Ministry of Transport
TE MANATŪ WAKA

Vehicle Fuel Efficiency Standard
Preliminary Social Impact Assessment

July 2019

Preface

This report documents a preliminary social impact assessment on the Vehicle Fuel Efficiency Standard (VFES) (also known as *Clean Car Standard*). The VFES legislates minimum standards for greenhouse gas (GHG) emissions performance on imported light vehicles (new or used) to reduce average emissions from the light vehicle fleet. This is one of the policy options of the Low Carbon Emissions Package that aims to reduce GHG emissions from road transport, such as the Feebate scheme (also known as *Clean Car Discount*). For a discussion on the impacts of the Feebate scheme, refer to the corresponding cost benefit analysis and social impact assessment reports.

Contacts

Head Office:
Ministry of Transport
3 Queens Wharf
Wellington 6140
+64 4 439 9000

Wellington postal address:
Ministry of Transport
PO Box 3175
Wellington 6011

Auckland Policy Office:
Level 6, Tower Centre
45 Queen St
Auckland

Auckland postal address:
Ministry of Transport
PO Box 106 238
Auckland

Tel +64 4 439 9000
Fax +64 4 439 9001
Email info@transport.govt.nz

Acknowledgement

This preliminary SIA has been prepared by the Domain Strategy, Economics and Evaluation team at the Ministry of Transport.

The Domain Strategy, Economics and Evaluation team operates within the Regulatory and Data Group of the Ministry of Transport. The team supports the Ministry's policy teams by providing the evidence base at each stage of the policy development.

The team is responsible for:

- Developing the Transport Evidence Base and the Transport Knowledge Hub which connects people from across the wider transport sector and promotes the sharing of transport data, evidence, knowledge, research, information, capabilities, and ideas.
- Providing economic input on business cases, funding requests, competition issues and specific projects such as value capture, natural disasters, and the social impacts on environment and health.
- Providing the evaluation function for the Ministry, including designing evaluation frameworks, developing performance metrics and indicators, and designing, conducting and procuring evaluations.

Important qualifications and information

Due to the lack of information, time and resources, this preliminary social impact assessment does not include the following items:

- ***Detailed projections of light vehicle imports to be purchased by household over the 6 years to 2025 by household and vehicle characteristics*** – Instead, this SIA utilises the light vehicle registration projections from the Vehicle Fleet Emission Model and the light vehicle imports purchasing patterns (by households only) for the three years to June 2018 from administrative data to provide an indication of the likely size of the population (of selected household characteristics) to be affected.

- ***A detailed analysis of the light vehicle imports purchasing patterns by specific geographic location such as region and/or local area*** – However, work is being scoped to investigate the kind of breakdowns that might be possible using the administrative data from Statistics New Zealand's Integrated Data Infrastructure.

- ***Estimates of the combined effect of implementing other emission related interventions (such as the Feebate scheme or the Euro 6 standard)*** – However, further analysis has been scoped to estimate the interaction effects of different vehicle related policies on vehicle registration, scrappages and the level of travel. Such an analysis would help to improve estimates of environmental and other outcomes.

- ***Any flow-on impacts onto the domestic used light vehicles market*** – However, work is being scoped to investigate how such impacts should be considered when revising the CBA and SIA.

Unless otherwise indicated, this SIA refers mainly to the purchase of light vehicles that are new to the fleet (either new or used imports) and not to the purchase of used light vehicles that are already in the fleet (i.e. change of ownership of vehicles already in the fleet).

Similarly, the discussion of the potential impacts of the policy on households refers mainly to households that might purchase a light vehicle new to the fleet (i.e. exclude businesses and government) over the six years to 2025. To get a sense of the relative size of the population to be affected, some household estimates are expressed as a percentage of total number of households in New Zealand.

An earlier draft of this SIA has been peer reviewed by the Department of Population Health, University of Otago and Infometrics.

Disclaimer

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GLOSSARY OF TERMS AND ABBREVIATIONS

BCR	Benefit-cost ratio
CBA	Cost-benefit analysis
CO_2	Carbon Dioxide
ETS	Emissions Trading Scheme
EV	Electric Vehicle
GHG	Greenhouse Gas
GVM	Gross Vehicle Mass
HTS	Household Travel Survey
ICEV	Internal Combustion Engine Vehicle
LCV	Light Commercial Vehicles
LEV	Low-emission vehicles
MoT	Ministry of Transport
MPV	Multi-purpose vehicle
MVR	Motor Vehicle Register
NEDC	New European Driving Cycle
NZTA	New Zealand Transport Agency
SIA	Social Impact Assessment
SUV	Sports Utility Vehicle
TRAP	Transport-Related Air Pollutants
VFES	Vehicle Fuel Efficiency standard
WLTP	World Harmonised Light Vehicles Test Procedure

1. Executive summary

1.1 Introduction

This preliminary Social Impact Assessment (SIA) aims to highlight the potential scale and distribution of impacts on households from implementation of a Vehicle Fuel Efficiency Standard[1] (VFES) of 105g CO_2/km by 2025, for all light vehicles entering the New Zealand fleet. This report should be read in conjunction with the preliminary Cost-Benefit Analysis (CBA), which assesses the impacts at the overall level.

The VFES is one of the policy options being considered as part of the Low Carbon Emissions Package that aims to reduce GHG emissions from road transport. Another policy within this Package is the Feebate scheme (also known as *Clean Car Discount*). A discussion of the economic and social impacts of this policy is provided in the respective preliminary cost benefit analysis and social impact assessment reports. Further work is being planned to estimate the combined impact of the two measures on the emissions of the light vehicle fleet.

1.2 Policy description

The VFES legislates minimum standards for greenhouse gas (GHG) emissions performance on imported light vehicles (new or used) to reduce average emissions from the light vehicle fleet. The Government is currently considering a sales-weighted average target of 105g CO_2/km by 2025. This standard will apply to both new and used imported light vehicles with a gross vehicle mass (GVM) below 3.5 tonnes.

During the implementation period of the VFES (2020-2025), vehicle importers will be required to comply with annual emissions targets that become increasingly stringent. They will need to alter the composition of their imported vehicle fleet towards an overall lower average emissions level. If all importers successfully reach their assigned (sales-weighted) targets, then the average emissions level across the entire New Zealand imported fleet will be 105g CO_2/km by 2025.

1.3 Approach

Scenario analysis

The preliminary CBA reveals that any household that buys a fuel-efficient and low-emission vehicle will benefit because the fuel savings are more than enough to offset any increase in upfront capital cost (hereinafter referred as price premium) of the low-emission vehicle (LEV). In per vehicle terms, on average, each purchase of a LEV that complies with the VFES could deliver a fuel savings benefit of between $4,300 and $11,200 (mid-range $6,800) over the lifetime of the vehicle. However, affording the upfront costs can be problematic, and especially for low-income households.

To understand the distributive impacts, the two main questions are:

- How will the VFES affect the price and/or availability of new or used imported ICEV vehicles in the 2020 to 2025 period?

[1] This has been referred as the "*Clean Car Standard*" in the cabinet paper and in the Consultation Document.

- What would be the likely impacts on different categories of the affected households, based on their behavioural responses to the changes in the prices or choice of imported vehicles[2], which would influence their vehicle purchasing choices in 2020-2025?

There is a lack of information on the likely behavioural responses of vehicle buyers and importers, and the flow-on impacts onto the domestic used cars market. This SIA uses a scenario analysis to understand the possible distributive outcomes of the VFES.

This scenario analysis focuses on two factors – vehicle prices and choices – and makes some assumptions about how importers might apply differential pricing strategies to rebalance profit margins so as to encourage the uptake of VFES-compliant vehicles. The scenarios provide a plausible description of the likely pathway of how vehicle prices and choices might change during the implementation period of the VFES. This SIA concludes with some suggestions for measures to speed up the transition process and to minimise any impacts or effects on low-income households[3] that might emerge.

If buyers and importers adjust their vehicle buying and selling behaviours relatively quickly and the price of EVs becomes on par with that of ICEVs, there will be no price and choice impacts. Comments received from the Motor Vehicle Industry suggested that the speed of adaptation may take at least 3-5 years and, therefore, there is likely to be a transitional period. During that transition period, average ICEV vehicle prices could be higher and vehicle choices more limited for new imports. For used imports, higher prices could emerge because of a reduced availability of older, higher- emission vehicles. This SIA uses scenarios to explore this in the absence of price and choice data. To understand the social impacts of individuals and households, this SIA mostly excludes vehicle imports purchased by companies, government and its agencies.

Based on existing vehicle purchasing patterns and light vehicle imports projections, about seven per cent of households might buy a light imported vehicle each year over the 6 years to 2025. Therefore, around 58 percent of households would not buy a light vehicle imports in the six-year transition period, and would, therefore, be unaffected by the VFES. The possible impacts on households that are likely to buy a vehicle during the implementation period (2020-2025) are represented in Table 1.

[2] Unless otherwise indicated, all analyses that look at breakdowns by household type only include light vehicle imports purchased by individuals. Over the three years to June 2018, 26% of all light vehicle imports (or 41% new and 10% used) were purchased by companies, and government or its agencies.

[3] Low-income households are classified as those with an annual equivalised disposable income which is less than 60% of the median household income (of $40,900 in 2017/18). The disposable income is "equivalised" to allow comparison across various household size and composition. In 2017/18, 60% of the median household income is $24,540 per equivalent adult. The household disposable income refers to the level of total household gross income after tax is deducted. Equivalised disposable income is the international standard income measure of inequality and hardship. It includes income from all sources such as social benefits, investment income and salary from paid employment, etc.

Table 1: Overall vehicle price and choice impacts of the VFES

	Household buys a pure electric vehicle between 2020 and 2025	Household buys a low-emission ICE vehicle between 2020 and 2025	Household buys a high-emission ICE vehicle between 2020 and 2025	Households do not buy any vehicle between 2020 and 2025
Long-term net impacts	Very large on-going fuel savings	Large on-going fuel savings	Ongoing higher fuel costs and less choice	No impact (at least 58% of households)
Transition period (short to medium term)	On-going fuel savings outweigh price premium (note)	On-going fuel savings outweigh price premium	May be slightly higher vehicle price and less choice	No impact (at least 58% of households)

Note: The term "price premium" refers to any increase in upfront capital cost of light imported vehicles.

Identifying groups of households that might be vulnerable

There are different measures to identify households that are potentially vulnerable to changes in transport-related policies (see Appendix 1 for further details). They include:

- **Income-based measures** – these are based on median, equivalised, disposable household income. Equivalised disposable income is a standard income measure of inequality and hardship[4]. It includes income from all sources such as social benefits, superannuation and salary from paid employment. Low-income households[5] make up around 24 percent of all New Zealand households. Those that might be expected to purchase a light vehicle import during the 6 years to 2025, make up around 9 percent (or 1.5 percent per year) of all households. The weakness with this definition is that it does not consider wealth and consumption and as such low income does not necessarily equate to hardship. For example, some of the low-income households may have other assets, particularly in the 65 years and above category, which could make it easier to finance a vehicle to benefit from better fuel efficiency.
- **Deprivation and hardship measures** – there are different deprivation and hardship measures, including the NZ Deprivation Index (NZDEP 2013) and DEP-17 scores developed by the Ministry of Social Development (MSD).

  Analysis based on NZDEP 2013 found an annual average of 1.4 percent of households in the most deprived areas (bottom 20 percent of all households) purchased at least one imported light vehicle during the period 2015-2018. This is very close to the estimate of 1.5 percent annual average discussed above using an income-based measure. Those that might be expected to purchase a light vehicle import during the 6 years to 2025 under this measure would make up of around 8.4 percent of all households.

[4] For example, see OECD, "What are equivalence scales?" http://www.oecd.org/els/soc/OECD-Note-EquivalenceScales.pdf.
[5] This SIA defines low-income households as those with an annual, equivalised, disposable income of less than 60 percent of the median household income (of $40,900 in 2017/18). The disposable income is "equivalised" to allow comparison across various household sizes and compositions. In 2017/18, 60 percent of the median household income was $24,540 per "equivalent adult". The household disposable income refers to the level of total household gross income, after tax is deducted.

Analysis based on MSD's DEP-17 measure found that there are 7 percent of households in material hardship[6] . Those that might be expected to purchase a light vehicle import during the 6 years to 2025 make up of around 2.6 percent of all households. This means on average households that might purchase a light vehicle import each year (during 2020-2025) and are in material hardship make up around 0.44 percent of all New Zealand households per year.

As these measures have different bases, different pictures can emerge as to what proportion of households in NZ might be affected by the standards i.e. 9 percent (income-based measure), 8.4 percent (based on NZDEP 2013) or 2.6 percent (based on DEP-17 i.e. the MSD's material hardship measure).

While the MSD's measure (DEP-17) is arguably the best measure of hardship, the SIA uses household equivalised income as an indicator of vulnerability because:

i. Income can act as a proxy for measuring the affordability of, or the ability to pay for, an increase in cost burden. In this case, there could be an increase in the prices of certain imported vehicles.

ii. DEP-17 measures have small sample sizes and therefore households cannot be disaggregated by emission band and other details to identify the impacts on households in detail. This means that we cannot disaggregate the DEP-17 measures into rural versus urban households, and other groupings such as single parent households with children. This makes it difficult to show the relative sizes of, and how, different groups of households might be affected by the policy.

1.4 Key assumptions

The key assumptions relating to the analysis undertaken for this SIA include the following.

- There is no other policy affecting the future availability of vehicle prices and choices.
- There is no economic shock (e.g. appreciation/depreciation of exchange rates) that affects vehicle prices or demand.
- Vehicle technologies continue to develop at the current rate.
- There is sufficient EV charging infrastructure to support the estimated increased uptake of EVs.

1.5 Key findings

There could be short-term impacts on the prices and choices of light vehicle but households that move to LEVs will enjoy ongoing fuel savings that outweigh any such increase.

- Vehicle prices and choices are the main influences on how car buyers behave. Fuel consumption (hence emissions performance) of a vehicle is only one factor amongst many that influence choice, and it is not necessarily the most important for many car buyers.
- In general, the prices of imported vehicles are affected by a number of factors, such as exchange rate, technological advancement and vehicle characteristics such as vehicle size, mileage and age. In addition, as vehicle buyers modify their vehicle demand (for example, vehicle downsizing can reduce emissions as well as vehicle price), the mix of vehicles to be imported will change. This will affect overall average vehicle prices across the import fleet.

[6] This refers to households with a DEP-17 score of 6 or more, i.e. households with missing 6 or more basics non-income items from a list of 17.

- Importers may apply different pricing strategies in response to the VFES. The VFES will operate as a fleet average requirement so, for example, importers might look to reduce prices of LEVs to give themselves room to import more expensive higher-emission ICEVs on which they make greater returns. Although these effects are plausible, there is not enough information to model them with any certainty.
- In an ideal situation, buyers and importers adjust their vehicle buying and selling behaviours relatively quickly and are able to source the right vehicles at the right prices. In this situation, there will be no price and choice impacts due to the policy.
- In the short-term (2020-2025), average ICEV vehicle prices could be slightly higher[7] and vehicle choices more limited for new imports. For used imports, higher average vehicle prices could emerge because of lower availability of older, higher- emission vehicles. This SIA uses scenarios to explore this in the absence of price and choice data.
- Households that are able to finance a light imported low-emission vehicle (LEV) would benefit, as the fuel savings are likely to outweigh any increase in vehicle cost. Results from the preliminary CBA indicate that each purchase of a LEV that comply with the VFES could deliver a fuel savings benefit of between $4,300 and $11,200 (mid-range $6,800) over the lifetime of the vehicle.

There are different measures of vulnerability, such as income and material hardship. The share of vulnerable households that might be affected is expected to be small (between 0.44 percent to 1.5 percent per year of all households, depending on the measures used).

- Low-income households account for 24 percent of households, but own only 18 percent of registered vehicles, and 16 percent of vehicles that entered the fleet in the three years to June 2018 (Table 15 in Appendix 3). Therefore, the share of the direct impacts of the VFES policy on low-income households would be smaller than the impacts on the remainder of households.
- On average, around 1.5 percent of all households that might purchase a light vehicle import each year (during 2020-2025) are low-income households.
- Some research argues that some of the households classified as low-income may not be considered in material hardship[8]. For example, some low-income households with members aged 65 and over may have other assets and therefore may have other options to lessen the impacts of the policy.
- Currently around 7 percent of all households are in material hardship. Analysis found that, on average, 0.44 percent of all households that might purchase a light vehicle import each year (during 2020-2025) are in material hardship.

A small percentage of low-income households that may need or wish to purchase an imported vehicle during the six years to 2025 and who may face a temporary increase in average vehicle price but some of these buyers could have strategies to mitigate or lessen the effects on them.

- Measures on material hardship has a small sample size and cannot be broken down by vehicle emission for analysing who might be affected. Therefore, this SIA used equivalised disposable income as a proxy of ability to pay to help gauge the proportion of households might be affected. It must be noted that

[7] The Australian government has investigated a 105 gCO2/km emissions standard for its vehicle fleet (DIRD, 2016). It estimated that the cost for vehicle suppliers to comply with the proposed standard could be $747 for a new conventional vehicle in 2021 and $1,582 in 2025. The cost premiums for suppliers to provide EVs and hybrids could be $9,482 in 2021 and $7,548 in 2025.

[8] Perry, B (2017), "The material wellbeing of New Zealand Households: Overview and key findings", Ministry of Social Development, Wellington.

results provided in this report are an indication of affordability based on equivalised disposable income and do not consider the impact of wealth and consumption.

- In addition, we cannot predict precisely how many households would be affected because it is uncertain how likely they are to buy a new or used imported vehicle during the implementation period (2020-2025).
- To understand the extent low-income households might be affected by the VFES, this SIA looks at the size of a set of representative household groups to give an indication of the possible size of the impacts. These include low-income households with Māori and Pasifika members, or with members aged 65 years or older or with a large number of household members.
- Based on vehicle registration projections and household data for the three years to June 2018, around 129,250 households (about seven per cent of all households) might be expected to purchase new or used imported light vehicles each year, or 42 percent of all households over the six years to 2025. This includes approximately 28,100 low-income households (1.5 percent of NZ total number of households) to be affected each year.

  In per year terms, this can be broken down into:

  - approximately 22,600 low-income households (1.2 percent of NZ total number of households) with two or more persons (There are 285,000 such households in total, 15.5 percent of all households).
  - approximately 6,000 low-income households (0.3 percent of NZ total number of households) with Māori or Pasifika members (There are 109,000 such households in total, 6 percent of all households).
  - approximately 10,230 low-income households (0.6 percent of NZ total number of households) with one or more members aged 65 years or older (There are 188,000 such households in total, 10.2 percent of all households).
  - approximately 1,860 low-income households (or 0.1 percent of NZ total number of households) consisting of one parent with dependent child(ren) (There are 47,400 such households in total, 2.6 percent of all households).
  - approximately 2,330 low-income households (or 0.12 percent of NZ total number of households) consisting of couples with three or more dependent children. (There are 20,700 such households in total, 1.1 percent of all households).

  Note that the above estimates are not additive because households can be categorised into different profiles based on their different characteristics (e.g. a Māori couple with 3 or more dependent children).
- Low-income households (and other households) have a number of options to lessen the impact of potential average price increases. These include:
  - Downsize to a smaller or different (and cheaper) vehicle type
  - Purchase a used vehicle from the domestic fleet
  - Hold on to their existing vehicle for longer
  - Switch to alternative modes of transport
  - Purchase a vehicle replacement ahead of VFES
  - Or, if the Feebate scheme is implemented concurrently, finance a light imported LEV and use the rebates to mitigate price increases.
- For those low-income households able to finance a light imported LEV they would also benefit as the fuel savings are likely to outweigh the higher initial vehicle cost by between $3,000 and $8,900 over the lifetime of the vehicle.

There could be increases in the choices of light imported vehicles with little or no difference in their prices as the market adjusts in the longer term.

- How long would it take for the market to return to equilibrium (i.e. no vehicle price or choice impact) would depend on a range of factors, some of which would be out of the control of the government. Having a better understanding of how consumers and the car industry may behave can inform policies to speed up the transition process and develop any required mitigation strategy.
- In the longer-term, the market will adjust so there could be little or no difference in vehicle prices[9] and there could be increased vehicle choices. Furthermore, all New Zealand households will ultimately benefit from the VFES as it will accelerate the replacement of the light vehicle fleet with low-emission vehicles which will reduce the overall GHG and other emissions and the associated negative impacts.

[9] Vehicle fleet modelling (this includes Vehicle Fleet Emissions Model and EV Prediction model) suggests the prices of EVs or petrol hybrid vehicles could become on par with conventional ICEVs between 2030 and 2035.

2. Background

Many countries have introduced or investigated the implementation of a Vehicle Fuel Efficiency Standard (VFES) regime to contribute their share towards meeting the global greenhouse gas (GHG) emissions reduction required under the Paris Agreement on Climate Change. These schemes legislate minimum standards for GHG emissions performance on imported light vehicles to reduce the average emissions from the light vehicle fleet.

The VFES is one of the policy options being considered as part of the Low Carbon Emissions Package that aims to reduce GHG emissions from road transport. Another policy within this Package is the Feebate scheme (also known as the *Clean Car Discount*). A discussion of the economic and social impacts of this policy is provided in the respective preliminary cost benefit analysis and social impact assessment reports. Further work is being planned to estimate the combined impact of the two measures on the emissions of the light vehicle fleet.

2.1 Policy rationale

The proposed VFES for New Zealand aims to help achieve New Zealand's GHG reduction commitment by changing the composition of the vehicle fleet towards low-emission vehicles. This policy applies a sales-weighted fuel efficiency standard of 105g CO_2/km by 2025 for all new and used light vehicles entering the fleet. Light vehicles (with GVM < 3.5 tonnes) include passenger cars, sports utility vehicles (SUVs), multi-purpose vehicles or people movers (MPVs), utes and light commercial vehicles (LCVs), including pickups and mini buses.

The VFES policy is anticipated to improve society's wellbeing owing to its potential impacts on the natural, physical and human capitals (as classified in the Treasury's Living Standards Framework) though influencing the uptake of light imported LEVs and the flow-on positive impacts on the environment (greenhouse and harmful atmospheric emissions) and mobility.

The average emissions level for the new and used light vehicles imported by New Zealand in 2018 was around 180g CO_2/km. Without the policy intervention, vehicle fleet modelling suggests that new light vehicle imports will only reach the desired target of 105g CO_2/km sometime between 2025 and 2030, with the corresponding date for used light vehicle imports being around 2035. The policy aims to bring forward this uptake by between 5 and 10 years. Doing so will reduce the fuel used by light vehicles and, thereby, reduce GHG emissions and potentially other transport-related air pollutants (TRAPs). This means that domestic used vehicle buyers will be able to purchase low-emission vehicles from the domestic fleet earlier than otherwise without the policy.

2.2 Costs and benefits of the VFES

To analyse the impacts, the CBA assumed that the VFES would gradually become more stringent until an overall imported fleet reaches an average of 105g CO_2/km by 2025. Annual sales-weighted targets will allow vehicle importers to change the composition of the imported fleet in a way that takes into account the weight of the vehicle, their average emissions and the number of units imported per year. A sales-weighted target enables those importers that currently import heavier type vehicles to be accommodated in this policy and to facilitate a smoother transition towards the standard. For a discussion of how the sales-weighted targets would work in practice, refer to the preliminary CBA or related discussion document.

Results from the preliminary CBA indicate that the policy has a BCR of between 2:1 and 6:1, with a net benefit of $1.2 to $4.7 billion[10] (2020-2041). In per vehicle terms, on average, purchases of each low-emission vehicle

[10] All the CBA estimates in dollar terms mentioned in this section are expressed in present values.

would deliver a fuel savings of between $4,300-$11,200 (mid-range estimate of $6,800) over the lifetime of the vehicle.

The policy might deliver wider societal benefits relating to health vehicle safety, or reduced congestion if some vehicle owners switch to public transport or active modes, due to changes in either vehicle price or choice because of the VFES. The CBA did not estimate the size of these benefits and, therefore, they are not the focus of this SIA.

2.3 Social and distributional impacts[11]

The Ministry's draft SIA Framework recommends that transport policies should address transport inequities that are observed in the existing distribution of transport resources (of which vehicle affordability is a key component), opportunities (e.g. access to employment), risks (e.g. to health and safety) or outcomes (e.g. observed travel patterns, and well-being). Table 2 summarises the results of the initial SIA of the VFES.

Table 2: Initial social impact assessment of the VFES

Step	Description	Analysis
Step 1	**Outline policy options**	The policy option under consideration is a VFES that applies sales-weighted average vehicle emission targets to vehicle importers based on vehicle mass for all (used and new) light vehicles (less than 3.5 tonnes) entering the New Zealand fleet from 2020. It has been assumed that the standard of 105g CO_2/km is only reached by 2025, and progressively lower sales-weighted targets are applied to each vehicle importer based on the average emissions of light vehicle imports in 2019.
Step 2	**Identify who is affected**	The policy will affect, in the first instance, vehicle buyers of imported light vehicles during the transition period (2020-2025). The average vehicle price for the same vehicle size and mass that meet the target are expected to be slightly higher, at least in the short term. Therefore, all vehicle buyers who would otherwise have bought a cheaper, high-emission vehicle would need to either pay more or downsize.
Step 3	**Identify potential positive and negative direct impacts, considering any mitigation measures to be adopted by those affected**	**Positive direct impacts that affect access to transport resources and exposure to transport risk:** • On-going reduction in fuel costs to vehicle buyers who buy a low-emission vehicle/EV (increase access to transport resources) • Long-term reduction in harmful pollutants and greenhouse gas emissions (reduce exposure to transport risk) **Negative direct impacts that decrease access to transport resources:** • Potential short-term increase in the prices of low-emission vehicles • Potential short-term increase in the prices of vehicles already in the fleet • Potential short-term reduction in choice of vehicles The timing of the impact and extent of changes will depend on behaviours of manufacturers, importers and buyers. **Mitigation measures that vehicle owners may consider to lessen any negative impacts:** • Downsize to a smaller or different (and cheaper) vehicle type • Purchase a used vehicle from the domestic fleet • Hold on to their existing vehicle for longer • Switch to alternative modes of transport • Purchase a vehicle replacement ahead of VFES • Or, if the Feebate scheme is implemented concurrently, finance a light imported LEV and use the rebates to mitigate price increases.
Step 4	**Consider pathways to impact**	• VFES could restrict the choice and raise the average prices of both new and used imports. • In the short term, the price of imported vehicles could potentially increase and/or the choice of vehicle models could reduce. • Emissions of GHG and other TRAP will gradually decrease over time as more LEVs enter the fleet. • In the medium to long terms, vehicle prices and choices are expected to adjust with minimum impacts.

[11] Unless otherwise indicated, the distributional impact analysis refers to imported vehicles purchased by individuals.

Step	Description	Analysis
Step 5	**Outline potential distributional impacts**	• In the short term, only households that are able to pay the upfront premium for low-emission vehicles will benefit directly from the policy. • Households that are vulnerable to cost increases are more likely to buy a second-hand vehicle from the fleet rather than pay a higher price. • There are, however, some potential positive wider social impacts, such as health and safety and affordability considerations for vulnerable groups that switch to public transport, active modes, or ride-sharing.
Step 6	**Decision to proceed with detailed assessment**	• Since the VFES is expected to result in social impacts, at least in the short term, a more detailed analysis is warranted to assess the nature and significance for vulnerable groups. • Further analysis of the impacts on vehicle owners who do not switch to low-emission vehicles could be justified when more information on the likely behavioural change becomes available, or is revealed during policy consultation or implementation.

Households that need to buy a vehicle during the implementation period may experience both direct and indirect impacts. However, around 58 percent of households that would not need to or wish to purchase an imported vehicle during the implementation period would not be affected. The direct impacts refer to the potential changes in vehicle purchasing price and vehicle choices. The indirect impacts refer to any flow-on impacts to the domestic used car market (both on price and volume) if prospective buyers of imported cars decide to keep their existing vehicle for longer.

The lack of information on how car purchasers may respond to price and choice changes makes it difficult to draw clear conclusions on how the impacts of the VFES will be distributed amongst various households. This SIA, therefore, uses a scenario approach, analysing four scenarios based on findings from Australia and the European Union and a combination of possible vehicle price and choice responses to the VFES. The aim of this SIA is mainly to highlight the size and incidence of the social impacts of the policy change. This might be useful to identify the potential need for and focus of any mitigation measures.

This report is organised as follows.

- Section 3 summarises the data on new and used light vehicle imports, and the domestic used car market.
- Section 4 describes the scenario analysis and summarises the results.
- Section 5 provides information on who buys these vehicles and identifies the population segments that would be most vulnerable to the policy change.
- Section 6 discusses the limitations of the analysis and summarises the key findings.
- The Appendices include a range of supporting analyses or information.

3. Vehicle imports and the market for used vehicles already in the fleet

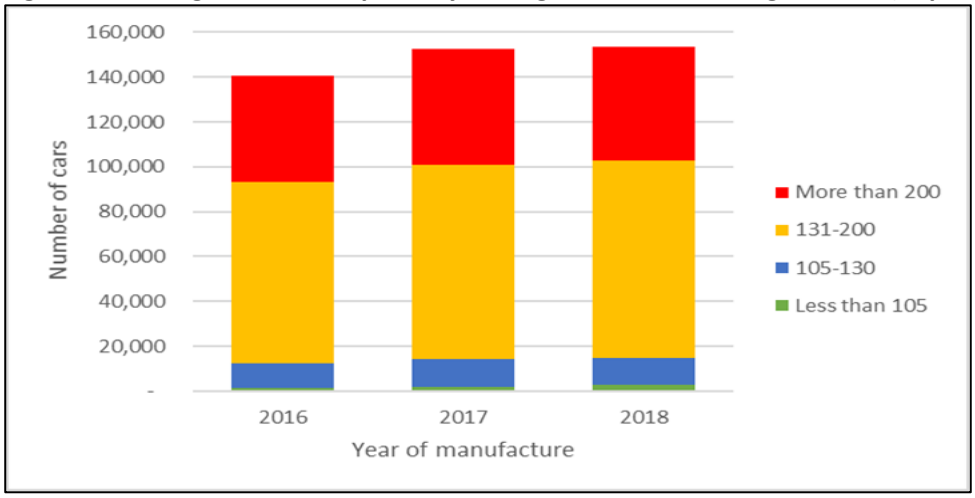
This section explains the emissions performance of New Zealand's light vehicle fleet and explores the possible price and availability impacts of a VFES.

3.1 Carbon dioxide emissions of the imported fleet

The average CO_2 emissions level of all new-to-the-fleet light vehicles imported in New Zealand between 2016 and 2018 was around 180g CO_2/km. Of these, only 5.2 per cent emitted less than the proposed standard of 105g CO_2/km (Source: Motor Vehicle Registry).

The average emissions of new light vehicles imported in 2016-2018 is shown in Figure 1 below. It indicates that only a small proportion (1.4 per cent) of the nearly 500,000 new light vehicles imported since 2016 had an emissions level below the proposed VFES of 105g CO_2/km. Vehicles falling within this emissions band include EVs, plug-in hybrids and some low-emission ICEVs. The majority (just under two thirds) of the new vehicles imported had emissions between 106g CO_2/km and 200g CO_2/km and the remainder had emissions greater than 200g CO_2/km.

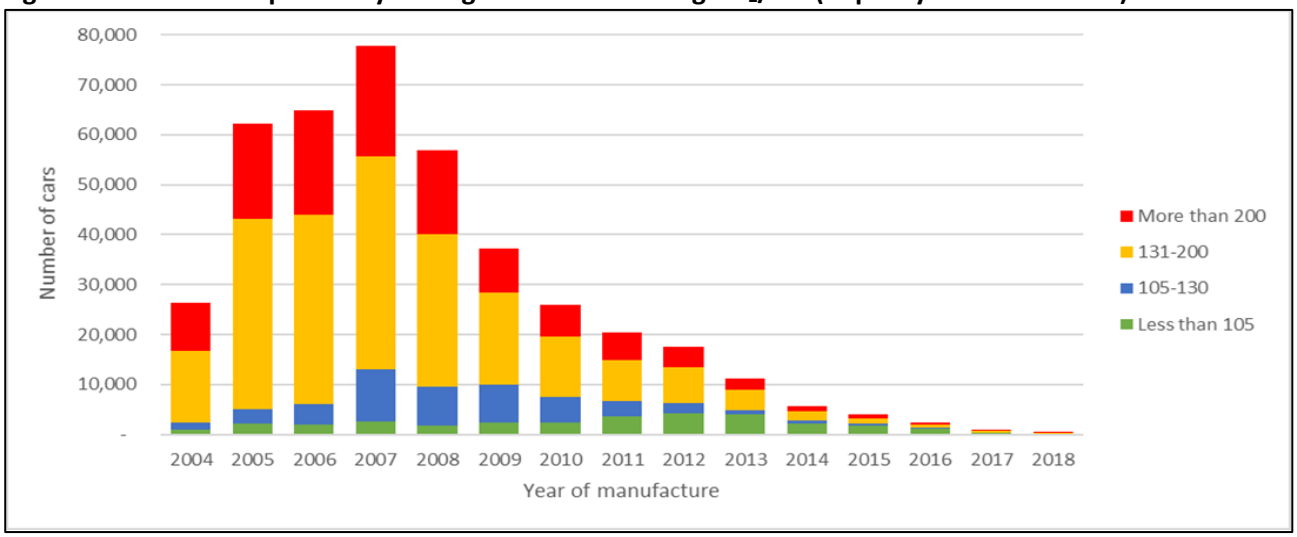
Figure 1: New light vehicle imports by average emissions band g CO_2/km (import years 2016-2018)



Source: Ministry of Transport, based on Motor Vehicle Registration statistics

Figure 2 shows the distribution of used car imports (2016 to 2018) by average emissions band. It shows that a large proportion of used car imports are older vehicles (manufactured before 2008), which tend to emit higher levels of CO_2. It shows that there is a larger proportion of used vehicle imports with average emissions below 105g CO_2/km compared with those of new vehicle imports (7.6 per cent versus 1.4 per cent). Looking exclusively at used vehicles first registered in New Zealand in 2018, 14,174 (10.6 per cent) emitted less than 105g CO_2/km. A large number (3,602) of these were electric vehicles. Of these electric vehicles, 93 per cent were Nissan Leaf models.

Figure 2: Used cars imported by average emissions band g CO_2/km (import years 2016–2018)



Source: Ministry of Transport, based on Motor Vehicle Registration statistics

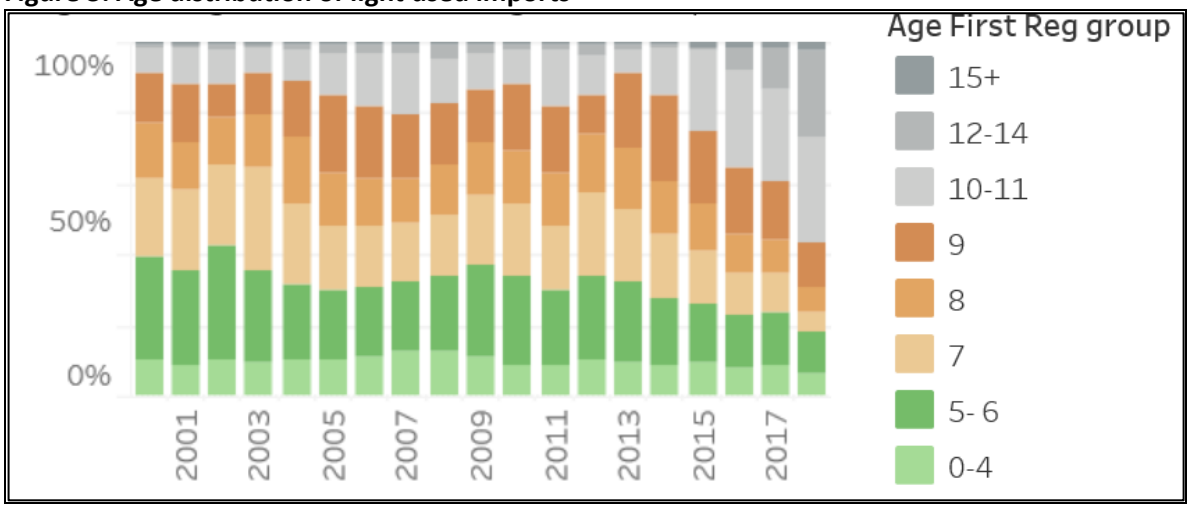
3.2 Vehicle prices and choices

The VFES works by increasing the proportion of low-emission vehicles that are imported and reducing the proportion of higher-emission vehicles, mostly ICEVs. This change may lead to an increase in vehicle price, especially during the initial years of the VFES intervention period.

Prices for vehicles are affected by a number of attributes such as vehicle type and engine power. Holding everything else constant and based on the evidence overseas (OECD/IEA 2019) (see Table 4), the average prices of low-emission vehicles may be higher than high-emission vehicles, at least in the short term. The Ministry expects this to be the case for some years until the price of EVs reaches parity with ICE vehicles. The key reasons are as follows.

- To reduce the average emissions level of vehicles entering the fleet, the share of low-emission vehicles will need to increase. These vehicles, especially EVs, are generally more expensive than high-emission conventional vehicles of similar size and type.
- Figure 3 shows the share of used light vehicle imports older than 10 years has increased over the past few years. In 2018, vehicles older than 10 years accounted for over 57 per cent of the total number of used light vehicle imports. For the emissions target in the VFES to be met, fewer of these vehicles will be able to be imported. Buyers of used imports will need to purchase newer vehicles which typically cost more.
- There is currently a limited number of low-emission vehicle makes and models available in New Zealand with a larger seating capacity. Unless importers start to import other variants, such as petrol hybrids that are available in other markets, the variety of such vehicles is likely to be limited in the short term.
- It is more difficult to improve the fuel efficiency of vehicles with significant towing capacity, as these vehicles tend to be heavier. While there are equivalent hybrids or EVs, these vehicles are likely to be more expensive being mostly available as new or near new models rather than as older used vehicles.
- If vehicle buyers react to the proposals by keeping their vehicles for longer, or purchasing a second-hand vehicle in the domestic market, this could reduce choice and raise the price of vehicles in the domestic used market as the demand will rise but the supply will fall.

Figure 3: Age distribution of light used imports

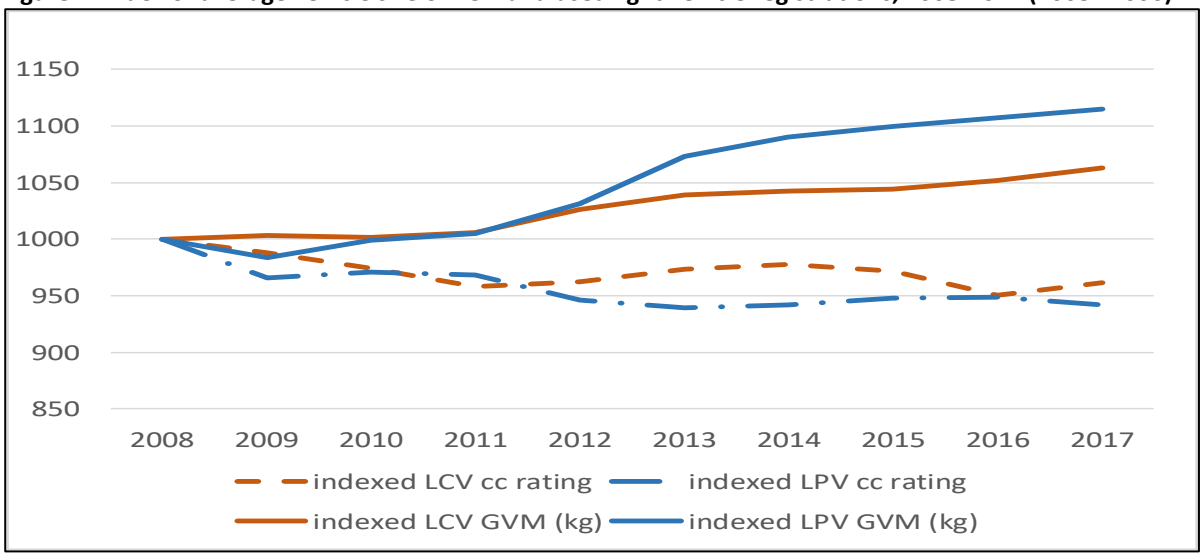


Source: Ministry of Transport, Quarterly Fleet Statistics (March 2019)

The extent of the price change is uncertain. It will depend on (i) the mix of vehicle types, makes and models that are available for sale; (ii) the marketing and pricing strategies adopted by importers to their maximise profits while meeting the sales weighted emissions target; and (iii) the willingness for car buyers to change behaviours (e.g. vehicle downsizing or switching to alternative modes).

In recent years, there has been an increasing uptake of large and heavier vehicles (particularly light passenger vehicles) (Figure 4). This trend needs to be urgently addressed. Since larger vehicles and those with a higher power rating tend to be more expensive[12], car buyers who choose to downsize (either based on engine power, vehicle weight, type or footprint) should be able to enjoy lower vehicle prices and fuel costs while reducing the external cost of vehicle emissions.

Figure 4: Index of average vehicle size of new and used light vehicle registrations, 2008-2017 (2008 =1000)

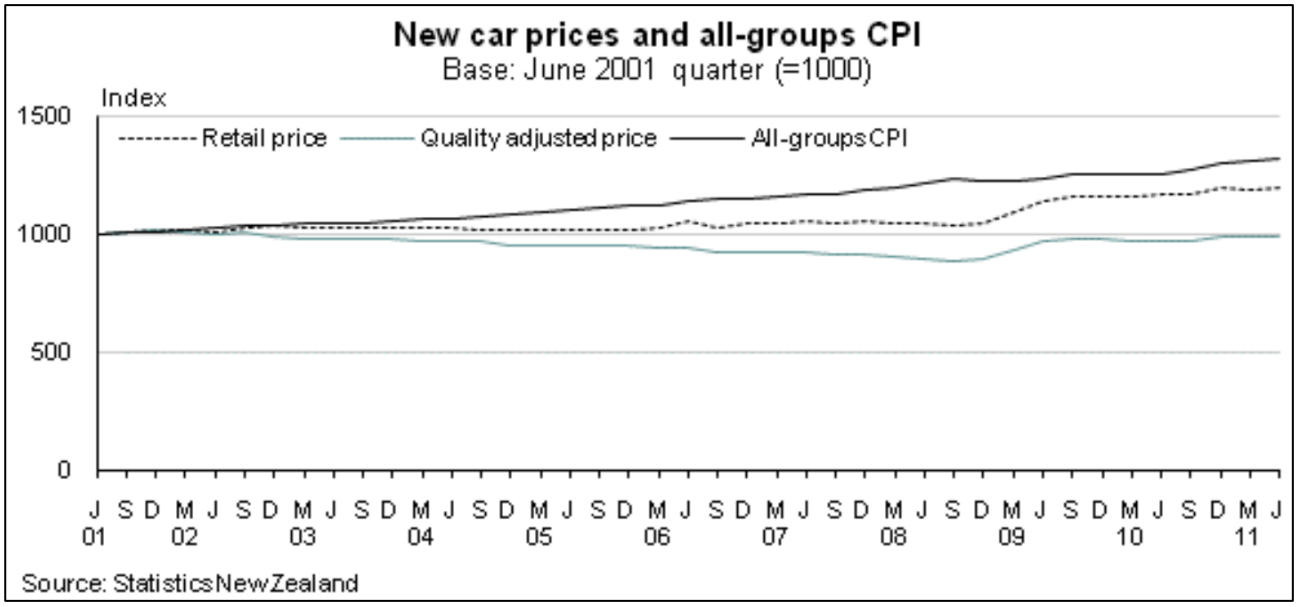


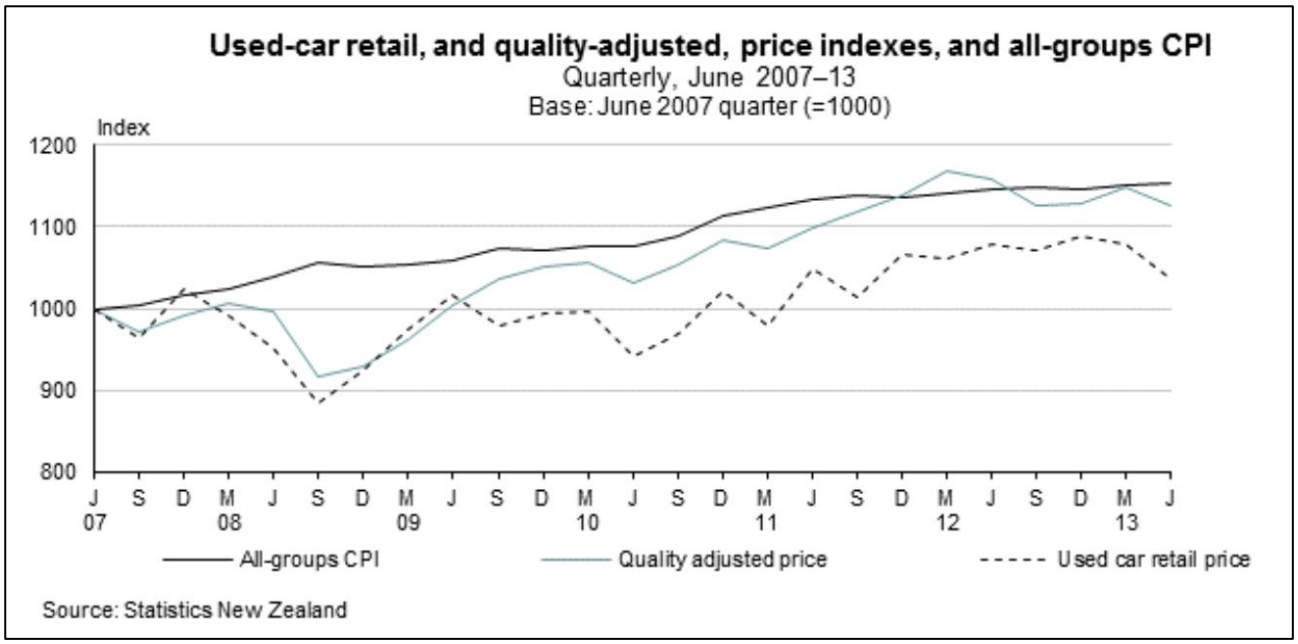
LCV = light commercial vehicles; LPV = light passenger vehicles; GVM = gross vehicle mass.
Source: Ministry of Transport, based on Motor Vehicle Registration statistics

[12] OECD/International Energy Agency (IEA), 2019, *Fuel Economy in Major Car Markets: Technology and Policy Drivers 2005-2017*, Paris.

However, car prices are also influenced by other external factors such as the exchange rate and technological development. Anecdotal evidence suggests new car retail prices have stayed roughly the same over time despite quality improvements. Figure 5 shows the quality-adjusted (i.e. holding vehicle characteristics such as vehicle mileage, features and age constant) price of new cars[13] compared with all items in the CPI between 2001 and 2011. The CPI has grown by roughly 30 percent in that time, whereas the retail prices of new cars has grown only by around 20 percent and no change in the quality-adjusted new car price. A similar comparison for used car prices (2001 to 2013)[14] are 15 percent increase in CPI, 5 percent in retail used car prices and 12 percent in quality-adjusted used car prices.

Figure 5: New and used car prices and all group consumer price index





[13] http://archive.stats.govt.nz/browse_for_stats/economic_indicators/prices_indexes/new-car-prices.aspx
[14] http://archive.stats.govt.nz/tools_and_services/newsletters/price-index-news/oct-13-used-car-market.aspx

Due to the lack of more recent data (since Statistics New Zealand does not normally develop and publish retail car prices), it is not appropriate to make any conclusion or forecast of future car prices without analysing any changes in vehicle quality or characteristics. Apart from a potential step change in technological requirement, the VFES might also affect car prices due to changes in vehicles availability. The following sections discuss the interaction between prices and availability in more detail.

Car prices for new imports

There are two sources of information to help gauge how vehicle prices might change during the VFES implementation period. One is based on experience from countries with similar schemes. Another is based on a study of the impacts of a VFES in Australia. These are briefly explored below.

An official evaluation of the 130g CO_2/km standard implemented in the European Union (EU) found a relatively insignificant impact on vehicle production costs incurred by manufacturers [15]. Nonetheless, New Zealand's proposed VFES will likely to have a different impact as observed in the EU due to significant structural differences between the New Zealand and EU vehicle markets. For example:

- EU manufacturers were assumed to absorb part of these costs rather than passing them onto consumers in the price. In addition, they were given fairly long lead times to allow them to adapt their vehicle ranges to the standard, with the announcement in 2009 for implementation by 2015.
- Unlike the EU, New Zealand does not have any local vehicle manufacturing and, therefore, imports all of its vehicles. In the EU, only 19 percent of all light vehicles entered the fleet annually are used. However, the share in New Zealand is 55 percent[16].
- The EU standard applied to new cars only, whereas here it will apply to both new and used imports.
- The EU standard was less of a change. When the EU announced a 2015 VFES target of 130g CO_2/km, the average emissions of new vehicles was around 146g CO_2/km (Source: European Environment Agency[17]) and reached 120g CO_2/km by 2015. This represents an improvement of 26g CO_2/km over four years, compared with the required 70g CO_2/km reduction in New Zealand over six years (assuming announcement of policy in 2020 and implementation of the target by 2025).
- Due to the popularity of large SUVs and utes (pick-up trucks) in New Zealand, the average efficiency of the New Zealand light vehicle fleet is notably worse than that of the EU. In 2017, new vehicles in the EU emitted 119g CO_2/km[18] on average, partly owing to the EU standard, versus 180g CO_2/km for new vehicles in New Zealand. Table 3 below shows the most popular vehicles in New Zealand, Australia, Japan and the EU in 2017.
- There are some additional flexibilities and allowances that are available to manufacturers in the EU targets that will not be replicated in the New Zealand VFES. For example, manufacturers earn "super credits" on EVs, so a manufacturer gets credit for one extra EV and this will rise to two by 2020, and then fall back to one by 2023. There are also flexibilities for "eco-innovations", which deliver CO_2 savings on the road (e.g. solar sunroofs and LED headlights).

[15] Gibson, G et al, 8th April 2015. Evaluation of Regulations 443/2009 and 510/2011 on the reduction of CO_2 emissions from light-duty vehicles: Final Report.
[16] Mehlhart, G, Merz, C, Akkermans, L and Jordal-Jorgensen, J (2011), "European second-hand car market analysis", Oko-Institute e.V., Germany, https://www.oeko.de/oekodoc/1114/2011-005-en.pdf (accessed on 27/2/2019).
[17] The current average emissions target for EU is 95 gCO_2/km by 2021. https://www.eea.europa.eu/data-and-maps/indicators/average-co2-emissions-from-motor-vehicles/assessment (accessed on 1/3/2019)
[18] ICCT (2019), "CO_2 emission standards for passenger cars and light-commercial vehicles in the EU", WWW.THEICCT.ORG.

Table 3: Vehicle popularity – New Zealand, Australia, Japan and Europe (2017)

	New Zealand	Australia	Japan	Europe
1	Ford Ranger	Toyota Hilux	Toyota Prius	Volkswagen Golf
2	Toyota Hilux	Ford Ranger	Nissan Note	Renault Clio
3	Toyota Corolla	Toyota Corolla	Toyota Aqua	Volkswagen Polo
4	Toyota RAV4	Mazda 3	Toyota C-HR	Ford Fiesta
5	Holden Colorado	Hyundai i30	Honda Freed	Nissan Qashqai
6	Mitsubishi Triton	Mazda CX-5	Honda Fit	Peugeot 208
7	Kia Sportage	Mitsubishi Triton	Toyota Sienta	VW Tiguan
8	Mazda CX-5	Nissan X-Trail	Toyota Vitz	Opel / Vauxhall Corsa
9	Nissan Navara	Hyundai Tuscon	Toyota Voxy	Skoda Octavia
10	Toyota Hiace	Volkswagen Golf	Nissan Serena	Opel / Vauxhall Astra

Note: Shaded cells indicate vehicle makes and models that are common to New Zealand.
Sources:

- New Zealand https://www.stuff.co.nz/motoring/news/100417840/most-popular-nz-car-for-2017-still-a-truck (accessed on 1/3/2019).
- Australia https://www.carsales.com.au/editorial/details/top-10-selling-vehicles-of-2018-116216/ (accessed on 28/2/2019)
- Japan https://www.best-selling-cars.com/japan/2017-full-year-japan-best-selling-car-models-mini-cars/ (accessed on 1/3/2019)
- Europe https://www.best-selling-cars.com/europe/2017-full-year-europe-top-selling-car-models/ (accessed on 1/3/2019)

Vehicles with petrol engines are typically the cheapest option to purchase, but they have high level of GHG emissions (OECD/IEA, 2019). Vehicles with diesel engines, hybrids and EVs offer improvements in fuel economy, but these vehicle powertrain models typically come with a price premium. The OECD/IEA report[19] compared fuel economy and vehicle price by vehicle size and power in the advanced and emerging economies. They found vehicles with diesel engines have better fuel economy but come with a slight price premium (and a higher level of harmful emission per litre of fuel consumed). They also found hybrid vehicles are not always more expensive than diesel counterparts but these vehicle deliver better fuel economy performance (Table 4).

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)

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:

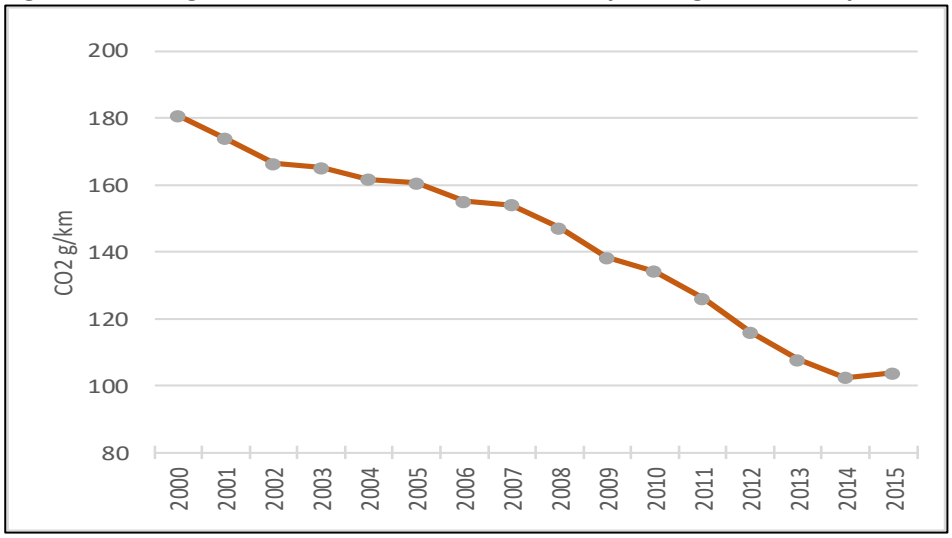
- The average CO_2 emissions of a new light vehicle imported into Australia (at 172g CO_2/km in 2017) was close to that of New Zealand (at around 180g CO_2/km)[20].

[19] OECD/International Energy Agency (IEA), 2019, *Fuel Economy in Major Car Markets: Technology and Policy Drivers 2005-2017*, Paris.
[20] National Transport Commission (NTC) (2018), "Carbon dioxide emissions intensity for new Australian light vehicles 2017: Information paper June 2018, National Transport Commission, Australia https://www.ntc.gov.au/Media/Reports/(F4FA79EA-9A15-11F3-67D8-582BF9D39780).pdf (accessed on 28/2/2019).

- 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 CO_2/km.
- Australia will no longer have any local vehicle manufacturing and, like New Zealand, will need to rely on importing vehicles from other countries.

In addition to the above, the source of vehicles is also an important influence. In 2017, around 70 per cent of new light vehicles that entered the New Zealand fleet were sourced from Japan. The average emissions of new light vehicles manufactured and registered in Japan after 2014 already met the proposed standard (Figure 6). On average, new light vehicles manufactured and registered in Japan since 2000 had better emissions performance than the average New Zealand fleet right now. As the vehicle makes and models that are typically purchased in Japan are different from those in New Zealand (Table 3), the average emissions of New Zealand's new imports are 70g CO_2/km higher (due to larger vehicle size). When the VFES comes into force, some vehicle purchasers may change their purchase decisions by either downsizing or switching to EVs. In either situations, there will be a reduction in choice. For those choosing to downsize, there might be a reduction in price but for those switching to EVs there would be a price premium.

Figure 6: Average CO_2 emissions of domestic new passenger cars in Japan 2000-2015 (test cycle-based)



Source: Japan Automobile Manufacturers Association (2017)[21]

New EV prices

Infometrics estimates that the effective price difference between a battery EV and a petrol ICEV is around $8,000 without the VFES policy.[22] 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.

[21] Japanese Automobile Manufacturers Association (2017), *The Motor Industry of Japan 2017*, Japan.
[22] From work commissioned to Infometrics (on 1/3/2019) based on provisional estimates from the recently updated but unpublished EV projection model.

The VFES could also reduce EV prices and increase ICEV prices in some theoretical scenarios. For example, importers might reduce the price of EVs (to encourage uptake and enable them to get under the VFES target) and increase the prices for high-end ICEVs on which they make more money.

Car prices for used imports

In 2017, over 95 percent of used light vehicle imports were sourced from Japan, with an average age of 9.7 years and average emissions of 177g CO_2/km. A ten-year-old used light passenger car imported from Japan today on average emits around 140g CO_2/km. If New Zealand import similar mixes of vehicles as those registered in Japan, to purchase vehicles that emit less than 105g, on average the vehicles would need to be manufactured after 2014 (roughly ten years old by 2025). However, in 2018, about 57 per cent of used light vehicles imported were older than ten years, and 26 per cent were older than 12 years. If preferences for vehicle age remains the same, then by 2025 some car purchasers who would have bought vehicles more than 10 years old may need to buy cars that are less old.

For example, it costs between $600 and $1,300 more to purchase a ten-year-old vehicle compared with an 11-year-old vehicle, increasing to between $2,500 and $5,000 extra compared with a 15-year-old vehicle. Buyers might respond to any price increase by changing their behaviour, e.g. replacing their vehicles with one already in the fleet, or postponing the purchase. However, by 2030, the average emissions of used vehicles imported from Japan would have met the proposed target (without the VFES) since new vehicles registered in Japan from 2014 would have an average emissions of 105g CO_2/km or less.

Evidence obtained from Trade-Me vehicle sales data[23] shows petrol-powered vehicles were by far the most popular in the vehicle sales (86 percent of sales) through Trade-Me. Petrol vehicles tend to be cheaper with the average vehicle price for petrol-powered vehicles (around $6,000) around 40 percent lower than that of diesel vehicles (around $10,000) of the same vehicle segment (i.e. by body type such as SUV vs hatchback) (Table 5). They also tend to be older and have a higher CO_2 emission than the diesel counterparts. However, further analysis is needed to control for differences in vehicle characteristics to better understand how specific attributes (e.g. engine size or emissions) influence price.

Table 5: Average vehicle sales price for vehicles sold on Trade-Me (between Feb 2017-Feb 2019)

Selected vehicle segment with sufficient sales data	Petrol-powered vehicles			Diesel-powered vehicles			Price difference – petrol vs diesel (%) (note 3)
	Average vehicle sales price	Average CO_2 emission g/km	Average vehicle age	Average vehicle sales price	Average CO_2 emission g/km	Average vehicle age	
Hatchback	$4,348	165.1	14.8	$5,199	148.3	10.5	-16%
Recreational vehicles and SUV	$8,320	238.2	23.8	$15,786	232.2	16.8	-47%
Sedan	$3,877	216.7	14.6	$7,859	170.8	12.4	-51%
Station Wagon	$3,863	212.6	17.5	$8,655	208.8	19.1	-55%
Ute	$8,446	263.6	16.6	$21,645	240.0	13.6	-61%
Van	$5,956	245.3	22.4	$8,392	233.8	16.5	-29%
All body type (note 2)	**$6,046**	**223.1**	**20.3**	**$10,334**	**208.6**	**15.6**	**-41%**

Notes:

1. The Trade-Me data includes vehicle makes and models currently available in New Zealand, as a result there is not enough sales data on low-emission vehicles less than 105g CO2/km by vehicle segment to understand any price differential between emission levels and fuel types for such vehicles.
2. Includes Convertibles, Coupe and other (but non-specified) vehicle types.
3. A negative value represents a lower sales price for petrol-powered vehicles.

[23] The Trade-Me sales data covers the period from 1 February 2017 to 28 February 2019 and includes 92,908 vehicle sales records. Of these, around 48,241 has information on CO_2 emission, vehicle sales price, vehicle body type and fuel type. This dataset includes both used vehicles sold by private owners (59%) and vehicle dealers (41%).

4. Assessment of wider social impacts – scenario analysis

This section first discusses the likely behavioural responses of vehicle suppliers and buyers as a result of possible changes in vehicle prices and choices. A discussion on scenario analysis follows. The scenario analysis uses different combinations of vehicle price and choice assumptions to ascertain the likely impacts of the VFES.

4.1 Behavioural response of vehicle suppliers and buyers

The proposed VFES is expected to lead to changes in the composition of the imported vehicle fleet by favouring those with low or zero emissions. During the implementation period (2020-2025), the VFES could potentially have impacts on the price and availability of imported vehicles. The magnitude of these impacts will depend on how buyers will respond to changes in the market and how each importer chooses to adapt its fleet in response to demand and their respective emissions target.

The potential behavioural responses of importers include the following.

- Promote low-emission vehicles more aggressively.
- Reduce the selling margins on low-emission vehicles.
- Restrict the supply of vehicles with high emissions.
- Raise the prices of vehicles with high emissions.
- Cooperate with other importers to mutually reach their VFES targets.

On the other hand, there are strategies that households can adopt to minimise any cost impact on them:

- Purchase a replacement ICE vehicle before the start of the implementation period and keep the vehicle for a few years until the price premium has eventually dropped.
- Downsize to a smaller or different type of vehicle (which potentially costs less and has on-going fuel savings).
- Replace their vehicle from the domestic fleet.
- Keep their existing vehicle for longer.
- Switch to other modes such as public transport and ride shares.
- Or, if the Feebate scheme is implemented concurrently, finance a light imported LEV and use the rebate to mitigate price increases.

By an iterative process, these behavioural responses will influence the types and price of vehicles imported into New Zealand to correspond with the changes in consumer demand for vehicles that would be prompted by the VFES. Changes in demand for imported light vehicles will have an impact on the demand for vehicles already in the fleet, as these are substitutable (to a varying degree) for new and/or used imports. How these vehicle-purchasing decisions will be affected is highly uncertain, particularly during the transition period (2020-2025).

After the transition period, it is expected that the market for new and used vehicle imports will gradually reach a new equilibrium – one with a larger variety of low-emission vehicles and possibly at no change in vehicle prices. In the longer term, the low-emission ICEVs and petrol hybrids/EVs are expected to reach price parity with their high-emission counterparts[24]. This will lessen the indirect price effects on vehicles already in the fleet, as more low-emission vehicles are gradually resold into the domestic used vehicles market.

[24] Vehicle fleet modelling (including the Vehicle Fleet Emissions Model and the EV Uptake model) suggests the prices of EVs or petrol Hybrid vehicles could reach price parity with other conventional ICEVs between 2030 and 2035.

4.2 Price-choice scenarios

The impact on the variety of makes and models that importers make available to the New Zealand market is highly uncertain. A sales-weighted target should allow vehicle importers to continue providing their existing vehicle line-ups, except that a significant increase in the number of low-emission vehicles would be required with corresponding decrease in high-emission vehicles. Therefore, vehicle importers will likely limit the numbers of high-emission vehicles they import.

Given the high level of uncertainty in the expected market changes during the transition period, four scenarios were developed to gauge how households might respond to potential increases or decreases in vehicle prices and choices caused by the VFES. These four scenarios are illustrated in Table 6.

Table 6: Price-choice scenarios

Scenario	Explanation
A Price increases Choice decreases	Low-emission ICEVs, hybrids and EVs are more expensive than their high-emission vehicles (HEV) due to a range of reasons outlined in Section 3.
B Price increases Choice decreases slightly	In the immediate years after the VFES target is attained, vehicle importers would have had sufficient time to adjust their imported fleet and would have reached the right balance between the heavier HEVs and the smaller LEVs. A wider selection of hybrid and pure electric vehicles could also possibly be made available by most importers. In this scenario, vehicle price for zero or low-emission vehicles could decline substantially by the end of the target period but might not yet be on par with the high-emission counterparts.
C Price increases slightly Choice decreases	The scenario represents the case where importers have difficulty sourcing enough varieties of both new and used low-emission vehicles, but those varieties that they can supply are not much more expensive than the current mix of imported vehicles. The combination of these changes results in a smaller choice of vehicle models that are imported but where the price premium of imported, low-emission vehicles is small (or even negative), so they would be more affordable to vehicle buyers, including lower-income households.
D No price or choice impacts	This scenario may better reflect the medium- to longer-term outcome of the VFES policy if importers apply price strategy to rebalance profit margins. In the longer term, it is expected that prices of EVs will reach parity with comparable ICEVs without government intervention. In other words, technological developments, particularly in EV technology and battery capacity, and market forces would bring the prices of these vehicles down to a more affordable range for medium- and low-income households.

4.3 Results of the price-choice scenarios

To illustrate the likely impacts of the VFES on different users, it is necessary to obtain a picture of the share of vehicles by vehicle type (EVs, low-emission ICEVs, hybrids, performance ICEVs and other ICEVs) for different price and choice scenarios. These scenarios vary by the degree to which importers may apply pricing strategy to influence demand (e.g. reduce the price premium of low-emission vehicles and increase the price of high-emission vehicles to shift their demands).

In the longer term, most vehicle buyers will benefit from switching to low-emission ICE vehicles or EVs and will enjoy on-going fuel savings from those vehicles. For car buyers who continue buying high-emission vehicles, they will face higher cost due to fuel and potential higher vehicle prices due to reduced choices (Table 7). Scenario D represents such a long-term scenario.

Table 7: Overall vehicle price and choice impacts of the VFES

	Household buys a pure electric vehicle between 2020 and 2025	Household buys a low-emission ICE vehicle between 2020 and 2025	Household buys a high-emission ICE vehicle between 2020 and 2025	Households do not buy any vehicle between 2020 and 2025
Long-term net impacts	Very large on-going fuel savings	Large on-going fuel savings	Ongoing higher fuel costs and less choice	No impact (at least 58% of households)
Transition period (short to medium term)	On-going fuel savings outweigh price premium	On-going fuel savings outweigh price premium	May be slightly higher vehicle price and less choice	No impact (at least 58% of households)

During the transition period, however, there are likely to be impacts on vehicle price and choice. Results of the assessment are summarised in Table 8. It shows the likely required mix of vehicles by vehicle type to achieve an overall sales-weighted average emission of 105g CO_2/km. The modelling work completed looks into the vehicle mix by 2025. Hence, the results presented is an annual figure for 2025. The uptake requirements in earlier years will be lower as the targets will be less stringent.

A comparison of the results between Scenarios A and B with that of Scenarios C and D shows that, with lower average cost of new imported vehicles, uptake of EVs will increase, which will reduce the share of low-emission ICEVs required. Factors that affect EVs uptake include older generation EVs have a lower driving range, a shorter expected battery life but a relatively high price premium compared with an equivalent ICEV. However, over time (post 2025) when the new generation of EVs starts to enter the used imports market, their uptake will increase more sharply.

The extent to which importers can successfully rebalance the profit margin to achieve a profit neutral position is uncertain. Any price increases are likely to be imposed on the segments of population that have low price sensitivity, such as those preferring performance vehicles and high-end luxury vehicles. In reality, there could be different levels of pricing for different market segments. The key results are that the average prices of EVs, low-emission ICEVs and hybrid vehicles would reduce but that of other ICEVs would become more expensive.

Table 8 shows that while the uptake of hybrids, EVs and other low-emission vehicles will need to increase substantially, between 30 percent and 40 percent of the imported fleet could still be made up of high-emission vehicles (such as SUVs, performance or sports vehicles, people movers, and multi-purpose vehicles). To minimise the distributional impacts, it is important to ensure large, low-income households and those located in rural[25] communities or on the outskirts of cities and towns have the ability to buy the larger vehicles they might need without large change in vehicle prices. Estimates suggest during the three years to June 2018, approximately 12 percent of total number of vehicles were purchased by households reside in rural area (see Table 16 and Table 17 in Appendix 3). Over the same period, the share of vehicles purchased by low-income rural households was estimated at around 2 percent.

[25] According to Statistics New Zealand, rural areas are separately classified according to the varying influence of nearby urban areas. It consists of rural areas with high urban influence, rural areas with moderate urban influence, rural areas with low urban influence and highly rural/remote areas.

Table 8: Potential results of the VFES

Scenario • **Price for low-emission vehicles** • **Vehicle choices**	**Plausible uptake of pure battery EVs (with an average emission of 25g CO_2/km)**	**Uptake of low-emission ICEVs or hybrid vehicles required (with an average emission of 65g CO_2/km)**	**Availability of high-emission ICEVs (performance ICEVs or large-size ICEVs) (with an average emission of 180g CO_2/km)**
A • Price increases • Choice decreases	• 15% to 20% • At a high price premium • Choices limited	• 40% to 55% • At a moderate price premium • Choices limited	• 30% to 40% still be available • Choices limited
B • Price increases • Choice decreases slightly	• 20% • At a high price premium • Choices available	• 35% to 50% • At a moderate price premium • Choices available	• 30% to 40% still be available • At a moderate price premium • Choices limited
C • Price increases slightly • Choice decreases	• 30% • At a moderate price premium • Choices limited	• 30% to 40% • At a moderate price premium • Choices available	• 35% to 45% still be available • At a high price premium • Choices limited
D • No price or choice impacts	• 30% • No price or choice impacts	• 25% to 30% • No price or choice impacts	• 40% to 45% still be available • No price or choice impacts

Note: Refer to Appendix 2 for information on key assumptions used in the scenario analysis.

Company- or government-owned vehicles

Company-owned or government owned vehicles can be affected in two different ways.

- For buyers of light vehicle imports that decide to switch to EVs or low-emission ICEVs, there will be a price premium. This represents a cash flow impact as the fuel savings from switching should be able to repay the upfront cost relatively quickly since they tend to do more mileage. Nevertheless, the size of the cash flow impact could be a deterrent.
- For those that cannot source a low-emission light vehicle imports that meets their operational needs, they would need to buy a more expensive version that does (assuming that importers apply some level of price rebalancing strategy) but potentially with reduced choice.

There are advantages to encouraging businesses to adopt zero or low-emission vehicles because business vehicles tend to have a higher turnover rate. Therefore, an increased uptake by these users should speed up the replacement of the vehicle fleet.

Medium- and high-income earners

Although the VFES could affect a small proportion of low-income households as they are more vulnerable to cost increases, the VFES requires a large proportion of households (many would be medium- and high-income earners) to change their purchase behaviour in order to ensure the vehicle fleet is gradually replaced with low-emission vehicles. Targeting advertising campaigns and provision of information (e.g. around the net

benefit of switching to low-emission vehicles) to medium- to high-income earners will help to encourage such a behavioural shift.

High-income earners are typically early adopters of new technologies (e.g. Figure 9 in Appendix 3 shows high-income earners tend to buy a larger share of new vehicles). Therefore, they will benefit from fuel savings by buying low-emission vehicles even without the VFES. As such, the impacts on high-income earners are likely to be minor relative to their ability to pay and lifestyle choices.

4.4 Likely pathway of how buyers and importers would respond to the VFES

Although the starting point for the scenario analysis was to understand the likely impacts with different price and choice responses, 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**. Another likely scenario is for price to adjust (fall) first – i.e. Scenario C. It is difficult to predict which of the two medium-term scenarios will prevail. It is likely to be a price-choice race between importers with the equilibrium hopping between Scenarios B and C. However, Scenario C is highly likely for used imports and new imports if importers rebalance their profit margins between vehicle types.

In the **longer term**, EVs and ICEVs will reach price parity and battery technology will mature such that the uptake of EVs will increase sharply. However, to achieve this longer-term outcome, manufacturers, importers, and consumers need to be persuaded to change their behaviours. The VFES plays an important role to provide these actors a signal on the importance of their actions and the overall net financial benefits of behavioural changes to the vehicle owners as well as to the wider benefits to the society.

5. Who could be affected?[26]

This section looks into the characteristics and size of selected household profiles based on Treasury's analysis using administrative data available in Statistics New Zealand's Integrated Data Infrastructure (IDI). The analysis provides information to help ascertain who might purchase imported light vehicles during the VFES implementation period.

5.1 Factors contributing to vulnerability

The impacts of the policy on car purchasers depend on the following.

- **Level of exposure** – Households that do not purchase a vehicle in the transition period are unaffected. Owners of older vehicles (including some low-income households) seem more likely to require vehicle replacement in the transition period and, therefore, will be exposed to any impacts of the policy.
- **Ability to pay** – Income is a key factor affecting ability to pay, which in turn will affect behavioural responses (such as whether to buy a more fuel-efficient vehicle or keep an existing vehicle for longer).
- **Ability to adapt** – The ability to adapt is related to having access to alternative modes and is influenced by household and demographic characteristics, household location and physical capability. For example, rural households, or otherwise remote households without access to alternative transport modes would have a lower ability to adapt.

5.2 Identifying households that could be vulnerable

There are different measures to identify households that are potentially vulnerable to changes in transport-related policies (see Appendix 1 for further details). They include:

- **Income-based measures** – these are based on median, equivalised, disposable household income. Equivalised disposable income is a standard income measure of inequality and hardship[27]. It includes income from all sources such as social benefits, superannuation and salary from paid employment. Low-income households[28] make up of around 24 percent of all New Zealand households. Those might be expected to purchase a light vehicle import during the 6 years to 2025 make up of around 9 percent (or 1.5 percent per year) of all households.
- **Deprivation and hardship measures** – there are different hardship measures, including NZ Deprivation Index (NZDEP 2013) and DEP-17 scores developed by Ministry of Social Development (MSD).

  Analysis based on NZDEP 2013 found an annual average of 1.4 percent of households in the most deprived areas (bottom 20 percent) purchased at least one imported light vehicle during the period 2015-2018. This equates to around 8.4 percent of all households over the 6-year to 2025. This is very close to the estimate of 1.5 percent per year discussed above using an income-based measure.

[26] Unless otherwise indicated, this section refers to imported vehicles purchased by individuals.
[27] For example, see OECD, "What are equivalence scales?" http://www.oecd.org/els/soc/OECD-Note-EquivalenceScales.pdf.
[28] This SIA defines low-income households as those with an annual, equivalised, disposable income of less than 60 percent of the median household income (of $40,900 in 2017/18). The disposable income is "equivalised" to allow comparison across various household sizes and compositions. In 2017/18, 60 percent of the median household income was $24,540 per "equivalent adult". The household disposable income refers to the level of total household gross income, after tax is deducted.

Analysis based on MSD's DEP-17 measure found that there are 7 percent of households in material hardship.[29] Those households that might be expected to purchase a light vehicle import during the 6 years to 2025 make up of around 2.6 percent of all households. This means on average households that might purchase a light vehicle import each year (during 2020-2025) and are in material hardship make up around 0.44 percent per year.

Table 9. Comparison of share of households that might be expected to purchase a light vehicle imports by vulnerability measure

	Ref	Low-income households	NZDEP 2013 (bottom quintile)	Households in material hardship (based on DEP-17)
Shares of all NZ households	A	24%	20%	7%
Shares of all NZ households might be expected to purchase a light vehicle imports during the 6 years to 2025	B	9% (or 1.5% per year)	8.4% (or 1.4% per year)	2.6% (or 0.44% per year)
Relative share of households might be expected to purchase a vehicle during the 6 years to 2025	B/A	37% (or 6% per year)	42% (or 7% per year)	37% (or 6% per year)

Table 9 compares households as a percent of the total number of all households that might be affected by the policy using different measures of vulnerability. It shows that around 8.4 to 9 percent of all households (using either income-based or NZDEP 2013 measures) will be impacted over the 6 years. However, when looking exclusively at households that are in material hardship (using DEP-17), it is only 2.6 percent. This is not surprising given this group of households are considered the most deprived group of the population.

In the next six years when the VFES Scheme is implemented, it is unclear whether or not these potentially vulnerable groups of households (i.e. households with low income or classified as being in material hardship):

- would want or need to purchase an imported light vehicle,
- would (or could) amend their vehicle choices in light of the proposed policy, and
- could afford such a vehicle.

While the MSD's DEP-17 measure is arguably the best measure of hardship, the SIA uses household equivalised income as an indicator of vulnerability because:

i. Income can act as a proxy for measuring the affordability of, or the ability to pay for, an increase in cost burden. In this case, there could be an increase in the prices of certain imported vehicles.

ii. DEP-17 measures have small sample sizes and therefore households cannot be disaggregated by emission band and other details to identify the impacts on households in detail. This means that

[29] This refers to households with a DEP-17 score of 6 or more, i.e. households with missing 6 or more basics non-income items from a list of 17.

we cannot disaggregate the DEP17-based measure into rural versus urban households, and other groupings such as single parent households with children. This makes it difficult to show the relative sizes of, and how, different groups of households might be affected by the policy.

5.3 Income, vehicle choices and emissions

This SIA focuses on income, household and demographic characteristics as the key factors and looks into the impacts of the policy on the five household profiles outlined in Table 10. These profiles have been chosen based on their likely level of exposure, ability to pay and ability to adapt. In this table, low-income households are classified as those with an annual equivalised disposable income which is less than 60 percent of the median household income (of $40,900 in 2017/18). The disposable income is "equivalised" to allow comparison across various household size and composition. In 2017/18, 60 percent of the median equivalised household income is $24,540 per equivalent adult.

Table 10: Characteristics of selected low-income households

Households earning less than $25,450 in 2017/18 by household profiles (note 2)	Mean household equivalised income by household size (median in brackets)	Mean household disposable income (not equivalised by household size) (median in brackets)	Estimated number and share of household group (% of all households)	Estimated number of households that do not own a vehicle, as of August 2018 (% within household type)	Estimated number of households that purchased at least one vehicle from July 2015 to June 2018 (% within household type purchased new imports)
All low-income households	$17,402 ($19,624)	$26,424 ($23,108)	444,700 (24.2%)	137,200 (30.8%)	84,200 (38%)
Low-income households with two or more persons	$17,215 ($19,200)	$31,454 ($33,470)	285,000 (15.5%)	71,000 (24.9%)	67,900 (36%)
Low-income, single-parent households with dependent child(ren) only	$17,900 ($19,212)	$29,833 ($30,358)	47,400 (2.6%)	17,700 (37.3%)	5,600 (13%)
Low-income households with Māori or Pasifika members (note 2)	$17,574 ($19,270)	$32,571 ($30,603)	109,900 (6.0%)	39,500 (28.8%)	18,000 (18%)
Low-income households with members aged 65 or over (note 2)	$19,658 ($20,533)	$24,857 ($21,542)	188,000 (10.2%)	56,400 (41.1%)	30,700 (63%)

Notes:

1. Low-income households are classified as those with an annual equivalised disposable income, which is less than 60% of the median household income ($40,900 in 2017/18).
2. The two household profiles are not additive (i.e. not mutually exclusive) to other low income household profiles because each household profile can have multiple household characteristics (such as single-parent Māori).
3. The total number of households as of June 2018 was around 1.83 million.
4. The analysis uses Household Labour Force Survey linked to data (analysis conducted in March 2019) on taxable income and benefits and motor vehicle registrations. The analysis makes use of Treasury's estimates of annual disposable household income for survey respondents.
5. Source: Ministry estimates based on IDI data

The segments of the population with disabilities[30] and the elderly population may be vulnerable to any price changes associated with the VFES policy if they need to purchase a vehicle within the next six years because these individuals may be physically constrained in terms of their ability to switch to alternative modes. Census

[30] Currently, there is not enough information to ascertain the current vehicle choices of people with disabilities.

2013 data shows that nearly 30 per cent of all elderly population live alone, and many of them would want to continue driving to meet their needs for essential services. Furthermore, those requiring the use of wheelchairs might also be affected by the VFES. The EU implemented an exemption for special-purpose vehicles built to accommodate wheelchair access[31].

The VFES might result in a possible relative disadvantage for solo mothers in large, low-income households, as they are likely to be more numerous than men in similar circumstances, with responsibility for caring for children. Within the single-parent household profile, the least advantaged are likely to be low-income women and men with large families who rely on owning a large but cheap car for convenience and cost reasons. Appendix 4 provides a list of top 20 imported vehicle makes and models purchased by low-income households during the three years to June 2018.

Another important dimension is household location. Low-income earners located in rural communities or on the outskirts of cities and towns would face higher costs due to a lack of, or less frequent, public transport services. Even within the three biggest cities (Auckland, Wellington and Christchurch), there are communities with low incomes who could be affected if they have specific transport needs due to employment arrangements (e.g. jobs requiring night shifts). At the time when preparing this report, location-specific information was not available to assist with such assessment.

The analysis uses Household Labour Force Survey (July 2015-June 2018 quarters inclusive) linked to data on taxable income and benefits with that of motor vehicle registrations. The analysis makes use of Treasury's estimates of annual equivalised disposable household income[32] for survey respondents.

Table 11 shows the estimated distributions of new and used light imported vehicles registered during July 2015 to June 2018 by emission band and equivalised household income quintile. While the estimated distribution of average emissions for different income quintiles is broadly similar, the average emissions for vehicles registered to low-income households are slightly lower than those for high-income households (172g CO_2/km vs 180g CO_2/km for new imports and 177g CO_2/km vs 181g CO_2/km for used imports). Given that estimated average emissions for all income quintiles are greater than 170g CO_2/km, households of any income groups needing or wanting to buy a high-emission imported light vehicle over the implementation period will be affected if the VFES leads to changes in vehicle price or choice. That said, worse-off households might have less ability to manage any price increases. Therefore, the next section looks into more details on vehicle ownerships for low-income households.

[31] See https://ec.europa.eu/clima/policies/transport/vehicles/cars_en

[32] Household disposable income refers to the level of total household gross income after tax is deducted. Equivalised disposable income measure is the international standard income measure of inequality and hardship.

Table 11: Distribution of light imported vehicles registered to households during July 2015 to June 2018, by emission band and income quintile (for vehicles with fuel consumption recorded)

Equivalised household income per annum by income quintile	Average emission CO_2/km	Emission band								%
		lower than 105g CO2/km		106g CO2/km – 130g CO2/km		131g CO2/km – 200g CO2/km		over 200g CO2/km		
		Share of total all income groups for new imports (share within income quintile in *blue italic*)								
1 – lowest income	172.1	0.2%	*1%*	1.3%	*10%*	9.1%	*67%*	3.0%	*22%*	13.6%
2	172.4	0.1%	*1%*	1.3%	*11%*	8.1%	*64%*	3.2%	*25%*	12.8%
3	177.6	0.2%	*1%*	1.4%	*9%*	9.9%	*62%*	4.6%	*28%*	16.1%
4	177.4	0.2%	*1%*	1.7%	*8%*	13.5%	*64%*	5.7%	*27%*	21.1%
5 – highest income	179.9	0.3%	*1%*	2.9%	*8%*	22.7%	*62%*	10.6%	*29%*	36.6%
All income groups	**177.0**	**1.0%**	***1%***	**8.7%**	***9%***	**63.3%**	***63%***	**27.0%**	***27%***	**100%**
		Share of total all income groups for used imports (share within income quintile in *blue italic*)								
1 – lowest income	177.4	0.6%	*4%*	1.6%	*12%*	7.1%	*53%*	4.0%	*30%*	13.3%
2	178.8	0.7%	*3%*	2.3%	*12%*	10.4%	*53%*	6.3%	*32%*	19.7%
3	179.5	0.7%	*3%*	2.8%	*11%*	13.1%	*53%*	7.9%	*32%*	24.5%
4	178.8	0.7%	*3%*	2.4%	*10%*	13.3%	*55%*	7.6%	*31%*	24.0%
5 – highest income	181.1	0.7%	*4%*	1.8%	*10%*	9.7%	*52%*	6.3%	*34%*	18.6%
All income groups	**179.2**	**3.5%**	***3%***	**10.9%**	***11%***	**53.6%**	***54%***	**32.1%**	***32%***	**100%**

Note: This table only includes vehicles purchased by individuals (i.e. exclude those purchased by businesses, government and its agencies).

5.4 Potential impacts on low-income households

It is uncertain when a household will need or wish to replace a vehicle, as it will depend on the age and condition of the vehicle they currently own. According to the CBA and vehicle fleet modelling, over the six years to 2025, there could be approximately 1.36 million new or used light vehicles entering the fleet. After deducting the proportion that is bought by companies or government (based on 2017 shares), it is estimated that approximately one million vehicles could be purchased by individuals over that period.

Based on the IDI analysis, on average 1.3 light imported vehicles (assessed over the three years to June 2018) were purchased per household because a small number of households purchased more than one vehicle over that period. If this rate continues, around 776,200 households (or 42 percent of total households) could be affected over the VFES implementation period (2020-2025). This, however, is considered as the upper limit because there may be more households that would purchase more than one vehicle over a six-year period (compared to the 1.3 vehicles per household over the three-year period analysed). Table 12 shows the estimated number of households that might buy imported light vehicles each year over the implementation period, for the selected household profiles.

The potential impacts of the policy are an increase in the average price of vehicles and reduction in the availability of certain vehicle types, affecting any households (including low-income households) that might be purchasing a light vehicle new to the fleet during the implementation period. Analysis estimated that low-income households account for 24 percent of households but 18 percent of registered vehicles and 16 percent of vehicles registered during the three years to June 2018 (Table 15 in Appendix 3). Of the total 444,700 low-income households, around 84,200 low-income households (4.6 percent over 3 years or 1.5 percent per year, both expressed as a percentage of all New Zealand households) purchased a new or used imported vehicle over the last three years to June 2018.

In per year terms, this can be broken down into:

- approximately 22,600 low-income households (1.2 percent of NZ total number of households) with two or more persons (There are 285,000 such households in total, 15.5 percent of all households).
- approximately 6,000 low-income households (0.3 percent of NZ total number of households) with Māori or Pasifika members (There are 109,000 such households in total, 6 percent of all households).
- approximately 10,230 low-income households (0.6 percent of NZ total number of households) with one or more members aged 65 years or older (There are 188,000 such households in total, 10.2 percent of all households).
- approximately 1,860 low-income households (or 0.1 percent of NZ total number of households) consisting of one parent with dependent child(ren) (There are 47,400 such households in total, 2.6 percent of all households).
- approximately 2,330 low-income households (or 0.12 percent of NZ total number of households) consisting of couples with three or more dependent children. (There are 20,700 such households in total, 1.1 percent of all households).

Table 12: Estimated number of households to be affected per year

	New Vehicles	Used Vehicles	Total
Estimated total number of light vehicle imports (2020-2025)	704,026	659,682	1,363,708
Proportion of vehicles to be purchased by individuals (based on 2017 shares)	59%	90%	-
Number of vehicles to be purchased by individuals - 2020-2025	415,375	593,714	1,009,089
Number of vehicles to be purchased by individuals, average per annum	69,229	98,952	168,182
Estimated number of households to be affected per annum (based on 1.3 vehicles purchased per household, during July 2015 to June 2018)	53,200	76,050	129,250
% total households affected per annum	3%	4%	7%
Estimated average annual number and share of low-income households who might purchase at least one vehicle during 2020-2025 (based on purchasing pattern during July 2015 to June 2018) (Unit = households and % of households)			
All low-income household types			
% of total number of households in NZ	0.58%	0.95%	1.53%
Number of households pa	10,600	17,500	28,100
Two or more persons low-income households			
% of total number of households in NZ	0.5%	0.7%	1.2%
Number of households pa	9,100	13,530	22,600
Couple with three or more dependent children low-income households			
% of total number of households in NZ	0.02%	0.10%	0.12%
Number of households pa	410	1,920	2,330
One parent with dependent child(ren) only low-income households			
% of total number of households in NZ	0.01%	0.09%	0.1%
Number of households pa	250	1,610	1,860
Low-income households with member(s) aged 65 or over (note)			
% of total number of households in NZ	0.35%	0.20%	0.56%
Number of households pa	6,490	3,750	10,230
Low-income households with Māori or Pasifika member(s) (note)			
% of total number of households in NZ	0.06%	0.27%	0.33%
Number of households pa	1,100	4,900	6,000

Notes:

1 Figures may not sum to total due to rounding.

2 The last two household profiles are not additive (i.e. not mutually exclusive) to other low-income household profiles because each household profile can have multiple household characteristics (such as a Māori single parent). These subgroups include all household types (including single person households).

The total number of low-income two- or more-person households that could be affected over the six years is 135,600 (being 22,600 x 6). A similar calculation can be conducted for other low-income household subgroups to obtain the six-year totals. However, these are likely to be the upper bounds of the estimates as there may be more households purchasing more than one vehicle over a six-year period. Furthermore, there are many strategies (e.g. switching to vehicles already in the fleet) households could adopt to minimise any cost impacts on them.

6. Limitations, summary and conclusion

6.1 Limitations

The SIA and the CBA are both subject to the limitations listed below, due to the lack of information and data, particularly around likely responses by vehicle importers and vehicle purchasers to the VFES. Further research, particularly on data and modelling requirements, will form part of the Ministry's work in terms of the Domain Plan and Research Strategy.

- **The mix of vehicles that have emissions levels above or below the VFES target for each weight class is unknown and, therefore, their effects have been combined in the CBA.** It is uncertain how importers would respond to the policy by adjusting the mix of vehicles imported or by strategically pricing the vehicles to encourage the uptake of the right mix of low-emission and high-emission vehicles. It may be logical that, to discourage the purchase of high-emission vehicles, importers may increase their margins on high-emission vehicles. However, further data and modelling would be required to better understand the behaviour of importers. The short-term evaluation and monitoring of the vehicle market forms is also a part of the wider work under the Evaluation Strategy.
- **Share of vehicle purchasers who would opt for alternative transport modes or switch to the domestic used cars market**. The preliminary CBA did not estimate the impacts of these behavioural responses as the analysis aimed to understand the outcome assuming all importers meet their targets and there would be no change in the volumes of vehicles that are imported. It would be necessary to refine the CBA to estimate the likely impact of these possible responses. However, more research would be required to obtain the information required (such as by surveying how importers and vehicle buyers would behave).
- **This SIA ignores the life-cycle impacts of EVs**. An important element relates to battery recycling and disposal. As the number of EVs increases over time, the demand for battery disposal and recycling will increase, which will have unintended environmental impacts. It would be useful to better understand the scale of such impacts to allow mitigation measures to be implemented.
- **This SIA does not assess the distribution of the environmental benefits, mostly related to TRAPs, on the most disadvantaged communities.** Research suggests that these are more prone to live in areas that have a higher exposure to TRAPs[33]. The VFES scheme is expected to reduce TRAPs and it may be inferred that the most disadvantaged communities will disproportionately benefit from this reduction. However, further research is require to determine the environmental benefits of the VFES scheme on these communities.
- **The results obtained from the Integrated Data Infrastructure (IDI) analysis are not official statistics.** The IDI related analysis is subject to estimation errors that might be inherent in the various datasets (e.g. Household Economic Survey). Therefore, it is intended to provide an indicative picture of the characteristics of households that purchased new or used imported light vehicles over the three years to June 2018. The analysis should be repeated when Census 2018 data becomes available during 2019/20.

[33] See Pearce, J. and Kingham, S (2008), "Environmental inequalities in New Zealand: A national study of air pollution and environmental justice", Geoforum, Vol 9, Issue 2, March 2008, Pp. 980-993.

6.2 Discussion

This SIA is constrained by the quantity and quality of data currently available. In particular, there is no reliable information to help estimate consumers and industry behaviours. Further research to understand the impact of vehicle standards on the domestic and international new and used car markets in New Zealand is important, given the importance of the impact of standards on the flow of cars into the New Zealand market and price. This should cover information on price sensitivity to vehicle ownerships (for different household groups and locations) and the trade-off consumers are likely to make between price and vehicle features. Such research will be useful for not only developing vehicle emissions standards or policies, but also for informing vehicle safety and harmful emissions reduction-related policies and the implementation of policies.

When faced with financial constraints, consumers and importers often need to make trade-offs between vehicle features. There is a risk that having a VFES might affect the environmental and/or safety outcomes if other standards in these areas are not introduced. This risk can be mitigated by developing vehicle-related environmental policies in conjunction with similar safety policies to ensure interventions maximise co-benefits with no adverse impacts, and at the same time minimise the cost burdens to vehicle owners.

To speed up the transition process, measures to incentivise businesses (e.g. vehicle rental companies) to replace their fleet with low-emission vehicles can be beneficial. This is because these vehicles tend to travel longer distances and, therefore, have a shorter payback period. When these vehicles are later resold onto the domestic used car market, they are likely to be cheaper because companies would have already recovered the costs through fuel savings. Increasing the lead-in time before introducing the VFES may also help as it will provide opportunity to the industry to develop marketing and pricing strategies.

Mitigation measures might be required to help low-income households to adapt to market changes brought about by the VFES. Examples of measures to consider include introducing exemptions to support car owners with disabilities, facilitating access to finance to buy low-emission vehicles including EVs, improving access to public transport for low-income households (e.g. the Green Transport Card scheme), and providing financial incentive to car owner to scrap their older high-emission vehicles and to purchase a low-emissions replacement.

6.3 Monitoring and evaluation

The results obtained from this analysis are sensitive to the following data and assumptions:

- Any impact on the upfront ownership cost of low-emissions vehicles, particularly hybrids and EVs
- Any changes in the overall volume and mixes of light vehicles to be imported
- Any changes in the age and vehicle features (eg power source, engine size, vehicle mass, safety and harmful emissions) of light vehicle imports
- Any changes in the scrappage rates of vehicles
- Any changes in the amount of travel by light vehicles

If the VFES were to be implemented in New Zealand, it would be useful to build in a reporting or monitoring mechanism to collect the above and other related information, to understand the impacts on household groups that might be vulnerable to policy changes and, for monitoring and evaluation purposes.

6.4 Summary and conclusion

Results from the preliminary CBA indicate that the policy has a BCR of between 2:1 and 6:1, with a net benefit of $1.2 to $4.7 billion (2020-2041). Any household that buys a low-emission vehicle (typically use less or no fuel) will benefit because the fuel savings are more than enough to offset any increase in the price of the LEV. In per vehicle terms, on average, each purchase of a LEV that comply with the VFES could deliver a fuel savings benefit of between $4,300 and $11,200 (mid-range $6,800) over the lifetime of the vehicle.

It is not possible to estimate exactly how the VFES will impact on vehicle prices or their availability, because it depends on whether and how buyers and importers would response to the policy. Whether there are any other changes on the other influences (e.g. exchange rate) on new or used car prices and availability is also unknown. In an ideal situation, buyers and importers adjust their vehicle buying and selling behaviours relatively quickly and are able to source the right vehicles at the right prices. In this situation, there will be no price and choice impacts due to the policy.

In the short term (2020-2025), average ICEV vehicle prices could be slightly higher and vehicle choices more limited for new imports. For used imports, higher prices could emerge because of lower availability of older, higher- emission vehicles. This SIA uses scenarios to explore this in the absence of price and choice data. Households of all income groups who purchase new or used imports in the transition period will be affected by any change in pricing or availability, but low-income households that need to buy an ICEV in the transition period would be more exposed. In the case of larger households (five persons or more), they may also be unable to give up certain features such as seating capacity.

Households that are more vulnerable to any cost changes are likely to respond to any pricing or availability impacts from the VFES by continuing to use their existing vehicle, purchasing a vehicle that is already in the fleet, switching to public transport, ride sharing or adopting active modes. Households that opt to retain their existing vehicles or to replace their existing vehicle with a used, high-emission vehicle already in the fleet, will incur higher ongoing maintenance and fuel costs and will be relatively more exposed to the risks of lower vehicle safety and reliability. The severity of these impacts would depend on factors such as the availability of alternative transport modes, whether households have the resources to use those modes (e.g. physical ability to walk to work), and whether they have an existing vehicle to retain. On the other hand, households that are willing and able to switch to public transport and/or active modes, or to ride-sharing, will save on the vehicle purchasing and operating costs and potentially gain health and safety benefits.

The balance between the costs and benefits of these options is not clear-cut. Some households might have poor access to public transport (particularly in rural or other remote areas) while, for those with better access, the VFES might be the nudge that causes a mode switch to public transport, or a partial switch, if the household decides against buying a second car. The same applies to active modes: some households might not be located where they can reach their destinations by active modes but, for those that are; the policy might cause a switch to walking or cycling. In the longer term, technological advancement and gradual phase-out of high emission vehicles in the global fleet would bring about a greater range of low-emission models at a lower upfront cost premium. These longer-term market developments would benefit all light vehicle buyers, including low-income households, through a wider choice of low-emission vehicles both in the imports and domestic car markets and lower fuel costs.

We also note that this policy is being considered alongside the Feebate scheme, which may enable some low-income households to mitigate any price increases by purchasing a light imported LEV and receiving the rebates. For those low-income households able to finance a light imported LEV they would also benefit as

the fuel savings are likely to outweigh the higher initial vehicle cost by between $3,000 and $8,900 over the lifetime of the vehicle.

Based on vehicle registration predictions and vehicle purchase patterns observed in the three years to June 2018, households that are expected to purchase an imported light vehicle ***in the six years to 2025*** would make up around 42 percent of all New Zealand households. Analysis suggests a relatively small share of households are low-income households (9 percent in the six years to 2025 or 1.5 percent per year), rural households (5 percent in the six years to 2025 or less than 1 percent per year) would be affected. The share of households in material hardship (2.6 percent in the six years to 2025 or 0.44 percent per year), are expected to be even smaller.

Appendix 1: Different measures of households vulnerability

There are different measures to identify households that are potentially vulnerable to negative impacts from transport-related policies. They include:

- **Income-based measures** – these are based on median, equivalised, disposable household income[34]. While income-based measures provide a good indication of ability to pay, they do not account for wealth and consumption. Because income measures are typically household-based, they are useful for understanding the relative income position at the household level.
- **Deprivation and hardship measures** – there are different level of hardship measures, ranging from deprivation, material hardship to severe material hardship. Examples of such measures include the NZ Deprivation Index 2013, developed by the University of Otago; the NZ Index of Multiple Deprivation (IMD), developed by The University of Auckland; the Material Wellbeing Index (WMI) and DEP-17 scores developed by the Ministry of Social Development; and the Material and Social Deprivation Index, by Eurostat (EU-13). The IMD measure is area-based and therefore does not provide information at the household or individual level, whereas the DEP-17 measure relies on a small sample size and cannot be broken down by emission band on vehicles owned.

As these measures have different bases, different pictures can emerge depending on which measure is used. This appendix explains these measures briefly and outlines some similarities and differences between them, from the perspectives of analysing the impacts of the VFES or the Feebate schemes.

Income-based measure

The VFES and Feebate SIAs define low-income households as those earning less than 60 percent of the median, equivalised, disposable household income, before deducting housing costs ($40,900 in 2017/18). The disposable income is "equivalised" to allow comparison across various household sizes and compositions. Disposable income refers to the level of total household gross income, after tax is deducted. Equivalised, disposable income includes income from all sources such as social benefits, investment income and salary from paid employment, etc.

This SIA uses household equivalised income as an indicator of vulnerability because it indicates the affordability of, or the ability to pay for, an increase in cost burden. In this case, there could be an increase in the prices of certain imported vehicles.

The New Zealand Index of Multiple Deprivation (IMD)

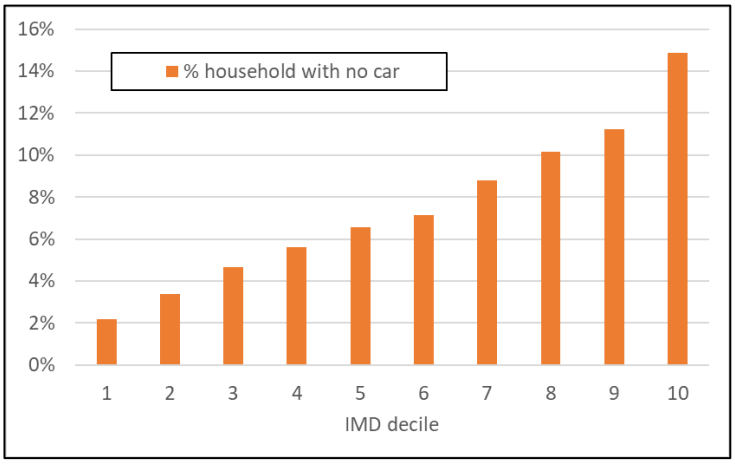
The New Zealand Index of Multiple Deprivation (IMD) measures deprivation at the neighbourhood level in custom-designed data zones that have an average population of 712. Data zones are aggregations of census meshblocks. The meshblock is the smallest geographic unit for which statistical data is collected and processed by Statistics New Zealand. A meshblock is a defined geographic area, varying in size from part of a city block to large areas of rural land. The IMD uses routinely collected data from government departments, census data and methods comparable to current international deprivation indices, to measure different forms of disadvantage. It comprises 28 indicators grouped into seven domains of deprivation: Employment, Income, Crime, Housing, Health, Education and Access to services. Figure 7 below shows the percentage of households that do not own a light vehicle by IMD decile. This clearly indicates the relationship between car

[34] Statistics New Zealand uses six different measures based on different cut-off rates (50% or 60%) and treatment of housing costs

ownership and the level of deprivation. Even in the most deprived areas, however, at least 85 percent of households do own a light vehicle. In the next six years, it is unclear whether or not these households:

- would want or need to purchase an imported light vehicle,
- would (or could) amend their vehicle choices in light of the proposed policy, and
- could afford such a vehicle.

Figure 7: Percentage of households that do not own a light vehicle, by IMD decile



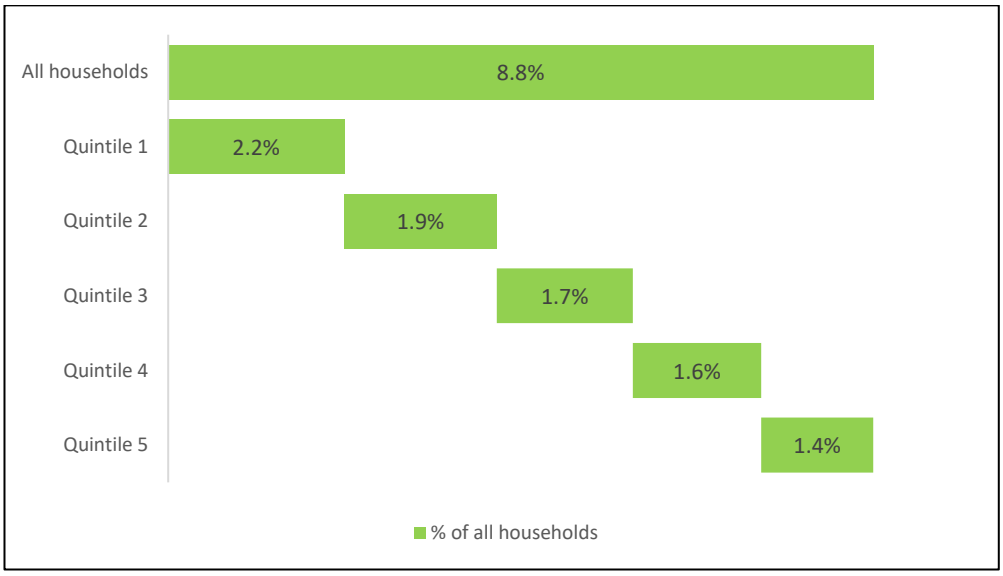
Source: IMD and Census 2013 data

The New Zealand Deprivation Index (NZDep)

The New Zealand Deprivation Index (NZDep) combines census data (2013) relating to income, home ownership, employment, qualifications, family structure, housing, access to transport and communications. The index provides a deprivation score for each meshblock in New Zealand. Meshblocks are the smallest geographical areas defined by Statistics New Zealand, with a population of around 60–110 people each. The deprivation index groups the deprivation scores of meshblocks into deciles, with the highest scores representing the most deprived areas. The deprivation index estimates the relative socioeconomic deprivation of an area and does not account for the different levels of deprivation of each individual (or household) within a meshblock. The indicators used to generate the index may also change over time, depending on their relation to deprivation.

The NZ Transport Agency completed a high-level analysis of the relationship between motor vehicle imports (both new and used) and the socioeconomic profile of New Zealand households. Households were segmented into quintiles based on NZDep 2013 and this data was merged with the information in the Motor Vehicle Register. The analysis found that an annual average of 1.4 percent of households in the most deprived areas (quintile 5) purchased at least one imported light vehicle during the period 2015-2018 (see Figure 8). This figure is very similar to the one identified using the income-based measure (of 1.5 percent, see Section 5.2).

Figure 8: Percentage of households (based on NZDep2013) that purchased an imported light vehicle – annual average (2015-2018 calendar years) by income quintile
(Quintile 1: least deprived – Quintile 5: most deprived)



Source: NZ Transport Agency

Measures of material hardship

The three types of material hardship measures[35] are outlined below:

- *Material wellbeing index (MWI)* - The MWI is made up of 24 items that give direct information on the day-to-day actual living conditions that households experience. These items include food, clothes, accommodation, electricity, transport, keeping warm, maintaining household appliances in working order, and so on, and also about the freedoms households have to purchase and consume non-essentials that are commonly aspired to. Statistics New Zealand and Ministry of Social Development believe this index gives the same results at the DEP-17.
- *DEP-17* – According to Statistics New Zealand, the DEP-17 index focuses on the low living standards end of the spectrum. Statistics New Zealand and Ministry of Social Development believe the index gives the same results as the MWI when looking at the bottom quintile (20 percent), but the DEP-17 scoring may seem more intuitive (e.g. a score of 6+/17 simply means "missing 6 or more basics from the list of 17").
- *Material and Social Deprivation Index by Eurostat EU-13* - this 13-item index is used in Europe and we use it to monitor how New Zealand ranks internationally – it ranks households in much the same order as DEP-17 does. However, currently the Household Economic Survey questions are not the same as EU-13, so they are not directly comparable internationally.

[35] Perry, B (2017), "The material wellbeing of NZ households: Overview and key findings", Ministry of Social Development, Wellington.

An analysis of households that purchased a new or used imported vehicle between 2015 and 2018 using DEP-17[36] indicates that just under 7 percent of all households are in a state of material hardship. Table 13 below compares the proportion of households that purchased imported light vehicles in 2015-2018 by household status (based on income or material hardship measures). It shows that higher shares of households with higher incomes, and of those that are not in material hardship, purchased light vehicle imports. However, it also indicates that around 20 percent of households that are in material hardship purchased vehicles in the three years to June 2018. However, the extent to which these households want or need to purchase an imported light vehicle in the next six years, whether they would or could amend their vehicle choices and whether they could afford such vehicles is unclear.

Due to the relatively small sample size used for the DEP-17, which consists of 12,500 households over a 3-year period, estimates based on material hardships are subject to higher estimation errors.

Table 13: Light vehicle imports purchase by household characteristics (July 2015 – June 2018)

July 2015 – June 2018 - light vehicle imports purchased, by household characteristics • **Material hardship – DEP-17 6 or above** • **Low income - Less than 60% median disposable HH income**	**% bought new or used imports**	**% did not buy (note)**	**Share of all NZ households**	
			Based on DEP-17	**Based on income-measure**
Households in material hardship	**20%**	**80%**	**7%**	**n/a**
Households not in material hardship	**31%**	**69%**	**93%**	**n/a**
All households based on material hardship measure	**30%**	**70%**	**100%**	**100%**
Estimates based on income-based measure				
Low-income households	**19%**	**81%**	**-**	**-**
All households based on income measure	**28%**	**72%**	**-**	**-**

Note: The above do not sum to the same totals as the income-based analysis due to the smaller sample size used in the HES and DEP-17 work.

[36] Integrated Data Infrastructure and MVR, Treasury, June 2019

Table 14 shows the proportion of households purchased a light vehicle import in the three years to June 2018 by main household income source. It shows that a lower share of households (between 13 and 20 percent) with benefits as the main income source purchased a light vehicle imports compared to other households. For example, between 27 (low-income) and 32 percent (other income) of households with earnings as the main income purchased a light vehicle imports in the three years to June 2018. Low-income households with NZ Superannuation as the main income source account for 8.6 percent of all NZ Households. There are another 7.9 percent that belong to other income groups (i.e. there are 16.4 percent of all NZ households receiving NZ Superannuation as the main income source).

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.

Appendix 2: Additional details on the scenario analysis of the VFES

The scenario analysis outlined in Section 4 was based on preliminary modelling work completing by Infometrics using the revised EV Uptake Model.

The key assumptions used are:

a. Average emissions in 2025 for EVs, low-emission ICEVs and hybrids, and other ICEVs are 25, 90 (except for new imports with VFES policy, a value of 65 is used assuming a larger share of hybrids will be imported) and 180g CO_2/km respectively.
b. BAU 2025 EVs uptake for new and used imports are based on Infometrics' March 2019 revised EV Uptake Model.
c. Scenarios differ by the degree to which importers might balance car prices or profit margin to reduce any price impacts of the VFES, with no such pricing strategy for Scenario A and fully flexible pricing strategy for Scenario D.
d. Scenario A's new EVs uptake is 20 percent higher than BAU and 3 times higher for used due to the policy change.
e. Scenario B's new/used EVs uptake is 10 percent higher than Scenario A due to an increase in vehicle choice availability.
f. Scenario C's new EVs uptake is based on Infometrics' March 2019 revised EV Uptake Model. For used EVs uptake, it is assumed to be half that of new EVs.
g. Scenario D's new/used EVs uptake is 10 percent higher than Scenario C due to increase in vehicle choice availability.
h. The uptake of low-emission ICEVs and hybrids is calibrated such that the overall weighted average is 105g CO_2/km.

Appendix 3: Analysis of integrated data on Motor Vehicle Registrations (MVR), Household Labour Force Survey (HLFS) and Household Economic Survey (HES)

Unless otherwise indicated, the data and estimates included in this appendix are sourced from analysis (performed by NZ Treasury) of Statistics New Zealand's Integrated Data Infrastructure linked data. These tables exclude light vehicle imports purchased by businesses, government and its agencies.

Table 15: Description and characteristics of household profiles and vehicle ownership

Household profiles	Estimated total number of households		Estimated number of low-income households (see note below)		Estimated number of low-income households that do not own a vehicle		Estimated number of vehicles currently registered to low-income households		Estimated number of low-income households that purchased at least one vehicle during July 2015 to June 2018		Estimated number of vehicles purchased by low-income households during July 2015 to June 2018	
One-person household	382,100	21%	159,700	36%	66,200	48%	145,000	22%	16,400	19%	18,900	18%
Couple only	490,600	27%	93,200	21%	15,500	11%	168,900	26%	23,200	28%	29,500	28%
Couples with 1 or 2 dependent children only	292,600	16%	34,000	8%	7,000	5%	67,900	11%	10,900	13%	14,800	14%
Couples with 3+ dependent children only	82,500	4%	20,700	5%	3,600	3%	48,600	8%	7,000	8%	8,500	8%
All other couples with children	157,700	9%	17,500	4%	3,100	2%	47,000	7%	5,200	6%	7,200	7%
One parent with dependent child(ren) only	92,200	5%	47,400	11%	17,700	13%	53,900	8%	5,600	7%	6,700	6%
All other one-parent with child(ren)	74,900	4%	18,200	4%	5,400	4%	28,400	4%	3,300	4%	4,100	4%
All other households	261,600	14%	54,000	12%	18,700	14%	86,100	13%	12,700	15%	17,100	16%
Total	**1,834,200**	**100%**	**444,700**	**100%**	**137,200**	100%	**645,700**	**100%**	**84,200**	**100%**	**106,700**	**100%**
Share of total number of households	**100%**		**24.2%**		**7.5%**		**-**		**4.6%**		**-**	
Share of low-income households	**-**		**-**		**30.9%**		**-**		**18.9%**		**-**	
Share of total number of registered vehicles	**-**		**-**		**-**		**18.2%**		**-**		**16.1%**	
Further breakdowns of low-income households	**Estimated total number of households**		**Estimated number of low-income households (see note below)**		**Estimated number of low-income households that do not own a vehicle**		**Estimated number of vehicles currently registered to low-income households**		**Estimated number of low-income households that purchased at least one vehicle during July 2015 to June 2018**		**Estimated number of vehicles purchased by low-income households during July 2015 to 2018**	
Total households	**1,834,200**	**100%**	**444,700**	**100%**	**137,200**	**100%**	**645,700**	**100%**	**84,200**	**100%**	**106,700**	**100%**
Households with Māori or Pasifika members	412,000	23%	109,900	25%	39,500	29%	168,100	26%	18,000	21%	21,900	21%
Households without Māori or Pasifika members	1,422,200	77%	334,800	75%	97,500	71%	477,600	74%	66,200	79%	84,800	79%
Households with members aged 65 or over	492,100	27%	188,000	42%	56,400	41%	237,200	37%	30,700	36%	37,400	35%
Households without members aged 65 or over	1,342,100	73%	256,700	58%	80,600	59%	408,500	63%	53,500	64%	69,300	65%

Note: Low-income households are classified as those with an annual equivalised disposable income which is less than $24,540 (or less than 60% of the median household income of $40,900 in 2017/18).

The shares of new or used light vehicle imports for rural households comparing to the remaining households based on data for the three years to June 2018 are shown in the tables below.

Table 16: Estimated share of new and used imported light vehicles (July 2015 – June 2018) – rural households

July 2015 – June 2018	New imports	Used imports
Rural households	17%	8%
The remaining households	83%	92%
Sub-total	**100%**	**100%**

Table 17: Estimated share of total imported light vehicles (July 2015 – June 2018) – rural households

July 2015 – June 2018	New imports	Used imports	New + used
Rural households	6%	5%	12%
The remaining households	31%	57%	88%
Sub-total	**37%**	**63%**	**100%**

The shares of new or used light vehicle imports for low-income households comparing to the remaining households based on data for the three years to June 2018 are shown in the tables below.

Table 18: Estimated share of new and used imported light vehicles (Jul 2015–Jun 2018)- low income households

July 2015 – June 2018	New imports	Used imports
Low-income households	16.4%	16.1%
The remaining households	83.6%	83.9%
Sub-total	**100%**	**100%**

Table 19: Estimated share of total imported light vehicles (July 2015 – June 2018) – low income households

July 2015 – June 2018	New imports	Used imports	New + used
Low income households	6%	10%	**16%**
The remaining households	31%	52%	**84%**
Sub-total	**37%**	**63%**	**100%**

The shares of new or used light vehicle imports by low-income household segments based on data for the three years to June 2018 are shown in the tables below.

Table 20: Estimated share of new and used imported light vehicles registered to low income household segments (July 2015 – June 2018)

Low-income household segments	%new	% used	total
1. One-person household	48%	52%	100%
2. Couple only	64%	36%	100%
3. Couples with 1 or 2 dependent children only	28%	72%	100%
4. Couples with 3+ dependent children only	18%	82%	100%
5. All other couples with children	29%	71%	100%
6. One parent with dependent child(ren) only	13%	87%	100%
7. All other one parent with child(ren)	24%	76%	100%
8. All other households	17%	83%	100%
Total	**38%**	**62%**	**100%**

Table 21: Estimated share of total imported light vehicles registered to low-income household segments (July 2015 – June 2018)

Low-income household segments	%new	% used	total
1. One-person household	8%	9%	18%
2. Couple only	18%	10%	28%
3. Couples with 1 or 2 dependent children only	4%	10%	14%
4. Couples with 3+ dependent children only	1%	7%	8%
5. All other couples with children	2%	5%	7%
6. One parent with dependent child(ren) only	1%	5%	6%
7. All other one parent with child(ren)	1%	3%	4%
8. All other households	3%	13%	16%
Total	**38%**	**62%**	**100%**

Table 22: Estimated shares of new and used imported light vehicles registered to low-income households with and without Māori or Pasifika members (July 2015 – June 2018)

Low income households with and without Māori or Pasifika members	%new	%used	Total
Households with one or more Māori or Pasifika members	18%	82%	100%
Other low-income households	43%	57%	100%
Total	**38%**	**62%**	**100%**

Table 23: Estimated shares of total imported light vehicles registered to low-income households with and without Māori or Pasifika members (July 2015 – June 2018)

Low income households with and without Māori or Pasifika members	% new	% used	Total
Households with one or more Māori or Pasifika members	4%	17%	21%
Other low-income households	34%	45%	79%
Total	**38%**	**62%**	**100%**

Table 24: Estimated shares of new and used imported light vehicles registered to low-income households with and without members aged 65 and over (July 2015 – June 2018)

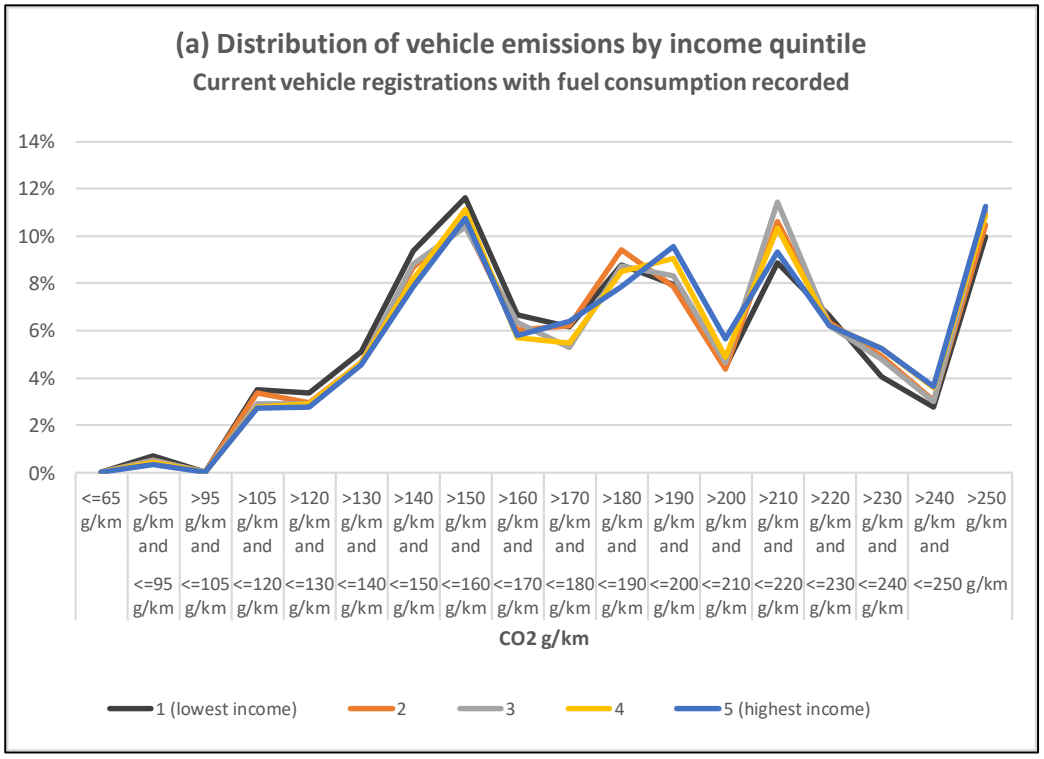
Low income households with and without members aged 65 or over	% new	% used	Total
Households with members aged 65 and over	63%	36%	100%
Other low-income households	24%	76%	100%
Total	**38%**	**62%**	**100%**

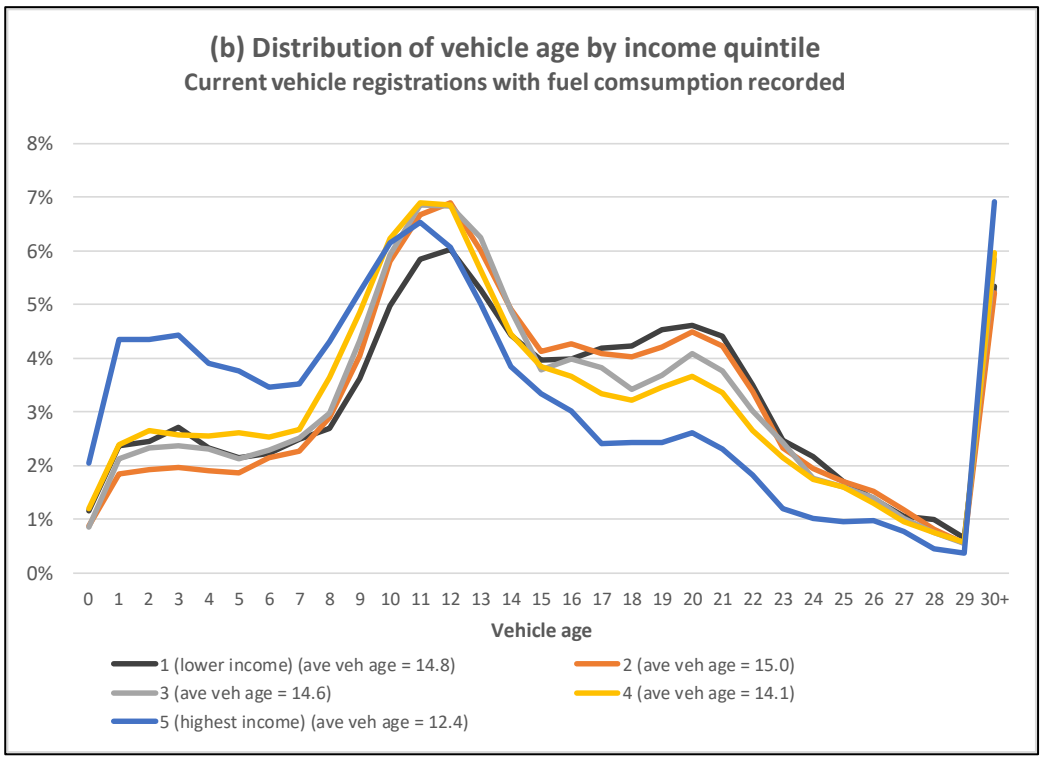
Table 25: Estimated shares of total imported light vehicles registered to low-income households with and without members aged 65 and over (July 2015 – June 2018)

Low income households with and without members aged 65 or over	% new	% used	Total
Households with members aged 65 and over	22%	13%	35%
Other low-income households	16%	49%	65%
Total	**38%**	**62%**	**100%**

Figure 9 shows the distributions of vehicle emissions and vehicle age of *vehicles registered as of August 2018* by household income quintile. It shows similar patterns of share of current ownership by emission band. It also shows that the households of the highest income quintile tend to purchase a larger share of newer vehicles.

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





Source: Ministry of Transport, based on results performed using IDI

Appendix 4: Top 20 most popular vehicles for low-income households

Table 26: Vehicle popularity for low-income households – Top 20 new light vehicles imported from July 2015 to June 2018

Make	Model	Count	Vehicle Type	Tare Weight (kg) > X to <= Y	Indicative CO_2 g/km	Indicative low price	Indicative high price
TOYOTA	COROLLA	1480	Sedan/Wagon	1000-1400	131.7-155.2	$28,990	$39,490
HONDA	HR-V	1360	SUV	1200-1400	155.2-162.2	$29,990	$39,990
HONDA	JAZZ	1350	small ICEV	1000-1200	119.9-124.6	$21,990	$26,790
SUZUKI	SWIFT	1180	small ICEV	up to 1,000	112.8-145.7	$21,990	$29,900
FORD	RANGER	1110	Ute	1400-1800	198-229	$30,000	$60,000
KIA	SPORTAGE	1080	SUV	1400-1800	141-200	$30,000	$60,000
TOYOTA	HILUX	930	Ute	1600-2200	161-191	$30,000	$60,000
TOYOTA	YARIS	800	small ICEV	1000-1200	122-151	$20,000	$30,000
MITSUBISHI	TRITON	800	Ute	1800-2000	161-181	$40,000	$60,000
VOLKSWAGEN	TIGUAN	790	SUV	1400-1800	122-181	$40,000	$80,000
MAZDA	CX-5	770	SUV	1400-1600	151-181	$40,000	$70,000
MITSUBISHI	MIRAGE	710	Small ICEV	up to 1000	112-122	$10,001	$20,001
TOYOTA	RAV4	710	SUV	1600-1800	198	$32,990	$52,990
NISSAN	QASHQAI	630	small ICEV	1200-1400	159-178	$36,270	$44,990
SUZUKI	VITARA	630	small SUV	1000-1200	123-145	$27,990	$33,990
MAZDA	CX-3	590	small SUV	1200-1400	130-161	$30,000	$50,000
HYUNDAI	TUCSON	580	small SUV	1400 - 1600	185	$23,200	$32,950
MAZDA	MAZDA3	570	small ICEV	1200-1400	134	$28,990	$32,795
KIA	CERATO	560	small ICEV	1200-1400	158-167	$31,990	$41,990
HOLDEN	CAPTIVA	550	small SUV	1600-1800	178-235	$40,990	$56,990

Data sources:

1. The list of most popular vehicle makes and models is sourced from Treasury's IDI analysis completed in March 2019.
2. New cars price information was downloaded from http://www.nzautocar.co.nz/prices-a-e.html on 15 March 2019.

Table 27: Vehicle popularity for low-income households – Top 20 used light vehicles imported from July 2015 to June 2018

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 price paid for the vehicles purchased during 2015-2018.

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