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2 October 2017

Steven Bailey
Low-emissions economy inquiry
Productivity Commission
PO Box 8036
WELLINGTON

Sent via email: info@productivity.govt.nz

Dear Steven

Low-emissions economy

First Gas welcomes the opportunity to submit on the Productivity Commission's issues paper "Low-emissions economy" released in August 2017 (the "Issues Paper").

Introduction and summary of points addressed

First Gas considers that natural gas can play an important role in the transition to a low-emissions economy, where New Zealanders incomes and wellbeing continue to grow.

Natural gas has lower carbon emissions than other fossil fuels, notably coal. Substitution from coal to natural gas for industrial process heat and electricity generation would provide immediate reductions in carbon emissions. Increased use of natural gas in space heating and for heavy vehicles can also reduce emissions in New Zealand. These reductions can be achieved without the "disruptive and potentially painful impacts" on businesses and households the Productivity Commission perceives might result from emissions reduction programmes.[1] The reductions in CO_2 can be achieved now, without waiting for technological innovation or commercialisation, and they can be achieved at minimal economic cost, without altering production or final consumption patterns.

In this submission, First Gas:

- Suggests an analytical framework for identifying the least cost/highest benefit options for transitioning to a low-emissions economy;
- Provides information on the emissions from natural gas use, relative to other fuels such as coal and geothermal, to assist the Productivity Commission's analysis of options;
- Outlines six opportunities where natural gas could be used to reduce total carbon emissions; and
- Discusses the policy initiatives that could be used to create incentives for an early transition to natural gas, to realise the benefits from the opportunities we have outlined.

We welcome the opportunity to contribute to this inquiry and would be happy to meet with the Productivity Commission to discuss our submission points further.

About First Gas

First Gas operates 2,500 kilometres of gas transmission pipelines (including the Maui pipeline), and more than 4,800 kilometres of gas distribution pipelines across the North Island. These gas infrastructure assets transport gas from Taranaki to major industrial gas users, electricity generators,

[1] Issues Paper, page 1.

businesses and homes, and transport around 20% of New Zealand's primary energy supply. Carbon emissions from the use of natural gas account for just over 12% of New Zealand's gross emissions.

Our distribution network services 61,500 consumers across the regions of Northland, Waikato, Central Plateau, Bay of Plenty, Gisborne and Kapiti. For further information on First Gas, please visit our website www.firstgas.co.nz.

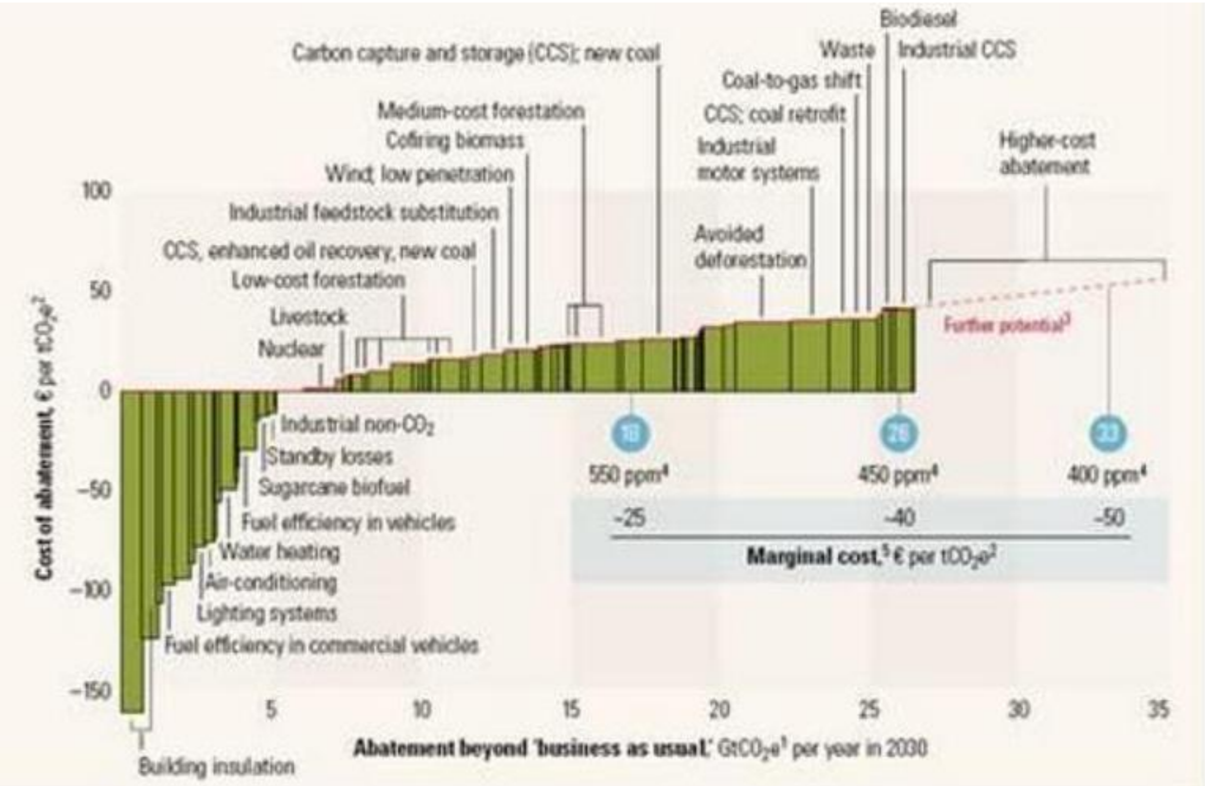
Recommend an analytical framework to identify the optimal transition path

First Gas recognises and appreciates the Productivity Commission's commitment to "provide insightful, well-informed and accessible advice". However, we are surprised by some of the gaps in existing data and analysis identified in the Issues Paper, given the lengthy policy debates on climate change and significant policy interventions that have occurred in New Zealand. We expected that marginal abatement cost (MAC) curves and demand and supply elasticities, in response to carbon prices, would have been analysed.

A MAC curve shows the additional reduction in carbon emissions from a wide range of potential sources of emission reductions and the economic cost of achieving those reductions. In the language of economics, the MAC curve represents a supply curve for emission reductions, or alternatively the minimum economic price society must pay to achieve a given level of reduced emissions. A policy path that follows this supply curve would maximise the benefits and minimise the costs of transitioning to a lower net-emissions economy.

In Figure 1 we reproduce an example of a MAC curve. This example was prepared by McKinsey and Company back in 2007, and is possibly the first example of a comprehensive MAC curve.

Figure 1: Illustration of marginal abatement curve



Source: The McKinsey Quarterly 2007, Number 1

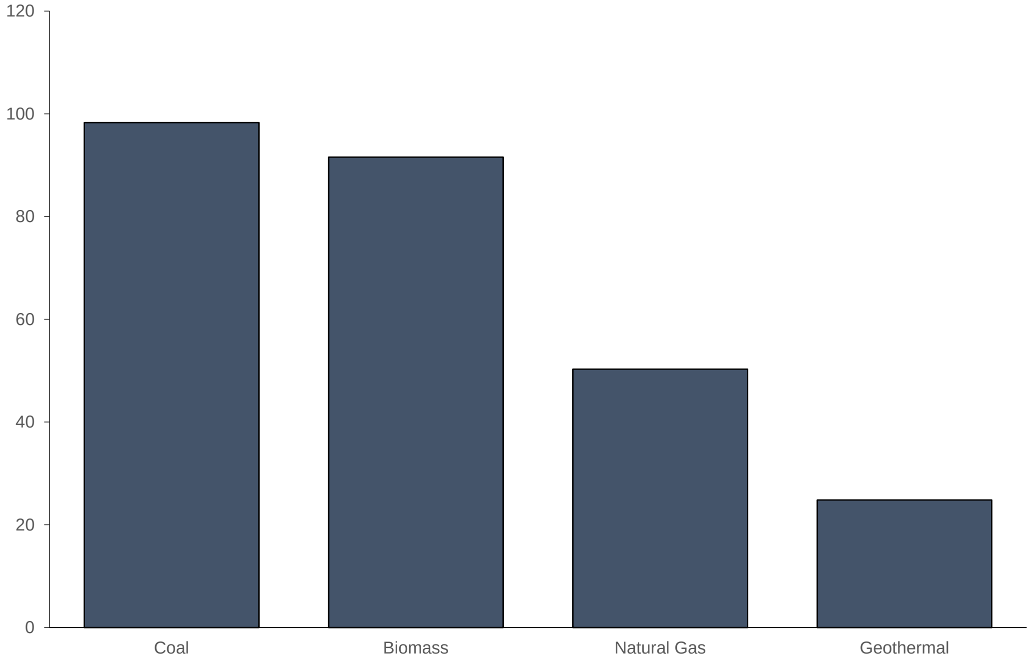
A MAC curve prepared for New Zealand in 2017 would likely look very different from the McKinsey MAC curve prepared a decade ago for the major economies of the world. However, the concept of a MAC curve has lost none of its analytical power. The presumption underlying the curve is that policy-makers are interested in capturing all the cheapest sources of abatement – that is, policies should pick the "low hanging fruit" first.

First Gas encourages the Productivity Commission to prepare a MAC curve for New Zealand to underpin its evidence-based recommendations on how New Zealand can minimise the cost of moving to a lower net-emissions economy, and to provide a basis for assessing the likely effects of its policy proposals. Indeed, we consider it will be difficult for the Productivity Commission to be confident in its recommendations without forming a view of the relative costs of alternative sources of emissions abatement.

Clean burning natural gas can produce less emissions than coal and geothermal electricity generation

Gas is a cleaner burning fuel than coal, and a relatively low greenhouse gas emitting fossil fuel. In Figure 2, we show estimates of the carbon released in producing the same amount of energy using coal, biomass, natural gas, and geothermal fuels. The high-level estimates as shown in Figure 2 provide helpful context, but are not sufficient for policy design as discussed below.

Figure 2: CO_2 emissions kg per GJ



The comparison between natural gas and coal is both straightforward and stark. In both cases, the fuel is extracted from being sequestered underground and burning it releases CO_2 emissions (and other emissions, especially in the case of coal). However, natural gas releases half the amount of CO_2 to produce the same amount of energy as coal. Emissions from an activity currently using coal would approximately halve, were the activity to substitute natural gas for coal.

The net emissions from burning biomass are more complex to assess. If the biomass comes from waste that would otherwise be left to rot (and thereby release its carbon), there may be little net carbon emissions from burning biomass. However, if vegetation (for example, a tree) is felled specifically to use as fuel and not replanted, or the vegetation takes many years to re-grow, using biomass for fuel may have a larger impact on global warming than using natural gas.

Geothermal energy is also complex to analyse. When geothermal fluid is discharged, trace amounts of gas are also released. The largest proportion of the gas released is CO_2 with lesser amounts of hydrogen sulphide and methane.[2] The amount of carbon emissions from New Zealand geothermal plants varies widely and can range from as low as 9 kg/GJ to as high as 166 kg/GJ. To illustrate this variation, the chart below shows the emission rates from 7 geothermal electricity generation plants operating in New Zealand.

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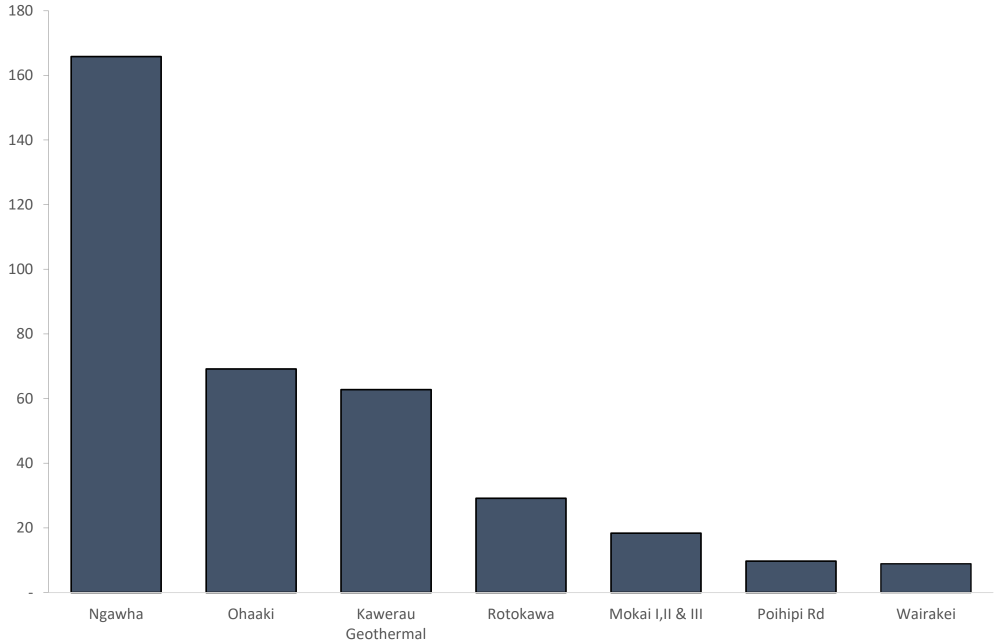
[2] https://nzgeothermal.org.nz/emissions/

Figure 3: CO$_2$ emissions (kg per GJ) for New Zealand geothermal plants



New Zealand's existing gas-fired electricity generation plants were commissioned over a period exceeding 30 years. The efficiency at which these plants convert gas to electricity varies. The newer plant, such as Genesis Energy's EP3 unit emits about 108 kg CO_2 per GJ, whereas the oldest plant, the Genesis Energy Rankine units, emit nearly 150 kg CO_2 per GJ. Hence, the Ngawha geothermal plant emits more carbon in generating a given amount of electricity than the least efficient gas fired power station, and about 50 percent more than the most efficient gas fired power station.[3]

First Gas is not advocating for policies that would discourage geothermal generation. We make these points to support the Productivity Commission in undertaking evidence-based policy and to ensure its recommendations are targeted to the outcomes that it seeks to achieve. Policies that promote renewable energy over fossil fuels would not necessarily result in reductions in carbon emissions and a target of, say, 100 percent renewable electricity generation would not achieve zero emissions from electricity generation.

Opportunities to use natural gas to reduce total emissions

As natural gas is clean burning relative to other fossil fuels, it can play an important role in the transition to a low-emissions economy. New Zealand has a relatively extensive reticulated gas network across the North Island, making natural gas a viable choice for domestic, commercial and industrial uses. It is an ideal choice in locations where renewable fuels are unavailable, impractical, or too costly with current technologies, or where the use of renewable fuels needs to be supplemented with a reliable energy source. In the following sections, we discuss the opportunities to use natural gas to reduce total carbon emissions:

1. Converting industrial heat process users from coal to gas;
2. Displacing coal with natural gas at the Huntly Rankine units;
3. Using gas-fired generation to support renewable electricity generation;
4. Using CNG or LNG for New Zealand's heavy vehicle fleet;
5. Using natural gas for space heating in place of electricity; and
6. Future options to reduce the carbon content of fuels transported via existing pipeline infrastructure, for example through the blending of biogas into the natural gas stream or conversion to hydrogen.

[3] The statement by the Energy Efficiency and Conservation Authority (EECA) on its website that "a geothermal power station still produces fewer greenhouse gas emissions than the cleanest natural gas-fuelled power station" is not correct: https://www.eeca.govt.nz/energy-use-in-new-zealand/renewable-energy-resources/geothermal/

We outline each of these opportunities below and provide analysis of the possible emission reductions. We provide this information to assist the Productivity Commission's with its assessment of emissions reductions opportunities, to help it determine what are the most viable opportunities for New Zealand. We recognise that there are several factors involved that may lead to parties not pursuing these options at present.

1. Converting industrial heat process users from coal to gas

Significant carbon emission reduction benefits are available from converting industrial heat processes from coal to gas (be it natural gas or LPG). As shown in Figure 4 and Figure 5 below, there is still a reasonable quantity of coal used for both intermediate and high level process heat in the North Island (approximately 10 PJ per annum).

Figure 4: North Island delivered fuel energy for intermediate temperature process heat

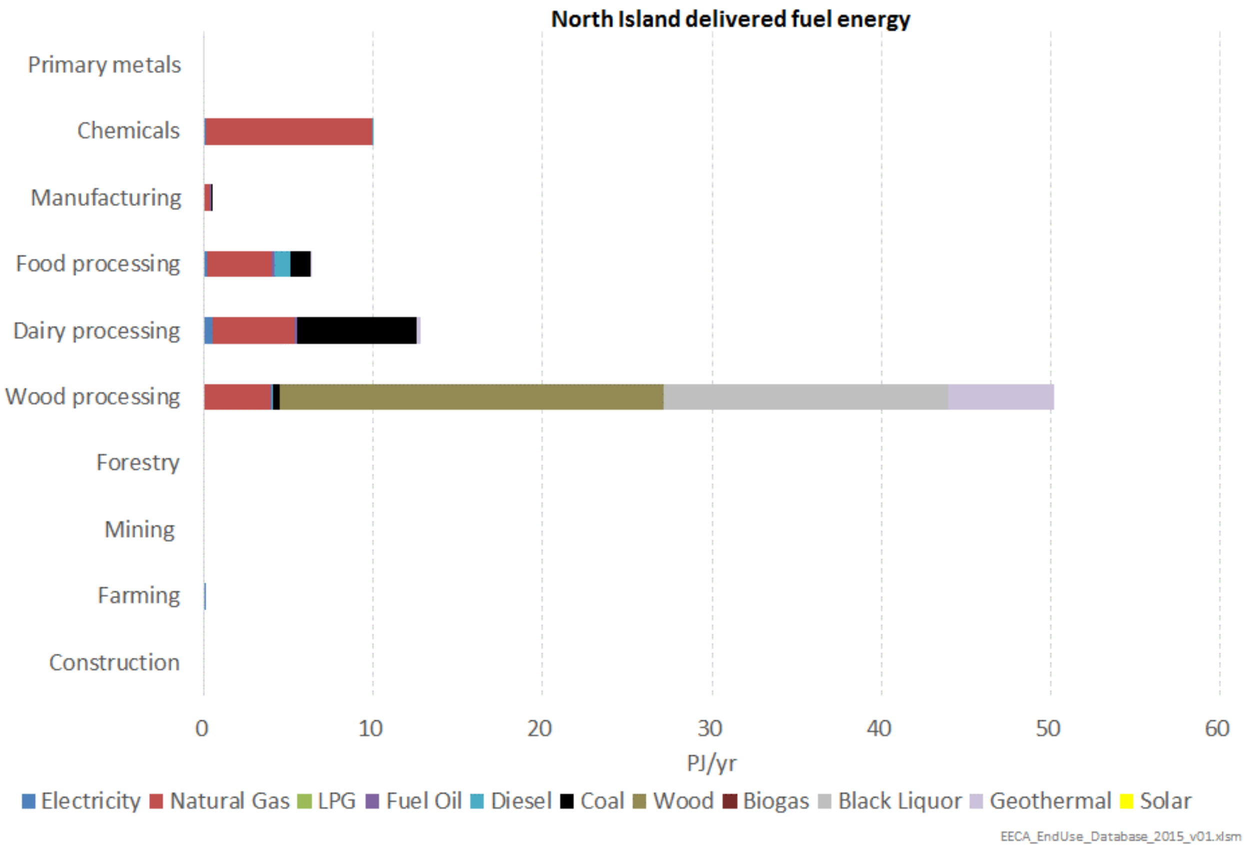
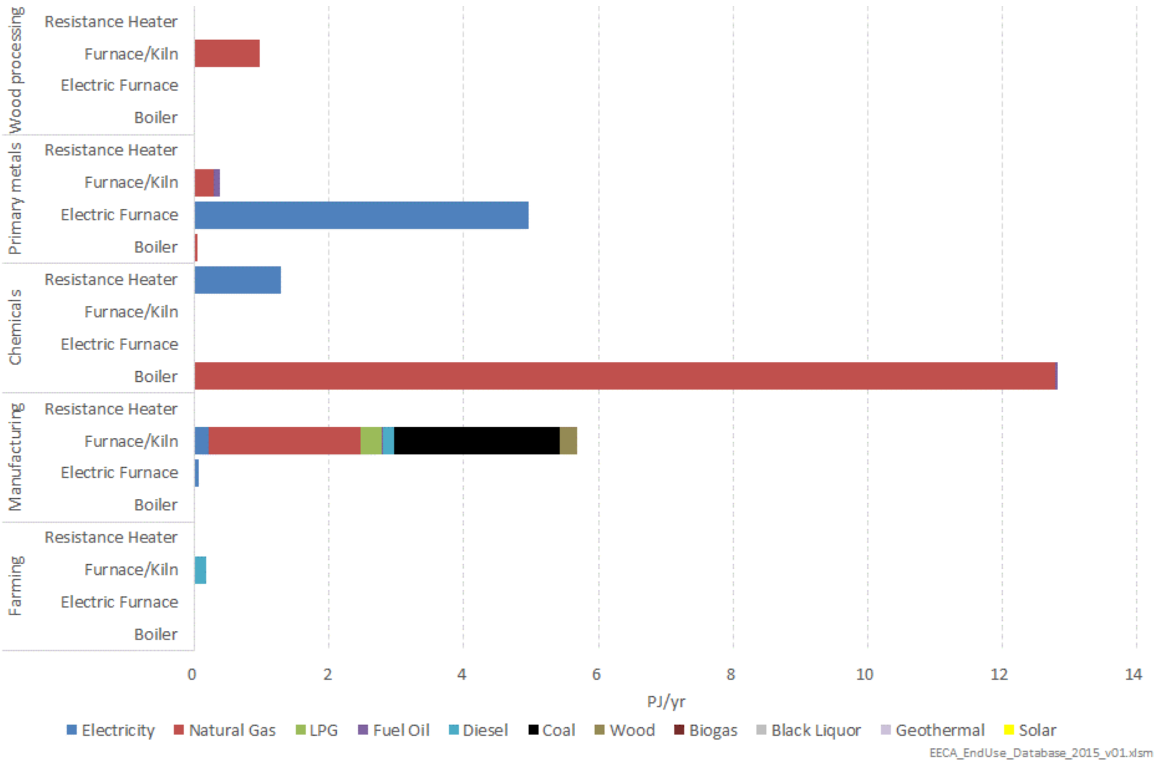


Figure 5: North Island delivered fuel energy for high-temperature process heat



Depending on the distance to the closest gas transmission or distribution pipeline, gas is a viable and more efficient option for many of these businesses. First Gas has been in discussions with several parties about the possibility of connecting to our gas pipeline network. These discussions have informed our suggestions below on what policy initiatives could secure immediate reductions in emissions.

In Table 1, we estimate the reductions in CO_2 emissions from substituting natural gas for coal in North Island industrial process heat plants. We are working closely with the companies that own these plants to agree the terms of developing a pipeline that would fully service their requirements using natural gas. This will require a long-term commitment to use the new pipeline infrastructure, and will likely involve difficult decisions to replace boiler equipment before the end of its useful life.

Table 1: Emission reduction potential from converting North Island industrial heat processes users to gas

Benefit 1: Converting North Island industrial processes from coal to gas					
Option	**Coal use per annum**		**CO2 emissions – tonnes**		**CO_2 reduction**
	GJ	**Tonnes**	**Status quo – coal**	**Equivalent gas**	
Plant A	150,000	6,818	13,725	8,103	5,622
Plant B	1,500,000	68,182	137,250	81,029	56,221
Plant C	300,000	13,636	27,450	16,206	11,244
Plant D	250,000	11,364	22,875	13,505	9,370
Plant E	990,000	45,000	90,585	53,479	37,106
Total	**3,190,000**	**145,000**	**291,885**	**172,321**	**119,564**

We note that there are also broader benefits from switching from coal to natural gas. Using natural gas piped directly to site lowers the local pollution, from for example, ash particulates and coal truck movements. It also opens up a new cost-effective source of energy for industrial, commercial and residential consumers in the region.

We also encourage the Productivity Commission to look at the benefits from reducing coal use within the food processing sector[4], which is outlined in the Green Party's plan for reducing greenhouse gas emissions.[5]

2. Running Huntly Rankine units on gas rather than coal

Genesis Energy operates two 250 MW Rankine units at Huntly (another 250 MW unit has been placed in long-term storage, while the fourth unit has been permanently retired).[6] These units were constructed as dual fuel, able to operate on natural gas or coal. In Table 2, we estimate the reductions in CO_2 emissions had Genesis Energy operated the Huntly Rankine units entirely on natural gas rather than coal (or a combination of gas and coal) over the past two years.[7]

Table 2: Emission reductions from operating Huntly on gas rather than coal

Benefit 2: Huntly burning gas instead of coal (953 MW)		
PJ used	**Coal used in internal generation**	
	FY2017	**FY2016**
Q1 (July – Sept)	0.4	1.8
Q2 (Oct – Dec)	0.3	3.3
Q3 (Jan – March)	0	2.0
Q4 (April – June)	1.5	2.2
Totals	**2.2**	**9.3**
Emissions using coal under status quo (tonne CO_2)	201,300	850,950
Emissions using gas from new pipeline (tonne CO_2)	118,842	502,378
Total carbon reduction (tonne CO_2)	**82,458**	**348,572**

Like industrial process heat users, there are a range of factors that lead Genesis Energy to continue to operate its plant on coal rather than natural gas. One factor is that coal can be stored relatively cost-effectively, with the coal stockpile at Huntly maintained to cover periods of low hydro storage in the electricity system.

Equivalent to taking every car off Wellington's streets

If natural gas had been burnt instead of coal by the North Island industrial process heat users, and in the Huntly Rankine units in financial year ending June 2017, carbon emissions would have been 200,000 tonnes[8] less than they were. For the year ending June 2016, emissions would have been nearly 470,000 tonnes[9] less. The fluctuating values arise because the Huntly Rankine units are used as back-up electricity generation, and coal consumption varies depending upon generation requirements and Genesis Energy's operating decisions on whether to use gas or coal (or some other fuel in its generation portfolio).

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[4] Where the majority of thermal coal used is to provide heat for drying milk.

[5] Page 17, *Yes we can! A plan for significantly reducing greenhouse gases*, Green Party discussion paper, September 2015, https://www.greens.org.nz/sites/default/files/policy-pdfs/Yes%20We%20Can.pdf

[6] Genesis Energy, (29 June 2015), *Second stored coal unit to retire* (press release).

[7] As the units can run on either gas or coal, the quantity of coal burnt depends both on the demand for electricity from thermal generation (e.g. which is impacted by inflows to hydro generation and consumer demand) and decisions by Genesis on relative fuel costs.

[8] 82,458 + 119,564 = 202,022

[9] 348,572 + 119,564 = 468,135

To place these quantities of emissions in context, 200,000 tonnes equates to the annual emissions of 54,000 thousand cars. 470,000 tones would equate to the emissions from 125,000 cars.[10] New Zealand has on average approximately 600 cars for every 1,000 people.[11] Hence, the emissions that could have been saved using natural gas for industrial process heat boilers and at the Huntly Rankine units in 2017 would be equivalent to removing all the cars from Palmerston North city in 2017 (population of 86,300) or all the cars from Wellington city in 2016 (population 207,900).[12]

The emission savings in switching from coal to gas could have been made without any noticeable change to the way we live, to consumption decisions, or to the output from the electricity generation and industrial plants. If a MAC curve had been prepared for New Zealand, we suggest that these opportunities to reduce emissions would be located at the low-cost end of the curve.

3. Increased renewable electricity generation will rely on gas fired plants

Natural gas also supports the development of renewable energy in New Zealand. Therefore, it will be important that policy initiatives recommended by the Productivity Commission do not discourage the use of natural gas for future electricity generation.

Over the last 25 years, geothermal and wind electricity generation have increased as a proportion of total electricity generation. As a result of this increase, the proportion of New Zealand's electricity supply generated from renewable sources has increased from 72.5% in 2000 to 84.3% in 2016.[13] Future projections for the sector generally point to further increases in renewables:

a) The **Ministry of Business, Innovation and Employment** (MBIE) produces "Electricity Demand and Generation Scenarios" (EDGS) periodically. Four of MBIE's five latest EDGS scenarios suggest renewables could increase to somewhere between 87% and 91% of the electricity supply by 2030. These projects include a small increase in hydro, but, in some cases, a trebling of wind capacity;
b) **The BusinessNZ Energy Council's Energy Scenarios** ("BEC2050") would see renewables reach 86% in its market-led "Kayak" scenario, and 97% by 2030 in its government-led Waka scenario; and
c) **MBIE's "Global Low Carbon" scenario** has a similar narrative to BEC2050's "Waka" scenario. New Zealand's commitment to the Paris Climate Agreement in November 2016, setting a Nationally Determined Contribution of a 30% reduction below 2005 greenhouse gas emissions by 2030, increases the probability of additional renewable electricity generation.

However, an increased role for renewables does not mean a diminished role for gas-fired generation plant. For example, MBIE's "Global Low Carbon" scenario, which has the highest renewable proportion of its scenarios (91%), also includes the highest capacity of flexible gas peaking plant.[14] This peaking plant would be needed to manage the intermittency of wind and solar generation in meeting system demand.

The BEC2050 report also notes the importance of maintaining capacity in flexible gas generation in a high-renewables scenario:[15]

> *The main issue for New Zealand is the 3-4TWh variation in hydropower outputs due to inflow variations. The model preserved a significant amount of flexible gas capacity which, in the "average" hydrological year modelled, is only required to generate 1.8TWh, a load factor of less than 20%.*

Security of electricity supply is an issue of national importance, and concerns both the medium-term need to respond to low inflow hydro conditions (part of what is known as "energy adequacy"), and the

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[10] The average car in New Zealand emits 3.74 tonne of CO_2 per year: https://ecotricity.co.nz/news/carbon-knowledge/ Hence

[11] http://www.ehinz.ac.nz/assets/Factsheets/Released-2015/EHI8-9-NumberOfVehiclesInNZ2000-2014.pdf

[12] Population statistics taken from: http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7502

[13] Ministry of Business, Innovation and Employment, "Energy in NZ", 2015.

[14] As opposed to baseload gas plant, such as the combined-cycle gas generators at Huntly Unit 5, Taranaki Combined Cycle and, until recently, Otahuhu B. These types of gas plant are less flexible than open-cycle units (which we refer to here as "flexible peaking plant"), the latter tending to have very fast startup times and can easily vary their output to match the requirements of the system.

[15] "*New Zealand Energy Scenarios: Navigating energy futures to 2050*", BusinessNZ Energy Council, p80. I note that the abbreviation "TWh" used by BusinessNZ here is "terawatt hours", or 1,000,000,000 kilowatt hours.

short-term need to respond to reductions in wind (and solar) output (part of what is referred to as "capacity adequacy").

MBIE and BusinessNZ narratives point to the fact that, given the state of technology today, intermittent and uncertain renewables are likely to be paired with highly flexible gas generation if we are to continue to enjoy both dimensions of security of supply in the same manner as we do today. This point is recognised in the government's overarching *Energy Strategy 2011 – 2021* where it states that "for the foreseeable future some fossil fuel generation will be required to support supply security".[16]

A policy that sought to reduce the use of natural gas in electricity generation, for example by raising its cost, might have the unintended consequence of limiting additional renewable energy options.

4. Use of CNG or LNG for New Zealand's heavy vehicle fleet

New technology and continuing (comparatively) low prices for natural gas has stimulated interest internationally in converting heavy vehicles to natural gas (CNG or LNG).[17] As noted in the Issues Paper, heavy vehicles "contribute 22% of transport emissions and are more difficult to electrify".[18] CNG and LNG are predominantly used in heavy vehicles and are typically used for depot-based refuelling, where compression or liquefaction facilities can connect to the existing gas distribution network. CNG has historically been used in New Zealand, and is used as a transport fuel internationally (as is LNG).

A recent report by Concept Consulting[19] reviewed the merits and economics of using these fuels in our New Zealand fleet. The report outlines that there are two broad options for using natural gas as a vehicle fuel:

- Fuelling a vehicle directly with natural gas, with the gas stored in the vehicle in either liquid form (i.e. LNG) or compressed form (i.e. CNG); or
- Fuelling a vehicle with a liquid fuel that has been synthesised from natural gas in one form or another.[20]

The report concluded that there would be prospective benefits from CNG buses or return-to-base heavy vehicles. The report also noted that LNG or dimethyl ether (DME)[21] for heavy truck applications could be viable in the future.

The Government of South Australia identified the following benefits from considering natural gas for transportation:

- Even when the energy needed to compress or liquefy is considered, natural gas is cheaper than conventional fuels;
- Greenhouse gas emissions are 20% to 25% lower using CNG or LNG, when compared to petrol or diesel;
- Natural gas reduces particulate matter, nitrous oxides and complex hydrocarbon emissions; and
- It is domestically sourced, reducing dependence on oil imports.[22]

First Gas is not aware of much work in New Zealand to investigate the use of CNG or LNG for New Zealand's heavy vehicle fleet. However, it does seem to be an area worth exploring for our heavy vehicle fleet (not the mass-market).

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16 Page 6, *New Zealand Energy Strategy 2011–2021*, Ministry of Economic Development, http://www.mbie.govt.nz/info-services/sectors-industries/energy/energy-strategies/documents-image-library/nz-energy-strategy-lr.pdf

17 See for example https://www.scania.com/uk/en/home/experience-scania/news-and-events/news/2017/02/scania-waitrose-cng-trucks.html

18 Page 25 of the Issues paper.

19 *Possible commercialisation options for new gas discoveries*, February 2015, Concept Consulting. http://gasindustry.co.nz/about-us/news-and-events/events/invitation-to-release-of-report-possible-commercialisation-options-for-new-gas-discovery/.

20 Section 5.3 of the Concept Consulting report, February 2015.

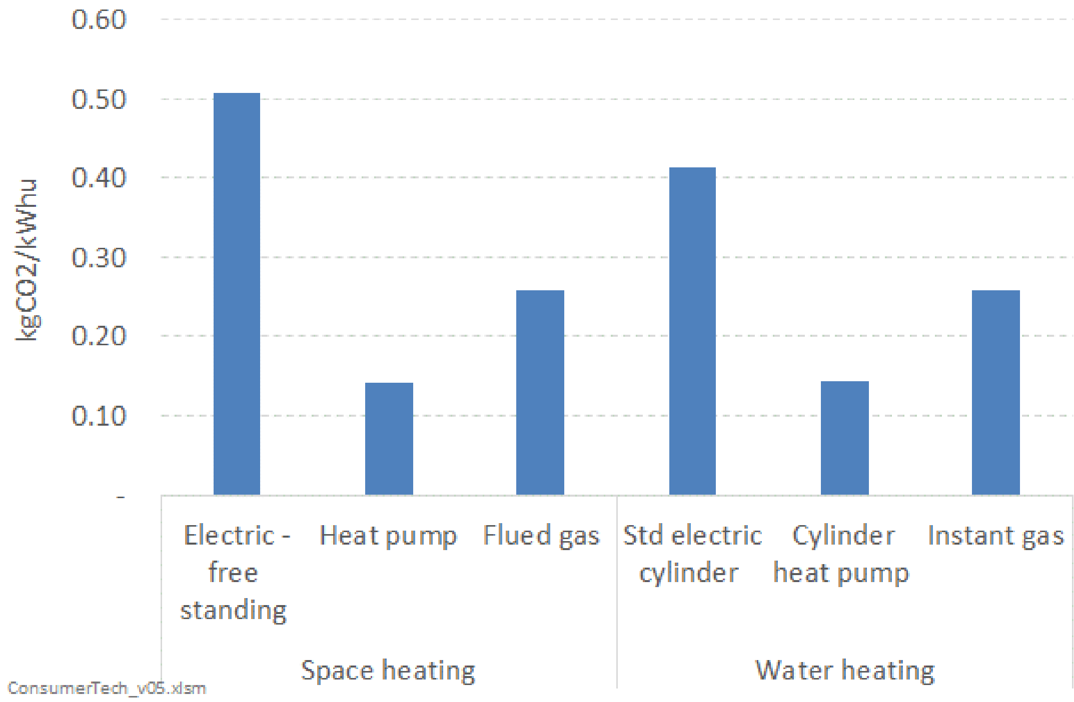
21 Converted from methanol through dehydration, or directly from natural gas. Has similarities to both LPG and diesel.

22 Government of South Australia, Department of Planning, Transport and Infrastructure, Natural Gas (CNG and LNG) webpage, http://www.lowemissionvehicles.sa.gov.au/knowledge_bank/transport_fuels/natural_gas_cng_and_lng

5. Greater use of natural gas for space heating

The development of MAC curves (discussed above) would help consumers understand the least cost options available to them to reduce emissions. In Figure 6, we show estimates of the carbon emissions from alternative means of home heating and water heating. These estimates show that heat pumps produce the least quantity of emissions followed by gas appliances. Traditional resistance heaters are carbon-intensive because they use more energy and space heating tends to coincide with peak demand for electricity (for example, winter evenings), when thermal generation units are being run to meet demand.

Figure 6: Estimated effective CO_2 intensities of different space and water heating technologies



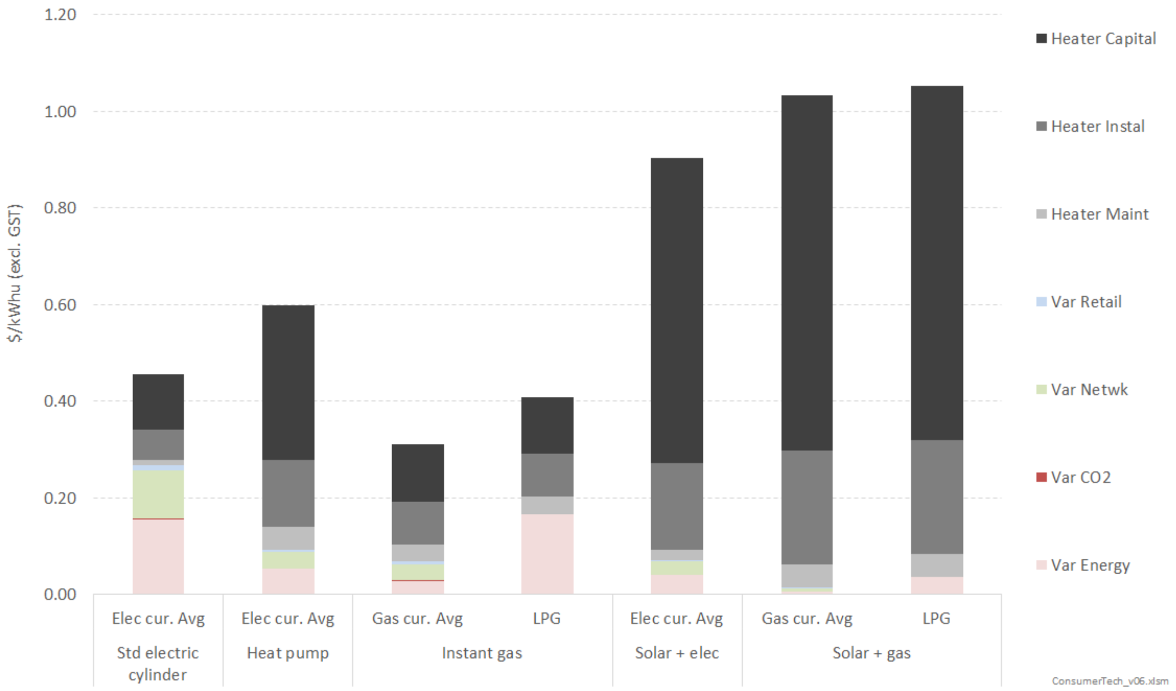
Source: *Consumer Energy Options in New Zealand – 2016 update*[23], prepared by Concept Consulting for the GIC, 7 March 2016

However, heat pumps are expensive. When the upfront capital costs are considered, switching to natural gas becomes the most cost-effective method for households to reduce the carbon emissions from space and water heating. Figure 7 shows the total annual costs (including capital costs) for a medium-sized water heating requirement.

Concept Consulting found that gas was the lowest cost for consumers (and from a whole of New Zealand perspective) for space heating, setting aside the costs of network connection. If a consumer was already connected to the gas network, gas would remain the least cost option for consumers and would typically be the lowest cost option for New Zealand (depending upon whether additional capacity is required in the electricity network).

[23] http://www.gasindustry.co.nz/dmsdocument/5260

Figure 7: Typical annual running costs and variablised heater costs for a medium-sized water-heating requirement (expressed in $/kWh)



Source: *Consumer Energy Options in New Zealand – 2016 update*[24], prepared by Concept Consulting for the GIC, 7 March 2016

These examples highlight both the potential for emission reductions and the need to carefully consider the relative cost to consumers and New Zealand of achieving the reduction. The least carbon emitting option (heat pumps in the charts above) may not be best transition to a low-emissions economy that continues to grow incomes and wellbeing.

6. Options to reduce the carbon content of fuels transported via existing pipeline infrastructure

Less immediate than the options discussed above, there is potential over the medium term to reduce the carbon content of fuels transported via the existing gas pipeline infrastructure. These options include:

- blending of biogas into the natural gas stream;
- greater capture of gases emitting from landfills (including landfills closed years ago); or
- conversion to hydrogen.[25]

These options have the benefit of making use of existing infrastructure (the large capital investments in the pipelines and consumer investment in gas using equipment) and avoiding changes to production and consumption patterns, while achieving further reductions in carbon emissions. First Gas encourages the Productivity Commission to consider these possibilities as it prepares comprehensive MAC curves looking out to the medium-term.

[24] http://www.gasindustry.co.nz/dmsdocument/5260

[25] For example, see recent UK report on a test area for converting to hydrogen gas. http://www.northerngasnetworks.co.uk/wp-content/uploads/2016/07/H21-Report-Interactive-PDF-July-2016.pdf

Policy initiatives to reduce emissions through the use of natural gas

The opportunities we outline above illustrate the 'low hanging fruit' possible from switching from higher emitting fuels to natural gas. First Gas contends that were the Productivity Commission to prepare a MAC curve for New Zealand, the opportunities that we have identified to reduce emissions would be located at the low-cost end of the curve. A policy initiative that creates incentives for an early transition to gas may therefore form part of efficient transition path to a low-emissions economy. We also note that due to the long life of CO_2, an early mitigation of carbon emissions contributes more to alleviating global warming than a delayed pathway followed by a rapid decline.[26] As a result, policy initiatives that encourage an early transition from high carbon emission fuels to lower carbon emission fuels, at minimal economic cost, will be an important part of moving to a lower net-emissions economy while continuing to grow incomes and wellbeing.[27] Picking 'low hanging fruit' now is preferable to waiting until some future date.

Discussion of policy initiatives available

A policy initiative could enhance incentives to switch from higher emitting fuels to gas by making it:

- costlier/less profitable for firms to continue with high emitting fuels such as coal; or
- less costly/more profitable for firms to switch to natural gas when that would lower emissions.

However, mechanisms that impose costs on the firms currently using coal in the North Island, or households using resistance heating, may conflict with other policy objectives:

- Firms using coal for process heat are predominantly producing for export. As the Issues Paper notes, the NZ ETS system is designed to maintain international competitiveness of New Zealand production and to prevent emissions leakage;[28]
- Raising the cost of electricity generation from the Huntly Rankine units could raise the wholesale price of electricity during peak periods, such as the winter months. Raising electricity prices would seem an expensive option for consumers to address fuel usage at a single plant – there are no other coal fired generation plants of significance and none are likely to be built;[29] and
- Raising electricity prices to encourage a move from resistance heaters to gas appliances may conflict with the government's objectives in relation to energy hardship.[30]

Policy initiatives that might make it less costly for firms to switch to natural gas would include direct subsidies and tax incentives. Direct government subsidies or grants to address externalities are generally viewed as a more efficient mechanism than tax concessions. The disadvantage of direct government grants, however, are that they tend to be discretionary to some extent, uncertain, and the accountability of public servants for how the grants are spent tends to inevitably give rise to complex and expensive application and approval processes.

The tax system avoids many of these concerns by providing for the government subsidy by automatic application of tax law which under a system of self-assessment means the business determines itself that it qualifies for the government subsidy. The Inland Revenue Department (IRD) audits that self-assessment, with final appeal to independent judiciary.

However, providing incentives to convert to gas generation via tax concessions (rules that specifically reduce the level of income on which tax is levied or provide a reduce rate of tax) impacts only those businesses that are taxpayers. If a business is not a taxpayer, because for example it is in a tax loss position and is unlikely to move out of that loss positon in the immediate future, the business does not benefit from such tax concessions. It, therefore, would not be greatly incentivised to invest in gas conversion. This aspect of tax concessions may be less of a concern for coal to gas conversions, as the public interest is in supporting conversions for firms that would continue to operate into the future (and presumably therefore would expect to be profitable).

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[26] Royal Society of New Zealand, (2016), *Transition to a low-carbon economy for New Zealand*, Wellington, page 35.

[27] Terms of reference for inquiries into the opportunities and challenges of a transition to a lower net emissions economy for New Zealand, page 2.

[28] Issues Paper, page 14.

[29] There may be some smaller plants still capable of operating such as coal fired back-up boilers in hospitals etc.

[30] http://www.stats.govt.nz/browse_for_stats/people_and_communities/Households/energy-hardship-report.aspx

Accelerated depreciation

A typical form of tax incentive is accelerated depreciation. Accelerated depreciation generally provides a loading to the prescribed rate of depreciation used to estimate the ongoing fall in asset value while the asset is available for business use. Accelerated depreciation and similar forms of tax incentives are unlikely to align private and social benefit because accelerated depreciation provisions:

- May encourage investment in a sub-optimal form;
- Provide only a timing advantage (which is a function of interest rates) since it provides excess depreciation deductions which are clawed back on disposal of the asset of by way of the imputation system; and
- Are measured in the government's fiscal accounting as a permanent cost, while offering firms only a timing advantage.

Income tax credits

First Gas considers that there may be merits in looking at the suitability of income tax credits for gas conversion costs. Income tax credits, unlike tax concessions, do not reduce the level of income or the rate of tax levied on income. Instead they provide a general government subsidy to the recipient through the tax system. Family tax credits are an example, but tax credits can and have been used to recognise economic externalities.

The certainty and simplicity advantages of the tax system over a grants-based system can be obtained through a tax credit mechanism. This is how the New Zealand government provided incentives for research and development expenditure for the year 1 April 2008 until 31 March 2009. The research and development tax credits applied at a rate of 15% of the eligible expenditure of the business. Eligible expenditure basically covered all research and development expenditure including depreciation and employee costs. The stated aim was to encourage New Zealand firms to increase investment in research and development, on the basis that such investment had spill-over benefits to the wider economy. The credit could be used to meet a firm's other income tax liabilities and any excess could be refunded. This mechanism meant that imputation did not necessarily claw back the credit when profits were distributed as a dividend. There was no claw-back if depreciation was recovered.

In effect, New Zealand's research and development tax credit provided a mechanism by which the government met part of the costs of research and development investment, in recognition of the spill-over benefits or externalities of such expenditure by private firms that considered only private and not social benefits when making investment decisions. The perceived disadvantage of the mechanism was that it was not budget constrained since it was available as a matter of legislative right. The definition of what constituted research and development versus normal costs of a business was also problematic. It seems for that reason, with New Zealand's fiscal position tight following the Global Financial Crisis of 2008 – 2009, the tax credits were replaced by grants in 2009.

It would seem, however, that gas conversion costs would be easier to define and audit than the necessarily vaguer concept of research and development costs. Thus, if the government wanted to encourage gas conversion in recognition of externality benefits of such investment the tax credit mechanism could be usefully explored. The credit could be a government contribution to costs (as per the research and development credits) or a contribution to the investment (including a portion of the costs of acquiring assets).

Concluding comments

First Gas is encouraged that the government has tasked the Productivity Commission with this inquiry and welcomes its open approach to seeking information to support its work.

Our submission has set out several near-term and longer-term opportunities that we consider would help reduce New Zealand's emissions, by using natural gas across the North Island. We have also outlined an analytical framework that we consider will support the Productivity Commissions to better identify the lowest cost/highest benefit options that will transition New Zealand to a lower-emissions economy.

First Gas is keen to support the government's work to reduce emissions and looks forward to continued engagement on this inquiry. We reiterate that we would be happy to meet with Productivity Commission staff to further discuss any of the points we have raised.

If you have any questions regarding this submission or to set up a meeting, please contact me on 04 979 5368 or via email at karen.collins@firstgas.co.nz.

Yours sincerely

Karen Collins
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