The Climate Change Commission Advice Report: A review and submission

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Part one: Introduction and overview

This submission focuses primarily on the transport section the of Climate Change Commission's report. We also comment on several structural decisions that drive many of the specific recommendations, in particular the decision to effectively move from a net to a gross zero carbon target. Our narrower focus does not mean that we necessarily agree with the Commission's recommendations that we have not covered.

The key recommendations on transport are that: electric vehicle subsidies should introduced as a matter of urgency; no imported light internal combustion engine (ICE) vehicles should be registered from 2032 and that some form of emission standard should be imposed before that.

The effect of these measures could be to disrupt much of the used import car market, impacting primarily on the lower income people the Commission purports to

support. EV subsidies could be very expensive but the Commission has withheld any detail on these costs.

In terms of getting to a substantially electrified vehicle fleet by 2050 this is all unnecessary. The electric car revolution is coming, but it may just be a few years later arriving in New Zealand. If we simply impose a realistic carbon price and leave the market to work we will get were we want to be. Moving early could initially cost well over $1000 per ton of carbon saved to the benefit of urban elites and virtue signalling corporates.

The Commission says that they are committed to a 'true' consultation. But they initially gave only six weeks for the consultation and have withheld their models. Without access to the full detail of those models it is not possible to properly scrutinize several of the Commission's claims. The Commission also says that it will:

consider all evidence we receive through consultation and are prepared to change any part of our work in light of this.

This remains to be seen, but some of the comments in the report are not reassuring. For example in chapter 17 of the Evidence Report it is stated:

Processes that are well known in behavioural science, such as group polarization and science denial, pose a significant challenge to climate policy.

This suggests that when the Commission strike a submission that it disagrees with it can be written off as just science denial.

The Commission also says that it is independent. But this is a partisan report driven by a vision of 'the good life' that is anti-car, pro-compact urban city and deeply into recycling (regardless of the cost). The discussions and recommendations read straight from the Labour/Green playbook.

Many people disagree with some of these policies. The compact urban form mantra has locked up land and has driven up house prices so they are out of reach of many New Zealanders. Many people like the freedom and convenience that cars provide. They don't want to be bullied out of their 'dependence' on them. Others object to pointless, financially opaque, and expensive recycling initiatives.

They don't want unnecessary intrusions into their lives in the name of the Commission's cultural revolution. They don't want to see the state deeply involved in planning the economy when more efficient market oriented policies are available that allow people to make their own choices.

Others disagree, but these disagreements are best resolved through the political process. That can be advanced and unwound depending on the philosophy and objectives of the party or parties in power.

The Commission's job should be a straightforward technical one: how to get from where we are now to net zero carbon emissions by 2050, at the least cost. Instead it has effectively changed the objective from net to gross zero emissions, disregarding the clear intent of the legislation that gained near unanimous Parliamentary support a little over a year ago.

It is misusing its position to push policies that are sometimes only tangentially related to the objective of net zero emissions by 2050. Once cars are electric it doesn't matter, from an emissions perspective, whether you have a compact urban form or not. It doesn't matter whether you take public transport or not. But that is not how it will be played. Decision-makers will push expensive and ineffectual schemes draping them with 'climate change necessity' arguments backed by the Commission's 'evidence' and recommendations.

The Commission is playing a political game that is intended to lock in future governments to the Commission's vision. But it is a dangerous game that risks undermining the consensus required to reach the net zero target. If people feel they are being railroaded into accepting broader objectives that they disagree with, they may well reject the whole enterprise.

The Commission's report would have been more palatable if it was based on robust, transparent and honest analysis. It says:

The advice and recommendations contained in this report draw on robust evidence and expert analysis.

But too often this is not the case. Often the Commission resorts to mantras, or to foreign evidence that is simply not applicable to New Zealand's particular circumstances. When evidence is cited it is often misrepresented. On the critical issue of using exotic forest to offset gross emissions the Commission was simply deceptive about the evidence. It claims that exotic forests are too vulnerable to increasing high winds, fire and disease associated with climate change to be a reliable form of carbon sequestration. The supporting reference cited clearly shows that this is not true.

Further, the Commission simply ignores the legal requirement to conduct cost benefit analyses to support certain recommendations. We think that this is because it could not come up with the 'right' answers.

The Commission has set out its 'vision' of what it wants New Zealand to be.

It is an New Zealand where cities and towns are created around people and supported by low emissions transport that is accessible to everyone equally. Where strong local businesses produce low emissions, high-value products that are in demand locally and globally. Where employers are successful and can support themselves and their employees in the transition to climate-resilience. Where everyone lives in warm, healthy, low emitting homes. Where urban form encourages cycling and walking, alongside efficient, affordable and interconnected public transport networks.

Energy is affordable and accessible. Communities can generate their own electricity using low emissions generation.

In our vision of the future, Aotearoa has a circular economy and generates very little waste. The waste that we do generate is recovered, reused where possible, and otherwise used to generate energy.

We have recently visited a country where much of the Commission's vision is a reality. There is a heavy reliance on walking and cycling; public transport dominates private cars almost to exclusion; energy use in homes is very low and there is very little waste.

That country is North Korea. North Korea is a signatory to the Paris accord. Its intended NDC[1], which it describes as 'fair and ambitious' was prepared by 'a participatory and transparent process through stakeholder consultations,'

The Commission is not being paid to have visions. That is for the political process. What we need is dispassionate, robust, transparent and honest analysis. This is lacking in the Commission's advice and evidence reports.

This submission is structured as follows:

Part two: Key findings

Part three: Recommendations

[1] Intended Nationally Determined Contribution of Democratic People's Republic of Korea September

Part Three: General issues

A: The Commission's new pathway.

B: The Commission's failure to comply with the Act.

C: The Commission's principles.

D: Emissions trading versus direct interventions.

E: The value of co-benefits

F: Economic impact assessment.

G : The pace of adjustment.

Part four: The switch from a net to a gross carbon target. Exotic and indigenous forestry targets.

Part five: Light vehicles. Subsidies and emissions targets. This part is the core of the detailed analytical assessment.

Part six: Heavy vehicles.

Part seven: Buildings and urban form.

Our discussion is supported by the following appendices that constitute part of the submission.

Appendix one: Ministry for the Environment. Marginal abatement cost curves analysis for New Zealand: Potential greenhouse gas mitigation options and their costs

Appendix two: Dirty and dangerous? The 'Clean Car' Consultation Document

Appendix three: Health and other benefits from transport mode shifting

Appendix four: The New Zealand Transport Authority Car safety rating system

Part Two: Key findings

Commission has ignored the Climate change Act

The Act requires that emissons (other than biogenic emisions) be measured on a net basis. However, the Commission has substantitively ignored that requirement and is pursuing a zero gross emissions 2050 target. Its reasoning is that exotic forests are not an effective form of sequestration because of future climate changes. Including higher wind speeds, more droughts and more disease The paper cited by the Commission clearly showed that these effects would not be large and that exotic forests are expected to become a more effective means of reducing emisions with carbon fertilisation and rising temperatures increasing their productivity.

Gross zero targets will be costly

The Commission's economic modeling suggests that a gross zero target could cost $100 billion more than a net zero target. The Commission ignored advice from its reviewers to present the most relevant economic evidence that showed larger economic impacts.

Argument that EV subsidies are urgently required to meet 2050 targets is fallacious

The argument that EV subsidies are required now to ensure the 2050 target is met does not make logical sense. Expensive, subsidised EVs purchased now will have been long since scrapped by 2050. The Commission manipulated its modeling to ensure that future EV uptakes were conditional on current sales to give its recommendation the appearance of analytical support.

The Commissions' analysis is not supported by a cost benefit analysis, nor is information provided on the marginal cost of carbon abatement. It matters if the cost is $50 a ton, or if it is over $1000.

The EV revolution is coming and New Zealanders will buy these vehicles when they become less expensive and more capable. Subsidies will not be required.

A feebate scheme would impact on lower income families

The suggested 'feebate' scheme largely involves taxing used imports favoured by lower income families and using the proceeds to subsidise higher income earners who are in a position to purchase electric cars. It is a transfer from Mangere to Remuera and from Porirua to Khandallah.

It is clear that the Commission doesn't understand the logic of a feebate scheme in New Zealand and is recommending it as an option just to provide support for the Climate Change Minister's attempt to force through a policy that was previously rejected.

Direct subsidies option could be very expensive

The Commission does not state how big an EV subsidy is required to meet its target, even though it specified an amount in its modeling. Overseas experience suggests that subsidies would have to be quite high to get the results the Commission is seeking. If subsidies are sustained, as the Commission is recommending, the cost could well be in the region of $5 billion. Most countries are now trying to pull back their early EV subsidies because of fiscal cost concerns.

Emission targets not thought out

The Commission has recommended minimum emission standards, but it is clear that it has done no work on the issue and is just parroting some inadequate and misleading analysis done by the Ministry of Transport to support the 2019 Clean Car proposals.

EV targets unhinged from analysis and reality

In its recommendations the Commission says that 50 percent of vehicles must be EVs by 2027 to meet the 2050 zero target. This does not match its modeling, which shows a 20 percent share. As only a limited number of used EVs can be imported because the stock of suitable vehicles in Japan will be quite small, this target would mean that nearly all new car imports would have to be electric by 2027.

Claims of reduced air pollution grossly overstated

The Commission cites reduced air pollution as a major co-benefit from EVs. The supporting reference is a single paper that grossly overstates the benefits. The assumed number of lives lost from air pollution is 50 times the World Health Organisation's estimate. The over-estimate has been identified as an issue by the Parliamentary Commissioner for the Environment, but nothing has been done because it suits officialdom to be able to trot out a pumped up numbers.

No external review of transport modeling

The Commission engaged four external reviewers to assess its economic modeling. These were very light reviews of a few pages each, focusing on the macroeconomic model. The reviewers did not have a single word to say on the transport modeling in the ENZ model.

Limited evidence base

We reviewed all of the Commissions cited references relating to the sectors we covered. We found:

- The amount of supporting evidence was scant. For example, there was no evidence provided at all on the relationship between EV purchases and subsidies. Often the Commission made sweeping, unsupported assertions.' supported only by references to broad policy papers that did not have an authoritative discussion of the point being made.
- Favourable articles were cherry picked, while less favourable literature was ignored.
- Some references were blatently misrepresented. Others supported the Commission's arguments only weakly, if at all.

Commission strays beyond its brief

The Commission opines on policy issues, such as the optimal urban form, that have only a limited and passing relevance to meeting the 2050 target. Once electricity generation has been substantially decarbonized and cars are mostly electric, it does not matter, from an emissions perspective, whether we have a 'compact urban form', or not. Similarly, once building heating is zero emissions, energy efficiency is not an issue from an emissions reduction perspective.

The problem here is that when the Commission makes statements that actions in these areas are 'essential' to meeting the 2050 target, regulators and local authorities will seize upon them to push grossly uneconomic proposals.

Biofuels support advice arbitrary

The Commission recommends establishing seven biofuels plants by 2035, which will require subsidies. The sole reason is that other countries are doing it.

Ministry for the Environment fabricated light vehicle marginal cost of electrification estimates

The Ministry for the Environment has produced marginal cost of abatement estimates for light vehicle electrification that show that the costs are actually negative. They did this by assuming very high benefits from lower health costs and using fabricated modeling.

Perverse and inaccurate car safety ratings are promoting the purchase of large higher emitting vehicles

The Government has been promoting a move to larger vehicles through its used car vehicle safety rating system and advertising campaigns. This rating system is flawed

and misguided. Its is based on a Monash University statistically based Crashworthiness rating, which focusses on the safety of the vehicle occupant, ignoring the harm done to others. The smallest cars perform badly with this system because small cars will lose out to large SUVs in a collision. Monash also has a rating measure, the Aggressitivity rating that takes the safety of other road users into account. Large SUVs perform poory on this measure and small cars the best. This is combined with the crashworthiness rating to produce a total safety rating. This presents a much more favourable picture of the safety performance of small cars. However, despite it being the obvious choice from a public policy perspective, inexplicably this rating system is not used.

The rating systems measures relative, not absolute risk. This means that by construction, forty percent of vehicles are always in the bottom two quintiles and get a one or two star rating regardless of their absolute risk. These are decribed as presenting an unacceptable risk. Most small used cars will get this rating.

In our view the car rating system is perverse and should be reviewed, and in its current form, scrapped. The Government should not be in the business of promoting an arms race on vehicle size.

Part Three: Key Recommendations

The Commission should:

1. **withdraw** its recommendation to halt the import of ICE light vehicles by 2032 altogether or extend the date to 2039.

2. **withdraw** its recommendation to introduce emission standards.

3. **withdraw** its recommendation to subsidise electric vehicles.

4. **rerun** its current policy settings benchmark pathway with realistic carbon emission price increases.

5. **run** its emission models to 2100 to gain an understanding of the optimal pathway for exotic forestry withdrawals.

6. **disclose** all of its ENZ model structure and provide a comprehensive description of its transport modelling.

7. **review** the Kuschel modeling of the value of emissions reductions for health.

8. **review** the Rightcars car safety rating system.

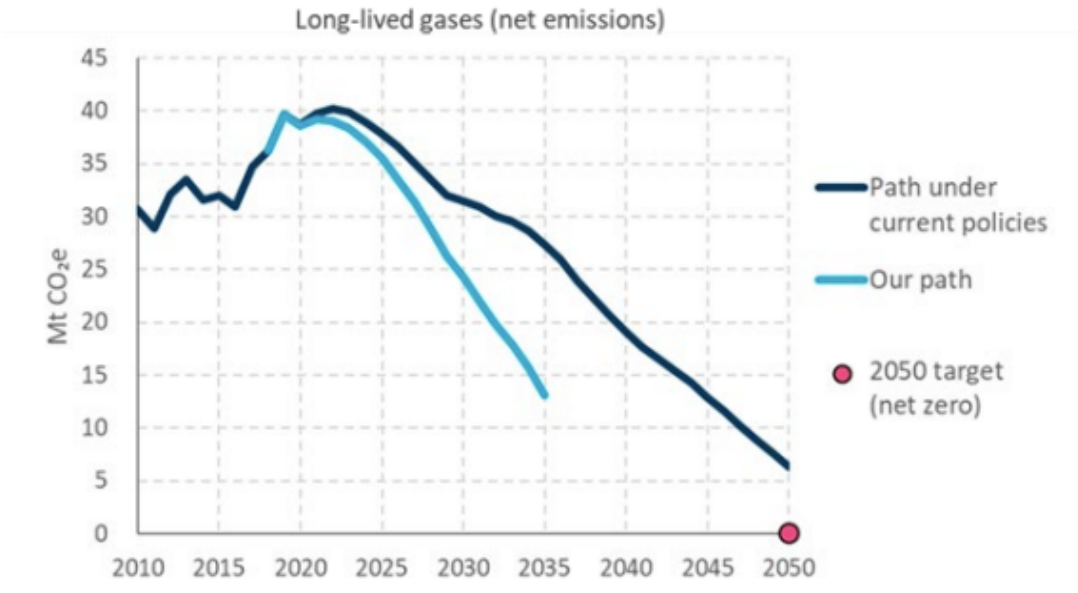
9. **restrict** its advice to actions that will have a material impact on reaching the 2050 net zero carbon objective.

Part four: General issues

A: The Commission's new path

It is helpful in understanding what is to follow if we first set out schematically the Commission's new path. The black line in figure one shows the Commission's estimates of net emissions under 'current policy'. The depiction of current policy is not really accurate because it assumes that the emissions trading scheme is not used beyond current carbon price levels. The carbon price is assumed to be fixed in real terms at $35 a ton. In the Advice report it is reported that the 2050 net zero emissions target can be met by increasing the carbon price to $50. The black line would then reach the 2050 red dot. The Commission does not like this outcome and is recommending a more 'ambitious' and costly path represented by the teal line.

Figure one: Long lived emission paths



B. Compliance with the Act

Net versus gross net zero target

The Act requires that emissons (other than biogenic emmisions) be measured on a net basis. However, the Commission has substantively ignored that requirement and is pursuing a zero gross emmissions 2050 target. The reasoning is that exotic forests are not an effective form of sequestration. This issue is discussed in Part four. It is clear that the Commission's arguments on sequestration are not supported by the evidence and that it has not advanced any new argument that was not known when the Act was passed.

Reviewing the target

The Act does require that the Commission review the target when setting emissions budgets. But in doing so there should be a formal and identifiable review process and the Commission should make a recommendation to the Minister on any change. This has not been done. The Act did not contemplate an early review of the 2050 target but reviews of the target post 2035 (s. 5S) are provided for. The target may only be changed if a significant change has occurred, or is likely to occur, to one or more of a the following conditions:

(i) *global action:*
(ii) *scientific understanding of climate change:*
(iii) *New Zealand's economic or fiscal circumstances:*
(iv) *New Zealand's obligations under relevant international agreements:*
(v) *technological developments:*
(vi) *distributional impacts:*
(vii) *equity implications (including generational equity):*
(viii) *the principal risks and uncertainties associated with emissions reductions and removals:*
(ix) *social, cultural, environmental, and ecological circumstances; and*

It would be very difficult to make a case that there has been a substantive change in any of those conditions since the Act was passed in 2019.

Need for a cost benefit analysis

The Act states (section 5M) that in performing its functions and duties and exercise its powers the Commission must consider, where relevant:

(b) existing technology and anticpated technological deveopments, including the costs and benefits of early adoption of these in New Zealand; and
I the likely economic effects.

The proposal to subsidise electric cars clearly requires an explicit consideration of the costs and benefits but there is no such attempt in the report. Nor is the information that would give the reader a sense of the costs and benefits provided.

Budgets must be ambitious

In the Evidence report the Commission states:

The Act states emissions budgets must be ambitious but achievable and that the Minister must meet emissions budgets as far as possible through domestic actions.

The Act does not state that emission budgets must be ambitious.

2050 target versus minimizing emissions over 2020-50

Frequently the Commission buttresses its arguments by saying that reducing emissions at any point in the progression will help support the global 1.5 degree warming target. This is true in a literal but trivial sense.

But the Act does not provide for a 2020- 2050 emissions budget or say that emissions should be reduced wherever possible. It does state in section 3 that the purpose is to contribute to the global effort under the Paris Agreement to limit the global average temperature increase to 1.5 degrees. But that is only in the context of describing the purpose of the 2050 zero net emissions framework that is the mechanism for furthering the support of the Paris Agreement.

C: The Commission's Principles

The Commission says that its analysis and recommendations are driven by a set of principles. Its principles and our comments are as follows:

Principle 1: Align with the 2050 targets

The Commission has not aligned with the 2050 carbon target, which is expressed in net, not gross, terms.

Principle 2: Focus on decarbonising the economy.
New Zealand should prioritise actions that reduce gross emissions within our borders, as well as removing emissions by sequestering carbon dioxide in forests.

Reducing emissions (net not gross) within our borders is required by the Act. The Commission is not prioritising the removal of carbon dioxide though forests. Cutting the supply of exotic forest sequestrations and increasing indigenous forests will have a negative impact over relevant time scales.

New Zealand should focus on decarbonising its industries rather than reducing production in a way that could increase emissions offshore.

Having regard to 'leakage' is sensible.

Forest sequestration should not displace making gross emissions reductions.
This is not a principle, it is the Commission's preferred outcome.

Principle 3: Create options.
There is much uncertainty in embarking on this decades-long transition. Uncertainty is not a reason for delay. There is value in creating options for meeting the targets and having the ability to adjust course as the transition proceeds. The decisions taken now should open up a wide range of future options and keep options open for as long as possible.

Preserving options can be a reason for delay. Once a decision is taken to go down a certain path the option is lost. There can be a value in creating options but in this report the value is often not assessed and compared with the cost of creating the option.

Principle 4: Avoid unnecessary cost.
The actions New Zealand takes to meet emissions budgets and targets should avoid unnecessary costs. This means using measures with lower costs and planning ahead so that technologies, assets and infrastructure can be replaced with low emissions choices on as natural a cycle as possible.

It is not clear that in practice cost minimisation loomed very large in the regulatory decision-making advice. Electric vehicle subsidies clearly do not meet any cost minimisation test.

Principle 5: Transition in an equitable and inclusive way.
This can mean anything but given the legislation the Commission had to say it.

Principle 6: Increase resilience to climate impacts.
The actions New Zealand takes to reduce emissions should avoid increasing the country's overall exposure to climate risks such as drought, flooding, forest fires and storms. Where possible, actions should increase the country's resilience to the impacts of climate change that are already being experienced and that will increase in the future.

The impacts of climate change on New Zealand over the next eighty years, even in a world where the Paris agreement is completely abandoned, are vastly exaggerated. A comprehensive review of the first National Climate

Change Risk Assessment that demonstrates this is forthcoming. The only substantive impact on New Zealand will be sea level rise, and it is difficult to see a strong connection between sea level rise and the Commission's advice. This 'principle' appears to have has been designed to justify the reduction in the role of exotic forest offsets.

• *Principle 7: Leverage co-benefits.*
The actions New Zealand takes to meet emissions budgets and targets should consider the wider benefits, including benefits to health, broader wellbeing and the environment. Co-benefits can provide further reason to take particular actions where the initial emissions reductions may be modest or appear relatively costly.

The importance of co-benefits will depend on realistic and honest assessments. This has not been the case in the Commission's analysis (see below).

D: Emissions trading versus interventions

One of the key issues in the Commission's reports is the balance between reliance on the emissions trading scheme and regulatory interventions. The Commission does pay obeisance to the rationality and economic efficiency of the trading scheme.

Emissions pricing is one of the strongest and most flexible levers available for tackling climate change. It works by making the businesses and people who make the decisions that create emissions feel the costs associated with those emissions.

The power of emissions pricing comes from how it allows those driving emissions to find their own ways of reducing emissions. Given they know their business, needs and capabilities best, this frequently leads to cost-effective outcomes as the price helps direct the allocation of resources towards lower emissions activities.

There is extensive empirical evidence showing how effective emissions trading and other market-based measures are at helping to allocate financial resources efficiently and achieve reductions at low cost.

But then the Commision backtracks and makes the case for intervention. The case for the strong primary role for the ETS is seen as rather dated and naïve.

As international research and experience now shows, the most effective and efficient approach is to implement a much more comprehensive and diverse suite of climate policies.7 See, for example (Canada's Ecofiscal Commission, 2017; Grubb et al., 2014; International Energy Agency, 2017; OECD, 2013b)

We reviewed this literature. If there is a central theme it is that interventions should be approached cautiously and should bear the burden of proof of a superior outcome. The Canadian paper, in particular, identified electric car subsidies as an example of a poorly-targeted intervention.

As our case study indicates, the mere existence of these problems is not enough to justify a policy response. The benefits of overcoming these market problems must outweigh the costs of doing so. We find electric vehicle subsidies to be a high-cost approach relative to other policy alternatives.

And in general:

In the absence of a clear rationale for policy, however, policies risk being driven purely by political or lobbying interests

The Commission raises the political motivation for interventions.

There are limits to the effectiveness of emissions pricing, however, which can be overcome with other policy interventions. For example, high, visible emissions prices can be unpalatable and lead to issues of acceptability.

The political unacceptabily of high emissions prices, in particular the direct impact on fuel costs, has often been cited as a reason to adopt sub-optimal strategies for transport. Recently, however, there is an emerging view[2] that higher fuel prices can have an important positive signalling effect. It tells the public that the government is serious about reducing emissions and will not be constrained by the old political barriers to effective action.

And of course the political unacceptabilty risk is a problem almost entirely of the Commission's making. If it had stuck to its legal mandate and made reasonable use of exotic forest sequestrations then the problem of excessively high carbon prices would not arise. With exotic forestry offsets the carbon price increases to just $50 by 2050.

There is also resort to market failure arguments:

There are also many other challenges associated with reducing emissions that are not strongly related to cost. For example, not every decision made by individuals and firms is based on an economically rational optimisation of costs. In these cases, standards and information can be more effective than emissions pricing in steering choices towards lower emissions measures.

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[2] Pystaick A. 2020 ' Carbon pricing as a political signaling tool' Memo

This statement relies on the bigger myth of the omniscient philosopher kings who create the regulations unaffected by politics, status, power and financial reward.

A particular problem here is the political need for 'announceables'. If there is a big problem there can't be a simple clear solution. There must be a list of interventions as long as the problem is big.

There are reasons to intervene to reduce emissions. The Commission mentions the network externalities and policy cordination problems citing Verde & Kardish, (2020) However, there is nothing in this paper about market failure in light transport markets, which is the main focus of the Commission's interventions.

But it does not provide the 'full incentive' that would be justified when positive spillovers and other social benefits of low emissions innovation are taken into account.

The positive spillovers, where they exist, can be readily be addressed through an externalty tax that could, for example, be readily applied to, say, diesel fuel.

A long-term view of cost-effectiveness must be taken, to not only consider just what emissions reductions are cheapest in the near-term but also how actions now can influence future costs. For example, investments in demand-side incentives for key low emissions technologies – such as financial support for electric vehicles (Evs) – can lead to improvements that reduce costs for future users of those technologies. These dynamic effects go beyond the life of a particular intervention and mean that some apparently very expensive actions contribute to a more economically efficient, socially equitable, transition over time. (*Gillingham & Stock, 2018)*

The problem with the 'dynamic effect' argument is that it can be used to justify almost anything. The Gillingham and Stock paper sets out a whole list of ineffective and expensive interventions, but then identified Germany's massively expensive subsidies of solar power as a possible dynamic exception. They argued that the solar power industry would never have got off the ground without it. It provided the Chinese the initial incentive to get into the market, which generated the technological advances and economies of scale that drove down prices. The point is arguable but it certainly doesn't justify subsidising small scale solar power in places like Scotland for example.

The dynamic argument is largely nonsense in the New Zealand context. Increasing New Zealand EV demand now is unlikely have much impact on future EV users. We are obviously not going to spark innovation or have an economies of scale effect in the international automobile market

Finally the Commission addresses the 'waterbed issue' that refers to the idea that emissions reductions achieved through other policies displace more cost effective reductions that would have otherwise occurred due to the ETS.

We have not addressed the waterbed issue as we believe that this is being handled by other submitters. Their message is that the Commission is wrong on the facts.

The Commission concludes:

The Government also has choices around the extent to which it relies on the NZ ETS or other policies to make these emission reductions happen.

The more that non-ETS policies are used, the more likely it is that the NZU price in the NZ ETS can be lower while still achieving the same overall amount of emission reductions.

This reads as an open invitation for the Government not to push ETS prices.

E: The value of co-benefits

The Commission places considerable weight on the value of co-benefits, and in particular on the value of reducing ICE vehicle emissions for health. This is based on a 2012 study by the Ministry of Transport and Ministry of Health (Kuschel)[3] that assessed the health costs from vehicle emmissions at $1 billion a year.

The Kuschel study grossly overstates the health costs of motor vehicle emmisions, and in particular emissions from light petrol ICE vehicles. It assumes death rates that are 50 times that produced by the WHO modelling for New Zealand. The overstatement has been noted by a previous Parliamentary Commissioner for the Environment. We reviewed the shortcomings and errors in the Kuschel report in our paper.' A question of trust' [4], which was submitted to the Select Committee on the Zero carbon bill. The MfE should have read the analysis and passed it on to the Commission.

Despite the warning signs there has been no reassessment of the health cost analysis and the MfE, the Climate Change Commission and others continue to rely on and promote its misleading results.

The following is our assessment as presented in 'A question of trust'.

[3] Kuschel G, Metcalfe J, Wilton E, Guria J, Hales S, Rolfe K, Woodward A. 2012. Updated health and air pollution in New Zealand study.

[4] Tailrisk Economics 2019 'A Question of Trust'

Health Co-benefits from emissions reductions

Air pollution from human activity is estimated to cause around 1000 premature deaths per year. The total cost of deaths related to air pollution is estimated at $4.28 billion per year (Kuschel et al, 2012).

A cost of $4.28 billion per year is a big number and if a significant part of that can be reduced by emission reduction initiatives it provides support to the co-benefit narrative.

The source on the health cost figure is the 'Updated health and air pollution in New Zealand' (HAPINZ) study (2012). However, the MfE notes that the $4.28 billion is likely to be an overestimate.

We note that:

- The methodology is different from other estimates created for the Global Burden of Disease study (Ministry of Health, 2016). Using a like-for-like methodology reduces the estimate for air pollution deaths from 1000 to 570.
- The HAPINZ update study valued a death at $3.5 million, which was the figure used to value the cost of traffic accident deaths. The previous HAPINZ study used a figure of $750,000. Because air quality primarily causes deaths in old age, it was assumed in the earlier study that only 5 years of life would be lost. The Update, on the other hand, assumed that all deaths should be valued equally, regardless of age. The social cost of a death at 20 years of age, with the loss of 60 future years of life, is the same as a death at 85 with the loss of, say, 2 years of life. This is not a judgment we share and we did not see any convincing arguments in the Update to justify it. Using the previous methodology reduces the value of the benefits by a factor of 4.5.

Adjusting for the number and value of lives lost reduced the annual cost to around $550 million. The MfE was aware that $550 million was the more credible total estimate and should not have repeatly cited the $4.28 billion estimate through their review.

The next issue is the amount of air pollution attributable to emissions that contribute to climate change. In the HAPINZ report 22 percent of emissions were attributable to motor vehicles and 10 percent to industrial processes. The biggest source is domestic emissions, but this is almost entirely from renewable wood, which is not the target of climate emissions policy. So at most only a third of emissions costs can be identified as an emissions reduction co-benefit. This would bring down the annual cost to about $180 million.

The MfE tried to duck this issue by repeatedly claiming that it is 'difficult' to attribute emissions to their source. The information is readily available in recent MfE and Statistics New Zealand reports. The real reason for ignoring this information, we believe, is that the MfE didn't want to dilute the 'big headline number' effect.

Impact of emmisions on excess deaths

The most important issue is the yawing gap between the HAPINZ airpollution death estimates and those reported by the World Health Organization in their paper '*Ambient air pollution: A global assessment of exposures and burden of disease' 2016.* The study found that New Zealand had the equal first best air quality in the world, and that the number of deaths from all human sources in 2012 was **20.** The death rate per 100,000 people was 0.5 compared to the HAPINZ estimate of about 25.

The MfE must have been aware of this divergence and should not have used the HAPINZ results unless it was confident that the underlying science was robust. Looking at the HAPINZ analysis we identified a number of issues.

- Deaths are estimated to increase by 7 percent per 10 mg. per cubic mete increase in air particulates. But hospital admissions for illness classes related to pollution, increased by less than 1 percent. This difference should have raised some questions about the reliability of the mortality results.
- The HAPINZ estimate was based on a single New Zealand study (Hales 2010). The Hales analysis was not based on actual measures of air pollution. Instead air pollution was modeled from estimates of source emissions, using a model calibrated from just Christchurch's measured and modeled levels of pollution. This might have biased the results. Christchurch is not a 'normal' New Zealand city from a pollution perspective. It is admitted, by Hales, that this approach will, at the least, have narrowed the confidence interval, around the central estimate, but the question of bias was not addressed.
- The modeled emissions by city or town are not used directly. Rather they are aggregated into four groups, suppressing variability, and further narrowing the reported confidence intervals. As the confidence interval was already 1.03-1.10 around the central estimate of 1.07, it is possible that a more robust approach would not have shown a statistically significant relationship between mortality and pollution levels.
- The Hales study was not independently reviewed for the HAPINZ report. The relevant section in the report (appendix 3) on health outcomes and the exposure –response relationships, was prepared by Hales. This breached a basic rule for the use of science in policy development. There should be a separation between the original research and the decision-making for the

report.

- Finally, it was just assumed that there was no threshold effect. That is, even the smallest amount of air pollution was assumed to have a mortality effect. The explanation was that *'this is in line with current thinking for exposures in the range typically experienced in New Zealand',* and two references (Schwartz et al. 2002, Schwartz et al, 2008) were cited in support. The absence of a threshold might have been in line with the report authors' own thinking, but this is not an argument. The 2008 Schwartz paper was a response to a decision by the U.S. Environmental Protection Agency (EPA) not to tighten the annual average standard for particles (15 µg/m). The EPA argued that there is no convincing evidence for effects below that level (U.S. EPA 2006). Schwartz presents a study that comes to a contrary view. But that is only one opinion, and looking at the study, the confidence intervals for the low exposure levels prevalent in New Zealand were broad (not significantly different from zero) suggesting that the US EPA was right, at least for New Zealand.

In a 2015 report[5] the Parliamentary Commisioner for the Environment raised some questions about the robustness of the New Zealand cost of air pollution estimates, though without going as deeply as we did into the underlying analysis. She posed the question: why, with similar air quality, Australia's total premature death estimates were only fifty percent larger than New Zealand's despite the Australian population being five times larger. The Commissioner's report was ignored.

To conclude, the New Zealand evidence is not robust and should be reviewed. The Commission should not use the vehicle emission reduction co-benefit argument unless it is satisfied that is based on sound scientific evidence of a material impact.

F: Economic impacts

An attempt at assessing the impact of the proposed actions on New Zealanders is set out in chapter 12 of the Evidence Report. It is difficult to assess the value of the modelling because the Commission has not, as it should have, released the modelling on which it is based, or presented much detail on the results. We are therefore retricted in what we can say. We are not alone in this. One of the Commission's reviewers (Hafstead) commented:

[5] Parliamentary Commissioner for the Environment. 2015. The state of air quality in New Zealand Commentary by the Parliamentary Commissioner for the Environment on the 2014 Air Domain Report.

I don't quite understand why much of the discussion in Chapter 12 is qualitative and doesn't present more C-PLAN results. What is the reasoning for this?

The Commission was quite effusive in talking up its modelling efforts on its webite.

Experts from New Zealand and around the world have reviewed these models and agreed that they are high quality and up for the job.

The experts said that they were "impressed by both the scope and detail of the modelling efforts, and believe that these provide a robust quantitative framework to support ambitious climate policy proposals for Aotearoa". Our economy wide model C-PLAN was also described as being 'best in class'.

The Commission was cherry picking from individual responses. What the reviewers actually said (the Stroombergen summary) was:

1. The models are sensible and fit for purpose.
2. There is nothing so seriously suspect about the modelling that it would impede the Commission from publishing the work done to date.
3. A general equilibrium model (C-PLAN) combined with bottom-up technology based modelling (ENZ) is supported by all reviewers

Which is not quite so gushing.

The reviews were actually quite limited (just a few pages each) and it appears that the reviewers were provided with little more than the information that appears in the Evidence report. None of the reviews focused on the transport sector modelling.

The macroeconomic results

The key impacts are set out in figure two (their table 12.2)

Figure two: Commission's GDP results

Table 12.2: GDP projections from the Commission's C-PLAN modelling ($ billion)

C-PLAN scenarios	2017	2025	2030	2035	2050
Current Policy Reference	270	329	362	396	512
Transition Pathway 1 (TP1): More removals	270	329	362	395	510
Transition Pathway 2 (TP2): Methane technology	270	329	362	395	510
Transition Pathway 3: (TP3) Less removals	270	329	362	395	508
Transition Pathway 4 (TP4): Faster reductions	270	329	358	392	508

These findings are in line with international estimates, such as those by the United Kingdom Committee on Climate Change and the European Commission [8]

Issues with the modelling

The first issue is that only GDP results are presented. The more relevant measure is consumption. GDP can be sustained by unproductive investment but consumptioon will have to fall to fund that investment. The Stroomberg review of the modelling identified the lack of a welfare based measure as an issue. And were told that the impact on real gross national disposable income would be about 1 percentage points across all pathways, almost doubling the cost of the pathway 4 policies. These results should have been presented in preference to the GDP results.

The second issue is that comparing the impact on GDP outcomes tends to lead to lower perceptions of the costs of the policies. The cost is 'only' just over 1 percent of so of GDP in 2050, so who cares. If, however, the costs are represented in terms of dollar amounts over 2020-2050 then they appear much more significant. Very roughly the cost of transition pathway 4 is $100 billion (in nominal GDP rather than present value terms). The cost of pathway 1 is $35 billion.

Further in pathway 1 the costs could potentially be less than the $35 billion. In the Advice report the Commission says that :

We have tested a variation to the current policy reference case assuming a slightly higher NZ ETS unit price of $50. In this variation, new forest planting increases to around 1.3 million hectares by 2050, allowing net zero emissions to be reached with minimal further reductions in gross emissions. The results suggest that Aotearoa could meet the net zero target for long-lived gases with relatively little additional change.

This suggests that if we count the cost in terms of real national disposal income cost then the cost of the Commission's ambition could well lie in the range of $100 -150 billion.

The Commission also downplays the 'ambitious' policy costs by comparing them with the costs of a recession.

Looking out to 2035, our modelling suggests that reducing emissions to meet our proposed emissions budgets would cost Aotearoa no more than $190 million each year over emissions budget 1, $2.3 billion each year over emissions budget 2, and $4.3 billion each year over emissions budget 3.

The aggregate cost are $950 million to 2025. $11.5 billion over 2035-30 and $21.5 billion over 2030-35 for a total of $43 billion.

This impact is small, compared to normal fluctuations in GDP caused by the business cycle. There would be recessions and booms in the next 30 years that are not due to climate

change. By comparison, in the year ending March 2009, the global financial crisis caused a 1.6% drop in GDP from the previous year, as compared to growth of 2-3% in previous and subsequent years. The recession caused by COVID-19 is likely to be larger again.

The comparison is misplaced. The aggregate unnecessary cost of perhaps $100-150 billion, is 30-50 percent of GDP, which is greater than than the cost of the GFC. But more relevantly we did not voluntarily choose to be subjected to the GFC.

Third, the time paths consider a straightline path to the zero carbon target (ie a reduction of one third per decade) with a boost to 36 percent in the first decade under the ambitous option. A straightline path will almost certainly be sub-optimal . Technology and costs are evolving rapidly and it makes sense to delay capital investments, particularly in the transport sector, until those costs come down.

Finally, the Commision does not consider costs post 2050. It just asserts that these will be 'substantial' if we do not take their ambitious early decarbonisation route. This is a complex issue that requires careful analysis. But there is none.

G: A gradual vs abrupt transition

The Commission's discussion on this issue runs as follows:

A key challenge is judging how fast the country's transition needs to be. There is a question as to how to balance the urgency of preventing dangerous climate change and its associated costs, with managing the impacts of disruptive economic transformation. There is also a question about our strategy as a nation – do we lead, which might come with higher costs but also first-mover advantages, or be a follower, delaying action until others show us the way and costs come down?

Nothing we can do directly will affect climate change outcomes and believing that New Zealand's policies can be the spark that ignites a world-wide crusade borders on the delusional. Norway spent billions very heavily subsidising Evs for years with little effect. There are no first mover advantages in buying more electric cars or erecting more windfarms.

It makes the case against too rapid a transition:

Experience, including the country's own experience of reforms in the 1980s, has shown that rapid transformative change is socially and economically painful. This counts against very fast early action.

However, it also argues that this experience counts against too slow a transition for reasons that are not clear.

It also counts against waiting until solutions have been found and fully proven elsewhere before rapid uptake and transformation at home.

Delaying action would lead to a similar abrupt decline in emissions, but later. This also carries risks of increased costs, even though technology solutions may be cheaper. Continued investment in the wrong type of infrastructure, for example, could lock in emissions and cause stranded assets. Delaying action would also increase the country's contribution to global emissions.

The mission is not to minimise contributions to global emissions over the transition period. If that were the case we would always take the most rapid adjustment path,

In contrast, early but consistent action would allow for a more gradual and steadier pace of change, with more scope for managing impacts. While there is uncertainty about the future pathway, the technologies for reaching emissions reduction targets in Aotearoa are mostly known.

By adopting these technologies early rather than waiting for costs to come down, people can learn by 'doing', while steadily building up supporting infrastructure and services and helping overcome user barriers and reach critical mass.

It doesn't take time to adapt and innovate to drive an electric car. We have done it. You press go and drive. In terms of electric maintenance and infrastructure support it pays to be a later adopter. Some of the early bugs will have been worked out. There will be a learning curve for businesses in learning how to use an electric truck fleet but again users can learn from overseas experience if they are a later adopter.

Early signalling gives businesses time to adapt and innovate, find solutions that are both good for the climate and good for the bottom line, and replace assets and infrastructure with low emissions options on as natural a cycle as possible. Modelling carried out for Westpac in 2018 showed that taking planned action on climate change was more cost effective and could save New Zealand $30 billion in GDP by 2050, compared to delaying action until 2030.

We have reviewed the Westpac analysis. It was about the rate of removal of free credits from the agricultural sector and was not about the rate of adjustment across the whole economy.

The research, which was carried out by EY and Vivid Economics, was based on the modelling of two scenarios: a central scenario, where early climate change action is taken, and a shock scenario. The key difference between the two is that in the

central scenario, agriculture is gradually introduced into the emissions trading scheme over 2020-30. In the shock scenario agriculture is introduced to the scheme in 2030, and is only given two to five years to adjust to its full impact.

The early but slow introduction reduces agricultural output by 2.1 percent, compared to a 13.7 percent reduction with the shock event. This appears to be the key to the reduction in GDP of 0.4 percent which drives the cumulative $30 billion loss.

As no one is arguing for phasing out free agricultutural credits over a short period the report has nothing useful to say about the speed of adjustment issue across the whole economy. The Commission should not have used it to push its case.

While pressing for a decarbonisation of the economy the Commission makes an exception for steel and cement.

We have conservatively assumed that domestic steel making, cement and lime production continue to operate at current levels of production and do not achieve efficiency improvements.

Part five: Forestry

The Commission's advice is to move from a net to a gross net emissions target, reducing, and, as far as possible, eliminating the role of exotic forestry post 2050. The argument for the change is that:

Relying heavily on forestry before 2050 is likely to make maintaining net zero long-lived greenhouse gas emissions after 2050 difficult. It would delay action, lead to higher cumulative emissions and make the job ahead of us more difficult.

Their plan is to ramp up indigenous plantings to 25,000 hectares per year, establishing close to 300,000 hectares of new native forests by 2035

native afforestation could be suitable for areas of less productive land where exotic afforestation is inappropriate. It would therefore not come at the expense of other economic activity.

It is not explained why exotic forestry is 'inappropriate'.

Exotic afforestation would continue the trajectory expected under current policies up until 2030, averaging around 25,000 hectares per year. From 2030 onwards, the rate of afforestation for carbon removals would reduce.

To achieve this, exotic forests would have to be removed from the ETS or face a scaled back price. Controls would also need to be placed on where afforestion happens, presumably to avoid 'inappropriate' plantings.

It is argued that with a sustained high rate of planting through to 2050, new native forests could provide a long-term carbon sink of more than 4 $MtCO_2$ per year, helping to offset residual emissions from hard-to-abate sources such as agricultural nitrous oxide.

The Commission makes two arguments to support its plan.

Intergenerational equity

It is argued that forcing earlier gross emissions reductions will avoid pushing the burden to future generations. The argument here seems to be that if all of the lower cost forestry emissions are used up to meet the 2050 target too easily, the post 2050 generation will be unfairly disadvanataged.

This argument depends on what assets be are talking about.

- Shortlived assets such as cars and trucks.
  These assets are not passed down to the next generation. They wear out. It makes no sense to force the current generation to prematurely buy expensive electric cars when the next generation will be able to readily buy cheap ones. One of the reasons for having a supply of exotic credits post 2050 is that it provides for the runoff of ICE cars and trucks. Even if new vehicles are nearly all electric post 2040 there will still be a long tail of ICE vehicles in the fleet.

- Privately-owned long-lived assets.
  These assets will be maked down in price because of their emissions intensity when they are passed to the next generation. The burden is borne by the current generation.

- Long-lived public assets.

> The next generation will only benefit if they are funded from the current generation's consumption. If they are funded by debt (or a reduction in other capital formation) then the next generation will be no better off.

As we understand it the current generation's sacrifice of exotic forests credits will not be much help to the next generation. The exotic forests will only go to reducing emissions prior to 2050. They will have to rely on indigneous forests to offset 'hard to reduce' emssions. But there will be precious little of those. Figure three shows that by 2050 there will only be 0.7 m tonnes of offsets available.

Figure three: Pre 2035 forest plantings

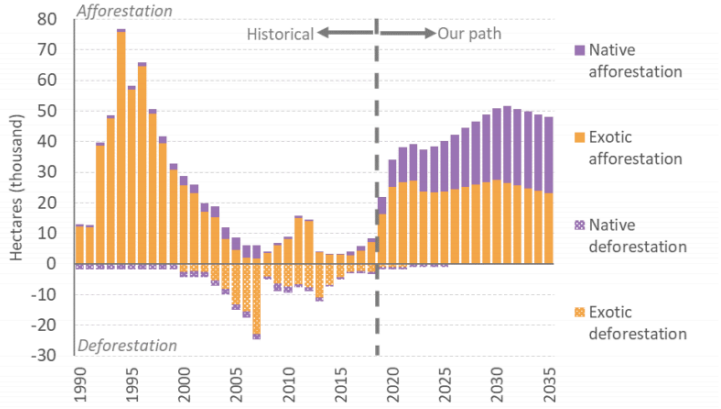


Figure 3.18: Afforestation and deforestation by year in our path.

Even if the the amount of plantings increase markedly above the Commission's planned 25,000 hc. per year, it could be decades before there will be an appreciable amount of off-sets. The Commission says that 4 million tonnes of offsets will be available, but doesn't say when. There is no evidence of any modelling to substantiate the 4m tonne figure. All we are give in figure four is the amount of offsets under current policy up to 2050. There is no comparable figure under their preferred pathway or any post-2050 modelling results.

The Commissions sells its plan by focusing on the reduction in the amount of exotic forests previously thought necessary. They don't mention the amount of land that will have to be diverted to indigenous forests to make a difference even more than 100 years in the future.

Figure four: Net emission removals by forests

7.7.7 Net emissions removals by forests

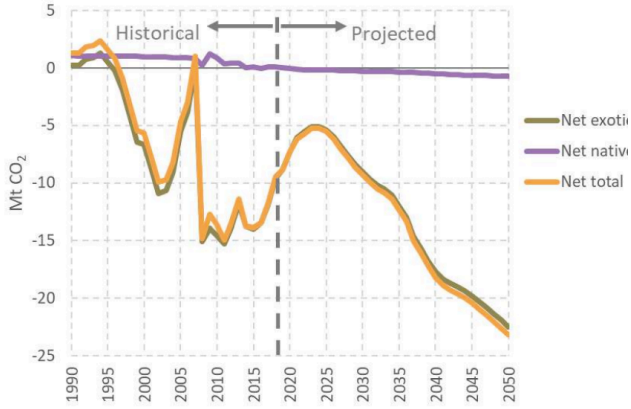


Figure 7.24: Current Policy Reference case net forest emissions

Nor is too much thought given to the costs of their model. Exotic forests will be self – funding and may generate wider economic benefits. Indigneous forests at the required scale are not. The Commission made no effort to assess the fiscal cost.

Exotic forests are an insecure form of sequestration

The Commission makes a number of arguments that exotic forests are not a secure form of removals.

There are risks associated with the permanence of forestry removals, especially as climate change makes forest fires, heavy winds, storms, droughts, pests and pathogens more likely.

The climate change risk argument is hugely exaggerated. The science tells us that these risks are moderate and in any event are more than offset by an increase in exotic forest productivity with carbon fertilisation and higher temperatures. This issue was covered in Watt et al[6], which was cited in support of the Commision's argument. This was highly misleading. Overall Watt makes a case against the Commission's argument. This what they had to say:

Forest productivity: Up 37 percent by 2090 uncer RCP 6.0 (which assumes a substantial overshooting of the Paris agreement).

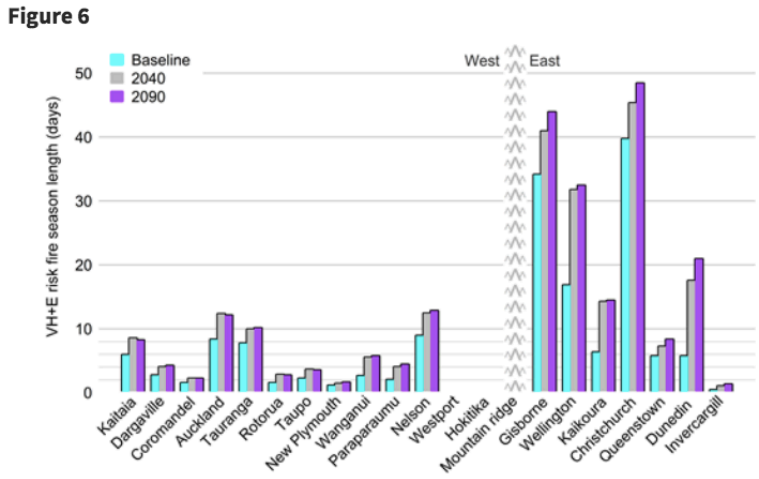
Extreme wind: Increases by 1-5 percent under RCP 6.0. The probability of a damaging wind event in a given year increases by .07 for mature trees, which are

[6] Watt, M.S., Kirschbaum, M.U., Moore, J.R., Pearce, H.G., Bulman, L.S., Brockerhoff, E.G. and Melia, N. 2018. Assessment of multiple climate change effects on plantation forests in New Zealand.

more vulnerable to wind damage. The damage likelihood is highly location specific, so all a potential forester has to do is avoid the most vulnerable areas.

Fire risk: The increases in high fire risk days is highly location specific, but is mostly not large.

Figure five: Watt increase in fire risk days



Biotic impacts: This is a comlicated story with some positives and negatives.

There is an argument for carefully thinking though the timing of exotic forest plantings. If, (to take an extreme example) all of the available land were planted this decade then there would be a limited supply to meet offset needs post 2050. A steadier rate of plantings could be preferered. The issue is whether this can be left to the market to respond to emision prices or whether some form of split- pricing regime could generate a better outcome.

Part five: Light vehicles

The Commission makes three recommendations with respect to light vehicles

- A ban on imports of light internal combustion engine vehicles from 2032.
- Electric vehicle subsidies to be introduced as a matter of urgency.
- A reduction of carbon emissions of imported vehicles to 105/gm per km. by 2028.

Light vehicle subsidies

The Commission is not entirely clear why subsidies for light vehicles need to be introduced as a matter of 'urgency', so we need to unpick what we think is their logic.

The starting point is that nearly all light vehicles must be electric by 2050 if something close to zero gross emssions is to be achieved. Of course, had the Commission started with a 2050 target based on net emissions then the light vehicle electrification emissions at this point could be less demanding.

Their baseline calculations show that under 'current policy settings' light vehicle emissions in 2050 would be 1.7 million tonnes of carbon a year. This, however, would reduce to near zero post 2050 as ICE (Internal combustion engine) vehicles are gradually retired from the fleet. This analysis should have been done but has not been provided.

The Commission then works back from 2050 to a conclusion that new light ICE vehicles should be banned from 2032 (or from 2035 depending on what part of the report you read). Though they don't say so, the eighteen year gap is probably related to the average age at which a light vehicle leaves the fleet. Then it is claimed that for this to occur 15 percent of vehicles entering the fleet in 2025 must be Evs. And as purchases of new vehicles are currently very low, because they are very expensive, and because the vehicles that dominate New Zealand new vehicle sales are not yet available it follows that EV imports must be subsidised as a matter of urgency. Without a subsidy the uptake in 2025 would be 5 percent. Table x shows the projected uptake under the Commission's current policy reference case.

Table one: Reference case vehicle sales

Table 7.6: Current Policy Reference case percentage of electric vehicles entering the fleet

	2018	2020	2030	2040	2050
Light passenger vehicles	2%	2%	17%	71%	99%
Light commercial vehicles	0%	1%	15%	78%	100%
Motorcycles	0%	0%	10%	55%	99%
Medium trucks	0%	0%	3%	30%	88%
Heavy trucks	0%	0%	2%	13%	52%
Buses	2%	4%	34%	94%	100%

Note: In 2025 the EV uptake is projected to be five percent for light passenger and commercial vehicles.

Assuming total imports of 300,000 vehicles a year, 15,000 would be electric, of which, say, 10,000 would be new vehicles. In 2020 there were about 2400 new BEV (Battery electric vehicle) and PHEV imports (plug in hybrid electric vehicle) imports.

Because imports of used Evs are limited by the low stock of vehicles available in Japan, in practice the burden of reaching the 15 percent target will fall substantially on new vehicle imports, which will need to be about 25 percent of imports by 2025 (assuming a constant supply of used Nissan Leafs from Japan of about 5000 a year).

Figure six: Prefered EV uptake

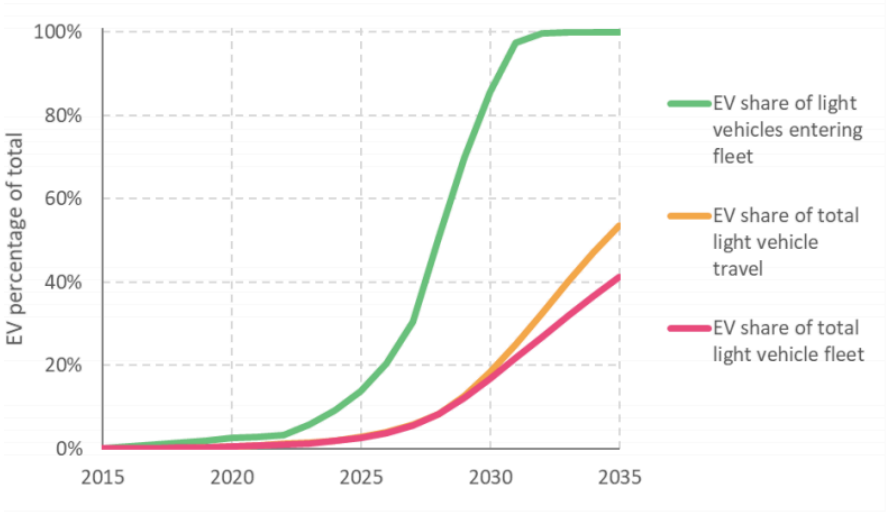


Figure 3.10: Uptake of light electric vehicles in our path.

To understand why the the Commission might think that it is essential for Evs to be subsidised now it is necessary to understand the structure of the New Zealand car market and the Commission's ENZ model, which provided the analytical support for the Comission's conclusions.

Structure of the New Zealand light vehicle market

The share of new light vehicle sales by class is shown in table x. Most new vehicle sales are in the SUV and Ute classes. Most New Zealanders, and in particular, lower income purchasers, rely on Japanese used car imports which have an average age of eight years when imported, to upgrade their vehicles.

Table two: New Zealand new light vehicle sales 2020

Class	Market share %
SUV	52.4
Ute	24.8
Cars	21.9
Vans	4.3

The Commission's ENZ model

The starting point for the ENZ model is a summary report from Bloomberg New Energy Finance that says that the cross-over points for EV/ICE costs are 2024 on a total cost of ownership basis and 2029 for the upfront cost of the vehicle.

The Bloomberg summary report is scant. There is no information on how the total cost of ownership calculation was done. We have not reviewed the full report (because of the cost), but neither did the Commission, for reasons that are not explained. In our view the Commission should not have used the Bloomberg results as the lynchpin of its modelling without a full understanding of what was driving the results.

The 2024 total cost price parity estimate looks to be extremely optimistic. Evs do have lower fuel and maintenance costs, but for modern efficient vehicles with long new car warranties these advantages are dwarfed by the much higher upfront costs for motorists who travel average distances. A close comparison in the New Zealand market is the longer range Kona EV (a compact SUV) at $78,000 compared to $38,000 for its ICE comparator.

The 2029 upfront cost crossover point is really just a guess. No one really knows how the technological and production cost improvements that could drive this result (or results, because the outcomes will be different by vehicle class and markets) will evolve. There is a risk that parity could be significantly delayed, making the ban on ICE vehicles from 2032 much more costly.

One notable feature of the Bloomberg model is that it shows that New Zealand's uptake of Evs will not lag behind Europe and Japan in the current policy reference case in the medium term. Indeed by 2040 New Zealand will be slightly ahead. This is shown in the Commission's comparison in chapter seven of the evidence report shown below. We wouldn't put too much store on the difference but it does draw attention to the Commission's motives. They want to be seen as ambitous and a shining light to the world now. Just being in the pack in 2040 doesn't cut it.

Table three: Commission's RV uptake comparison

Table 7.37: Comparison of Current Policy Reference electric vehicle uptake for light passenger vehicles (cars and SUVs) with other projections

	2018	2030	2040	2050
Current Policy Reference	2%	17%	71%	99%
BNEF 2020 - Global	0%	28%	58%	NA
BNEF 2020 - Europe	0%	34%	66%	NA
BNEF 2020 - Japan	0%	14%	60%	NA
TIMES-NZ - Tui	0%	11%	100%	100%
TIMES-NZ - Kea	0%	42%	100%	100%
IEA Stated Policy Scenario, Global	0%	17%	NA	NA
Ministry of Transport	2%	41%	87%	85%

Adjustments to Bloomberg within ENZ

The ENZ vehicle adustments are set out in the appendix of chapter seven of the evidence report. The full explanation and our comments are as follows:

> *Electric vehicles may be either pure battery electric vehicles or plug-in hybrids. The split for vehicles imported new starts with the actual split in 2019 and moves gradually to 100% battery electric by 2035.*
>
> *Consumers choose between conventional vehicles and electric vehicles based on the total cost of ownership of each type of vehicle over an assumed five-year ownership period.*
>
> *The major driver of electric vehicle uptake is the assumed decline in battery costs. This is based on projections by Bloomberg New Energy Finance's Electric Vehicle Outlook 2020. These figures suggest, for example, that the cost of batteries for a typical light passenger vehicle will decline from about NZD13,500 in 2018 to NZD6,100 in 2030 even while the battery size increases from 53kWh to 66kWh (with a corresponding increase in vehicle range).*
>
> *It also implies that, based on cost alone (excluding penalties), the purchase price of a light electric vehicle will drop below the purchase price of a conventional vehicle sometime between now and 2030.*
>
> Somewhere between now and 2030 is scarcely helpful.
>
> *There are also non-price barriers to electric vehicle uptake, such as consumer range anxiety and lack of vehicle charging infrastructure. These barriers are discussed in more detail in Chapter 4b: to represent these, ENZ includes three classes of penalties to slow the uptake of electric vehicles in New Zealand compared to what costs alone would indicate:*

- global early tech capital cost penalties, reflecting the global barriers to electric vehicle production;
-New Zealand specific capital cost penalties, reflecting barriers to electric vehicle uptake specific to this country;
- productivity penalties, which apply mainly to trucks, reflecting how batteries could reduce vehicle payload or range, thereby increasing operating costs per unit of payload.

Global cost penalty

This reflects supply issues that could mean that fewer vehicles will be directed to the New Zealand market even when there is a demand for them. The global barriers to EV production will only be transitory, where they exist. The leading EV manufacturer, Tesla, put its Shanghai factory together from breaking ground to vehicle delivery in a little over one year. New factories in Berlin and Texas will come on stream this year.

New Zealand specific capital cost penalaties (higher prices in New Zealand)

The Commission's thinking on New Zealand's barriers to EV uptake appears to have been guided by the Bloomberg report.

This lack of choice is compounded by a lack of leverage in accessing future supply of new electric vehicles. New Zealand is a small distant market, in need of right-hand drive vehicles. Automakers are expected to prioritise their passenger electric vehicle efforts on the markets with the most stringent regulations (such as China and Europe) for the next 10 years (Bloomberg) This means New Zealand may face restricted access to supply, particularly in the absence of any regulations or incentives to drive greater uptake.

The Bloomberg Electric Vehicle Outlook paper said:

Automakers focus their passenger EV efforts on the markets with the most stringent regulations for the next 10 years, leading to low rates of EV adoption in the Rest of World category.

The rest of the world category is mostly the developing world, which New Zealand is lumped in with. The conclusion the Commission seems to have drawn is that the lack of 'stringent' regulations are the stumbing point.

Driving on the left will slow things down a bit. The Tesla model 3 took a couple of years to arrive in New Zealand. The Tesla Cybertruck [7](pictured), which is targeted

[7] Even at a possible price of more than $80,000 the Cybertruck may appeal to the westie tradie market with its Mad Max looks, strong towing capacity, a 400km range and 5.6 second 0-60mph time. Some might even go for top of the range model with a 800km range and 2.9 second 0-60 time (in the supercar range). The Cybertrucks probably won't be here for a couple of years given the two year delay in getting the Tesla model 3. However, throwing a subsidy at 'the problem' won't get them here any faster.

at the Ute market is due for release in the US towards the end of 2021 or the beginning of 2022. With 650,000 pre-orders[8] (before they gave up counting) there will be a big backlog in the US which will reduce the incentive to produce a right hand drive version just for the Australian, New Zealand and for a smaller market in the UK where they don't really do Utes. However, the Cybertruck is now open for pre-orders (with a $200 refunable deposit) on the Tesla New Zealand website reflecting an intention to bring it to New Zealand.

New Zealand specific 'penalties' reflecting our small size are a fact of life which affects the cost of many imports. This does not provide an argument that they should be subsidised. We may not get the full selection of vehicles available in some markets but this will not have a prolonged impact on the total uptake of Evs. It has not stopped New Zealand having one of the highest rates of vehicle ownership in the world. Further, it is not clear that there will necessarily be much of a price penalty in New Zealand. The Tesla 3, New Zealand's most popular new EV, which can readily be bought on line, costs the same in New Zealand as in the UK.

The reality is that more affordable Evs are coming to New Zealand. The MG EV (a SIAC China brand) is less capable than higher priced vehicles but is already selling well. We were informed by one Wellington dealer that they are budgeting 40 sales a month. Another large Chinese manufacturer, BYD, has recently announced that it will be coming to Australia and New Zealand with afforable vehicles. Peugeot, Volkswagen, BMW amongst others have announced the arrival of new elelctric vehicles.

Figure seven : Tesla Cybertruck.

Similarly we will have to wait for the genuinely affordable small vehicles that will replace the likes of the Suzuki Swift and Mazda 2. They will probably come out of China. But it will take some time for small cars that meet Western tastes and regulatory requirements to be developed, tested in Europe and eventually make in down to New Zealand.

[8] Preorders cost US$100 and are refundable so they don't represent firm purchase commitments.

Bias against Evs

In addition to the technical factors discussed above the model embeds a bias against Evs.

In addition, there is a bias against electric vehicles built into the consumer choice function. This causes conventional vehicles to take a larger share of the market than electric vehicles even when the total operating costs of electric vehicles (including penalties) and conventional vehicles are the same. This bias reduces as electric vehicles gain in market share.

The bias assumption can be used to justify the subsidy. The subsidy increases the number of Evs on the road, which in turn decreases the bias, which increases the market share.

Whether there is a true bias against Evs in New Zealand is untested. The current low EV uptake can be explained by their high prices; their limited capacities (range and charging speed) and unavailability in key market sectors. There are no electric Utes and large SUVs available anywhere in the world. Even if there is an 'irrational' bias this will naturally fade quite quickly. The bias against automobiles in favour of horses rapidly disappeared in that transport revolution without any assistance from subsidies.

The problem with the Commission's 36odeling is that the detail of the model, and in particular the model coefficient values and the reasoning behind them are not disclosed. It would have been straightforward to do so.

Limit on the EV growth rate

The assumption that probably has the biggest impact on the 'need' to subsidise electric vehicles sits innocently at the end of the discussion.

There are also limits in the model on the speed at which the electric vehicle shares of newly registered vehicles can increase.

What this means is that if you want to hit a certain EV uptake by 2040, or any other date, then it is 'necessary' to pump up the 2025 numbers because later and steeper trajectories are not permissible in the model.

There is no reason for a growth restriction to be imposed. EV uptakes should just flow naturally from the other variables in the model. Given the uncertainies around all of those variables a host of time paths are possible. No explanation is given for need for and calibration of the rate of growth restriction but its role is obvious. To deliver what the Commission and the Minister want – a rationale for EV subsidies.

The ‘model’ is realy just a convoluted concoction to provide some form of analytical cover for that outcome.

The modeling affords the Commission a response to the obvious question. Why buy very expensive Evs today, which will be scrapped in 15 years, contributing nothing to the 2050 target, when much cheaper and better Evs will be available in seven or eight years? The Commission’s answer is that unless people buy expensive Evs now then fewer people will be able to buy an EV later, because the Commission’s very scientific model says this. And we cannot deny the science.

Additional arguments for subsidising Evs, are also advanced.

Falling behind

Setting an ambitious policy package is important to ensure New Zealand does not lose further ground with other countries that are already implementing policies to accelerate the electrification of their fleets. Without this we risk becoming a dumping ground as manufacturers send the cars they cannot sell in those markets to New Zealand .

It doesn’t matter if we ‘lose further ground’ to other countries In the short run. The only people who might be particularly bothered are the policy elite who might be embarrassed because New Zealand is lagging behind on the international EV league tables, and who will miss out on an EV subsidy.

The argument that we will become a dumping ground for unsold ICE vehicles is mostly nonsense. Japan is not making many Evs and will not be sending us cheap ICE cars because Evs have taken over the market. Over time they will scale back their ICE vehicle production to match domestic and international demand.

Subsidies are effective

Experience internationally shows that policies to reduce the up-front cost of efficient vehicles have the strongest impact on purchase decisions.
(German et al., 2018).

The German study did not explicitly conclude that reducing up-front costs had the strongest impact on vehicle sales The study was a compendium of EU and Norwegian measures intended to promote more efficient vehicles, with some case studies. It is now very dated (experiences up to 2016) when it comes to electric vehicles. It also pointed out some of the unintended consequences of some of the policies that were adopted:

Finally, the case studies also illustrate the wider, often unintended, impacts of vehicle taxation. One such unintended impact is the potential for additional vehicle mileage and

associated impacts on CO2 emissions if less costly vehicles result in increased vehicle ownership ("rebound effects").

For example, in the Netherlands, it is estimated that tax reductions for small, low-emissions cars caused an annual extra sale of some 25,000 to 30,000 cars. In France following the introduction of the bonus-malus system in 2008, sales of new vehicles increased by 3.5 %, resulting in a revenue deficit of EUR 225 million.

A second unintended impact is the potential for air quality impacts of increased dieselisation, if vehicles are encouraged on the basis of CO2 emissions alone, without additional consideration of other emissions. In Ireland, this kind of situation caused a shift in diesel car share from 27% of new cars in 2007, to 70% in 2016.

Mechanisms for subsidising Evs

The Commision suggests two mechanisms for subsidising Evs.

A fee-bate scheme:

This involves taxing imports of ICE vehicles on the basis of their emissions and using the proceeds to subsidise Evs. The apparent attraction is that there is no direct fiscal cost. The increased taxes pay for the subsidies. The Commission says that these schemes have worked overseas. Well, not really. There are only three examples. The Netherlands tried it and scrapped it after a year. The French scheme quickly ran up a large fiscal deficit and as noted above actually increased emissions in the short-run. The Swedes introduced a scheme in 2018. It is not clear whether it made a substantial difference to the uptake of Evs.

For a fuller review of the feebate scheme see appendix two.

What is obvious from this analysis is that in New Zealand a feebate scheme would disproportionately impact lower income consumers who can only afford cheaper used imports, for the benefit of the high income earners who will be buying Evs. It is a transfer from Mangere to Remuera, from Porirua to Khandallah.

Government subsidies:

The other option is a direct government subsidy. What is not mentioned is the size of the subsidy that is required to put EV purchases on the 'right' growth path. The Commission must know this because their ENZ model won't work without a specific subsidy input. It matters whether the subsidy is as small as a book token or big enough to make Evs cheaper than ICE vehicles now. The public is entitled to know and there could be significant fiscal implications that should have been modelled. The Commission is unclear on how long subsidies should remain in place. In their recommendation they say until:

such time as they are cost competitive with the equivalent ICE vehicle.

This could have several interpretations. It could mean until 2024 using the Bloomberg total cost estimate, or it could be to 2032 and beyond. What we do know is that once subsidies are introduced in can be difficult to get out of them, because governments are reluctant to see a slump in sales. It is not unreasonable to think there could be a substantial fiscal costs. The initial subsidy might have to be a big one to boost new sales from the current 2,400 to 40,0000 by 2025, and subsidies are likely to be required well beyond that date. Half a million vehicles with an average subsidy of $10,000 amounts to $5 billion and it is possible to come up with much larger estimates. It all depends on the scale of your 'ambition' and how EV prices will evolve.

What is also missing

What is also missing from the analysis are many more of the essentials. In particular, here is no information on the cost per tonne of carbon saved and how this number will evolve over time. The closest the Commission comes is a statement that Evs that travel 35-40,000 kilometres are already cheaper on a total cost basis than an equivalent ICE vehicle according to the Energy Efficency Authority's online calculator. The Commission could easily have produced current figures for an average kilometre travelled examples, but they didn't. When we tried the calculator, to check the results, it wouldn't work. Our best like-for-like assessment for a vehicle travelling average distances is a cost of at least $1000 -1500 a tonne, an extremely expensive way of reducing emissions. Note that It is difficult to get a single authorative estimate of the cost because a number of factors influence the outcomes including: depreciation rates; interest rates; the costs of appropriate like-for-like comparison vehicles; assumed kilometres driven; relative servicing costs; the price of electricity; and the amount of carbon embedded in fuel consumption

MfE marginal cost estimates

The MfE[9] has produced estimates of the marginal costs per tonne of carbon abatement for light electric vehicles and other abatement options. The Commission cited the paper but did not report on its results. The MfE paper actually reported a marginal benefit, rather than a cost, for light Evs. It did this by first assuming high benefits for air quality improvements. As we demonstrated in Part four I these benefits are grossly overstated and are based on bad science. Second, what purport to be marginal costs of abatement estimates are not marginal costs at all but are averages for the 2020-30 decade. High marginal costs in the first part of the decade

[9] Ministry for the Environment. (2020b). Marginal abatement cost curves analysis for New Zealand: Potential greenhouse gas mitigation options and their costs

are hidden by assumed low marginal costs in the latter part. Third, there were a number of technical issues with the paper that overstated the benefits and reduced the costs.

This was just another case of a government agency fabricating 'evidence' to support an agenda. The Minister for Climate Change approved the release of the report and was probably fooled by it. He probably genuinely believes that there are immediate social benefits for increasing the uptake of Evs and that he can affect the outcomes by addressing the 'market failures' that are reducing demand. There is a fuller analysis of the MfE paper in appendix one.

No cost benefit analysis

There is no cost benefit analysis for either the direct subsidy or the feebate scheme. There was one in the Ministry of Transport's paper, which is reviewed in appendix x. It claims that the net benefits are $550 million and the benefit cost ratio is 2.6. However, this was a contrived result generated by a series of implausible technical assumptions. For example, it is assumed that fuel prices were twice current prices and that consumers are so stupid that they were only counting fuel savings in the first year when considering more fuel efficient vehicles.

Ban on ICE vehicles from 2032

The possible logic behind the ICE ban is that by 2032 Evs will be cheaper and better than ICE vehicles and consumers will be buying them anyway. So there is will be no great harm done by implementing a ban. A ban provides the Commission and the Government with an 'announceable' at little economic cost. However, this forgets the used import market.

As the Commission notes, the Japanese have been developing ordinary hybrids as a transition vehicle, seeing hydrogen fuel cell vehicles as the vehicle of the future. There is a limited supply of Evs in Japan and little in the pipeline. The Japanese now seems to realise that they might have backed the wrong horse and new PHEVs and BEVs are starting to come out and are under development. But it is unlikely that there will be deep used car market for these by 2032. They will need to have been produced over 2022-8 at the latest.

The other issue is that we do not know that new Evs will be cheaper than ICE vehicles by 2032. We know the direction of travel but not the speed, so there is a material risk that there could still be a material price gap by 2032.

Further, if the Commission is thinking of 2050 as the date vehicles should exit from the fleet the used imports will exit well before that date. As they are eight to ten years old when they are imported then they will only last another eight to 10 years. They will be mostly gone into the early 2040s.

The Commission recognises the used import problem but not the obvious solution. There is no pressing (or any) reason to impose a 2032 deadline.

The likely consequence of the ban is that there will be a rush 'top up' on ICE cars prior to the cutoff, effectively extending the cutoff date. Beyond that people will simply keep ICE cars for longer because they cannot afford even a used EV. A 2025 Toyota can easily last to 2055.

Instead of taking the sensible route the Commission muses about 'equitable' responses.

Putting a restriction or ban on the import and manufacture of internal combustion engine vehicles should be made in the context of an equitable transition, with additional measures put in place, if necessary, to make Evs accessible to all New Zealanders.

It is not at all clear what it meant by measures that will make Evs accessible to 'all New Zealanders. Do they mean that Evs should be subsidied so all New Zealanders can afford them , or just that people will be able to access EV taxis. It appears that the Commission has not thought very deeply about the issue and that this is just a throwaway line to meet 'equity' concerns.

Improve the efficiency of the light vehicle fleet

The proposal to apply fuel efficiency standards is a just a rerun of the proposals presented in the Clean Car initiative in 2019 (including the feebate scheme to fund an EV subsidy). The Commision does not appear to have done any analysis of their own or have much understanding of the issues. They are just supporting the Minister as he has a second crack at proposals that failed to gain enough support in Parliament the first time round.

The only substantive difference between the MOT and Commission analysis is the Commission's presentation of the emission savings.

Over the next five years, more than 1.2 million light vehicles will likely enter the vehicle fleet. If powered by fossil fuels, these vehicles will lock in up to 50 Mt of carbon dioxide emissions over the next two decades. That is the equivalent of over half of the annual gross emissions in New Zealand.

This is not the relevant information (which looks to be exaggerated in any event). The relevant information is the amount of the reduction in emissions. The MOT analysis put that at about 5 million tonnes, over the 20 years, which is around 0.5 percent of New Zealand's annual emmissions. 0.5 percent is not nearly as impressive as '*over half'.*

The Commission presents the following arguments in chapter 4b of the Evidence report. We briefly comment on some of the points here. A full review of the MOT analysis, which is the basis of most of the Commission's claims is presented in Appendix 2. It was a rather shoddy and in some areas, dishonest, report.

Chapter 4b arguments

Improving the efficiency of the conventional vehicle fleet could save 0.26 Mt CO_2 per year. The efficiency of new and used conventional vehicles has improved in recent years, despite vehicles tending to increase in both engine and overall size. However, the light vehicle fleet is emissions-intensive compared to most developed countries and evidence indicates that our performance is getting worse (New Zealand AA).

The reference is to an AA report on the difference between claimed and real world fuel efficiency figures. The AA reported that this difference appears to be getting worse internationally. It was not a comment that New Zealand's performance has been getting worse than international comparators. The Commission's statement was misleading.

There are two key reasons for this:

• Although efficiency is generally improving within vehicle weight classes as manufacturers introduce fuel-saving technologies, New Zealanders are increasing choosing to purchase larger, heavier vehicles.

Misleading safety assessments are part of the problem,

The move to larger, heavier vehicles has been a trend in several countries. It part this has been driven by safety concerns. Larger, heavier vehicles are safer than small ones because they tend to win the collisions. The Government has been promoting this move to larger vehicles through its used car vehicle safety rating system and advertising campaigns. We think that this rating system is flawed and misguided. First, the rating system focuses on the safety of the vehicle occupant ignoring the harm done to others. The smallest cars perform badly with this system. A rating system that takes the safety of all road users into account is available and presents a much more favourable picture of the safety performance of small cars. However, it is not used for reasons we do not understand.

Second, the rating system measures relative, not absolute risk. This means that by construction, about forty percent of vehicles are always in the bottom two quintiles and get a one or two star rating. These are decribed as presenting an unacceptable risk. A disproportionate number of these will be small, fuel efficient vehicles.

In our view the car rating system is perverse and should be reviewed, and in its current form, scrapped. The government should not be in the business of promoting an arms race on vehicle size.

This a long and complicated story. A draft report on the 'Rightcars' safety system presented in Appendix four provides the detail.

Back to the efficiency arguments

Returning to the Commission' s fuel efficiency argument.

Manufacturers choose to provide less efficient model variants into the New Zealand vehicle market than to markets where vehicle fuel efficiency standards apply.

Manufacturers obviously do not choose which used vehicles come to New Zealand. With new vehicles manufacturers do have to make choices because it is not economic to supply every model variant to a small market. The Commission implies that manufacturers are somehow pushing less fuel efficient vehicles than the market would 'truly' prefer, but there is no evidence to support this.

If New Zealand were to match the average fuel efficiency of new vehicles today in other jurisdictions (without any further technology improvements from today's internal combustion engine vehicles), this could see around a 33% reduction in CO2 emissions over the life of the vehicle.

This assertion appears to be based on some misleading analysis by the Ministry of Transport. The argument that New Zealand vehicles are less efficient than in other countries is largely overstated. New Zealand vehicles might have higher fuel consumption than those in European countries but this is largely because we have larger vehicles because our needs and preferences are different. A vehicle suitable for towing a boat will use more fuel than a tiny car suitable for getting around dense European cities, but that does not make it less efficient.

Under the heading 'Car imports have poor fuel efficiency' in the MOT report there is the following:

The light vehicles imported into New Zealand today are among the most fuel inefficient of

any OECD country. As a result, they produce more emissions and cost significantly more to run. The table below shows the average annual fuel use cost to drive a light petrol vehicle in New Zealand, compared to other countries. On average, New Zealanders pay 65 percent more in vehicle fuel costs than the average person in the European Union, even though petrol prices are higher in Europe.

This statement is supported by the following table.

Table four: Vehicle fuel efficiency comparisons

		New Zealand	United Kingdom	European Union	Japan	United States
Fuel efficiency - petrol equivalent	ltrs/100km	9.5	5.8	4.9	6.2	8.6
Petrol Price inclusive of duties & taxes[1]	NZ$/ltr	$1.92	$2.26	$2.25	$1.81	$1.05
Vehicle use	kms	11,000	11,000	11,000	11,000	11,000
Fuel Use Cost	NZ$	$2,007	$1,443	$1,213	$1,235	$995

To allow international comparisons 2017 data has been used.

It presents a misleading picture of the relative fuel efficiency of New Zealand imports.

- The New Zealand data appears to be based on the entire fleet average. The comparators are new to fleet averages, which because of improved efficiency over recent years, will be lower than the respective entire fleet fuel efficiency figures.

- The New Zealand data is based on actual or 'real world' fuel consumption data, which can be up to 30 percent higher than the test data for new to fleet vehicles.

- The Ministry has an estimate of the 'new to fleet' fuel 'efficiency' for New Zealand (7.6 litres /100 k), but chose not to use it, obviously to make the New Zealand performance look worse.

- The EU data does not include used vehicle imports (that are important in central European countries like Poland).

- The EU and UK figure look 'good' because they include a high proportion of 'dirty' diesel vehicles.

- The Japanese figure look better because of the share of tiny 'Kei cars' in their fleet.

- New Zealand has a higher proportion of commercial vehicles in its light vehicle fleet.

If New Zealand had European levels of diesels and we had a proper like for like comparison, New Zealand car efficiency would probably not look too different from European levels.

More efficient conventional vehicles may cost more upfront but deliver significant fuel savings. The additional capital cost of a vehicle emitting 110 gCO2/km, over one emitting 180 gCO2/km in 2021, is estimated to be an average of $750 per vehicle. In 2025 this additional vehicle cost is estimated to be $1,580 per vehicle. However, the fuel savings are estimated to average $6,800 per vehicle over the vehicle lifetime. (MOT)

The MoT's analysis is nonsense. If the Commission had looked at the relative costs of comparable hybrid and non-hybrid vehicles in New Zealand they would have found that the price difference is not $750. A Corolla GX costs $29,990. The Corolla GX Hybrid costs $33,690.

Commission's approach/policies

On the policy response there is the following:

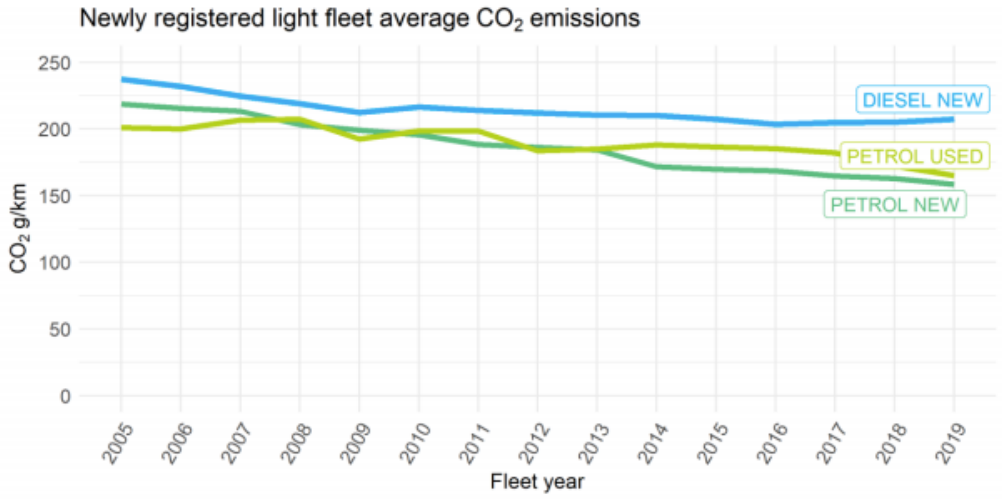
A fuel efficiency or carbon dioxide standard would increase the supply of low emitting vehicles in the new Zealand fleet. These regulations all require suppliers to meet an overall average fuel economy or carbon dioxide emissions level, weighted across new and used-import vehicle sales within the country where the standard applies.

There is a range of different international examples of how a standard could be designed. If such a standard were in place, suppliers would need to stock and sell more fuel-efficient conventional vehicles, more petrol hybrids and more Evs to meet carbon dioxide fleet targets or pay a penalty.

What this ignores is the fact that oversea fuel efficency standards are directed at the manufacturers of fleets of new vehicles. This gets very messy with used imports where there are large number of small importers. For that reason **no** OECD countries apply fleet efficency standards to used imports.

Even though New Zealand does not have explicit fuel efficiency or emission standards we have benefitted as efficiency standards have improved in the manufacturing countries to meet their standards. Over the past 10 years emissions have fallen by around 20 percent. These figures will probably continue to improve as more new and used vehicle purchasers chose hybrid vehicles.

Figure eight: Co2 emissions new to fleet



Source: MOT

What was clear from our analysis of the Clean Cars proposals is that emission standards would impact disproportionately on lower income consumers. The Commission has not considered this issue.

The Commission's advice

The Commission's advice on the light vehicle fleet and some further comments are set out below:

Time-critical necessary action to accelerate light electric vehicle uptake

Light electric vehicle uptake needs to be accelerated as fast as possible. To meet our proposed emissions budgets and be on track for 2050, at least 50% of all light vehicles (cars, SUVs, vans and utes) and motorbike imports should be electric by 2027 (both battery EV and plug-in hybrid EV).

The 50 percent 2027 target does not match their modelling results, nor is it backed by any discussion or analysis in either of their reports. The 2027 EV uptake figure in figure 3 above is about 20 percent. To reach the 50 percent target almost all new vehicles would have to be electric by 2027. It appears that the Commission has been enthused with a late burst of heightened ambition in setting this target.

To achieve this, we recommend in the first budget period the Government:

a. *Place a time limit on light vehicles with internal combustion engines entering, being manufactured, or assembled in New Zealand , other than in specified exceptional circumstances. The limit should be no later than 2035 and, if possible, as early as 2030.*

Introduce a package of measures to ensure there are enough Evs entering New Zealand , and to reduce the upfront cost of purchasing light electric vehicles until such time as they are cost competitive with the equivalent ICE vehicle.

c. *Improve the efficiency of the light vehicle fleet and stop New Zealand receiving inefficient vehicles by introducing an emissions target for light vehicles new to New Zealand of 105 grams CO2 per kilometre by 2028.*

What is the point of setting a 2028 target if ICE cars are to be banned by 2032?

d. *Develop a charging infrastructure plan for the rapid uptake of Evs to ensure greater coverage, multiple points of access and rapid charging, and continue to support the practical roll out of charging infrastructure.*

This we agree with.

Progress indicators

a. Government to have consulted, no later than 30 June 2022, on preferred policy options for accelerating EV uptake (including a date for placing a time limit on the import of ICEs).

b. Cabinet decisions on preferred policy options to be made, as soon as possible but no later than 31 December 2022, on accelerating EV uptake.

2016 *Government to have implemented regulations on improving the fuel efficiency by 30 June 2022.*

Necessary Actions 3

We recommend that, in the first budget period the Government make progress on the following:

a. *As part of a policy package introduce a fiscal incentive, such as a feebate or subsidy, to reduce the upfront cost of Evs until such time as there is price parity with ICEs.*

This appears to suggest that upfront price parity is the target.

b. *As part of an equitable transition, evaluate and support interventions such as leasing, hire and sharing schemes to remove barriers and address some of the upfront capital costs of Evs.*

Electric cars can already be leased, hired and shared. There is nothing in the Commission's analysis that suggests some magic new solution that will make a difference. It opens the way, of course, to all sorts of (subsisised) schemes that will claim to make a difference.

c. *Investigate ways to bulk procure and ensure the supply of Evs into New Zealand and work with the private sector to do so.*

This is the recommendation that is in the current Electric Vehicles Programme which dates from 2016. It states:

Will work across Government and the private sector to look into bulk-buying electric vehicles

There appears to have been no action or progress for four years. This is a response to a non-problem and unlikely to make any difference. The Government is unlikely to be a successful wholesale car dealer. However, on a semi-serious note, the Government could pre-order, say, 10,000 Cybertrucks and allocate the orders to interested parties on request. This would be cheap (just the funding costs of the $2 million deposit over a couple of years); low risk (the deposits are refundable); and would generate a large amount of positive publicity. Elon Musk would probably be keen to chat to the PM about it. It is the ultimate 'announceable'.

d. *Evaluate how to use the tax system to incentivise EV uptake and discourage the purchase and continued operation of ICE vehicles.*

This is a new recommendation that was hardly discussed in the documents but could potentially have far-reaching effects. If the Commission is just referring to possible disadvantages under the fringe benefit tax regime then it should have said so.

e. *Work with the private sector to roll out EV battery refurbishment, collection and recycling systems to support sustainable electrification of light vehicle fleet.*

The need for this is a long way down the track.

f. *Evaluate the role other pricing mechanisms beyond the NZ ETS, such as road pricing, can play in supporting the change to a low emissions and equitable transport system.*

This opens the way for yet more permanent or semi-permanent subsidies.

g. *In setting these policies the Government needs to mitigate impacts for low-income households and people with disabilities, regional and remote access, and with limited access to electricity.*

This is another throwaway with scarely any thought to what it means. Once you mitigate the impact of the Commission's actions for these classes only a minority of the population would be left.

Part six: Heavy trucks and transport mode shifting

The Commission's recommendations relating to heavy transport are as follows:

a. Set a target and introduce polices so that at least 140 million litres of low carbon liquid fuels are sold in New Zealand by 31 December 2035.
b. Introduce low carbon fuel standards or mandates to increase demand for low carbon fuels, with specific consideration given to aviation.
c. Introduce incentives to establish low emissions fuel plants, such as biofuel sustainable aviation fuel, and make those fuels more competitive with traditional fossil fuels.
d. Place further emphasis on decarbonising the rail system, and establish an investment strategy and clear targets to increase the share of rail and coastal shipping.

The discussion on heavy transport focused on three possible solutions; electric, hydrogen and biofuels. All are expected to be part of the solution with electric trucks taking longer because of technical issues.

There are challenges associated with battery-electric heavy trucks due to the size, weight, and cost of the batteries, and time required to recharge them. These challenges are less of an issue for medium trucks typically used for local deliveries and other short-haul duties with lighter loads.

Biofuels are the most favoured new solution and the preferred pathway assumes six percent of liquid fuels for domestic use are low carbon fuels by 2035 (140 million litres per year). This would require building about another 7 equivalent sized plants similar in capacity to Z Energy's existing Wiri plant, which has a capacity of 20 million litres per year. The reasoning was basically that some other countries had subsidies and mandates, so New Zealand should too. Why the target had to be 140 million litres and not a higher or lower number and what it would cost would be was not

discussed. The Commission's numbers suggest a price gap of around 50 cents a litre so we could be looking at a subsidy of $70 million a year.

What the Commission does not mention is that the MoT's Green Freight working paper suggests that the Z Energy is not a commercial success and that Z Energy is considering its options. Upping the ante by a factor of seven might be an effort to mask that failure.

On hydrogen there is the following:

Work is currently underway across the private sector to build hydrogen plants and develop a hydrogen refueling network in New Zealand The cost of creating this infrastructure is significant, and has required government funding to de-risk private sector investment.

This is mostly wishful thinking. Green hydrogen vehicles have an energy efficiency of thirty percent, so the economics are very hard to crack. Many big players have being trying for years and New Zealand is unlikely to make the decisive breakthrough.

Nevertheless the government seems invested in the idea of a role for green hydrogen releasing a 'green' paper 'A vision for hydrogen in New Zealand' in 2019. The Commission seems reluctant to rain on that parade.

What is missing in the Commission's discussion of heavy transport seems to be a full understanding of the possibilties for heavy EV trucks. Tesla unveiled its Semi heavy truck a few years ago and it seems that the first production vehicles will appear at the end of the year or early 2022. There are two versions of the Semi: the smaller battery pack version with a range of 500 km costing $US 150,000 and larger pack with a range of 800 km, costing $US180,000[10]. The trucks will be able to charge at a rate of 1000 kw an hour so specialised chargers will be required to support them. Several large North American trucking firms have placed large orders. It may be several years before they are available in New Zealand but by then the technology and the economics will have further improved.

The MOT's Green freight working paper, which the Commission cited, did mention Tesla briefly:

Tesla is also planning a network of ultra-fast charging stations that can charge the Tesla Semi in under 30 minutes during a driver's compulsory rest breaks.

[10] We only have Elon Musk's word on these figures. He has been known to be over optimistic on timing but be has delivered on the substance . Tesla's market capitisation (over $600 billion) exceeds that of all the auto manufacturers in the world by a wide margin so they have virtually no financial constraints. They can raise new capital at will.

But had more to say about developments with hydrogen trucks.

The Nikola Motor Company intends to build a network of 700 hydrogen refuelling stations across the United States and Europe to build up a base of supporters to invest in the hydrogen vehicles it is developing. This approach will provide the required backbone of refuelling infrastructure for commercial vehicles, as well as privately owned passenger vehicles.

Unfortunately the founding chairman of Nikola has resigned after making several fraudulent statements and the company is now being investigated by the SEC. It turned out that one of their trucks described in a promotional video clip as being 'in motion' was inoperative and was actually rolling down a hill. The officer responsible for the hydrogen refuelling station rollout was the Chairman's brother, who had been a concrete driveway contractor.

The possibility of electric heavy trucks arriving in numbers this decade obviously raises questions about the biofuel recommendations and mode shifing to rail and shipping. What is the point of trying to shift cargo to rail and sea if those modes will be outcompeted by zero emission trucks in a few years?

The Commission should place its recommendations on hold until it better understands the prospects for heavy electric trucks.

Part seven: Urban form buildings, walking and cycling

Walking cycling and public tranport

The Commission sets out 'ambitious' assumptions in its modelling for increases in walking, cycling and public transport.

We also assume that the share of this distance travelled by walking, cycling and public transport can be increased by 25%, 95% and 120% respectively by 2030

But this doesn't amount to much for cycling and walking because the share of distances travelled is so low. The projections are not backed by any analysis for public transport. The current and prospective shares for the reference case shares are set out in figure nine (their table 7.4).

Figure nine: Reference case household travel

Table 7.4: Current Policy Reference case household passenger kilometres by travel type (billions)

	2018	2020	2030	2040	2050
Pedestrian	0.9	0.8	0.9	1.0	1.0
Cyclist	0.3	0.3	0.4	0.4	0.4
Local train	0.6	0.7	1.5	1.9	2.3
Local bus	1.2	1.1	1.5	1.7	2.0
Local ferry	0.1	0.1	0.1	0.1	0.1
Motorcycle	0.3	0.3	0.3	0.3	0.3
Taxi / vehicle share	0.1	0.1	0.2	0.2	0.2
Light vehicle passenger	18.4	16.6	19.4	20.0	20.5
Light vehicle driver	34.1	31.2	38.0	40.4	41.9
Total	56.0	51.2	62.2	66.0	68.7

Despite the lack of importance of biking and walking in reducing emissions there is a rather shameless pitch for the climate change consulting industry.

Another important aspect is the need to undertake research to identify opportunities to change behaviour in a way that aligns with emissions reduction goals and create structures that support the pursuit of those opportunities.

Based on very little, there is the following set of necessary actions:

Necessary action 2
Develop an integrated national transport network to reduce travel by private vehicles and increase walking, cycling, low emissions public and shared transport

a. Deliver specific and timebound targets to increase low emissions public and shared transport and walking and cycling, and supporting infrastructure through strengthening the direction of the Government Policy Statement on Land Transport.

b. Significantly increase the share of central government funding available for these types of transport investment, and link funding with achieving our emissions budgets.

c. Improve mobility outcomes through measures including supporting public transport uptake nationally and locally by reducing fares for targeted groups (such as for those under 25 years of age), and improving the quality and integration of services.

d. Encourage Councils to implement first and last kilometre travel solutions in their transport networks, such as increased on-demand and shared vehicle and bike services, secure park and ride solutions at public transport, and encouraging micro-mobility options.

2016 *Further government encouragement for working from home arrangements.*

Most of these actions, from an emissions reduction perspective will be trivial. Governments have been trying to get people to exercise more for decades, mostly with little effect. While it might be nice to get more pleasant community facilities and for people to adopt healthy lifestyles, it has little to do with emissions reductions. Further, a realistic review of the literature suggests that many of these mode shifting exercises fail or have little effect. Our review in 'A Question of Trust' is presented in Appendix three.

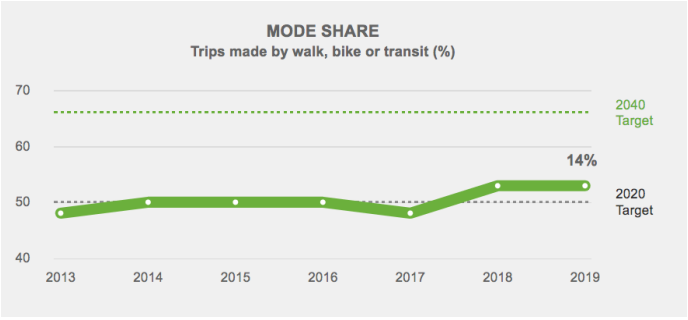
Similarly, it is something of a fantasy to assume that public transport use can be increased by enough in a decade or so before the ban on ICE vehicles to make a material difference. Some public transport proposals can take a decade or more to put in place; councils are financially stretched and public transport is only effective in delivering efficient outcomes for a limited number of people. 'Specific and time bound targets' will make no difference to peoples' behaviour. By the time there is a noticeable impact a large part of the fleet will be electric so the mode of transport will not affect emissions.

The case of Vancourer is used to show that measures to divert people away from cars can work.

Experience overseas has shown that significant shift in ways of travel can be achieved with effective strategies. For example, in 2008 Vancouver set a target for half of all trips to be made by public transport, walking or cycling by 2020. This goal was met two years ahead of schedule and the city is now aiming for two thirds all trips by foot, bicycle and public transport by 2040. To achieve this change, Vancouver focused on providing people with travel choice, through investing heavily in walking, cycling and public transport improvements. Land use policies have also been a major part of Vancouver's success

Figure ten shows Vancouver's mode share performance in recent years. They did achieve the target two years ahead of schedule, but there was essentially no progress over 2013-19.

Figure ten : Vancouver Mode shares



Note that these figures are for the numbers of trips. On a kilometer travelled basis the share of walking biking and public transport would have been much less.

Private vehicles are an major issue with urban congestion but this is not an emissions issue once the fleet is electric.

Energy in buildings

The Commission says:

Continued improvements in the energy efficiency of existing buildings is also essential, particularly in large commercial buildings and public buildings.

And makes the following recommendations:

Necessary action 9
a. Continuing to improve energy efficiency standards for all buildings, new and existing stock, through measures like improving insulation requirements. Expand assistance which targets low-income households.
b. Introducing mandatory measures to improve the operational energy performance of commercial and public buildings.
c. Setting a date by when no new natural gas connections are permitted, and where feasible, all new or replacement heating systems installed are electric or bioenergy. This should be no later than 2025 and earlier if possible.

The measures a. and b. have not been developed in any detail and are not costed. The Commission cites two reports in support of its position. The first[11] is a review of the international literature on 'building beyond code'. It has only limited value because the differences between code and above code standards and costs can differ markedly between jurisdictions. The second[12] was a commissioned report promoting the Homestar (a rating system), which had a financial interest in the results. Most of the estimated net benefits had nothing to do with energy efficiency.

Continued energy efficiency improvements of existing large commercial and public buildings is not essential once they have been decarbonised. Energy efficiency decisions should be left to commercial decision-making.

[11] Bealing, M. (2020). Building Beyond Minimum Requirements: A literature review (External Report NZIER ER48 [2020]). BRANZ

[12] Sense Partners. (2018). Codebreakers: Constructing KiwiBuild homes to a standard above the New Zealand Building Code (p. 20). New Zealand Green Building Council.

With respect to homes, efficiency decisions should be left to the home owner. It is not the Commission's job to be promoting a particular energy efficiency outcome. The contribution to emissions reductions over 2022-50 will be minor and is likely to come at a significant cost.

For example our assessment[13] of the benefit/ cost ratio of the Healthy Homes increased insulation proposals for existing rental homes produced a benefit cost ratio of 0.38. Efforts to further increase insulation levels would generate lower benefit/cost ratios as the marginal value of insulation falls with its thickness.

Urban Form

The Commission throws its weight behind the compact urban form philosphy that has been partially responsible for driving up house prices when Councils hold land from the market. Because urban forms change only gradually urban form is not really part of the emissions reduction solution. Once transport has been electrified it doesn't matter whether cities are compact or dispersed from an emmissions perspective.

However, the Commission has two necessary actions.

We recommend that, in the first budget period the Government promote the evolution of urban form to enable low emissions transport and buildings through ongoing legislative reform:

a. *Develop a consistent approach to estimate the long-term emissions impacts of urban development decisions and continually improve the way emissions consequences are integrated into decision making on land use, transport and infrastructure investment*

As noted above there is no long-term relationship. The Government should save itself the consulting fees.

b. *Ensure a coordinated approach to decision making is used across Government agencies and local councils to embed a strong relationship between urban planning, design, and transport so that communities are well designed, supported by integrated, accessible transport options, including safe cycleways between home, work and education.*

This has nothing to do with longterm emissions abatement. Urban planning is not in the Commission's mandate and it should stay out of the political debate on urban form.

[13] Tailrisk Economics The proposed Healthy Homes Regulations: An Assessment

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Appendix one

Ministry for the Environment. Marginal abatement cost curves analysis for New Zealand: Potential greenhouse gas mitigation options and their costs

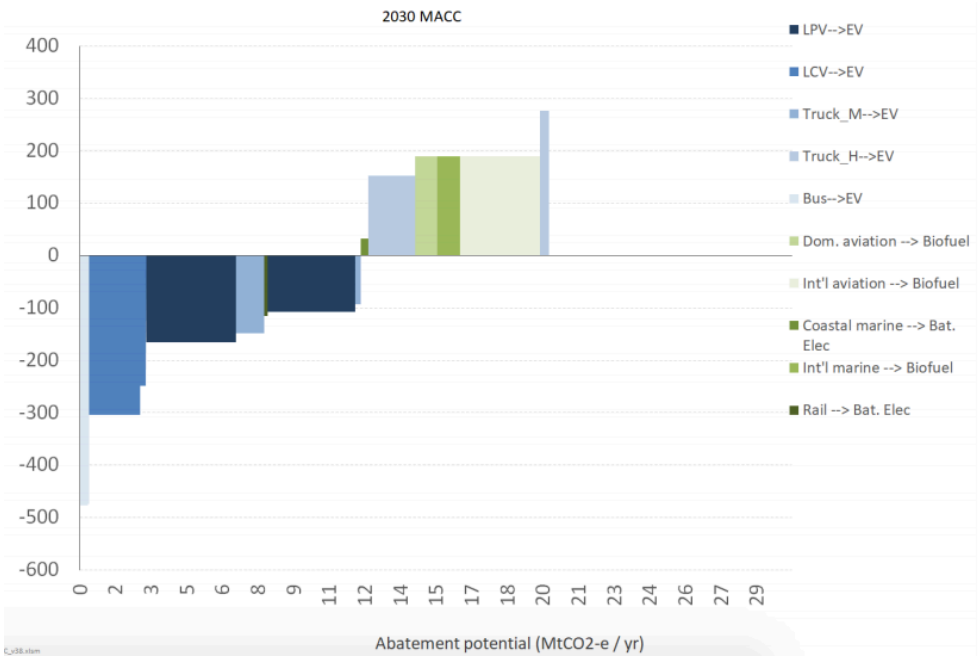
This appendix discusses the recent MfE paper, which we believe has had a major impact on MfE and Climate Change Commission thinking on the issue of pushing electric cars. The paper went before the Minister for approval to be released publicly.

The paper argues that contrary to conventional analysis, switching to electric cars does not come at a very high cost (estimates can come in at more than $1000 a ton of C02). Rather there is a significant cost saving.

This is illustrated in the summary outputs of the modelling which shows the costs or savings on the y axis , and the potential for abatements, given the normal additions to the light vehicle fleet over 10 years, in millions of tonnes of Co2 on the X axis. Light passenger vehicles are represented by two navy blocks with savings of about $100 and $160 a ton and light commercial vehicles in blue have savings of $300 a ton.

There are two reasons for the savings. First, there are the conventional costs and benefits of operating the vehicles. Second are the health savings from avoided ICE air pollution which are assumed to be very high.

Figure one: Marginal cost of emmissions abatements



Marginal cost of carbon

There are two issues with the estimates. The first is presentational. The marginal abatement benefit is not the benefit of switching from ICE vehicles to Evs in 2019, which is the first year of the programme. Rather it is the weighted average for replacing all incoming ICE vehicles with Evs over a 10 year period. It averages current costs when Evs are expensive with later costs when the price has come down. But the cost in 10 years time is not relevant to the decision to purchase an EV now. The buyer cannot spirit himself into the future and come back with a cheap 2030 model that will reduce his average cost of ownership.

In other word this is not a marginal abatement cost methodology. It generates average costs over a decade.

There is a risk that this is not understood by policy makers and will lead to suboptimal decision making. The point can be illustrated with a simple two period model. In the first period (2020-25) Evs are much much more costly than ICE cars and the MAC is $1000/ton. Then there is a huge technical breakthough that leads to a big fall in the price of Evs and there is an operating benefit of $2000/ton. The optimal policy response is not to switch to Evs in the first period because the carbon cost is too expensive. The switch would take place in 2025.

However the MfE's model will be showing a weighted average benefit for the whole period of $1000 ton. The policy maker sees this, gets excited and switches to Evs in 2020 at a very high cost.

There are also some more 'conventional' issues with some of the detailed inputs into the model set out in their appendix A. All of them tend to understate the true cost of carbon. There is also some good work in the paper.

Issue	**Comment**
Total cost of carbon calculation horizon is 15 years	A long horizon will understate the costs. It ignores transaction costs when cars are sold within the period. A more conventional assumption is a 3-5 year horizon.
No discount rate mentioned	The net benefits from lower EV operating costs should be discounted to the present.
Used and new car imports distinguished	Used EV imports should be ignored. There is only a small supply in Japan but the model assumes that all ICE vehicles will be replaced after 15 years. It is not appropriate to assume a 15 year assessment horizon for a used import. Some of the older ones may be practically unusable in 5 years or so.
Current capital cost differential between Evs and ICE is $16k for cars $20k for vans	These are understated. The difference for cars is more like $30k. It is possible that the low figure represents some average of new and used prices. As noted above it is best to work just with new vehicles.
No home/ business charger required for most owners 3 point plugs sufficient to charge after average journey	`With much larger batteries three point chargers can take up to two days to recharge after a long trip.
Expensive away from base charging 15% falling to 6.5%	Looks to be too low but not consequential
Fuel costs of EV half ICE	Looks reasonable
Relative maintenance costs	Maintenance for ICE vehicles may be overstated. They come with long

warranties which are already embedded in the purchase price.

Emissions health costs

The report is vague about the health benefits of reducing emissions. There is a discussion about the total emissions cost from the Kuschel estimate and how it is apportioned between vehicle types. Estimates of the saved health costs per ton of emissions, that fed into the marginal abatement cost figures, were not produced.

Source of the estimates

It appears that the estimates were largely a cut and paste from a report by Contact Consulting for orin Energy. There was no sunsatntive discussion on many of the critical model inputs. Reports by consultants to commericially motivated clients should be treated with caution.

Appendix two

Dirty and dangerous?
The 'Clean Car' Consultation Document: A review

Part one: Introduction

On 9 July the Associate Ministry for Transport released the Government's 'clean car' proposals. It was accompanied by a Ministry of Transport discussion paper *'Moving the light vehicle fleet to low-emissions: discussion paper on a Clean Car Standard and Clean Car Discount',* which is intended to provide the public with the necessary background to inform their responses in the consultation process. The main purposes of this paper are to review the quality of the information and analysis presented in the discussion paper, and second, to serve as a submission.

The consultation document was released with six accompanying papers: a paper to Cabinet seeking approval for the consultation and release of the paper; a Regulatory

Impact Statement (RIS); two cost benefit papers (one each for the emission targets and the 'feebate' proposals; and two Social impact papers. We have read all of the documents (which come to nearly 300 pages), and checked most of the references. Where relevant we refer to material in the supporting documents papers.

This paper is organised as follows.

Part two: Key conclusions
Part three: The rationale for the policies
Part four: Calibration of the policies
Part five: How the policies might work
Part six: The impact on emissions
Part seven: Cost benefit analysis
Part eight: Equity impacts
Part nine: First to 100: A rational alternative

Part two: Key conclusions

The consultation paper should be withdrawn

The paper is full of errors, misleading statements and is inadequately researched. The supporting cost benefit analysis has been obviously fabricated to produce extravagantly positive results, which will mislead the public. The paper as a whole is false and misleading.

The 'clean car' could be renamed the dirty and dangerous car policy

The policies will encourage the importation of dirtier diesel cars and less safe small cars.

The cost benefit analysis is grossly misleading

The high benefit to cost ratios were generated by a model that used some absurd assumptions to generate its results.

- It was assumed that consumers only take the first year's fuel savings into account when deciding whether to purchase a more fuel efficient car. As a consequence consumers buy fuel inefficient cars which unnecessarily cost them thousands over time. According to the Ministry the polices will save them from their own stupidity. We think that the Ministry's claims are both offensive and clearly fabricated for political purposes. Consumers are not stupid.

- It is assumed that vehicles that can meet the targets will cost only $2000 more than equivalent conventional petrol vehicles. 'Off-the-shelf' cars cannot meet the targets, but it is assumed that overseas manufacturers will develop new variants, just for the New Zealand market, to meet the requirements.
- The current price gap between new electric vehicles and conventional vehicles is assumed to be just $8000. It is more like $25,000.

The policies will have almost no impact on our capacity to meet the 2050 targets
The vehicles affected by the policies will be scrapped by 2050. Subsidising electric cars now will have almost have no impact on the uptake of electric vehicles as prices fall and they become a mass market option in New Zealand 8 to 15 years from now.

Limited impact on C02 emissions
It is calculated that CO2 emissions will be reduced by a maximum of 5 percent, when more realsistic assumptions suggest a number more like 3 percent. The simpler alternative of increasing fuel prices could, acccording to the Ministry, reduce emissions by 11 percent.

The policies will be inequitable
Lower income consumers will have to pay for the better-off to purchase electric cars with an $8000 rebate. A used people mover in the $10,000 price range could cost $4000 more – a 40 percent tax rate.

There is a substantial fiscal risk
The feebate scheme is meant to be self-funding, but there is a significant risk that government will have to meet much of the bill.

There are high hidden tax increases
The tax on a new work vehicle could be around $8000. Used japanese imports like people movers could cost lower income purchasers, $4000 to $5000 more, a tax rate of 40 to 50 percent.

There are more efficient ways to achieve the policy objectives
Our 'First to 100' proposal will get international attention and is a more efficient and effective way to reduce emissions. Increasing the carbon tax to $100 on fuel would increase prices by about 10 percent. A fuel tax increase has several obvious advantages:

- It does not require a new and expensive administrative framework.
- It will be more effective in reducing emissions. On the Ministry's numbers, emissions would fall by 11 percent rather than 5 percent with the proposals.

That is is because a fuel price impacts on all emitting vehicles immediately, not just new to fleet vehicles. It directly targets the problem. Drivers who drive further, drive less efficiently, and have a vehicle with higher fuel consumption are emitting more and will pay relatively more.

- It does not involve subsidies to the better off from lower income used car purchasers.
- It would generate revenue that could be spent on safer roads.
- It would send a 'global leadership' signal that New Zealand is serious about reducing emissions, and is not just tinkering with schemes like the feebate proposal, just to be seen to be doing 'something'. For political reasons governments have shied away from fuel price increases because they are unpopular. Being 'first to 100' would demonstrate that the Government is prepared to back its words with deeds and is politically courageous. Other countries may be encouraged to develop a political backbone.

Part three: The rationales for the policies

The Associate Minister's foreword

The Associate Minister of Transport foreword to the consultation paper sets a tone of necessity and urgency. There is a direct link, we are told between meeting our Paris commitments, and the proposed measures. We respond to this perspective in the body of our paper, but address some of the Associate Minister's specific statements here.

We also need action in the major emitting sectors. The Interim Climate Change Committee has recommended that the Government prioritise reducing emissions in the transport sector.

The Interim Climate Change Committee is due to report on transport emissions on 30 September 2019. We would have expected that the Government would have held off on pursuing these proposals until after the Interim Committee's report was released, and the public had had an opportunity to comment on it. The Associate Minister appears to have jumped the gun, and may have undermined the Interim Committee's independence.

New Zealand is one of only three developed countries that has no regulations, or meaningful incentives, to influence the fuel efficiency of light vehicles entering our country. As a result, the vehicles supplied into New Zealand are among the most fuel inefficient, and polluting, of any OECD country.

This means we end up pumping more pollution into the atmosphere and use more fuel to keep our cars moving. If our cars were as fuel efficient as the vehicles entering the European Union, we would pay on average $794 less per year at the pump.

The Associate Minister has confused emissions of CO2, which is just a greenhouse gas and not a 'pollutant', with other emissions which are pollutants. In the EU cars do have lower C02 emissions levels, and have better fuel economy, but this is partially because a high proportion are diesels, which are much more polluting than petrol engined vehicles. The effect of the proposed policies will be to increase the share of diesel light vehicles on New Zealand roads. This is acknowledged in the draft Regulatory Impact Statement, but there is no mention of the issue in the Consultation paper. The average fuel savings figure of $794 is an exaggeration based on some invalid data comparisons, and makes no mention of the higher cost of the vehicles that will generate those savings.

The Government is proposing to introduce two proven policies to increase the supply and reduce the cost of fuel efficient and electric vehicles coming into New Zealand. The first policy is the Clean Car Standard (which is a vehicle fuel efficiency standard). This policy would require vehicle importers to bring in progressively more fuel efficient and electric vehicles.
Vehicle fuel efficency standards are not proven in countries with a heavy reliance on used car imports. There is no fuel efficiency standard for used car imports in the EU, for example.

The second policy is the Clean Car Discount (which is a feebate scheme). This policy would make fuel efficient and electric vehicles more affordable for Kiwis to buy, potentially by a discount of up to $8000 for new vehicles and $2,600 on used vehicles.

The description of the second policy as a 'Clean Car Discount' is misleading, deflecting attention from that tax component of the feebate scheme. Low emission tax and subsidy scheme would be a fairer description.

The feebate approach has not been widely proven. The Netherlands had a feebate scheme from 2006 to 2010. It had a limited impact (studies varied between 0.1 to 1 percentage point impact on new vehicle emissions[18]) and was scrapped. The French scheme has persisted, but had operational problems[19] , which will probably be

[18] Arno Schroten,Sanne Aarnink Ben Gardiner, Wojtek Szewczyk, Shalini Mittal 2014 User Guide Feebate Simulation Tool Report 2014 ICCT

[19] D'Haultfoeuille et al., 2010 X. D'Haultfoeuille, I. Durrmeyer, P. Février What did you expect? Lessons from the French 'Bonus/Malus'

repeated in New Zealand, and had little effect on emissions. There are **no** examples of feebate schemes being applied to used car import markets.

The Clean Car Standard and Clean Car Discount would help us to significantly reduce the emissions from transport, and also result in fuel savings for motorists.

Both statements are misleading. There will be only a limited impact on CO2 emissions, a maximum of 5 percent on the Ministry's calculations, and probably significantly less using more realistic assumptions. The fuel savings will come at the cost of higher vehicle prices and lower choice, which will outweigh those savings.

We now address the arguments in the body of the Consultation Document .

Consultation Document arguments

Schemes necessary to meet 2050 emission targets

One of the key arguments in the Consulation paper is that the scheme is necessary for New Zealand to reach its 2050 emissions targets.

If we want a largely electric fleet by 2050, nearly all newly registered vehicles would need to be electric by the early 2030s. The Ministry of Transport projections suggest that only around 40 percent of vehicles entering New Zealand will be electric in 2030 without further government intervention or incentives

This is obviously not true. With the policies there may be a small uptick in the purchase of Evs through to 2025, but all, or nearly all, of these vehicles will be scrapped by 2050. Similarly all, or nearly all, of internal combustion engine (ICE) vehicles that they will have replaced will be scrapped by then. The widespread uptake of Evs will depend on further technical developments, a broader model range and critically, lower prices, and this will be unaffected by a New Zealand scheme which subsidises Evs during the 2020's. For new EV vehicles we will probably have to wait to past 2025, before prices come down to make Evs a mass market possibility. For used vehicles, there will be a lag of five years or so, before the supply of used vehicles in the exporting countries is large enough to make a difference.

The EV market is developing rapidly and we do not need to take action to meet the 2050 targets now. We have at least until 2030 to see how EV uptake evolves and take action then if necessary.

Increasing fuel prices will not make a big enough difference

There is no serious discussion of alternative proposals in the Consultation paper. However, the obvious alternative, increasing fuel prices, was briefly considered in the RIS. It was rejected because it would not make a big enough difference. Over the longer term, the Ministry argued, a 10 percent in fuel prices would only lower fuel consumption by 11 percent. However, the proposals lower consumption by a maximum 5 percent, and that on some very optimistic assumptions. In our book 11 percent is bigger than 5 percent, so it is impossible to understand the Ministry's logic here. The Associate Minister and the Ministry must be dealing with some 'alternative facts.'

Car imports have poor fuel efficiency

The light vehicles imported into New Zealand today are among the most fuel inefficient of any OECD country. As a result, they produce more emissions and cost significantly more to run. The table below shows the average annual fuel use cost to drive a light petrol vehicle in New Zealand, compared to other countries. On average, New Zealanders pay 65 percent more in vehicle fuel costs than the average person in the European Union, even though petrol prices are higher in Europe.

This statement is supported by the following table.

		New Zealand	United Kingdom	European Union	Japan	United States
Fuel efficiency - petrol equivalent	ltrs/100km	9.5	5.8	4.9	6.2	8.6
Petrol Price inclusive of duties & taxes[1]	NZ$/ltr	$1.92	$2.26	$2.25	$1.81	$1.05
Vehicle use	kms	11,000	11,000	11,000	11,000	11,000
Fuel Use Cost	NZ$	$2,007	$1,443	$1,213	$1,235	$995

To allow international comparisons 2017 data has been used.

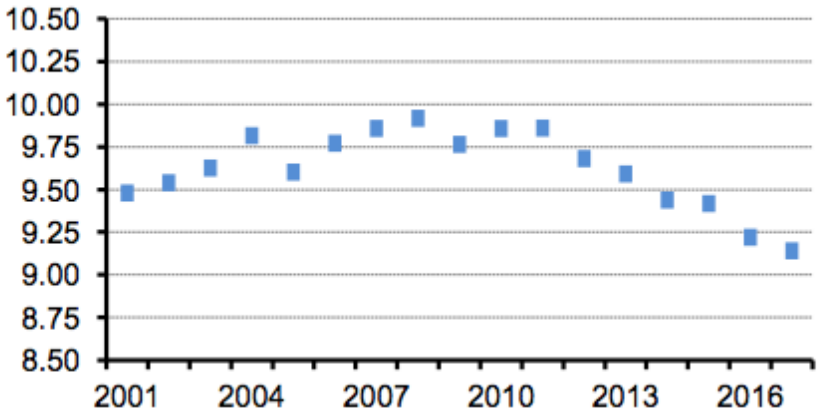
It presents a misleading picture of the relative fuel efficiency of New Zealand imports.

- The New Zealand data appears to be based on the entire fleet average. The comparators are 'new to fleet' averages, which because of their improved efficiency over recent years, will be lower than the respective entire fleet fuel efficiency numbers. The Ministry's comparision is deceptive.
- The New Zealand data is based on actual or 'real world' fuel consumption data, which can be about 30 percent higher than the test data for 'new to fleet' vehicles for the foreign countries in the table.
- The Ministry has an estimate of the 'new to fleet' fuel 'efficiency' for New Zealand (180gm/km. or 7.6 litres /100 k), but chose not to use it, obviously to make the New Zealand performance look worse.
- The EU data does not include used vehicle imports (that are important in central European countries like Poland).

- The EU figures look good because they include a high proportion of 'dirty' diesel vehicles.
- Fuel usage is not a good measure of vehicle 'efficiency'. Larger vehicles, which use more fuel, are not necessarily less efficient than a small vehicle, because they are serving different functions. New Zealand vehicles are larger than European vehicles, in part because our needs are different. New Zealand has a higher proportion of commercial vehicles, that use more fuel, in its figures.

The Consultation paper focuses on new to fleet data ignoring the performance of the overall fleet, which has been improving in recent years.

Figure 1: Average fuel effciency New Zealand fleet



Source: Transport Annual Fleet statistics 2017

Access to the lowest consumption vehicles

The second limb to the argument that New Zealand's current performance is 'poor', is that New Zealanders are not getting a choice of more fuel-efficient vehicles. A comparison is made of the lowest fuel consumption of variants of cars imported into both New Zealand and the UK.

Kiwis are also missing out on many of the fuel efficient vehicle models sold overseas. For example, in the United Kingdom the top selling 17 new light vehicle models have on average 21 percent lower emissions that the most efficient variants available in New Zealand. This comparison is shown in Appendix 1.

The comparison was nearly two years out of date, and there have been some changes since it was prepared. For example for the RAV4, the hybrid is now available

in New Zealand (and they are selling like hotcakes), with a similar fuel consumption to the UK RAV 4 model. But the key difference between the UK and New Zealand lowest fuel consumption data, is that the UK variants with the lower consumption are almost all diesels, whereas in New Zealand they are petrol models. Diesels have been pushed in the UK, and in Europe, to meet fuel consumption standards. We can expect a similar effect in New Zealand.

If the Government is happy with that outcome, to make the new car fuel consumption figures look better in the short run, then that is fine, but diesels are widely regarded as a more polluting option, so the 'clean car' title for the policies is somewhat incongruous.

Table one: UK and New Zealand fuel consumption

Model	Best NZ variant	Tailpipe CO_2 (g/km)	Best UK variant	Tailpipe CO_2 (g/km)	Difference %
Toyota Corolla (sold as Auris in UK)	1.8L Petrol Hybrid	96	1.8L Petrol Hybrid	79	18
Toyota Rav4	GX 2.2D/4WD/6AT/SV/5DR/5S	176	Petrol Hybrid AWD 2.5 VVT-i Auto	118	33
Toyota Yaris	GX 1.3P/5MT/HA/5DR/5S	134	1.5 VVT-i hybrid Auto with 15 inch alloy wheels	75	44
Kia Sportage	Urban EX 2.0P/6AT/SV/5DR/5S	182	'1' 1.7 CRDi 114bhp ISG	119	35
Mazda CX-5	GSX DSL 2.2D/4WD/6AT/SV/5DR/5S	158	2.2 SKYACTIV-D (150PS) 4WD A6	144	9
Mazda 3	GLX 2.0P/6AT/HA/5DR/5S	136	1.5L Turbo Diesel, 6 Spd Manual	99	27
Mitsubishi Outlander	XLS 88KW/PHEV/4WD/AT/SV/5DR/5S	39	GX5h 2.0 PHEV	44	-13
Suzuki Swift	GL 1.2P/5MT/HA/5DR/5S	106	1.2 2WD	116	-9
Suzuki Vitara	SPORT 1.4P/6AT/SV/5DR/5S	138	1.6 2WD	106	23
Hyundai Tucson	2.0 CRDi LIMITED 2.0D/4WD/6AT/SV/5DR/5S	178	2.0l CRDi 4WD, 100kW Diesel A6	160	10
Hyundai i30	GD CRDI 1.6D/7AM/HA/5DR/5S	136	1.6L Turbo Diesel, 6 Spd Manual	94	31
Hyundai Santa Fe	DM 2.2D/4WD/6AT/SV/5DR/5S	205	2.2l CRDi 4WD 18" or 19" wheels	159	22

Nissan Qashqai	N-TEC 2.0P/CVT/HA/5DR/5S	159	dCi 110 16/17 inch wheel	99	38
Nissan X-Trail	ST-L 2.5P/6CVT/SV/5DR/5S	188	dCi 130 2WD 17" wheel	129	31
Ford Focus	Trend Diesel 2.0D/6AT/HA/5DR/5S	115	1.5 Duratorq TDCi (105PS) with stop/start – 5 Door	88	23
Subaru Outback	2.0D SLT Premium 2.0D/4WD/6CVT/SV/5DR/5S	165	2.0D SE Lineartronic AWD CVT	159	4
HONDA HR-V	L 1.8P/CVT/SV/5DR/5S	160	1.6 i-DTEC S	104	35

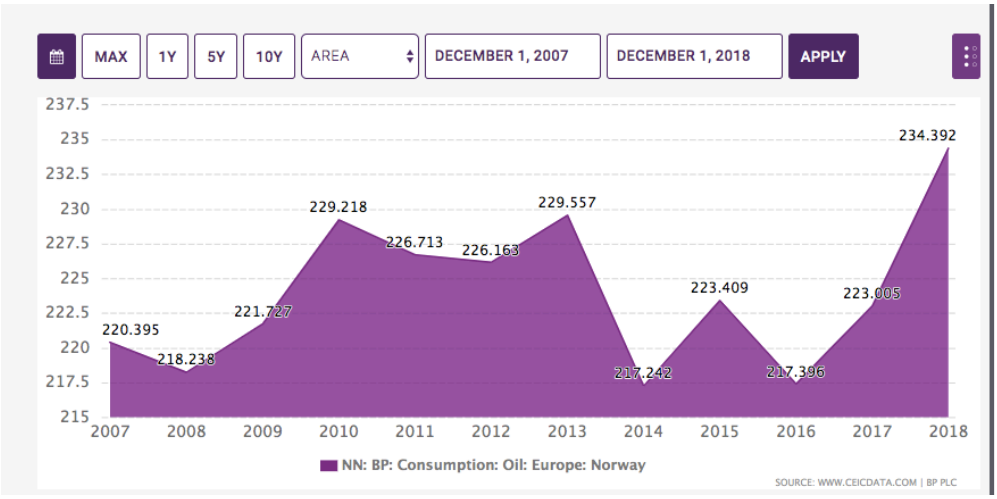
Used car low fuel consumption options

The argument that New Zealanders do not get the choice of the most fuel efficient vehicles simply does not work for used imports, which account for just over half of light vehicle imports. Importers have access to the full range of vehicles on the Japanese used car market (which accounts for 95 percent of used imports).

Effectiveness of fuel efficiency standards

It is argued that fuel efficiency standards are effective in reducing light vehicle emissions. It is supported by an EU study that suggested that 65-85 percent of the improvement in emissions were due to mandatory standards. It is true that emissions standards, when they have applied to large manufacturers in large markets, have made a difference to fuel efficiency test results. But it is less obvious that there is such a strong case for vehicle importing countries to apply standards, as they will get the benefits of technological advances in fuel economy in any case. And it appears that the standards have been less effective in reducing actual fuel consumption than the test results, which the standards are based on, would suggest. There has been a steady and substantial divergence between 'real world' (which is what matters from an emissions reduction perspective) and test results as the pressure to meet the standards has increased.

Norway is a good example. It has had the biggest improvement in 'new to fleet' emissions in Europe (down 65 percent to 93 gm/l. by 2015), but if we look at its fuel consumption figures there appears to have been limited progress.



Other arguments

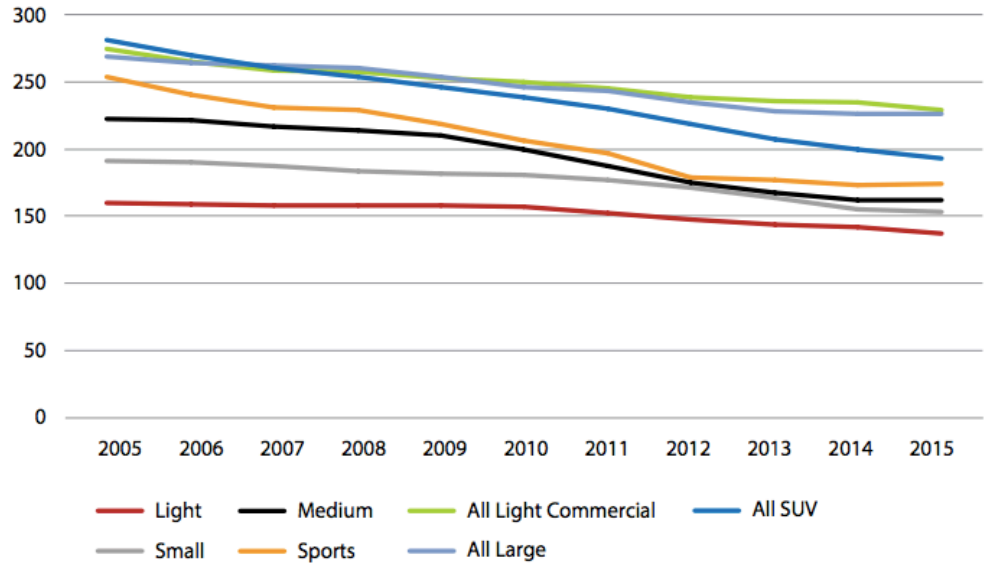
A 'plague' of big SUVs and pickups

One of the messages that comes through the documents is that one of the problems is that New Zealanders are buying more big SUVs and pickup, and that this is a issue that has to be addressed. SUV's (more upright versions of small and medium cars, as well as the big units) have become more popular in New Zealand, but this is a world-wide trend. In Canada, for example, 50 percent of new vehicles are now SUVs or pickups. But the new big SUVs are not necessatly the gas guzzling monsters they have been painted as. Many have a similar fuel consumption of medium-size cars of just a few years back. For example, the fuel economy of the popular Ford Ranger at 7.8 l/100km is nearly the same as the 'new to fleet' average of 7.6l/100km.

Figure two: Ford Ranger 2.2

And the Ministry's statistics (their figure 5 below) show that SUVs have had the biggest effciency gains of any vehicle segment.

Figure 5: Average New Vehicle Efficiency (gCO_2/km)by segment, 2005–15, (NTC 2015, 2016)[10]



New Zealand Productivity Commision Advice

The New Zealand Productivity Commission, in its 2018 'Low-emissions economy' report, favorably reviewed emissions limits and the feebate scheme. We were highly critical of their analysis in our submission on the draft report, which was a poor piece of analysis at odds with the more authorative Australian Productivity Commission's work. As the Ministry has relied heavily on some of the Commission's analysis we have presented our submission in Appendix one. It provides more detail on some of the issues.

Possible co-benefits

The RIS states

In terms of interdependencies, as far as possible the Associate Minister of Transport is seeking vehicle emission policies that have the co-benefit of increasing vehicle safety and vice-versa. This is because New Zealand's vehicle fleet is currently not consistent with a transport system that is free of death and serious injury.

The Associate Minister is likely to be disappointed. The incentives are to buy smaller vehicles, but according to the Ministry's used vehicles safety ratings there is a clear correlation between vehicle weight and death and injury risk. The smaller the vehicle, the greater the risk. While it is true that New Zealand's vehicle fleet is not consistent with a transport system that is free from death and serious injury, no currently conceivable and acceptable[20] transport fleet is.

[20] If all cars were limited to a maximum speed of 5kph that might work, but people are likely to object.

Part four: Calibration of the policies

Emission standards

There are two components to the proposed emission standard, the average fleet standard and the vehicle weight adjustment factor.

Fleet average emissions

A 105 gram per kilometre travelled target was chosen, in part, we are told, because it aligns with the standard that was recently investigated in Australia by the Australian Department for Infrastructure and Regional Development (DIRD). A 105 gm/l standard might have been investigated in Australia, along with 115, 125 standards, back in 2016, but it has not been adopted, possibly because the economic analysis that was used to justify the recommended 105 gm./l. target was deeply flawed. We explain why below in the cost benefit analysis section.

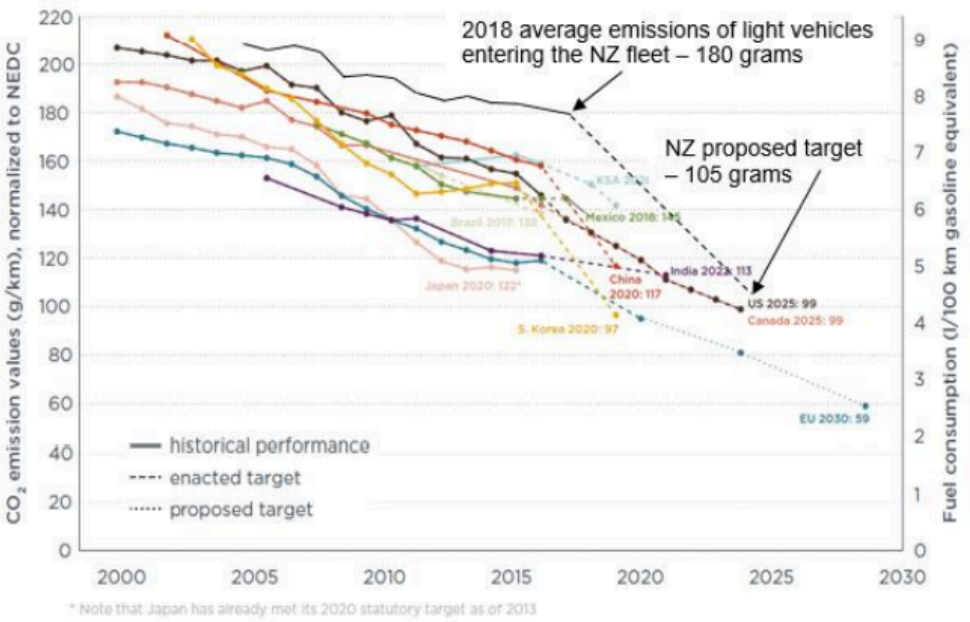
This target would not be as stringent as standards in Canada and the European Union. It would also not be as strong as the average emission profile of vehicles already entering the Japanese fleet

We don't know enough about the Canadian standard to comment, but on the EU, presumably the Ministry is talking about the 2021 EU limit, which is 95 gm./l. for cars, and 147 for light commercial vehicles. The targets have a number of wrinkles, including a 'super-credit' for low emission vehicles (Evs) and credits for eco-innovations. These can lower the measured emissions targets by up to 14.5 g/km. It also appears that European car makers will not be able to meet these targets, as consumers shy away from diesel cars, which were the main driver behind the fall in CO2 emission rates. Also, in Europe, used cars imports are not subject to the standards.

So it is by no means clear that the proposed New Zealand standard is above the EU standard.

The critical claim is that the standard is not as strong as vehicles currently entering the Japanese fleet, because this will be important to understanding how used imports are affected when the policies come fully into effect in 2025.

Comparison of global CO_2 regulations for new passenger vehicles



Source: ICCT (January 2019) *Policy update: CO_2 emissions standards for passenger cars and light-commercial vehicles in the European Union. Note: the Trump administration has removed the US 2025 target.*

The evidence for this claim, presented in the consultation document is a single figure, which we reproduce above. It shows that the average for Japan was about 118 g/km and that the 2020 target is 122 g/km. On its own evidence it appears that the Ministry is simply wrong on its claim about Japan.

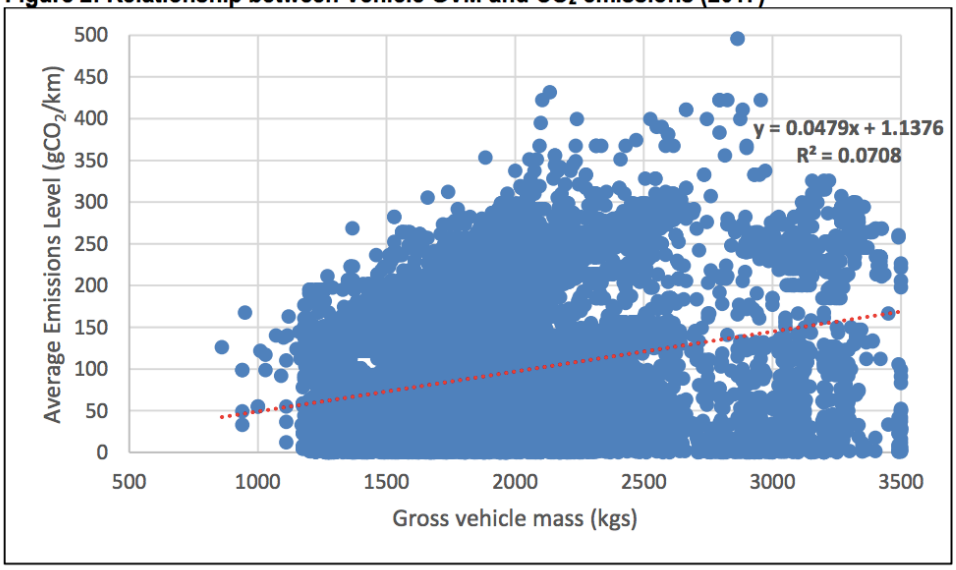
The weight variation factors

The second component is the weight variation factors, which assign different emissions limits to vehicles with different weights. They:

are designed to *help maintain a diversity of vehicle types by allowing suppliers of heavier vehicles, for example utes and large SUVs, to meet higher emissions targets than for average sized vehicles.*

The factors were, purportedly, calculated by estimating a relationship between weight and emissions from actual data of vehicles entering the New Zealand fleet. The data is shown in their figure 2 below. The problem with this analysis is that the exercise was either bungled or fabricated. The data shows a relatively heavy weighting of vehicles with emissions of under 50 gm/k, when only a small proportion of vehicles (Evs and plug-in hybrids) could have meet that standard. It also apparently captures vehicles that may not even exist. How many Evs sold in New Zealand had a gross weight of between 3000 and 3500 kilograms?

Figure 2: Relationship between Vehicle GVM and CO_2 emissions (2017)



Calibration of the feebate scheme

There is no discussion in the consultation document on why the various fees and rebates in the feebate scheme were set at the proposed levels. In the RIS there is a brief statement that the fees and rebates were set with respect to the social costs that are not captured in fuel prices because the current carbon price of $25 is insufficient to fully cover social costs. The obvious solution is, as we suggest, to increase the carbon price on transport fuel. And how a subsidy for diesel vehicles is somehow justified on other social costs grounds is beyond us.

Looking through the cost benefit and social impact papers the proposed fees and rebates have been jumping around (a $5000 EV subsidy appears in one of the documents), and the assumptions used in the modeling do not match the final figures in the Consultation document proposals. It appears that the final fees and rebates were set on a last minute whim.

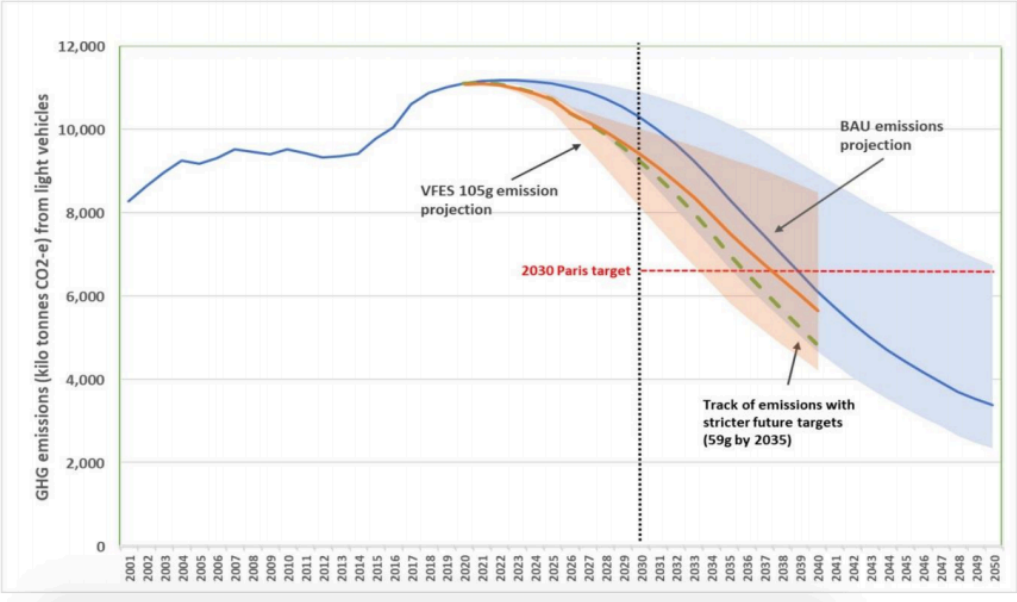
Part five: Impact on emissions

We are told that it is estimated that an emissions target of 105 gram CO2/km in 2025 could reduce emissions by 5.1 million tonnes over 2020–2041 and that the feebate scheme will reduce emissions by 1.6 million tonnes over the same period. The reader might think that the two policies together will reduce emissions by 6.7 million tonnes, but that is not the case. The two policies were not modelled together and the results are not additive. The Ministry acknowledges that a combined

modelling exercise should have been done, and says that it will do so when it gets around to it. It then then covers itself by saying that the reductions from both policies will be more than one policy alone. Readers, however, are likely be mislead into thinking that the feebate scheme will save an additional 1.6 million tonnes. The reality is that the Ministry simply doesn't know.

The only information we are given on the impact is a very difficult to read graph shown below.

The impact of the vehicle fuel efficiency standard (VFES) on light vehicle emissions



The contribution of the policies is shown by the difference between the business as usual (orange line) and the green line. At 2025 there is no discernible difference and we can just make out a difference by 2030, where it is assumed that there is a further tightening of policy.

What is clear from the figure is that there is great uncertainty around the estimates, so the claim that the proposed policy changes are somehow 'essential' to meet the 2050 target doesn't have much substance.

It is important to understand what is claimed here. It is that over the course of 20 years the policies will reduce emissions by at least 5.1 million tonnes . This is an average of 255,000 tonnes a year. The maximum reduction is about 500,000 tonnes a year, or 5 percent of the 'business as usual' number. This is not a big contribution, and the impact has, almost certainly, been exaggerated.

- The baseline estimates are overstated. No account is taken of any improvement in emissions that will occur in the conventional ICE fleet as more efficient models come into the fleet.

- The base-line assumes a low EV uptake scenario, worsening the do-nothing outcome. A median estimate, would have been more appropriate.

- The impact of the policies on the EV uptake is exaggerated. It is assumed that the uptake of used Evs will increase by a factor of three due to the $2700 subsidy. This is probably impossible. There is a limited supply of Nissan Leafs (total sales in Japan have been about 100,000) and there is competition for those from other countries. Sri Lanka, for example has 5000 Evs[21], almost all used Nissan Leafs, and has been a vigourous competitor in the Japanese used car market. The subsidy will place further pressure on a finite resource, driving up auction prices. Some of the subsidy will flow to Japanese car sellers.

- The uptake of new Evs is based on a model that assumes that the price gap between ICEs and full electric cars is $8000. Consequently electric car imports are assumed to increase to between 15-35 percent (depending on the scenario) by 2025. The $8000 price gap is obvious nonsense. The true figure is currently more like $25,000-$30,000. We discuss the Ministry's price gap evidence further below. Only about 40 percent of imports are assumed to be conventional ICEs by 2025, which is a stretch.

- The model was reversed engineered to achieve the 105 gm./l. target. It was just assumed that the objective would be met and the model inputs were adjusted accordingly. There was no serious analysis of whether affordable models that would make this possible would be available to New Zealand importers.

A more realistic assessment

A more realistic assessment of the impact would be a 2-3 percent fall in emissions by 2025. The fall in emissions over 2020-2041 will be less than the reported 5.1

21

million tonnes but is is not possible to assess by how much on the information avaialble to us.

Part six: How the policies might 'work'- the used car market

The Japanese used car market

Before discussing how the policies might work in practice it useful to have a basic understanding of how the used car market works. 95 percent of used imports come from Japan and these imports are heavily concentrated in the 9 to 12 year age group in order to hit New Zealand retail pricing points in the $8000 to $10,000 range. This means that the cars that will be impacted when the schemes take full effect by 2025 have already been produced so it is important to have a good understanding on the fuel efficiency of vehicles produced around the period 2013- 2016.

What impact would the emissions target have on the supply of used vehicles into New Zealand?

The Ministry gives the impression that it will be an easy matter for used car importers to meet the emission standard by adjusting their vehicle mix from a range of low emitting cars that are already in the Japanese fleet and that will be available in 2025.

The vehicle fuel efficiency of vehicles entering the Japanese market today is one indicator that there could be a sufficient supply of low-emission vehicles available to vehicle importers to comply with a standard of 105 grams CO2/km in 2025. In 2014, the average emissions of new light vehicles manufactured and registered in Japan met the proposed target of 105 grams CO2/km. This is 10 years ahead of the full phase in date for New Zealand's standard. The Japanese passenger vehicle fleet is now trending to achieve an average of 82 grams CO2/km by 2020. 9

We checked the reference for the 82g/km claim. We found no such evidence. All that appears in that document is the figure shown above. It appears that what the Ministry has done, is trended down the line in the figure. They essentially just made up the number, and then tried to leave the impression that it had authorative support. The ICCT reported that the Jjapanese fleet standard for cars for 2020 is 20.3 kilometreslitres per litre, or about 115g/kml.

In the RIS there is also a claim that the average emissions for new cars (not all light vehicles) in Japan in 2018 was 100 g/km. The reference was a report from the Japanese Vehicle Manufacturers Association. There is just a single number in that report, with no supporting documentation on how it was calculated, or any breakdown by vehicle subclass. It is likely that the number was heavily influenced by the inclusion of tiny 'Kei' cars. The Kei car class is heavily restricted by dimensions, engine size (660cc) and power, is tax favoured, and is apparently popular in smaller towns and rural areas In Japan.

A few have appeared in New Zealand, (some are designed for export with larger engines) but have not sold well, because, amongst other things, their dimensions were calibrated to immediate post war Japanese bodies, not your average modern Kiwi family. Many would not meet modern safety standards.

How the Ministry depicts the policy

Appendix 4 of the Consultation Document is a table that shows how 50 'illustrative' vehicles might be affected by the policies, in the first operational year. One might expect that they would have focused on the 2013-16 Japanese vehicles that are most likely to be imported in 2015.

But that is not what is presented. Only 20 of the examples are from Japan. The other models appear to have been selected, in part, to give the impression that there are large numbers of 'gas–guzzling' used imports. The Holden Commodore and the Ford Falcon make the list. The Ministry is perfectly aware of the composition of used imports. The following table, taken from one of the Social Impact reports show the top twenty most popular imports. There is no sign of the 30 non-Japanese vehicles.

Table 28. Top 20 most popular <u>used</u> light vehicles imported from July 2015 to June 2018 for low-income households

Make	Model	Count	Vehicle Type	Tare Weight (kg) > X to <= Y	Indicative CO_2 g/km	Indicative low price	Indicative high price
NISSAN	TIIDA	3180	small ICEV	1200 - 1400	125 - 185	$6,000	$10,000
SUZUKI	SWIFT	3010	small ICEV	up to 1000	120 - 190	$6,000	$11,000
HONDA	FIT	2320	small ICEV	1000-1200	129 - 166	$5,000	$7,000
TOYOTA	WISH	2220	MPV	1400 -1600	159	$7,000	$14,000
MAZDA	DEMIO	2180	Hatchback ICE	1000 - 1200	120 – 145	$9,000	$13,000
TOYOTA	VITZ	1900	small ICEV	1000-1200	117 – 164	$5,000	$14,000
TOYOTA	PRIUS	1580	hybrid	1,200-1,400	80	$9,000	$15,000
MAZDA	MPV	1380	MPV	1800 - 2000	240	$10,000	$22,000
MAZDA	AXELA	1310	ICEV	1200 - 1400	130 - 200	$8,000	$12,000
TOYOTA	HIACE	1300	light van	1600 - 1800	234 - 292	$15,000	$29,000
TOYOTA	ESTIMA	1260	MPV PEHV	1600 - 1800	116	$9,000	$25,000
HONDA	ODYSSEY	1180	MPV	1800 -2000	178 - 218	$6,000	$14,000
NISSAN	NOTE	1140	ICEV	1000 - 1200	119 - 159	$5,000	$10,000
TOYOTA	MARKX	1060	MPV	1400 - 1600	187	$10,000	$15,000
SUBARU	LEGACY	1040	wagon	1400 - 1600	198	$7,000	$17,000
MITSUBISHI	OUTLANDER	1030	MPV	1600 - 1800	215 - 240	$9,000	$19,000
MAZDA	PREMACY	1000	MPV	1200 - 1400	234 - 370	$5,000	$11,000
NISSAN	DUALIS	970	SUV	1400-1600	194.635	$8,000	$15,000
HONDA	STREAM	950	large ICEV	1400-1600	157	$5,000	$14,000
TOYOTA	COROLLA	940	Sedan/Wagon	1000-1400	131.7-155.2	$6,000	$13,000

Data sources:

1. The list of most popular vehicle makes and models is sourced from Treasury's IDI analysis completed in March 2019.
2. Emissions and used cars prices shown in this table are indicative only. They were obtained from Trade-Me based on vehicles manufactured between 2009 and 2010 (searched performed on 29 March 2019) and do not represent the actual emission level or

The Ministry focuses on the first year of the policies

In its discussion of the impact of the feebate scheme the Ministry focuses on the first year where some of the popular imports will get a rebate.

A simple analysis in Appendix C (Appendix four in the Consulation paper) *shows, however, that a number of larger SUVs and utes currently sold in New Zealand would face a fee under the Clean Car Discount policy. At the same time, there are some mid-range price new and used utes and new and used vans, SUVs, and people-movers that would be unaffected in 2021. Some SUVs and vans already sold in New Zealand would attract a discount in 2021.*

The 2025 outcomes are presented in the Consultation paper, but in a tabular form that is hard to read and there is no discussion of the results.

We have represented the relevant information on vehicles with rebates or penalties in the table below.

First year

Winners	**Rebate**
Ford focus, Holden Cruze, Lexus GS300	$200
Citron c3, BMW 116, BMW 3, Toyota Corolla	$500
Nissan Tilda, Suzuki Swift, Honda Fit, Skodia Fabia, Lexus GS300	$800
Mazda Demio, Toyota Camry Hybrid, Toyota Estima PHEV, Hyundi i30	$1100

Losers	**Penalty**
Camry,Nissan Tilda, Mazda 3, Ford Kuga	$1100
Ford Focus, Kia Sportage D, Nissan X-Trail, Nissan Dualis	$1200
Ford Falcon 6, Commodore SV6 ,Honda Odessey	$1300
Ford Territory D,Holden Colorado D	$1400
Holden Commdore V8, Range Rover,Toyota Landcruiser	$1500

2025

Winners	**Rebate**
Toyota Prius H, Honda insight H, Fiat 500 Renault Megane diesel	$500
Porsche Cayenne PHEV, Toyota Yaris	$900

hybrid	
2016 BMW 740e PHEV, Mercedes C350	$1300
Holden Volt PHEV, Outlander PHEV, Toyota Prius PHEV	$1700
Nissan Leaf, Mitsubshi MiEV	$2100

Losers	**Penalty**
Ford focus D, Holden Cruze D, Lexus RX 450	$700
Mitsubishi Outlander D, Honda Jazz P	$800
Holden Cruze P, Ford Modeo D, Nissan Pulsar	$900
Corolla, Skoda Superb, Mazda Cx5 P Mitsubishi Outlander	$1000
Camry, Tilda, Mazda 3, Ford Kuga	$1100
Focus, Kia Sportage,NissanX-trail, Nissan Duallis	$1200
Ford Falcon,Commodore SV6, Honda Odessey	$1300

To assess what might happen in 2025 we present two data sets. The first is a comparison of the proposed emission standards for New Zealand, and the Japanese standards. The relevance of this is that the Ministry has inferred that it will be relatively easy to import low fuel consumption vehicles from Japan , because the standards were already in effect by 2014. The table clearly shows that the Japanese standards are in fact more lenient than the proposed New Zealand standards. In particular it shows that for larger vehicles, (work vehicles, MPVs) there is a large gap between New Zealand and Japanese standards.

Table two: Japan/New Zealand emission standards

Weight class Kerb weight kg	**Japan 2020 Km/litre**	**Japan 2020 Gm67/km.**	**New Zealand proposed gm/km.**
< 740	24.6	96.5	80
741-855	24.5	96.9	80
856-970	23.7	100.2	80
971-1080	23.4	101.5	85
1081-1195	21.8	108.9	85

1196-1310	20.3	117	95
1311-1420	19	125	95
1421-1530	17.6	134.9	103
1531-1650	16.5	143.9	106
1651-1760	15.4	154.2	112
1761-1870	14.4	164.9	117
1871-1990	13.5	175.9	122
1991-2100	12.7	187.0	130
2101-2270	11.9	199.6	136
2271 and above	10.6	224.1	141

Source: TransportPolicy.net

Table three: Consultation paper, proposed emission targets

Vehicle weight band (kilogram tare weight)	105 gram emission target adjusted by weight
Up to 1,000kg	80
>1,000kg to <=1,200kg	85
>1,200kg to <=1,400kg	95
>1,400kg to <=1,600kg	103
>1,600kg to <=1,800kg	112
>1,800kg to <=2,000kg	122
>2,000kg to <=2,200kg	130
>2,200kg	141
Weighted average	**105**

The second set of information was a data set obtained from the New Zealand Vehicles Importers' Association (VIA) which showed the CO2 emissions, prices and weights of 2015 vehicles sold in Japan. 2015 was selected because it will be at the centre of importers' preferred market by 2025. There were a number of vehicles that met the proposed New Zealand standards. Most of these were Kei cars.

The other possibiliies were a limited set of mostly Toyota and Honda hybrids. Table four is a list of vehicles with emissions of under 105 gm/l. Those under the standard are shown in red. There will also a few vehicles such as the Toyota Estima hybrid that will meet the weight-adjusted standard.

Table four: Possible compliant used imports 2025

Car	Type	Emission	Weight	Emission limit proposed policy
Honda Fit (Jazz)	Small car	94	1170	85
Honda Fit hybrid	Small car	67-81	1170	85
Mazda Demio diesel	Small car	86-100	1040	85
Toyota Fielder (Corolla)	Small station wagon	99	1100-1135	85
Toyota Aqua (Prius c)	Small car	64	1180	85
Toyota Corolla Axio hybrid	Small car	67	1100-1200	85
Honda Shuttle hybrid	Variant of the Fit	73-85	1170	85
Honda Grace hybrid	Small car	68- 77	1180	85
Toyota Sienta hybrid	Mini MPV	84	1210-1310	95
Toyota Corolla Fielder hybrid	Small station wagon	67	1100-1135	85
Honda Vezel hybrid	Small SUV	90-100	1180-1270	95
Toyota Prius	Medium car	67	1380	95
Mazda Cx-3 diesel	Small SUV	95	1340	95
Honda Jade hybrid	Compact MPV	93	1530	103
Toyota Noah hybrid	MPV mainly sold to Asian countries.Limied japan supply	96	1560-1730	103-112
Toyota Prius PHV	Plug –in hybrid	72	1435	103
Daihatsu Altis hybrid	Rebadged Camry	96	1450-1550	103

Toyota Camry hybrid	Medium sized car	97	1450-1550	103

What this shows is that used car consumers will have a much more limited choice of vehicles by 2025. It will be either a Toyota and Honda hybrid or a Kei car. If it is a hybrid then this will come at a price premium of about $3000-4000.[22]

How much difference the emissions standards will make to the hybrid car uptake is uncertain. New Zealanders have already discovered used hydrids. At the time of writing there were about 1700 used Toyota hydrids for sale on Trademe and 500 used Honda hybrids. Over the next few years many more Japanese used hybrids will come into the New Zealand price range and a significant increase in import volumes can be expected.

The Kei car option

Kei cars may be one of the few options open to lower income families who can't afford a hybrid. One option that might appeal to rugby fans is the Mazda Scrum pictured below. Unfortunately it will not take a full rugby scrum (or even a single lock, unless he puts his head out the window). Unfortunately also it will, with emissions of 118 gm/km, still incur the fee and probably a high emission vehicle tax, because it will be over the 80gm/l. limit for a small vehicle.

Mazda scrum

Take a Slash

A compliant Kei car alternative would be the Honda Slash (pictured below), which, with emissions of under 80 gm/km could qualify for a rebate, at least in the early years of the feebate scheme.

[22] VIA estimate. Personal communication.

2015 Honda Slash

Making Kei cars acceptable

One of the problems with Kei cars (apart from being more dangerous than larger cars) is that they may be perceived as being too small for New Zealanders' needs. The Ministry may be working on this and some promotional material that may help in this respect is presented below.

Can this family fit into this car?

Easily

The Guinness Book of Records record for people stuffed into a Smart car is 20.

Toughen up and save the planet!

Insult to injury?
The Ministry adds insult to injury by sayings that consumers who make the switch will be saving money, through lower fuel bills. Consumers are perfectly aware that small cars cost less to run than larger but more suitable vehicles. They will not appreciate being told that they will be so much better off by being forced into a Kei car.

Associate Minister for Transport mislead Cabinet?
In the Cabinet paper seeking Cabinet's consent to the consultation the Associate Minister made the following statement:

I am confident that there will be a sufficient supply of new and used vehicles compliant with a 105 g CO2/km standard. Japan is our largest supplier of new and used vehicles and the average new vehicle entering its fleet had emissions of 105 g CO2/km in 2014.

This was misleading. The Ministry had not done the work to check that there would be a supply of suitable vehicles in Japan to meet the needs of the used car market. Similarly there was no analysis of the new cars currently available on the market, or likely to be available by 2025.

Other impacts: Market stability
The policies could have a destablising effect on some sectors of the market.

- It will kill the new EV market in the leadup to the introduction of the feebate scheme. Why buy now, when if you wait for a while, you get a $8000 subsidy.
- The used Japanese import market will load up on models which will bear heavy taxes later on. People movers will be particulary affected as there are likely to be few low emitting subtitutes. Vehicles can still be obtained but

there may be a penalty fee of, say, $3000 (60gm/ X $50) plus the feebate tax of $2000. A total of $5000 on what would have been a $12000 vehicle.

- Purchases of used cars will fall and the existing fleet will be kept for longer.
- The used car market will change to an agency market for cars that exceed emission limits. Cars will be imported in the customers name to keep under the three car limit. Dealers may also enlist 'friends and family' to import three cars each to keep cars on the lot. At an extreme, no used cars exceeding the limits will be subject to policies. On the other hand used cars that are under the limit will be imported in the importer's name to secure the rebate. In most of our analysis below we have assumed that the loophole will be closed off because the fiscal risk is obvious.
- The emission limit boundaries may be gamed. Importers might select a heavier vehicle just over a weight class boundary, in preference for a lighter more efficient model variant under the boundary.

Fiscal risk

The feebate scheme poses a substantial risk. As noted above, there will be a flood of electric vehicles in the first years. On the other hand only a limited number of cars in the first couple of years will incur a fee. In subsequent years there could be significant leakage to private importing if this is not closed off. New car importers will change their product mix, to more diesels, and lower emissions hybrid and other vehicles, which are already in the pipeline for the New Zealand market. If the government attempts to 'balance the books' by shifting the subsidy/penalty bands, imposing penalties on a wider band of vehicles, this will exacerbate market instabilty. A manufactuer bringing a vehicle to market in New Zealand on the assumption that it will receive a rebate may find that is subject to a fee.

When the French introduced their feebate scheme 2008 they soon ran into fiscal problems, despite the scheme being introduced with only a few months warning. By 2011 the scheme was 1.5 billion euros in deficit.

The only analysis that relates to possible fiscal implications is the following figure presented in the Consultation paper.

There is no evidence, that we could see, in any of the documents that the Ministry actually tried to estimate the actual cash flows of the feebate scheme.

Part seven:The cost benefit analysis

Results

The Ministry says that its 'preliminary' cost-benefit analysis of the proposed clean car emission standard indicates that it has a benefit-cost ratio of 3:1 and a net present value of $2.4 billion. The feebate scheme has a benefit to cost ratio of 2.6 and a net present value of $413 million.

As noted above, the costs benefit analyses were conducted independently and there was no joint cost benefit analysis, or any assessment of the marginal costs and benefits, of the feebate scheme, assuming the emissions scheme is in place.

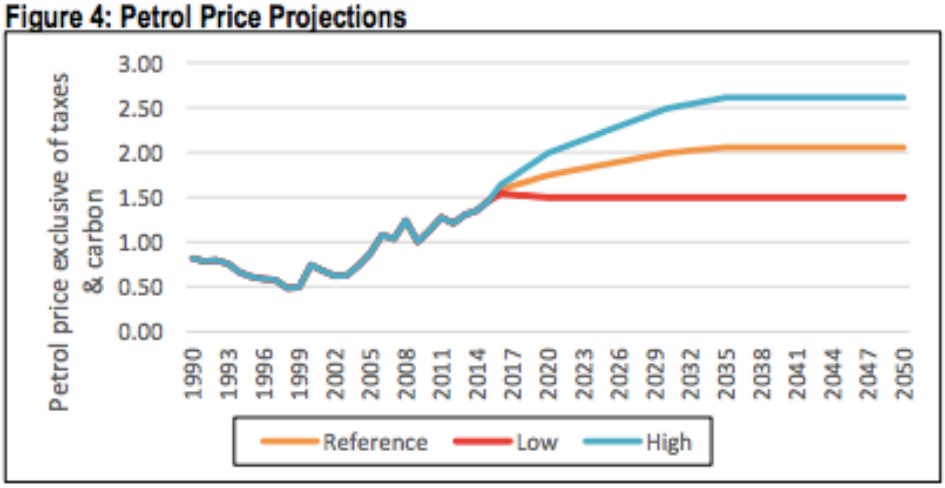
Quite apart from this basic flaw in the analysis, the separate cost benefit analyses were basically scams. Key variables have been manipulated to generate unrealistically favorable results.

The results largely depend three critical inputs.

1. Future fuel prices

The major benefit from the polices is from fuel saving. It is assumed that there will be a substantial increase in fuel prices (the orange line in the figure below), and hence in fuel savings, over the modelling horizon. There is no discussion in any of the documents of why this assumption was adopted, or of what it implies in terms of future oil prices. It appears that a doubling of oil prices has been assumed. A more neutral assumption would have been to hold oil prices steady at current levels. The effect of the Ministry's assumption is to increase gross benefits by about 25 percent.

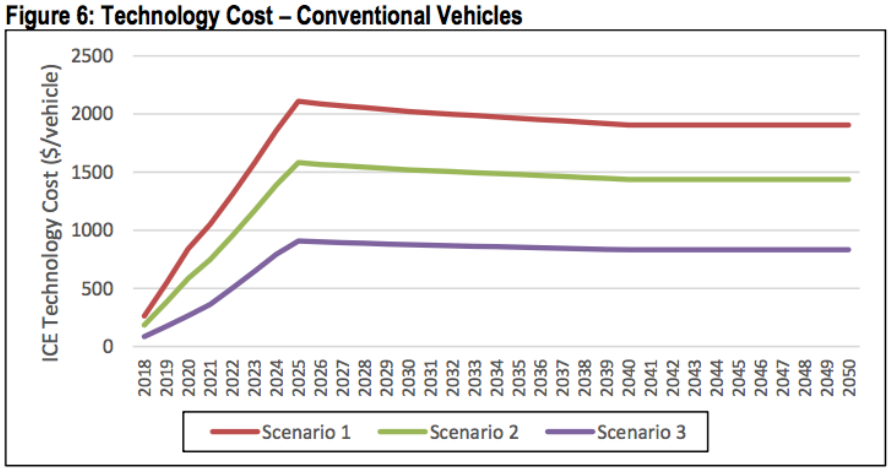
Figure 4: Petrol Price Projections



2. Higher cost of more fuel-efficient vehicles

The higher costs of more fuel-effcient vehicies was taken from a 2016 report by the Australian Department of Infrastucture and Regional Develoment (DIRD). The higher cost scenario of around $2000 by 2025 in the figure below was assumed. The DIRD analysis, in turn, relied on some US and EU studies, which produced some highly variable results. The obvious problem with this analysis was that the cost figures related to large European and American manufacturers, who were given many years to make the required improvements. The results are obviously not relevant to New Zealand (or for Australia for that matter). The per unit cost of making any material technical innovations for the New Zealand market would be prohibitive.

Figure 6: Technology Cost – Conventional Vehicles

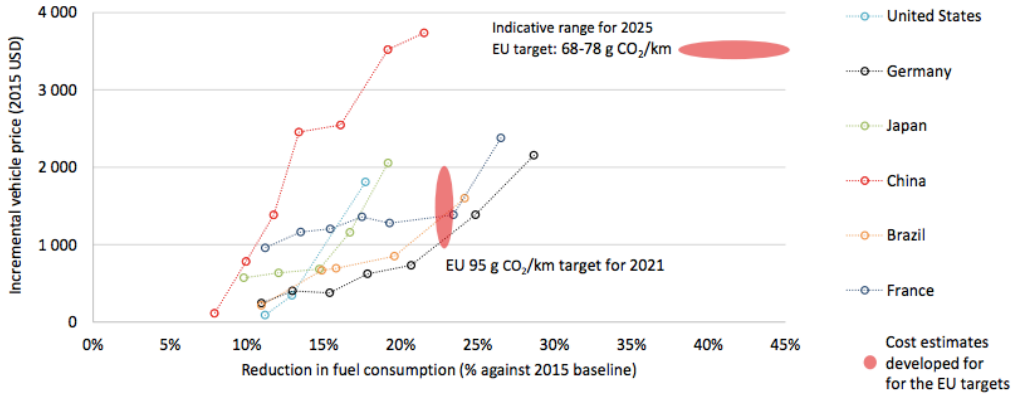


The Ministry did have more relevant information on the likely cost of more fuel effcient vehicles. The following table taken from of a recent OECD/IEA report[23], was referenced in one of the Ministry's papers. The report summarises the data as follows.

Overall, the analysis of price increments and fuel economy improvements across all segments and all countries indicates that consumers across the world pay a price premium for a 15% fuel economy improvement ranging between USD 500 and 2500, with a global average value in theorder of USD 100 per percentage point reduction in fuel use per km. These ranges grow to USD800 - 4000 for a 20% improvement.

For New Zealand the proposed standards will require a more than 40 percent increase in fuel efficiency, so any cost assessment from this data would be a multiple of the Ministry's estimate.

Figure 3 • Price increments per percentage point fuel economy improvement[3] in selected markets, 2015



Note: g CO_2/km = gram of carbon dioxide per kilometre.

Sources: the price assessment is from IEA elaboration and enhancement for broader coverage of IHS Markit database; the technology cost estimates for the EU targets are based on the range given by ICCT (2015a) for passenger cars; the indicative target range for 2025 is that indicated by the European Parliament in 2015 (EP, 2015).

Table 4: Average fuel economy improvement and price premiums of hybrids and diesels relative to a similar petrol vehicle, 2017 (Data for advanced economies with fuel price > USD1 per litre)

	City car	Medium car	Small SUV/ pick-up truck	Large car	Large SUV/ pick-up truck
Fuel economy improvements relative to petrol vehicle benchmark (% increment)					
Hybrid	37%	35%	27%	35%	33%
Diesel	24%	25%	20%	27%	25%
Price premium relative to petrol vehicle benchmark (% increment)					
Hybrid	14%	30%	29%	4%	6%
Diesel	19%	12%	21%	9%	11%

Source: OECD/IEA (2019)

[23] OECD/IEA 2017 International comparison of light-duty vehicle fuel economy Ten years of fuel economy benchmarking

And, of course the Ministry could always have surveyed the price premiums for more efficient New Zealand new vehicles. The price premium for a new RAV4 hybrid for example is about $5000, and $3500 for the Toyota Corolla hybrid. Diesels are available, or could be available, for some models, and they typically cost around $3000 - $6000 more than the petrol variants.

Diesel and hybrids might make a 30 percent improvement in fuel economy taking the average vehicle emissions down from 180 gm/l to 125, but that would still leave the difficult 20 to go. Assuming that would attract a penalty of $100 a gm. the total cost to consumers is more like $6000, or around $5000 ex GST. The estimate of the capital cost for modelling purposes should have been 250 percent of the Ministry's figures.

The explanation for using the spurious 'Australian' data is that the Australian market is similar to the New Zealand market.

In 2016, Australia considered introducing a VFES similar to New Zealand's design. Their estimated price changes have been used in the preliminary CBA given a few similar circumstances between New Zealand:

- *The average CO2 emissions of a new light vehicle imported into Australia (at 172g CO2/km in 2017) was close to that of New Zealand (at around 180g CO2/km)*
- *The top ten selling new cars (none of which meets the proposed standard) in Australia in 2017 are also relatively similar to those purchased by New Zealand (Table 3). In fact, only 3.8 percent of all new cars purchased in 2017 in Australia had average emissions of less than 120g CO2/km.*
- *Australia will no longer have any local vehicle manufacturing and, like New Zealand, will need to rely on importing vehicles from other countries.*

The real reason for using the the DIRD data appears obvious. The Ministry wanted to understate the true cost of the policies.

3. Value of fuel savings –internalisation of fuel costs

The most critical variable in the cost benefit analysis is what the Ministry describes as the 'internalisation of fuel costs' factor. The logic here is that if consumers are forced to buy smaller vehicles they will spend less on fuel, but this does not mean that they are necessarily better off. If they understood that a smaller, or more efficient vehicle would provide fuel savings over time but they still preferred a larger vehicle, or cheaper less fuel efficient vehicle, that better suited their needs, then being forced to buy a smaller vehicle would impose a welfare loss. The decrease in

fuel costs would be outweighed by the their loss of utility. For example, take a larger family that buys a people mover that costs $10 more a week to run, compared to a small car, but the famlly gets utility from the larger vehicle of $20 a week. If they have to buy the small vehicle they will be $10 a week worse off, not $10 better off.

The Ministry explains it this way.

Economic theory states that a 'rational' individual would consider the full operating cost of all vehicle types available on the market and will subsequently purchase the one that maximises his/her utility over the whole lifetime of the vehicle. This implies that the individual would purchase the most fuel efficient vehicle available on the market since the fuel savings obtained therefrom would outweigh the additional 'technology' cost of these vehicle types. Hence, it follows that direct government intervention to change consumer behaviour would not be required since a 'rational' individual would automatically choose the best option.

However,the Ministry then argues that New Zealand consumers, systematically do not behave rationally. Indeed, they are assumed to be extremely stupid. The Ministry assumes that they only take the first year's fuel savings into account when making a purchasing decision. Faced with the choice of a vehicle that costs, say, $600 more, but saves $500 a year, and a slightly cheaper but much less efficient vehicle, New Zealand consumers always choose the latter. The justication for this assumption is that:

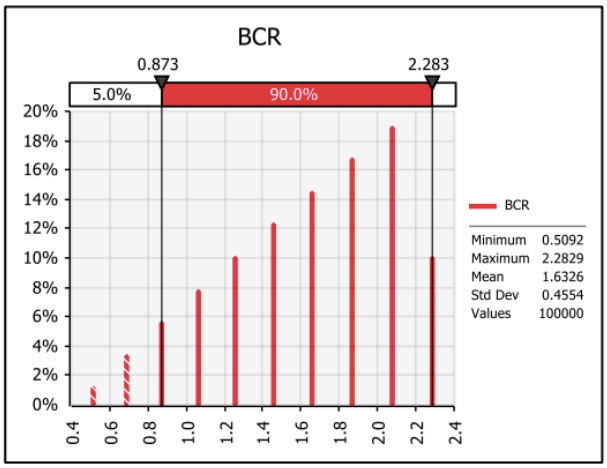
Various studies show that individuals do not internalise the full operating cost of their preferred type and will only consider the total cost of operating the vehicle over one or two years. Therefore, the need for government intervention to incentivise a change in behaviour in favour of fuel efficiency or low emissions vehicles..

The 'various studies' are not cited, because they do not exist. While some studies do suggest that consumers undervalue fuel savings, (while others argue they do not), we have not seen any that makes the extreme claim that the Ministry relies on for its modelling. In the RIS there is a reference to one study cited by the New Zealand Productivity Commission that suggests consumers overly discount fuel savings in the US. But that study did not cite any evidence. It just reported that the empirical analysis was inconclusive

The Ministry's results are extremely sensitive to their consumer irrationalty assumption. Sensitivity analyses were conducted for all of the important variables, but the 'internalisation of fuel costs' sensitivity analysis was done in a way that made it difficult to see what was going on. We are not told how the results would change if different assumptions (say 5 or 10 years savings internalised) were used. We are just

presented with a range of benefit cost ratios, which shows that some internalisation assumptions (probably the more plausible ones) generated benefit/cost ratios below 1. This sensitivity analysis was probably designed to give the Ministry 'plausible deniability'. If pressed on the unreasonableness of their assumptions they can say that it was subjected to sensitivity testing , and there was a low probability that it would result in a benefit cost ratio of less that one.

Figure three: Sensivity analysis of internalisation of fuel costs



With respect to consumer rationality the Australian Productivity Commission produced a useful report on the issue in their 'The Private Cost Effectiveness of Increasing Energy Efficiency' in 2005. It discussed the efficiency of a number of markets where regulatory interventions were being contemplated. With respect to motor vehicles their key conclusions were as follows:

The Commission considers that the bounded rationality of consumers is an insufficient ground for justifying intrusive measures such as minimum standards. The case for intervention relies on notions of ***omniscient*** *regulators who are capable of making decisions that are in the best interests of energy users. If those users were capable of collecting and digesting the relevant information, the presumption is that they would come to the same conclusion as the regulator, that is, to not purchase the energy-inefficient appliance. This might decrease search costs but given the diverse preferences of energy users, must inevitably leave some consumers worse off.*

Whether reducing fuel consumption through greater fuel efficiency is privately cost effective will depend on the savings from lower fuel consumption compared to any capital cost of improving fuel consumption and the value to consumers of any other loss in amenity required to achieve those savings. The absence of any clear market failures impeding vehicle buyers from making privately cost-effective energy efficiency improvements suggests that

opportunities for such improvements are limited.

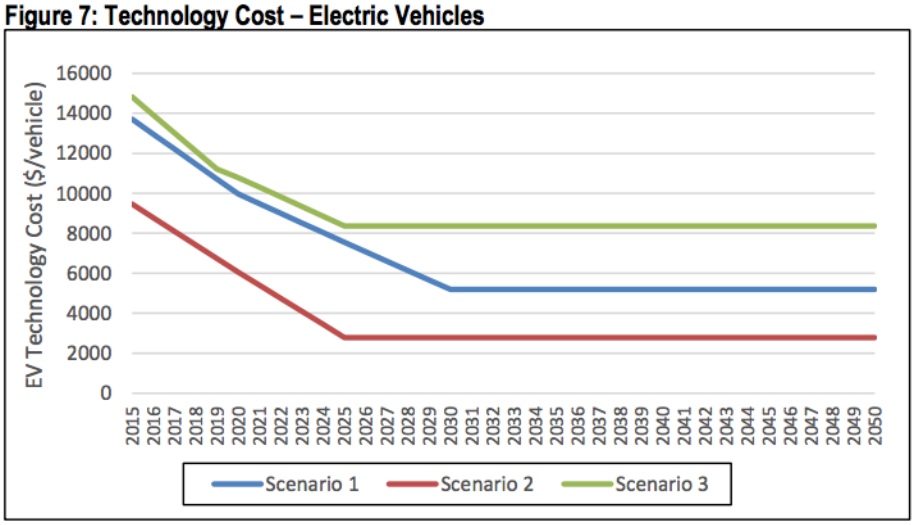
The Ministry obviously is not an omniscient regulator, nor are they acting in the interest of consumers. The economic analysis appears to be designed to serve the interests of the Associate Minister of Transport.

4. Battery electric car costs

The pricing of electric cars assumptions are described as follows.

The cost estimates for new EVs were obtained from a study undertaken to support the VFEM projections. These costs refer to a battery electric vehicle (BEV) with a range of 160km.

Figure 7: Technology Cost – Electric Vehicles



These assumptions are simply wrong. They are saying that in 2019 the additional cost of an EV is between $6000 and $11,000. They are using an outdated model and the price differentials bear no relationship to the prices of new EVs that are currently available in New Zealand, or that will soon become available.

In the Social Impact Study it appeared to be clarified that the $8000 price differential is based on, amongst other things, the total operating cost over four years

Infometrics estimates that the effective price difference between a battery EV and a petrol ICEV is around $8,000 without the VFES policy. This uses the recently updated EV Projection Model, which takes into account factors such as the implicit price penalties associated with limited model variety and limited battery range. The $8,000 result is from the base case scenario of the model, calculating the present value of the average price difference based on total operating costs spread over 4 years.

We estimated the cost of ownership over four years for a new Nissan Leaf and a Corolla hybrid. The results are shown in table five. Our operating cost differential was $18000. Note that these estimates incude GST.

Table five: Operating costs petrol hybrid and EV. 10.000 km. 4 years

	Corolla Hybrid	**Nissan Leaf**
Assumptions		
Purchase price $ (excluding ORC)	33490	59990
Fuel cost $2.20 ltr., 'real world' consumption 5l/100km	1100	
Electricity cost		$300 assumes no charging station costs
Kilometre charge.		$720
Depreciation 4 years	60%	60%
Financing rate	6%	6%
C02 emissions, per year	10,000 x .115= 1.15 tonnes	Assumed to be 20% fossil fuel electricty generation. Approx 0.2 tonnes
Maintenance, servicing cost difference	Difference of $250 per annum assumed.	
Cost Difference 4 years		
Depreciation	20094	35940
Financing costs	8038	14398
Running costs	5400	1200
	33532	**51538**
		Net cost/net savigs
Emission reduction $ tonne		$5000 approx.

Note that the $5000 per tonne of CO2 saved cost is a 'worse case' scenario. If we consider the cost over the life of an EV (optimistically 15 years given uncertainties about battery life) it comes down to $1200-1500 a tonne, depending on kilometres driven.

In the feebate economic analysis the average cost of new vehicles was cited as $60,000. In the RIS there is the following discussion on prices.

The higher upfront cost of purchasing EVs – new EVs are currently more expensive to make and buy than equivalent conventional vehicles. The cheapest new EV retails for around

$48,500 compared with $36,500 for its petrol equivalent. Another comparison is the e-Golf at $65,990 compared to the TSI Highline Golf at $41,990. These examples show a 32%, 38% and 57% market premium respectively. Some used EVs entering the fleet are sold at a similar price to petrol or diesel equivalents because they attracted subsidises when first sold in Japan.

This is somewhat confusing, conflating plug-in hybrids with full battery EV prices and missing some obvious comparisons (such as the Hyundai Kona where the price comparison is $32000 for the ICE and $72000 for the EV), and leaving one example out altogether.

There is also mention of the Mitsubishi Outlander Plug-in-hybrid. Rather inconveniently the price of this vehicle has come down to its conventional equivalent's price, undercutting the Ministry's argument that subsidies for EVs are necessary until price parity is reached with conventional vehicles. The Ministry seems to argue that this may be an outlier, which might be true. Subsidies for plug-in-hybrids have been scrapped in the UK, in part it appears, because some buyers were taking the subsidy but not plugging the vehicles in, running on petrol instead. Sales for the Outlander collapsed and Mitsubshi may be trying to offload excess stock in New Zealand. This suggests that the main beneficiary of a PHEV subsidy may well be Mitsubishi.

It is difficult to understand what the Ministry is up to with EV pricing, but it seems clear that they have got the EV price numbers badly wrong in their economic modelling, and that this has overstated some of the benefits.

5. Welfare losses

The welfare losses capture the costs to consumers from distortions to their preferred purchase patterns.

The present value of these deadweight losses for the fuel efficiency standards is small. The maximum annual cost of $2.9 million, and a net present value cost is $25 million. These low costs are a function of the assumed low capital cost of achieving the emission standards, and would increase in a non-linear fashion (say by a factor of 6 to 8) with the more realistic cost assumptions discussed above.

For the feebate scheme, however, the welfare costs are much higher. The present value cost is $233 million for new vehicles, and $47.5 million for used vehicles. There is no explanation of why the costs are much higher than for the emissions scheme, and why the new vehicle cost is higher than the used vehicle cost. On the

latter point, the difference, probably, is because it is assumed that the cost of these vehicles is relatively low and that the prices increases will also be low. Our analysis suggests that the highest proportionate 'taxes' could fall on used imports, so the deadweight losses will be significantly higher than the Ministry's estimates.

Implementation costs

The emissions scheme has a $7.5 million set-up and $1.5 million annual running cost, with a present value cost of $39.8 million. The feebate scheme costs are $7.5 million and $2.75 million with a midpoint PV cost of $37 million. These costs were overstated. It is assumed that the costs would run on past 2025.

The cost to vehicle importers was not assessed, awaiting responses to the consultation process.

Conclusion

The Ministry's conclusion that there will be large economic gains from the schemes is based on deeply flawed analysis and appears to be a scam.

- Petrol price savings have been increased by around 25 percent because of unexplained ol price increases
- Capital costs have been understated by a factor of around 2.5. There has been no serious analysis of what the costs will be.
- The assumption that consumers are completely irrational when assessing the value of fuel effcient vehicles is implausible and is not backed by any evidence.
- The Ministry's assumptions on electric car costs appear to bear little connection to reality.

Part eight: Equity impacts

The Ministry goes to considerable effort to examine distributional effects, with a focus on the impact on the low income group. Equity is meant to be a key policy evaluation criterion. The RIS states:

An equitable and inclusive society
8. The extent to which the initiative's costs and benefits impact across society.
Consistent with an equitable and inclusive transition, the initiative's costs and benefits do not disproportionately impact, or focus, on any one group. If they do have

disproportionate impacts that are unavoidable, there is a way that their impact can be managed or minimised.

In the RIS, direct government grants were considered, but were rejected on equity grounds.

Many European countries provide grants, or subsidies, for the purchase of new ultra low emissions vehicles, like EVs and plug-in hybrids. However, this option has been discarded in the New Zealand context as a subsidy from government revenue involves a wealth transfer from low income New Zealanders to middle and high income groups.

This argument is not strictly correct, as there is a transfer from tax payers in general to middle and high income groups, rather than from low income New Zealanders as such. But the general idea that the beneficiaries will generally be middle and high income earners is correct.

How the Ministry could come to an apparently different conclusion for the emissions and feebate schemes, which obviously involve a transfer from lower income groups, is not clear, and takes some explaining. The analysis is a combination of obfuscation and muddle, partially designed to deflect attention from the obvious. The urban policy elite's new EVs will be partially funded by low income families who rely on the used car market for affordable transport.

The Ministry's approach is to demonstrate that not many low income people purchase used or new car imports each year so the impacts are not very consequential. The table below from the Social Impact study suggests that only 19 percent of the low income group purchased a new or used import over the three years to 2018, compared to 32 percent for the 'not-low income' group.

Table 14: Light vehicle imports purchased, by main income source (July 2015 – June 2018)

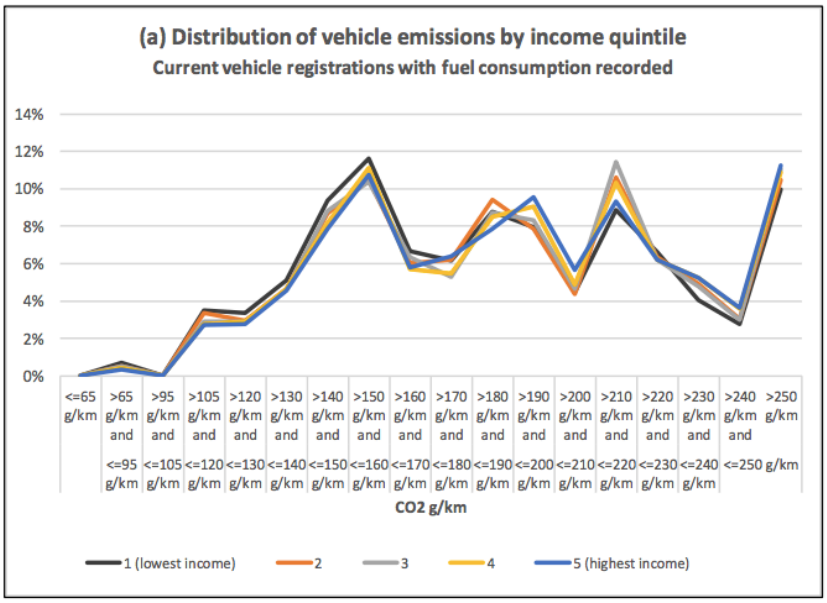
July 2015 – June 2018 June years - light vehicle imports purchase HH income and main income source	% bought new or used imports	% did not buy (note)	Share of all NZ households
Low income - NZ superannuation	16%	84%	8.6%
Low income - benefits	13%	87%	5.2%
Low income - earnings	27%	73%	7.9%
Low income - other/none	18%	82%	2.6%
Not low income - NZ superannuation	20%	80%	7.9%
Not low income - benefits	16%	84%	2.0%
Not low income - earnings	32%	68%	64.4%
Not low income - other/none	27%	73%	1.5%
Total – this table	**28%**	**72%**	**100%**
Previous estimates based on income-based measure only			
Low income households	**19%**	**81%**	-
All households	**28%**	**72%**	-

Note: The above might not sum to the same totals due to disaggregation of information.

What this ignores is that an increase in the price of used imports, or a decrease in availability, will impact on prices across the whole of the used car market. For example, if the price of a used import goes up by $5000, then five years later, when it is onsold to a still lower income purchaser, then the price will be, say $2500 higher. The market will anticipate these price increases right down the pricing chain. Over time most people buying a used car will face higher prices.

The Ministry also claims to have data on the relationship between incomes and car emissions, which helped to inform their analysis. This is unlikely to be true. There is no information on income in vehicle registration forms. The Ministry claims to be relying on linked information produced by Treasury. It is unlikely that the such data can be generated, without the underlying base data, and there appears to have been some mistake in the data generation process. A clue to this is that the distribution of vehicle emissions is identical by income cohort.

Figure 9: Vehicle ownership by income quintile (vehicle registrations as of August 2018)



Let them buy BMWs

The other line of the argument in the Social Impact Analysis is that there are many opportunities for low income buyers to avoid or reduce the cost of the policies by selecting more economical vehicles.

Evidence suggests that vehicle prices are likely to increase and choices are likely to be limited in the short term – i.e. Scenario A.

The question is how long it would take for the market to adjust. There are two possible paths – with either price falling or choice rising first. A study in Australia (NTC, 2018) found that if "Australian consumers had purchased vehicles with best-in-class carbon dioxide emissions in 2017, the national average carbon dioxide emissions would have been reduced to 76 g/km, a 58 per cent reduction". To achieve a similar effect, New Zealand would require consumers to demand the low-emission variants that would not otherwise be imported to New Zealand. This means that the choice of vehicles must increase (as importers import these vehicles to meet demand). If the adjustment takes place relatively quickly, it may be possible to achieve results similar to Scenario B in the short to medium term.

A 58 percent fall in emissions simply by selecting the lowest emission vehicle looks impressive. Until you see the prices of the lowest emission vehicles. This is the list. Looking at the segments, the Fiat 500 and Toyota Prius C are already available in New Zealand. All of the lowest emitters in the low emission segments are (expensive) BMWs.

Segment	Make and model (fuel source/s)*	Best-in-class vehicle emissions intensity (g/km)
Micro	Fiat 500 (petrol)	90
Light	Toyota Prius C (petrol-electric)	90
Small	BMW i3 REX (electric-petrol)	12
	Toyota Prius C (petrol-electric)	80
Medium	BMW 330E (electric-petrol)	49
	Mercedes-Benz C300 BTH (diesel-electric)	105
Large	BMW 530E (electric-petrol)	46
	Mercedes-Benz E220D (diesel)	108
Upper large	BMW 530E (electric-petrol)	50
	Mercedes-Benz S300 BT (diesel-electric)	118
Sports	BMW i8 (electric-petrol)	49
	BMW 220D coupe (diesel)	107
People mover	Citroen C4 Grand Picasso (diesel)	120
SUV small	Mini Cooper (electric-petrol)	49
	Citroen C4 Cactus (diesel)	92
SUV medium	Mitsubishi Outlander (electric-petrol)	41
	Peugeot 3008 (diesel)	124
SUV large	Volvo XC90 (electric-petrol)	49
SUV upper large	Land Rover Range Rover (diesel)	182
Pick-up/chassis 4×2	Nissan Navara (diesel)	166
Pick-up/chassis 4×4	Nissan Navara (diesel)	172
Vans/cab chassis	Citroen Berlingo (diesel)	108
Light buses	Toyota Hiace (diesel)	228

As noted above the Ministry rejected a straight subsidy to EV purchasers on equity grounds. The logic that it is somehow more acceptable to take money from the lower income families that need an economical people mover, to give to consumers who can afford a $40,000 to $80,000 car, somehow escapes us. We doubt that the lower income families will get much comfort from the fact that at least they are not

helping to pay for some richer person's $80,000 plus car. Nor will they get much comfort from the Ministry's 'helpful' advice in Appendix 4 of the Consultation paper that cars that will avoid the fee are available. They could get a $1300 rebate if only they were smart enough to buy a 2016 BMW 740e (which might come down to $80,000 or so by 2025),or a Mercedes C350 PHEV. A Porsche Cayenne PHEV will secure a $900 rebate, possibly not enough to make it affordable for a family shopping at the $8,000 price point.

Other impacts

The other impact of the Clean Car Discount could be for households that require a larger vehicle for work or other purposes. There is limited data available to assess how the Clean Car Standard or discount policies would affect these households. This is primarily because we do not have complete data and pricing information on all vehicles that are available in the market within these vehicle segments.

This is a lame excuse. Half a day on the internet would collect all of the new car prices.

Appendix three

Health and other benefits from transport mode shifting

Active transport

One of the MfE's biggest pitches is for active (walking, cycling) transport. Mostly this is an argument that active transport will make people healthier. This might be true, but whether people can be induced to do it, and whether the various proposals to encourage active transport make economic sense, is a different story. Mostly this is not a climate emission story. The realistic reduction in the level of transport emissions is very small (one percent), and in any case will fall with the electrification of car transport, and/or the widespread adoption of electric scooters (which have no health benefits and significant costs).

But we get a lengthy argument for the case for active transport (and by implication more investment), which we discuss here.

Increased use of active transport means fewer vehicle kilometres travelled in private cars. Switching modes from private cars to active transport saves considerable space in cities. Cycling takes up 1/18th of the space of cars, including roads and parking (Litman, 2015). As a result, the increased use of active transport reduces congestion, which in turn reduces costs associated with building infrastructure and creates benefits in time saved. Increase in active transport (e.g., walking and cycling) will lead to increase in exercise overall.

The Litman study is a pitch for 'optimal' urban development compared to urban sprawl. There is no direct analysis of active transport as such, but some small associations between more compact cities and health outcomes are reported.

Active transport is unlikely to be offset by increased calorie intake or reductions in other forms of exercise. As a result, those people who use active transport are 76 per cent more likely to meet the minimum recommended guidelines for exercise (Shaw et al, 2017).

This might be true, but this does not tell us anything about the likelihood that those who do not use active transport can be induced to do so. The Shaw study also showed that people using public transport were no more likely to meet the minimum exercise recommendations than those who use private transport.

The health risks of active transport are acknowledged but largely waived away.

…the Government has signaled increased investment in safer cycling and walking infrastructure to mitigate this. The rate at which cyclists are killed or injured decreases as overall cycling numbers rise, partly because of decreased use of cars (which endanger cyclists) but also because of 'safety in numbers'. As more cyclists take to the road, they are more noticed by drivers and hence become safer (Macmillan et al, 2014).

The 'safety in numbers hypothesis' might be logically possible, but MacMillan does not present any evidence to support this conjecture, and how likely it is that a 'safety threshold' will be reached.

Overall, the benefits of active transport remain positive. Longitudinal studies (ie, over time) have shown 'all-cause mortality' was 30 to 40 per cent lower in people who cycled compared to those who did not use active transport (Haines, 2012).

Haines references two studies to support this claim. We consider them in our discussion of the MacMillan study.

There is a strong link with demand management, as denser urban form and investment in infrastructure is key to encouraging the use of public and active transport (WHO 2009).

The urban form of New Zealand cities will not change materially over the relevant time frame.

A systematic review in the United Kingdom found (despite a variety of methods used) overwhelmingly positive benefit-cost ratios for investment in active transport interventions, with an average benefit-cost ratio of 5:1 (Cavill, 2008).

The main purpose of the Cavill paper was to assess the quality of papers reporting benefit/cost ratios for active transport measures. It found that the quality was generally low, with a lack of transparency on the methodologies. In particular, many relied on optimistic assumptions about the uptake of active transport. The benefit cost ratios were all over the place, with the ratios ranging from -0.4 to 32.5, with a median of 5.1. This median figure doesn't mean anything in the absence of a careful consideration of the individual results. The MfE should not have used it.

Co-benefits
The largest co-benefit of active transport appears to be more people getting their recommended 'dose' of exercise. Around half of New Zealanders currently do not meet the recommended levels of exercise (Ministry of Health, 2016). According to the Global Burden of Disease study, low levels of physical activity caused 1079 premature deaths (3% of the total) and the loss of 14,000 disability adjusted life years in New Zealand during 2016 (1.32% of the total).

The Ministry of Health estimates tell us that insufficient exercise is not a major cause of losses in disability adjusted life years, but the figure overstates the potential for active transport to make a difference. DALY's are disproportionately borne by the elderly, who do not work. There are many other forms of exercise that may be more effective for the target groups than cycling to work. Cycle lanes are unlikely to be a health intervention priority, if health promotional funding was allocated rationally.

A large-scale switch to active transport could potentially avert almost all of these negative impacts. A complete shift in modes is unlikely, but even bringing other New Zealand cities up to the levels of public and active transport seen in Wellington (27.5% of trips by walking and 1.3% by bike) would create considerable benefits for both health and congestion (Shaw et al 2018).

It might, but wishing it were so, doesn't make it so.

Macmillan et al (2014) go further showing best practice investments in Auckland's cycling infrastructure could give a high return on investment (between 6 and 25 times the investment required) and results in levels of cycling seen in Europe (40% of trips by 2050).

Scale of co-benefits

The absolute scale of benefits depends on the scale of the mode shift. Given current levels of investment in active transport, Macmillan et al (2014) estimate the business as usual mode shares for cycling and light vehicles at five per cent and 75 per cent respectively in 2050.

That scale of mode shift would cost $630 million in infrastructure investment, but would generate considerable net benefits overall, totaling over $13 billion by 2050 (a benefit-cost ratio of 24:1). Improved exercise levels will reduce mortality; 4000 lives saved at a value of $12.4 billion. Reductions in air pollution are worth another $78 million over that time, but this is more than offset by higher levels of cyclist injuries and fatalities with a cost of $1.45 billion.

The MfE have misreported the MacMillan study. The $630 million cost and the $13 billion net benefits relate to ambitious targets that achieve Copenhagen (40 percent) shares of cycling, not to a cycling share of five percent.

In relative terms, the health impacts of any increase in active transport are likely to outweigh the emissions reductions benefits significantly. In the Macmillan et al (2014) study mentioned above, the health benefits outweighed the climate benefits by a factor of almost 12 to 1.

Given the small emissions reduction effects, there could be a co-benefit to emissions ratio of more than one, for active transport proposals. But this does not tell us anything about the overall benefit to cost ratio, which is what should matter.

From the evidence scanned and reviewed, we have not found studies that look at the benefits of active transport on reduced congestion. In-house calculations suggest the congestion benefits could conservatively be at least four times the health benefits.

If the MfE wishes to cite its in-house calculations then it should release the detail.

Strength of evidence
The strength of evidence is strong.
Here, as elsewhere, there is a lack of clarity about the strength of evidence metric. Is it the evidence on the level of the co-benefits, which the MfE needs to support its case that co-benefits offset some of the economic costs of climate change. Or is it the evidence on the ratio of co-benefits to emission reduction benefits (which is irrelevant to answering the level of benefits question).

The Macmillan study
Taken at face value the Macmillan study looks impressive. An investment of $640 million generates benefits of about $14 billion and net benefits of over $12 billion. On inspection, however, this outcome proves to be extraordinarily flimsy.

The report discusses a number of bicycle lane investment scenarios for Auckland. The biggest investment of $640 million is the one (mis)reported by the MFE above. It assumes 'international best practice' of building separated bicycle paths on arterial routes will deliver Copenhagen levels (the highest in the developed world) of bicycle trips (40 percent compared to about one percent now) by 2051. The active transport uptake is just assumed (an exercise in wishful thinking) to flow from 'international best practice'. There is no evidence to support it, nor is any consideration given to how Auckland is different to Copenhagen

The model is complicated, with many inputs, most of which are calibrated (largely just made-up), but the critical variable driving the high benefits to cost ratio is the number of lives 'saved' through the health benefits of cycling. We focus on this benefit, but many of the other cost and benefits in the study appeared to be biased to generate positive results. On the health benefits the model is calibrated having regard to two studies on the difference in death rates of people who cycle to work and those who don't.

The first[24] was a study on women in Shanghai aged between 40 and 70. It showed that cyclists had a lower death rate, but the effect was not quite statistically significant.

The second is a Danish study [25]of 20-93 year olds. It reports that cycling to work reduces mortality rates by 28 percent, after accounting for a number of covariates, including other exercise. In other words, even if you do other exercise, (including leisure time cycling), cycling to work will reduce your expected mortality rate by 28 percent. This looks too good to be true. If it were true we would expect Denmark to shine in international life expectancy tables. But it does not. It is ranked 27th by the WHO, below New Zealand at 17. We might also expect doctors to be specifically 'prescribing' cycling to work, even for patients who are getting plenty of other exercise.

There looks to be something amiss with the Andersen study, but we are not close enough to the detail to suggest what might be driving their strong result. However, there is a UK study[26], which is more relevant to New Zealand (a low rate of cycle use), which produced a similar result. There was a health benefit (a forty percent reduction in mortality) to cycling to work, but no benefit from walking. On inspection

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24 Mathews et.al. 2007

25 Andersen et. al. 2000

26 Andersen et al. 2017 'Association between active commuting and incident cardiovascular disease, cancer, and mortality: prospective cohort study' *BMJ* 2017*;* 357

it seems clear that the work/cyclists were a different population to the rest of the population. 90 percent were getting their recommended dose of exercise, compared to only 50 percent of the walking and automobile commuters. The cyclists were not just getting their exercise from cycling to work (an average of only just 30 miles a week), but were probably generally more health conscious, in ways that were not being systematically picked up by the model. This, rather than cycling to work as such, was probably the key driver of the mortality results.

Other studies seem to generate less significant results. For example, a 2013 review [27]paper on the health benefits of active transport reported the following.

Twenty-four studies from 12 countries were included, of which six were studies conducted with children. Five studies evaluated active travel interventions. Nineteen were prospective cohort studies which did not evaluate the impact of a specific intervention. No studies were identified with obesity as an outcome in adults; one of five prospective cohort studies in children found an association between obesity and active travel. Small positive effects on other health outcomes were found in five intervention studies, but these were all at risk of selection bias. Modest benefits for other health outcomes were identified in five prospective studies.

Overall the results might have been positive but were not transformational.

Despite the centrality of the Danish study results to the overall cost benefit results, there is no discussion in Macmillan of its plausibility, its relevance to Auckland or of other less positive studies. Macmillan and the MfE appear to have cherry-picked the evidence.

Effectiveness of cycling promotion programmes

An obvious omission in the MfE's analysis, and in the Macmillan study, is any mention of any evidence on the effectiveness of cycling promotion investments. If people who currently do not get enough exercise, do not respond to the improved cycling environment or cycling promotions, then there will be no health benefits. If you build it, they might not come.

There is a substantial literature here, and we discuss some relevant papers.

The first[28] is a review of 12 studies from 12 countries. Seven of the studies related to individual or group-based interventions to encourage cycling. These were effective in

[27] Saunders LE[1], Green JM, Petticrew MP, Steinbach R, Roberts H 2013 'What are the health benefits of active travel? A systematic review of trials and cohort studies'.

[28] Glenn Stewart, Nana Kwame Anokye, Subhash Pokhrel 2015 What interventions increase commuter cycling? A systematic review BMJ vol 5 issue 8 2015

only three of the interventions. The more relevant are the environment interventions (cycle lanes etc.), which showed only small improvements. Nowhere were there any transformational effects from these sorts of investments. The paper summarised the following studies.

The English CCT (Cycling Cities and Towns) programme aimed to increase cycling through capital and revenue investments. Changes in cycle commuting between 2001 and 2011 in the CCTs were compared with changes in matched towns. The analysis indicated that cycling to work in the intervention towns increased by 0.69 percentage points.

In Ireland, the Department of Transport set a target of increasing cycling from 2% of journeys in 2009 to 10% by 2020. There were a range of interventions, including financial incentives (tax-free loans to purchase cycles);infrastructure change (traffic calming, cycle lanes including segregated lanes), promotional events such as Bike week (family rides, removing traffic from streets, repair clinics and promotion talks), and a shared bike scheme. Census data indicated that cycle modal share fell from 6% in 1996 to 4% in 2002 and 2006, but had risen to 5% in 2011. However, it is was not clear as to what extent the post 2008 financial crisis in Ireland might have affected the results, as people might have taken up cycling out of financial necessity.

One US study assessed the effects of transport/cycle infrastructure on cycle commuting. Cycle commuter modal share increased in central Minnesota (from 2.8% to 3.3%, at the University of Minnesota and Minneapolis (from 0.788% to 0.841%), compared with the suburbs where the cycle commute share fell from 0.335% to 0.279%.

Other studies

A Danish study[29] showed that efforts to encourage cycling to school found that infrastructural changes near schools and school cycling promotions made no difference to commuter cycling rates.

A summary [30]of studies of Dutch and Danish experiences in encouraging modal changes towards cycling found increases of between 2- 9 percentage points. See their table 4 below

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[29] Lars Østergaard Jan Toftegaard Støckel, and Lars Bo Andersen Effectiveness and implementation of interventions to increase commuter cycling to school: a quasi-experimental study

[30] Interventions in bicycle infrastructure, lessons from Dutch and Danish casesKees van Goeverden a*, Thomas Sick Nielsen b, Henrik Harder c, Rob van Nes

Figure seven: Modal shifts in active transport

Table 4. Modal shifts in share of all cyclists in trips in the after situation

Study	Shift from walking	Shift from car	Shift from PT	Shift from all motorized modes
Tilburg (Goudappel en Coffeng and Rijkswaterstaat, 1980)		2%	0%	
The Hague (DHV *et al*, 1980)		2%	0%	
Delft (Katteler *et al*, 1987)	3%	3%[1]	0%	3%
Bryggebroen (COWI, 2009a)		2%		11%
Åbuen		2%		
Albertslundruten		2.5%		9%
Farumruten		5%	6%	10%

1: 1% car driver, 2% car passenger

Closer to home Chapman et al.[31] compared active transport outcomes in two New Zealand cities that had active transport interventions, with two that did not. They found that

Relative to the control cities, the odds of trips being by active modes (walking or cycling) increased by 37% (95% CI 8% to 73%) in the intervention cities between baseline and postintervention. The net proportion of trips made by active modes increased by about 30%. In terms of physical activity levels, there was little evidence of an overall change.

There was no actual increase in active travel. The decline observed in preceeding years was merely arrested.

Transportation Research Procedia 10 (2015) 403 – 412

[31] Chapman R, Howden-Chapman P, Keall M, et al. 2014 'Increasing active travel: aims, methods and baseline measures of a quasi-experimental study.' BMC Public Health;14:935.

Appendix four

The New Zealand Transport Authority Car safety rating system

Part one: Introduction

In December 2019, the Government launched *Road to Zero: NZ's road safety strategy 2020-2030* which set out a strategy for reducing road deaths and serious injuries by forty percent over the next decade.

Of the 40 percent reduction it is estimated that 50 percent will be due to better roads and lower speed limits, 25 percent to better vehicles, and 25 percent to 'other' factors. The measures that are intended to improve vehicles' safety, particularly using the car safety rating system, are the primary focus of this report.

The initial actions to improve the safety of the fleet are to:

- *Raise the safety standards for vehicles entering New Zealand.*
- *Increase understanding of vehicle safety*
- *Implement mandatory ABS for motorcycles.*

The specific 2030 target is to decrease the share of one and two starred vehicles in the New Zealand light fleet from the current level of over forty percent to twenty percent.

The immediate task is to improve consumers' understanding of vehicle safety.

Rapid advances in technology mean vehicles are getting safer, and we have the data to support good consumer choices. Yet, many New Zealanders don't know about the role their car's safety plays in their chances of having or surviving a crash.

If we want people to buy safer cars, they need reliable, understandable and accessible information about which cars to buy. We can improve our fleet safety through building demand for safer vehicles.

This includes building on existing initiatives, such as making the information on the RightCar website (which contains data on safety, fuel economy and vehicle emissions) more readily accessible. This can help people choose safer, cleaner and more economical cars.

This might sound fine, but the problem is that the New Zealand Transport Authority, which is responsible for implenting the car rating policy, does not fully understand the rating system used on its Rightcars website and elsewhere. This could result in consumers being given misleading information, and could drive sub-optimal policy initiatives.

The used car rating system developed by the Monash University Accident Research Centre (Monash), which underpins the Righcar ratings, has five risk grades, which measure *relative* risk. About a fifth of all cars are allocated to each grade. No matter how safe cars become over time there will always be two fifths of car models in the lowest two grades. This does not mean that these are necessarily 'unsafe'. But the NZTA falsely states that these cars offer little or no protection in a crash. The NZTA has set itself a difficult target. To reduce the share of one and two star cars in the New Zealand fleet to twenty percent the fleet will have to comprise newer and bigger vehicles than the Australian light vehicle fleet.

Second, the rating system used favours large cars and SUVs, because big is better in a collision. The ratings only consider the occupants' safety, and not the harm done to others. An alternative Monash measure that does measure the risk to all road users, and which does not so strongly favour large vehicles , is available, but is generally not used in the Rightcar system.

The main purpose of this paper is to examine the Rightcar safety ratings, and associated publicity, with particular emphasis on the robustness of the Monash used car rating system theory and analysis.

The paper is organised as follows

Part two sets out our key findings.

Part three looks at some of the car safety claims made in the Road to Zero strategy papers.

Part four analyses the rating system presented on the Rightcars website.

Part five provides an overview and critique of the Monash University Accident Research Centre risk grading methodology, which underpins much of the Rightcar rating system.

Part six reviews a very recent Monash paper which appears to have been produced to provide support for the strategy.

Part seven discusses the advertising promoting the Rightcar website and considers whether there has been a breach of advertising standards.

Part eight discusses some implications of the Road to Zero plan.

Part two: Key findings

Breaches the advertising standards code

Certain claims made on the Rightcars website and in television advertising breach the advertising standards code. A complaint will be made to the Advertising Complaints Authority.

Rightcars is using the wrong used car risk metric

Two main risk metrics are produced by Monash. The first, the crashworthiness risk rating measures the risk to the driver. The second, the total secondary safety rating, designed for public policy purposes, measures the risk both to the driver and other road users. The crashworthiness index favours large vehicles, whereas the secondary safety rating shifts the balance to smaller and medium vehicles. For some unexplained reason Rightcars has primarily used the crashworthiness index, implicitly promoting a vehicle size arms race amongst consumers.

Use of multiple risk metrics can be arbitrary and confusing

Rightcars is using three different risk metrics: one relevant to new cars; one relevant to the safety of the driver, and one measuring the risk to all road users. A vehicle's rating will depend on which one is used and ratings can change sharply over time. A five star car can suddenly become a one star vehicle.

Individual vehicle risk ratings can be unreliable

Many of the individual vehicle ratings are not statistically robust. As a result consumers may be induced to purchase vehicles that offer provide little or no improvement in safety from a societal perspective. At present some cars are being unfairly maligned and some unduly praised.

Qualitative descriptors of the ratings ranging from 'excellent' to 'very poor' exaggerate the real differences and should be dropped.

Goal of reducing the proportion of one and two star ratings to 20 percent could be unrealistic and harmful

The Monash rating system is a relative risk system that always places about 40 percent of Australasian used vehicles in the lowest two risk grades, regardless of how vehicle safety improves over time. If New Zealand wishes to reduce that share to 20 percent the fleet will have to be newer, and on average, larger than the Australian fleet. Draconian measures to achieve this will be economically costly and could be counterproductive, if there is a switch to motorcycles, or if it becomes too costly to upgrade to a newer car if used car imports are cut.

Rightcar ratings system needs to be reviewed

There are multiple issues with the underlying Monash models and the way Rightcars is using the information from the models. It is time for the system, including the use of the Monash model, to be fundamentally reviewed.

Part three: Claims about vehicle ratings

This part sets out the 'facts' about the rating system and its use, presented in the Road to Zero strategy documents. The capitalisations were in the original text.

Rating system 'facts'

- A car with a FIVE-STAR SAFETY RATING or crashworthiness rating offers the SAFEST LEVEL OF PROTECTION for its occupants while a ONE-STAR CAR OFFERS THE LEAST.

- Vehicles with a ONE AND TWO STAR crashworthiness rating make up 45% OF THE FLEET, BUT 66% OF DEATHS AND SERIOUS INJURIES on our roads occur in these vehicles.

- Young drivers are more likely to be driving less safe cars. 81% OF DEATHS AND SERIOUS INJURIES FOR YOUNG PEOPLE OCCUR IN ONE AND TWO STAR CARS.

- You're at least 90 PERCENT MORE LIKELY TO DIE or be seriously injured in a crash IN A ONE-STAR SAFETY-RATED CAR than in a five-star safety-rated car.

- 1 IN 5 VEHICLES imported in 2016 had A ONE OR TWO STAR SAFETY RATING.

The NZTA makes a particularly strong claim for its car safety ratings. It is claimed on the Rightcars website that:

*one and two star rating provide **little or no** protection in a crash.*

This is an obvious nonsense. If these vehicles offered little or no protection then the death and serious injury rate would be similar to that of motorcycles. That is about 20 times higher than cars. On their own information one star rated vehicles are about twice as risky as five starred vehicles.

Regulating to improve vehicle safety

The following case is made for regulating to improve the safety of vehicles entering the fleet under the heading 'What we know'.

Improvements in vehicle safety over the last decade have saved the lives of New Zealanders. We know that improvements in vehicle safety technology (including features such as crumple zones, airbags, and other structural improvements in vehicle design) have significantly improved safety outcomes.

Most of the existing fleet (including one and two starred cars) will already have these safety features. The best information from the Monash modelling by year of manufacture suggests that there has not been a substantial improvement in vehicle safety technology over the last decade. From 2005 to 2017 the improvement, which is probably overstated, is around 10 percent.

Research found that improvements in vehicle safety accounted for 45 percent of the reduction in deaths and serious injuries between 1990 and 2012.

The source of this research is not cited but it is probably based on the Monash modelling on the improvement of crashworthiness by year of manufacturer. As discussed in part five this modelling is problematic. While it is fair to say that safety improvements might have made a contribution the 45 percent contribution is probably an exaggeration.

Despite improvements in vehicle safety, in 2017, about 45 percent of the cars in New Zealand's fleet had a crashworthiness rating of one or two stars.

This statement conveys a lack of understanding of the rating system. It is a **relative** safety system with ratings being assigned so roughly twenty percent of vehicles models are in each quintile. In a relative risk system there is never any improvement in the numbers in the bottom two quintiles despite improvements in the absolute level of risk. So the fact that about 45 percent of vehicles still have a one or two star rating should not come as a surprise, nor should it necessarily be a concern.

A second point is that the Rightcars website says that 41 percent of New Zealand cars have a one or two star rating.

These vehicles (one and two stars) *account for about 66 percent of all deaths and serious injuries. Our younger drivers, who are also among our most high risk drivers, typically drive these vehicles.*

Again the source of the data is not cited, but even if correct, it probably overstates the risk of these vehicles because it does not adjust for all relevant driver

characteristics. If more reckless drivers disproportionately drive one and two starred cars then the risk of the car will be overstated.

Research shows that you are at least 90 percent more likely to die or be seriously injured in a crash in a one-star safety-rated car than a five-star safety-rated car.

This appears to be taken from the Monash crashworthiness modelling, which we discuss below.

A rationale for regulation

The above arguments provide, in the NZTA's view, a justification for imposing minimum standards.

Currently, we have too much variability in the safety of the vehicles coming into New Zealand. Whilst most new cars have the newest safety features, not all do. We also know that many used cars we import vary greatly in their safety performance. We believe that this needs to change.

There are opportunities to improve the safety of vehicles entering the fleet through greater regulation. Requiring vehicles to meet specific standards at entry is the most effective method of improving the safety of vehicles entering the fleet. This creates a minimum standard that vehicles imported to New Zealand (both used and new) must meet, regardless of age. This means that the safety benefits are spread across all members of society.

We will return to the risks of this strategy in part six.

Increase understanding of vehicle safety

The second limb of the strategy is to improve consumer understanding of car safety so they voluntarily purchase safer vehicles. This will be driven by the information provided on the Rightcars website. The following is the discussion:

The safety of different vehicles – both used and new – can vary greatly, and we know that many people are unaware of the impact of vehicle safety on crash outcomes. We would like both vehicle buyers and sellers to understand and value the role that a safe vehicle plays in keeping them (as well as their passengers and other road users) safe on the road.

We'd like people to know how they can tell if their vehicle, or a vehicle they may be looking to buy, is a safe one, so that they can make informed choices about purchases. We'd like information about vehicle safety performance to be readily available when people are looking to buy a vehicle, including supporting sellers to understand and share knowledge about the role vehicles play in keeping people safe.

Together these initiatives are intended to achieve the following:

By 2030, we want to see a greater proportion of safer 4-and 5-star safety rated vehicles with fewer than 20 percent of light vehicles having a safety rating of one or two stars.

Part four: The Rightcar description of their rating system

According to the Rightcar website three ratings systems are used to rate light vehicles, all on a scale of five stars (best) to one star (worst). They are:

- The ANCAP ratings, which are generally applied to new cars;
- The Monash Used Car Safety Rating (UCSR) which assesses the level of safety of **used** vehicles already in the market;
- The Vehicle Safety Risk Rating VSRR.

The problem with this approach is that the three ratings systems are conceptually different and can generate different rating results depending on which one is used.

The ANCAP safety rating system

The ANCAP ratings are produced by The Australasian New Car Assessment Programme, which assesses the level of safety provided by new vehicles entering the market.

The ANCAP tests have evolved over time. There are now four tests: occupant safety; child occupant safety; vulnerable road user safety, and safety assists. The rating is based on the lowest score in any category. The occupant safety test is conceptually similar to the the variant of the used car rating used by Rightcars, the crashworthiness rating. Both focus on the safety of adult occupants. As cars have been designed for the ANCAP tests the great majority of cars meet the five star standard and generally exceed the required score by a good margin. Of the 236 current ANCAP rated models 203 have five stars, 24 four stars, six have three stars and only one had two stars. The key feature of the ANCAP system is that it provides an absolute test. It is a test of how well a car performs against a fixed standard, not how it performs relative to all other cars in the real world.

Used Car Safety Rating (UCSR)

The Used Car Safety Ratings (UCSRs) are produced by the Monash University Accident Research Centre (Monash) and assess the safety performance of **used** vehicles already in the Australasian market using statistical models based on real world accident performances. Monash produces four safety rating measures,

which we discuss below. The crashworthiness rating, the measure used by Rightcar, is based on the probability that the driver occupant in a towaway crash will be killed or hospitalised. The lower this probability the better the rating.

As noted above the UCSR is a relative risk test. Vehicles are roughly divided into quintiles based on the probability of being killed or seriously injured. The best 20 percent receive a five star rating and the lowest 20 percent one star. Therefore, forty percent of car models will always be in the lowest two grades regardless of how car safety improves over time.

A key feature of the Monash ratings is that they attempt to adjust for driver and crash characteristics that might bias the outcomes. The basic idea is that different cars might be disproportionately driven by different people and in different circumstances, which might affect risk estimates based on the raw data. These adjustments are:

- The age of the driver. Older drivers are more likely to be more severely injured in a crash and young drivers perhaps more likely to have higher speed crashes that result in more severe injuries;
- The speed zone. Crashes on the open road are more likely to result in serious injuries;

The sex of the driver. Women are more vulnerable than men, increasing their risk, but may be less reckless drivers, decreasing the risk;

- The State (or New Zealand) the accident occurs in. Different states have different definitions of accidents and injuries which can significantly affect the reported serious injury rates;
- The year of the accident. This is meant to capture unexplained trends in the crashworthiness measure but, as explained below, may introduce a bias toward newer vehicles.

The Monash safety ratings

The crashworthiness rating

As noted above the Crashworthiness rating is Monash's 'flagship' product and provides the main basis for the Rightcar ratings. Crashworthiness is defined as the modelled probability of being killed or severely injured (where severe is defined as spending at least one night in hospital) in a towaway crash.

Table one below presents a summary of crashworthiness rating outcomes (third column on the left) by vehicle market group. The key takeout from the table is that the smaller the vehicle the worse the performance. Large SUVs are the best

performers, with a crashworthiness rating of 3.09 percent, and light cars the worst at 5.72 percent. This is a robust result, consistent with other studies, and with the basic laws of physics. If a large and a small vehicle collide the deceleration will be greater in the small vehicle. Larger vehicles will also have larger crumple zones that provide more protection.

Table one: Crashworthiness ratings average by vehicle class

Market Group	Injury Risk (%)	Injury Severity (%)	Crashworthiness Rating*	Overall rank order	Lower 95% Confidence limit	Upper 95% Confidence limit	Width of Confidence interval
Overall Average	**18.13**	**23.11**	**4.19**				
SMALL SUV	21.00	22.82	4.79	8	4.58	5.02	0.44
MEDIUM SUV	16.08	21.31	3.43	2	3.32	3.54	0.23
LARGE SUV	13.42	23.00	3.09	1	2.98	3.20	0.22
COMMERCIAL - UTE	16.22	23.78	3.86	3	3.75	3.97	0.22
COMMERCIAL - VAN	17.96	24.09	4.33	6	4.15	4.51	0.35
LARGE	17.48	23.60	4.12	4	4.02	4.23	0.21
MEDIUM	18.58	22.81	4.24	5	4.13	4.35	0.22
PEOPLE MOVER	18.50	23.78	4.40	7	4.21	4.60	0.39
SMALL	20.77	23.47	4.87	9	4.76	5.00	0.24
LIGHT	23.13	24.72	5.72	10	5.57	5.87	0.30

* Serious injury rate per 100 drivers involved

The difference in performance by vehicle size is also shown by the number of models with each star rating. Again light cars are the worst performers. 28 have a one or two star rating and there is only one four star and one five star rating. Thirteen large SUVs have five stars and none have one or two stars.

Table two: Crashworthiness by models in market classes

Star rating	Light cars	Small cars	Medium cars	Large cars	People movers	Com.vans	Utes	Compact SUV	Medium SUV	Large SUV
One										
	20	23	5	7	1	1	4	6	1	
Two										
	8	9	11	5	1	1	7	3	7	
Three										
	2	9	9	6	3	3	6	-	4	4
Four										
	1	13	13	6	2	1	2	1	7	4
Five	1	5	8	5	2	5	7	6	15	13

Monash have pumped up the differences between the safety ratings with their public descriptions of their ratings. They have applied the following emotional and misleading descriptors to their star ratings:

Five stars: Excellent

Four stars: Good

Three stars: Marginal

Two stars: Poor

One star: Very poor

What is not conveyed to the public is that a one star crashworthiness rating means that the probability of being killed or seriously injured (hospitalised) in a tow-away accident is actually quite low, even if the vehicle has just one star. It is difficult to get a fix on this, because Monash does not present its data in a way that makes it easy to give the numbers an absolute risk interpretation, but for a newer (2005-2015) one star vehicle it is probably around 6-8 percent. A five star rating will have a probability of about four percent or less. The 'very poor' descriptor conveys the impression that the outcome is much worse than a six to eight percent risk, and very much worse than that of an 'excellent' performer.

We conducted an informal survey of what people thought were the probabilties of being killed or severely injured in a tow-away accident and the estimates ranged from 20 to 70 percent. They also thought that there would be a much larger difference between a one star and five star rating.

The problem is that the actual risk rates are not available in the Monash public rating reports and on Rightcars. Few consumers are likely to track down the Monash research papers to look at, and then try to interpret, the numerical ratings.

The upshot is that the Monash safety ratings are misleading, and can be unnecessarily alarmist. If Rightcars is genuinely concerned with providing consumers with accurate safety information then the qualitative descriptors should be dropped and replaced by the quantitative risk indicators.

Aggressivity rating

The problem with the crashworthiness rating is that some of the superior performance of large vehicles is bought at the expense of the occupants of smaller vehicles and other road users. The aggressivity rating attempts to capture this effect by rating cars by the deaths and serious injuries inflicted on other cars' occupants or unprotected road users. The results, shown in table three, are a mirror image of the crashworthiness ratings. Large SUVs go from being the best performer to the worst, inflicting twice as many deaths and injuries (5.66 percent compared to 2.89 percent) as the best performer, light cars. The best performing individual model is the Mazda 2, the worst, by a factor of four, an older Ford Bronco.

Table three: Aggressivity rating by market group

Market Group	Other Driver Injury Risk (%)	Other Driver Injury Severity (%)	Aggressivity Rating *	Overall rank order	Lower 95% Confidence limit	Upper 95% Confidence limit	Width of Confidence interval
Overall Average	**16.15**	**25.68**	**4.15**				
SMALL SUV	15.35	25.38	3.90	4	3.66	4.14	0.48
MEDIUM SUV	16.23	25.41	4.12	6	3.97	4.28	0.31
LARGE SUV	19.77	28.63	5.66	10	5.46	5.86	0.40
COMMERCIAL - UTE	17.95	27.07	4.86	8	4.71	5.01	0.30
COMMERCIAL - VAN	19.66	26.52	5.22	9	5.00	5.44	0.44
LARGE	16.37	25.18	4.12	5	4.01	4.24	0.23
MEDIUM	15.14	24.22	3.67	3	3.56	3.78	0.22
PEOPLE MOVER	17.24	26.06	4.49	7	4.28	4.72	0.45
SMALL	13.53	23.33	3.16	2	3.07	3.25	0.18
LIGHT	12.46	23.18	2.89	1	2.79	2.99	0.20

* Serious injury rate per 100 drivers of other vehicles and unprotected road users involved in collisions with vehicles from the given market group

Total secondary safety rating

The Total Secondary Safety Rating (TSSR) combines the crashworthiness and aggressivity ratings. The effect is to wash out much of the difference between the market groupings. Light cars are still the worst performers, with a 4.73 percent risk, but this is only 10 percent worse than the average of 4.22. Large SUVs are no longer the best performers, being supplanted by medium SUVs. Given uncertainties inherent in the modelling (which are not all captured by the reported confidence intervals) it is not clear whether many of the differences between the classes are statistically significant.

Table four: Total Secondary safety rating by vehicle class

Market Group	Injury risk (%)	Injury severity (%)	Total Secondary Safety Index*	Overall rank order	Lower 95% Confidence limit	Upper 95% Confidence limit	Width of Confidence interval
Overall Average	**17.47**	**24.13**	**4.22**				
SMALL SUV	19.54	23.76	4.64	8	4.49	4.80	0.37
MEDIUM SUV	16.18	23.03	3.73	1	3.63	3.82	0.23
LARGE SUV	15.90	25.76	4.10	2	3.99	4.20	0.25
COMMERCIAL - UTE	16.98	25.33	4.30	5	4.20	4.40	0.24
COMMERCIAL - VAN	18.64	24.94	4.65	9	4.52	4.79	0.32
LARGE	17.43	24.34	4.24	4	4.15	4.34	0.22
MEDIUM	17.66	23.48	4.15	3	4.05	4.24	0.22
PEOPLE MOVERS	18.20	24.61	4.48	7	4.34	4.62	0.33
SMALL	18.38	23.46	4.31	6	4.22	4.41	0.22
LIGHT	19.57	24.20	4.73	10	4.63	4.84	0.26

* Serious injury rate per 100 road users involved

Using the TSSR significantly changes the spread of relative risks. Whereas a one star rated vehicle is at least 90 percent more risky than a five star vehicle using the crashworthiness metric, this difference falls to 40 percent using the TSSR metric. Further, it is also less likely that the TSSR measures for selected individual vehicles are statistically different from one another, making it more difficult to reliably identify more, or less, safe vehicles.

Primary safety rating

The primary safety rating is meant to show the risk of getting into an accident and is calculated by the modelled number of accidents over the number of registrations. However, different cars are used differently. Those that travel more will, other things being equal, have higher accidents rates. Monash tries to adjust this by calculating relative risk (with a benchmark of 1 not the actual risk) for vehicles in each market grouping. This does not seem to work very well because the standout result is that older cars tend to perform better than newer cars. This just reflects the fact that

older cars are driven less and so statistically will have lower accident rates. One of the worst performing models is the Prius 3. This because they are often used as taxis, which have much higher mileages and will naturally have a higher accident rate. For these reasons the primary safety ratings are not given a high profile, except in Monash's recent modelling of New Zealand data, which is discussed in part seven.

The Ministry has chosen the wrong risk measure

It is obvious that from a public policy perspective, the right risk metric is the Total Secondary Safety Rating. While it might be in an individual's interest to have the biggest and meanest vehicle on the road their higher degree of safety is at least partially at the expense of other road users. It is difficult to see the social value in a policy that promotes an unproductive, vehicle size, arms race amongst road users. As other road users get bigger vehicles some of the advantages of size are lost, and it is necessary to get a yet bigger vehicle to maintain a safety edge. Quite apart from the limited safety advantage of increasing the average size of the vehicle fleet there are the obvious disadvantages of higher purchase prices, running costs, emissions and congestion.

Why the NZTA is not using the TSSR is beyond us. It is not as if they weren't warned about the problems with relying on the crashworthiness rating. When Monash first produced their aggressivity rating[32] in 2000 they said:

Vehicle safety ratings in Australia to date have concentrated primarily on estimating the relative protection a vehicle provides to its own occupants. Consumer information has typically recommended that people purchase vehicles that offer maximum safety benefits to them as occupants without recourse to the risk the specific vehicles may pose to other road users. This study has demonstrated that this advice may not necessarily provide a net gain to society as a whole. One example is a recommendation for people to buy large four-wheel-drive vehicles based on their occupant protection performance without noting that these vehicles pose a high injury risk to other vehicle occupants in a collision.

Whilst the issue of aggressivity may not be a high priority for vehicle consumers, the information should be valuable to both legislators and those promoting vehicle safety generally. The availability of vehicle aggressivity ratings in conjunction with crashworthiness ratings will allow these groups to focus legislation and consumer advice to achieve better vehicle safety performance overall.

[32] Report No. 171 July 2000

Vehicle Safety Risk Rating (VSRR)

The VSRR rating is described by Rightcars as follows:

The VSRR assesses vehicles that don't have an ANCAP or UCSR. It's used for vehicles where there are too few of these vehicles currently being driven to provide enough crash and injury data, so the rating is based on the average crash rating of similar vehicles (eg other small SUVs) from the same year of manufacture.

The VSRR assesses how well a vehicle is likely to perform in a crash; in terms of how well it protects occupants of the vehicle and those the vehicle crashes into - pedestrians, cyclists and occupants of other vehicles.

What appears to be described here is the Monash Total Secondary Safety rating discussed above. This makes it even more difficult to understand why the TSSR was not used for all of the ratings. The Rightcars description of the VSRR does not appear to be quite accurate. The Monash approach is to exclude vehicles with insufficient data points (less than 100 incidents and 20 serious injuries). Other cars are run through the model to produce a numerical rating. If the confidence interval is too wide, they do not receive a public star rating from Monash. However, the estimates are available and presumably were used in the VSRR. Because of the small sample sizes these ratings are not very robust. Cars are being rated by Rightcars which would not get a rating from Monash.

In terms of the numbers Rightcar says that about 65 percent of cars receive a UCSR rating, 30 percent an ANCAP or a VSRR rating and 5 percent are unrated. This seems to be based on the number of models rated rather than on the number of vehicles on the road.

Impact of methodology choice on the rating

Which methodology is used will have a significant impact on the rating, particularly for light and small cars. Because there is a strong relationship with vehicle mass these vehicles will generally get a low rating on the Monash Crashworthiness test.

Of the 31 light cars rated by Monash, 26 received a one or two star rating. There was only one four star and one five star rating. However, nearly all new light cars receive a five star ANCAP rating. Over time, as more data is collected, the more popular of these models will receive a Crashworthiness rating which will generally result in a much lower rating. The rating on a five or six year old vehicle might fall from five to three of even one or two stars. The same vehicle which had met the highest safety standard suddenly offers ‘little or no protection’. This problem is more acute for more popular cars because they will receive a crashworthiness starred rating at an earlier date.

Crashworthiness by year of manufacture

One of the most influential outputs from the Monash modelling is the crashworthiness by year of manufacture analysis, which is depicted in figure one for Australasian cars.

This data appears to shows sustained improvement over time, but there has been a leveling off in the 2010s. Figure two shows the figure by year of manufacture by market segment type. The distinctive outcome here is that large and medium SUVs have continued the downward trend but light vehicles and people movers have deteriorated moderately. It might be that the divergence in the performance is explained by the increasing number of larger SUVs on the road which detrimentally affects light car performance on a crashworthiness basis. Unfortunately the year of manufacture analysis was not done on a TSSR basis so it is not possible to see if vehicles have become safer over time on this more comprehensive measure.

Figure one: Crashworthiness by year of manufacture Australasia

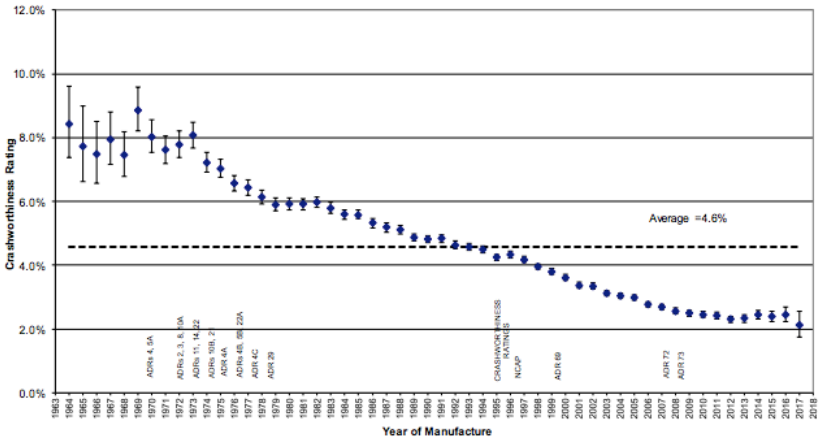
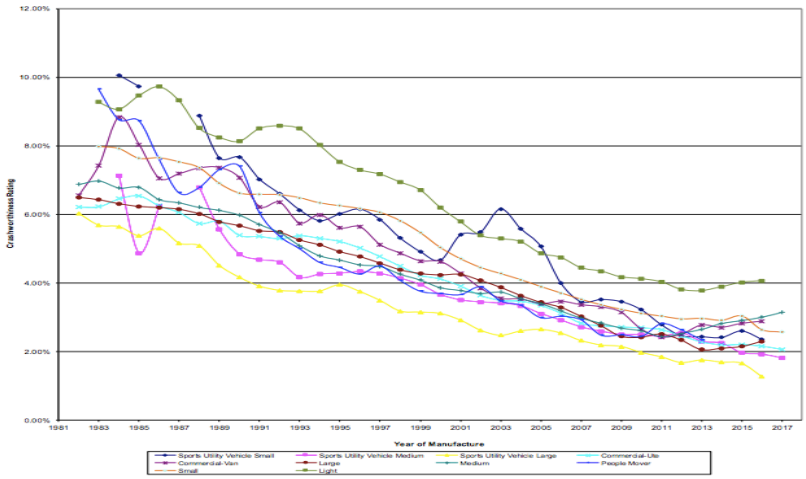


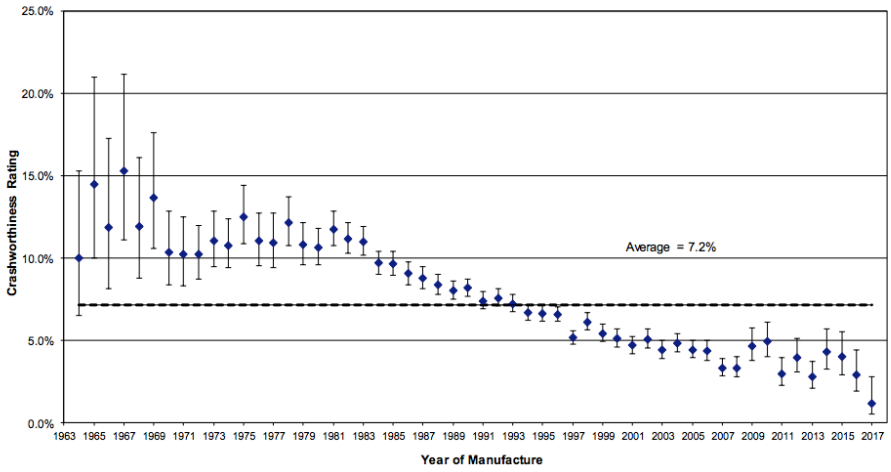
Figure two: Crashworthiness by year of manufacture and vehicle class



This modelling appears to have impressed the NZTA and was probably behind their apparent wish to reduce the number of older cars on our roads. They have had modelling done specially for New Zealand, which is shown in figure three. This appears to be where the 45 percent improvement in crashworthiness from 1990, cited above, came from. The problem with the New Zealand modelling is that the results post 2008 appear to be unstable, with wide confidence bands and some implausible central estimates. The crashworthiness estimate of about 1.2 percent for 2017 is less than half the Australasian rate. It is obviously unlikely that there was either a breakthrough in vehicle engineering that only affected cars sold in New Zealand, or there was a radical change in the composition of vehicles sales. Part of the problem will be the relatively small sample, but it seems that there is something wrong with the model, to produce such an extreme result.

Note that excluding 2017, the New Zealand rates are higher than the Australasian rates. However, the data are not directly comparable because the New Zealand data trend is based on two car collisions, which tend to be more serious.

Figure three: Crashworthiness by year of manufacture New Zealand



Problem with the year of manufacture modelling

One problem with the year of manufacture modelling is that it is difficult to reconcile the results with the actual death/serious injury data which are presented in Appendix one of the Monash 2019 update report. Table five shows the actual death and injury rates. We separated the data into four periods of manufacture. The data is showing an upward, not a downward trend.

Table five: Crashworthiness by decade of manufacture

Years of manufacture	Deaths and serious injuries/accidents %
1982-1987	5.2
1988-1997	6.2
1998-2007	7.3
2008-17	7.9

Second we examined the actual crashworthiness data for three popular models that had a long manufacturing history. We would expect that this data would be relatively untainted by changing demographic and behavioural influences over time because the demographics of the respective customer group would probably have been relatively stable.

Table six: Crashworthiness by model

Ford Falcon	**Deaths and serious injuries/accidents%**
82-88	4.0
88-92	4.5
92-94	5.1
94-98	5.8
98-02	6.9
02-08	6.8
8-16	4.8
Holden Commodore	
82-88	4.8
89-93	5.9
93-97	6.0
97-02	6.8
02-07	6.8
06-13	5.9
13-17	5.8
Toyota Corolla	
82-84	5.4
86-88	5.3
89-93	6.3
94-97	6.4
98-01	6.6
02-07	7.3
07-13	8.2
12-17	10.5

Again there is no obvious sign of downward trends in the data. For the Corolla there was an upward trend.

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Adjusting for non-vehicle factors

The answer Monash would give to the question of why the modelled and actual results diverge is that this is due to countervailing trends in nonvehicle factors that their econometric model identifies and adjusts for.

Looking at the adjustment variables, however, we did not find this explanation totally convincing. None of the identified variables would seem to have a strong trend element.

- sex: driver sex (male, female)
  The drivers sex ratios are likely to be fairly constant over time so this factor did not drive the results.
- age: driver age (≤25 years; 26-59 years; ≥60 years)
  There will be more older drivers than there were 30 years ago,and older drivers are possibly more prone to serious injuries, but they do not constitute a high proportion of road casualties so the change could explain only a limited proportion of the downward trend.
- speedzone: speed limit at the crash location (≤75 km/h; ≥80 km/h)
  The logic here is that injury severity is a function of speed so this variable adjusts for vehicles that are disproportionately driven in high or low speed zones.The mix of accidents by speed zone is probably fairly stable over time.
- The number of vehicles involved (one vehicle; >1 vehicle):
  There is no reason to expect that there will have been a trend over time in the proportion of multivehicle to single vehicle crashes.
- State: jurisdiction of crash (Vic, NSW, SA, Qld, WA, NZ)
  This adjustment is there to reflect some large variations in crashworthiness by jurisdiction (in particular Queensland with a rate two or three times the average) that cannot be due to driver behaviour or the crashworthiness of the vehicle. It is clear that jurisdictions are not recording accident data consistently but it is not obvious how this could have generated a trend over time. However, there is a risk that the jurisdiction adjustment variable could interact with other variables to generate some unknown but perverse outcomes.

Year of accident

The year of the accident variable is to adjust for observed but unexplained variations in crashworthiness over time. We understand that there is a separate adjustment variable for each year. These adjustment variables are not disclosed so it is difficult to say whether they are the major driver of the divergence.

There could be a number of explanations for changes in the year variable over time, but it was conjectured in one of the Monash papers that it could be due to changes in reporting standards. To illustrate, suppose that the reporting standard in year one included a large

number of ‘tow-away’ crashes, but it was amended to a more restrictive definition in year two. There is no change in the reporting of the number of serious injuries and deaths. Assume that in year one there are 100 deaths and injuries and 2000 accidents.. The crashworthiness index is .05. In year two the actual number of accidents is unchanged, but the reported number of accidents falls to 1000. The raw crashworthiness index increases to 0.10 although there has been no change in the true crashworthiness of the vehicle fleet. To adjust for the reporting change the crashworthiness index has to be divided by a factor of two, in year two, to be comparable with the year one figure

This makes sense conceptually, but the problem with the Monash modelling is that it is simply assumed that all year to year variations are due to changes in non-vehicle factors. This is a strong assumption, which is not consistent with the outcome of the modelling which purportedly demonstrates that crashworthiness has changed quite markedly over time. If, as is plausible, there has been a downward trend in crashworthiness then the year of the crash variables will have picked some of this up, and therefore overstate the non-vehicle year by year influence. In effect the downward trend will be counted twice, overstating the relative risk of older vehicles and understating the risk of newer vehicles.

This is not just a minor technical issue, it is pretty fundamantal. It puts at risk all of the crashworthiness estimates and in particular the general result that older cars are materially more risky than newer cars. However, because the Monash modelling and the relevant parameters are not fully reported we cannot be sure what is driving the results. At the least, the issue points to the need for a full, independent review of the modelling.

Further Issues with the Monash ratings

Limited disclosure of the modelling

As discussed above there is limited information on the modelling. We are simply told that the calculations are based on modelled data but are given very limited information on the modelling. The model is not specified. We do not know, amongst other things, how statistically robust the adjustment variables are; whether basic tests to see if the estimates are stable over time were conducted; or whether the modelling has been independently validated.

Statistical robustness of ratings

Monash say that only vehicles with a statistically robust estimate of their crashworthiness are given a star rating. The main robustness test is that the 90 percent confidence interval should be 2 percentage points or less. However, the interval separating the quintile boundaries is only 0.7 percentage points. That means that most of the star ratings are not statistically robust at that confidence level.

Checking the robustness of ratings we found that by excluding mostly irrelevant older (pre-2000) vehicles only a relatively small number were within their respective rating boundaries. These were almost all light or small cars in the one star grade. Virtually all of the two to five star vehicle confidence intervals crossed the rating boundaries.

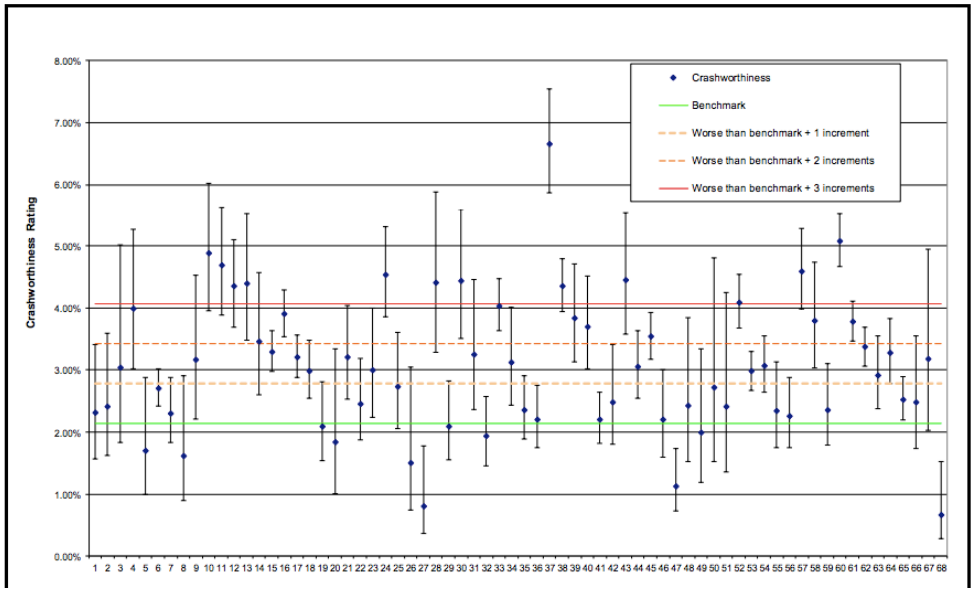
This is illustrated in figure four which shows the mean and confidence intervals for medium-sized SUVs. The green line represents the boundary between five stars and four and the red line the one star and two star boundary. The dotted lines are the intermediate three and two star boundaries. Note that the identities of the models are not shown because the print was too small to be read. Three models are unambiguously in the one star category, but these were all very old vehicles which are no longer relevant from a consumer choice perspective. Two were unambiguously five star vehicles. The rest covered two, often three or four, and in one case all five, star categories.

To be fair to vehicle sellers (whose cars may be tarred with a one star brush when it may well be a four star vehicle), and to give purchasers the full picture, the ratings should give the range of possibities. Rather than being represented by two stars a car should be given a range of one to four stars. The proponents of the system might argue that this would be overly complex and the system would lose its meaning if there was little perceived difference between models in many cases. Our view is that if that is the reality it should be disclosed.

If we consider what should be the more relevant total secondary safety ratings the statistical significance issue becomes more pronounced. The width of the rating boundaries is only 0.4 percentage points compared to 0.7 for the crashworthiness ratings.

A second issue is that the confidence bounds do not take account of errors in the central estimates of the 'non-car'(age of driver etc.) variables. The explanation for this is that the non-car estimates are applied to all models. So any errors will apply equally to all vehicles and so will not affect their relative risk. In our view this is a mistake. Non-car factors impact differently on different models (which is why they are modelled in the first place) so the errors will impact disproportionately. Adjusting for this omission would increase the confidence intervals.

Figure four: Medium SUVs mean and confidence bands of crashworthiness ratings



To illustrate the impact of statistical noise on the ratings it is useful to examine the case of the two light cars that received higher ratings. The relevant data is shown in table seven. The three columns on the left show the raw data, the fourth the crashworthiness rating, and the LCB and HCB are the lower and upper confidence bounds.

The 2009 - 13 Honda City received a five star rating, whereas the Honda Jazz, which shares the same platform, scored just one. Intuition suggests that the cars should have had similar ratings. On the raw data the Honda City had a low (safer) crashworthiness score (6.7 percent), compared to 11.2 percent for the Honda Jazz. However, the Honda City and the Jazz both had small samples, so it is more likely that the difference in the ratings is due to statistical noise than to any fundamental difference in vehicle safety. It is also possible that the non-car adjustments could have generated perverse outcomes.

The 2013-17 Nissan Micra received a four star rating, but looks like everyone's idea of a vulnerable small car. Looking at the actual accident data it had one of the highest death and injury rates but for some reason this outcome was transformed by the modelling, to a low crashworthiness score. This likely points to some unreliability in the modelling rather than the relative superiority of the Nissan Micra in a crash.

Table seven: Light car accident data

Model	Raw data Involved	Raw Sev. injured	Rate %	CWR	LCB 90%	HCB 90%
Honda City 2009 -13	493	33	6.7	2.81	1.94	4.08
Nissan Micra K13 11-16	486	61	12.7	3.08	2.25	4.06
Honda Jazz 08-14	1202	134	11.2	4.36	3.59	5.39

Ratings are biased to rarer and newer vehicles

Monash does not assign ratings on the basis of their mean crashworthiness number. Rather they use the lower band of the confidence interval. This favours rarer and newer vehicles which have as yet relatively fewer accidents and so get wider confidence intervals (providing it is not so wide that it fails the confidence band test for being assigned a rating), relative to more popular and older vehicles with a large sample size. To illustrate, assume we have two vehicle models and that the crashworthiness boundary between the second and third star is 3.3 percent. The older car, with more observations, has a mean risk of 3.6 percent and a confidence interval of 0.5 percent. The lower confidence band is therefore 3.35 percent, which is above 3.3, so the model is assigned a two star rating. Then we have a newer vehicle with fewer observations, a mean risk of 4.1 percent and a confidence interval of 1.8 percent (so it makes the cut for being assigned a star rating). The lower confidence band is 3.2 percent, so the model is assigned a three star rating.

In our view this outcome is clearly wrong. We are talking about risk and the mean score is the best measure of this. It does not make sense for a model with a crashworthiness risk of 3.6 percent to receive a worse risk weighting than one with a risk of 4.1 percent.

Again this is not a relatively minor technical issue. It is probably responsible for the popular late model Corolla receiving a two star rather than a three star rating.

Use of outdated data

Monash has focused on the number of observations rather than their relevance and quality. Since the original modelling in 2001 new data has been added but nothing has been dropped off. As a consequence the event horizon is now 29 years which increases the risk of the results being influenced by changes in a host of historical factors that may not be relevant to the safety performance of the current vehicle fleet.

Table eight presents the share of observations by model year[33]. The most relevant years, 1998-2017, account for only 33 percent of the observations. The reason why older models are so heavily heavily represented in the data is that they have had more years to generate accident events than recent models.

Table eight: Observations by model years

Model year	Percent of total observations
2008-2017	3
1998-2007	30
1988-1997	45
Pre-1988	22

Confusing and perverse outcomes

To illustrate the confusing and sometimes perverse ratings Rightcars can generate we present the results for two popular smaller vehicles, the Suzuki Swift and the Toyota Corolla. We also present the results for the Peugeot 207[34].

There are 12 ratings for the Suzuki Swift that are set out in table nine. The first point to note is that there is extraneous detail. Whether a car is New Zealand new or a used import should not affect its safety rating. Monash has produced a paper for NZTA which shows, as expected, that there is no difference between imported and New Zealand new vehicles with the same year of manufacture. Similarly it should not matter whether the transmission is automatic or manual.

Second, Rightcar have been careless in describing the model years. On two occasions the headline information does not match the dates on the more detailed information page.

Third, and most importantly, the rating can vary depending on what system applies. The sole ANCAP rating is a five for the manual Suzuki 2017-20. Once we switch to the VSRR system it becomes a three star rating for an equally new automatic. The three star rating is due to a good performance on aggressivity. The biggest change is when there is a shift to the USCR ratings, which are always one star for this Suzuki model.

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[33] Note that we restricted our calculations to models with more than 1000 accidents. Because later models tend to have fewer observations this would have understated the share of the 2008-2017 vehicles.

[34] Statement of interest. The writer owns a 2012 Peugeot 207.

As discussed above what is going on here is that when sufficient time has passed to generate enough accident observations to get a Monash star rating, the Swift, along with most other light cars, receives a one star USCR rating, compared to the 5 star ANCAP rating it began life with. Obviously the structure of the car has not changed, it has not suddenly become structurally unsound. The problem is that two very different rating systems are being used.

An argument has been put to us by the NZTA that it is not invalid to combine the ANCAP and crashworthiness ratings because the ANCAP ratings change over time. By the time the car gets a used car rating the ANCAP rating will have changed and a car that previously received a 5 star rating would receive a lower rating with the new assessment. However, there is no evidence that this is true in practice and will be true in the future. In fact the structural element of the ANCAP rating system has been relatively constant over recent years. There is nothing to demonstrate that a pre-2017 Swift would receive a one star ANCAP rating if it were retested under the current test regime. Further this does not explain why the larger vehicles, which receive the five, star ratings under the used car system, are not similarly impacted.

Table nine Suzuki Swift ratings

Year	Rating	Source
Manual 2017-20	5	ANCAP
Automatic 2018-20	3	VSRR
Automatic 2004-5	3	VSRR
Import automatic 2003-6	2	VSRR
Import 2001-16 CVT	1	USCR
2011-20 (or 2012-13)	1	USCR
2004-10 Import manual	1	USCR
2004-10 import CVT	1	USCR
2000-2006 import	1	VSRR
2000 Manual	1	USCR
1993-94 Saloon	1	USCR
1993-99	1	USCR

Toyota Corolla

There are no fewer than 36 Toyota Corolla ratings. The main pattern is that from 2012 all hatchbacks receive an ANCAP rating with its five stars. Prior to that the two star used car rating kicks in and the pre-2000 ratings are all one star. The interesting outcome here is that the 2012-17 hatchback retains its five star ANCAP rating despite the used car rating of two stars being available. The Victoria Australia equivalent of the Rightcar site rates these Toyotas as a two star.

Our understanding is that Monash ratings should supersede the ANCAP ratings once they became available. We do not know why this was not done in this case.

On the other hand the 2017-20 Corolla station wagon seems to have been badly treated. It is rated on the VSRR system and receives just a single star.

Table ten: Toyota Corolla ratings

Year	Rating	Source
2019-20 Saloon	5	ANCAP
2016-18 Hatchback	5	ANCAP
2018 -20 Hatchback	5	ANCAP
2012-16 Hatchback	5	ANCAP
2014-16 Saloon	5	ANCAP
2012-13 saloon import	2	UCSR
2001-15 stationwagon import	2	USCR
All earlier variants	1	Mostly USCR
2017-2020 Stationwagon	1	VSRR

Peugeot 207 and 208

Not all small cars get an adverse rating. The 2007-12 Peugeot 207 received a five star rating on the VSRR methodology. The model just makes the five star rating cut on the total secondary safety scale, but whether this is due to the car or the drivers is an open question. While it is well known that Peugeot 207 drivers are cautious and caring for others, which would have helped the result, more likely the result was just a statistical fluke.

The successor vehicle to the 207, the Peugeot 208, does not fare so well, with the ratings for essentially the same vehicle ranging from two to five stars for no apparent reason.

2012-17	Automated manual	5 stars	ANCAP
2012-19	Automatic	3 stars	VSRR
2012-13	Import	3 stars	ANCAP
2014	Automatic	2 stars	VSRR

Confused? So are we.

Key risk variables are missing

The logic of the Monash methodology is that it adjusts for behavioral and other factors that impact on accidents but are not related to the structural properties of the vehicle model. In this respect there are several notable omissions from the

modelling, mostly, we assume, because the data is not available for all of the jurisdictions covered. Some of the possibilities are:

Seat belt use

Seat belt use has a significant effect on accident outcomes and that usage can vary by different classes of vehicles. For example, a recent New Zealand studyfound that in 66 percent of cases where seatbelts had not been used in accidents, vehicles involved were over 16 years old, a much higher ratio than their share of the new Zealand vehicle fleet.

Speeding and alcohol use

Speeding can result in worse accident outcomes and it is likely that the incidence of speeding is not equal over different vehicle models or classes of vehicles. Older cars are probably more likely to be involved in speed-related accidents. There may also be a relationship between alcohol use and accident outcomes.

The reality is that it very difficult to reliably separate the role of vehicle characteristics and behavioural factors. People differ in the caution they exercise on the road and may self-select the vehicles they drive. For example a cautious driver may select a Volvo because they have had a reputation for being safe cars. That may well be true, but the statistical outcome may be enhanced because Volvos are driven by a more cautious group of drivers.

Part seven: Review of the Monash report: Analysis of the potential benefits of making safer vehicle choices in New Zealand September 2020

Recently Monash produced a report that analysed the potential benefits of changing the mix of vehicles in the New Zealand fleet[35]. The key message was that there is substantial scope to reduce injury outcomes by improving the choice of vehicles within market classes .

Purportedly, this was an independent report that is not identified as being commissioned by the NZTA. While that might be literally true, it is likely that the report was a response to the New Zealand authorities' 'needs' as it is targeted to produce results supporting their narrative.

Four topics are discussed in the report:

- Trends in the distribution of safety outcomes by year of manufacture
- The distribution of risk outcomes by market group
- The benefits of changing the risk composition of market groups
- The benefits of retrofitting safety improvements to parts of the vehicle fleet.

Before we address this analysis in detail we note the following:

- The accident period considered is up to 2015-16. The data for the Monash 2019 update went up to 2017. A year has passed since then, so it is reasonable to assume that 2017-2018 data could have been used. There must be a suspicion that the earlier data was used because it generated outcomes consistent with a narrative that vehicle safety could be improved by promoting higher starred vehicles
- The base information that went into the modelling, and the more detailed results has not been disclosed. This makes it difficult to understand what might be driving the results.
- The number of crash vehicles in 2015-6 was 23532, and there were 1981 fatalities and serious injuries, a rate of 8.3 percent.

[35] **ANALYSIS OF THE POTENTIAL BENEFITS OF MAKING SAFER VEHICLE CHOICES IN NEW ZEALAND MIKE KEALL STUART NEWSTEAD SEPTEMBER 2020 REPORT NO. 341b.**

Trends in the distribution of safety by year of manufacture

The process was to first divide the crashed vehicles roughly into deciles by year of manufacture, and then, within those deciles, allocate the accident rates for the different models into quintiles. For an unstated reason the earliest and latest data years were not used. The average number of crashes per decile/quintile was about 400, which is a small sample (compared to those in the Australasian study discussed in part four), which would have had relatively large error bounds. Importantly, these error bounds were not reported.

Three different measures of safety were assessed. The Crashworthiness and Total safety indexes were as described in part four. A further measure is a version of the Primary Safety Index (PSI). Here the PSI definition was manipulated to create a different measure. The actual PSI was multiplied by the vehicle's crashworthiness rating to give a probability of fatality and injury rating. This is a different concept from the PSI, which just measures primary safety. The data, however, is misleadingly referred to as a PSI in the document.

As noted in part four there appears to be no obvious trend in the PSI which is centred around an index number of 1. So when it is multiplied by the CWR this creates a series essentially driven by the CWR. The point of what otherwise appears to be a pointless exercise, presumably was to claim that all three safety measures were used and all were pointing in the same direction.

The result is shown in figures five, six and seven. Looking at the results we see that the Crashworthiness and PSI outcomes are almost identical. The total secondary safety rating quintiles are more tightly packed

Figure five: Crashworthiness quintile ratings over time

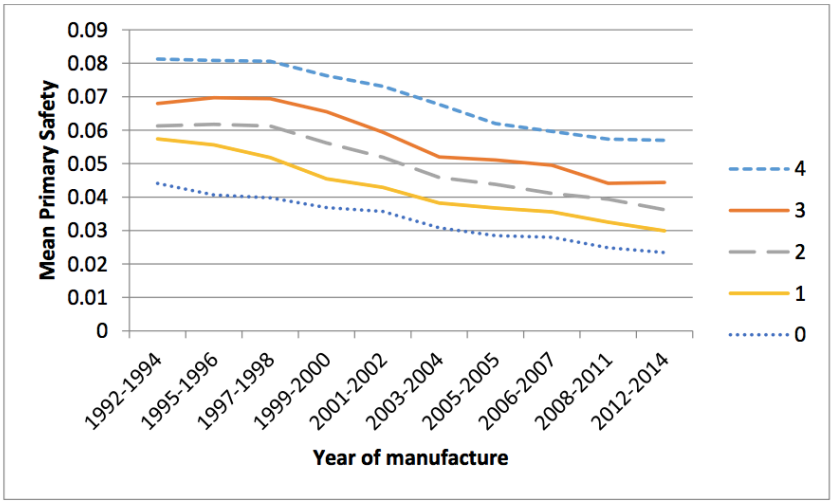


Figure six: Total secondary safety rating quintiles over time

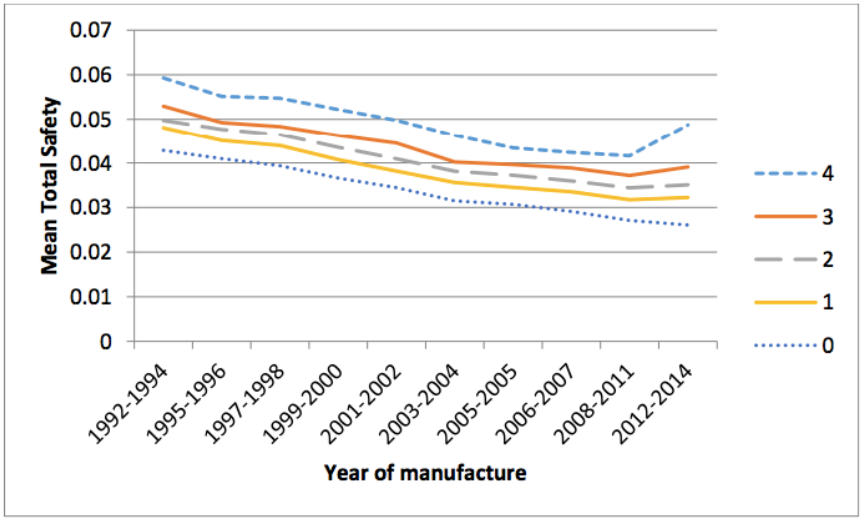
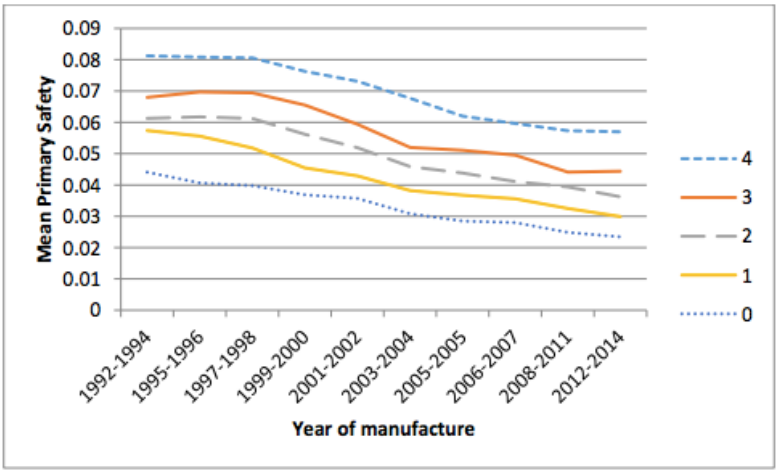


Figure seven: 'PSI' ratings by quintiles over time



The key outcomes across all measures were described as follows:

- Safety has improved over time. As discussed in part four, the improvement is partially explained by a possible flaw in the analysis that double counts actual structural improvements. There is no comparison with the 2019 Australasian data that showed that safety improvements appear to have bottomed out in recent years.
- The improvements have been greater in the lowest (safest) quintile. The following table shows the proportionate changes over the ten years to 2012-2014. There was no detailed enquiry as to what was generating these

outcomes but some sweeping conclusions were drawn as to their significance. However, there could be some simple explanations that have little to do with underlying vehicle safety. For example, if the year of the accident variable, which drives much of the results, is additive in the model, then this will generate higher proportionate changes in the 'safe' quintiles. If the year of accident changes by say 1 percentage point over the 10 years this will generate a 31 percent fall from a starting point of 3.5 percent, but only a 13 percent improvement if the starting point is 7.5 percent. Statistical noise could also be driving some of the results.

Table eleven: Proportionate changes over 10 years by quintile

quintile	CWR	TSI	PSI
0	27%	17%	24%
1	21%	9%	22%
2	16%	8%	21%
3	11%	3%	15%
4	12%	-5%	16%

The uptick in the TSR in the last observation period, in particular, was imbued with great significance. It is sometimes described as a worrying recent trend when it was neither a trend or very recent. It is an uptick in a single observation point, and 2013-14 is not very recent. It is possible that the uptick was just a statistical quirk. Recall that around 2011-14 the CSR estimates bounced around for no obvious reasons.

Trends in safety distribution within market groups

This analysis looked at the range of 'safety' outcomes in the then current crash fleet according to market groups. A range of figures are presented that display percentiles within the specified market group of the crash fleet, with a solid line providing the overall percentile distribution. These are presented in figures eight and nine. for the CWR and the TSSR. We have not presented the PSI results because, as discussed above, this analysis was just a contrivance that essentially mimicked the CWR.

The commentary on these results was as follows:

This (CWR) graph shows that even the 10th percentile CWR for light cars is still relatively high (indicating relatively poor safety performance), about equal to the overall fleet median.

This was not news: we know that small cars perform worse on a crashworthiness basis.

The report then argues that the interquartile range has a particular significance.

A commonly used measure of the spread of a distribution is the interquartile range, which is the 75th percentile minus the 25th percentile. The CWR interquartile range was largest for small cars, followed by large and medium cars. The largest TSI interquartile range was also for small cars, followed by large SUVs. The largest PSI interquartile range was for light cars followed by small cars. The smallest ranges were for vans and people movers.

A small range indicates that the fleet concerned is relatively homogeneous in terms of safety, which is probably an indication of a well-functioning market in terms of safety.

It could indicate a number of things, including a wide range of safety preferences. In itself it says little about whether a market is well-functioning or not.

Although a wide range for market groups such as small cars is cause for concern, it also highlights potential for initiatives aimed at increasing fleet safety to shift vehicle purchasing preferences towards safer vehicles, as such vehicles clearly exist within the given market group.

This discussion conveniently omits the TSI analysis which is the most relevant from a policy perspective. Figure eight shows that small and light car distributions were not materially different from the average.

The discussion comes across as an almost desperate attempt to find something, anything, to find some form of market imperfection that the NZTA can remedy with appropriate interventions.

Figure eight: CWRs by percentiles and market group

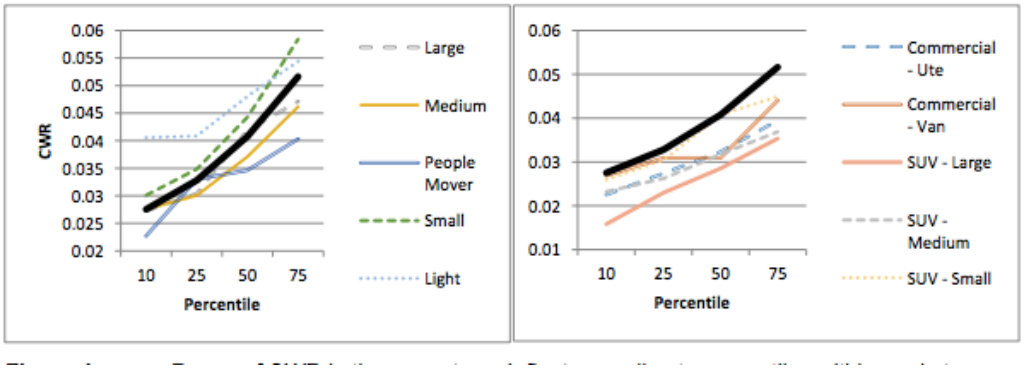
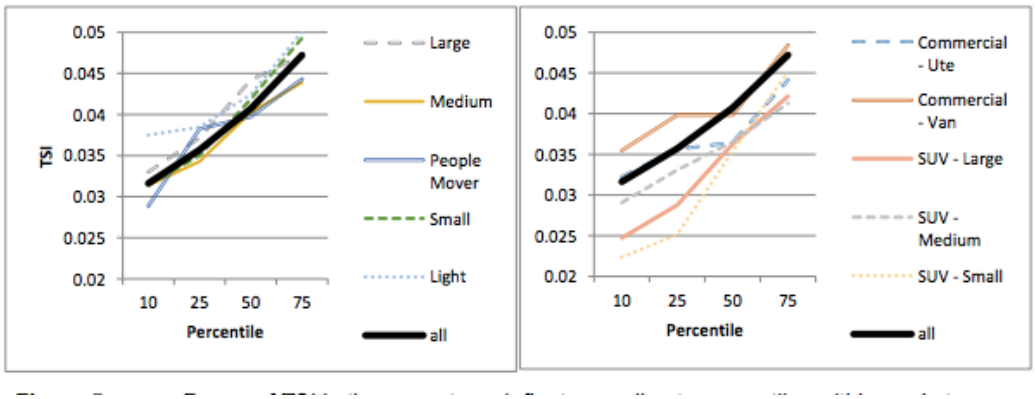


Figure nine: TSIs by percentiles and market group



Scenario Analysis

The most significant part of the analysis was a set of scenarios that measured the savings in terms of lower deaths and injuries and the economic value of the savings. A scenario would be run in, say, the light vehicle class, where all of the vehicles were assumed to have the same outcomes as the top performing 10 percent. The reduction in fatalities and the economic value of the change in the fleet structure are then calculated. Scenarios using different percentiles and risk metrics were run. Some of the results are presented in figure ten and eleven.

We suspect that the analysis has been structured to get around the argument that the rating system will drive consumers to larger cars. It can be argued that by restricting the analysis to market groups, the analysis demonstrates that improvements can be made by improving the safety mix within each group.

Figure ten shows the benefits for the entire fleet. If each market group performs as well as the top 10 percent then the benefits of avoided deaths and injuries, using the TSR metric, are about $1300 million over two years, a reduction of nearly 30 percent from the status quo. The other metrics generate somewhat lower results. Targeting higher percentiles, not unexpectedly generates lower benefits. Figure eleven breaks down the overall results by market group. Most of the benefits come from improving the composition of the small and medium car group.

Figure ten: Benefits of improvements

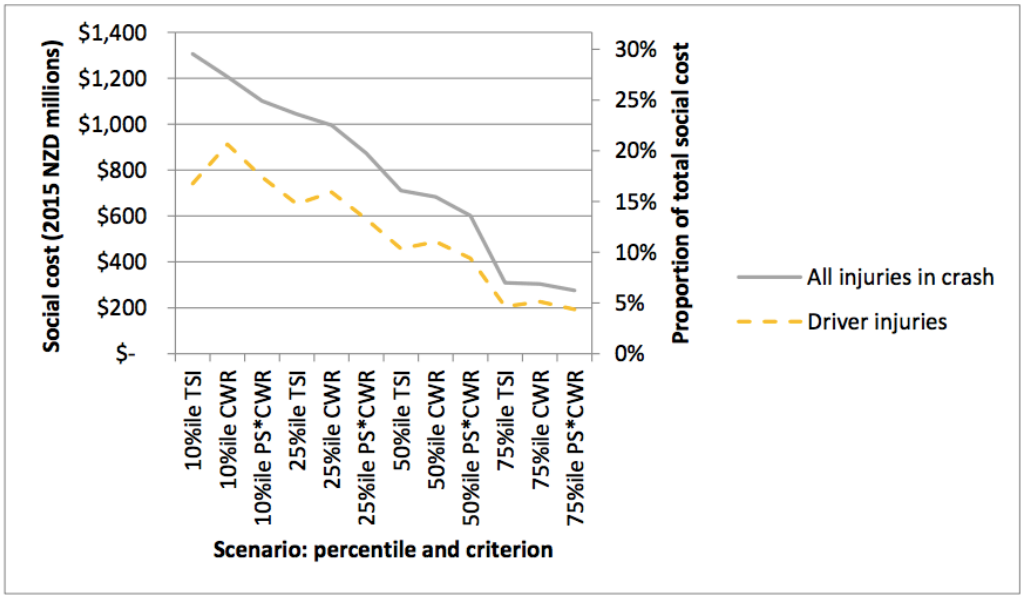
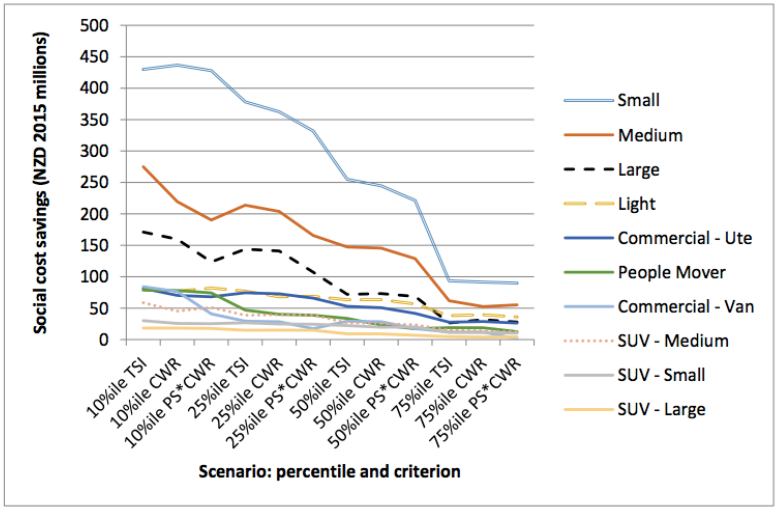


Figure eleven: Benefits by market group



We found this analysis, to say the least, to be unhelpful.

'Gains' due to randomness ignored

The analysis overstates the potential gains from intra-group selections. The performance of the safest decile, measured ex-post, might be partially due to underlying structural factors, but randomness could also play a significant, and possibly dominating, role especially with the tenth percentile scenario.

To illustrate, suppose the fleet of crash vehicles was identical, except for color, which obviously will have no impact on crash outcomes (colour might influence the probability of having a crash but it does not affect the consequences of a crash, which is what is being measured here). However, with small sample sizes there will be significant, ex post, variations in measured performance by vehicle color. It would obviously be ridiculous to conclude that vehicle safety could be improved by switching the fleet to all blue if that was the 'best performing' vehicle in an ex-post evaluation of performances over two years.

In part this is what is happening here. By statistical chance (and from noise in the modelling) there will be some 'good' vehicle performers. In part three we noted that the best four and five star light vehicles must have been due to chance and model anomalies. However, in this analysis the conclusion is drawn that substantial gains can be made by assuming that similar outliers in the New Zealand modelling exercise are robust indicators of future performance.

No information on what cars are in the best performing group

We are given no information on which cars are in the best performing group and can draw no conclusions on whether the results are reasonable and statistically robust. Almost certainly given the small sample of sizes, the estimates are not robust. To address this lacuna, we have analysed some of the data in the 2019 Monash report. We have focused on the small vehicle fleet because this is the biggest driver of Monash's estimate of the gains from improving the fleet mix. Using the TSR risk metric we identified post 2000 models that had a confidence interval of less than two percentage points. Vehicles manufactured prior to 2000 are no longer a significant part of the used vehicle market, accounting for only 3 percent of the vehicles listed on Trademe, and there is almost no possibility of their supply being augmented by used imports. There is too much uncertainty around the performance of vehicles with a confidence interval of more than two percentage points to be even mildly confident in their true capacity.

There were 52 models, so five were in the 10th percentile. The TSRs for these models are presented in table twelve together with their lower and upper confidence levels, and the confidence intervals. We also present the same information for used vehicles that are realistic affordable alternatives to the 10th percentile vehicles.

Table twelve: 10th Percentile vehicles and alternatives TSRs

Model	TSR	LCL	UCL	Confidence interval
Prius V 2012 -17	1.52	0.91	2.54	1.64
Mercedes B class 2012-17	1.55	0.92	2.61	1.6
Prius 3 2009-16	2.36	1.82	3.06	1.25
Audi A-3 2013-17	2.44	1.68	3.54	1.88
Subaru impreza 2012-16	2.75	2.37	3.19	0.82
BMW 1	2.82	2.4	3.82	0.92
Alternatives				
Mazda 3 2012-17	2.95	2.45	3.53	1.07
Mitsi lancer 2008-17	3.23	2.95	3.52	0.58
Nissan Pulsar 2012-17	2.95 (3.51 Tiida)	2.18	4	1.87
Toyota Corolla 2007-13	3.65	3.49	3.81	0.33
Honda Civic 2012-16	**4.07**	**3.51**	**4.72**	**1.21**

Of the five the Prius v can be excluded because it is not a small car. It is substantially heavier than the weight limit for this vehicle class. The Audi, the Mercedes and the BMW are largely irrelevant because there is no prospect of materially increasing the supply of affordable used vehicles for these models. Which leaves just two, the Subaru Impreza, and the Prius 3. Their superior performance is possibly partially explained by their vehicle mass, which is at the top of the range for this class. Looking at the alternatives there is probably not too much between them in terms of their safety performances, having regard to the confidence intervals, which would be larger than the numbers presented above, once model risk is accounted for.

The Honda Civic looks to be an outlier, but the earlier model had a TSR of 3.5, so the 4.07 is probably a statistical blip Similarly the Pulsar should be similar to the Tiida at about 3.5. Whether the Mazda 3 is truly a superior car is anyone's guess. The upshot is that there is probably little between the models and there is a limited capacity to improve the safety performance of the small vehicle fleet by improving the mix without shifting to what are effectively middle-sized cars.

No regard to the practicality and costs of improving the fleet

3.5 million vehicles would have to be replaced to bring the fleet up to the standard of the top 10 percent of vehicles. As many of these would have to be newer and more expensive premium vehicles this would be both costly and could only be achieved over a sustained period. The NZTA's strategy paper assumes that the improvement takes 10 years. By that time the annual benefits of about $650 million a year would be secured. If we assumed that the additional cost was $20,000 a vehicle then the aggregate cost would be $70 billion or $7 billion a year. Cutting that cost to $5,000 by focusing just on better performing used imports (assuming that the improvement in risk is real and not a statistical mirage) is still likely to see the costs still well outweigh the benefits.

Analysis is dated

The data relates to crashes in 2015-6, and pre-2000 vehicles accounted for a relatively high proportion (around 30 percent) of the crash fleet. As the scrappage rate of these older, poorer performing vehicles is about 12 percent per annum[36], about half will have dropped out of the fleet by now. As they will have been replaced by better performing vehicles, this reduces the benefit of replacing them with the best performing 10 percent of vehicles.

[36] Fleet Statistics 2018 Ministry of Transport

Fitting safety technology to existing cars

The final section analyses the benefits of fitment of proven safety technology to existing cars. The first is low speed autonomous emergency braking (AEB) fitted to 2012-15 vehicles. Based on a paper by Cicchio[37] this is estimated to decrease front to rear injury crashes by 45 percent**.** This just one study. There are other studies with lower estimates.[38]

The results are set out in table thirteen.

Table thirteen: Autonomous emergency braking fitment benefits

Year of manufacture	n vehicles	% vehicles	Per car fatal	Per car severe	Per car minor	SC savings (NZ millions)
2012	15	2%	0	1	10	$1.36
2013	22	2%	0	1	15	$1.70
2014	28	3%	0	1	15	$1.70
2015	13	1%	0	1	10	$1.04
2016	1	0%	0	0	1	$0.03
TOTAL savings						$5.84

It is not clear whether these benefits are just for one year or for the remaining life of the vehicles. We will not comment further here other than to note that the standard NZTA estimates of the injury costs are probably too high. It is implausible, for example, that a minor injury that doesn't require a stay in hospital has a cost of $77,000. The cost of deaths and serious injuries is a major issue in itself so we will leave it there.

We also note that no attempt is made to cost the fitment exercise. By way of illustration if the cost was, say, $2000 and 300,000 cars were affected (no information is given in the report on the number of fitments) then the cost would be $600 million, well above any measure of the benefits.

37

38 **For example** Irene Isaksson-Hellman estimated the improvement to be 23 percent. **The Effect of a Low-Speed Automatic Brake System Estimated From Real Life Data** Advancement of Automotive medicine 2012 Oct; 56: 231–240.

The second safety technology scenario tested involved more widespread fitment of Electronic Stability Control to vehicles manufactured in 2011-2014. The effectiveness of the technology was based on estimates specific to Australian and New Zealand conditions that ESC reduced the rate of single vehicle crashes by 32% for crashes leading to driver injury. (Scully and Newstead, 2010). The results were as follows:

Table fourteen: ESC fitment benefits

Year of manufacture	n vehicles	Injuries			SC savings (NZ millions)
		Fatal	Severe	Minor	
2011	14	0	4	14	$1.34
2012	14	3	4	15	$5.38
2013	12	0	5	7	$1.41
2014	16	0	7	13	$2.05
TOTAL savings					$10.17

Discussion and implications

To give a sense of the tone and content of Monash's discussion of their results we present the following excerpts from their discussion and implications section together with some additional comments.

The safety of the fleet improved significantly across year of manufacture ranges spanning 22 years. For all three measures, the best-performing quintile consistently had a much better rating than the other quintiles and the worst quintile considerably worse.

The quintile performance was true by construction as the quintiles were populated on the basis of their rating performance. It is however not very informative.

For the most recent years of manufacture, there was a noticeable increase for the worst CWR quintile compared to this quintile for previous years (meaning there was a deterioration in safety). This may represent a concerning recent tendency for a segment of the market to be particularly poor in terms of safety.

There was no 'noticable increase' in the 'worst CWR' quintile in the last observation period (see figure five).

Such segmentation may also represent marketing focus by manufacturers and retailers. For example, if low price is the paramount criterion for a segment of the market, safety may be compromised with little loss of sales.

This trend for the poorest performing quintile contributed to growing safety disparities within the fleet in vehicles manufactured during the past decade: whereas the safest quintiles each improved substantially (by 27%, 17% and 24% for mean CWR, TSI and PSI respectively), there were much smaller improvements for the worst quintiles, or a deterioration (in terms of TSI, by 5%).

As discussed above it is more likely that the 'poor results' are an artifact of statistical noise, a dysfunctional model and misleading reporting. These are not recent results as the data for some of the results stops at 2014.

When safety was compared between market groups, light cars performed particularly badly. Even the 10th percentile CWR for light cars was still relatively poor, about equal to the overall fleet median. Although a wide range for the safety indices for small cars is cause for concern, it also highlights potential for initiatives aimed at increasing fleet safety to shift vehicle purchasing preferences towards safer vehicles, as such vehicles clearly exist within the market group.

The opposite result for the TSR is ignored.
Scenarios were tested in which vehicles were allocated the average safety of the best 10% of the market group. In terms of fatal and serious injuries prevented for all road users, the best scenario by quite a margin was to have the entire fleet performing as well as the best 10% in terms of TSI, followed
by a fleet performing as well as the best 10% in terms of crashworthiness.

The substantial improvement in secondary safety for vehicles manufactured over the past 20 years is consistent with the beneficial influence of vehicle safety ratings on consumer choices and manufacturers' focus on safety. Ideally, with the passage of time, a fleet should reach consistently higher levels of safety that are present in all vehicles.

The description of the substantial improvements in secondary safety over 20 years is not consistent with the relatively more robust Australasian modelled data which showed a levelling off of the improvements. The focus on the role of vehicle ratings in this 'improvement' is largely an exercise in self promotion.

There were some concerning trends in the New Zealand fleet for more recently manufactured vehicles to be more disparate in their safety, with many vehicles performing well, but a significant minority performing poorly. There were also particularly wide safety disparities within the market group light cars. Although the poor safety of an important proportion of this market group is a concern, there is also an opportunity to focus information and marketing to current or potential buyers of such vehicles to encourage safer options, which do exist in the fleet currently.

As discussed above, the 'concerning trends' statement is based on a single, possibly random, observation, and with respect to light cars, some marginally relevant information using the crashworthiness data. The TSR data does not support the concern about the widening safety disparities.

Part nine: Compliance with advertising standards code

The NZTA has run two television advertisements to promote its vehicle safety ratings and placed specific information on the Rightcars site. The first was also on their website. In our view these breach the Advertising Standards complaints code.

The first advertisement combined three conversations which purported to provide information on the effects of side airbags and to set in the viewers mind that there is a strong connection between some macabre crash outcomes and a one star safety rating. The implication is that the one star car owner is exposed to these risks, but these risks can be avoided if they buy a car with a higher safety rating .

It was claimed that the occupants will be '*turned inside out'* in a side on crash and with the implication that side airbags will provide protection. This was misleading. An airbag will not provide protection against a violent intrusion that will turn an occupant 'inside out'.

And

'Very low protection in a head on crash. This engine will come all the way to meet you'

The truth is that many one star cars have five star new car ratings which include protections against head-on collisions.

The second advertisement, '1 –star reality', involves a couple examing an uncomfortably small car with a one star rating. The intent, clearly, is to establish a link between the small size of a car and safety risk. The large male partner could barely get into the car and commented :

can't imagine …… if we were to crash in a car like this there is no way we would survive'

However, the scene was staged. The seats were pushed to unnatural positions and angles; the headrests were pulled out of place and the roof lining pulled down to give an impression of a lack of space and enhance a sense of vulnerability.

The 'car vendor' turns out to be a vehicle safety promoter who informs the couple that the car has a one star safety rating. He does not correct the male customer on his survivability assessment. Based on the Monash data the probability of a being severely injured (defined as spending at least one night in hospital, which is not necessarily a severe injury as commonly understood) or killed in a one star car crash is about 5 percent. If deaths were 10 percent of that figure then the chance of being killed is 0.5 percent or 1:200.

The clearest breach of the code is the claim that one and two star rated cars offer little or no protection in a crash. This is clearly false and alarmist. Many of these vehicles would have had a high ANCAP rating when new, which means that they offer a relatively high level of protection. A vehicle that offered little or no protection would have the same injury rate as a motorcycle which are 20 times as risky as cars. A two star rated car is about 15 percent more risky, on a total secondary safety basis, than the average car.

The Advertising Standards Code

Purpose of the Code

The purpose of the Advertising Standards Code is to ensure that every advertisement is a responsible advertisement. All advertising must be legal, decent, honest and truthful and respect the principles of fair competition, so that the public can have confidence in advertising.

The relevant parts of the Advertising Standards code are as follows

PRINCIPLE 1: SOCIAL RESPONSIBILITY

Advertisements must be prepared and placed with a due sense of social responsibility to consumers and to society.

Rule 1 (g) Fear and distress
Advertisements must not cause fear or distress without justification.

Guidelines
If It can be justified, for example, on educational grounds the fear or distress must not be excessive.

Advertisers must not use a shocking claim or image merely to attract attention
Advertisers must not exploit superstition or vulnerable audiences.

The implication in the second advertisement that there was a high probablity of death in a small car was designed to prey on fear.

The claim that one and two star vehicles offer little or no protection in a crash is designed to prey on fear.

Principle two: Truthful representation
Rule 2 (a) Advertisements must be identified as such
Rule 2(b) Advertisementsmust not mislead or be likely to mislead, deceive or confuse consumers, abuse their trust or exploit their lack of knowledge. This includes by implication, inaccuracy, ambiguity, exaggeration, unrealistic claim, omission, false representation or otherwise.

There are obvious breaches in both advertisements and in the 'little or no protection claim' on several of those counts.

Rule 2 (e) Advocacy advertising

Advocacy advertising must clearly state the identity and position of the advertiser.
The identity of the advertisers must be obviousand easily recognised

We found it almost impossible to identify the authority ultimately responsible for the television advertisements

An advertisement we are unlikely to see.

The NZTA seems to be on a crusade against small cars, but possibly doesn't want to be too explicit about it because the Government has identified large vehicles to be a problem from an emissions perspective. We thought we would help the NZTA out by creating the advertisement they might like to, but can't, produce.

The scene is a used car lot. The salesperson approaches a couple looking at a small car.

Salesperson: Looking for a car?

Wife: Yes, and this one looks to be what we need. It's small, economical, good for the environment and just right for around town use. We don't want to unnecessarily add to congestion. At $12,000 it's affordable.

Salesperson: But it's got a one star safety rating and the NZTA says that it offers little or no protection in a crash. Little or no protection… you might as well be riding a motor bike. Now this big SUV over here is just what you need. Five star safety rating … and a really good aggressivity rating. You need that. In a crash you get to kill the other guy. That small car has a low aggressivity rating, which means you're the one that gets killed.

At $35,000 it's a snip. You can't pay too much for your own safety. You got teenage kids?

Wife:Yes

Salesperson: Then you need this SUV. New drivers have more accidents, but with this vehicle they will be killing other people's kids and those little old ladies that putter about in small cars, not themselves. Weaponise your kids with a larger vehicle is what the NZTA is advising.

Wife: But what about the environment and other people?

Salesperson: A better environment is not going to do you much good if you are dead will it? You have to look after number one in this world.

Wife: (looking very uncomfortable) I think we've heard enough.

Part eight: Policy implications

The Ministry and the NZTA are on a mission to substantially change the structure of the New Zealand fleet using regulatory and 'public information tools'. The change will have to be drastic to reducing the share of one and two star vehicles in the New Zealand light vehicle fleet from 45 (or 41 percent) to 20 percent. It will mean that the New Zealand vehicles in the fleet will have be newer and bigger than those in the Australian fleet.

Intervention and public education

At this time the balance between regulatory intervention and public information is uncertain. If the Government goes down the regulatory route it is likely that regualtions would choke off the supply of older (8 to 10 years), smaller and cheaper ($8000-$10,000 price point) imported cars. There might also be moves to force older cars off the road by artifically toughening warrant of fitness standards.

Quite apart from the safety effects, these moves are likely to result in a reduction in vehicle numbers that may be seen as intrinisically desirable in some quarters. Cheaper imports allow poorer people to have their own cars when they should be taking public transport, walking or biking.

The effect of these policies could be to:

- Increase used car prices
- increase the demand for new vehicles, though the effect will be marginal. There will be little direct substitution from cheaper used imports to new cars, but higher used cars prices will reduce depreciation rates and make it cheaper for the better off to purchase a new car.

- Increase motorcycle purchases. These are more than twenty times more risky than the average light vehicle. The issue of the impact of reducing car imports on overall road deaths was discussed in a 2016 Monash paper *However, increasing the proportion of new vehicles in the NZ fleet must not come with the consequence of increasing motorcycle use. The potential safety benefits of increasing the number of new vehicles in the NZ fleet back to 1990 levels would be completely offset if total motorcycle travel exposure doubled (from the current 1% of all travel to 2% of total travel).*

- Cars will be retained for longer. To the extent that older cars are less safe than the replacement imports then safety will be reduced.

In the 2016 Monash report their scenario 8 modelled the effect of decreasing the proportion of used imported vehicles in the fleet on the age of the fleet if vehicles are retained longer. The proportion of vehicles aged over 25 years increases from 1.8 percent of the fleet, to 9.6 percent. The effect is to increase deaths and serious injuries by 3.7 percent.

On their scenario 7: Decreasing the proportion of used imported vehicles in the fleet in preference for new vehicles, the reported concluded:

This would be likely to have little effect. Potentially, reducing the supply of used vehicles would increase the price, effectively increasing the cost of safety (in terms of the safety that can be purchased for a given price).

- There may be a small diversion to bicycles. These are about six times more risky than an average vehicle. In the Netherlands[39], for example, road deaths amongst the occupants of cars fell by more than 50 percent over the last 20 years but there was no fall in cycling deaths, which are now almost as high as deaths amongst car occupants.

In short, restricting vehicle imports will have only a limited impact on fatality and serious injury rates but will impose a substantial welfare loss to those most directly affected.

Workplace implications

There is a risk that workplaces will be pressured to dispose of their one and two star vehicles. The policy document made the following statement:

As discussed in Focus Area 3: Work-related road safety, businesses and organisations will continue to have a significant role to play in generating demand for safer vehicles and improving the vehicle safety of the New Zealand fleet over time.

In practice this might mean that many workplaces will not be able to use used light cars, which are economical and 'fit-for-purpose' for many businesses.

Consumer education

The thrust of this paper is that the current Rightcar rating system is not an appropriate system for improving consumer understanding of risk.

- The NZTA should fundamentally review the risk information on the Rightcar site and seek a genuinely dependent review of the Monash methodology.

[39] Statistics Netherlands 2020 'Decline in road fatalities larger among motorists than cyclists'

- A system based on the crashworthiness rating is not appropriate from a public policy perspective. It is not the Ministry's job to encourage a larger vehicle arms race. The Total Secondary Safety Rating should be used instead on the Rightcars website.
- The ratings are biased by vehicle age. This can be partially fixed by Monash. They could reduce the double counting of vehicle safety improvements over time, and base the ratings on mean TSR scores. If they cannot do that then the NZTA should commission their own rating system.
- Ratings are often not statistically robust. This can be partially mitigated by dropping the number of rating grades from five to three. Five ratings provide a spurious degree of accuracy.
- Emotionally charged descriptors should be dropped. Above average, average and below average is all that is required. The actual TSSRs should be disclosed, together with the statistical bounds around those numbers
- The target to reduce the share one and two stars vehicles to 20 percent should be dropped. It sets an unnecessarily tough target in a system, which by construction, 40 percent of vehicles will be in the lowest two quintiles.
- The misleading and exaggerated claims made on the Rightcars site and in advertisements are a breach of advertising standards and should be withdrawn. We will be making a complaint to the Advertising Complaints Authority to push this issue to a head.

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