Submission form: Consultation on the Sustainable Biofuels Mandate

Submitter information

MBIE and MoT would appreciate if you would provide some information about yourself. If you choose to provide information in the section below, it will be used to help MBIE and MoT understand how different sectors view the Sustainable Biofuels Mandate proposal. Any information you provide will be stored securely.

Your name, email address, phone number and organisation

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Phone number:	[redacted]
Organisation:	

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How the Sustainable Biofuels Mandate would work

1. Do you support having a GHG emissions reduction mandate?

☒ Yes ☐ Yes, with changes ☐ No ☐ Not sure/No preference

Please explain your views.

My submission is as an individual. My expertise was developed while working as a crop scientist with Plant & Food Research and under contract to the Department of Chemical & Process Engineering at the University of Canterbury.

It is very encouraging to see the NZ government finally making a clear commitment to start replacing fossil fuels in this current decade. Most other Climate Change Commission approaches to decarbonising the NZ economy will be slower than is possible with an ambitious Biofuels Mandate. I fully support the Discussion Document Part 2 position that biofuels have a key role to play in decarbonising transport in NZ.

My submission will provide an informed view and evidence as to why the challenges thought to be holding back the biofuels opportunity in NZ are not as great as you have been advised. Your list of challenges on page 11 of the Discussion Document provide a good framework for my comments.

1. Domestic production is reduced by high overseas demand for feedstocks; and
2. There is a 'Blend wall' limitation.

The first gen biofuels should only be made at the scale of available waste stream feedstocks in NZ, since they do not make a sufficient contribution to % emissions reduction to be scaled up. These include bioethanol from whey and biodiesel from fats and grease. The latter could be used in fossil diesel blends until syn-diesel replaces fossil diesel. If there are insufficient non-transport markets for ethanol it might be used to supply commercial vehicles in specific areas in a city (or by a smaller fuel supply company) if the vehicle engines are altered to use 100% ethanol as in Brazil.

I agree the 'Blend wall' limitation is valid for current biofuels and this reinforces my comments on conventional biofuels, including for heavy vehicles.

Government should signal to major fuel suppliers that they obtain future supplies from NZ producers of syn-fuels, which will be set up to use a larger scale feedstock supply. I believe (like the Bioenergy Association) that bioenergy feedstocks can meet the demand if the signals are given for reliable contracts.

As a crop scientist with years of expertise in non-woody feedstock species for use in NZ, I can state that growing grain to make bioethanol is a bad use of land and so is growing oilseed crops for biodiesel (rapeseed as a break crop cannot be scaled up much and the oil of some cultivars is also a useful food). Land use change to grow cellulosic crops for advanced biofuels instead of these crops would reduce emissions much more effectively (probably in the -100% range compared to fossil fuel). This is based on my Life Cycle Assessment (LCA) Reports on biomass species (discussed under your Questions 2 and 10 and referenced at the end of this submission).

3. Biofuels are not cost competitive with fossil fuels.

The focus in your discussion doc is on current first generation biofuels and scale up. As just noted, that is not a good way to go. The more useful cost analysis would be on advanced drop-in biofuels (see below).

4. Financial and technical barriers to developing drop-in biofuels.

The financial barrier (3x higher cost of biofuels) may be overstated for some processes. The 3x estimate could be for fuel processes that require very large scale, such as Fischer-Tropsch synthetic

diesel and thermal or enzymatic bioethanol. Part of the cost may be feedstock production using purpose-grown energy forests, which can take decades to grow. Large perennial grass species can be harvested from the second year, providing cash flow and quicker CAPEX payback. Waste stream feedstocks are a good starting point and usually lower priced, but are not likely to supply the biofuel feedstock needs at the scale for widespread transport use, or even just for heavy transport.

Other technologies coming on-stream are viable at lower scales and can be more distributed to where the fuel demand is. Nearby feedstock supply is also easier to obtain. For example, synthetic diesel can be made via high temperature pyrolysis at a scale that fits regional NZ needs. The feedstock for pyrolysis can be forest waste, cellulosic perennial grasses or other crops, or urban waste (construction or packaging). Non-woody cellulosic feedstock production is the area of my research expertise (see Question 10 below).

Pyrolysis has advantages for carbon emissions reduction, since it can produce a valuable coproduct along with syn-diesel. This is biochar, which sequesters carbon or has high-value industrial uses of the component graphene. The result is that the syn-diesel price can be similar to current fossil diesel.

5. Lack of certainty and incentives.

This has clearly been the case. Developing incentives should start with a much more up to date investigation of current commercial start-up companies making drop-in biofuel. Some are likely to prove more cost competitive with fossil fuels, therefore needing smaller incentives. But they still need the types of government support that will increase certainty. The current surviving incentives in NZ, such as excise duty exemption for bioethanol should also be investigated and perhaps a sunset date applied if that fuel is to be used in a small niche market that does not need to be subsidised (see item 1).

6. Coordination challenges.

This is a key part of the lack of certainty. Some public/private efforts now operating overseas are also worth investigating as to how the 'chicken and egg' issue was dealt with there.

2. Do you support the proposal to require certifcation of lifecycle emissions of biofuels sold in New Zealand using international standards?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Please explain your views.

Yes. Life Cycle Assessment of the crop species I researched was a key part of my major project on biomass supply for production of synthetic fuels. My reports to the University of Canterbury CAPE engineering department are available, including LCA of growing the best feedstock species (Cradle to Farm Gate). Therefore MBIE will not have to rely on the often less relevant work in North America (as in Appendix 1).

In my input to Question 10 below I offer an overview of my NZ findings on matching feedstock supply to biofuel production at levels in an ambitious Biofuels Mandate.

My LCA findings include the environmental footprint, which is the best guide to how a feedstock species meets the Biofuel Sustainability Criteria for certification. The LCA Reports are referenced at the end of this submission.

I have also provided my views on the first bullet (fuel/food competition) under Question 7 below. This includes a view that there may be one difference in the relevant criteria in NZ, compared to criteria in the EU and USA.

3. Do you support applying the Sustainable Biofuels Mandate to all liquid transport fuel?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Please explain your views.

To all types of transport fuels, not a blend to apply to all fuels sold.

4. Are the proposed initial emission reduction percentages for 2023–2025 appropriate for New Zealand? If not, what should they be?

☐ Yes, I agree ☒ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

I do not advise scaling up conventional biofuels much beyond 2025, but the start-up of some drop-in biofuels could (with a little support) already be coming online from 2025.

5. Do you support having single GHG emissions reduction percentages across all fuel types, or do you favour separate reduction percentages? Why and how many separate percentages would you suggest we have?

☐ Yes, I agree ☒ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

A single percentage seems good, but that should not mean all fuel types are equally supported for NZ. Allowing large scale use of the cheapest biofuel would be a mistake, especially if that is bioethanol—a bad choice for NZ biofuel after 2030. Biofuels for blending should be capped with a lowering cap as other means of getting petrol cars off the road take effect.

6. Do you support provisional emission reduction percentages being set for 2026–2030 and 2031–2035 with the percentages being finalised in 2024 and 2029 respectively?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

Since I prefer to see the focus on drop-in fuels, finalising percentages just before the target periods makes sense for those emerging technologies. The percentages should quickly move towards 100% by the end of this decade.

7. Do you support the proposal that biofuel producers must be certifed against an established sustainability standard to count towards achievement of the emissions reduction percentage?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

I think the conventional biofuels (other than using waste stream feedstocks) are not likely to be up to the necessary sustainability standards. New cellulosic feedstock fuels should meet standards easier.

I don't see a question that asks for input on the important matter of what are rational criteria for setting sustainable feedstock production standards relevant to NZ (rather than just adopting overseas standards verbatim). I have important input on this, having thought about it during a decade of research on feedstock species.

The discussion document provides an outline of likely considerations in these criteria that will go into the setting of NZ standards. I am in agreement with the second and third bullet, but can provide some helpful input on the first bullet on the fuel/food competition issue. The conventional biofuels made from food (grains and beans and cooking oil) are clearly in competition with food supply. Using NZ land for energy feedstocks if currently producing high value human foods is also hard to justify. The views of some of my fellow environmentalists seem based on the very valid arguments made overseas against current biofuels, but the NZ situation is quite different. Pastoral land is used to produce cash-earning protein exports, with the domestic markets fully supplied. Most of the exported protein does not feed malnourished people or go to countries with large hungry populations.

Land use change can have a positive impact in NZ if the production of biofuel feedstocks becomes a viable option for pastoral farmers. It need not reduce cow numbers, but if feedstock crops replaced supplemental feed for cows and reduced cow numbers somewhat it would be a positive effect on carbon (methane) emissions. This is a double win along with fossil fuel substitution.

8. Do you support having a joint fuel industry/government information campaign to inform New Zealanders about biofuels and the Sustainable Biofuels Mandate?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

9. Do you support the labelling proposal that informs consumers about specifc biofuels at the point of sale?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

10. Should New Zealand try to overcome the challenges that domestic biofuel producers face in maintaining access to afordable supplies of domestically produced feedstocks? Do you have any suggestions for how this challenge could be overcome?

☐ Yes, I agree ☒ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

The failure of the Emissions Trading Scheme to bring in sustainable biofuels to date and lack of promise for it to do so in this critical next decade is clearly grounds for an active role by government. My submissions to the CCC strongly favoured active intervention, such as mandates regarding fuel and

vehicle types either encouraged or to be phased out. The visionary 'all electric' future pushed by the big gentailers (out of self-interest) appeals to many of my young environmentalist friends. But a realistic timeline for that transformation is not quick enough and electric is most appropriate for the light fleet during the critical next 15-20 years.

NZ support of biofuel production at a highly subsidised level should not need to be done. The key government support is to bring biomass growers and start-up processors together to overcome the 'chicken or egg' challenge. It would help to have a clear initial focus, as noted in the next paragraph. Among potential syn-diesel technologies, those most able to entice a feedstock supply should be favoured. Long term purchase contracts will also give biomass growers a more stable income than most current agricultural land uses.

Within the drop-in biofuel options the obvious focus for NZ should be on syn-diesel, starting with the heavy vehicle and rail markets. Bioethanol or related fuels should only be promoted for short term use in light vehicles as they are phasing out. So government policy should advise those making processing plant investment to take this into account. Such fuels should be aimed at full drop-in use in modified petrol engines (such as in Brazil), since petrol should be phased out long before the light fleet completes its conversion to electrics.

<u>My input on feedstock production</u>

Production of non-woody biomass for energy is an important part of a Biofuels Mandate discussion, since it determines where fuel production can be located in areas not near current forests. Research with my Plant & Food Research colleagues screened dozens of species and in the end found two superior species.

A NZ variety of Jerusalem artichoke (*Helianthus tuberosus*; called JA in my publications) is best for making ensiled feedstock for biogas production in the way forage maize is used in the EU, but JA is more sustainable (unless maize fertiliser can be recycled, as described in the paper by Trolove et al in my citation list at the end of this submission). JA has very high dry mass yield and can be widely grown in the southern two thirds of NZ. Biogas can be purified for injection into the North Island gas grid or liquefied for transport fuel.

The best species for cellulosic biofuel production is giant miscanthus (*Miscanthus x giganteus*) or Mxg. There is a NZ company that now has considerable experience growing Mxg in diverse regions of NZ. While awaiting development of bioenergy processing plants to use Mxg for biofuel, the company Miscanthus NZ Ltd has identified other valuable agricultural uses. You will likely receive a submission from Peter Brown of Miscanthus NZ with such details, along with information on his overseas collaborators representing a workable syn-diesel technology.

I have never researched a crop species having such impressive attributes as Mxg. The LCA Reports I did on three species indicated that the carbon footprint to grow Mxg is extremely low, much superior to even the best cereal crop species (Triticale) used in bioethanol production. Mxg sequesters a high tonnage of soil organic carbon in its massive root system, enough to offset its entire 20-year production footprint (cradle to farm gate), making it carbon negative to grow.

My research in the area of biomass cropping is extensive and results are contained in many reports during my last 8 years with Plant & Food Research. Most of these were in an MBIE funded project (Contract number of UOCX0804) on biomass gasification by the University of Canterbury. Some are also in science journal publications (see references at end of this submission).

My recent consulting work to the Queenstown Lakes District Council involved a carbon sequestration report with carbon sequestration engineer George Hooper, as part of a larger consulting team enlisted to assist their Climate Action Plan. Carbon sequestration potential was assessed to be very effective using Miscanthus and coppiced tree plantations to produce bioenergy feedstocks on a fairly small area within that challenging terrain and climate. The report should now be available from the Queenstown

Lakes DC. Such carbon sequestration and use of above ground biomass for bioenergy would be even more effective in most of the rest of NZ.

My relevant conclusions have been presented in submissions to the Productivity Commission, Zero Carbon Bill, MfE call on Agricultural Emissions, the Ministry of Transport Green Freight and the Climate Change Commission draft Advice Report.

What I consider my main contribution in those submissions is making the link between the carbon benefits of replacing fossil fuels with biofuels and the C benefits of positive Land Use Change from livestock (or crops to feed cattle) to highly sustainable bioenergy feedstock crop species. This land use option can be an effective incentive for pastoral farmers to grow biofuel feedstock crops, which can reduce ruminant methane—a double win for emissions reduction. This aspect is detailed in the One Big Thing section of my submission on the Draft Advice Report of the CCC.

How could the Sustainable Transport Biofuels Mandate be implemented?

11. Do you think the minimum threshold for compliance of 10 million litres of transport fuel in a calendar year in New Zealand is appropriate? If not, what level would you change it to?

☐ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☒ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

12. Do you agree with the method for calculating a supplier's GHG emission reduction?

☐ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☒ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

13. Do you think the annual reporting regime, including its offences and fines, is practical and appropriate?

☐ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☒ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

14. Do you support the performance of fuel suppliers being published to enable consumers to reward the industry leaders in reducing GHG emissions?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

15. Will the proposed penalties encourage fuel suppliers to achieve the required emission reductions? If not, would level should they be?

☐ Yes, I agree ☒ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

The penalties seem appropriate. However, since I favour drop-in technologies, I think some allowance should be made for those fuel suppliers who commit to buy from wholesale NZ producers of those fuels with the best sustainability credentials. Being newer technologies, producers may take longer than expected to achieve planned volumes of wholesale production.

16. Do you support the proposal for fuel suppliers to defer achieving their emissions reductions for years 1 and/or 2, in full or in part, to the following year?

☒ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

For wholesale fuel producers with new drop-in fuels this should apply for the first 2 years from the time they reach the 10m litre volume.

17. Do you support fuel suppliers banking any surplus emissions reductions in a year and using it to reduce the percentage needed to be achieved the following year?

☐ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☒ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

[insert response here]

18. Do you support fuel suppliers borrowing for shortfalls in emissions reductions in a year, and making the shortfall up the following year?

☐ Yes, I agree ☒ I agree in part ☐ No, I don't agree ☐ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

This might also be helpful for wholesale producers of drop-in biofuels as they bring a new technology online.

19. Do you agree with the proposal to allow trading through the use of entitlement agreements?

☐ Yes, I agree ☐ I agree in part ☐ No, I don't agree ☒ Not sure/no preference

Is there anything you would like to tell us about the reason(s) for your choice?

Sustainable Biofuels Mandate

[insert response here]

RESEARCH EVIDENCE, provided by A R Renquist

The best non-woody biomass species for NZ biofuels:

- Renquist R, Kerckhoffs H. 2012. Biomass gasification crops for the climatic range of New Zealand. *Sustainable Agricultural Reviews* 11: 77-131. Springer Science. DOI 10.1007/978-94-007-5449-2_5.
- Kerckhoffs H, Renquist R. 2013. Biofuels from plant biomass. *Agronomy for Sustainable Development* 33: 1-19. INRA. DOI 10.1007/s13593-012-0114-9.

NZ pastoral/arable/underutilised land better used for biofuels to replace fossil fuels, as quantified by this Plant & Food Research group:

- Trolove, S., Kerckhoffs, L.H.J., Heubeck, S., and Renquist, R. 2013. The potential of anaerobically digested crops to supply New Zealand rural fuel requirements. *Agronomy New Zealand* 43: 95-104.
- Renquist, R., Heubeck, S., Trolove, S. and Kerckhoffs, L.H.J. 2014. Closed-Loop N Cropping System: new land uses to make rural biofuel. *Agronomy New Zealand* 43: 105-120.
- Kerckhoffs, L.H.J., Trolove, S., Shaw, S., Heubeck, S. And Renquist, R. 2014. Methane production from biofuel crops grown in New Zealand. *Agronomy New Zealand* 44: 49-60.

The best two non-woody species for biofuel in NZ (also better than most tree species):

- Renquist, A.R. and L.H.J. Kerckhoffs. 2021. Giant miscanthus (Miscanthus × giganteus) biomass productivity in New Zealand (in preparation).
- Renquist, A.R. and L.H.J. Kerckhoffs. 2021. Jerusalem artichoke (*Helianthus tuberosus*) shoot biomass productivity in New Zealand (in preparation).

Detailed Research Reports on the best biomass species:

NOTE: For biomethane the closed-loop system can grow high yield species with little or no fertiliser input. For cellulosic biomass giant miscanthus is high yielding with very small footprints for nitrogen, water or energy—as demonstrated in Life Cycle Assessment from Cradle to Farm Gate. The Protocol reports for main species provide practical details on requirements to grow each species. (Reports can be obtained from the authors or from Prof Shusheng Pang of the Dept of Chemical and Processing Engineering, Univ of Canterbury).

- Kerckhoffs, L.H.J., Trolove, S., Heubeck, S., and Renquist, R. 2012. Biogas fuel from a closed-loop nitrogen supply cropping system. SLMACC project C11X0901 2009-2012. MPI Technical Paper 2014/10, 84pp.
- Renquist R, Kerckhoffs H. 2013. Jerusalem artichoke and giant miscanthus biomass for gasification. Plant & Food Research Year 5 Report to the BTSL project, University of Canterbury by Bioenergy Cropping Solutions Ltd, Palmerston North, New Zealand.
- Renquist, R. 2014. Life Cycle Assessment of Giant Miscanthus (*Miscanthus × giganteus*): a New Zealand 'Cradle to Farm Gate' assessment of net energy yield, global warming potential and eutrophication impacts of biomass crop production for bioenergy. Report to the University of Canterbury BTSL Project by Bioenergy Cropping Solutions Ltd.
- Renquist, R. 2014. Life Cycle Assessment of Jerusalem artichoke (*Helianthus tuberosus*): a New Zealand 'Cradle to Farm Gate' assessment of net energy yield, global warming potential and eutrophication impacts of biomass crop production for bioenergy. Report to the University of Canterbury BTSL Project by Bioenergy Cropping Solutions Ltd.
- Renquist, R. 2014. Life Cycle Assessment of Triticale (*× Triticosecale*): a New Zealand 'Cradle to Farm Gate' assessment of energy balance, global warming potential and eutrophication impacts of biomass crop production for bioenergy. Report to the University of Canterbury BTSL Project by Bioenergy Cropping Solutions Ltd.

RESEARCH EVIDENCE, provided by A R Renquist (cont.)

- Renquist, R. 2014. Life Cycle Assessment and Synchrony of Supply of Three Biomass Species: Giant Miscanthus (*Miscanthus × giganteus*), Triticale (× *Triticosecale*) and Jerusalem artichoke (*Helianthus tuberosus)***.*** Report to the BTSL Project by Bioenergy Cropping Solutions Ltd.
- Renquist, R, Kerckhoffs, H. 2014. Protocol: growing giant miscanthus (*Miscanthus × giganteus*) biomass for gasification to biofuel. Report to the Biogas to Syngas to Liquids (BTSL) Project, University of Canterbury, by Bioenergy Cropping Solutions Ltd and Massey University.
- Renquist, R, Kerckhoffs, H. 2014. Protocol: growing Jerusalem artichoke (*Helianthus tuberosus)* biomass for gasification to biofuel. Report to the Biogas to Syngas to Liquids (BTSL) Project, University of Canterbury, by Bioenergy Cropping Solutions Ltd and Massey University.
- Renquist, R, Kerckhoffs, H. 2014. Protocol: growing Triticale (× *Triticosecale*) biomass for gasification to biofuel. Report to the Biogas to Syngas to Liquids (BTSL) Project, University of Canterbury, by Bioenergy Cropping Solutions Ltd and Massey University.