSG-based LNG export projects in Queensland – representing a combined investment of over \$60 billion¹⁵³ - commenced operations during 2015.

About 50 percent (1,230PJ) of total gas production in 2014/15 was produced for the Australian domestic market, with the other half exported as LNG. The share of production for the domestic market has fallen from 71 percent 10 years ago, with exports increasing at a faster rate than domestic consumption.

Australia's proved and probable (2P) gas reserves as at August 2015 stood at around 126,000PJ, of which some 43,000PJ (34 percent) is CSG¹⁵⁴.

¹⁵² EIA: *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States*, 10 June 2013.

¹⁵³ Australian Energy Regulator: *State of the Energy Market 2015*. Projects are Curtis LNG (\$20 billion), Gladstone LNG (\$18.5 billion), and Australia Pacific LNG (\$24.7 billion). Other LNG projects include Chevron's Gorgon Project (\$70.5 billion - 90 percent complete as at August 2015; Chevron's Wheatstone Project (\$29 billion - 65 percent complete as at August 2015); Woodside's Northern Territory Ichthys Project (\$34 billion - 74 percent complete as at August 2015)), and Shell's Prelude floating LNG Project (\$10-\$13 billion) due to commence shipments in 2017.

¹⁵⁴ Australian Energy Regulator, *State of the Energy Market 2015*.

The Australian Energy Regulator (AER) notes that while the LNG sector currently faces challenges of global oversupply and falling prices, the ANZ Bank forecasts that LNG prices will recover over the next five years due to rising demand for clean energy from Asia.

The United States is described as having 'won the lottery on natural gas'¹⁵⁵. Thanks to newly-discovered and potentially huge reserves of unconventional gas – primarily from shale deposits, but also CSG – the US has turned from a significant gas importer, to having domestic reserves estimated by some to last for the next 100 years. The EIA acknowledges that natural gas from shale formations has rejuvenated the natural gas industry there, and records that proved reserves in the US have risen by the highest level since the EIA began publishing proved reserves estimates in 1977¹⁵⁶. Proved shale gas reserves¹⁵⁷ in the USA increased from 24,470PJ in 2007, to 210,000PJ in 2014. Coalbed methane proved reserves totalled 16,800PJ in 2014. Together, these unconventional sources accounted for 56 percent of America's total proved gas reserves, which, at 408,000PJ is a record level for the US¹⁵⁸.

The US Department of State is sharing its industry and regulatory experience with other countries through an Unconventional Gas Technical Engagement Programme¹⁵⁹ created in 2010 as the Global Shale Gas initiative, but subsequently renamed to reflect a focus on all forms of unconventional gas. The EIA projects that shale gas will account for 14 percent of total global gas supplies by 2030.

China and India are pursuing shale gas resources, and significant potential is seen in areas of South America and Africa. Russia's Gazprom, a major supplier of conventional gas to Europe and likely to be seriously affected by market change caused by an influx of cheaper gas, is interested in acquiring shale gas assets in the US to gain expertise, and is developing a CSG business within Russia.

The sleeping giant is China, which tops the list of technically recoverable unconventional gas reserves. The IEA has estimated China's total recoverable unconventional gas resources at 1.8 million PJ, of which more than 60 percent is in shale beds and the rest in CSG¹⁶⁰. China produced around 189 PJ of unconventional gas in 2014 (CSG 139PJ, shale gas 50PJ), a 42 percent increase on the previous year. CSG production was up 23 percent, while shale gas expanded over five-fold. China's total gas output in 2014 rose 10.7 percent to 5,117 PJ, although demand in that country has been softening.

Nonetheless, China has been investing \$16 billion to increase CSG output to over 1,100PJ by 2020. Shale gas production on a major scale in China could change the international market by reducing LNG demand, and poses a particular problem for large gas exporters, like Australia, which nationwide has LNG projects representing a total investment of over \$200 billion recently commissioned or soon to come on stream.

Europe is currently looking at what the unconventional gas potential is for member States and the EU as a whole, with an eye to replicating the US success story. Currently there are no proven, economically recoverable reserves, although there is some active exploration in locations such as Poland. A number of projects are underway to map out unconventional gas resources, including the

¹⁵⁵ Yale Environment360, 13 August 2012.

¹⁵⁶ EIA, *US Crude Oil, Natural Gas, and NG Liquids Proved Reserves*, 19 December 2014.

¹⁵⁷ 'Proved' reserves are assessed differently than 'technically recoverable' reserves.

¹⁵⁸ <http://www.eia.gov/naturalgas/crudeoilreserves/>

¹⁵⁹ <https://www.doi.gov/intl/itap/uqtep>

¹⁶⁰ Reported, *The Economist*, 14 July 2012.

Shale Gas Research Initiative, an interdisciplinary research project aimed at developing a black shale database¹⁶¹.

A 2011 study concluded that while unconventional gas is likely to strengthen the long-term security of some countries, especially in Central and Eastern Europe, the EU as a whole 'will not experience the type of bounty created by additional domestic gas resources in the United States'¹⁶².

There are a number of obstacles to unconventional gas achieving its potential contribution to world energy. For instance, estimating reserves is uncertain as the gas sits in complex formations that often cover a very large area. Production rates, particularly from shale, are initially high, then decline rapidly before reaching a long-term production rate that can be long-lived compared with conventional gas wells. Such is the uncertainty that questions have been raised about the accuracy of shale reserves estimates in the United States and whether they have been overstated¹⁶³. Other obstacles include:

- environmental impact, primarily water contamination, but also fugitive methane leakage from wells.
- public resistance and the shape of regulations as legislators seek to catch up with unconventional gas developments.
- the extent and cost of extraction¹⁶⁴.
- supply saturation and price impact as increasing production puts downward pressure on international gas prices, affecting the economics of unconventional gas production.
- population density and land access¹⁶⁵.
- relative lack of water for water-intensive fracking operations.

¹⁶¹ www.gas-shales.org/index.php/en.html

¹⁶² Atlantic Council: *European Unconventional Gas Developments, Environmental Issues and Regulatory Challenges in the EU and the US*, June 2011.

¹⁶³ Reported, New York Times 25 June 2011: *Insiders Sound an Alarm Amid a Natural Gas Rush*; Arthur E. Berman, Labyrinth Consulting Services, in *US Shale Gas: Magical Thinking & The Denial of Uncertainty*, 9 January 2012, Duke University Nicholas School of the Environment, suggests the US shale reserves are overstated by 100 percent.

¹⁶⁴ Over 15,000 wells have been drilled in the Barnett Shale in Texas and Oklahoma since the first well in 1981. In 2009, 1,121 wells were drilled in the Marcellus Shale in Pennsylvania and West Virginia.

¹⁶⁵ For example, Europe is more densely populated than North America, where many successful shale gas plays are in very sparsely populated areas.

6.12 Gas Hydrates

Methane, the main component of natural gas, is a gaseous hydrocarbon at standard temperatures and pressures. It is generally recovered during conventional oil and gas drilling and production.

It can also occur 'unconventionally' under conditions of high pressure and very low temperatures. It has been found under the Arctic permafrost and beneath the sea floor, particularly in deep water continental margins. The methane doesn't bond with the water; rather it is found as a highly compressed crystalline solid encased within an ice structure.

When liberated from the ice as it reaches warmer temperatures and lower pressures, the volume of methane gas is 160 times greater than that of the hydrate form.

New Zealand has potentially massive resources of gas hydrates – a mixture of methane and water frozen into an ice – under the seabed along its deep-water continental margins.

Research into these resources – also known as methane hydrates – has been conducted since 1993, and in April 2012 research institute GNS Science concluded a two-year \$1 million gas hydrates programme funded by the Foundation for Research, Science, and Technology (MBIE). Gas hydrate presence has been observed in the Hikurangi margin, east of the North Island, the deep-water Taranaki and Northland basins to the west of the North Island, and regions of Fiordland (Figure 24).

The two-year research programme was led by GNS in collaboration with the National Institution of Water and Atmospheric Research (NIWA), the University of Otago and the University of Auckland. The study had a particular focus on the Hikurangi Margin due to its large area and proximity to major population centres, making it economically the most attractive for potential production. The Hikurangi margin contains a gas hydrate region of more than 50,000sq km, with initial estimates of some 20 trillion cubic feet (20,000PJ) of gas¹⁶⁶.

GNS Science reports that even if only a fraction of New Zealand's gas hydrates become commercially recoverable, they could provide the main source of natural gas for the country for several decades.

The objectives of the study were to assess the regional distribution of gas hydrates and characterise individual gas hydrate reservoirs. It included analysis of seismic data to improve understanding of gas hydrate reservoir rocks, investigation of gas hydrate formation mechanisms, initial production modelling, and an assessment of production impacts on the seafloor environment.

¹⁶⁶ Petcher and Henrys 2003: *Potential gas reserves in gas hydrate sweet spots on the Hikurangi Margin, New Zealand*, Science Report, Institute of Geological and Nuclear Sciences.

Figure 24: Gas Hydrates Areas of Interest



Source: GNS Science

A number of countries, including Japan, the United States, Canada, India, South Korea and Latin America are carrying out national gas hydrate research and development programmes aimed at commercial production. The American Geological Institute cites reports estimating the natural gas potential of methane hydrates as approximately 400 million trillion cubic feet (420 billion PJ), compared to the world's currently known gas reserves of 6,700 trillion cubic feet (7 million PJ).

However, international research is generally limited in scale and breadth. For some countries there is no urgent need to look to mine methane hydrates as they have access to much cheaper natural gas and coal seam/shale gas resources for many years. Other countries, particularly those with few indigenous energy resources, are looking more closely at early commercialisation of gas hydrates.

Japan, for example, has been testing a well drilled into the offshore Nankai Trough, and in March 2013 announced¹⁶⁷ – in a world first – that it had extracted natural ‘ice’ gas from methane hydrates. The immediate discovery is reported to potentially hold the equivalent of 11 years of gas imports, and all gas hydrates around the Japanese coast could meet that country’s gas needs for the next century. Such a scenario would radically change the world’s energy outlook. Japan hopes to bring ‘ice’ gas to market on a commercial scale within five years.

Gas hydrate production tests in northern Canada in 2002 and 2008 trialled hot water injection and depressurisation techniques, with depressurisation producing more methane than expected through modelling.

However, the American Geological Institute reports there are many technological problems and safety hazards that must be addressed before methane hydrates can be economically and safely extracted.

Recovery methods, such as steam or hot water injection and depressurisation, are aimed at causing the methane to sublime – transition from a solid to gas without passing through an intermediate liquid phase - to allow production. Once transitioned to gaseous form, there is a high risk of methane leakage with associated environmental and safety risks. Additionally, geologists suspect that gas hydrates may play an important role in stabilising the seafloor, and that drilling these deposits on a large scale could cause underwater landslides.

The US Department of Energy, in conjunction with US oil company ConocoPhillips and Japan Oil, Gas and Metals National Corporation, is testing whether methane molecules can be exchanged with carbon dioxide molecules within the hydrate in-situ, by pumping waste carbon dioxide from conventional wells into a hydrate deposit. If the carbon dioxide-methane exchange technique works, it will remove the need to add or dispose of fluids and avoid destabilising the seafloor.

¹⁶⁷ Japan Oil, Gas and Metals National Corporation (JOGMEC) media release: *Gas Production from Methane Hydrate Layers Confirmed*, 12 March 2013.

7 Gas Processing

The industry is well serviced with gas processing facilities, which tend to be built in conjunction with the development of new fields, and tailored to the reserves, wellstream composition and production characteristics of the particular field. Third party access, when required, is governed by commercial contracts. A finite term information disclosure regime for gas processing facility owners that ended in June 2014 did not identify competition or entry barrier issues and no need was seen for regulated access.

7.1 Background

In the underground reservoirs from which it is produced, natural gas exists in association with oil, condensate (a light hydrocarbon liquid), water and other compounds and impurities such as carbon dioxide and hydrogen sulphide. Together, these components form the well stream that flows to the surface.

The well stream is processed to separate the oil and other hydrocarbon liquids (condensate, natural gasoline) and to remove the water, leaving a raw gas stream comprising mainly methane, but also heavier hydrocarbons including propane, butane and ethane, as well as carbon dioxide and other impurities.

To achieve technical specifications¹⁶⁸ for transmission and general market use, the heavier hydrocarbons and impurities must be removed, or reduced. In some cases, non-specification gas is transported by private pipelines to petrochemical and certain large end-users.

Propane and butane are often extracted – as liquefied petroleum gases (LPGs) - as valuable products in their own right for supply to the domestic and export LPG markets.

7.2 Current State of the Gas Processing Market

Gas processing facilities in New Zealand are generally built in conjunction with the development of a newly-discovered producing field, and are tailored to the size, well stream composition and current and predicted production characteristics of the particular field. They can range from relatively simple, skid-mounted facilities to much larger, more complex treatment plants.

The previous (2004) Government Policy Statement on Gas Governance (2004 GPS) recognised access to processing facilities as a potential barrier to entry as production from the Maui and Kapuni fields declined and the New Zealand gas market became more dependent on supplies from multiple smaller fields, with potentially shorter production lives.

This hasn't proved the case to date. The willingness of gas processing owners to make their facilities available was demonstrated in a 2004 proposal by NGC (now Vector) to establish a gas gathering network centred on its Kapuni gas treatment plant (KGTP) in Taranaki. The intention was to tie small gas discoveries directly into the KGTP, thereby making more efficient use of that facility, while avoiding potentially unnecessary development costs for marginal fields. The invitation to developers to utilise the

¹⁶⁸ The New Zealand Standard: Specification for reticulated natural gas NZS 5442:2008

KGTP was extended to the large offshore Kupe field owners who, after considering a range of options, decided to construct their own dedicated processing facilities. Earlier, Swift Energy had opted to build its own production facilities for the Rimu field. No small producers took up NGC's offer and the 'gas gathering' concept appears to have lapsed.

Since then, new processing facilities, such as for TAG's Sidewinder and Cheal fields, have been developed from scratch.

A reason that producers are opting for field-dedicated processing facilities may be that the treatment of new discoveries has been relatively straight forward and without the complexities of high carbon dioxide levels that characterise the Kapuni field.

A short-term gas processing information disclosure regime¹⁶⁹ was introduced in 2008 to monitor gas processing availability and the outcome of any third party demand for access – with a view to ascertaining whether a permanent regulatory regime is required. No access issues emerged and the few calls for access by third parties were subject to commercial negotiations. Accordingly, co-regulator Gas Industry Co recommended to the Minister¹⁷⁰, and the Minister agreed, that regulated access to processing facilities was not required, and the disclosure regime lapsed upon its expiry in June 2014.

7.3 Gas Processing Facilities

There are currently 12 gas processing facilities operating in New Zealand, with an indicative combined capacity of approximately 286PJ per annum. A 13th, a small, skid-mounted separation facility on the Kahili field onshore Taranaki, is mothballed. A disclosure notation advises a recommissioning period of three to six months for existing Kahili facilities and that a compressor is needed to enable gas export.

Significant new processing capacity has been commissioned as new fields, including Pohokura and Kupe, have come on stream, and as smaller production facilities associated with the Sidewinder and Cheal fields have been completed and interconnected with the transmission system. In September 2013, NZEC concluded funding arrangements for the joint acquisition, with L&M Energy, of the Waihapa production station from Origin Energy as part of an expansion into midstream operations in Taranaki. Table 5 lists the gas processing facilities and their reported processing capacity.





































In other cases, existing processing plants have been expanded to accommodate new production. In September 2011 Todd Energy commissioned a new \$75 million LPG plant at the McKee production station. This development is described by Todd Energy¹⁷¹ as the first straddle-type plant in New Zealand, in which it is fed by propane and butane-rich pipeline specification gas from the Mangahewa and Pohokura fields, extracts these LPGs, and returns the lean gas back to the pipeline.

¹⁶⁹ Gas (Processing Facilities Information Disclosure) Rules 2008

¹⁷⁰ Gas Industry Co: Letter to Minister *Recommendation on the Gas (Processing Facilities Information Disclosure) Rules 2008*, 16 April 2013

¹⁷¹ Todd Energy media release: *Prime Minister Opens Todd Energy McKee LPG Plant*, 15 September 2011.

Table 5: Gas Processing Facilities

Facility Name	Facility Operator	Indicative Capacity (PJ pa)	Forecast Spare Capacity as a % of Capacity		
			0-24 months	2-5 years	5+ years
Cheal A Production Station	TAG Oil NZ Limited	3.8			
Kahili Separation Facility	Vector Gas Limited	Nil	Nil	Nil	Nil
Kaimiro Production Station	Greymouth Petroleum Limited	1.8			
Kapuni Gas Treatment Plant	Vector Gas Limited	25			
Kowhai A Wellsite	Greymouth Petroleum Limited	5			
Kupe Production Station	Origin Energy Resources NZ Limited	25			
Maui Production Station	Shell Todd Oil Services	86			
McKee-Mangahewa Production Station	Todd Taranaki Limited	McKee: 6 Mangahewa 5-12			
Pohokura Production Station	Shell Exploration New Zealand Limited	83.2			
Rimu Production Station	Origin Energy Resources NZ Limited	8.5			
Sidewinder Production Station	TAG Oil NZ Limited	4			
Turangi A Wellsite	Greymouth Petroleum Limited	10.95			
Waihapa Production Station	Origin Energy Resources NZ Limited	14.9			

Forecast Spare Capacity Legend	
	>25% Spare Capacity
	5-25% Spare Capacity
	<5% Spare Capacity

Source: information provided under the Gas (Processing Facilities Information Disclosure) Regulations 2008 (as at August 2013). These are the final disclosures made under the Processing Facilities Information Disclosure Regulations, which lapsed in June 2014. Waihapa production station has since been acquired jointly by NZEC and L&M Energy.

With six processing facilities operating at greater than 95 percent capacity, and most others advising spare capacity of between 5 percent and 25 percent, these facilities appear to be appropriately-sized for their purpose, with consequent production and economic efficiencies.

The spare capacity reported for the Maui production station at Oaonui and the Kapuni gas treatment plant reflects the declining production from those fields in the past decade. However, further drilling on

both of these fields was expected to enhance gas production levels and higher utilisation of the processing facilities.

The Maui production station has historically had a high capacity relative to throughput, as it has acted essentially as a swing producer for the New Zealand gas market. The operator, Shell Todd Oil Services, notes in its 2013 disclosure that a rationalisation of facilities had been completed, with redundant equipment being disconnected.

The KGTP was the only facility to report greater than 25 percent spare capacity, but noted that this was expected to reduce to less than 25 percent due to development of the Kapuni field. Depending on further field development, spare capacity would remain at less than 25 percent for 2 to 5 years, before increasing in the longer term. The Gas Conditioning Plant (GCP) adjoining the KGTP is currently mothballed, with an estimated 12-15 month recommissioning timeframe to return it to service. The GCP has capacity of 18PJ/year of 43 percent CO₂ gas (or greater for low CO₂/high calorific value (CV) gas). It was originally built to deliver high CO₂ gas to Methanex as a feedstock for methanol production, as well as a smaller volume to Ballance Agri-Nutrients. The KGTP's Benfield CO₂ removal process is nominally capable of removing concentrations of hydrogen sulphide (H₂S) but resource consents are not held for this activity.

Other disclosure commentary by processing facility owners included:

Sidewinder Production Station: Interruptible gas processing capacity available.

Cheal Production Station: Interruptible processing capacity available for both oil and gas.

McKee-Mangahewa Production Station: The McKee and Mangahewa facilities are highly integrated. The Mangahewa facilities are constrained by condensate stabilisation capacity, due to LPG richness. No ullage due to ongoing exploration, appraisal and development activities.

Kupe Production Station: No spare capacity is foreseen in the next five years.

Kaimiro Production Station: Gas facilities are fully utilised due to gas lift/reinjection operations.

7.4 Reliability

The information disclosure regime did not require the disclosure of information relating to outages, planned or unplanned. The Pohokura production station has been the subject of three relatively brief outages in 2010, 2012 and 2016 that triggered the industry's critical contingency management processes. Overall, processing facilities' operational reliability record is strong.

7.5 Regulatory Performance

The term 'gas processing facility' is not specifically defined in the Gas Act or GPS, but commonly refers to the equipment, located at or near wells and/or further downstream, which processes raw gas or gas/condensate streams. Equipment can also include on-site liquid storage where that is an integral part of a gas processing facility, and any protocols for accessing gas processing facilities could extend to associated gas gathering pipelines. The short-term disclosure regime defined a gas gathering facility only as 'a facility which separates the various constituents of the fluid from a well so as to remove impurities and provide specification gas and gas liquids.'

Gas processing policy objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> • Gas industry participants and new entrants are able to access third party gas processing facilities and related services on reasonable terms and conditions. • Barriers to competition are minimised. • Energy and other resources used to deliver gas to consumers are used efficiently. • Incentives for investment in gas processing facilities is maintained or enhanced. • The full costs of producing gas are signalled to consumers. 	<p>Access to gas processing facilities is subject to commercial negotiations between owners and access seekers. Apart from a gas gathering proposal by the then NGC centred on its Kapuni gas treatment plant in 2004, gas processing facility owners do not appear to actively seek third party gas into their plants. However, the response to the NGC proposal, and disclosures by facility owners on the outcome of approaches to them for access, indicate very little demand for such access.</p> <p>To date, no issues relating to gas processing facility access have arisen and there is no evidence that the facilities are operating inefficiently, or that their owners are posing barriers to competition.</p> <p>Investment in gas processing facilities is directly driven by discoveries, field and production characteristics, as well as producers' field development programmes. Processing costs will generally be reflected in the producers' gas price to their wholesale customers.</p>

7.6 International Gas Processing Access Practices

The New Zealand gas processing market, like the industry generally, is small by international standards. Access arrangements in overseas jurisdictions, while similar in some respects, do not have direct application to New Zealand's circumstances.

Access to gas processing facilities in other countries is generally by way of commercial negotiation. In some countries, notably the UK and Canada (Alberta), industry codes for access to gas processing facilities have been developed, with regulatory oversight and provisions for intervention in certain circumstances to resolve any access issues.

A review of access protocols in Australia, the United Kingdom, United States and Canada – all relatively large gas markets - shows that while they directly regulate access to transmission pipelines, they have differing approaches to gas processing.

Around 30 percent of Alberta's gas production is 'sour' gas (containing significant amounts of hydrogen sulphide), which is processed in around 250 gas processing plants. For environmental reasons, the development and location of sour gas processing facilities is subject to tight regulatory controls.

The regulatory regime in Alberta in fact seeks to minimise the proliferation of sour gas processing plants. The industry there has developed voluntary guidelines for oil and gas processing tariffs to promote commercial negotiations for processing agreements¹⁷². Model agreements are also widely used.

The USA has over 6,000 gas producers, many of them very small, and approximately 600 gas processing plants. Restructuring has led to a number of large dedicated gas gathering and processing

¹⁷² Called Custom Agreements in Canada, and referred to as Access Protocols in other jurisdictions.

businesses being established¹⁷³, with gas being gathered over hundreds of kilometres in some instances. A variety of gas processing facility access arrangements are negotiated, including fees for service, percentage of proceeds, and 'keep whole', in which processed gas returned to the third party equals the energy content of the raw gas delivered into the plant.

In the UK, as the large North Sea reserves diminish there is significant spare pipeline and processing capacity, and a focus on smaller, less economic developments. Owners of gas processing facilities or pipelines connecting to the transmission system or large users are required to publish annually their main commercial conditions for access. Information to be provided includes advice on how to apply for access, sample tariffs and/or pricing methodology, expected capacity and constraints, terms and conditions on use of the infrastructure, technical, operating, environmental protection, and safety requirements. Access disputes can be resolved by the Secretary of State.

There appear to be two key drivers – the UK government's desire to maximise hydrocarbon recoveries from the North Sea (and an associated desire to maximise the utilisation of existing infrastructure and ensure it remains in place as smaller reserves are developed), and an EU directive¹⁷⁴ which requires the UK to ensure third party access to gas infrastructure and facilities.

A non-statutory industry code¹⁷⁵, introduced in 1996, provides for facility owners to publish data on a web portal, the provision of key information by access seekers to demonstrate a bona fide application, and notification of an agreed work plan and of concluded agreements to the Secretary of State. The Secretary can intervene after six months if the parties are unable, or unwilling, to reach agreement, and has powers to determine access terms.

In Australia, the need for regulation of upstream facilities, including gas processing, has been examined on a number of occasions. A 1998 review concluded that a mandatory access scheme was not necessary and the Australian Petroleum Production and Exploration Association (APPEA) subsequently issued a statement of best practice principles for the commercial negotiation of third party access to upstream facilities.

Overall, no overseas jurisdiction matches New Zealand's circumstances, although some parallel may be seen in the UK's concern to ensure upstream facilities are retained in the context of developing reserves that, without the existence of nearby infrastructure, may not be economic.

¹⁷³ Following a FERC order (636) in 1992, many companies restructured so that their gathering, processing and transportation functions were placed into affiliated companies, spun off or sold.

¹⁷⁴ European Second Directive on Gas.

¹⁷⁵ Code of Practice on Access to Upstream Oil and Gas Infrastructure on the UK Continental Shelf.

8 Gas Transmission

The main gas transmission pipelines are available to gas shippers under non-discriminatory, open access arrangements, and interconnection arrangements are in place to receive gas from new fields, or deliver gas to users. Accordingly, no significant barriers to entry have been identified.

Potential capacity issues on the transmission system have eased since 2009 when periods of congestion on the transmission North Pipeline affected the ability of then owner, Vector, to offer new capacity contracts on that section of the pipeline, prompting competition concerns. Capacity availability increased particularly with the retirement of two gas-fired power stations in Auckland - together accounting for about 60 percent of the North Pipeline capacity - in the second half of 2015.

Although transmission system capacity is considered adequate for the foreseeable future, the industry is continuing a programme to improve transmission access and pricing arrangements following the 2009 constraints. This programme is now being led by the new (single) owner of both pipeline systems, First Gas, and involves the development of a proposed single access code to replace the currently separate access arrangements - akin to common carriage on the Maui line, and contract carriage on the former Vector system.

While now under single ownership, the transmission systems are currently separately regulated under a Commerce Commission price-quality regime introduced in 2013. The Commission is in the process of resetting transmission price/quality paths to take effect in 2017.

The transmission infrastructure is generally reliable and fit for purpose. A serious Maui pipeline outage in October 2011, affecting a large number of consumers in the upper North Island, provided a reminder of the industry's reliance on these assets and prompted a review of gas supply emergency response arrangements. Changes were implemented in 2014.

8.1 Background

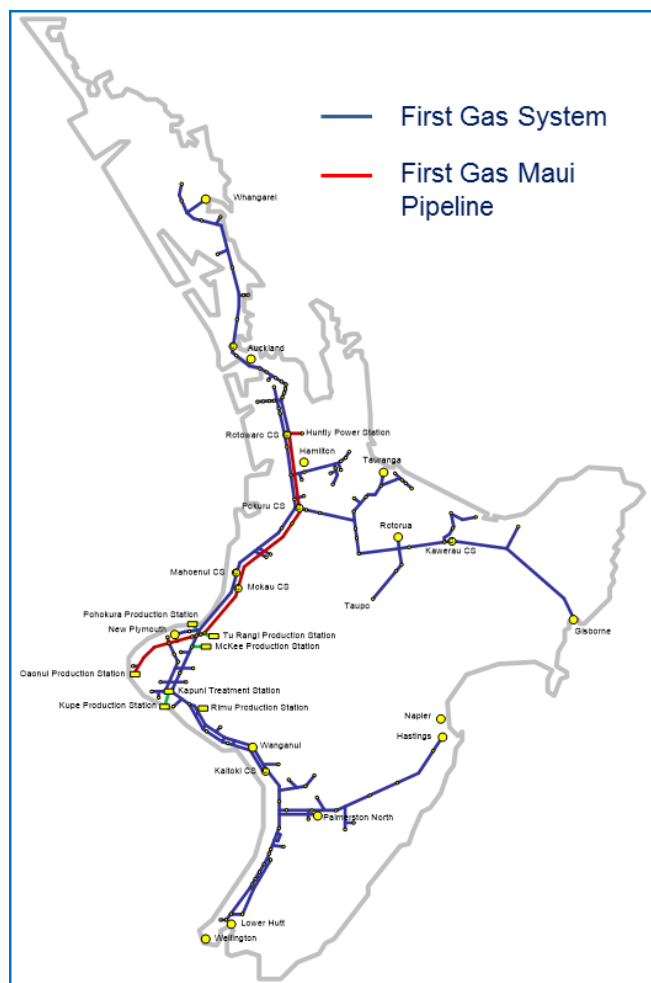
Transmission pipeline systems transport gas at high pressure from production stations to delivery points supplying end-users and lower pressure local area gas distribution networks. There are two open access pipeline systems in New Zealand (Figure 25), with both now owned by First Gas:

- the 309km Maui pipeline (mostly 750mm diameter), extending from Oaonui, in southwest Taranaki, to Huntly.
- the 2,211km system (mostly from 155mm to 220mm diameter), generally radiating from the Maui pipeline and delivering gas throughout the North Island¹⁷⁶.

Open access to gas transmission pipelines began in the mid-1990s when then owner NGC introduced an open access regime for its transmission system. Open access on the Maui pipeline was introduced in 2005.

¹⁷⁶ On 20 April, having obtained various approvals, including from its shareholders and the Overseas Investment Office (OIO), Vector sold its subsidiary Vector Gas Limited to Colonial First State Asset Management for \$952.5 million. Vector Gas' assets comprise the gas transmission pipelines and gas distribution pipelines outside Auckland. Upon purchase, Colonial First State renamed Vector Gas Limited as First Gas Limited (FGL). First Gas media release: *Colonial First State Asset Management Completes Purchase of Vector Gas Limited*, 20 April 2016. On 15 June 2016, having obtained OIO approval, MDL sold the Maui pipeline to First State for \$335 million. Ownership

Figure 25: Open Access Transmission Pipelines



Natural gas pipelines benefit from large economies of scale that allow the unit cost of gas transportation to decline as volumes increase. This means that it is generally not economically efficient to provide alternative transmission pipeline services, although there is some local by-passing. For this reason, gas transmission pipelines are regarded as natural monopolies.

Increasing transmission capacity involves large, lumpy, sunk investments, which, in the New Zealand context, must be contemplated against a backdrop of fluctuating gas supply and demand.

8.2 Current State of the Transmission Market

The transmission sector has evolved with the growth of the industry. The transmission system, initially developed by the Government and its agencies to transport gas from a single onshore field, Kapuni, to Auckland and Wellington, underwent substantial expansion in the 1980s to deliver the benefits of the huge Maui gas discovery to the rest of the North Island. The system has largely met the needs of consumers and, in the absence of major new discoveries in other parts of the country, there has been little new transmission investment since the 1980s.

is also with First Gas. First Gas media release: *Acquisition of Maui Pipeline*, 15 June 2016; also Shell New Zealand media release: *Maui Mining Companies complete Maui Pipeline Sale to First State Funds*, 15 June 2016.

Although gas has grown in 45 years to become a substantial contributor to New Zealand's primary energy supply, the New Zealand gas industry itself is small by international comparison. Transmission sector governance has consequently been built on fit-for-purpose codes and contracts, rather than the formal regulations generally found in larger jurisdictions.

The adequacy of industry arrangements, however, is under scrutiny in the light of substantial and fundamental changes that have occurred in the gas industry over the last decade. The previously Government-owned pipelines that, with the construction of the privately owned Maui pipeline, spearheaded the transmission system expansion in the 1970s and 1980s have transferred to private ownership; economic regulation has seen a move to formal controls over transmission pricing and investment returns; and declining production from the predominant Maui field has been replaced by multiple smaller fields.

The evolution of transmission arrangements accelerated in response to the shift from dependence on long-term contracts based on the supply of gas from the Maui field, to more varied and shorter-term supply arrangements from multiple fields. In particular, arrangements for access, connection, pipeline balancing and critical contingency management have all become more sophisticated, with greater service definition and formal rules around gas supply emergency management.

However, part of the legacy of the industry's historic development has been the existence of two transmission systems, where just one might be considered appropriate for a market of this size. Further complexity for an industry coming to grips with changing market dynamics was presented by the different access regimes for the two main transmission systems – a common carriage style regime applies to the Maui pipeline, while access to the Vector system acquired by First Gas is by contract carriage arrangements. Recent industry thinking has been directed at how these can be more closely harmonised and a move towards a single code is now in train with both systems under the ownership of First Gas.

The adequacy of existing governance arrangements had faced a number of challenges:

- Periods of capacity scarcity on the Transmission North Pipeline, which services New Zealand's largest region, Auckland, raised market competition concerns in 2009. It became evident the constraints related more to a need for improved utilisation of existing physical capacity, than an immediate need for investment in new physical capacity. Capacity demand has since eased, with considerable further alleviation arising from the retirement of the two Auckland gas-fired power stations – Otahuhu B and Southdown – in the second half of 2015. The industry to date has taken a gradual, rather than radical change approach, with a focus on an evolutionary redesign of the code-based arrangements to make better use of existing infrastructure. This approach has now been superseded by a single code development process led by First Gas.
- fundamental gas transmission issues were identified by NERA¹⁷⁷ at the time as the lack of a price signal for capacity, little clarity around the effectiveness of a capacity secondary market, and uncertainty about the effect of the default/customised price-quality regulation on gas pipeline investment (the default/customised price quality regulation is discussed in more detail in **Section 3.6, Commerce Commission – Economic Regulation, Page 26**). There was also a belief that the point-to-point capacity definition is complex and inefficient¹⁷⁸.

¹⁷⁷ NERA Consulting: *Efficiency of Existing Vector gas pipeline governance arrangements; Problem definition*, March 2012.

¹⁷⁸ Larry E. Ruff, Special Advisor, Market Reform: Comments on PEA advice to Gas Industry Co on Transmission Access and Capacity Pricing in New Zealand.

- a five-day gas outage on the Maui pipeline in 2011 highlighted the gas market's heavy reliance on that pipeline, and raised questions over transmission pipeline integrity generally. The incident confirmed the general effectiveness of the formal critical contingency management processes, but pointed to areas of improvement, which were implemented in 2014.

Transmission Market Structure

Transmission services and wholesale gas trading are interlinked, as arrangements for trading gas must be accompanied by an ability to transport it from a field to the end-user. The wholesale market in New Zealand is discussed separately in **Section 10.0, Wholesale Market, Page 129**.

Transmission market participants are:

- the pipeline owner and operator.
- owners of facilities physically interconnected with the transmission system (interconnected parties, or Welded Parties), who operate under the terms and conditions of an Interconnection Agreement (ICA) with the pipeline owner. They are involved in the physical transfer of gas into, or out of, the pipeline.
- Shippers, who buy transmission services to transport gas for consumption or onsale in the downstream wholesale and retail markets. They fall into three categories: electricity generators, petrochemical manufacturers, and retailers supplying end-users connected to the transmission and reticulated gas distribution networks.

In addition to the open access pipelines, there are smaller pipelines owned by gas producers, and in some cases end-users, that do not offer open access. This chapter focuses on the Maui pipeline and First Gas North Island system as the open access transmission facilities and which together convey over 80 percent of all gas. For completeness, smaller private pipelines that are generally only available for use by the owner or end-user are listed in Table 14, **Page 98**.

The Maui and Vector pipelines were operated under a complex structure involving a total of six operator roles. MDL and Vector each had three operators – Technical, Commercial and System. Five of these roles were undertaken by business units within Vector, and the sixth by an independent contractor, Transact Management Limited. First Gas is now responsible for all three operator roles in which are set out in Table 6.

Operating arrangements associated with First Gas' ownership of the former Vector system have yet to be finalised, but First Gas has advised that Vector will provide certain transitional services to First Gas under a Transitional Services Agreement for up to nine months.

For the present, First Gas is continuing the Vector and MDL pricing and access arrangements, including the Vector Transmission Code (VTC) and Maui Pipeline Operating Code (MPOC). These documents can be found on the First Gas Website¹⁷⁹.

While the potential for the operators to face conflicts of interest, due to an affiliation with gas shipping or production businesses, has diminished, First Gas confirms that part of its Commercial Operator role is 'adherence to confidentiality and ring fencing obligations'.

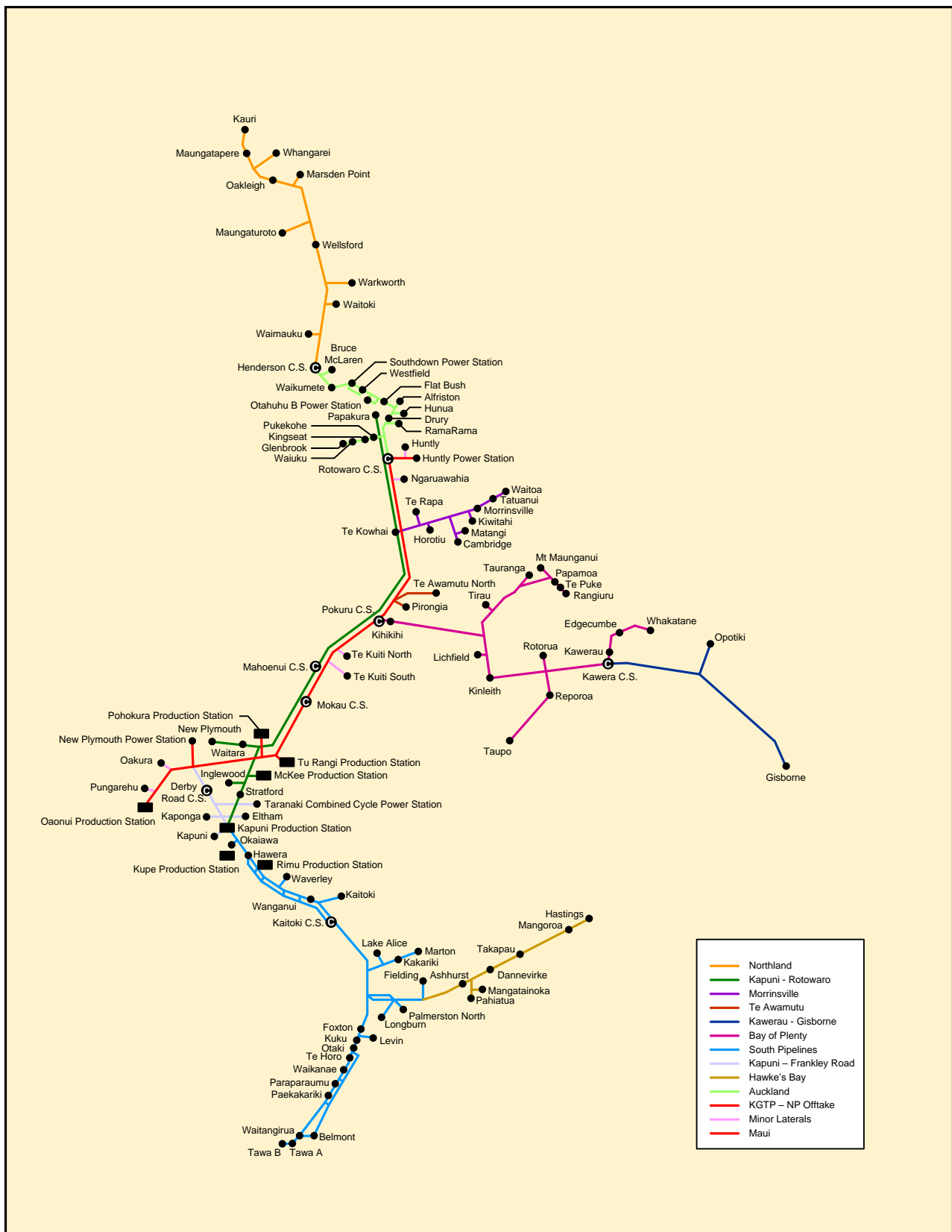
¹⁷⁹ www.firstgas.co.nz

Table 6: Operator Roles

First Gas	
Technical Function	<ul style="list-style-type: none"> • Preparation of asset management plans • Managing and operating the pipelines in conformity with all legislative and regulatory requirements and in accordance with instructions from First Gas • Monitoring and controlling pipeline gas flow • Monitoring gas metering and pipeline pressures • Calculating pipeline capacity • Scheduling routine or planned pipeline maintenance • Providing timely information as required for the safe and smooth operation of the Pipeline, including technical advice
Customer, Commercial and Regulatory Functions	<ul style="list-style-type: none"> • Tariff calculation • Code and associated contract administration • New Interconnection Agreements (ICAs) and Transmission Services Agreements (TSAs) • Management of prudential requirements • Administration of service contracts • Administration of the Balancing Agent function and administration of the Balancing Gas Exchange (BGX) • OATIS¹⁸⁰ (Open Access Transmission Information System) improvements • Dispute resolution • Gas demand forecasting • Coordination of Critical Contingency related activities and other pipeline incidents • Administration of the Incentives Pool • Invoicing including tariff charges, payments, and general accounting • Adherence to confidentiality and ring fencing obligations • Maintenance of the Maui Pipeline Information Exchange • Setting limits and tolerances for Welded Points of the Maui pipeline • Commerce Commission liaison and administration of compliance with Commerce Commission price-quality and information disclosure regulations • Gas Industry Company liaison and participation in industry body related work streams • Ministry of Business, Innovation and Employment liaison • Preparation of regulatory disclosures
System Operator Functions	<ul style="list-style-type: none"> • Administration and operation of OATIS • Administration of the nominations regime, confirming the feasibility of proposed Scheduled Quantities, curtailing as required, and confirming approved Nominations and Scheduled Quantities • Calculation of Line Pack and pipeline capacity • Management of processes in OATIS associated with monitoring daily activity by Maui Pipeline users • Management of Contingency Events, including Curtailment of Nominations and Scheduled Quantities, and industry communications • Communication to industry of planned maintenance and unplanned events • Provision of information services relevant to metering and data acquisition

¹⁸⁰ Open Access Transmission Information System. OATIS is also a public platform through which the general public is able to access information on some operational aspects of the transmission pipelines.

Figure 26: Transmission Pipeline Schematic



The pipeline transports gas from the Maui field and from fields owned by other parties. Currently, six production stations (Receipt Welded Parties) directly inject gas into the Maui pipeline. Three gas consumers (Delivery Welded Parties) – Methanex’s Motunui and Waitara Valley methanol plants, and Genesis’s Huntly power station - take direct delivery of gas and account for slightly more than half of the gas flowing through the Maui pipeline. Twelve Shippers use the pipeline, and gas from the Maui line flows into the First Gas North Island system at 13 interconnection points.

After carrying approximately 18PJ of gas in its first year of operation in 1979, the Maui pipeline carried 143PJ of gas in 2015 – approximately 78 percent of New Zealand’s total gas supply. Volume variability on the pipeline primarily reflects gas requirements for electricity generation and petrochemical production.

From the commencement of deliveries in 1979 until the start of the Maui Open Access Regime in 2005, this pipeline was used only by the Maui Mining Companies and for the sole purpose of transporting gas from the Maui field. However, a Government policy statement in 2003 requiring an open access regime across gas transmission pipelines, together with the progressive depletion of the Maui field from the early 2000s, drove initiatives to create the physical and commercial conditions to allow non-Maui gas to be transported on the pipeline.

Today, gas from the Maui field accounts for around 30 percent of the gas carried by the Maui pipeline.

Shippers and Welded Parties conduct their daily pipeline operations using the OATIS pipeline management system. Shippers input daily flow nominations and forecasts and Welded Parties monitor the metered flow of gas through their Welded Point against the quantity they are scheduled to flow.

Table 7: Maui Pipeline

Pipeline Segment	Nominal Bore		Length (km)
	Length-weighted Average Pipe Diameter (mm)	inches	
Oaonui-Frankley Road	850	34	44
Frankley Road-Huntly offtake	750	30	247
New Plymouth power station lateral ¹	500	20	9
Huntly power station lateral	400	16	<u>9</u>
			309

¹ The New Plymouth power station was decommissioned in 2007

Table 8: Maui Pipeline Statistics (year ended 31 December)

	2014	2015
Gas conveyed (GJ)¹	158,174,000	142,630,000
Offtake/connection points	26	26
Operational expenditure (\$m)	11.5	11.1
\$/TJ of gas delivered	73	78
\$/km of pipeline	37,238	36,025
Expenditure on Assets (\$m)	2.9	1.5
\$/TJ of gas delivered	18	10
\$/km of pipeline	9,327	4,839

Information provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012

¹ All gas conveyed for parties other than the pipeline owner

Table 9: Maui Pipeline statistics 2011-2015

	2011	2012	2013	2014	2015
Gas conveyed (GJ)	113,652,355	126,080,000	135,246,000	158,174,000	142,630,000
Total customers	12	12	12	12	12

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997; Information from 2013 provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012

Access and pricing

The terms and conditions governing access to the Maui pipeline are set out in the MPOC¹⁸¹. The MPOC contains the detailed rules governing the operation of the Maui pipeline, processes, responsibilities, and the timing of key information exchanges.

First Gas's Maui pipeline business is subject to the Commerce Commission's determination under Part 4 of the Commerce Act that sets a default price-quality path (DPP) from 1 July 2013 and applies to assessment periods until September 2017. The DPP determination does not prescribe a pricing methodology, but imposes a revenue cap that limits the price First Gas may charge. Two tariffs apply to the Maui pipeline¹⁸². Tariff 1, to provide for a return on assets and investments, is a charge on each gigajoule transported one kilometre (gigajoule kilometre, or GJ.km), with the total representing the quantity of gas shipped multiplied by the distance that gas travels. Tariff 2, to recover operating costs, is levied on each GJ of gas transmitted. Table 10 sets out Maui pipeline tariff trends in the period 2011-2016.

In any given year, if Maui pipeline total revenues are more or less than the revenue cap, Tariff 1 may be adjusted for the following years in a manner that endeavours to reduce pricing volatility for

¹⁸¹ The MPOC is published at www.oatis.co.nz under the Maui Information Exchange.

¹⁸² [MDL Disclosure of Current Prices, 1 July 2015](#).

Shippers. Tariff 2 may be similarly adjusted in following years if total operating expenditure recovery is more or less than required.

Table 10: Maui Pipeline tariffs

	July 2011 – June 2012	June 2012 –June 2013	From July 2013	From July 2014	From July 2015	From July 2016
Tariff 1 (cents.GJ.km)	0.1875	0.1953	0.1505	0.1685	0.1578	0.1578
Tariff 2 (c/GJ)	3.9	7.9	7.9	7.6	7.7	7.2

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997; Information from July 2013 provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012.

8.4 First Gas North Island System

The transmission system First Gas acquired from Vector (First Gas North Island System) consists of four main sub-systems for statistical reporting. Each comprises numerous sections with varying pipe sizes. The system delivers gas to 139 delivery points that supply distribution networks and direct individual consumers, such as power stations and industrial plants.

For reporting purposes under the previous Information Disclosure regime, then owner Vector broke its transmission pipelines into four sub-systems – North/Central, Bay of Plenty, Frankley Road-Kapuni, and South. Under the subsequent Commerce Commission-administered information disclosure regime introduced in 2012, Vector changed this breakdown into South-Kapuni-Frankley Road, Bay of Plenty, North, Te Awamutu North and Minor sub-systems, and this approach has been continued at this time by First Gas.

Essentially, the First Gas North Island System is made up of the original Kapuni pipelines - built in 1968/69 to transport gas from the Kapuni field in South Taranaki to Auckland and Wellington – and new pipelines installed during the substantial system expansion in the mid-1980s. The Kapuni pipeline was reinforced by looping between Huntly and Auckland in 1981 and the total system was extended to Tauranga in 1982, Hastings and Whangarei in 1983, and Gisborne in 1984. Construction of additional pipeline loops has improved deliverability on various parts of the system.

Table 11: First Gas North Island System (as at 30 June 2015)

Pipeline Segment	Nominal Bore		Length (km)
	Length-weighted Average Pipe Diameter (mm)	inches	
South-Kapuni-Frankley Rd	220	8.6	1,030
Bay of Plenty	156	6.1	610
North	189	7.4	548
Te Awamutu North	155	6.1	7
Minor	69	2.7	16
			2,211
Looped sections			
Hawera-Kaitoke	300	12	87.3
Otaki-Belmont	300	12	55.7

Table 12: First Gas North Island System Statistics (Year ending 30 June 2015)

	2013	2014	2015
Gas conveyed (GJ)			
South-Kapuni-Frankley Rd	39,554,000	31,333,000	32,223,000
Bay of Plenty	8,473,000	8,504,000	8,901,000
North	43,637,000	40,872,000	42,237,000
Te Awamutu North	400,000	611,000	503,000
Minor	229,000	341,000	379,000
	92,293,000	81,661,000	84,243,000
Including gas conveyed other than for the pipeline owner	76,163,000	55,234,000	70,705,000
Offtake/connection points	138 ¹	139 ¹	159 ²
Operational expenditure (\$m)	32.6	29.7	28.3
\$/TJ of gas delivered	375	366	338
\$/km of pipeline	14,752	13,423	12,795
Expenditure on Assets (\$m)	15.6	17.6	28.6
\$/TJ of gas delivered	180	217	343
\$/km of pipeline	7,085	7,968	12,954

Information provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012

¹ Offtake points

² Connection points

Table 13: First Gas North Island System – Gas Conveyed 2011-2015

	2011	2012	2013	2014	2015
Gas conveyed (GJ)	94,261,000	99,253,000	92,293,000	81,661,000	84,243,000

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997; information from 2013 provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012

Access terms and conditions

The First Gas North Island System has operated under a policy of non-discrimination, in which the same service (including terms) is available to customers in the same circumstances, since the mid-1990s. First Gas at this time continues to operate a contract carriage regime, with the multi-lateral terms and conditions set out in the VTC, introduced in November 2007. Bilateral contracts exist in the form of Transmission Services Agreements (TSAs), but each TSA incorporates all the common terms by reference to the VTC. This improves transparency and avoids individual TSA's getting out of sync. The standard offering is an annual block of point-to-point capacity, including an option to buy the same amount of capacity in the subsequent year (a 'grandfathered right').

Shippers are required to enter into a TSA. Supplementary Agreements are available to meet special needs, such as long-term arrangements for electricity generators.

Pricing methodology

The First Gas North Island System is also subject to a revenue cap set by a Commerce Commission's DPP determination. For the present, First Gas is continuing Vector's pricing methodology and related arrangements. During 2012/13 Vector reviewed its gas transmission pricing methodology and consulted with industry in light of the new pricing regime as well as the then capacity congestion issues on the Transmission North Pipeline. This led to provisional pricing for the period 2013-14, which proposed adjustments to the balance between the fixed and variable components of charges – involving higher fixed charges and a lower variable fee. In part, the rebalancing was aimed at incentivising less consumption in the then 'constrained Auckland' pipeline. Following submissions, Vector's final pricing methodology applied from 1 October 2013.

Prior to the review, Vector in turn had largely continued the pricing methodology it inherited when buying NGC¹⁸³ in 2005. Designed by NGC in the mid-1990s, it was based on an optimised system cost allocation model with two main pricing elements:

- Capacity Reservation Fee (CRF), expressed as \$/GJ of reserved capacity/year, to recover a return on, and costs of fixed system assets. CRF reflects the distance gas is transported and is recovered in 12 equal monthly payments. Overrun fees applied to deliveries made in excess of reserved maximum daily quantity (MDQ) and were charged each month to overruns made in the previous month.
- Throughput Fee (TPF), expressed as \$/GJ of gas taken at a delivery point, to recover variable costs. This was applied each month to deliveries made in the previous month and is the same across the system.

For the purposes of the DPP regime, the current total target revenue comprises four components:

- CRF – based on an annual reservation of GJ capacity.
- TPF – based on GJ consumption.
- Fixed Fee – included as a component of some non-standard contracts.
- Overrun Fee – set equal to 10 times the CRF divided by 365 days.

As a result of the review and consultation process, 11 'pricing regions' were established for the purposes of calculating target revenue. Actual prices vary considerably, and full pricing information is

¹⁸³ NGC Holdings Limited (formerly the Natural Gas Corporation of New Zealand Limited).

set out in Vector's Posted Price Schedule, which provides CRF and TPF prices for different delivery points across nine pipelines. It is now available on the First Gas website.

8.5 Other Transmission Pipelines

Smaller gas transmission pipelines are special purpose lines or are used to transport gas from producing fields to connect with the Maui or Vector pipelines, or with end-user facilities. Where they do not connect with the Maui or Vector pipelines, their flow rates are not metered into, and not included in the throughput information disclosed by, those open access systems. Their flow information is therefore known only to the owners.

The following pipelines are listed in Schedule 6 of the Commerce Act 1986 as exemptions from Part 4 of that Act. They are not subject to open access, or to the information disclosure requirements and price-quality paths that apply to the Maui and First Gas North Island System pipelines.

Table 14: Other (non open access) Pipelines

Owner	Pipeline
Todd Taranaki Limited	McKee Production Station-Tikorangi gas pipelines.
Vector	Low Temperature Separator (LTS) pipeline (50km), originally used to supply non-specification, high CO2 content gas from Vector's Kapuni gas treatment plant to the Faull Road mixing station (where it was blended with Maui gas for providing a CO2-rich feedstock gas to Methanex). Now used as line pack storage.
Nova Energy Limited	All gas pipelines.
NZEC	Waihapa production station to New Plymouth (45km) (formerly owned by Origin Energy, and originally owned by Swift Energy New Zealand). Rimu production station to Mokoia mixing station (First Gas' south system) (1km).
Methanex	Bertrand Road to Waitara Valley methanol plant, via Faull Road mixing station. Tikorangi (Maui pipeline welded point) to Faull Road mixing station. Faull Road mixing station to Motunui plant (minor gas pipeline). Faull Road mixing station to Waitara Valley methanol plant main process gas pipeline.
TAG Oil	Sidewinder production station to the First Gas pipeline at Durham Road (3.5km)
Energy Infrastructure and Petroleum Infrastructure	Pipeline from the Maui pipeline to the Pohokura production station and the Methanex methanol plant.

*Nova Energy distribution pipelines are discussed in **Section 9.2 Gas Distribution, Page 117***

8.6 Transmission Capacity Services

At this time, different capacity services apply to the Maui pipeline and the First Gas North Island System. The Maui pipeline common carriage-oriented service requires no advance bookings and Shippers have no specific contract rights to capacity. Because it is open to all-comers, there is no guarantee of availability should demand for capacity exceed supply.

By contrast, the contract carriage regime applying to the First Gas North Island System offers a 'firm' service that is guaranteed to be available under all but emergency and *force majeure* conditions.

Capacity is booked in advance and paid for a full year, irrespective of the extent to which it is to be used.

First Gas also offers a higher cost non-booked service (primarily through authorised or unauthorised overruns) for Shippers requiring capacity at short notice or for a short period, as well as an interruptible service, although interruptible contracts are infrequent and their terms are confidential.

Contractual congestion – when demand for capacity exceeds the technical availability – may lead to underutilised capacity if Shippers who have booked it neither use it for themselves nor release it to the market, thus making it unavailable to other Shippers who are willing, but unable, to access it. Such ‘hoarding’ of capacity is not possible under the Maui pipeline common carriage approach, but there is potential for it to occur if capacity on the First Gas North Island System becomes fully booked¹⁸⁴.

8.7 Transmission Capacity Access

In October 2009 Vector announced that its North Pipeline, supplying gas to Auckland and Northland, was constrained¹⁸⁵ and that it was unable to sell any more reserved capacity¹⁸⁶.

In addition to the reserved capacity held by users under the VTC, firm capacity was committed under non-code or supplementary agreements, primarily for the Otahuhu and Southdown gas-fired power stations, which have since closed. This power station capacity accounted for around 60 percent of the total capacity of the North Pipeline.

Vector’s announcement at the time raised capacity allocation and investment issues and prompted an urgent review of transmission pipeline capacity allocation and pricing arrangements. Large gas consumers supplied from the pipeline complained that, when tendering their gas supply, they received fewer competitive bids from retailers and that bids from non-holders of capacity entitlements were conditional on securing capacity. The reduced competition occurred because of the nature of existing access arrangements on the North Pipeline, and concerns were raised over lack of transparency on how Vector determined the level of the pipeline’s commercial capacity.

A number of industry participants took the view that, while a capacity-constrained pipeline may not be able to accommodate new demand, it need not affect competition among retailers to supply an existing consumer. The industry has been addressing long-term transmission capacity and pricing issues through a Gas Transmission Investment Programme (GTIP)¹⁸⁷ established by Gas Industry Co in 2011 and aimed at:

- ensuring existing and future gas transmission assets are used efficiently.
- establishing the need for gas transmission investment.
- laying an effective pathway for efficient gas transmission investment to take place.

Short-term issues were addressed through a series of seven commitments – known as the ‘Bridge Commitments’¹⁸⁸ – which were adopted by Vector and the majority of Shippers on the North Pipeline in August 2011. The initiatives included the establishment of an online Gas Transmission Exchange (GTX) to facilitate the trading of capacity rights, and agreements to free up, on an interruptible basis, some

¹⁸⁴ Gas Industry Co Gas Transmission Access Issues Review, 2006.

¹⁸⁵ A pipeline is ‘constrained’ when it cannot reliably transport additional gas without breaching operational parameters.

¹⁸⁶ Reserved capacity sets the limit on the amount of gas a user can have transported without incurring overrun charges.

¹⁸⁷ <http://gasindustry.co.nz/work-programmes/gas-transmission-investment-programme/gtip-foundation-and-governance/>

¹⁸⁸ <http://gasindustry.co.nz/work-programmes/transmission-pipeline-capacity/short-term/the-bridge-commitments/>

capacity held for electricity generation through changes to Supplementary Agreements that previously prohibited such trading. It also became apparent that:

- events of physical capacity scarcity are rare, are limited to only a few days and do not necessarily occur annually.
- the capacity market in New Zealand is thin.
- non-transparency may be hindering secondary trading.

Notwithstanding the initial concerns of large users, there was little demand from them for additional capacity – in requesting capacity from incumbent Shippers, seeking additional capacity on the GTX, or requesting any spare capacity held under Supplementary Agreements. After more than a year of inactivity, the GTX was decommissioned in December 2014 and there has been sparse use of the other Bridge Commitments undertakings, with no reports of capacity unavailability constraining retailers' ability to respond to competitive tenders.

These factors suggested there was no enduring capacity shortage on the North Pipeline and that capacity issues were not impeding customer switching and competition. The retirement of the Otahuhu and Southdown power stations in the second half of 2015 further reduced pressure on available capacity and the need for significant new investment in the medium term.

Nonetheless, solutions to the longer-term management of transmission capacity to improve allocation efficiencies are considered important so that the industry can respond proactively if capacity access re-emerges as a significant issue. This could arise from new supply, or major new demand.

The industry's focus turned to designing improvements to the access arrangements – including better harmonisation of the Maui and (then) Vector access regimes – to provide the most efficient use of the existing assets until a new investment is justified. Immediate priority issues were seen as demand management, capacity nomination, and transparency.

To address shortcomings in present arrangements, which rely largely on non-price mechanisms to allocate capacity, the GTIP presented what it considered to be characteristics of an ideal transmission market in New Zealand¹⁸⁹ and recommended a path towards achieving these.

An industry working group¹⁹⁰ comprising representatives of transmission system owners and Shippers was formed to develop an industry response to the future path recommendations¹⁹¹. At the same time, in response to a recommendation that it should consider regulatory options in case they are required, Gas Industry Co has set out options as a first step towards developing a counterfactual design for implementation if the industry efforts falter¹⁹².

While the working group made some progress in the areas of transparency, VTC change processes and congestion management, it made little headway with the core issue of capacity allocation and pricing.

When the announcement of the prospective sale of the Vector and Maui transmission systems was announced towards the end of 2015, Gas Industry Co suspended the code convergence work and has since advised the industry that while the previous work remains relevant, there are now natural

¹⁸⁹ *Advice from Panel of Expert Advisers: Report to Gas Industry Company, July 2013*

¹⁹⁰ Gas Industry Transmission Access Working Group (GITAWG)

¹⁹¹ Industry-led process: <http://gasindustry.co.nz/work-programmes/gas-transmission-investment-programme/industry-led-process/>

¹⁹² <http://gasindustry.co.nz/work-programmes/gas-transmission-investment-programme/transmission-access/#options-for-improvement/>

incentives for First Gas to converge the code arrangements and to also streamline replacement of the OATIS system to manage a converged system. Gas Act objectives provide scope for additional new analyses and options to emerge and, accordingly, it envisages a move from the previous 'evolutionary convergence' approach to one in which First Gas will lead the development of a single code. It acknowledges the potential for such a single code to be agreed by relevant parties, but anticipates the need for a regulatory backstop.

From an industry governance perspective, the industry body considers that, while First Gas will be concerned to ensure convergence delivers on its own business objectives, the converged regime must also:

- meet the Gas Act objectives; and
- strive to maintain the good-will and buy-in of stakeholders, particularly existing contract holders.

Gas Industry Co is working with First Gas and stakeholders to determine how best this can be achieved.'

As part of its move towards a single code, First Gas issued for consultation and Options Paper¹⁹³ that explores possible forms that a new gas transmission access code could take. First Gas believes that a single code will ensure that transmission arrangements support gas industry growth through creating a single set of end-to-end transmission access arrangements to transport gas from source to locations throughout the North Island.

Capacity consultation

In parallel with, but separate to, the GTIP, Vector conducted its own programme of consultation with industry participants on its transmission regime, including capacity modelling and pricing methodology. The consultation concluded in December 2013 with the publication of capacity determinations and pipeline review papers for each pipeline making up the then Vector transmission system. For the moment, First Gas is continuing Vector's Capacity Allocation Methodology, which is available on the First Gas website.

Maui pipeline capacity constraints

Although there has been no effect on deliveries to date there is a potential capacity constraint on the Maui pipeline's ability to deliver gas north of the Mokau compressor station¹⁹⁴.

The pipeline section south of Mokau collects gas from a number of fields. It also has a number of large delivery points, which are close to, or contiguous with, receipt points. Operating pressures in this section of the line are designed to be between 42 and 48 bar to allow production stations to inject gas into the pipeline.

The pipeline's ability to deliver gas north of Mokau is influenced by the flow through the Mokau compressor station. This station has two compressors in order to provide a n+1 reliability standard. The maximum guaranteed flow at this location is 330 terajoules (TJ) a day, based on one compressor in operation. First Gas reserves the right to curtail nominations when this level is exceeded. The two

¹⁹³ *Gas Transmission Access: Single Code Options Paper (SCOP2)*

¹⁹⁴ Presentation: *Maui Pipeline Capacity*, Don Gray, to GTIP meeting, March 2012 <http://gasindustry.co.nz/work-programmes/gas-transmission-investment-programme/gtip-foundation-and-governance/advisory-panels/panel-of-expert-advisors/members/meetings/>. Also refer *MDL: Transitional Disclosure of Pipeline Capacity, May 2013*

compressors can be operated together to achieve increased flow, but this will reduce reliability. There have been no curtailments north of Mokau for capacity reasons since the commencement of open access.

Curtailment processes and procedures are set out in the MPOC and First Gas's Standard Operating Procedures.

8.8 Gas Balancing

The volume of gas in a pipeline relates to the gas pressure in the pipeline. Operating conditions must be maintained below the upper safe pressure limit for the pipeline, and above the minimum required to maintain the supply of gas to consumers. On the Maui pipeline, pressures will rise or fall as parties who inject gas into the pipeline over- or under-inject, and as parties who receive gas from the pipeline under- or over-take relative to their respective scheduled volumes. Managing the gas inventory in a pipeline is referred to as balancing. The Maui pipeline owner buys and sells balancing gas in order to manage gas volumes and maintain gas pressure within safety and operational limits. When pipeline systems get out of balance and balancing costs are incurred to remedy the situation, those costs have historically been socialised among pipeline users, rather than directed to the users responsible for them.

Transmission pipelines balancing is performed under a market-based balancing (MBB) regime introduced by (then) MDL in October 2015. While the subject of some opposition from shippers, MBB was considered by the industry body, Gas Industry Co, to be an improvement on the status quo.

The new regime is being closely monitored and Gas Industry Co has completed its review of how MBB has been working in its first year of operation¹⁹⁵. It found that under MBB primary and secondary balancing has significantly improved, but considers there is scope for further investigation and improvement. This reflects, primarily, increased secondary balancing activity since the introduction of daily cash-outs when, at face value, improved primary balancing would be expected to reduce the need for secondary balancing. Further industry feedback is being sought.

The introduction of MBB was the latest significant move in lengthy efforts to improve transmission balancing arrangements since the introduction of open access on the Maui pipeline in 2005.

Such improvements proved difficult to achieve, with one complicating factor being the physical and commercial overlap between the Maui pipeline, governed by the MPOC, and the First Gas North Island System governed by the VTC. While Gas Industry Co was set to pursue regulated balancing arrangements in 2009, industry participants declared a clear preference for an industry-led solution over regulation.

The process has since followed a chequered path. Balancing actions and related costs have declined as some improvements, including the introduction in 2009 of a Balancing Gas Exchange (BGX)¹⁹⁶, enabled MDL to manage its residual balancing role more effectively. However, some underlying inefficiencies remained – in particular the socialising of balancing costs. Code changes sought by MDL for the introduction of back-to-back (B2B) balancing, which would direct costs towards pipeline users with excess imbalance and remove cross subsidies, were supported by the Gas Industry Co but not implemented by MDL. Instead, MDL reviewed its approach and presented the MBB proposal modelled on the European Union regime¹⁹⁷. It retains elements of B2B, and involves daily cash-outs of imbalance positions. It also opened the way for balancing transactions to be conducted on an open wholesale

¹⁹⁵ Gas Industry Co [Review of Market-Based Balancing - November 2016](#)

¹⁹⁶ Restructured as the Balancing Gas Information Exchange (BGIX) with the introduction of MBB on 1 October 2015.

¹⁹⁷ European Code on Gas Balancing of Transmission Networks

market where practicable¹⁹⁸ (in particular the emsTradpoint platform), rather than as previously solely through the BGX, which was available only to MPOC signatories.

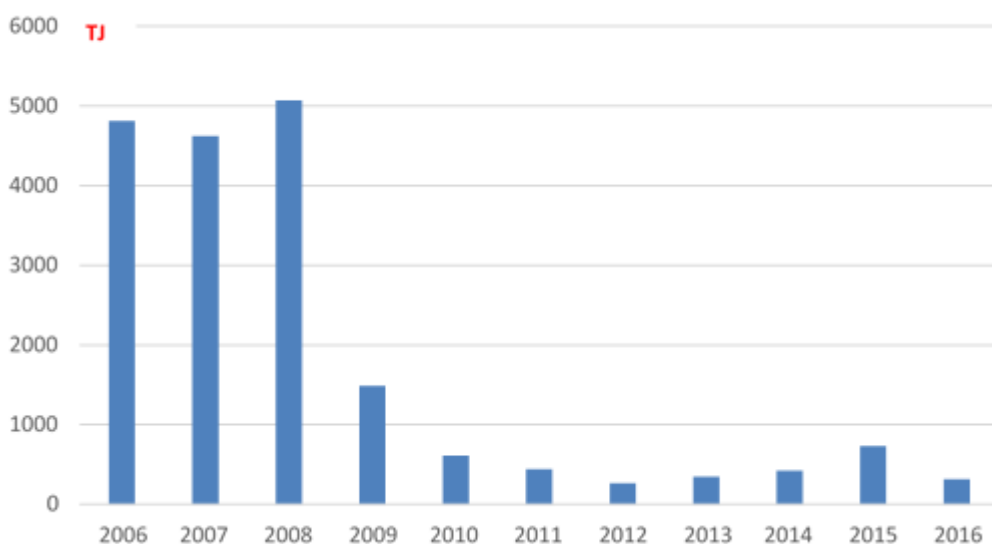
Historically, the Maui and (then) Vector transmission pipelines were operated as a single system, using Maui as the balancing gas source. Separate balancing of the Maui pipeline and Vector pipelines commenced with the introduction of Maui open access in 2005. With Vector initiating further separate balancing arrangements for its main transmission pipeline system, a previously single balancing 'pool' became four. This proved to be complex, and Vector subsequently ceased balancing arrangements on its pipelines in favour of Maui again becoming the balancing system. Consequently, balancing-related changes to the MPOC generally require parallel changes to the VTC. Improved efficiencies are expected to result from the current programme, led by First Gas, to develop a single code governing both pipeline systems.

Prior to 2009, balancing services were essentially free to holders of legacy Maui gas contracts, but following the expiry of these contracts in 2009 interconnected parties and gas Shippers became responsible for imbalances they create.

These changes incentivised transmission customers to self-balance, and the BGX, an online platform displaying pipeline balance conditions and enabling gas producers and wholesale gas consumers to post offers to buy and sell balancing gas, provided participants with better information on which to base their balancing decisions.

There was consequently a significant reduction in volumes of gas that needed to be purchased or sold to balance the Maui pipeline (Figure 28) from a high of 5,069TJ in 2008 to a low of 264TJ in 2012.

Figure 28: Balancing Gas Purchases and Sales



Source: Gas Industry Co Quarterly Report June 2016

Note: 2016 data available for first six months only

The move to MBB, with mandatory daily cash-out of excess imbalances has resulted in increased volumes of balancing gas. This may decline to some degree as Shippers become accustomed to the

¹⁹⁸ <http://gasindustry.co.nz/work-programmes/mpoc-change-requests/mpoc-change-request-october-2014-market-based-balancing/#change-request>

new regime and choose to self-balance. It is also possible that where balancing transactions occur at market prices it may be rational for some Shippers to accept the default balancing service provided by the pipeline owner. As this would represent a conscious commercial decision by the Shipper, the scale of balancing transactions under the new regime should not be seen, of itself, as an indicator of efficiency.

8.9 Interconnection with Transmission Pipelines

Open access effectively allows any party meeting prudential requirements of a transmission system owner to have gas transported through the system on posted terms and conditions. The Commerce Act 1986 allows access seekers, or the Commerce Commission, to take action against a pipeline owner that acts in an anti-competitive manner in respect to access.

Both the MPOC and VTC provide interconnection arrangements where it is necessary for a party wishing to inject or withdraw gas from the system to first construct a connection point.

First Gas allows parties to connect to the Maui pipeline if they meet the requirements of the MPOC, ensure there is no interference with the safe operation of the pipeline, and indemnify First Gas for loss arising from the installation of the welded point. These provisions do not appear in the VTC. Interconnection references relate mainly to the relationship between First Gas and parties who own, or wish to develop, facilities that interconnect with the First Gas pipelines. However, as with the Maui pipeline, interconnecting parties must satisfy minimum standards set by First Gas.

First Gas publishes technical, procedural and general requirements for new welded points for each system.

The arrangements have evolved as several new connections to the transmission systems since open access began have enabled the refinement of technical requirements and the development of more detailed interconnection processes.

In the past, problems had arisen with interconnections to both pipelines, including unscheduled delays, confusion over roles, perceived financial barriers, and unresolved complaints. These issues led to the development of guidelines¹⁹⁹, which set out principles, procedures, documentation requirements and dispute resolution procedures expected to be included in transmission system owners' interconnections policies.

The pipeline owners' arrangements generally align well with the guidelines, and new connections have been monitored and evaluated by the industry co-regulator against them. Recent evaluations have included two physical connections to First Gas North Island System pipelines, a physical connection to the Maui pipeline and two 'virtual' interconnections relating to the establishment of wholesale gas trading markets²⁰⁰.

The guidelines are designed for open access pipelines and do not apply to private pipelines.

8.10 Transmission Pipeline Integrity

New Zealand's main gas transmission systems cross some of the North Island's most rugged terrain and have a strong reliability record over their 35 to 45 years of operation. In that time, there have

¹⁹⁹ Gas Industry Co: *Guidelines on Interconnection with Transmission Pipelines*, November 2009

²⁰⁰ <http://gasindustry.co.nz/work-programmes/interconnection/latest-2014-review/>

been five significant outages, two of them caused by third party damage, one by severe flooding and two by landslips:

- The rupture of the Kapuni North pipeline at Pukearuhe on the North Taranaki coast in 1977, due to a slow moving landslide.
- The rupture of the Kapuni North pipeline near Inglewood, Taranaki, circa 1985, due to being struck by a mechanical digger.
- The rupture of the Kapuni South pipeline at Himatangi in the lower North Island in 2003, due to being struck by a bulldozer.
- The forced shutdown of the pipeline supplying Hawke's Bay in 2004, when a section of pipe became detached from a bridge at Awapuni that was swept away during severe flooding.
- The rupture of the Maui pipeline at Pukearuhe, near the 1977 Kapuni pipeline failure site, in 2011, due to a slow moving landslide.

The five-day Maui pipeline failure in October 2011, caused by a 95mm crack in the pipeline wall near a seam weld, resulted in an estimated gross economic loss of \$200 million²⁰¹ and demonstrated the extent of the industry's dependence on this pipeline. Curtailment instructions were initially issued to all gas consumers, excluding households, but including essential service providers.

Reduced supply was managed by use of line pack, curtailment, and reconfiguring the smaller adjacent First Gas 200mm pipeline which was unaffected. Small commercial and industrial consumers were progressively allowed to resume careful use of gas as the supply position stabilised and as progress was made on the pipeline repair and recommissioning.

The 2011 Maui pipeline outage provided the principal case of a Gas Disruption Study²⁰² commissioned by MBIE to examine the likely consequences of a major gas disruption event and the risk management approaches to reducing economic losses. In summary, it finds there is a high degree of resilience and that existing industry standards and market structures pose no undue threat to security of supply.

However, it is recognised that the gas transmission pipelines traverse narrow, erosion-prone coastal terraces in North Taranaki, where erosion rates of around a metre a year in some areas are reported. It is an area that has seen a number of mitigation measures to protect the pipelines that deliver gas to the northern and eastern regions of the upper North Island.

In 2005 Vector completed the replacement and relocation inland of a 1.2 km section of the Kapuni-Auckland pipeline, which had become exposed to coastal erosion²⁰³. Around the same time, another length of the Kapuni-Auckland pipeline was re-laid inland when it came under threat from accelerating erosion caused by the partial collapse of a protective headland in an area known as Twin Creeks²⁰⁴.

In addressing broader coastal erosion issues in the area, the Taranaki Regional Council sought to work collaboratively with the pipelines' operator (then Vector) with respect to erosion and gas pipelines in

²⁰¹ MBIE: [Review of the Maui Pipeline Outage of October 2011](#), October 2012

²⁰² Worley Parsons: [Gas Disruption Study – Report on the Potential Impacts on the NZ Gas Market](#), January 2014.

²⁰³ Vector Annual Report 2006

²⁰⁴ Taranaki Regional Council, *Coastal Erosion Information, Inventory and Recommendations for State of Environment Monitoring*, November 2009.

the Twin Creeks area. In 2011, the Taranaki Regional Council issued a resource consent for the relocation of a 2km section of both pipelines just south of the Tongaporutu River²⁰⁵.

The landslide damage to the Kapuni pipeline in 1977 occurred while the Maui pipeline was being built. Construction of the Maui line was suspended and the route redesigned to clear the landslide zone. Investigations into the October 2011 Maui pipeline outage, however, established that 25 metres of the pipeline was within the edge of the landslide. It was unclear to investigators whether the landslide zone had since increased, or its exact extent was not fully understood in 1977²⁰⁶. The investigations concluded the gas leak was caused by a section of the pipeline failing due to a sudden overload caused by a landslide. Metallurgical investigations found that no property, defect or flaw in the pipe itself contributed to the failure.

The section of pipeline has been stabilised through a range of measures and a programme established to implement longer-term solutions for the pipeline in the area. Prior to the Maui pipeline sale to First Gas, MDL earmarked \$41.7 million for this work over four years from 2015-2019²⁰⁷.

The first Gas Transmission Asset Management Plan issued by Vector under the new information disclosure regime reports at least two remedial projects at river crossings following flood events or loss of cover through scouring of the river bed in river and stream crossings²⁰⁸.

In particular, it notes active erosion on parts of the coastline adjacent to the Whitecliffs walkway at Tongaporutu, in North Taranaki, has been occurring for a number of years and poses a risk to the ongoing integrity of the 200mm line.

Vector investigated various options to mitigate risk to the affected section of the 200mm pipeline, including relocating about 2.5km to a new alignment at a cost of approximately \$23 million, or isolating and abandoning that section, with or without interconnecting to the Maui pipeline at locations either side of the erosion zones.

Gas pipelines, like other infrastructure facilities, are subject to planned and unplanned²⁰⁹ incidents²¹⁰ and interruptions²¹¹ from time to time. Often these are rectified quickly and pass unnoticed by the industry participants and consumers.

In April 2016, Gas Industry Co, released for consultation an issues paper on transmission security and reliability²¹². The initiative recognises that while the New Zealand gas supply system has a high degree of resilience, and that existing industry operating standards and market structures pose no undue threat to security of supply, it is four years since the last significant interruption to transmission services. Since then the introduction of the price-quality regime and associated Information disclosure requirements under the Commerce Act have improved transparency and understanding of transmission

²⁰⁵ Reported: Taranaki Daily News, 29 October 2011

²⁰⁶ Vector: *2011 Maui Pipeline Failure Technical Investigation Report*, April 2012.

²⁰⁷ MDL Asset Management Plan December 2014

²⁰⁸ Vector Transmission Asset Management Plan Section 6.3.4

²⁰⁹ 'Unplanned interruptions' are defined as '... any interruption in respect of which less than 10 days' notice, or no notice, was given, either to the public or to all consumers affected by the interruption.'

²¹⁰ 'Incidents' are defined as '...any event, including a near miss, that has the potential to impact on the delivery of gas transmission services or operations' All potentially relevant events are recorded by Gas Control and range from an unplanned shutdown of a large production station, to failure to start a compressor, and a vehicle access gate being left open.

²¹¹ 'Interruptions' are defined as '...the cessation of supply of gas for a period of one minute or longer'.

²¹² Gas Industry Co: [Gas transmission Security and Reliability Issues Paper, April 2016](#)

security and reliability. However, information about security and reliability can be difficult to bring together and interpret and 'it is timely to review the new landscape'.

In statutory disclosures for the past year (prior to the pipeline systems sales to First Gas), MDL reported²¹³ 72 (previous year: 51) potentially relevant events – or 'incidents' –and Vector reported²¹⁴ 123 (previous year: 122).

Included in the total events were 55 'curtailments' resulting in reductions in scheduled gas transmissions on the Maui system (previous year: 18), and 34 (previous year: 32) on the Vector system. All were caused by third parties.

MDL also recorded 9 events (previous year: 10) in which a compressor unit failed to start.

Vector commented that of the 123 incidents reported, 56 were station equipment and product control-related, 33 involved unauthorised work over the pipeline, and 34 were curtailments. The curtailment events resulted from 'Gas balancing effects on the Vector system from the Maui pipeline. These were due to third parties on the Maui system (typically production station trips and unplanned outages)'.

Table 15 sets out transmission system events in the latest reporting year and Table 16 sets out causes.

Table 15: Transmission System Integrity – Events (2015)

	Incidents	Planned Interruptions	Unplanned Interruptions		Curtailments	Interruptions/ 100km of pipeline	Emergencies
			Number	Hours			
Maui ¹	72	-	-	-	55	17.8219	-
First Gas ²	123	-	-	-	34	1.5378	-

Information provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012

¹ Year ended 31 December 2014

² Year ended 30 June 2015

Table 16: Transmission System Integrity – Incident Causes (2015)

	Interruptions - Third Party	Interruptions - Equipment Failure	Pressure-Related	Gas Specification-Related	Odourisation-Related	Gas Leaks
Maui ¹	55	-	-	-	-	-
First Gas ²	34	-	13	14	1	10

Information provided pursuant to the Commerce Commission Gas Transmission Information Disclosure Determination 2012

¹ Year ended 31 December 2014

² Year ended 30 June 2015

8.11 Critical Contingency Management

Critical gas supply emergencies are managed under the Gas Governance (Critical Contingency Management) Regulations 2008 (CCM Regulations)²¹⁵, which replaced a voluntary industry arrangement, the National Gas Outage Contingency Plan (NGOCP).

²¹³ <http://firstgas.co.nz/about-us/regulatory/regulatory-disclosures/>

²¹⁴ Vector GTB Information Disclosure Schedules 1-10, year ended 30 June 2015

²¹⁵ www.legislation.govt.nz/regulation/public/2008/0426/latest/DLM1683495.html

The CCM Regulations were introduced in light of the growing complexity of the gas industry and the need for greater certainty around the industry's response, including demand curtailment, during a serious supply disruption. They were also the result of a request to Gas Industry Co by industry participants to review the NGOCP arrangements due to:

- a general view among participants that the arrangements were no longer appropriate.
- the absence of a contingency pricing regime in respect of non-compliance and/or gas supply imbalances during gas outage and contingency situations.
- the lack of certainty in voluntary arrangements, as evidenced by a large participant withdrawing from the arrangements and committing only to 'acting reasonably and responsibly' during gas contingencies²¹⁶.

The purpose of the CCM Regulations is to 'achieve the effective management of critical gas outages and other security of supply contingencies without compromising long-term security of supply.' They provide for the appointment of a Critical Contingency Operator²¹⁷ (CCO), which is responsible for determining, managing, and terminating critical contingencies, as well as associated activities, such as training and exercises.

The Maui pipeline failure in October 2011 was the first substantial test of the CCM Regulations, although they have been triggered briefly on three other occasions. The regulations have generally proved to be effective, and improvements highlighted by the contingency events have been implemented, including through amendments to the CCM Regulations²¹⁸ that took effect on 1 March 2014. Major changes included:

- clarifying and tightening criteria for eligibility for an Essential Services designation.
- a new, highest priority Critical Care designation.
- a new Electricity Supply designation.
- adjusting and broadening the criteria for Critical Processing designations.
- Gas Industry Co takes responsibility from retailers for processing and determining special designation applications.
- Expanded public communications responsibilities for affected asset owners and the CCO.

8.12 Regulatory Performance

Government policy objectives for gas transmission are focused primarily on access, efficiency, pricing, investment, and security of supply. Until recently, the existing transmission arrangements largely fulfilled these objectives. However, industry events and market changes have recently prompted a review of some aspects of current arrangements to ensure their ongoing effectiveness and relevance.

²¹⁶ Gas Industry Co: *Statement of Proposal – Gas Outage and Contingency Management Arrangements*, August 2007.

²¹⁷ Core Group, New Plymouth - <http://www.cco.org.nz/>

²¹⁸ Gas Industry Co - *Recommendation to the Minister of Energy and Resources to amend the Gas Governance (Critical Contingency Management) Regulations 2008*, July 2013

The industry has identified areas requiring improvement and, in keeping with a policy preference for industry-led, non-regulated solutions ahead of regulatory intervention where possible, it has initiated programmes to achieve stronger policy alignment. The primary areas of attention have been:

- Improving transmission access and pricing, including, efficient infrastructure use and competitive activity through development of a single code for the currently separate Maui pipeline and First Gas North Island System.
- improving transmission balancing arrangements.
- implementing refinements to critical contingency management processes.

Gas transmission policy objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> • Gas industry participants and new entrants are able to access transmission pipelines and related services on reasonable terms and conditions. • Barriers to competition are minimised. • Energy and other resources used to deliver gas to consumers are used efficiently. 	<p>The open access arrangements on the two major transmission systems provide non-discriminatory access to transmission infrastructure. They are generally operating satisfactorily. Improvements to access and pricing arrangements are being progressed in the light of capacity constraints on the North Pipeline in 2009, notwithstanding that these have since been alleviated to a degree. Progress towards a single code governing both transmission pipeline systems is being made under the single ownership of First Gas.</p> <p>The introduction of Interconnection Guidelines, prompting transmission system owners to formalise their policies and processes for interconnection, has largely resolved problems previously encountered by parties wishing to connect to transmission pipelines. While there should no longer be difficulties for parties in understanding the interconnection process and documentation, new interconnections have been monitored to see if any further improvements are necessary. Assessments of both physical and 'virtual' interconnections to the transmission pipelines conclude that arrangements are closely aligned with Interconnections Guidelines.</p> <p>The Interconnection Guidelines do not apply to private pipelines. An information sharing protocol exists between regulators, and any access issues arising on private pipelines will be reviewed.</p>
<ul style="list-style-type: none"> • Incentives for investment in gas transmission is maintained or enhanced. • The full costs of producing and transporting gas are signalled to consumers. • Delivered gas costs and prices are subject to sustained downward pressure. 	<p>Laying a pathway for efficient future investment in new transmission capacity was an integral component of the programme developed to address the North Pipeline capacity access and pricing issues that arose in 2009.</p> <p>Objectives of Part 4 of the Commerce Act also include that there are incentives for efficient investment. Previous transmission system owners had voiced concerns about the effects of economic regulation of their business, and their willingness to invest.</p> <p>A new market-based balancing regime introduced in October 2015 is expected to improve transmission balancing arrangements compared with the previous arrangements. A review of its first full-year of operation found it to be working satisfactorily, although some improvements have been identified.</p> <p>Gas transmission pricing is subject to a price-quality regime administered by the Commerce Commission.</p>

Gas transmission policy objectives (Gas Act & GPS)	Performance status
	Establishing price signals at times of constrained capacity has been part of industry attention to improved capacity and access and pricing arrangements for transmission pipelines and is part of the code convergence deliberations.
<ul style="list-style-type: none"> Risks relating to security of supply are properly and efficiently managed by all parties. Sound arrangements for the management of critical gas contingencies. 	<p>The introduction of the CCM Regulations, replacing an industry code, significantly improved the industry's arrangements for responding to serious supply emergencies.</p> <p>The Maui pipeline outage in 2011 proved the CCM Regulations to be generally effective, and identified improvements have been addressed through changes to the CCM Regulations in March 2014.</p>
<ul style="list-style-type: none"> Accurate, efficient and timely arrangements for the allocation and reconciliation of upstream gas quantities. 	Gas Industry Co published <i>Gas Reconciliation Requirements and Procedures</i> ²¹⁹ , explaining how physical flows and commercial transactions in the gas supply chain are reconciled and energy quantities used in each commercial transaction are derived. That document will be updated in the future to reflect a unified set of arrangements following transmission code convergence.

8.13 International Transmission Market Practices

Transmission access arrangements in New Zealand are to a degree in step with those of other jurisdictions. A comparison of international practices, however, requires caution, as each gas market has evolved in its own unique environment, influenced by supply/demand characteristics, ownership arrangements, political imperatives, and geography. There is no 'off the shelf' solution that works in all circumstances.

Transmission market trends internationally are towards open access, the structural separation of transmission systems, transparency, and private ownership. Regulatory roles are clearly defined, and regulatory objectives centre on efficiency and competition.

New Zealand's policy objectives for gas transmission are largely consistent with those overseas, especially around open access, efficiency and competition. A number of overseas market practices, aimed at achieving these objectives, are currently not found in the New Zealand context and are being addressed by the industry. They include:

- market mechanisms for allocating scarce transmission capacity.
- a secondary market for capacity trading.
- transparency of capacity reservations, gas flows, and contract information.
- use of interruptible contracts.

In the United States, gas transmission operations are characterised by private ownership, with common interstate regulation following the formation of the Federal Energy Regulatory Commission (FERC) in 1930. The structural separation of gas transmission from other gas market interests began in 1992, and was completed in 2000.

²¹⁹ <http://gasindustry.co.nz/about-the-industry/requirements-and-procedures-documents/>

A critical element of the competitive pipeline market in the United States is the free and transparent flow of information. A FERC order²²⁰ requiring full transparency was issued in 2000. The disclosure of transactional information includes the shipper's identity as, in FERC's determination, other shippers would not otherwise be able to assess whether they are similarly situated to the transacting shipper for the purposes of revealing undue discrimination or preference.

Interstate services for natural gas must be unbundled, although many companies provide retailing and marketing services via legally separate entities. Transmission services are provided on an open access basis, with pricing for interstate services being set by FERC. Capacity is sold under long-term contracts specifying receipt and delivery points for the capacity in question. Pipeline owners require that a shipper's total injections at a receipt point equal total offtakes at the delivery point specified (that is, they are balanced).

Capacity on the system can be purchased on an interruptible or firm basis. Firm has the highest priority in terms of transmission rights for specified receipt and delivery points and contracts typically are for periods of 10 to 20 years. The differentiation between interruptible and firm helps the system operators to manage capacity where constraints occur.

In the EU, regulations cover individual countries and the EU collectively. Non-discriminatory third party access to gas transmission systems has been mandated by the EU since 2003. There is a mix of public and private ownership of transmission infrastructure, with vertical structural separation of ownership. Carriage regimes vary, but tend towards entry-exit²²¹.

The Council of European Energy Regulators (CEER) has defined a 'Target Model' for the European gas market. The market consists of interconnected entry-exit zones with virtual hubs, allowing shippers to freely trade gas within each entry-exit zone.

The EU also has a strong focus on system planning and development. Transmission operators draw up a 10-year network development plan each year, and regional investment plans every two years. The European Network of Transmission System Operators for Gas (ENTSO-G) prepares a 10-year network development plan for the entire EU every two years, and this is reviewed by the Agency for the Cooperation of Energy Regulators (ACER).

Transmission pipelines have been under private ownership in the UK since the floating of Government-owned British Gas in 1986. Vertical separation of transmission system owners commenced in the same year and was completed in 1990.

Fully connected to the EU, the UK operates an entry-exit regime, with a capacity auctioning mechanism governed by a 2001 Network Code.

Private ownership is also a strong feature of the Australian transmission sector. Apart from Victoria, which has a 'market carriage' regime²²², access is via contract carriage arrangements.

Pipelines in Australia – transmission and distribution – are governed under a single regulatory and operational regime introduced in 2008 by the National Gas Law and National Gas Rules. The Australian

²²⁰ FERC Order 637

²²¹ An entry/exit regime is one where capacity can be booked at both entry and exit points. Gas enters the system at any entry point and leaves the system at any exit point, at prices independent of distance of transport, and with no need to define a flow route.

²²² Under the Victorian market carriage regime, transmission system users are not required to enter contracts. Instead, a party's daily gas flow is determined by its bids into the wholesale gas market. The bids are despatched according to price, with the lowest bids clearing first. Pipeline charges are then based on actual gas flows following the dispatch process.

Energy Regulator (AER) regulates pipelines in jurisdictions other than Western Australia, where the regulator is the Economic Regulation Authority²²³.

Transmission and distribution pipelines can be 'covered' and subject to full or light regulation, or not regulated. The full regulation process employs a building block approach, including a return on capital, in which the regulator determines total network revenues and reference tariffs. Under light regulation, there is no upfront price regulation, but pipeline owners must publish access prices and other term and conditions.

Of the 25 major gas transmission pipelines in Australia – totalling 15,264km – seven (representing 7,411km) are 'covered'. Of these, four are subject to full regulation, two to light regulation and one to 'partial, light'. In 2014 regulatory coverage of the small (47km) Dawson Valley pipeline in Queensland was revoked by the Federal Minister for Industry, who was not satisfied that access to the pipeline would promote a material increase in competition in upstream or downstream markets.

²²³ Regulatory oversight was transferred from state and territory agencies in July 2008.

9 Gas Distribution

The gas distribution market is well established, with four open network services providers, and one non-open access network owner. No efficiency or competition issues have been identified around open access gas distribution networks.

The networks were founded in the early days of local manufactured gas operations, or constructed as new towns and cities became serviced with natural gas following the development of the Kapuni and Maui fields. Distributors have continued to invest in network expansion. However, there is more pipe in the ground, increasing consumer connections, and the market is seeing improved throughput following a period of relatively static volumes.

The distribution networks generally operate to a high level of reliability and a formal downstream gas reconciliation regime is providing an efficient process for allocating to retailers the portion of gas on a distribution network used by their customers. Levels of unaccounted-for gas have declined substantially.

9.1 Background

Gas distribution networks were originally developed to transport gas to local consumers from coal-based manufactured gas plants that were established in most major New Zealand towns and cities in the late 19th Century. With the demise of town gas plants and the advent of natural gas from the Kapuni field in 1970, gas networks gradually became confined to the North Island²²⁴. New networks were established during the 1980s as the substantial transmission system expansion at that time opened previously unserved regions to natural gas, particularly in Northland, East Cape, the Bay of Plenty, Waikato, Manawatu and Hawke's Bay.

Odourised high pressure gas passes from the transmission system into the local area gas distribution networks via gate stations, where the pressure is reduced for reticulation to commercial businesses, offices, community facilities, such as hospitals and swimming pools, and to households.

Distribution networks generally comprise intermediate, medium and low pressure pipelines. The intermediate and medium pressure mains form the backbone of the network, supplying larger users, and feeding into lower pressure pipes supplying smaller-volume end-users. Distributors use regulator stations within their networks to further adjust pressure for delivery to end-users. Distribution networks terminate at the various gas measurement systems (GMS) located at end-user premises. The GMS owner may be a distributor, a retailer or another party.

The networks may be open access providing non-discriminatory transport and interconnection to all suppliers or retailers, or private bypass pipelines, where the pipes are laid parallel with, or as an extension of, open access networks. Private pipelines are not available for access by other parties and are typically owned and operated by, and for the exclusive benefit of, the party that owns all gas transported on the system.

²²⁴ In the past decade localised reticulated LPG networks have been established in a number of South Island centres.

Distribution networks typically have economies of scale - where average costs reduce as throughput increases - and scope, where providing a combination of services is less expensive than supplying them individually. Other characteristics include:

- gas distribution has a high proportion of shared inputs, as gas is supplied through a single pipeline for multiple suppliers and end-users.
- there are many low volume users.
- investments in gas distribution are largely 'sunk', in that they have no alternative uses.
- the assets are long-lived, as much as 80 years.

9.2 Current State of the Distribution Market

There are five gas distribution companies in New Zealand. Four own and operate open access networks:

- Vector, which has consolidated its gas networks ownership in the greater Auckland area.
- First Gas, which entered the gas distribution market on 20 April 2016 with the purchase of Vector's non-Auckland gas networks. It owns gas networks in Northland, Waikato, Bay of Plenty, Gisborne and Kapiti.
- Powerco, which owns and operates five networks in the lower half of the North Island.
- GasNet, a subsidiary of Wanganui Gas, which covers the Wanganui and Rangitikei regions.

The fifth distributor, Nova Energy, part of the Todd Corporation, owns smaller networks that bypass existing networks.

In the electricity industry, the separation of lines and retail businesses was enforced with the electricity sector reforms of 1999²²⁵. Although there was no similar requirement for gas industry participants, there has been a natural and voluntary drift away from common ownership of gas retail and network operations since the exclusive area franchise model was abandoned as part of the industry's deregulation in 1992.

Vector retains a relatively small number of larger customers through its subsidiary Ongas, after NGC (which it acquired in 2005) exited mass market retailing in 2001. Powerco, formerly also a retailer, is now solely a network company, and Wanganui Gas structurally separated its retail and network businesses in 2008 and subsequently sold its retail business, Energy Direct NZ, to Trustpower in 2013.

For the purposes of competition law, the Commerce Commission sees the networks as separate regional markets, and therefore views each as a natural monopoly. Against this backdrop, Nova Energy has constructed bypass networks to deliver natural gas directly to its customers. This began by tapping and piping landfill gas in the Wellington and Porirua areas and, following acquisition by the Todd Corporation, extended to include bypass networks in Hutt Valley, Hastings, Hawera, Papakura, East Tamaki and Manakau City.

²²⁵ The 'Bradford Reforms', introduced by the then Minister of Energy, Hon Max Bradford.

Distribution pipeline owners primarily contract, in the form of Network Service Agreements (also called Use of System Agreements – UoSA), with gas retailers to provide distribution services to end-users, and in some cases have direct contractual relationships with larger consumers.

In support of the provision of non-discriminatory transport and interconnection, open access distributors contribute to various associated processes, including customer switching, gas reconciliation, the reduction of unaccounted-for gas (UFG) through leak surveys and repairs, and disconnections and reconnections.

Periodic reviews of distribution arrangements have found the open access arrangements for distribution networks are well understood and practiced by system users. An assessment²²⁶ found no access issues relating to open access networks.

Concerns were raised, however, about the quality of contractual arrangements between distributors and retailers. These related particularly to slowness on the part of distributors to update their contracts with retailers to reflect changing roles and responsibilities of parties, as well as provisions of new gas safety rules introduced in 2010²²⁷. This led to the development of a set of industry-agreed contract principles under a Gas Distribution Contracts Oversight Scheme (Distribution Scheme), introduced in 2012, and which includes an assessment regime by independent assessors²²⁸. In this regard, it is similar to a Retail Gas Contracts Oversight Scheme (Retail Scheme) introduced in 2010, with the exception that the Distribution Scheme recognises that, as commercial entities, parties to distribution arrangements are better able to represent their interests than residential consumers.

The first assessment under the Distribution Scheme, in March 2013, resulted in 'nil' alignment with the principles as distributors at that stage had not published their new contract arrangements. However, the Independent Assessor rated the distributors' then 'draft' contracts as having 'moderate' alignment. New contracts had been published by the second assessment in March 2014, which found alignment had improved to 'substantial'.

The lack of access to private networks has been of concern for some retailers, and an issue regarding access to private transmission pipelines was raised in 2010 by the Minister of Energy and Resources. A review concluded that private pipeline owners were outside the provisions of the voluntary Transmission Interconnection Guidelines, which were designed for open access systems.

Efficiency issues arising from the lack of access to a private pipeline are considered to be minor where it runs in parallel to an open access network, and where it has provided end-users with a choice they previously did not have. In the absence of evidence that private pipeline owners hold market power, or have abused any power, there is no move to regulate them²²⁹.

There is nonetheless recognition that significant issues can arise where there is no parallel open access network and the private network is the only means of supplying end-users, or where end-users cannot easily change from the private network to the open access network. Regulatory agencies are sharing any information on private pipeline access concerns or disputes and will review any issues that arise.

²²⁶ Gas Industry Co: *Gas Governance Issues in Distribution: Issues Paper*, 7 September 2010.

²²⁷ Gas (Safety and Measurement) Regulations 2010.

²²⁸ <http://gasindustry.co.nz/work-programmes/gas-distribution-contracts-oversight-scheme/overview/>

²²⁹ Gas Industry Co: *Interconnection to Private Transmission Pipelines: Advice to the Associate Minister of Energy and Resources*, May 2010.

In an adjudication²³⁰ on alleged breaches of the Reconciliation Rules and Switching Rules by Nova Energy with respect to its bypass network – and a challenge by Nova as to whether its private pipelines made it a ‘gas distributor’ as defined by the Gas Act, and therefore not subject to these Rules – the Rulings Panel found that Nova was not a gas distributor in terms of the definition. However, the Rulings Panel recommended that the regulator urgently consider a legislative amendment to bring the closed bypass network within the definition of ‘gas distributor’ so that the relevant regulations applied to it. This was effected with a change to the Gas Act in 2012.

9.3 Gas Distribution Market in New Zealand

Figure 29 shows the geographical location of distribution networks in the North Island.

²³⁰ Rulings Panel Decision 18 May 2010 available at <http://gasindustry.co.nz>

Figure 29: Gas Distribution Networks

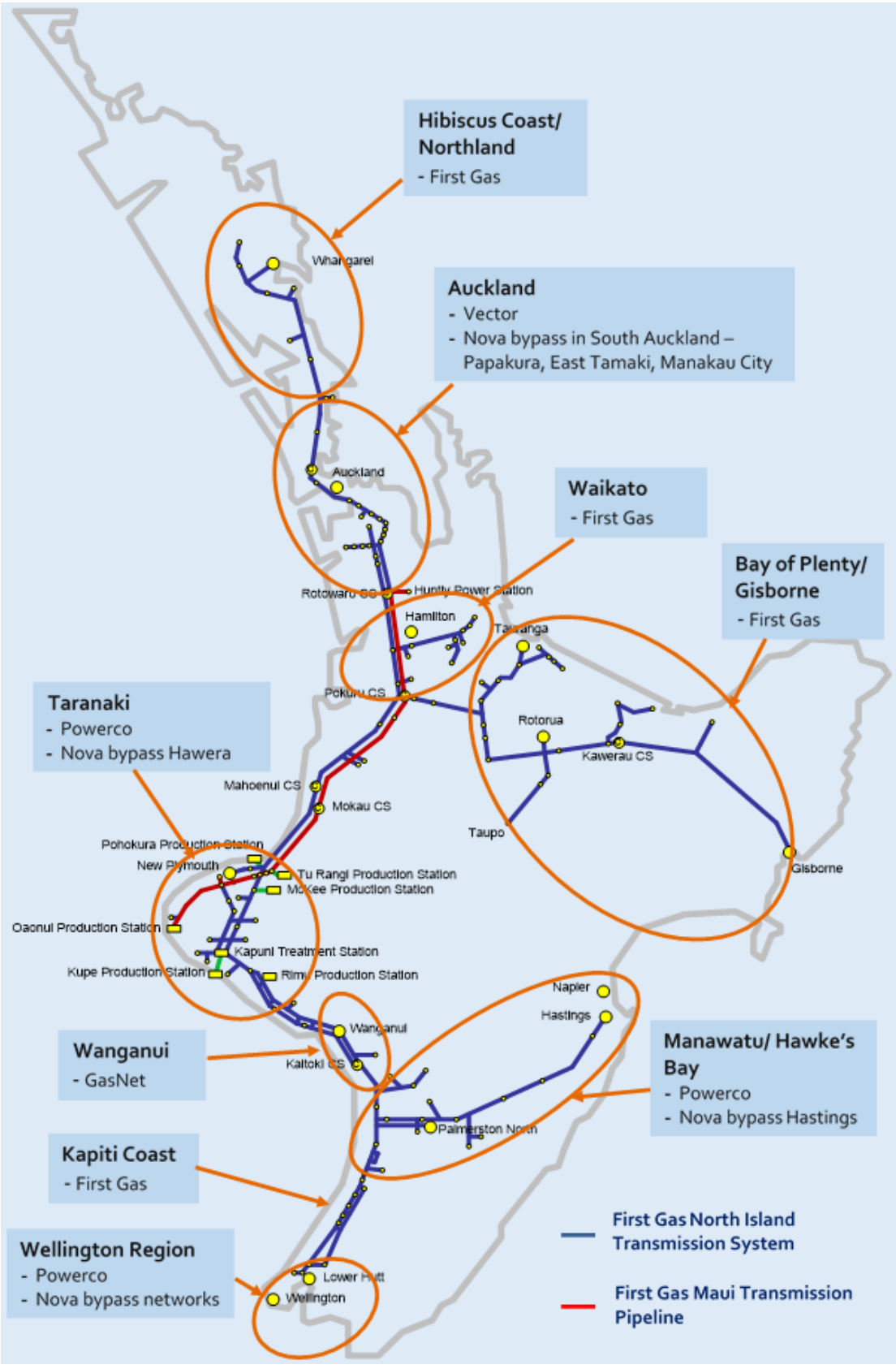


Table 17: Gas Distributors – Physical Characteristics (2015)

Distributor	Network Length (km)	Region	Connections	Proportion of Connections (%)	Density (customers /km)
Vector ¹					
- Auckland	5,900	Greater Auckland,	97,278	35.0	16.5
- Non Auckland	4,870	Northland, Waikato, Bay of Plenty (including Rotorua, Taupo), Gisborne, Kapiti	65,965	23.7	13.5
Powerco	6,315 ²	Greater Wellington, Hawke's Bay, Manawatu, Horowhenua, Taranaki	104,380	37.6	16.5
Gasnet	659	Wanganui, Rangitikei	9,887	3.6	15.0
Nova	100 ³	Wellington, Porirua, Hutt Valley, Hastings, Hawera, Papakura, Manukau City	222	0.1	Not known
Total	17,744⁴		277,732	100	15.6

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ Vector sold its non-Auckland networks to First Gas on 20 April 2016.

² Comprises 5,738km of 'active' pipes and approximately 500km of inactive pipe, which does not currently convey gas.

³ Nova Energy is not subject to the statutory information disclosure requirements. It has populated the Gas Registry with information on connections to its private networks since October 2013 following a change to the Gas Act to bring Nova's networks within the definition of 'gas distributor' (see **Page 117**). Nova does not otherwise publish information about its networks. The Commerce Commission Gas Control Inquiry, Final Report, November 2004, records the length of Nova's Distribution network as 100km as at 30 June 2003.

⁴ Total of open access networks only. Excludes Nova.

Table 18: Gas Distributors – Operational Characteristics (2015)

Distributor	Total gas conveyed (GJ)	Share of gas conveyed (%)	Load factor ¹ (%)	Maximum monthly gas entering system (GJ)
Vector				
- Auckland	12,590,616	36.8	78.2	1,341,216
- Non Auckland	10,197,752	29.9	82.3	1,032,184
Powerco	9,136,409	26.7	72.6	1,048,920
Gasnet	1,124,135	3.3	84.7	110,559
Nova ²	1,125,750	3.3	Not known	Not known
Total	34,174,662	100	(average) 79.4	3,532,879

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012

¹ Load Factor is calculated as the annual amount of gas entering a distribution system against the annualised maximum monthly amount of gas entering the system.

² Nova Energy is not subject to the statutory information disclosure. Nova volume derived from information publicly available on OATIS.

Network Development

Table 19 sets out reported network lengths in the five years to 2015. It shows that distributors have continued to invest in network expansion, notwithstanding concerns about price control. The total length of open access natural gas distribution networks expanded by 929km to 17,744km during the five-year period. At 30 June 2015²³¹, they had a combined Regulatory Asset Base value of \$868 million.

²³¹ In 2012 Powerco changed its statutory balance date from 30 June to 31 March.

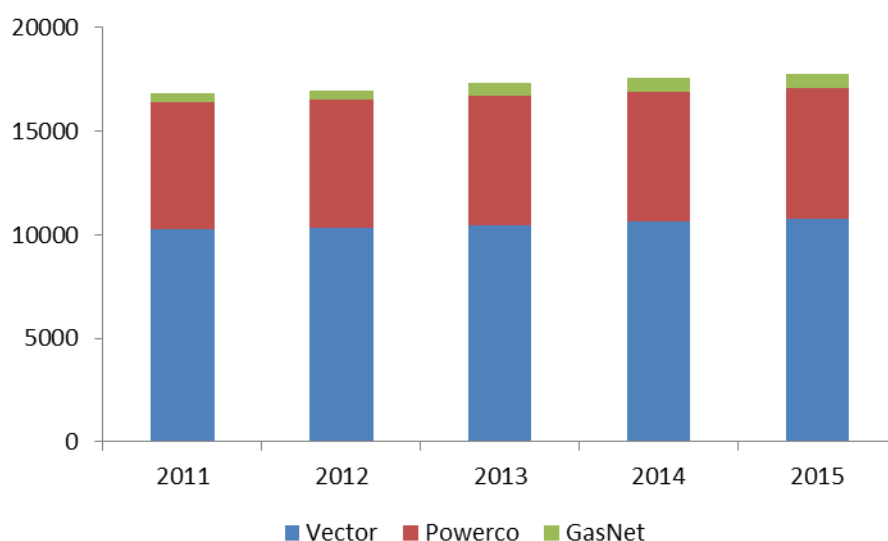
Table 19: Network length (km) 2011-2015

Distributor	2011	2012	2013	2014	2015
Vector	10,252	10,326	10,479	10,623	10,770 ¹
Powerco	6,177	6,216	6,218	6,279	6,315
GasNet	387	388	645 ²	657	659
Total	16,816	16,930	17,342	17,559	17,744

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997. From 2013, information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ Includes 4,870km of non-Auckland networks sold by Vector to First Gas on 20 April 2016

² Figures from 2013 include services; previous years exclude services.

Figure 30: Network Length (km) 2011-2015

Note: GasNet figures from 2013 include services

Connections and Throughput

The number of reported gas distribution network connections increased by 13,793, to 277,732 in the past five years (Table 20) reflecting particularly growth in the expanding Auckland region. Connections growth in other regions has been at more moderate levels.

In 2015, gas conveyed through the distribution networks increased for the second successive year following a period of static volumes, when they fluctuated in a range of 32.4PJ and 33.1PJ (Table 21).

Table 20: Distribution Connections 2011-2015

Distributor	2011	2012	2013	2014	2015
Vector	151,104	153,585	156,952	159,738	163,243 ¹
Powerco	102,482	102,696	102,794	103,358	104,380
GasNet	10,353	10,338	10,229	10,216	9,887
Nova	Not known	Not known	216 ²	219	222
Total	263,939	266,619	270,190	273,531	277,732

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997. From 2013, information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ Includes 65,965 connections to non-Auckland networks sold by Vector to First Gas on 20 April 2016.

² Nova Energy is not subject to the statutory information disclosure requirements. It has populated the Gas Registry with information on connections to its private networks since October 2013 following a change to the Gas Act to bring Nova's networks within the definition of 'gas distributor' (see **Page 117**). Nova does not otherwise publish information about its networks.

Figure 31: Distribution Connections 2011-2015

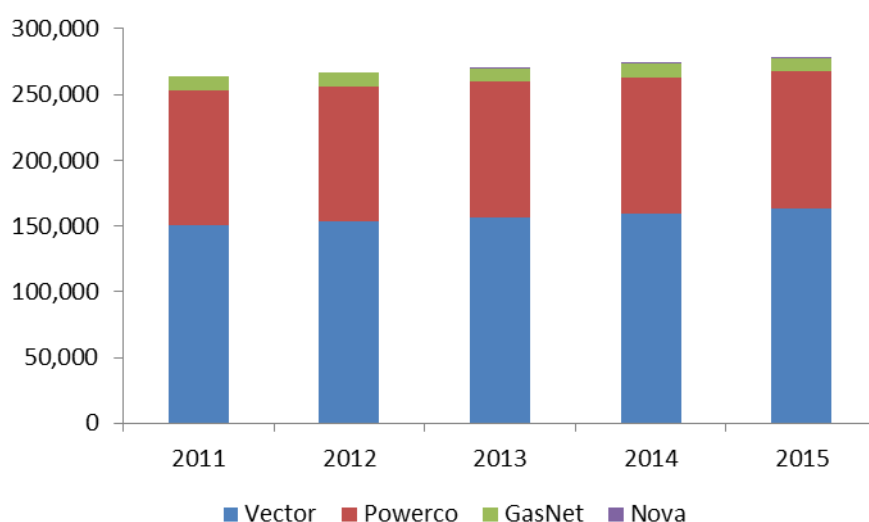


Table 21: Gas Conveyed (GJ) 2011-2015

Distributor	2011	2012	2013	2014	2015
Vector					
Own retail	6,846,374	6,183,747	5,941,120	6,244,000	6,228,368 ¹
Other parties	14,286,380	15,814,139	15,648,000	15,690,671	16,560,000 ²
Total	21,132,754	21,997,886	21,589,120	21,934,671	22,788,368
Powerco					
Own retail ³	--	--	--	--	--
Other parties	8,887,622	9,067,142	8,762,903	8,942,366	9,136,409
Total	8,887,622	9,067,142	8,762,903	8,942,366	9,136,409
GasNet					
Own retail ⁴	222,735	252,204	--	--	---
Other parties	952,133	922,857	1,150,413	1,106,607	1,124,135
Total	1,174,868	1,175,061	1,150,413	1,106,607	1,124,135
Nova					
Own retail ⁵	1,279,820	1,212,937	1,033,256	1,106,451	1,125,750
Other parties	-	-	-	--	---
Total	1,279,820	1,212,937	1,033,256	1,106,451	1,125,750
Total	32,475,064	33,453,026	32,535,692	33,090,095	34,174,662

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997. From 2013, information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ 'Other Parties' are 'persons not in a prescribed business relationship'.

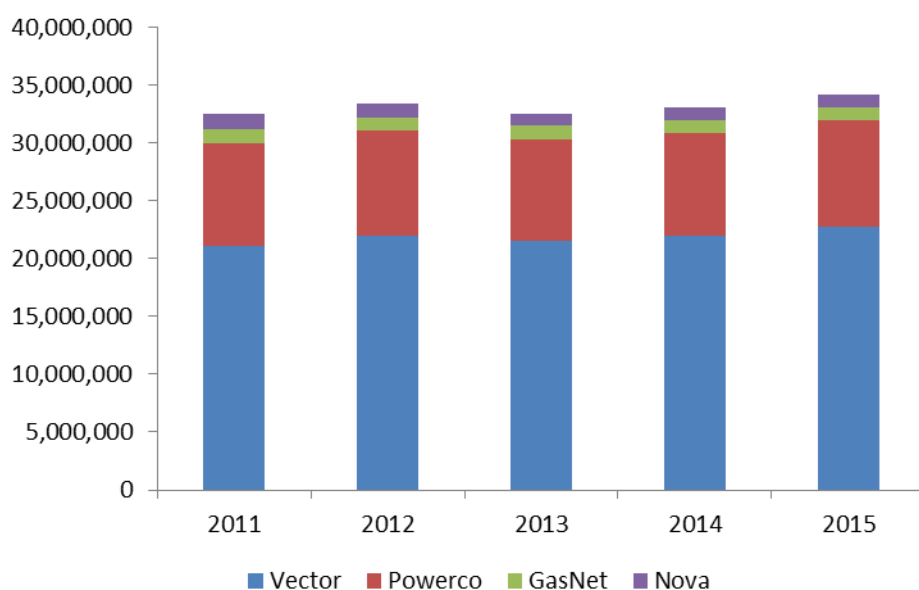
² Includes 4,232,752GJ of own retail gas conveyed on non-Auckland networks sold by Vector to First Gas on 20 April 2016.

³ Includes 5,965,000GJ of gas conveyed for other parties on non-Auckland networks sold by Vector to First Gas on 20 April 2016.

⁴ Powerco does not retail gas.

⁵ GasNet Limited is owned by Wanganui District Council, which also owned the gas retailer Energy Direct until its sale to Trustpower in 2013.

⁶ Nova Energy is not subject to the statutory information disclosure. Nova volume derived from information publicly available on OATIS.

Figure 32: Total Gas Conveyed (GJ) 2011-2015

Costs

The basis for reporting open access network costs has changed with the move to the new Information Disclosure regime in 2013. Recent past cost trends, reflecting the former Information Disclosure requirements, are included in **Appendix A, Page 201**. Table 22, Table 23 and Table 24 set out the operational and capital expenditure, and revenue metrics reported by distribution businesses in 2015.

Table 22: Network Operational Expenditure (2015)

Distributor	Total \$m	Expenditure/ Gas Delivered \$/TJ	Expenditure/ Average ICPs \$/ICP	Expenditure/ km Pipeline \$/km
Vector	16.9	755	105	1,570
Powerco	15.5	1,688	149	2,662
GasNet	1.6	1,404	159	2,396

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

Table 23: Network Expenditure on Assets (2015)

Distributor	Total \$m	Expenditure/ Gas Delivered \$/TJ	Expenditure/ Average ICPs \$/ICP	Expenditure/ km Pipeline \$/km
Vector	25.6	1,143	158	2,377
Powerco	14.4	1,569	139	2,474
GasNet	0.7	625	71	900

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

Table 24: Line Charge Revenue (2015)

Distributor	Total Regulatory Income \$m	Revenue/ Gas Delivered \$/TJ	Revenue/ Average ICPs \$/ICP
Vector	75.5	3,371	467
Powerco	51.2	5,566	491
GasNet	4.8	4,162	473

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012

Gas Consumer Density

Customer density in New Zealand averages about 15.6 customers per kilometre of pipe, significantly lower than the average of 49 customers per kilometre on distribution networks in eastern and southern Australia²³².

²³² Calculated from Australian Energy Regulator: *State of the Energy Market 2015*– total gas customers 3,656,200; total length of mains 74,110km. The difference may be explained by a much higher housing density in Australia.

Table 25: Gas Consumer Density 2011-2015

Distributor	2011	2012	2013	2014	2015
Vector	14.7	14.9	15.0	15.0	15.2
Powerco	16.6	16.5	16.5	16.5	16.5
GasNet	26.8	26.6	15.8	15.5	15.0

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997. From 2013, information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

Load Factor

The load factor for distribution networks in New Zealand currently ranges between 72-84 percent.

Table 26: Load Factor (%) 2011-2015

Distributor	2011	2012	2013	2014	2015
Vector	70.07	79.05	82.81	85.01	81.44
Powerco	70.86	71.79	76.39	72.77	72.59
GasNet	86.93	86.39	86.48	86.75	84.73

Information to 2012 provided pursuant to the Gas (Information Disclosure) Regulations 1997. 2013 Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

Network Reliability

Table 27, Table 28 and Table 29 set out incidents, interruptions and supply reliability measures on open access gas distribution networks, using changed reporting criteria under the 2012 Information Disclosure regime. Recent past reliability trends using the former criteria are included in **Appendix A, Page 201**.

Gas distribution pipes are generally underground, and not affected by bad weather. However, they are vulnerable to third party damage and water ingress. Surface installations are vulnerable to flooding, third party damage and mechanical failure. The networks generally operate to a very high level of reliability, but a single major incident can have a significant effect on overall reliability performance as evidenced by water incursion incidents on Powerco's network at Silverstream in July 2008, and part of GasNet's network in 2010. Water inundation also affected Powerco's Wellington CBD mains in 2006.

In explanatory comments to its Information Disclosure for 2015²³³, Vector says unplanned indicators for its North Island sub-network improved, but deteriorated in Auckland due to two third party-related events that accounted for 29 percent of the total unplanned SAIDI result. Improved planned SAIDI and SAIFI reflected the completion of pipeline replacement projects in Hamilton and fewer riser valve replacements in Auckland.

Powerco notes that while there were fewer planned interruptions, unplanned interruptions increased. The variations are not considered significant and overall are in line with expectations of running a gas network. SAIDI was lower and the past year was atypical with Powerco replacing areas of asbestos pipe. Powerco restates its 2015 Gas Asset Management Plan view that SAIDI is very volatile year-to-year and makes short-term trend analysis difficult and potentially misleading²³⁴. GasNet comments in

²³³ Vector Gas Information Disclosure 2015, 23 December 2015

²³⁴ Powerco Gas Information Disclosure 2015, 17 March 2016

its Information Disclosure for 2015²³⁵ that, as signalled in the previous year, it has implemented improvements in its reliability data capture processes. There were fewer planned interruptions due to reduced service disconnections during mains renewal work. Unplanned interruptions caused by third party damage were down due to a number of factors, particularly less and different work in the roading corridor.

Table 27: Pipeline Incidents and Events (2015)

Distributor	Planned Interruptions	Unplanned Interruptions	Interruptions/ 100km of Pipeline	Unplanned Outages ¹	Unplanned Outages ¹ Caused by 3 rd Party Damage	Emergencies
Vector ²	1,529	546	19.5	10	7	182
Powerco	199	728	20.2	4	2	17
GasNet	169	98	40.6	-	-	2

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ Outages are events that affect more than five customers.

² Includes 463 planned interruptions, 77 unplanned interruptions, 34 unplanned outages, 4 unplanned outages caused by third party damage and 64 emergencies on non-Auckland networks sold by Vector to First Gas on 20 April 2016.

Table 28: Pipeline Incidents – Causes (2015)

Distributor	Confirmed Public Reported Gas Escapes (Escapes/1000km)	Gas Leaks Detected by Routine Survey (Leaks/1000km)	3 rd Party Damage (Events/km)	Pressure- Related	Non- Compliant Odour
Vector:					
- Auckland	40.8	1.4	60.7	4	2
- Non Auckland	52.1	0.2	60.9	2	3
Powerco:					2 ¹
- Wellington	76	3	53	-	
- Hutt Valley/ Porirua	96	17	48	2	
- Taranaki	85	9	49	-	
- Manawatu/ Horowhenua	67	5	68	1	
- Hawke's Bay	11	2	38	-	
GasNet	74.1	39.4	53.6	11.0	-

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ Total for Powerco's networks.

²³⁵ GasNet Information Disclosure 21 December 2015

Table 29: Network Reliability Indices (2015)

Distributor	SAIDI ¹	SAIFI ²	CAIDI ³
Vector			
Overall:			
- Based on total interruptions	1,670	11.2	149
- Unplanned: Caused by third party damage	901	3.7	246
Auckland:			
- Planned interruptions	564	5.4	104
- Unplanned interruptions	151	1.1	141
Non Auckland:			
- Planned interruptions	728	7.7	94
- Unplanned interruptions	128	1.5	86
Powerco			
Overall:			
- Based on total interruptions	883.9	10.7	82.2
- Unplanned: Caused by third party damage	147.8	2.5	59.6
Taranaki:			
- Planned interruptions	300.8	1.7	173.7
- Unplanned interruptions	420.7	5.1	81.8
Manawatu & Horowhenua:			
- Planned interruptions	-	-	-
- Unplanned interruptions	75.6	2	53.8
Hawke's Bay:			
- Planned interruptions	-	-	-
- Unplanned interruptions	15.7	0.6	25.3
Wellington:			
- Planned interruptions	595.6	6.1	97.2
- Unplanned interruptions	358.9	5.4	66.6
Hutt Valley & Porirua:			
- Planned interruptions	175.8	1.5	119.7
- Unplanned interruptions	922.4	10.4	88.91
GasNet			
Overall:			
- Based on total interruptions	1.3	0.009	144
- Unplanned: Caused by third party damage	0.1	0.001	95
- Planned interruptions	0.8	0.005	150
- Unplanned interruptions	0.4	0.003	158

Information provided pursuant to the Gas Distribution Information Disclosure Determination 2012.

¹ **System Average Interruption Duration Index (SAIDI).** *Planned:* The length of planned time, in minutes that the average customer spends without supply over a year measured in customer minutes per customer. *Unplanned:* The length of unplanned time, in minutes that the average customer spends without supply over a year measured in customer minutes per 1,000 customers.

² **System Average Interruption Frequency Index (SAIFI)** – *Planned:* The number of planned supply interruptions which the average customer experiences over a year, measured in customer interruptions per customer. *Unplanned:* The number of unplanned supply interruptions which the average customer experiences over a year, measured in customer interruptions per 1,000 customers.

³ **Customer Average Interruption Duration Index (CAIDI).** The sum of the duration of each interruption (excluding Transmission system interruptions), divided by the total number of interruptions (excluding Transmission system interruptions), measured in minutes. It gives the average outage duration that any given customer on the network would experience in a year.

9.4 Regulatory Performance

As with gas transmission systems, Government policy objectives for gas distribution networks centre on access, efficiency, pricing, investment, and reliability. Given the close interface between distribution and retail, there are a number of policy objectives – particularly around clarity of market structures and roles – that are common to both sectors of the industry.

Gas Distribution policy objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> • Gas industry participants are able to access distribution pipelines and related services on reasonable terms and conditions. • Consistent standards and protocols apply to the operations relating to access to all distribution pipelines. • Barriers to competition are minimised. • Energy and other resources used to deliver gas to consumers are used efficiently. 	<p>Arrangements on the open access distribution networks provide non-discriminatory access to distribution infrastructure and services.</p> <p>The Gas Distribution Contracts Oversight Scheme and its associated contract assessments contribute to ensuring consistent standards and protocols, and that the terms for retailers using distribution networks are fair and reasonable.</p> <p>To date, no issues relating to gas distribution access have arisen and there is no evidence that the facilities are operating inefficiently, or that their owners are posing barriers to competition.</p>
<ul style="list-style-type: none"> • Incentives for investment in gas distribution is maintained or enhanced. • The full costs of producing and transporting gas are signalled to consumers. • Delivered gas costs and prices are subject to sustained downward pressure. 	<p>Notwithstanding distribution network owners' concerns about economic regulation of these assets, continuing investment in gas distribution networks is evident from year-on-year network expansions.</p> <p>Distribution services pricing is subject to economic regulation (price control).</p>
<ul style="list-style-type: none"> • Risks relating to security of supply are properly and efficiently managed by all parties. 	<p>Reliability information indicates that distribution networks generally operate to a high level of reliability.</p>
<ul style="list-style-type: none"> • There is an efficient market structure for the provision of gas metering, pipeline and energy services. • The respective roles of gas metering, pipeline and gas retail participants are able to be clearly understood. 	<p>The Downstream Reconciliation Rules provide an efficient process for allocating distribution charges to retailers based on the portion of gas on a distribution network used by their customers.</p> <p>The Gas Distribution Contracts Oversight Scheme requires contracts to provide clear information about respective roles.</p>

9.5 International Distribution Market Practices

International regulatory approaches to gas distribution networks reflect their natural monopoly structure and are primarily aimed at managing the risk of monopoly pricing. However, in Australia there have been recent examples of a softening of regulation over some distribution pipelines.

Australia has 11 gas distribution networks totalling 74,110km. Various tiers of regulation apply, based on competition and significance criteria. Seven networks, representing approximately 69,000km of pipe in NSW, ACT, Victoria and South Australia, are subject to full regulation by the AER. Two are under light regulation and two are not regulated.

In February 2015, the 2,700km Australian Gas Networks system in Queensland became the first major network to convert from full to light regulation, with the National Competition Council (NCC) determining that light regulation will be similarly effective to full regulation, while providing cost savings that may benefit consumers. The 3,000km Allgas Energy network in Queensland is also subject to light regulation. In 2004, coverage of the 680km Wagga Wagga gas network was revoked and the relatively new Tasmanian network is not regulated.

The AER publishes an Access Arrangement Guideline that details the regulatory process, while separate guidelines address dispute resolution and regulatory compliance.

In the UK, gas distribution networks and independent gas transporters are regulated by OfGem to 'protect consumers' interests through the promotion of effectively functioning markets and networks'²³⁶. OfGem's main focus is on charging arrangements. Gas distribution networks are required to maintain a use of system charging methodology, which must explain to customers the principle of, and methods used, to calculate charges. These methodologies must achieve prescribed objectives of reflecting costs, facilitating competition, and reflecting developments in gas distribution.

Quality of service arrangements are aimed at protecting consumers and are seen by Ofgem as a 'key balance to price control incentives to reduce costs.' These are implemented through a number of different frameworks including Guaranteed Standards of Performance (GSOPs), Overall Standards of Performance (OSOPs), third party and water ingress arrangements, and output reporting.

In the United States, State public utility commissions oversee and regulate private local natural gas utilities. Gas utilities owned by local governments are typically overseen by local government agencies to ensure that the needs and preferences of customers are met in a cost effective manner.

State regulation of local distribution companies has a variety of objectives, including ensuring adequate supply, dependable service, and reasonable prices for consumers, while also allowing for an adequate rate of return for investor-owned utilities. State regulators are also responsible for overseeing the construction of new distribution networks, including approving installation sites and proposed additions to the network. Regulatory orders and methods of oversight vary from State to State.

Historically, local distribution companies offered only 'bundled' services, combining the cost of transportation, distribution, and the natural gas itself into one price for consumers. Unbundled retail packages have been available to USA consumers since the early 1990s.

²³⁶ <https://www.ofgem.gov.uk/>

10 Wholesale Market

The New Zealand wholesale market is small and relatively concentrated. Competitive tendering for gas supply occurs, and no specific concerns have been raised by industry participants about buying or selling gas as a commodity. There are a number of producers and wholesalers active in the market. Some producers sell gas directly to end-users. Secondary trading has traditionally been arranged bilaterally between parties. However, for both primary and secondary trading, there has historically been no transparency of terms that enable discovery of prices or other information, such as trading frequency – although these are understood to be occasional only.

A commercial trading platform established in 2013 has also become a platform for balancing transactions associated with a new market-based transmission pipeline balancing regime. This platform is providing improved transparency of prices and volumes, and assists in fulfilling Government policy objectives for 'efficient arrangements for the short-term trading gas'.

10.1 Background

The wholesale market involves wholesalers buying gas from producers to on-sell to gas retailers, large petrochemical manufacturers, electricity generators and major industrial customers. Gas producers also sell directly to large consumers and, where vertically integrated, to their own gas retail arms²³⁷.

Having become the sole purchaser of Kapuni gas through its NGC state-owned enterprise in 1970, the Government's role as the principal gas wholesaler was substantially expanded with the development of the Maui field later in the 1970s. The Government underwrote the field's development both by becoming half owner, and agreeing to be the sole purchaser of the gas it produced. In doing so, the Government took aboard the market risk by committing to take-or-pay purchases of a gas reserve that significantly exceeded the then level of demand for it. It therefore became a role of Government to develop the market.

Initially, the Government of the day envisaged Maui gas being used primarily for electricity generation, and planned four 1,000MW power stations – one in New Plymouth, one at Huntly, and two in Auckland. An over-estimate of electricity demand, however, resulted in a decision not to proceed with the two Auckland power stations, and left the Government facing a large take-or-pay liability for Maui gas.

The development of the Maui field coincided with a series of international oil price shocks that severely impacted New Zealand's balance of payments. The Government came to see Maui as a way to mitigate this impact through direct use and import substitution. So emerged the Maui-driven 'Think Big' projects, which included using the gas for gasoline, methanol and urea production, electricity generation and, in compressed form (CNG), as a transport fuel. It also drove wider use of gas in homes, businesses and industry.

²³⁷ 'Gas wholesale(r)' is defined in a range of technical ways in various industry legislation and contracts. MBIE does not include producer sales to large industrial consumers for the purposes of wholesale pricing analysis. This is discussed further in **Section 11.0, Natural Gas Pricing, Page 148**. In Australia, the AER applies this description: 'Gas producers sell gas in wholesale markets to major industrial, mining and power generation customers, and to energy retailers that onsell it to business and residential customers'.

These policies, Maui's predominance as a source of natural gas, the take-or-pay commitments, and a price escalator that saw the wholesale gas price diminish in real terms over time, were major factors in shaping the wholesale gas market for over 30 years. The early effects were:

- long-term agreements, with high annual take-or-pay commitments.
- flexibility through buyers' ability to store prepaid gas, and Maui's ability to act as a swing supplier to meet demand on the day.
- an effective price cap on the overall gas market due to the real-term price reduction in the Maui gas contract price.
- investment in gas utilisation by industrial and commercial companies taking advantage of plentiful supply and low prices.
- electricity prices also influenced by cheap and plentiful domestic gas reserves.
- a restricted ability for other fuels to compete on price with Maui gas.
- suppressed incentives to explore, develop, and produce gas from other fields²³⁸.

With the attenuation of gas reserves under the original Maui 'legacy' contracts, the wholesale market has undergone fundamental change in the past decade. From abundant, cheap gas from a dominant field, the market became short on supply, manifesting in higher gas prices, which in turn resulted in:

- some major industrial users, including methanol manufacturers, restricting or ceasing operations due to their inability to source natural gas at a competitive price.
- switching to other fuels, including to geothermal and biomass in the timber processing industry.
- increased marginal costs of electricity generation.
- more complex, less flexible unbundled contracting arrangements.
- higher levels of exploration, improved financial viability of smaller reserves previously unable to compete with Maui gas, and the development of new fields including Kupe and Pohokura.
- the creation of open access on the Maui pipeline and increased complexity in the transmission market.
- the cessation of the Government's role in the wholesale gas market.

10.2 Current State of the Wholesale Market

The wholesale gas market in New Zealand remains small and relatively concentrated. *Energy in New Zealand* lists four gas wholesalers - Vector, Nova Energy (Todd), Contact Energy and Greymouth Petroleum. Each is vertically integrated to varying degrees through other levels of the supply chain.

Todd and Greymouth Petroleum are also gas producers and retailers (Todd through its exploration and production subsidiary, Todd Energy, and its wholesale/retail subsidiary Nova Energy). Nova also owns private pipelines and is a consumer at its gas-fired McKee peaker plant. Vector is a distributor and retailer, and Contact is a retailer and gas-fired power station owner. Another retailer, Genesis Energy,

²³⁸ For example, the Kupe gas field which was discovered in 1986 did not get a development commitment until 2006, for reasons that included the predominance of lower-cost Maui gas.

has vertical ownership arrangements, sourcing gas for its Huntly power station and retail operations under a contract for 100 percent of gas from the Kupe field, of which it is a joint venture partner.

Other producers selling gas into the market are Shell, OMV and newcomers TAG Oil and NZEC as they commence operations at a number of small onshore Taranaki fields.

The New Zealand gas market continues to be founded largely on bilateral contracts between producers/wholesalers and retailers and, in some case, directly with large end users, although they tend to be of shorter duration than during the height of the Maui era. This is in contrast with trends away from the long-term contract model in larger overseas markets (see below).

Until 2013, there was no formal multilateral market or centralised wholesale market mechanism in New Zealand. Informal short-term trading and gas swaps happened, including gas buyers wanting to manage take-or-pay exposures under their long-term contracts, and producers seeking an outlet for smaller parcels of gas from new discoveries.

The transaction terms and conditions are typically confidential to the contracting parties, casting a veil over the extent to which such trading occurs, the volumes involved and the prices at which gas is changing hands.

Two competing commercial wholesale gas spot markets were established in November 2013, although only one of them, emsTradepoint, is actively trading.

In the primary wholesale market, the contractual framework, commonly involving take-or-pay provisions, reflects the large investments made by producers and counterparty buyers, such as electricity generators and petrochemical producers, and serves to cover the field risks and financial positions of the parties.

An example of the dominance of bilateral arrangements was the 10-year gas supply agreement in 2012 between Todd Energy and Methanex, which underwrites a combined capital investment of up to \$860 million. Under the arrangement Todd Energy further developed the Mangahewa field through additional drilling and production plant expansion, enabling Methanex's return to full methanol production.

10.3 International Wholesale Gas Market Practices

Trends in gas markets overseas indicate a growing proportion of spot market trading, rather than long-term contractual arrangements. It is a reflection of the influence that supply diversity and market density has on wholesale market liquidity, and the degree of trading sophistication the market requires. Table 30 contrasts the New Zealand market with other countries where market conditions more readily lend themselves to spot trading.

Table 30: Supply and Demand Density

	Gas Consumers	Annual Gas Consumption (PJ)	Number of players
New Zealand	264,500	204	Producers: 10 ¹ Transmission: 2 Distribution: 4
Australia	3.7 million	1,230	Producers: 13 ¹ Transmission: 11 Distribution: 8
United Kingdom	23 million	2,783	Producers: Multiple domestic/imports Transmission: 1 Distribution: 4
United States	73 million	25,580	Producers: 6,300/imports Transmission: 160 Distribution: 1,200

¹ excludes small minority interests

Australia

In Australia the AER reports²³⁹ 'while gas prices were historically struck under confidential long-term contracts, there has been a recent shift towards shorter-term contracts and the emergence of spot markets'.

Australia effectively has two markets, with east and west evolving differently. The gas prices are also significantly different, although they are converging with the development of East Coast LNG.

A number of Australian market improvements were initiated as a result of an explosion at the Esso Longford gas plant, which crippled Victoria's gas supplies for two weeks in 1998. Measures introduced subsequently have significantly improved the transparency of gas market operations and the ability to manage supply disruptions.

A wholesale spot market for gas sales was established in Victoria in 1999 to manage system imbalances and pipeline network constraints. Typically, gas traded at the spot price accounts for 10 to 20 percent of wholesale volumes in Victoria. The balance is sourced via bilateral contracts or vertical ownership arrangements between producers and retailers. Notably, the spot market price outcomes in Victoria are widely used as a guide to underlying contract prices.

Australia has a National Gas Market Bulletin Board²⁴⁰ and a short-term trading market in southern and eastern Australia. The market is designed to enhance gas market transparency and competition by setting prices based on supply and demand conditions.

The online National Gas Market Bulletin Board was established in 2008 by industry participants in response to a Ministerial Council on Energy request for a national plan to accelerate the development of a reliable, competitive and secure natural gas market. It provides transparent, real-time gas market

²³⁹ Australian Energy Regulator: *State of the Energy Market 2011*.

²⁴⁰ <http://www.gasbb.com.au/>

information and covers major gas production plants, storage facilities, demand centres and transmission pipelines. It was redeveloped in December 2014.

Some, but not all, of this type of information is available to Shippers, but not other market participants, in New Zealand through OATIS, and more recently through the emsTradepoint platform and BGIX

United Kingdom

A similar trend has been evident in the United Kingdom since major restructuring, including interconnection with European and Irish suppliers, in the 1990s. Previously, gas was traded mainly through bilateral contracts.

The introduction of a Network Code for market participants and subsequent changes to the roles of participants in balancing demand and supply allowed other forms of trading to gain prominence. This included the development of spot markets at a number of points onshore, where gas is delivered to the National Transmission System (NTS) from offshore, and trading on the pipeline system - or 'Onsystem trading' - via a single notional delivery point.

Other European gas wholesale markets had differing characteristics until a move to the Gas Target Model²⁴¹ aimed at transforming the European gas market by integrating the various national markets into a single liberalised market.

United States

Bilateral contracts dominate the market for natural gas in the United States. Federal regulations requiring unbundled services mean that the wholesale market is clearly separated into a market for natural gas as a fuel, and for transportation of natural gas.

Prices are generally tied to publicly quoted gas prices at major trading hubs. The New York Mercantile Exchange operates a transparent natural gas futures market for gas delivered to the largest trading hub – the Henry Hub, Louisiana. Following issues with the authenticity of published price information, regulations are in place to ensure the integrity of published prices. Reporting is voluntary, but the information submitted is required to be factual, accurate and complete.

10.4 Wholesale Market Needs in New Zealand

There has been debate about what New Zealand needs in the way of a wholesale gas market. Views have ranged from a need to develop a wholesale mechanism, to leaving things as they are. The wholesale spot market established in 2013 will likely resolve this difference over time.

Through its published policy objectives, it is clear that the Government wants to see arrangements in place for the efficient short-term trading of gas²⁴².

Historically, there has been no broad industry consensus for a formal or regulated short-term wholesale trading regime. A trial platform established in 2010 for short-term wholesale gas trading was abandoned due to lack of support, and amid some concerns over the trial mechanisms.

That experience highlighted the challenges of a market that continues to be characterised by:

²⁴¹ <http://www.acer.europa.eu/en/gas/gas-target-model/pages/main.aspx>

²⁴² 2008 GPS: Efficient arrangements (exist) for the short-term trading of gas.

- a low number of supply sources and sellers.
- the firm commitment of production from large fields to longer-term contracts.
- limited demand-side density. Most demand is from a relatively small number of large power generation, petrochemical and industrial users. These users represent just 0.6 percent of gas customers, but account for over 90 percent of consumption. By contrast, most of the gas available for consumption in the UK is used by the numerically high residential and commercial sectors and, in Victoria, residential use accounts for over a third of total consumption.
- the absence of brokers to join sellers and buyers, or to aggregate gas from a number of sources into more saleable packages.
- New Zealand's gas self-dependence and non-connection to international gas sources, such as through cross border supply or LNG importation.
- the size of the New Zealand economy, which represents an effective cap on potential growth.

Section 41 of the Crown Minerals Act (CMA) – which requires producers to seek approval for gas sale agreements - at a cost per application of \$1,000 - is also cited as a barrier to gas producers participating in small volume trades²⁴³. The application fee, which could represent between 10 and 30 percent of the proceeds from a 1,000GJ sale, is a significant deterrent for deals involving small volumes of gas.

Under the CMA, permit holders have to give NZP&M a copy of any dealing that has a duration of 12 months or more for approval. Without this approval, the contract will be void.

The central question, however, remains. That is whether New Zealand needs, or can sustain, a fully-fledged wholesale spot market. The NZISCR report doesn't think so, concluding:

'There does not seem to be any prospect or need for a spot market for gas in New Zealand. ... The market is rather small to support one, and many of the functions that buyers and sellers would get from a spot market seem to be provided by flexible long-term gas purchase contracts and the ability of the Maui pipeline to handle some overage and underage through line packing. The attempt to establish a spot market was not successful. There was some criticism that the attempted spot market was too complex, and that a simpler one might have worked, but on balance such success does not seem likely.'

That doesn't necessarily relieve a need for wholesale market efficiency improvements. There are many structural similarities between the gas and electricity markets in New Zealand - the fungibility of the products; the local market self-sufficiency with no imports or exports; generation/production that is distant from markets; transmission and distribution delivery systems that are largely natural monopolies; infrastructure that is sunk and involving long-term investment horizons; oligopolies at the generation/production end; and competitive retail markets. The respective wholesaling regimes, however, are very different.

The electricity market has evolved complex processes that reflect its role as an essential form of energy with 2 million consumers nationwide and disparate generation facilities. Electricity is priced in half hour tranches as a combined energy and transmission commodity, through a transparent spot market at

²⁴³ Gas Industry Co: Letter to Hon Hekia Parata, Associate Minister of Energy and Resources, *Gas Wholesale Market*, 20 December 2010.

various trading points. Forward price is signalled through hedge products, long run marginal cost curves, and regular demand and investment forecasts. Both the supply and demand side are fully informed about price.

Despite the industry structure parallels, in the New Zealand context such wholesale market complexity is arguably not suited to gas – a largely optional fuel, with 268,000 consumers, limited supply sources and operating in a highly competitive energy market.

While non-standard bilateral contracts may not affect the relative bargaining positions of the parties, or end-user choice, by themselves they do not fully represent 'efficient arrangements for the short-term trading of gas'. Rather, public market mechanisms for ad-hoc gas sales and purchases that remove opacity of wholesale gas trading and allow gas to go to users who value it most highly, have the potential to encourage efficient use of resources, improve competition and provide consumers with the pricing signals and other information they need for their energy use decisions.

10.5 Spot Market Developments

The wholesale gas spot market platforms established in November 2013 by emTrade (subsequently renamed emsTradepoint²⁴⁴), part of the national electricity grid owner/operator, Transpower Limited, is helping to fill the market efficiency and information transparency gaps that are undesirable in a modern energy trading market.

As at 30 September 2015, emsTradepoint had reported trades totalling 3,230,000GJ with a traded value of \$18 million. Prices ranged from \$0.94 to \$20.00/GJ²⁴⁵ (**see also Section 12.2, Page 163**).

In a further development emsTradepoint and the ASX have jointly launched the ASX New Zealand Gas Futures²⁴⁶ using emsTradepoint's indices as the reference price for the new monthly and quarterly gas futures. This initiative complements other energy trading risk management tools, including the existing New Zealand electricity derivatives platform, also operated by ASX.

From a policy fulfilment perspective, regulators are closely following the wholesale market developments. Given the significant change they represent to historic wholesale gas trading practices, Gas Industry Co commissioned an analysis of the New Zealand wholesale market²⁴⁷ from United States-based energy trader Beverly Beaty. It looks at international best practices, evaluates the design and functionality of the NZX and emsTradepoint products and is intended to help parties who would like to be more active in gas trading, but may lack direct experience with trading on a centralised platform.

²⁴⁴ <http://www.emstradepoint.co.nz/>

²⁴⁵ emsTradepoint *2015 Annual Review*

²⁴⁶ Market Announcement – Transpower: *ASX launches emsTradepoint-linked New Zealand Gas Futures*, 7 April 2015

²⁴⁷ *Essentials of Efficient Natural Gas Trading in New Zealand*

10.6 Regulatory Performance

Gas wholesale policy objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> • The supply of gas meets New Zealand's energy needs by providing competitive market arrangements. • Delivered gas costs are subject to sustained downward pressure. 	<p>There is a relatively small number of parties engaged in the wholesale gas market. Competitive tendering occurs for gas supply, and participants have not raised specific concerns about difficulties in selling or buying gas as a commodity. Transmission pipeline constraints can potentially impact on wholesale gas trading if the purchaser is unable to have it transported to the end user(s). However, congestion issues raised in 2009 have since been alleviated.</p> <p>Changing market dynamics, including new sources of supply, have moved negotiation leverage from supplier to buyer.</p>
<ul style="list-style-type: none"> • Efficient arrangements for the short-term trading of gas. 	<p>An attempt in 2010 to establish a spot trading platform failed due to lack of interest. A commercially-based wholesale gas spot market platform that commenced operations in 2013 is helping to fulfil Government policy expectations for effective short-term gas trading arrangements.</p>
<ul style="list-style-type: none"> • Accurate, efficient and timely arrangements for the allocation and reconciliation of upstream gas quantities. 	<p>Gas Industry Co has published Gas Reconciliation and requirements, explaining how physical flows and commercial transactions are reconciled and energy quantities used in each commercial transaction are derived. That document will be updated in the future to reflect a unified set of arrangements following transmission code convergence.</p>

11 Retail Market

The retail gas market continues to grow, with around 10,500 new consumers in the past five years. Market contestability has strengthened, and over 99 percent of gas consumers have a choice of seven or more retailers. Customer switching between retailers has increased markedly to 19 percent. Stronger retail competition is also evidenced by reduced market concentration, reflecting new retailers entering the market and smaller retailers increasing their market share.

The industry is performing well against Government policy objectives for the retail market and the protection of small consumer interests. A retail contract evaluation scheme introduced in 2010 has seen a major improvement in the clarity and detail of retailers' supply arrangements with small consumers. A suite of other market enhancements benefitting small consumers has included a switching regime to enable consumers to efficiently change their retail supplier, and the implementation of a formal consumer complaints scheme through Utilities Disputes Limited (formerly the Office of the Electricity and Gas Complaints Commissioner).

11.1 Background

Retail is the sector in which consumers purchase gas from retailers for their direct use. Retailers buy gas at the wholesale level for profitable on-sale to their customers, and contract with transmitters and distribution companies for transportation services to customers' premises. Retailers bill customers for all costs.

The retail gas market was founded on local town gas supply dating from the 19th Century. Following the discovery of natural gas, existing local area distribution networks expanded and new networks were established on the back of the transmission system expansion into most of the North Island's populated centres during the 1980s. Retail operations were preserved under exclusive area retail franchises until the New Zealand gas market was deregulated in 1992.

11.2 Current State of the Retail Market

There are 10 retail brands, owned by nine different retail companies, competing in the New Zealand gas retail market - Contact Energy, Genesis Energy, Energy Online (a subsidiary of Genesis), Greymouth Gas, Nova Gas, Mercury, Trustpower Limited, Vector Gas, Pulse Energy and Switch Utilities. Of these, Greymouth Gas and Vector Gas supply only commercial and industrial users, and are the only two not also engaged in selling electricity. The number of retail brands declined from 11 in September 2016 when Trustpower absorbed into the Trustpower brand the customers of its subsidiary, Energy Direct NZ²⁴⁸, which it acquired from Wanganui Gas in July 2013. The retail market is segmented into industrial, commercial and residential consumers (Figure 33). Each has different characteristics:

Industrial: Large users, often with internal energy management expertise. They generally work with their energy provider at a one-to-one level.

Commercial: A wide range of businesses and community facilities. Retailers generally maintain direct account management relationships with these consumers, especially those at the volume upper end.

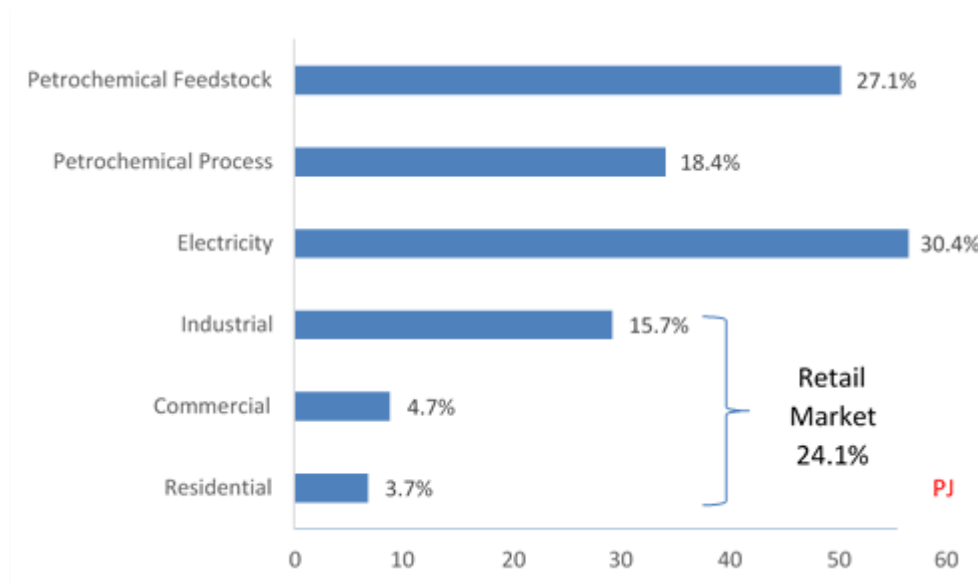
²⁴⁸ Energy Direct had 10,067 as at August 2016

Residential: Households (also referred to as the 'mass market'). Apart from the monthly bill, complaints or issues, and periodic marketing communications, there is generally little contact between these customers and their retailers. The average household gas consumption in New Zealand is about 27 gigajoules (GJ) a year.

Overall, retail consumers account for about a quarter of annual gas consumption.

In most cases, consumers are able to select their supplier from among multiple retailers active in their area. There is consequently a healthy level of competition for the retail consumer.

Figure 33: Retail Market Contribution to Total Gas Consumption 2015



Source: 2016 Energy in New Zealand.

Based on gas market consumption of 185PJ, which excludes production losses, own use and transmission losses.

Industrial includes 1.6PJ used in the agriculture, forestry and fishing sectors.

11.3 Retail Market Trends

Table 31 sets out the customer numbers and gas use by retail consumer groups in the period 2011-2015. It shows increasing consumer numbers across the board.

Over this period, the amount of gas consumed per household averaged about 25 GJ/year, compared with an average of over 30 GJ/year recorded in the early 2000s.

Gas consumption records also include its use as a transport fuel – compressed natural gas (CNG) – and in agriculture, forestry and fishing. Following the oil shocks of the early 1970s, compressing natural gas for use in motor vehicles was widely seen as a means of reducing New Zealand's reliance on imported oil, while also reducing transport-related environmental emissions. With a subsidy policy in place, the use of CNG quickly increased along with vehicle fuel system modifications to accommodate dual CNG/petrol use, and vehicle manufacturers began developing dedicated CNG-fuelled vehicles. An extensive North Island-wide refuelling network was also developed. However, following the removal of subsidies, the CNG market and associated infrastructure collapsed. After reaching a peak of 5.8 PJ in 1985, CNG use faded over the next two decades and in 2015 accounted for just 0.02 PJ. In the past decade, gas use in agriculture, forestry and fishing has ranged between 1.5 and 2.1 PJ/year.

Table 31: Retail Market Trends by Consumer Group 2011-2015

	2011		2012		2013		2014		2015	
	¹ Customers	PJ	Customers	PJ	Customers	PJ	Customers	PJ	Customers	PJ
Industrial ²	1,300	27.7	1,500	23.8	1,500	22.9	1,500	29.6	1,800	29.2
Commercial	10,000	5.6	14,000	7.9	14,000	7.7	14,000	8.7	14,000	8.8
Residential	247,000	5.7	246,000	6.3	248,000	5.7	249,000	6.6	253,000	6.8
Total	258,300	39.0	261,500	38.0	263,500	36.3	264,500	44.9	268,800	44.8

Source: *Energy in New Zealand*

¹ Gas customer table was discontinued after 2010. Customer numbers since are estimates contained in the *Energy in New Zealand* narrative.

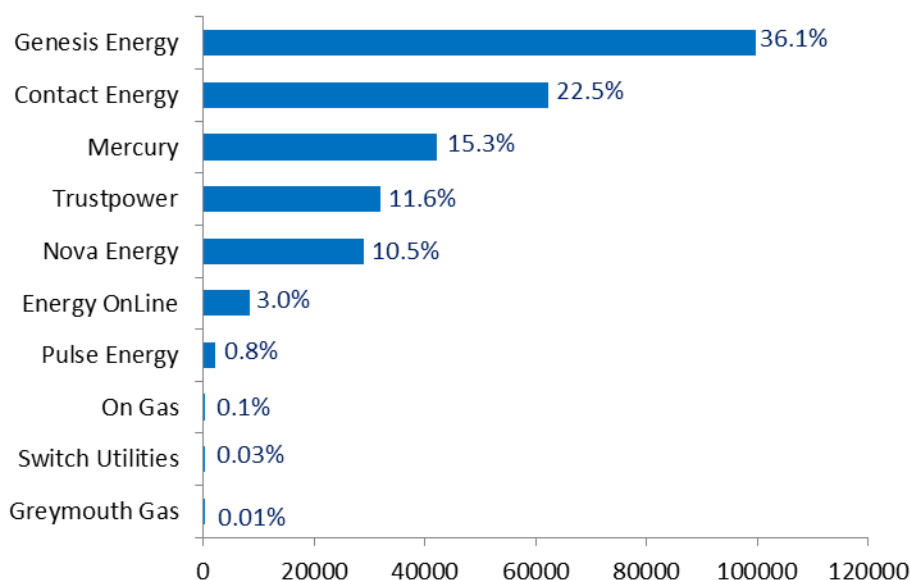
² Includes agriculture, forestry and fishing sector use. Excludes petrochemical process gas.

11.4 Retailers

The current number of retailers reflects a combination of amalgamations, a liquidation and three new entrants in recent years. Auckland Gas and Bay of Plenty Energy, both subsidiaries of Todd Corporation, were absorbed into Todd's Nova Energy brand in 2011 and 2012 respectively, and one retailer, E-Gas, exited in 2010. E-Gas, which held 3 percent of gas customers and 9 percent of allocated volumes, went into voluntary liquidation following audits under the Reconciliation Rules (**see Section 11.11, Reconciliation Rules Audits, Page 148**). Its customer base was acquired from the liquidator by Nova. In addition to maintaining the Energy Direct brand until September 2016, Trustpower had been retailing gas in its own name since November 2013. After absorbing the Energy Direct customers, Trustpower's gas customer numbers increased to 31,960. Pulse Energy and Switch Utilities extended their electricity retailing activities to include natural gas in, respectively, October 2014 and July 2015.

Figure 34 shows retailers' market share by active ICPs on open access pipelines as at September 2016. Genesis Energy is the largest retailer by customer numbers, supplying gas to 99,688 ICPs, followed by Contact (62,258), Mercury Energy (42,203), and Nova (28,951). Vector Gas and Greymouth Gas supply large consumers only. Market share changes by customer numbers over the past two years are shown in Figure 42.

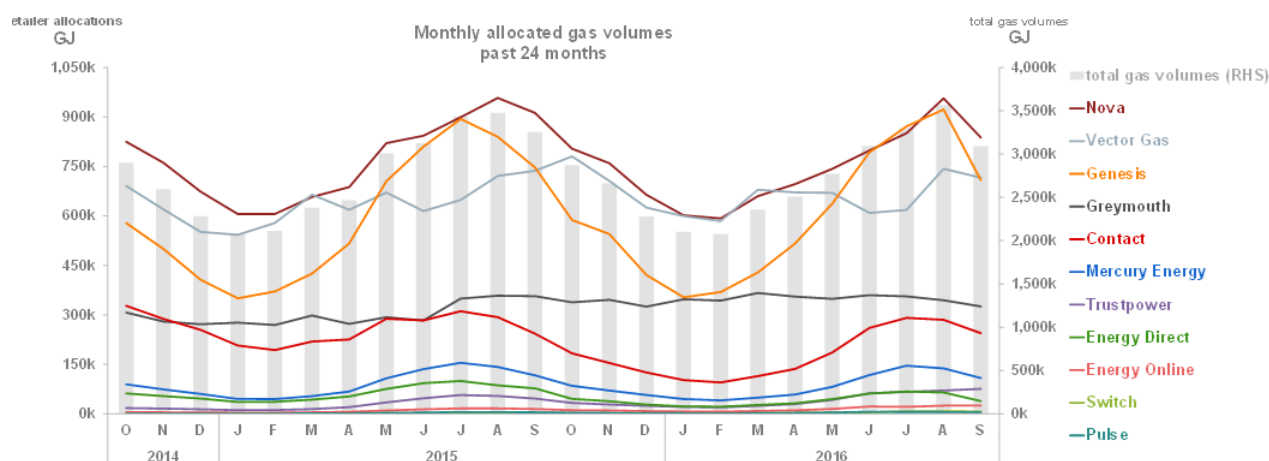
Figure 34: Retailer Market Share by Customers



Source: Gas Industry Co Quarterly Report September 2016
Does not include ICPs on Nova's private pipelines.

Figure 35 shows gas volumes allocated to retailers at shared gas gates (market share by volume). Through the amalgamation of its Auckland Gas and Bay of Plenty brands, its acquisition of E-Gas customers and organic growth, Nova Gas became the leading holder of allocated gas share in May 2011. Vector Gas and Genesis are the next highest by allocated gas volume. The load profiles of Genesis, Contact, and Mercury typify a predominantly mass market customer base, peaking in winter and troughing during summer. The comparatively steady profile of Greymouth Gas reflects its supply to mainly industrial loads.

Figure 35: Retailer Market Share by Allocated Gas Volume 2014-2016



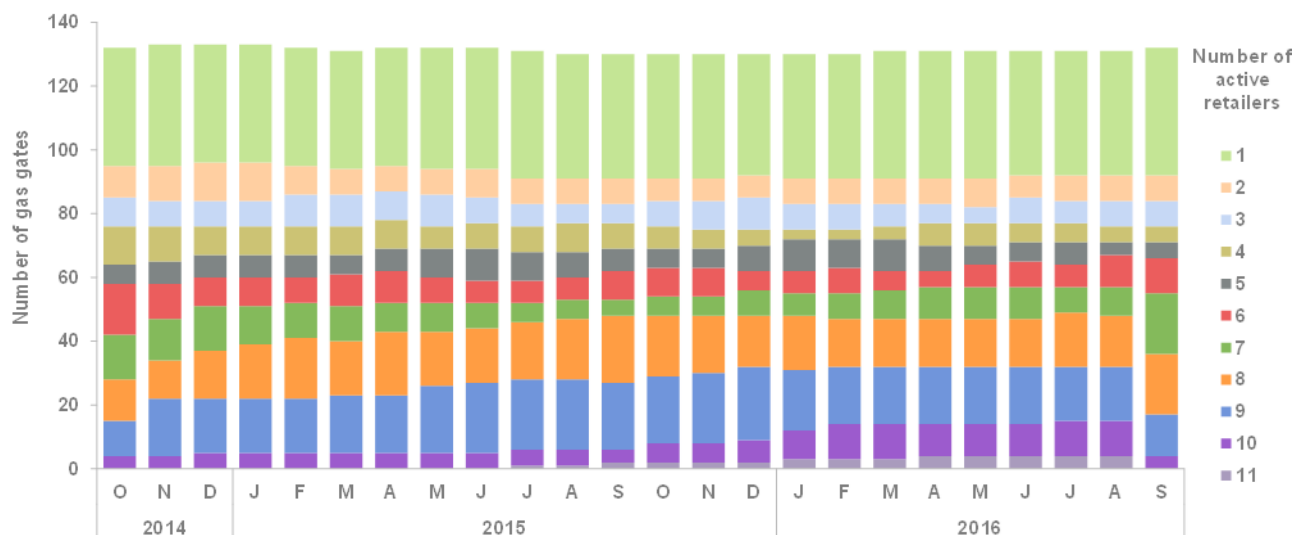
Source: Gas Industry Co Quarterly Report September 2016

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.

11.5 Customer Choice

Customers generally have access to multiple retailers at most points on the transmission system. Figure 36 shows the number of gas gates by the number of retailers – with potential competition for customers increasing in line with the number of retailers that trade at a gas gate. All 10 retailers are active at a small number of gates. However, these are all in the Greater Auckland area gates and tend to be the largest, representing about 40 percent of consumers.

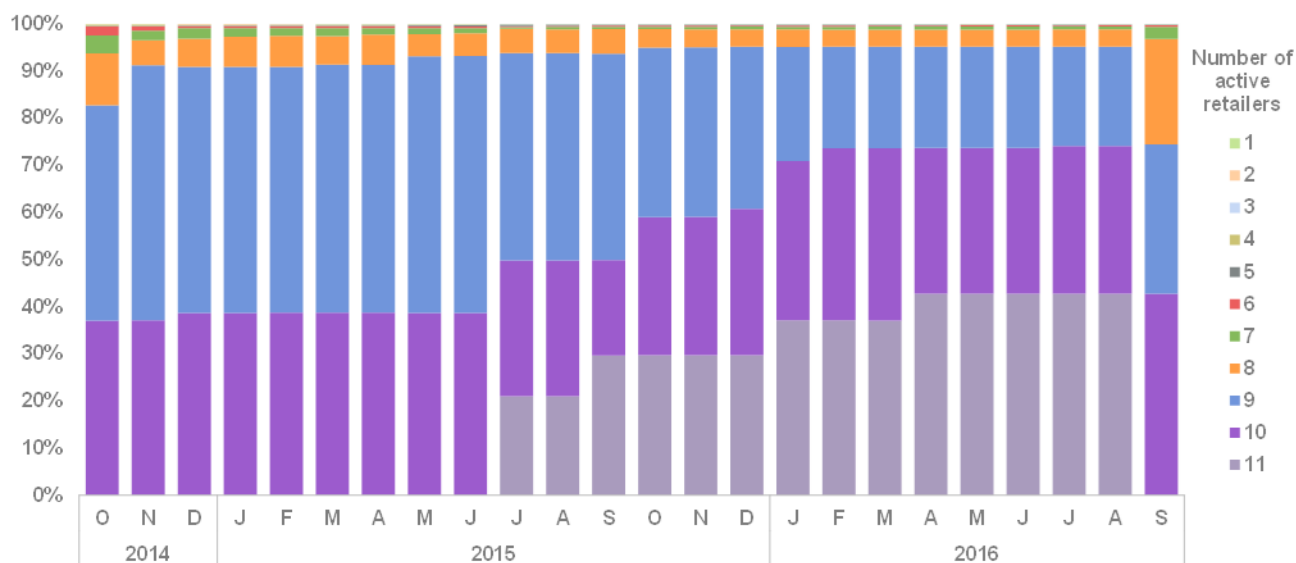
Figure 36: Gas Gates by Number of Retailers 2014-2016



Source: Gas Industry Co Quarterly Report September 2016

Figure 37 plots the proportion of gas customers who are served from the gates at which multiple retailers trade. The graph shows the changes arising from the entry of Trustpower, Pulse and Switch Utilities. Around 99 percent of consumers are connected to a gate where at least seven retailers trade.

Figure 37: Connections Served by Multiple Retailers 2014-2016



Source: Gas Industry Co Quarterly Report September 2016

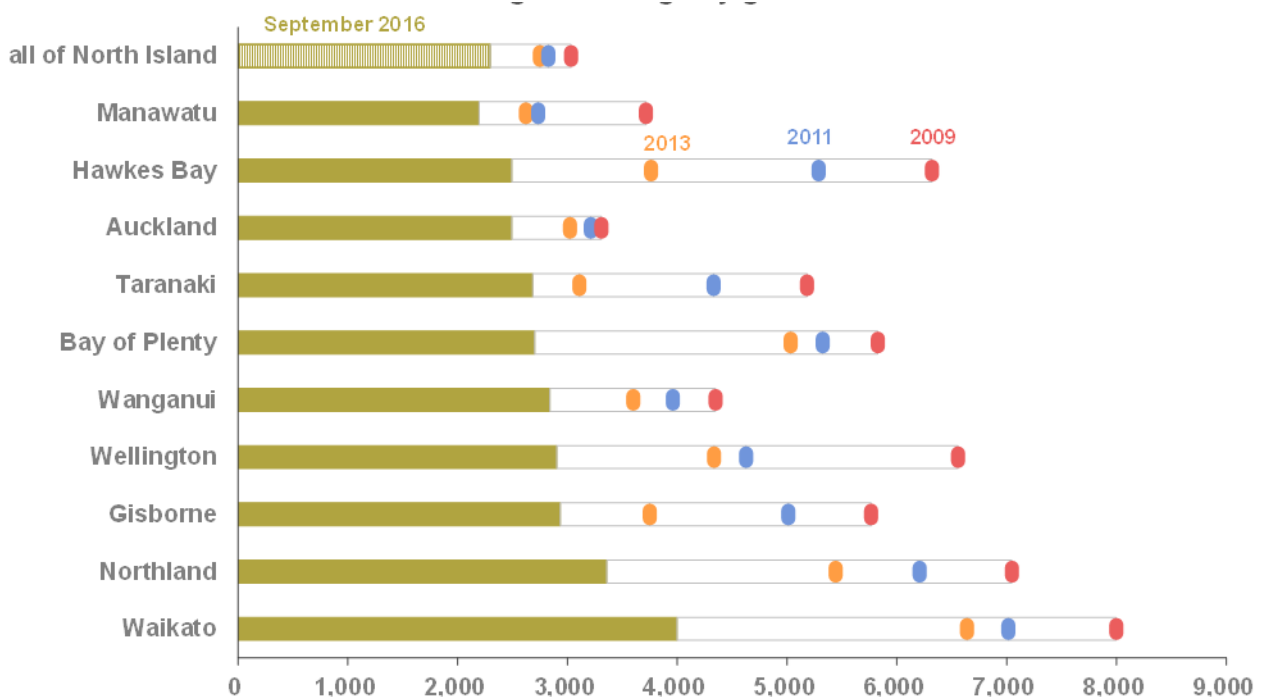
Includes data from ICPs on open access distribution networks only.

The Herfindahl–Hirschman Index (HHI) uses the size and number of competing firms to measure market concentration. Generally, the lower the level of market concentration, the more competitive the market is deemed to be. The index ranges from 0 to 10,000; a low score indicates a low level of market concentration, with a number of competing firms, each with a small proportion of market share, while an HHI score of 10,000 represents a market with a single retailer²⁴⁹. The US Department of Justice considers markets with an HHI of between 1,500 and 2,500 to be moderately concentrated, and those with an HHI greater than 2,500 to be highly concentrated²⁵⁰.

Figure 38 shows the HHI of the retail gas market, based on ICPs, at the time the registry went live in February 2009, and as at September 2016. During that time, the HHI has decreased in all regions, indicating that the retail gas markets in these areas have become less concentrated. Nationally, the HHI stands at 2,296, compared with 3,033 in February 2009 (the start of the registry).

Until 1992, when the new Gas Act disestablished local exclusive franchise areas, gas retailing occurred through local vertically-integrated monopolies. With the consequent onset of retail competition in the gas market – as in the electricity sector - these former monopoly providers became ‘incumbents’, subject to competing retailers vying for customers in their areas. In most regions, there is still a dominant retailer, but the decrease in HHI shows that they have become less dominant as new retailers have entered the market and smaller retailers have increased their market share.

Figure 38: Retail Gas Market Concentration 2009-2016



Source: Gas Industry Co Quarterly Report September 2016

²⁴⁹ HHI for a retail market equals the sum of the squares of each retailer's market share. HHI equals 10,000 if there is a retailer with a 100 percent market share; HHI equals 2,000 if there are, say, five retailers each with a 20 percent market share; and HHI equals 6,500 if one of five retailers has 80 percent market share and the other four each has 5 percent market share.

²⁵⁰ <http://www.justice.gov/atr/public/guidelines/hhi.html>

11.6 Customer Switching

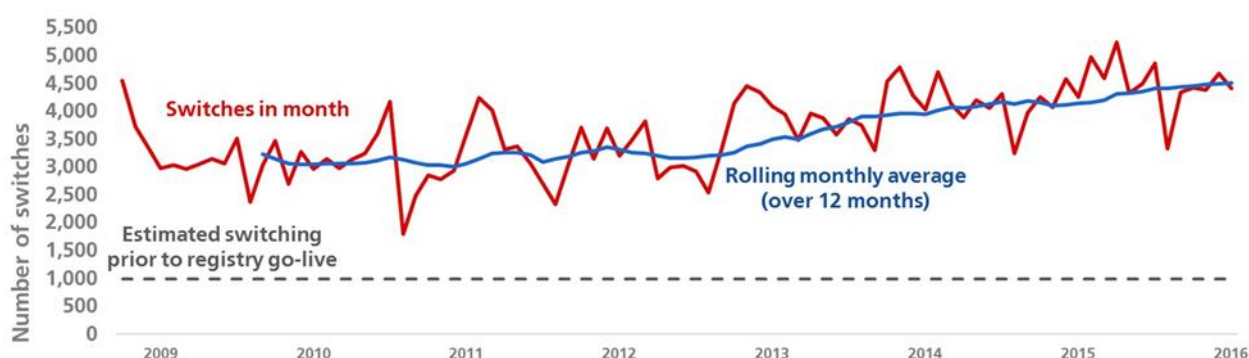
The Switching Rules formalised existing industry arrangements, which took the form of a protocol within the former Reconciliation Code. That arrangement had no enforcement provisions and, among other things, the Switching Rules introduced a formal binding governance regime for customer switching between competing retailers.

A centralised Gas Registry stores key information about every customer installation, facilitates the switching process, and monitors switching timeframes from initiation to completion.

Switching rates, which are an indicator of contestability in the market, have increased from less than 1,000 a month to a monthly average of around 4,500. In the year ended 30 June 2016, gas customer switches totalled 54,149²⁵¹. Annual customer churn has increased from 5 percent to 19.7 percent, one of the highest rates of utility switching worldwide. Gas sector switching activity since 2009 is plotted in Figure 39.

It is evident that gas consumers, in particular residential dual gas and electricity users, have responded during this time to a high profile customer switching promotion - 'What's my Number'²⁵² - conducted for electricity consumers by the Electricity Authority. The campaign encourages energy consumers to find out if, and how much, they can save by switching retailer.

Figure 39: Gas Consumer Switching Activity 2009-2016



Source: Gas Industry Co 2016 Annual Report.

Includes switches on open-access distribution networks; switches from open-access to bypass networks (or vice versa) are not recorded in the Gas Registry.

The level of switching activity is also evident in Figure 40 which sets out the frequency of switching by different consumer groups. It shows that:

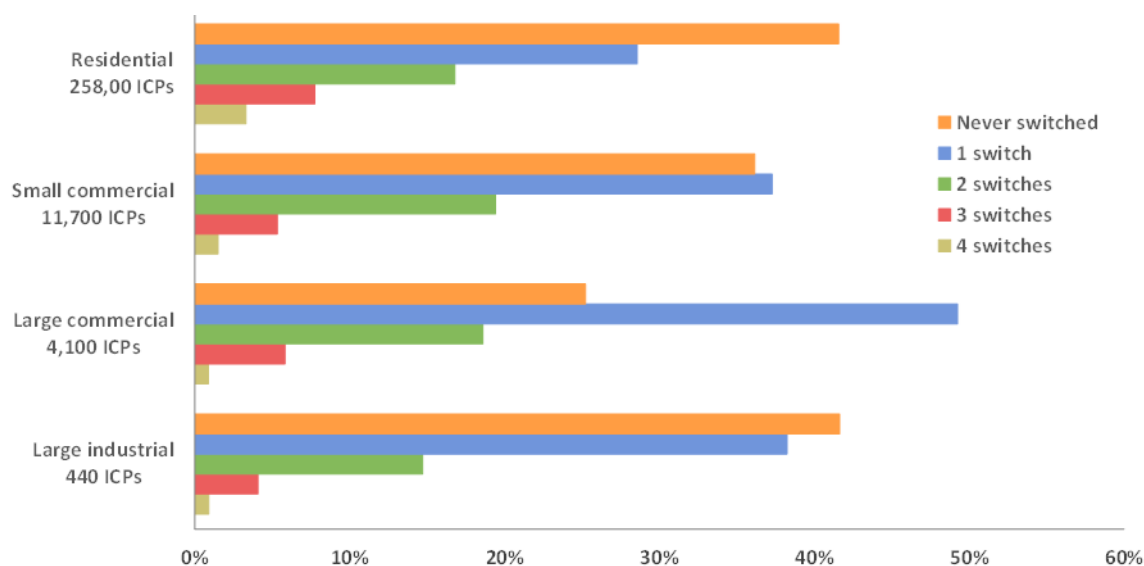
- 54 percent of residential customer sites
- 65 percent of small commercial sites
- 73 percent of large commercial sites
- and 46 percent of large industrial sites

have switched retailers at least once since the start of the Gas Registry in March 2009.

²⁵¹ Gas Industry Co 2016 Annual Report

²⁵² www.whatsmynumber.org.nz/

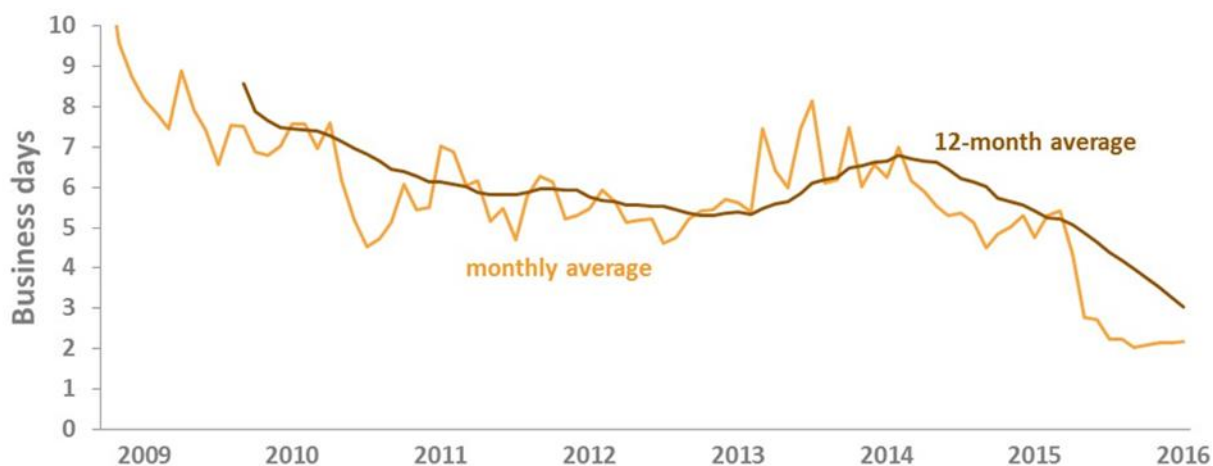
Figure 40: Switching by Customer Sites since 2009



Source: Gas Industry Co 2016 Annual Report

Switching Rules have brought consumer benefits in the form of substantially shorter processing times (Figure 41). Since July 2011, the 12-month rolling average switching time progressively improved to about five business days, compared with weeks or even months prior to the commencement of the Gas Registry in 2009. Since September 2015, the Switching Rules have required that all switches must be completed within 10 business days of inception. In the year ended 30 June 2016, 72 percent of switches were completed within three days.

Figure 41: Customer Switch Time 2009-2016

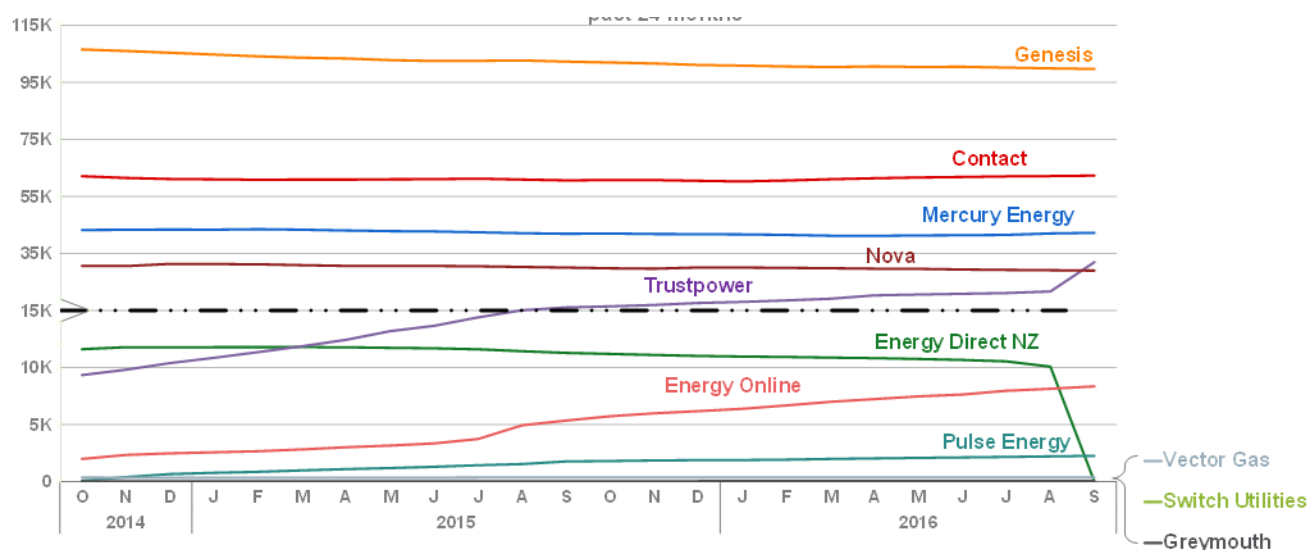


Source: Gas Industry Co 2016 Annual Report.

11.7 Retailer Market Share

The improved ability for consumers to switch has also impacted on retailers' market share. Figure 42 shows trends in customer market share since 2014. The increase for Trustpower in September 2016 reflects its absorption of its subsidiary retailer, Energy Direct, into the Trustpower brand.

Figure 42: Market Share by ICP 2014-2016

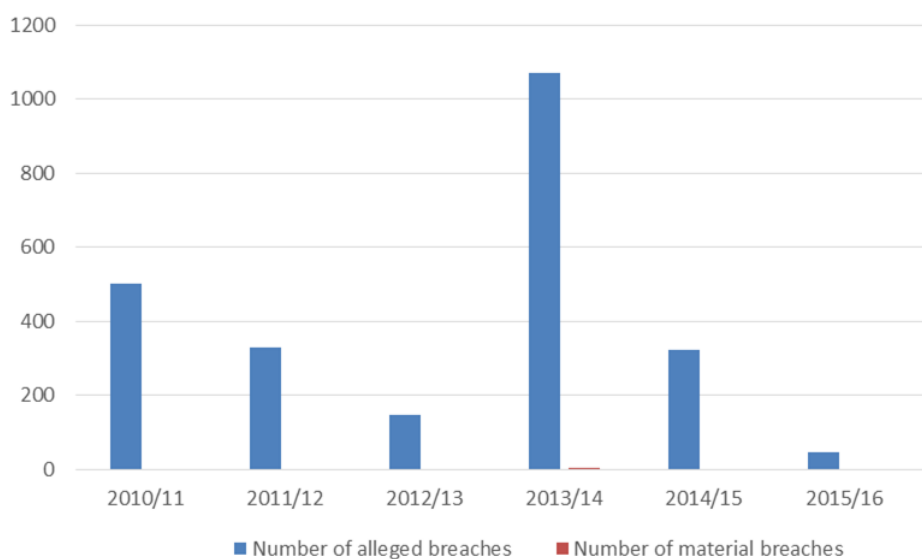


Source: Gas Industry Co Quarterly Report September 2016
ICPs on open access distribution networks

11.8 Switching Rules Breaches

In the first year after the introduction of the Switching Rules, nearly 5,500 switching breaches were alleged. Many of those could be attributed to retailers' unfamiliarity with the Rules. As their understanding has improved, the number of switching breach allegations has fallen significantly (Figure 43), from 450 a month in the first year of operation to a current average of fewer than 13 per month. In the year ended 30 June 2016, Switching Rule breaches were at an historic low, with only 45 received.

Figure 43: Switching Rules Breaches 2010-2016



Source: Gas Industry Co 2016 Annual Report
Recorded by date of breach notice
4 material breaches occurred in 2014

11.9 Downstream Reconciliation and UFG

As with the Switching Rules, the Reconciliation Rules introduced a formal governance regime to replace the industry code, which was considered to be unfair to incumbent retailers, and suffered from a lack of information transparency. The Reconciliation Rules provide a formal process of attributing volumes of gas consumed to the retailers responsible for them. A number of minor amendments to the Reconciliation Rules took effect on 1 June 2013, and options for further changes to improve the accuracy of initial allocations are being considered²⁵³.

The amount of gas that retailers estimate their customers have used is subtracted from the gas volume leaving the transmission system at a gas gate and entering the local distribution network. The difference is unaccounted-for gas (UFG), which arises from technical losses on the system, metering inaccuracies, and retailer estimation errors.

The UFG is allocated to all retailers at a gas gate in proportion to their consumption submissions. The resulting totals are used in determining the wholesale charges they are responsible for. UFG imposes an unnecessary cost on the market, as it is gas that retailers must pay for, but cannot sell. As such, the extent of UFG is a measure of market efficiency.

Transparency associated with tracking and apportioning these costs is assisting retailers and other participants, including distributors and meter owners, to take steps to reduce UFG.

The move to a rules-based regime has delivered an ongoing stream of cost savings to the industry in excess of \$2.5 million a year²⁵⁴ through:

- more equitable allocation of UFG among retailers.
- performance and event auditing.
- increased confidence in, and efficiency of the gas market.
- readily identifiable anomalies in consumption data through greater information transparency.

The industry has published a Requirements and Procedures document²⁵⁵ that provides an overview of the reconciliation arrangements, including the key legislative and commercial documents. It explains how physical flows and commercial transactions in the gas supply chain are reconciled and how the energy quantities used in each commercial transaction are derived.

Figure 44 sets out rolling UFG as a GJ total and as a percentage of gas consumed. It shows that, notwithstanding seasonal winter spikes, since the Reconciliation Rules came into effect annual UFG has fallen from 600,000GJ to below 400,000GJ, and to as low as 1.1 percent of gas consumed, compared with over 2 percent prior to the introduction of the regime.

The industry is currently developing an alternative allocation methodology to improve downstream reconciliation processes. This includes a day-after delivery (D+1) trial which is intended to provide

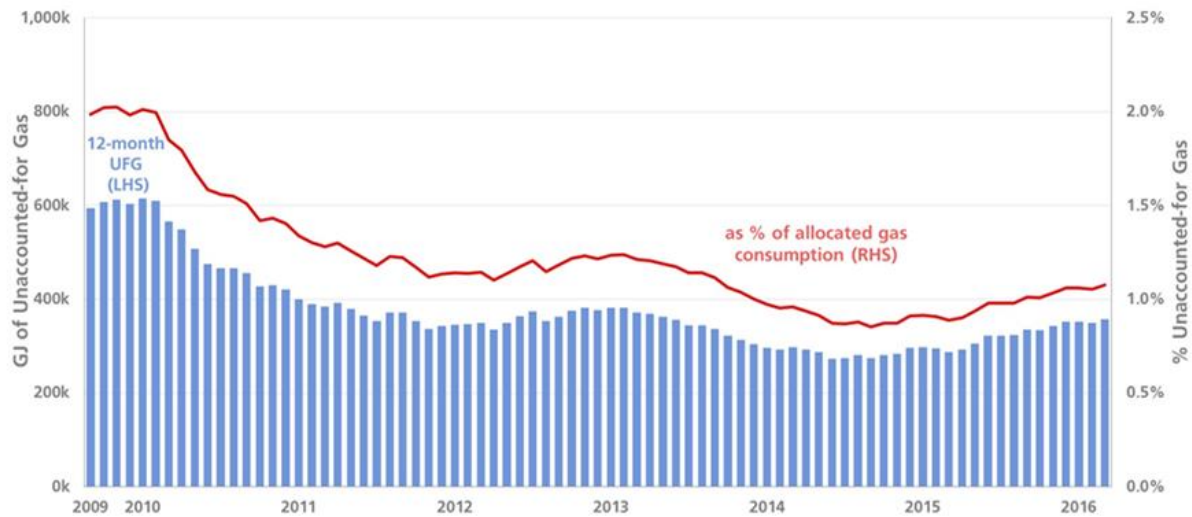
²⁵³ <http://gasindustry.co.nz/work-programmes/downstream-reconciliation/operations/#overview>

²⁵⁴ Gas Industry Co: Calculated, based on the amount of unattributed UFG uncovered through performance and event auditing, in particular the volumes associated with event and performance audits that identified significant under-reporting of volumes by E-Gas.

²⁵⁵ <http://gasindustry.co.nz/about-the-industry/requirements-and-procedures-documents/>

shippers with more timely information on their daily allocated quantities on the day after gas has flowed. This will help them better manage their downstream reconciliation and transmission balancing positions²⁵⁶.

Figure 44: Unaccounted-for Gas 2009-2016



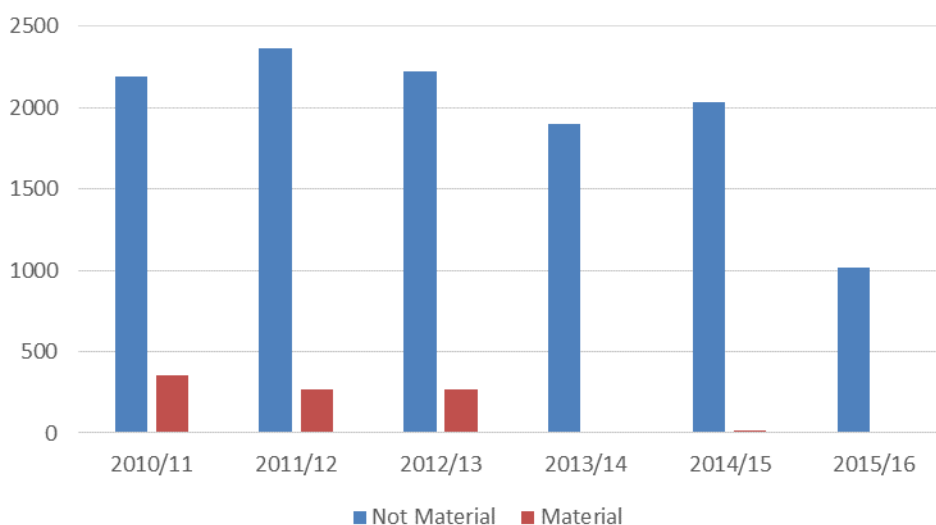
Source: Gas Industry Co: 2016 Annual Report

11.10 Reconciliation Rules Breaches

Reconciliation Rules breaches are shown in Figure 45. Breach levels have remained relatively consistent over the last three years and it is possible that changes to the Reconciliation Rules that came into effect from June 2013 will see breach levels drop. However, the changes do not affect rule 37 - requiring the accuracy of consumption provided at the initial stage to be within a specified tolerance level of the information provided at the final stage - which accounts for over 90 percent of Reconciliation Rules breach allegations. Industry participants are demonstrating a generally good understanding of the Reconciliation Rules and most breaches do not have a material impact on the market.

²⁵⁶ <http://gasindustry.co.nz/work-programmes/downstream-reconciliation/daily-allocation/>

Figure 45: Reconciliation Rules Breaches 2010-2016



Source: Gas Industry Co: 2016 Annual Report
Recorded by date of receipt of breach notice

11.11 Reconciliation Rules Audits

Baseline audits of all retailers, completed in 2011, showed that retailers are achieving a high level of compliance with the Reconciliation Rules, have good processes for receiving and storing metering data and validating customers' consumption volumes, and are producing the information required by the Allocation Agent.

However, they highlighted areas of improvement, especially in converting meter readings into the amount of energy used. Inaccuracies, resulting in under-reporting of customer volumes and consequently higher UFG, pointed to a need for some retailers to take better account of temperature and altitude in their calculations. An energy conversion guideline has been developed to improve consistency in retailers' conversion calculations.

In 2010, an unprecedented spike in UFG levels during a sudden cold snap, led to the discovery of erroneous consumption reporting by retailers and, in particular, revealed serious and systemic misreporting by one retailer, E-Gas. Event audits, and a subsequent performance audit, found other discrepancies in E-Gas data over a period of months. Under the Compliance regulations, the matter was referred to the Investigator, and then to the Rulings Panel for determination. Before it could be heard, however, E-Gas declared itself insolvent and went into voluntary liquidation.

11.12 Insolvent Retailer Arrangements

E-Gas's exit from the market raised another challenge for the industry - what arrangements are appropriate for accommodating consumers who suddenly find themselves without a retailer. Backstop regulations²⁵⁷ were enacted under the urgent regulation-making provisions of the Gas Act²⁵⁸ to transfer E-Gas's customers to viable retailers if the liquidator was unable to effect a sale. The regulations ultimately were not needed as the liquidator found a buyer in Nova Energy.

²⁵⁷ Gas Governance (Insolvent Retailer) Regulations 2010

²⁵⁸ Section 43P

The regulations were allowed to expire, but the event prompted the industry to assess the market issues arising from the insolvency of a gas retailer. Key questions were whether a regulatory backstop is required, or if normal insolvency processes are sufficient to achieve satisfactory outcomes. The main market failure was identified as orphaned customers – consumers who are still able to take gas from the network but with no retailer to pay for use of that gas. Industry consideration of these issues was further informed by a discussion paper by an independent specialist, Castalia Strategic Advisers²⁵⁹.

In September 2013, the Minister accepted advice from Gas Industry Co that permanent backstop regulations are not necessary to manage risks associated with the insolvency of a gas retailer, but that backstop regulations should be available if required in the event of a future retailer insolvency. The advice commented that normal insolvency arrangements generally work well and should be allowed to run their course. Further, gas-specific backstop regulations could reduce the incentive for industry participants to reach a commercial agreement, may lack flexibility to deal with a range of potential retailer defaults, and reduce the scope for a new competitor to enter the gas market by way of acquiring an insolvent retailer's assets.

A process to be followed in the event of future retailer insolvencies has been developed. It includes measures enabled by Switching Rules and Reconciliation Rules amendments approved by the Minister in 2014.

The Electricity Authority is also considering retailer insolvency from a policy perspective, and some companies involved in both the electricity and gas markets have argued for an alignment in regulatory responses. However, as the two markets, their contractual arrangements, and the regulatory powers of Gas Industry Co and the Electricity Authority are fundamentally different, a single approach is unlikely from a practical viewpoint.

11.13 Retail Contracts

A Retail Contracts Oversight Scheme (Retail Scheme)²⁶⁰ introduced in 2010 establishes benchmarks to ensure retailers' supply contracts with small consumers²⁶¹ are in the long-term best interests of those consumers.

The benchmarks include requirements for retail contracts to clearly set out retailer and consumer obligations, reflect market structures, and support an effective complaints resolution process.

Retailers' alignment with the contract benchmarks has been assessed annually by an independent assessor²⁶² and rated on a qualitative scale of 'Full', 'Substantial', 'Moderate', and 'None'. A baseline assessment of publicly available retail contract arrangements in 2010 rated the industry's overall alignment with the benchmarks as 'Moderate'. While identifying areas of poor alignment in the written arrangements, the assessor reported that, in practice, gas retailers were achieving the intent of the benchmarks. At that time areas requiring improved clarity in the contracts included:

- rights to exit a contractual arrangement.
- reasons for price increases over 5 percent when notifying customers of such a change.

²⁵⁹ All documents relating to insolvent retailer deliberations, including Castalia's *Discussion Paper on Gas Retailer Insolvency – Report to Gas Industry Company*, June 2012, are available at <http://gasindustry.co.nz/work-programmes/insolvent-retailers/>

²⁶⁰ <http://gasindustry.co.nz/work-programmes/retail-gas-contracts-oversight-scheme/>

²⁶¹ Consumers using less than 10TJ per year.

²⁶² The current independent assessor is Palairt Law.

- metering obligations, especially the frequency of readings.
- disconnection processes.
- where customers may access information about supply interruptions.

A second assessment in 2011 again rated alignment with the benchmarks as 'Moderate', but noted retailers were taking active steps to improve their contracts, and the third, in 2012, saw a significant improvement to an overall rating of 'Substantial'

Following the 2012 assessment, the Retail Scheme administrator, Gas Industry Co, initiated industry consultation on a review aimed at ensuring it remains fit for purpose and that compliance costs are appropriate compared with the benefits. The outcome was a move from annual to three-yearly assessments (although retailers are required to provide annual confirmation as to whether they have changed their standard published contracts), and the inclusion of a set of Reasonable Customer Expectations (RCEs). The RCEs cover matters that a consumer should expect to see in a gas supply contract and sit above the more detailed benchmarks.

The first post-review assessment, in July 2015, also resulted in an overall 'Substantial' rating, but with stronger alignment across the benchmarks²⁶³.

Results from the first two assessments were published in a consolidated form, but results for individual retailers were made public from the 2012 assessment.

11.14 Consumer Complaints Process

The GPS requires that all small gas consumers have access to a free and independent complaints resolution system. In addition, in 2010 the Government amended the Gas Act to require every gas retailer to participate in such a scheme approved by the Minister. Complaints about gas retailers and gas distributors can be made by small consumers, including potential consumers, or by owners and occupiers of land into, through, or against which pipelines have been laid.

An effective, free and independent complaints resolution process for gas consumers has been provided by Utilities Disputes²⁶⁴ (formerly the Electricity and Gas Complaints Commissioner Scheme - EGCC) since 2010.

The Utility Disputes' service covers gas complaints for amounts of less than \$20,000 (or up to \$50,000 with the agreement of the gas company, or companies, involved).

Utility Disputes uses a range of dispute resolution techniques, such as mediation and conciliation in resolving complaints. If the complaint is not resolved, either party can ask the Utilities Disputes to make a decision. The decisions are binding on the company involved, but if consumers do not accept a decision, they can lodge a claim with the Disputes Tribunal or go through the court system. If the company is a state owned enterprise (SOE), the consumer may be able to make a complaint to the Office of the Ombudsman.

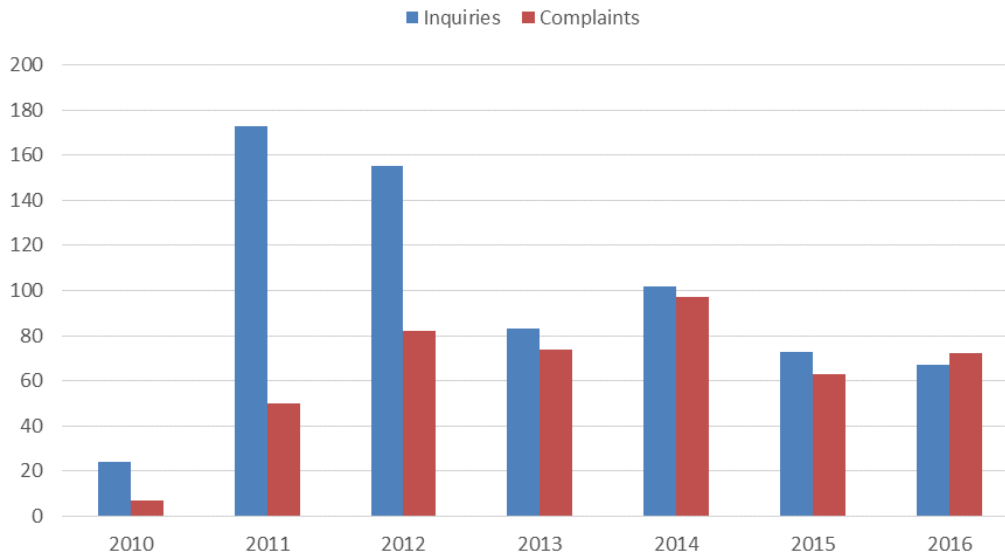
The Electricity Industry Act 2010 includes similar obligations in respect of electricity retailers and lines companies.

²⁶³ <http://gasindustry.co.nz/work-programmes/retail-gas-contracts-oversight-scheme/assessments/>

²⁶⁴ <http://www.utilitiesdisputes.co.nz/>

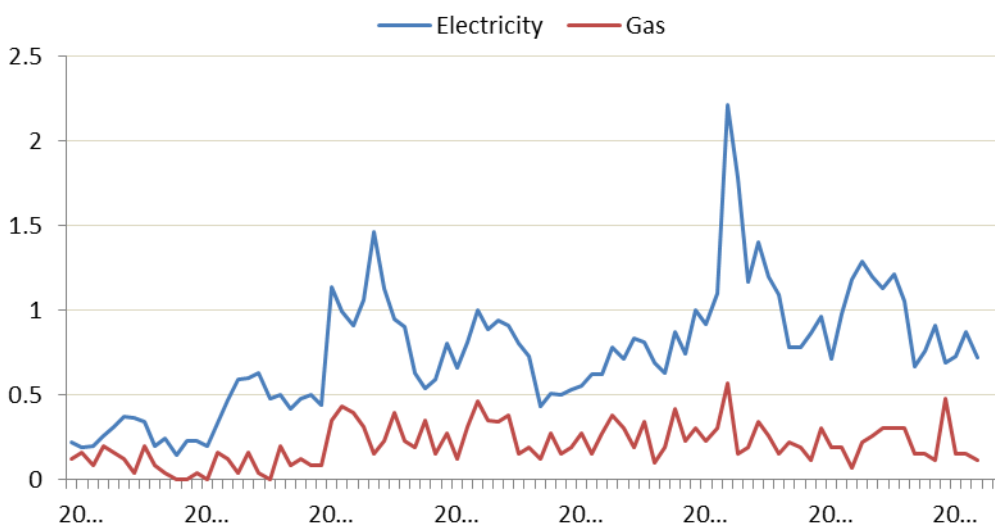
The most common grounds for consumer complaints involve billing, which accounts for almost half of all complaints, followed by customer service, disconnection, metering and supply issues. Figure 46 shows gas-related inquiries and complaints since the Scheme commenced as electricity and gas consumer complaints resolution scheme commenced, and Figure 47 compares the number of electricity and gas complaints per 10,000 ICPs.

Figure 46: Gas-related Consumer Inquiries and Complaints 2010-2016



Source: Gas Industry Co 2016 Annual Report
2010 covers three months from the commencement of Utilities Disputes as the approved consumer complaints resolution scheme (1 April 2010-30 June 2010)

Figure 47: Electricity and Gas Complaints per 10,000 ICPs



Source: Gas Industry Co 2016 Annual Report

11.15 Raising Awareness

With greater fragmentation of the gas industry, natural gas promotion is not as coordinated or afforded the same high profile as it was in the early years of the modern gas industry when largely orchestrated through the Gas Association of New Zealand (GANZ). Retailers provide gas-related consumer information on their websites and marketing promotions, but not at the level of former campaigns that incorporated significant print and television exposure. There is, however, some specific gas promotion, as well as dual electricity and gas offerings, as retailers find competitive advantage in being able to provide consumers with a single source supply of both forms of energy. In the case of Trustpower, the multiple utility offerings extend also to telecommunications.

The development of a robust market for residential customers was a key part of the Government's early drive for New Zealanders to embrace the then newly-available energy from Kapuni, and subsequently Maui. Extensive distribution networks were constructed, but despite having over 278,000 connections, penetration rates on the distribution networks are not as strong as in, for example, Australia.

Problems in the competitive positioning of residential gas have included its status as a discretionary fuel, complexities associated with the involvement of multiple parties in a gas connection (gas retailer, distributor, gasfitter, and appliance retailer), a comparatively high upfront investment in appliance purchase and connection, and the proportion of fixed charges in tariffs. The customer proposition to offset these difficulties has traditionally been centred on the significant lifestyle benefits of gas and its generally lower energy cost.

Other consumer issues have related to gas supply longevity, the fact that gas is a carbon fuel in an age of environmental sensitivity, and an increasing diversity of competition in water and space heating options, including LPG, heat pumps, low-emission solid fuel burners, solar panels and micro wind turbines. Whereas previously new subdivision developers may have automatically installed gas reticulation, they are now more carefully considering the competing options.

More generally, the promotional baton is being picked up by Gas New Zealand, a recently-formed gas sector group representing GANZ and the LPG Association of New Zealand.

The *Consumer Energy Options* report (**Page 15**) and the *Long-term Gas Supply and Demand Scenarios 2016 - Update* report (**Page 18**) are also intended to provide supporting information for industry marketing efforts.

11.16 Regulatory Performance

Policy and regulatory objectives for the retail sector have an emphasis on competition and the protection of small consumers. The latter recognises that, unlike large industrial and commercial consumers, residential and small commercial users do not have the same level of business resources and expertise to influence supply arrangements through negotiation.

Over the past five years, improved governance arrangements have further strengthened competition within the retail gas sector, generated market efficiencies and provided better protections for small consumers. The improvements have largely fulfilled all of the policy and regulatory objectives for the residential market, and have included:

- formal arrangements for customer switching between retailers, supported by active encouragement for consumers to seek out the best deal.

- formal downstream reconciliation arrangements, which have improved retailers' management of metering and consumption data, bringing a significant reduction in the economically inefficient UFG volumes on distribution networks.
- enhanced contract arrangements between retailers and smaller consumers.
- a formal consumer complaints resolution scheme for gas users.

Gas Retail Policy Objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> • The supply of gas meets New Zealand's energy needs by providing competitive market arrangements. 	Approximately 99 percent of small gas consumers are connected to a gate station where at least seven retailers trade. Market concentration across all regions has diminished since 2009
<ul style="list-style-type: none"> • Delivered gas costs are subject to sustained downward pressure. 	Customer switching arrangements in place since 2009 have strengthened market contestability and, by encouraging consumers to seek the best supply price, have contributed to downward pressure on delivered gas costs.
<ul style="list-style-type: none"> • All small customers have effective access to a complaints resolution system. 	Utilities Disputes provides a free and independent complaint handling service for small gas consumers.
<ul style="list-style-type: none"> • Contractual arrangements between gas retailers and small consumers adequately protect the long-term interests on small consumers. 	The outcome-based objectives for retail contracts under the Retail Gas Contracts Oversight Scheme are designed to ensure retail contracts are in the long-term interests of consumers. Retail contracts have been independently assessed for alignment with the benchmarks, and alignment is rated as 'Significant'.
<ul style="list-style-type: none"> • Effective and efficient customer switching arrangements that minimise barriers to customer switching. 	Efficient arrangements enabling consumers to switch between competing retailers are provided by the Switching Rules. Switching rates have quadrupled, and switching times have declined substantially since these Rules came into effect.
<ul style="list-style-type: none"> • Accurate, efficient and timely arrangements for the allocation and reconciliation of downstream gas quantities. 	Arrangements for the allocation and reconciliation of downstream gas quantities are provided by the Reconciliation Rules. These have introduced transparency, enforceability and certainty to the downstream reconciliation function. Further improvements, including through trialling of a day-after delivery (D+1) allocation methodology, are in train.
<ul style="list-style-type: none"> • An efficient market structure for the provision of gas metering, pipeline and energy services. 	This policy objective is met through provisions of a number of regulatory arrangements. The Reconciliation Rules provide a process for efficiently allocating gas transported through distribution networks; the Gas Distribution Contracts Oversight Scheme sets out terms for retailers using those networks; and the Retail Gas Contracts Oversight Scheme incorporates expectations relating to metering roles and responsibilities.
<ul style="list-style-type: none"> • The respective roles of gas metering, pipeline and gas retail participants are able to be clearly understood. 	The Retail Gas Contracts Oversight Scheme and Gas Distribution Contracts Oversight Scheme require that industry contracts provide clear information about respective roles.

11.17 International Retail Market Practices

New Zealand's gas retail market policy objectives are very much in line with those of overseas jurisdictions, which share the common themes of competition, delivered energy costs, and small consumer protection.

Full competition was introduced in the UK from 1999, when customers were able to shop around for their gas supplier. Considerable store is placed in an efficient switching regime, which energy regulator Ofgem maintains keeps pressure on costs, and promotes greater choice of tariffs and services for customers. There is an increasing reliance in the UK on self-regulation to supplement market mechanisms in meeting customers' needs. These have included codes of practice and the creation of a consumer complaints services through an Energy Supply Ombudsman scheme.

In Australia, state and territory governments were responsible for regulating the retail energy markets until 1 July 2012, when the Australian Energy Regulator (AER)²⁶⁵ assumed this function under the National Energy Customer Framework (Customer Framework), which incorporates the National Energy Retail Law, National Energy Retail Rules, and National Energy Retail Regulations. Together, these set out the key protections and obligations for energy consumers and their suppliers.

The reforms were the final stage in the transition to national regulation of energy markets in Australia, and are aimed at streamlining regulation to support an efficient retail market with appropriate consumer protection. They have moved consumer protections for energy customers in Queensland, NSW, the ACT, Victoria, Tasmania and South Australia into a single framework enforced by AER. Provisions under the AER's jurisdiction include:

- monitoring and enforcing compliance.
- issuing authorisations, and exemptions, to retailers to sell energy.
- providing an online energy price comparison service²⁶⁶ for small customers.
- administering a national retailer of last resort scheme if a retail business fails.
- reporting on the performance of the market and participants, including energy affordability, disconnections and competition indicators.

In order for the Customer Framework to apply, each participating jurisdiction passes its own legislation adopting the Retail Law, Rules and Regulations. They may choose to change the way that these apply, for example by creating additional or different protections and obligations for customers and businesses in their regions. Western Australia and Northern Territory do not participate in the reforms.

Previously, electricity and gas companies in Australia were required by their licences to comply with service standards in industry codes and other guidelines.

The AER is not involved in setting retail energy prices. The government of some states and territories – Queensland, NSW, the ACT, South Australia and Tasmania – remains responsible for control of the energy prices in those regions, however, most of these are for electricity only. Regulated prices for gas are applied only in NSW and South Australia. In Victoria, there are no regulated prices for gas or electricity.

²⁶⁵ <https://www.aer.gov.au/>

²⁶⁶ www.energy-made-easy.gov.au

Consumer protection was included in a series of legislative packages from 1996 to 2009 to harmonise and liberalise the EU's internal energy market. The measures allowed new gas and electricity suppliers to enter Member States' markets, and consumers to choose their supplier (industrial from 1 July 2004, and domestic from 1 July 2007). An objective of the EU internal market is to ensure a functioning market with fair market access and a high level of consumer protection.

Extensive amendments have been made with new Gas Directives relating to consumer protection²⁶⁷. Member States must ensure that the roles and responsibilities of energy undertakings are defined with respect to contractual arrangements, commitment to customers, data exchange and settlement rules, data ownership and meter responsibility.

Other features include:

- access to consumer information as a means of improving customers' ability to switch supplier.
- vulnerable customer definition and arrangements.
- complaints and dispute settlement.
- the effective communication to all consumers of the Commission's Energy Consumer Checklist, which provides consumers with practical information about their rights.

In North America, electricity and gas consumer protection arrangements are generally under the jurisdiction of State Public Utility Commissions (USA) and provincial governments (Canada).

Ontario, for example, introduced new rules in 2010²⁶⁸ to provide greater consumer protection. It gave the Ontario Energy Board more powers to crack down on non-compliance and to regulate such issues as the form of contracts and invoices; the availability of information in other languages; contract renewals, extensions and amendments; and enhanced rights for contract cancellation, including a 10-day cooling off period. It can make regulations on security deposits and service cancellations, as well as issue directives on energy company employee training, employee background checks, and identification requirements such as badges. The legislation allows the government and the board to regulate some segments of the industry, while leaving others subject to competition.

²⁶⁷ European Commission: Interpretive Note on Directive 2009/72/EC Concerning Common Rules for the Internal Market in Electricity and Directive 2009/73/EC Concerning Common Rules for the Internal Market in Natural Gas, 22 January 2010.

²⁶⁸ Energy Consumer Protection Act 2010.

12 Natural Gas Pricing

The availability of multiple retailers and significant consumer switching between retailers indicate competitive forces are at work in the retail market. Pricing generally signals the full cost of producing and transporting gas.

As sought by Government policy objectives, delivered gas costs and prices are subject to 'sustained downward pressure' in a number of ways. Gas Supply Agreements (GSAs) are reflecting increased competition following the initial post Maui 'reset', and new entrants together with new sources of gas have increased short-term gas supply availability with a positive impact on gas price trends. However, current projections for a tightening supply/demand balance in the next 4-5 years in the absence of reserves replenishment may result in increased wholesale gas prices. Mechanisms have been put in place to enable consumers to readily compare retailer prices and to switch supplier easily and quickly. Transmission and distribution prices are constrained by regulation in the form of a price-quality control regime that took effect on 1 July 2013.

This section describes natural gas pricing in different parts of the market, whether by sector or region, and considers whether price differentials are a natural outcome of a competitive market. Publicly available pricing information is used where possible, but as these sources are not comprehensive, an accurate assessment of the composition of end prices to different consumer types is challenging. A number of assumptions are therefore made to bridge information gaps, and to simplify complexities arising from the uniqueness of each consumer by creating an 'average', or aggregate, to draw out key structural features of price. Pricing is an important part of the Gas Story and this discussion is a considered interpretation of available information and related factors that influence pricing.

Note: For the present, First Gas, which acquired Vector's transmission system and non-Auckland distribution networks on 20 April 2016 and the Maui pipeline on 15 June 2016, is continuing the pricing arrangements of the previous owners, Vector and MDL. These can be found on the First Gas website.

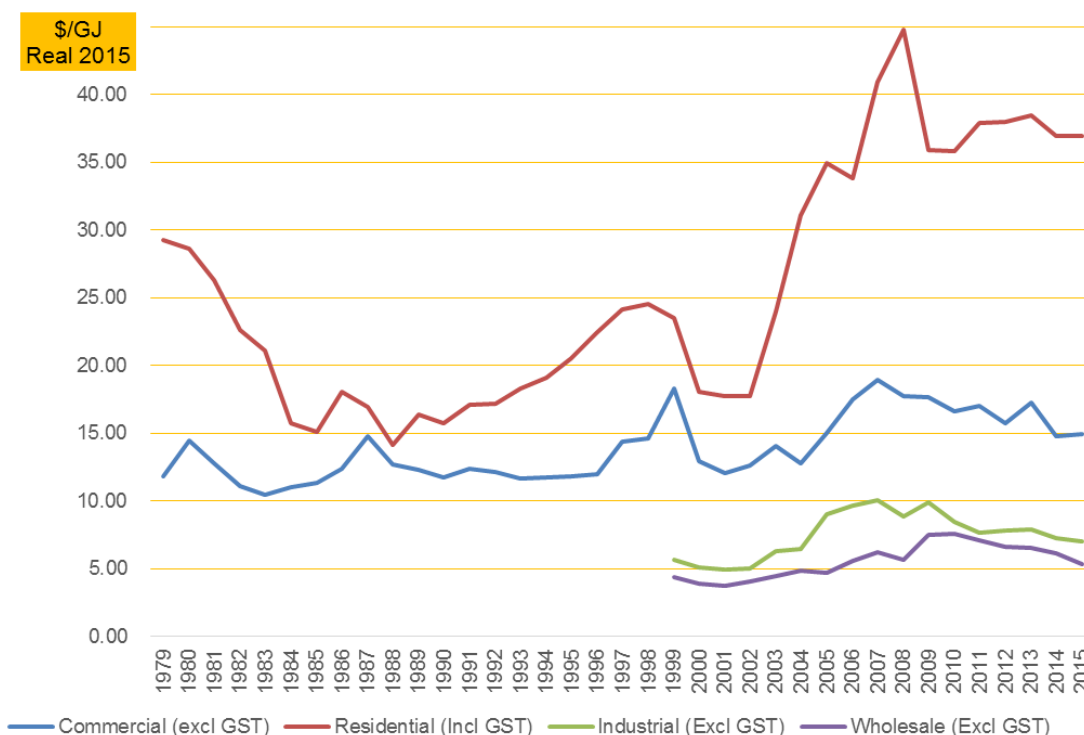
12.1 Background

There are a number of public reference points for natural gas prices – industrial, commercial, residential and wholesale prices published annually by MBIE in *Energy in New Zealand*, wholesale prices emerging from the emsTradepoint wholesale trading platform, residential tariffs published by individual retailers, and various statutory financial disclosures for regulated entities such as gas transmission and distribution companies, that assist price unbundling analysis. Annual reports of publicly listed major participants are also a source of information.

MBIE provides aggregate data on gas prices through retailer quarterly surveys and publishes price series for four main sectors (Figure 48):

- wholesale (GST exclusive)
- industrial (GST exclusive)
- commercial (GST exclusive)
- residential (GST inclusive)

Figure 48: Average Natural Gas Cost by Customer Type (Real 2015)



Source: MBIE 2016 Energy in New Zealand

An alternative source of pricing information became available in October 2013 with the establishment of emsTradepoint's screen-traded physical commodity gas product platform. While more a spot-trading facility than a comprehensive wholesale market play, the emsTradepoint market reveals a price for a standardised gas product for delivery at a single notional gas hub (adjacent to Frankley Rd on the Maui pipeline) for delivery; on the day or day ahead (up to two weeks); for a block week (up to eight weeks ahead); or for a block month (up to 24 months ahead).

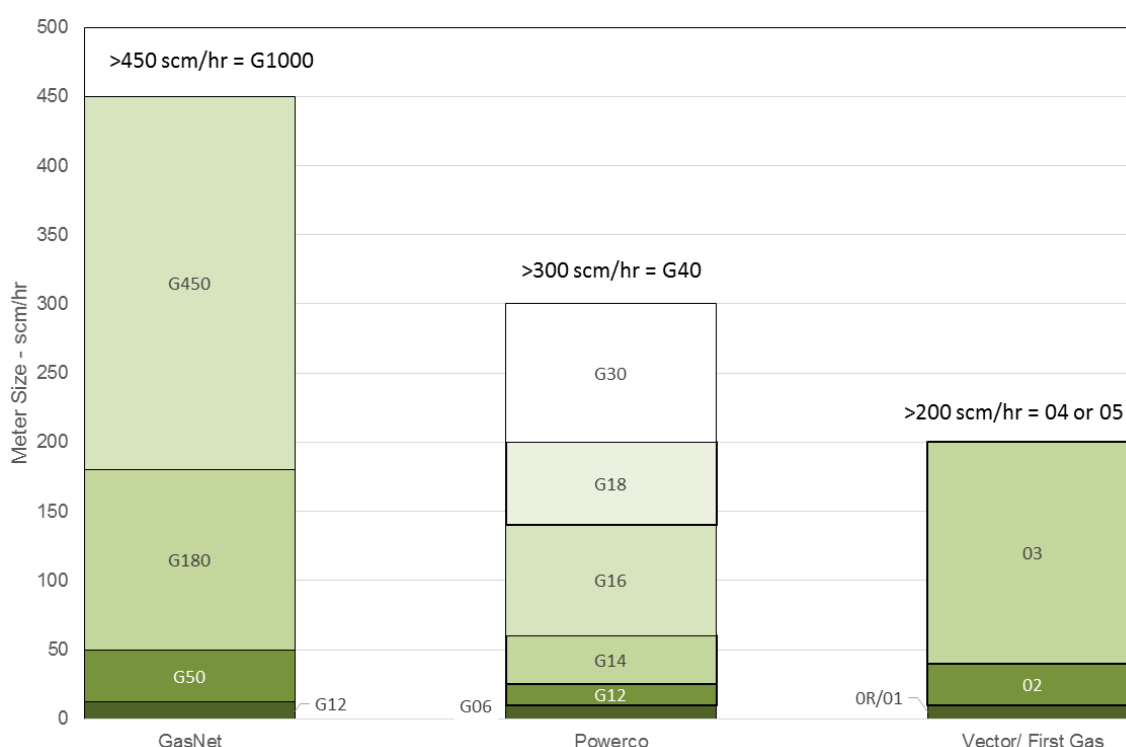
MBIE uses specific definitions to segment the gas market into its four broad categories. In general this is not the same way retailers segment the gas market, although there are similarities in the residential category. The residential sector is defined by MBIE as consisting of living quarters for private households. The commercial sector consists of non-manufacturing business establishments, such as hotels, motels, restaurants, wholesale businesses, retail stores, and health, social and educational institutions. The industrial sector consists of all facilities and equipment used for producing, processing or assembling goods (but excludes gas sold for electricity generation).

Retailers segment on the basis of load category, rather than purpose, and tend to mirror the network (distribution) company's approach to segmentation. This is because retailers are price takers on regional networks, but have to compete with other retailers on those networks for customers. They therefore carry volume risk through switching activities. To minimise this risk their pricing reflects how the network companies charge them.

Network companies have been progressively rationalising their load groups for setting tariffs as they adjust their medium and long-term pricing outcomes away from legacy structures to meet the new

challenges of changed regulatory and business environments. The considered trade-off is between reducing administrative complexity and creating the right pricing signals to end consumers for gas investment and usage whilst enabling network companies to earn an acceptable regulated return on their investments. Vector Distribution reduced 16 standard price plans to five across its (then) North Island networks in 2013 and subsequently created a further GA05 Industrial category in 2015 as an option for larger industrials²⁶⁹. First Gas is continuing Vector's pricing methodology and load categories while it develops its own pricing methodology, expected to be implemented in the pricing year commencing 1 October 2018. In 2015 Powerco rationalised its residential pricing to three regions, but maintained five pricing regions for its other load categories. GasNet has moved from 11 standard load groups to five (Figure 49). Nova maintains a private network and its pricing is not subject to public disclosure.

Figure 49: Network tariff structures (from 1 October 2016)



Source: Network Pricing Disclosures

For large consumers (in excess of 200 scm/hr) pricing can often be on-application and highly customised.

It is understood that retailers and network companies maintain internal commercial guidelines for their standard tariffs. These are not published for competitive reasons, although under the Commerce Commission's information disclosures for gas pipeline businesses a limited amount of transparency is created on non-standard pricing for transmission and distribution charges²⁷⁰. In a number of instances, particularly for very large customers, tariffs will be non-standard. Given the load diversity in the

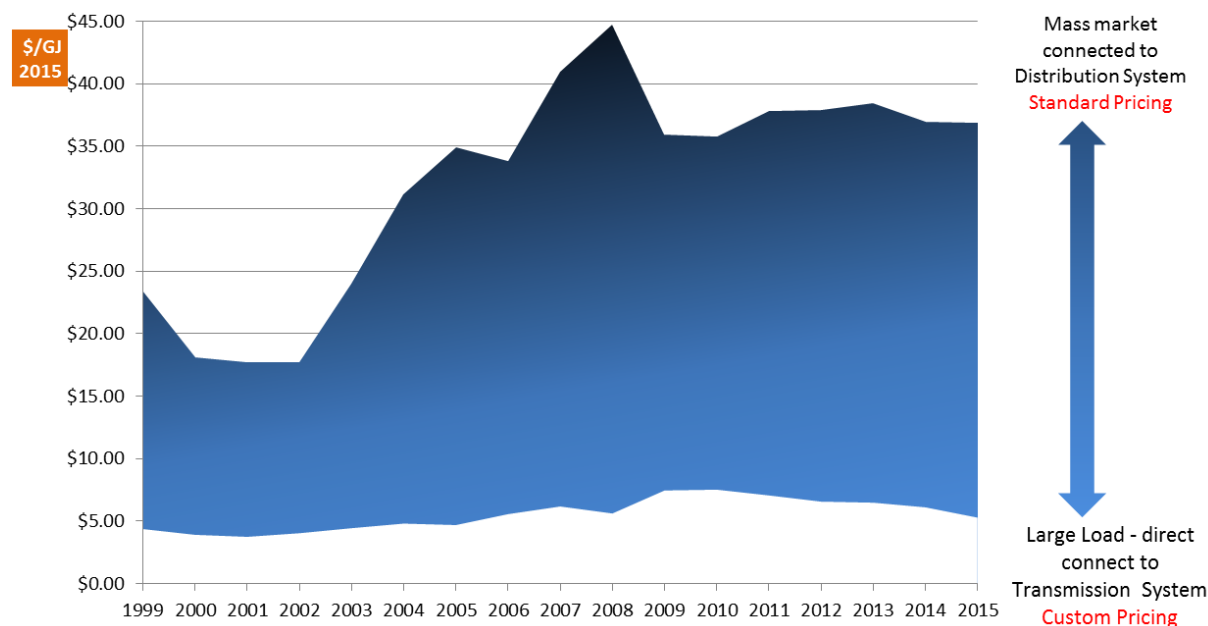
²⁶⁹ Plan deemed suitable for industrials in excess of 12000 MWh pa. This is equivalent to about 43 TJ pa.

²⁷⁰ The Default Price-Quality Path Compliance Statements give some insight into the number of ICPs on non-standard transmission or network prices and the weighted average price of those connections.

market, and opportunities for significant business consumers to negotiate tailored arrangements, commercial and industrial prices are expected to vary considerably.

Retail pricing is consequently more like a continuum between standard pricing and custom pricing than hard categorisation might suggest (Figure 50). This essentially reflects the approach for other commodities where cost-to-serve and price inelasticity see mass market consumers charged more per unit than large users. However there are signs of increasing customisation of the mass market, with different options for bundling services and products to match user profiles.

Figure 50: Gas Price Continuum (real \$2015)



12.2 Wholesale Gas Price

The concept of a wholesale gas price in the New Zealand market has become increasingly difficult to untangle from its various price determinants as the market has moved away from what the term encompassed in the early years of the 21st century and the meaning of the term as defined in the Gas Act (gas purchased for the purpose of on-sale). In 2000 the Maui gas field was the dominant supply and delivered a single product under the Maui Gas Contract anywhere on the Maui transmission system at a single price to one wholesale customer (the Crown) with a lot of demand flexibility at a reducing real gas price²⁷¹ over a long-term (30-year) agreement. Today there are a number of gas fields delivering to a larger number of big customers. Terms for tranches of gas vary from relatively short (intra-year) to intermediate (10 years as between Todd and Methanex) to longer (Kupe to Genesis). Price captures both the market conditions at the time (whether market was perceived to be short or long) and the investment underwriting requirements of gas treatment facilities (the degree to which it can accommodate demand swing). The wholesale price is inclusive of a carbon charge, but excludes any transport costs. It is heavily influenced by differing contract structures from different fields settled in different periods of the gas market. Consequently a range of wholesale gas prices prevail in the market as a function of the time that the contract was entered into, the gas price escalation formula

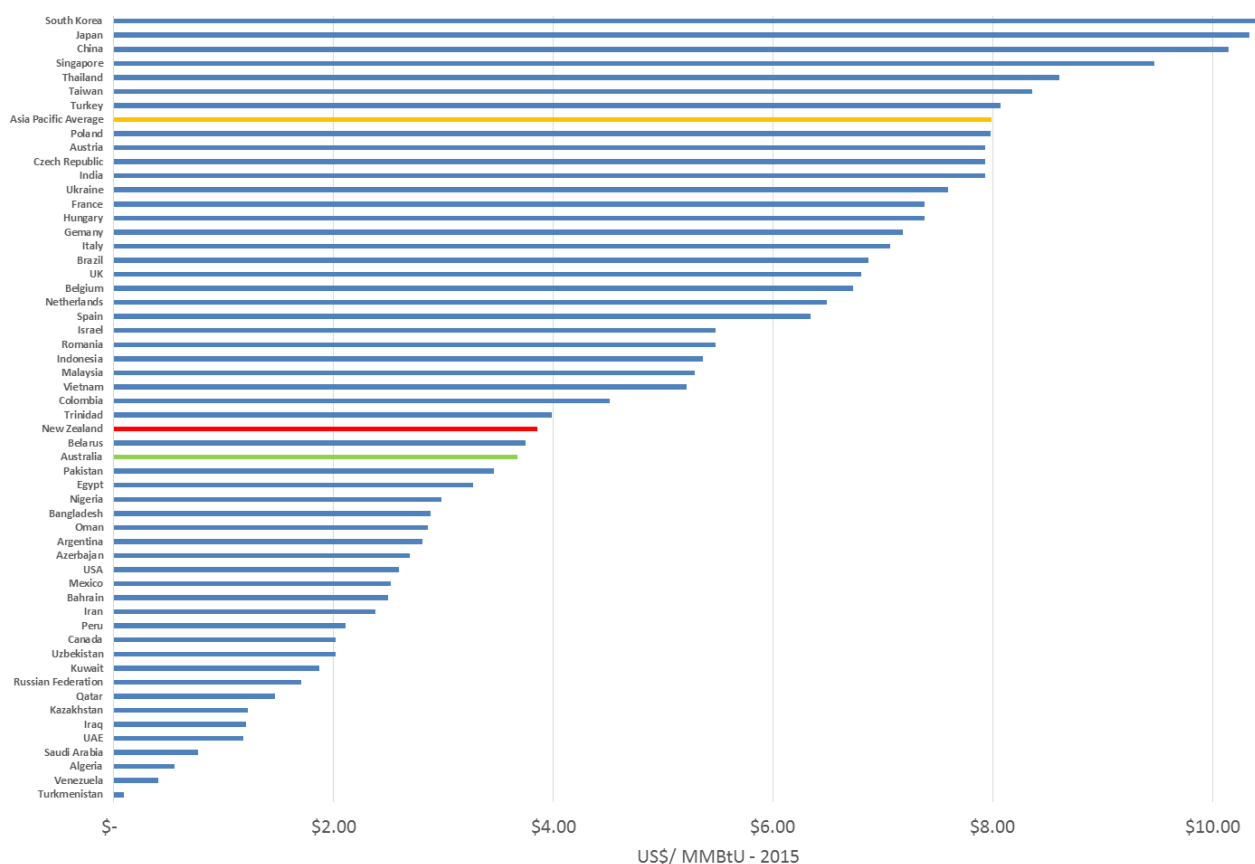
²⁷¹ The escalation clause was the greater of either 50 percent of the inflation rate, or the inflation rate less 3 per-cent. The gas price included transmission charges for delivery to any point on the Maui pipeline.

applied, and the service being bundled in the agreement, including take flexibility or swing being offered.

In New Zealand the wholesale gas price is generally set by gas-on-gas (GoG) competition characterised by an interplay of supply and demand through multiple buyers and sellers entering into bilateral agreements although the significant portion of gas sold to Methanex is generally set by netback from final product. GoG is the dominant mechanism for setting wholesale gas price globally accounting for 45% of total world gas consumption in 2015²⁷².

Based on a global survey of wholesale gas prices, New Zealand as reported by MBIE for 2015, at US\$ 3.86/ MMBTU, is positioned towards the middle of surveyed countries Figure 51²⁷³. Care is needed in interpreting this data as wholesale price in the survey is considered from the 'point of first sale' in the country. Wholesale price can therefore cover different points in the gas chain (wellhead price, border price, hub price, city-gate price)²⁷⁴.

Figure 51: Wholesale Prices in 2015 by Country



Source: International Gas Union

²⁷² International Gas Union – *Wholesale Gas Price Survey-2016 Edition*

²⁷³ Data displayed other than for New Zealand is for countries with more than 7 bcm (280 PJ pa) consumption. Asia Pacific average (orange) and Australia (green) are shown as comparisons

²⁷⁴ In New Zealand the wholesale price is generally the price at the supplier's welded point on the transmission system, or in the case of emsTradepoint the notional trading point at Frankley Rd.

To date the most comprehensive source of public information on wholesale gas prices has been the data produced quarterly and annually by MBIE in its publication *Energy in New Zealand*. Since October 2013 the emsTradepoint platform has also been providing some transparency around smaller trades between market participants for a fungible gas product.

MBIE's determination of wholesale gas price should be distinguished from the discussion on the Wholesale Gas Market (**Section 10.0, Page 129**), which considers the wholesale market more generally in terms of wholesalers buying gas from producers for on-sale. The *Energy in New Zealand* methodology for calculating the wholesale price is based on a definition of wholesale gas being '*gas for retail sale and electricity generation*²⁷⁵'. The average wholesale price is calculated by dividing the sales revenue (excluding any delivery costs but including the carbon charge) by the amount of gas sold in this category.

This price definition is at odds with the term 'wholesaler' used elsewhere in the *Energy in New Zealand* where wholesalers are considered to be Vector, Todd Energy, Contact Energy and Greymouth Petroleum²⁷⁶. The definition also excludes all direct gas sales by producers to large end-users, such as Methanex or Ballance Agri-Nutrients, if that gas is received at their site gates. Conversely, if Methanex acted as its own shipper for some of its gas, that volume would be included under wholesale sales.²⁷⁷ . Accordingly, the wholesale price published by MBIE may not reflect significant supply agreements that involve lower price terms. This is distorting not only for wholesale price data as might be generally understood to encompass the term, but also for the industrial price category as used by MBIE where some of these larger volume sales are being captured in those statistics.

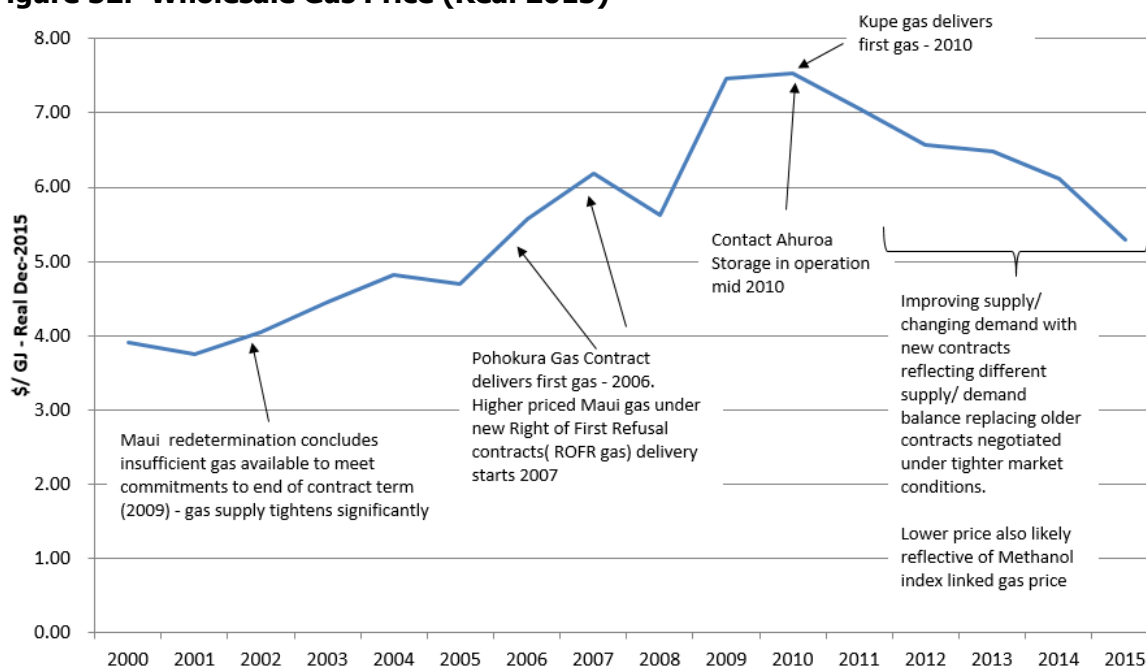
Wholesale price data trends however do reflect important structural changes in the market since 2000, particularly the shift in supply (reserves and field diversity) and demand changes (shift in gas demand for electricity generation) as well as contract structures (commodity indexing in Methanex agreements) (Figure 52).

²⁷⁵ 2012 *Energy Data File* – technical notes for section I. Prices. Definitions not published in *Energy in New Zealand* since then, but MBIE confirms that these have not changed.

²⁷⁶ 2016 *Energy in New Zealand*.

²⁷⁷ If gas is picked up at a point that is not the large user's plant gate, in theory the gas may be shipped to any delivery point on the transmission system for purpose of on-sale rather than own use.

Figure 52: Wholesale Gas Price (Real 2015)



Source: MBIE 2016 Energy in New Zealand

While it is difficult to identify and separate all of the factors that shape the wholesale gas price curve, there appears to be two main periods; one of increasing real prices as a result of the 2002 Maui redetermination, which created a tight supply situation; and a second period of easing prices as the supply conditions improved and contract structures changed, particularly with Methanex adopting commodity-linked pricing for its gas purchases.

Before 2002 the Maui Gas Contract dominated supply and its price escalator ensured an annual decrease in the real price of gas. Maui's abundance and flexibility to meet swing demand at a reducing real price was generally a disincentive to investment in new field development. Following the redetermination of reserves in 2002, which left the field with insufficient reserves to meet its contract, large users, particularly electricity generators, and Methanex were left to compete for the next available tranche of gas from the then undeveloped Pohokura field, whose Final Investment Decision also hinged on the gas price that would help underwrite the development. The first tranche of Pohokura gas contracts negotiated in 2006 saw a significant increase in the gas price as a tight supply situation coincided with high demand, particularly from electricity generators with baseload gas fired generation assets. This was followed by new Maui reserves sold under Right of First Refusal (ROFR) contracts at the new market price²⁷⁸. Gas contracts renewed from the Kapuni, Mangahewa and McKee fields also rose from 2002, reflecting the tightening market for supply and an expectation of higher prices for Pohokura gas.

Aside from a higher price, the new contract structures were also different. The original Maui contract, for example, had minimum take-or-pay provisions, but it also allowed buyers to bank gas paid for but

²⁷⁸ Because 'reserves' by definition are resources that are economic to recover, if the price of gas increases more investment is justified to produce more technically difficult recoverable resources. Hence reserves under the Maui contract at the Maui gas price expired, but marginal reserves under Maui ROFR contracts from the same gas field were able to be added to the overall gas supply.

not taken – known as prepaid gas. Maui take-or-pay quantities applied over a 12-month period, allowing buyers to balance their obligations across different seasonal demand periods. As long as the buyer had taken the minimum take-or-pay quantity at the end of the 12-month period, the average price would match the marginal price (i.e. fully variable)²⁷⁹. Post-Maui contracts appear to have tightened these provisions considerably, affecting the average gas price paid for by electricity generators²⁸⁰. The more restrictive provisions also partly reflected the new gas facility designs having less excess capacity and the need to underwrite the fixed costs of the facility through capacity bookings. These new pricing structures particularly affected thermal power stations where demand for gas is seasonal and dependent on hydro storage. This meant that generators needed to book and pay for facility capacity to meet peak needs, which would be largely underutilised on a daily basis²⁸¹. This affected the average price of uplifted gas by reducing the flexibility to effectively convert the fixed cost represented by take-or-pay²⁸² provisions into a fully variable component.

Between 2010 and 2014 some of the forces that shaped the upward trend have moderated as the market adjusted to a new equilibrium. Factors that have influenced a softening of the wholesale price have included:

- Contact Energy's Ahuroa storage facility which has provided flexibility by enabling Contact to store gas taken but not immediately used under its contracts, and to use it when required for gas-fired electricity peaking generation at Stratford.
- increased gas reserves.
- expiry of the first tranches of Pohokura gas and renegotiation of terms.
- less demand from generators for gas as a combination of new geothermal, wind, and gas peaking plant displaced gas baseload generation – including the closures of Contact's Otahuhu B and Mercury's Southdown CCGT plants in 2015.
- greater demand for gas by Methanex, on price terms that reflect the international commodity price for methanol, rather than Producer Price Index (PPI) escalation²⁸³.

emsTradepoint proxy wholesale price

The NGP:TRS²⁸⁴ (Natural Gas Physical: Trading Region South), listed by emsTradepoint is the first exchange-traded natural gas product in New Zealand. It is physically settled by Approved Nominations at the Trading Region South Hub on the Maui pipeline, adjacent to Frankley Road (Figure 53).

²⁷⁹ By 1998 (20 years into the 30-year contract) the actual take exceeded the annual contract quantity in only two years. However the ability to uplift the prepaid gas at a later date ensured that eventually all the gas is paid for at the variable price.

²⁸⁰ Various Contact Energy investor presentations point to reduced flexibility in gas contracts as a commercial driver for investing in the Ahuroa gas storage facility.

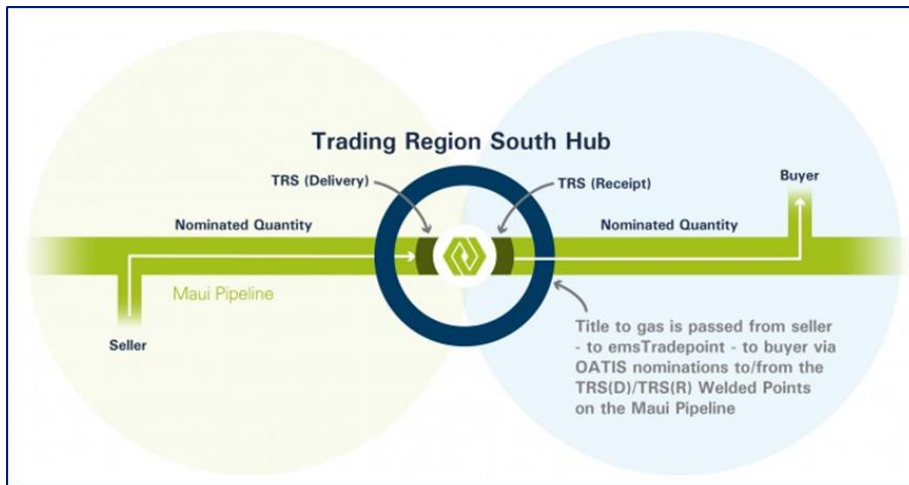
²⁸¹ Ref: Contact and MRP monthly and quarterly operational data.

²⁸² Take-or-pay is a generic term used to describe a contract in which a buyer commits to 'take' a specified quantity of gas and to 'pay' for that quantity irrespective of uptake. The Maui Contract enabled buyers to uplift gas paid for, but not taken, at a later date for no cost apart from the Energy Resources Levy. As such, it gave buyers flexibility to vary their daily offtakes to match their demand within minimum and maximum quantities, while guaranteeing producers a stable income to underwrite their investment in the field. It is not a feature of more recent take-or-pay contracts.

²⁸³ http://methanex.com/investor/documents/2013/Methanex_Annual_Report_2012.pdf

²⁸⁴ From 1 October 2015 the NGP-FR product was replaced with NGP-TRS (Natural Gas Physical – Trading Region South) and trading point was shifted from the Vector SKF line to the Maui line.

Figure 53: emsTradepoint



Source: emsTradepoint

emsTradepoint is emerging as a proxy for the wholesale gas commodity price, as opposed to an inferred wholesale price that encapsulates a range of bespoke contract terms, including the value of the commodity as well as supply security and take flexibility.

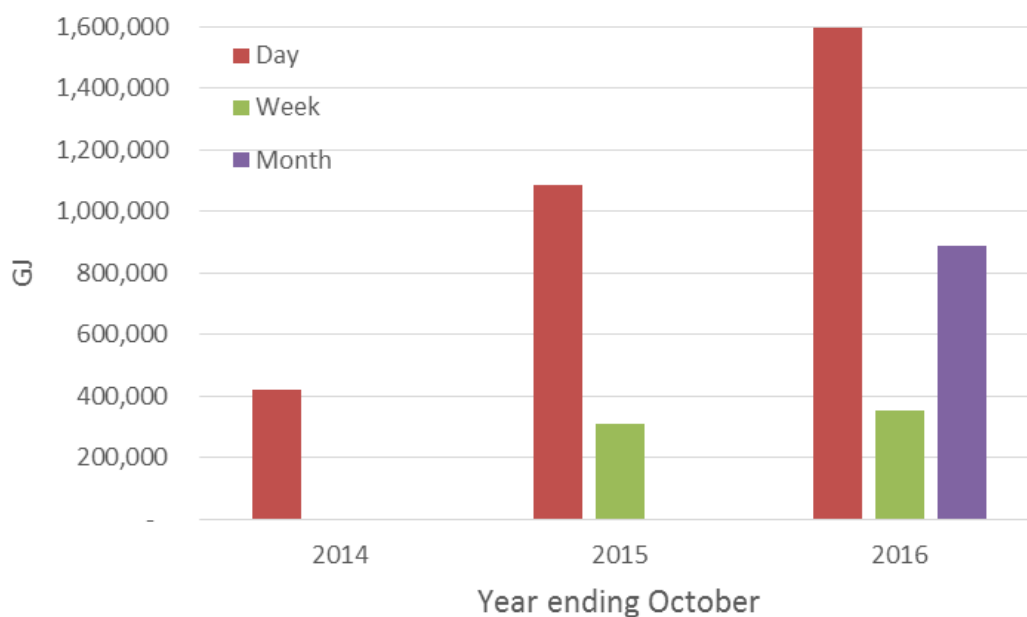
Since its establishment in October 2013, emsTradepoint's New Zealand gas market has grown to encompass 11 trading participants in the pool. It is also working on a delivery solution for parties who wish to trade gas on the screen, but who don't have shipping arrangements in place.

Trade is available in three products; NGP-TRS (D) for the current day plus up to the next 13 days; NGP-TRS (W) for the next full week plus up to the next 7 weeks; NGP-TRS (M) for the next full month plus up to the next 24 months²⁸⁵.

Trading and volume has grown since the platform's inception (Figure 54).

²⁸⁵ The contract window of listed products is a function of the trading board. It does not restrict participants to place orders ahead of this window. If a participant wishes to place a bid or offer for product ahead of the listed period, upon their request, emsTradepoint can add listings for future products to the trading board.

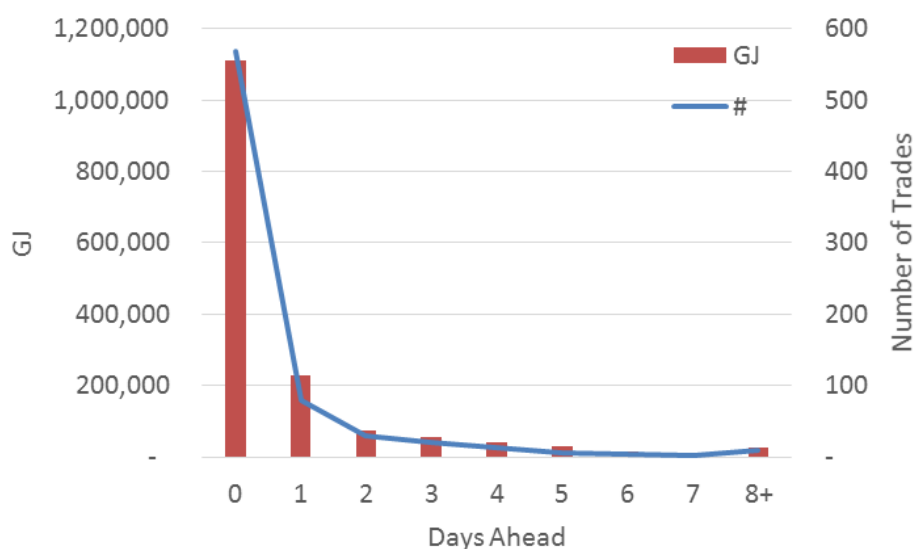
Figure 54: emsTradepoint Product and Volume



Source: emsTradepoint

The day product is the most commonly traded product and, since the introduction of market-based balancing²⁸⁶, on the day trading (OTD) is the dominant transaction averaging 2-3 TJ per trade (Figure 55).

Figure 55: Day product trading - Year-ended October 2016



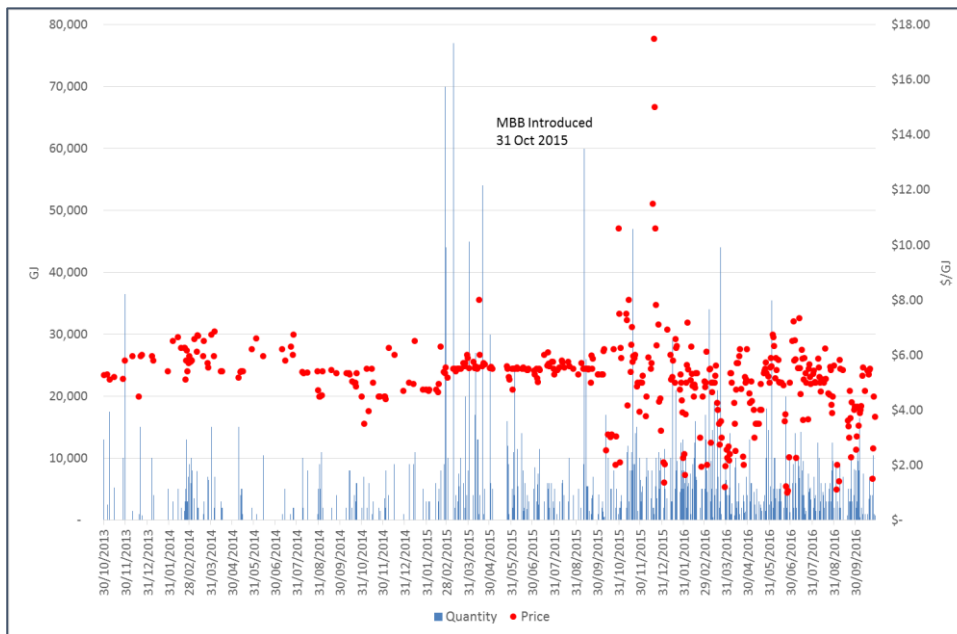
Source: emsTradepoint

²⁸⁶ MBB was introduced into the Maui Pipeline Operating Code on 1 October 2015 requiring welded parties to the Maui pipeline to be in balance at the Maui welded points (ie: actual deliveries to match approved nominated deliveries) with imbalances outside of tolerances to be cashed out. This has stimulated day trading by shippers.

The weekly strip product began trading in February 2015, typically for the week and two weeks ahead as strips. The monthly product started trading in January 2016. There have been only a few trades in the monthly product, but these have so far been purchased as strips of up to 3 months indicating the market is being used to cover seasonal gaps of 2.5-5 TJ/ day in gas portfolios.

Price volatility has increased since the introduction of MBB with the lowest price achieved being \$1.00/ GJ and the highest \$17.50/ GJ (Figure 56)²⁸⁷.

Figure 56: Price Trend Day product - by time of trade



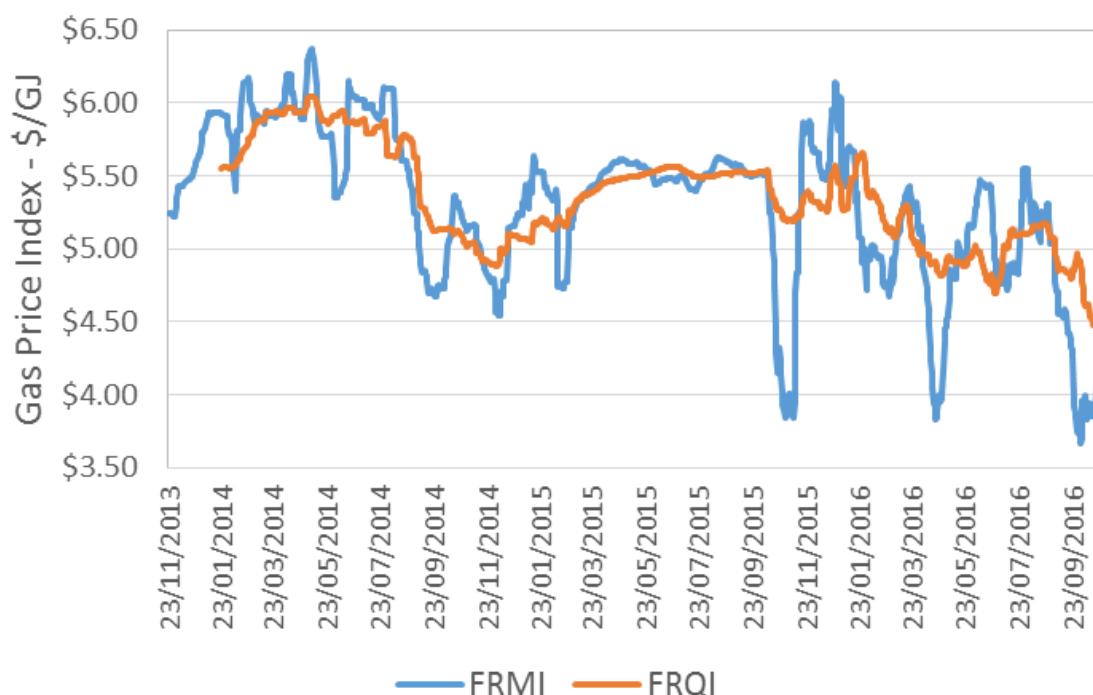
Source: *emsTradepoint*

Nonetheless, monthly and quarterly indices have trended downwards with the June 2016 quarterly weighted price of \$4.78/GJ being considerably lower than the \$5.31/ GJ reported by MBIE in its quarterly update²⁸⁸ (Figure 57).

²⁸⁷ The mechanics of market-based balancing are under review. It is expected that spreads will reduce and stabilise as adjustments are made.

²⁸⁸ Both prices include the carbon charge. The difference in reported prices reflects a difference in the products with MBIE data including all contract types with different inherent service levels and negotiating periods, and *emsTradepoint* reflecting a single traded contract.

Figure 57: emsTradepoint Frankley Rd Natural Gas Indices²⁸⁹



Source emsTradepoint

With greater depth and liquidity developing in the spot market over time it is conceivable that emsTradepoint products might evolve to become proxy price markers for New Zealand gas on which to base gas price in gas sales agreements. This would help overcome some of the difficulties with longer-term contracts with locked-in price terms that are no longer reflective of the actual market conditions or value of gas. It would also remove a price risk for both parties in a supply agreement if gas price is more responsive to supply and demand characteristics through the term of the agreement²⁹⁰.

The bilateral gas contracting market is still the dominant form for gas commodity trading, but the emerging market for monthly product strips is an early indication of the potential the market has to replace bespoke bilateral arrangements with a more flexible product. In particular with an active trading platform where surplus and deficit gas may be traded with multiple buyers and sellers the arguments for fixed-term bespoke arrangements become less compelling when compared with the greater flexibility of building a portfolio based on product strips and spot trading for daily or weekly differences. That such a contracting strategy has yet to have pickup may indicate caution by downstream participants waiting to see depth and liquidity in the traded market before doing so. This may take some time as the ability to switch contracting arrangements is also a function of parties' inability to change their purchasing arrangements where suppliers have negotiated exclusivity.

Nevertheless the trading platform is a potential disintermediator in the wholesale market allowing upstream producers to contract directly with the downstream market without the need for a wholesale aggregator. The ability to disintermediate will to a large extent also rely on developments in the gas

²⁸⁹ FRMI is the rolling monthly weighted average price, FRQI is the rolling quarterly weighted average price

²⁹⁰ Currently buyers and sellers face the same price risk over a longer term, but experience that risk differently. When gas prices are perceived to be low, sellers may be reluctant to enter into long-term agreements based on a pricing formula that only allows for inflation adjustment in case supply tightens in the future. Conversely when prices are high, buyers may be reluctant to enter into long-term supply agreements in case supply constraints ease and prices reduce.

transmission market, particularly the access regime, which is currently under review, and the associated range of transmission products and secondary market for them.

12.3 Retail Gas Price

The retail gas market is described in **Section 11.0, Page 137**. *Energy in New Zealand* broadly divides the retail market into residential (household), commercial, and industrial sectors.

Retail Market Participants

Retail market participants are primarily retailers, distribution network companies and meter service providers.

Retailers generally develop broad pricing regions in which to compete. The regions are customarily defined by the incumbent gas network (First Gas, Vector, Powerco and GasNet,), and often aligned with electricity pricing areas, themselves defined by lines companies and grid exit points.

The sales region approach enables the market to be segmented based on cost structures, since regions are often defined by pricing breaks in gas delivery infrastructure (transmission tariffs as well as different network tariff structures). Prices for using the First Gas North Island transmission system differ for different zones of the system. Network companies differ in their allocation of fixed and variable costs.

Retailers attempt to match their price structures with the delivered cost of gas and use fixed costs in their tariff structures to mitigate their volume or price risks. Cost of Supply Models (COSM) are used to determine tariffs. Within regions, tariffs are affected by the number of customers each retailer has and the retailer's overall market share. As retailers spread their fixed costs over their retail base in an area to avoid volume risk, tariff differences between retailers can arise within the same region. Tariffs will also be affected by each retailer's strategy to retain or gain market share and increasingly a dual fuel offer strategy is seen as important for gaining or retaining market share in electricity retailing.

As previously noted, retailers tend to classify customer groups by load rather than business activity. A Vector and First Gas network customer, for example, is classed as commercial if it is between 10-200 scm/hr, and industrial if greater than 200 scm/hr. GasNet has a fixed and variable tariff structure for up to 10TJ annual use and a fixed tariff structure for over 10TJ or non-standard agreements. Retailers make pricing plan distinctions between 'home' and 'business', with further distinctions between small to medium and large business customers.

End-users have ready access to competing retailers and to the tools to assess competing retail offerings. Consumer NZ's online Powerswitch facility²⁹¹ enables residential consumers to assess their best energy provider options based on their household consumption patterns. Retail contracts generally don't restrict customer switching or switching frequency, and switching statistics indicate consumers are both aware that they have a choice and exercise that choice (see **Section 11.6, Customer Switching, Page 143**)²⁹².

An attempt to extend Powerswitch to include business consumers was unsuccessful due to extensive price variations and a retailer preference for tailoring competitive offerings to end-users. From the business consumer's viewpoint, too, there are benefits in an ability to negotiate with individual retailers.

²⁹¹ www.powerswitch.org.nz/powerswitch

²⁹² In some cases special price offers are linked to minimum fixed terms.

The Retail Gas Bundle

The retail gas price bundle has a number of components:

- Producer (commodity) price comprising:
 - producer costs
 - Government charges (royalties, taxes, own use carbon charges)
 - producer (wholesale) margin
- Gas Transmission (First Gas) price comprising:
 - transmission costs
 - Government charges (taxes)
 - transmission margin
- Distribution network charges comprising:
 - distribution costs
 - Government charges (taxes)
 - distribution margins
- Metering charges
 - metering costs
 - Government charges (taxes)
 - metering margins
- Carbon charge
- Gas Industry Company levy
- Cost to service retail market²⁹³
- Retail margin
- GST (for residential gas use)

Few of these elements are publicly disclosed and it is difficult to comprehensively and accurately unbundle the retail price. In some instances, such as Gas Metering Services (GMS), retailers are less inclined to publish prices as metering is not part of the regulated business.

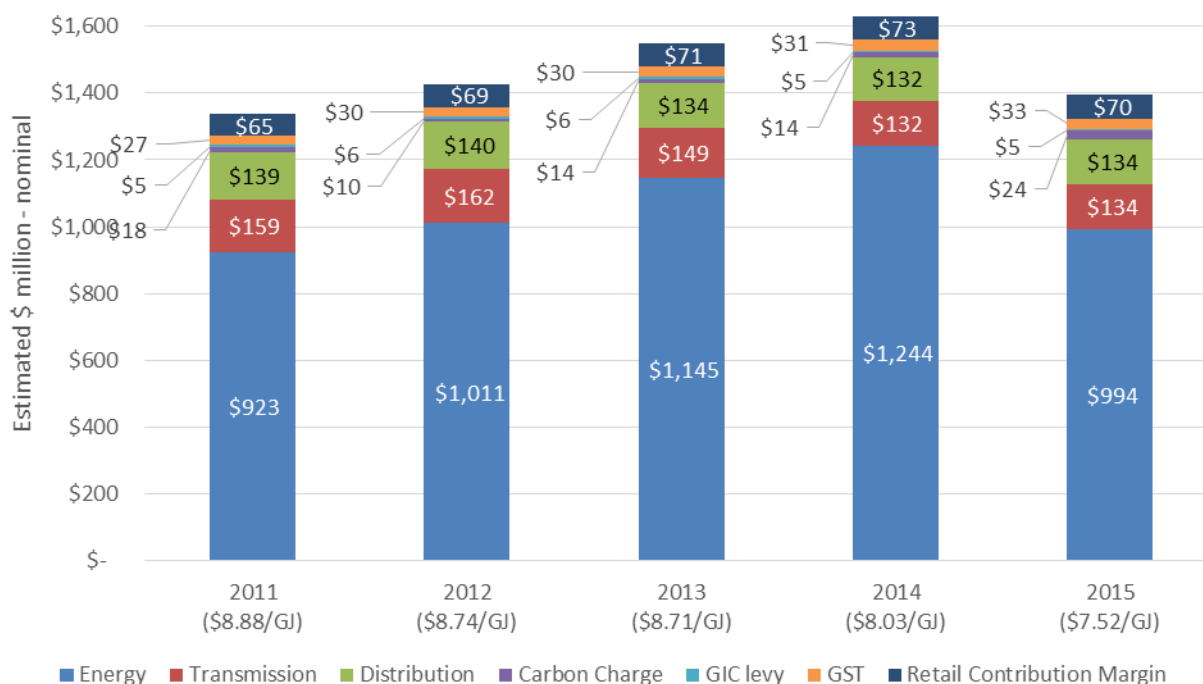
²⁹³ Retail operations include call centres, billing and payment collection, bad debts, and account management, and discounts.

The analysis in this section as far as possible uses publicly available information including financial disclosures by companies subject to the statutory information disclosure regime²⁹⁴, *Energy in New Zealand*²⁹⁵, Gas Allocation Agent data, and retailer residential pricing.

A number of simplifying assumptions need to be made to arrive at an approximate breakdown of the retail gas price. A particular difficulty is matching various reporting periods with pricing years under regulation. Other numbers require some broad assumptions (eg: a nominal contribution margin across all parts of the value chain that includes cost to service as well as profit²⁹⁶) and other estimates such as the carbon charge.

Within the total value chain, from gas injected into the transmission system to the end-user, the direct value of all gas sold in 2015 was approximately \$1.4 billion, or \$7.52/GJ. This was down from \$1.6 billion and \$8.03/GJ in 2014 reflecting both the lower volume of gas used and lower wholesale gas prices. The various estimated components of this revenue are shown in Figure 58.

Figure 58: New Zealand Gas Industry Estimated Total Revenue Breakdown 2011-2015 Calendar Year



Source: Areté Consulting Ltd

The revenue components of delivered gas as a percentage of total revenue is shown in Figure 59 indicating that on a weighted average basis the gas bundle is predominantly energy costs. The overall weighted average is, however, heavily influenced by industry volume, particularly petrochemicals, and electricity generation, which do not incur charges that other parts of the gas sector see, such as

²⁹⁴ Primarily gas pipeline businesses.

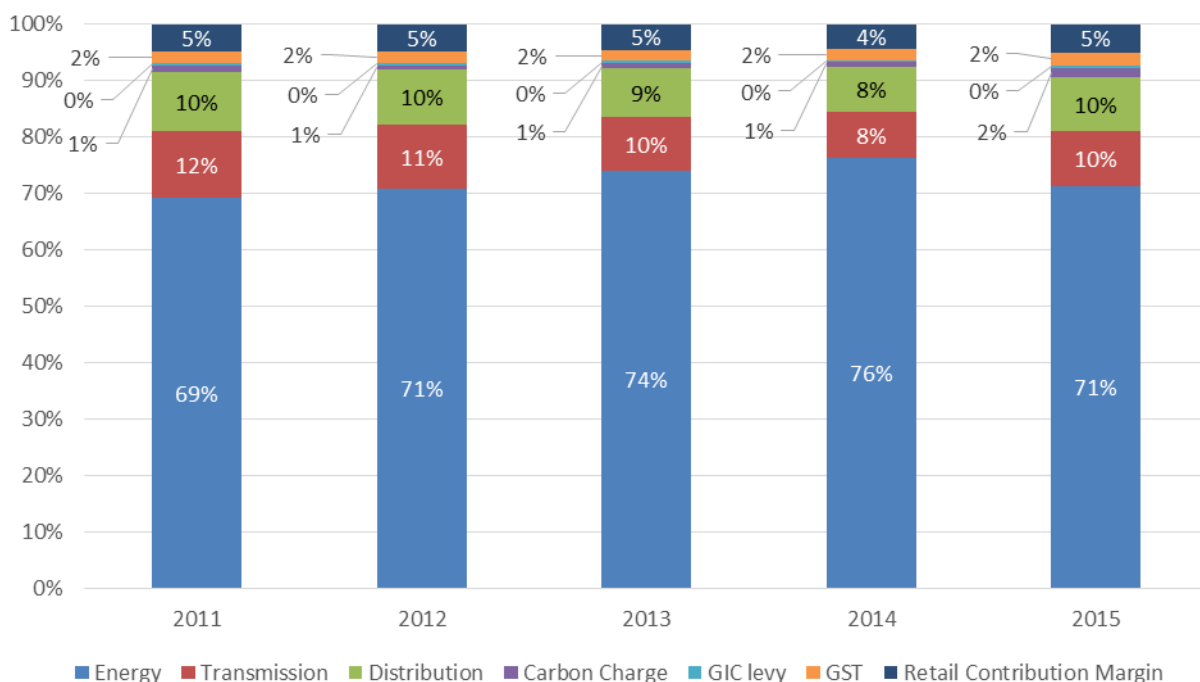
²⁹⁵ Average prices, ICP numbers for residential, commercial, and industrial, wholesale price as proxy for gas price for electricity generation gas.

²⁹⁶ 10 percent margin is assumed for the retail market (residential, commercial, and industrial). Other elements will also include profit margins (transport, wholesale margin) but typical margins are difficult to determine

distribution costs, and GST. Generally transmission costs are also lower for these large users due to their relative proximity to key supply points on the transmission system.

A feature of the price bundle is the difference between the regulated components (transmission and distribution) which guarantee total revenue (transmission) or weighted average price (distribution) and unregulated components where prices fluctuate based on competitive supply and demand dynamics. Regulated parts of the value chain generally maintain their real revenue whereas other components can vary up or down.

Figure 59: New Zealand Gas Industry Estimated Total Revenue Breakdown 2011-2015 Calendar Year



Source: Arete Consulting Ltd

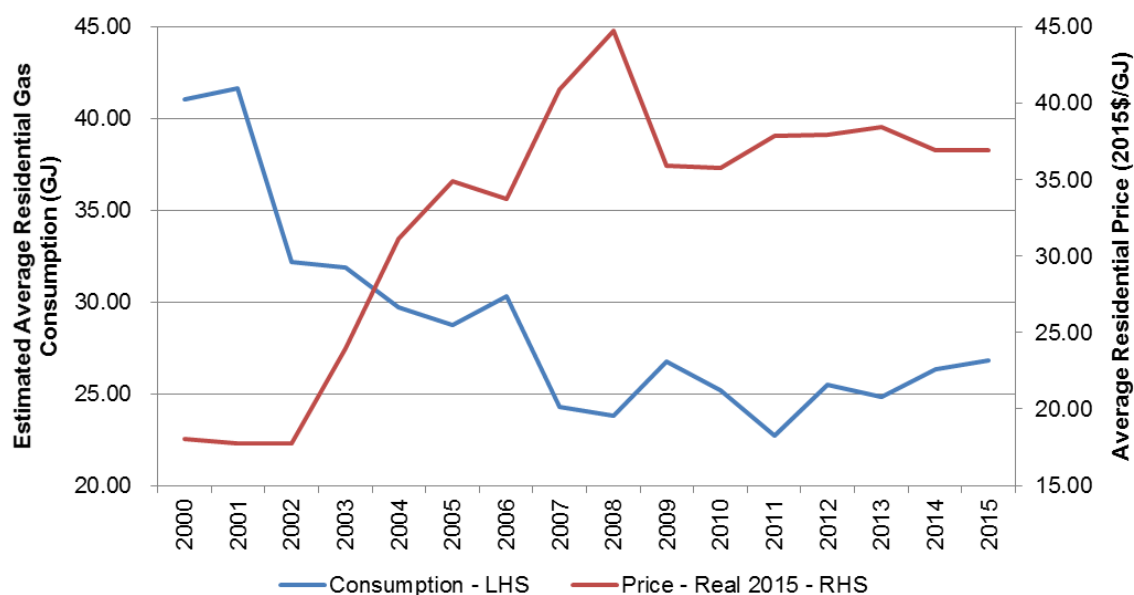
12.4 Residential Market

Figure 60 shows the average residential price increased faster than for other sectors between 2002 and 2008, but has since declined and levelled off in real terms. Unravelling residential price trends over the last few years is difficult as the average price reflects both movements in average demand by households and tariff structures that have shifted towards a greater fixed cost component in the delivered gas.

Similarly, tariff structures are affected by the changing mix of load groups on each network, market share in those segments, and, increasingly, incentives associated with dual-fuel (electricity and gas) offerings.

A strong driver of rising average residential gas prices from 2002 has been a decline in average household demand. As consumption per household fell and the fixed cost component of residential gas price increased, the average cost of gas to households has risen. However, the real residential price has fallen from a peak in 2008, coinciding with both increased gas supply and falling demand, particularly for thermal generation gas.

Figure 60: Residential Price Relative to Average Consumption per Household



Source: 2016 Energy in New Zealand

A GST increase from 12.5 percent to 15 percent on 1 October 2010 represents approximately \$0.80/GJ in the 2011 figures

Gas is a discretionary fuel for households but, as a commodity, is cost-effective relative to electricity particularly where the fixed cost of connection can be spread over a larger household demand²⁹⁷. A typical retail variable gas tariff averages around 8.0 c/kWh compared to electricity at around 23c/kWh. Nevertheless, retailers' promotion of gas use is invariably affected by the substitutability of other energy forms being sold by the retailer, including electricity and LPG. Whereas dedicated infrastructure providers, such as gas transmission and network companies, are incentivised to promote a wider uptake of gas in order to spread the fixed cost of the investment across a larger base, energy retailers see gas as part of a broader offering in the energy market to which they are largely indifferent as to the form of that energy. In some cases a gas offering may simply be another way to leverage greater share of electricity sales.

In an effort to promote broader uptake of gas Powerco is the only gas distributor that has offered a variable only network cost for low residential users in order to incentivise low user households to remain connected to their infrastructure. These are generally passed through by retailers, but since other fixed costs remain in the gas bundle the overall price signal impact of zero network fixed charges are significantly weakened.

There has been a broader trend of increasing the fixed cost component of a residential bill. From 2012 to 2014 this has increased by approximately 4 percent, a step change that occurred in 2013. For an average consumer the fixed cost portion of their residential bill is now 40- 60 percent²⁹⁸. The increase

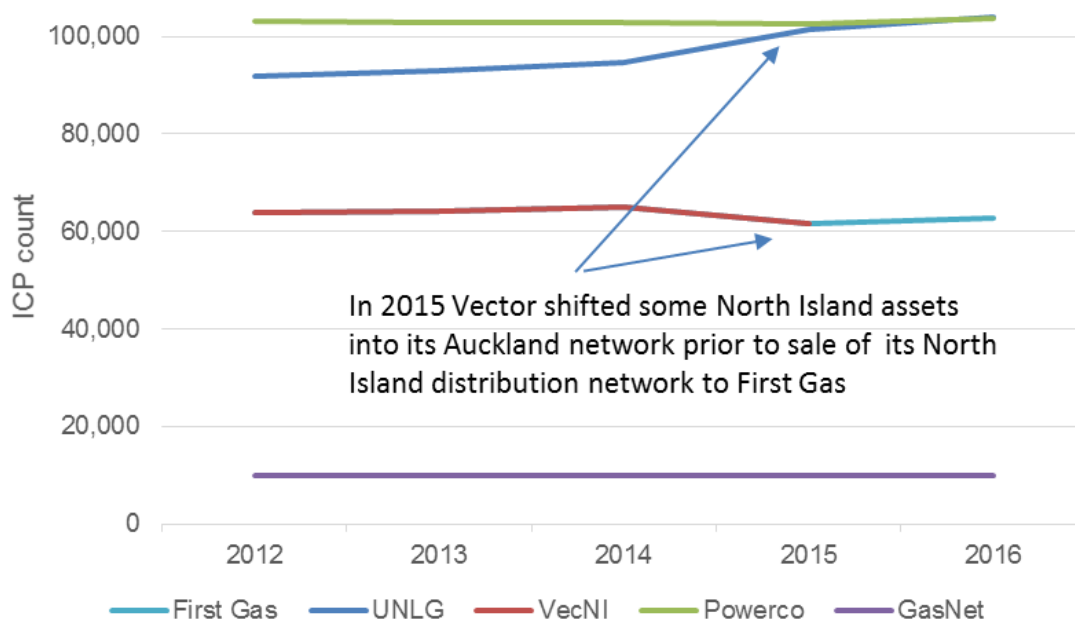
²⁹⁷ Total costs, including gas connection, gas fitting and appliances, may reduce this differential.

²⁹⁸ Variations between retailers and percentage appear largely a function of the network that is being used to service the customer base.

in the fixed portion of the household bill appears to reflect a similar shift in transmission and distribution network price structures²⁹⁹.

Although some of these changes might be expected to negatively influence connection decisions, the residential gas price does not seem to be a deterrent to increasing gas connections to households, particularly in Auckland. Connected and active connections have been increasing by about 3,200 each year since 2011. Around 2,400 connections per annum have become inactive or decommissioned over the same period³⁰⁰. Growth in active connections however has been primarily driven by population in Auckland while the rest of the North Island has been relatively static Figure 61³⁰¹.

Figure 61: Active Connected ICPs³⁰²



Source: Distribution Disclosures

The use of a weighted average price does mask significant regional variation and consumption patterns. Using Genesis as a typical example of pricing variation among retailers, the average price paid by households depends on geographical location and individual household consumption Figure 62.

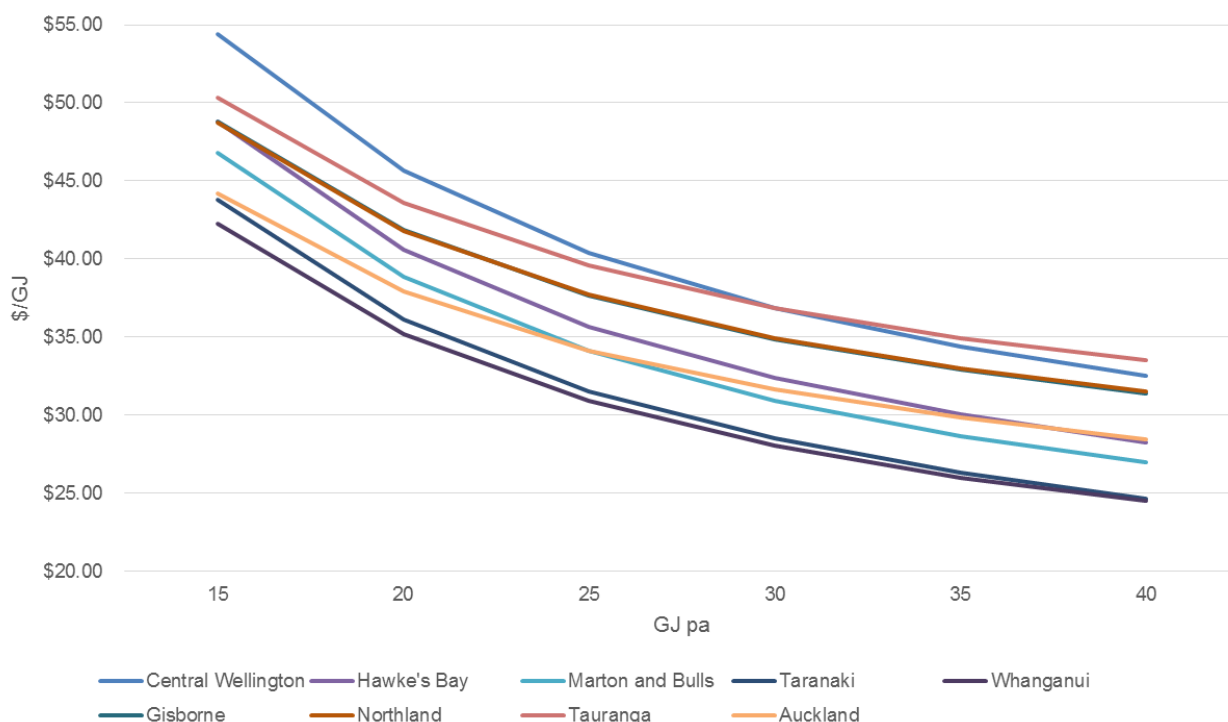
²⁹⁹ The residential bill contains a number of fixed cost components including; transmission capacity reservation fee, daily charges for use of distribution network, meter charges, GIC ICP levy, and retailer cost to service. Of these changes to Vector transmission and distribution fixed cost components are the most apparent reason for altering the fixed cost component of the overall price bundle.

³⁰⁰ Source – Gas Switching statistics. Note, not all connection statistics would relate to households, but of the 283,668 active (September 2015) connections approximately 95 percent relate to households.

³⁰¹ The North Island pattern is distorted by Vector's decision to include Wellsford, Warkworth, Waitoki, and Drury 2 with its UNLG network from July 2015.

³⁰² UNLG is the United Network that supplies the Auckland region. VecNI are now the First Gas North Island (other than UNLG) networks.

Figure 62: Residential Gas Price for Standard³⁰³ Consumer (2016 – GST incl.)



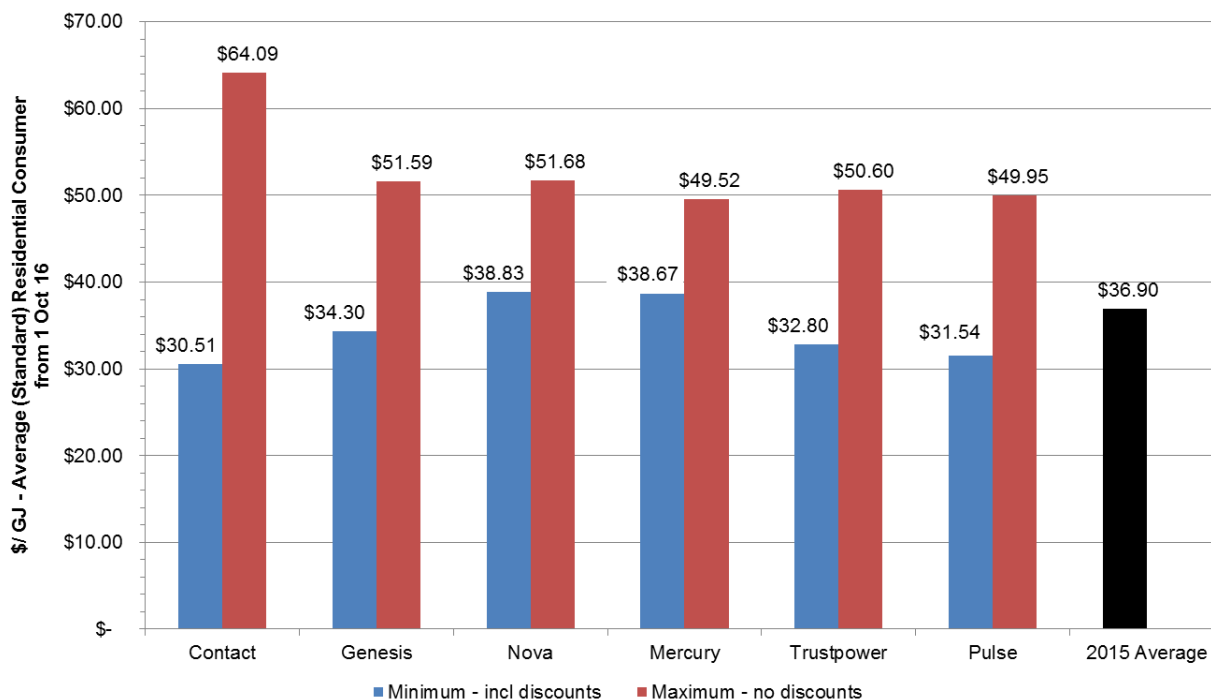
Source: Genesis 1 October 2016 residential tariff

Location plays a role in pricing due to gas transmission distances and distributor asset utilisation. These are approximately the same for each retailer given that all gas is delivered out of Taranaki and each retailer contracts with the same transmission owner and distributor within a pricing region. However, pricing is also differentiated because each retailer will have different market strategies based on its unique mix of other assets (including electricity generation and energy contracts), and broader energy offerings, including LPG and electricity.

The wide range of residential pricing within each retailer is evident in Figure 63 and reflects increasing mass market segmentation. Points of difference for retailers are based on different discount structures including dual fuel, prompt payment, and electronic payment discounts, different fixed-to-variable cost components, and, depending on the region and network, low demand, and high demand residential plans. More recent innovations include fixed price plans, where the price is locked in for 12 or 24 months, and increased bundling of services such as Trustpower's single provider offering for electricity, gas, internet, and telephone.

³⁰³ Standard consumer assumed to be where household consumption is greater than 4,000 kWh/year (14 GJ). Prices include GST and 10 percent prompt payment discount. Only a range of regions selected to provide clarity

Figure 63: Residential Gas Price for an Average³⁰⁴ Consumer (2016 – GST incl.)



Source: Retail tariffs 2016

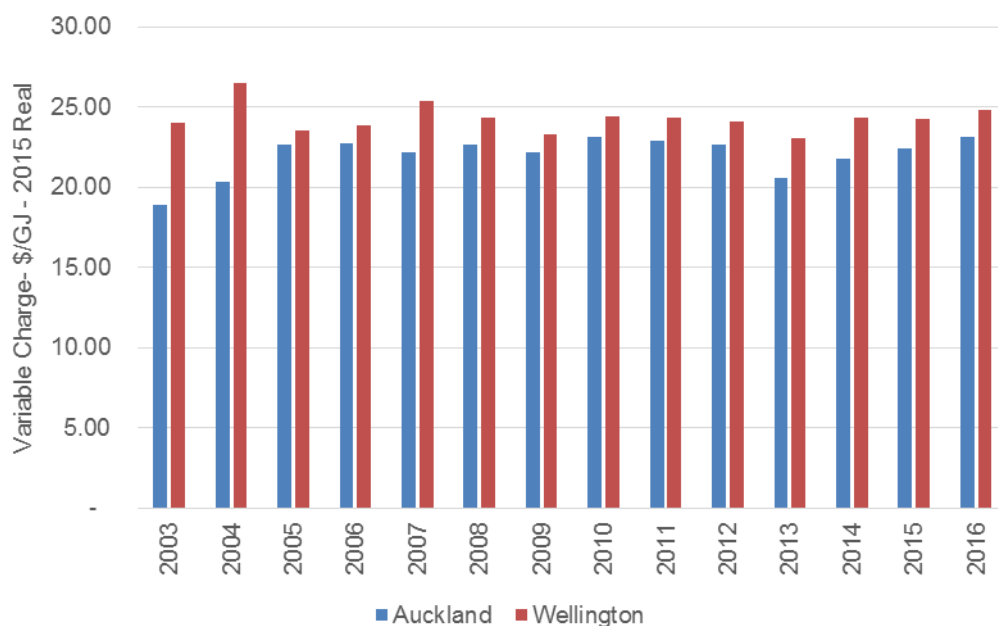
Increasingly gas is being offered by retailers that in the past may have offered only electricity. Newer entrants into gas retailing include Trustpower, Pulse and Switch Utilities. Dual fuel offerings are a response to consumer demand for a single retail provider for household energy, and which also serve to assist retailers in retaining or growing market share in the residential electricity market.

Price is also affected by how the tariff is split between variable and fixed components. Figure 64 and Figure 65 separate the real price trend between variable and fixed cost residential tariffs in the Auckland and Wellington markets³⁰⁵.

³⁰⁴ Approximately 25 GJ/year (6,667 kWhr) average: 2016 Energy in New Zealand.

³⁰⁵ Exclusive of discounts, inclusive of GST. The data is an average of Contact Energy and Genesis Energy which have operated in both regions for the period covered.

Figure 64: Variable charge Residential tariff - Real 2015



Source: Retail tariffs

Figure 65: Fixed charge Residential tariff – real 2015



Source: Retail tariffs

From these figures, the real variable price has been relatively flat since the structural lift from initial Maui pricing in the mid-2000s and is also less regionally dependent. Fixed charges have shown a general real increase over the same period with a pronounced difference between regions. Price

unbundling of the residential tariff provides an explanation of how the difference arises, while noting that fixed price steps occurred in Wellington in 2006 and in both Wellington and Auckland in 2013.

The relationship between fixed and variable charges in residential tariffs is affected, amongst other things, by pricing methodologies used by regulated gas pipelines. Pricing methodologies explain how transmission and network charges are arrived at based on cost allocation models. There have been a number of changes since the start of the first regulatory period for gas pipeline businesses in 2012. This was particularly noticeable for Vector which shifted its transmission pricing structure from 60:40 fixed:variable split in 2012 to 85:15 in 2015, and in its network business from 20:80 fixed:variable to 40:60 fixed:variable³⁰⁶.

The step change in 2006 for Wellington is not readily ascertainable in the absence of complete pricing information at that time, but Powerco had a significant fixed price step between 2004 and 2007³⁰⁷

Residential Price Bundle

The residential gas price comprises fixed (daily charge) and variable components. Generally these are intended to reflect the retailer's cost structure in delivering gas to households, plus a margin. As noted, there are significant variations from the average residential gas price depending on regional pricing differences, discounts available and taken, and volume used.

Volume-insensitive costs are reflected in fixed charges, and volume-dependent costs are passed through in the variable price component. These are rebalanced periodically to reflect changes in consumption patterns and other price adjustments in the value chain.

The residential market analysis approach used in this section has been to average the prices of leading retailers that collectively represent around 99 percent of all ICPs.

Overall Residential Price Bundle

The overall estimated residential price bundles for 2012-2015 for the Auckland and Wellington markets are shown in Figure 66 and Figure 67. These are for the average (25 GJ/year) household consumer. Broad assumptions used to arrive at a price breakdown are:

- published wholesale price less carbon charge is used as a proxy for energy price
- carbon charge is assumed to be an estimated average of traded New Zealand Units over respective periods
- First Gas Maui transmission is calculated from Frankley Road based on First Gas Maui published tariffs. For the Wellington residential market it is assumed that Maui and Frankley Road transport is not required³⁰⁸.

³⁰⁶ Source: - Vector Gas Transmission and Distribution Pricing Methodology. Pricing structures for GasNet and Powerco are 50:50, and 40:60 respectively and haven't altered since 2012 whereas Maui transmission is fully variable.

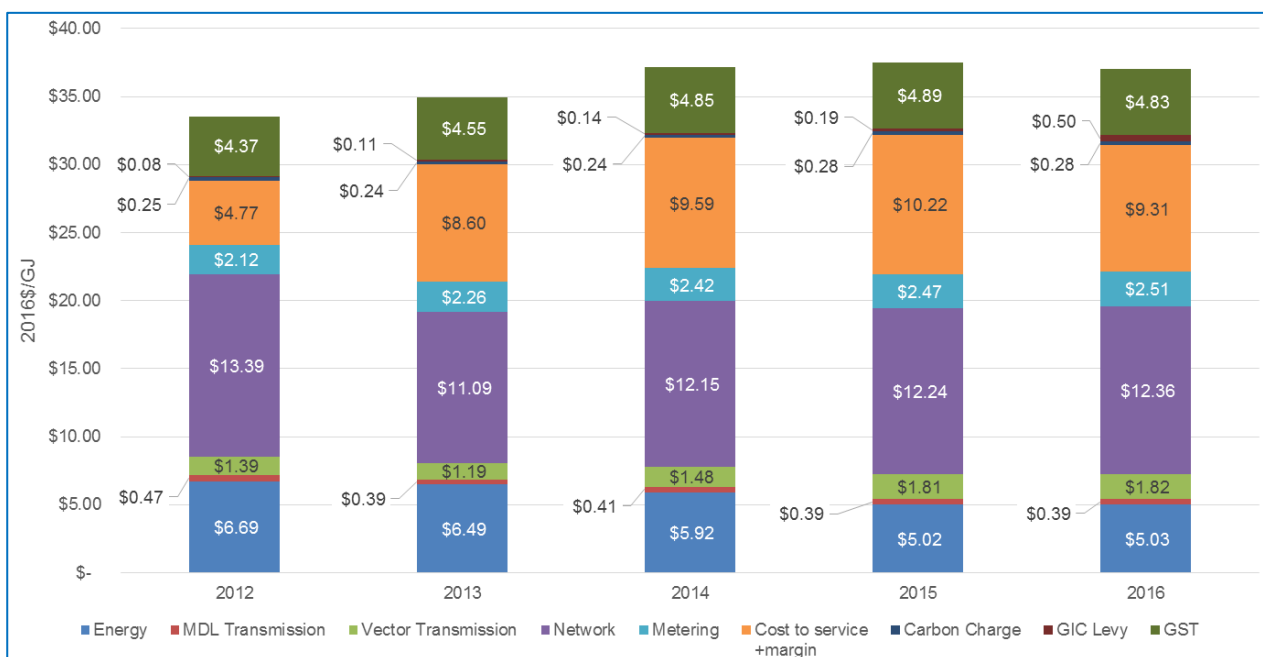
³⁰⁷ From \$0.30/ day to \$0.50/day. Variable charge decreased at the same time, but the impact was likely largely offset by a strong rise in the wholesale gas price.

³⁰⁸ Wellington is serviced from the First Gas South system and the receipt point is close to the Kupe, Rimu and Kapuni gas fields. Physically these fields can deliver all the demand for gas south of Kapuni.

- First Gas North Island transmission charges are estimated based on posted prices, residential volume from network pricing methodology, and an assumption that reserved capacity is 1.7 times the average throughput³⁰⁹
- distribution is based on published network charges (Vector UNL for Auckland, Powerco for Wellington) based on the standard (25GJ/year) user.
- metering is assumed to be the GMS fee published by Powerco for the residential load group.
- GIC levy is assumed to be gazetted figures.
- GST is the 15 percent component of the total delivered cost
- total delivered cost is an average of the major retailers' residential prices inclusive of their prompt payment and dual fuel discounts³¹⁰.
- cost to service and margin is derived as the difference between total cost and the sum of the other components.

The breakdown should be treated as indicative only.

Figure 66: Residential Price Bundle (Real Q3\$2016) – Auckland market

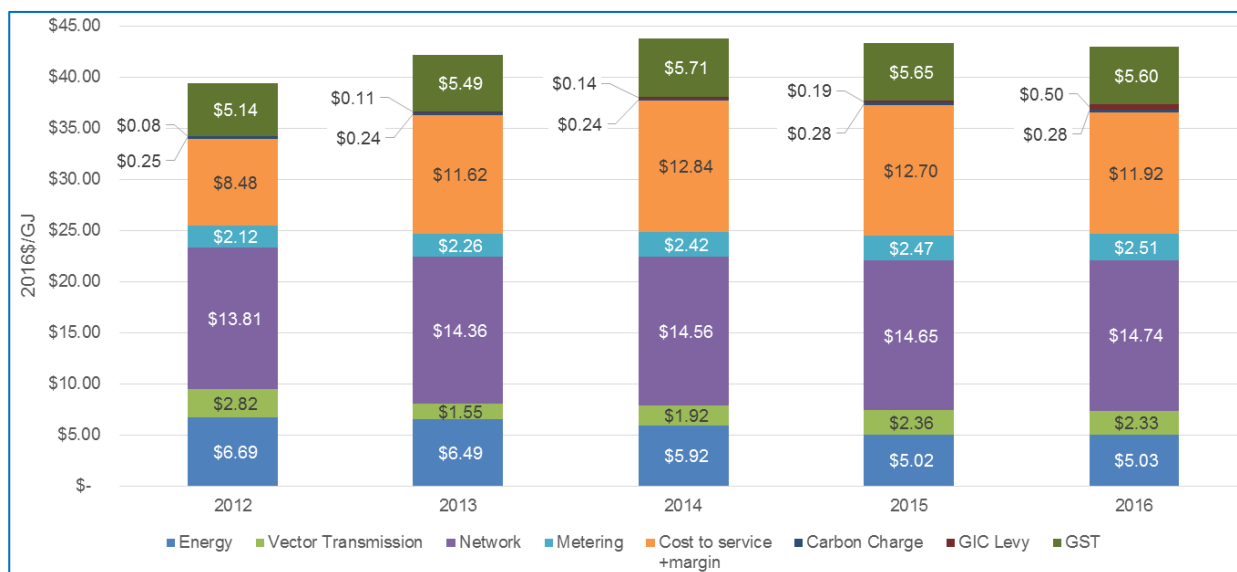


Source: Areté Consulting Ltd

³⁰⁹ Based on DPP Compliance statements showing reserved capacity vs throughput for various transmission delivery points

³¹⁰ Discounts vary between 10 and 22 percent, if taken. PPD and dual fuel discounts appear to be the norm with Genesis for example reporting that 73 percent of its gas customers are dual fuel.

Figure 67: Residential Price Bundle (Real Q3\$2016) – Wellington market



Source: Areté Consulting Ltd

The main observations from this are:

- the price differential between Auckland and Wellington (approximately \$6/ GJ) primarily reflects a higher retailer cost-to-service and margin in Wellington as well as higher network costs. This also drives a higher GST.³¹¹
- the energy cost represents a relatively low portion of the overall cost (approximately 13 percent).
- transportation charges and metering represent about 46 percent of the overall gas price to households.

12.5 Industrial Gas Price

Approximately 1,800 ICPs are classed by MBIE as industrial users, and the sector is characterised by a large diversity in load. At one extreme, Methanex took approximately 73,111,000GJ (73 PJ) of gas in 2015; at the other end, an Auckland bottling firm uses 1,000 GJ annually. Like the commercial sector, there is no identifiable 'typical' industrial customer although an average consumption excluding petrochemicals is about 20TJ/year.

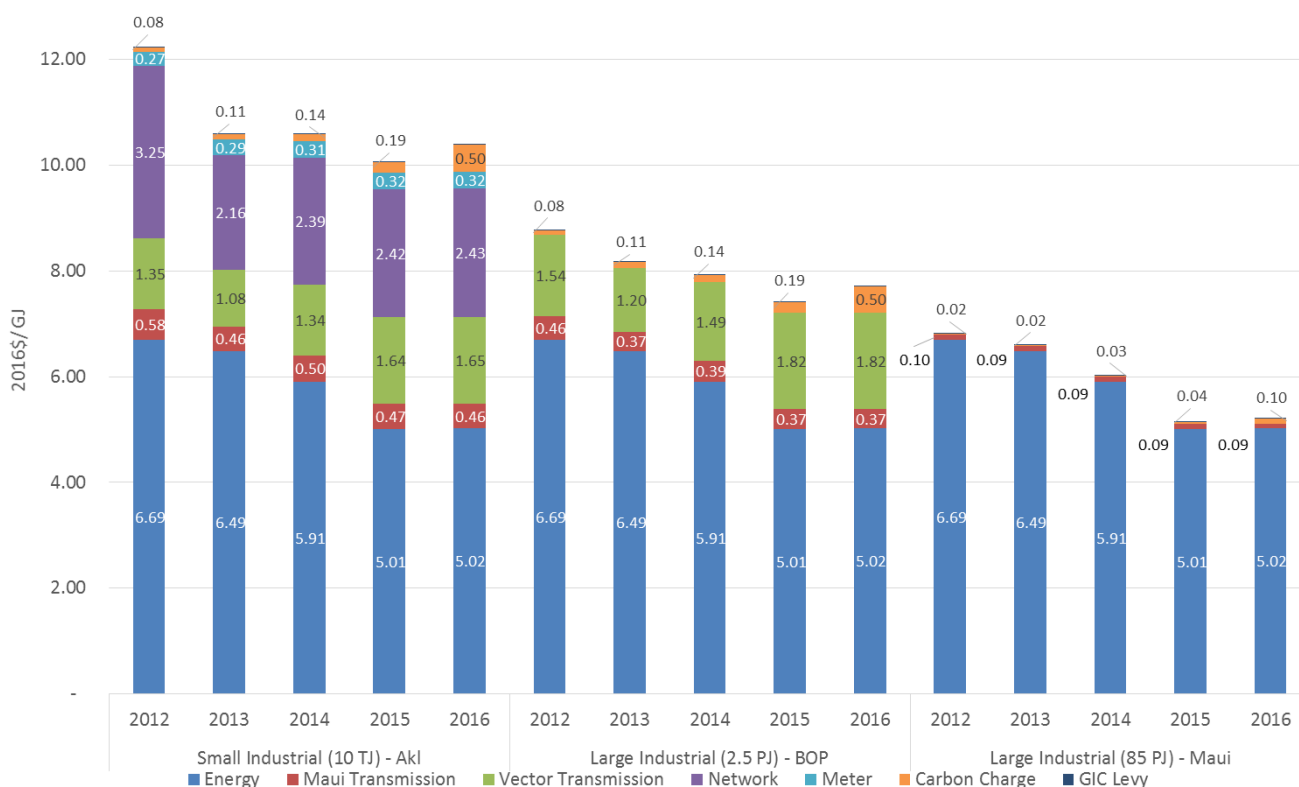
Large consumers, such as Methanex, Ballance Agri-Nutrients, Oji Fibre Solutions, NZ Steel, Refining New Zealand and larger Fonterra dairy factories have direct connections to the transmission system, avoiding distribution network charges. Transmission costs can also be significantly lower, particularly if the users can be supplied directly from the Maui pipeline and are close to supplying gas fields. For a

³¹¹ Caution is required in interpretation since cost-to-service and margin is a residual calculation absorbing all of the errors in assumptions of other price components. Nevertheless, it seems that Auckland has both scale economies positively affecting retailer overheads and network costs, and also lower transmission costs on the First Gas North Island transmission system.

number of industrial users, carbon charges are largely mitigated through allocations for emission-intensive and trade-exposed industries. These industrials are also able to contract directly with producers (for example, Methanex with Todd) avoiding further wholesale brokering charges.

Pricing arrangements in the industrial sector are highly customised and there is little public transparency of their commercial terms. The potential diversity in gas price for industrial users is illustrated in Figure 68. This compares a large scale petrochemical operation with a large user in the Bay of Plenty (2.5PJ/year) and a small industrial plant in Auckland (10TJ/year)³¹². The energy charge assumes a published wholesale price³¹³.

Figure 68: Industrial Gas Price Diversity and trends³¹⁴



Source: Areté Consulting Ltd

Unlike residential customers where the energy component represents about 15 percent of the delivered gas cost, industrial consumers experience energy costs of 60-99 percent of the delivered price. Energy costs including energy transport, tend to be an important business cost driver particularly for very large energy-intensive consumers.. The industrial price bundle has benefited from an easing of gas commodity prices in recent years. This has offset to some extent the rising cost of delivery, which after a regulated decrease in 2013 has climbed back strongly for a number of users, particularly on the First

³¹² Actual costs can only be estimated from public information. Energy charges in particular are likely to be different than the average reported wholesale price.

³¹³ Actual energy charge will depend on other features of the gas contract including swing. Small industrials are likely to have flexible take arrangements which will be at a premium to high take-or-pay provisions perhaps more typical of large users. Since published wholesale price captures both high swing and low swing contracts the actual energy price for small industrials is likely to be higher, and for large industrials lower than what is shown here.

³¹⁴ Excluding any retail margin and retail cost-to-service

Gas North Island transmission system after a shift in pricing methodology to a greater fixed cost component.

Like large scale commercial customers, industrial customers are attractive to retailers because of the very low cost to service on a per-unit gas cost basis. Industrial demand profiles are relatively predictable, as they often run baseload operations or have stable seasonal demand patterns. Industrial customers are also prepared to sign exclusive term contracts which offset the retailer's gas book risks. Issues for industrial users go beyond short-term gas price however. The capital intensive nature of their operation and exposure to global competition through exports or import substitution bring into play both price and non-price considerations relating to domestic gas market conditions including:

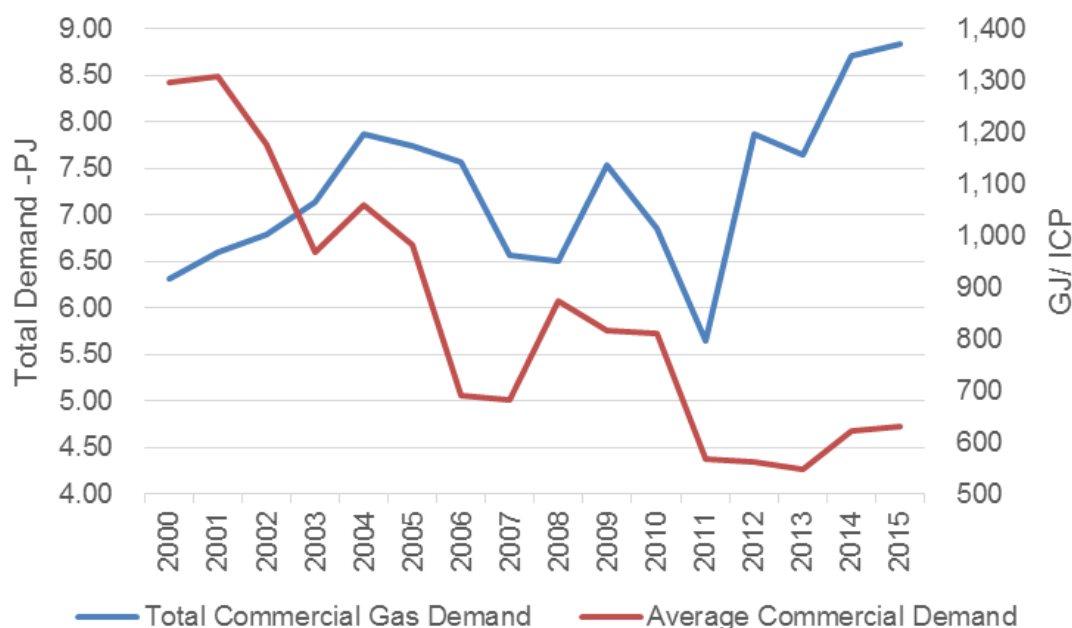
- profit volatility when revenue is exposed to currency exchange and product competition in global markets but gas input costs are ratcheted to domestic inflation under term arrangements.
- trade-off between gas price, take flexibility, and transmission capacity booking
- potential for asset stranding if gas reserves are not being replaced and influence on decisions to expand or renew gas-fueled plant.
- changes in pricing methodologies for gas transport infrastructure.

12.6 Commercial Gas Price

Commercial gas consumption in New Zealand appears to be growing, even as average consumption has fallen³¹⁵ Figure 69.

³¹⁵ MBIE has reservations about the reliability of this data as historically there has been considerable fluctuation in these statistics.

Figure 69: Commercial Gas Demand



Source: 2016 Energy in New Zealand

Energy in New Zealand defines the commercial market as non-manufacturing business establishments such as hotels, motels, restaurants, wholesale businesses, retail stores, and health, social and educational institutions. MBIE records approximately 14,000 ICPs match this category and that their average consumption in 2015 was 631 GJ. There is considerable variation around this average figure as, within this broad category the smallest commercial consumers use little more than a typical household (25 GJ/year), while some public facilities could consume up to 20,000 GJ/year. Based on Vector's Auckland network disclosures, the small commercial category (10-40 scm/hr) has an average consumption of about 300 GJ/year, whilst large commercial (40-200 scm/hr) is more typically 2,000 GJ/year. This also approximately matches Powerco's G12/G14 (400 GJ/year) and G16/G18 (2,100 GJ/year) average profiles.

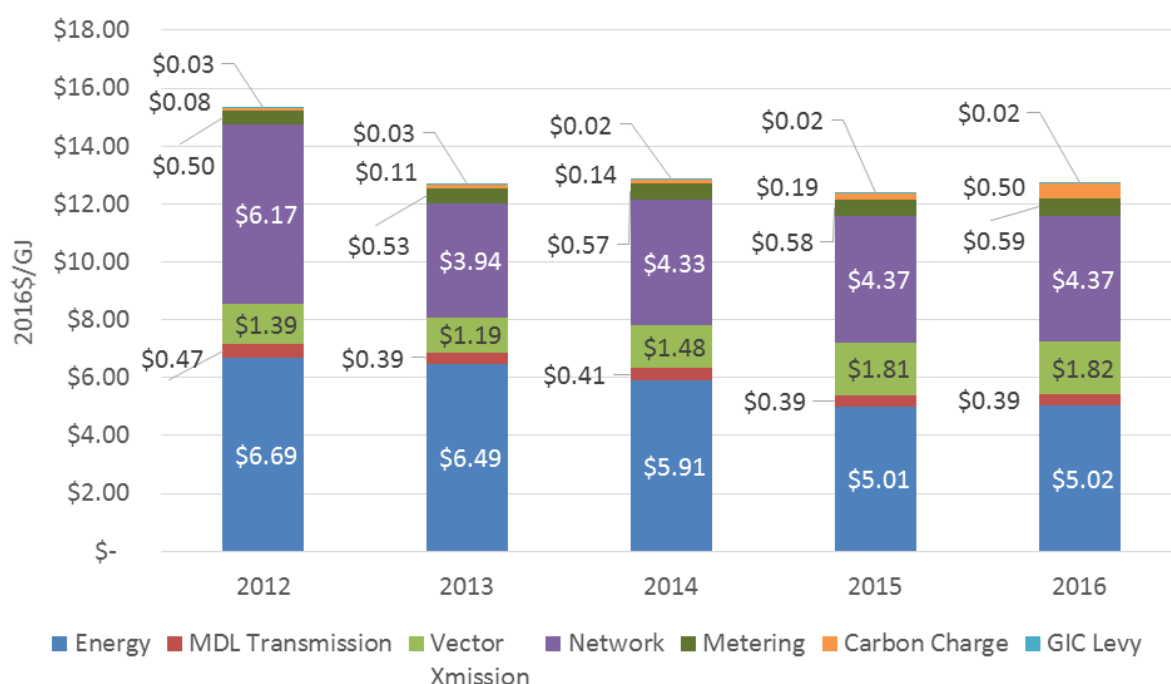
Given the potential scale economies of commercial enterprises, retailers compete aggressively for this business and there is less transparency around commercial tariff structures. This constrains an analysis of commercial prices, particularly the ability to accurately identify commercial demand based on load group reporting by network companies. For example, Powerco includes small commercial in its G11 load group, which also includes residential. Vector has a business category (less than 10 scm/hr) and two commercial categories (10-40 scm/hr and 40 -200 scm/hr) although it is likely that Vector's commercial load group will also include customers otherwise identified as industrial by MBIE. GasNet makes no distinction between residential, commercial, or industrial users. Lack of price information due to commercial sensitivity also makes price unbundling difficult. For larger commercial users with bypass risk, network companies are also prepared to negotiate non-standard pricing.

In terms of price bundles, commercial customers will span the range between residential and industrial pricing and be affected by the same issues. Small commercial enterprises with demand similar to residential use will have similar price structures and breakdown as residential whilst very large

commercial demand (eg: hospitals, universities) will have pricing similar to network-connected industrial Time-of-Use customers.

A bottom up assessment of a small commercial³¹⁶ is shown for the Auckland (GA02) (Figure 70) and Wellington (G12) (Figure 71) markets. This excludes retail contribution as there are no published prices to estimate these. The purpose is to demonstrate that regional differences are likely to be a feature of commercial prices as well. Of note is the drop in real terms between 2012 and 2013 in the Auckland market. This appears to reflect the Commerce Commission's determination of initial price adjustments for the start of the first regulatory period. The Commission's determination resulted in Vector requiring average adjustments of -29 percent for its then transmission system and -18 percent for its distribution networks (including Auckland), whereas Powerco had an uplift of 4 percent for its network (including Wellington).

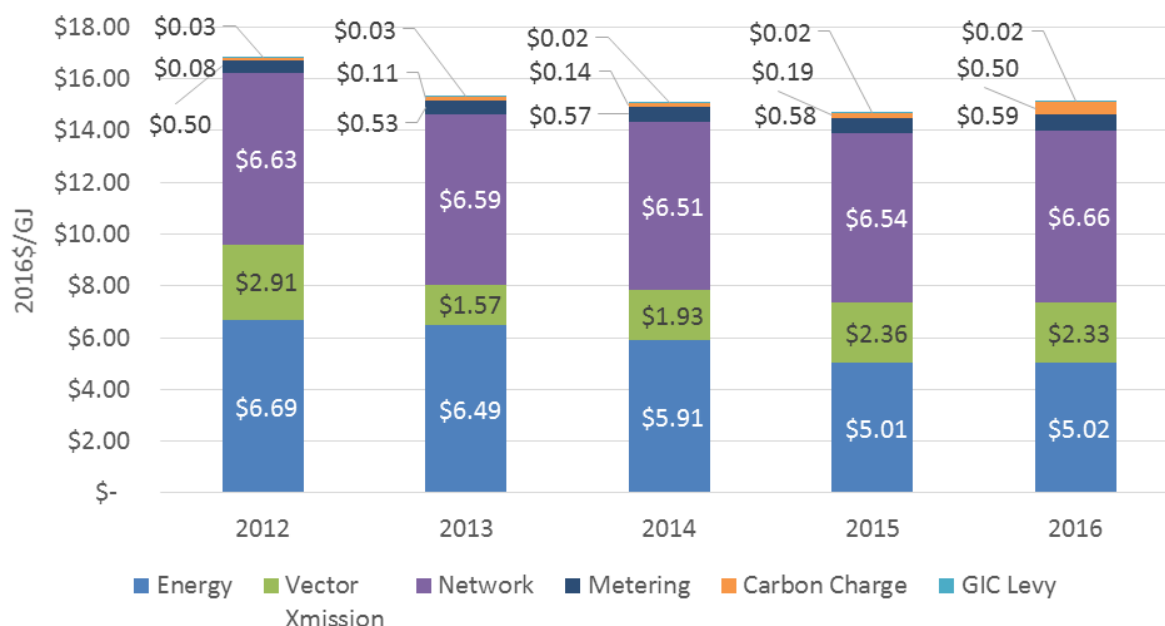
Figure 70: Small Commercial Price Bundle (Real Q3\$2016) – Auckland market



Source: Areté Consulting Ltd

³¹⁶ MBIE average 600 GJ pa

Figure 71: Small Commercial Price Bundle (Real Q3\$2016) – Wellington market



Source: Areté Consulting Ltd

The declining real price time series trend for this sector seems to indicate that there are unlikely to be significant competition issues in this sector. End-users may in fact have some advantage over retailers in this instance as information asymmetry benefits them, rather than retailers. Consumers can get competitive quotes without a retailer knowing what a competitor may be prepared to offer.

12.7 Regulatory Performance

Gas Act and GPS policies relating to gas pricing include:

Gas pricing policy objectives	Performance status
<ul style="list-style-type: none"> Delivered gas costs and prices are subject to sustained downward pressure The full costs of producing and transporting gas are signalled to consumers. 	<ul style="list-style-type: none"> Natural monopoly gas transmission and distribution services are subject to economic regulation administered by the Commerce Commission. 99 percent of gas consumers can choose between at least seven retailers. Downward pressure on pricing is achieved through retailer competition for customers, which is facilitated in part by competitive gas pricing information available to consumers and regulated switching arrangements for consumer switching between retailers..

13 Gas Metering

Gas metering is joining the international movement towards 'smart' metering technologies and is working its way through particular challenges applying to the gas sector. Gas metering is subject to technical regulation, which is reflected in the Reconciliation Rules and industry contracts. Metering services are excluded from the definition of gas pipeline services under Part 4 of the Commerce Act. While the Commerce Commission has described competition in gas metering services as 'limited', it has decided not to make an inquiry at this time to ascertain if these services should be regulated.

13.1 Background

Gas delivered to each consumer is measured by a meter installed at the user's premises. Meters are of varying size and sophistication, reflecting the amount of gas use at the ICP, and are central to accurate billing and system reconciliation.

Meter types range from standard devices for residential and small commercial users, to Time of Use (ToU) devices with and without telemetry, for larger users. Around 95 percent are in the smaller category, flowing up to 10 standard cubic metres of gas an hour (sm^3h^{-1}). There are larger meters flowing at $3,000 \text{ sm}^3\text{h}^{-1}$ or greater.

Gas meters (also referred to as gas measurement systems (GMS)) are variously owned by retailers, distributors and independent suppliers. They are more complex, and more expensive, than other energy metering systems, as the meter itself is part of a total GMS installation, which as a minimum also includes filtration, pressure regulation, and associated pipework. Maintenance costs are consequently higher than for other types of energy metering installations.

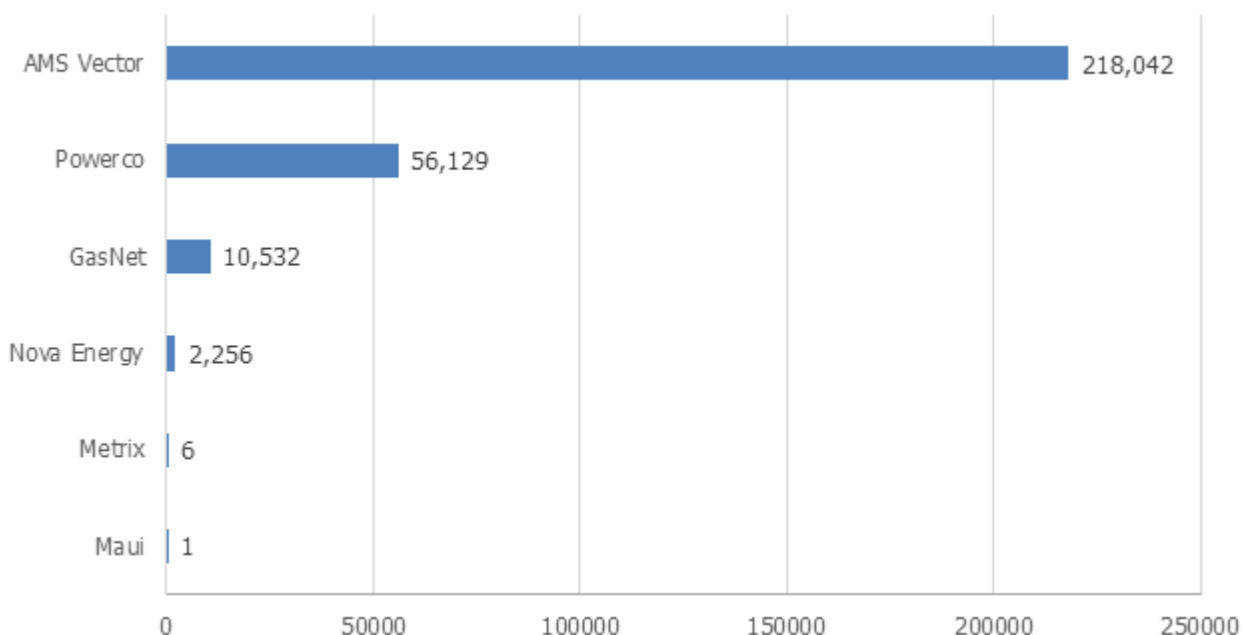
There are currently four main suppliers of gas metering services in New Zealand – Vector, Powerco, GasNet, and Nova Energy. Powerco supplies metering services only in its network areas, and Nova gas is the only meter supplier to its customers on Nova Gas-owned distribution networks. Nova also supplies meters on other networks³¹⁷.

Gas meter ownership is set out in Figure 72. Vector, through its acquisition of Contact Energy's gas metering business in 2013³¹⁸ and its existing Advanced Metering Services subsidiary is the largest owner, followed by Powerco. Nova supplies more than 2,200 gas meters to customers on non Nova-owned networks.

³¹⁷ Commerce Commission: *Decision Paper - Authorisation for the Control of Supply of Natural Gas Distribution Services by Powerco Ltd and Vector Ltd*, 30 October 2008

³¹⁸ Commerce Commission media release: *Commerce Commission clears Vector to acquire Contact gas metering business*, 29 April 2013. Also see Contact Energy media release: *Contact confirms sale of Gas Metering business*, 25 October 2012.

Figure 72: Gas Meter Ownership



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

13.2 Current State of the Gas Metering Market

Gas metering is primarily governed by provisions of the Gas Act and the Gas (Safety and Measurement) Regulations 2010 (Safety Regulations). Gas measurement obligations on meter owners and retailers are also set out in the Reconciliation Rules, and measurement standards are covered by a variety of formal Standards overseen by Standards New Zealand. The main standard, NZS 5259:2015: Gas Measurement³¹⁹, places requirements on the GMS owner for the accuracy of the meter, associated regulator and, where installed, the corrector³²⁰. It specifies acceptance tests for gas meters and correctors, meter selection and installation, and provides direction on the conversion of measured volume to energy. There are a number of other formal Standards relevant to metering³²¹.

There is no direct gas sector equivalent of the electricity Metering Code³²², which codifies market participants' obligations in relation to metering standards, metering installations, testing and compliance.

In addition to the legislative and regulatory requirements, responsibilities relating to gas metering are addressed in service provider agreements between the parties. In addition, the industry has published a *Gas Measurement Requirements and Procedures* document that provides an overview of the legal requirements and technical standards that apply to gas measurement³²³.

³¹⁹ Updated following review of NZS 5259:2004

³²⁰ Generally, correctors are only used in installations above 10TJ/year.

³²¹ Including NZS 5258 relating to gas distribution; ASNZS 4645, a new distribution standard developed jointly with Australia and which will ultimately replace NZS 5258; NZS 5601 relating to downstream installation, ASNZS 4944 relating to in-service compliance testing; hazardous areas standards.

³²² Electricity Industry Participation Code 2010, Part 10 – also referred to as the Metering Code.

³²³ <http://gasindustry.co.nz/about-the-industry/requirements-and-procedures-documents/>

Under the Safety Regulations and Reconciliation Rules, meter owners are responsible for ensuring that metering equipment complies with the NZS 5259 standards. Under the Reconciliation Rules, retailers are responsible for ensuring that metering equipment is installed and interrogated at consumer installations where they are the 'responsible retailer', and for ensuring that volume conversions comply with the measurement and verification standards.

In addition, the Retail Scheme principles³²⁴ require that retailers' supply arrangements with small consumers, should clearly describe:

- the requirements for metering relevant to the pricing options selected by the consumer.
- the frequency of meter readings.
- the obligation to ensure metering is conducted in accordance with relevant industry standards and codes of practice.

While there are a number of gas meter services providers, the Commerce Commission has observed that competition in the provision of these services is limited. In 2004 it noted³²⁵:

'...there is little indication of vigorous competition on a day-to-day basis for the provision of meters, and there are very few examples of one supplier's meters being replaced by a similar meter from another supplier....' and

'The Commission considers that while there is a degree of contestability for the supply of meters, in practice little substitution occurs. Consumers face a significant cost if they wish to have an existing meter removed and a new one installed.'

At that time, the Commission concluded that metering met the thresholds for control, and that metering should be treated as one component of the various gas service markets, rather than a discrete market.

Authorisations³²⁶ issued by the Commission for distribution services provided by Powerco included price-quality regulation of meters, after the Minister placed the metering services of Powerco under control for the Authorisation. Vector at the time did not supply meters on its controlled network.

The Commerce Amendment Act 2008 (section 55A(4)) specifically excludes meters from the definition of 'pipeline'. No distinction is made between:

- end-user meters that record individual or entity consumption of end-user gas pipeline services, and
- operational meters, such as those at gas transmission receipt and delivery points, and a number of other meters that gas distribution and gas transmission businesses find necessary for providing gas conveyance services.

The Commission's view is that, while end-user meters currently are excluded from Part 4 regulation, operational meters are assets used in the supply of gas pipeline services. Costs associated with the supply, operation and maintenance of operational meters should thus be included in the pipeline owner's regulatory asset base, and their operating costs recognised.

³²⁴ Gas Industry Co Retail Contracts Oversight Scheme – see also **Page 149**.

³²⁵ Commerce Commission: *Gas Control Inquiry, Final Report*, November 2004.

³²⁶ Commerce Commission: *Authorisations for the Control of Supply of Natural Gas Distribution Services by Powerco Limited and Vector Limited*, 30 October 2008 and expiring on 1 July 2012.

Industry participants' views on metering governance have been aired in the context of the general review of the Reconciliation Rules. Generally, it is considered that metering disciplines are well established under the Reconciliation Rules, that commercial arrangements ought to provide sufficient obligations on meter owners, and there is no need for new rules, guidelines or principles for metering contracts³²⁷.

That view, while supported by the majority of participants, isn't unanimous. A small number of retailers do not believe all meter owners operate in a contestable environment and suggest more regulation is needed due to the complexities of gas metering technology, the need to incentivise technological advancement, and, as a matter of principle, a desirability for meter owners to be treated the same as retailers or transmission system owners³²⁸. Others³²⁹ believe that regulations should not act as an impediment to incentivising technological developments such as smart meters.

Since it approved Vector's acquisition of Contact Energy's gas metering business for \$59.9 million in 2013, the Commerce Commission looked at whether it should undertake an inquiry into gas metering services under Part 4 of the Commerce Act (under which it can recommend to the Minister of Commerce that specific goods or services become regulated). In April 2016, the Commission announced that, while still concerned about the limited competition for gas metering services, it had decided on a cost-benefit basis not to initiate a formal inquiry at this time³³⁰.

13.3 Meter and Energy Conversion Accuracy

Gas metering presents some unique challenges compared with liquid flow metering. Unless compensated for, the influence of temperature, pressure, altitude and compressibility can cause metering inaccuracies. Gas meters are driven by the differential pressure between the gas upstream and downstream of the meter. Volumetric errors are typically below 1 percent. While meters are often consistently accurate over their lives, higher volumetric errors can occur due to age, lack of maintenance or, in the case of turbine and rotary meters, insufficient throughput. Proper meter management therefore includes regular recalibration, maintenance and appropriate sizing in accordance with the expected and measured flow³³¹.

Audits associated with the Reconciliation Rules have revealed instances of inaccuracies in converting meter readings into energy, and a need for retailers to take better account of temperature and altitude in their calculations³³². Many of the inaccuracies resulted in under-reporting of customer volumes, with consequently increased UFG. The issue has been addressed through the development of a guideline note on energy conversion factors³³³ that serves as a consistent reference point for retailers in their energy conversion calculations.

There is some industry focus on meter owner accountability where a metering problem causes a retailer to receive Reconciliation Rules breach notices. The broad consensus among participants is that

³²⁷ Gas Industry Co: *Statement of Proposal: Downstream Reconciliation Rules Review*, 26 July 2012.

³²⁸ Energy Direct NZ, Greymouth Gas: *Submissions on Statement of Proposal: Downstream Reconciliation Rules Review*, 30 August 2012.

³²⁹ Vector Limited: *Submission on Statement of Proposal: Downstream Reconciliation Rules Review*, 30 August 2012

³³⁰ Commerce Commission media release: *Commission will not undertake gas metering inquiry*, 1 April 2016.

³³¹ Maunsell/AECOM: *Allocation of Unaccounted For Gas*, Report to Gas Industry Company, June 2007.

³³² Gas Industry Co: 2011 Annual Report

³³³ <http://gasindustry.co.nz/dmsdocument/2849>

these ought to be resolved under the contractual arrangements between the metering owner and the retailer³³⁴.

13.4 Smart Meters

Technology for smart gas meters exists, but it is more complex and is not yet being rolled out to the same extent as smart electricity meters in New Zealand, or of smart meters overseas where it is being heralded for a range of benefits to consumers, energy suppliers and energy networks. In New Zealand, over 1.2 million advanced electricity meters have been deployed to date, and the figures become much higher in larger markets overseas. In the UK, for instance, the Department of Energy and Climate Change has set a timetable for the installation of 50 million smart electricity and gas meters over 26 million households across England, Scotland and Wales by the end of 2020³³⁵. It estimates this rollout will have a \$14 billion net benefit over 20 years.

The main issues for smart gas meters are higher cost and a complexity in balancing GMS safety with the need for connecting a power source for communications. For safety reasons, gas meters are subject to an exclusion zone in which sources of ignition, including electricity sockets and switches, are prohibited. Power supplies (mains or solar) for ToU equipment must be intrinsically safe, so as not to present a potential source of ignition, and require initial and subsequent periodical certification by a qualified electrician. Although battery-powered equipment can be employed, it also needs to be appropriately certified for the area in which it is being fitted, and its finite life is seen as a disadvantage.

Challenges lie in finding a commercial resolution acceptable to GMS providers and retailers, as well as certainty for GMS owners in respect to safety where third parties wish to connect energy management systems to their metering equipment. From 2013, meter owners have been required under the Safety Regulations to develop safety management systems for meter installations.

In New Zealand, intelligent gas meter installations so far have been limited to a small number of large TOU consumers. However, trials have commenced of a variety of smart gas meter technologies, including battery-powered remote reader units retrofitted to latest-technology residential meters, and integrated advanced domestic capacity gas meters. The latter have the battery and modem located under the cover and are about a fifth of the size of current domestic gas meters.

Vector reports that, subject to successful trials, it intends to install smart gas meters whenever it establishes a new connection or when an old meter reaches the end of its useful life. It anticipates that Vector's smart gas meter fleet could expand significantly in a move that will mirror the transformation of Vector's electricity metering fleet over the last few years³³⁶.

Communications capabilities associated with these units potentially allow remote connection and disconnection as is being proposed in other countries, and may enable residential users to access consumption information via their retailers. The units have the potential for more general roll-out to small gas consumers.

As smart energy metering technology generally continues to evolve, cautions have been sounded about how 'smart' is 'smart', including a call by the New Zealand Parliamentary Commissioner for the

³³⁴ Submissions on Gas Industry Co *Statement of Proposal: Downstream Reconciliation Rules Review*, 26 July 2012.

³³⁵ www.smartenergygb.org – established to lead national public engagement on the smart meter rollout

³³⁶ Vector Interim Report 2015

Environment (PCE) in 2009³³⁷ for a moratorium on the rollout of advanced electricity meters, which it says lack core technology that make them 'really smart'. The Commissioner had earlier³³⁸ said that New Zealanders are missing out on smart power – which could save electricity users across the country \$125 million a year through consumption reduction – because most of the meters being installed are 'dumb smart meters'.

The PCE's report contained nine recommendations relating to a range of electricity smart meter issues. In an Update Report in 2013³³⁹, the PCE noted a number of retailers rejected the conclusion of the initial report. Noting that this is an area of rapid change, and the near completion of the smart meter roll-out, the PCE reported that some of the initial recommendations had been superseded by events.

The PCE has taken the view that the focus should now be broader and should look at how New Zealand's electricity grid can be made smarter. More effective and efficient smart grids 'will be a fundamental requirement for reaching the Government's target for 90 percent of electricity to be generated from renewable sources by 2025'.

And in the UK, British Gas, which began a smart gas meter rollout in 2010 to get a march on competitors, found in 2012 that it had to replace many of the 400,000 meters it had installed after technological advancement rendered them obsolete, and British government guidelines deemed they did not meet the newly-defined protocol³⁴⁰.

13.5 Regulatory Performance

Gas Metering policy objectives (Gas Act & GPS)	Performance
<ul style="list-style-type: none"> Gas industry participants are able to access distribution pipelines and related services on reasonable terms and conditions. Barriers to competition are minimised. Energy and other resources used to deliver gas to consumers are used efficiently. 	<p>The Commerce Commission considers that while there is a degree of contestability for the supply of meters, in practice little substitution occurs. Consumers face a significant cost if they wish to have an existing meter removed and a new one installed. The definition of gas pipeline services under Part 4 of the Commerce Act explicitly excludes metering services, but the Commerce Commission has decided not to conduct an inquiry into metering services under Part 4 of the Commerce Act.</p>
<ul style="list-style-type: none"> There is an efficient market structure for the provision of gas metering, pipeline and energy services. The respective roles of gas metering, pipeline and gas retail participants are able to be clearly understood. 	<p>The Reconciliation Rules set out the responsibilities of meter owners and retailers for the purposes of meeting the gas measurement and data provision requirements of the Reconciliation Rules.</p> <p>There is a broad, though not unanimous, industry view that commercial agreements and other obligations (such as measurement standards), provide sufficient control for meter owners, and there is no market 'failure' that warrants regulatory or other intervention.</p> <p>Clear information relating to metering is included in upgraded supply contracts between retailers and small consumers.</p>

³³⁷ Parliamentary Commissioner for the Environment media release: *Commissioner calls for moratorium on meter roll-out*, 21 September 2009.

³³⁸ Parliamentary Commissioner for the Environment media release: *Kiwis miss out on smart power*, 25 June 2009.

³³⁹ Parliamentary Commissioner for the Environment: *Smart electricity meters: How households and the environment can benefit*, Update Report, June 2013

³⁴⁰ Reported: The Telegraph, 5 April 2012.

13.6 International Metering Market Practices

Various gas metering governance practices are adopted in other countries, with a number undergoing reviews and changes to transition to smart metering technology.

In the UK, the regulator, Ofgem, established a current tariff cap regime for gas metering in its review of price control of (then) Transco³⁴¹. Ofgem's 2002 review separated price controls for gas metering from Transco's other businesses. In 2012 Ofgem completed a review of metering arrangements, and in October 2013 published a decision on regulatory changes to facilitate an efficient transition to smart meters³⁴². Ofgem's preferred approach is to require National Grid to offer terms to provide metering services to other gas distribution networks and to initiate a process to review the associated regulated metering tariffs.

With respect to smart meters, gas and energy companies are required to install smart meters in every home and business in Great Britain. However, this isn't mandatory for consumers, who can choose not to opt in.

Rules and standards aimed at ensuring consumers are protected and get the full benefits from the upgrade to smart meters include:

- technical standards for smart metering equipment.
- meeting the needs of vulnerable people.
- data access - so consumers always have choice over their data.
- security - making sure the systems are secure.

In the EU, the European Regulators Group for Electricity & Gas (EREG) has issued to Member States guidelines for good practice on regulating electricity and gas smart metering³⁴³.

Development of the guidelines stems from European Parliament directives on common rules for internal electricity and gas markets³⁴⁴ and a European Commission mandate³⁴⁵ for the development of an open architecture for utility meters involving communications protocols and functionalities. It has the general objective of harmonising European standards that will enable inter-operability of utility meters, including water, gas, electricity and heat. The EREG is engaging in a more proactive policy for customer empowerment, recognising that smart metering systems can enable customers to better control their energy consumption and adjust their behaviour to lower their energy bills. It believes metering data provided to customers can make supplier switching more efficient and easy, and encourage increased customer participation in energy markets.

In Australia, the National Gas Rules contain comprehensive provisions for metering installations and responsibilities in Victoria. In other parts of Australia metering arrangements are covered in State legislation or regulations.

³⁴¹ Formerly part of British Gas, later part of Lattice Group PLC, which subsequently merged with National Grid.

³⁴² Ofgem: *Decision and further consultation on the regulation of traditional gas metering during the transition to smart metering*, 25 July 2012 and Ofgem: *The regulation of traditional gas metering during the transition to smart meters – final proposals and statutory consultation*, 31 October 2013.

³⁴³ EREG: *Final Guidelines of Good Practice on Regulatory Aspects of Smart Metering for Electricity and Gas*, 8 February 2011.

³⁴⁴ Also referred to as the 3rd Package adopted on 13 July 2009.

³⁴⁵ Mandate M/441

In the United States, metering is included in natural gas rules and regulations set by Utilities Districts, and the Department of Energy has updated its Metering Best Practices guide for Federal energy managers³⁴⁶. It covers electricity, gas, water, air and steam and updates the first edition published in 2007.

A formal code³⁴⁷ governs gas metering arrangements and practices in Singapore.

³⁴⁶ US Department of Energy, *Federal Energy Management Program: Release 2.0 Metering Best Practices – A Guide to Achieving Utility Resource Efficiency*, August 2011.

³⁴⁷ Energy Market Authority of Singapore: *Gas Metering Code*, 2008.

14 Gas Safety

Natural gas safety requirements have been strengthened in recent years, through both generic and industry-specific health and safety regulation. This was primarily the responsibility of the Ministry of Business, Innovation and Employment prior to the creation in 2013 of a new Crown Agency, WorkSafe New Zealand. In addition to national workplace health and safety performance, a health, safety and environmental management regime has been developed under EEZ legislation, which includes offshore oil and gas exploration.

While the prospects of a serious gas quality-related incident are considered small, concerns over gas quality arrangements have led to the production of a *Gas Quality: Requirements and Procedures* document for the industry.

14.1 Background

Safety and gas supply reliability are closely interdependent. A range of safety and quality requirements apply across the gas supply chain – most of them at the distribution and retail levels, but also with a number of important requirements, including gas quality standards, on upstream players.

Key aspects of a safe and reliable gas supply are:

- gas quality - maintaining the composition and burning characteristics of gas within the range specified by NZS 5442:2008 - the specification for reticulated natural gas (Gas Specification) - and restricting contaminant levels, particularly dust particles and liquids such as condensates.
- odourisation - maintaining detectable levels of odorant³⁴⁸.
- supply pressure - maintaining pressure within contracted limits.
- supply continuity - avoiding interruption to supply.
- installation and appliance integrity.

The safety regime administered by divisions within MBIE, was generally transferred to the newly-formed WorkSafe New Zealand Crown Agency in 2013. This included:

- Energy Safety³⁴⁹, which administers elements of the Gas Act, the technical provisions of the Gas (Safety and Measurement) Regulations 2010 (Gas Safety and Measurement Regulations), and the Hazardous Substances and New Organisms Act 1996. Energy Safety promotes, monitors, and enforces the safe use and supply of gas and appliances. Energy Safety publishes annual reports on gas accidents. A responsibility it held for investigating workplace gas-related accidents was transferred in 2009 to the Department of Labour (DoL), which subsequently became part of MBIE. Energy Safety continued to be responsible for investigating non workplace-related gas accidents involving the public.

³⁴⁸ As specified in NZS 5263:2003 Gas Detection and Odourisation.

³⁴⁹ <http://www.energysafety.govt.nz/>

- Labour Group, formerly the stand-alone DoL, which managed general health and safety in employment legislation, and specifically (in the gas sector context) the Health and Safety in Employment (Pipelines) Regulations 1999 (HSE Pipelines Regulations), and the Health and Safety in Employment (Petroleum Exploration and Extraction) Regulations 2013.
- High Hazards Unit³⁵⁰, which has an inspection, assessment and enforcement role regarding workplace practices and systems in the petroleum, mining and geothermal industries. Its petroleum industry focus is on exploration and extraction, both onshore and offshore.
- Building & Housing Group, formerly the stand-alone Department of Building and Housing, which administered the Plumbers, Gasfitters and Drainlayers Act 2006 (PGD Act). This Act brought significant changes to the rules covering gasfitters (as well as plumbers and drainlayers), including a two-tier license system, to improve public health and safety. It also introduced consistent regimes for the electricity and gas sectors relating to the registration of workers, competency-based licensing, updated procedures for addressing complaints against workers, and strengthened enforcement provisions. This role is carried out by the Plumbers, Gasfitters and Drainlayers Board (PGDB) established under the Act, and which describes its purpose as 'to protect the public health and safety by ensuring that ...gasfitters are competent and licensed'.

The Skills Organisation manages education and training for these industries³⁵¹.

Changes to gas (and electricity) certification regimes from 1 July 2013 were also aimed at improved safety for consumers³⁵². The changes streamlined certification regimes, reducing compliance costs while extending certification to cover all gas installation work.

Amendments to the Gas Act in 2006 required gas distribution companies to develop, implement and maintain a Safety Management System (SMS) that will ensure their gas supply systems do not pose a significant risk of serious harm to the public, or to third party property. The first audits of gas supply companies' SMS were carried out in May 2013. A standard³⁵³ sets out SMS content to assist compliance. A Gas Community Group, administered by Standards New Zealand and comprising representatives of regulatory agencies and industry associations³⁵⁴ also has public safety outcome goals.

14.2 Standards

There are numerous Standards relevant to the gas industry. The Standards are very technical in nature and include numerous detailed operating and network requirements (such as odourisation requirements and pressure limits). See also **New Zealand Standards, Page 39**.

New Zealand Standards are developed by a statutory officer within MBIE, using technical committees of industry experts for approval by an Independent Standards Approval Board.

³⁵⁰ <http://www.worksafe.govt.nz/worksafe/about/what-we-do/high-hazards> Established in August 2011 to improve leadership, planning and relationship management in inspection and enforcement work in the mining, petroleum and geothermal industries. Its creation followed the Pike River coal mine tragedy, and reviews of DoL resources dedicated to the petroleum production and mining industries. It had two teams, Mining and Petroleum/Geothermal, each with regionally-based inspectors led by a Chief Inspector.

³⁵¹ The Skills Organisation www.skills.org.nz is an industry training organisation (ITO) for multiple industries. The previous ITO for the gas sector, the Plumbing, Gasfitting, Drainlaying & Roofing Industry ITO merged with The Skills Organisation on 1 October 2012.

³⁵² Joint media release, Minister of Energy and Resources, and Minister of Building and Construction: *Safer outcomes for gas and electrical work*, 27 September 2012.

³⁵³ NZS 7901:2008 Electricity and Gas Industries – Safety Management Systems for Public Safety.

³⁵⁴ Organisations represented include Master Plumbers, Gasfitters and Drainlayers NZ, WorkSafe New Zealand, PGDB, PGDR ITO, GANZ, LPG Association, and Standards NZ.

14.3 High Pressure Pipelines

The HSE Pipelines Regulations replaced the Petroleum Pipeline Regulations 1984 and introduced significant changes, including a requirement for all pipelines to be operated with a current 'Certificate of Fitness'. Provisions include empowering the Certifying Authority to carry out safety inspections and examinations of pipelines, and to impose limitations or conditions where required.

Under the Pipelines Regulations, pipeline operators must appoint managers to manage pipeline operations and supervise health and safety aspects of the operations. The regulations outline an employer's general duties, including the management of hazardous substances, and contain provisions relating to certification and the notification of certain operations. They impose duties on employers in relation to land occupiers and controlling authorities, and provide for emergency procedures. All owner-operators must have current certificates of fitness for their pipelines, and these have to be renewed every five years.

Published guidelines³⁵⁵ inform pipeline owners and operators of minimum requirements needed for a pipeline Certificate of Fitness.

14.4 Gas Appliances

Changes to the safety regime for gas (and electricity) appliances introduced in 2002 recognised New Zealand's trade relations with other countries, particularly the Trans-Tasman Mutual Recognition Agreement (TTMRA) with Australia. The changes sought to harmonise the New Zealand and Australian appliance safety regimes and enable market-to-market supply and sale. In 2009, the Gas Technical Regulators Committee, comprising New Zealand and Australian representatives, agreed to a common Australian/New Zealand gas appliance approval mark, known as the 'gas tick'. The Gas Safety & Measurement Regulations 2010 require use of this common mark on gas appliances from 4 May 2012.

Energy Safety requires gas appliance suppliers to make a formal declaration that their appliances meet the relevant safety requirements. Once approved, the appliance is listed on the Energy Safety website. To complete the loop, retailers and gasfitters must confirm that appliances are listed on the Energy Safety website before supplying or installing the appliance.

Amendments to the Gas Safety & Measurement Regulations in 2011 included adjustments to the appliance certification regime to eliminate compliance costs, and measures towards accepting certification of North American gas appliances.

14.5 Current State of Gas Safety

Requirements around gas safety are comprehensive and, in many cases, have been updated and strengthened in recent years. The Gas Safety and Measurement Regulations cover broad aspects of gas safety, including the safety of gas distribution systems, and safety of gas at the point of supply to the end-user.

Improvements over previous versions of the regulations include a clearer definition of the point of supply (the outlet of the GMS), and a clear allocation of responsibilities. For example, the regulations provide that:

- the odourisation of gas is the responsibility of:

³⁵⁵ MBIE: [Guidelines for a Certificate of Fitness for High-Pressure Gas and Liquids Transmission Pipelines](#)

- the retailer at the point of supply
- the gas distributor at points where gas is received into or delivered out of the distribution system, and while the gas is in the distribution system
- compliance with the Gas Specification is the responsibility of the retailer or wholesaler supplying the end-user.
- the accuracy of gas measurement is the responsibility of the GMS owner.
- supplying gas at a pressure that ‘...ensures the safe supply, passage, and use of the gas...’ at an end-user’s installation is the responsibility of the retailer or wholesaler supplying the end-user.
- the design, construction, maintenance, and operation of distribution systems to provide continuity of supply and safety is the responsibility of the owners/operators.

14.6 Gas Quality

While safety considerations generally are well covered by the industry, there are particular concerns around industry arrangements for managing gas quality. Quality is important as it affects combustion performance, safety, supply reliability, and the long-term integrity of the gas transportation system. A serious gas quality incident could also cause economic and reputational harm.

Gas quality-related incidents appeared to have increased with the introduction of new fields³⁵⁶. However the possibility of serious quality-related events is considered small and there is no evidence to suggest that gas quality is not being managed by parties in the physical supply chain in a rigorous and professional manner³⁵⁷.

Because of the potential impact of a quality-related issue in a common gas facility - such as a pipeline – for general reticulated market use, there is a heavy onus on the industry to ensure a high degree of transparency, both in quality management practices, and of the gas itself in meeting the Specification³⁵⁸.

Principal concerns about gas quality management are:

- the parties with the legislative responsibility for achieving compliance with the Gas Specification may not have sufficient influence over the parties who physically control gas quality.
- the complexity and largely confidential contractual linkages between them.
- the risk that costs associated with a quality-related outage may not be borne by the party that caused it³⁵⁹.

Overall, the approach taken in contractual arrangements by transmission system operators, network operators, retailers and wholesaler is consistent with the Gas Specification referred to as the ‘standard’ for gas quality in New Zealand³⁶⁰. Under the Maui and First Gas North Island System interconnection

³⁵⁶ Gas Industry Co: *Advice on Gas Quality Arrangements*, letter to the Associate Minister of Energy and Resources, 21 December 2010.

³⁵⁷ Gas Industry Co: *Gas Governance Issues in Quality: Investigation Update*, 1 August 2012.

³⁵⁸ There is some trading in non-specification gas, such as gas supplied for petrochemical production, but this generally involves a single large end-user and is effected through a dedicated delivery system.

³⁵⁹ Gas Industry Co: *Gas Governance Issues in Quality: Issues Paper*, 7 September 2010; Gas Industry Co: *Advice on Gas Quality Arrangements*, advice to the Associate Minister of Energy and Resources, 21 December 2010.

³⁶⁰ Powerco and GasNet Network Service Agreements provide for non-specification gas to be transported if all retailers agree and the requesting retailer indemnifies the Network Service Operator against claims from others.

agreements, the injecting party is responsible, either directly or indirectly, for monitoring and ensuring gas quality³⁶¹. Most of the contractual arrangements seek to limit liability.

Significant questions for the industry are whether appropriate arrangements are in place to prevent gas quality incidents, and whether the costs of a gas quality incident will be met efficiently – including whether damages can flow through the contractual chain to land on the ‘causer’. As potential consequences often drive behaviour, the worry is that current arrangements may not be providing proper incentives for the good control, monitoring, reporting and auditing of gas quality.

Contractual provisions regarding losses or damage caused by non-specification gas could be improved. Elements of current industry arrangements - for instance some key interconnection points that are not subject to an interconnection agreement, and industry agreements that limit liability for damage - may result in situations where compensation for gas quality losses may be irrecoverable, and liability cannot be passed to the appropriate party.

Gas retailers, in seeking to reconcile their difficulties in having the legislative responsibility for gas quality, but not the ability to directly control that quality, proposed a ‘Gas Information Exchange Protocol’ to verify compliance with the Gas Safety and Measurement Regulations. This has evolved into a *Gas Quality: Requirements and Procedures* document³⁶² which aims to give gas industry stakeholders an understanding of legislation relevant to gas quality, how gas quality is managed in its journey from production station to consumer, and the availability of information about gas quality.

14.7 International Gas Quality Practices

Denmark and Victoria, Australia, provide relevant comparisons with New Zealand as both have co-mingled gas supply, comparable gas volumes, and open access transport systems.

In Denmark, the transmission system owner is responsible for physically monitoring the gas quality (unlike New Zealand or Australia). Where responsibility for a non-specification gas incident cannot be attributed to a causer, the costs of damages are socialised.

The Victoria Transmission System is supplied by transmission systems delivering gas from remote fields – making it different from New Zealand where there is generally no intermediate transmission system and gas is injected directly into the transmission system by the producers. The responsibility for monitoring gas quality in Victoria rests with the injecting transmission system owner, and in New Zealand it is with the injecting producer.

Where there is a grid operator, such as in Victoria³⁶³, the operator is responsible for ensuring injection point flows are continuously monitored for compliance with the relevant gas specification.

New Zealand’s arrangements for monitoring gas quality are not as prescriptive as other regimes. In Victoria, for example, continuous monitoring of virtually all gas parameters is mandatory, while in New Zealand the regime allows periodic sampling of parameters such as water and sulphur. As a result, there is a higher risk in New Zealand for delays in identifying non-specification gas, and for the causer to be not identified at all.

³⁶¹ Indirectly if the injecting party is another transmission system operator who has had gas injected into its pipeline by a producer, who then has the gas quality responsibility.

³⁶² <http://gasindustry.co.nz/work-programmes/gas-quality/>

³⁶³ Other examples are Ireland and Holland

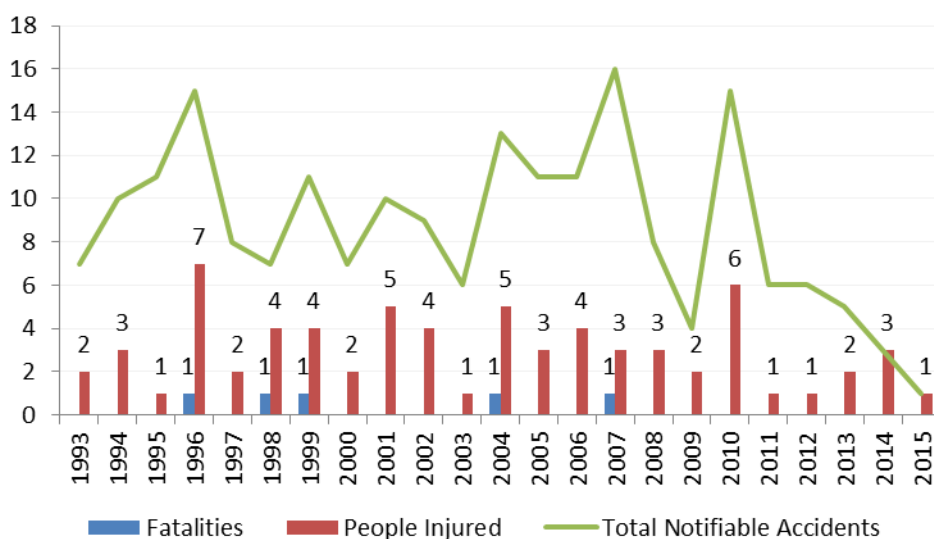
New Zealand does not have Australia's quality procedures of setting notification, alert and curtailment limits for each component of the gas specification. Also, the gas specification limit for water in New Zealand is higher than other overseas standards and carries a higher risk of hydrate formation.

14.8 Gas Safety Incidents

Energy Safety reports on natural gas accidents affecting the public and relating to transportation systems and appliances. In the 23 years to 2015 (inclusive), there were 199 notifiable accidents, of which five involved fatalities, and 56 caused injury to a total of 69 people (Figure 73)³⁶⁴. Of the total notifiable accidents, 140 (70 percent) were non-casualty accidents that resulted in property damage.

Energy Safety notes that, with this small number spread over a 23-year period it is not possible to identify a trend for fatal and injury accidents. It reports, however, that three fatal accidents involved fixed space heaters, and the other two each involved a gas cooker and water heater. The last fatality was in 2007.

Figure 73: Notifiable Natural Gas Accidents 1993-2015

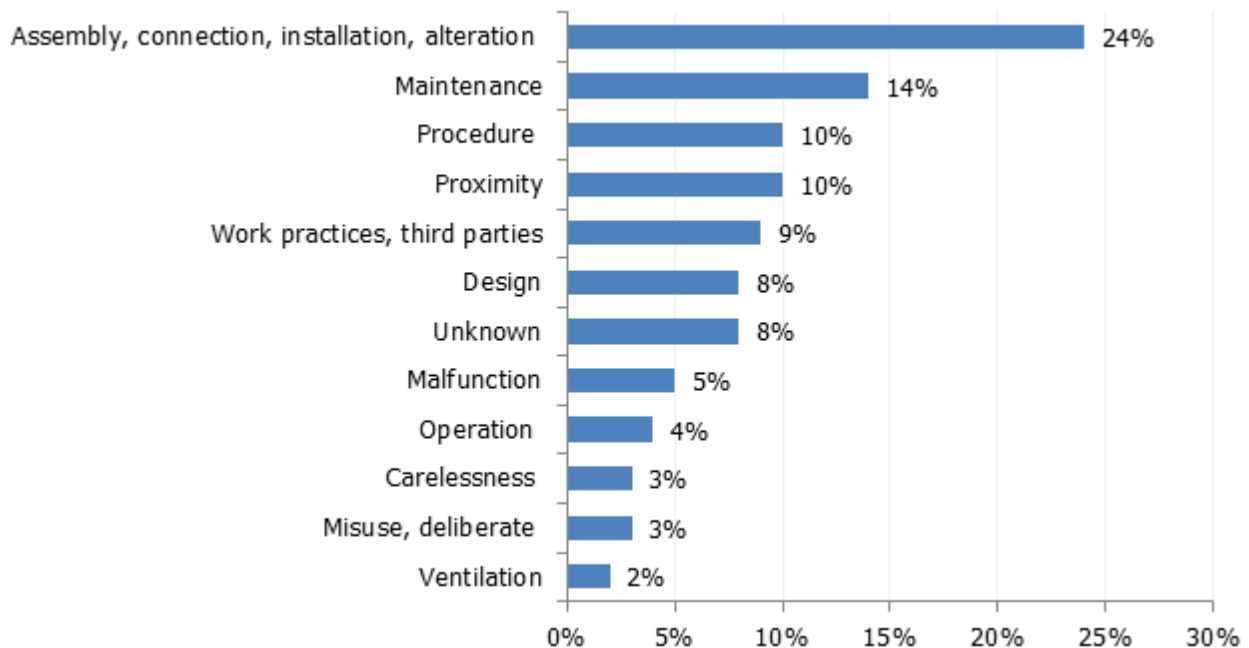


Source: Energy Safety: Summary of reported gas accidents 2015

Figure 74 shows the main causes of notifiable gas accidents involving members of the public. The most common has been incorrect assembly, connection, installation or alterations, faulty work practices and procedures, lack of maintenance, and proximity (in which an appliance has been too close to a combustible product).

³⁶⁴ Energy Safety: Summary of Reported gas accidents 2015, available at <http://www.energysafety.govt.nz/about/publications/accident-summaries/2015-accident-summaries/executive-summary/natural-gas>

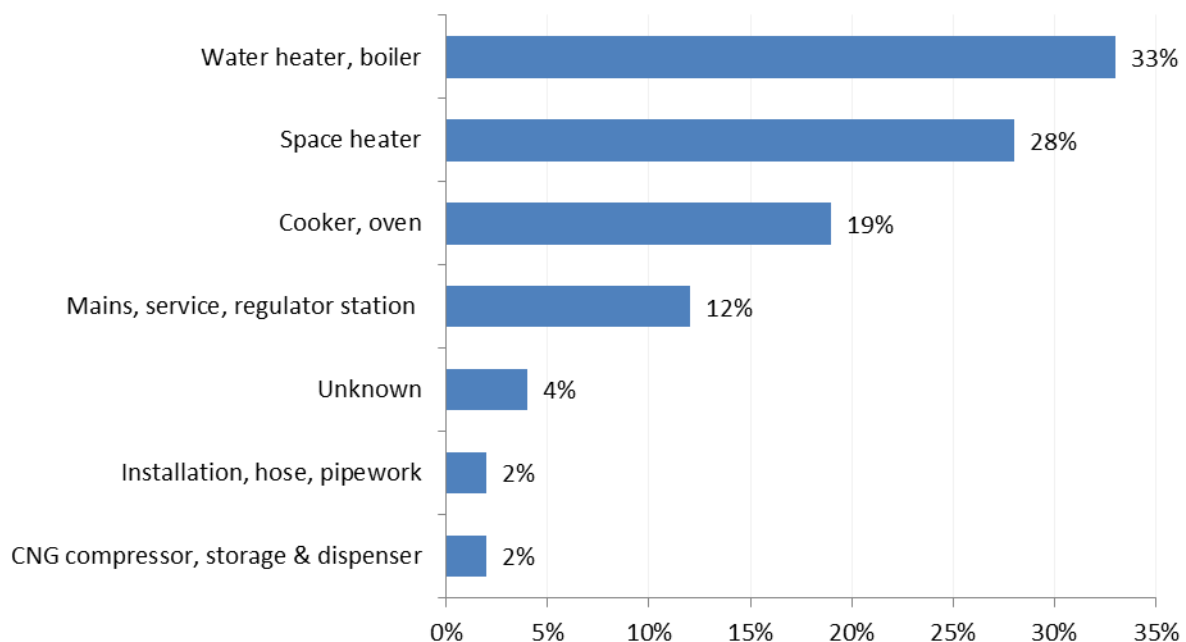
Figure 74: Causes – Notifiable Natural Gas Accidents 1993-2015



Source: Energy Safety: Summary of reported gas accidents 2015

By equipment type (Figure 75 and Table 32), three categories of appliance – water heaters/boilers, space heaters, and cookers – accounted for approximately 80 percent of notifiable accidents, and over 90 percent of those cases involved fire or explosion.

Figure 75: Equipment – Notifiable Natural Gas Accidents 1993-2015



Source: Energy Safety: Summary of reported gas accidents 2015

Table 32: Natural Gas Accidents by Equipment Type 1993-2015

Equipment	Notified Accidents	Fatalities	Injury Accidents	People Injured
Mains/service and regulator stations	25	-	12	15
Space heaters	55	3	11	12
Cookers/ovens	37	1	11	14
Water heaters	65	1	14	17
Other	17	-	8	11
Total	199	5	56	69

Source: Energy Safety: Summary of reported gas accidents 2015

14.9 Regulatory Performance

Gas safety policy objectives (Gas Act & GPS)	Performance status
<ul style="list-style-type: none"> Gas is delivered to existing and new customers in a safe, efficient and reliable manner. Risks relating to security of supply are properly and efficiently managed by all parties. 	<p>Safety requirements relating to natural gas previously fell under a variety of different Government bodies, a number of which were brought under the administration of a single Ministry, MBIE, during 2012, and subsequently transferred to a new Crown Agency, WorkSafe New Zealand, in 2013.</p> <p>Natural gas safety requirements are comprehensive and, in many cases, have been updated and strengthened in recent years.</p> <p>Gas quality is a significant factor in supply reliability and is reflected in the publication of a <i>as Quality: Requirements and Procedures</i> document³⁶⁵.</p>

³⁶⁵ <http://gasindustry.co.nz/about-the-industry/requirements-and-procedures-documents/>

Appendix A – Historic Trends (discontinued)

These tables, published in the first edition of the New Zealand Gas Story were compiled from information disclosed under the previous Information Disclosure regime - the Gas (Information Disclosure) Regulations 1997 - which has been discontinued, or changed in some manner for reporting under new Information Disclosure requirements that took effect in 2013.

They are included here to provide some information on historic trends, while a new data history using the changed reporting criteria progressively builds in future years.

Appendix Table 1: Vector Pipeline Statistics 2008-2012

	2008	2009	2010	2011	2012
Gas conveyed (GJ)					
North & Central	64,426,662	48,979,436	49,639,637	49,878,815	54,439,302
Bay of Plenty	9,736,411	8,941,627	8,896,534	8,433,746	8,096,206
Frankley Rd-Kapuni	20,580,125	23,483,527	25,072,109	25,538,592	25,168,994
South	10,505,779	10,643,670	10,661,819	10,409,572	10,548,259
Total gas conveyed	105,248,977	92,048,260	94,270,089	94,260,725	99,252,761
Total customers	14	14	12	11	10
Load factor (%)					
North & Central	85.3	67.9	78.9	75.0	81.7
Bay of Plenty	84.0	83.6	87.4	81.7	89.8
Frankley Rd-Kapuni	75.7	74.2	66.1	69.3	78.6
South	76.3	73.2	73.4	72.3	75.9

Vector has changed the breakdown of its transmission sub-systems for reporting under the new regime.

Appendix Table 2: Direct Line Costs (\$/km) 2008-2012

	2008	2009	2010	2011	2012
Maui	38,858	46,603	32,349	35,015	35,599
Vector	3,170	4,366	3,708	4,765	5,148

Basis for reporting expenditure has changed.

Appendix Table 3: Unplanned Transmission System Interruptions

	2008		2009		2010		2011		2012	
	Number	Hours	Number	Hours	Number	Hours	Number	Hours	Number	Hours
Maui	-	-	-	-	-	-	1	138	-	-
Vector	6	30.5	-	-	-	-	1	2	2 ¹	128.5

Basis for reporting system reliability has changed

¹ Unrelated to Vector's system – one (of 120.5 hours) relates to the October 2011 Maui pipeline outage and the other (8 hours) arose from the March 2012 Pohokura Production Station outage.

Appendix Table 4: Distribution Network Costs 2008-2012

Distributor	2008	2009	2010	2011	2012
Vector					
Direct lines cost/km (\$)	707	701	753	799	910
Indirect lines costs/customer (\$)	116	109	104	120	125
Powerco					
Direct lines costs/km (\$)	981	1,210	1,208	1,306	1,353
Indirect lines costs/customer (\$)	73	91	93	85	90
GasNet					
Direct lines costs/km (\$)	2,916	2,337	1,711	1,759	1,766
Indirect lines costs/customer (\$)	84	82	99	95	100

Basis for reporting expenditure has changed

Appendix Table 5: Unplanned Distribution System Interruptions (hours/customer) 2008-2012

Distributor	2008	2009	2010	2011	2012
Vector	0.0305	0.0072	0.0259	0.0114	0.0163
Powerco	0.001889	0.0861 ¹	0.01070	0.0180	0.0206
GasNet	0.018	0.0258	0.2542 ²	0.0127	0.0106
Average	0.0167963 (1.01 minutes)	0.0397 (2.38 minutes)	0.096933 (5.81 minutes)	0.0140333 0.84 minutes	0.0158333 (0.95 minutes)

Basis for reporting system reliability has changed

¹ Includes 0.0831 hours/customer water inundation outage, Silverstream, July 2008

² Includes 0.225 hours/customer water inundation outage, St Johns Hill, June 2010

Glossary

\$	New Zealand dollars, unless otherwise stated.
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APPEA	Australian Petroleum Production and Exploration Association
BGX	Balancing Gas Exchange
CAIDI	Customer Average Interruption Duration Index
CEER	Council of European Energy Regulators
CO ²	Carbon dioxide
CMA	Crown Minerals Act 1991
CCM Regulations	Gas Governance (Critical Contingency Management) Regulations 2008
CCO	Critical Contingency Operator
CNG	Compressed Natural Gas
CSG	Coal seam gas
EECA	Energy Efficiency and Conservation Authority
EEZ	Exclusive Economic Zone (New Zealand)
EIA	Energy Information Administration (USA)
ENTSO-G	European Network of Transmission System Operators for Gas
ERGEG	European Regulators Group for Electricity & Gas
ETS	Emissions Trading Scheme
EU	European Union
FERC	Federal Energy Regulatory Commission (USA)
GANZ	Gas Association of New Zealand
Gas Act	Gas Act 1992
GJ	Gigajoule (10 ⁹ joules). The average residential gas consumption is 23GJ/year
GPS	Government Policy Statement on Gas Governance
GTX	Gas Transmission Exchange

ICP	Installation Control Point (customer connection)
IEA	International Energy Agency
ISCR	New Zealand Institute for the Study of Competition and Regulation Inc
ITO	Industry Training Organisation
KGTP	Kapuni Gas Treatment Plant, owned by Vector
Km	Kilometre
Linepack	The amount of pressurised gas stored in a pipeline
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MBIE	Ministry of Business, Innovation and Employment
MDL	Maui Development Limited
MPOC	Maui Pipeline Operating Code
NGC	NGC Holdings Limited (formerly Natural Gas Corporation), acquired by Vector in 2004.
North Pipeline	The section of the Vector transmission system from Huntly to Whangarei, via Auckland
NZEC	New Zealand Energy Corporation
NZES	New Zealand Energy Strategy
NZEECS	New Zealand Energy Efficiency and Conservation Strategy
OATIS	Open Access Transmission Information System
Ofgem	Office of the Gas and Electricity Markets (UK gas and electricity markets regulator)
2P reserves	Proved and probable reserves. Also referred to as P50 reserves.
PEPANZ	Petroleum Exploration and Production Association of New Zealand
PEP	Petroleum Exploration Permit
PGDB	Plumbers Gasfitters and Drainlayers Board
PPP	Petroleum Prospecting Permit
PMP	Petroleum Mining Permit
PML	Petroleum Mining Licence

PJ	Petajoule (10^{15} joules, or 1 million GJ). 1PJ is equivalent to the average annual gas use of approximately 43,000 households
Petrocorp	Petroleum Corporation of New Zealand Limited (former Government-owned enterprise acquired by Fletcher Challenge Limited (FCL) in 1987)
Reconciliation Rules	Gas (Downstream Reconciliation) Rules 2008
RMA	Resource Management Act
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	System Control and Data Acquisition transmission operating system
SMS	Safety Management System
SOE	State Owned Enterprise
Switching Rules	Gas (Switching Arrangements) Rules 2008
UFG	Unaccounted-for Gas
VTC	Vector Transmission Code