# Submission template

## Submitting on the *Gas Transitions Plan Issues Paper*

This is the submission template for responding to the consultation document *Gas Transition Plan Issues Paper.* The Ministry of Business, Innovation and Employment (**MBIE**) seeks your comments by **5pm on Thursday, 02 November 2023**.

Please make your submission as follows:

1. Fill out your details under the "Your name and organisation" heading and, if applicable, check the boxes underneath on privacy and confidentiality.
2. Fill out your responses to the discussion document questions. Your submission may respond to any or all of the questions. Where possible, please include evidence to support your views, for example references to independent research, facts and figures, or relevant examples. If you would like to make other comments not covered by the questions, please provide these in the "General comments" section at the end of the template.
3. Before sending us your submission:
    a. delete this first page of instructions
    b. if your submission contains any confidential information, please:
        - state this in the cover page or in the e-mail accompanying your submission
        - set out clearly which parts you consider should be withheld and the grounds under the Official Information Act 1982 (**OIA**) that you believe apply
        - provide a separate version excluding the relevant information for publication
4. Submit your submission by either:
    a. emailing this template as a PDF or Microsoft Word document to gastransition@mbie.govt.nz
    b. mailing your submission to:

        Energy Resources Markets Branch
        Ministry of Business, Innovation and Employment
        15 Stout Street
        PO Box 1473, Wellington 6140
        Attention: Gas Transition Plan Issues Paper submission

Please direct any questions that you have in relation to the submissions process to gastransition@mbie.govt.nz.

**Release of Information**

Please note that submissions are subject to the OIA and the Privacy Act 2020. In line with this, MBIE intends to upload copies of submissions received to MBIE's website at www.mbie.govt.nz. MBIE will consider you to have consented to uploading by making a submission unless you clearly specify otherwise in your submission. MBIE will take your views into account when responding to requests under the OIA and publishing submissions. Any decision to withhold information requested under the OIA can be reviewed by the Ombudsman.

# Submission on the *Gas Transitions Plan Issues Paper*

| | |
|---|---|
| **Name** | |
| **Organisation (if applicable)** | Plant & Food Research (retired) and Bioenergy Cropping Solutions (consultant) |
| **Contact details** | |

## Release of information

Please let us know if you would like any part of your submission to be kept confidential.

☐ I would like to be contacted before the release or use of my submission in the summary of submissions that will be published by MBIE after the consultation.

☐ I would like my submission (or identified parts of my submission) to be kept confidential, and **have stated below** my reasons and grounds under the Official Information Act that I believe apply, for consideration by MBIE.

| |
|---|
| I would like my submission (or identified parts of my submission) to be kept confidential because [Insert text] |

[To check the boxes above: Double click on box, then select 'checked']

## Responses to questions

| | Chapter 2: Transitioning our gas sector |
|---|---|
| 1 | **How can New Zealand transition to a smaller gas market over time?** |
| 2 | **What is needed to ensure fossil gas availability over the transition period?** |
| 3 | **What factors do you see driving decisions to invest or wind down fossil gas production?** |
| 4 | **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?** |
| 5 | **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?** |
| | **Fossil gas and electricity** |
| 6 | **What role do you see for gas in the electricity generation market going forward?**<br>**No baseload role; for peak smoothing using blended NG/biomethane** |
| 7 | **What would need to be in place to allow gas to play this role in the electricity market?**<br>**A major scale-up of anaerobic digestion for biogas** |
| 8 | **Do you think gas can play a role in providing security of supply and/or price stability in the electricity market? Why / Why not?**<br>**Stopping gas too soon will cause peaking failures in electricity supply** |
| 9 | **Do you see alternative technology options offering credible options to replace gas in electricity generation over time? Why / Why not?**<br>**Yes. If biogas for peak smoothing is built up, then wind and solar can be increased more.** |

| | |
|---|---|
| 10 | **If you believe additional investment in fossil gas infrastructure is needed, how do you think this should be funded?** |
| | |
| **Chapter 3: Key issues and opportunities** | |
| | **Renewable gases and emissions reduction technologies** |
| 11 | **On a scale of one to five, how important do you think biogas is for reducing emissions from fossil gas? Why did you give it this rating?** |
| | 5. I have expertise and research results showing the feedstock supply can provide substantial biogas, so it can be important for reducing NG emissions. |
| 12 | **Do you see biogas being used as a substitute for fossil gas? If so, how?** |
| | Biomethane can be injected into the North Island gas network as a 1:1 substitute. |
| 13 | **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?** |
| | 2. It can only blend into the gas network at a 20% ratio. It can make a small contribution based on the uses that it suits. |
| 14 | **Do you see hydrogen being used as a substitute for fossil gas? If so, how and when?** |
| | Very limited. |
| 15 | **What else can be done to accelerate the replacement of fossil gas with low-emissions alternative gases?** |
| | Support changed land use by pastoral farming in appropriate areas. |
| 16 | **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?** |
| | 5 since it will add flexibility to help a new digester industry get established. It is also the way to enable credits for C emissions reduction. |
| 17 | **What role do you see for the government in supporting such a scheme?** |
| | Govt should create support incentives for use of such gases for residential, commercial, industrial and power peaking uses. |
| | **Carbon Capture, Utilisation and Storage** |

| | |
|---|---|
| 18 | **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?** |
| | 2 I only support Capture and Utilisation of CO2, not permanent storage. |
| 19 | **What are the most significant barriers to the use of CCUS in New Zealand?** |
| | |
| 20 | **Do you see any risks in the use of CCUS?** |
| | |
| 21 | **In what ways do you think CCUS can be used to reduce emissions from the use of fossil gas?** |
| | |
| | **Options to increase capacity and flexibility of gas supply** |
| 22 | **What role do you see for gas storage as we transition to a low-emissions economy?** |
| | Possibly in existing gas fields, for use in electricity peak smoothing. |
| 23 | **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?** |
| | 4 (as in Q24) but with some reservations. |
| 24 | **What should the role for government be in the gas storage market?** |
| | Support the public benefits of helping potential investors do such storage, since they are large. |
| 25 | **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?** |
| | |
| 26 | **What risks do you anticipate if New Zealand gas markets were tethered to the international price of gas?** |
| | No need to. Also, no need to import gas since renewables like biogas are very feasible. |
| **General comments** | |
| See my associated Word file, Renquist submission to gas transition plan issues.doc<br>Or see a copy here: | |

## A R Renquist, General Comments on the MBIE Gas Transitions Plan

30 October 2023

I have been involved for many years in the Bioenergy Association, BANZ, efforts on behalf of the bioenergy sector and to inform government policy on issues and opportunities for the use of bioenergy to reduce fossil fuel greenhouse gas emissions. My motivation has been as a 53-year supporter of climate change mitigation actions. This has included two decades of crop science research for the CRI Plant & Food Research, half of which has related to bioenergy cropping. When I refer to CRI research findings in this submission it is my own research and that of my colleagues. Although I am a party to the Bioenergy Association submission on this MBIE plan, this submission is my own expert voice on the topic of NZ agricultural production of feedstocks for anaerobic digestion to biogas, as a means of achieving a renewable, low carbon emissions gas energy supply, starting as soon as government policy encourages such investment. There is also biofuel potential from forestry wood, produced on land that it often too steep for grazing. But that liquid or gas biofuel will be made with emerging technologies that are not commercialised. Biogas from non-woody biomass is fully commercialised technology and widely used.

With reference to the BANZ submission, I agree with the scale of bioenergy required for the 2050 target, which is 60 PJ of gas energy. However, the largest component of the energy (40 PJ) in the BANZ document includes a new source, syngas from wood, to the extent that traditional anaerobic digestion (AD) to biogas may not scale up to a 40 PJ supply. I agree that syngas from wood will certainly be feasible as a commercial source before 2050. I also have six years research experience with that technology, but using cellulosic arable species rather than wood (with the Dept of Chemical and Process Engineering or CAPE at University of Canterbury).

What I will provide here is the pathway to reaching the 60 PJ 2050 target entirely with AD biogas (which is also the preference of the Bioenergy Association). The gas industry view (the Wood Beca Report) cited in the BANZ submission is that 20PJ of biogas could be produced by 2035 from existing sources of organic waste. If syngas from wood is excluded, the 2050 biogas supply is estimated to be 23 PJ, little changed from 2035. I note that about 75% of even that quite low 2050 biogas output will come from agricultural land, so my expertise is highly relevant to accurate policy planning.

While MBIE is presumably focused on energy matters, my insight is that optimal policies to mitigate climate change will be achieved if policies on energy, agriculture, environment and transport are integrated and research based. The CRI research programme operated at this interface and produced knowledge as to why a focus on land use change (LUC) could: 1) improve pastoral farm resilience, while reducing ruminant emissions and damage to waterways; 2) provide a new source primary energy to replace natural (fossil) gas (NG) in the North Island gas network; and 3) offer some renewable transport fuel for vehicles in the more difficult transport categories.

The scale of land use (less optimal grazing/cropping land) required to produce feedstock biomass for AD biogas has been estimated a few times. Some estimates have as the target to replace all NG currently used. This is similar to estimating how many cars NZ will need in 2050 based on the assumption that the number of cars per person will not change. The Wood Beca report calculated the required land area to replace 150 PJ of NG with biogas as 1.7M ha, or 21% of all grazing land. That estimate in not relevant to the 2050 biogas target and is misleading in that it makes the required scale of LUC sound like a real worry in terms of the 'food versus biofuel' global moral issue. Essential gas needs in 2050 will actually be more like 60 PJ (as calculated in the BANZ submission). It also estimates the biogas energy yield per hectare, rather than relying on the actual values for various biomass crop species demonstrated in the CRI research. The actual value is 220,000 ha (2.6% of marginal grazing land) [Trolove, et al, 2013]. This area of land to remove from grazing is easy to identify for other environmental reasons than the need to produce biogas to replace fossil NG.

The BANZ submission provides much detail on what can be achieved by 2030, 2040 and 2050 in the Occasional Paper 24, Gaseous Biofuels and Biofertiliser Route Map to 2050. My view, focused on

agricultural biomass to AD biogas (a fully commercialised technology), is that the scale-up curve can be steeper before 2040 compared to the curve in the BANZ OP24 paper that requires some syngas biofuel (a technology not yet commercialised).

The path scenario in the BANZ submission, modified based on our CRI research, can reasonably aim for a total of 50 PJ agricultural biogas by 2040, half of which can be from purpose-grown biomass crops, assuming the farm district AD facilities are in place when needed. From 2040 another 10PJ AD biogas can be added and with that there can be 100% biogas substitution of essential NG by 2050.

The feasibility of this is based on CRI research findings for biomass yields (tonnes dry mass per ha) for several species and mapping of the extent of 'marginal' arable land (in locations where summers are too often too dry for yields that warrant the expensive inputs for high value arable crops). Research using the recommended species indicated a reasonable average value for biogas productivity (energy yield) is 180 GJ/ha/year. Using this rate, the share of the total 60 PJ for 2050 from purpose-grown plantings (35 PJ) would require the biomass from about 220,000 ha in total. But a significant part of this land will become available for reasons other than land use change for the sake of biofuel production.

One of the worst sources of C emissions in NZ is the cultivation of peat soils, drained for farming. We currently have 168,000 ha of farmed peatlands releasing soil CO2 at rates from 5 to 25 tCO2/ha/yr. Any responsible programme to mitigate climate change will need to include the re-wetting of thousands of ha of such land, so they resume peat formation. Once re-wetted, the best use of some of that land will be for landowners to grow native biomass crops such as raupo and harakeke, using paludiculture (wet agriculture) to grow and harvest biomass. My CRI research has already documented high dry mass yields from raupo. By 2040 this should be implemented on at least 50,000 ha of the current 168,000 ha, for strong climate change mitigation reasons and to enable landowners to put land to economic use.

To calculate the area of pastoral land requiring land use change expressly for growing biogas feedstock crops, the total 220,000 ha can be reduced by the 50,000 for wet agriculture and by another 50,000 ha where biomass species on productive riparian buffers on intensive dairy farms will capture nutrients before they get into the waterway. In addition, there are likely to be at least 100,000 ha where biogas cropping could work, but traditional farming no longer will. It will need to stop for protection of water quality because 1) soils are infertile and new nutrient caps will be too low to get profitable yields; 2) waterways in some areas have excessive nutrients infiltrated into them via livestock 'urine spots' (the Rotorua and the Lake Taupo catchments); and 3) there is too-frequent risk of drought to invest in inputs for arable crops (parts of Hawkes Bay, Wairarapa, and some other regions on both North and South islands, as mapped in the CRI analysis). Other land where pastoral farming will no longer work, but biomass cropping could, includes areas with invasive species (alligator weed in Northland), flood protection zones that don't allow for livestock farming, and the red zones in Canterbury.

These factors collectively offer about 200,000 ha that are suitable for biomass cropping. The total is quite close to the 220,000 ha (2.6% of the 8.5M ha used for grazing) calculated to be needed as feedstocks for 35 PJ of biogas production. It is clear that in the next decade there should/will be 200,000 ha of former grazing land that will need alternative land use. The expensive, slow growing mix of native species typically used on better-drained land is probably not well suited to re-flooded wetlands. The preferred species, to be left for perpetuity, may not be that different than the species proposed for biomass harvesting. Crops for biogas production on a quarter of the re-wetted land will not be 'pushing livestock off the land,' rather it will be offering a viable use of the land for a purpose that has many benefits to the landowner, society and the NZ economy.

I trust that MBIE can see the logic in the BANZ submission case for supportive government action to enable bioenergy technology to achieve the necessary Gas Industry Transition to renewable, low carbon gas supply of essential energy. I think the 2040 target is lower than necessary. I also note that 75% of the intermediate (2035 or 2040) biogas target will be produced using agricultural

feedstocks (of noncontroversial types that do not involve land use change). My expertise is therefore very relevant to assessing biomass cropping methods that could increase biomass production.

My message, based on the results from a decade of bioenergy crops research, is that the additional production of biogas up to the 60 PJ target by 2050 using purpose-grown biomass crops in the NZ context is not 'biofuel displacing food' and is therefore not controversial. The following is an overview of the seven years of research that demonstrated this.

Plant scientists Renquist and Kerckhoffs led a team researching biofuel crops in the CRI, Plant & Food Research. We first made a wide review of dozens of species that may yield high biomass in NZ and have other optimal attributes as feedstocks for AD biogas or for cellulosic feedstocks for liquid fuel or bioenergy [Kerckhoffs and Renquist 2012]. More than a dozen species were studied in replicated MPI-funded field trials in Kerikeri and Hawke's Bay and in smaller trials in several North Island regions. Longer detailed trials were continued with the most promising species. One preference for bioenergy species is that they be perennial, to minimise tillage. This was true for the best species in each category, Miscanthus for syndiesel (funded by MBIE through the University of Canterbury) and Jerusalem artichoke for ensiling as AD feedstock, in the MPI-funded project called the Closed-Loop Nitrogen crop rotation system.

However, rotated crops like those in the novel CLN system needed to include annual species to even out the supply of feedstock and to get the benefits of specialty crops, such as legumes. Forage varieties of species like sorghum proved excellent, despite conventional plantings normally requiring more N fertiliser than desirable for a biomass crop. In a CLN system nutrients are all supplied by the previous crop's digestate and this biofertiliser has special properties that can increase soil organic carbon (SOC) over time. This is also claimed by the Australian soil carbon scheme to occur in response to the right farming practices, touted to 'sequester' carbon in the soil, offsetting ruminant methane emissions (a claim viewed as controversial by soil scientists). If AD biofertiliser proves to be the main means of increasing soil carbon it will be a strong incentive for a greatly scaled-up farm AD industry in NZ, in order to replace the high CO2 emissions from synthetic fertiliser manufacture.

The CRI research did not just cite literature to make 'guesstimates' of how much biogas the different biomass species were able to produce. The CRI values were calculated. Samples were ensiled and shipped to a specialist lab run by a world-leading AD scientist in BOKU, the technical university in Vienna. Results were used with our replicated crop yield data to give real world calculations of how much biogas and energy could be produced (both gross and after typical farming and processing industry energy inputs and losses were subtracted) [calculation by environmental scientist Stephan Heubeck at the CRI NIWA]. Results from Hawke's Bay field trials were then applied using crop models and adjustments in the crop yields for marginal soil/climate sites in all of the cropping regions of NZ [done by CRI soil scientist Stephen Trolove].

The CLN research was published in three of the refereed papers and presented in several other outputs listed in the technical note TNGB32, included in the Agriculture Appendix to the BANZ Route Map to 2050 report.

The CLN project was integrated with my work researching cellulosic feedstock crops for the syngas programme in Chemical and Process Engineering, Canterbury University [Rocky Renquist 2008-2014]. The MBIE funding enabled longer-term field trials of the best species and supported detailed Life Cycle Assessments of Miscanthus, Jerusalem artichoke, and the best-yielding cereal crop, forage Triticale, as well as a Crop Protocol report for each species—containing all aspects of production and their costs. In 2014 alone I delivered 8 confidential reports to the CAPE Department during the final year of the research [see list in the BANZ technical note TNGB32 in the Agriculture Appendix].

This quick overview of my biomass crop research can be supplemented, on request, with the details of the many outputs listed in the Bioenergy Knowledge Centre report named Technical Note Gaseous Biofuels 24. Most are available as pdf, ppt, or doc files.

An important final consideration is for me to explain why my analysis of biomass cropping in NZ has convinced me that such use of marginal grazing land in not controversial. There is a well-known international principle that "energy cannot be produced at the expense of food production." The food versus biofuel issue was first raised in the EU, where it is completely valid. Although arable crop land is limited there, the same crops that were used for food have been used for biofuels (with economic returns being the only driver). But even there, the restrictions on biofuels (such as from woody biomass) are not blanket bans. In North America the argument against using crops for biofuel that would otherwise be exported to feed people is also valid.

But now take a clear look at the NZ situation: 90-95% of the animal protein crops are exported, not to 'feed the world' where people are hungry (the Climate Commission has the data to reject this idea; only 3% goes to countries with high rates of hunger). Those exports, along with many food tech specialty products made here, are sold to "pamper the palates of the prosperous", to quote a previous Parliamentary Commissioner for the Environment, Morgan Williams.

In a future world guided by principles such as embodied in the UN Development Goals, NZ food growers can contribute to the goal that all people (overseas and here in NZ) have access to health-giving food. Rain-fed NZ land is better used for plant-based food to export. The land with less consistent rain during the growing season is still very useful for growing the right biomass species to produce the triple benefits: increased supply of sustainable primary energy, new income opportunity for land owners and lower climate change emissions (all using only 2.6% of grazing land). If a fourth benefit is also desired, enough sustainable low-emissions syndiesel biofuel for the agriculture and forestry sectors could be achieved using an additional 1.3% of grazing land to grow Miscanthus for conversion by pyrolysis (a near-commercial technology).

These multi-sector benefits is why I have made submissions to the Climate Change Commission, MfE, MPI and Waka Kotahi, noting that the LUC I am supporting should be considered in an integrated way.

There is also a somewhat 'outside the box' reason for MBIE, MPI and MfE to develop policies that are supportive of a plan to quickly, or at short notice, launch a NZ bioenergy sector emphasising AD biogas. The reason is that global food technology advances are quite possibly going to badly disrupt the world markets for animal protein. NZ needs to have a Plan B to its reliance on such exports, including making productive use of part of the huge area (8.5M ha) currently used for grazing. Displacing imported energy and domestic fossil fuel production would be a valuable use, along with production of plant-based food to export.