First Gas Limited

15 November 2019

Interim Climate Change Committee
Level 1, Environment House
23 Kate Sheppard Place23
WELLINGTON 6011

Sent via email: feedback@ICCC.mfe.govt.nz

Dear David

Call for evidence: options available to reduce greenhouse gas emissions Call for evidence: options available to reduce greenhouse gas emissions

Firstgas Group (Firstgas) welcomes the opportunity to make a submission to the Interim Commission on Climate Change ('the Commission') on its call for evidence to reduce greenhouse gas emissions. Firstgas supports the transition to a low carbon economy. We believe that carbon budgets can achieve that goal by demystifying the longer-term pathways to reduce emissions, while identifying realistic solutions that lower emissions today.

As a gas infrastructure owner and operator, Firstgas has expertise and experience in supplying energy to New Zealand households and businesses across a range of sectors. A brief overview of Firstgas and our work to date on alternative fuels is provided in **Attachment 1**. Our experience is that energy users make choices based on their understanding of cost, reliability and environmental impacts (the "energy trilemma"). The Commission's fundamental task in preparing carbon budgets for the energy sector is to help move users' choices towards options that have lower carbon emissions, while factoring the other elements of the trilemma (cost and reliability) into the analysis.

Executive summary

We believe that gas infrastructure can help achieve New Zealand's long-term goal of net zero emissions in 2050, while also delivering year-on-year reductions in emissions in the near term. We see this call for evidence as an important opportunity to communicate how gas-based technologies and innovations can reduce carbon emissions. Like other components of the energy sector, developments in this area are moving quickly and we therefore welcome an ongoing dialogue with the Commission.

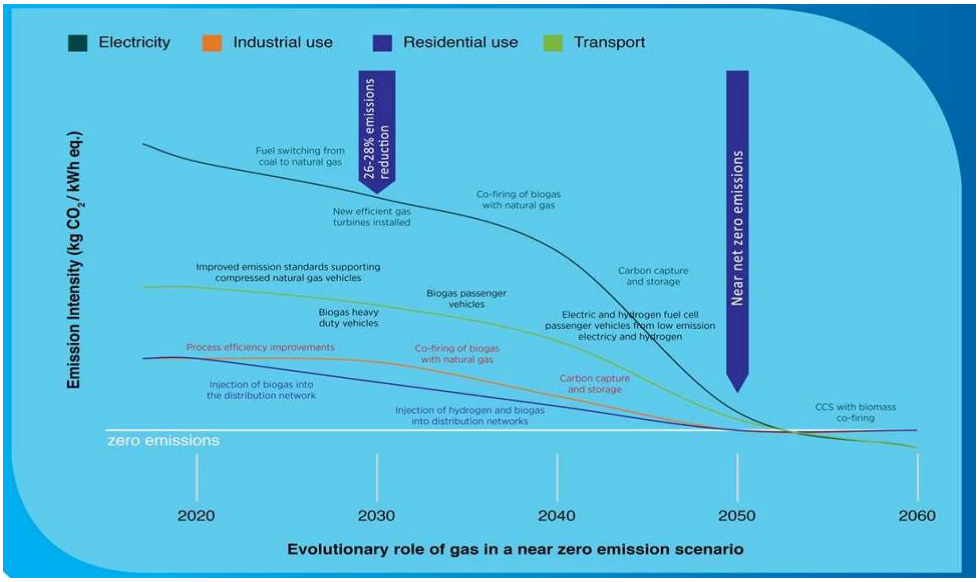
We have divided our evidence into two key areas:

- **Switching from high carbon fuels (coal) to lower carbon fuels (natural gas and LPG).** We estimate that connecting five of the remaining large North Island coal users to natural gas would reduce emissions by 500,000 tonnes per annum (in a normal hydrological year). These savings can be made relatively quickly, and certainly before 2035. The costs to unlock these carbon savings arise from gas pipeline investment, boiler replacements, and fuel costs.
- **Blending renewable gas (biogas and green/blue hydrogen) into the gas stream.** The blending of renewable gas into existing gas distribution networks is already occurring overseas through pilot projects and commercial ventures. Blending 20% of renewable gas into gas distribution networks in New Zealand would require 6.5 PJ of fuel and would reduce emissions by 350,000 tonnes per annum (while also removing waste emissions if biogas is captured from landfills and wastewater treatment plants). These savings will likely take time to realise as technical barriers are addressed and confidence in these alternative fuels grows. The cost of producing renewable gas to blend into the gas stream is currently higher than natural gas.

We expand on each of these areas below. We also set out our responses to the Commission's consultation questions in **Attachment 2**.

Our approach to identifying carbon reductions using gas is illustrated in the following diagram from Energy Networks Australia. This shows how the path to a low-carbon economy can initially rely on coal to gas switching and biogas injection into distribution networks to deliver emissions reductions of 26 – 28%. These initiatives are then followed by developments in electric and hydrogen technologies and carbon capture and storage (CCS) to achieve near to net zero emissions in 2050. While the specific impacts of these changes will differ in New Zealand, we believe the pathway is the same.

Figure 1: Illustrative decarbonisation pathway for gas (Australia)[1]



Switching from high carbon fuels to lower carbon fuels

New Zealand has committed via the Paris Accord to reducing global temperature increases to less than 1.5 degrees. To achieve this outcome, we are aiming for net zero carbon emissions in 2050. The actual temperature change will be a function of total emissions between now and 2050. Getting to a carbon zero point in 2050 but with a significant increase in emissions in the meantime is clearly not helpful. Where we can reduce emissions earlier rather than later, we should take those options.

New Zealand consumes between 20-30 PJ of coal each year for process heat and electricity generation. As the fuel with the highest carbon content, coal use provides a clear opportunity to reduce emissions. While much of New Zealand's coal is used in the South Island, several large North Island sites continue to use coal.

Full electrification of medium temperature process heat is not technologically viable at present, and even if it was viable the construction of the electricity networks and the generation capacity to sustain the volumes of electricity required would take a significant period to complete. By way of example the 400kV North Island grid upgrade project took twenty years from inception to completion.

Four large dairy factories in the North Island use coal and together emit 270,000 tonnes of carbon dioxide per annum. These plants are varying distances away from the gas pipeline network (which connects the other 15 or so dairy factories in the North Island). Switching to natural gas at the remaining dairy factories would reduce emissions by around 100,000 tonnes to 170,000 tonnes per annum.[2]

A significant amount of coal is also used at the Huntly Power Station, which has 750 MW of electricity generation capacity (known as the Rankine units) that can run on either coal or gas. The operation of these units is highly dependent on electricity market conditions – in wet periods the units are only operated infrequently, whereas in dry periods they generate a lot of electricity. Whether coal or gas is used in the Rankine units depends on the relative price and availability of those fuels (discussed further below). Over the past four years, the Rankine units have generated 3.2 million tonnes of

[1] Energy Networks Australia (2016)

[2] https://www.stuff.co.nz/business/114647854/converting-three-fonterra-factories-to-gas-could-save-100000-tonnes-of-carbon-emissions

carbon emissions by burning coal. If the units had been run on gas, these emissions would have been 1.9 million tonnes (a saving of 1.3 million tonnes).

Costs of coal to gas fuel switching

The Huntly Power Station and one of the dairy factories mentioned above are already connected to gas pipelines with sufficient capacity to supply their needs. The continued use of coal at these sites simply reflects historical decisions that were made to install coal boilers and cost advantages that coal has over gas (including storage costs, which are important for dispatchable power generation).

Other major coal users in the North Island will require gas network investment to connect. We have been working on various plans to connect these facilities and depending on the approach taken, the investment cost is likely to fall in the range of $30 – $60 million. At our regulated cost of capital, this amounts to a cost of carbon in the order of $30 – 60/tonne (which is higher than the current ETS cap of $25/tonne).

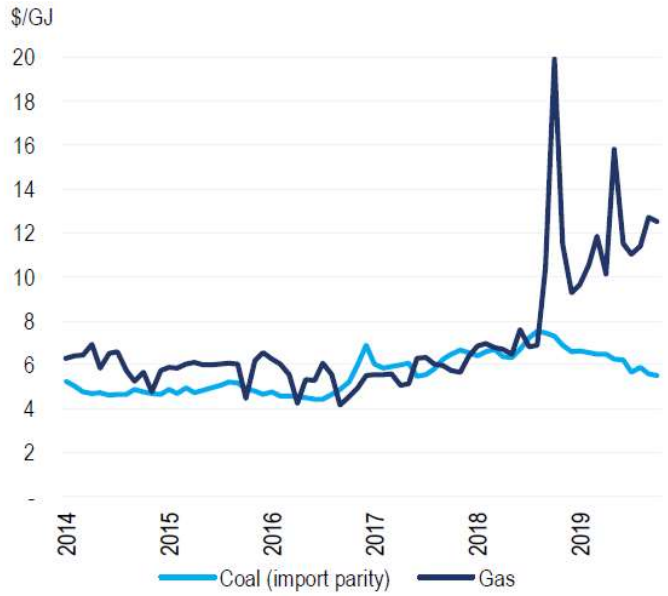
In addition to the costs of extending gas pipelines, achieving these carbon savings will require boiler replacements by the end-users. This gives rise to two separate costs:

- Scrapping any remaining value of existing coal boilers; and
- Capital investment in new gas boilers.

A range of factors will offset part of these costs. For example, gas boilers require less land area to host than coal boilers, freeing up sites for other use. Gas also has virtually no handling cost, whereas coal requires active handling and stockpile management. There are also clear community benefits in switching away from coal in eliminating truck movements on local roads and reducing local air particulates (such as fly ash).

The other cost that is borne by any party looking to switch fuels is any commodity price differential. Users typically will not switch to a fuel that they expect to be more expensive. The following graph tracks an estimate of coal and gas prices in New Zealand compiled by Enerlytica. This is based on publicly traded and disclosed prices, which exhibit more variability for gas than the term contracts used to source most gas in New Zealand. However, the point holds that until 2018 coal and gas were reasonably comparable in cost, while over the past 18 months gas prices have increased substantially due to domestic scarcity. While commentators expect current tight market conditions to ease, any uplift in the expected price of gas relative to coal will increase the cost of reducing emissions using gas.

Figure 2: Coal versus gas proxy costs (energy only) at source



Source: Enerlytica

Other barriers to coal to gas switching

Two non-cost barriers are also relevant to user decisions to continue to use coal (rather than switching to gas):

- **Uncertainty on future carbon prices.** As mentioned above, the current ETS cap of $25/tonne is unlikely to compensate for the costs of switching from coal to gas where gas network investment is required. However, carbon prices are expected to rise. The key challenge for coal to gas switching is how quickly carbon prices will move to levels that clearly justify the investment (likely to be above $50/tonne); and
- **Uncertainty on future gas supply.** Gas users have experienced gas supply issues due to production station outages over the past 12-18 months. There is also some uncertainty about future gas supply in New Zealand with several major fields coming off peak production and restrictions placed on future offshore exploration. These supply dynamics affect users' willingness to invest in conversions until they are confident of their ability to source competitively priced gas over the life of new assets.

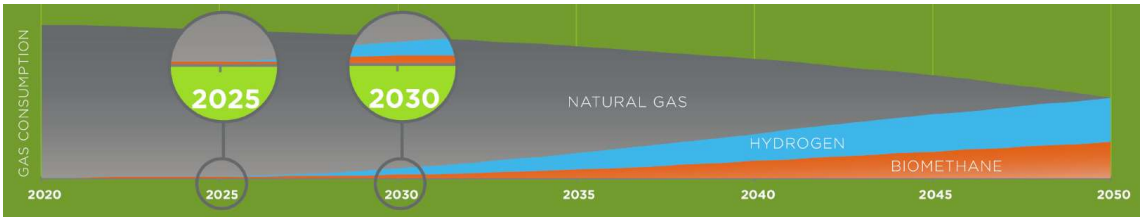
Blending renewable gas into the gas stream

Opportunities exist to decarbonise natural gas and LPG supplies by blending biogas and hydrogen into gas supply. Biogas is generally considered carbon neutral, although the carbon accounting depends on the specific source of the energy. Hydrogen is zero carbon if produced from renewable electricity (green hydrogen) or if the carbon emissions in the process of steam reformation are captured and sequestered (blue hydrogen).[3] The International Energy Agency Energy Outlook 2019 noted these developments stating:[4]

> *Low-carbon hydrogen is enjoying a wave of interest, although for the moment it is relatively expensive to produce. Blending it into gas networks would offer a way to scale up supply technologies and reduce costs. Our new assessment of the sustainable potential for biomethane supply (produced from organic wastes and residues) suggests that it could cover some 20% of today's gas demand. Recognition of the value of avoided CO2 and methane emissions would go a long way towards improving the cost competitiveness of both options.*

Other country-level studies also emphasis renewable gas as an important way to reduce emissions. For example, in the UK Navigant recently released a report which steps through the various phases for increasing the reliance on renewable gas, as shown in the graph below.[5]

Figure 3: Projected gas consumption in the UK (natural gas, hydrogen, biomethane)



Biogas

There are several possible sources of biogas in New Zealand. Landfill gas has been collected for a long time and is primarily used on site to generate electricity. However, some sites directly pipe landfill biogas to commercial and residential energy users. For example, biogas from the Burwood landfill in Christchurch is used to heat the local swimming pool and other commercial properties.[6] Wastewater treatment plants are also a potential source of biogas. Apart from municipal waste and wastewater, there are other source of biogas that can be captured and injected into gas networks. For example,

[3] Further detail on hydrogen can be found here: https://www.mbie.govt.nz/have-your-say/a-vision-for-hydrogen-in-new-zealand-public-consultation/
[4] https://webstore.iea.org/download/summary/2467?fileName=English-WEO-2019-ES.pdf
[5] Navigant (2019), Pathways to Net Zero: Decarbonising the Gas Networks in the UK: http://www.energynetworks.org/assets/files/Navigant%20Pathways%20to%20Net-Zero.pdf
[6] https://www.bioenergyfacilities.org/facility/burwood-landfill-trigeneration-from-landfill-gas

waste streams from processes like diary and food processing can help to mitigate local environmental issues while also capturing value from the gas. The Eco Gas biogas plant in Reporoa is an example of this type of development.[7]

The Bioenergy Association estimates that the total potential supply of biogas is close to 6 PJ per annum,[8] although how much of this could be economically injected into pipelines is unknown. Our view is that more information on this topic (i.e. possible sources of biogas, distance from existing gas pipeline infrastructure) would be valuable.

Hydrogen

Renewable hydrogen is already being blended into gas pipelines overseas.[9] There is an emerging consensus that blends of up to 10% will have no impacts on gas quality and use, with hydrogen levels in some areas already lifted to 20%.[10] There is also a global consensus emerging that repurposing gas pipelines is essential to enabling the growth of hydrogen.[11]

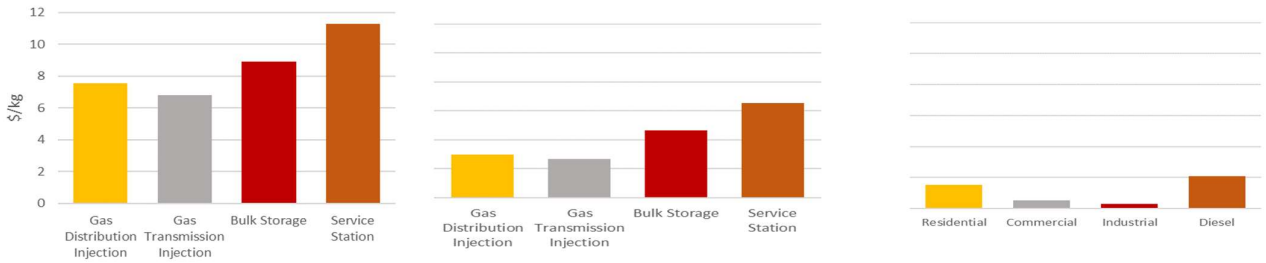
In New Zealand, a total of 33 PJ of gas is distributed across Vector, Powerco and Firstgas' distribution networks each year. If 20% of that natural gas was replaced with either biogas or hydrogen, then this would reduce emissions by 350,000 tonnes per annum (plus the removal of waste emissions if biogas is captured from landfills or wastewater treatment plants).

Costs of blending renewable gas into the gas stream

The cost of producing biogas is very site specific. In some cases, biogas feedstock is a waste stream that would need to be managed in other ways, with the avoided costs of waste management making it relatively cost competitive as a fuel. In contrast, the production cost of hydrogen is currently the greatest barrier to large-scale development. However, as the price of carbon rises then both biogas and hydrogen should become more competitive with natural gas.

The following graphs highlight the current and projected cost differentials between hydrogen and natural gas/diesel.[12] The hydrogen cost estimates come from Concept Consulting's report on Hydrogen in New Zealand, released earlier this year. 'Current' costs reflect the present methods of production from electricity, while 'opportunistic' costs incorporate the potential for new technology and more efficient production methods to drive down costs.

Figure 3: Comparison of hydrogen and natural gas/diesel costs



Hydrogen (current) **Hydrogen (opportunistic)** **Natural gas / diesel**

Other barriers to blending renewable gas into the gas stream

Two non-cost barriers will also need to be overcome for biogas and hydrogen to reach their potential:

- **Gas quality issues.** The current specification for gas has parameters that are calibrated to natural gas composition. Both biogas and hydrogen have different compositions, which mean

[7] See: https://tandg.global/waste-to-energy-plant-announced-by-minister-shane-jones/
[8] https://www.biogas.org.nz/nz-biogas-opportunities
[9] See for example: https://www.energiepark-mainz.de/en/
[10] https://www.eon.com/en/about-us/media/press-release/2019/hydrogen-levels-in-german-gas-distribution-system-to-be-raised-to-20-percent-for-the-first-time.html
[11] World Energy Council (2019). Energy Infrastructure Affordability Enabler or Decarbonisation Constraint https://www.worldenergy.org/publications/entry/innovation-insights-brief-energy-infrastructure-affordability-enabler-or-decarbonisation-constraint
[12] Hydrogen costs from page 7, Concept Consulting, Hydrogen in New Zealand Report 1 – Summary, http://www.concept.co.nz/uploads/2/5/5/4/25542442/h2_report1_summary_v4.pdf. Natural gas and diesel costs from https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/energy-prices/

that blending may bring the gas delivered outside of the specification. The increase in use and viability of these renewable gases will likely require changes to the gas specification; and
- **Safety concerns.** Like any new fuel, renewable gases need to prove that they can be safely produced and distributed. Without direct experience, users will naturally need to be assured that they are safe to use.

Contact details

If you have any questions regarding this submission, please contact me on , via email at

Yours faithfully,

Ben Gerritsen
General Manager Commercial and Regulation

Attachment 1: About the Firstgas Group and our work on alternative fuels

Firstgas operates 2,500 kilometres of gas transmission pipelines and more than 4,700 kilometres of gas distribution pipelines across the North Island. These gas infrastructure assets transport natural gas from Taranaki to major industrial gas users, electricity generators, businesses and homes, and transport around 20 percent of New Zealand's primary energy supply. Our distribution network services approximately 63,000 consumers across the regions of Northland, Waikato, Central Plateau, Bay of Plenty, Gisborne and Kapiti.

The Firstgas Group also owns energy infrastructure assets across New Zealand through our affiliate Gas Services NZ Limited (GSNZ), a separate business with common shareholders that owns the Ahuroa gas storage facility and Rockgas. The Ahuroa gas storage facility (trading as Flexgas) can store up to 18PJ of gas, with expansion planned over the next two years to increase the injection and withdrawal rates of the facility. Rockgas has over 80 years' experience providing LNG to over 90,000 customers throughout New Zealand.

Firstgas is committed to investigating the opportunities for renewable gas and alternative fuels that will reduce New Zealand's carbon emissions. Our gas transmission and distribution networks cover much of the North Island and are ideally placed to support the development, transfer and use of emerging fuels. We have announced that we will begin feasibility studies and a hydrogen trial this year. We intend to base staff at the new National Energy Development Centre to design and run an initial trial of hydrogen in gas pipelines to demonstrate that the existing gas network can be repurposed and is suitable for conversion to transport hydrogen.

Previous reports and submissions

Vivid Economics, "Gas infrastructure in a net zero New Zealand": https://firstgas.co.nz/news/gas-infrastructure-futures-in-a-net-zero-new-zealand/

Productivity Commission Low-emissions economy inquiry: https://firstgas.co.nz/wp-content/uploads/Productivity-Commission_Low-emissions-economy-Oct-2017.pdf

MBIE and the Energy Efficiency and Conservation Authority - Process in Heat
https://firstgas.co.nz/wp-content/uploads/First-Gas-submission_Process-Heat_Feb-2019.pdf

Attachment 2: Response to consultation questions

Question	Firstgas response
1 In your area of expertise or experience, what are the specific proven and emerging options to reduce emissions to 2035? What are the likely costs, benefits and wider impacts of these options? Please provide evidence and/or data to support your assessment.	Our areas of expertise are in infrastructure investment and operations. Our natural gas pipelines supply energy predominantly for industrial uses in power generation and industrial process heat (86% of natural gas is currently consumed by industrial users). We also supply more than 400,000 households and businesses from pipelines and our LPG business, Rockgas. This provides affordable and convenient energy for water heating, space heating and cooking. This submission describes two areas that believe can significantly reduce carbon emissions in the energy sector and the costs and barriers associated with these options: **Fuel switching from coal to gas/LPG and blending biogas and/or hydrogen into natural gas/LPG.**
2 In your areas of expertise or experience, what actions or interventions may be required by 2035 to prepare for meeting the 2050 target set out in the Bill? Please provide evidence and/or data to support your assessment.	Based on our experience, we believe the following steps are essential to meeting New Zealand's 2050 target: • **Certainty on future carbon pricing policies and regulations.** Meaningfully reducing emissions will require private investment, which in turn requires a level of market maturity and stability. Investors can manage price volatility that comes from changes in market fundamentals (like reductions in the cost of carbon abatement), but will not invest in markets that regularly shift due to policy change; and • **Clarity on other government interventions outside the ETS.** There seems to be a widespread view that relying solely on carbon pricing will not achieve the 2050 target. If this is the case, government should signal how complementary measures will be used to deliver the carbon savings required and what criteria will be used to support carbon reduction initiatives
3 In your areas of expertise or experience, what potential is there for changes in consumer, individual or household behaviour to deliver emissions reductions to 2035? Please provide evidence and/or data to support your assessment.	The areas highlighted in our submission do not require specific behavioural changes from consumers, individuals or households. In many ways, this makes the suggestions in this submission more attractive since consumer attitudes can remain unchanged, with changes in the supply chain driving lower carbon outcomes. However, the options presented in this submission all increase costs for consumers relative to taking no action. This is to be expected given that we are trying to reflect the external impacts of using energy sources that have previously been allocated no cost. The Vivid Economics report commissioned by Firstgas and Powerco (and referenced in our letter above) provides estimates of how much additional cost the average household might be expected to bear in an energy future that is consistent with net zero emissions in 2050. Those estimates range from $1,700 per household per annum (under an approach where we continue to range on a diverse mix of fuels and focus mitigation efforts on the lowest cost options) to $2,700 per household per annum (if we accelerate emissions reductions through aggressive electrification or use of hydrogen in gas networks).

Question	Firstgas response
4 When advising on the first three emissions budgets and how to achieve the 2050 target, what do you think the proposed Commission should take into account when considering the balance between reducing greenhouse gas emissions and removing carbon dioxide from the atmosphere (including via forestry)?	We think the Commission needs to place significant weight on both abatement and sequestration. It is clear from the Productivity Commission inquiry that New Zealand's least-cost pathway to net zero by 2050 will involve greater carbon sequestration (e.g. via forestry). The Productivity Commission estimated that an additional 2.8 million hectares of carbon sink forestry would be needed by 2050. However, it is also clear that gross emissions will also need to fall. The Vivid Economics report identifies the level of forestry as one of the key uncertainties around achieving net zero. Vivid particularly highlighted social and community risks of large-scale afforestation programmes, which could create pushback against continued forestry conversions.
5 What circumstances and/or reasons do you think would justify permitting the use of offshore mitigation for meeting each of the first three emissions budgets? And if so, how could the proposed Commission determine an appropriate limit on their use?	The reason to permit the use of offshore mitigation is simple – it can provide opportunities to reduce emissions that may be more efficient or effective than those available in New Zealand. There is also no reason why mitigation opportunities in New Zealand shouldn't be used to offset emissions in other countries that only have higher cost abatement opportunities. As a matter of principle, since climate change is a global problem then enabling global solutions makes sense. The reality of trading emissions reductions is clearly more complicated and New Zealand's experience demonstrates how linking our carbon market to other markets can undermine progress. We would therefore only support offshore mitigation being used to meet our goals if: • A credible regime exists for determining that emissions have been reduced (rather than credits having been generated via an allocation mechanism); • There is reciprocity that enables emission reductions in New Zealand to be used to count towards the other country's targets or objectives; and • Limits apply to the use of offshore mitigation that require some reduction in domestic emissions.
6 What sector-specific policies do you think the proposed Commission should consider to help meet the first emissions budgets from 2022-35? What evidence is there to suggest they would be effective?	We believe that the Commission has an important role to play in improving the Information that is available on least cost mitigation options in New Zealand that maintain energy affordability and reliability. This may come through commissioning research in New Zealand, but can also be achieved by sharing technical reports and studies from overseas (e.g. UK Climate Commission report into hydrogen)

Question	Firstgas response
7 What cross-sector policies do you think the proposed Commission should consider to help meet the first emissions budgets from 2022-35? What evidence is there to suggest they would be effective?	We believe these needs to be continued reliance on the ETS. We would like to see it used effectively with longer term signalling or price commitments. We also believe that clarity is needed on links with international markets. As noted above, since climate change is a global problem, people know that international linkages make sense. However, linkages also have the prospect of shifting the market price as opportunities to abate emissions at lower cost are revealed. Need to resolve how decisions will be made on internal linkages for price to have long term credibility We would also like to see clear and improved carbon reporting. Firstgas is a member of the Climate Leaders Coalition and is setting target for our business that are consistent with national targets. We will report against those targets, but also support clear government processes for measuring carbon and reporting progress across the economy.
8 What policies (sector-specific or cross-sector) do you think are needed now to prepare for meeting budgets beyond 2035? What evidence supports your answer?	The magnitude of the change requires cross-sector technological innovation and change**.** We would strongly encourage the Commission to develop tools that can promote this type of investment and promote long term economic viability. This will include: • Investment in research; and • Investment in developing technologies.
9 What evidence do you think the proposed Commission should draw upon to assess the impacts of emissions budgets?	Evidence from parties that are keen to invest, have realistic options, and can technically deliver. Clearly, the Commission should not rely on evidence that lacks commercial viability unless government policies (like subsidies) are able to fill the gap. Also, we warn against relying on evidence that is predicated on future technological advancements – we need to continue to track those developments, but also need to take action with what we have available today.
10 What policies do you think the proposed Commission should consider to manage any impacts of meeting emissions budgets? Please provide evidence and/or data to support your assessment	We are concerned about affordability impacts of meeting emissions budget on the energy market. The cost of electricity and gas is almost certain to rise over the next 50 years. We would like the Commission to consider specific measures to ensure improved outcome for energy poverty and ensure equal access to energy.