National Energy Research Institute

20 October 2023

Comments from NERI[1] on:

The Gas Transition Plan

Introduction

Gas consumption in 2022 was 140PJ NG and 7.5PJ LPG, with 35PJ of the NG being for non-energy uses[2]. The NG is 100% locally produced and LPG 83%. Neither is directly exported, but a component of the NG is indirectly exported in products.

The starting point for the Plan is that:

- fossil gas use will fall as emission are reduced; but
- fossil gas will continue to be necessary to aid the transition of other fuels; and
- that creates risks and an uncertain environment that need to be managed.

So, the evolution of the gas sector will be uncertain as are the options that might become available to meet future needs. Aspects of this are sufficiently uncertain that the appropriateness of significant regulatory change at this time to constrain supply is risky.

Our submission is that this situation can and should be first improved by investing in applied research into the key issues.

In this submission we identify these at a high level and recommend that research investments should be made to address them.

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[1] The National Energy Research Institute (NERI) is a Charitable Trust incorporated in New Zealand (NZ). Its primary purpose is to enhance NZ's sustainability and to benefit the NZ community by stimulating, promoting, co-ordinating and supporting high-quality energy research and education within NZ. Its research members are GNS Science, Scion, University of Canterbury, University of Otago and the Western Institute of Technology at Taranaki, and its industry association members are the Bioenergy Association of NZ, BusinessNZ Energy Council, the Carbon and Energy Professionals New Zealand, Gas NZ, the New Zealand Geothermal Association, the New Zealand Wind Energy Association, la Ara Aotearoa Transporting New Zealand, and Tourism Industry Aotearoa.

[2] MBIE (2023) *Energy Balance Tables*. These number differ slightly, but not materially, from those quoted in the Transition Plan.

Business as usual

Under current policy settings (primarily the ETS) we have the following uses for NG and LPG; an assessment of the potential replacements; and an assessment of when these replacements might become economic based on marginal abatement cost estimates[3]. We note that replacing existing installations is often significantly more expensive than new installations because of the need to write off capital.

LPG & NG use and marginal abatement costs				
Use	**LPG (PJ)**	**NG (PJ)**	**Replacement**	**CO_2-e $/t when economic**
Electricity generation	-	32		
- High Capacity Factor		10	Renewables base load	<$50
- Medium CF		10	Renewables peaking	<$100
		4	CCUS	~$100
- Low CF		7	Renewables peaking	<$500
Industry	4	48		
- Food		17	Electricity/biomass	$50-$120
- Chemicals		24	CCUS	$100-$300
Commercial	2	7		
- new installations			Electricity	<$0
- existing			Electricity	<$0 LPG /$100-$300 NG
Residential	4	7		
- new installations			Electricity	<$0
- existing			Electricity	<$0-$700 LPG /$400-$1300 NG
Total	10	94		

The MfE marginal abatement analysis acknowledges its limitations including: the limited selection of options (e.g., it assumes using over supply of wind and solar to service peaking electricity generation, but both biogas or NG with CCUS could be options); whether the options really provide a like-for-like replacement (e.g., cooking with electricity vs. gas); and the impact of sunk costs on existing major users.

Improving this analysis is a specific area where investment in applied research in the NZ context would help clarify priorities for action.

Taking this analysis on face value we can tentatively conclude:

- At a CO_2-e of $100/t there will in most circumstances be lower cost non-gaseous clean fuels available for new energy users. This means that by and large over time much of the growth will be economically replaced by clean alternatives.
- However at least half of existing NG use will require gases, with either NG with CCUS or renewable gases potentially the lowest cost/only replacements.
- This suggests a need to invest in confirming this and lowering the costs of these options.
- Until this work is done arbitrarily curtailing the local production of fossil gases is likely to be counterproductive.

[3] MfE (2020) *Marginal abatement cost curves analysis for New Zealand*

Some suggested themes for the necessary research are:

- The use of bio and synthetic clean fuels for peaking generation e.g., in GTs. This should include liquid and gaseous fuels.
- The impact of changing electricity demand-side characteristics on the need for peaking generation, e.g., as much as a third of the 2035 electricity load could be for BEVs, and DG will be a larger component of our generation.
- Ways to lower the cost of industrial CCUS in the NZ environment, against other alternatives.
- Lowering the cost of options for drop-in clean gas fuels for existing residential and commercial users.
- Confirming that renewable gases will have a limited role in transport fuels in NZ.
- Understanding the place and significance of energy efficiency in these markets.
- Understanding alternative industrial activities. It is possible that the outcome of this work could mean new uses become competitive and progressively displace existing fossil gas fuelled industries.

Consultation questions

P26

- *How can New Zealand transition to a smaller gas market over time?*
- *What is needed to ensure fossil gas availability over the transition period?*
- *What factors do you see driving decisions to invest or wind down fossil gas production?*
- *Does the Government have a role in enabling continued investment in the gas sector to meet energy security needs?*
- *If yes, what do you see this role being?*
- *Does the Government have a role in supporting vulnerable residential consumers as network fossil gas use declines?*
    - *If yes, what do you see this role being?*

Based on the above discussion energy/industrial users will shift away from fossil gas as the CO_2-e price rises over $100/t, but some of these will use NG with CCUS and existing commercial and residential users will not be particularly responsive to this price pressure and need renewable gases.

Regardless of other initiatives our recommendation is that a key role for Government is to invest in applied research into the potential options and into lowering their costs.

One outcome of this work is likely to be the availability of sufficient competitive drop-in replacements for commercial and industrial users that maintain the viability of the local gas distribution networks, and even potentially grow their use at the margin.

Similarly, there will be significant remaining demand for bulk NG to be used in industrial and generation applications with CCUS.

Because the supply of some of the potential replacements (e.g., bioNG and bio-propane) will be closely tied up with what happens with the production of other biofuels, this work should be undertaken in conjunction with those workstreams[4].

Also, again while this research is in progress the Government should be selective in terms of making any dramatic policy shifts.

Finally, it is important to remind that these conclusions are dependent on the marginal abatement work being accurate, and this is itself a mater to be established.

P27

- *What role do you see for gas in the electricity generation market going forward?*
  - *What would need to be in place to allow gas to play this role in the electricity market?*
- *Do you think gas can play a role in providing security of supply and/or price stability in the electricity market? Why / Why not?*
- *Do you see alternative technology options offering credible options to replace gas in electricity generation over time? Why / Why not?*
- *If you believe additional investment in fossil gas infrastructure is needed, how do you think this should be funded?*

The answers here are uncertain at present and more work is required. The key issues are:

- At what point does CCUS become economic in the generation stack? (N.B. geothermal is also concerned about this)
- Gas Turbines with an easily stored fuel are likely to be the generators used for Low CF peaking. There are a range of renewable fuel options, but liquid and gaseous biofuels appear attractive. How viable is this option and can we lower the cost?
- The nature of electricity demand will change, and this will influence the need for peaking generation. What will the impact be?

Again, this research should be a priority. Note that an outcome might be that at this stage we can't tell and so we need to be enhancing our ability to adapt to that uncertainty. This implies investing in increasing our options and in flexibility on both the supply and demand sides.

P32

- *On a scale of one to five, how important do you think biogas is for reducing emissions from fossil gas?*

[4] Wood Beca, (2023) "*Gas Transition Plan - Biogas Research Report*" discusses the closer-to-market technologies. However, it uses dated work on biowaste availability in NZ (see instead Hall, P, (2022) "*Residual biomass fuel projections for New Zealand*" Scion), and doesn't discuss the potential from emerging thermo-chemical processes by the 2030s, e.g., hydrothermal processes (Jens, J et al (2021) "*Market state and trends in renewable and low-carbon gases in Europe*" Gas for Climate Consortium; Motola V. et al (2022) "*Bioenergy in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets*" EU).

    - *Why did you give it this rating?*
- *Do you see biogas being used as a substitute for fossil gas?*
    - *If so, how?*

On the analysis so far, it appears that bio-NG will be the lowest cost option for existing domestic and commercial users for fossil NG. As such, investment in this option is indicated. This should include the options for enhancing yields from AD and alternative ways to produce these gases from decentralised waste.

The question of options for replacing LPG is unclear and needs further work. The production of propane as a co-product from other liquid biocrude refining (e.g. SAF and marine fuels) needs to be considered, and any regulatory action to curtail the use of LPG fuels should be linked to clarifying these options.

We have noted above the potential role of NG in the electricity sector, and the option of fossil NG with CCUS needs to be in the mix.

P37

- *On a scale of one to five, how important do you think hydrogen is for reducing emissions from fossil gas use? Why do you think this?*
    - *Do you see hydrogen being used as a substitute for fossil gas? If so, how and when?*
- *What else can be done to accelerate the replacement of fossil gas with low-emissions alternative gases?*

The role of hydrogen is unclear, but electro-hydrogen remains inefficient and expensive as a direct fuel in thermal applications in NZ in comparison with direct electricity use (particularly if heat pump technology will meet the need). Injection of hydrogen into the NG line is being investigated by First Gas and the value of using various types of clean hydrogen versus bio-NG will emerge out of this[5].

The most likely application of hydrogen will be in the production of industrial chemical. These will be a matter for the major producers – Methanex and Balance. The potential to produce hydrogen rich gases from other feedstocks (e.g., biomass gasification) is an option that needs to be further investigated, particularly for applications where high purity is not required e.g., to enhance AD reactions[6].

The most useful investments the government could be making is to systematically investigate the various clean gas options, not just limited to hydrogen, their timing in terms of technology readiness, and how to reduce their cost.

[5] On the face of it using electricity to produce hydrogen to then service loads that could be addressed by electricity will be inherently inefficient, so this limits the end uses where enhancing NG in this way would make sense.

[6] Beca, Firstgas Group, Fonterra and EECA (2021) *Biogas and Biomethane in NZ*

P39

- *On a scale of one to five how important is a renewable gas trading to supporting the uptake of renewable gases?*
  - *Why have you given it this rating?*
- *What role do you see for the government in supporting such a scheme?*

A certification system could be useful, but any implementation should take account of international recognition, and the need to integrate into wider energy sector initiatives.

P43

- *On a scale of one to five how important do you think CCUS is for reducing emissions from fossil gas use?*
  - *Why did you give it this rating?*
- *What are the most significant barriers to the use of CCUS in New Zealand?*
- *Do you see any risks in the use of CCUS?*
- *In what ways do you think CCUS can be used to reduce emissions from the use of fossil gas?*

Based on work to date CCUS will be the lowest cost method to address around 1/3rd of the gas use by the sector and will help to maintain the fossil fuel NG system during the transition. CCS is also required (and used) in some geothermal generation plants where the field provides a natural sink, and there may be synergies.

Again, investment is needed into cutting the costs of CCUS and addressing any other barriers to its use by large point source producers of CO_2 from NG i.e., electricity generation and industrial applications.

P45

- *What role do you see for gas storage as we transition to a low-emissions economy?*
- *On a scale of one to five, how important do you think increasing gas storage capacity is for supporting the transition?*
- *Why did you give it this rating?*
- *What should the role for government be in the gas storage market?*

Again, this needs to be considered as part of the wider questions around options, but the evidence would suggest that the supply will become partly:

- *more decentralised (bioNG) with more limited demand for largescale storage, and*
- *focussed on a small number of large emitters with CCUS, capable of arranging their own storage requirements to buffer their loads.*

The use of biogas in Low CF peakers will call for long-term storage, and this will be integral to the service. Using a suitable liquid biofuel may be preferred.

P47

- *Our position is that LNG importation is not a viable option for New Zealand. Do you agree or disagree with this position?*
- *If so, why?*
- *What risks do you anticipate if New Zealand gas markets were tethered to the international price of gas?*

It seems that international trade in gaseous fuels will remain limited, but commercial considerations will resolve this regardless. Based on the MfE assessment that CCUS becomes competitive at a CO_2-e price of ~$100-$300/t then imported LNG will not compete with local NG with CCUS.

The argument for tethering gas markets to international prices is unclear from the discussion document. Regardless, at a time of uncertainty and change being faced by NZ gas markets it is important to allow the various fuels to compete on their local merits including any CO_2-e charges. It will therefore be important that their pricing reflects the costs of local supply, rather than arbitrary pricing based on overseas benchmarks.

Recommendation

We recommend that before taking any major changes to the regulation of NG and LPG limiting their use in NZ, there is a need to improve our understanding of the options, their likely timeframes, and where appropriate to invest in accelerating and/or lowering their costs.

This requires agreement on an applied research programme set in the context of the various potential applications of clean gases, and investment in that.

Specific issues include:

- Better understanding the marginal abatement costs of these gases in their current and future applications; and
- Targeting those that are economic now and through the 2020s, and those like CCUS and clean gases that both could make a material difference and appear to be the lowest cost replacements.

Further detail is covered in the body of this submission.

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