Submission on the *Gas Transitions Plan Issues Paper*

Name	
Organisation (if applicable)	
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Release of information

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October 30, 2023

Credentials

I am a senior, experienced geologist (BSc, MSc - University of Otago; PhD, University of California Santa Barbara) recently retired. My involvement with the petroleum industry began from about 1979-80, initially with consulting assignments and internships and for about seven years with a major international oil and gas company in the USA. During that period, I was engaged in exploration and geological specialist assignments and contributed to the discovery, appraisal and development planning for several oil and gas fields mainly in the offshore Gulf of Mexico, with experience in several other US basins including the North Slope of Alaska.

I repatriated to New Zealand in 1988 and served with the New Zealand Geological Survey, before being appointed in 1992 to the executive of the newly formed CRI, Institute of Geological and Nuclear Sciences (GNS Science), established through the amalgamation of precursor DSIR divisions. In 1997 I co-founded GeoSphere Ltd to promote and participate in resurgent exploration of petroleum in New Zealand. The company initiated and was instrumental in the redevelopment of the Moturoa oil field and discoveries of the Kowhai gas field and Copper Moki oil field in Taranaki and undertook a wide range of consulting assignments including design and execution of exploration work programmes across most of New Zealand's prospective sedimentary basins, as well as analysis and advice on the gas market situation and outlook during that period. I was a regular participant and expert commentator in industry conferences and workshops. For several years I convened the Oceans programme for the Centre for Advanced Engineering, University of Canterbury. In 2001 I served on a Ministerial Advisory Committee on Oceans Policy.

From 2009 -2016 I held senior management positions with New Zealand Oil & Gas Ltd in Wellington, overseeing a substantial exploration portfolio in New Zealand and building an international portfolio through projects in Indonesia and Tunisia.

I was Deputy Chair of the Petroleum Exploration and Production Association of New Zealand, 2006-08, and in 2019 I was inducted into that organisation's Hall of Fame.

During my progressive retirement since 2016, I have undertaken several consulting, research and advisory assignments, as well as serving as Convenor for the Petroleum Special Interest Group of the Geoscience Society of New Zealand (2020-22). I served on GNS Science's Strategic Science Users Advisory Panel 2016-18. I contributed to Endeavour Fund research programmes as a sub-contractor to GNS Science (2017-22), and as Adjunct Professor in the School or Earth and Environment at the University of Canterbury where I was also involved in the formulation of the Endeavour Fund proposal for research into geostorage for green hydrogen, which was successful in 2022.

In 2018-19, I undertook consulting work for the Gas Industry Company contributing to their analysis of future gas supply and demand.

Introduction

Of the bundle of inter-related energy policy consultation documents released for submissions by 2 November 2023, I have elected to submit on one: the Gas Industry Transition. I hope though that points made here which are relevant to other topics will be considered there as well.

In this Submission my responses to the consultation questions follow a discussion of the Consultation document as a whole, to provide the framework from which my views have arisen.

Nomenclature

I will use the established and objective term "natural gas" rather than the novel and pejorative term "fossil gas" which is used throughout the Consultation document, having been introduced internationally very recently for emotive reasons. The term natural gas was coined some 200 years ago to distinguish gas produced from within the earth from that manufactured by heating coal in cities in New Zealand and many other countries. Natural gas displaced coal gas due to its superior economic and environmental characteristics.

Biogas, biomethane, SNG (synthetic natural gas) and most types of hydrogen are new classes of manufactured gas.

Natural gas is a division of petroleum, as is crude oil. It may be pure methane (CH_4) but usually contains other hydrocarbon and inert gases in trace to significant proportions. Frequently natural gas produced from sub-surface petroleum fields requires some processing to reduce impurities and comply with standards to ensure consistent combustion performance.

LPG is a product of such processing, separating propane (C_3H_8) and butane (C_4H_{10}) which can be readily compressed to a liquid phase, but drawn for consumption as gas at ambient pressure. As such, LPG is a product of natural gas but not of manufactured gas including coal gas, biogas and hydrogen.

Importantly, natural gas, and its derivatives are routinely used as feedstocks for petrochemicals, the manufacture of hydrogen, and other synthetic fuels, as well as directly as a transport fuel. The use of natural gas is not solely as a fuel for combustion, heating, steam raising or electricity generation. Significant New Zealand industries are dependent on natural gas feedstock (notably methanol and nitrogen fertiliser) and are likely to cease being commercially viable within a few years, unless natural gas production is sustained.

Discussion

Modern New Zealand had inherited a remarkably resilient energy system that gave our enterprises and households a significant measure of security of supply, and energy costs that were relatively stable and amongst the lowest in the world for several decades. This has constituted a competitive advantage for our economy and the overall well-being of New Zealand society. Recent policies have put the functionality of this vital component of our economy at risk. After several years of not mere neglect but serious mistreatment, New Zealand's gas industry is in a precarious state. This puts our energy system as a whole in significant peril in respect of

- security of supply,
- affordability for all consumers (domestic, commercial and industrial), and
- environmental impacts additional to greenhouse gas emissions.

The situation has arisen from the undue weight and urgency given to greenhouse gas emissions ("gold standard" compliance with commitments made under the Paris Agreement) relative to other considerations that are vital to a functional and resilient energy system upon which our households and enterprises rely.

I completely accept the proposition that New Zealand's energy system will have to accommodate a transition away from natural gas (and other fossil fuels). Ultimately, this is due to the finite character of the petroleum resource quantity in nature: hence the label "non-renewable".

I do not however buy in to the narrative that greenhouse gas emissions associated with the combustion of natural gas (and its derivatives) require undue urgency in effecting such a transition, when it is at the expense of the reliability and affordability of energy for New Zealand's households and enterprises, and indeed without due regard to other environmental considerations.

The idea of a ***trilemma*** has been well developed over several years to promote balance between conflicting considerations in national energy supply systems[1]. As the Executive Director of the BusinessNZ Energy Council has observed, "Transitioning to a sustainable energy system which is secure and affordable – and in doing so, equitable – is a balancing act. The question is not whether we should, rather it's how to do it affordably, and what trade-offs we are willing to accept." In considering that question, one must also assess, objectively, the extent to which costly measures can be assured to result in benefit – in this case, implicitly the stabilisation of global climate – of magnitude at least corresponding to the costs. I do not see evidence for such analysis. Indeed, as an expert in historical geology, while accepting the greenhouse effect on global temperatures, I question whether stabilisation of global climate is remotely achievable.

Since 2018, the New Zealand government has explicitly given primacy to addressing threats from climate change via the imperfect proxy of greenhouse gas emissions and atmospheric CO_2 levels, as promulgated in the Paris Climate Accords in 2015, whereby New Zealand made significant commitments to emissions reductions.[2] This is clearly expressed in the Ministerial Foreword to the Consultation Documents. In my view it is negligent to subsume other crucial considerations for ensuring a truly sustainable energy system, to this narrow segment of the environmental sustainability dimension.

Viewed holistically, and with due consideration of non-climate detriments (especially, compromising security and equity of the resulting energy system) arising from policies to achieve these commitments, the actions of government since 2018 including the passage of the Climate Change Response (Zero Carbon) Amendment Act 2019 and establishment of the Climate Change Commission, could arguably be characterised as reckless.

Some of the economic detriment of a transition designed primarily to meet emissions targets in order that the world remains within atmospheric greenhouse gas levels might be justifiable where, e.g. by proving new technology and by establishing required infrastructure, they serve to facilitate roll-out of future energy system components which will be essential in ensuring an eventual orderly transition to a zero-carbon or low-carbon energy system. This would include deployment and proliferation of proven renewable energy technologies and supporting infrastructure, as we have seen in recent years with

[1] See https://www.worldenergy.org/publications/entry/world-energy-trilemma-index-2021

[2] New Zealand's Nationally Determined Contribution to the Paris Agreement is to reduce greenhouse gas emissions by 30 per cent below 2005 levels by 2030.

- wind power
- rooftop solar panels
- electric and hybrid passenger vehicles,

where the costs are reasonable and manageable for the New Zealand economy to bear. Conversely, some measures intended to assist in achievement of commitments under the Paris Agreement e.g. by physically capturing CO_2 and removing it from the atmosphere (which may or may not impact even infinitesimally on climate outcomes as intended) would actually worsen the functionality (reliability and affordability) and potentially non-climate environmental impacts of our energy system, and compromise the orderly achievement of the energy transition.

New Zealand's current gas industry transition course is deficient in its consideration of the need for sustainable ***functionality***. There have already been perverse outcomes, for example the importation of coal to fuel thermal electricity generation using the Rankine turbines at the Huntly power station which were intended to be run on indigenous fuel resources, whether coal from the field the power station is collocated with, or natural gas to which it is connected by high pressure pipelines. Loss of global competitiveness and premature closure of energy-intensive industries will be more deleterious for New Zealand than any consequences of failing to achieve emissions commitments.

To achieve an orderly energy system transition which balances the dimensions of the Energy Trilemma, the objective criteria for decision-making must be much broader than simply compliance with emissions commitments made several years ago, without due attention to the consequences for energy security and energy equity. Other countries are now dealing with this realisation. The UK government has revived petroleum exploration in the North Sea. In Australia, while offshore New Zealand has been closed for the past 5 ½ years, exploration has been successful with significant discoveries both onshore and offshore WA. Conversely in some eastern states, the intended expansion of renewable energy, although energetically supported by government and commercial interests, is proving insufficient in quantity and pace, and governments have accepted the need to maintain coal-fuelled power plants for significantly longer than intended under their ambitious transition plans[3].

[3] https://www.economist.com/asia/2023/10/19/australias-energy-transition-is-in-trouble

Responses to consultation questions

Consultation Questions: Chapter Two

• How can New Zealand transition to a smaller gas market over time?

Unless a scale is maintained which justifies ongoing investment in discovery and development of New Zealand's indigenous resources, the gas market is in danger of disorderly collapse rather than orderly transition to some irreducible scale as the Question implies to be intended. The symptoms of such a premature collapse are evident in several supply shortfalls in recent years, as well as in the very substantial reductions to proven and contingent gas reserves in New Zealand fields reported in 2023. The only means of ensuring order so as to allow for eventual depletion and/or substitution of gas by new energy supply classes is to allow market forces to determine the relative merits of competing energy development business cases, which will require review and removal of several deliberate obstacles to continuing development of our natural gas resources (as well as exploration for further discoveries) for industries and consumers which depend on its attributes.

• What is needed to ensure fossil (natural) gas availability over the transition period?

Any prior assurance of an orderly transition is already severely compromised. Gas producers have continued to invest in development of their resources but face persistent head winds largely imposed by government and its various agencies under the justification of "dealing with" climate change, urgently. Gas-reliant industries are under real threat of losing competitiveness, while also being encouraged to exploit substantial subsidisation of alternative energy options that would not otherwise make commercial sense.

The Issues Paper and other related documents generally acknowledge that thermal fuel will be required at least periodically for electricity generation during peak demand and/or curtailed supply from renewable sources. But in seeking to absolutely limit this recourse as far as possible, business cases for maintaining and further developing (to sustain) natural gas production capacity can hardly be expected to justify the large capital investments required. Some assurance of demand volume and timing as well as price will be necessary or such investments will not be made and eventually (such as with a dry year and curtailed hydroelectric output) New Zealand's electricity supply, as well as output of important industries, will fall short of requirements.

A continuing level of thermal power generation is thus highly desirable to ensure that gas producers have a viable business and therefore the incentive to sustain their operations, otherwise there is a likelihood that fields will be decommissioned long before the increasingly sporadic demand for their gas production for peak electricity generation ceases. The market needs to be allowed to operate unencumbered by prejudicial measures that threaten its ongoing functionality and asset integrity.

• What factors do you see driving decisions to invest or wind down fossil (natural) gas production?

Many factors will combine: some intrinsic to each field, such as the rate at which gas can be produced, processing requirements, field operating costs, additional revenue streams such as condensate and LPG; and others extrinsic, such as the nature of customers' offtake requirements (e.g. whether continuous – at a plateau rate, or accommodating natural decline - or episodic), producer price net of carbon charges and such burdens as well as royalty and taxation.

The most important factors are likely to be realised price (net of costs and imposts), and timing of production – the greater the extent to which sales are restricted e.g. to dry year or other energy shortfall circumstances, the weaker any major development, or indeed maintenance, investment case will be.

Nor should exploration for undiscovered resources, including within prospective offshore areas, continue to be prohibited. 25 years ago, discovered and developed resources were only sufficient to sustain New Zealand's natural gas industry for another decade or so; reinvigorated investment in exploration and successes such as the discovery of Pohokura field in 1999 led to the development of that and other Taranaki fields, both previously and newly discovered, and successive net upwards revisions in estimated reserves, sustaining the industry up to the present (after a down-turn through the mid-2000's).

• Does the Government have a role in enabling continued investment in the gas sector to

meet energy security needs?

Yes

o If yes, what do you see this role being?

The Government owns the resource endowment under the Crown Minerals Act. Besides the obligation to ensure a secure, equitable and environmentally sustainable energy system for New Zealand, the Government secures a direct economic benefit through imposition of a royalty on production. The initial development and expansion of New Zealand's natural gas industry was heavily promoted by Government; however, from the 1990's until about 2015, market forces have (arguably at least) been more effective and efficient at maintaining industry vitality through additional discoveries and development[4]. I favour reversion to such settings to enable, rather than attempt to steer, the industry towards desired outcomes any narrower than simply to sustain a functional industry (to the benefit of customer industries and the general energy system and economy).

It may be suggested that a state owned enterprise would be an effective means of ensuring desired outcomes, especially if adequate private sector interest is not forthcoming. The establishment of Petrocorp in the 1970's was at least moderately successful in stimulating discovery and development subsequent to the development of Kapuni and Maui fields by the Shell BP and Todd joint venture from the 1950's. However I would consider that any such proposal should be evaluated very carefully, and not pursued unless it is very clear that settings of the nature of those which proved effective from the mid 1990's would be insufficient.

• Does the Government have a role in supporting vulnerable residential consumers as

network fossil (natural) gas use declines?

[4] New Zealand's most recent petroleum discovery (Toutouwai-1, OMV, offshore Taranaki, 2020) remains unappraised due at least in part to government's active discouragement of a long-lived production industry including such collateral effects. However such a recent discovery does attest to remaining prospectivity within New Zealand's extensive sedimentary basins.

That should not be necessary if gas (which may well be natural gas blended with biogas and/or green hydrogen for several years) is allowed to compete for consumer preference on its merits.

o If yes, what do you see this role being?

The most effective means of providing for vulnerable residential consumers would be to allow the system to evolve towards substitutes for natural gas over the long term, i.e. when New Zealand's natural gas endowment has been discovered, developed and depleted to the extent of market demand.

Consultation Questions: Chapter Three

• On a scale of one to five, how important do you think biogas is for reducing emissions from

fossil (natural) gas?

2

o Why did you give it this rating?

The technical viability of biogas production is well understood, and it is a mature technology. This is aptly demonstrated by the Reporoa plant which has been able to divert putrescible waste from Auckland, transport it to Reporoa, and then convert it to biogas for use as fuel and CO_2 as a growth enhancer in greenhouses. Part of the economic case for that plant depends on the ability to backload aggregate from the Waikato to Auckland in the trucks that deliver the waste to Reporoa. There are limited further such opportunities in New Zealand, but they are worth pursuing.

• Do you see biogas being used as a substitute for fossil (natural) gas?

Yes, to a limited extent.

o If so, how?

Biogas has limited direct uses or suitability for substitution because of its low calorific value (approx. 20MJ/m^3). Biogas cannot be used as a pipeline gas because it typically comprises just 50-55% CH_4, with considerable proportions of CO_2, N_2 and water alongside other impurities. The wobbe index for pipeline gas (which determines its suitability for gas appliances) means that even low levels of blending are unacceptable (without the additional expense of converting biogas to biomethane) because of the danger of slugs of low-quality gas in the pipeline. Thus, the practical scope for biogas to substitute for natural gas is mainly as a fuel for electricity generation.

Threat of accelerated closure of the natural gas infrastructure under the imperative to reduce emissions will dampen investment in potential emerging energy system components such as biogas or biomethane.

• On a scale of one to five, how important do you think hydrogen is for reducing emissions

from fossil (natural) gas use? Why do you think this?

3.

New Zealand has a tremendous advantage in that we have a large and heterogeneous book of renewable electricity generation, and energy demand which varies on both diurnal and seasonal scales further modulated by climatic and economic cycles. There are periods when renewable electricity generation is vastly surplus to instantaneous demand and hence could hypothetically be utilised as near-free feedstock to produce green hydrogen by electrolysis.

Such green hydrogen could be sold via the natural gas pipeline infrastructure as a component of a blended gas. At initial low proportions there appear to be no great technical obstacles, but achievement of scale would have to await attention to issues as laid out in the issues paper and above. Whether and under what circumstances the investment in electrolysis and storage (possibly blended gas storage as the capacity of line pack were to be exceeded) would be commercially justified would be for the judgement of any proponents.

• Do you see hydrogen being used as a substitute for fossil (natural) gas? If so, how and when?

I envisage the possibly viable pathway would be slow and via blending at low levels of substitution for a number of years. Further to the preceding response – it may for example prove viable to collocate a green hydrogen (electrolysis) plant with an access point to the gas pipeline network and a geostorage facility from which thermal fuel could be drawn for a gas turbine which could be used to generate electricity over periods of peak demand. The costs of the hydrogen infrastructure would need to be offset by arbitrage of the price of electricity between periods of high and low demand over supply (whether from a specific renewable power station, or from the electricity grid when its inputs approach 100% renewable – not an infrequent incidence).

• What else can be done to accelerate the replacement of fossil gas with low-emissions

alternative gases?

There are few options available in New Zealand. One resource not considered in the Issues paper is waste-to energy. I understand there are proven routes for the manufacture of synthetic natural gas (SNG) or hydrogen via the gasification / pyrolysis of plastics and other wastes. Such technologies have not been considered in the Issues paper.

It will be essential that future policy neither emphasises specific options or forecloses others but, instead, allows enterprises to pursue practical innovations and trial emerging technology without the burden of regulatory uncertainty. There may be a need for regulation to shelter such propositions from any anti-competitive behaviour on the part of infrastructure operators and other established participants in energy markets.

• On a scale of one to five how important is a renewable gas trading to supporting the uptake

of renewable gases?

2-3?

o Why have you given it this rating?

Undecided. Appears sensible in theory but probably complex in practice, especially initially when a market would have limited scale and participants.

• What role do you see for the government in supporting such a scheme?

Gas Industry Company may be better placed to Government to develop and facilitate such a scheme.

• On a scale of one to five how important do you think CCUS is for reducing emissions from

fossil gas use?

1-5

o Why did you give it this rating?

It is certainly important when emissions reduction is presented as the goal. However, considering the overall sustainability of our energy system, I consider on balance CCUS challenging to achieve in New Zealand, and of benefit (strictly in terms of contributing to the achievement of GHG emissions targets as opposed to optimised energy trilemma outcomes) only in restricted circumstances at best.

• What are the most significant barriers to the use of CCUS in New Zealand?

1. Purely considering sustainability, the sequestration process would require energy which would better be used for "real" purposes rather than simply emissions reduction and supposed fixing of global climate.
2. There probably are some limited options for the recovery of CO_2 from existing industrial participants (e.g. Kapuni gas treatment plant), and its utilisation e.g in methanol and urea manufacture (and potentially polycarbonates). There is also prospect of the recovering and similarly utilising CO_2 from fluids associated with geothermal electricity generation. A key question remains as to how such initiatives would be recognised and rewarded, currently this is a major commercial barrier to uptake of these options.
3. Uncertainties around storage (such as the following) dominate the economic evaluation of CCS projects:
    a. Price of carbon in determining project "revenue" from sequestration
    b. site-specific technical factors
    c. site-specific commercial factors
    d. absence of legislation governing sub-surface property rights
    e. treatment of long term (full life cycle) liabilities
    f. social licence questions and impact on consenting
    g. Treaty of Waitangi considerations.
4. The assertion in the Issues Paper that emissions capture technology is technically and economically viable as an adjunct to natural gas production is misleading, even ignoring *inter alia* the costs and liability issues involved in the acquisition and proving of a sequestration site. While globally there are several variably-successful projects which demonstrate sequestration of CO_2, this is by no means certain to be feasible in New Zealand's particular geological, infrastructural and political/regulatory circumstances.

While the most favoured path for CCS appears to be to utilise depleted petroleum reservoirs for sequestration, such use competes with

a) full depletion of the recoverable resource, unless the reinjection will demonstrably enhance and extend petroleum production, and
b) the potential use of such well understood reservoirs for gas (including blended and ultimately primarily renewable gas) storage, as per the Ahuroa field. Storage of fuel is far more attractive than inert gas sequestration from the point of view of energy system viability and sustainability. Any residual resources in a depleted reservoir at the initiation of a storage scheme would serve as cushion gas for the storage volume, ideally.

• Do you see any risks in the use of CCUS?

Economic and legal risks as per preceding comment. CO_2 is not actually toxic or combustible in most circumstances, so loss of containment really only risks un-forecast emissions.

• In what ways do you think CCUS can be used to reduce emissions from the use of fossil (natural) gas?

Development of new gas reservoirs which happen to have elevated levels of CO_2 might be enabled by CCS or CCUS to the extent that emissions charges were thereby avoided, and/or social licence hurdles surmounted. But, my preceding arguments apply.

• What role do you see for gas storage as we transition to a low-emissions economy?

Gas storage is important to modulate increasingly spiky demand (driven by direct use and thermal electricity fuel when seasonal and other climatic factors combine to curtail renewable energy supply) with a gas production system comprising wells with diminishing capacity (maximum production rate). Blending of small proportions of renewable gas (hydrogen, biomethane) could be a feature of stored gas, a step along the ultimate transition pathway.

•On a scale of one to five, how important do you think increasing gas storage capacity is for

supporting the transition?

5

o Why did you give it this rating?

Assuming New Zealand's gas industry is able to find a forward pathway in the face of numerous obstacles and threats, and especially in the absence of any new discoveries and development of fresh reservoirs in existing and/or new fields, it will become increasingly difficult to meet sporadic peak demand from fields whose wells undergo declining productive capacity due to natural depletion of the finite volumes of gas in place. Continuous production, with volume surplus to immediate demand being held in storage facilities, will help to manage that problem and maintain the capacity to cover at least short term peak demand periods.

• What should the role for government be in the gas storage market?

As far as possible, rely on market participants (including gas producers, wholesalers and major industrial customers) to find optimal arrangements which they can implement on commercial terms that are satisfactory to them. Government, through New Zealand Petroleum & Minerals, will need to be well informed and adequately resourced to deal with technical and regulatory issues that are likely to arise.

• Our position is that LNG importation is not a viable option for New Zealand. Do you agree

or disagree with this position?

I agree.

o If so, why?

Apart from the close analogy with what has sadly actually become of New Zealand's thermal coal industry, it seems utterly absurd that we would deliberately encourage the demise and dismemberment of our gas production system (including its sustainability via exploration) and then incur the considerable capital and commodity costs to enable gas importation. The scale of gas demand in the New Zealand economy without Methanex and thermal generation is likely to be trivial in comparison to that of the past 40-50 years and insufficient and sporadic to approach commercial justification of LNG importation.

LNG contracts are typically on long term basis (10 plus years) into markets with significant base-load demand, unlike New Zealand after the inevitable closure of the petrochemical industries. Whilst there is an emerging global spot market for LNG which would seem to be the only recourse for sporadic (e.g. dry year) thermal fuel demand spikes, prices in that market are highly variable and would present too great a commercial risk for any NZ LNG import scenario. Indeed in 2023, some purchase bids (e.g. Pakistan) for LNG have reportedly failed to secure offers since all shipments were snapped up by European customers to replace Russian natural gas supplies.

Regasification facilities, expensive to build and maintain, would very likely be largely unused and effectively stranded.

• What risks do you anticipate if New Zealand gas markets were tethered to the international

price of gas?

Further severe deterioration of economic competitiveness, loss of existing gas-based industries, and significant adverse impact on the general well-being of New Zealanders.