MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

COVERSHEET

Minister	Hon Dr Megan Woods	**Portfolio**	Energy and Resources
Title of Cabinet paper	Sustainable Biofuels Mandate: final policy design	**Date to be published**	15 December 2021

List of documents that have been proactively released		
Date	**Title**	**Author**
October 2021	Sustainable Biofuels Mandate: final policy design	Office of the Minister of Energy and Resources
28 October 2021	Sustainable biofuels mandate: final policy design ENV-21-MIN-0058 Minute	Cabinet Office
August 2021	Regulatory Impact Statement: Sustainable biofuels mandate: final policy design	MBIE

Information redacted **YES / NO**

Any information redacted in this document is redacted in accordance with MBIE's policy on Proactive Release and is labelled with the reason for redaction. This may include information that would be redacted if this information was requested under Official Information Act 1982. Where this is the case, the reasons for withholding information are listed below. Where information has been withheld, no public interest has been identified that would outweigh the reasons for withholding it.

Some information has been withheld for the reason of free and frank opinions.

Contents

Coversheet: Sustainable Biofuels Mandate

Advising agencies	*Ministry of Business, Innovation & Employment and Te Manatū Waka (Ministry of Transport)*
Decision sought	*Cabinet's agreement to the final design of a sustainable transport biofuels mandate following public consultation during June and July 2021. Key decisions include the scope of the mandate and the targets.*
Proposing Ministers	*Minister of Energy and Resources and Minister of Transport*

Summary: Problem and Proposed Approach

Problem Definition

What problem or opportunity does this proposal seek to address? Why is Government intervention required?

The transport sector is New Zealand's second biggest source of greenhouse gas (GHG) emissions, contributing 21.1 per cent to total emissions over the 1990-2018 period. Since 1990, transport emissions have increased by 90 percent and within transport, road emissions have more than doubled.

New Zealand has set a legislated target, in the Climate Change Response Act 2002, to transition to a net zero greenhouse gas (GHG) emissions economy (excluding biogenic methane) by 2050. New Zealand also has a climate commitment under the Paris Agreement to reduce GHG emissions by 30 per cent below 2005 levels by 2030.

All demonstrated pathways to achieving our 2050 goal in the Climate Change Commission's advice require a rapid decarbonisation of the transport sector. The New Zealand Emissions Trading Scheme (NZ ETS) is the primary mechanism for pricing emissions, but it is insufficient on its own to drive the changes needed in the transport sector.

Through increasing the use of biofuels as an alternative to fossil fuels, a sustainable transport biofuels mandate seeks to reduce greenhouse gas (GHG) emissions from the transport sector. Biofuels are the only practical option for reducing emissions from the aviation sector, and are a viable option for reducing emissions from other hard-to-abate parts of the transport sector. While the light vehicle fleet transitions to electric vehicles, biofuels can be used in conventional internal conventional engine (ICE) light vehicles in the short to medium term.

Without government intervention, fuel consumers do not have sufficient incentives to use biofuels, as biofuels, particularly advanced biofuels, are more expensive than their fossil fuels equivalent. This is likely to continue due to the very small marginal impact the ETS has on fuel prices.

The Ministry of Business, Innovation and Employment (MBIE) consulted on a proposed sustainable biofuels mandate in July 2021 and received 63 submissions. The submissions generally acknowledged that biofuels will play an important role in decarbonising transport.

A sustainable biofuels mandate could take multiple forms, this Regulatory Impact Statement looks at the key design options of the mandate and the overall impact of the sustainable biofuels mandate. The key design options regarding the mandate are its metric (how it is measured), and whether targets should apply to all transport fuels (one target for all) or separate targets should be developed for the different fuels (petrol, diesel, and jet fuel).

Section A: Summary of preferred option

Summary of Preferred Option or Conclusion (if no preferred option)

How will the agency's preferred approach work to bring about the desired change? Why is this the preferred option? Why is it feasible? Is the preferred approach likely to be reflected in the Cabinet paper?

This includes:

- the scope of the mandate (how it will be measured and what fuels it will apply too),
- the targets, and

The preferred option for the scope of the mandate presented in the Cabinet paper is Option C - A biofuels mandate with an emissions intensity reduction target that applies to all transport fuels, with a separate target for aviation introduced from 2025 onwards.

A single emissions intensity target for transport fuel, excluding aviation, provides the most flexibility for obligated parties to reduce the overall costs of the mandate. This flexibility would make it easier for them to respond to short-term supply disruptions. It would also help them manage any seasonality in biofuel supply and climatic conditions that can restrict where biofuels are used.

The preferred emissions intensity target will start at 1.2 per cent below baseline for petrol, diesel and aviation fuel, progressing to 3.5 per cent below baseline for petrol and diesel by 2025 and provisional targets of 5 per cent and 9 per cent below baseline for 2030 and 2035 respectively. Having to meet more stringent emissions intensity targets over time will incentivise obligated parties to sell more biofuels (with low lifecycle emissions) in place of their fossil fuels equivalent.

The key issue in setting targets is to achieve the right balance in facilitating growth in biofuel supply without introducing significant fuel price shocks of a magnitude that reduce economic activity and wellbeing, fuel supply risks, and sustainability risks (i.e the biofuels used do not achieve credible emissions reductions).

Revising targets up would increase the emissions reductions delivered by the mandate at an additional economic cost while potentially heightening fuel supply and sustainability risks and vice versa.

Because of the critical importance of aviation to New Zealand’s economy and social wellbeing, and the limited options to decarbonise, we propose that there should be a separate mandate for aviation emissions. Without a separate mandate for aviation, it is highly unlikely that any obligated party would choose to supply sustainable aviation fuels due its high relative cost and additional supply chain considerations. A separate target for aviation fuel will be developed over the next year to be introduced from 2025 onwards.

The preferred option will achieve an appropriate balance between significant emissions reduction (0.85% below baseline in 2025) and its impact on the economy (with Real Net National Income modelled to be 0.12% below baseline in 2025). An emissions intensity target would allow us to track New Zealand’s emissions reduction associated with gradually substituting biofuels for fossil fuels.

The emissions intensity targets for 2023-2025 under this preferred option are feasible, taking into account the engine specification requirements and the biofuels supply chain (particularly the rise in advanced drop-in biofuels compatible with existing infrastructure). The level of the 2023-25 targets also mean that the impacts of a biofuels mandate on fuel prices are manageable - Average petrol blend prices and average diesel blend prices could be up to

5 cents/litre (c/L) and up to 10c/L higher[1] than baseline prices of their neat fossil fuels equivalent in 2025.

Section B: Summary Impacts: Benefits and costs

Who are the main expected beneficiaries and what is the nature of the expected benefit?

The primary benefit of a sustainable transport biofuels mandate is that New Zealand will be able to achieve material progress on the path to net zero emissions, thereby contributing to global efforts to address climate change impacts, improving air quality and delivering better health outcomes. The main beneficiaries of emissions reduction are the New Zealand general public.

As a biofuels mandate is a demonstrable government action to address climate change, the New Zealand Government will also enhance its credibility to influence international climate change negotiations.

Businesses that switch to biofuels for their operations in response to the biofuels mandate could use green branding to enhance their market position. A biofuels mandate, which will expand the biofuels market in New Zealand, could also strengthen the market position for domestic biofuels producers and producers of biofuels feedstock (such as the forestry and wood processing sectors). For example, these sectors could build a strong 'story' around how they are sustainably fuelling New Zealand in the future – or helping other sectors to decarbonise.

A biofuels mandate could help build the momentum for developing biofuels production capacity in New Zealand, but it will likely need to be complemented with other interventions to provide sufficient incentives for investments in building significant domestic biofuels production capacity.[2] New Zealand needs to compete with other countries for capital investments, and investors take into account a range of factors in their decisions, such as feedstock costs, other production costs and proximity to markets. Should there be sufficient momentum for domestic biofuels production, primary industries that produce feedstocks for biofuels will benefit.

Where do the costs fall?

Upstream fuel suppliers at the point of obligation (e.g. fuel importers and refineries) will need to invest in fuel infrastructure to store and blend biofuels, change the way they manage their fuel supply chains (with more biofuels that are typically more costly than fossil fuels), and face additional compliance costs associated with the biofuels mandate-related emissions reporting. Downstream fuel retailers (including supermarkets selling fuels) will also need to update their retail outlets to sell biofuel products. The fuel sector is expected to pass on at least some of the costs associated with the implementation of the biofuels mandate to fuel users.

[1] Note this estimate is subject to a high degree of uncertainty, as it will depend on future biofuels prices, the cost of new infrastructure, and the future cost of petrol and diesel.

[2] Stage One Report of MPI's New Zealand Wood Fibre Futures Project indicated it was unlikely that investment in domestic biofuels production would occur without some form of biofuels mandate as well as other Government interventions.

The transport sector (e.g. airlines, freight operators) and businesses using diesel (such as farming, heavy construction and fishing) will face higher fuel costs, as biofuels are more expensive than their fossil fuels equivalent. Transport is a key input for many businesses, and higher fuel costs will therefore raise the costs of many goods and services across the economy. Households using transport fuels in their internal combustion engine (ICE) vehicles will also face higher fuel costs.

The higher fuel costs resulting from the introduction of a biofuels mandate will reduce energy equity. This may have a greater impact on some fuel consumers over others, particularly those who are dependent on private cars (with conventional internal combustion engines) for travel and where there are barriers to considering other options, for example the high up-front cost of EVs or the availability of public transport. Examples of fuel consumers who could be impacted more by higher fuel costs include rural households and low-income households that will likely be slower to switch to EVs.

On the other hand, higher fuel costs would increase the pace at which drivers switch to EVs, hybrids or more efficient internal combustion engines, or it could encourage greater mode shift to active or public transport. In this light, this approach is complementary to other announced emissions reduction transport policies including the Clean Car Discount, and the proposed Clean Car Standard, which will mitigate the impact of higher fuel costs on households over time. Higher fuel costs are likely to fall disproportionately on low-income households, especially those without access to public transport or who are depended on their vehicles for their mobility.

What are the likely risks and unintended impacts? How significant are they and how will they be minimised or mitigated?

New Zealand currently has limited infrastructure for storing and blending biofuels because of the under-developed biofuels market here. To allow for sufficient time for biofuels infrastructure to develop fully, the initial mandated target will start at a relatively low level and progressively increase over time, and there will mechanisms that allow a certain degree of flexibility in meeting the emissions intensity target. For example, in the first two years of implementing the biofuels mandate, fuel suppliers at the point of obligation will be able to apply for a deferral of meeting the emissions target. These fuel suppliers will also be allowed to bank, borrow and trade emissions reduction achieved through biofuels supply.

In the initial years of implementing the biofuels mandate, some fuel suppliers may also face challenges in sourcing biofuels, and officials expect that most of the biofuels will need to be imported from overseas to start with. There are some risks associated with security of biofuels supply, particularly given that the advanced biofuels markets is still under development. The aforementioned flexibility mechanisms will help mitigate these risks.

The fuel cost increase resulting from the biofuels mandate will affect households and businesses. The relatively low mandated target in initial years of implementation will mitigate the risk of fuel prices becoming unaffordable. Officials will monitor the fuel price movements, and will undertake periodic review of the biofuels mandate to monitor the impact on fuel prices.

Higher blends of conventional biofuels could cause engine performance problems, and the quality of biofuels may vary between different producers, as they use different feedstocks and different production methods. Officials will undertake periodic reviews of the biofuels mandate and engine fuel specification regulations in consultation with key stakeholders,

such as the fuel sector and the transport sector. More resources will need to be dedicated to fuel quality monitoring to mitigate this risk.

Some biofuels may come from sources that could cause sustainability concerns, such as biofuels produced from palm oil. Sustainability criteria for biofuels that can count towards the New Zealand biofuels mandate is considered in this paper, and officials propose to undertake further work on this issue to ensure biofuels used to meet the mandate are sustainably sourced and achieve credible emissions reductions, while balancing economic considerations.

Should investors develop biofuel production plants in New Zealand in response to the biofuels mandate, there will be implications for land use and biomass availability in New Zealand. For example, there could be competition for forest residues between solid wood fuels (used for process heat) and liquid biofuels (used for transport), and more intense competition for agricultural land. There could also be competition for other organic waste, which could have implications for composting businesses in New Zealand.

The risks associated with resource allocation can be mitigated through both the international framework for biofuels' sustainability certification and domestic resource management policy framework. It is expected that domestically produced biofuels would meet sustainability criteria[3] under the mandate if they were to be counted towards New Zealand's biofuels mandate. Domestically, local government is expected to consider the land use implications when considering resource consents, while central government will keep an oversight of the overall resource management framework, waste management framework and bio-economy development.

Section C: Evidence certainty and quality assurance

Agency rating of evidence certainty?

The modelling results on the potential impacts of the sustainable biofuels mandate are dependent on assumptions on a range of matters, such as technological developments, carbon prices, biofuels prices, fossil fuel prices, future transport decarbonisation actions, and structure of the New Zealand economy.

The CGE modelling work to understand potential impacts is good for assessing the direction of the impacts for the different policy options. However due to the large amount of assumptions we have had to make, quantifying the impacts is subject to a high degree of uncertainty and can create misleading perceptions on the magnitude of the impacts.

There are uncertainties in all these matters. For example, biofuels prices could be lower than assumed because of new technological breakthroughs in the future. Sensitivity analysis indicates that if the assumed long-term crude oil price is changed from around $50-60 per barrel to around $80 per barrel, with no corresponding movement in biofuels prices, the impact of the preferred policy option (uniform emissions intensity target for all transport fuels) on real GDP could reduce by 45 per cent in the period to 2035.

Other green technologies and EV uptake could move faster than assumed. The structure of the New Zealand economy could be different from the model assumption that there will be no major structural change in the New Zealand economy between now and 2035. It is also

[3] Details of the sustainability criteria will be specified in regulations, and the draft regulations are being developed.

difficult to anticipate whether new sizeable low-emissions industries, including a significant domestic biofuels industry, could emerge in New Zealand in the period to 2035. If there was a sizable domestic biofuel industry the economic cost impact of the mandate would be reduced.

To be completed by quality assurers:

Quality Assurance Reviewing Agency:
Ministry of Business, Innovation and Employment Regulatory Impact Analysis Review Panel
Quality Assurance Assessment:
MBIE's Regulatory Impact Analysis Review Panel has reviewed the attached Impact Statement prepared by MBIE. The Panel considers that the Impact Statement meets the criteria necessary for Ministers to make informed decisions on the proposals in this paper.
Reviewer Comments and Recommendations:

Impact Statement: supplementary analysis for in-principle agreement to a biofuels mandate

Part 1: Current state and problem definition

Section 1: General information

1.1 Purpose

The Ministry of Business, Innovation and Employment (MBIE) and the Te Manatū Waka are responsible for the analysis and advice set out in this document, except as otherwise explicitly indicated.

This document has two parts. It sets out:

- The current state and problem definition (**Part 1**).
- Analysis and advice for the purpose of informing Cabinet decisions on the key policy design features; the scope of the mandate and the targets (**Part 2)**.

A supplementary analysis was provided to Cabinet in April. This provided a high-level assessment of the biofuels mandates against a broad range of options for increasing the demand for and supply of biofuels in New Zealand transport. Cabinet agreed in principle to the implementation of a biofuels mandate. The assessment of the merits of a biofuels mandate, against other options, has not been repeated in this paper. It can be found here: https://www.mbie.govt.nz/dmsdocument/15620-sustainable-transport-biofuels-mandate-supplementary-analysis-report-and-regulatory-impact-statement-proactiverelease-pdf

Further analysis of options for public consultation was provided in Part 3 of this Regulatory Impact Statement. The following analysis builds on this, incorporating stakeholder feedback, further evidence and modelling results.

1.2 Key Limitations or Constraints on Analysis

The Prime Minister announced Cabinet's in-principle decision to implement a biofuels mandate in January. The Minister of Energy and Resources and the Minister of Transport reported to Cabinet in April 2021 with draft proposals, and public consultation was delayed until June to July 2021. There has been relatively limited time for detailed analysis of all parts of the sustainable biofuels mandate and its alternatives. Therefore, our quantitative analysis of the potential impacts of biofuels policy options, focuses primarily on the specific options for a biofuels mandate.

As mentioned in section C, there is uncertainty in the future outlook of biofuels and more widely transport energy technologies. Therefore, assumptions on biofuels markets were made when modelling the potential impacts of a biofuels mandate. For example, it is assumed that the domestic production of biofuels is expected to be very limited in the short term and will need to rely on biofuel imports. Future developments, such as

technological breakthroughs and policy developments, could deviate from those assumptions.

Furthermore, as the emissions reduction plan is yet to be finalised, there is some uncertainty in the modelling assumptions for the transport emissions baseline.

1.3 Responsible Manager (signature and date):

Osmond Borthwick

Acting Manager Energy Markets Policy

11/10/2021

Section 2: Problem definition and objectives

2.1 What is the current state within which action is proposed?

The transport sector is New Zealand's second biggest source of greenhouse gas (GHG) emissions, contributing 21.1 per cent to total emissions over the 1990-2018 period. Since 1990, transport emissions have increased by 90 percent and within transport, road emissions have more than doubled.

Around two-thirds of domestic transport emissions come from cars, SUVs, utes and vans. Heavy road vehicles are responsible for around a quarter of domestic transport emissions, aviation 7 percent, and shipping and rail 2 per cent.

It is important to decarbonise the transport sector in order to meet New Zealand's goal under the Climate Change Response Act 2002 to transition to a net zero GHG emissions (excluding biogenic methane) by 2050, and New Zealand's commitment under the Paris Agreement to reduce GHG emissions by 30 per cent below 2005 levels by 2030.

All demonstrated pathways to achieving our 2050 goal in the Climate Change Commission's advice require a rapid decarbonisation of the transport sector. The New Zealand Emissions Trading Scheme (NZ ETS) is the primary mechanism for pricing emissions, but it is insufficient on its own to drive the changes needed in the transport sector.

Opportunities to decarbonise transport modes

To understand the costs associated with different options to decarbonise transport, we looked at their estimated marginal abatement costs (MAC). The MAC is a measure of the abatement potential of greenhouse gas mitigation measures and the relative costs associated with each of these measures. A marginal abatement cost curve (MACC) is a graph that visualises the MAC of mitigation measures to assist in comparing the cost-effectiveness of abatement options in a consistent way. Although they are not a complete measure, they can inform decisions about cost-effective transition pathways to a low-emissions economy.

The Ministry for the Environment prepared a marginal abatement cost curve (MACC) analysis for New Zealand. The assessment is subject to several assumptions and estimations, but presents a picture of the relative costs of GHG mitigation options.[4]

Light vehicles

[4] Ministry for the Environment. 2020. Marginal Abatement Cost Curves Analysis for New Zealand: Potential Greenhouse Gas Mitigation Options and Their Costs.

The impacts were evaluated from a national economic perspective, which means it does not take into account who bears the costs of the options. Further, the report only looked at the technical potential of emissions abatement options i.e. it did not evaluate non-cost barriers to the take-up of options such as infrastructure constraints and supply constraints, or the realisable potential of the policy option. We have looked at non-cost barriers further on in this report. Overall, the report's authors note that this analysis has required assumptions to be made, but consider it to be "a reasonable basis for evaluating the relative costs of the different abatement options, and the likely first-order estimates of the scale and cost of such options".

This analysis is also sensitive to the oil price and the cost of batteries, which is expected to decline over time as electric vehicles achieve scale.

EVs are the most significant opportunity to decarbonise light vehicles. A 2019 analysis of marginal abatement costs for GHG mitigation options indicated that switching to EVs for light and medium road vehicles (new vehicles entering the fleet) will deliver net public savings on a lifecycle basis.

However, EV purchase price parity with conventional vehicles is unlikely to occur until the late 2020s. While there are other interventions to increase the electric vehicle proportion of the fleet, there are still many internal combustion engine (ICE) vehicles entering and remaining in the fleet. Every ICE vehicle that enters the fleet today will, without further action, be driven until it is, on average, 20 years old. For new ICE vehicles purchased in 2020, it will not be until 2040 that many of them will be replaced with EVs.

Therefore, increasing the share of renewable fuels used presents an opportunity to decarbonise light ICE vehicles already in the fleet or that will enter the fleet in the next decade or so. Biofuels could play a key role in the decarbonisation of transport by acting as a transition fuel, lowering emissions from ICE vehicles until they are gradually replaced with EVs. Biofuels, being more costly than fossil fuels, will also increase the incentive for motorists to switch to EVs in order to reduce their per km costs.

Heavy vehicles

Heavy vehicles, the majority of which are freight vehicles, are responsible for almost a quarter of New Zealand's transport GHG emissions. Nearly all trucks in New Zealand use diesel. Future alternative green fuels for heavy vehicles include electricity, green hydrogen and biofuels.

However, currently battery electric and hydrogen heavy trucks are still only being produced as demonstration models. A 2020 working paper by the Te Manatū Waka examining green fuels for freight noted that the upfront cost of electric trucks (including both battery electric vehicles, and fuel cell electric vehicles using hydrogen gas) is a significant barrier for freight operators to transition their fleets and will remain so in the near future. Significant investments in infrastructure for recharging or refuelling such trucks will also be needed. The upfront cost of low and zero-emissions heavy vehicles is likely to remain a significant barrier for the next five years, and many will not achieve price parity with diesel vehicles until after that.[5]

Setting aside the practical barriers to hydrogen and battery electric heavy trucks, an analysis of the marginal abatement costs for trucks by the Ministry for the Environment concluded that it is lowest for electric vehicles when the charging frequency is overnight.[6] However, when the charging frequency is more or less frequent than overnight, biofuels are estimated to have the lowest marginal abatement cost.

Table 1 - estimated marginal abatement costs for fuel-switching for heavy trucks

Recharging frequency	Once a fortnight	Once a week	Once every two days	All overnight	50% top-up during day	Full top-up during day	Full top-up twice a day

[3] Te Manatū Waka, Green Freight Strategic Working Paper, 2020

[6] Analysing the impact of different recharging periods is important for battery electric vehicles because it represents the optimal battery size taking into account charging frequency and electricity supply costs, which vary throughout the day.

Biofuel $/tCO$_2$e	$189	$189	$189	$189	$189	$189	$189
Bat. Elec $/tCO$_2$e	$859	$477	$192	-$41	$109	$190	$248
Hydrogen $/tCO$_2$e	$525	$450	$425	$456	$451	$449	$446

By comparison, the Climate Change Commission's draft supporting evidence for consultation referred to a cost of emissions reduction of $400/tCO$_2$e of synthetic renewable fuels[7].

Biofuel blends (i.e. biofuels blended with their fossil fuels equivalent) can be used in conventional ICE heavy vehicles, and major truck manufacturing companies like Scania, are now producing truck engines capable of running entirely on biofuels.

Aviation, marine and rail

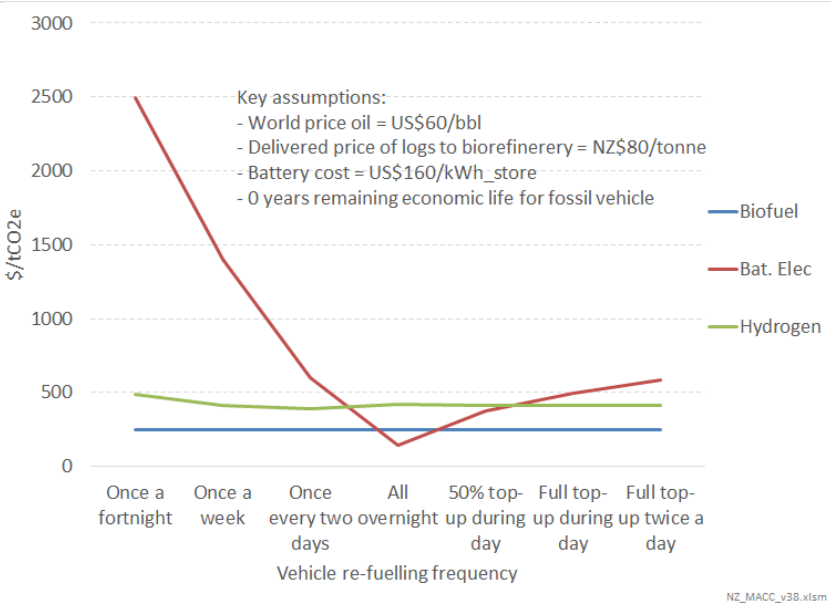
Biofuel blends can also be used in aviation, marine transport and rail. Air New Zealand has identified sustainable aviation fuel (the type of biofuels designed specifically for aviation) as the main green fuel for decarbonising aviation, as electricity and hydrogen are not suitable for long-haul flights.

For shipping, there are more green alternatives, including biofuels (renewable diesel, biodiesel or liquefied biogas), methanol, liquefied natural gas (LNG) and hydrogen. From a technology perspective, renewable diesel is more suitable for shipping than biodiesel, as biodiesel is known to have technical issues for marine use. For example, bacteria and mould may grow if condensed water accumulates in biodiesel fuel. Microbial growth will lead to excessive formation of sludge, clogged filters and piping over time.

An analysis of the marginal abatement costs for hydrogen, battery electric and biofuels for marine transport showed that, similar to heavy trucks, increasing the use of biofuels is the most cost-effective alternative fuel for reducing emissions, except for a scenario where battery electric vehicles are charged overnight. There was no relevant data for methanol or LNG.

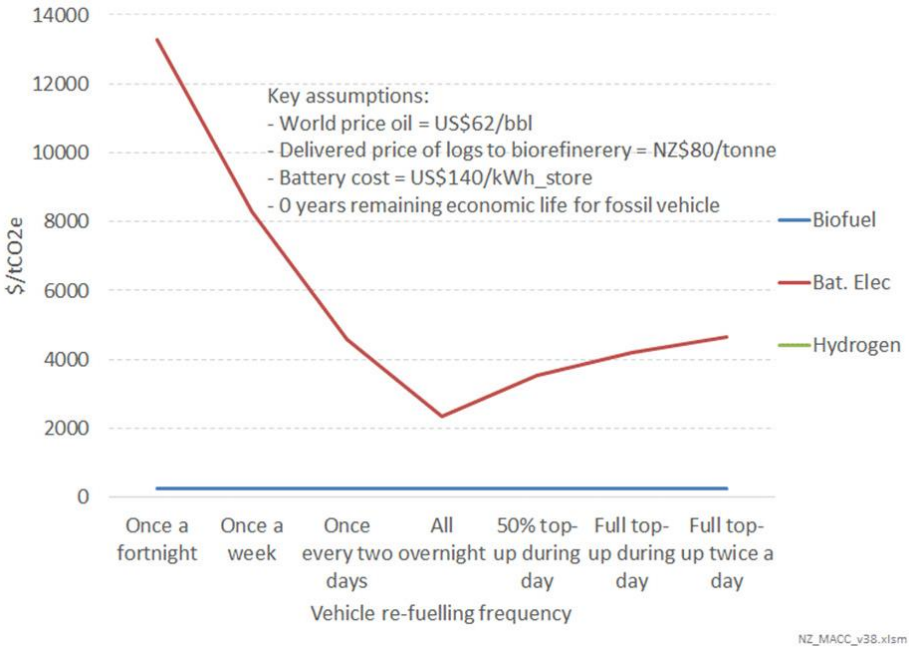
The marginal abatement costs for alternative marine fuels are compared in the figure below.

[7] Climate Change Commission, Draft Supporting Evidence for Consultation – Chapter 4b: Reducing emissions – opportunities and challenges across sectors – *Transport, buildings and urban form*



Source: MfE (2020)[8]

Similarly, the following figure shows that biofuels are the most cost-effective alternative fuel for reducing emissions in aviation compared to battery electric vehicles.



Source: MfE (2020)[9]

For rail, electrification is assessed as being the most cost-effective option (it has a negative marginal abatement cost, which means that it has a net benefit even without taking into account the benefits of carbon emissions reductions).

[8] MfE, *Marginal abatement cost curves analysis for New Zealand: Potential greenhouse gas mitigation options and their costs,* January 2020. https://www.mfe.govt.nz/publications/climate-change/marginal-abatement-cost-curves-analysis-new-zealand-potential-greenhouse

[9] Ibid.

Note that this analysis represents the lowest-cost way to reduce emissions from fossil fuels; it may still have a significant price premium above fossil fuels.

Difference between conventional biofuels and advanced biofuels in terms of production method and emission savings

Biofuels are derived from natural sources such as plants, animal wastes, forest residues, and other organic material. In broad terms, they can be classified as conventional or advanced biofuels. Conventional biofuels, such as bioethanol and biodiesel (fatty acid methyl ester), are produced through technologies that are already available at commercial scale. Most bioethanol is produced from agricultural crops, while most biodiesel is produced from vegetable oils and waste oils. As conventional biofuels have different chemical properties from fossil fuels, they can cause engine problems over time and are therefore subject to blend limits.

The blend limits for conventional biofuels are low: 10 per cent for bioethanol, 5-7 per cent for biodiesel for road transport use in most countries. In marine transport, due to poor performance in cold waters, limits of up to 7 per cent are applied to biodiesel. Biodiesel is not suitable for aviation because it does not fulfil the key jet fuel requirements such as stringent cold flow viscosity and high energy density specifications.

In contrast, advanced (drop-in) biofuels, such as renewable diesel, can be blended with fossil fuels in much higher proportions or even used in neat form, and are compatible with existing fuel infrastructure, as they have similar chemical properties to fossil fuels. Nevertheless, blending limits can be applied to advanced biofuels to ensure that the final fuels comply with fuel standard specifications in a particular jurisdiction. In aviation, limits of up to 10% or up to 50% of drop-in fuels are applied depending on the conversion pathway.

Advanced biofuels can be produced through a number of conversion technologies, such as hydro-treatment (reacting feedstocks with hydrogen), biochemical processes and thermal conversion. Their feedstock ranges from tallow and forest residues to other organic waste.

Different types of biofuels have different lifecycle emissions, depending on the source of their feedstock and the production method. Many but not all biofuels have lower lifecycle emissions than fossil fuels. Due to the land-use change impact, biofuels produced from vegetables oils have relatively high lifecycle emissions, and in some cases, higher emissions than from fossil fuels. On average, biodiesel from soybean oil can increase lifecycle emissions by 57 per cent, and biodiesel from palm oil by 104 per cent on an energy content basis (gCO_2-e/MJ fuel).[10]

Compared to conventional biofuels, advanced biofuels from forestry residues and energy crops emissions have much lower lifecycle emissions. Furthermore, as blended fuels, advanced biofuels can generate greater emissions savings because they can be blended with fossil fuels in much higher concentrations. Emissions savings are in the range of 21-

[10] Sapere report

50 per cent for a final fuel containing 50% drop-in fuel, depending on the feedstock and conversion pathway. [11]

On the other hand, due to the blending limits, conventional biofuels have relatively low emissions reduction potential, even if they are produced from sustainable feedstock. For example, a seven per cent biodiesel blend containing biodiesel produced from waste oils can achieve emissions savings of roughly 3-6 per cent, while a 10 per cent bioethanol blend (E10) can achieve emissions savings of roughly 1-6 per cent. [12]

Current biofuels supply in New Zealand is very limited

Bioethanol and biodiesel are currently the most common biofuels. Bioethanol is typically blended with petrol for use in light ICE vehicles, while biodiesel is typically blended with mineral-based diesel for use in heavy ICE vehicles. Biodiesel blends can also be used in ships but are not commonly used, as most ships, particularly large ones, use heavy fuel oil, which is much cheaper than mineral-based diesel, as well as biodiesel blends.

Biofuels constitutes less than 0.1 percent of New Zealand's total liquid fuel sales, compared with about 4 percent globally or even higher in some countries with ambitious renewable fuels targets.

At present, most of the bioethanol in the New Zealand market is imported from Australia, while only a very small amount of bioethanol (0.13 PJ in 2019) is produced domestically primarily from whey (a dairy by-product). Globally, the US and Brazil are the biggest bioethanol exporting countries, but New Zealand has not traditionally imported from those countries.

Similarly, only a very small amount of biodiesel is produced in New Zealand, using tallow, rapeseed oil and used cooking oil as feedstock.[13] Some tallow-based biodiesel is also imported from Australia.

Future biofuels demand and new investments are shifting towards renewable diesel

Over the next decade, biodiesel production in OECD countries is expected to fall, as OECD countries shift toward advanced biofuels, driven by the need to overcome blending limits and sustainability concerns gradually. On the other hand, biodiesel production in non-OECD countries, such as Argentina, is expected to increase driven by supportive policies.

Based on current technological developments and direction of policy support in other countries, it is expected that the global production and uptake of advanced drop-in biofuels will start to expand and potentially overtake that of conventional biofuels from 2025. Most of the new investments in biofuels production capacity are directed towards renewable diesel, a type of advanced drop-in biofuel.

[11] Ibid

[12] Ibid

[13] Fulton Hogan

New Zealand could have potential to develop significant domestic biofuels production capacity in the future but this depends on capital investments and government interventions

New Zealand currently does not produce any advanced drop-in biofuels. However, Sapere estimated that 9.2 PJ of advanced drop-in biofuels (270 million litres), which is equivalent to 7 per cent of New Zealand's total energy demand from petrol light vehicles, diesel heavy vehicles, marine vessels and aviation, could potentially be produced in New Zealand by 2030, using local tallow and forest biomass as feedstock. This estimate is an upper boundary estimate based on low-carbon-fuel demand potential, potential feedstock supply and Sapere's judgement on technology pathways. To reach this local production level over time, significant capital investments in the order of tens to hundreds of millions of dollars per annum between now and 2035.[14]

Due to increasing pressure to reduce emissions and move away from fossil fuels, there is growing interest in domestic biofuel production by potential feedstock suppliers (e.g. the forestry and wood processing sector, the waste management sector, technology providers, end-users. However, the findings of the Ministry for Primary Industries' (MPI) New Zealand Wood Fibre Futures Project indicate that large-scale domestic biofuels production capacity is not expected to developed in the absence of some form of biofuels mandate to provide certainty of demand, and other government interventions to improve the feasibility.

Systems thinking about resource allocation (particularly in relation to land use, skills, and feedstock availability and collection) will also be required to ensure that resource allocation across the economy functions effectively.

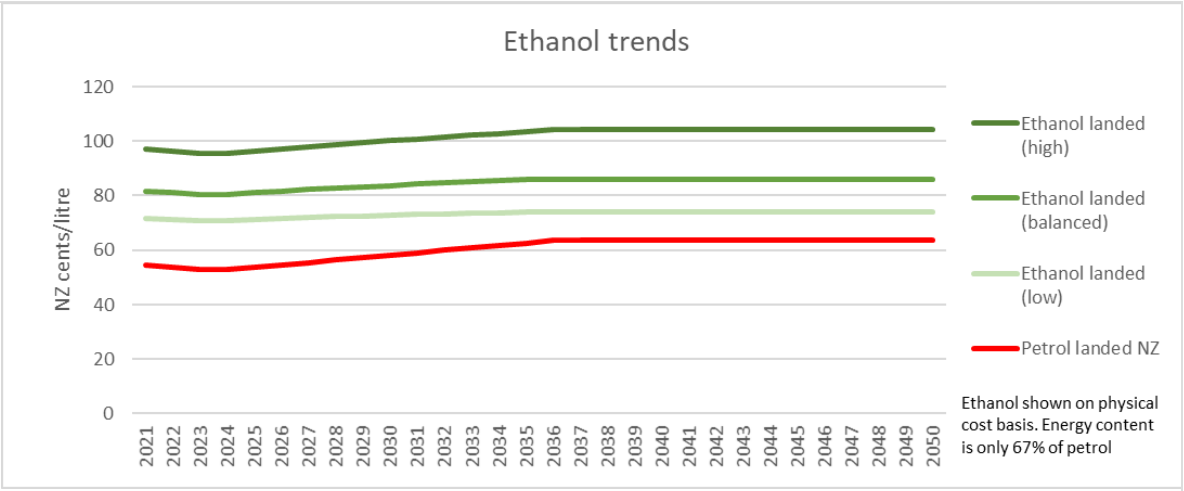
If a sizeable biofuels industry is developed in New Zealand, it could have significant positive impacts on regional development, primary industries that are able to produce the feedstock for biofuels (e.g. wood residues from the wood processing sector), and possible exports (assuming that New Zealand's biofuels produces are internationally competitive).

Biofuels prices are and will remain higher than fossil fuels

While biofuels can result in emissions savings and some of them are compatible with existing fuel infrastructure, they have not replaced fossil fuels mainly because biofuels, particularly those from sustainable sources, are not cost competitive with fossil fuels. There are multiple factors driving up the biofuels prices, such as limited feedstock supply resulting in high feedstock costs, lack of economies of scale, financial barriers and technical barriers.

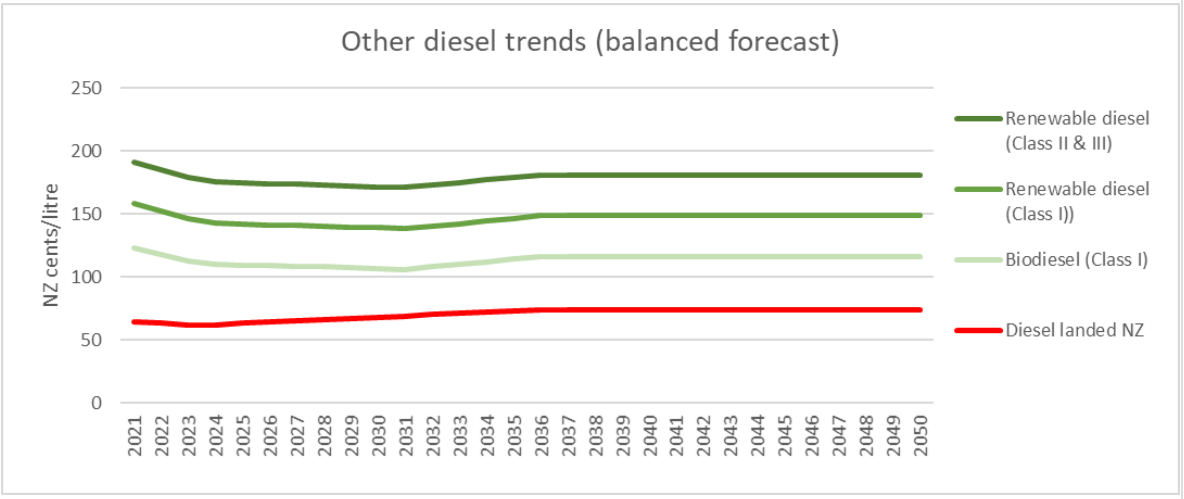
Bioethanol is the cheapest type of biofuels and has a well-established international market, but it is still expected to cost more than petrol over the long term. The bioethanol price trend is shown in the graph below.

[14] Sapere (2021), *Biofuel Insights: An independent report prepared for EECA*.



Source: Hale and Twomey (2021)[15]

Renewable diesel is currently trading at nearly three times the cost of fossil fuel diesel and a reasonable premium is expected to remain over this decade because of high demand in countries where there are existing biofuels mandates or governments provide other policy incentives. Conventional biodiesel is less expensive than renewable diesel but is and will remain more expensive than mineral-based diesel. The price trends of renewable diesel, conventional biodiesel and mineral-based diesel are compared in the graph below.



Source: Hale and Twomey (2021)[16]

Sustainable aviation fuel is even more expensive than renewable diesel because planes have stricter fuel energy and performance requirements.

Note that the price trends illustrated above represent estimates of the prices of globally traded commodities, rather than bottom-up estimates of fuel production costs. It is expected that global demand for biofuels, driven by emission reduction policies, will generally exceed available supply, and the fuels will generally trade at some multiple of relevant fossil fuels for the foreseeable future.

Overseas policy developments

[15] Hale and Twomey, *Biofuels price forecast*, 22 January 2021.

[16] Hale and Twomey, *Biofuels price forecast*, 22 January 2021.

Globally, 68 countries have enacted biofuels mandates, at the national or subnational level to address the challenges limiting biofuel uptake. Most of these mandates require a certain proportion of fuel sales to be biofuels, or require a biofuels to be blended with their fossil fuels equivalent at a certain percentage. For example, in Queensland, 4 per cent of the total volume of regular unleaded petrol sales and ethanol-blended fuel sales by liable fuel retailers must be ethanol.

Some of the advanced economies not only have biofuels mandate based on fuel sales volumetric targets or biofuel blend targets, but also clean/renewable fuel standards based on the carbon intensity of transport fuels (which is based on the lifecycle emissions of fuels). For example, California's Low Carbon Fuel Standard requires a 20 per cent reduction in carbon intensity of transport fuels by 2030.

2.2 What regulatory system(s) are already in place?

New Zealand has set a legislated target, in the Climate Change Response Act 2002, to transition to a net zero greenhouse gas (GHG) emissions economy (excluding biogenic methane) by 2050. In May 2022, the Government will publish its final Emissions Reduction Plan to put New Zealand on track to meeting this target and the five-year emissions budgets. New Zealand also has a climate commitment under the Paris Agreement to reduce GHG emissions by 30 per cent below 2005 levels by 2030.

In 2008, the Government introduced a biofuels sales obligation, with an aim to incentivise the use and domestic production of biofuels. Had this obligation been implemented, it would have required suppliers of petrol or diesel in New Zealand to also supply a minimum proportion of biofuels. The biofuel proportion was initially 0.5 percent of a liable supplier's petrol and diesel sales, rising to 2.5 percent over four years. However, it was repealed shortly after the General Election in 2008 before it was to come into effect. Between 2009 and 2012, the Government implemented a biodiesel grants scheme, which was discontinued when the Government at the time shifted its focus from subsidising conventional biofuels to investing in research and development of advanced ones.

Since then, the main policy incentives for biofuels remaining in New Zealand have been the New Zealand Emissions Trading Scheme (NZ ETS), a short-lived grant programme for biofuel production in New Zealand, the excise tax exemption for bioethanol and some R&D support to research institutions, such as Scion.

The NZ ETS zero-rates the biofuel component of transport fuels, but the current carbon price translates to only around 10 cents per litre for diesel and 9 cents per litre for petrol.[17] The carbon price under the NZ ETS is just below $40 per tonne of CO2-e, while the Climate Change Commission's modelling indicates that "meeting the 2050 [emissions reduction] target will involve marginal abatement costs higher than these NZ ETS auction price control settings, at around $140 in 2030". Nevertheless, the NZ ETS will continue to evolve over time and the ETS carbon price could potentially rise to a much higher level in light of international and domestic climate change developments, including the carbon budgets that are to be set later this year.

[17] MBIE Weekly Fuel Price Monitoring (https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-statistics-and-modelling/energy-statistics/weekly-fuel-price-monitoring/)

The petrol excise duty is 70.024 cents per litre, while bioethanol is exempt from excise duty. The bioethanol excise tax exemption was introduced in the 1980s mainly for managing the risks associated with oil dependence. Biodiesel and other biofuels do not have the same tax advantage.[18]

In combination, the price signals from the NZ ETS (the carbon price as well as zero-rating of the biofuel component) and the excise tax exemption for bioethanol has to date been insufficient to incentivise higher sales of petrol-ethanol blends.

As biofuels prices are and will likely remain higher than their fossil fuels equivalent, the private sector does not have the incentive to switch from fossil fuels to biofuels in the absence of further government intervention. This is evidenced by the low uptake of biofuels in New Zealand, Z Energy's mothballing of its Wiri biodiesel plant, and Gull's recent decision to withdraw from supplying biodiesel blend to New Zealand.

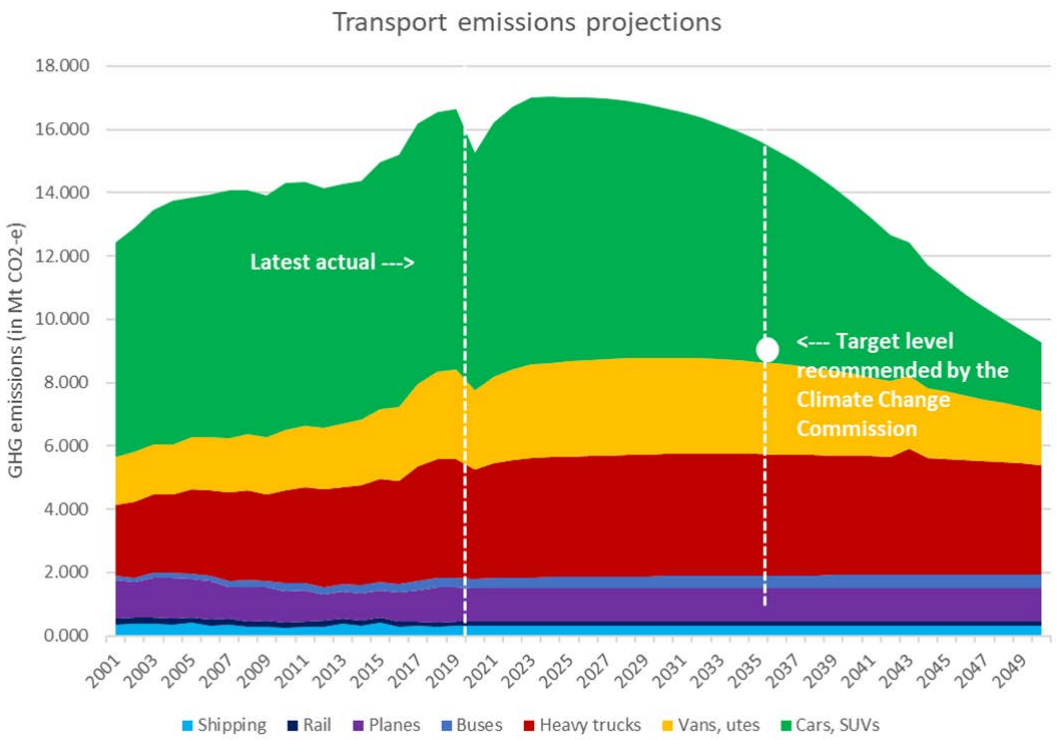
In parallel with the development of the biofuels mandate proposal, to which this Regulatory Impact Statement relates, Te Uru Rākau has been undertaking an initiative called New Zealand Wood Fibre Futures, which is looking into the business case for producing biofuels and biocrude oil (among other products) from woody biomass in New Zealand.

There are also maximum biofuel blend levels under the Engine Fuel Specifications Regulations. Those limits were set based on a range of criteria, such as technical and commercial viability, environmental outcomes and consumer protection. The bioethanol blend limit in petrol is 10% by volume, while the biodiesel limit in diesel is 7% by volume.

2.3 What is the policy problem or opportunity?

Decarbonising transport is key to New Zealand being able to achieve net zero CO_2 emissions and future carbon budgets. With the Te Manatū Waka's base case projection, transport emissions are expected to continue to increase until around 2026. Emissions are then projected to plateau before slowly declining around 2032. This projection assumes the rate of uptake of electric vehicles (EVs) will speed up once EVs achieve price parity with conventional vehicles. The emission trends for transport are shown in the graph below.

[18] Diesel is not subject to excise tax but diesel vehicles pay broadly comparable road user charges (RUC). There is a RUC exemption for BEVs but no comparable RUC exemption for biodiesel vehicles (because there is no simple way to administer it).



Source: Te Manatū Waka (2021)

Electrification of the light fleet will not happen fast enough and little decline in emissions is expected in the other areas of transport

It is clear from this projection that EVs and the future possibility of hydrogen will not transition transport fast enough to help meet our 2030 and 2050 emission targets. Our first commitment is to reduce emissions to 30 percent below 2005 levels for the period 2021–2030. To contribute to this target, road transport emissions would have to be lower than they were in 2005 in each year of the period 2021–2030. In 2030 transport emissions are expected to be over 20 percent higher than in 2005.

As well, with existing policies emissions from heavy trucks can be expected to remain above 2005 levels even by 2050. Levels from aviation, ships and rail are not expected to decline significantly between now and 2050.

A stronger and fuller set of measures are needed to effect rapid cuts in transport emissions to the level recommended by the Climate Change Commission. The magnitude of their recommended decline is marked on the graph.

If New Zealand's government policy settings remain unchanged, New Zealand will fall short of its 2050 net zero GHG emissions (excluding methane) target and will not be able to contribute its fair share to the global efforts to limit global warming to 1.5°C above pre-industrial levels. If global warming is not contained, New Zealand, as well as other countries, will be exposed to higher climate risks, such as drought, flooding, forest fires and storms. More discussion on the climate change impacts and risks can be found in the joint report published by the Ministry for the Environment (MfE) and Statistics New Zealand, *Our atmosphere and climate 2020,* which is available at https://www.mfe.govt.nz/sites/default/files/media/Environmental%20reporting/our-atmosphere-and-climate%202020.pdf.

The analysis of marginal abatement costs shows that biofuels provide a valuable opportunity to decarbonise:

- The existing ICE transport fleet, which is likely to remain in use for a long time
- Areas of transport where the current upfront cost of battery electric vehicles is a barrier to their uptake

As discussed section 2.1, biofuels from sustainable sources, particularly advanced biofuels can achieve significant emissions savings relative to fossil fuels.

However, there are a number of challenges that limit the production and use of biofuels in New Zealand. The key ones are that:

- **Biofuels are not cost-competitive with their fossil fuel equivalents.** This is particularly so for advanced biofuels (such as renewable diesel and sustainable aviation fuel). In New Zealand, existing policy measures, such as carbon pricing under the ETS, are not sufficient to close the price gap between biofuels and fossil fuels. There is therefore no economic incentive for fuel users to switch to biofuels.
- **There is past uncertainty in biofuels policy.** The removal of the Biofuels Sales Obligation in 2008 and the Biodiesel Grants scheme has made the market wary of biofuels. This is of particular concern to the ability of the forestry and biofuel sectors to pursue the commercial opportunity of turning woody biomass into liquid biofuels.
- **Biofuels production faces significant co-ordination challenges.** Feedstock producers are unlikely to commit to growing a crop for a biofuel producer without a guaranteed market, while a producer would not build a conversion plant without guaranteed supply of a sustainable feedstock. Nor would producers invest without more certain demand from customers. Also, producers would ideally like to have certainty in the pricing of feedstocks for biofuels for an extended period to ensure good returns on capital investments, but such certainty is unlikely to exist.
- **Global competition for sustainable feedstocks has led to high prices.** Most biofuels today use feedstocks grown on land that can otherwise be used for food, feed or material production. An increase in biofuel consumption can lead to cropland expansion through land-use changes, which could have flow-on impacts on food security, biodiversity and emissions. To combat this, advanced countries with biofuels mandates usually specify sustainability criteria for biofuels to ensure that the biofuels they use come from sustainable sources. These criteria also mean that biofuels from sustainable sources are in higher demand, driving up the prices of the feedstock for such biofuels, and therefore the prices of such biofuels. This is particularly true for renewable diesel where large industrial users in those countries are looking for alternatives to diesel use.
- **Conventional biofuels can only be used at low blend levels.** The use of conventional biofuels is limited by “blend walls”, which means that unmodified road vehicles can only use conventional biofuels in low-percentage blends. Higher blends risk engine damage and void vehicle manufacturers’ warranties. For bioethanol, there is a “blend wall” of 10 percent, and retail sales of biodiesel are limited to blends of 7 percent. However, some newer models of vehicles can

handle higher biodiesel blends and some commercial customers can enter into agreement with fuel suppliers to source higher biodiesel blends.

- **There are high financial and technical barriers to increasing production capacity for advanced biofuels.** While advanced drop-in biofuels can be blended at a much higher level and have much higher emissions reduction potential, they face high financial and technical barriers to developing advanced biofuels production capacity. The capital cost of developing an advanced biofuels plant is typically in the order of hundreds of millions of dollars. New conversion technologies have to be proven to operate reliably at scale before commercial deployment can occur. Proving a technology can create a catch-22 situation. To convince investors to fund construction and operation of a large-scale production facility, developers effectively need to have a large-scale production facility in place to persuade them that their conversion technologies will be successful and cost effective at scale.

Key challenges in the design of the sustainable biofuels mandate.

The scope of the mandate

Petrol, diesel, and jet fuel all have substantially different costs, characteristics and uses in the transport sector and this is the same for different biofuels. As a result, when setting the scope of the biofuels mandate there are options as to whether or not the mandate should apply to all fuels – allowing obligated parties flexibility and minimising costs – or if mandate should apply to each of the separate fuels – which would achieve greater emissions reductions from hard-to-abate uses. The scope will impact the degree of predictability in the economy as to where in the emissions reductions will occur and how costs are distributed across the economy.

The land use change impacts of biofuels

Internationally, there is evidence that increased demand for biofuels has led to negative environmental impacts and in some cases rising GHG emissions. Land use change (both direct and indirect[19]) caused by biofuel feedstocks can contribute to deforestation (therefore increasing net emissions rather than reducing them), loss of soil carbon, biodiversity loss, and competition for food – potentially increasing food prices and reducing food security.

Direct land use change is observable and will be accounted for in the life cycle analysis of biofuels. Indirect land use change (ILUC) however, cannot be measured directly[20] and this creates challenges for verifying the credibility of GHG emissions reductions from certain biofuels (usually food and feed-based biofuels). As a result, there is a risk that the GHG emissions benefits of these biofuels are overstated, and in the worst cases are causing net GHG emissions increases.

Based on historical observations, certain food and feed-based biofuels, such as those derived from palm oil or soy, are the most likely to create significant ILUC emissions (and therefore most likely to cause net GHG emissions increases).

[19] Direct land use change is the conversion of a piece of land from one use to another. Indirect land use change refers to the impacts occurring on other (non-observed) lands due to the displacement effect of land use change.

[20] Indirect land use change can be estimated in life-cycle analysis using economic models. The results can vary significantly based on which model is used and what assumptions are made.

The right target level to set will partially depend on which biofuel feedstocks are eligible. For example, if food and feed-based biofuels are excluded, the mandate's GHG targets would need to be less ambitious for obligated parties to feasibly meet them. At face value, this could be seen as lowering overall ambition. However, because high-risk feedstock are avoided, the risk of unintended consequences or locking-in undesirable pathways is reduced, and actual GHG emissions reductions are likely to be more reliable.

2.4 What do stakeholders think about the problem?

- *Who are the stakeholders? What is the nature of their interest?*
- *Which stakeholders share the Agency's view of the problem and its causes?*
- *Which stakeholders do not share the Agency's view in this regard and why?*

The fuel sector, fuel users (including private vehicle owners, freight operators, airlines and shipping companies), interest groups (such as AA, the Motor Trade Association and the BusinessNZ Energy Council) are the key stakeholders.

In July 2021, public consultation occurred on the discussion document *Increasing the use of biofuels in transport: consultation paper on the Sustainable Biofuels Mandate.*[21]

There were mostly positive views about introducing a greater role for biofuels in decarbonising transport. Many stakeholders acknowledged that biofuels will play an important role in decarbonising transport, particularly for the hard-to-abate areas of shipping, aviation, and heavy freight (and some thought that there should have been progress in this area earlier). Some stakeholders, including some fuel suppliers and peak bodies, thought that there should be more flexibility to reduce emissions in transport, and that a mandate removes their choice in achieving the objective.

The stakeholders who opposed the mandate did so on the grounds of:

- The cost of introducing biofuels in New Zealand is likely to be high, and it will increase fuel costs for households and individuals. Some stakeholders thought the costs would be higher than projected, because other governments are introducing similar mandates which will increase the demand for biofuels and the price.
- Biofuels are not compatible with New Zealand's vehicle fleet.
- One or two stakeholders who questioned the government's broader strategy around reducing emissions (i.e. their concerns were not limited to biofuels).

Different fuel companies may have different views on a biofuels mandate. Some fuel companies, which have a strong strategic focus on green investments and biofuels production facilities, such as Z Energy and Neste, are strongly supportive of a biofuels mandate. On the other hand, fuel companies that do not currently sell biofuels in the New Zealand market have reservations about the implementation of a biofuels mandate. Some of them noted that it will take time and significant amount of money for them to invest in

[21] https://www.mbie.govt.nz/have-your-say/increasing-the-use-of-sustainable-biofuels-in-aotearoa-new-zealand/

biofuels-related infrastructure, such as biofuels storage and blending facilities, and they may find it challenging to source biofuels.

GHG-based mandate
There was very strong support for the mandate to be based around GHG emissions reductions, rather than a volume-based target or one based on particular blend levels. Stakeholders submitted that this focused the mandate around the desired target (emissions reductions), and that it allows the most efficient solutions to emerge. Some noted that it would require stringency around the measurement of lifecycle emissions, to ensure that they are properly taking into account all components of a fuel's emissions.

Targets for specific fuels
There were mixed views about whether there should be specific targets for different fuels. Those who were in favour of separate targets (a slight majority) argued that without separate targets, fuel wholesalers will have an incentive to supply the lowest cost biofuels, primarily ethanol. As ethanol is a replacement for petrol, it would not be contributing towards the hard-to-abate sectors of heavy transport, aviation and marine. Those in favour of a single target argued that it was the simplest and most transparent approach and, importantly, allowed the most flexibility for the fuel sector to supply biofuels where they saw fit (where there was demand). This would also allow the fuel industry to optimise its costs.

Several submitters in the aviation industry had strong views that there should be a separate target for SAF, as without it there would be little to no uptake.

Sustainability criteria
All stakeholders thought that the sustainability of biofuels, and the credibility of emissions reductions, was very important. Most thought that using an international scheme to certify sustainability and emissions reductions, as was proposed, was appropriate, while others thought that the compliance costs would be high and some raised the potential for fraud. Fuel wholesalers raised the need for standardisation. A couple of stakeholders thought that New Zealand needed to set its own sustainability standard, and some thought that domestically produced biofuels should be exempt from such schemes (as an incentive).

2.5 What are the objectives sought in relation to the identified problem?

The high-level objectives are to:

- enable a just transition to a zero carbon and climate-resilient economy and society through increasing the supply and use of green fuels for transport, particularly for hard to abate transport modes
- ensure that New Zealand's energy and transport systems are sustainable, affordable and secure.

More detailed objectives on the design of the sustainable biofuels mandate are to:

- Set the scope of the mandate to encourage the use of biofuels that will result in emissions reductions, including from the hard-to-abate transport sectors such as aviation.

• Set the mandates targets to manage the balance between emissions reductions and the cost to obligated parties and the wider economy. • Set sustainability criteria that ensures emissions reductions from the biofuels used to meet the mandate are credible, and that the wider impacts of biofuels supply chains are managed.

Part 2: Analysis of key policy features of the Sustainable Biofuels Mandate

Section 3: Option identification

3.1 What options are available to address the problem?

This RIS focuses on the key policy design options for the sustainable biofuels mandate - the scope of the mandate and the targets.

A sustainable biofuels mandate could take multiple forms. The key decisions regarding the scope of the mandate are its metric (how it is measured), and whether targets should apply to all transport fuels (one target for all) or separate targets should be developed for the different fuels (petrol, diesel, and jet fuel).

Option A : Transport fuels volume-based sales target focusing on conventional biofuels

- This is similar to the repealed 2008 Biofuels Sales Obligation, which requires a certain proportion of fuel sales to be biofuels.
- A sales target of 1.5 per cent will be set for the period 2023-2025.
- There will be provisional fuel volume sales targets for the 2026-2030 period and the 2031-2035 period, and these targets will be reviewed in 2024 and 2029 respectively.
- The fuel sales target will cover petrol, diesel, and their conventional biofuels equivalent (namely bioethanol and biodiesel)
- The targets and fuels covered are based on those of the 2008 Biofuels Sales Obligation, and the blend limits of conventional biofuels.

Option B: Emissions intensity reduction target for transport fuels across the whole transport sector, with one single annual target for all fuels

- As emissions intensity targets will become more stringent over time, fuel suppliers are expected to sell more biofuels that have lower lifecycle emissions than fossil fuels to meet these targets.
- The targets will cover petrol, diesel, aviation fuel and their biofuels equivalent (including both conventional and advanced biofuels).
- Annual emissions intensity targets will be set for transport fuels for the 2023-2025 period. The target will of 3.5 per cent emissions reduction when compared to the baseline for petrol, diesel and aviation fuel by 2025. In the baseline scenario, biofuels are consumed at a negligible level.
- There will be provisional emissions intensity targets for the 2026-2030 period and the 2031-2035 period.
- The provisional targets for 2030 and 2035, would be set at 5 per cent and 9 per cent respectively. These targets will be reviewed in 2024 and 2029 respectively.
- These targets are set based on the blend limits of conventional biofuels, and the assumption that drop-in biofuels that can be blended with fossil fuels in much higher concentrations will become increasingly prevalent.
- Emissions reduction associated with biodiesel and renewable diesel sales for use in marine vessels can be counted towards the target for diesel.

Option C: Emissions intensity reduction targets for transport fuels across the whole transport sector, with a separate lower annual target for aviation fuels to be introduced from 2025 onwards.

- Similar to option B, although there will be a separate lower target for aviation fuels introduced from 2025 onwards, given that the worldwide production capacity of sustainable aviation fuel is relatively small compared to those of conventional biofuels and renewable diesel.
- This option would contain the same targets as option B for petrol and diesel – 3.5 per cent by 2025, and provisional targets of 5 per cent by 2030 and 9 per cent by 2035.
- The target for aviation would be developed over the 2021 – 22 period, and will involve engagement with the aviation industry.
- These targets are set based on the blend limits of conventional biofuels, and the assumption that drop-in biofuels that can be blended with fossil fuels in much higher concentrations will become increasingly prevalent.

Option D: Emissions intensity reduction targets focusing on diesel and aviation fuel

- Emissions intensity targets will be set for the 2023-2025 period for diesel and aviation fuel.
- There will be provisional emissions intensity targets for the 2026-2030 period and the 2031-2035 period, and these targets will be reviewed in 2024 and 2029 respectively.
- The targets cover diesel, aviation fuel and their biofuels equivalent (including both conventional and advanced biofuels)
- Target of 5.5 per cent below baseline for diesel and target of 2 per cent below baseline for aviation fuel by 2025.
- The annual targets for the period beyond 2025 will progressively increase over time (subject to future policy reviews). These targets are set based on the blend limits of conventional biofuels, and the assumption that drop-in biofuels that can be blended with fossil fuels in much higher concentrations will become increasingly prevalent.
- The relatively ambitious target for diesel/biodiesel/renewable diesel blends under this option reflects that the biofuels mandate will focus more on accelerating the uptake of drop-in renewable diesel under this option than under the other options discussed above.

The blend limits for different types of biofuels and the potential supply of these biofuels are taken into account when setting the biofuels mandate targets in the above options. Our understanding of the blend limits is based on literature review, and discussions with targeted stakeholders, such as fuel companies and Air New Zealand.

Overseas biofuels mandates, such as those in Australia, Europe and North America, are also considered.

Calculation of the obligation under different mandate options

Option A is a simple volumetric target. For example by 2025 an obligated party (fuel supplier) would need to ensure that 1.5 per cent of fuel they supply by volume would be biofuels to be compliant with the mandate.

Options B, C and D are all emissions intensity reduction targets. Each year a fuel supplier would have to demonstrate that the percentage emissions reduction it achieved, across its fuels, is at least equal to, or higher than, the required percentage. The percentage reduction would be calculated by comparing the emissions of its fuels (fossil and biofuels) against the hypothetic emissions had all its fuels been fully fossil.

The obligation under the mandate will be calculated according to the following formula for each target:

$$E_R = ((E_{FF} – E_B) / E_{FF}) \times 100$$

Where:

E_R = the required emission reduction for that year expressed as a percentage

E_{FF} = the emissions in tonnes of carbon dioxide equivalent if all the supplier's fuels were fossil fuels

E_B = the emissions in tonnes of carbon dioxide equivalent of the supplier's biofuel blends

3.2 What other options have been ruled out of scope, or not considered, and why?

We have not considered any options with a specific aim to incentivise investments in building domestic biofuels production capacity. This is outside the scope of the biofuels mandate.

Various government agencies are undertaking work that will inform the case for these options, but further investigation is needed before the case for such options can be clearly established. Te Uru Rākau is developing an Industry Transformation Plan (ITP) for the forestry and wood processing sector, which includes the New Zealand Wood Fibre Futures initiative. As part of this initiative, Te Uru Rākau has been looking into the business case for developing domestic production capacity in various wood-based products, including liquid biofuels and biocrude oil.

Te Uru Rākau's work will feed into the broader government work on bio-economy development. MBIE is contributing to this broader work, and has recently commissioned work on modelling the impacts of various biofuels policy scenarios, including both biofuels mandate and other complementary measures that aim to support development of a biofuels industry. The modelling results are not yet finalised, and further analysis of the alignment between these complementary measures and international trade obligations is also underway.

Section 4: Impact Analysis

4.1 Marginal impact: How does each of the options identified in section 3.1 compare with taking no action under each of the criteria set out in section 2.5?

The scope of the mandate and the proposed targets					
	No action	**Option A : Transport fuels volume-based sales target focusing on conventional biofuels (1.5 per cent by 2025 and provisional more ambitious targets after 2025)**	**Option B: Emissions intensity reduction target for transport fuels across the whole transport sector, with one single annual target for all fuels (3.5 per cent below baseline for diesel and petrol by 2025, with provisional targets of 5 per cent and 9 per cent for 2030 and 2035 respectively).**	**Option C: Emissions intensity reduction targets for transport fuels across the whole transport sector, with a separate lower annual target for aviation fuels (3.5 per cent below baseline for diesel and petrol by 2025, with provisional targets of 5 per cent and 9 per cent for 2030 and 2035 respectively). A separate target for aviation will be introduced from 2025 onwards.**	**Option D: Emissions intensity reduction targets focusing on diesel and aviation fuel (5.5 per cent below baseline for diesel and 2 per cent below baseline for aviation fuel by 2025 and provisional more ambitious targets after 2025)**
Emissions reduction	**0**	+	++	+++	+
Emissions reductions from hard-to-abate transport sectors - Long haul trucking, offroad vehicles and machinery, shipping, and aviation	**0**	+	+	++	+++
Energy equity (namely universal access to reliable affordable and abundant energy)	**0**	-	- -	- -	- -
Compliance burden	**0**	-	- -	- -	- - -
Wider economic effects (including impacts on regional and national economy)	**0**	-	- -	- - -	- -
Energy security	**0**	**0**	-	-	-
Government administration costs and complexity	**0**	-	-	- -	-
Overall assessment - Emissions reduction (including what part of the transport sector they come from) and wider economic effects are given more weight than other criteria in the assessment.	0	From the emission reduction perspective, it is the least favoured biofuels mandate option. This target would be the easiest and cheapest for obligated parties to meet and therefore would likely have the least economic impact.	A biofuels mandate option, which will achieve a balance between different criteria. This option will achieve significant emissions reductions, however hard to abate sectors such as aviation are unlikely to reduce emissions as a result. Option B provides greater flexibility for how obligated parties can meet the mandate. As a result, the compliance burden and potentially the wider economic effects are marginally less than option C and D, but greater than A.	A relatively balanced biofuels mandate option. Similar to option B out to 2025, beyond that Option C has a separate target for aviation fuels being introduced. This option will achieve the most emissions reductions from the hardest-to-abate sector, as aviation would have its own mandated target. Obligated parties maintain the flexibility to meet the mandate for petrol and diesel.	An option that focuses on delivering emissions reductions from the hard-to-abate sectors – trucking, offroad vehicles and machinery, shipping, and aviation.

Key: **+++** best outcome among all the options (including the status quo) **++** much better than doing nothing/the status quo **+** better than doing nothing/the status quo **0** about the same as doing nothing/the status quo **-** worse than doing nothing/the status quo **- -** much worse than doing nothing/the status quo **- - -** worst outcome among all the options (including the status quo)

4.2 How the impacts have been estimated

The estimates of the potential impacts of the of scope of the mandate and the proposed targets come from a modelling study that MBIE and MoT commissioned Sense Partners to undertake. Sense Partners' estimates of the economic cost impacts of biofuels may appear high relative to the estimates presented in the Ministry for the Environment's Marginal Abatement Cost Curves Analysis for New Zealand: Potential Greenhouse Gas Mitigation Options and Their Costs, which was mentioned in section 2.1. The caveats about the Ministry for the Environment's analysis are discussed in footnote 2. Furthermore, marginal cost curves analysis tend to represent the upfront or direct costs of an intervention, while Sense Partners' economic modelling takes into account both the direct costs and indirect impacts, which feed through the whole economy. Therefore, the two estimates are not a like-for-like comparison.

The modelling results from Sense Partners have been compared to two different baselines. In the stage I modelling, the baseline could be considered as a worst case scenario for progress towards meeting our emissions budgets, EV uptake and the electrification of trucks, buses and rail is slow, most people continue to drive cars and reduction in vehicle-kilometres travelled is very small. In this case, New Zealand would fall drastically short of meeting the first, second and third emissions budget as recommended by the Climate Change Commission. In the stage II modelling, the baseline could be considered as the best case scenario for progress towards meeting our emissions budget, a range of policies are implemented to accelerate the adoption of EVs, the electrification of buses and rail, and there is a significant amount of mode shift towards active and public transport. Policy to drive a faster uptake of biofuels (i.e. the mandate) is not included in this baseline. In this baseline, transport emissions reduce fast enough to meet our first emissions budget and possibly our second, however emissions reductions would be short of meeting the third budget.

For understanding the impacts below we have used the stage II baseline (unless stated otherwise). The CGE modelling work undertaken is good for assessing the direction of the impacts for the different policy options. However due to the large amount of assumptions we have had to make, quantifying the impacts is subject to a high degree of uncertainty and can create misleading perceptions on the magnitude of the impacts

The modelling results from Sense Partners depend heavily on the modelling assumptions, and there are substantial uncertainties in assumptions about biofuels prices, fossil fuel prices, EV uptake, future transport decarbonisation actions, and potential domestic biofuels production capacity. The model currently assumes that biofuels are almost entirely imported. Sense Partners advised that the modelling results for the costs of introducing biofuels will be moderated, should biofuels prices fall, fossil fuel prices rise, and/or additional innovation into energy efficiency takes place in response to higher fuel prices and carbon prices. Sensitivity analysis indicates that changing the modelling assumptions about the biofuels prices relative to fossil fuels' prices can have a significant impact on the modelling results.

For example, it is very likely that the mandate will impose a net cost on the economy, due to higher transport costs and the flow on effect this has. However quantifying the magnitude of this impact is highly uncertain. Sensitivity analysis indicates that if the assumed long-term crude oil price is changed from around $50-60 per barrel to around $80 per barrel, with no corresponding movement in biofuels prices, the impact of the preferred policy option on real GDP could reduce by 45 per cent in the period to 2035.

The magnitude and direction of the impacts have been considered alongside a wide evidence base on the supply and use of biofuels, from both domestic and international sources. This includes lessons from the adoption of biofuels mandates in Europe, the USA, and Queensland, and analysis by international organisations such as the International Energy Agency. Domestic analysis includes work from the Climate Change Commission, Scion, the Energy Efficiency and Conservation Authority, the Ministry for the Environment, the Ministry of Transport, the Ministry of Business, Innovation & Employment, and importantly submissions from stakeholders on the discussion document *Increasing the use of biofuels in transport: consultation paper on the Sustainable Biofuels Mandate.*

4.3 Description of impacts against each of the key criteria.

***Note** emissions reduction (including what part of the transport sector they come from) and wider economic effects are given more weight than other criteria in the assessment*.

Emissions reduction

Achieving emissions reductions from transport fuels is the primary focus of the mandate, as a result this criteria is weighted highly.

All options for the sustainable biofuels mandate will result in greater emissions reductions than the status quo.

Option B *(one single emissions intensity target for all fuels*) and Option C *(an emissions intensity target for all fuels, with a separate aviation target to be introduced from 2025)* are identical options out to 2025, and achieve the largest emissions reduction. Beyond 2025, Option C will achieve greater emissions reductions because a separate mandate will be introduced for the aviation sector, while the mandated target for all other transport fuels will remain the same as Option B. Under Option B, biofuels are not expected to flow to the aviation sector.

Option A *(a volume-based biofuels target for all fuels)* will likely have the least impact on emissions. A volume-based target is not as effective as emissions intensity reduction target in encouraging transport emissions reduction over time. Different types of biofuels have different lifecycle emissions, and a sales volume target will incentivise fuel suppliers to source and supply biofuels at least cost, rather than biofuels with highest emissions reduction potential.

Option D (*emissions intensity target focusing on diesel and aviation fuel)* would be better than the status quo and option A, not as good as B and option C. This is because option D does not cover petrol and petrol/biofuel blends, substantial emissions reductions are achievable through blending petrol with biofuel/ethanol while the light vehicle fleet transitions towards electric vehicles. Options A, B and C are all likely to utilise blending petrol and biofuels, achieving greater emissions reductions in the short term.

Wider economic effects

All options explored would come at a wider economic cost – this has been quantified to the extent possible in section 5.2 below. There will still be long-term economic growth, but the economy will grow at a slightly slower pace than in the baseline scenario.

Option A would likely have the lowest impact on the wider economy, as a volumes-based mandate could be met through the lowest cost (and lowest GHG reduction) biofuels.

Option C would likely have the largest impact on the wider economy as the impact of increased prices across petrol, diesel and jet fuel would affect the whole economy. However this is only marginally greater than Option B and D. It is worth noting that policies that reduce the use of internal combustion engines would help mitigate the wider economic impact of the biofuels mandate.

Industries with a heavy reliance on road and air transport and industries producing fossil fuels, are most impacted. Highlighted examples include fishing and aquaculture, fuel retailing, air and rail transport and non-metallic products manufacturing.

All options explored could help build some momentum for developing conventional biofuels production capacity in New Zealand (more momentum than the status quo), but this is not factored in the modelling.

Note in the baseline scenario we have used for comparing the impact of the biofuels mandate options to, New Zealand does not meet the emissions budgets recommended by the Climate Change Commission. The cost of not meeting these budgets, such as increased future costs to meet the 2050 target, or failure to achieve net-zero by 2050, has not been incorporated into this analysis. This is a significant limitation of the economic modelling results. We have estimated that the baseline scenario would be short of the third emissions budget by about 18Mt. Assuming a carbon price of $175 in 2035, this would amount to $3.15 billion. This cost has not been accounted for in our baseline scenario; however, it is incorporated into the cost estimates of the mandate. As a result the economic costs of the mandate could be overstated. It is worth noting that there is a large degree of uncertainty regarding the magnitude this cost. Further limitations of the modelling results and assumptions are outlined above in section 4.2.

Emissions reduction from hard-to-abate transport sectors

Where emissions reductions occur through the deployment of biofuels is also an important consideration. For example, emissions reductions through the use of biofuels in the light vehicle fleet could be considered as transitory as the light vehicle fleet is expected to rapidly convert to electric vehicles. In the long-haul trucking, shipping and aviation sectors however, biofuels presents one of the key opportunities to decarbonise these sectors in the medium to long term. Policy setting should guide biofuel deployment to these harder to abate sectors in the medium to long term.

Emissions reductions are likely to occur in heavy trucking, off-road vehicles and machinery, and shipping in Option B, C and D through the deployment of renewable diesel. As the mandate increases over time, a greater portion of emissions reductions will likely come from hard to abate sectors, due to the blend wall limits of mixing ethanol and petrol.

Option C and D are likely the only options that will encourage biofuels to flow towards the aviation sector. It is difficult to assess the extent of which this can feasibly occur (and at what cost) at this stage as sustainable aviation fuels are at an early stage of market development.

Option A is unlikely to result in emissions reductions occurring from hard-to-abate sectors until blend wall limits have been reached.

Energy equity (universal access to reliable affordable and abundant energy)

All options are worse than the status quo because biofuels are more expensive than their fossil fuels equivalent. This could translate to lower energy affordability over time. One mitigating factor for increased energy costs could be converting to alternative energy sources (such as electricity), changing transport modes, and/or more efficient travel/vehicles.

It should be noted that higher fuel costs are likely to fall disproportionately on low-income households without access to public transport or who are depended on their vehicles for their mobility.

Option A would likely have the lowest impact on the price of fuel and therefore on energy equity. A volumes-based mandate could be met through the lowest cost (and lowest GHG reduction) biofuels

Under Option B and C prices increase across all transport fuels, except jet fuel, by 2025.[22]

- Average petrol blend prices could be 0.2% (0.5c/L) above baseline petrol prices in 2025.
- Average diesel blend prices could be 5.8% (7.1c/L) above baseline diesel prices in 2025.
- Road passenger transport prices could be 0.34% above baseline in 2025.

Option D would see diesel blend prices increase by similar amounts, while jet fuel blend prices could increase by up to 8 per cent.

It should be noted that transport prices faced by households could drop in the initial years of implementing a biofuels mandate because the introduction of the mandate has an initial contractionary impact on the economy and could result in a decrease in economy-wide demand.

Energy security

As the targets in the biofuels mandate ramp-up over time there could be potential challenges for obligated parties to manage energy security whilst remaining compliant with the mandate. All options marginally reduce energy security when compared to the status quo and assuming obligated parties remain compliant.

Options B, C and D have more ambitious biofuels targets (which would require more imports of advanced biofuels with less mature international supply chains) than Option A and are also likely to have a greater impact on energy security. Any shortfalls in biofuels will need to be met by more imports of mineral-based fuels, and fuel companies will need to give overseas refineries advanced notice to order shipments of mineral-based fuels in the absence of a domestic refinery.

As New Zealand only has very limited biofuels production at present, we will be heavily reliant on biofuels imports at least in the first few years of implementing a biofuels mandate. There is also strong international competition for biofuels from sustainable sources; as a result there has been significant volatility in international biofuels markets.

[22] Note that these costs are based on the additional fuel cost alone for the Stage I modelling results. Transport cost could increase further because of other costs such as additional labour, capital equipment and maintenance.

This can make it challenging for obligated parties to secure supply at a price they are willing to pay. Supply chains of advanced biofuels, particularly sustainable aviation fuels, (Option C) is yet to mature.

Fuel suppliers will also need to develop infrastructure for storing, blending and selling biofuels in the initial years of implementation.

Compliance burden

All options explored will increase compliance costs on obligated parties (fuel suppliers) when compared to the status quo. Fuel suppliers will have to invest in additional infrastructure for storing, blending and selling biofuels. It is likely most of these additional costs (including the increased cost of sourcing biofuels) will be passed onto consumers.

Fuel suppliers will also need to report their performance relative to the emissions intensity reduction targets this will come with compliance burden.

A single emissions intensity target for transport fuel, rather than a separate targets for each fuel, provides the more flexibility for obligated parties to reduce the overall costs of the mandate. This could reduce the cost of compliance for Option B and C. Option B and C are essentially identical until 2025, as biofuels are highly unlikely to flow to the aviation sector. Option D (with separate targets for aviation and diesel) is likely to have higher compliance costs than all other options due to the split targets.

Beyond 2025, option C will have a higher compliance burden as the same emissions reduction target is maintained for petrol and diesel; however, a separate target is introduced for aviation and this will incur additional compliance costs.

Sustainable aviation fuels will require additional development of supply chains and infrastructure we expect the compliance burden to increase. Further SAF is significantly more expensive than traditional jet fuel.

Smaller compliance burden than option D because option C has a less ambitious emissions target for diesel and its biofuels equivalent.

Government administration costs and complexity

All options will come with additional monitoring, compliance and enforcement work for the Government. Namely policing emissions certification and compliance with obligations to meet target. This is unlikely to vary substantially across the options. More of this is detailed in Section 6 and Section 7 of this Regulatory Impact Statement.

Section 5: Conclusions

5.1 What option, or combination of options is likely to best address the problem, meet the policy objectives and deliver the highest net benefits?

A biofuels mandate with an emissions intensity reduction target that applies to all transport fuels, with a separate target for aviation introduced from 2025 (option C), is the preferred option from the perspective of emissions reduction, while still allowing some flexibility for how obligated parties meet the mandate.

A GHG-based target is preferred to a volume-based target

A fuel sales volume-based target, which will incentivise fuel suppliers to source and supply biofuels at least cost, rather than biofuels with highest emissions reduction potential. An emissions intensity target focuses the mandate on the desired outcome – emissions reductions.

In consultation, there was largely positive feedback on the option to adopt a GHG emissions reduction based mandate, rather than a volume-based blending mandate. Submitters noted that this approach focuses the mandate around the desired goal (i.e. GHG emissions reductions) and would allow the most efficient solutions to emerge.

A single target for petrol and diesel is preferred to separate targets for each fuel

A single emissions intensity target for transport fuel, excluding aviation, provides the most flexibility for obligated parties to reduce the overall costs of the mandate. This flexibility would make it easier for them to respond to short-term supply disruptions. It would also help them manage any seasonality in biofuel supply and climatic conditions that can restrict where biofuels are used.

The preferred emissions intensity target will start at 1.2 per cent below baseline for petrol, diesel, progressing to 3.5 per cent below baseline for petrol and diesel by 2025 and provisional targets of 5 per cent and 9 per cent below baseline for 2030 and 2035 respectively. Having to meet more stringent emissions intensity targets over time will incentivise obligated parties to sell more biofuels (with low lifecycle emissions) in place of their fossil fuels equivalent.

A separate aviation mandate should be introduced from 2025 onwards

There are limited abatement options for achieving significant emissions reductions in heavy transport. In particular, biofuels are currently the only realistic option for significantly reducing emissions associated with long-haul flight. Because of the critical importance of aviation to New Zealand's economy and social wellbeing, and the limited options to decarbonise, a separate mandate for aviation emissions will support the adoption of some sustainable aviation fuel. Without a separate mandate for aviation, it is highly unlikely that any obligated party would choose to supply sustainable aviation fuels due its high relative cost and additional supply chain considerations.

However, with SAF supply chain yet to mature, more analysis is required to gain a better understanding of the future SAF supply outlook, particularly the potential of SAF production in New Zealand. MBIE and Te Manatū Waka do not have a sufficient evidence base at this stage to put forward proposals for the specific design of a separate aviation mandate, including its targets and point of obligation.

We propose that officials carry out further work on the design of the aviation mandate in consultation with the aviation and fuels industry. We would aim to set the targets and the point of obligation by the end of 2022, to be introduced from 2025 onwards.

Given aviation's limited options to decarbonise long-haul flights, many submitters, including the Sustainable Aviation Fuel Consortium,[23] called for a separate aviation mandate.

The 2025 target and the provisional targets to 2035

The key issue in setting targets is to achieve the right balance in facilitating growth in biofuel supply without introducing significant fuel price shocks of a magnitude that reduce economic activity and wellbeing, fuel supply risks, and sustainability risks (i.e the biofuels used do not achieve credible emissions reductions).

Revising targets up would increase the emissions reductions delivered by the mandate at an additional economic cost while potentially heightening fuel supply and sustainability risks and vice versa.

We propose that the following emissions intensity targets are set:

Year*	**Proposed target**
2023	1.2%
2024	2.3%
2025	3.5%
Provisional targets	
2026	3.8%
2027	4.1%
2028	4.4%
2029	4.7%
2030	5.0%
2031	5.8%
2032	6.6%
2033	7.4%
2034	8.2%
2035	9.0%

The proposed target to 2025

Our first set of targets for 2023–2025 have had to be low compared to those applying in jurisdictions that lead in transport biofuel use, because New Zealand's current use of biofuels is extremely low and we do not have a domestic industry.[24] New Zealand's reliance on importing biofuels to meet the mandate is unique when compared to other jurisdictions that have developed similar policies. Allowing obligated parties sufficient time to develop the necessary infrastructure and reorganise their supply chains is a key consideration in setting these initial targets.

[23] The members of the Sustainable Aviation Fuel Consortium are Air New Zealand, Z Energy, Scion, LanzaTech and LanzaJet

[24] With the exception of Z's mothballed Wiri plant.

The 3.5% target by 2025 was developed based on research undertaken by MoT, the Ministry of Primary Industries,[25] and Sapere.[26] This was included in the consultation document *Increasing the use of biofuels in transport: consultation paper on the Sustainable Biofuels Mandate.* There were mixed views from obligated parties on the achievability of this target. Some noted that it was achievable so long as there was certainty, while others noted that there may be challenges in building the necessary storage, blending and distribution infrastructure in time. Most other submitters supported the 3.5% target by 2025.

Setting provisional targets from 2025 to 2035

There was very strong support for setting provisional targets to 2035 as early as possible to provide predictability and stability which are essential to encourage biofuel planning and investments. Long-term targets will be especially important to help spur investment in domestic production.

Beyond 2025, a number of factors will influence the rate at which the percentage targets can rise. These factors are:

- The 'blend walls' of conventional biofuels. Under fuel specifications, biodiesel blends are limited to 7 percent and ethanol blends to 10 percent. If all petrol and diesel for transport were blended to the maximum blend level, the total GHG emission reductions could be approximately 4.6 percent.[27]
- The rate at which advanced biofuels will be introduced into the fuel supply. The key constraints are:
    - Cost - with international prices for advanced biofuels expected to be 2–4 times higher than petroleum-based equivalents. This level of price premium makes it likely that these fuels will be introduced cautiously; in volumes that suppliers assess will result in fuel price increases that will be tolerated by the market.
    - The amount available internationally to be imported. As many of the conversion technologies are still being proven at scale, available volumes to be imported can be expected to be small with countries focusing on domestic supply
    - The long lead times to begin domestically produced advanced biofuels. Free and frank opinions
- The commitment to avoid biofuels that cause emission increases due to indirect land use change, which will limit the biofuels that will be imported.
- The limited availability of sustainable feedstocks for biofuels, with increasing demands for them from other sectors.

The provisional targets will be reviewed before they are set in 2024, and 2029 respectively.

We have a high degree of confidence on the evidence for the impact of the sustainable biofuels mandate out to 2025. Beyond this the magnitude of the impacts become more uncertain, however we are confident of the direction of the impacts.

[25] https://www.mpi.govt.nz/dmsdocument/41824/direct

[26] https://www.eeca.govt.nz/assets/EECA-Resources/Research-papers-guides/Liquid-Biofuel-Research-Report-March-2021.pdf

[27] This estimates assumes sugar cane ethanol is used with an emissions reduction of 54 percent and used-cooking oil biodiesel with an emissions reduction of 86 percent.

The modelling results indicate introducing a sustainable biofuels mandate could come at an economic cost and this is most significant in the 2030s. There are however significant uncertainties in the underlying modelling assumptions about a range of factors, this includes carbon prices, future technological advancements for both biofuels and competing transport technologies (i.e. EVs), feedstock costs, and their implications for the relative prices of biofuels and fossil fuels. The further we into the future our modelling results are the less certainty we can have in them.

When comparing the impact of the biofuels mandate on the economy to the baseline scenario, it should be considered that the baseline scenario fails to meet the third emissions budget. This means that to meet our emissions budgets, emissions reductions will need to occur in other parts of the economy and it is difficult to estimate where and at what cost this would happen.

We have estimated that the baseline scenario would be short of the third emissions budget by about 18Mt. Assuming a carbon price of $175 in 2035, this would amount to $3.15 billion. This cost has not been accounted for in our baseline scenario; however, it is incorporated into the cost estimates of the mandate. As a result the economic costs of the mandate could be overstated. It is worth noting that there is a large degree of uncertainty regarding the magnitude this cost.

5.2 Summary table of costs and benefits of the preferred approach

Affected parties *(identify)*	**Comment**: *nature of cost or benefit (eg, ongoing, one-off), evidence and assumption (eg, compliance rates), risks*	**Impact**[28] *$m present value where appropriate, for monetised impacts; high, medium or low for non-monetised impacts*	**Evidence certainty** *(High, medium or low)*
Additional costs of proposed approach compared to taking no action			
Regulated parties	Develop biofuels supply infrastructure (e.g. storage, blending and production facilities) in New Zealand The nature of the cost would depend on the strategy regulated parties adopt (i.e. domestic	Biofuels blending facilities will cost $50-250 million[29], dependent on the strategy taken, the market share of the regulated	medium

[28] Impacts in this section have been estimated based on the Sense Partners Stage II results and compared against this baseline (see description on page 29).

[29] This estimate is based on the assumption that bioethanol blending and storage facility at each terminal will cost $3 million per terminal, and the same applies to blending facilities for biodiesel and sustainable aviation fuels. It is assumed that 6-30 terminals will need bioethanol and biodiesel blending facilities, and 1-3 terminals will need sustainable aviation fuels blending facilities. Officials referred to Hale and Twomey's 2006 report, *Enabling Biofuels: Biofuels Distribution Options,* and the regulatory impact analysis statement in Canada Gazette, Part I, Volume 154, Number 51: Clean Fuel Regulations, regarding the cost of blending facilities.

	production vs imports, blending fuels vs importing drop in fuels), as there is flexibility for how the mandate would be met. depending on the strategy regulated parties adopt (i.e. domestic production vs imports, blending fuels vs importing drop in fuels)	party, and the number of fuel terminals and related infrastructure that needs to be upgraded.	
Regulated parties	Compliance costs, such as biofuels-related certification, emissions reporting and accounting	Relatively low cost for emissions reporting and accounting (compared with fuel infrastructure development cost)	Low
Regulators	Set up and administer monitoring, compliance and enforcement systems for biofuels mandate	$3 million per annum[30]	Medium Consultation with overseas government and certification bodies is required to test the cost estimate.
Wider government	Government revenue could fall as the economy contracts relative to baseline	Nominal tax revenue could be $10 - 12 million below the baseline in the period to 2025	Medium
Wider government	Higher fuel costs for government vehicle fleet and higher transport costs for officials' business trips	Road passenger transport prices could be less than half a per cent above baseline in 2025.	Medium
Other parties	Higher fuel and transport costs	Average petrol blend prices and	Medium

[30] This cost estimate is based on the assumption that 12 FTEs will be needed to administer the biofuels mandate and additional funding is needed for covering overhead costs, systems development and support (e.g. a database for registering emissions trade between fuel suppliers), and fuel testing.

		average diesel blend prices could be up to 5 cents/litre (c/L) and up to 10c/L higher[31] than baseline prices of their neat fossil fuels equivalent in 2025 respectively.	
Other parties	Real Net National Income (NNI)	Real NNI will be about $0.2 - 0.5 billion below baseline[32] in 2025, $2 – 3 billion below baseline in 2030, and $3 – 5 billion below baseline in 2035.	Low- Medium
Total Monetised Cost		$0.2 - 0.5 billion in 2025, $2 – 3 billion in 2030, and $3 – 5 billion. (Note: the Real NNI has taken into account private spending, investment and government spending)	Low- Medium
Non-monetised costs		*Medium*	Low- Medium

Expected benefits of proposed approach compared to taking no action			
Regulated parties	Build capability in biofuels distribution (not including production)	Medium	Medium

[31] Note this estimate is based on Stage I modelling results and conversations with key stakeholders. It is subject to a high degree of uncertainty, as it will depend on future biofuels prices, the cost of new infrastructure, and the future cost of petrol and diesel.

[32] We have estimated that the baseline scenario misses the third emissions budget by about 18Mt, assuming a carbon price of $175 in 2035, this would amount to $3.15 billion. This cost has not been accounted for in our baseline scenario; however, it is incorporated into the cost estimates of implementing the biofuels mandate.

	Build domestic biofuels production capacity (Note: Other complementary measures are likely to be needed to provide sufficient incentive for this.)	High	Low
	Build green credentials for fuel suppliers at point of obligation, as well as biofuels feedstock suppliers (e.g. wood processors)	Low	Low
Regulators	N/A	N/A	N/A
Wider government	Lower emissions associated with the public sector's transportation	Low	High
Wider government	Ability to set relatively ambitious carbon budgets, enhancing New Zealand's position in international climate change negotiations	Medium	Medium
Other parties	Emissions reductions About 0.5Mt CO2-e reduction in 2025 below the baseline, 1.4Mt CO2-e in 2030 below the baseline, and 1.5Mt CO2-e in 2035 below the baseline.	About $50 million in 2025, assuming a shadow carbon price of $100/ tCO2-e in 2025, about $200 million in 2030, assuming a shadow carbon price of $150/ tCO2-e, and $270 million in 2035, assuming a shadow carbon price of $175/ tCO2-e. Medium	Medium
Other parties	Reduce air pollution (which could exacerbate health conditions such as asthma and cardiovascular and respiratory issues)	High	High
Total Monetised Benefit		Not quantified because it is very challenging to quantify many of the benefits beyond emissions	Medium

		reduction, e.g. value of green credentials and potential positive impacts on domestic biofuels production capacity.	
Non-monetised benefits		Medium	Medium

8.3 What other impacts is this approach likely to have?

The higher fuel costs resulting from the introduction of a biofuels mandate will reduce energy equity. This may have a greater impact on some fuel consumers over others, particularly those who are dependent on private cars (with conventional internal combustion engines) for travel and where there are barriers to considering other options, for example the high up-front cost of EVs or the availability of public transport. Examples of fuel consumers who could be impacted more by higher fuel costs include rural households and low-income households that will likely be slower to switch to EVs.

On the other hand, higher fuel costs would increase the pace at which drivers switch to EVs, hybrids or more efficient internal combustion engines, or it could encourage greater mode shift to active or public transport. In this light, this approach is complementary to other announced emissions reduction transport policies including the Clean Car Discount, and the proposed Clean Car Standard.

The market for biofuels and feedstocks is an international market. There is some uncertainty in this market, particularly in the market for advanced biofuels, and if biofuels become less available (and therefore more expensive) the mandate could compromise New Zealand's energy security.

On the other hand, technological developments and advances in the production of biofuels may reduce the costs of biofuels.

A biofuels mandate can also create some momentum for building domestic biofuels production capacity, although it will likely need to be complemented with other interventions. Should commercial-scale biofuels plants be developed in New Zealand, there will be some benefits in terms of employment and regional development. Bio-refineries that can achieve economies of scale and are internationally competitive are likely to bring more economic benefits. On the other hand, an expanding biofuels sector will compete with other sectors for resources, such as woody biomass, thereby necessitating reallocation of resources, including land.

Section 6: Implementation and operation

6.1 How will the new arrangements work in practice?

The existence of a biofuels mandate would need to be implemented through new legislation or amendments to the Energy (Fuels, Levies, and References) Act 1989. The legislation would specify:

- the main elements of the biofuels mandate, including the point of obligation and the nature of the obligation (including the mandated target)
- establishing the obligation to monitor and report on emissions reductions
- establishing the penalty regime
- establishing the ability for producers to trade credits between each other, or to bank surplus emission reductions or borrow for shortfall.

The point of obligation

The 'point of obligation' (who must comply with the mandate) is set at all those who first import transport fuels to New Zealand or refine them[33]. This is a change to the consultation proposal, which required all fuel suppliers (fuel wholesalers and fuel resellers) that sell more than 10 million litres of transport fuel in New Zealand per year to comply with the mandate.

Many fuel resellers, who purchase fuel from one of the wholesalers, recommended setting the 'point of obligation' as close to the top of the supply chain as possible on the grounds that it would reduce compliance costs. It would also be easier for fuel wholesalers to meet the mandate as they deal with larger volumes. This would also align the mandate with the Emissions Trading Scheme and the general scheme at which excise and excise-equivalent duties are charged.

The penalty regime

One of the major considerations for establishing a penalty regime will be setting the penalties at a sufficient level to deter non-compliance. The design of the mandate consulted on in July 2021, included a civil penalty of $300 per tonne of CO_2 equivalent would apply where suppliers fail to achieve the minimum percentage emissions reduction. Some submitters commented that the penalty was too low, and there was a risk that fuel suppliers could elect to simply pay the penalty instead of participating in the mandate.

The penalty needs to be set at a level high enough to deter this; it needs to be higher than the cost of complying with the mandate. Penalty levels would be set through regulations (see below) The following factors influence compliance costs and would be considered when setting the penalty levels:

- Upfront capital costs associated with infrastructure construction and maintenance, such as labour, resource consenting, material, etc.
- The relative purchase price difference between fossil fuels and their biofuels equivalents (both imported and domestic), noting the various different types of biofuels available makes this complex.
- Costs associated with the verification of biofuels, labelling, and annual reporting.

Flexibility mechanisms for obligated parties

The ability for obligated parties to trade credits between each other, or to bank surplus emission reductions or borrow for shortfall would be established to provide mechanisms

[33] Under this definition Z Energy, Mobil, bp and Gull would need to comply with the mandate.

that make it easier for them to manage any variability, or fuctuations in biofuel supply. Trading via entitlement agreements could be a good way to achieve this.

uel suppliers would be able to trade with others to meet the mandated emission reduction percentages. Trading would be affected through entitlement agreements between fuel suppliers, or between fuel suppliers and biofuel owners. These agreements would record the transfer of the right to count an amount of biofuel for the purpose of complying with the Mandate, and would be signed by both parties.

Fuel suppliers would document the details of their trades in their annual returns to the regulator. To ensure the integrity of the trades, it would be an offence to sign a false or misleading agreement. This includes entering into more than one agreement for a particular amount of biofuel, or exporting biofuel that was covered by an agreement.

Supporting regulations

There would need to be supporting regulations to specify the detail required for the mandate. This includes:

- the methodology for assessing greenhouse gas emissions reductions achieved by obligated fuel suppliers through selling biofuels
- the requirements for certifying that biofuels meet the sustainability criteria
- default values for fuel energy content (petrol, diesel and common biofuels)
- penalty levels.

The Engine Fuel Specifications Regulations 2011 will also need to be reviewed to ensure that the fuel specifications for biofuels and the limits on biofuel blends will achieve the right balance between achieving emissions reduction and ensuring that biofuels and biofuel blends sold in New Zealand are appropriate for our transport fleet and climatic conditions.

The sustainability criteria for the biofuels used to meet the mandate in New Zealand will be specified in regulation that will be developed over 2022. This would include specifying which International sustainability certification schemes could be used certify biofuels against the sustainability criteria. These will be chosen based on their ability to work with New Zealand sustainability criteria, their robustness - including standards of transparency and good governance, and the accessibility of the scheme for obligated parties and auditing bodies.

The key elements of the sustainability criteria would be:

- Accounting methodology for indirect land use change emissions and/or restricting feedstocks that are considered high risk of creating negative indirect land use change impacts.
- Biodiversity: feedstocks should not be obtained from land or raw material that has a high biodiversity value.
- Impact on carbon stocks: avoiding deforestation of native forests, canopy forests or the destruction of wetlands or peatland to plant biofuel crops. The impact of biofuel crops on soil carbon should also be considered.
- Food and feed security: feedstocks should not adversely impact food and feed security.
- Water quality and availability: biofuels crops should not negatively affect water quality or significantly restrict its availability in an area.

- Use of waste: it will be important that the mandate supports the principles of the waste hierarchy and does not create perverse incentives such as increasing the production of waste.

MBIE and MoT will undertake targeted stakeholder engagements to test proposals for these regulation and an exposure draft of the regulations may be released for consultation.

The arrangements are proposed to come into effect at the beginning of the calendar year once legislation is passed and regulations are in place, currently projected to be 2023.

The regulating agency

The Environmental Protection Authority, together with the Ministry of Business, Innovation and Employment and Te Manatū Waka, will be responsible for implementing the mandate. This will include:

- developing the information technology to record and monitor compliance by obligated parties.
- providing guidance to obligated parties on annual reporting.
- confirming the amount of biofuels that must be supplied by obligated parties.

The Trading Standards team in MBIE is responsible for fuel quality monitoring. Monitoring the quality of biofuels is more complex than fossil fuels, as the feedstock for biofuels has more variability and the statistical sampling used for fossil fuels is unlikely to be adequate. MBIE's Trading Standards team already has some expertise in monitoring the quality of biofuels, although it will need to build capability and increase its capacity ahead of the biofuels mandate coming into effect.

Public communications

The introduction of the mandate will need to be supported by communications about what it might mean for households and businesses. This would need to cover:

- What the different biofuel blends are and what they would mean for vehicle use, for example blend walls for different types of cars.
- Whether there are specific blends that could not be used in some cars. For example the United Kingdom has a website where vehicle users can check this using the make, model and year of manufacture.

Transitional regime for compliance

During the first two years of the biofuels mandate, there is a risk that some suppliers may not be able to source sufficient biofuel volumes quickly enough to meet their required emissions reductions. This is because of the long lead-in times associated with increasing biofuel production and supply.

6.2 What are the implementation risks?

The implementation risks and how they can be mitigated are as follows:

- **Fuel infrastructure readiness:** there is a risk that not all fuel suppliers will have the biofuels-related infrastructure, such as biofuels storage and blending facilities,

in time for when the biofuels mandate comes into effect. The two-year deferral of compliance with the mandate from the date it begins will provide some flexibility to fuel suppliers. Approval to defer would need to be gained from the Minister of Energy and Resources, and an emissions penalty of 0.1 percent would be applied for deferral in the second year of operation of the mandate.

- **Risk of non-compliance:** there is a risk that regulated parties do not comply with the regime, and instead choose to buy their way out of the scheme by paying the penalties – this creates a risk that it is not effective at reducing greenhouse gas emissions, and is simply an extra tax on firms and households that consume fossil fuels. This risk can be mitigated by setting the penalties at a level which creates an incentive for compliance.
- **Security of biofuels supply and energy security risk:** there is a risk that fuel suppliers struggle to ramp up production or secure reliable supply chains for biofuels, creating energy security issues. This can be mitigated by the flexibility mechanisms of the mandate (i.e. banking, borrowing and trading of emission reduction), ability to switch between fuels for meeting the target, and the two year deferral of compliance from the date the mandate begins.
- **Risk of fuel quality problems or incompatibility with vehicles:** There is a risk that there could be unexpected issues with the quality of biofuels, which could damage vehicles or have negative environmental impacts. This risk can be mitigated by ensuring that Trading Standards have adequate time and funding to establish a robust biofuels monitoring framework, before the mandate comes into effect.
- **Risk of higher than anticipated compliance costs:** There is a risk that the cost of complying with the biofuels mandate could be higher than anticipated. For example, the costs associated with certification of greenhouse gas emissions and achievement of sustainability criteria and biofuels-related infrastructure development could be higher than expected. This can be mitigated by consulting with fuel suppliers to understand whether and how the particular design of the mandate could impact their cost structures in an unexpected way.
- **Environmental integrity of biofuels certification:** There is a risk that the lifecycle emissions of the biofuels sold by fuel suppliers are higher than claimed or the environmental integrity of the biofuels sold is questioned, unless a credible certification framework is in place. Officials will consult with international experts to identify the best practice for certifying lifecycle emissions and sustainability of biofuels.

Section 7: Monitoring, evaluation and review

7.1 How will the impact of the new arrangements be monitored?

Obligated parties, namely fuel suppliers, must submit independently audited annual reports to the regulator, the Environmental Protection Authority (EPA). These annual reports will set out the emissions reductions they have achieved through the supply of biofuels relative to the mandated percentages.

It is expected that the EPA will create a database for recording the information from these annual returns, such as the amount of biofuels supplied by obligated parties and the volume of emissions reduction traded between obligated parties. This database is expected to have some similarities to the Emissions Trading Register for the New Zealand Emissions Trading Scheme. Each year the EPA will verify and publicly report, at a high level, the performance of the obligated parties in meeting the target emissions reduction.

MBIE will also continue to monitor fuel price movements regularly, and may undertake fuel market studies should there be significant concern over fuel price increases following the introduction of the sustainable biofuels mandate. MBIE will also continue to liaise with the fuel sector regarding fuel security issues periodically and when fuel supply issues arise.

The information on emissions reduction achieved by obligated parties and fuel price movements will inform future reviews of the sustainable biofuels mandate.

7.2 When and how will the new arrangements be reviewed?

The Ministry of Business, Innovation and Employment and Te Manatū Waka will review the mandate after it has been in effect for two years to:

- Evaluate the GHG emission reductions achieved as a result of the mandate.
- Assess its impacts on fuel security, fuel availability and choice and fuel prices.
- Evaluate whether a single target for petrol and diesel is appropriate.
- Determine whether the mandate should be expanded to include other fuels such as electricity and hydrogen.
- Review the penalty levels to see if they are still appropriate by assessing the cost of non-compliance vs the cost of meeting the mandate.
- Identify any issues that fuel suppliers have experienced in implementing the mandate.
- Test whether there are any issues with the trading of credits between fuel suppliers.

If there are changes to be made to the mandate to better give effect to its objectives, we will report back to Cabinet to seek approval.