Annual Review 2025

Transport

Annual Review 2025: Transport

Submitted to the Minister for the Environment, Climate and Communications on 13 June 2025

Climate Change Advisory Council
McCumiskey House
Richview, Clonskeagh Road, Dublin 14, D14 YR62

Tel: 01 2680180

Email: info@climatecouncil.ie

www.climatecouncil.ie

ISBN: 978-1-80009-264-8

How to cite:

Climate Change Advisory Council (2025), *Transport Sectoral Review: Annual Review 2025.* https://www.climatecouncil.ie/councilpublications/

Acknowledgements

The Climate Change Advisory Council would like to acknowledge the significant contributions of the Secretariat of the Climate Change Advisory Council to the drafting of this part of the Annual Review 2025, especially:

Gina Kelly

Eleanor Mathews

Bryn Canniffe

Stephen Flood

George Hussey

The Climate Change Advisory Council also acknowledges the contributions of the following in the preparation of this Review:

- the Adaptation Committee of the Climate Change Advisory Council,
- the Environmental Protection Agency.

The Climate Change Advisory Council would also like to thank:

- Ecodiversity for their provision of technical and project management services,
- Prepress Projects for their copy-editing, proofreading, design and typesetting of this Review.

Summary for All

Key observations

In this Review, the Climate Change Advisory Council outlines observations and recommendations for the Transport sector. Recent storms such as Darragh and Éowyn have highlighted how vulnerable Ireland's transport infrastructure is to extreme weather events and how the impact of disruptions can ripple across the economy, livelihoods and society. This vulnerability extends beyond Ireland's borders, as seen when Storm Darragh caused extensive damage to Holyhead Port in Wales, forcing its closure and causing significant disruption to freight and passenger travel with resulting economic impacts in Ireland.

Transport is the biggest source of energy demand in Ireland, and emissions from the sector must halve by 2030 to meet the carbon budget. In 2024, transport emissions decreased by about 1.3% relative to 2023; however, continuing growth in demand is offsetting gains from more efficient vehicles and the increasing availability and uptake of public transport. Sales of new battery electric vehicles in 2024 fell by 24%, and a substantial increase in charging capacity will be required in 2025 to meet national and EU targets. Emissions are currently projected to significantly exceed the sectoral emissions ceilings, even in the most optimistic scenario.

Key recommendations

1. Public transport and school travel

The 2025 National Development Plan review must demonstrate increased ambition for sustainable public transport investment and ensure ongoing support for all major public transport projects. About one in five journeys are for the purpose of education, with journeys by car resulting in significant air quality issues near schools, increased transport emissions and congestion. The Government must shift more of these journeys onto buses, trains, walking and cycling. This will require further funding, a renewed focus on road safety and easier access to sustainable travel options.

2. Ports

The significant disruption caused by the closure of Holyhead Port in Wales, with knock-on impacts on supply chains and travel plans, shows how vital it is that Ireland's port infrastructure and that of its neighbours can resist and recover from extreme weather events. It is crucial that the National Ports Policy is updated to reflect these risks, and each port must adapt for and be able to withstand and rapidly recover from the impacts of extreme weather events. This requires a more integrated and systemic approach to planning for and managing climate risk, and developing the necessary capacity to adapt to climate change.

3. Electric vehicle supports

To support the Government target of having 800,000 electric vehicles on the road by 2030 it will be necessary to adjust the grants available to households to purchase electric vehicles and to accelerate the roll-out of publicly accessible charging capacity. The grant scheme needs to be re-focused on supporting the purchase of more efficient and cheaper/second-hand electric vehicles with a particular focus on those areas with the poorest access to public transport services and Just Transition principles.

Abbreviations

AFIR	Alternative Fuel Infrastructure Regulation
BEV	battery electric vehicle
BIK	benefit-in-kind
EV	electric vehicle
HGV	heavy goods vehicle
ICE	internal combustion engine
IMMAC	Infrastructure Manager Multi-Annual Contract
KPI	key performance indicator
LGV	light goods vehicle
NORA	National Oil Reserves Agency
NPF	National Planning Framework
NTA	National Transport Authority
OECD	Organisation for Economic Co-operation and Development
RES-T	renewable energy share in transport
RTFO	Renewable Transport Fuel Obligation
SEAI	Sustainable Energy Authority of Ireland
TII	Transport Infrastructure Ireland
TOD	transport-oriented development
VRT	vehicle registration tax
V2H	vehicle to home
WAM	with additional measures
WEM	with existing measures
ZEVI	Zero Emission Vehicles Ireland

Contents

Key observations

Transport sector emissions and main trends

- Motor petrol deliveries totalled 847.5 ktoe[a] in 2024 compared with 796.3 ktoe in 2023, an increase of 6.4%. Road diesel deliveries totalled 3,110.9 ktoe in 2024 compared with 3,101.2 ktoe in 2023, an increase of 0.3%. While Transport sector emissions decreased by approximately 1.3% in 2024, the benefits and savings from existing policies and measures are not keeping pace with the causes of increased emissions, including increasing transport demand in terms of fuel sales and vehicle kilometres, and corrective action is needed in the sector.[1]
- The Transport sector is the largest source of energy demand in Ireland, accounting for 43% of total energy demand in 2023. Between 2021 and 2023, the Transport sector expended 64% of its sectoral emissions ceiling under the first carbon budget and it is estimated to have used approximately 86% by the end of 2024. It looks increasingly unlikely that the sectoral emissions ceiling in the first or second carbon budget periods will be achieved, with exceedances of 4 Mt CO_2 eq and 15.5 Mt CO_2 eq, respectively, projected under the most optimistic scenario.[b][2]

Electric vehicles and charging infrastructure

- There was a 23.6% decline in new battery electric vehicle (BEV) registrations in 2024, with an 8.1% decline in used imports.[3] By comparison, there was a 2.4% decline in new internal combustion engine vehicle registrations, with an increase of 18.1% in used imports.[3] In 2024, new hybrid registrations increased by 20.1% and used hybrid imports increased by 44.5% compared with 2023.
- The total stock of BEVs at the end of 2024 was 72,640 compared with 57,367 BEVs in 2023 (~15,000 increase year on year). BEVs represented just 3.05% of the total passenger car fleet in 2024 (European Alternative Fuels Observatory, personal communication, 28 April 2025).
- At the end of 2024 there were 2,802 publicly accessible AC[c] charging points and 786 DC charging points. This equates to 7 charging points per 10,000 people in Ireland, which is considerably below the EU-27 average of 20 per 10,000 people or the average of 13 per 10,000 people in the UK.

---

a 1,000 tonnes of oil equivalent.

b The EPA's with additional measures scenario.

c AC (alternating current) charging points supply electricity that must be converted by the vehicle's onboard charger into DC (direct current) to charge the battery, which limits charging speed depending on the vehicle's internal converter. In contrast, DC charging points deliver electricity directly in the form the battery uses, allowing much faster charging by bypassing the onboard converter and supplying higher power levels.

- As of the end of 2024, Ireland had 138,118 kW of recharging power (European Alternative Fuels Observatory, personal communication, 30 April 2025), with circa 214,000 kW of recharging power needed by the end of 2025 in order to support Climate Action Plan targets and be in line with the EU Alternative Fuel Infrastructure Regulation.[4]

Public transport and active travel

- Six out of eleven phases of the redesigned BusConnects network in Dublin have been implemented and there has been a 48% increase in passenger boardings on redesigned routes. All 12 bus corridor schemes have received planning approval. The Climate Action Plan 2025 aims for at a least one core bus corridor to be approved and start construction in 2025.[5]
- In 2024, there were 282 BEV buses and 100 plug-in hybrid electric buses in operation compared with 61 and 100 in 2023, respectively.[6]
- The number of pupils using the School Transport Scheme reached 172,000 in 2024, up 6% from the previous year. Investment in the scheme increased from €219 million in 2019 to €512 million in 2024.
- Over €294 million was allocated in funding for active travel infrastructure around Ireland for 2025,[7] a slight increase on funding allocated in 2024,[8] bringing the total investment since 2020 to over €1.25 billion.[8] In terms of mode share, cycling increased slightly from 1.8% to 1.9% of trips between 2022 and 2023, while walking declined from 19.3% to 17.7%.[9]

Key recommendations

Deliver an efficient and accessible public transport system

- The 2025 National Development Plan review must demonstrate increased ambition for public transport capital investment and ensure ongoing fiscal support for all major public transport projects, including new priority projects identified in the All-Island Strategic Rail Review. A sustainable funding mechanism for current expenditure to support expanded public transport services is also required. More ambitious targets for progressive electrification of buses across all cities and towns should be set out under the next Climate Action Plan, along with a mechanism to track progress.
- The Climate Change Advisory Council strongly supports expanded eligibility criteria for the School Transport Scheme, improved integration of school transport with public transport services and expansion of the Safe Routes to School Programme. Ongoing funding to meet significant and increasing demand for school transport needs to be provided in Budget 2026.

Scale up adoption of electric vehicles and decarbonise private transport

- BEV adoption has a critical role to play in Ireland meeting its targets under both the Energy Efficiency Directive and the Effort Sharing Regulation. In order to achieve unprecedented rates of transition to BEVs, the Council recommends maintaining existing incentives, with targeted additional support focusing on resource-efficient BEVs for lower income households, particularly in areas with limited access to public transport. Targeted additional support for this cohort through a higher grant level of up to €10,000 for BEVs priced at less than €35,000 would increase affordability. Mechanisms such as scrappage schemes and taxation-related incentives should also be considered by Zero Emission Vehicles Ireland and the Department of Finance.
- The roll-out of publicly accessible electric vehicle charging infrastructure should be accelerated and must be supported by the ambitious roll-out of electricity network reinforcement, with strategic prioritisation by ESB Networks and EirGrid. Solutions including deployment of neighbourhood charging by local authorities within an appropriate distance of households, shared apartment charging and workplace charging need to be deployed urgently to address disparities in access to home charging for those without access to off-street parking. Local authorities and ESB Networks need to work together to identify suitable sites with available capacity for charging hubs.
- The sustainability of imported biofuels must be enforced, along with transparent, regular reporting of results by the National Oil Reserves Agency and the Department of Transport. Sustainability oversight within Ireland is critical, along with contributions to the development, review and implementation of the EU regulatory regime for biofuel sustainability.[10] A coherent plan for the most efficient use of sustainable biofuels across all sectors must reflect their limited availability and should be developed by the Department of Transport and Department of the Environment, Climate and Communications.

Make Ireland's transport systems more resilient

- Planning and support to realise the potential of vehicle-to-everything charging, including the development of appropriate guidance and technical standards for changeover switches, should be progressed immediately. Vehicle-to-everything charging can increase resilience in rural areas during power outages by providing temporary grid support while the main grid is restored, and also enhance grid stability and the reliability of renewable energy integration.[11,12]
- Extensive damage caused by Storm Darragh resulted in the total closure of Holyhead Port between 7 December 2024 and 16 January 2025, with the port not due to fully reopen until July 2025.[13] The impact on freight and passenger movements was significant. The urgent revision to the National Ports Policy by the Department of Transport must ensure that all ports take a harmonised approach to the integration of climate risks, to include cross-border and transboundary impacts, in port planning, operations, infrastructure investments and decision-making.

- The Government must scale up investment for measures to enhance the climate resilience of vulnerable and critical transport infrastructure, including road and rail routes and aviation infrastructure, and provide the necessary support services to ensure effective integration of these.

Embed demand management across the planning system

- Demand reduction in the Transport sector is essential to meet Ireland's carbon budgets, reduce congestion and support public transport and active travel projects. The finalisation and implementation of a strategy to make the transport system more efficient is urgently required by the Government. Implementation should focus on strengthened policies for demand management and support for local authorities to deliver active travel infrastructure and road space reallocation. Following recent approval of the revision of the National Planning Framework, transport-oriented development needs to be a focus of upcoming reviews of regional and spatial economic strategies.

1. Introduction

The Transport sector represents the second largest source of greenhouse gas emissions in Ireland, at 21.5% of national total emissions in 2023 and is projected to contribute 21.6% of Ireland's total emissions in 2030 under the with existing measures (WEM) scenario.[2] Emissions in the sector have remained relatively stable in the last 3 years, with a limited reduction in 2024, and emissions reduction measures have had a limited impact on increasing levels of transport demand.

Emissions for the sector were 11.8 Mt CO_2 eq in 2023, an increase of 0.3% compared with 2022,[14] and are estimated to be approximately 1.3% lower in 2024. Passenger vehicles account for the majority of road transport emissions, at 49% in 2023, followed by heavy goods vehicles (HGVs) and buses (29%) and light goods vehicles (LGVs) at 22%.

2. Sectoral emissions ceilings and Climate Action Plan targets

The Transport sector has been set a very ambitious sectoral emissions ceiling, with emissions levels needing to fall by 50% relative to 2018 levels by 2030. These emissions ceilings are 54 Mt CO_2 eq for the first carbon budget period (2021–2025; see Table 1) and 37 Mt CO_2 eq for the second carbon budget period (2026–2030).[15]

Approximately 64% of the sectoral emissions ceiling has been used in the first 3 years of the first carbon budget period (2021–2025; see Table 1).[14] Early estimates, based on the EPA's 2024 Quarter 4 Greenhouse Gas Emissions Indicator Report, indicate that 86% of the sectoral emissions ceiling has been used in the first 4 years of the first carbon budget period (2021–2025).[1]

Table 1: Reported Transport sector emissions for 2021–2023 in the context of the sectoral emissions ceiling (SEC) for the first carbon budget period, 2021–2025.
(Sources: Ireland's Final Greenhouse Gas Emissions 1990–2023[14] and Quarterly Greenhouse Gas Emissions Indicator Report.[1]) *As set out in Table 6 of the Quarter 4 2024 Greenhouse Gas Emissions Indicator Report.

Carbon budget period	SEC	Reported emissions, 2021–2023	Indicative emissions, 2024 YTD	Estimated % SEC used, 2021–2024*
2021–2025	54 Mt CO_2 eq	34.6 Mt CO_2 eq	11.43 Mt CO_2 eq	86%

Table 2 assesses progress against a number of indicators, including key performance indicators (KPIs) for 2025 and 2030 as set out in the Climate Action Plan. A number of improvements could be made to these KPIs in the Climate Action Plan 2026, including improved consistency between stock and flow indicators for fleet electrification, greater clarity on the fleet electrification target and its application to battery electric vehicles (BEVs) only, more detailed and measurable targets for public transport electrification, and additional KPIs for public charging, connectivity of public transport and active travel infrastructure delivery. It is clear that there remains a significant gap to target across a range of KPIs at this time.

Table 2: Progress on key Climate Action Plan targets as at the end of 2024.
(Sources: 1, Central Statistics Office.[16] 2, Sustainable Energy Authority of Ireland.[17] 3, Central Statistics Office.[18] 4, European Alternative Fuels Observatory.[6]) *This total includes Central Statistics Office data for vehicle-km travelled by both passenger cars and goods vehicles. Passenger car-km travelled saw a 3% decrease in 2022 compared with 2018, but goods vehicles-km travelled saw a 16% increase compared with 2018. **Data for total vehicle-km for 2024 have not yet been published by the Central Statistics Office. This information will be updated with indicators published with the Council's Cross-sectoral Review later in 2025. EV, electric vehicle; PHEV, plug-in hybrid electric vehicle; PSO, Public Service Obligation.

	Total vehicle-km (vs 2018)[1*]	Fuel deliveries (ktoe of fuel vs 2018)[2]	Sustainable transport trips (no. public transport trips vs 2019)[3]	Fleet electrification (no. passenger BEVs/PHEVs)[4]	Fleet electrification (no. electric buses)[4]	Fleet electrification (no. commercial BEVs)[4]
2022	1%	−4.7%	2%	35,713 BEVs and 25,318 PHEVs	13	2,227
2023	0.1%	−4.1%	26%	57,367 BEVs and 35,785 PHEVs	61	3,205
2024	TBC**	−2.6%	38%	72,640 BEVs and 41,933 PHEVs	282	4,150
2025 target	n/a	n/a	+125,000 sustainable journeys	175,000 passenger EVs	300 EV buses in PSO bus fleet	20,000 commercial EVs
2030 target	20% reduction	50% reduction	130% increase in daily public transport journeys	845,000 passenger EVs	1,500 EV buses in PSO bus fleet	95,000 commercial EVs

3. Indicators

3.1. Transport emissions and main trends

In 2023, transport emissions increased by 0.3% compared with 2022 (shown in Figure 1). In 2024, demand for diesel and petrol increased by 0.3% and 6.4%, respectively, with an estimated 1.3% decrease in transport emissions in 2024 (excluding international aviation and navigation).[17] In 2024, jet kerosene usage decreased by 1.5% in Ireland.

The latest EPA projections of future greenhouse emissions were published on 28 May 2025.[2] These projections show two scenarios for future emissions, which are known as the with existing measures and with additional measures scenarios[a][19] see Figure 2. Under the with additional measures (WAM) scenario, the Transport sector is projected to exceed its 2021–2025 sectoral ceiling by 4 Mt CO_2 eq and its 2026 sectoral ceiling by 12 Mt CO_2 eq.[b] Overshoot in the Transport sector has implications for compliance costs for the Effort Sharing Regulation and the Renewable Energy Directive, as outlined in the Climate Change Advisory Council's joint paper with the Irish Fiscal Advisory Council.[20] The consumption of energy from renewable sources in the Transport sector in Ireland (renewable energy share in transport (RES-T)) was 7.58% in 2023, an increase from 5.8% in 2022.[c][21] The target for RES-T within the revised Renewable Energy Directive (REDIII) is 29% for Member States by 2030. The latest EPA projections estimate a 16.3% RES-T share by 2030 under the WEM scenario and a 17.2% share under the WAM scenario.

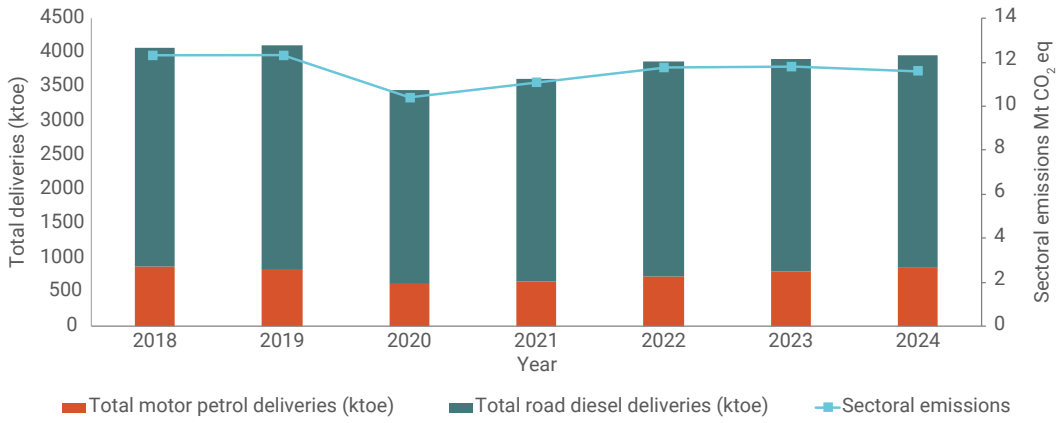

Figure 1: Sectoral emissions versus petrol and diesel deliveries, 2018–2024.
(Sources: Ireland's Final Greenhouse Gas Emissions 1990–2023[14] and Quarterly Greenhouse Gas Emissions Indicator Report.[1])

a See Box 4.1 of the Annual Review 2023 for a consideration of the different emissions projections scenarios.

b As pointed out in *Section 2*, it is not certain at this point how sectoral exceedances will be managed. There also remains the issue of unallocated savings in respect of the second carbon budget period, which will need to be clarified by the Government as soon as possible.

c Share of energy from renewable source in transport. Note that these percentages are unweighted, as a change in the methodology has occurred since the introduction of REDIII.

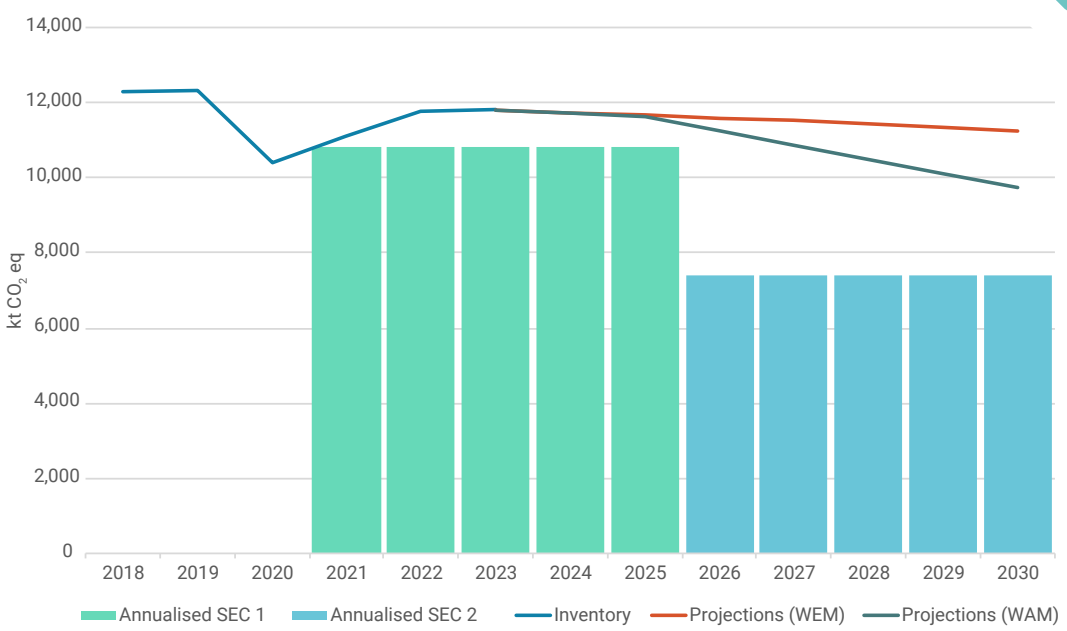

Figure 2: Sectoral emissions ceilings (SECs), emissions inventories and projections for the Transport sector for 2018–2030, with annualised SECs.
WAM, with additional measures; WEM, with existing measures.
(Sources: Ireland's Final Greenhouse Gas Emissions 1990–2023[14] and Ireland's Greenhouse Gas Emissions Projections 2024–2055.[2])

The recast Energy Efficiency Directive sets a legally binding target to cut final energy consumption across the EU by 11.7% by 2030, compared with 2020. Transport remains the largest contributor to final energy consumption in Ireland, with significant potential for the sector to contribute to Ireland meeting its target.

There was a 23.6% decline in new BEV registrations in 2024 (see Figure 3). New BEV sales for 2024 were 17,191 compared with 22,493 in 2023.[3] There was also an 8.1% decline in used BEV imports, with 1,714 used imports in 2024 compared with 1,865 in 2023.[3] By comparison, new internal combustion engine (ICE) registrations declined 2.4% in 2024 (with 63,161 new registrations in 2024 compared with 64,684 in 2023); however, used imported ICE registrations increased by 18.1% (with 44,754 registrations in 2024 compared with 37,880 in 2023). In 2024, new hybrid registrations increased by 20.1% (with 36,330 new registrations in 2024 compared with 30,242 in 2023) and used imported hybrid registrations increased by 44.5% (with 15,365 registrations in 2024 compared with 10,633 registrations in 2023).

At the end of 2024, Ireland had 138,118 kW of recharging power, with circa 214,000 kW of recharging power needed by the end of 2025 in order to support Climate Action Plan targets and be in line with the EU Alternative Fuel Infrastructure Regulation (AFIR)[4] (see Figure 4).

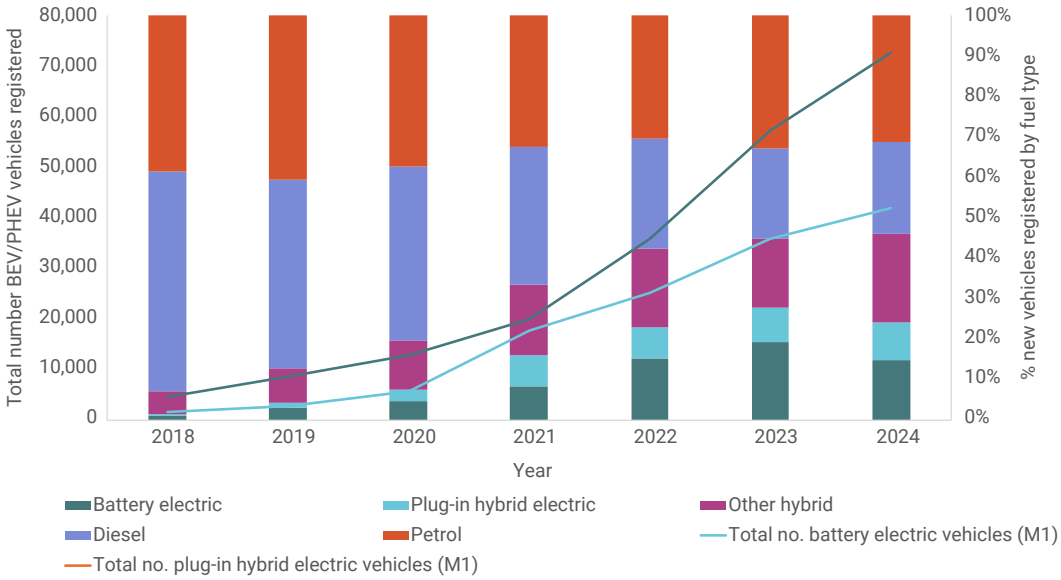

Figure 3: Total number of BEVs and PHEVs registered in Ireland and percentage of new private car registrations by fuel type, 2018–2024.
PHEV, plug-in hybrid electric vehicle.
(Source: Central Statistics Office.[3])

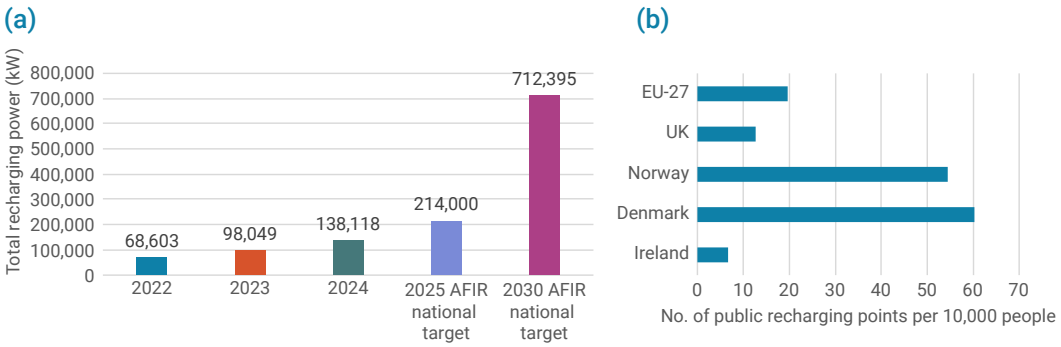

Figure 4: (a) Total recharging power in Ireland against Ireland's 2025 and 2030 AFIR national target estimates. (b) The number of publicly accessible recharging points per 10,000 people in Ireland, the UK, Norway, Denmark and the EU-27.
(Sources: Eurostat,[22] European Alternative Fuels Observatory[23] and UK Office for National Statistics.[24])

3.2. Transport resilience indicators

There are no specific indicators in the Transport Sectoral Adaptation Plan or Climate Action Plans to measure the climate resilience of transport infrastructure. However, the Climate Action Plan 2023 action[25] (AD/23/1) to publish a methodology for the use of potential climate adaptation indicators for the roads and light rail subsector was completed by Transport Infrastructure Ireland (TII) in July 2024. This report[26] identifies appropriate indicators according to the categories of climatological,

impact, implementation and outcomes. It is recommended that this indicator framework is applied to the air, heavy rail and maritime subsectors and that outcome-oriented targets and indicators are used to measure progress towards improving climate resilience in the forthcoming Transport Sectoral Adaptation Plan. This will require close collaboration between the Department of Transport and relevant state agencies.

4. Progress on previous Climate Change Advisory Council recommendations

4.1. Avoid–Shift–Improve framework actions

The Planning and Development Act 2024[27] was signed into law in October 2024, and an implementation plan[28] has been published along with significant efforts to increase resources through the Ministerial Action Plan on Planning.[29] There is significant interaction between planning policy, settlement patterns and transport demand. In 2024, the Council called for a strengthened role for transport-orientated development and more ambitious targets for compact growth and active travel within the National Planning Framework (NPF) review.[30] The revised NPF was published in April 2025 and has been approved by both Houses of the Oireachtas.[31] Although targets for compact growth have not been increased, the Council recognises the shift in the Urban Regeneration and Development Fund and 2025 Town and Village Renewal Scheme to specifically target a programme of acquisitions in each local authority to address long-term vacancy and dereliction.[32,33] The Council awaits the operational details of the newly proposed Towns and Cities Infrastructure Investment Fund. The expected focus of the fund is transport-oriented development (TOD) through investing in infrastructure, acquiring land and getting sites ready in towns and cities.[34,35] This is in line with the Council's 2023 recommendation to improve economic incentives for urban brownfield development, limit urban sprawl and revitalise vacant urban buildings.

In 2024, the Council urged the Government to finalise and implement the critical actions within the draft Moving Together Strategy,[36] as the Council is concerned about the lack of progression of policies to ensure a reduction in transport demand. The Climate Action Plan 2025 highlights the importance of the draft Moving Together Strategy and aims to establish an oversight mechanism to monitor and evaluate the strategy once it has been approved by the Government.[5] A review of taxation in the Transport sector with the goal of developing a system based on a 'user and polluter pays' principle is a key action within the draft Moving Together Strategy; this aligns with the Council's 2024 recommendation for a comprehensive review of transport taxation, but needs to be progressed urgently, particularly in the context of the significant investment required across the sector for decarbonisation. The Council welcomes changes in the fiscal Budgets 2024 and 2025 with respect to incentivising uptake of BEVs through an emissions-based approach to vehicle registration tax (VRT) for category B vehicles and benefit-in-kind (BIK) relief for BEVs and charger installation costs.[d][37]

2023 and 2024 saw increases in the number of passenger journeys on public transport linked to progress on a number of projects, including BusConnects and the Connecting Ireland Rural Mobility Plan, along with increased funding for active travel projects.[38] A significant number of rail projects also progressed through the planning system. The Council welcomes the ambition to significantly increase the number of pupils using the School Transport Scheme through a recent review by the Department of Education, and the success of the Safe Routes to School programme.

d The additional BIK relief currently available for electric vehicles will reduce from €35,000 in 2025 to €20,000 in 2026 and €10,000 in 2027.

4.2. Climate resilience

In 2024, the Council called on the Department of Transport to prioritise measures to strengthen the resilience of Irish ports through the revision of the National Ports Policy. The policy remains under consultation and is to be presented to the Government in 2025. It further calls on ports to take a harmonised approach to the integration of climate risks in their operations, planning, infrastructure investments and decision-making. An issues paper published as part of the National Ports Policy review highlighted the risk of climate change to port infrastructure and operations.[39] The issues paper invited submissions on the main climate-related risks to port infrastructure and operations, and the policies and structures that drive progress towards building climate resilience in Irish ports. The damage caused to Holyhead Port in Wales during Storm Darragh in December 2024 and the subsequent disruption has highlighted the vulnerability of ports and the broader economy to climate-related events, including transboundary climate risks.

The 2024 Annual Review called for critical roads and railways vulnerable to flooding to be identified and prioritised for funding through the Department of Transport and Iarnród Éireann. It also called for fit-for-purpose drainage systems that integrate the use of proven nature-based solutions to be prioritised for these critical roads and railways so that they will be resilient to more frequent and intense rainfall events. A total of €16.5 million was allocated for 315 adaptation projects in 2025 as part of the Department of Transport's total investment programme of €713 million for regional and local roads.[40] This represents a decline on the annual average of €17.3 million allocated to adaptation projects over the past 5 years. Iarnród Éireann published a Climate Adaptation Strategy in October 2024[41] and commenced the consultative process for the East Coast Railway Infrastructure Protection Projects, which will deliver enhanced coastal protection to the railway infrastructure between Dublin and Rosslare.[42] It has integrated climate adaptation works for the period 2025–2029 within its Infrastructure Manager Multi-Annual Contract (IMMAC), which serves as its main source of funding for the maintenance and renewal of railway infrastructure. TII is undertaking research on the impact of climate change on drainage systems and the effectiveness of current design standards to withstand future rainfall volumes.

5. Analysis and discussion

The Avoid–Shift–Improve framework is central to decarbonisation in the sector, and 'avoid' measures in particular are needed to deliver transformative change. Given the significant risk of the Transport sector exceeding its first and second sectoral emissions ceilings, recommendations in the 2025 review focus on critical actions that have the largest abatement potential (as outlined in the 2024 Climate Action Plan and in the latest EPA projections) within the first and second carbon budget periods and can be implemented within this time frame. These must be supported by enabling legislation, regulation and financial support.

5.1. Deliver an efficient and accessible public transport system

Surveys carried out by the Department of Transport have found that improved public transport is seen to be one of the most important policy measures, with improved routes, reduced fares and increased frequency of service highlighted as priority issues.[43] A large cohort with the desire to travel by more sustainable means cannot currently do so due to feasibility issues and limited access to public transport, especially in rural areas and for journeys to educational establishments.

Upgrades to Ireland's public transport and active travel infrastructure will be required to support decarbonisation of the sector, but are also a key factor in competitiveness, investment and trade in the context of a growing economy and population. According to the Institute for Management

Development's World Competitiveness Ranking in 2024, Ireland's infrastructure was the area with the weakest performance.[4] Recent analysis carried out by the Irish Fiscal Advisory Council found that Ireland's transport capital stock and infrastructure per capita remain below average[44] and that increased public investment in the transport system will be needed over the next 10 years.

A total of €35 billion[e][34] was allocated to transport capital investment in the National Development Plan (including road network upgrades), for large public transport initiatives such as Metrolink, BusConnects and Connecting Ireland.[45] Continued investment and funding certainty will be required through the National Development Plan review in 2025[46] to mitigate the historical cyclical nature of infrastructure investment[47] and to deliver public transport projects across Ireland. Successful delivery of public transport infrastructure in other jurisdictions has demonstrated the importance of a pipeline of projects enabling investment and development of State capacity to design and oversee these.[48] The Council previously welcomed the establishment of the Infrastructure, Climate and Nature Fund to future-proof necessary capital investment across sectors,[49] noting that funding for transport projects may not be available through the fund for some time.

There is a finite amount of funding available for transport infrastructure investment. Between 2021 and 2023, the ratio of capital expenditure on public transport to expenditure on roads improved significantly, with increased expenditure on public transport,[50] but estimates for 2025 indicate that expenditure on roads compared with public transport is increasing.[f][51] Notwithstanding the development of connections to the Trans-European Transport Network (TEN-T) and safety improvement considerations, the Council is concerned that greater investment in roads compared with public transport will embed greater car dependency in Ireland, with impacts on congestion and wellbeing. The Organisation for Economic Co-operation and Development (OECD) has recommended that national investment programmes prioritise sustainable mobility.[52] The Council is concerned that if public transport expenditure is not maintained as a priority beyond 2025, the delivery of high-capacity public transport infrastructure will be hindered, with associated negative impacts on congestion and urban sprawl. Investment in roads may undermine the viability of public transport projects, and prioritisation of projects with the greatest mitigation impact will be required.[34] The OECD has also highlighted a lack of effective implementation structures to achieve policy objectives for public transport deployment in Ireland. The latest updates for 2024/2025 for major public transport projects under Project Ireland 2040 show long lead-in times for delivery,[34] which will limit their ability to impact transport emissions within the first and second carbon budgets.[53] Extended planning and mobilisation periods for capacity have resulted in major projects in Ireland taking too long to complete.[g][54]

A sustainable funding model to support expanded public transport services is urgently required, and consideration should be given to multi-annual funding mechanisms and long-term sources of

e This was weighted towards the second half of the National Development Plan (2026–2030), with €22 billion allocated to that half compared with €13 billion allocated to the first half.

f Estimates for 2025 expenditure are for €637 million investment in national roads, €714 million in regional and local roads, and €2,057 million investment in sustainable mobility/public transport.

g The National Transport Authority commissioned analysis in 2024 that also indicates inflation in tender prices of between 26% and 35% from 2021 to 2023; however, it notes that prices are returning to more stable levels.

revenue.[h][55] The BusConnects Dublin programme is already delivering demonstrable results along redesigned bus routes, with significant increases across a range of KPIs.[56] Sustained funding and operational support to deliver increased frequency and capacity will be critical, along with planning permission and support for delivery of the core bus corridors project, bringing continuous bus priority infrastructure within urban areas.[56] This is needed to deliver improvements in journey times, service punctuality and reliability. These will be critical areas for delivery as the planned programmes in Cork, Galway, Limerick and Waterford move to implementation.

Replacement of diesel buses operating in urban areas would also demonstrably improve nitrogen oxide and particulate matter emissions.[57] The Climate Action Plan 2024 sets a target to have a fully electric fleet by 2035. It targets 300 electric buses in circulation by 2025 (with 282 in operation as of the end of 2024) and 1,500 by 2030, representing 3% and 15% of the current fleet, respectively. There are currently no targets for licensed commercial fleets, and the pathway to decarbonise these is uncertain. The Council recommends a higher level of ambition in the Climate Action Plan 2026 for electrification of Public Service Obligation bus services and commercial public transport fleets, along with reporting of progress against KPIs.

In rural areas, cars are the dominant mode of transport, used for 82% of all trips.[9] The National Transport Authority's (NTA's) latest National Household Travel Survey[58] demonstrated that a significant proportion of the population does not have access to public transport services. Outside urban areas there is limited connectivity to transport networks, for example a lack of park and ride facilities to access the rail network.[59] International research also points to the importance of shared and community transport options to achieve greater sustainable mobility.[60]

Since 2022, approximately 140 new or enhanced bus services have been introduced under the Connecting Ireland Rural Mobility Plan.[61] The weekly national average number of passenger journeys was 36,664 in 2022, 78,892 in 2023 and had increased to 105,986 by October 2024.[62] Demand-responsive transport solutions and vehicle borrowing schemes, particularly focused in dispersed, low-density patterns of settlements,[63,64] can support an inclusive, accessible and reliable transport network. To date, Local Link has provided demand-responsive transport services to areas not suited to fixed route services through pre-bookings with Local Link offices. The Council strongly supports the 2025 pilot of a smart demand-responsive transport service by Transport for Ireland to offer a more efficient and flexible service over a larger area. Continued engagement with local communities is required to scale up and integrate this solution with links to other transport modes. Rural public transport programmes, especially improved bus links through the Local Link programme, can reduce car dependence for local journeys and improve access to services.[65]

In order to meet decarbonisation objectives in the Transport sector, it is important to focus on the most car-intensive trip purposes, with indications that companion/escort journeys, including to educational establishments, are more car intensive than other trip purposes, and are driving significant transport energy demand in Ireland.[66] As set out in the 2024 Annual Review, based on Census 2022, over 50% of students travel to places of education by car. In the NTA's 2023 National Household Travel Survey, education accounted for 18% of all trip purposes.[9] The car is still seen by three in five people as the safest means of travel,[67] with safety seen as a substantial barrier to uptake of sustainable and active travel options for journeys to education.

h Out-turn expenditure in this area for 2023 was 8% higher than allocated for. Under Budget 2025, funding of €658,442 million was allocated for Public Service Obligation and Transport for Ireland Local Link services, an increase of 17% on 2024.

In 2024, the Council outlined its support for significant expansion of the School Transport Scheme by the Department of Education. In the 2024/25 school year, approximately 172,000 pupils used the scheme out of a total of 945,000 pupils in primary and post-primary education.[68–70] A sustained funding mechanism is required to broaden eligibility criteria for the scheme, implement technological improvements, including e-ticketing, and address resourcing of drivers, availability of vehicles for leasing through Bus Éireann, and fleet replacement and maintenance. The Council welcomes current pilot projects between the Department of Education and Department of Transport to integrate public transport networks with school transport routes and improve the overall efficiency of the scheme.[71] Further pilots and integration with other schemes could seek to improve infrastructure, such as parking bays for school transport.

Transport policies should also focus on increasing student safety and supporting walking and cycling routes to school through the Safe Routes to School Programme delivered by the NTA. There is a significant demand for the Safe Routes to School Programme, with approximately one quarter of all schools having applied for the programme and an additional 141 schools entering the programme at the end of 2024.[34]

5.2. Scale up adoption of battery electric vehicles and decarbonise private transport

Transport is Ireland's largest source of energy demand, and greater electrification of transport has significant potential to contribute to meeting Ireland's targets to reduce final energy consumption under the Energy Efficiency Directive due to the much higher efficiency of electric vehicles (EVs).[i][72] Electrification could also significantly contribute to meeting targets under the Effort Sharing Regulation,[20] with transport accounting for approximately one quarter of emissions under the regulation. A significant proportion of the Irish population has a high level of car dependency,[63] and policies supporting the adoption of BEVs are an important means of decarbonising transport for Ireland's dispersed population and staying within the Transport sector's emissions ceilings between now and 2030.

Research suggests that insufficient infrastructure access and disparities in access to charging hinder BEV adoption rates.[73] The Council welcomes ongoing work by Zero Emission Vehicles Ireland (ZEVI) to enable greater visibility of and real-time data on the location and availability of all EV chargers.[74] The OECD recently noted that the number of charging stations is relatively low in Ireland, with low recharging power per vehicle, according to an assessment carried out by the European Alternative Fuels Observatory in 2024.[23,75] The assessment noted the need for Ireland to invest in and rapidly scale up infrastructure to meet anticipated growth in EVs. As of Q4 2024, the number of public charging points per 10,000 people across the EU-27 was 20, compared with 7 in Ireland (see Figure 4).[4]

The deployment of charging infrastructure will require significant electricity network capacity, in many cases in areas of historically low demand,[76] along with shore-side charging facilities at ports and at airports and public transport depots. The delivery of the required grid capacity to power sites is a significant challenge[74] and strategic prioritisation of grid connections by ESB Networks and EirGrid is critical. The Council notes that there is currently no legislative basis to prioritise grid connections, and in its recent Electricity Sectoral Review[77] the Council urged the Government to align the legal mandate and strategy for all public bodies to have regard to the Climate Act 2021.

i The efficiency of an ICE vehicle is approximately 30% compared with electric motors, which convert approximately 90% of electrical energy to mechanical energy.

Planning requirements and the administrative burden for deployment of larger charging pools is also a challenge. The Council notes that 37.6% of the total expenditure allocation for 2024 for BEV grants and infrastructure was carried over into 2025.[78] The Transport, Electricity and Planning sectors will need to work closely to ensure network development and reinforcement meets compliance requirements under AFIR up to 2035.

For those without access to off-street parking, access to local chargers that offer slower charging speeds in return for a more cost-effective charging session and take account of behaviours and local circumstances will be critical.[79] A study carried out by the Sustainable Energy Authority of Ireland's (SEAI's) behavioural economics unit noted that a significant number of survey respondents (36%) did not have access to off-street parking for EV charging.[80] A number of cities in Europe have developed local overnight charging via lamppost charging and community charging hubs.[81] The On-Street Residential Chargepoint Scheme in the UK,[80] for example, provided targeted support to local authorities to install slow overnight charging for residents without off-street parking. Pilot projects to address this challenge, such as the Shared Charging Pilot Scheme,[83] a peer-to-peer charging solution, and collaboration between local authorities and private operators, are welcome. Workplace charging could also play an important role and reduce the need for overnight charging.[81]

Recent analysis of the Shared Island Sports Club EV Charging Scheme[84] identified a number of administrative frictions and associated delays in charger installation, and the Council recommends a similar assessment is carried out to assess the performance of the Apartment Charging Grant scheme. While the Energy Performance of Buildings Directive includes clear requirements for new apartments, recent analysis of the regulatory framework for access to EV chargers in apartment buildings[85] highlighted the implementation of 'right to plug' legislation as a key enabler of electrification of parking spaces in existing apartment buildings.[j]

Even where the total cost of ownership of BEVs is lower, the initial purchase cost plays a significant role in decision-making,[86] and grants have been found to positively affect adoption.[87,88] Taxation also has a critical role to play in increasing the total cost of ownership of ICE vehicles and less efficient, resource-intensive vehicles compared with BEVs. Research on mass market adoption suggests that this is achieved when total vehicle stock reaches approximately 16%;[k][89,90] however, BEV adoption stood at 3.05% in Ireland at the end of 2024,[6] suggesting a need for significantly increased incentives. A summary of incentives currently in place in Ireland has been prepared by the Parliamentary Budget Office.[91] The European Commission is currently undertaking work to exchange best practices on incentives, including taxation, across Member States, and funding sources to support these.[92]

Research on measures to encourage BEV adoption in Ireland[93] has found equity gaps for different income groups and financial barriers preventing a shift to BEVs. More recent research highlighting the affordability threshold for BEVs emphasised the advantage of policies supporting deployment of smaller, lighter BEVs that are more affordable and have lower environmental impacts.[94] It also recommended consideration of a differentiated subsidy in order to increase affordability for a wider segment of the population. The OECD has noted that subsidies for BEVs in Ireland have become

j These regulations typically place responsibility on apartment owners for the costs associated with installing and using the charger, and require the building owner, manager or homeowner association to approve a charger installation request if it meets reasonable requirements.

k According to the diffusion of innovation theory, the first 2.5% of a population to adopt a new technology are 'innovators', followed by 'early adopters' constituting 13.5% of the population. Together these populations bring total adoption of a new technology to 16%, following which early majority mass market adoption takes place.

more progressive as caps on grants for higher cost (new) vehicles have been introduced.[75] A study published in November 2024[95] estimated the impact of financial incentive policies on EV adoption in Europe using data from 30 countries[l] from 2012 to 2021. It found that purchase incentive policies have contributed significantly to BEV adoption in countries with higher gross domestic product per capita (> $31,000) and higher renewable energy consumption, with increases of circa 113% compared with adoption rates without incentives. This aligns with previous studies that concluded that a subsidy of €1,000 corresponds to average increases of between 8.1% and 16% in EV registrations.[96,97]

The appropriate level of targeting of subsidies has to consider the balance of the accessibility of a more complex grant scheme along with the maintenance and enhancement of existing incentives until a sufficient level of adoption is achieved. To date, incentives have not achieved the required rates of adoption to deliver emissions reductions within the first and second carbon budgets. The modelling underpinning the Council's recent carbon budget proposals, along with a recent study carried out by University College Cork, involves full vehicle electrification by 2040 with almost immediate phase-out of new fossil fuel vehicles in tandem with significant demand reduction.[98] In order to achieve unprecedented rates of transition, the Council recommends targeted additional support[95] focusing on resource-efficient BEVs for lower income households, particularly in areas with limited access to public transport, and a higher grant level of up to €10,000 for BEVs priced at less than €35,000 to increase affordability for such cohorts.[m] While this would represent a significantly higher level of subsidy per BEV, the overall cost to the Exchequer could be managed through appropriate targeting as per the Electric Small Public Service Vehicle Grant Scheme.[99] Annual maintenance costs are approximately half of those for ICE vehicles, and, based on annual average kilometres travelled by private cars, BEVs could save up to €1,000 in annual fuel costs.[100] *Section 5.4* reiterates the Council's call for a comprehensive review of taxation in the Transport sector, which could also consider the bonus–malus scheme in place in France, for example, to fund enhanced incentives.[101]

Increased supports for lower income households could drive significant demand.[102] Complementary solutions, including targeted scrappage schemes focusing on lower income groups in tandem with incentives for EV uptake, incentives for second-hand EVs, access to low-cost finance and preferential financial opportunities,[n] should also be considered along with an extension to taxation-related measures under Budget 2026. Scotland, for example, currently offers interest-free loans for both new and used EVs under its Low Carbon Transport Scheme.[o] A number of EU countries also offer subsidised leasing arrangements and enhanced levels of support for people with disabilities,

l Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the UK.

m This suggested increase is based on a review of the highest level of incentives in place in other European countries, but requires further refinement to ensure that it is targeted towards lower income households, particularly in areas with limited access to public transport.

n The Banking & Payments Federation of Ireland reported an increase in car loan values as of Q3 2024, potentially reflecting a shift to BEVs. See: https://bpfi.ie/publications/bpfi-personal-loans-report-q3-2024/.

o The loan is split into six funding streams: the Electric Vehicle Loan, the Used Electric Vehicle Loan, the Low Carbon Transport Business Loan, the Used Electric Vehicle Loan for Business, the Switched on Taxis Loan and the Low Carbon Hackney Cab Loan.

people living in remote areas and younger people, which could be considered in Ireland. The European Commission intends to promote the adoption of social leasing schemes for new and used EVs in 2025.[92] Critically, Ireland is one of few western European countries without Low Emissions Zones in urban areas, which, if implemented, could also serve to incentivise EV uptake.

The design of the CO_2 performance standards regulation (Regulation (EU) 2019/631) has a significant impact on available options and the supply of more affordable BEVs.[103] Recent proposals indicate that the 2025 compliance window may be extended up to 2027, which may delay the scale-up of BEV production in Europe.[104,105] Ireland must ensure that there is no further weakening of CO_2 emission performance standards for vehicles for 2030 and 2035 in its contributions to negotiations on the scheduled review of this critical legislation in 2026.[106] A number of studies have noted the weight parameter for calculating CO_2 targets and have recommended its removal to encourage the development of more resource-efficient vehicles.[107] A strategy should also be developed for Ireland's contribution to EU targets for recycling and recovery of EV batteries and associated skills requirements, which has significant potential to reduce mineral import requirements across the EU.

5.3. Ensure sustainability of biofuels

Previous recommendations from the Council have noted that quantities of sustainable, low-emission biofuels are limited,[107] with potential sustainability, biodiversity and indirect land use change impacts.[19,108] Concerns were raised by Ireland and other Member States in 2024 in relation to the sustainability of biofuel supply from palm oil derivatives, based on total reported consumption in the EU compared with global production potential.[109] The National Oil Reserves Agency (NORA) has recently recommended the removal of incentives under the Renewable Transport Fuel Obligation (RTFO) for biofuel products associated with palm oil mill effluent, which the Council strongly supports.[p][110]

As part of the development of the Renewable Heat Obligation and decarbonisation of the Transport sector under the RTFO, a coherent plan for the most efficient use of sustainable biofuels across all sectors in Ireland must reflect their limited availability and should be developed by the Department of Transport and the Department of the Environment, Climate and Communications.

An assessment by the Biofuels Sustainability Working Group conducted over 2023–2024 indicated scope for further work to continue to ensure a robust administration and legal grounding for sustainability oversight within Ireland, and noted Ireland's ongoing contributions to the development, review and implementation of the EU regulatory regime for biofuel sustainability.[10] The RTFO is administered by NORA, which grants RTFO certificates to obligated parties for renewable transport fuel and is responsible for supervision of certification bodies operating in Ireland.[111] The sustainability of biofuel supply chains needs to be verified by NORA and the Department of Transport to avoid the fraudulent incorporation of unsustainable products. Results of these verifications should be published on a regular basis to ensure consumer confidence, and, where verification and traceability is lacking, restrictions on certain types of biofuel imports should be considered.[112]

5.4. Develop a future-proofed approach to vehicle taxation

The Council welcomes a number of changes introduced in Budget 2025 to incentivise commercial BEV uptake. These include the introduction of an emissions-based VRT system for category B vehicles in the Finance Act 2024 along with the introduction of BIK exemptions on the installation

p This is specifically in relation to palm oil mill effluent-derived biofuels.

of home chargers. The European Commission has recently highlighted the importance of incentivising zero-emission corporate fleets through fiscal policy[113] and the Council recommends sustained measures to incentivise greater uptake in Budget 2026, including BIK relief and BIK exemptions on home charging.

No changes were introduced in Budget 2025 in relation to private vehicle taxation. The Council reiterates its call for a comprehensive review of taxation in the Transport sector by the Department of Finance across all vehicle categories (including VRT, motor tax, excise duty, carbon tax, fuel pricing and distance-based charges) by the end of the first carbon budget in 2025. This should align with a 'user and polluter pays' taxation principle accounting for the externalities of private car use, and should commence urgently given the need to phase out sales of any new ICE vehicles. The taxation of vehicles and fuel pricing also has a critical role to play in BEV adoption and overall transport demand. Increased taxation on the sale of new ICE vehicles would support the economic viability of BEVs and could fund targeted additional supports to increase affordability for lower income groups.[99]

This Review highlights the significant investment required to deliver public and active transport and to maintain an expanded level of public transport service. The increased and sustained revenues required to support these could be raised through a combination of taxation measures and phasing out of fossil fuel subsidies, along with measures based on usage, in line with previous recommendations of the Council. An implementation plan for the phase-out of fossil fuel subsidies in the Transport sector is required, as recommended by the OECD. This could also support targeted measures to offset impacts of the transition on vulnerable groups. It will be important to act on this in Budget 2026, given the scale of transport emissions in Ireland and the investment required for decarbonisation.

As electrification of the vehicle fleet progresses, Government policy on vehicle taxation will need to evolve further to continue to lower the emissions profile of vehicles in Ireland and consider other externalities that can be used as a basis for tax receipts into the future.[114,115] As with direct supports for greater EV uptake, the Council recommends a continuation of the VRT relief for BEVs and electric vans in Budget 2026, focused on more affordable and efficient BEVs.

5.5. Decarbonise commercial fleets

Section 5.4 of this Review noted a number of welcome recent developments in relation to commercial vehicle taxation. A recent EV fleet trial demonstrated the benefit to businesses of trialling EVs, identifying suitable charging requirements and solutions, and testing what works for particular businesses using telematics data.[116] It also highlighted a number of issues that need to be resolved for certain business types, particularly concerning vans. In early 2025, the Electric Small Public Service Grant Scheme was temporarily paused by the NTA due to the volume of applications received, reflecting the significant level of grant support provided under the scheme and level of demand.

In the freight subsector, emissions from HGVs and LGVs are projected to account for around 52% of total transport emissions by 2030 due to growth in services and a reduction in passenger transport emissions.[2] A recent SEAI report highlighted that the market for LGVs is currently being driven by requirements for zero-emission operations in a number of European cities.[117] As noted in the revision to the NPF, while the transition to zero-emission vehicles progresses in Ireland, additional measures to reduce the impact of freight movements are critical, including operational efficiencies, load consolidation and decarbonisation of last-mile deliveries.[31]

In 2024, new CO_2 performance standards for new trucks, coaches and buses were adopted by the EU.[118] Battery costs for HGVs (trucks and buses) have reduced significantly in recent years, but have not achieved price parity with LGVs (cars and vans).[119] The price of fuel cells for hydrogen HGVs has not fallen as fast as expected. The UK Climate Change Committee's Seventh Carbon Budget proposal

has highlighted a very limited role, or potentially no role, for hydrogen in the decarbonisation of heavier vehicles, with electrification as the main route to decarbonisation.[120]

A clear roadmap for the decarbonisation of freight, which distinguishes between classes of freight vehicles, is needed to support the transition to zero-emission vehicles and reduction of financial risk through maintenance of grant schemes for HGVs and public/private charging infrastructure.[121] The Council has previously highlighted the importance of supports for depot-based and destination charging infrastructure for zero-emission HGVs and LGVs. The expansion of the Zero-Emission Heavy Duty Vehicle Purchase Grant Scheme to include purchase grants for charging infrastructure at depots, commercial premises and logistics hubs was welcome.[122] This will also require network capacity and specialist skills for installation of infrastructure and vehicle management and maintenance. Support for businesses was enhanced in early 2025 through phase 3 of the ZEVI–TII EV Recharging Infrastructure LDV National Road Grant Scheme.[123]

Most HGV movements occur along key transport corridors, and so targeted deployment of high-capacity charging infrastructure will be critical to support significant fleet electrification.[119] Operational costs are also a significant factor for fleet operators, and HGVs are sensitive to policies impacting on costs, including taxation and road pricing. The cost of charging will represent a major component of operational costs,[124] including electricity costs, the impact of increased vehicle weight on the cargo capacity of HGVs and the efficiency of freight transportation, and the additional time needed for charging. Innovations looking at alternatives to fast charging, such as battery swapping and electric road systems, are emerging and have potential to reduce operating costs.[125] High-power infrastructure could reduce the need for larger battery capacities, in turn improving efficiency and lowering vehicle purchase costs.

As set out in the latest Climate Action Plan,[5] the All-Island Strategic Rail Review recommended a number of actions to support greater modal shift of freight to rail through first- and last-mile rail access at Dublin Port, a reduction in track access chargers and strengthened rail connectivity to ports. The Council strongly supports implementation of these actions to support a greater shift to rail freight in Ireland. A Working Paper commissioned by the Council recommended consideration of a more efficient rail connection and terminal at Dublin Port to facilitate some modal shift to rail.[121]

5.6. Embed demand management across the planning system

The Council's recent proposal on the third and fourth carbon budgets noted that final energy demand reduction is an important lever to meet carbon budgets, but there is limited evidence of policy that has been planned or implemented that is likely to reduce energy demand in the Transport sector significantly by 2030.[98] An overall reduction in transport demand is critical to make the transport system more efficient and reduce congestion, along with meeting the Climate Action Plan target of a 20% reduction in vehicle-kilometres travelled by 2030.

Enhanced coordination and implementation of complementary housing, urban area and transport policies is critical to reducing car dependency and facilitating improved public transport and active travel.[75] 'Avoid' measures in the Transport sector involve system change to reduce transport demand and have important co-benefits of reduced congestion and pollution, improvements in health and local placemaking, and reduced costs associated with delivering infrastructure. The latest SEAI energy projections note that dispersed development has led to high levels of transport poverty in certain regions across certain cohorts in Ireland.[126] The costs of provision and accessibility of public transport and active travel infrastructure are linked to the spatial distribution of development patterns. More compact forms of development also help to preserve natural habitats while reducing environmental impacts and infrastructure costs.[53]

The Council welcomes the strengthened commentary on sustainable mobility and the need to integrate land use and transport planning in the revised NPF.[31] Ensuring the integration of safe and convenient alternatives to the car into the design of Ireland's communities by prioritising public transport, walking and cycling accessibility is also welcome in the revised NPF, and requires specific indicators to measure achievement, for example by utilising the range of accessibility tools currently in development by the NTA. The revised NPF must take effect throughout the planning system as soon as possible in 2025, and policy objectives in relation to compact growth and TOD should be reflected in the upcoming reviews of regional and spatial economic strategies and in planning decisions by local authorities, particularly in the context of targets for new housing construction. There should be alignment between the NPF and national, regional and local plans, including county development plans and metropolitan area transport strategies. Public transport networks need to complement new housing and commercial development to support sustainable travel and TOD, and this should be reflected in the revised National Development Plan. As set out in the NPF, land management, institutional and funding arrangements are required to accelerate TOD at suitable brownfield and greenfield sites.[31] The Housing Commission also recently recommended that new housing guidelines should address the Climate Action Plan, NPF and Town Centre First Policy.[4]

A reduction in overall demand in the Transport sector, particularly from private vehicles, is one of the most effective means to achieve the sectoral emissions ceilings between now and 2030, in tandem with investment in walking, cycling and public transport infrastructure, and shared mobility services. The Council reiterates its call from the 2024 Annual Review for the finalisation and implementation of a strategy to make Ireland's transport system more efficient and reduce car dependency and congestion as per action TR/23/19 of Climate Action Plan 2023, and highlighted this issue in a letter to the Minister in early 2025.[127] This is required to strengthen the implementation of demand-management principles across the planning system, develop a future-proofed approach to taxation in transport, support local authorities to deliver active travel and road space reallocation projects, deliver efficiencies in the freight sector and develop enabling legislation to support demand management. It will be critical to ensure that demand-management measures are reflected in Metropolitan Area Transportation Strategies and City and County Development Plans as set out in the latest Climate Action Plan.[5] The Council looks forward to the development of a revised Sustainable Mobility Policy Action Plan for 2026–2030 in tandem with implementation of demand-management measures.

Transport is the second largest source of NO_x pollution and also contributes to particulate matter emissions and environmental noise, which are particularly concerning for human health impacts in towns, villages and cities.[53] A recent systematic review of pollution and health impacts of low-emission zones showed their significant positive effect in curbing nitrogen dioxide and fine particulate matter concentrations.[128] Public engagement and demonstration of the co-benefits of demand-management measures for transport, such as improved health and air quality, reduced noise pollution and improved placemaking, will be needed along with strong public and political support.[126,129]

The reallocation of road space is critical to support sustainable modes of transport and has also been demonstrated to contribute positively to local economies and wellbeing.[53] In its 2022 review of the Irish transport system, the OECD highlighted the significant potential of road space reallocation to improve urban environments and recommended better planning enforcement to ensure that settlements are connected by safe and accessible walking and cycling routes. This reallocation involves a reduction in space for on-street parking or car lanes in favour of pedestrianisation, dedicated cycling infrastructure and public transport, but can face initial opposition, requiring significant stakeholder engagement.[130]

While funding for active travel projects through the NTA and TII has increased notably in recent years, interventions for reallocating urban space to date have been incremental.[131] Permanent projects that deliver improved connectivity and a network of routes, improve road safety and cater to the

most vulnerable citizens need to be delivered efficiently and at scale. Wider transport planning and public transport projects also need to align with road space reallocation plans focused on the road-user hierarchy and active travel. Local active travel projects should continue to be delivered by local authorities through NTA funding mechanisms, with consistent implementation using the Design Manual for Urban Roads and Streets and Cycle Design Manual.[132,133] The development of the Design Manual for Urban Roads and Streets guidance on reallocating street space, to adopt consistent standards as set out in the draft Moving Together implementation plan, is a critical issue to progress.

5.7. Make Ireland's transport systems more resilient

5.7.1. Vehicle to X charging

As uptake of low-carbon technologies increases, access to a reliable and resilient electricity supply is critical, and EVs have a particular role to play in enhancing local resilience, particularly during outage events, and in contributing to demand-side flexibility. The International Energy Agency has suggested that grant support for EV chargers should require smart communication-enabled equipment to facilitate greater demand-side flexibility.[134] From 2022, EV home charger grants through SEAI apply only to smart chargers that support bidirectional charging.[135]

There is a significant opportunity for bidirectional charging, in tandem with solar photovoltaic and battery storage systems, to increase resilience to storm events. Bidirectional charging to supply homes (vehicle to home (V2H)) or, in future, grid services (vehicle to grid (V2G)) also offers potential for significant grid flexibility where appropriate standards, installation requirements, optimal tariff structures and automation are in place. Currently, only certain EV models facilitate bidirectional charging, mainly vehicle to load (V2L) or V2H.[136] Typical BEV batteries hold 40–100 kWh of energy, and a small EV (40 kWh) could, for example, power essential appliances for a day.[136] This should be clearly outlined to potential adopters.

In order to facilitate bidirectional charging in the event of an outage (V2H), a home must be separated from the electricity network with a Change Over switch.[137] Improved guidance and clear information provision in this area, along with appropriate standards for both installers and customers and consideration of grant support through SEAI to enable greater adoption, is required. This includes development of interoperability between all BEVs and chargers and standardisation at EU level.[138]

5.7.2. Port resilience

Damage to Holyhead Port in Wales caused by Storm Darragh in December 2024 highlights the vulnerability of ports to storm events, and the particular vulnerability of supply chains to transboundary risks, given Ireland's island status. The urgent finalisation of the forthcoming revision to the National Ports Policy by the Department of Transport, to ensure that all ports take a harmonised approach to the integration of climate risks in port planning, operations, infrastructure investments and decision-making, is of critical importance. This requires a more integrated and systemic approach to planning for and managing climate risk, and developing capacity to coordinate across systems, sectors, levels of governance and regions in addressing the challenge of climate change.

The establishment of a taskforce by the Welsh and Irish Governments to examine how to ensure the resilience of the critical trade route between Dublin and Holyhead is welcome.[139] The taskforce held its first meeting in March 2025 and agreed on terms of reference and priority areas for action, including contingency planning, current infrastructure projects and future development needs. The taskforce is primarily focused on the resilience of Holyhead; however, it plans to also consider the resilience of sea connectivity between Wales and Ireland more generally to ensure that transport links

can better withstand the challenges expected from climate-driven change in severe weather patterns as well as other hazards and threats. The taskforce will include participation from Welsh and Irish ports as well as the ferry industry, local authorities, business representatives, logistics bodies and surface transport operators.

Ireland and Wales are also collaborating on an industry-led green shipping lane between Dublin and Holyhead.[140] The initiative aims to establish a green corridor initiative shipping route between the two ports with financial support from the International Green Corridor Fund. The focus is on reducing emissions along green corridors to help accelerate maritime decarbonisation, which also has the potential to increase the resilience of the ports by reducing their dependency on fossil fuels.

5.7.3. Reducing vulnerability and risks to critical transport routes and assets

It is vital that funding is scaled up to prioritise and implement adaptation measures for critical transport infrastructure routes and assets, including road, rail, maritime and aviation infrastructure. The Department of Transport has put in place systems to identify and rehabilitate vulnerable regional and local roads infrastructure. The Climate Adaptation Strategy for Regional and Local Roads[141] requires local authorities to identify and map the roads most susceptible to climate-related impacts as well as critical infrastructure routes (lifeline roads) in each local authority. There is an urgent need for each local authority to finalise the identification of their critical infrastructure routes and present their funding needs to the Department of Transport. The climate change adaptation component of the existing Regional and Local Roads Investment Programme provides funding for small-scale projects relating to drainage, maintenance and repair of infrastructure, such as bridges. It should also prioritise the rehabilitation and maintenance of those routes identified as critical infrastructure routes and most susceptible to climate impacts. Over the past 5 years, the total funding under this programme for climate change adaptation projects has averaged €17.3 million for 333 projects per year, and the share of adaptation project funding in the overall programme declined from 4% in 2021 to 2% in 2025. There is a need to increase the climate adaptation grant component of this programme and the National Development Plan allocation to target larger scale projects that ensure the long-term sustainability and climate resilience of our vulnerable and critical roads. The quantity of finance required for this will depend on the critical infrastructure routes identified by local authorities.

Progress in identifying climate risks and vulnerabilities and investing in adaptation measures has been slower in the rail, aviation and maritime subsectors. The publication of the Iarnród Éireann Climate Adaptation Strategy (2024–2029) is welcomed, as are commitments to reduce service disruption following weather-related events and to invest in improved operations and asset resilience through its IMMAC for 2025–2029. It is recommended that a full risk and vulnerability assessment of the rail network is undertaken in line with the methodology of the National Climate Change Risk Assessment. Locations of the current rail network vulnerable to river and coastal flooding were identified in the Strategic Flood Risk Assessment that supported the All-Ireland Strategic Rail Review.[142] It is recommended that these sites are prioritised for adaptation measures in the IMMAC and that clear and ambitious climate resilience targets around levels of service and capital investment are included and monitored through the IMMAC. The Council notes that the Regional Airports Programme for 2026–2030 is under development and it is recommended for this programme to integrate climate change adaptation and consider adaptation needs and measures for operations at regional airports. Finally, the increasing expansion and development of offshore wind projects at Irish ports provides the opportunity to increase their resilience to the impacts of extreme weather, including coastal storms.

References

1 Environmental Protection Agency, 'Quarterly Greenhouse Gas Emissions Indicator Report (2024 Quarter 4)', May 2025. Accessed: Jun. 10, 2025. [Online]. Available: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/quarterly-greenhouse-gas-emissions-indicator-report-2024-quarter-4.php

2 Environmental Protection Agency, 'Ireland's Greenhouse Gas Emissions Projections 2024–2055', May 2025. Accessed: Jun. 10, 2025. [Online]. Available: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-GHG-Projections-Report-2024-2055-May25.pdf

3 Central Statistics Office, 'Vehicles licensed for the first time December and Year 2024'. Accessed: Mar. 31, 2025. [Online]. Available: https://www.cso.ie/en/releasesandpublications/ep/p-vlftm/vehicleslicensedforthefirsttimedecemberandyear2024/

4 National Competitiveness and Productivity Council, 'Ireland's Competitiveness Challenge 2024', 2024. Accessed: Mar. 31, 2025. [Online]. Available: https://www.competitiveness.ie/media/d2nhry3o/icc_2024_final_version.pdf

5 Government of Ireland, 'Climate Action Plan 2025', 2025. Accessed: Apr. 15, 2025. [Online]. Available: https://www.gov.ie/en/department-of-the-environment-climate-and-communications/publications/climate-action-plan-2025/

6 European Alternative Fuels Observatory, 'Vehicles and fleet'. Accessed: Apr. 01, 2025. [Online]. Available: https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/ireland/vehicles-and-fleet

7 National Transport Authority, 'Active Travel Investment Grants: 2025 Allocations', 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/wp-content/uploads/2025/01/Full-Allocations-Table-130125.pdf

8 National Transport Authority, 'A record €1 billion investment by Government since 2020 to prioritise safe walking and cycling for people'. Accessed: Mar. 31, 2025. [Online]. Available: https://www.nationaltransport.ie/news/a-record-e1-billion-investment-by-government-since-2020-to-prioritise-safe-walking-and-cycling-for-people/

9 National Transport Authority, 'National Household Travel Survey 2023 Research Report', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/wp-content/uploads/2024/08/NTA_NHTS2023_IpsosBA_Report_27August2024.pdf

10 Department of Transport, 'Alternative Fuels for Transport Working Group'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/publication/64263-alternative-fuels-for-transport-working-group/

11 I. Ukpanah, 'Vehicle-to-Grid (V2G): Turn Your Electric Car into a Power Plant'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.greenmatch.co.uk/blog/vehicle-to-grid

12 T. Horschig, O. Özgün, and F. Jones, 'How vehicle-to-everything (V2X) can turbocharge the energy transition'. Accessed: Mar. 31, 2025. [Online]. Available: https://www.dnv.com/energy-transition-outlook/v2x/

13 Irish America, 'Date Holyhead Port set to fully reopen confirmed'. Accessed: Mar. 31, 2025. [Online]. Available: https://www.irishamerica.com/2025/02/date-holyhead-port-set-to-fully-reopen-confirmed/

14 Environmental Protection Agency, 'Ireland's Final Greenhouse Gas Emissions 1990–2023', 2025. Accessed: May 28, 2025. [Online]. Available: https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-final-greenhouse-gas-emissions-1990-2023.php

15 Department of the Environment, Climate and Communications, 'Sectoral Emissions Ceilings'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/publication/76864-sectoral-emissions-ceilings/

16 Central Statistics Office, 'Vehicle Kilometres'. Accessed: Apr. 03, 2025. [Online]. Available: https://www.cso.ie/en/releasesandpublications/hubs/p-transo/transporthub/roadtrafficvolumes/vehiclekilometres/

17 Sustainable Energy Authority of Ireland, 'Monthly Oil Statistics'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.seai.ie/data-and-insights/seai-statistics/monthly-energy-data/oil-monthly

18 Central Statistics Office, 'Transport Dashboard'. Accessed: Apr. 03, 2025. [Online]. Available: https://www.cso.ie/en/releasesandpublications/db/db-transp/transportdashboard/

19 Climate Change Advisory Council, 'Annual Review 2023', 2023. Accessed: Apr. 25, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/annualreviewandreport/CCAC-AR-2023-postfinal.pdf

20 Climate Change Advisory Council and Irish Fiscal Advisory Council, 'A Colossal Missed Opportunity: Ireland's Climate Action and the Potential Costs of Missing Targets', 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/otherpublications/Ireland%E2%80%99s%20climate%20action%20and%20the%20potential%20costs%20of%20missing%20targets%20FINAL.pdf

21 Eurostat, 'Share of energy from renewable sources'. Accessed: Apr. 01, 2025. [Online]. Available: https://ec.europa.eu/eurostat/databrowser/view/nrg_ind_ren__custom_15115950/default/table?lang=en

22 Eurostat, 'Population on 1 January'. Accessed: Apr. 03, 2025. [Online]. Available: https://ec.europa.eu/eurostat/databrowser/view/tps00001/default/table?lang=en&category=t_demo.t_demo_pop

23 European Alternative Fuels Observatory, 'EAFO Analysis: Trends in EV Charging Infrastructure Across Europe'. Accessed: Apr. 01, 2025. [Online]. Available: https://alternative-fuels-observatory.ec.europa.eu/general-information/news/eafo-analysis-trends-ev-charging-infrastructure-across-europe

24 Office for National Statistics, 'Population projections'. Accessed: Apr. 03, 2025. [Online]. Available: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections

25 Government of Ireland, 'Climate Action Plan 2023: Annex of Actions', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/270057/95ebee81-a143-4371-b515-22fe62a38467.pdf

26 Environmental Protection Agency, 'Implementation of Climate Adaptation Indicators: Lessons Learned from the Transport Sector Environmental Protection Agency', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.tii.ie/media/klwm4nnz/epa_climateadaptationindicators_transportsector.pdf

27 Government of Ireland, 'Planning and Development Act 2024; S.I. No. 34 of 2024'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.irishstatutebook.ie/eli/2024/act/34/enacted/en/

28 Department of Housing, Local Government and Heritage, 'Planning and Development Act 2024: Implementation Plan', Mar. 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/320667/f86c9fae-db80-41d5-a2bf-b0f3a9827bcb.pdf

29 Government of Ireland, 'Ministerial Action Plan on Planning Resources', Oct. 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/308010/787b412a-3a2d-4cac-8706-ae7b97aac8bd.pdf

30 M. Donnelly, 'Letter from Chair of the Climate Change Advisory Council Re: First Revision to the National Planning Framework Consultation CCAC Response'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/councilcorrespondenceandadvice/NPF%20Review%20Consultation%20Input%20CCAC.pdf

31 Government of Ireland, 'Final Draft Revised National Planning Framework for the Approval of Each House of the Oireachtas Before it is Published', 2025. Accessed: Apr. 20, 2025. [Online]. Available: https://www.npf.ie/first-revision-to-the-national-planning-framework/final-draft-revised-national-planning-framework-april-2025/

32 Houses of the Oireachtas, 'Urban Development – Dáil Éireann Debate, Tuesday, 11 Feb 2025'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.oireachtas.ie/en/debates/question/2025-02-11/380/

33 Department of Rural and Community Development, 'Our Rural Future: Minister Calleary launches 2025 Town and Village Renewal Scheme'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/4f20a-our-rural-future-minister-calleary-launches-2025-town-and-village-renewal-scheme/

34 Department of Transport, 'Incoming Ministerial Brief', Jan. 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/321104/84e8be97-694d-4b71-a563-546f2c3fdfc2.pdf

35 Houses of the Oireachtas, 'Regeneration Projects – Dáil Éireann Debate, Wednesday, 12 Feb 2025'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.oireachtas.ie/en/debates/question/2025-02-12/176/

36 Department of Transport, 'Moving Together: A Strategic Approach to the Improved Efficiency of the Transport System in Ireland', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/290392/2f64c07e-5eb2-4a7c-a5f8-78d1d9ce3ede.pdf

37 Revenue.ie, 'Private use of employer provided vehicles'. Accessed: Mar. 31, 2025. [Online]. Available: https://www.revenue.ie/en/employing-people/benefit-in-kind-for-employers/private-use-company-cars/exemptions.aspx

38 National Transport Authority, 'Annual Report and Financial Statements 2023', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/publications/annual-report-and-financial-statements-2023/

39 Department of Transport, 'Review of National Ports Policy 2013', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/274074/fba467e2-4371-46bf-982a-88b581a8772d.pdf

40 Department of Transport, 'Ministers announce €713 million for regional and local roads'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/df86e-ministers-announce-713-million-for-regional-and-local-roads/

41 Iarnród Éireann, 'Climate Adaptation Strategy 2024', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.irishrail.ie/getmedia/41a4b78f-b435-4f04-8e08-5b94a30d07de/adaption_V4.pdf

42 Iarnród Éireann, 'East Coast Railway Infrastructure Protection Projects ECRIPP'. Accessed: Apr. 03, 2025. [Online]. Available: https://www.irishrail.ie/en-ie/about-us/iarnrod-eireann-projects-and-investments/ECRIPP

43 Department of Transport, 'Press release: Department launches "Your Journey Counts" campaign as new research outlines support from public to cut transport emissions'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/a6a5e-department-launches-your-journey-counts-campaign-as-new-research-outlines-support-from-public-to-cut-transport-emissions/

44 N. Conroy and K. Timoney, 'Irish Fiscal Advisory Council Working Paper No. 23: Ireland's Infrastructure Demands', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.fiscalcouncil.ie/wp-content/uploads/2024/10/Irelands-Infrastructure-Demands.pdf

45 A. Barrett *et al.*, 'The National Development Plan in 2023: Priorities and Capacity', 2024, https://doi.org/10.26504/sustat123

46 Department of Public Expenditure, NDP Delivery and Reform, 'Press release: Ministers Chambers announces a review of the National Development Plan'. Accessed: Apr. 23, 2025. [Online]. Available: https://www.gov.ie/en/department-of-public-expenditure-ndp-delivery-and-reform/press-releases/ministers-chambers-announces-a-review-of-the-national-development-plan/

47 T. McNally and M. McGlynn, '"More realistic funding" model needed for transport projects, Government warned'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.irishexaminer.com/news/arid-41589244.html

48 B. Hopkinson, 'How Madrid built its metro cheaply'. Accessed: Apr. 01, 2025. [Online]. Available: https://worksinprogress.co/issue/how-madrid-built-its-metro-cheaply/

49 Department of Public Expenditure, NDP Delivery and Reform, 'Build 2024: Construction Sector Performance and Capacity', 2024. Accessed: Apr. 03, 2025. [Online]. Available: https://www.gov.ie/en/publication/ceb9d-build-2024-construction-sector-performance-and-capacity/

50 C. Ginty, 'New data shows 2:1 public transport vs road funding split started to be met in 2024'. Accessed: Apr. 01, 2025. [Online]. Available: https://irishcycle.com/2025/01/17/new-data-shows-21-public-transport-vs-road-funding-split-started-to-be-met-in-2024/

51 Government of Ireland, 'Irish Public Spending Data'. Accessed: Apr. 23, 2025. [Online]. Available: https://whereyourmoneygoes.gov.ie/en/

52 Organisation for Economic Co-operation and Development, 'OECD Environmental Performance Reviews: Ireland 2021', 2021. Accessed: Apr. 01, 2025. [Online]. Available: https://www.oecd.org/en/publications/oecd-environmental-performance-reviews-ireland-2021_9ef10b4f-en.html

53 Environmental Protection Agency, 'Chapter 11: Environment and Transport in State of the Environment Report', EPA, 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.epa.ie/publications/monitoring--assessment/assessment/state-of-the-environment/EPA-SOER-2024-Chapter-11-EnvironmentTransport.pdf

54 National Transport Authority, 'Inflation Report Update', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/wp-content/uploads/2024/02/2024-NTA-Inflation-Full-Report.pdf

55 Department of Public Expenditure, NDP Delivery and Reform, 'Revised Estimates for Public Services 2025: Climate and Environmental Expenditure', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/316128/cbe35b2f-5acf-4ab8-9e4b-1dc681e04066.pdf

56 National Transport Authority, 'Bus Connects Dublin Progress Report, March 2025', 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/wp-content/uploads/2025/03/BC-Programme-Progress-Report-Mar-2025.pdf

57 E. Mulholland and F. Rodríguez, 'The Rapid Deployment of Zero-emission Buses in Europe', 2022. Accessed: May 13, 2025. [Online]. Available: https://theicct.org/publication/the-rapid-deployment-of-zero-emission-buses-in-europe/

58 National Transport Authority, 'National Household Travel Survey 2022', 2022. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/publications/national-household-travel-survey-2022/

59 Government of Ireland, 'Climate Conversation 2023 Report: From Individual Action to Collective Engagement', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/297690/9395b1ab-7d7b-4ace-b111-ef77d699f7d5.pdf

60 B. Caulfield, 'Sustainable Mobility Beyond the Big Cities', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://www.tii.ie/media/whfdgcgu/rgc-2023-14-prof-brian-caulfield-trinity-college-dublin-sustainable-mobility-beyond-the-big-cities.pdf

61 National Transport Authority, 'Connecting Ireland Insights Issue 8', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/wp-content/uploads/2024/10/Connecting-Ireland-Bulletin-Q3-2024.pdf

62 National Transport Authority, 'News release: People now using TFI Local Link services 100,000 times a week in rural Ireland'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.nationaltransport.ie/news/people-now-using-tfi-local-link-services-100000-times-a-week-in-rural-ireland/

63 P. Carroll, R. Benevenuto, and B. Caulfield, 'Identifying hotspots of transport disadvantage and car dependency in rural Ireland', *Transport Policy*, vol. 101, pp. 46–56, Feb. 2021, https://doi.org/10.1016/J.TRANPOL.2020.11.004.

64 Department of Transport, 'National Demand Management Strategy, Captive Car Users Sub-Group Report', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/290309/fae6b1dc-f01e-4dd9-a8b5-9eb404a50980.pdf

65 F. Byrne, L. Link, L. Offaly, and C. Ross, 'Connecting Ireland and Rural Public Transport Investment – Opportunities for Rural Regeneration', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://www.opr.ie/wp-content/uploads/2023/04/April-2023-Councillor-Training-Conor-O-Donovan-Presentation.pdf

66 V. O'Riordan, F. Rogan, B. Ó Gallachóir, T. Mac Uidhir, and H. Daly, 'How and why we travel – mobility demand and emissions from passenger transport', *Transportation Research Part D: Transport and Environment*, vol. 104, p. 103195, Mar. 2022, https://doi.org/10.1016/J.TRD.2022.103195.

67 Department of Transport, 'Department launches "Your Journey Counts" campaign as new research outlines support from public to cut transport emissions'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/a6a5e-department-launches-your-journey-counts-campaign-as-new-research-outlines-support-from-public-to-cut-transport-emissions/

68 Eurydice, 'Ireland: "School Transport 2030" – new developments of the school transport scheme'. Accessed: Apr. 01, 2025. [Online]. Available: https://eurydice.eacea.ec.europa.eu/news/ireland-school-transport-2030-new-developments-school-transport-scheme

69 Department of Education, 'School Transport 2030: Review of the School Transport Scheme – Phase 3 Report', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/285291/b8dea5c5-5c6b-4888-b695-39e38d7a60ea.pdf

70 Department of Education, 'Press release: School transport scheme brings record number of children to school in 2024'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/ebc22-school-transport-scheme-brings-record-number-of-children-to-school-in-2024/

71 Department of Education, 'School transport'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/service/07a71-school-transport/?referrer=https://www.gov.ie/en/service/school-transport/#school-transport-scheme-pilot-projects-20242025

72 Sustainable Energy Authority of Ireland, 'Under the Bonnet: Taking a closer look at the significant differences between vehicles powered by fossil fuels and those powered by electricity'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.seai.ie/blog/under-bonnet

73 Y. Liu *et al.*, 'Reliability of electric vehicle charging infrastructure: A cross-lingual deep learning approach', *Communications in Transportation Research*, vol. 3, p. 100095, Dec. 2023, https://doi.org/10.1016/J.COMMTR.2023.100095.

74 Department of Transport, 'Draft National Policy Framework for Alternative Fuels Infrastructure', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/318486/5050458a-e3b6-4ffa-8755-bf6463478e70.pdf

75 Organisation for Economic Co-operation and Development, 'OECD Economic Surveys: Ireland 2025', 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://www.oecd.org/en/publications/oecd-economic-surveys-ireland-2025_9a368560-en.html

76 ESB Networks, 'Price Review 6: Business Plan', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.esbnetworks.ie/docs/default-source/publications/esb-networks-pr6-business-plan-final.pdf?sfvrsn=c480444a_5

77 Climate Change Advisory Council, 'Electricity Sectoral Review: Annual Review 2025', Apr. 2025. Accessed: May 12, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/

78 Parliamentary Budget Office and Houses of the Oireachtas, 'Climate and Environmental Expenditure 2025', 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://data.oireachtas.ie/ie/oireachtas/parliamentaryBudgetOffice/2025/2025-02-28_climate-and-environmental-expenditure-2025_en.pdf

79 Behavioural Insights Team and Transport Research Laboratory, 'Driving and Accelerating the Adoption of Electric Vehicles in the UK', 2020. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.publishing.service.gov.uk/media/5f4f8fe0d3bf7f0a28d9ca9c/driving-and-accelerating-the-adoption-of-electric-vehicles-in-the-uk.pdf

80 Sustainable Energy Authority of Ireland, 'Driving Purchases of Electric Vehicles in Ireland', 2020. Accessed: Apr. 01, 2025. [Online]. Available: https://www.seai.ie/sites/default/files/publications/Driving-Purchases-of-Electric-Vehicles-in-Ireland.pdf

81 A. Tankou, K. Lee, M. R. Bernard, and A. Bui, 'Policies and Innovative Approaches for Maximizing Overnight Charging in Multi-Unit Dwellings', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://zevalliance.org/wp-content/uploads/2024/01/Policies-and-innovative-approaches-to-maximizing-overnight-charging-in-multi-unit-dwellings_dec23.pdf

82 Office for Zero Emission Vehicles, 'On-Street Residential Chargepoint Scheme guidance for local authorities'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.uk/government/publications/grants-for-local-authorities-to-provide-residential-on-street-chargepoints/on-street-residential-chargepoint-scheme-guidance-for-local-authorities

83 Department of Transport, 'Press release: Minister announces grants for electric motorcycles, small public service vehicles and new charging pilot to boost EV adoption'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/8a782-minister-announces-grants-for-electric-motorcycles-small-public-service-vehicles-and-new-charging-pilot-to-boost-ev-adoption/

84 P. Lentz, C. Augustenborg, and L. Lades, 'Administrative Frictions in Ireland's Shared Island Sports Club EV Charging Scheme', 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://publicpolicy.ie/environment/administrative-frictions-in-irelands-shared-island-sports-club-ev-charging-scheme/

85 Transport & Environment, 'Right to Plug: How to guarantee seamless EV charging in shared buildings'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.transportenvironment.org/articles/right-to-plug-how-to-guarantee-seamless-ev-charging-in-shared-buildings

86 International Energy Agency, "'Trends in Electric Cars" in "Global EV Outlook 2024"', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-cars#electric-car-sales

87 D. Cerruti and M. Filippini, 'Center of Economic Research Working Paper No. 23/388: Adoption of Battery Electric Vehicles: The Role of Government Incentives and Solar PV'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.researchgate.net/publication/385000004_Adoption_of_Battery_Electric_Vehicles_the_Role_of_Government_Incentives_and_Solar_PV

88 A. Santonja, P. Haan, and A. Zaklan, 'Effectiveness and heterogeneous effects of purchase grants for electric vehicles', *Environmental Resource Economics*, vol. 88, pp. 185–223, Nov. 2024, https://doi.org/10.1007/S10640-024-00929-Z.

89 S. Hardman, M. Shafaeen, and G. Tal, 'Identifying mass market adoption in the transition to electric vehicles', *Environmental Research Letters*, vol. 19, p. 111005, Sep. 2024, https://doi.org/10.1088/1748-9326/AD7BD1.

90 T. Mac Uidhir, B. Ó Gallachóir, J. Curtis, and F. Rogan, 'Achieving the unprecedented: modelling diffusion pathways for ambitious climate policy targets', *Energy and Climate Change*, vol. 3, p. 100073, Dec. 2022, https://doi.org/10.1016/J.EGYCC.2022.100073.

91 Parliamentary Budget Office, 'An Overview of Ireland's Electric Vehicle Incentives and a Comparison With International Peers', 2022. Accessed: Apr. 01, 2025. [Online]. Available: https://data.oireachtas.ie/ie/oireachtas/parliamentaryBudgetOffice/2022/2022-06-02_an-overview-of-ireland-s-electric-vehicle-incentives-and-a-comparison-with-international-peers_en.pdf

92 European Commission, 'Questions and answers on the Commission unveiling the Action Plan to drive innovation, sustainability, and competitiveness in the automotive sector'. Accessed: Apr. 01, 2025. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/qanda_25_636

93 B. Caulfield, D. Furszyfer, A. Stefaniec, and A. Foley, 'Measuring the equity impacts of government subsidies for electric vehicles', *Energy*, vol. 248, p. 123588, Jun. 2022, https://doi.org/10.1016/J.ENERGY.2022.123588.

94 A. Stefaniec, R. Egan, K. Hosseini, and B. Caulfield, 'The challenge of making EVs just affordable enough: assessing the impact of subsidies on equity and emission reduction in Ireland', *Research in Transportation Economics*, vol. 109, p. 101495, Mar. 2025, https://doi.org/10.1016/J.RETREC.2024.101495.

95 E. Correia Sinézio Martins, J. Lépine, and J. Corbett, 'Assessing the effectiveness of financial incentives on electric vehicle adoption in Europe: multi-period difference-in-difference approach', *Transportation Research Part A: Policy and Practice*, vol. 189, p. 104217, Nov. 2024, https://doi.org/10.1016/J.TRA.2024.104217.

96 C. Münzel, P. Plötz, F. Sprei, and T. Gnann, 'How large is the effect of financial incentives on electric vehicle sales? – A global review and European analysis', *Energy Economics*, vol. 84, p. 104493, Oct. 2019, https://doi.org/10.1016/J.ENECO.2019.104493.

97 P. Plötz, T. Gnann, and F. Sprei, 'Can policy measures foster plug-in electric vehicle market diffusion?', *World Electric Vehicle Journal*, vol. 8, no. 4, pp. 789–797, Dec. 2016, https://doi.org/10.3390/WEVJ8040789.

98 Climate Change Advisory Council, 'Carbon Budget Proposal Report', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.climatecouncil.ie/media/CCAC%20Carbon-Budget%20Proposal%202024-final.pdf

99 Department of Transport, 'Electric Vehicle Policy Pathway Working Group Report 2021', 2021. Accessed: Apr. 23, 2025. [Online]. Available: https://assets.gov.ie/static/documents/electric-vehicle-policy-pathway.pdf

100 Sustainable Energy Authority of Ireland, 'Fuel Price Comparison'. Accessed: Apr. 03, 2025. [Online]. Available: https://www.seai.ie/blog/fuel-price-comparison

101 Climate Change Committee, 'Understanding the tail of the electric vehicle transition', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.theccc.org.uk/wp-content/uploads/2025/02/Understanding-the-tail-of-the-electric-vehicle-transition-ERM.pdf

102 E. Muehlegger and D. S. Rapson, 'Subsidizing low- and middle-income adoption of electric vehicles: quasi-experimental evidence from California', *Journal of Public Economics*, vol. 216, p. 104752, Dec. 2022, https://doi.org/10.1016/J.JPUBECO.2022.104752.

103 S. Wappelhorst and S. Díaz, 'Moving past the early market: How to get battery electric vehicles to the mainstream'. Accessed: Apr. 01, 2025. [Online]. Available: https://theicct.org/how-to-get-bevs-to-the-mainstream-sept24/

104 Transport & Environment, 'Press release: EU to gift weaker climate targets to car industry in return for no commitments'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.transportenvironment.org/articles/eu-to-gift-weaker-climate-targets-to-car-industry-in-return-for-no-commitments

105 European Commission, 'Press release: Commission boosts European automotive industry's global competitiveness'. Accessed: Apr. 01, 2025. [Online]. Available: https://ec.europa.eu/commission/presscorner/detail/en/ip_25_635

106 Transport & Environment, 'Press release: EU Auto Plan is a major concession to industry – it must be the last'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.transportenvironment.org/articles/eu-auto-plan-is-a-major-concession-to-industry-but-will-it-be-the-last

107 Q. Schobbens, J. Defauw, P. Vermeulen, B. Martin, and M. Jonas, 'Study into the Electrification Needs of Mobility in Belgium and the Related Impacts: Final Report', 2021. Accessed: Apr. 01, 2025. [Online]. Available: https://frdo-cfdd.be/wp-content/uploads/2022/11/Rapport-Vfinale-dec-2021_EN.pdf

108 Climate Change Advisory Council, 'Annual Review 2024: Transport', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/annualreviewandreport/AR2024-Transport-final.pdf

109 General Secretariat of the Council of the European Union, 'Information note: Biofuels supply from palm oil derivatives and fraud prevention', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://data.consilium.europa.eu/doc/document/ST-14325-2024-REV-2/en/pdf

110 F. Bergin, 'Letter from National Oil Reserves Agency to the Department of Transport Re: Awarding of RTFO certificates to POME-derived renewable fuels'. Accessed: Apr. 23, 2025. [Online]. Available: https://assets.gov.ie/static/documents/National_Oil_Reserve_Agency_Letter_to_DoT.pdf

111 Department of Transport, 'Public Consultation – Considerations for a Revised Renewable Transport Fuel Policy 2025–2027', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/313940/a0c63348-81e2-4eb0-9f09-a480099d2364.pdf

112 D. Murray and M. O'Brien, 'Fuels paradise: The penny begins to drop on fraud in biofuel supply chains'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.businesspost.ie/news-focus/fuels-paradise-the-penny-begins-to-drop-on-fraud-in-biofuel-supply-chains/

113 European Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Decarbonise Corporate Fleets'. Accessed: Apr. 01, 2025. [Online]. Available: https://transport.ec.europa.eu/document/download/1498648c-63fc-4715-975d-ccbc64703da5_en?filename=Communication%20-%20Decarbonising%20corporate%20fleets.pdf

114 Department of Finance, 'Potential Fiscal Impacts of the Transition to a Lower Carbon Economy in Ireland', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/264379/1cbd97c7-1a35-430e-a639-a385ea71d960.pdf

115 Department of Finance, 'Energy and Vehicle Taxation Tax Strategy Group – 24/09', Jul. 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/299825/36cc9a9e-24a8-4dfa-9b89-d2cd3b2cef54.pdf

116 Sustainable Energy Authority of Ireland, 'Electric Vehicle (EV) Commercial Fleet Trial Report', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.seai.ie/sites/default/files/publications/ev-commercial-fleet-trial-report-2024.pdf

117 Sustainable Energy Authority of Ireland, 'Ireland's Sustainable Energy Supply Chain Opportunities', Mar. 2025. Accessed: Apr. 23, 2025. [Online]. Available: https://www.seai.ie/sites/default/files/publications/irelands-sustainable-energy-supply-chain-opportunities.pdf

118 EUR-Lex, 'Regulation (EU) 2024/1610 of the European Parliament and of the Council of 14 May 2024 amending Regulation (EU) 2019/1242 as regards strengthening the CO_2 emission performance standards for new heavy-duty vehicles and integrating reporting obligations, amending Regulation (EU) 2018/858 and repealing Regulation (EU) 2018/956', The European Parliament. Accessed: Apr. 01, 2025. [Online]. Available: https://data.consilium.europa.eu/doc/document/PE-29-2024-REV-1/en/pdf

119 ERM, 'ZEV HDV Uptake Trajectories – Modelling Assumptions', Feb. 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://www.theccc.org.uk/publication/zev-hdv-uptake-trajectories-modelling-assumptions-erm/

120 Climate Change Committee, 'The Seventh Carbon Budget – Advice for the UK Government', Feb. 2025. Accessed: Apr. 01, 2025. [Online]. Available: https://www.theccc.org.uk/wp-content/uploads/2025/02/The-Seventh-Carbon-Budget.pdf

121 C. Rowland, P. Weldon, and N. Farid, 'Climate Change Advisory Council Working Paper No. 30: Research to Assess Specific Measures for Road Freight Emission Abatement under the ASI Framework', 2024. Accessed: Apr. 23, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/councilworkingpaperseries/Working%20Paper%20No%2030%20Research%20to%20assess%20specific%20measures%20for%20road%20freight%20emission%20abatement%20under%20the%20ASI%20framework.pdf

122 Transport Infrastructure Ireland, 'Zero-Emission Heavy Duty Vehicle – Recharging Infrastructure Grant Scheme'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.tii.ie/en/roads-tolling/alt-fuel-projects-unit/zehdv-i/

123 Department of Transport, 'Press release: Minister O'Brien announces further EV infrastructure expansion and business supports for a zero emission future'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/9cd34-minister-obrien-announces-further-ev-infrastructure-expansion-and-business-supports-for-a-zero-emission-future/

124 V. Aryanpur and F. Rogan, 'Decarbonising road freight transport: the role of zero-emission trucks and intangible costs', *Scientific Reports*, vol. 14, pp. 1–11, Jan. 2024, https://doi.org/10.1038/s41598-024-52682-4.

125 International Energy Agency, 'Trucks and Buses'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.iea.org/energy-system/transport/trucks-and-buses

126 Sustainable Energy Authority of Ireland, 'National Energy Projections 2024', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.seai.ie/sites/default/files/publications/National-Energy-Projections-Report-2024.pdf

127 M. Donnelly, 'Letter to Minister Darragh O'Brien, 28 January 2025'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.climatecouncil.ie/councilpublications/councilcorrespondenceandadvice/1.%20Letter%20to%20Minister%20Jan2025.pdf

128 S. Broster and K. Terzano, 'A systematic review of the pollution and health impacts of low emission zones', *Case Studies on Transport Policy*, vol. 19, p. 101340, Mar. 2025, https://doi.org/10.1016/J.CSTP.2024.101340.

129 Department of Transport, 'Public Engagement on Climate Action and Sustainable Mobility: Strategic Approach 2024–25', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/293600/9a9172b3-e072-4306-857b-86ea9efd990e.pdf

130 Department of Transport, 'National Demand Management Strategy: Optimal Use of Space Sub-Group Report', 2024. Accessed: Apr. 03, 2025. [Online]. Available: https://assets.gov.ie/290304/fdbae05c-112f-4f9a-b0ac-33698e3e36de.pdf

131 R. Egan and B. Caulfield, 'There's no such thing as cycle traffic: A critical discourse analysis of public opposition to pro-cycle planning', *Journal of Cycling and Micromobility Research*, vol. 2, p. 100014, Dec. 2024, https://doi.org/10.1016/J.JCMR.2024.100014.

132 Department of Transport, 'Design Manual for Urban Roads and Streets', 2023. Accessed: May 12, 2025. [Online]. Available: https://www.gov.ie/en/department-of-transport/publications/design-manual-for-urban-roads-and-streets/

133 National Transport Authority, 'Cycle Design Manual', 2023. Accessed: May 12, 2025. [Online]. Available: https://www.nationaltransport.ie/publications/cycle-design-manual/

134 International Energy Agency, 'Ireland 2024: Energy Policy Review', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://iea.blob.core.windows.net/assets/13918b88-36ae-4fa4-bc6f-4ddb1b8c3c08/Ireland2024.pdf

135 Sustainable Energy Authority of Ireland, 'EV Smart Charger Product Register Webinar', 2022. Accessed: Apr. 01, 2025. [Online]. Available: https://www.slideshare.net/slideshow/ev-smart-charger/251852456

136 Zero Emission Vehicles Ireland, 'Can Your EV Power Your Home During a Power Cut?' Accessed: Apr. 03, 2025. [Online]. Available: https://www.zevi.ie/news/can-your-ev-power-your-home-during-a-power-cut

137 ESB Networks, 'Future Smart Electric Vehicle Charging with Vehicle to Grid (V2G) Capability – National Network, Local Connections Programme', 2022. Accessed: Apr. 01, 2025. [Online]. Available: https://www.esbnetworks.ie/docs/default-source/publications/quick-user-guide-smart-electric-vehicle-charging-with-vehicle-to-grid-capability.pdf?sfvrsn=e77bcf70_8

138 Transport & Environment, 'Batteries on Wheels: The Untapped Potential of EVs', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://www.transportenvironment.org/articles/batteries-on-wheels-the-untapped-potential-of-ev-batteries

139 RTÉ, 'Irish and Welsh Governments work on Irish Sea links'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.rte.ie/news/business/2025/0307/1500836-irish-and-welsh-governments-work-on-irish-sea-links/

140 Maynooth University, 'News release: MU partners on Dublin to Holyhead Green Corridor'. Accessed: Apr. 01, 2025. [Online]. Available: https://www.maynoothuniversity.ie/news-events/mu-partners-dublin-holyhead-green-corridor

141 Department of Transport, 'Climate Adaptation Strategy for Regional and Local Roads', 2023. Accessed: Apr. 01, 2025. [Online]. Available: https://www.gov.ie/en/press-release/439de-climate-adaptation-strategy-for-regional-local-roads-document/

142 Department of Transport and Department for Infrastructure, 'Strategic Flood Risk Assessment of the All-Island Strategic Rail Review', 2024. Accessed: Apr. 01, 2025. [Online]. Available: https://assets.gov.ie/301097/2cd00c37-0c14-4991-a813-410bc3956846.pdf