SIMI

Independent Report
to SIMI by Arup and
Jim Power Economics

ARUP

Reducing light fleet carbon emissions to achieve Irish Government targets.

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Abbreviations

AC	Alternating Current
ACA	Accelerated Capital Allowance
AEMO	Australian Energy Market Operator
BEV	Battery Electric Vehicle
BIK	Benefit in Kind
BNEF	Bloomberg New Energy Finance
CAP	Climate Action Plan
DC	Direct Current
EPBD	Energy Performance of Buildings Directive
ESB	Electricity Supply Board
EU	European Union
EV	Electric Vehicle
EVC	Electric Vehicle Council
FCAI	Federal Chamber of Automotive Industry
GHG	Green House Gas
GST	Goods and Services Tax
HGV	Heavy Goods Vehicle
ICCT	International Council on Clean Transportation
ICE	Internal Combustion Engine
IET	Institution of Engineering and Technology
IPPR	Institute for Public Policy Research
LCT	Luxury Car Tax
LCV	Light Commercial Vehicle
LEV	Low Emission Vehicle
LEVTI	Low Emissions Vehicle Toll Incentive
LPG	Liquefied Petroleum Gas
LVF	Light Vehicle Fleet
MACC	Marginal Abatement Cost Curve
MaaS	Mobility as a Service
NSAI	National Standards Authority of Ireland
NSW	New South Wales
NTA	National Transport Authority
NVDF	National Vehicle and Driver File
OMSP	Open Market Selling Price
PCP	Personal Contract Plan
PHEV	Plug-in Hybrid Electric Vehicle
PT	Public Transport
RED	Renewable Energy Directive
RUC	Road User Charging
R&D	Research and Development
SA	South Australia
SPSV	Small Public Service Vehicle
SEAI	Sustainable Energy Authority of Ireland
SIMI	Society of the Irish Motor Industry
SUV	Sport Utility Vehicle
TAI	The Australian Institute
TEN-T	Trans-European Network for Transport
TIV	Total Industry Volume
UK	United Kingdom
US	United States
VAT	Value Added Tax
VKT	Vehicle Kilometres Travelled
VRT	Vehicle Registration Tax
VW	Volkswagen
V2G	Vehicle to Grid
WLTP	Worldwide Harmonized Light Vehicle Test Procedure
ZEV	Zero Emission Vehicle
ZLEV	Zero and Low Emissions Vehicle

Four Point Plan to a Clean Fleet

Executive Summary

The Society of the Irish Motor Industry (SIMI) commissioned Arup and Jim Power Economics Limited to review global best practice, existing Irish practice, and potential future options to accelerate the achievement of emissions reduction targets and increase the uptake of zero emissions vehicles in line with the ambitions of the Irish Government. It is expected that those targets will be so legislated for, and the industry is keen to collaborate with the Government to assist decarbonising the national transport fleet.

SIMI requested that we review the broadest approaches to decarbonisation of the light vehicle fleet, beyond only electrification. SIMI also required that we identify within those potential actions those that SIMI members might have a role in delivering; and those that SIMI would be reliant upon others for.

In a relatively small right-hand-drive economy many of the options available to other countries are harder to achieve at the same rate as in the rest of Europe. Ireland has a slower and smaller supply chain with around 120 000 new car sales per annum (pre-Covid) and an average car fleet age of 9 years (2021). With currently three times as many used vehicles being sold, there is an insignificant second-hand electric vehicle market.

Electric vehicles account for just around 8% of annual new car sales and dealers are selling every electric vehicle landed in the country. Plug-in hybrid electric vehicles (PHEVs) which until recently were supported with rebate benefits captured a similar proportion of the market.

To sell nearly a million electric vehicles by 2030, in line with Government policy, is unlikely. Supply disruptions wrought by Covid, Brexit and the global chip supply shortage, combined with potential rare mineral shortages keeping battery prices high, has delayed both availability and price parity by two years. This basket of challenges may well keep prices beyond the average buyer until mid-decade, even with higher carbon taxes on existing modes, and risks further aging the fleet.

Acknowledging that such high sales growth is unlikely, even with Government stimulation of the market, we have also looked at how total carbon fleet emissions might be reduced more rapidly with a holistic approach to the national light vehicle fleet, and in doing so how social equity might be maintained or enhanced.

This approach would require a broad spectrum of interventions, across a combination of sectors, some of which might challenge a variety of policy positions.

Approach

This research is produced independently of SIMI's position to inform SIMI about the options available, and for it to determine those that are suitable for its purposes.

The question is no longer if change will occur, it is a question of how this will happen. The speed of adoption of an electric future is unparalleled in automotive history, particularly in the European Union where multi-layered EU wide incentives, regulations and penalties are being put in place to influence action. Manufacturers are rapidly adjusting to get ahead of any possibility of being left behind.

This advice does not rely on primary research. It is an analysis of what is known, what has been used elsewhere, and what with modification may work in Ireland based on insights gained from talking to various stakeholders. Therefore, the potential actions recommended are for inclusion in a comprehensive review by Government that would undertake economic analysis of the entire programme of interventions and rank them by greatest positive effect on emissions reduction, affordability, equity, and acceptability.

To get to that point comprehensive consumer research would be required, along with market, equity, and emissions modelling, which is beyond the scope of this exercise. We have taken the liberty of suggesting where additional effort may be beneficial. We believe much of the economic and financial analysis is best done by Government as it bears the responsibility of allocating general revenue. The consumer research may be better undertaken in partnership with SIMI, given its consumer knowledge, and the SEAI with its investment in equity research to date.

Ireland remains significantly behind European wide rates of adoption of EVs in the passenger car market[1], despite having relatively high local emissions, but also high comparative average income. Part of this rests on previous decisions to create diesel vehicle dominance, and part on the timid approach to getting the supporting infrastructure in place for light fleet electrification.

However, like the rest of the world, Ireland also needs to adapt appraisal methodologies to accurately reflect the primary driver of change, which is emissions reduction, rather than typical analytical methods focused on cost-benefit, where benefit is narrowly defined.

Such a change in focus will better enable Government to make decisions which may not appear classically economically sensible in the short term, but which on reflection are far better for rapid decarbonisation. This report briefly touches on this issue as well.

[1] According to a publication by the International Council on Clean Transportation (ICCT) the European average of EV shares of new passenger cars in 2020 was 11%. Ireland was at 7% in 2020. https://theicct.org/sites/default/files/publications/ev-uptake-eu-cities-oct21.pdf

Categories of Action

This report covers recommendations on four categories of actions that outline where the motor industry can actively participate, where it needs Government and other sectoral support to succeed, and where it is an observer. This combination of planning across multiple Government and private players to deliver a coordinated and clear set of incentives to consumers will, we believe, aid decarbonisation most rapidly.

1. Rapidly reduce national fleet emissions

- incentivise the phase-out of the "worst polluters" in the Light Vehicle Fleet (LVF) and expedite sales of zero and low emissions vehicles (ZLEVs); incentivise scrappage, increase incentives for fleet changes, provide options to trade up, across or out of higher polluting Internal Combustion Engine (ICE) vehicles.

2. Building consumer confidence

- empower consumers with knowledge and confidence in different technologies, ensure enabling services are available and support retained value.

3. Incentivising consumer actions

- reduce barriers to consumer adoption of electric vehicles, simplify and expand financial options and subsidies, rapidly create secondary markets.

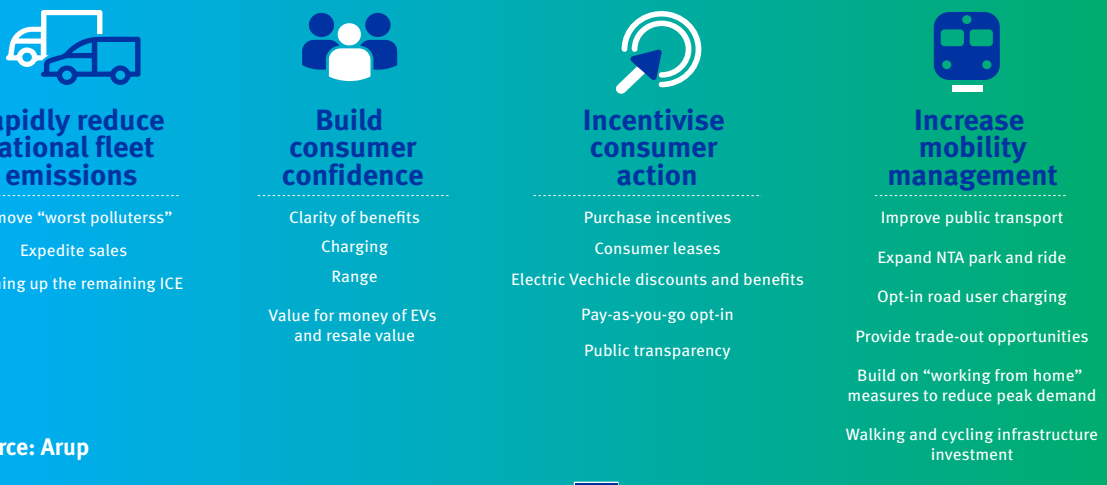
4. Increasing mobility management

- increase feasible and viable alternatives to car use cognisant of regional differences, invest to avoid growth in vehicles per 1000 population as economy rebounds.

This report outlines a list of potential measures that Government and the motor industry can jointly investigate to realise emission targets. In each section there is a list of potential consumer research/education that would support actions, and a list of economic analysis that would feed into a trade-off analysis and investment appraisal process. These have not been placed in order of priority or execution and require additional behavioural economic and consumer analysis as referred to at the end of each section. Where possible we have also included case-studies, relevant EU public statements or other supporting information that might be of use.

Building on existing initiatives and programmes will reduce emissions faster. Introducing additional measures to remove the worst polluters and convert the rest of the fleet to the lowest emission class vehicles will enable every vehicle owner to participate in accelerating change.

Figure 1: Four Categories of Action



Source: Arup

Introduction

Emission targets at both EU and national policy levels will require a radical transformation of Ireland's mobility system. Transport accounts for around 39% of energy related CO2 emissions[2] and plays a key role in achieving emission reductions. Avoiding unnecessary travel by encouraging a shift from private cars to public transport, promoting walking and cycling, and improving vehicle efficiencies, including through electrification and lowered emissions of ICE fleets, are central to achieving emissions reductions in Irish transport. A new perspective on where investment is most effective and what policies are required to decarbonise transportation in an affordable, equitable and acceptable manner, is required.

Ireland's commitments set out in the 2021 Climate Action plan provides a roadmap to reduce the country's greenhouse gas emissions and tackle the climate crisis. This includes reducing emissions by 51%[3] by 2030 and achieving net zero emissions no later than 2050[4]. Additional Government commitments include the adoption of 945,000 electric vehicles[5] in Ireland by 2030, and in the same year ceasing the sale of new fossil-powered cars[6]. The Climate Action Plan 2021 is not a standalone document and closely relates to the earlier published Climate Action and Low Carbon Development (Amendment) Act in 2021. It also stands in conjunction with existing national policy plans including: Project Ireland 2040; the National Planning Framework; National Remote Work Strategy; National Adaptation Framework; Our Rural Future – Rural development policy 2021-2025; and forthcoming Sustainable Mobility Policy.

At a European level (EU Green Deal), on 14 July 2021, the European Commission adopted a series of legislative proposals outlining how to achieve climate neutrality in the EU by 2050, including an intermediate target of at least 55% net reduction in greenhouse gas emissions by 2030 (Fit for 55%). Standards for cars and vans will accelerate the transition to zero-emission mobility by requiring average emissions of new cars to come down by 55% from 2030 and 100% from 2035 compared to 2021 levels. As a result, all new cars registered as of 2035 will be zero-emission in the European Union.

In consideration of these stringent emission targets, decarbonisation has become an increasingly pressing topic in the context of transportation. Ireland's above average transport emissions, CO^2eq. per person of 2.5t (2018) when compared to the EU average of 1.9t (2018), further underlines the urgency to act and avoid that Ireland becomes last-in-class when in it comes to the reduction of transport emissions. In the following report we review global practices, existing Irish practises, and potential future options to accelerate the uptake of zero and lower emissions vehicles in line with the ambitions of the Irish Government to rapidly reduce carbon emissions.

The report covers four main categories of action: rapidly reducing national fleet emissions, building consumer confidence, incentivising consumer actions, and increasing mobility management. The recommendations listed under each category of action can serve as a set of measures Government and the motor industry can jointly investigate to realise emission targets more rapidly.

[2] https://www.seai.ie/data-and-insights/seai-statistics/key-statistics/co2/

[3] https://www.marei.ie/wp-content/uploads/2021/07/MaREI-Note-on-Irelands-first-two-Carbon-Budgets-1.pdf

[4] https://www.gov.ie/en/publication/984d2-climate-action-and-low-carbon-development-amendment-bill-2020/

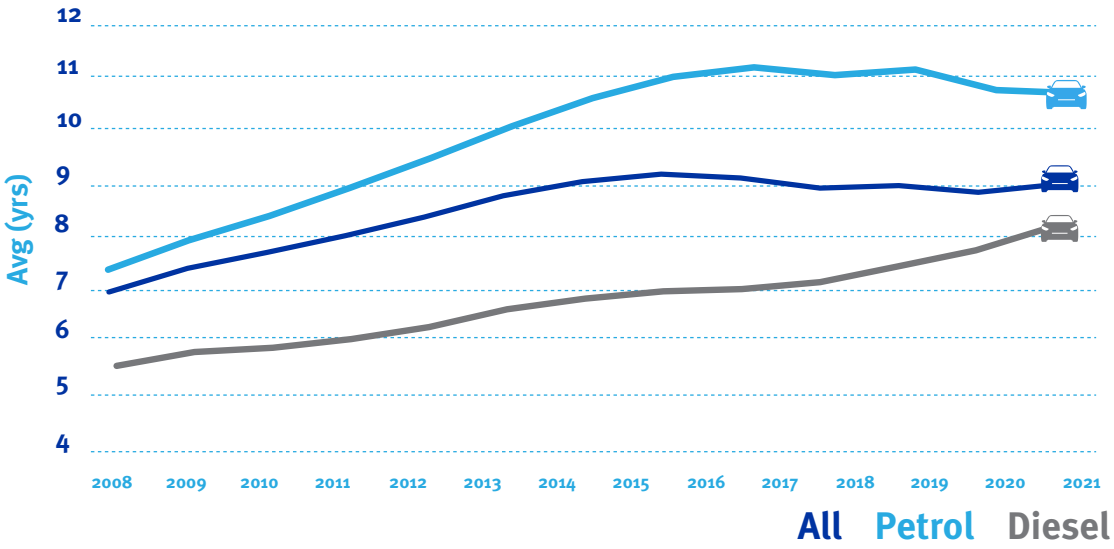
[5] 945,000 target consists of 940,000 Light Vehicle (845,000 electric passenger cars, 95,000 electric vans), 3,500 low emitting trucks and 1,500 electric buses

[6] https://www.gov.ie/en/press-release/5da6c-minister-ryan-announces-funding-approval-for-on-street-charge-points-for-electric-vehicles/

1 Rapidly reduce national fleet emissions

In order to rapidly reduce emissions and put Ireland on track to meet its 2030 commitment, a rapid renewal of the light vehicle fleet (LVF) is essential. Currently the average age of the car fleet continues to increase. In October 2021, the average age for all vehicles increased to 9 years from 8.65 years in 2019; the average age of petrol cars has increased marginally from 10.8 to 10.82 years between 2019 and 2021; and the average age of diesel cars has increased from 7.32 years to 8.3 years. This means there is a substantial number of older vehicles still in regular use. Older cars are more polluting, and those that sit outside the average age are significantly more polluting. The figure below shows the average age of the national fleet between 2008 and 2021, and clearly illustrates an upwards trend of the mean average age of cars in Ireland over this period.

Figure 2: Average Age National Fleet 2008-2021



Source: Jim Power Economics

To move towards an overall lower emission fleet, incentives will have to be put in place to encourage the elimination of the oldest vehicles as quickly as possible, and to reduce the average fleet age substantially.

The combination of Covid-19 and Brexit disrupting markets, the shortage of silicon chips globally pushing out delivery of new vehicles by up to a year and the global focus on electrification challenging battery rare-earth mineral supplies is combining to unsettle consumer confidence, keep prices higher than had been predicted and provide consumer excuses to stick with what they know.

In the Climate Action Plan (CAP) 2021, the Irish Government states that promoting cleaner, safer and more sustainable mobility is critical for climate policy. Approximately 20% of Ireland's greenhouse gas (GHG) emissions originate from transportation, of which road transport is responsible for 96% of GHG emissions. Despite the ongoing development of the broader sustainable travel ambitions the most cost-effective abatement opportunities for transport[7], identified in the Marginal Abatement Cost Curve (MACC), are in the electrification of transport. In simple terms, it is cheaper to accelerate EV uptake than to change how people move by supplying more alternatives. However, both need to occur if Ireland is to reduce its 12.2Mt (2018) transport emissions to just 6-7 Mt by 2030[8].

[7] Climate Action Plan 2019
[8] Climate Action Plan 2021

Fast falling battery prices are likely to put the overall cost of EVs on par with those of fossil fuel vehicles over the next decade. Whether this is now achievable in the same time frame without more aggressive subsidisation is worth critically analysing, as it has been fundamental to previous modelling efforts.

Incentivising a strong EV car market is essential to shift consumer's ownership towards less polluting vehicles and provide opportunities for a strong secondary market. In order to achieve the electric vehicle targets as set out in the 2021 Climate Action Plan, this would require the registration of nearly a million EVs by 2030[9]. The table below shows the uptake requirements across different vehicles.

In the Climate Action Plan 2021, the Government set a target to increase the fleet of EVs and low emitting vehicles (LEVs) on the road to 945,000 by 2030.
This target comprises:

- **845,000 electric passenger cars, with a focus on BEVs.**
- **95,000 electric vans.**
- **3,500 low emission HGVs.**
- **1,500 electric buses.**

Table 1: Electric Vehicle Targets in Climate Action Plan 2021

Vehicles	2018	2025	2030
Electric Passenger Cars	C 2,000	175,000	845,000
Electric Delivery Vans	C 85	20,000	95,000
Low Emission Trucks	C 20	700	3,500
Electric Buses	N/A	300	1,500
Total EVs & Low Emission Vehicles	N/A	196,000	945,000

Source: Climate Action Plan 2021

The CAP 2021 estimates that in order to achieve the required decarbonisation in transport by 2030 around c.1.4 $MtCO^2eq$. in additional abatement impact will need to come from reducing ICE car kilometres by c. 10% and adding an additional 500,000 (14%) public transport and active travel journeys per day. The electrification of passenger cars (845,000 with a focus on BEVs) and transition to low emission vans (95,000 with a strong focus in BEVs) should collectively amount to an additional abatement impact of c.2.9 $MtCO^2eq$., while 3,500 low emission HGVs should provide an abatement of c. 0.3 $MtCO^2eq$., and electrification of mass transportation (1,500 EV buses and expanding electrified rail services) an additional c.0.4 $MtCO^2eq$. in CO^2 abatements.

It is estimated that on average a car runs for 13 years before it is taken out of use. This long lifecycle means that if we want every passenger car to be running on electricity by 2050, BEVs would need to be close to 100% of sales within the next 15 years. In 2021, BEVs accounted for 10.8% of total car sales. There is a very long way to go to achieve the targets set in the Climate Action Plan for 2030 and 2050.

Below we have modelled the evolution of the car fleet out to 2030 based on three different new car sales scenarios [fully detailed in appendix E]. The three scenarios show the level of new car sales and the level of EVs and PHEVs that would have to be sold to reach the Climate Action Plan 2021 targets.

[9] Climate Action Plan 2021

Table 2: 'Constrained' New Car Sales Scenario

	New Car Sales	End-Year Car Fleet	EV % New Car Sales	Total EV	PHEV % New Car Sales	Total PHEV	EV & PHEV
2020	88,325	2,215,127	4.5%	4,010	2.80%	2,473	6,483
2021	105,000	2,250,220	8.5%	8,925	7.50%	7,875	16,800
2022	120,000	2,285,207	10.0%	12,000	10.00%	12,000	24,000
2023	120,000	2,298,095	15.0%	18,000	15.00%	18,000	36,000
2024	120,000	2.310,209	20.0%	24,000	18.00%	21,600	45,600
2025	120,000	2,321,597	25.0%	30,000	20.00%	24,000	54,000
2026	135,000	2,347,301	30.0%	40,500	20.00%	27,000	67,500
2027	135,000	2,371,463	35.0%	47,250	20.00%	27,000	74,250
2028	135,000	2,394,175	40.0%	54,000	20.00%	27,000	81,000
2029	135,000	2,415,525	45.0%	60,750	20.00%	27,000	87,750
2030	135,000	2,435,594	45.0%	60,750	20.00%	27,000	87,750
22-30	1,155,000		30.1%	347,250	18.2%	210,600	557,850

Source: Jim Power Economics

Under the 'constrained' scenario, the car fleet is projected to reach 2.44 million by 2030. Over the period, 2022 to 2030 it is estimated that a cumulative total of 557,850 new EVs and PHEVs would be sold. This would be equivalent to 22.9% of the car fleet in 2030.

Over the period 2022 to 2030, EVs and PHEVs at 557,850 would be equivalent to 48.3% of cars sold over the period.

This total would be 287,150 short of the target of 845,000 vehicles set in Climate Action Plan 2021.

Table 3: 'Progressive' New Car Sales Scenario

	New Car Sales	End-Year Car Fleet	EV % New Car Sales	Total EV	PHEV % New Car Sales	Total PHEV	EV & PHEV
2020	88,325	2,215,127	4.5%	4,010	2.8%	2,473	6,483
2021	105,000	2,250,220	8.5%	8,925	7.5%	7,875	16,800
2022	130,000	2,295,207	15.0%	19,500	10.0%	13,000	32,500
2023	130,000	2,318,095	20.0%	26,000	15.0%	19,500	45,500
2024	130,000	2,339,009	25.0%	32,500	18.0%	23,400	55,900
2025	130,000	2,358,669	30.0%	39,000	20.0%	26,000	65,000
2026	150,000	2,397,149	35.0%	52,500	20.0%	30,000	82,500
2027	150,000	2,433,320	40.0%	60,000	20.0%	30,000	90,000
2028	150,000	2,467,321	45.0%	67,500	20.0%	30,000	97,500
2029	150,000	2,499,282	50.0%	75,000	25.0%	37,500	112,500
2030	150,000	2,529,326	50.0%	75,000	25.0%	37,500	112,500
22-30	1,270,000		35.2%	447,000	19.4%	246,900	693,900

Source: Jim Power Economics

Under the 'progressive' scenario, the car fleet is projected to reach 2.53 million by 2030. Over the period, 2022 to 2030 it is estimated that a cumulative total of 693,900 new EVs and PHEVs would be sold. This would be equivalent to 27.4% of the car fleet in 2030.

Over the period 2022 to 2030 EVs and PHEVs at 693,900 would be equivalent to 54.6% of new cars sold.

This total would be 151,110 short of the target of 845,000 vehicles set in Climate Action Plan 2021.

Table 4: 'Accelerated' New Car Sales Scenario

	New Car Sales	End-Year Car Fleet	EV % New Car Sales	Total EV	PHEV % New Car Sales	Total PHEV	EV & PHEV
2020	88,325	2,215,127	4.5%	4,010	2.80%	2,473	6,483
2021	105,000	2,250,220	8.5%	8,925	7.50%	7,875	16,800
2022	160,000	2,325,207	15.0%	24,000	10.00%	16,000	40,000
2023	160,000	2,375,695	20.0%	32,000	15.00%	24,000	56,000
2024	160,000	2,423,153	25.0%	40,000	18.00%	28,800	68,800
2025	160,000	2,467,764	30.0%	48,000	20.00%	32,000	80,000
2026	180,000	2,529,699	35.0%	63,000	20.00%	36,000	99,000
2027	180,000	2,587,917	40.0%	72,000	20.00%	36,000	108,000
2028	180,000	2,642,642	45.0%	81,000	20.00%	36,000	117,000
2029	200,000	2,714,084	50.0%	100,000	25.00%	50,000	150,00
2030	200,000	2,781,239	50.0%	100,000	25.00%	50,000	150,00
22-30	1,580,000		35.4%	560,000	19.5%	308,800	868,800

Source: Jim Power Economics

Under the 'accelerated' scenario, over the period 2022 to 2030 a total of 1.58 million new cars are sold. EVs account for 35.4% of the total and PHEVs account for 19.5%. However, by 2030 new car sales of 200,000 are projected, with 50% of those EVs and 25% PHEVs. This is a very ambitious target and would still deliver just over the 845,000 targeted in the Climate Action Plan 2021.

The scenarios above clearly illustrate the magnitude of the challenge ahead. With targeted action, specific fleet sectors can be rapidly electrified and EVs may reach purchase price parity with internal combustion engine vehicles before the end of this decade, although this will likely be achieved by the Government policy of placing escalating carbon taxes on ICEs more so than a drop in unit cost of batteries.

However, the reliance on pure EVs alone may put Ireland at risk of failing to achieve its transport emission targets to 2030. High upfront costs of EVs and the limited supply of affordable right-hand-drive EVs remains a considerable barrier to entry. In 2020 total battery electric vehicles (BEV) sales across Europe was only 6 times the total annual vehicle sales rate in Ireland, despite Ireland representing 1% of the total European vehicle market[10].

Actions on rapid fleet renewal should therefore promote the adoption of EVs alongside a gradual up-trading to newer Euro-class ICE vehicles and cleaner fuels. This is both a way of providing hedging while the market rebalances, and of more rapidly getting the worst polluting vehicles off the road.

[10] https://www.eea.europa.eu/data-and-maps/indicators/proportion-of-vehicle-fleet-meeting-5/assessment

1.1 Removing the "worst polluters"

The reality of an aged national fleet in Ireland has meant the continued use of polluting vehicles. 31.1% of vehicles are Euro 4 (pre-2011) or older, totalling 700,429 cars, while 63.8% of the national fleet in Ireland is Euro 5 (pre-2016) or older, with only 35.8% of cars classed as Euro 6[11]. Table 5 gives a breakdown of the national car fleet by Euro Emission Standard in 2021.

Table 5: National Car Fleet by Euro Emissions (Jan-Oct 2021)

Euro Class	Volume	%	Cumulative Volume	%	CO_2 Tonnes	%
Euro 1&2	21,969	0.9%	21,969	0.9%	19,772	0.5%
Euro 3	131,846	5.9%	153,815	6.8%	113,455	3.6%
Euro 4	546,614	24.3%	700,429	31.1%	420,489	13.2%
Euro 5	724,074	32.2%	1,424,503	63.3%	867,631	27.2%
Euro 6	805,417	35.8%	2,229,920	99.1%	1,771,352	55.5%
BEV	20,513	0.9%	2,250,433	100.0%	0	0%
Total LVF	2,250,433	100.0%	2,250,433	100.0%	3,192,698	100.0%

Source: Jim Power Economics

The reality is that there are too many older, more polluting, cars on the road. Table 6 illustrates the considerable difference in emission standards between particularly Euro-4 and Euro-5/6.

Table 6: Euro Car Standards

Introduction date			Emission limits		
Euro standard	**New approvals**	**All new registrations**	**Petrol NOx**	**Diesel NOx**	**Diesel PM**
Euro-1	1 July 1992	31 December 1992	0.97g/km	0.97g/km	0.14g/km
Euro-2	1 January 1996	1 January 1997	0.5g/km	0.9g/km	0.1g/km
Euro-3	1 January 2000	1 January 2001	0.15g/km	0.5g/km	0.05g/km
Euro-4	1 January 2005	1 January 2006	0.08g/km	0.25g/km	0.025g/km
Euro-5	1 September 2009	1 January 2011	0.06g/km	0.18g/km	0.005g/km
Euro-6	1 September 2014	1 September 2015	0.06g/km	0.08g/km	0.0045g/km

Source: SMMT[12]

[11] https://www.simi.ie/en/environment/drive-greener/national-vehicle-fleet
[12] https://www.smmt.co.uk/industry-topics/emissions/testing/

Older Euro-classes, or "worst polluters", contribute significantly to overall pollution and threaten the successful decarbonisation of the LVF in the long run as many of these vehicles, without providing people viable alternatives, will remain in use for many years to come. They are typically held by those with the least ability to change technology due to low income. Preliminary analysis by Jim Power suggests that removing Euro 1-4 class light vehicles from the national fleet would reduce total carbon emissions by approximately 875 000 tonnes. We note that this is a relatively simple analysis that would require refinement based on the distribution and likely use of the fleet. It is suggestive, however, that more work should focus not only on EV replacement, but also phasing out older vehicles as discussed above.

In the transition to cleaner alternatives, in part through the elimination of the "worst polluters", the issue of equity should be addressed front and centre throughout the transition process. People with the least ability need the greatest assistance to move into less carbon intensive vehicles. Getting the oldest vehicles off the road often means helping those with the least economic capacity to make the biggest change, and this requires more investment compared to the top end of the market to remain fair and equitable. For example, the Irish Government recently reduced the cost of public transport for younger people to reduce car dependence, although it is far too early to judge effectiveness.

Taking into consideration the equity gap, it will be necessary to model the inducements required to get motorists to trade up to less polluting cars. In cases where drivers of those older cars would not have the financial ability to trade up to a new EV, incentives could act as a counterbalance to stringent emission regulation and provide people a fair and affordable pathway to cleaner alternatives [Transport Scotland covers the social aspect of affordability]. Car owners, drivers and passengers represent the great majority of the adult public. However, they are as diverse as the population in capacity and willingness to pay for climate change as recent surveys show [Appendix D - The Irish Times-Ipsos poll], and in their understanding of the link between personal action and collective benefit.

Simply pricing people out of owning or operating a car is unlikely to be feasible, particularly in rural Ireland where alternatives are less reliable to meet the daily living needs of an ordinary person. While people have been strongly resistant to abandoning car ownership, they have for some time been reducing the number of and length of average trips. Covid-19 trip data is already showing a move towards more local, short trips being taken as people adopt a hybrid work practice. Whether this will evolve into less total car ownership is reliant on many complex and long-term decisions by Government. With the short-term nature of carbon targets, relying on perfect and widespread execution of such complexity is risky compared to decarbonising the fleet as much as possible. As a precautionary principle, this might be the highest probability investment.

Furthermore, as diesel and petrol prices rise rapidly with changes to excise and potential carbon tax pricing, the attractiveness of used PHEVs may well increase. While these vehicles are inherently complex, heavy and have proven to be inappropriately used in recent times, there is growing recognition that they may have a continued role. Abandoning them would be environmentally catastrophic, and with the price of liquid fuels set to escalate, the incentive to actively charge the batteries will be much higher. Small battery packs may well enable the typical short trips of Irish people to be done emissions-free at an affordable price. This technology may well be worth investigating again with an open mind as a strictly transition technology. It may not be ideal, but it is better than a Euro 1-4 vehicle remaining in the fleet in terms of carbon output.

1.1.1 Trade up/out/across incentives

a) Introduce graduated trade up incentives that encourage consumers to trade more polluting vehicles for lower emission vehicles (with respect to the Euro class Green Star Ratings). Graduated trade-up incentives might initially target the removal all pre-euro Euro class vehicles (other than registered classic vehicles), and then systematically phase out each consecutive group of pre and lowest Euro class rated vehicles. In order to mitigate profit driven scrappage or trading a minimum of 24 months between the purchase and sale of the vehicle could be mandated.

b) A scrappage of €2000-4000 could be implemented to remove any continually registered pre-Euro class 3 vehicle from the national fleet. Under Budget 2021, there is €15 million secured by the Department of Transport to support taxi and hackney drivers in scrapping their older vehicles and replacing them with electric alternatives[13]. This policy could be replicated to include private EV purchases given their significant numbers.

c) Introducing trade-across incentives might encourage consumers to switch across from low emissions ICE vehicles to EVs. The implementation of higher incentives to move from Euro 6 to EV, if the Euro class vehicle is less than three years old, would encourage a shift to electric while also increasing the supply of higher Euro class vehicles, with low mileage, on the second-hand vehicle market. Encouraging the emergence of an independent internal second-hand market reduces Ireland's dependency on imports of used vehicles from international right-hand drive markets.

1.1.2 Graduated taxation

Taxation is used already to shift consumer perception and incentivise action. The preferential taxation treatment of diesel vehicles in Europe dramatically increased their share of sales and abruptly disrupted the market place. A lesson from that shift was that it is important for the management of change to consider supply chains, pricing parity and energy supplies in deciding at what point to make the change. There are strong parallels with the previous public target of accelerating diesel sales with the current target of accelerating electric vehicle sales, with the benefit of having learned from previous efforts.

a) Targeted taxation and incentives have been shown to nudge consumers in adopting lower CO_2 emitting vehicles. (This is supported by case studies from France, the Netherlands and Norway[14]). In Ireland, VRT and annual motor tax have been based on CO_2 emissions since 2008. In learning from that initial change shock in 2008 and to avoid extending ICE sales through incentives that are competing with electrification, a more encompassing taxation policy (including NOx and other pollutants) may be adopted.

b) A progressive increase in taxation on polluting vehicles, in accordance with the Euro vignette, will help push the adoption of lower emission vehicles. However, this must be tempered in the speed of adoption with understanding the average spend on a new car today, and ensuring that all market segments have a near price parity equivalent. There are anomalies today at the top end of the market where it is now cheaper to buy the electric version of a luxury vehicle. However, at the city car and light SUV end of the high-volume market this is not the case. Parity is likely to be some years off as noted elsewhere in this report.

[13] https://www.gov.ie/en/press-release/9c69a-electric-vehicle-grant-scheme-to-prioritise-fully-electric-cars-as-part-of-drive-to-halve-countrys-carbon-emissions-by-2030/

[14] https://www.eea.europa.eu/themes/transport/vehicles-taxation

c) While Government may be tempted to use high prices of EVs, combined with increasing taxation on fossil fuels and ICEs, to reduce total car sales, this is considered a high-risk approach. The ability to build public buy-in would be eroded, particularly outside of the inner urban areas where abundant public transport is available and people have more choice in many aspects of daily living. Cynicism might be triggered. The other risk is that as manufacturers ramp up investment in EVs they are consequently reducing development in ICEs. However, manufacturers will not stop producing ICEs while they are legally able to sell them. The global market for ICEs will still grow from today as a significant part of the world population has not even begun to consider electrification. The lack of R&D costs for manufacturers to recoup, and the ability to make higher margins at lower sales prices may, even when combined with taxation policy to increase day to day costs, result in lower purchase costs for ICE in the lead up to 2030. Therefore, this might further erode parity being reached, grow the ICE legacy fleet and undermine the Government policy position.

d) Making motorists pay for usage and pollution created as part of the cost of driving to encourage alternative modes, or more sustainable modes, is in line with the general polluter-pays principle advocated in both the EU and Ireland. However, this approach requires alignment with incentives, and a test of equity, to ensure that people unable to realistically change vehicles are not unduly penalised, and that it applies in line with adequate supply of low emissions vehicles in the Irish market to avoid perverse outcomes.

e) A much more sophisticated approach to data gathering and modelling options should be adopted by Government that helps increase confidence that new policies are realistically able to be adopted, identifying what mitigation is required to deliver distributional equity across population cohorts, before being discussed publicly. This may avoid the early scrapping of very useful policies because the consequences were not adequately foreseen; ensure public confidence is maintained; and balance the need to incentivise manufacturers to reduce price points with the need to assist consumers more rapidly adopt EVs than would occur in an unsupported marketplace.

1.2 Expedite Sales

Expediting the sale of zero and low emissions vehicles on the Irish market is an important step towards electrification of the Light Vehicle Fleet (LVF). Currently 94.10% of cars in the national fleet are either petrol or diesel. Electric vehicles accounted for just 0.9% of the total and plug-in hybrid vehicles accounted for 1.0% of the total (table 7).

Table 7: Private Cars in National Fleet by Type (October 2021)

Type Of Fuel	Total	%
Petrol	818,383	36.4%
Diesel	1,299,401	57.7%
Petrol & Electric	77,638	3.4%
Diesel & Electric	3,524	0.2%
Petrol & Ethanol	7,399	0.3%
Electric	20,513	0.9%
Plug in Hybrid	23,229	1.0%
Other	346	0.1%
Total	2,250,433	100.0%

Source: Jim Power Economics

Heavy reliance on fossil fuels, and low adoption of EVs underpins the urgency to increase uptake of low and zero emissions vehicles by removing the "worst polluters" and transitioning to ICE cleaner alternatives while the EV market matures.

Change in the right direction is already underway. In recent years there has been a change in purchasing trends in favour of EVs and PHEVs. The market share of diesel is steadily declining from 46.6% of new registrations in 2019 to 33.4% in 2021, and petrol's share has declined from 40.6% in 2019 to 32.2% in 2021. Conversely, electric vehicles have increased market share from 2.9% in 2019 to 8.2% in 2021 and plug-in hybrid electric vehicles have increased market share from 1.1% in 2019 to 7.5% in 2021.

However, despite the adoption of EV and PHEV picking up pace, the current LVF remains dominated by aged diesel and petrol vehicles and still a significant, early push to low emission vehicles (LEV) is required if the Government is to meet its emission targets.

1.2.1 Start with fleets and Government controlled/ influenced markets

a) The Government is leading the way by requiring all fleet vehicles to be replaced with ZEVs if feasible, however they should preferably be encouraged to turn them over every 2/3 years to support a second-hand market. This acceleration of EV adoption will enable the Government to meet the EU Clean Vehicles Directive targets, which requires 38.5% of light-duty vehicles purchased by public fleets to be electric between 2021 and 2025 and the same between 2026 and 2030[15]. Rapid Government fleet renewal will not only clean up the existing Government fleet but also bring a consistent supply of second-hand EVs to the Irish market. The Irish Government is already moving in this direction with their commitment in the CAP 2021 to ensure that public sector fleets should use the Public Procurement Framework for EVs where appropriate.

'A Plan for Fairly Decarbonising How People Travel (IPPR)' includes a strategy for rapid Government fleet adoption in the UK. This includes the announcement that public funds will no longer be used to purchase carbon emitting cars from 2022 onwards.

Government procurement and rapid turnover strengthens the used EV market and creates sufficient demand for manufacturers to bring new models into the country. Particularly for sedans, light vans and SUVs, Government could use its market power to mandate EV procurement from the 2022 budget year.

To reduce the public sector GHG emissions further (which accounts for about 30% of total public sector's GHG emissions) Government can also use its procurement strength to require that all transport services provided to it must be with zero emissions vehicles, and that all light vehicles must be replaced every two years.

[15] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L1161&from=EN

b) Beyond Government and semi-state light fleets, all taxis and hackneys should be regulated to transition to EV and be traded every 2 years from 2026 onwards. Targeting taxis and hackneys would help develop the infrastructure network needed to give private vehicle drivers the confidence to switch, as they are more likely to use fast and rapid chargers. Additionally, from an emissions perspective, electrifying a single fulltime ride-hailing vehicle, which averages roughly 65,000 km per year, can have the same emissions impact as electrifying three privately owned vehicles. This is largely a result of their heavier duty cycles[16]. Already, grants of up to €12,500 support the purchase of electric vehicles in the taxi/hackney/limousine sector but combining with compulsory change would have uniform effect[17].

c) Regulation on rental car fleets may be incentivised to move towards zero emissions objectives as soon as possible; subject to charging and fleet availability. Rental car fleets could transition from 75% electric and 25% hybrid for new vehicles from 2023, to 100% electric by 2027. Regulation removes competitive nervousness about making the first move and strengthens vehicle manufacturer commitment to the market. Additionally, the transition to electric in the rental car industry exposes more drivers to experience EV driving risk free, and helps build the second-hand market for EV, similar to taxis.

d) Accelerated Capital Allowances (ACA) for businesses should be reviewed and extended. For EVs, the accelerated capital allowance could be based on the lower of either the actual cost of the vehicle or €60,000, up from the current limit of €24,000, to align with the current cap on Government EV grant schemes. Beyond the flat cost of the vehicle this could include an integrated tax-deductible for on-site charging infrastructure. As the price of EVs drops the cap on ACAs may be tapered off until 50% of the market has been penetrated or EVs reach price parity with their equivalent ICE vehicles counterparts.

1.2.2 Incentivise light commercial fleets to switch

a) All light commercial vehicles (LCV) smaller than 1.5 tons could be incentivised to go electric by 2026, while LCVs smaller than 4.5 tons could be targeted for electric by 2030. Potentially no LCVs could be granted commercial registration if pre-Euro 6.

The Institute for Public Policy Research (IPPR) proposed that businesses should decarbonise their fleets and ban the purchase of combustion-engine vehicles for large commercial fleets by 2025, in-line with Norway's aim of achieving this for all passenger cars and light vans[18]. However, without incentives most small businesses in particular will be far less likely to take action.

The high duty cycles of LCVs, carrying more people and goods, longer trips and more topography for non-urban users may result in more substantial range concerns, and the current LCV EV market must be adequately developed to address demand, but more importantly, the charger network would need enhancement (see below). Therefore, ensuring coordinated incentives and investments as a pathway to EV adoption for LCVs should be developed. The creation of higher demand for charging through the LCVs and taxi markets may be necessary to attract network investment.

[16] https://rmi.org/insight/ev-charging-for-all/

[17] https://www.gov.ie/en/press-release/9c69a-electric-vehicle-grant-scheme-to-prioritise-fully-electric-cars-as-part-of-drive-to-halve-countrys-carbon-emissions-by-2030/

[18] https://www.ippr.org/files/2021-06/all-aboard-june21.pdf

Table 8: LCV Fleet by Euro Standard

Euro Standard	Number	%
Euro 1&2	9,356	2.8%
Euro 3	40,755	12.1%
Euro 4	80,341	23.9%
Euro 5	85,742	25.5%
Euro 6	119,501	35.7%
Total	335,695	100.00%

Source: Jim Power Economics

At the end of 2012, there were 335,695 LCVs registered in Ireland. 50,111 or 14.9% of these vehicles were Euro Emission Standard 1, 2 and 3, meaning that they were registered before 2006. This is a low-margin sector, so a mandate will be required to shift practice, along with creative financial incentives and products, similar to those proposed below for the private lease market.

1.3 Cleaning up the remaining ICE

As set out in the National Development Plan, the 2019 Climate Action Plan, and the Programme for Government, the Government has previously announced that the sale of new petrol and diesel cars will be banned from Irish roads from 2030 onwards. For Europe this is 2035 under the Fit for 55 policy, in conjunction with amendment of the Renewable Energy Directive (RED II), Alternative Fuels Infrastructure Directive, EU emissions trading scheme, and amendment of the regulation setting CO2 emissions standards for cars and vans[19]. This commitment provides a clear long-term target, but additional action can be taken, over the coming decade, to systematically phase-out remaining ICE vehicles and lower the emissions profile as they will remain in service well into the 2030's.

a) Once the oldest ICEs (euro 1-4) are eliminated, consider reviewing the biofuel obligation mix to 20% in petrol or 50% in diesel (for post-2009 Euro 5 fleet). This would need to be coordinated with phase out of the oldest vehicles, otherwise engine damage would occur.

In 2020, 239 million litres of biofuels replaced about 209 million litres of fossil fuels, avoiding approximately 520 $KtCO^2eq$. GHG emissions[20]. The bio-fuel blend rates proposed in the 2021 Climate Action Plan however only suggest increasing blend rates systematically between 2018 and 2030 from E5/B4.5 in 2018 to E10/B12 in 2025 and E10/B20 in 2030. Although the CAP 2021 clearly recognises the value in biofuel replacement as a CO^2 abatement mechanism it does not go far enough to maximize abatement in transport GHG emissions from biofuels. This reflects the aged fleet and its inability to effectively use higher biofuel mixes. De-ageing the fleet would have significant benefits directly in carbon abatement, but also enable much higher biofuel mixes for what will be a decade or more of continued diesel use as supply chains for EVs ramp up.

[19] https://www.interregeurope.eu/policylearning/news/12610/commission-launches-the-fit-for-55-package/?no_cache=1&cHash=a371af17736f1f2f09030ee45e7dd6f2

[20] Climate Action plan 2021

b) Remove subsidy of the excise on carbon-based fuels for certain commercial uses, and instead subsidise the biofuel component of diesel and petrol to encourage cleaner fuel blends. This may have a stronger effect on the Heavy Goods Vehicle (HGV) fleet as well.

The 2021 CAP recognises that electrification of HGVs is short term is not likely and that intermediate measures to reduce emissions should be achieved in the interim including increasing the blend rate for biodiesel to 20% and bioethanol to 10% by 2030, as well as supporting EU regulations that promote more stringent HGV vehicle emission standards and comply with the provision of EU mandatory alternative fuel infrastructure deployment targets. Despite these measures and others proposed this will only amount to an estimated 5.2MT reduction in CO_2 emissions by 2030, leaving a gap of 0.9MT in reaching our 51% reduction targets. Further incentives, including removing subsidies on carbon-based fuels, are therefore required to accelerate the adoption of cleaner fuel blends for HGVs more rapidly.

Suggested focus of additional economic analysis

Recommended Actions	Suggested focus of additional economic analysis
Remove the "worst polluters"	
1.1.1.a – Introduce trade-up incentives	• Using behavioural economics determine the level of incentives required to nudge consumers to trade-up towards each consecutive Euro-class or EV. • Determine incentives by class of vehicle and user type.
1.1.1.b – Trade-out scrappage incentive	• Determine the scrappage rate that most effectively removes the majority of any continually registered pre-Euro class vehicle from the national fleet over time. • Determine incentives by class of vehicle, user type and location to find an optimisation path.
1.1.1.c – Trade-across incentives	• Determine the required incentives for Euro-class 6 owners to switch to electric. • Determine the value per tonne of carbon saved to the economy to evaluate incentive rates. • Determine the required charging infrastructure incentives required along with the vehicle incentives as total cost per tonne of carbon mitigated rate.
1.1.2.a/b/c/d/e – Graduate taxation	• Investigate taxation policy based on the European Commission polluter-pays principle (extension of VRT and motor tax based on WLTP). • Model effects of progressive tax increase on biggest polluters. • Model effects on business consumers separately of various taxation changes to incentivise the most rapid uptake.
Expedite Sales	
1.2.1. a – EV on replacement gov. fleets	• Estimate cost to Government for rapid EV uptake and short-cycle replacement. • Model stimulation of second-hand EV market and acceleration of consumer willingness to buy a used Government EV towards the total carbon saving goal. • Model availability of EVs in market and potential stimulus of total supply.
1.2.1. b – EV on replacement taxis	• Based on data from existing programmes conduct cost-benefit analysis and determine what would be required to stimulate accelerated uptake. • There is strong demand in taxi markets for used low-km hybrid models. Model the distribution of used Government fleet into the taxi market and private markets
1.2.1. c – Rental car fleets	• Model the energy distribution demands of rental fleets based on refuelling patterns. • Model the second hand market of used EVs from rental fleets and the likely distribution.

1.2.1. d – Accelerated Capital Allowances	• Model benefit for businesses when considering thresholds for VAT and ACA reliefs. • Economic analysis of the effect of various emission thresholds for ACA.
1.2.2. a – 1.5 ton LCV electric by 2026, 4.5 ton LCV electric by 2030	• Analyse the effect on the consumer price index of increased delivery costs of this option. • Analyse the total market size and model the supply chain of available relevant vehicles. • Model the net carbon benefit of this change and determine the priority in relation to the rest of the market.
Cleaning up the remaining ICE	
1.3. a - Increase biofuel mix	• Model the cost of derogating the biofuel mix from excise as it increases relative to the decline in total sales. • Evaluate the potential cost of subsidies to fuel resellers to retain supply as the market transitions but ICE vehicles remain legal and available to purchase in the secondary market, or EVs remain unsuitable for some sections of demand.
1.3. b – Remove subsidy of the excise on carbon-based fuels	• Model the demand for ICE fuels as the price increases with sensitivities for relative parity pricing of vehicles and the ability of consumers to pay for alternatives.

Source: Jim Power Economics, Arup

Suggested focus of additional consumer research

Recommended Actions	Suggested focus of additional consumer research
Remove the "worst polluters"	
1.1.1.a – Introduce trade-up incentives	• Consumer willingness to trade-up to a lower emitting vehicle and what obstacles need to be removed. • Sentiment towards ICE vs electric by location and income. • Awareness of carbon policy and need for change.
1.1.1.b – Trade-out scrappage incentive	• Threshold for trading in vehicle for scrappage. • Level of potential demand for such a scheme and its distribution.
1.1.1.c – Trade-across incentives	• Understand what resistance remains to trade across technologies, and what the extent or strength of challenges are. • Understand what the relative roles of the private and public sector are in creating positive perceptions.
1.1.2.a – Graduate taxation	• Sentiment for higher taxes on "worst polluters" and how equity might be perceived.
Expedite Sales	
1.2.1. a – EV on replacement gov. fleets	• Use Government procurement as a test bed for messaging to determine why resistance is so strong to the adoption of EVs in Government fleets.
1.2.1. b – EV on replacement taxis	• Understand perceptions of EVs and their use in taxi fleets from both supplier and user perspectives. • Critically understand what level of reassurance via charging infrastructure would be required to shift negative perceptions. • Identify the lower cost ability to integrate disability capability into EV vehicles compared to ICE.
1.2.1. c – Rental car fleets	• Rental car fleet operator willingness to switch electric. • Rental fleet customer willingness to use electric and what charging infrastructure would be required to build confidence.
1.2.1. d – Accelerated Capital Allowances	• Determine threshold for capital allowance limit that encourages businesses to adopt EV.
1.2.2. a – 1.5 ton LCV electric by 2026, 4.5 ton LCV by 2030	• Understand the operator (driver and fleet management) perception of the current EV van fleets and potential for change. • Determine if there is any willingness to pay by consumers (corporate consumers) for "clean fleet" status.
Cleaning up the remaining ICE	
1.3. b - Increase biofuel mix	• Build consumer confidence about the ability of vehicles of Euro V and later to use the biofuels without engine degradation.
1.3. a – Remove subsidy of the excise on carbon-based fuels	• Build consumer case of the need for change and awareness of the changes.

Source: Jim Power Economics, Arup

2 Build consumer confidence

Consumer confidence in electric and hybrid vehicles is closely linked to consumer perception of value for money, technology readiness for their lifestyle requirements, cost of ownership and range anxiety. To move from early adopters, who seek out EVs, to shifting reluctant consumers to a less well-known product, a range of coordinated actions is required. While adoption is increasing slowly as more product range arrives in the Irish market, SIMI motor dealer members report consumer resistance to paying more for an EV equivalent of an ICE model, although with slightly less concern at the top end of the market. There is also significant reticence about what the retained value might be, whether charging infrastructure supply will improve (particularly for those without off-street parking) and whether another better model is just around the corner. All of these are valid concerns and are typical of an emerging market where reticence is first overcome by early adopters, then an aspirational market is created followed by mass adoption as prices decrease with increased competition.

This typical market strategy is less certain with EVs because of the supply chain issues, the rapid shift in technology that is occurring in response to battery technology upgrades and the combination of both leading to a slowing in mass-market pricing. This is, therefore, more typical of a market failure. In normal times it would be most prudent to sit it out, let the various challenges be sorted and ride the tail of the implementation wave. However, Ireland has adopted an aggressive target to catch up with emissions ambitions. It therefore finds itself competing with more advanced markets able to deliver greater sales with more visible Government supports. Some of this is optics, due to a lack of cut-through with consumer engagement and information on the various subsidies already available from Government, and some is real, based on a lack of coordination and planning across various key players.

Getting the coordinated action together, simplifying access to both information and supports, and delivering confidence to consumers will accelerate uptake of both EVs and newer, less polluting ICEs. This section outlines potential actions to move Ireland up the league table of EV adoption from laggards to leaders.

2.1 Clarity of Benefits

Rapid electrification, and continuous developments in technology and carbon policy surrounding zero- and low-emission vehicles (ZLEVs), have left consumers uncertain about what options are best for them. Alleviating this uncertainty by creating clarity about the advantages of EVs and low-emission vehicles is key.

a) Implementing a Government approved Green Star rating system for new and used vehicles sold through dealerships may be very useful, for example with a maximum rating of 6 green stars for a zero carbon at tailpipe vehicle with as close to zero carbon in the manufacturing chain and 0 stars for anything pre-Euro class. In conjunction with emissions ratings, a lifetime operating and maintenance costs rating (as EVs are cheaper from a fuel and maintenance perspective) could also be introduced. Seeing this value upfront could help justify the (currently significantly) higher upfront cost.

Introducing a clear common standard to gauge the carbon emissions of vehicles across the product lifetime, allows consumers to make conscious choices about the sustainability of their car purchases. This may be applied retroactively to cover both the second-hand vehicle market and new vehicle market.

The national vehicle and driver file (NVDF) could be enhanced so that any registration plate search included the Green Star Rating for that vehicle.

b) Launching an official demystifying Government website for consumers that provides the facts and addresses common misunderstandings about EVs, hybrids, biofuels, embedded

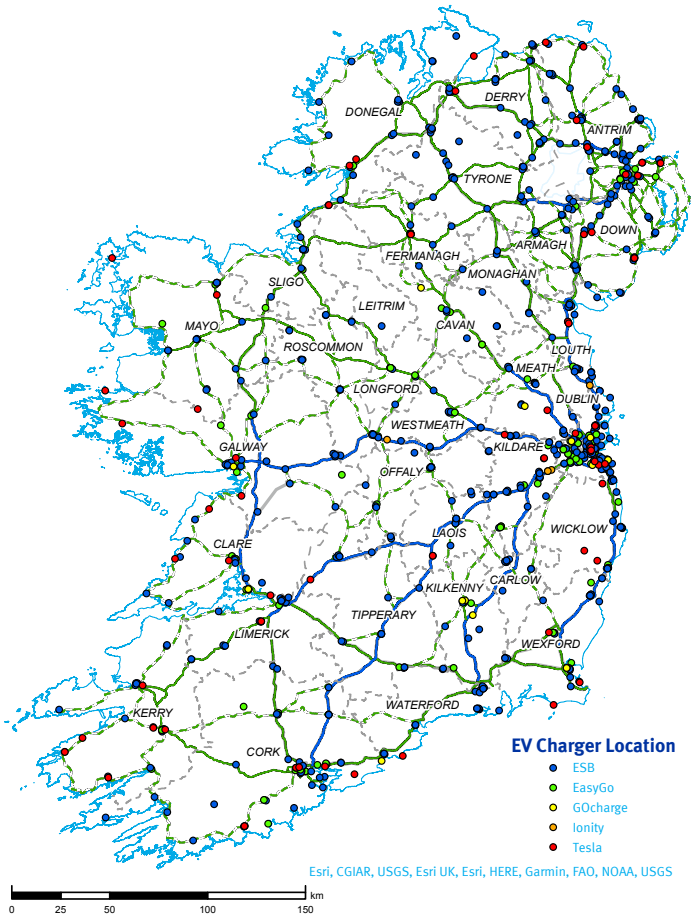
carbon and energy carbon used in charging. A complimentary multi-media campaign could increase awareness of available incentives for EVs. This could be linked through from the SEAI or Drive Greener SIMI information site. However, Government independence will be important to consumer confidence given the complexity of information and the competing interests.

c) Ensure there is an affordable clean-power scheme for people buying into EVs. This comforts EV users they are accessing clean energy as opposed to carbon intensive base-load energy. Regulating public charging stations with clean-power certification would have a similar effect and negate misleading claims that are rampant across social media.

2.2 Charging

Currently there are 1,900 chargers installed at 800 sites across the island of Ireland as part of the ESB, EasyGo, Tesla, GOcharge and Ionity networks. With an average of only 2.3 chargers per location and some remaining geographical gaps in the charging network the charging infrastructure network requires further development before range anxiety is fully addressed. Given the indicative requirement for at least one public charging point per ten EVs outlined in the EU Alternative Fuels Infrastructure Directive[21] there is clearly a need for a further action, with a particular focus on rural areas, where infrastructure is often patchy outside the major national road corridors.

Figure 3: EV Charging Locations on the Island of Ireland



Source: Arup - data sources: ESB, EasyGo, Ionity, Tesla, zap-map.com (GOcharge)

[21] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

There are around 44,000 EVs under taxation in Ireland, including close to 21,000 BEVs and around 23,000 PHEVs (rounded figures October 2021). As more and more people make the switch to EVs and PHEVs, in line with the Government target of 940,000 light electric vehicles on Irish roads by 2030, adequate investment in charging infrastructure will be essential to build and maintain consumer confidence. Additionally, the limitation of the current network means fast chargers are often not present, offline, located inconveniently or being used (especially when only one charger is available at a location).

Efforts by the Climate Action fund and ESB to jointly invest €20 million in new charging infrastructure across the country (90 additional high-power chargers, 52 additional fast chargers, and 264 replacement standard chargers) are promising. This will include upgrading 50 standard 22kW AC charging locations to 50kW DC fast chargers, vastly contributing to the number of high-power hubs on the network[22].

The 2021 CAP also reiterates the Government's continued commitment to support the expansion of the EV charging network alongside public investment to drive consumer confidence in the availability and reliability of public charging infrastructure. The CAP 2021 also proposes setting a strategy for EV charging stations with a target to stay ahead of demand, coupled with clear planning rules that facilitate the installation, and increase the obligation, over time.

The CAP 2021 does however fail to provide clear EV charging infrastructure targets in cities or go beyond what is required through EU legislation when considering the broader road network. It could be argued that ambitions for EV charging infrastructure does not go far enough. The 29 new charging points to be rolled out in Dublin County, for example, are simply too few to instil consumer confidence in EV charging infrastructure[23].

The European Commission aims to have 30 million EVs on the road by 2030 and estimates that 3 million public chargers will be needed to support them. By the same measure, Ireland would need 100,000 public chargers, with all new being fast chargers. To achieve this investment in public charging infrastructure, a broader approach to charging infrastructure might be required to include policies on charging at home (where most charging takes place apart from on long trips[24]) as well as diversifying the distribution of fast charge points across the country by modelling-informed network development to ensure charging installations support a complete/robust network across the country and are not purely market driven.

There is definitely scope to integrate private market investment into charging infrastructure to speed up the roll out process and to off-set the capital intensity required to build a wide spread charger network. The often-quoted statistic of most charging occurring at home should be taken with caution, it reflects the current conditions globally where people buying electric cars are likely to have off-street parking and access to charging. In the US the people least satisfied with EV ownership are those without access to home charging, but this is really a reflection of a fractured charging market with limited services, and blocks through proprietary network access.

Integrating private market charging business models might be organised through special benefits for network members while retaining universal access, which is no different to having a service station loyalty card giving additional benefits despite the fuel being sold to anyone who requires it.

Looking towards innovative charging solutions might provide much-needed public attention and create momentum for the investment in more charging locations across the country. As an example the Irish telecoms company Eir and EasyGo will replace 180 phone boxes with EV rapid charge points[25].

[22] https://www.windsor.ie/news/new-ev-charge-points/

[23] https://www.gov.ie/en/press-release/5da6c-minister-ryan-announces-funding-approval-for-on-street-charge-points-for-electric-vehicles/

[24] https://insideevs.com/features/457944/electric-vehicle-chargers-gas-stations/

[25] https://electrek.co/2020/12/08/egeb-ireland-phone-boxes-ev-chargers/

The risk in all charging networks is that the technology is rapidly evolving. However, it is in the market's own interests to ensure that new chargers are backwards compatible.

As network charging evolves, using inductive charging in the road surface, Government will have to determine if it is in its interests to procure technology and include in the road surface, licence the technology to be used in its roads network and share revenue, or enable a full private model to operate on public infrastructure. Given the nascent nature of this technology, but the high consumer attraction to never having to charge the vehicle, it is worth Government engaging with the issue now and determining how it will position itself to ensure Ireland can benefit.

Additional Information: Delivering on the EU Green Deal

In the recently published Fit for 55 announcement the EU sets ambitious charging infrastructure targets. To ensure that drivers are able to charge or fuel their vehicles at a reliable network across Europe, the revised Alternative Fuels Infrastructure Regulation will require Member States to expand charging capacity in line with zero-emission car sales, and to install charging and fuelling points at regular intervals on major highways. By 2025, charging pools for cars and vans should amount to 300kW power output every 60km and at least 600kW by 2030, across the TEN-T core network. On the TEN-T comprehensive network the target is 300kW power output every 60km by 2030 and at least 600kW by 2035[26]. In Ireland the TEN-T road network currently stretches between Newry, Dublin, Cork and Limerick[27]. The Core Network is due to be completed by 31 December 2030, while the Comprehensive Network is due to be completed by 31 December 2050[28]. If the network expands in Ireland, the charging infrastructure will have to follow suit.

A new Social Climate Fund has been proposed to provide dedicated funding to Member States to help citizens finance investments in energy efficiency, new heating and cooling systems, and cleaner mobility. The Social Climate Fund would be financed by the EU budget, using an amount equivalent to 25% of the expected revenues of emissions trading for building and road transport fuels[29].

2.2.1 Charging at home

a) Ensure that sufficient green grid energy is available in off peak times to provide for cheap power. This is particularly relevant from an affordability perspective as about 80% of electric vehicle charging occurs on domestic power[30]. This distortion would be expected to lower as more on-street and distributed charging networks are delivered, giving consumers without home charging confidence to buy an EV.

b) Implement a national requirement immediately for developers (and redevelopers) of residential buildings to provide a minimum of 10% of spaces with chargers and have the remainder be supply ready to install chargers on demand. This should increase at 10% per annum in anticipation of the policy being successful. This could be extended to non-residential buildings as well (shopping malls, car parks, public buildings etc.).

[26] https://www.electrive.com/2021/07/14/eu-commission-presents-fit-for-55-climate-package/
[27] https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html
[28] https://www.gov.ie/en/publication/331b18-trans-european-network-for-transport-ten-t-and-connecting-europe-fac/
[29] https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541
[30] https://www.autocar.co.uk/car-news/advice-electric-cars/how-charge-your-electric-car-home

b) The EU Energy Performance of Buildings Directive (EPBD) 2021 requires new buildings or buildings undergoing major renovations (containing one or more than one dwelling) that have more than 10 parking spaces to enable the subsequent installation of a charge point for every parking space[31]. The CAP 2021 makes the recommendation to review and amend the building regulations regarding the installation and required number of charging points in both residential and non-residential buildings.

c) Ensure landlords with off-street parking are required on request to provide off-street EV charger connection point(s) and ensure that new home constructions are required to provide off-street charging connection points for every parking space. This can be seen as an extension of the home Charger Grant Scheme which provides support towards the full cost of installation of a home charger up to a maximum of €600[32]. Currently, applicants must be the owner of an eligible new or second-hand electric vehicle (EV), but this could be expanded to include off street parking connections. The Government might consider if the €600 is sufficient.

Stakeholder engagement can provide useful insights about where investments in charging infrastructure is best made. The Hague is running a programme where municipalities are allowing locals to request a charge point to be installed. Additionally, in Amsterdam local Government is working with partners to identify areas where there are charge points, where they have been requested and where ideal locations for future charge points to be installed are, with information shown about electricity supply. This is also an approach that is being used elsewhere around the world.

d) Perhaps enable the charging connection and installation cost to be included in the vehicle cost for the purposes of consumer finances for both new and used vehicles (and integrate vehicle and charger grants into a single point of sale process to make consumer choices easy). The less complexity and forms to be completed the more people are easily swayed to participate.

e) Prioritise smart meter connections for people with electric vehicles to maximise use of off-peak tariffs.

f) Investigate incentivising vehicle-to-grid (V2G) energy transfer in peak times to manage base load demand with both payment per kw into the grid and lower tariffs to charge in off peak.

g) As a priority have the ESB prepare for the demand changes across the grid that would inevitably arise from incentivising consumer action, noting that all investment in consumer incentives is negated if the supply to charge vehicles is withheld, over-priced or delayed.

2.2.2 Distribution of chargers

Modelling should serve as a precursor to investment in charging infrastructure to determine the best mix and location of chargers to determine where Government support is required to enhance consumer confidence to the point that it will trigger consumers to switch to EV, and where convenience options are likely to be commercially attractive, to lower the cost to the Exchequer of rapidly building consumer support. To grow that consumer confidence, based on existing knowledge, it is expected that Ireland would:

[31] https://merrionstreet.ie/en/news-room/news/minister_obrien_signs_new_regulations_for_the_installation_of_electric_vehicle_recharging_infrastructure.170770.shortcut.html

[32] https://www.seai.ie/technologies/electric-vehicles/why-drive-electric/easy-to-charge/

a) Ensure that every service station forecourt has a minimum of one fast-charger, or if there are more than four fuel pumps, one fast charger for every four pumps or part there-of, with just transition funding to assist while the charging market is still in low demand (but which cannot grow without charging being easily available). Investigate the feasibility for smaller fuel pump stations to comply with IET Code of Practise for EV installation as well as the National Standards Authority of Ireland (NSAI) standards for charging of electric vehicles[33]. Additionally, clarify actions on destination chargers for businesses more broadly.

b) Support both Local Authorities and service station forecourts in the capital cost in acknowledgement that initially EV chargers in public places are to increase confidence and will have minimal financial return. Ideally fast or very fast charging would be a requirement to minimise charging time and increase turnover per charging unit. Link to a national strategy for distribution of fast chargers to avoid "charging desserts" and maximize the utility of charging investments.

c) Regulate on-street charging in a provision ratio starting with one per 20 on-street bays as soon as possible and moving to one in 10 by 2030. This policy should be aligned with the development of a national infrastructure strategy to address on-street, location and fast charging infrastructure needs to stay ahead of demand, having particular regard to non-urban needs, as proposed in the 2021 CAP.

In Finland new non-residential buildings with 11 to 30 parking spaces, must have a charging point installed in at least 50% of the parking spaces [Finnish directive].

In line with the EU Energy Performance of Buildings Directive (EPBD), the Energy Performance of Buildings Regulation 2021 stipulates new regulations for the installation of EV charging infrastructure[34]. New regulations require new buildings or buildings undergoing major renovations (other than a dwelling) to enable the installation of at least one recharging point for every 5 car parking spaces. Existing buildings (other than a dwelling) with more than 20 car parking spaces, are to enable the installation of one or more recharging points before 1 January 2025[35].

d) Legislate that on-street bays are to only provide free parking while charging is active and with a 15-minute buffer, after which stringent fines/towing apply. Avoid clamping as this removes a bay from service. Enforcement here is key and the policies that are already implemented in some regions should be adapted.

In Dublin city a car must be actively charging and display a valid ticket for the period it is parked in the EV charging space otherwise your vehicle will be clamped[36]. However, there is no incentive to remove the vehicle once clamped.

e) Regulate that chargers on public land or in-service station forecourts must be accessible by any EV, regardless of subscription service (same as applies to parking bay use with app payments). Guaranteeing interoperability between charging providers and infrastructure is key.

EasyGo and other charging providers, are providing public charge points privately, including partnerships with shops, and other destinations for customer charging. Regulation must guarantee compatibility with EVs across the market without the requirement for an account with the supplier.

[33] https://www.nsai.ie/about/news/nsai-publishes-new-national-rules-for-electrical-installations/

[34] https://merrionstreet.ie/en/news-room/news/minister_obrien_signs_new_regulations_for_the_installation_of_electric_vehicle_recharging_infrastructure.170770.shortcut.html

[35] https://www.caro.ie/news/eu-(energy-performance-of-buildings)-regulations-2

[36] https://www.dublincity.ie/residential/parking-dublin-city-centre/electric-vehicle-charging

f) Ensure that workplaces which are planned around motor vehicle access by employees provide EV charging at the same rate as proposed off-street parking (c).

g) Correlate the incentives for charger installation with the target for EV uptake and review annually to stay ahead of demand and avoid queuing.

h) Work with fuel resellers to manage the transition and avoid early failure of liquid fuel supplies, which will remain critical for the freight sector into the mid-2030's.

i) Introduce Government competitions/grants to explore charging use-cases for different fleets/charging needs. This can help create templates for freight and last-mile vehicle charging needs, infrastructure sharing between users (i.e. buses and taxis), etc. The New York Clean Transportation Prize and Drive Dundee Electric[37] are successful examples of using competitions/grants to explore charging use-cases.

2.3 Range

Misconceptions about range and battery size can play a significant role in consumer choices when making the decision to go electric. 2021 model BEVs have all-electric ranges of 200km to 550km, while some higher-end models such as the Tesla Model S Plaid+ can range up to 835km per the latest industry data[38]. The compact geography of Ireland also means most trips are well within the ranges of high end EVs currently on the market without the need for fast charging stations. However, on average Irish people only drive 14.6 km per trip. Lower range EV and PHEV models are therefore adequate zero emission mobility options for the vast majority of journeys, for most people. However, it is always recognised that with insufficient education effort range anxiety will remain a real issue for the majority of society. Adequate fast charging on motorways should be available to avoid 'range anxiety' for all available EV models and to encourage smaller battery models, which are cheaper and may accelerate uptake.

To alleviate 'range anxiety' a coherent communications campaign should be rolled out to inform people about the cost comparison between battery price and average required range. In addition, people may be informed about the Worldwide Harmonized Light Vehicle Test Procedure (WLTP) cycle to make better informed decision about the sustainability of their travel patterns by focusing on simple and straight forward metrics.

a) Launch a public information campaign that shifts perceptions from "big battery best" to smaller, more affordable batteries that are more suited to people's travel patterns. Make a comparison of how much fuel you buy using an ICE vehicle per kms travelled per day/week translated to battery requirements. Also mention that EV manufacturers tend to provide warranties on the battery and range for 8 plus years (remaining capacity differs between manufacturers but is commonly 70% after 8 years)[39] to alleviate worries about capacity degradation or the high cost of battery replacement. Personas as a relatable "like me" marketing tool can be used to reach consumers across Ireland. SIMI is developing personas for its market research which could be expanded.

b) This public information campaign could be seen as an expansion of the SEAI and Low Emission Vehicle Task Force efforts, but could be enhanced with more accessible information and more broadcast strategies.

[37] The Dundee Council received funding from the Scottish Government and Office for Low Emission Vehicles to become an exemplar city for the uptake of ULEVS. Public charging bays are shared between EV Taxis, local residents and the public to maximise usage, while multi-storey car parks have incorporated solar powered EV charging in designated EV parking spots.

[38] https://www.bordgaisenergy.ie/home/ev-charger?utm_source=facebook&utm_medium=social&utm_campaign=sustainability_article_7&utm_term=ev_chargers&utm_content=link_post

[39] https://thedriven.io/2021/07/23/how-much-are-replacement-batteries-for-electric-vehicles-in-australia/

c) Explaining the Worldwide Harmonized Light Vehicle Test Procedure (WLTP) cycle in plain English for consumers, that it is an average just like km per litre rating, and what the effects of very cold weather and extended motorway speed would mean to effective range. The content on the EU WLTP Facts site is a good start, but it needs to be in a single local portal

d) Consolidate the excellent education resources spread across various semi-state energy suppliers either into a single portal, or at least linked through, making sure they are consistent.

2.4 Value for money of EVs and resale value

Retained value is everything in the car market, where the gap between the existing vehicle and the new vehicle dictates many consumer choices. More widespread recognition of the value for money in purchasing an electric vehicle will boost consumer confidence. Addressing concerns about battery deterioration and resale value will provide consumers more confidence in selling/ buying EVs.

Bloomberg New Energy Finance (BNEF) expects average lithium-ion battery prices to fall to under $60 per kilowatt hour by 2030, down another 60% from where they are today[40]. Since the battery pack is the most expensive part of an electric vehicle, accounting for about 30% of the total cost to consumers[41], this will result in lower EV purchasing costs and cheaper battery replacement costs. This is key for driving down the cost of EVs towards price parity with ICE vehicles.

Over the long-term batteries may outlast the vehicles themselves and become an asset[42].

a) Launch an education campaign on the low annual running cost of an EV compared to a similar ICE vehicle by using personas as a relatable "like me" marketing tool. Also cover the incentives that balance out the financial risk of switching. This initiative also relates to financing options below, as removing the upfront purchase price from the equation can help consumers access the lower life cycle costs of an EV without suffering "sticker shock" of the higher initial purchase price.

b) Apply 'fear of missing out' tactics in the upper-mid-price market to encourage rapid trade-in cycles as people rush to update to the newest vehicles, thereby generating a stronger second-hand market.

c) Create confidence in the resale value of an EV by introducing a remaining battery life/ performance certification based on a decade of battery performance data. The battery recycling industry is now assuming 15 years effective battery life[43].

d) Promote the user-friendliness and performance of EV vehicles. This can be done through experiential events such as those organised by the LEV taskforce. This experience is more powerful than a TV or radio advertisement. Better performance should also be brought to the foreground to overcome resistance from those who are interested in cars as ego extensions – many EVs outperform ICE brand equivalents.

[40] https://www.bloomberg.com/news/newsletters/2021-07-27/hyperdrive-daily-your-next-car-might-be-a-chinese-ev?cmpid=BBD080321_hyperdrive&utm_medium=email&utm_source=newsletter&utm_term=210803&utm_campaign=hyperdrive

[41] https://www.bloomberg.com/news/articles/2020-12-16/electric-cars-are-about-to-be-as-cheap-as-gas-powered-models

[42] https://www.wired.com/story/what-happens-after-a-million-mile-battery-outlasts-the-car/

[43] https://www.edfenergy.com/electric-cars/batteries

Suggested focus of additional economic analysis

Recommended Actions	Suggested focus of additional economic research
Clarity of Benefits	
2.1.a – Implement Green star rating	• Determine effect on consumer purchasing behaviour. • Cost-benefit analysis. • Analysis of existing star rating schemes in other energy saving sectors.
Charging	
2.2.1.b – Developers provide minimum of 10% of spaces with chargers	• Analyse cost to developers and rental/selling value of charging point availability over time.
2.2.1.c – Landlords provide charge connection point on request	• Analysis of rental value of charging point availability over time.
2.2.1.d – Charge point installation costs included in vehicle cost	• Analysis of ROI difference of separate vs integrated schemes on uptake rates and thus emissions.
2.2.1.f – Incentivise V2G in peak times	• Analysis of long term cost savings for grid providers of enabling Vehicle to Grid (V2G) for grid and peak stabilisation.
2.2.1.g – ESB prepare for the demand changes across the grid	• Analyse cost for ESB to prepare for demand changes across the grid.
2.2.2.a – Forecourt fast-charger	• Analysis of EV uptake benefits of different rates of forecourt fast charging supply and value to targets (to set subsidy if required, and grandfathering clauses).
2.2.2.b – Capital cost chargers	• Included in above (2.2.2.a)
2.2.2.f – Workplaces plan charging access	• Model effect of measure on employee travel to work patterns.
2.2.2.g – Correlate incentives for charging installation with EV uptake	• Model the maturation of the market and the requirement for incentives, the rate of incentive decreases over time and the point where expiring incentives has a marginal effect.
2.2.2.h – Avoid early failure of liquid fuel supply	• Model long term economic viability of liquid fuel supply in different scenarios and identify where market failure might occur and what Government intervention might be required.
2.2.2.i – Introduce Government competitions/grants	• Determine cost of organising Government competitions/grants to explore charging use-cases for different fleets/charging needs.
Value for money of EVs and resale value	
2.4.a – Education campaign on low annual running cost EV	• Determine education campaign running cost.
2.4.c – Resale-value EV	• Analysis of the resale value of EVs in a range of scenarios depending on the speed of cost reduction in new EVs and EV uptake.

Source: Jim Power Economics, Arup

Suggested focus of additional consumer research

Recommended Actions	Suggested focus of additional consumer research
Clarity of Benefits	
2.1.a – Implement Green star rating	• Full consumer research package on what type of rating and messaging will have the greatest positive effect on EV uptake.
2.1.b – Demystifying website to address common misunderstandings	• Test consumer response to message types and content. • Understand existing attitudes and understanding of the range of issues. • Identify the most common perceptions affecting EV take-up.
2.1.c – Clean-power Supply	• Identify strength of supply of green power in decision making by socio economic group and location.
Charging	
2.2.1.a – Green Energy availability in off-peak	• Included in above (2.1.c).
2.2.1.b – Developers provide minimum of 10% of spaces with chargers	• Developers' and redevelopers' of residential buildings sentiment to implementing policy on request of charging point.
2.2.1.c – Landlords provide charge connection point on request	• Landlord sentiment to implementing policy on request of charging point.
2.2.1.d – Charge point installation costs included in vehicle cost	• Identify whether integrating all subsidies into the point of sale, and whether the dealer can complete on behalf of the consumer, would increase the attractiveness of EV purchase, and by how much.
2.2.1.e -Prioritise smart meters for EV owners	• Identify resistance points to smart meters and options to overcome that resistance.
2.2.2.a – Forecourt fast-charger	•Identify among potential users the attractiveness of forecourt charging, spread across commercial and private users.
2.2.2.f – Workplaces plan charging access	• Measure employee demand for EV charging infrastructure at the workplace (identify alignment with other destination charging locations).
Range	
2.3.a – Public information campaign battery size	• Test consumer perception of acceptable range aligned with the availability of fast and very fast charging.
2.3.b – WLTP explained	• Current awareness of WLTP and test different methods of explaining it.
Value for money of EVs and resale value	
2.4.a – Education campaign running cost EV	• Test various messages about EV operating costs and what is most important and most easily understood by consumers, separated by commercial and private users.
2.4.d – User-friendliness EV	• Test various potential methods of engaging with potential consumers on the benefits of EV use and whether physical interaction; virtual demonstrations or other options would increase likelihood of purchase.

Source: Jim Power Economics, Arup

3

3 Incentivise consumer action

In order to successfully shift the LVF electric, beyond consumer confidence, incentives are necessary to encourage consumers to take action and make the switch to ZLEVs. Government supports are essential to boost uptake of EVs and address the market failure that would otherwise see EV levels remain below optimum levels.

Government subsidies and infrastructure investment have been a crucial driver for EV uptake in recent years and are necessary to continue EV uptake at an accelerated pace in the coming decade. On average, in 2019, a BEV purchaser received a direct subsidy from the State of €13,616[44]. (Note – in 2022 due to changes in VRT rates, SIMI estimates this subsidy to now be €8,682). These incentives include: a purchase grant, vehicle registration tax (VRT) relief, a toll incentive, a home charger installation grant, and reduced motor tax rates. Continued, and most likely increased, subsidisation of EVs will be required to reach Government targets for decarbonisation and electrification of the LVF.

The cost of incentivising EVs to the Exchequer is already rapidly accelerating and the pace is rising. Currently the benefits are predominantly for the middle class that can afford the switch to EVs in the first place, leaving many unable to access current incentives. To address this, future incentivisation should make considerations about the equity of EV incentives and introduce alternative mechanisms (opt-in Road User Charging, increased taxation on "worst polluters", etc.) to balance Exchequer expenditure where applicable.

Case Study: Norwegian EV Adoption

The rapid shift to EV has proven feasible in other European countries. Norway has become a model country in Europe regarding the adoption of EV and electrifying their national fleet. Norway's percentage of EV sales was more than 70% in 2020[45], and the country will ban all new petrol, diesel and hybrid sales from 2025[46]. This provides interesting insights for the adoption of EV in Ireland in order to reach its own 2030 targets.

As stated by the Norwegian Roads Authority: The Norwegian success in introducing electric vehicles into the market during the last years, lies upon three pillars of incentives that have incentivised consumer action.

- Making it attractive to use - Permission to use of the bus lane during rush hours is probably most important. Also includes free use of toll roads and of ferries.
- Facilitating the use of electric vehicles – Charging infrastructure – mainly handled by the public entity called ENOVA, providing economic support for low emission technologies – the establishment of charging facilities all over the country
- Making it economically attractive to purchase - Vehicle taxation policy– responsibility within the Ministry of Finance.

Given the substantial differences between Ireland and Norway key adaptations are required when considering the above-mentioned policy actions. Nonetheless, useful lessons can be drawn from the Norwegian EV implementation strategy including incentivisation through infrastructure investment, EV usage benefits and economic incentives.

[44] https://assets.gov.ie/25107/eb5a541e3b614c94a3e47c8d068e72c9.pdf
[45] https://www.statista.com/statistics/696187/electric-and-hybrid-cars-number-in-norway/
[46] https://thedriven.io/2020/11/25/victoria-releases-details-of-ev-road-user-charge-as-critics-multiply/

3.1 Purchase incentives

Providing enhanced purchase incentives to consumers reduces the changeover cost and provides a financial incentive to invest in EV as opposed to ICE vehicles. This may increase take up while prices remain high. Options to trigger action to buy include:

a) Implement a zero up-front tax on purchases by removing all point of sales taxes and charges on the purchase of a new or used electric vehicle until 50% of all new vehicle sales are electric for personal or fleet use (perhaps only if buyer opts into per km usage rate, see below) to incentivise early take-up.

b) Extend current incentives including Benefit-In-Kind (BIK) tax relief for EVs to 2026 in addition to an extension of the SEAI grants to keep market stability while the supply of EVs matures.

c) Review purchase incentives and enable access at the point of sale with no further application process, to make purchasing a no wait, no barrier option.

In the 2021 CAP Government has committed to review and update VRT and other fiscal and regulatory incentives in the EV sector, as well as considering fiscal and regulatory disincentives for ICE vehicles. This needs to occur in a consumer focussed manner with the least possible bureaucratic requirements to make a decision to change to EV easy.

d) Adjust incentive maximums for vehicles to include those that are "aspirational" vehicles as opposed to "luxury vehicles", as these are important to stimulate sales and visibility – noting that prices for EVs are currently still significantly higher than equivalent ICEs and publish a pathway for reduction to stimulate price decreases as supply increases and to ensure that people understand incentives are temporary market stimulus.

e) Accept that some form of support even in the upper middle market will be required to stimulate early sales until more fleet is available in the market, and this can be made fair by providing proportionally deeper discounts to cheaper vehicles (to also stimulate a greater range of models being made available).

f) Regulate insurance of EVs to ensure that price-gouging for "new models" does not add additional costs to ownership.

3.2 Consumer leases

Implement all-in consumer personal leases, including charging infrastructure and power.

a) Enable private buyers to use a personal lease with all consumables included for a standardised monthly payment, incorporating all incentives possible to lower the rate. Hyundai Motor UK has launched a new all-in-one monthly subscription service for its line-up of hybrid, plug-in hybrid and fully electric models [Link].

b) Enable private buyers to have rolling leases with short terms to stimulate second-hand market while staying in the newest vehicles.

c) Enable manufacturers to offer guaranteed buy-back terms as part of finance packages.

d) Implement zero interest finance on 6 star-green rated vehicles. Consider zero financing backed by Government guarantee for personal contract plans (PCP) arrangements and on defined period loans, allowing all additional costs such as charging installation to be included.

e) Enable low-tax company-provided benefits through an employer led purchase scheme. In the UK low-tax company-provided loans led to a 90% uptake of EVs through employer led purchase schemes [Low Carbon Transport Business Loan].

3.3 Electric Vehicle discounts and benefits

In addition to the EV incentives already mentioned in this report (free parking while charging, purchase incentives) other EV discounts and benefits might be introduced.

a) Introduce free tolls for EVs as an extension of the current tolling benefits. Existing Low Emissions Vehicle Toll Incentive (LEVTI) provide a 50% reduction on tolls for battery electric vehicles and 25% reduction on tolls for plug-in hybrid electric vehicles with a maximum refundable cap of €500 for private vehicles[47]. This initiative will run until December 31st 2022 or when the threshold of 50,000 Low Emission Vehicles (LEVs) is reached.

b) Allow EVs to use bus lanes. This incentive has proven highly effective in the adoption of EV in Norway but requires careful preliminary analysis/modelling before implementation in Ireland[48].

Pay-as-you-go opt-in

a) Transition to pay-as-you go per km charge as opt-in that replaces every other tax, charge and fee related to ownership. Investigate subsidising incentives by moving to a pay-as-you-go road user charging scheme for EVs, transitioning that to roads and public transport budgets once incentives phase-out.

The multiple trials in the US of pay-as-you-go Road User Charging have only succeeded politically and with consumers as an opt-in. Pricing is typically set to be the same or less than equivalent combinations of fuel excise and other taxes as incentive to opt-in. The principle is that when more than half of the public have opted-in the discussion changes to shifting to all pay-as-you-go. This resolves the financial problem of loss of fuel excise for the funding of the road network, can be used to incentivise EV take-up and requires only an annual inspection of the odometer (later it will be via telematics) and the payment of the charge to effectively register for the forthcoming year. It can be done in a more complex way, with greater technology, but at commencement this is not recommended. Some jurisdictions are attempting to force the issue which has met strong public resistance. At less than 1% of the fleet, early adoption may well be prudent.

Case Study: Road User Charging in Victoria and New South Wales (NSW)

Victoria and NSW have both committed to the implementation of Road User Charging for EVs. This entails a 2.5 cent/km charge will apply to electric and other zero-emission vehicles (including hydrogen), and a 2.0 cent/km charge will apply to plug-in hybrid-electric vehicles (PHEVs). The levied charges would equate to about $500 Australian for an EV doing 20,000km annually and around $400 Australian annually for a PHEV[49]. This is in contrast to the 42.7 cents taxed for every litre of petrol and diesel sold at the pump equating to an average cost of around $1,000 Australian (with a fuel economy of 11.1[50] – fuel excise per km is approximately 4.7 cents)[51].

[47] https://www.eflow.ie/low-emissions-vehicle-toll-incentive/
[48] https://elbil.no/english/norwegian-ev-policy/
[49] https://www.drive.com.au/news/victoria-passes-road-user-tax-for-electric-vehicle-owners-industry-reacts/
[50] https://www.budgetdirect.com.au/car-insurance/research/average-fuel-consumption-australia.html
[51] https://www.aaa.asn.au/get-involved/excise-calculator/

The state Government will exempt EVs from luxury vehicle rate of stamp duty and also benefit from a $100 Australian annual discount on vehicle registration. A $3000 rebate on EVs and other zero emissions vehicles has also been implemented.

Registered operators will be required to provide a photo image of their vehicle's odometer reading at the start and end of the registration period, from which the annual charge is calculated. Appendix A provides a complete overview of Road User Charging in Victoria and NSW.

3.5 Public transparency

Be totally transparent and expedient with the public. Clear and consistent public communications will provide certainty for the public and private sector on budget supports and ensure consumer confidence and awareness of Government ICE vehicle and EV policies. The establishment of an Office for Low Emitting Vehicles to co-ordinate the implementation of existing and future EV measures and infrastructure is a positive development. Equally promising is the Government's intent to develop and launch an extensive communication and engagement campaign to drive the availability and understanding of key information regarding EVs, tailored to household, business and public sector consumers[52].

a) Track on a Government website the extent and duration of supports and when they will expire so that markets can adjust as incentives reduce when the market becomes a predominantly electric one. Note that manufacturers will reduce their prices to maintain market position once they have a foothold, so a phased withdrawal can have positive price benefits. As price parity is achieved due to reduced production costs and increased demand supports should be eliminated.

b) Transfer counter-productive incentives for non-EVs into the funding pool for EVs.

c) Potentially disallow tax-deductibility on new commercial vehicles that are not EV once the electric LCV market is adequately established mid-decade.

[52] Climate Action Plan 2021

Suggested focus of additional economic analysis

Recommended Actions	Suggested focus of additional economic analysis
Purchase Incentives	
3.1.a – Implement a zero up-front tax on purchases	• Model the carbon benefit vs the cost of implementing over time with phase-out scenarios.
3.1.b – Extend current incentives for EV up to 2025	• Included in above (3.1.a).
3.1.c – Review purchase incentives	•Included in above (3.1.a).
3.1.d – Adjust incentives to include “aspirational” vehicles	• Model where the cap should be for incentives taking into account the shorter term need to stimulate turnover and creation of a second-hand EV market.
3.1.e– Support to stimulate early sales	• Model cost of incentives required to stimulate EV uptake until adequate price parity between EV and ICE vehicles is reached.
3.1.f – Regulate insurance of EVs	• Review insurance rates for EVs and vehicles of equivalent sale price and determine if there is any gaps that are not explainable in realistic terms.
Consumer Leases	
3.2.b – Enable private buyers to have rolling leases with short terms	• Analyse effect on consumer purchasing power.
3.2.d – Implement zero interest finance on 6 star-green rated vehicles	• Using behavioural economic analysis determine the uptake of 6 star-green rated vehicles given the implementation of zero interest finance.
EV Discounts and Benefits	
3.3.a – Free tolls for EVs	• Model economic effect of removing tolls for EVs to determine incentive cut-off date.
Pay-as-you-go opt-in	
3.4.a – Transition to pay-as-you-go per km charge as opt-in	• Conduct a Strategic Assessment Report and, if successful, a Preliminary Business Case on Road User Charging for EV to determine the effect on affordability of incentives and transition to an all EV fleet.

Source: Jim Power Economics, Arup

Suggested focus of additional consumer research

Recommended Actions	Suggested focus of additional consumer research
Purchase Incentives	
3.1.a – Implement a zero up-front tax on purchases	• Consumer perception of taxation and grant scheme of EVs in Ireland and what has the greatest effect on purchasing behaviour.
3.1.c – Review purchase incentives	• Review most effective purchase incentives though consumer research.
3.1.d – Adjust incentives to include “aspirational” vehicles	• Threshold for consumer perception of “aspirational” versus “luxury”.
3.1.f – Regulate insurance of EVs	• Determine what types of incentives and actions will work at what stage of market maturity, and with different types of personas, to determine the most effective pathway.
Consumer Leases	
3.2.a – Enable private buyers to use a personal lease	• Better understand what consumers most value in terms of ease of transaction, price vs convenience and upfront saving vs whole of life costs.

Source: Jim Power Economics, Arup

4

4 Increase mobility management

Net zero transport will not be attained through the adoption of zero emission vehicles alone. There is a need to reduce trips, make more efficient trips, and reduce vehicles making trips.

However, it must also be recognised that while the cost of subsidising the shift to low emissions private mobility may be high in the short term, the cost of increasing with uniformity public and shared mobility options is both recurrent and never-ending. Simply removing one option, car use, does not reduce costs but rather increases them. People need to be able to move as required seven days per week and the cost of this can be very high for Governments.

Balancing reduction of trips or the number of movements required to support those trips where they are relatively concentrated is relatively easy with the current range of service types and with moderate investment in public transport supply spread over time.

Dealing with edge use cases, weekends, nights, shift-workers which are widely distributed and hard to predict can be very expensive to develop sufficient supply.

It is therefore expected that there will continue to be a desire for private vehicle ownership in significant numbers, even though the use of such vehicles may decline over time. However, with the reduced cost of ownership and operation brought about by EVs, ownership might persist longer than previously expected.

Even different ownership models suffer from the same issue, that those edge cases are when demand for independent movement increase substantially, and for relatively short time periods. That intensity in constrained times makes for a poor business model, which is why public transport is a public good and generally requires Government support.

Nevertheless, the expansion of Government efforts in the area of mobility management will improve the reach, efficiency, and affordability of public transportation (PT) services, and this will be generally beneficial. At what point this incentivises consumers to adapt their mobility patterns and reduce reliability on private vehicle transport is very difficult to forecast.

The 2021 CAP sets out the ambition to deliver an additional 500,000 daily sustainable journeys by 2030 (c.14% increase on current levels) through the implementation of major transport projects including BusConnects, Connecting Ireland, expanding rail services and infrastructure in and around major urban centres, and a significant increase in walking and cycling investment. New technology will also increasingly play a key role in the realisation of Ireland's climate action goals, with Mobility as a Service (MaaS) and micro-mobility options extending both the number and length of sustainable trips across Ireland.

To provide citizens with reliable and realistic sustainable mobility options to enable better mobility choices a broad suite of supports should be utilized. This would ideally include mobility management programmes, such as increased safe cycling facilities, improved access to public transport services across greater geography with more frequency, changes to planning conditions, changes to work practices, changes to parking availability and many other actions promote the more frequent use of public transport. Treating private car use inclusively as part of this options set, and focussing on shifting the balance, is likely to be more realistically productive.

The public transport fleet itself should also be electrified. The National Transport Authority (NTA) intends to purchase up to 800 buses under a Framework Agreement over a period of five years, with the first buses expected to arrive in the second half of 2022. The investment in electrification of public transport means greater emission reductions and in the context of bus networks, tends to skew benefits towards lower-income groups[53].

Recommendations on public transport improvements should also be aligned with improved planning practices that inherently reduces the need for vehicle transport. This may include increasing access to stores, employment, transport services and other local amenities by reducing walking and cycling distances. The overlay of a sustainable public transport network could equally supplement longer distance travel in urban centres[54].

4.1 Improve public transport

Implementing better public transport hours of operation, coverage and pricing will incentivise different usage patterns and reduce reliance on private vehicle transport. This is true for urban areas but even more so for rural regions where public transport is currently not a viable option for many. This reduces the number of cars on the road and benefits communities economically, socially and health wise.

Also, the recently published 'Travelling in a Woman's Shoes' report outlines the need to address inequality present in current public transport implementation, particularly when it comes to women's user experience.

a) Acknowledging that second car ownership arises from a lack of confidence in availability, accessibility, and affordability of public transport alternatives, increase the time and geographical coverage of public transport, first in urban areas where the greatest change is possible and subsequently across the country. As set out in the CAP 2021, cities with a population exceeding 75,000 that are required to develop an urban sustainable transport plan should ensure their transport strategies reflect CAP sectoral emission reduction targets.

b) Reduce the maximum waiting time between services to no more than half an hour seven days per week, with an ultimate goal of 15-minute maximum headway and a minimum of 18 hours of intensive service per day.

c) Consider a maximum total public transport fares cap regardless of mode and other public transport pricing incentives to reduce car reliance. This could potentially be extended to a no-fare zone in Dublin (and other cities) that correspond with future car-free or low-emission zones.

d) Consider multi-modality that can be paid for with integrated ticketing and improve the alignment of location and frequencies between different modalities.

e) Increase the frequency of trains and trams across the day and week to erode the need for a car.

f) Investigate the feasibility of flexible transit, shuttle and other first- and last-mile services to bridge the gap to public transport in suburban areas and offer alternatives to vehicle trips, building on the NTA experience in exurban and rural areas.

[53] https://assets.publishing.service.gov.uk/Government/uploads/system/uploads/attachment_data/file/953951/Transport_and_inequality_report_document.pdf

[54] https://www2.deloitte.com/global/en/pages/public-sector/articles/urban-future-with-a-purpose/15-minute-city.html

4.2 Expand NTA park and ride

a) Expand the National Transport Authority (NTA) park and ride scheme and include free EV charging for first 10 years in addition to free parking. Particularly in regional and suburban areas where range could be an issue, and where long-distance commuting significantly contributes to congestion in urban centres. Reconsider the cumulative cost of parking and the cost of public transport tickets to avoid high costs disincentivising EV users from utilizing NTA Park & Ride. Additionally, park and rides may serve as ideal locations to accelerate shared charging approaches.

The 2016-2035 Transport strategy for the Greater Dublin Area sets clear objectives that could be replicated across urban areas in Ireland. This includes developing a network of strategic rail-based park and ride facilities at appropriate points where rail services intersect with the national road network, and assessing the potential for bus-based park and ride, in particular, close to high quality road corridors leading from Hinterland towns. Additionally, this may include implementing suitable charging structures for park and ride facilities to make it more likely that those who most need the service (i.e. those outside walking distance and where alternative public transport options are not available), will obtain parking[55].

4.3 Opt-in Road User Charging

a) Expand/Introduce Road User Charging (RUC) for demand and congestion management by acknowledging that in a transition environment it is harder to remove cars than reduce their usage (in parallel with the provision of better alternatives). Simultaneously consider the equity implications of Road User Charging to ensure any proposal is fair according to the location of application, means of the individual and the provision of alternatives. Opt-in Road User Charging should not punish driving, specifically where alternatives are insufficient for realistic choice, but driving in peak times in congested areas.

4.4 Provide trade-out opportunities

a) Enable the scrappage of a registered older vehicle in return for an electric bike or scooter.

From 9 April 2021, people in France will be able to trade in old diesel or petrol car and receive a grant of up to €2,500 to go towards an electric bike [France's Scrappage Scheme]. Similar schemes have been equally successful in Finland and Lithuania. In Finland the car scrappage scheme offers up to €1,000 for an ebike, ecargo bike, escooter or a public transport ticket (with a majority opting for an ebike). Lithuania set up a car trade-in scheme for ebikes, pedal cycles, cargo bikes and e-scooters. Again, the scrappage offer was €1,000[56].

b) Enable the scrappage of a registered older vehicle in return for a two-year public transport free pass, or share ride access pass with a travel cap.

c) Continue tax breaks through businesses for cycling, e-cycling and expand to e-scooters (including legalising e-scooters for personal and hire use).

[55] https://www.nationaltransport.ie/wp-content/uploads/2016/08/Transport_Strategy_for_the_Greater_Dublin_Area_2016-2035.pdf

[56] https://irishcycle.com/2021/02/05/set-up-scrappage-scheme-to-swap-cars-for-ebikes-or-cargo-bikes-campaigners-tell-minister-ryan/

4.5 Build on 'working from home' measures to reduce peak demand

a) Maintain tax credits and grants, in line with the National Remote Working Strategy[57], to facilitate remote working, while also encouraging much greater flexibility in work attendance, eg. walking kids to school, then public transport to work out of peak.

Emissions from the Transport sector are estimated to have fallen by over 2 Megatons of carbon dioxide in 2020, compared to 2019, which amounts to reductions of almost 17% (not including emission associated with international aviation). When looking more closely at the reduction in road transport fuel consumption we find petrol consumption reached its lowest levels in April 2020, over 70% below the level from the same month in 2019, and in the same month diesel reached its lowest point of 55% below the level from the same month in 2019[58]. Although severe movement restrictions are not sustainable or desirable in the long run, the emission reductions illustrate how changing travel patterns can effectively reduce emissions and supports the argument that promoting 'working from home' measures could maintain some level of reduced emissions.

b) Keep demand for car driving to those complex trips that are difficult to replicate with alternatives and which are uneconomic to provide with PT.

4.6 Walking and cycling infrastructure investment

a) Allocate walking and cycling infrastructure investment where it has greatest impact in reducing the need to drive first, then on tourist focussed greenways. In the 2021 budget, NTA allocated €240m to councils for cycling and walking infrastructure. General projects in the scheme include the reallocation of overall road space which will include segregated cycling lanes and widened footpaths, cyclist parking, raised pedestrian crossings and reducing road width at crossing points as well as other improvements[59]. NTA investment planning in walking and cycling infrastructure should take reduced vehicle usership into consideration. In the CAP 2021 the Government has committed to constructing an additional 1,000km of cycling and walking infrastructure, continue the improvement and expansion of the Active Travel Greenway Network, development of a coherent and connected National Cycling Network strategy, sustainable mobility plans for schools and encourage an increased level of modal shift towards active travel (walking and cycling). Ensuring this is done in a manner which creates the highest practical use is critical to it being a successful mitigation measure, as opposed to what can be done most quickly or most easily.

[57] https://www.gov.ie/en/publication/51f84-making-remote-work-national-remote-work-strategy/
[58] https://www.seai.ie/publications/The-Impact-on-2020-Greenhouse-Gas-Emissions-of-COVID-19-Restrictions.pdf
[59] https://www.cyclingireland.ie/news-item/nta-allocates-240m-to-councils-for-cycling-and-walking-infrastructure-/

Suggested focus of additional economic analysis

Recommended Actions	Suggested focus of additional economic analysis
Better public transport	
4.1.a – Ownership of second cars arises from lack of PT	• Trade-off analysis of investments into public transport, EV and multi-modal systems for the cost from the public purse.
4.1.b – Reduce waiting times to no more than half an hour seven days per week	• Model the cost versus the medium to long-term benefits of increasing supply of public transport.
4.1.c – Consider maximum total public transport fares cap	• Model economic viability of maximum total public transport fares cap.
4.1.d – Multi-modality that can be paid for with integrated ticketing	• Investigate the economic benefit for consumers of an integrated ticketing system across a multi-modal transport system.
4.1.e – Increase the frequency and/or size of trains & trams	• Cost-benefit analysis compared to alternatives.
4.1.f – Feasibility of flexible transit	• Cost-benefit analysis compared to alternatives.
Expand NTA park and rides	
4.2.a – Expand the National Transport Authority (NTA) park and ride scheme	• Model best location for NTA park and ride's based on driving change to use and limiting vehicle kilometres travelled.
Opt-in Road User Charging	
4.3.a – Introduce Road User Charging for demand and congestion management	• Full Strategic Assessment Report and, if successful, Strategic Business Case for opt-in Road User Charging.
Provide trade-out opportunities	
4.4.a – Scrappage old vehicle for electric bike or scooter	• Model benefits of such a scheme to reduce carbon and decrease Vehicle Kilometres Travelled (VKT).
4.4.b – Scrappage old vehicle for two-year public transport free pass	• Model benefits of such a scheme to reduce carbon and decrease VKT, investigate scenarios of different types of transport being included.
4.4.c – Continue tax breaks for (e-)cycling and expand e-scooter	• Model benefits of such a scheme to reduce carbon and decrease VKT, investigate scenarios of different types of transport being included.
Build on 'working from home' measures to reduce peak demand	
4.5.a – Maintain tax credits and grants to facilitate remote working	• Trade-off analysis between benefits of tax credits to facilitate remote working or no tax credits to facilitate remote working.
4.5.b – Keep demand for car driving to those complex trips	• Model reduction in vehicle use when keeping demand for car driving to predominantly complex trips. • Investigate the financial benefit to consumers by reducing car use.

Source: Jim Power Economics, Arup

Suggested focus of additional consumer research

Recommended Actions	Suggested focus of additional consumer research
Better public transport	
4.1.a – Ownership of second cars arises from lack of PT	• Consumer research to establish what are the preconditions for families to reduce their vehicle car ownership.
4.1.c – Consider maximum total public transport fares cap	• Determine what is considered a fair fare cap and what part it would play in decreasing car use
4.1.d – Multi-modality that can be paid for with integrated ticketing	• Determine if a Mobility as a Service (MaaS) like system would have any net positive benefit on consumer behaviour to reduce VKT and emissions per person, what the minimum inclusions would need to be to remain attractive, and whether other options might be more attractive.
4.1.f – Feasibility of flexible transit	• Determine consumer preferences for flexible transit solutions.
Expand NTA park and rides	
4.2.a – Expand the National Transport Authority (NTA) park and ride scheme	• Consumer preference of NTA locations and mode of public transport. • Isolate pain-points for consumers of current NTA park and ride scheme and identify what would make park and ride more likely to reduce the length of trips by car.
Opt-in Road User Charging	
4.3.a – Introduce Road User Charging for demand and congestion management	• Effect of Road User Charging on consumer behaviour. • Consumer perspective on RUC.
Provide trade-out opportunities	
4.4.a – Scrappage old vehicle for electric bike or scooter	• Determine the consumer profile of potential scheme users to feed into economic analysis of scheme benefit.
4.4.b – Scrappage old vehicle for two-year public transport free pass	• Determine the consumer profile of potential scheme users to feed into economic analysis of scheme benefit.
4.4.c – Continue tax breaks for (e-)cycling and expand e-scooter	• Determine the consumer profile of potential scheme users to feed into economic analysis of scheme benefit.
Build on 'working from home' measures to reduce peak demand	
4.5.a – Maintain tax credits and grants to facilitate remote working	• Determine consumer appetite for homeworking in relation to mobility options.
4.5.b – Keep demand for car driving to those complex trips	• Analyse consumer demand for car driving of complex trips and determine how public transport could be more effective for the remaining travel.

Source: Jim Power Economics, Arup

Responsibility Matrices for Actions

The responsibility matrix below makes a proposal for the role of stakeholders in each proposed action for rapid fleet renewal. This is done according to five roles; develop, fund, influence, implement and promote.

The following abbreviations/labels are applied (this is consistent across all categories of action):

Stakeholder	Abbreviation
Government (including semi-state Government organisations)	G
Public Engagement (Government + key stakeholders)	P
SIMI – Society of the Irish Motor Industry	S
Vehicle Manufacturers	M
Fuel Resellers	F
Car Dealers	D
Energy Retailers	E

Individual roles are proposed as a recommendation on the basis of the current distribution of responsibilities in Ireland.

Rapidly Reduce National Fleet Emissions

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Remove the "worst polluters"					
1.1.1.a – Introduce trade-up incentives	G	G	GPSD	GSD	GSD
1.1.1.b – Trade-out scrappage incentive	G	G	GPSD	G	GPSD
1.1.1.c – Trade-across incentives	G	G	GMD	G	GPSD
1.1.2.a/b/c/d/e – Graduate taxation	G	G	GS	G	GP

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Expedite Sales					
1.2.1. a – EV on replacement gov. fleets	G	G	GMD	G	GMDE
1.2.1. b – EV on replacement taxis	G	G	GMD	G	GPMDE
1.2.1. c – Rental car fleets	G	G	GMDE	GMDE	GPMDE
1.2.1. d – Accelerated Capital Allowances	G	G	GMD	G	GPMD
1.2.2. a – 1.5 tons LCV electric by 2026, 4.5 tons LCV electric by 2030	G	G	GMDE	GMDE	GPMDE
Cleaning up the remaining ICE					
1.3. a - Increase biofuel mix	G	G	GMF	GMF	GF
1.3. b – Remove subsidy of the excise on carbon-based fuels	G	G	G	GF	G

Source: Jim Power Economics, Arup

Building consumer confidence

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Clarity of benefits					
2.1.a – Implement Green star rating	GSM	GSM	GSM	GSMD	GSMDE
2.1.b – Demystifying website to address common misunderstandings	G	G	GSMD	G	GSMD
2.1.c – Clean-power supply scheme	GE	GE	GE	E	GE
Charging					
2.2.1.a – Green grid energy availability in off-peak	E	GE	GE	E	GPSMDE
2.2.1.b – Developers provide minimum of 10% of spaces with chargers	GE	GFE	GPFE	GE	GPSMDE

Recommended Actions	Develop	Fund	Influence	Implement	Promote
2.2.1.c – Landlords provide charge connection point on request	GE	GFE	GPFE	GE	GPSMDE
2.2.1.d – Charge point installation costs included in vehicle cost	GE	GME	GMFE	GSMDE	GPSMDE
2.2.1.e – Prioritise smart meters for EV owners	GE	GE	GE	GE	GPSMDE
2.2.1.f – Incentivise V2G in peak times	GE	GE	GE	GE	GPSMDE
2.2.1.g – ESB prepare for the demand changes across the grid	GE	GE	GE	GE	GPSMDE
2.2.2.a – Forecourt fast-charger	GFE	GFE	GFE	GFE	GPSMDE
2.2.2.b – Capital cost chargers	GE	GFE	GFE	GFE	GPSMDE
2.2.2.c – Regulate on-street charging	GE	G	GSFE	G	GPSMDE
2.2.2.d – Free parking when charging is activated	G	G	G	G	GPSMDE
2.2.2.e – Interoperability charging infrastructure	GMFE	GMFE	GSMFDE	GE	GPSMFDE
2.2.2.f – Workplaces plan charging access	GE	GE	GSMFE	GE	GPSMFDE
2.2.2.g – Correlate incentives for charging installation with EV uptake	GE	GE	GSMFE	GE	GPSMDE
2.2.2.h – Avoid early failure of liquid fuel supply	GF	GF	GMF	FG	GFS
2.2.2.i – Introduce Government competitions/grants	GPSMDE	G	GPSMDE	GSDMEP	GPSMDE
Range					
2.3.a – Public information campaign battery size	GSDMP	GDSM	GDSM	GDSM	GDSM
2.3.b – WLTP explained	G	G	GS	G	GPSMDE
2.3.c – Consolidate education resources	G	G	GS	G	GPSMDE
2.3.d – Promote the user-friendliness and performance of EV vehicles	GSDMP	GDSM	GDSM	GDSM	GDSM

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Value for money of EVs and resale value					
2.4.a – Education campaign running cost EV	GPSMDE	GSE	GPSMDE	GPSMDE	GPSMDE
2.4.b – Fear of missing out tactic	SMD	SMD	SMD	SMD	SMD
2.4.c – Resale-value EV	GSMD	GSM	GSMD	GSMD	GSMD
2.4.d – User-friendliness EV	MD	MD	GSMD	GPSMDE	GPSMDE

Source: Jim Power Economics, Arup

Incentivising consumer actions

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Purchase Incentives					
3.1.a – Implement a zero up-front tax on purchases	G	G	GS	G	GPSMDE
3.1.b – Extend current incentives for EV up to 2025	G	G	GS	G	GPSMDE
3.1.c – Review purchase incentives	G	G	G	G	G
3.1.d – Adjust incentives to include “aspirational” vehicles	G	G	GS	GD	GPSMDE
3.1.e– Support to stimulate early sales	G	G	GSD	G	GPSMDE
3.1.f – Regulate insurance of EVs	G	G	G	G	GPSMDE
Consumer Leases					
3.2.a – Enable private buyers to use a personal lease	G	G	G	G	GPSMDE
3.2.b – Enable private buyers to have rolling leases with short terms	G	G	GD	G	GPSMDE
3.2.c – Enable manufacturers to offer guaranteed buy-back terms	GMD	MD	GSMD	GMD	MD
3.2.d – Implement zero interest finance on 6 star-green rated vehicles	GMD	GMD	GSMD	GMD	GPSMDE
3.2.e – Enable low-tax company-provided benefits through an employer led purchase scheme	G	G	GD	G	GPSMDE

Recommended Actions	Develop	Fund	Influence	Implement	Promote
EV Discounts and Benefits					
3.3.a – Free tolls for EVs	P	G	G	G	GPSMDE
3.3.b – Allow EVs to use bus lanes	G	G	G	G	GPSMDE
Pay-as-you-go opt-in					
3.4.a – Transition to pay-as-you-go per km charge as opt-in	G	G	GS	G	GPSMDE
Public Transparency					
3.5.a – Track Government support	G	G	GS	G	GPSMDE
3.5.b – Transfer counter-productive incentives for non-EVs into the funding pool for EVs	G	G	GS	G	GPSMDE
3.5.c – Disallow tax-deductibility on new commercial vehicles	G	G	GS	G	GPSMDE

Source: Jim Power Economics, Arup

Mobility Management

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Better public transport					
4.1.a – Ownership of second cars arises from lack of PT	G	G	GP	G	GP
4.1.b – Reduce headways to no more than half an hour seven days per week	G	G	GD	G	GP
4.1.c – Consider maximum total public transport fares cap	G	G	G	G	GP
4.1.d – Multi-modality that can be paid for with integrated ticketing	G	G	G	G	GP
4.1.e – Increase the frequency and/or size of trains & trams	G	G	G	G	GP
4.1.f – Feasibility of flexible transit	G	G	G	G	GP

Recommended Actions	Develop	Fund	Influence	Implement	Promote
Expand NTA park and rides					
4.2.a – Expand the National Transport Authority (NTA) park and ride scheme	GP	G	GP	G	GPS
Opt-in Road User Charging					
4.3.a – Introduce Road User Charging for demand and congestion management	G	G	GSMD	G	GSMD
Provide trade-out opportunities					
4.4.a – Scrappage old vehicle for electric bike or scooter	G	G	G	G	GPD
4.4.b – Scrappage old vehicle for two-year public transport free pass	G	G	G	G	GPD
4.4.c – Continue tax breaks for (e-)cycling and expand e-scooter	G	G	G	G	GP
Build on 'working from home' measures to reduce peak demand					
4.5.a – Maintain tax credits and grants to facilitate remote working	G	G	G	G	G
4.5.b – Keep demand for car driving to those complex trips	GP	G	GP	G	G
4.6.a – Allocate walking and cycling infrastructure investment where it has greatest impact	GP	G	GP	G	G

Appendix

Appendix A: Case Study: Road User Charging in Victoria and New South Wales

This note looks at the recent implementation of Zero and Low Emission Vehicles Distance-based charging in Victoria and the planned Road User Charging implementation in New South Wales (NSW) and identifies lessons learnt that may be applicable in the Irish context.

The distance-based Road User Charging is being introduced as an alternative to the fuel excise tax and classic tolling currently charged to Internal Combustion Engine (ICE) vehicle drivers.

This case study will focus on the method of implementation and the communication around, and the reaction to, the introduction of the distance-based RUC.

The key lessons learnt are summarised at the end of the note. It should be noted that the schemes are in their infancies, future iterations of this note will be prepared to analysis the implementation of the schemes once they have passed the initial operating phase.

Australian Context Road User Charging for EVs

Electric vehicle uptake in Australia accounts for just 0.7% of the overall market in 2020. However, the Australian Energy Market Operator's (AEMO) forecasts a significant uptake of EV by 2050 [60] (Appendix A) amounting to 1.58 million or 90% of new vehicle sales[61]. This is in line with global trends.

Until recently there was almost zero stimulus of the EV market, and the global head of Volkswagen publicly criticised the Prime Minister, saying until there was equivalent stimulus VW would not import its electric vehicles into Australia.

The national Governments responded negatively, but NSW and Victoria which are the two most populous states accounting for half of Australia's population, introduced various incentives and concessions to stimulate uptake.

The projected growth of EVs, on the Australian market, over the coming decade will reduce fuel excise revenues, potentially stifling Government transport investment[62]. At the moment the Australian fuel excise scheme implements a $0.427 Australian fuel excise (in addition to a VAT equivalent called Goods and Services Tax, Luxury Car Tax, stamp duty and registration costs). Australian motorists that purchase petrol and diesel will contribute over $11bn Australian in fuel excise to the federal budget, this financial year[63]. EVs are not captured in this scheme.

EVs do however contribute significantly to Government revenue through Goods and Services Tax (GST), Luxury Car Tax (LCT), stamp duty and registration. Due to the higher initial purchase price, EVs often contribute more to Government revenue than equivalent petrol and diesel vehicles[64].

[60] https://www.energycouncil.com.au/analysis/driving-towards-evs-how-are-we-travelling/

[61] https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/demand-forecasts/efi/2018/final---aemo-ev-insights---september-2017.pdf

[62] https://infrastructure.org.au/ruc-for-evs/

[63] https://www.aaa.asn.au/fuel-excise-explained/

[64] https://www.mynrma.com.au/cars-and-driving/electric-vehicles/our-mission/taxes

Nonetheless, a recent survey of 4,512 Australians conducted by the Australian Automobile Association (AAA) shows 79.9% agree owners of EVs should contribute to road costs beyond GST, LCT, stamp duty and registration. At the same time, 78% of the participants agree new Road User Charging policy for EVs should not discourage the uptake of electric and ultra-low fuel consumption vehicles[65].

A distance-based charging scheme for EVs would ensure all motorists contribute to the investment in, and maintenance of, road infrastructure fairly and sustainably[66]. A careful balance with adequately matching incentives should simultaneously avoid discouraging EV uptake. In economic terms, the fuel excise also includes calculations to offset the externalities caused by burning fossil fuel to the environment and human health. The Federal Treasury considers that it is legitimate that EVs do not contribute to those equivalent costs.

Reaction to the implementation of distance-based Road User Charging has been varied. Victoria and New South Wales (NSW) have announced (and in the case of Victoria launched) concrete distance-based Road User Charging schemes. South Australia (SA) has delayed EV Road User Charging by a year (new date: July 2022[67]) to allow time to monitor similar measures interstate and to ensure a degree of "national consistency"[68]. The Queensland transport minister Mark Bailey has expressed the Government is open to similar road-user charges but regards the move as being premature. And Government representatives from Western Australia, Tasmania, and the Australian Capital Territory have previously indicated they are not considering the road-user tax at this stage[69].

There is a growing body of thought that since fuel excise is a national Government responsibility, so too should any Road User Charging system. Road User Charging for heavy goods vehicles is already in trial, and the national Government has undertaken extensive research previously into light vehicle Road User Charging for all light vehicles. It has not found sufficient political support in the national Government to proceed.

Part A: Victoria – ZLEV Road User Charge

General Overview

In May 2021 the Victorian Government passed the 'Zero and Low Emission Vehicle Distance-based Charge Bill 2021'. This entails, from July 2021, a 2.5 cent/km charge will apply to electric and other zero-emission vehicles (including hydrogen), and a 2.0 cent/km charge will apply to plug-in hybrid-electric vehicles (PHEVs). Plug-in hybrid EVs (powered by electricity and petrol) will be required to pay fuel excise as well as a distance-based fee. This is to incentivise people to charge their batteries, something that has proved to be difficult globally. Conventional hybrid and mild-hybrid vehicles (that cannot be charged by an external power source) will not be charged. The levied charges would equate to about $500 Australian for an EV doing 20,000km annually and around $400 Australian annually for a PHEV[70]. Although only 0.1% of Victorian cars are currently electric the Victorian Government is expected to collect revenue of $30m Australian a year[71].

To counterbalance the implementation of a distance-based Road User Charging the Victorian Government also announced a $3000 Australian subsidy for EV purchases and set a target that aims to see 50% of new vehicle sales to be fully electric or hydrogen by 2030. The subsidy is capped for vehicles priced below the LCT threshold - $68,740 AUD, and with up to 20,000 zero-emission purchases to receive the subsidy over the next 3 years[72].

[65] https://www.aaa.asn.au/fuel-excise-explained
[66] https://infrastructure.org.au/ruc-for-evs/
[67] https://www.mynrma.com.au/cars-and-driving/electric-vehicles/our-mission/taxes
[68] https://www.abc.net.au/news/2021-03-04/sa-electric-car-tax/13216892
[69] https://www.drive.com.au/news/victoria-passes-road-user-tax-for-electric-vehicle-owners-industry-reacts/
[70] https://autotalk.com.au/industry-news/victoria-third-state-to-propose-ev-tax
[71] https://www.energycouncil.com.au/analysis/driving-towards-evs-how-are-we-travelling/
[72] https://www.drive.com.au/news/victoria-passes-road-user-tax-for-electric-vehicle-owners-industry-reacts/

This policy is part of a bigger $100 million AUD package that also includes commitments to build charging infrastructure and integrate more zero emission vehicles (ZEVs) in Government and commercial fleets[73]. The State Government will also exempt EVs from luxury vehicle rate of stamp duty and also benefit from a $100 Australian annual discount on vehicle registration[74]. Federal GST and LCT will continue to apply.

Method of Implementation

The registration for ZLEV is made through VicRoads. Registered operators will be required to provide a photo image of their vehicle's odometer reading at the start and end of the registration period. A request is sent via email or mail for their odometer readings to be provided via their myVicRoads account.

For brand new vehicles, the starting odometer will be assumed to be okm if the start-period odometer reading is not declared by the ZLEV registered operator[75]. The submitted odometer reading is then used to calculate the annual charge.

The distance calculation is as follows:

- Distance travelled during registration period (end odometer reading less start-odometer reading)
- Plus any additional days of use between the start period and date of first declaration (based on average use per day throughout the registration period)
- Less any additional exempt distance declared (private road use)

The total distance charged is multiplied by the applicable road-use rate for the type of vehicle. There will be no road user charges for travel off-road (such as on private property farm tracks and mining leases), but drivers must provide evidence of off-road use[76].

Failure to comply will result in a vehicle registration suspension.

Public communication was done in part through the VicRoads website in addition to Treasurer Tim Pallas' information brief and other public announcements.

Reaction to ZLEV Road User Charge

The reactions to the ZLEV Road User Charge in Victoria have been summarised in the table below according to different stakeholders and interested parties. Given the implementation period is still very recent, a subsequent review at a later time might provide more insight into public reactions and those of other stakeholder.

Vehicle Manufacturers	Prior to the bill's approval an open letter was sent to Victorian MPs, signed by 25 organisations including Uber and Volkswagen (alongside other think tanks and environmental groups), that warned of the threat to EV adoption without significant incentives to balance it out, as well as advocating for cross-state compatibility[77]. Plug-in hybrid EVs stand to be taxed double; road-user charge (RUC) and the fuel excise -spokesperson for Volkswagen Australia[78].

[73] https://thedriven.io/2021/05/01/victoria-to-offer-3000-subsidy-for-electric-vehicles-sets-50pct-target-by-2030/
[74] https://www.solarquotes.com.au/blog/sa-ev-tax-mb2049/
[75] https://www.vicroads.vic.gov.au/registration/registration-fees/zlev-road-user-charge
[76] https://www.racv.com.au/royalauto/moving/news-information/road-user-charging-explained.html
[77] https://www.abc.net.au/news/2021-04-22/victoria-electric-vehicle-levy-road-users-opposed-by-industry/100086872
[78] https://www.drive.com.au/news/victoria-passes-road-user-tax-for-electric-vehicle-owners-industry-reacts/

Australian Automobile Association (AAA)	Following announcements from both Victoria and NSW about new EV RUC's the AAA has urged the federal Government to roll out a consistent EV Road User Charging nationally[79].
Federal Chamber of Automotive Industries (FCAI)	The FCAI has been critical of Victoria's ZLEV Road User Charging move, suggesting any Road User Charging should be nationally consistent while recognising the importance of EVs and other low emission vehicles[80].
Electric Vehicle Council (EVC)	The Electric Vehicle Council (EVC) is critical of the EV Road User Charging and advocates the Government should encourage EV uptake rather then discourage it[81].
University of Queensland	Research, by Dr Jake Whitehead, at the University of Queensland found that road-user taxes targeting zero- and low- emission vehicles disincentivises consumers. This is largely due to a skewed perception of the associated cost. This study is supported by a survey conducted by the electric vehicle council in early 2021, which found 72.1% of Victorians thought the tax would lead to a decline in sales[82].
The Australia Institute (TAI)	"Other countries are using the willingness of some people to pay a personal premium to buy electric cars as a way to drive down greenhouse gas emissions at very low cost to Government, but Australia seems determined to hold back the tide of technology," TAI economist Richard Denniss said. "Australian drivers pay fuel excise when they fill up their vehicle with petrol, diesel or LPG. ZLEV owners currently pay little or no fuel excise but still use our roads. These changes ensure ZLEV owners make a fair contribution to funding Victorian roads[83]."
Public	Initial hesitation to register on VicRoads has led to warning letters and threat of vehicle registration suspension.
Other	It is seen as a cash grab - Introducing a road-user charge would allow the state Government to directly raise revenue from motorists who drives on its roads[84]. Victorian Greens opposed imposing a road usage tax specifically on electric car users at this time. "No-one's against the idea of talking about road funding reform - it's really just about timing," transport spokesperson Sam Hibbins said in a statement.

[79] https://autotalk.com.au/industry-news/victoria-third-state-to-propose-ev-tax
[80] https://autotalk.com.au/industry-news/victoria-ev-registration-suspension-threatened
[81] https://autotalk.com.au/industry-news/victoria-third-state-to-propose-ev-tax
[82] https://electricvehiclecouncil.com.au/wp-content/uploads/2021/04/2021-EVC-Submission-to-the-SA-Department-of-Treasury-and-Finance-on-RUC.pdf
[33] https://thedriven.io/2020/11/25/victoria-releases-details-of-ev-road-user-charge-as-critics-multiply/
[84] https://thenewdaily.com.au/finance/consumer/2021/05/17/victoria-ev-tax-cash-grab-lobby/

It is noted that the policy was developed initially by the Infrastructure Partnerships Australia as part of a plan to expedite investment in clean energy networks, was refined by the national Government, then made its way back to the Victorian state Government. It should be viewed in the context that the national Government is considered somewhat behind international trends on climate action, including electric vehicle policies.

If the national Government chooses to act IPA does expect that the state-based schemes would be rescinded.

It should also be viewed in the context that the fiscal cliff faced with the loss of fuel excise is the most likely trigger to Road User Charging in Australia, rather than a commitment to electric vehicles which are seen politically as an inevitability driven by international markets and, therefore, not something to invest taxpayer funds into.

Part B: New South Wales – EV Road User Charging

General Overview

In the release of the 'Electric Vehicle Strategy' the NSW Government has outlined the implementation of a distance-based Road User Charging for EVs of 2.5 cent/km and 2 cent/km for plug-in hybrids, that will be introduced on 1 July 2027 or when electric vehicles reach 30% of new vehicle sales (whichever is earlier). Tax cuts and incentives have been announced in September 2021 for the coming 4 years. This includes a $3000 Australian rebate for $25,000 battery and hydrogen fuel cell electric vehicles under $68,750 AUD, alongside the abolition of stamp duty for EVs under $78,000 AUD[85].

As a counterbalance to the implementation of Road User Charging all stamp duty will be abolished for all EVs, including plug-in hybrids, from 1 July 2027 or when EVs make up at least 30% of new car sales (whichever is earlier). Currently the cost of stamp duty in NSW is $3 per every $100 for cars under $45,000, and $1350 plus $5 per every $100 for cars above $45,000 AUD. Drivers of EVs should not pay on average more under the Road User Charging than EVs currently pay through stamp duty and fuel excise[86].

Learning Points

Below are summarised the learning points identified in reviewing the current/future implementation of kilometre-based Road User Charging in Victoria and NSW.

- Ensure technical compatibility of EV Road User Charging across regions (Nationally) by implementing common standards and incentives.
- Provide clear communication about change for consumers in implementing EV RUC.
    - Victoria extensively uses the VicRoads website as a communication tool.
    - Victoria used the influence of Infrastructure Partnerships Australia on the political class to create a pathway for the public service to advance policy options for consideration.
- Counterbalance EV Road User Charging policy with adequate EV incentives (for both consumers and producers) and investment in infrastructure that facilitates EV adoption (charging infrastructure). Taking a phased approach might mitigate disruption in EV uptake, which should be encouraged before implementing Road User Charging policies (NSW introduced a target of 30% EV uptake). Measuring the effect of implementing Road User Charging on the uptake of EV, for a particular mix of incentives, will provide useful insights on this necessary balance.

[85] https://www.solarquotes.com.au/blog/sa-ev-tax-mb2049/

[86] https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Climate-change/nsw-electric-vehicle-strategy-210225.pdf

- Revenue driven by EV Road User Charging schemes should be invested beyond road maintenance and mirror revenue expenditure derived from fuel excise.

    -Just like fuel excise is a general tax, Road User Charging should go to maintenance and excess of public transport (hypothecation).

Arguably the above learning points are equally valid in the Irish context. Compatibility, clear public communication, counterbalancing incentives, and hypothecation of Road User Charging revenues are all critical questions when implementing a Road User Charging scheme in Ireland.

Appendix B: List of current EV and diesel Incentives in Ireland

Current BEV and PHEV Incentives

- SEAI is offering grants for private vehicles of up to €5,000 for a Battery Electric Vehicle (BEV) and €2,500 for a Plug-in Hybrid Electric Vehicle (PHEV) purchased and registered in Ireland. Buyers of PHEVs will no longer get €2,500 grant from January 2022. Approved EVs with a List Price of less than €14,000 will not receive a grant [the cars eligible for grants can be viewed here];

- VRT relief of up to €5,000 for a BEV. VRT relief is applicable to BEVs with an OMSP up to €50,000. No VRT relief is available for vehicles with a value above €50,000. The €5,000 relief for Battery Electric vehicles is being extended to end 2023 [more information here];

- Both EVs and PHEVs benefit from a 7% VRT rate based on WLTP CO_2 Levels [more information here]. From January 2022 a revised vehicle registration tax table is being introduced. The 20 band table will remain with an uplift in rates beginning with a 1% increase for vehicles that fall between bands 9-12; 2% for bands 13-15; and then a 4% increase for bands 16-20.

- Benefit-in-Kind (BIK) tax relief for battery electric vehicles. BEV's currently qualify for a 0% BIK rate on the first €50,000 of the vehicle value without any mileage conditions. PHEV vehicles do not qualify for this relief as they can still consume fossil fuels [more information here] The BIK exemption for battery electric vehicles will be extended out to 2025 with a tapering effect on the vehicle value. This measure will take effect from 2023. For BIK purposes, the original market value of an electric vehicle will be reduced by €35,000 for 2023; €20,000 for 2024; and €10,000 for 2025;

- Grants for both EVs and PHEVs will only apply to cars under €60,000 [more information here];

- Public Charge Point Scheme provides a grant of up to €5000 to local authorities to support the development of on-street public chargers [more information here];

- Home Charger Grant Scheme provides support towards the full cost of installation of a home charger up to a maximum of €600. The applicant must be the owner of an eligible new or second-hand electric vehicle (EV) [eligibility for grant can be viewed here];

- Low rate of annual motor tax [more information here];

- Low Emissions Vehicle Toll Incentive (LEVTI) of 50% for battery electric vehicles and 25% for plug-in hybrid electric vehicles; it will run until December 31st 2022 (or up to a maximum of c. 50,000 LEVs). Maximum refundable cap of €500 for private vehicles and €1000 for LGV, SPSV and HDV;

Commercial-Market-Specific Incentives

- Accelerated Capital Allowances (ACA) for businesses. For cars coming under the category "Electric and Alternative Fuel Vehicles" the accelerated allowance is based on the lower of either the actual cost of the vehicle, or €24,000 [more information here];

- A maximum grant of €3,800 is available for qualifying N1 category EVs when purchased commercially. Approved EVs with a list price of less than €14,000 will not receive a grant [more information here];

- Grants of up to €12,500 to support the purchase of electric vehicles in the taxi/hackney/limousine sector [more information here];

- Under Budget 2021, €15 million secured by the Department of Transport to support taxi and hackney drivers in scrapping their older vehicles and replacing them with electric alternatives [more information here];

Current Internal Combustion Engine Vehicle Incentives

- A VAT-registered trader is generally entitled to deduct VAT charged on the purchase or hire of a motor vehicle for use in his or her business (petrol is not included) [more information here]

- CO_2 based VRT and motor tax rates incentivised purchase of more energy efficient cars (diesel). Vehicles are categorised in CO_2-emission band rates based on WLTP (since 1/1/2021). The VRT and tax increased with emission-levels, as expressed by these band rate [more information here].

Appendix C: List of Assumptions Euro class Carbon Reductions – Jim Power Economics

This exercise investigates the impact of using incentives to take Euro 1, 2 & 3 cars out of the fleet on CO_2 emissions. At the end of October 2021, there were 21,969 Euro 1& 2 cars on the road. There were 131,846 Euro 3 cars on the road.

Removing Euro 1&2

These calculations assume an average CO_2 emission of 180g/km, based on data for pre-2000 Euro 1&2 cars provided by SIMI. The average KMs travelled by a car in Ireland in 2020 was 16,272. Given the age of these vehicles an average of 5,000 kms for Euro 1&2 cars was estimated.

Therefore, the total KMs travelled by 21,969 Euro 1&2 cars in 2021 was 109,845,000. 180g/CO_2 by KM would translate into 19,772,100,000 grammes of CO_2. Converting this into tonnes would work out at 19,772 tonnes of carbon taken out of the system.

Removing Euro 3

These calculations assume an average CO_2 of 165g/km based on data for Euro 3 cars provided by SIMI. The average KMs travelled by a car in Ireland in 2020 was 16,272. Given the age of these vehicles an average of 5,000 kms for Euro 3 cars was estimated.

Therefore, the total KMs travelled by 131,846 Euro 3 cars in 2021 was 659,380,000 172g/CO_2 by KM would translate into 113,454,975,000 grammes of CO_2. Converting this into tonnes would work out at 113,455 tonnes of carbon taken out of system.

In total, incentives to remove Euro 1,2 &3 cars from the system would take a gross CO2 tonnage of 133,227 out of the system.

However, those 153,815 older cars taken out would ultimately be replaced by 153,815 new cars up the supply chain.

If we assume these new cars would average 5,000 km. CO2 106g/KM.
153,815 new cars *5000km = 769,075,000 Km *106g = 81,521,950,000 g of CO2.
This would equate to 81,522 tonnes of CO2.

The net effect of removing 153,815 older cars from the fleet would be a reduction of (113,455-81,522) 70,177 tonnes of CO2 from the system.

Removing Euro 4
In October 2021, there were 546,614 Euro 4 Cars. Assuming an average of 5,000 KM travelled per annum and applying the average CO2 emissions to each year we find, taking 546,614 Euro 4 cars off the road would reduce CO2 by 420,489 tonnes.

	NO. Cars	AVG KM	Total KM	CO2g/KM	gCO2	Tonnes Co2
2006	79,147	5,000	395,735.000	165	65,296,275,000	65,296
2007	108,710	5,000	543,550,000	165	89,685,750,000	89,686
2008	145,417	5,000	727,085,000	158.53	115,264,785,000	115,265
2009	84,901	5,000	424,505,000	152.25	64,630,886,250	64,631
2010	128,439	5,000	64,195,000	133.31	85,611,015,450	85,611
Total	546,614		2,733,070,000		420,488,711,750	420,489

However, those 546,614 older cars taken out would ultimately be replaced by 546,614 new cars up the supply chain.

If we assume these new cars would average 5,000. CO2 106g/KM.
546,614 new cars *5000km = 2,733,070,000 Km *106g = 289,705,420,000 g of CO2.
This would equate to 289,705 tonnes of CO2.

The net effect of removing 546,614 older Euro 4 cars from the fleet would be a reduction of (420,489—289,705) 130,784 tonnes of CO2 from the system.

Removing Euro 5

There are 724,074 Euro 5 Cars. Assuming an average of 10,000 KM travelled per annum and applying the average CO_2 emissions to each year we find, taking 724,074 Euro 5 cars off the road would reduce CO_2 by 867,631 tonnes.

	No. Cars	AVG KM	Total KM	CO2g	Tonnes Co2
2011	134,020	10,000	1,340,200	128.31	171,961
2012	130,163	10,000	1,301,630,0000	124.69	162,300
2013	127,435	10,000	1,274,350,000	120.55	153,623
2014	152,679	10,000	1,526,790	115.69	176,634
2015	179,777	10,000	1,797,770,000	112.98	203,112
Total	724,074		7,240,740		867,631

However, those 724,074 older cars taken out would ultimately be replaced by 724,074 new cars up the supply chain.

If we assume these new cars would average 10,000 KM at CO_2 106g/KM.
724,074 new cars *10,000km = 7,240,740,000 Km *106g =. This would equate to 767,518 tonnes of CO_2.

The net effect of removing 724,074 older Euro 5 cars from the fleet would be a reduction of (867,631-767,518) 100,113 tonnes of CO_2 from the system.

Climate Change

In order to tackle climate change, for each of the following, please tell me if you would personally support it or if you would be opposed to it?

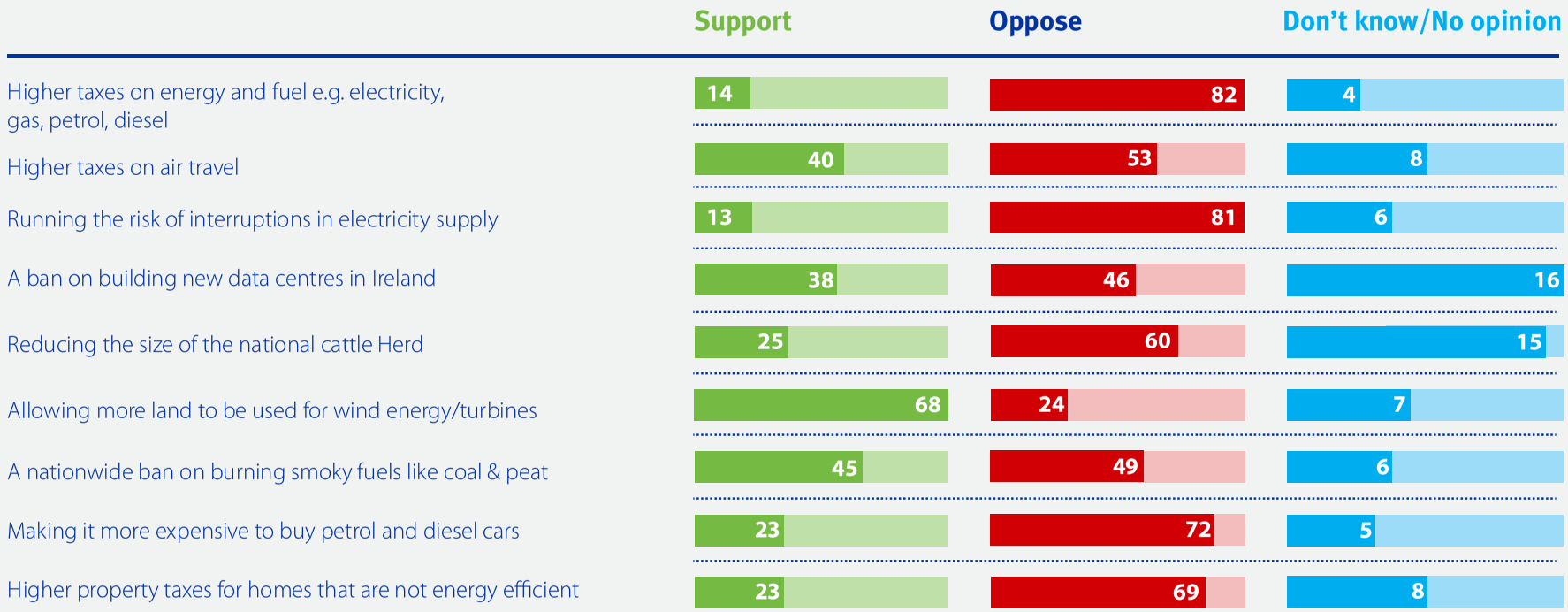


Table: IRISH TIMES GRAPHICS . Source: IPSOS/MRBI. Created with Datawrapper

Appendix E: Car fleet projections out to 2030 – Jim Power Economics

This section attempts to model the evolution of the car fleet out to 2030 based on three different new car sales scenarios.

Table 1 shows the trend in new car sales, EVs and PHEVs between 2017 and 2021.

Table 1: Recent Trends in New Car Sales, EVs & PHEVs

	New Car Registrations	EVs	% Of Total	PHEVs	% Of Total
2017	131,334	622	0.05%	326	0.02%
2018	125,671	1,233	1.00%	739	0.60%
2019	117,109	3,444	2.9%	1,346	1.10%
2020	88,325	4,013	4.50%	2,492	2.80%
2021	104,932	8,646	8.2%	7,891	7.52%

Source: SIMI Motorstats

Three different new car sales scenarios are modelled – constrained, progressive and accelerated.

The three scenarios show the level of new car sales and the level of EVs and PHEVs that would have to be sold to reach the Climate Action Plan 2021 targets.

THE 'CONSTRAINED' NEW CAR SALES SCENARIO

A number of assumptions are made:

- 6% of the car fleet becomes obsolete every year. This is based on the average rate of obsolescence between 2010 and 2021.
- Average new car sales between 2022 and 2030 total 128,833.
- Average used imports between 2022 and 2030 total 32,222.
- The car fleet to reach 2.44 million by 2030.
- EV sales gradually increase from 8% of new car sales in 2021 to 45% by 2030.
- PHEV sales gradually increase from 7.5% of new car sales in 2021 to 20% by 2030.

	New Car Sales	End-Year Car Fleet	EV % New Car Sales	Total EV	PHEV % New Car Sales	Total PHEV	EV & PHEV
2020	88,325	2,215,127	4.5%	4,010	2.80%	2,473	6,483
2021	105,000	2,250,220	8.5%	8,925	7.50%	7,875	16,800
2022	120,000	2,285,207	10.0%	12,000	10.00%	12,000	24,000
2023	120,000	2,298,095	15.0%	18,000	15.00%	18,000	36,000
2024	120,000	2,310,209	20.0%	24,000	18.00%	21,600	45,600
2025	120,000	2,321,597	25.0%	30,000	20.00%	24,000	54,000
2026	135,000	2,347,301	30.0%	40,500	20.00%	27,000	67,500
2027	135,000	2,371,463	35.0%	47,250	20.00%	27,000	74,250
2028	135,000	2,394,175	40.0%	54,000	20.00%	27,000	81,000
2029	135,000	2,415,525	45.0%	60,750	20.00%	27,000	87,750
2030	135,000	2,435,594	45.0%	60,750	20.00%	27,000	87,750
22-30	1,155,000		30.1%	347,250	18.2%	210,600	557,850

Source: Jim Power Economics

Under this 'constrained' scenario, the car fleet is projected to reach 2.44 million by 2030. Over the period, 2022 to 2030 it is estimated that a cumulative total of 557,850 new EVs and PHEVs would be sold. This would be equivalent to 22.9% of the car fleet in 2030.

Over the period 2022 to 2030, EVs at PHEVs at 557,850 would be equivalent to 48.3% of cars sold over the period.

This total would be 287,150 short of the target of 845,000 vehicles set in Climate Action Plan 2021.

THE PROGRESSIVE NEW CAR SALES SCENARIO

A number of assumptions are made:

- 6% of the car fleet becomes obsolete every year. This is based on the average rate of obsolescence between 2010 and 2021.
- Average new car sales between 2022 and 2030 total 141,111.
- Average used imports between 2022 and 2030 total 32,222.
- EV sales gradually increase from 8% of new car sales in 2021 to 50% by 2030.
- PHEV sales gradually increase from 7.5% of new car sales in 2021 to 25% by 2030.

	New Car Sales	End-Year Car Fleet	EV % New Car Sales	Total EV	PHEV % New Car Sales	Total PHEV	EV & PHEV
2020	88,325	2,215,127	4.5%	4,010	2.80%	2,473	6,483
2021	105,000	2,250,220	8.5%	8,925	7.50%	7,875	16,800
2022	130,000	2,295,207	15.0%	19,500	10.00%	13,000	32,500
2023	130,000	2,318,095	20.0%	26,000	15.00%	19,500	45,500
2024	130,000	2,339,009	25.0%	32,500	18.00%	23,400	55,900
2025	130,000	2,358,669	30.0%	39,000	20.00%	26,000	65,000
2026	150,000	2,397,149	35.0%	52,500	20.00%	30,000	82,500
2027	150,000	2,433,320	40.0%	60,000	20.00%	30,000	90,000
2028	150,000	2,467,321	45.0%	67,500	20.00%	30,000	97,500
2029	150,000	2,499,282	50.0%	75,000	25.00%	37,500	112,500
2030	150,000	2,529,326	50.0%	75,000	25.00%	37,500	112,500
22-30	1,270,000		35.2%	447,000	19.4%	246,900	693,900

Source: Jim Power Economics

Under this 'constrained scenario, the car fleet is projected to reach 2.53 million by 2030. Over the period, 2022 to 2030 it is estimated that a cumulative total of 693,900 new EVs and PHEVs would be sold. This would be equivalent to 27.4% of the car fleet in 2030.

Over the period 2022 to 2030 EVs and PHEVs at 693,900 would be equivalent to 54.6% of new cars sold.

This total would be 151,110 short of the target of 845,000 vehicles set in Climate Action Plan 2021.

THE ACCELERATED NEW CAR SALES SCENARIO

A number of assumptions are made:

- 6% of the car fleet becomes obsolete every year. This is based on the average rate of obsolescence between 2010 and 2021.
- Average new car sales between 2022 and 2030 total 175,556.
- Average used imports between 2022 and 2030 total 32,222.
- The car pool is projected to reach 2.78 million by 2030.
- EV sales gradually increase from 8% of new car sales in 2021 to 50% by 2030.
- PHEV sales gradually increase from 7.5% of new car sales in 2021 to 25% by 2030.
- By 2030, EVs and PHEVs at 868,880 would account for 31.2% of the car pool.

	New Car Sales	End-Year Car Fleet	EV % New Car Sales	Total EV	PHEV % New Car Sales	Total PHEV	EV & PHEV
2020	88,325	2,215,127	4.5%	4,010	2.80%	2,473	6,483
2021	105,000	2,250,220	8.5%	8,925	7.50%	7,875	16,800
2022	160,000	2,325,207	15.0%	24,000	10.00%	16,000	40,000
2023	160,000	2,375,695	20.0%	32,000	15.00%	24,000	56,000
2024	160,000	2,423,153	25.0%	40,000	18.00%	28,800	68,800
2025	160,000	2,467,764	30.0%	48,000	20.00%	32,000	80,000
2026	180,000	2,529,699	35.0%	63,000	20.00%	36,000	99,000
2027	180,000	2,587,917	40.0%	72,000	20.00%	36,000	108,000
2028	180,000	2,642,642	45.0%	81,000	20.00%	36,000	117,000
2029	200,000	2,714,084	50.0%	100,000	25.00%	50,000	150,000
2030	200,000	2,781,239	50.0%	100,000	25.00%	50,000	150,000
22-30	1,580,000		35.4%	560,000	19.5%	308,800	868,800

Source: Jim Power Economics

Over the period 2022 top 2030 a total of 1.58 million new cars are sold. EVs account for 35.4% of the total and PHEVs account for 19.5%. However, by 2030 new car sales of 200,000 are projected, with 50% of those EVs and 25% PHEVs. This is a very ambitious target, and would still deliver just over the 845,000 targeted in the Climate Action Plan 2021.

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