26 March, 2021

NZ Automobile Association submission on:

Draft advice on Climate Change

SUBMISSION TO:	Climate Change Commission
REGARDING:	Response to CCC Draft Advice
DATE:	26th March 2021

ATTENTION:	Submissions analysis team
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NOTE TO REQUESTOR:

The AA is happy to speak to this submission in person.

Contents

Introduction

The New Zealand Automobile Association (NZAA or AA) welcomes the opportunity to provide comment on the Commission's draft advice to Government on climate action in Aotearoa.

While the New Zealand Automobile Association will criticise the Commission's findings with some vigour this should not be interpreted as in any way criticism of either the Commission's purpose or the work of the Commission's staff. The AA fully supports the purpose of the Commission and its role as an independent advisor to the Government on climate change issues.

The AA is also impressed by the amount of work and the thoroughness that the Commission's staff have put into preparing the draft report. That said we also recognise that the Commission has, itself, been working to a very tight timetable to prepare this draft report to a highly professional level and that the draft report is only the first step in a very long journey. We hope this AA submission provides useful antithetical thinking that can ultimately be synthesised into policy which benefits the people of New Zealand.

Elevator Pitch:

> *The Climate Change Commission has followed European thought leadership and has not contextualised its advice to recognise New Zealand as a small, impecunious right-hand drive nation in the Eastern hemisphere. Given the tight timeframes required to meet Climate Emergency and Paris Agreement emission targets more emphasis is needed on improving emissions from the existing fleet within existing urban frameworks.*

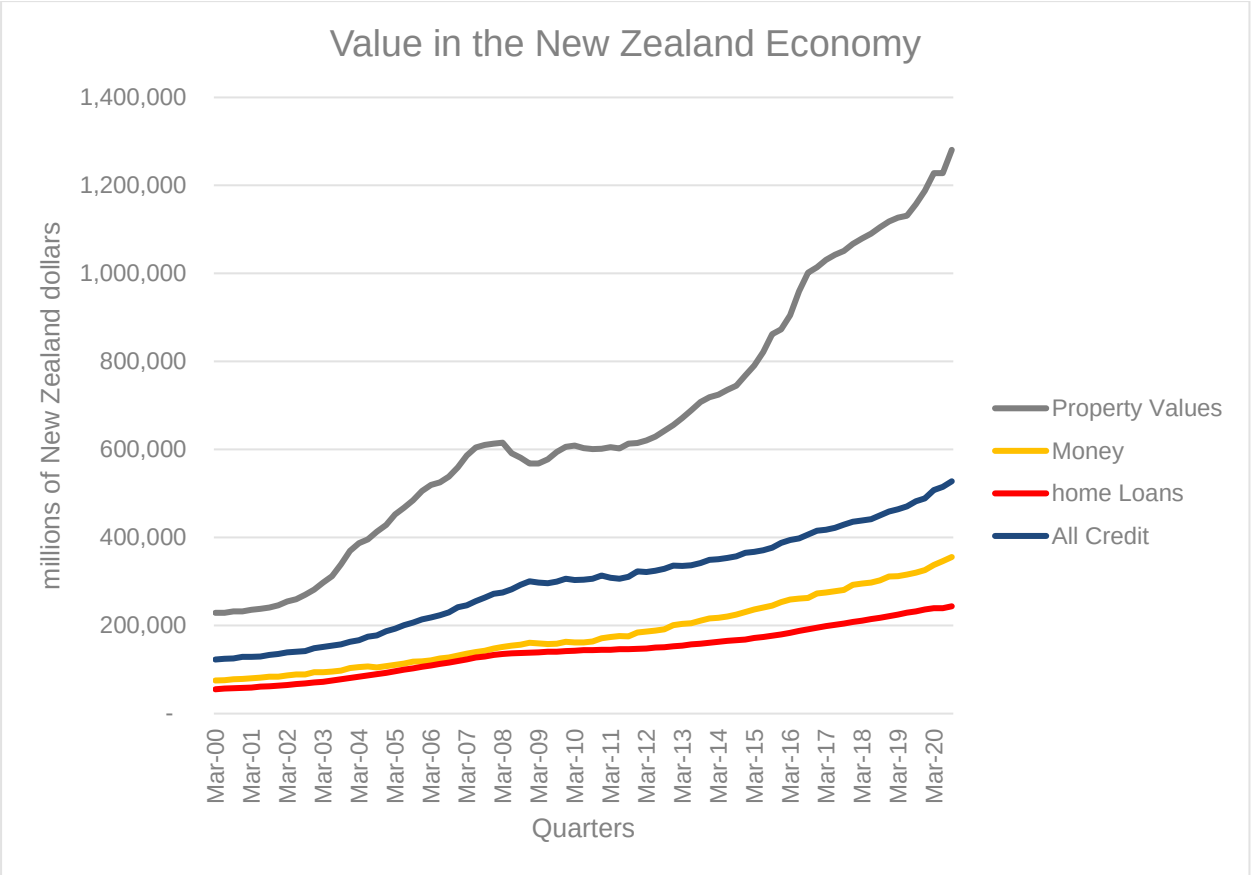
Our broad critique is as follows:

1) Much of the Commissions economic modelling is based on techniques which cannot meet the fundamental questions of both the public and private sector. That is **who**, should optimally invest in **which** new emissions reducing technology and **when**? Instead Commission modellers make informed guesses of when these sectors *might* make such investments, and attempt to determine the effect this would have on the flow of goods and services in the economy. Unfortunately this then becomes a circular argument when the Commission raises the prospect of market interventions by government to force individual's investments in particular technologies at particular times (e.g. a fossil fuel phase out).
   The fundamental questions for decision-makers remain:
   a) **Which** technology has what potential to reduce **how much** GhG emissions?
   b) **What** is the cost of these technologies to investors, infrastructure providers and regulators?
   c) **Which** agency (households, firms, govt) has what incentive to invest?
   d) **Which** agency has what means, knowledge and confidence to invest?
   e) **How** can these agencies be meaningfully and economically incentivized to invest?

   The Commission has not answered these critical questions.

   Another main concern is that the Commission's general equilibrium model generates land value changes by industry based on changing trading conditions. It does not model the housing market. This means that the effect of land prices as an investment market in themselves is not captured. Given the massive impact of land values on the New Zealand economy and their

effects on the nation's credit and costs of trade such limitations make the model an exercise in economic theory.



2) The Commission has projected far too many savings from the rapid adoption of electric vehicles. These projections are not based on any historical rate of change in New Zealand or the automotive industry. We note that the EV target of 64,000 vehicles by 2021 set by Minister Bridges in 2016 will be undershot by roughly half this year (assuming 8,000 more EVs are added to the fleet to reach 32,000 this year) demonstrating the ease with which politicians can set distant targets without accountability. We will present evidence that the rates of change are not credible and reasons why the automotive world and indeed the influential purchasing nations in New Zealand's Eastern Pacific and Indian Ocean hemisphere are not only unlikely to meet, but from a emissions reduction perspective would be unwise to meet.

3) The Commission has based its projections on a European regulator and technology push model which assumes that there is a domestic manufacturing base and all cars added to the register are new. In fact the automotive market in New Zealand is a far more complex balance of cultural supply and demand factors and costs and pricing are a vital part. The rise of the SUV in automotive culture should not be ignored. The axiom "culture eats strategy for breakfast" is completely relevant to any discussion on transformation and this culture has not been addressed by the Commission.

4) The Commission proposal relies too heavily on imported car technology by contrast Finland has adopted a strategy of adapting its fuel using domestically developed technology. The result is that Finnish companies are rapidly expanding globally to become leaders in biofuels. Ironically

this means that at present New Zealand tallow is being processed in Finnish owned plants in Singapore for production of biofuels. There is a need for the Commission to look at opportunities as well as domestic costs.

5) The Commission has focused too much on urban transformation which it notes is a very long term strategy which (given the inevitable rise of EVs over a similar timeframe) is not strictly relevant to reducing New Zealand's emissions. By contrast contemporary congestion has a very real effect on emissions due to the way the today's internal combustion engine driven fleet operates. While mode shift is a potential mitigation pathway there is no evidence that mode shift is reducing emissions given the enormous growth in automotive transport demand. Responses to congestion are more to do with successful urban management some of which falls outside the scope of transport agencies.

What we think the Commission should do

While the commission has begun the useful process of centralising what is known about transport and emissions the AA is concerned that a great deal remains unknown. This yields the following recommendations for next steps for the Commission before releasing its final report.

1. That the Commission immediately revise its EV modelling on emissions reductions based on the following:

    a. EV uptake rates which reflect uptake rates of new automotive technology from historical New Zealand precedents such as SUVs and hybrid technology.

    b. The commission investigate the probability of EV supply constraints at prices New Zealanders can afford

    c. Investigate vehicle purchasing cycles in the motor vehicle register and using IDI data examining fleets and households based on income, home ownership status and vehicle age.

    d. The commission model the emission effects of non-scrappage of the existing fleet in the presence of high new vehicle prices

    e. The debt effects on households of different levels of increased expenditure on automotive technology, the access to debt markets and the significance of housing equity, and the significance of increased depreciation rates for new automotive technology, on households of different income levels.

2. That the Commission itself soon commissions or co-commissions with other relevant government agencies a major investigation into the benefit costs of various synthetic fuels (stage two or above biofuels) strategies for New Zealand including:

a. The question of investment agency for synthetic drop-in replacement biofuels in New Zealand. This should canvas public-private partnerships with local and international firms as well as Iwi and local crown research agencies, the question of competition between PPPs and the scope for other agencies to gain a level playing field should they wish to enter the market.

b. The research and development and investment timeline needed for production of drop-in replacement biofuels depending on the agency model adopted.

c. The construction, logistical and regulatory site requirements for synthetic fuel plants in New Zealand and the return on investment levels at various rates of efficiency and ETS price. Of particular concern here is the access to geothermal resources and planning delay.

d. The export benefits of synthetic fuel supply from direct sales, and indirect sales via tourism, exports at different levels of carbon tariffs in various markets (e.g. the EU).

e. A cost-benefit analysis of intervention options at various stages of the biofuels development chain.

3. That the commission ultimately investigates the relative emission time based cost/benefits of planning and non-transport technology policies on transport, in particular examining:

a. The effect on emissions of congestion and de-congestion on emissions allowing for realistic mode change

b. The effect on emissions of proposed public transport investment allowing for urban densification and mode change as well as technology shift to electric private vehicles, compared to faster investments in alternate modes (e.g cycling and electric pedestrian vehicles) and traffic management approaches.

c. The cost benefit of these different strategies in the context of the actual socio-geographies of the rapid growth regions of Auckland, Waikato, Bay of Plenty and Canterbury.

d. Investigate the emissions benefits of flexible and informal public transport systems ranging from current Uber-style technology to semi and fully automated vehicles.

e. Investigate the emissions potential of increased uptake of electric pedestrian mobility devices and the potential points of market failure that might hinder their use

About the New Zealand Automobile Association

The NZAA is an incorporated society with over 1.7 million members, representing a large proportion of New Zealand road users. The AA was founded in 1903 as an automobile users' advocacy group, but today our work reflects the wide range of interests of our large membership, many of whom are cyclists and public transport users as well as private motorists.

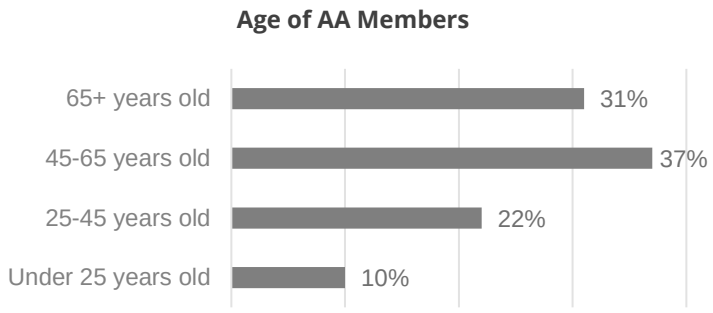
Across New Zealand, the motoring public regularly come into contact with the AA through our breakdown officers, 37 AA Centres and other AA businesses. Seventeen volunteer AA District Councils around New Zealand meet each month to discuss local transport issues. Based in Wellington and Auckland our professional policy and research team regularly surveys our Members on transport issues and Members frequently contact us unsolicited to share their views. Via the AA Research Foundation, we commission original research into current issues in transport and mobility. Collectively, these networks, combined with our professional resource, help to guide our advocacy work and enable the NZAA to develop a comprehensive view on mobility issues.

Motorists pay over $4 billion in taxes each year through fuel excise, road user charges, registration fees, ACC levies, and GST. Much of this money is reinvested by the Government in our transport system, funding road building and maintenance, public transport services, road safety work including advertising, and Police enforcement activity. On behalf of AA Members, we advocate for sound and transparent use of this money in ways that improve transport networks, enhance safety and keep costs fair and reasonable.

Our advocacy takes the form of meetings with local and central government politicians and officials, publication of research and policy papers, contributing to media on topical issues, and submissions to select committees and local government hearings.

Total Membership	1.7+ million members	
	Just over 1 million are personal members	
	0.7 million are business-based memberships	
% of licenced drivers	Half of licenced drivers are AA Members	
Gender split	54%	Female
	46%	Male

Age range & Membership retention



Half of AA Members have been with us for 10 years or more.

Summary of contents and argument of this submission

Chapter One

AA Members support environmentalism but have low faith that the world will meet its climate change targets and so are only willing to forego small sums of money toward climate change costs (implying they think the sacrifice is futile). They support the concept of the clean car standard and would like to see their ETS contribution from fuel purchases hypothecated to climate change expenditure.

Chapter Two

New Zealand transport is dominated by the need for a car. The more people migrate to New Zealand the more cars they buy and the more the car dominates emissions. However we show that

1. Migrants are focused into particular locations where congestion exacerbates their emissions
2. New Zealanders are buying larger and larger vehicles and that SUVs are a global issue. As the IEA warns this cultural preference for SUVs threatens to swamp any savings from EVs in the short term.
3. There is a gender equity issue in vehicle purchasing that needs to be considered.

Chapter Three

The EV is not a zero emissions vehicle, its emissions depend on the carbon intensity of the local electricity supply. This explains why Australia has not moved to support the adoption of the EV, and while some manufacturers believe they can produce non battery electric vehicles that emit less per kilometre than the grid (in specific markets). This fully rational reluctance, plus the small size of the right-hand-drive market, and the growing demand from the left-hand-drive market explains why there could well be supply issues for right-hand-drive EVs

Chapter Four

Some nations have taken rhetorical stances in favour of phasing out fossil fuel vehicles though legislation to this effect is much rarer. Deeper analysis however suggests phase outs may increase emissions in those markets. It appears the European nations appear to backing out of a previous policy blunders with so called “Clean diesel” vehicles. However the strategic issues around continuity of supply of battery materials are far from settled for such move. There are also potential equity issues over competition for electricity supply between EV owners and non EV owners in times of dry year scarcity. AA Members see a phase out date as premature.

Chapter Five

Biofuels are recognized by the IPCC as a legitimate mitigation option. Second generation biofuels use non-food vegetation (such as forestry) as feedstock New Zealand officials have not pursued biofuels with vigour. However Finland (a small, forested nation of 5.5 million) has demonstrated that second biofuels are a workable option and have been expanding their biofuels to the point that they will probably achieve their 2029 target of 30%. This makes the Commissions estimate of 3% for New Zealand look rather unambitious. Indeed New Zealand generally appears to be well behind the rest of the world in biofuel development despite numerous natural advantages.

Chapter Six

The cities in the main population growth centres in New Zealand are generating the greatest increase in emissions are low density on a population weighted basis. This is partly due to increased traffic but also because traffic management has not kept pace with growth creating increased congestion. Urban authorities have tended to focus on very large public transport initiatives which do not show a significant potential for emissions abatement but are mainly about reshaping cities over the very long term. We suggest that instead of emphasizing marginal mode shift more focus should be placed on improving the efficiency of the vast volume of traffic in the here and now. We also suggest more effort be placed on examining problems of agency (i.e. is local government best placed to reduce emissions) in terms of efficient investment in promoting working-from-home, micro-mobility and ride hail innovations.

Chapter One - AA Members and Climate Change

The following are the results of a Member survey before the general election in October 2020 which mirror a similar survey in 2017. The number of respondents was 1079.

Question: How do Members feel about environmentalism?
Unequivocally supportive – 81% support or strongly support, a slight decrease on 2017

Question: What sort of transport habits do they have?
94% use a car (an eighth using cycles and public transport) and blame the car for three times more greenhouse gas emissions (38%) than cars are actually responsible for (12%). Though their response is correct if biogenic methane is excluded. Essentially the same as 2017.

Question: Have expectations regarding telework or electric vehicles changed?
In 2017 only 5.5% of employees were certain they would use teleconferencing, in 2020 48% of employees worked from home one or more days a week. Prospects for electric vehicle purchases were down slightly in line with increased financial concern related to the Covid-19 pandemic.

Question: Have views on global response to climate change changed?
No. As in 2017 two thirds still believe climate change targets are unlikely to be met by NZ and hardly anyone believes the world will achieve them. At this time Donald Trump was still US President.

Question: How much do New Zealanders want to contribute to combating climate change now compared to 2017:
As in 2017 half of those surveyed would still volunteer no more than $20 per month. But in 2020 those who are more committed to environmentalism volunteered more to increase the average from $26 to $30 per month

Question: Have views about increased prices due to climate change shifted since 2017?
On a scale of 0 to 10 where 0 is relaxed and 10 is very upset a 5% increase in petrol and grocery prices averages 5 in 2020, where it was 3.92 in 2017. A 25% increase has increased only slightly to 7 in 2020 when it was 6.6 in 2017.

Question: How would Members respond to higher prices now compared to 2017?
No change. A 5% fuel price increase makes almost no difference to travel choices. A 25% increase would "certainly" make 11% change the way they travel, while 25% would "probably" change.

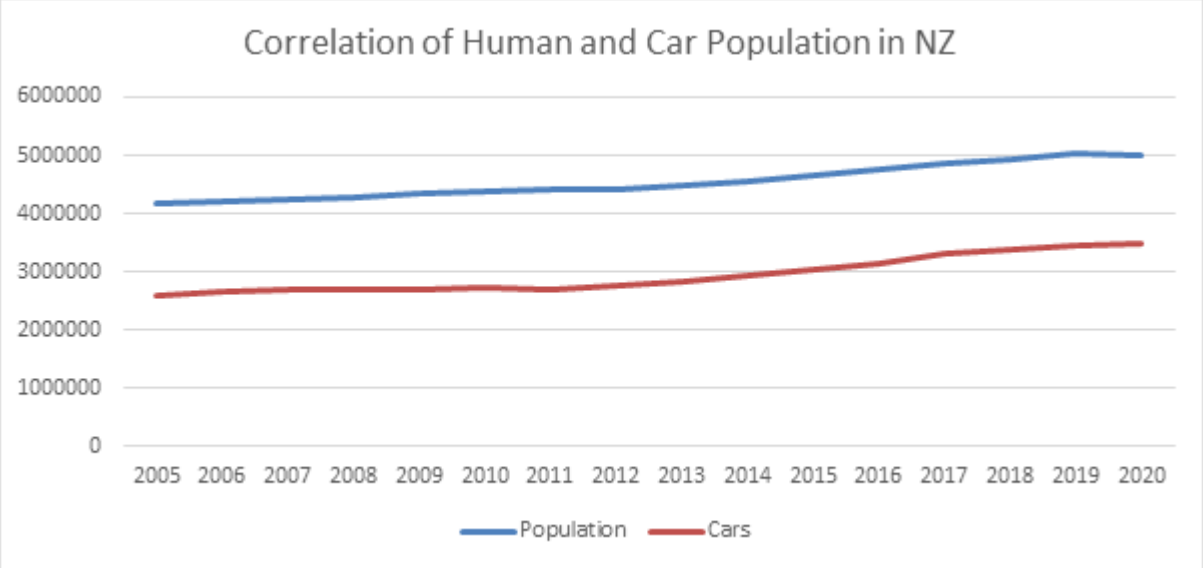
Question: What do Members think about the "Clean Car Standard"?
They support it 2:1, so long as it does not compromise road safety, locational and gender equity and the extra cost is no more than the cost of the vehicle's emissions above the standard over its lifetime.

Question: What do Members think about hypothecating ETS income?
They support it 3:1.

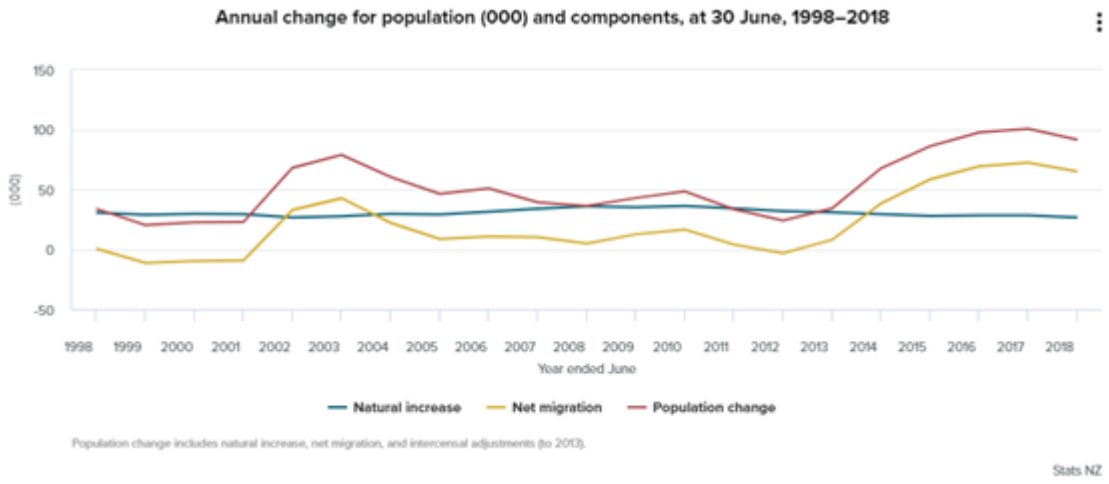
> The AA is firmly of the view that the income from the ETS (which at $39 a tonne would be $588 million per annum at 2019 volumes) should be hypothecated to climate change mitigation.

Chapter Two – New Zealand Transport Emissions Since 2005.

We take as read the Commission's focus on light vehicles. New Zealand is a highly car dependent country. The more people there are the more cars we buy and drive on our roads.



The correlation between population and vehicle numbers is extremely high[1]. Therefore the more people there are, the more cars they will buy, and the country has maintained a positive immigration policy for quite some time.



Statistics New Zealand has published the following map showing the regions that have experienced the most population growth in recent times.

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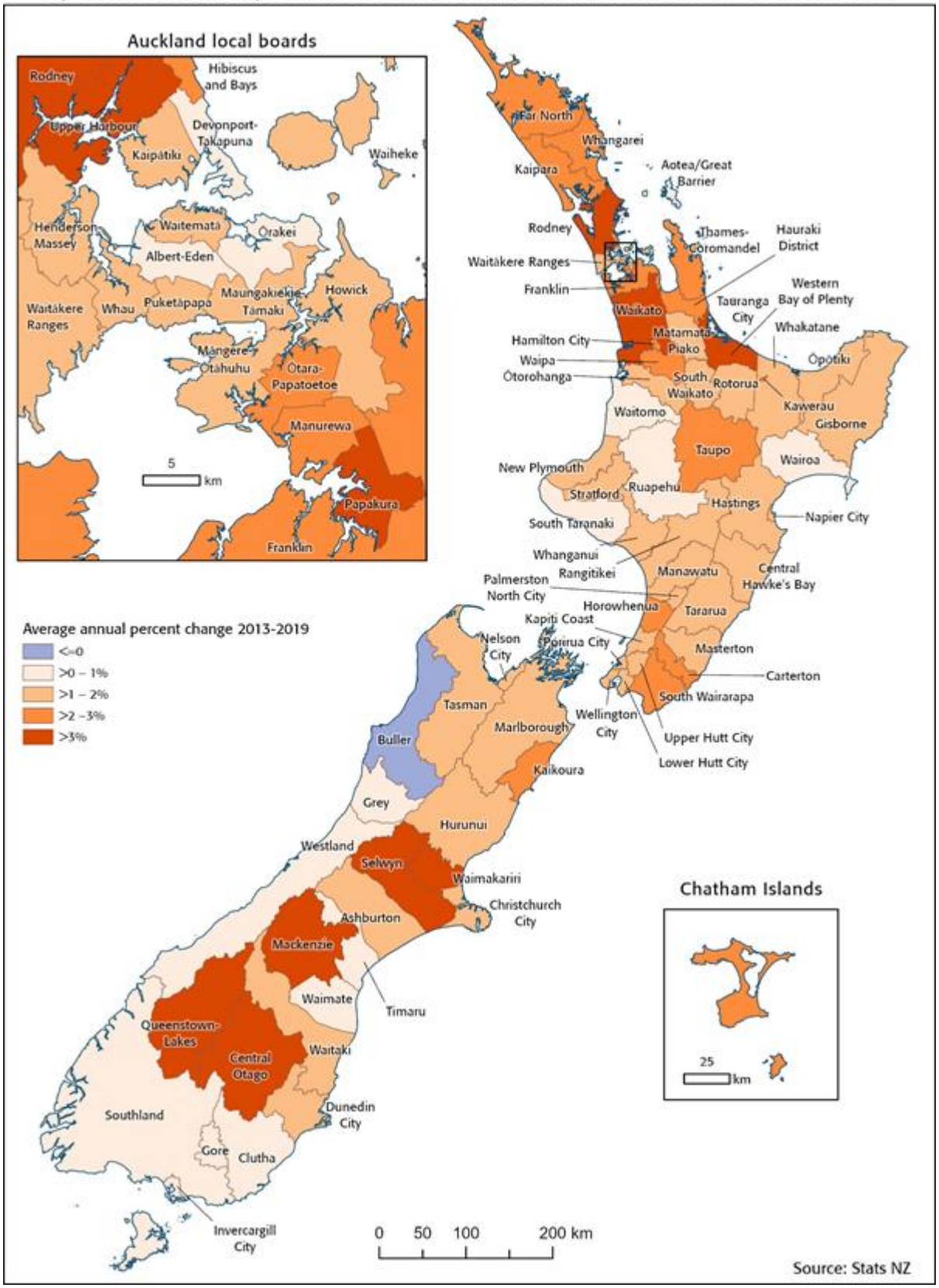
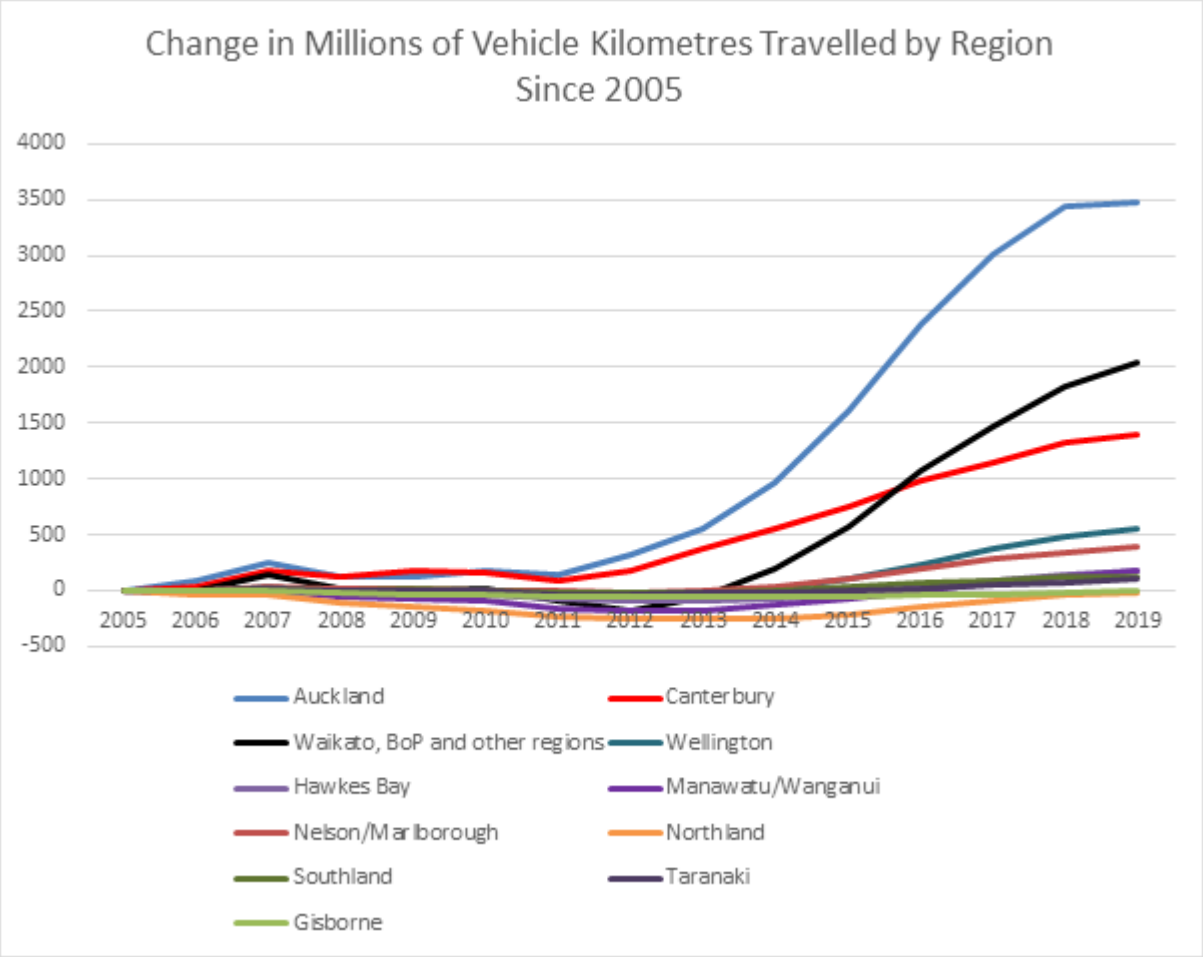
[1] r^2 = 0.986845145, Students T-Test p-value= $1.76564x10^{-12}$

Estimated resident population change,
by territorial authority and Auckland local board areas, 30 June 2013 –30 June 2019

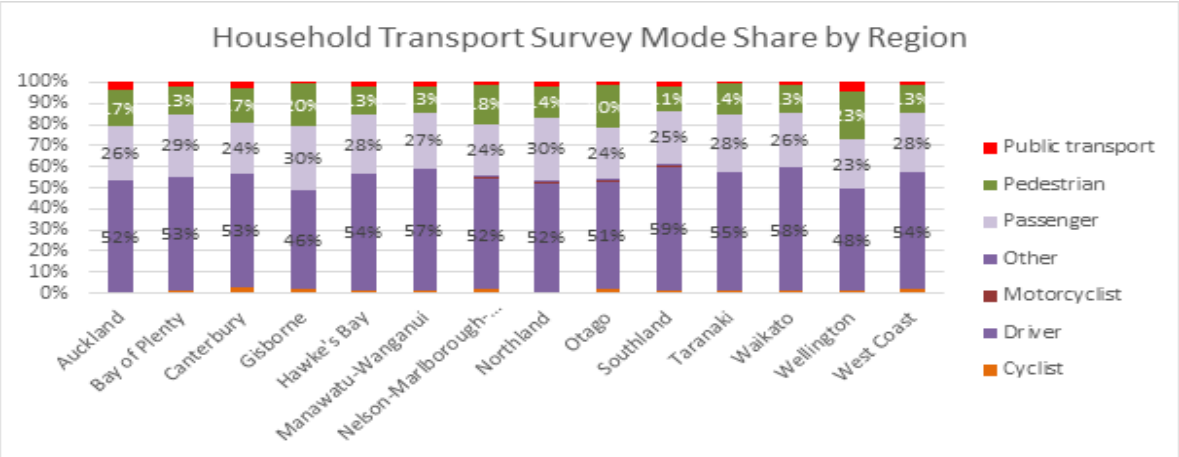


Not surprisingly this is reflected in the change in kilometres travelled by region.



Which shows that the growth in emissions has occurred where the population has grown the most. This is hardly surprising but it does suggest that a geographically focused emissions abatement policy on high growth areas makes more sense than on areas where growth is negative.

The Household Transport Survey shows the role of the car remains central to transport throughout the whole country

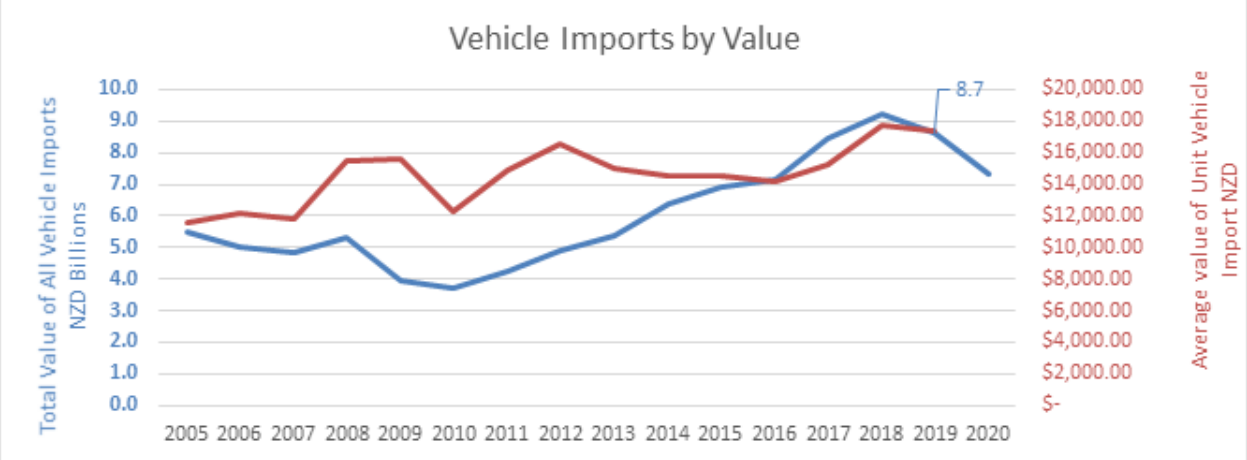


Traffic Congestion Increases Emissions

Congestion has a corrosive effect on internal combustion engine (ICE) vehicle efficiency. The internal combustion engine expends 80% of its fuel energy as heat and noise and continues to do so whether the vehicle is in free flow traffic or creeping in traffic jams. In general ICE vehicles are at their most efficient when operating at between 60 and 80km/h. The efficiency of roading networks therefore have a direct bearing on travel time and hence the emissions of the vehicle fleet when converting fuel to completed trips. The more delay the more fuel an ICE vehicle expends and the more emissions it creates. This is incontrovertible physics but because road controlling authorities are not responsible for the emissions on their networks techniques to reduce emissions remain unmeasured and untested. Barth and Booriboonsomsin (2010) suggest these could reduce emissions by 7- 12%.

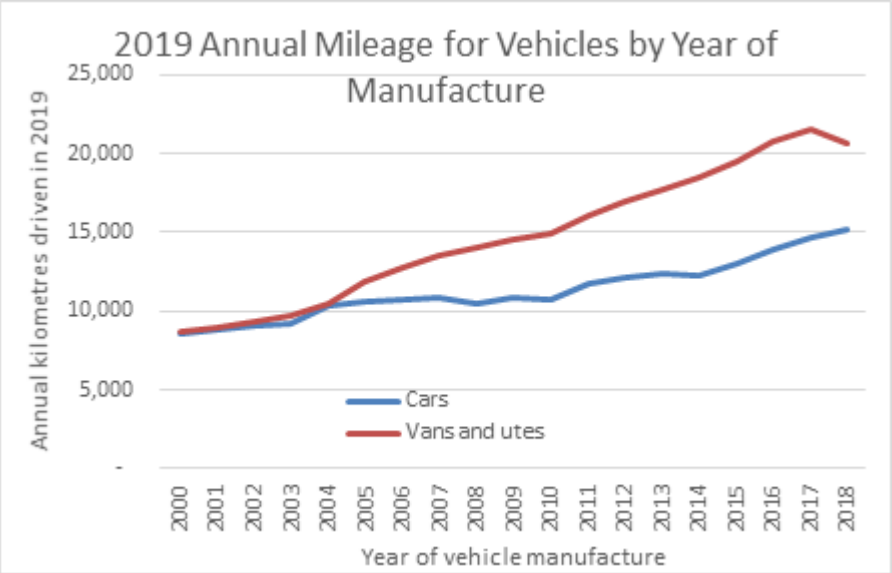
Notably the Tomtom international congestion monitor for 2020 ranks Auckland the most congested city in Australasia followed by Sydney, Wellington (3rd), and Hamilton (4th). Christchurch is ranked seventh and Tauranga is ranked ninth. This correlates with the population growth in these areas but also demonstrates that growth in travel by region can also correspond with a reduction in vehicle efficiency in these areas due to growth in congestion. Failure to efficiently manage traffic growth, or worse policies which regard congestion increases as a means to encourage modal shift (the evidence being that in the absence of responsive alternatives minimal shift occurs) simply increase the emissions beyond the rate due simply to population growth. To date the trade-off between congestion reduction by direct means and mode shift has not been properly studied in a New Zealand context. By contrast the costs of congestion have with NZIER (2017) finding that reducing Auckland congestion would be worth 1% of Auckland's GDP.

But it is not just about the quantity of cars on our roads. It is also about their qualities. This brings us to the nature of the New Zealand fleet. The dispersed nature of settlement and low urban densities in New Zealand means the public spend a significant amount of money ($8.7bn in 2019) on cars each year. This has ranged from 3.5% to 1.9% of GDP over past fifteen years. The average value of each imported vehicle (including Cost Insurance and Freight) ranged from around $12,000 up to $17,500 by 2019. Given that the average value of a new vehicle is considerably greater this suggests that the imported value of used vehicles (3/5ths of imports) is considerably lower. That is because the average age of a used vehicle at import has increased from 7.3 years to 10.23 years since 2000. In short the public are voting with their wallets for low cost private transport.

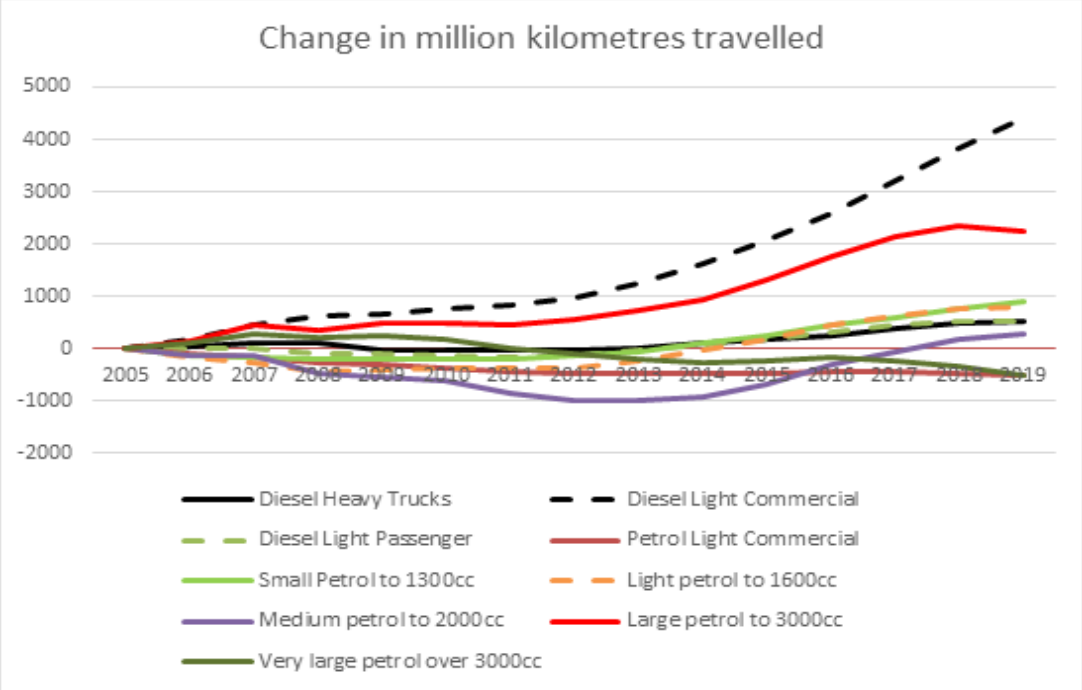


85% of all light vehicles are imported from Japan and 24% of all vehicles sold in New Zealand are made by Toyota. Most of the remainder come from Europe or the Americas.

However it would be wrong to conclude that used vehicles contribute the most to Greenhouse gas emissions because the older the vehicle the less distance on average it is driven per year (and the less fuel it burns and hence the less emissions it makes). New Utes and vans are driven the furthest.

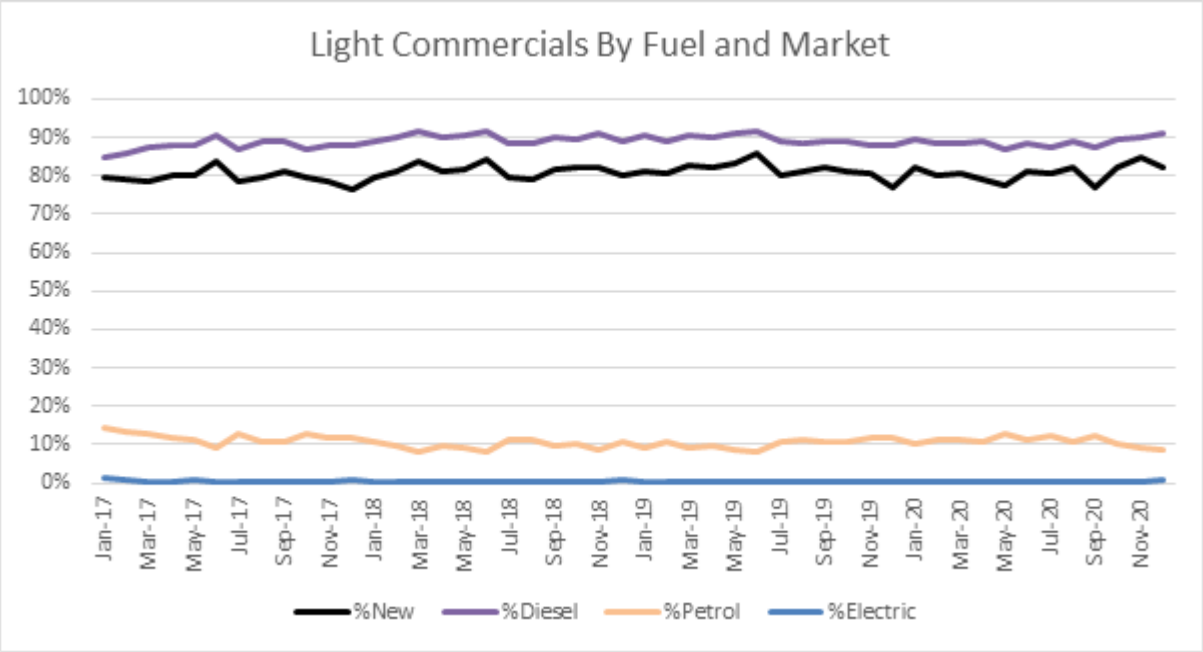


In fact most of the kilometres (and hence emissions) growth most has come from new diesel light commercial vehicles and large petrol engine vehicles to 3 litres. These have replaced the medium vehicle category to 2 litres. What we are effectively talking about is the rise of the SUV and Ute. This is not just a New Zealand phenomenon.



Diesel Light Commercials and 3L Petrol SUVs are an issue

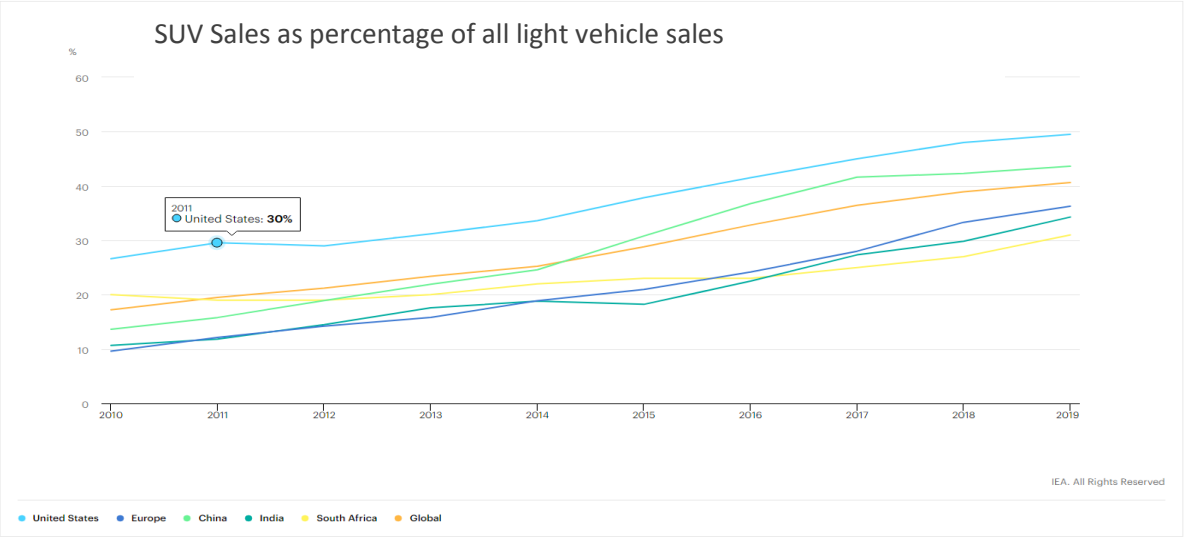
As the following graph shows the light commercial fleet is mostly new and diesel.



The International Energy Agency reports that the global impact of the rising share of SUVs in the global fleet has had a global effect on emissions. It states "**SUVs were the second-largest contributor to the increase in global CO2 emissions since 2010 after the power sector**"

The authors state **"While discussions today see significant focus on electric vehicles and fuel economy improvements, the analysis highlights the role of the average size of car fleet. Bigger and heavier cars, like SUVs, are harder to electrify and growth in their rising demand may slow down the development of clean and efficient car fleets. The development of SUV sales given its substantial role in oil demand and CO2 emissions would affect the outlook for passenger cars and the evolution of future oil demand and carbon emissions.**"

It notes:" *If consumers' appetite for SUVs continues to grow at a similar pace seen in the last decade, SUVs would add nearly 2 million barrels a day in global oil demand by 2040, offsetting the savings from nearly 150 million electric cars*".



However it should also be noted that there is a difference in usage between diesel and petrol vehicles.

MoT Household Travel Survey data shows:

Purpose by % of VKT	Petrol	Diesel
01. Went home	32%	28%
03. Went to work	13%	16%
04. Shopping/personal appointments/services/volunteer	23%	20%
05. Social visit/entertainment	16%	13%
06. Made a trip for work	8%	17%
07. Completed study/education	1%	1%
09. Accompany someone/dropped someone off/picked someone up	6%	4%
11. Sport and exercise	2%	2%

So not surprisingly diesel vehicles are used more for work than petrol vehicles. It should also be remembered that not all SUVs are employed by farmers and tradespeople, some of that work may be accountancy. It should also not be forgotten that trips for shopping or entertainment generate trade and hence work for someone else.

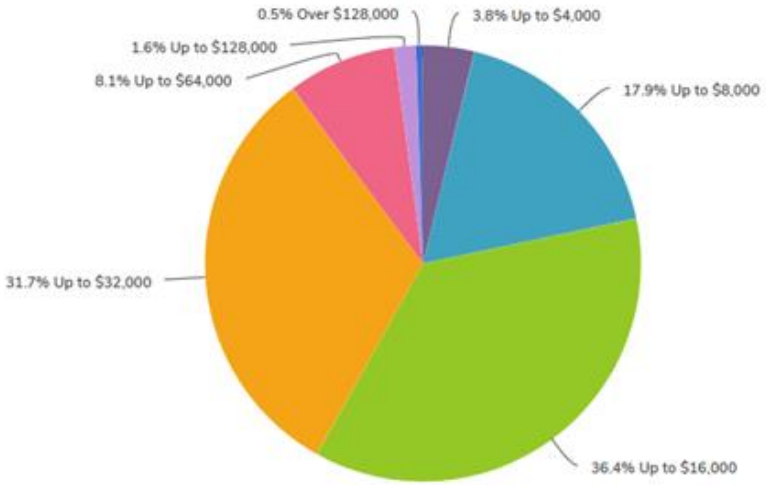
What we are facing here, is, culture. New Zealanders have adopted a culture of buying large vehicles in much the same way as Americans and Australians have. What we have seen to date is New Zealanders replacing small, old hatchbacks which do not emit much in the way of Greenhouse Gases with EVs, while the market for high emitting diesel light commercials continues to grow.

This has been partly because of the shortage of PHEV and BEV SUVs on the New Zealand market, but mostly because the low purchase prices of conventional SUVs and Utes make the size to price equation seem more attractive to buyers i.e. “More car for your money”.

What AA Members Think

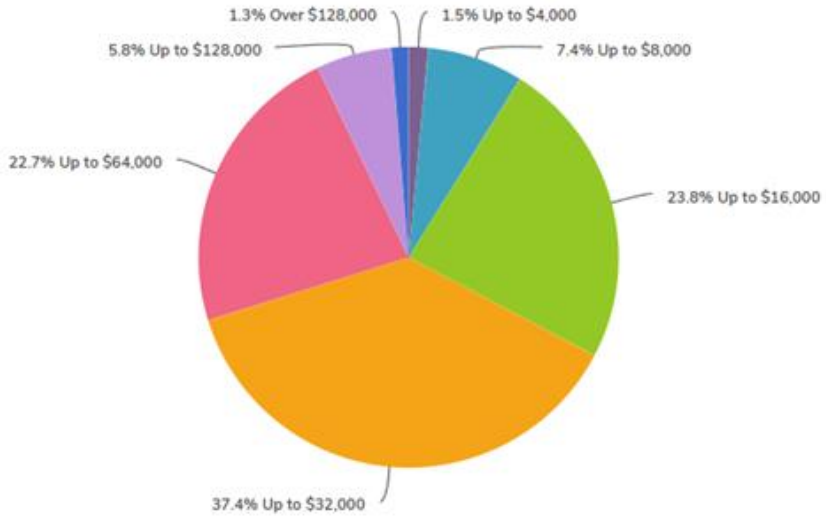
The latest AA Membership survey focused on the Climate Change Commission report and asked Members how much they would be prepared to spend on replacing their current vehicle. It was notable the difference in budgets and vehicle types between men and women.

Women (n=442)



Compared with

Men (n=662)



The income gap between men and women was 9.5% in 2020 . This suggests that the low cost second hand vehicle is largely the domain of women. Women, on average, drive 8,000km per year compared to men who drive more expensive vehicles on average 12,000km a year. Women drivers therefore emit fewer GhG than men. Gender equity is a real issue.

AA Member Surveys (Carbon Costs October 2020) have found Members support (67%) increased costs for importing high emitting vehicles but there were conditions:

1) Three quarters insisted on no compromises for road safety
2) Half felt that the policy should:
    a) make a proportional contribution to climate change goals
    b) be fair regardless of where people live
    c) be fair with respect to gender

But simply increasing import costs runs the risk of a perverse outcome. If the price of new SUVs is increased this will decrease supply against a clear demand and drive up the price of old SUVs in the domestic fleet, and hence encourage owners to continue maintaining old diesel vehicles for even longer than they do now. The simplest disincentive for using high emitting vehicles is a high carbon price. This also serves as an incentive for buyers to switch to low emissions fuels.

At present the most important border controls on vehicles relate to safety. From 1 July 2015 all imports were required to have electronic stability control. Frontal impact standards mean that Japanese micro cars (Kei class) which make up a third of the Japanese fleet but which have tiny 650 to 800cc engines and emit less than 100gm CO_2 per km.

The overall nature of the New Zealand fleet is determined by a raft of such rules rather than any overall strategy on imports or retirement. Such a strategy is well overdue. This is not a call for central planning of 5 million New Zealanders transport needs, but rather a call for a better grasp by officials of the drivers of the vehicle market.

Conclusions

- Immigration drives population growth and population increases drive transport demand increases. As the Government sets immigration policy it is effectively setting emissions policy via transport.
- The growth in emissions is largely concentrated in Auckland and the Waikato, Bay of Plenty triangle, with some growth in Canterbury. It is clear that effective localised policies in these areas could have more effect on emissions growth than national policies.
- Very high rates of congestion in these population growth areas compounds the inefficiency of growing local fleets.
- New Zealanders spend significant sums on equipping themselves with cars to drive but because New Zealand is a car dependent nation this means that disadvantaged groups (who generally contribute less to emissions than more affluent groups) will be marginally more disadvantaged by increased vehicle costs and flat taxes as opposed to progressive ones.
- 85% of all light vehicles imported into New Zealand are sourced from Japan due to the fact both nations drive on the left side of the road. Some manufacturers (e.g GM) have completely abandoned the right hand drive market. Therefore the manufacturers of Japan effectively define the scope of what is possible within the New Zealand fleet.
- The trend towards SUVs has locally and internationally had a significant effect on emissions growth since 2005. The physics of heavier vehicles necessitates increased energy per kilometre travelled. The substitution effect of SUVs on medium vehicles may significantly impact on emissions reducing effect of small numbers of very low emissions vehicles.
- A better understanding of how New Zealand's vehicle fleet meets its needs and how it could be better structured to meet long term goals should form the basis of an overall fleet strategy.

Chapter Three – Battery Electric Vehicle Supply and Demand

There is no question that the automotive industry is being disrupted by the advent of battery electric vehicles and shocked by the equity which Tesla has been able to raise (Tesla is the largest automaker by market capitalization). However the question at issue for the Climate Change Commission is the rate with which the New Zealand public will want to invest in electric technology vehicles.

To understand this a global view is needed. Unfortunately globally there is a widespread misconception among environmental lobbyists that the absence of a tailpipe on battery electric vehicles means that these vehicles are so-called "zero emission vehicles" and not responsible for any Greenhouse gas emissions. This is simply not the case. Liquid fuels, pressurised gas fuels and solid state batteries are all simply means to store energy. The energy in batteries comes from an electricity grid and the generation and distribution of electricity produces greenhouse gas emissions.

In New Zealand the emissions intensity of electricity generation ranges from 150 grams per kilowatt hour (September 2020 when hydro was 54% of generation) down to 72 grams per kilowatt hour (December 2018 when hydro was 63% of generation). The Nissan Leaf is the most popular battery electric car in New Zealand comprising about two thirds (64%) of the electric fleet and consumes (on average) 17.2 kwH per 100 km. That means a Leaf was responsible for emitting 25g of CO2 per km in September 2020 and half that in December 2018. The September 2020 figure is the equivalent of a petrol vehicle with an efficiency of 1 litre per 100 kilometres.

Effect of Electricity Carbon Intensity Internationally

There is no question that in New Zealand a Leaf produces much less emissions than a conventional ICE car. But this is not so in nations which do not boast the same share of renewable generation as New Zealand does. For this reason replacing internal combustion engine vehicles with battery electric vehicles is not necessarily an emissions reducing strategy for all nations.

In 2016 the Germany upper house resolved that all vehicle sales from 2030 should be electric. But because Germany's electricity carbon intensity is at best 401 grams per kilowatt hour (at maximum wind and solar production) it is possible that such a mandate could actually increase German Greenhouse gas emissions[2] rather than reduce them because the shortfall in energy needed for transport cannot be met by sufficient renewables. This will drive up the grid carbon intensity making BEVs emit more.

While Australian environmentalists have complained that their government has fallen behind the world for failing to mandate or stimulate the BEV car market in that country there are good reasons why this has not happened. The problem is the emissions intensity of the Australian grid which is mostly powered by coal.

[2] https://theconversation.com/germanys-plan-for-100-electric-cars-may-actually-increase-carbon-emissions-72997

Australian Electricity Carbon Intensity as Petrol Vehicle Fuel Efficiency Equivalent

	NSW/ACT	VIC	QLD	WA	SA	TAS	NT
GCO2/KWH	830	1080	790	700	490	140	640
GCO2/KM	160	209	153	135	95	27	124
Petrol vehicle L/100KM Equivalent	6.9	9.0	6.6	5.8	4.1	1.2	5.3

Given that the average Toyota Corolla hybrid achieves 4.2L/100km a Nissan Leaf emits more CO_2 per kilometre in all Australian states except South Australia and Tasmania.

The Australian government has therefore rightly determined that the country does not stand to gain from more electric vehicles. Unfortunately this pattern is true across almost all the nations that drive on the left hand side of the road or manufacture vehicles for that market. This is the energy intensity of these grids of these nations (best case), notably before new generation must be found for an electric vehicle fleet.

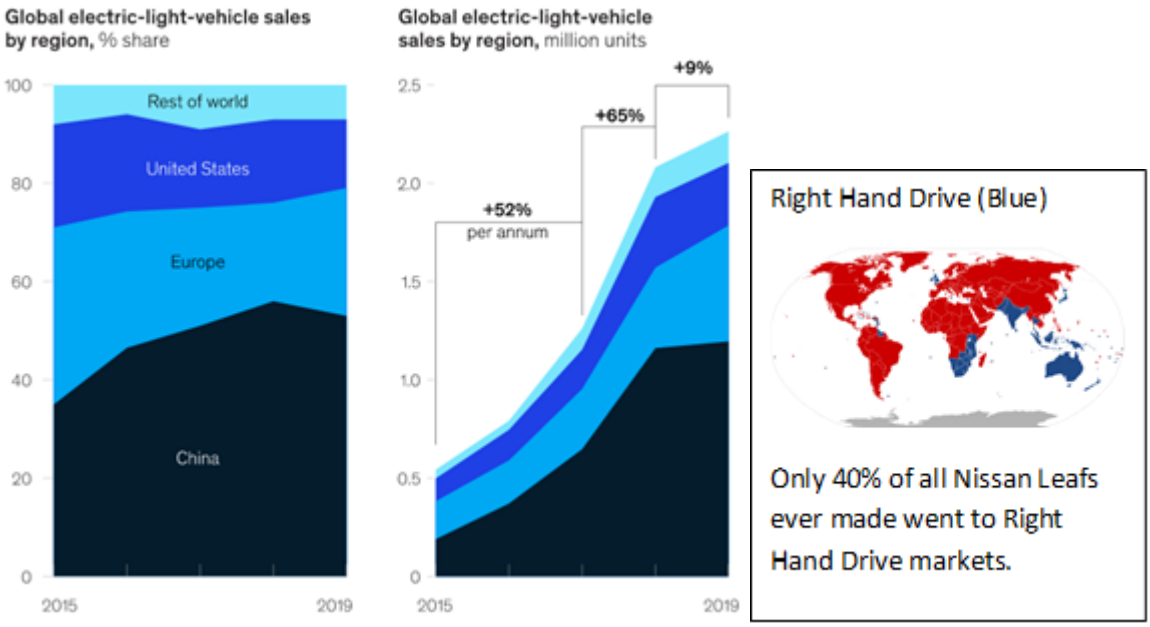
	JAPAN	KOREA	THAILAND	SINGAPORE	CHINA	INDIA	SOUTH AFRICA	UK
GCO2/KWH	506	500	445	250	555	708	928	347
GCO2/KM	87.5	86.5	77.0	43.3	96.0	122.5	160.5	60.0
L/100KM EQ	3.8	3.7	3.3	1.9	4.1	5.3	6.9	2.6

Source: https://www.carbonfootprint.com/international_electricity_factors.html

One can understand why Akio Toyoda the president of Toyota has questioned the wisdom of transferring the responsibility for reducing transport emissions and providing the necessary daily energy to national grid operators. As a nation reliant on manufacturers in other countries providing technology New Zealand policy makers should be more aware of the business drivers that could lead to supply constraints on electric vehicles globally than has to date been the case.

Right Hand EV Production Rates

At present EVs are around 2.5% of global light vehicle sales. The largest manufacturer is Tesla which in 2019 produced 370,000 units in 2019 and just shy of 500,000 in 2020. This annual output is less than Toyota's 750,000 unit monthly production. By far the bulk of deliveries are to left hand drive markets with sales in Europe in particular growing on the back of strong incentive schemes.



Source: McKinsey 2020

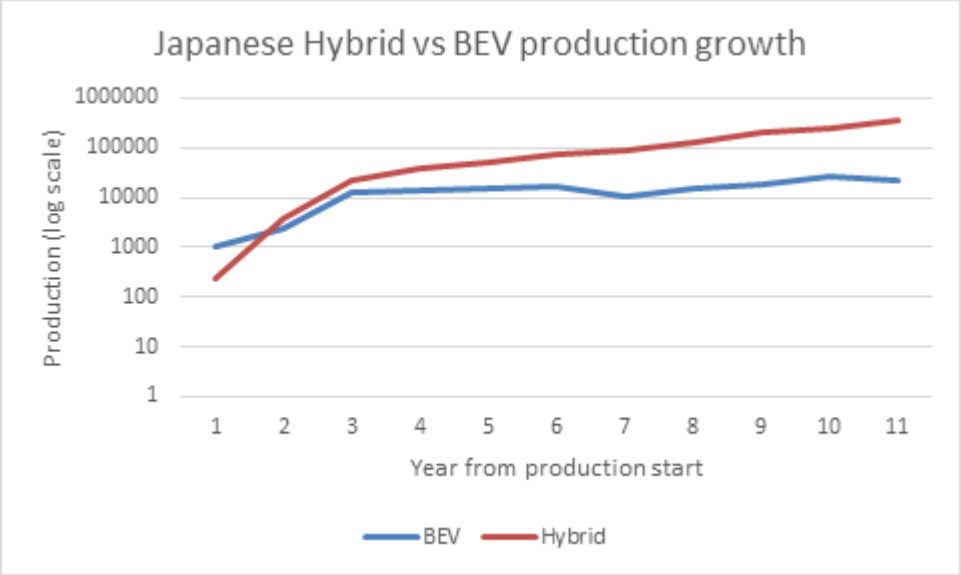
By contrast the main manufacture of right hand drive units is Japan which produces significantly less.

Japanese Production	HYBRID	PHEV	BEV
2012	887,863	10,968	13,469
2013	921,045	14,122	14,756
2014	1,058,402	16,178	16,110
2015	1,074,926	14,188	10,467
2016	1,275,560	9,390	15,299
2017	1,385,343	36,004	18,092
2018	1,431,856	23,230	26,533
2019	1,472,281	17,609	21,281
12-YEARS Total	10,896,322	141,689	152,134

Source Data: Japanese Automobile Manufacturers Association

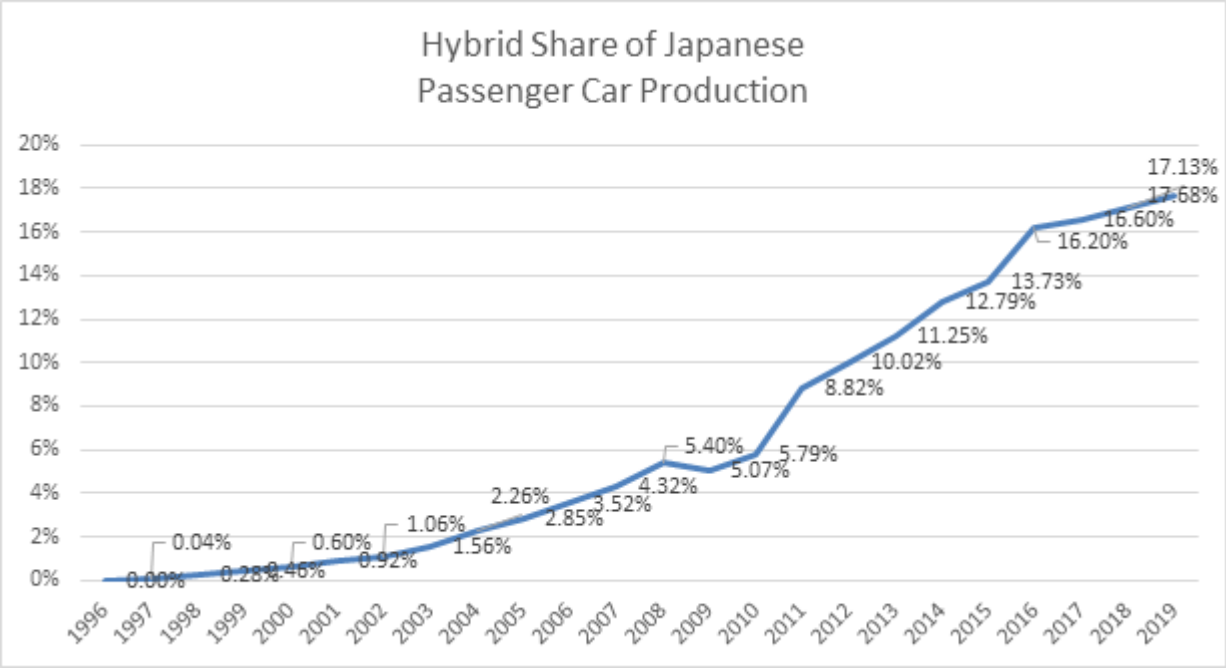
In short Japan's total production of Battery Electric and Plug-in Hybrid vehicles to date is the equivalent of one year's imports to New Zealand.

If we compare the rate of production growth between Japan's hybrid and battery electric development it becomes apparent that Japanese manufacturers are not growing their BEV production as quickly as hybrid production grew, when comparing year by year production (1996 is year one for hybrids 2010 year one for BEVs)



It is also important that any assumptions about the ability for manufacturers to economically transform production lines from one technology to another is based on commercial realities rather than ephemeral political edicts – especially those in Europe which has little to do with the NZ market.

The transformation of the Japanese motor industry from conventional internal combustion engine technology to hybrid technology has been evolutionary rather than revolutionary.



Source Data: Japanese Automobile Manufacturers Association

It has taken the Japanese automakers over 25 years to transform production from 100% conventional technology to less than 20% hybrid. This is why Tesla has been able to claim such a significant share of the EV market. It doesn't have to rely on sales because capital markets have given it such a vast market capitalisation (over US$653 billion at time of writing) to work from.

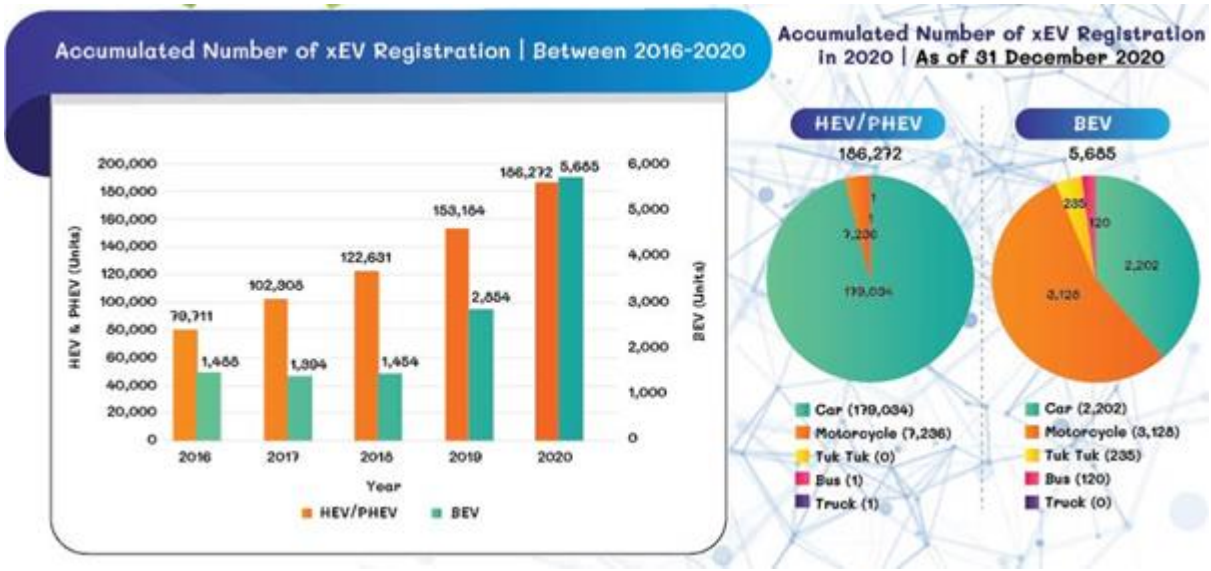
Toyota aims to increase its EV production to 500,000 units annually by 2025 and has announced six new models to achieve this. However, if you compare the exponents of the power equations describing the Japanese growth of hybrids (2.5) vs the growth of BEVs (1.2) it becomes apparent that if the Japanese had invested as much in BEVS as it did hybrids it would have already passed this target by now. As it is it will have to take a leaf of Tesla's book and develop completely new systems and factories to have any chance of coming close to meeting this target.

Given the competition from Tesla it is highly likely that Toyota is more likely to compete in the enormous left-hand drive EV market than the right-hand drive domestic market it already owns. The only challenge could come from Tesla's new Gigafactory in Shanghai which will reportedly manufacture 100,000 right hand drive units per year. The obvious destination for most of these vehicles is Japan.

Of the other manufacturing nations in the eastern hemisphere progress is even more limited.

South Korea exported 276,000 hybrid and electric vehicles in 2020. However of the 17,693 hybrids and plug in hybrids sold in January 2021 only 1,654 (9.3%) were plug in hybrids. As Korea is a left hand road nation it is not clear how many were right hand drive.

Thailand, the source of so many of the SUVs exported to Australasia is even further behind in both take-up and manufacture with joint ventures with SAIC and Mitsubishi only recently started.



Source: Thai Electric Vehicle Association

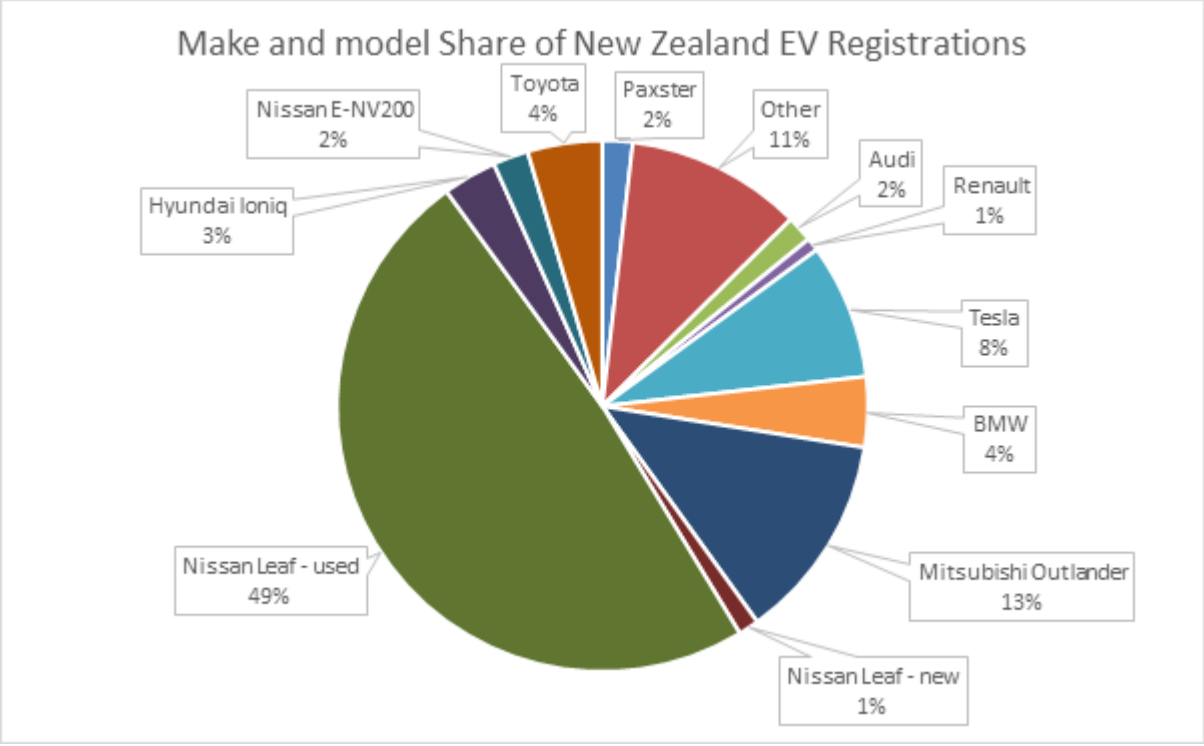
While China is a huge manufacturer of electric vehicles it exports very few. This is largely because the domestic market absorbs most of its production leaving exports to state owned corporations such as SAIC Motor Corporation (formerly Shanghai Automotive Industry Corporation) which sells under a number of brands including MG and Roewe. The major interest to New Zealand is the MG - ZS range of electric SUVs built in Thailand, however the lack of any EV incentive scheme in Australia means that the Australasian market is considered difficult to enter.

Indian manufacturers like South African manufacturers have barely begun to start in electric vehicle production and likewise have huge domestic markets to attend to.

To distribute cars to New Zealand any manufacturer must already be quite large and well established globally. Indeed all auto manufacturers for new car sales regard New Zealand as part of the greater Australasian market and anecdotally it has been difficult for fleet buyers seeking EVs to find a source of supply. By itself New Zealand (without Australia, which has already seen the collapse of its domestic manufacturing industry due to small scale) is a tiny right hand drive market in a vast left hand drive world brimming with richer opportunities. All of this suggests that the international availability of new right hand drive electric vehicles will be constrained.

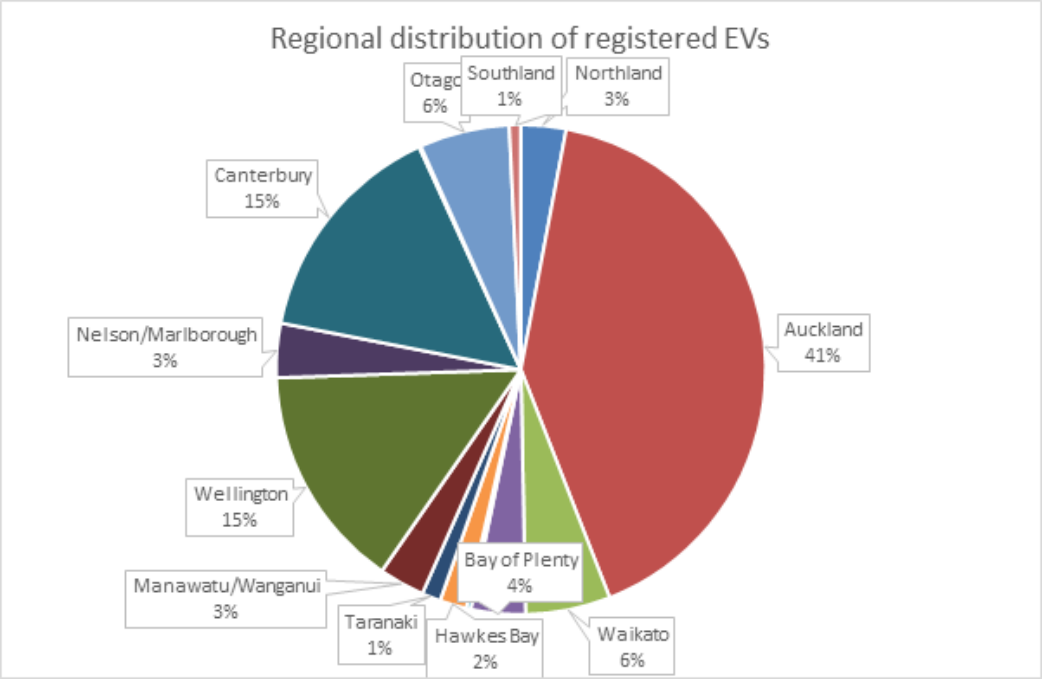
New Zealand uptake of EVs to date

To date (end of 2020) the New Zealand EV market (totalling 24,037 vehicles) has not varied significantly from the general automotive market. Second hand Nissan Leafs completely dominate EV registrations. In that second hand imports make up at least half of it. Among new vehicle registrations it is notable that Tesla has managed to achieve a sizeable share of the very small luxury EV market.



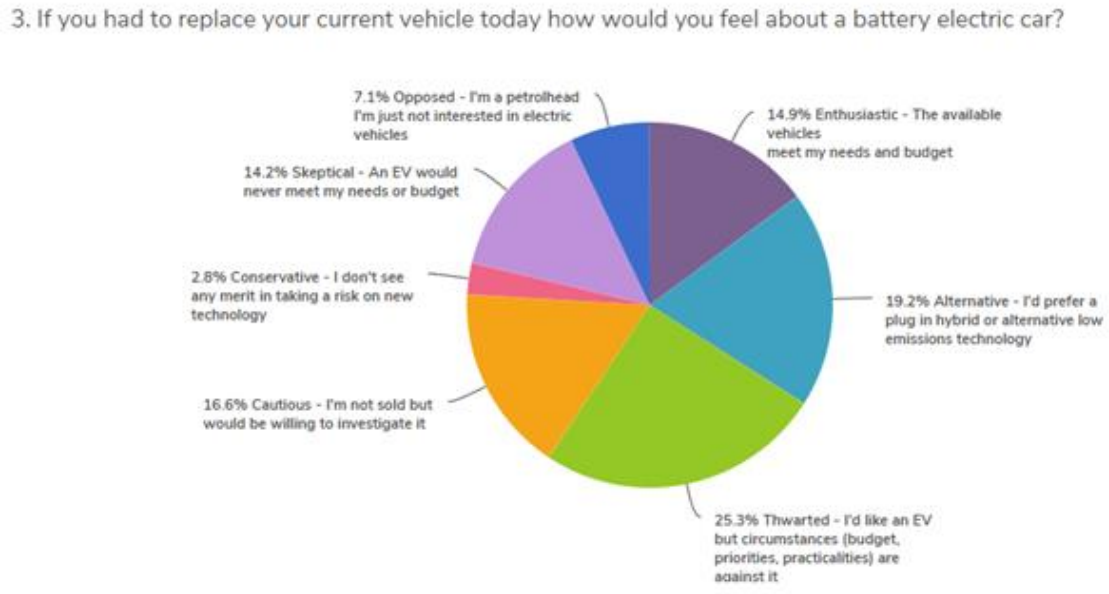
Source Data: Ministry of Transport

It is also plain that EVs are largely attractive to those living in our largest urban areas.



What AA Members think

For this submission the AA ran a Member survey which included questions on vehicle purchasing of EVs.



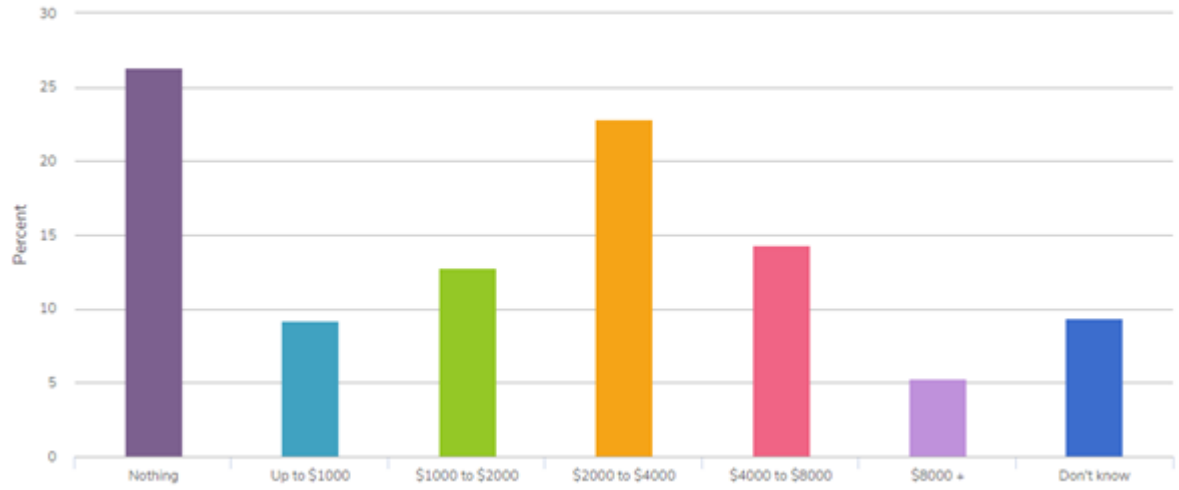
We asked about attitudes to EVs, as well as budgets and common beliefs about EVs.

6. What do you think of the following sentences about Electric Cars?

	True	False	Not sure	Responses
Electric cars cost too much for what they are Count Row %	1,036 63.5%	199 12.2%	396 24.3%	1,631
Electric cars are much cheaper to run than liquid fuel cars Count Row %	1,009 61.9%	177 10.9%	445 27.3%	1,631
Electric cars pay taxes for the roads at the moment Count Row %	253 15.4%	727 44.3%	660 40.2%	1,640
Electric cars' batteries degrade unpredictably Count Row %	547 33.4%	354 21.6%	737 45.0%	1,638
Electric cars are expensive to look after Count Row %	257 15.7%	691 42.2%	688 42.1%	1,636
Electric cars' batteries are not good for the environment Count Row %	882 53.7%	273 16.6%	487 29.7%	1,642
Electric cars create less Greenhouse gas emissions than liquid fuel vehicles in NZ Count Row %	1,222 74.6%	163 9.9%	254 15.5%	1,639
Totals Total Responses				1642

n = 1,655

5. If you were replacing your current vehicle and had the choice of a hybrid vehicle with reduced petrol consumption what is the most extra you would you be prepared to pay for a hybrid over conventional technology?



Criticisms of the Climate Change Commission's assumptions

The Climate Change Commission appears to have based its fleet EV uptake model on the Ministry of Business Innovation and Enterprise's Electricity Demand and Generation (EDG) Scenarios and the Ministry of Transport Vehicle Fleet Model (VFEM). We say appears because the information that has been released by the Commission is unfortunately obscure and unhelpful in this regard.

The EDG model is essentially based on an assumed preference for EVs as soon as the price reaches a parity with internal combustion models. Models for the price differential are based on best guess values derived from international literature. Unfortunately this literature is locked into nations where vehicles entering the fleet are always new. This is not the case in New Zealand where over half are used. While these vehicles have lower purchase prices they also have much shorter lives in New Zealand than comparable internal combustion engine models – something the public is aware of. Early versions (2015) of the EGD also assumed PHEV models would predominate however this has proven not to be the case.

The VFEM model (kindly shared by the Ministry of Transport) does not explicitly state its assumptions but provides a number of scenarios for the uptake of EVS. Unfortunately when compared with reality there are interesting discrepancies. The VFEM seems to exclude the used market from its totals.

Year Registration	Japanese BEV + PHEV Production	VFEM Projections	Actual NZ New Registrations	Actual Used	% New of Japanese production	% Used of Japanese Production
2014	32,288	325	362	127	1%	0%
2015	24,655	502	656	336	3%	1%
2016	24,689	1,493	1,360	1,129	6%	5%
2017	54,096	3,652	1,780	1,469	3%	3%
2018	49,763	5,415	3,942	7,696	8%	15%
2019	38,890	6,926	6,740	11,785	17%	30%

Source data: JAMA, MOT

NB: While most of the Used EVs are Japanese in origin this is not true of new vehicles.

The good news is that the VFEM model uses a more conservative growth curve than the actual rate of production growth of hybrids. Unfortunately there is no evidence as yet that Japanese manufacturers will replicate the hybrid rate with BEV and PHEV models and current growth is well behind hybrids.

What however the percentage of Japanese production is showing is that New Zealand used car dealers have been quick to supply the New Zealand market with used Leafs but are effectively mining a dwindling resource. In short the uptake of EVs which has occurred in recent years has been dependent on a supply of low cost second hand vehicles bought by-and-large by individuals rather than fleet buyers.

This reinforces serious questions regarding vehicle retirement and scrappage. Second-hand electric vehicles have a shorter working life in New Zealand than second-hand diesel vehicles which on average drive 40,000km further than petrol vehicles. More to the point vehicles with both larger

petrol and diesel engines tend to be driven further. This raises the question of whether electric vehicles are simply substituting for small petrol vehicles and not the large petrol and diesel commercials which have seen so much growth in the last fifteen years.

This could well mean that the effect of substituting a 25 gm CO2e /km Leaf for a 105gm CO2e Yaris which is driven 80,000km less than the average Ute is not going to make any significant difference in the short term, given population (and hence fleet) growth and the continuing demand for long-lived large utilities.

Conclusions

There is no question that EVs are a sea-change in the automotive world. This is not in dispute. The question at issue is volume supply to a small right-hand drive nation (New Zealand) which usually coat-tails on a larger market (Australia) that is rightly sceptical about the benefits of EVs given the carbon intensive nature of its electricity grid.

The benefits of EVs to New Zealand's greenhouse gas emissions are not matched in many other countries. This is especially important with regard to Australia to which automotive manufacturers attach New Zealand as a single market for logistical convenience. Therefore supply of new models of EVs is likely to continue to be dictated by the rate with which Australia greens its electricity generation. In the used market the question will be whether the Japanese car industry is able to convince its government that it can deliver lower emissions per vehicle than the Japanese grid.

The right hand drive market is a very small subset of the total automotive market. Even the Nissan Leaf has mostly been sold to the left hand drive market. The main export manufacturers servicing Australasia are Japan and Thailand. Japan sells both new and used small, and medium and large engine vehicles plus second hand European vehicles. Thailand tends to supply larger engine SUVs. Korea has entered the Australasian market in competition with Japan. China markets commercial vehicles and sells right hand drive vehicles (especially the MG brand) to Britain. The European luxury vehicle manufacturers have always had a presence in New Zealand. However the main action for manufacturers is in the left hand drive market where the bulk of the world's markets are and competition for market share is becoming heated. We anticipate supply restrictions as manufacturers pursue larger and more lucrative markets.

Scarcity of supply may well mean that prices do not fall as quickly as the Commission has assumed in its modelling regardless of the costs of production.

We find AA members support EVs in theory but are dubious about them in practice and many lack quite basic knowledge about them.

Chapter Four – Phase Out of Internal Combustion Engines

A number of nations have declared the intention to introduce cut-off deadlines for the sale of non-electric vehicles. Many of these are incorporated in climate action plans although actual enforceable legislation is considerably less common. The objective appears to be to force manufacturers to make technology transitions that would not occur under normal commercial conditions.

Source ICCT 2020

Germany in particular appears to be the main source of this movement with the Bundesrat (upper house) passing a resolution (which is *not* a law, despite what numerous sources say) calling for a ban by 2030 in 2016. A second part of the vote called for an elimination of EU policies that favour diesel cars, including lower taxes on sales of new diesel automobiles and lower taxes on diesel fuel. Government officials argued that these current lower costs for diesel cars are detrimental when trying to encourage buyers to switch to zero emissions cars. While not enforceable the Bundesrat vote is meant to guide legislators.

European Commission's Previous Strategy was "Clean Diesel"

In some ways the German move brings to a close a decades-long effort by European officials to favour so-called "clean diesel". Carnes and Helmers (2015) trace the European Union's efforts to shift automobile production toward diesel power trains in the name of greenhouse gas reduction. By contrast to Europe the US and Japan rejected the diesel substitution as infeasible and in fact not only did greenhouse gas reduction in Europe not occur but Carnes and Helmers[3] allege that European

[3] Cames and Helmers Environmental Sciences Europe 2013, 25:15
http://www.enveurope.com/content/25/1/15

officials were actually acting to find markets for European refineries facing shrinking demand for heating oil in the face of a growing switch to LNG for home heating.

“Clean Diesel” VW Golf at US motor show in 2012.

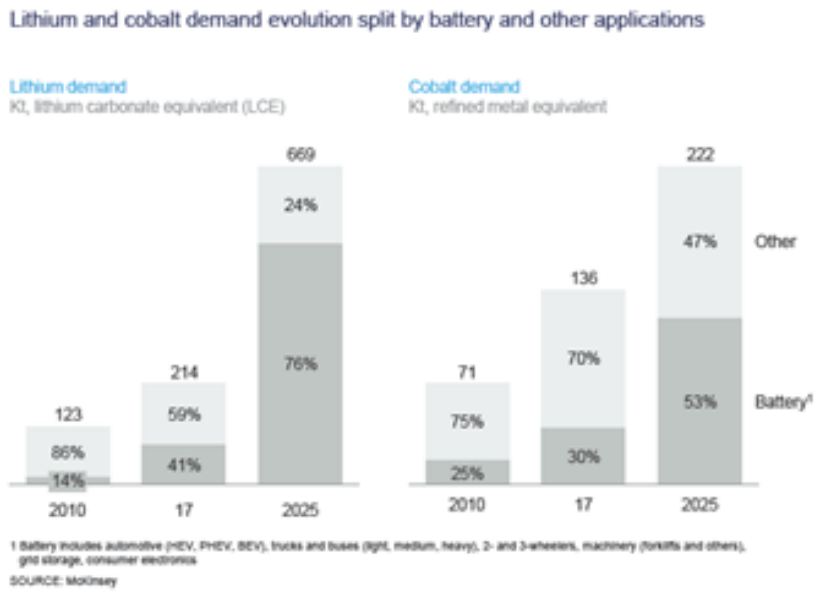
Be that as it may the net result of the European Union’s excursion (through preferential regulatory and fiscal discrimination) into diesel automobiles has been more carbon emissions than might otherwise have been, growing and dangerous levels of local air pollution (particulate matter less than ten microns in particular) and widespread fraud among automotive manufacturers (so called Dieselgate) trying to resolve the contradictions between EU emissions regulations and feasible engine technology.

Coincidentally in 2016 (as it was being pilloried for Dieselgate globally) Volkswagen (which that year pipped Toyota to be Forbes’ world’s largest automotive manufacturer) announced an “electrification strategy” to be completed by 2025. Days before the announcement Volkswagen, without consultation, pulled the plug on its South Korean battery suppliers and switched to Chinese suppliers While Volkswagen may be happy to rely on Chinese firms to provide the technological underpinning of its diesel to electric pivot, in Brussels the EU was becoming concerned that Europe was in danger of losing strategic control of automotive energy systems. The European Commission is not the only one concerned about the sustainability of EV battery supply.

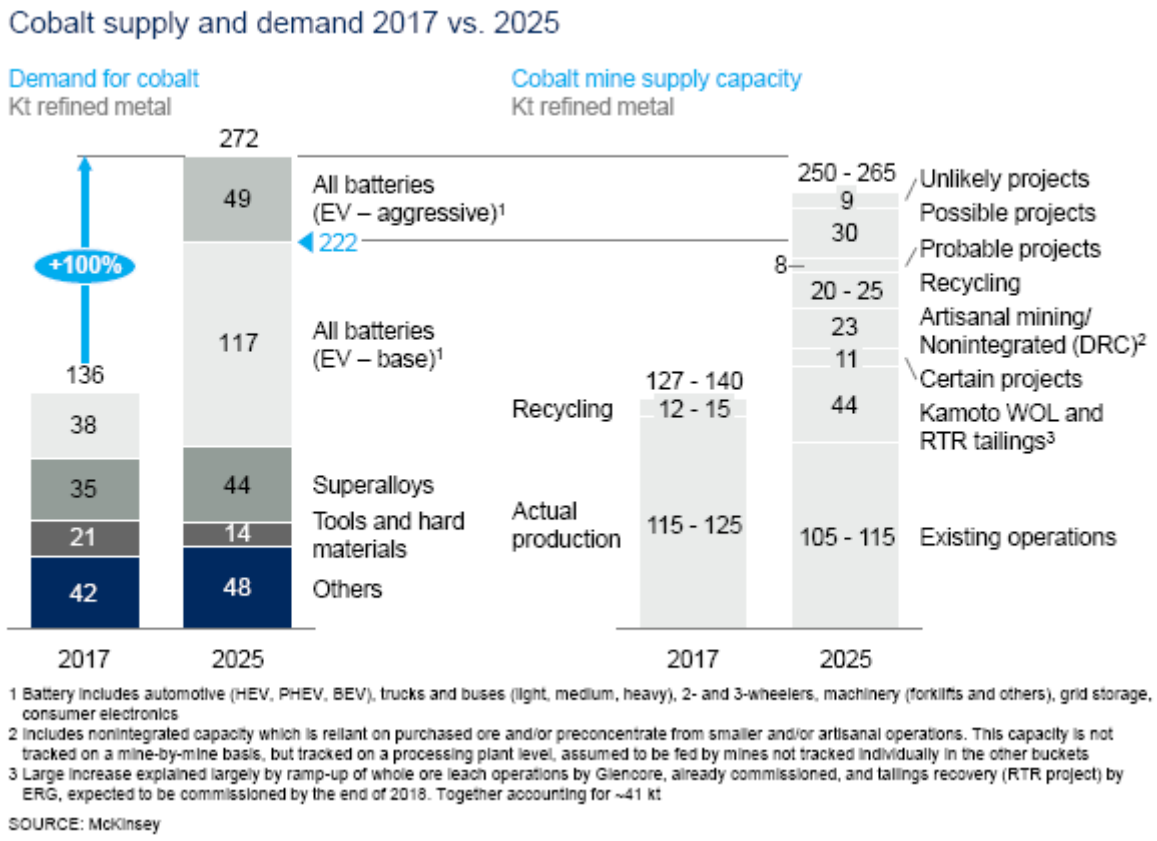
Strategic concerns related to battery technology

McKinsey[4] notes that for its projections of 36 million EV units globally will depend on many things including supply of Lithium and Cobalt. 86% of Lithium supply comes from Chile, Australia and China while 69% of the world Cobalt is mined in appalling conditions in the Democratic Republic of Congo.

[4] “Lithium and cobalt - a tale of two commodities”, McKinsey and Company, Metals and Mining, June 2018



Of the two the supply of cobalt is the most concerning. McKinsey suggests that there are significant risks if there is high levels of demand and there is a stability risk with the DRC given its history of renegade uprisings and interventions from neighbouring nations.



As a result the European Commission[5] is concerned about the supply of these minerals. It states "The supply chain of these materials is potentially vulnerable to disruption. In view of the large

[5] European Commission SWD(2018) 245/2 final "Report on Raw Materials for Battery Applications"

quantities needed in the future, the sustained extraction and exploitation of these resources is fundamental and recycling of materials will increasingly become important for reducing the EU's dependency on third country markets and should be encouraged in the framework of the transition to a circular economy." And is seeking to stimulate production within the confines of Europe. This, it notes, will take considerable time as much of the necessary geological fieldwork has not been done.

In short it appears that the rush to announce phase outs of internal combustion engines is following in the political footsteps of Europe's diesel adventure. Commercial and political public relations considerations are taking precedence over sound planning. By contrast China, a nation which has historically led the world in EV development and sales, which has strategically secured lithium and cobalt supplies, and which is governed by a single communist political party thoroughly used to rule by decree has not made any announcements about phasing out internal combustion engine vehicles. This is probably because the Chinese grid can only match a Yaris hybrid for emissions and the Chinese Communist Party is not troubled by popular environmentalist movements effecting political processes.

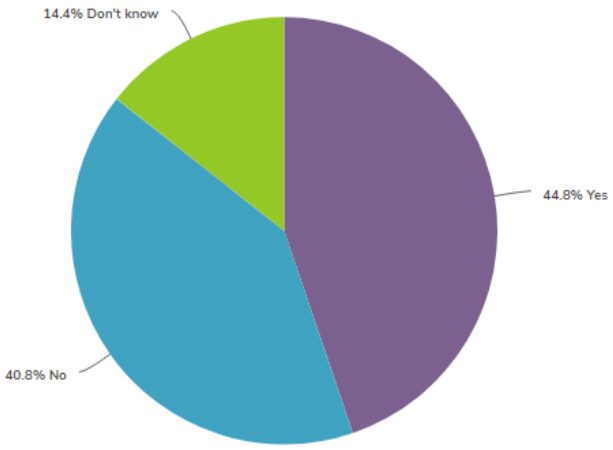
Consequences of reliance on electric vehicles.

Currently New Zealand requires 200 Petajoules of energy to move its transport fleet. Fortunately electric vehicles are considerably more energy efficient than fossil fuel driven vehicles but even so moving to a fully electric fleet will ultimately mean needing another estimated 4,500GwH of production. This is roughly double the amount of energy produced by all the country's wind farms. It is also the difference between a peak hydro production year and a low hydro production year Typically when hydro production and/or wind production is low gas and coal have picked up the difference

At the same time New Zealand has a target of increasing of phasing out 8.2GwH of coal and oil based electricity generation so effectively New Zealand will need to find 12.7GwH of new renewable electricity production over the next thirty or so years to meet this level of demand. In the past 30 years New Zealand has added 12GwH of generation so this is apparently feasible.

The problems will occur in timing if EV uptake is not predictable. For this reason electricity companies have a considerable interest in the way in which the EV fleet grows and its charging is managed. In association with the Electricity Networks Association we asked Members various questions about preferences for managing the charging of EVs (which we are happy to share with the Commission) but the most interesting was their response to the priority they thought EVs should receive when the electricity grid is under pressure.

22. If hydro lake levels are low and there is an electricity shortage do you think electricity network operators should have the ability (whether they use it or not) to specifically restrict the recharging of electric vehicles so that household electricity supply is prioritised?



This strongly suggests that an "us" and "them" outlook could easily develop over EVs. On the one side people will not be happy if they have to forgo a hot shower to charge someone else's Tesla. On the other people who depend on an EV to get to work won't be impressed if their vehicle can't take them anywhere in the morning because a major electricity project is delayed, there's no wind and lake levels are low.

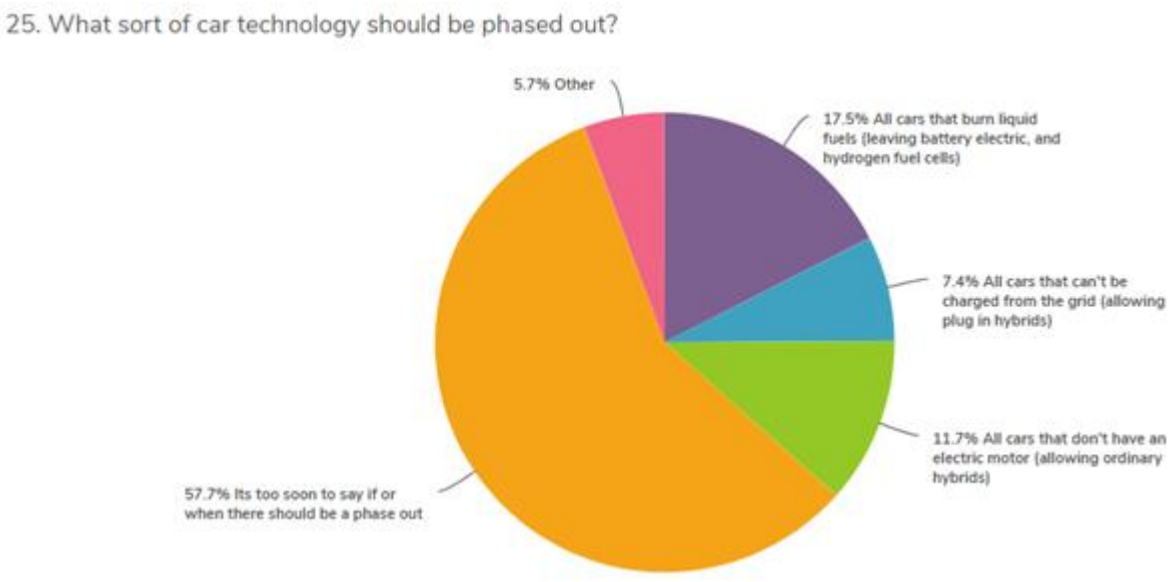
What AA Members think.

AA Members were asked as part of the survey for this submission on their views on whether New Zealand should announce a ban on fossil fuel powered vehicles. Their views are as follows.

We stated in the question preamble:

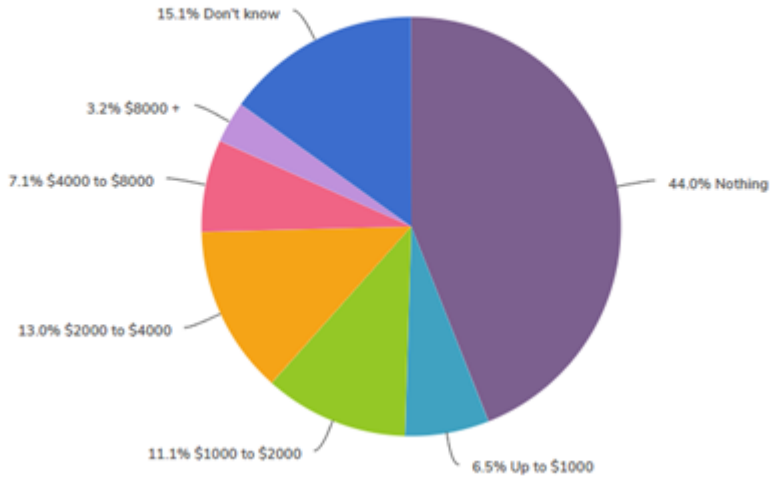
> These questions are about a possible future ban on the sale of conventional internal combustion engines by the New Zealand government.
>
> A number of countries have announced an intention to ban conventional petrol and diesel engine vehicle sales at some point in the future. The idea is that large markets will close their doors to these technologies to force manufacturers to switch to electric drive technologies. The most common date in Europe (Germany home of VW, BMW, DB and Sweden home of Volvo and Saab) is 2030 although France (home of Renault (43% owner of Nissan), Peugeot) and Spain (SEAT) have nominated 2040. Japan, which supplies most of our vehicles, has mentioned a possible 2035 ban on vehicles that cannot be electrically powered (leaving the door open for petrol electric hybrids).
>
> New Zealand imports 250,000 cars each year at an average price of $16,000 each. This affordable price is only possible because over half are second hand imports from Japan. The New Zealand car market is smaller than Sydney's.
>
> It can be expected that the supply of EVs will be restricted by the limited number of right-hand drive cars made, competing global demand from larger and richer economies, and the supply of critical materials and components. At present Japan makes less than 30,000 right hand drive EVs each year. This will probably mean higher vehicle prices the earlier we eliminate conventional technology.

And asked



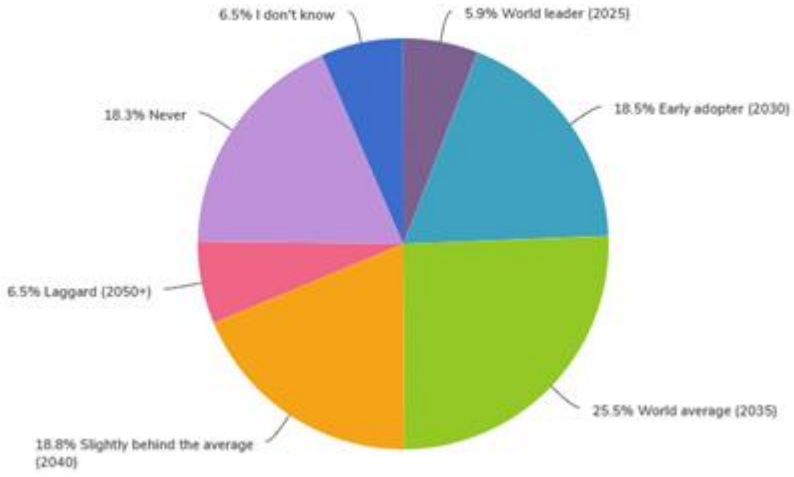
N= 1219

24. How much extra do you think cars should cost on average so that the country can meet a conventional vehicle phase out date?



n- 1176

26. On a timeline where do you think New Zealand should position itself in respect to phasing out internal combustion driven cars?



N = 1,184

It is apparent there is not a lot of AA Member support for an internal combustion engine phase out among AA Members and even among those who may countenance one only a small minority (25.4%) support favour a BEV and PHEV only level.

AA Members were not generally in favour of a phase out resulting in extra costs for vehicles with only 23.3% prepared to pay more than $2,000 more for a car for that reason. A similar number (24.4%) favoured early adoption of a phase out.

Conclusions

The rush to declare phase outs of internal combustion engine vehicles appears to be more rhetorical than legal. As we have seen with our own politicians setting targets (the 64,000 EVs by 2021 target set by Transport Minister Bridges – 6-May-2021) it is very easy for politicians to set "ambitious" targets when they are unlikely to be in office when the due date falls. The European Commission has been down this road before with diesel and it is by no means clear that it is ready to enact a Union-wide phase-out with any actual teeth.

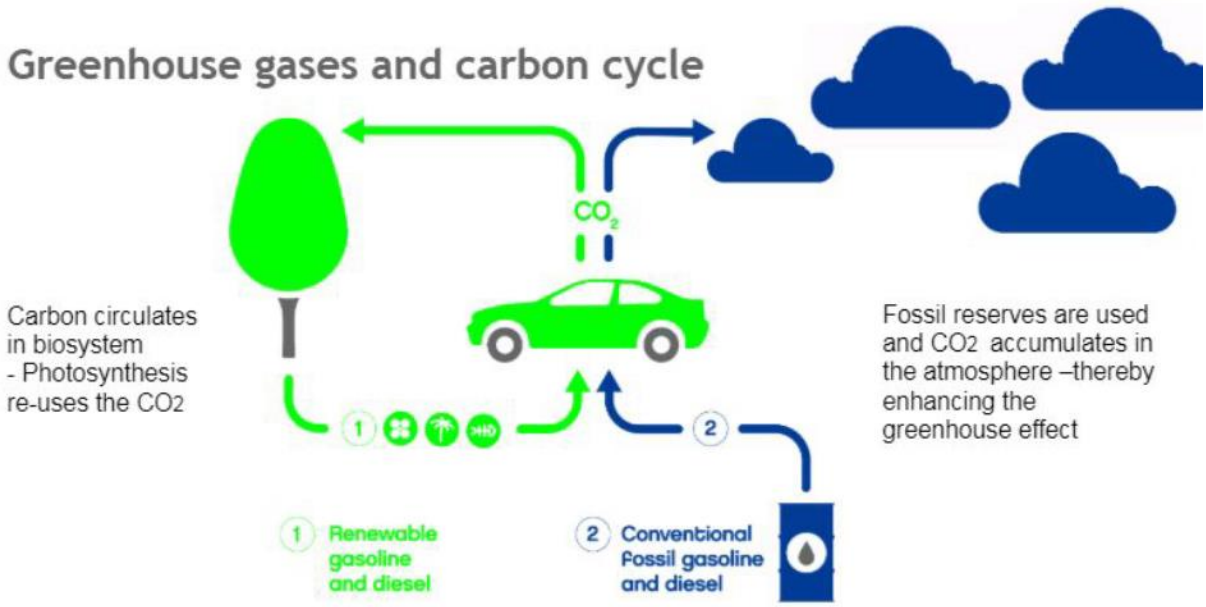
While Europe appears to have achieved electricity with a low enough carbon intensity in recent years the addition of the transport fleet's extra energy requirement to grid demand could easily reverse this. The Commission is evidently clear that Europe has almost no strategic resources for battery production and would become completely dependent on China. Even China – which has a huge EV production base – has not set a date for a fossil fuel phase out. This is once again probably because the energy intensity of its generation is high and unlikely to be reduced by adding its colossal transport energy need to grid demand.

AA Members are not convinced that announcing an internal combustion engine phase out is wise with only around quarter in support.

Chapter Five – Biofuels: The Other Pathway

If the rate of EV uptake is likely to be slowed by supply and New Zealand needs to achieve greenhouse gas savings quickly the obvious alternative is to green the fuel used by the existing fleet, rather than waiting for the public to warm up to EVs.

The production of automotive fuel from vegetation is as old as the internal combustion engine. Nicolaus Otto, the inventor of the modern four-cycle internal combustion engine, used ethanol to power an early engine in 1826. Currently New Zealand consumes 0.18 of a Petajoule of biodiesel and bioethanol, which since the mothballing of the Z biodiesel plant at Wiri is all imported, mostly by Gull which sells first generation biofuels in a ten percent blend mostly sourced from Singapore.



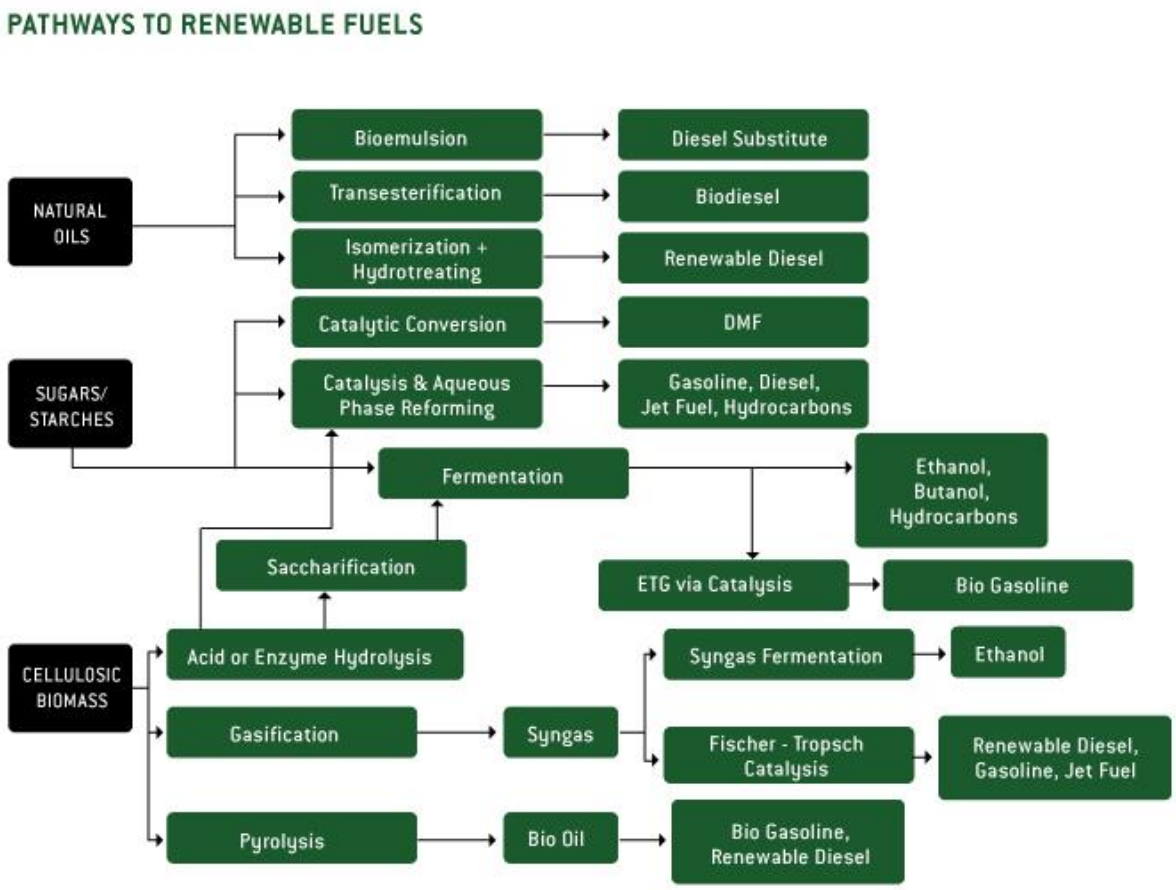
Credit: Neste

The IPCC certainly recognizes biofuels as a valid Greenhouse gas emissions mitigation strategy for transport. Fuels made from plants and animals in the carbon cycle are not counted as Greenhouse gases as fossil fuels are for the purposes of national reporting. Chapter Two of the IPCC 2011 Report on Renewable Energy is the most detailed IPCC report on biofuels and suggests that depending on how land use change and other matters are treated the range of global mitigation potential from biofuels is potentially extremely high.

The obvious benefit of biofuels is that there is no need to wait for the public to make literally millions of investments which while individually small are still the second most expensive thing households buy after the family home. Instead large scale investments can be made which fit into the existing liquid fuels infrastructure and replace fossil petrol or diesel with biofuels either in part (through blends) or entirely.

There are a lot of different ways to make biofuels. While the simplest involve creating vegetable oils or fermenting alcohol the more interesting do not use food crops and instead take woods or lignocellulosic feedstocks and process them into liquid fuels. The two main pathways of interest

involve either pyrolysis or the Fischer-Tropsch catalysis. These typically require higher oil prices to be competitive without assistance.



Credit: Advanced biofuels Association

But despite New Zealand having a Biofuels Roadmap (published by Scion in 2015) and large amounts of marginal land both the Productivity Commission and the Climate Change Commission have not emphasized the potential of biofuels to meet New Zealand's climate change obligations. The Climate Change Commission has proposed that 3% of fuels be biofuels by 2030.

By contrast the Finnish government in 2019 passed legislation for a biofuels sales obligation that required that 30% of all fuels sold in 2029 are biofuels. The country had targets of 10% by 2016 and 20% by 2020[6]. But 30% is not a stretch target as Finland reached 15% in 2015. According to a 2014 fact sheet "A recent study on the 2030 EU climate targets concluded that the most cost-efficient way to reduce emissions in Finland is to invest in the production and uptake of domestic, advanced drop-in biofuels as they do not require changes to the vehicle fleet or fuel distribution system."

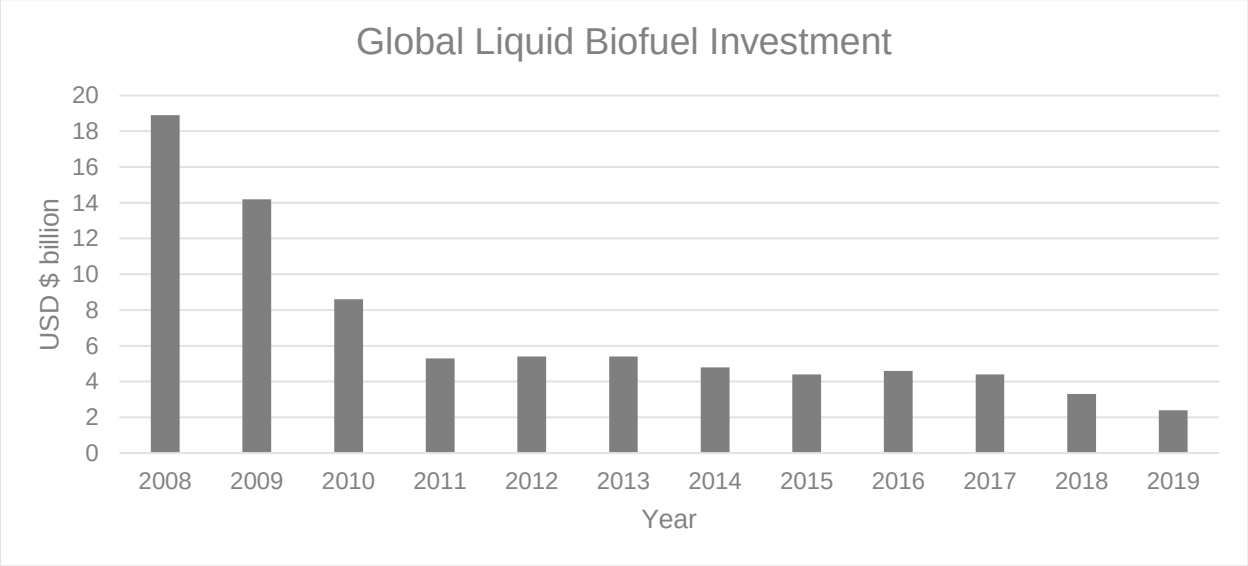
The result is that Finnish companies Neste Oil, Pöyry Finland Oy, and St1 are expanding globally to roll out sustainable fuel deliveries around the world. Neste Oyj has established refineries in

[6] https://www.etipbioenergy.eu/images/EBTP_Factsheet_Finland_250416_582afad9527a8.pdf

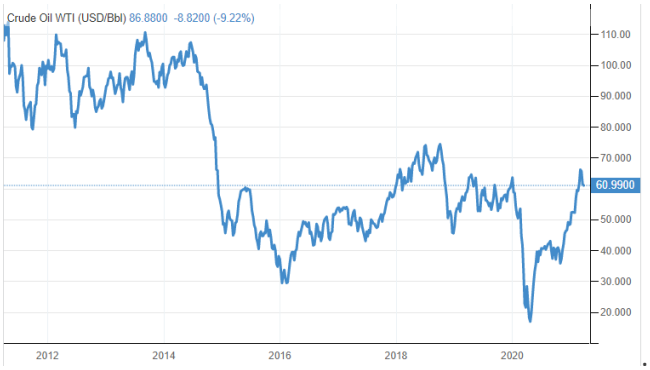
Rotterdam and Singapore. Neste's NEXBTL renewable diesel is a drop-in replacement fuel which can be used in any level of blend with fossil diesel – and in fact burns cleaner than fossil diesel. In 2015 as a technology demonstrator, the Neste/CLP Motorsports team crossed the United States (4000km from Jacksonville Florida to Santa Monica California) using just a single tank of 138 litres of Neste NEXTBL renewable diesel fuel achieving fuel economy of 3.2l/100km at an average speed of 108km/h.

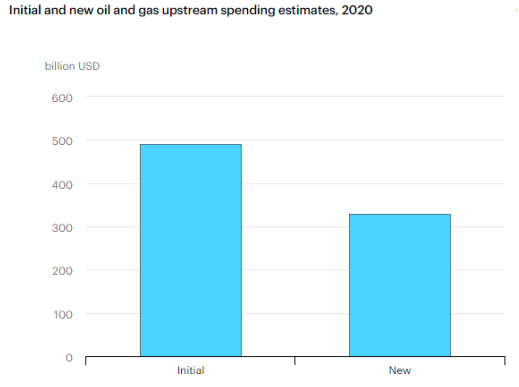
Neste, in particular, has done relatively well in the tiny biofuels market where its €11.7 billion turnover makes it a minnow in the energy world alongside the fossil fuel oil giants. In 2020 the company reported a profit of €1.3 billion and Neste's renewable products division sold approximately 2.97 million metric tons in 2020, up 4 percent from 2019. Despite this, it was clear that Neste, like all energy companies, suffered during the first year of Covid-19 with reduced revenues and profits on previous years.

Internationally investment in biofuels is down. The United States, Germany and obviously long-time biofuels stalwarts like Brazil have kept up a significant Biofuels investment but nothing like the heyday back in 2008. This is because biofuels struggle in a low fossil fuel price environment dominated by fracking and shale oil prices.



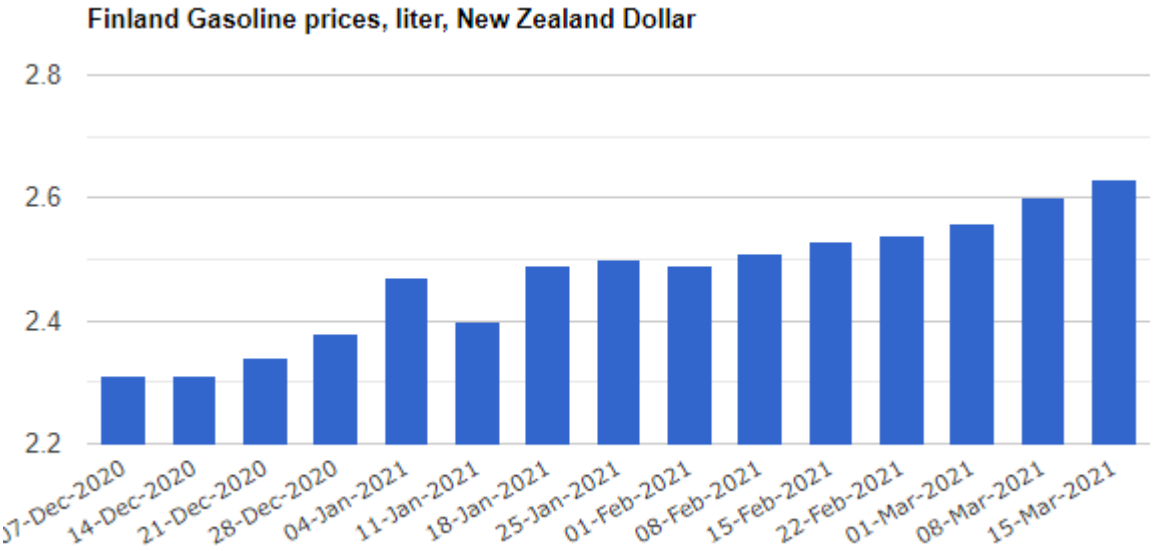
While investment has followed oil prices down fossil fuels still attract two hundred times more.





Sources: IEA

The price of high levels of biofuels in Finnish fuels means 40c higher fuel prices in Finland than New Zealand. This is also because the Finns levy a carbon tax of €62 ($104) per tonne (25.5cpl petrol and 28cpl diesel) on all liquid fuels. As this is not levied on biofuels producers have room for higher costs.



Not surprisingly AA Members would get extremely upset with such an increase. In our October 2020 Carbon Costs survey we asked members to rate their level of upset out of ten based on price increases caused by the ETS. We asked about 5% and 25% increases i.e. from $2 to $2.10 and $2.50.

Views on climate petrol price increases by age and gender (tables)

	(5% increase)	(25% increase)
	0 (Relaxed) to Very upset (10)	0 (Relaxed) to Very upset (10)
2020	How would you feel if the price of petrol went up on average 10c per litre from $2 00 to $2 10 per litre because of the ETS?	How would you feel if the price of petrol went from $2 00 to $2 50 per litre because of the ETS?
Women 18-54 (19%)	4.57	6.59
Men 18-54 (14%)	4.18	6.10
Women 55+ (45%)	5.58	7.19
Men 55+ (22%)	5.73	7.58
Total	5.22	7.00

2017	How would you feel if the price of petrol went from $2 00 to $2 10 per litre because of the Paris Agreement?	How would you feel if the price of petrol went from $2 00 to $2 50 per litre because of the Paris Agreement?
Women 18-54 (17%)	3.80	6.18
Men18-54 (22%)	3.47	5.99
Women 55+ (32%)	3.82	6.93
Men 55+ (26%)	4.51	7.04
Total	3.92	6.62

Change	How would you feel if the price of petrol went from $2 00 to $2 10 per litre	How would you feel if the price of petrol went from $2 00 to $2 50 per litre
Women 18-54 (17%)	+20%	+7%
Men18-54 (22%)	+20%	+2%
Women 55+ (32%)	+46%	+4%
Men 55+ (26%)	+27%	+8%
Total	+33%	+6%

The pressure of Covid-19 on budgets was thought to have made AA Members more sensitive.

However, this must be taken with a grain of salt as the price of 91 petrol went from $1.90 in June 2020 to $2.48 in October 2018 and while there was a great deal of unhappiness about this spike (as monitored by AA surveys) it shows that a 60 cent variation (usually blamed on the Government and oil companies regardless of their actual roles) is not outside the scope of recent experience.

The cost of biofuels in New Zealand at present is based on imported fuels from Singapore and Australia. Ironically, the Singapore government is effectively competing with the New Zealand government for New Zealand tallow and is offering incentives to Neste's biorefinery to buy tallow from New Zealand meat producers. This has led to the mothballing of the small biodiesel plant at Wiri because it is uneconomic to process feedstock at the price Neste can offer.

The Climate Change Commission has raised concerns about biofuel imports citing sustainability issues. The Finnish government overcomes these by requiring biofuels to be certified as sustainable with non-sustainable biofuels attracting the same taxes as fossil fuels.

There is no good reason to hinder the trade in biofuels or feedstock in an open market economy. Concerns about feedstock sources can be dealt with in the same manner as Finland. However, if New Zealand wants to reduce its emissions it will need to encourage the use of biofuels by ensuring that they can be delivered to New Zealand customers at an economic price whether they are made internationally or locally.

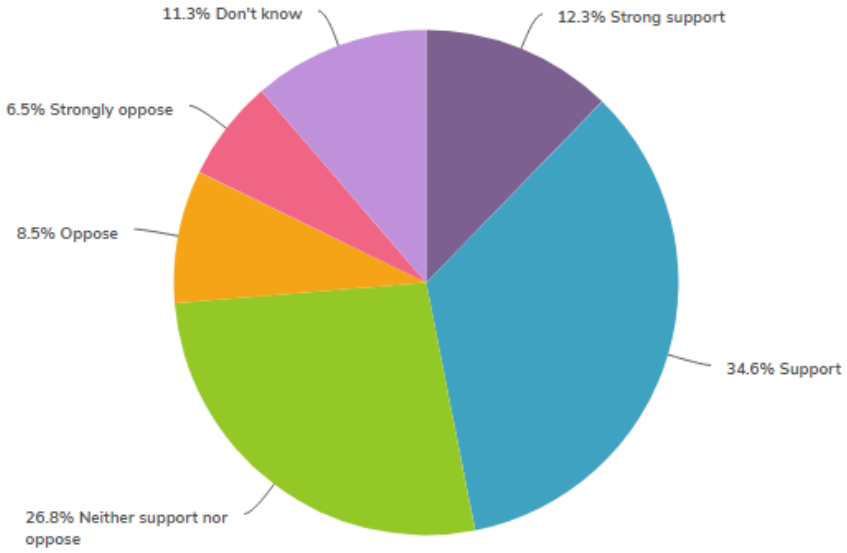
Internationally, the evidence is that biofuels do not just happen. The low cost of fossil fuels makes competition difficult and most of the liquid fuels market is still based on oil. To achieve Finnish levels of biofuels in the liquid fuels requires interventions such as the Finns have adopted.

Moreover, New Zealand officials need to be aware that other nations' officials look at such questions from the viewpoint of national interest. Singapore, for instance, places a very large value on being a transport hub, in the same way as Rotterdam. Securing a source of sustainable biofuel for customers sensitive to sustainability issues is an important part of these global corporation's long term strategy, and they will work with officials to ensure their strategy can be realized. New Zealand needs more than a roadmap for Biofuels it needs a complete integrated strategy including the farming and forestry sector, local government, Iwi, and the fuel marketing sector. This appears to be the approach the Finns have adopted and it appears to be paying dividends.

To scope the public's view, we asked AA Members about biofuels but first stated:

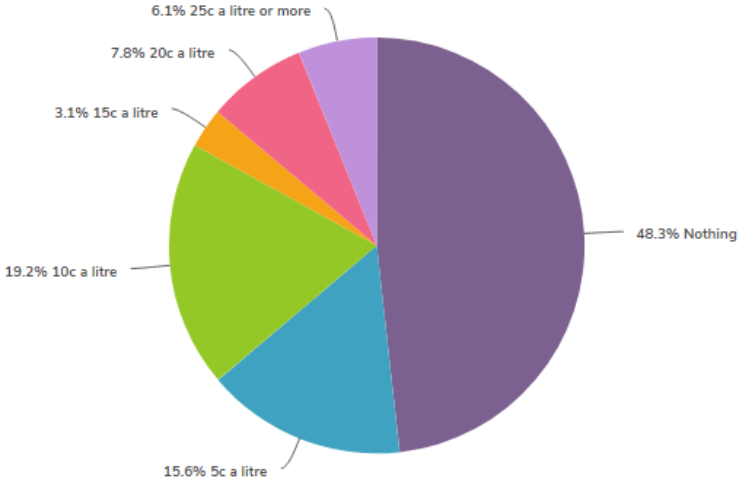
> An alternative to phasing out vehicles that burn fossil fuels is to phase out the fuels themselves. This would mean increasingly replacing fossil fuels with chemically identical synthetic fuels. This means that synthetic fuels work exactly the same as fossil fuels and can be used in a mix or on their own without effecting an engine. The main difference between synthetic fuels and fossil fuels is synthetic fuels don't add more carbon to the carbon cycle because they are made from carbon already in the carbon cycle (i.e. in the air or trees). This has the benefit that all vehicles effectively become zero emissions rather than just new technology vehicles. In time as electric technology replaces liquid fuels the need for synthetic fuels would reduce, however for some applications such as international aircraft liquid fuels are likely to be needed for the foreseeable future.

28. What do you think of phasing out fossil fuels and replacing with chemically identical synthetic fuels?



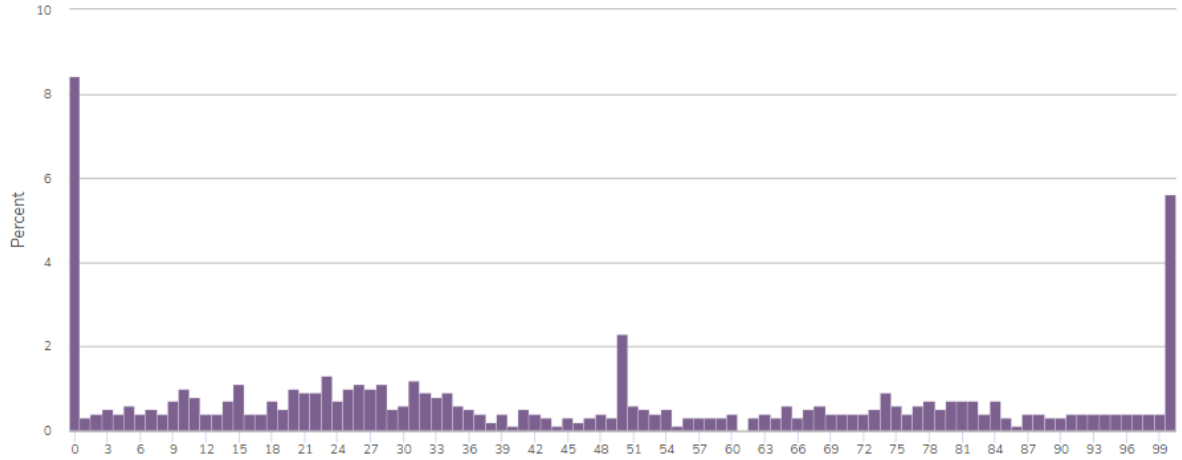
Not quite a half support, but the important values are the don't knows and those on the fence which come to nearly 40%.

29. How much more per litre would you be prepared to pay for all fuel knowing that it was effectively zero emissions?



The AA Membership was split pretty much down the middle between those who saw no value and those who saw some.

30. Thinking about government strategy on climate change which policy would you prefer to see emphasized the most?Slide the slider to the side you think would be best for the country.



Average	StdDev
29.5	34.5

In this question respondents could slide a slider between one side labelled “Import strategy: Rely on supply of EVs from overseas plus government taxes and incentives to change the vehicle fleet to new technology” with max value 0 and the other side with label “Self-sufficiency strategy: Develop synthetic fuels using existing fuel taxes on greenhouse gases and require fuel companies to sell an increasing amount of NZ made synthetic fuel” with max value 100.

AA Members significantly favoured the option “Import strategy: Rely on supply of EVs from overseas plus government taxes and incentives to change the vehicle fleet to new technology” over “Self-sufficiency strategy: Develop synthetic fuels using existing fuel taxes on greenhouse gases and require fuel companies to sell an increasing amount of NZ made synthetic fuel” which is not surprising given public discussion has been all about EVs rather than biofuels.

Chapter Six – Urban Development.

As we saw in Chapter One most of the growth in emissions since 2005 follows the growth in settlement patterns. This focuses concern on Auckland, the Waikato to Bay of Plenty area, and Canterbury. This is not to say that other areas should not consider proportional mitigation efforts but that it makes sense to focus national attention on these key growth areas. Not surprisingly these cities are the most densely populated in the country and account for 48% of the population.

Rank	Urban area	Population	Area (km^2)[1]	Population density (per km^2)
1	Auckland	1,470,100	607.10	2,421.9
2	Christchurch	383,200	295.15	1,298.3
3	Wellington City	215,100	112.29	1,915.6
4	Hamilton	176,500	110.37	1,599.2
5	Tauranga	151,300	135.12	1,119.7

It is widely believed that denser urban cities emit less per person because people need less energy to move around in pursuit of trade, recreation and public participation. This is largely because common origins and destinations make it possible to provide shorter trips (high agglomeration) and denser public transport systems.

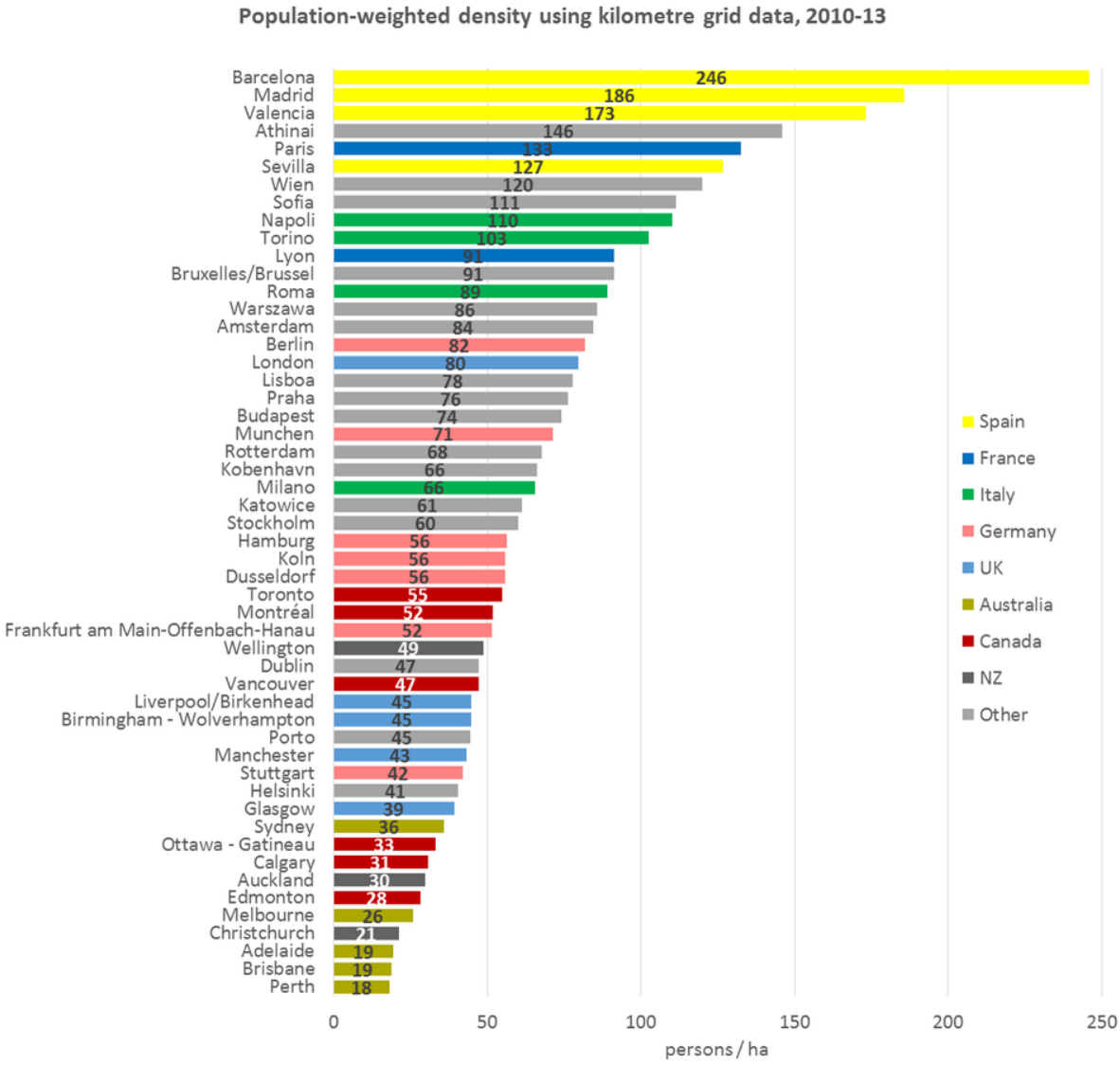
But to put this into a global perspective it is better to look at urban population weighted density. This takes out large tracts of reserve land or parks and focuses on just how closely packed people's actual dwellings are. This changes the picture quite a lot and shows that Wellington is just ahead of Dublin and a long way ahead of Auckland or Christchurch. This is also reinforced by the fact that Wellington's share of public transport travel is much higher than any other New Zealand city.

It also demonstrates that comparisons of Auckland and Christchurch with Amsterdam, London, Stockholm, Vienna or similar such paragons of cycling or public transport are completely unrealistic. These dense European cities were built over centuries (and rebuilt after wars) and have larger richer populations. More reasonable comparators are cities such as, Adelaide, and Ottawa which have similar development patterns, GDPs, and population sizes.

The Climate Change Commission has stated that more compact cities reduce emissions but suggested that it can produce better quality of life. This must be regarded as highly subjective. A comparison of Most Liveable Cities[7] finds that Auckland tends to score more highly in liveability indexes compared to Wellington despite being 3/5ths as dense on a population weighted density

[7] https://en.wikipedia.org/wiki/Most_livable_cities

basis. This suggests that Wellington's famous wind (where by some accounts it does lead the world) and climate in general may be a more significant indicator of liveability than simple urban density.



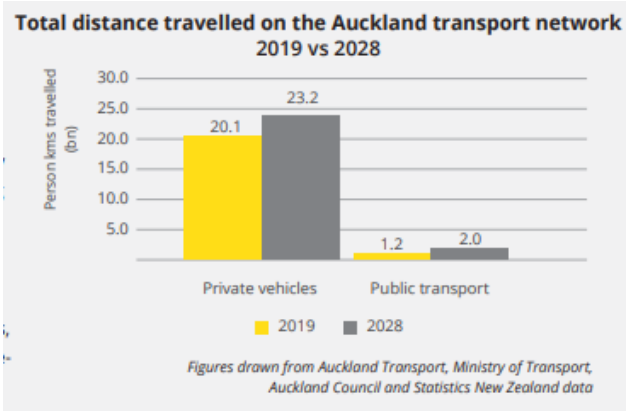
Source: Charting Cities[8]

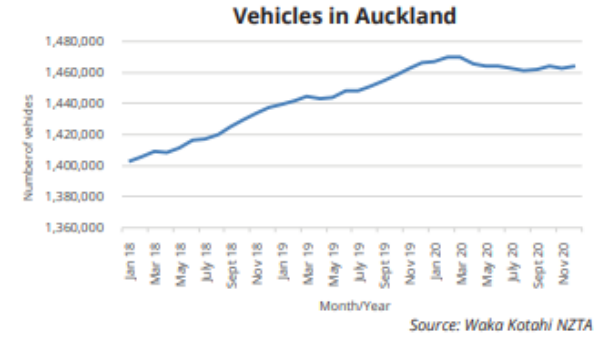
While it has become highly popular for cities to seek to slow or exclude car traffic in an effort to provide greater quality of life for 'urban spaces' there has been some confusion about the effects on emissions. Unless the total volume of fossil fuel propelled traffic is actually reducing all that happens is that other routes become used. If the capacity of these routes is overwhelmed congestion occurs. If congestion occurs emissions begin to rise disproportionately to the number and size of vehicles on the road.

What this means is that while the theory of urban density is all very well, in practice city's performance should be measured on *actual* emission levels. A city which diverts resources to non-

[8] https://chartingtransport.com/2019/04/21/how-is-density-changing-in-australian-cities-2nd-edition/

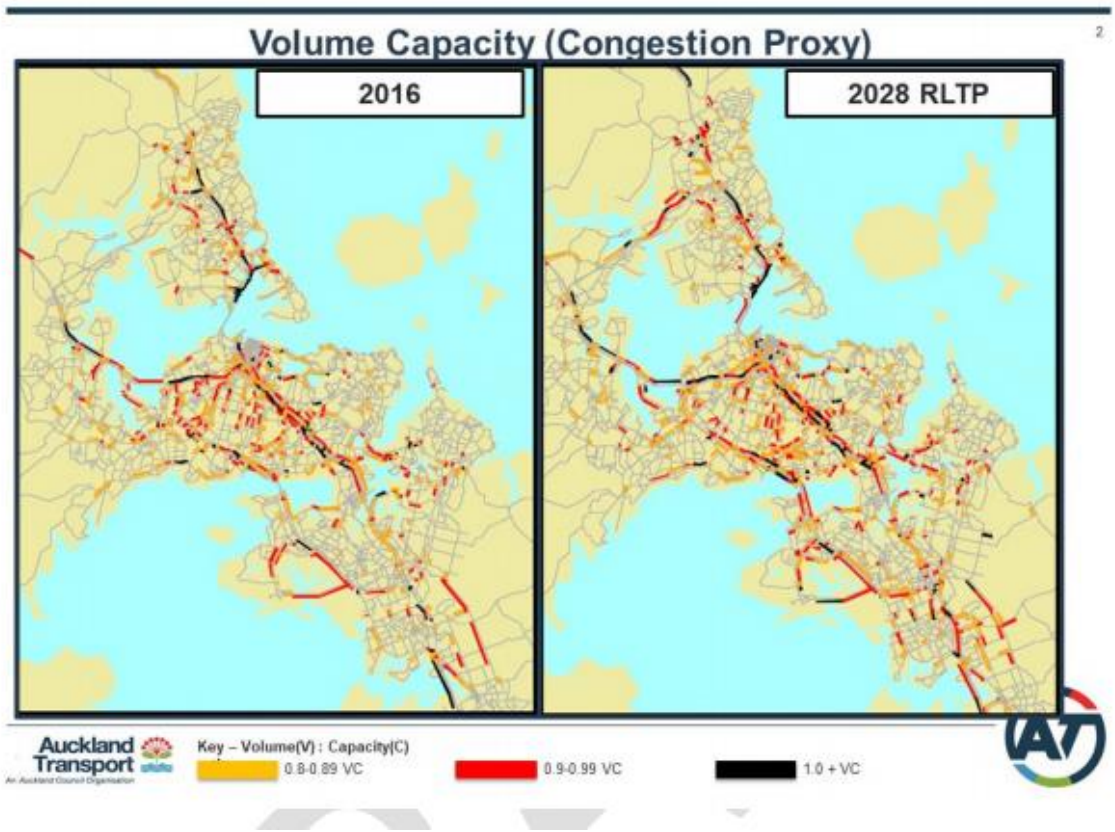
car modes needs to demonstrate that it is actually achieving meaningful mode substitution in terms of Greenhouse Gas emissions. This should also include the emissions costs of failure to act on areas where emissions are increasing due to lack of intervention.





With almost a third of New Zealand's population and most of our population growth, Auckland is of crucial importance. Yet congestion reduction is not a significant component of the Regional Land Transport Programme to 2028 and it is difficult to discern any difference that the programme is intended to make to congestion.

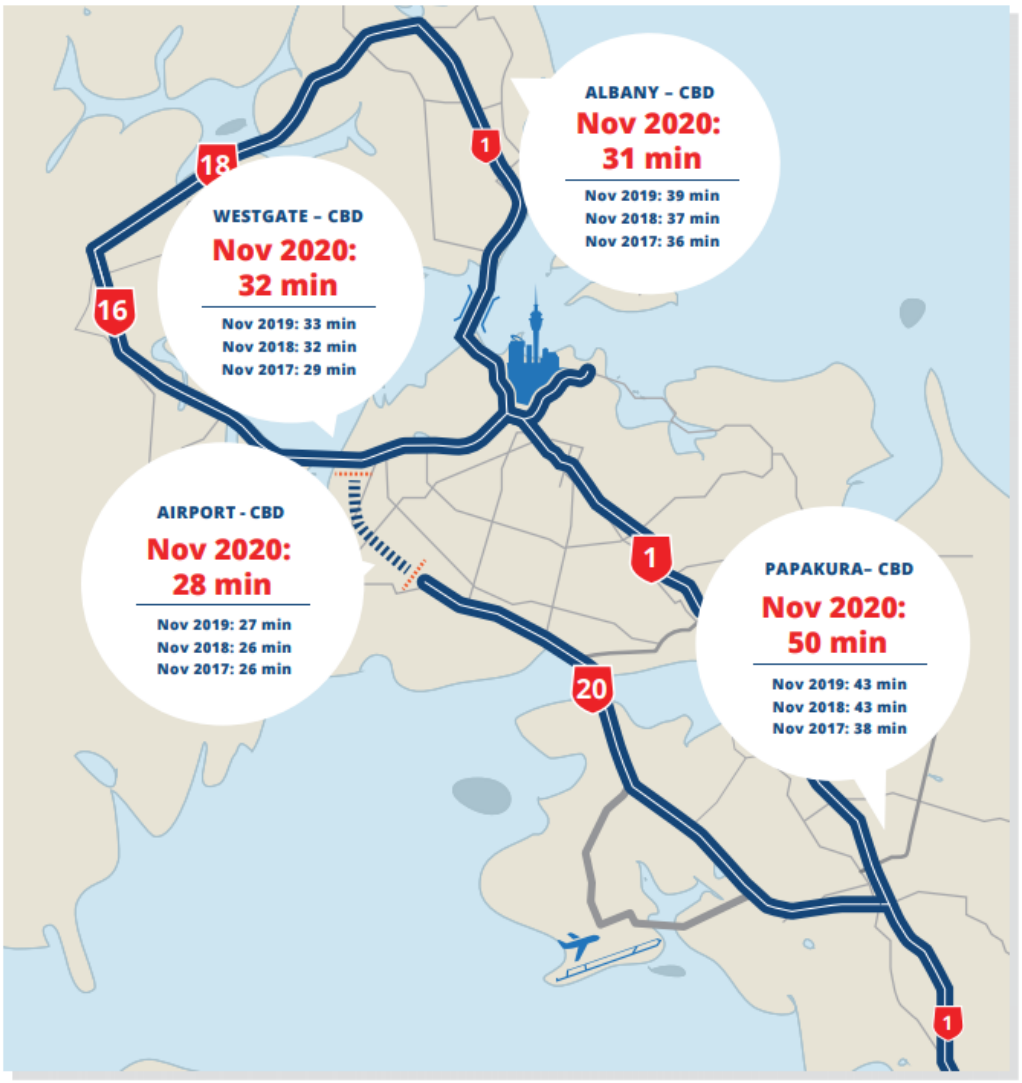
FIGURE 7: CONGESTION IN AUCKLAND (2016 AND 2028)



Time lost to congestion over the year by the average motorway user

In fact the only actual progress on Congestion has come serendipitously from the Covid-19 pandemic. But this has not been even. Motorways in the north are enjoying more free-flow but in the South congestion is actually worse. This may reflect differing occupations ability to work from home.

Morning peak travel times in November



While Auckland Council in particular has favoured highly expensive fixed public transport investments in an effort to increase urban density in fact Auckland has been expanding rapidly on its outskirts to accommodate its rapidly growing population. As such It is by no means clear that by focusing on the inner city that Auckland is, in fact, pursuing the best strategy for reducing emissions in the short-term. Commentators other than the AA have pointed out that the emissions reductions from the proposed ATAP projects will not make a significant impact on gross emissions[9]. The time and money taken to achieve relatively marginal mode shift might reduce more emissions when applied to dealing with congestion growth. In short some people may not like car dependency but it isn't going to change in the foreseeable future so we should manage our cities accordingly.

This does not mean building our way out of congestion, although some such interventions can help at the margin. As Matthew Barth and Kanok Boriboonsomsin explain in their 2010 paper on

[9] https://www.newsroom.co.nz/auckland-transport-overhaul-wont-reduce-emissions

Californian highway management[10], emissions reduction stems from network management which aims to keep the traffic network operating within the bounds of efficient operating speeds.

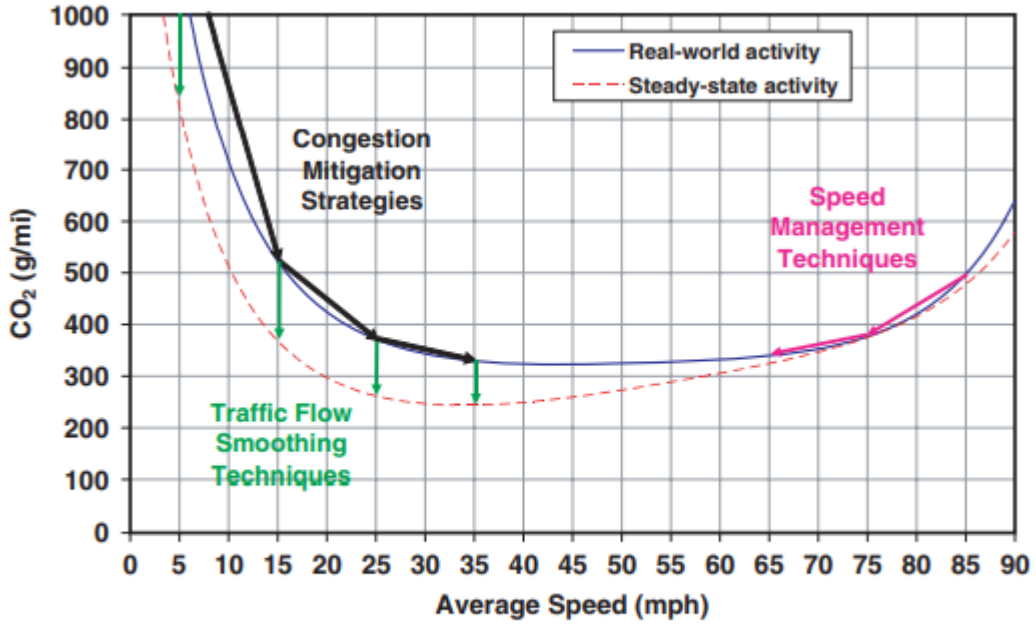


FIGURE 4 Possible use of traffic operation strategies in reducing on-road CO_2 emissions.

This means better management of urban networks via signals, lane space management, intersection design and parking management through a process of continual and evolutionary process improvement.

In short cities should be evaluating projects in terms of an overall lowest cost abatement strategy. Unfortunately we have observed a tendency by urban transport planners to think entirely in terms of transport levers under their own control. For example: Road marking and traffic controls; Parking areas and costs; Public transport services. Whereas as the Climate Change Commission itself has pointed out telework and deliveries could have a significant effect on congestion.

Once again the problem of agency becomes important. The reason hundreds of thousands of people commute each day is they have a contractual obligation to go to a specified workplace. Employers' management practices are affected by a range of legislation very of little of which encourages them to support working from home. None of this is within the purview of urban transport planners.

The role of electric pedestrian vehicles and cycles also deserves more attention.

[10] https://www.researchgate.net/publication/46438207_May_2010Real-World_Carbon_Dioxide_Impacts_of_Traffic_Congestion

At present the very high cost of these vehicles essentially limits them to a rich person's plaything or only for the highly committed cyclist willing to forgo a car. However if battery technology does get cheaper (as expected) it is highly likely that personal (or "micro") mobility devices could become more significant to urban transport. What is probably more likely to stimulate uptake in these devices is better credit arrangements to make their purchase comparable with public transport.

Finally, the rise intelligent booking and routing systems pioneered by Uber also means that public transport no longer needs to be based on the traditional hub-and-spoke arrangements. This allows public transport to span a greater range from bus to ride-share. What is important here is that operating agencies such as Regional Land Transport Authorities are encouraged to innovate rather than defend status quo arrangements.

Summing Up

While many environmentalists appear to have a built-in aversion to cars the public pay no heed and continue to purchase them in very large numbers. This is because cars provide New Zealanders with the best transport solution for most of their transport needs. However internal combustion cars, and especially SUVs, produce serious amounts of greenhouse gas when fuelled by fossil fuels.

The Climate Change Commission has adopted the view that New Zealand should best wait for foreign automotive technology suppliers to provide the nation with electrically powered vehicles because the New Zealand grid has very low carbon intensity and that would conveniently solve the transport problem.

Unfortunately New Zealand is a right-hand-drive nation and most of the world market is left-hand-drive. This means that 80% of vehicles are sourced from Japan which has not produced many battery electric or plug-in hybrid vehicles to date, and rate of technology change which has occurred with the switch to hybrids is still far slower than the Commission hopes for. Given the small size of the right-hand market, the relative wealth of the left-hand market and the lack of support from Australia we believe that EV supply may be far more constrained than the Commission imagines.

The AA therefore commends the Finnish response to the Climate Commission. The Finns have focused on replacing the fuel supply rather than switch the fleet to electric. Having started far earlier Finland (which is, like New Zealand, a small nation of 5.5 million with a large amount of wood) has made huge strides toward reducing the emissions of the vehicle fleet by substituting fossil fuels with sustainable biofuels.

This provides a pathway which avoids many of the potential equity issues which access to electric vehicles present and provides a credible complimentary strategy to waiting for foreigners to provide vehicles to solve our problems.

We also believe that there are significant problems with the management of immigration and transport emissions in New Zealand. To date settlement has concentrated in a few main urban areas and the increase in emissions which would normally occur with increases in population has been compounded by a failure to adequately manage growing congestion. Instead there has been a focus on expensive public transport projects for urban redevelopment which do not appear to have much to offer from an emissions abatement perspective. We question whether regional government is actually innovative or empowered enough to pursue the abatement policies needed in these high growth urban areas.