Working Paper No. 30

June 2024

# Research to assess specific measures for road freight emission abatement under the ASI framework

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A working paper commissioned by the Climate Change Advisory Council, Ireland.


# Research to assess specific measures for road freight emission abatement under the ASI framework

## FINAL REPORT

MDS Transmodal

SYSTRA

June 2024

Ref: 223031 Final Report v6 170624

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## ABSTRACT

This report sets out the results of research on how Ireland could by 2030 reduce its carbon emissions from the road haulage sector, which is regarded as one of the more 'difficult to decarbonise' sectors of the transport industry.

It describes how freight transport in Ireland is dominated by road freight transport, which handles 99% of all freight moved within the country. It then shows how the EU will gradually require the sector to switch to zero emission trucks by 2055 by requiring manufacturers of trucks to gradually sell a higher proportion of zero emission vehicles and by providing a minimum level of refuelling/recharging infrastructure for these vehicles. However, this alone is likely to be too slow for the sector to make a significant contribution to Ireland's target of a 50% reduction in $CO_2$ emissions by 2030 compared to 2018.

The report makes suggestions about how a more significant contribution might be made by the freight sector to reducing carbon emissions based on the Avoid-Shift-Improve (ASI) framework. It suggests that it will be difficult to avoid freight movements, as this would imply a downturn in economic activity. The main opportunity to secure a shift of road freight to an alternative mode of transport for movements within Ireland would be provided by rail, but this mode will struggle to make a meaningful contribution to reducing carbon emissions by 2030. This means that the focus should be on improving road freight movements by incentivising a switch of road haulage from using diesel propulsion to greater use of zero emission trucks through the introduction of a cohesive package of 'carrot and stick' measures. This package of policy measures would encourage a rapid take-up of zero emission technology by the market, particularly for the regional and urban freight segments of the market which use the smaller trucks for which battery electric technology is already available.

# EXECUTIVE SUMMARY

## Section 1 Introduction

The Climate Change Advisory Council (CCAC) commissioned MDS Transmodal, in association with SYSTRA, to undertake research on decarbonisation of the freight sector in Ireland.

The overall aim of the study was to apply the Avoid-Shift-Improve (ASI) framework to identify and characterise specific measures for emissions reduction in inland road freight in Ireland with a scope to include primarily heavy goods vehicles (HGVs) and including ways to measure the impact of such measures in terms of emissions reductions where possible.

The ASI framework in relation to road haulage and the freight sector can be characterised as follows:

- Avoid: reducing road freight vehicle kilometres travelled, principally by securing efficiencies in the sector;
- Shift: switching road freight to other modes, principally rail in Ireland;
- Improve: improving the emission level of freight trips on the road network that remain essential, principally by switching to zero emission (ZE) HGVs.

The three main tasks in the project were to:

- Set out the freight transport context in Ireland in terms of historic road and rail freight volumes, existing national policy and the impact of Brexit on the market (section 2);
- Set out the likely future impact of EU legislation and technology on Ireland's road freight market (section 3);
- Describe and evaluate potential measures that Ireland could take to decarbonise 'heavy' freight flows, including setting out key areas for consideration and further evaluation (sections 4 and 5). In addition, four illustrative scenarios were run using the Ireland Freight Model (IFM)[1] to demonstrate the potential impact of some measures.

## Section 2 Freight transport in Ireland

### The freight transport market

Freight transport is needed because goods available at one geographical location are required at another location for processing, sorting or consumption. It is therefore a derived demand as the transport is not required in itself, but only to satisfy another demand.

[1] A new multi-modal freight transport demand simulation model, which was developed by MDS Transmodal for the National Transport Authority in 2023-24.

Freight transport services are delivered almost exclusively by private sector companies which invest heavily in fixed infrastructure, such as port facilities and distribution centres, and mobile equipment such as HGVs, LGVs and forklift trucks. Freight transport is therefore a largely market-based activity, but the private sector freight transport services need to use publicly owned infrastructure.

Freight transport movements are meeting an economic need, but they also have impacts on the environment and on the quality of life and health of citizens. These wider impacts on society can justify intervention by the public sector in the marketplace where the costs incurred by society are not fully incorporated into the costs experienced by the market.

The freight transport industry is highly competitive, facilitated by the relative ease of entry into the road haulage market, which is the dominant mode of freight transport. This means that most individual providers of freight transport services have low margins and seek to minimise their costs to remain competitive in the marketplace. Any interventions by the public sector designed to decarbonise the sector will affect the costs in the market and lead to a response from the private sector operators. Any resulting changes in costs will be passed on, in the medium to long-term, to the freight industry's customers (shippers and receivers) and, ultimately, to the wider economy.

## A statistical picture of freight transport in Ireland

165 million tonnes of road and rail freight were lifted in 2022, requiring 12.5 billion tonne kilometres (tkm) of freight transport.

Road freight amounted to 12,383 million tkm in 2022, lifting 164 million tonnes of goods[2]. The average length of road haul was 75km, but this falls to 65km for domestic movements within Ireland.

By comparison, rail freight amounted to 81 million tkm in 2022, lifting 0.4 million tonnes of goods and the average length of rail haul was 193 km. The modal share for rail in 2022 was therefore 0.2% in terms of tonnes lifted and 0.7% in terms of tonnes moved. This is the lowest modal share for rail freight in the EU for any member state with a rail network.

While the average length of haul for an HGV by Irish-registered vehicles of 75km (and only 65km within Ireland) is well within the effective range of a modern battery electric HGV, the deviation around this mean has an important impact on the feasibility of using electric HGVs. 80% of all tonnes moved in 2022 was over distances up to 150km, which is well within the effective range of an existing HGV of (say) 225km[3]. Almost 60% of tonnes moved were transported only up to 50km and would therefore allow a round trip back to a depot to be achieved with a single battery charge.

[2] By Irish registered HGVs carrying out both domestic movements within Ireland and import/exports movements (including across the land border).
[3] 75% of the maximum range stated by manufacturers on a single charge.

At the end of July 2022 there were 42,000 HGVs that were taxed in Ireland and therefore likely to be operationally active. Of this total operational fleet, about 23,000 (54%) were operated by 3,847 licensed road haulage operators that can carry out haulage work for third parties, whereas the rest were operated by own account operators. While the average number of HGVs per licensed third-party road haulage operator is 5.9, 70% of licensed operators have no more than three HGVs and 49% have only a single HGV[4]. This means that the third-party road haulage industry is fragmented and, although there are some hauliers that have fleets that offer scale economies, there are large numbers of small family-owned businesses and owner drivers.

## Existing national freight transport policy

The most important and directly relevant policy document is **Ireland's Road Haulage Strategy 2022-2031** (Department of Transport, 2022), which sets out the strategic and policy direction for the road haulage sector from 2022 to 2031. Key aspects of the strategy are as follows:

- The strategy highlights that greenhouse gas (GHG) emissions from HGVs and LGVs account for 20% and 18% of total transport-related GHG emissions respectively.
- The strategy argues that the road freight sector faces considerable challenges in abating emissions in the short to medium term due to alternatives to diesel powertrains not yet being widely available and an avoid-shift-improve (ASI) approach will be required from the road freight sector in the interim.
- While there has been a high level of uncertainty over the technological pathway for the decarbonisation of HGVs, the strategy states that, "this pathway is now becoming clearer, with electric trucks emerging as the preferred technology" and that, "Hydrogen as a fuel is not expected to play a significant role in the decarbonisation of the road freight sector before 2030".
- Ireland has a target of 3,500 low emission HGVs on its roads in 2030.
- The strategy argues that the pace of transition to zero emission HGVs in Ireland is not clear, but diesel HGVs are still expected to make up most of the HGV fleet in 2030. It also notes that it will take time for battery-electric HGVs to become widely available and affordable. Therefore "interim non-technological solutions and complementary measures will need to be implemented in the short- to medium-term to meet the required emissions abatement targets".

The policy document argues that the opportunities for multimodal transport for domestic transport as a means to secure modal shift away from road freight will be focused on **switching more traffic to rail** for trunk hauls and then, where necessary, using road freight services for local collection and delivery. Two key policy documents have been published about rail freight in the last two years, namely the *All-Island Strategic Rail Review* and the *Rail Freight 2040 Strategy*.

[4] *Ireland's Road Haulage Strategy 2022-2031,* Department of Transport, 2022, page 16.

### The impact of Brexit

As the UK is the largest right hand drive market in Europe, Ireland has tended to import a large proportion of its used HGVs from the UK. The departure of the UK from the EU is believed to have significantly reduced the number of second hand cars imported from the UK to Ireland, but does not appear to have had the same effect on imports of used HGVs. Since 2018 about 30% of Ireland's imports of HGVs have been used vehicles and the proportion of Ireland's second hand imports from the UK have represented about 90% of this total in each year. The UK therefore remains by far the most important source of imports of second hand HGVs and there does not appear to have been a significant impact on the second hand market in Ireland due to the UK's departure from the EU.

## Section 3 The impact of Europe and technology

### Introduction

External factors will influence the decarbonisation of Ireland's road freight sector. EU legislation will have an impact in terms of emission reductions and vehicle technology trends in the EU will influence the technologies that are deployed in HGV fleets In Ireland. Vehicle technology trends must be considered from the perspective of Ireland's current market and policies, strategies and technologies supported in other EU countries and how these might impact Ireland. The UK's efforts in road freight decarbonisation will also have an impact on Ireland's road freight sector.

### Impacts of new and revised EU legislation on Ireland's road freight emissions

There is a significant legislative revision process currently occurring in the European Commission, where existing legislation is being reviewed and updated and new policies are being created to achieve the EU's 2050 net zero target. New and revised EU legislation will impact Ireland, with direct or indirect impacts on Ireland's road freight sector and its emissions. In particular, the Fit for 55 Package, proposed in 2021 and adopted in 2023, comprises a package of legislative proposals to achieve the policy goals first proposed in the European Green Deal. The Fit for 55 Package's policy proposals aim to achieve an interim target to reduce $CO_2$ emissions in the EU by 55% by 2030.

The table below summarises new and developing EU legislation that has both direct and indirect impacts on Ireland's road freight emissions and on zero emission heavy goods vehicles (ZE HGVs).

| Legislation | Adopted? | Relevant to Ireland's road freight sector? | Impact on Ireland's road freight emissions? | Scope for Ireland to go further? |
|---|---|---|---|---|
| **EU Emissions Trading System – ETS 2** | **Yes** – ETS 2 operational in 2027 or 2028 | **Yes** – new system to cover fuel supply in transport | **Medium** – likely to benefit TCO** of ZE HGVs | **Somewhat** – use of levers to further increase fuel costs |
| **CO2 emissions performance standards – cars and vans** | **Yes** – stricter targets from 2030 onwards | **Somewhat** – limited to freight carried in LGVs | **Medium** – limited to freight carried in LGVs (relatively small proportion) | **Somewhat** – continue to offer incentives for cars and LGVs |
| **Energy Tax Directive (ETD)** | **No** – still in development | **Likely** (once agreed) – varying taxes for fuel types | **Likely medium** – specifies minimum tax rates | **Unclear** – in theory, Ireland can have higher tax rates |
| **Alternative Fuels Infrastructure Regulation** | **Yes** – stricter targets from 2025 | **Yes** – new targets stipulated for HDV infrastructure | **High** – creates enabling conditions for infrastructure | **Yes** – continued monitoring of ZE HGV infrastructure |
| **CO2 emissions performance standards – HDVs** | **Yes** – political agreement reached | **Yes** – much stricter emission targets for new HDVs from 2030 | **High** – impacts new HDVs, but not until after 2030 | **Somewhat** – continue to offer incentives for HDVs |
| **EU Sustainable Batteries Regulation (SBR)** | **Yes** – implementation by mid-2025 | **Yes** – batteries manufactured for HDVs | **Medium** – emissions from a lifecycle perspective | **No** – legislation is evolving |

***TCO = total cost of ownership, which is an estimation of the expenses associated with purchasing, deploying, using, and retiring a HGV. TCO is particularly important in the context of zero emission HGVs, as whilst the higher upfront costs can be a deterrent to purchase, the costs of using and operating a zero emission HGV can be lower than for comparable internal combustion engine (ICE) vehicles, due to aspects such as lower fuelling costs and possibly lower maintenance and repair costs.*

With respect to the impacts of EU legislation on Ireland's road freight sector emissions:

- The Fit for 55 Package (and subsequent legislative developments) include road transport and road freight within its scope.
- For the road freight sector, the full impacts of emission reductions resulting from EU legislative developments may not be felt until close to 2030 and beyond, in consideration of the early stage of the market and the difficulty of decarbonising heavy road freight.

This is evidenced through the proposed dates for the introduction of many of the aspects within the Fit for 55 Package that are relevant to road freight. For example:

- The EU Emissions Trading System 2 will not be live until 2027 at the earliest;
- The impacts of the updated $CO_2$ emissions performance standards for cars and vans will only impact a relatively small proportion of Ireland's road freight due to its scope focusing solely on vans;
- Full agreement on the updated Energy Tax Directive is yet to occur;

- Infrastructure for zero emission HGVs under the updated Alternative Fuels Infrastructure Regulation (AFIR) has targets between 2025 and 2030;
- The changes to the $CO_2$ emissions performance standards for heavy duty vehicles or HDVs will only take effect from 2030; and
- The Sustainable Batteries Regulation is still in development and has a phased approach.

The amended HDV $CO_2$ emission performance standards regulation is likely to drive the biggest impacts on Ireland's road freight emissions through stipulating more stringent targets for emissions from new HDVs, with the stricter emissions targets beginning in 2030. The updated regulation will work in tandem with other regulations (e.g., ETS 2, ETD) to make the total cost of ownership (TCO) more attractive for fleet operators.

The targets in the AFIR, and the associated financial support from the Alternative Fuels Infrastructure Facility (AFIF), are essential to create the enabling conditions for zero emission HGVs. The necessary infrastructure to support further zero emission HGVs should be continuously monitored.

The UK's influence on Ireland's road freight emissions should be recognised, especially in the context of the UK announcing phase out dates for new non-zero emission HGVs (2035 for <26t and 2040 for >26t). The EU has yet to formally commit to phase out dates.

In Ireland's context, the Fit for 55 Package and subsequent legislation is a suitable package of legislation to reduce Ireland's road freight emissions – the legislation works in combination, sends the right unified message, and addresses some criticisms from existing legislation, updating the legislation in the context of net zero targets. There is also significant scope for Ireland to introduce measures above and beyond the Fit for 55 Package.

Beyond stated commitments in each piece of EU legislation, it is difficult to predict what new legislation may be developed in the coming years, primarily due to the European Parliamentary elections taking place in June 2024, which are likely to have an influence on further emphasis on net zero legislation. Several pieces of EU legislation have review clauses built in; for example, the $CO_2$ emission performance standards for both new heavy-duty vehicles and new cars and vans have review clauses for 2027.

### Impacts of EU technology trends on Ireland's road freight emissions

In consideration of the impacts of EU technology trends on Ireland's road freight sector emissions:

- There are many factors that impact the pace of HGV decarbonisation in Ireland, including the policy and fiscal landscape, technological readiness and vehicle availability, and infrastructure considerations; many of these factors have a strong interaction with the EU market beyond EU legislation, along with the UK market.

- In particular, Ireland is reliant on imported zero emission HGV technology, along with the global supply chain for zero emission vehicles. In the short-term, Ireland's right-hand drive vehicles (for Ireland's left-hand drive system) may pose difficulties in obtaining zero emission HGVs in Ireland, though this is mitigated to some extent by the UK providing a large market in close proximity to Ireland which OEMs will want to supply.
- Many European countries are developing policies, strategies, incentives and fiscal measures, and providing funding for vehicles, infrastructure and R&D in the HGV decarbonisation space, with a view to developing the enabling conditions for road freight emission reductions. Ireland could seek to learn from other European countries and / or develop trials focused on zero emission HGV and supporting infrastructure deployment.
- It is too early to assess whether Ireland has the necessary skills to deploy zero emission HGVs and infrastructure, or whether these skills will need to be imported. Skills need to be considered from the contexts of infrastructure deployment and vehicle management and maintenance.
- Across Europe, battery electric vehicles have had a relative head start over hydrogen-fuelled vehicles, as it is a more established market due to EVs being deployed in passenger car and van markets.
- In the context of HGVs, there is growing agreement that there is a need to distinguish between classes of HGVs from a technological perspective. Battery electric technology is currently being deployed for smaller HGVs for regional and urban distribution, and one recent study by the OECD highlighted it as a "low regret" investment that could benefit larger HGV categories in terms of technological development.
- For longer haul road freight, technological development is not as well-advanced, and as such both battery electric and hydrogen-fuelled HGVs are still being considered.
- Ireland's road system is well-suited to current battery electric HGV ranges, with the average length of haul for an Irish-registered HGV being 75km for longer distance journeys overseas and to / from Northern Ireland, and 65km for domestic movements (though with large variation around this average); the primary dependency on the EU market is availability of vehicles.
- The UK is also supporting development of zero emission HGVs, through designated funding for demonstrating zero emission HGV and infrastructure deployment, development of technical standards, and expanding current infrastructure funding streams. These aspects may also influence Ireland's road freight emissions.

# Section 4 Developing potential measures

## Introduction

This section of the report focuses on developing a 'long list' of potential ASI measures that the public sector in Ireland, in partnership with the private sector, could pursue to reduce carbon emissions from

HGVs up to 2030 over and above what is already being done at a national level and what Ireland will be required to do by the EU.

It then reports on a high-level and qualitative evaluation of the measures in an attempt to highlight those that are most likely to be effective in reducing carbon emissions - as quickly as possible - while also taking account of potential economic impacts and practical (if not political and legal) deliverability issues.

## Avoid measures

A total of six avoid measures were identified and then evaluated.

As freight transport is a derived demand, it is inherently difficult to avoid the movement of freight without assuming a reduction in economic activity. The avoid measures are therefore generally designed to reduce the number of HGV trips (and HGV km) required to transport a given quantity of goods by increasing the efficiency of the demand for, or the supply of, road haulage.

As the road freight transport industry is highly competitive, the most effective avoid measures are those which allow road hauliers to reduce their costs. The widespread deployment of longer semi-trailers on longer distance trunk hauls for lighter but more voluminous goods, for example, would therefore make a contribution to reducing carbon emissions at little or no cost to the public purse.

Many of the avoid measures set out in this report involve the development of some infrastructure and/or regulatory approvals or involve collaboration between economic operators (who usually compete with each other). This makes them difficult to implement and slow to take effect.

## Shift measures

Given the timescale for the report of 2030, the 'long list' of additional Shift measures includes a single measure that might assist in shifting freight movements from road to rail by 2030.

## Improve measures

A total of fourteen 'improve' measures were identified and then evaluated. Within the ASI framework, the main requirement is for road freight to be 'improved' by making the transition from ICE propulsion to ZE propulsion. The major concern within the road freight industry about this transition is likely to relate to how to make the technological transition to ZE vehicles without losing competitiveness. Greater investment certainty is therefore likely to be welcomed by the industry. The public sector has a key role to play therefore in reducing the investment risk by, for example, providing a clear 'road map' in terms of the most appropriate technology and reducing the financial risk by maintaining or introducing grant schemes for the purchase of ZE HGVs and recharging/refuelling infrastructure.

Given its geography and the relatively short haulage distances and improving battery technology, battery electric HGVs appear to be the best option for Ireland in terms of technology and the Government could choose to emphasise its support for this technology. LGVs and most rigid HGVs used for urban and regional deliveries and collections can already be operated effectively using battery technology, although the larger HGVs used for inter-regional and international movements may be more difficult to decarbonise efficiently without further improvements in the battery technology and the deployment of very high-powered charging technology.

The key concern in Ireland, as elsewhere in relation to the use of battery electric HGVs, could be the ability of the electricity grid to provide the required power on a reliable basis in suitable locations for the road haulage industry (haulage depots, distribution centres, ports, major manufacturing plants, motorway service stations).

Another potential barrier to the take-up of ZE HGVs would be the supply of right hand drive vehicles, given that Ireland is a relatively small market for the manufacturers. This could be addressed by the public sector acting as the customer for large orders from the manufacturers, based on back-to-back leasing or debt finance agreements with Irish road hauliers.

### Hybrid measures

A total of four hybrid measures were identified in the long list and then evaluated.

The main hybrid measures are market-based measures which change the costs incurred by the road haulage industry and, by generally increasing costs (particularly for ICE vehicles) and for the whole market, provide a clear incentive to switch to ZE vehicles and secure some efficiencies by a (probably marginal) reduction in empty running.

These measures would generally increase costs for the road haulage industry (which would have to pass these costs on to the wider economy) but would provide strong incentives through market forces to reduce costs by switching to ZE HGVs. These measures would also, at least in the short to medium term, have less impact on the public purse than improve measures.

The individual measures have been assessed in isolation but should be implemented as cohesive packages of complementary measures.

# Section 5 Conclusions and areas for consideration

## Areas for consideration and further development: enabling conditions

At a national level there needs to be a strong focus on enabling conditions for the transition to zero emission HGVs, due to the nascency of the HGV decarbonisation market. Any measures should take account of the competitive nature of the road haulage industry and therefore seek to reduce the uncertainty and risk of introducing zero emission HGVs during a transition period in which diesel HGVs would be able to continue to operate - without additional measures – at a lower cost. This focus on enabling conditions needs to extend beyond physical infrastructure and vehicles.

| Road map for HGV decarbonisation |
| --- |
| Ireland should develop a road map for HGV decarbonisation which makes a clear distinction between classes of HGVs. It should express a preference for smaller HGVs – used for regional and urban logistics – to be battery electric. It should also explain that, although some shorter distance movements of larger HGVs are already suitable for battery electric operation, there remains some uncertainty about the most appropriate technology for the decarbonisation of longer distance movements by the largest articulated HGVs. Further measures to support HGV decarbonisation will therefore encourage relatively rapid decarbonisation of regional and urban freight flows, while allowing operators of larger HGVs a longer period of time to make the transition to zero emission vehicles.<br>Timescale: 2024-25 |

| Research and development (R&D) and standardisation |
| --- |
| Ireland should establish or engage in R&D programmes on the decarbonisation of HGVs by seeking to get involved as much as possible in existing EU-level HGV decarbonisation programmes or provide dedicated funding for zero emission HGV R&D. Developing standards for HGV decarbonisation on issues such as fast charging technology for HGVs and vehicle and battery maintenance should also be monitored and, where appropriate, adopted in Ireland.<br>Timescale: 2024-30 |

| Skills requirements for HGV decarbonisation |
| --- |
| Ireland should seek to get ahead of the skills requirements, as the large-scale deployment of zero emission HGVs is likely to require specialist skills for the implementation of the AFIR (when the required infrastructure will be developed throughout the EU) and additional deployment of recharging/refuelling infrastructure and for vehicle management and maintenance. An understanding of the skill requirements should start with an immediate assessment of the required skill quantities and skill gaps.<br>Timescale: 2024-25 |

In order for road hauliers to feel confident that they can make the transition to purchasing zero emission HGVs, there will need to be sufficient recharging or refuelling infrastructure in place. As well as public en route recharging/refuelling for longer distance movements (as required by the AFIR), there will mainly be a need for private depot-based and destination recharging/refuelling infrastructure. In order to assess the scale of need, there is also likely to be a need for the public sector to monitor the uptake of public and private infrastructure for zero emission vehicles.

| Monitor the required infrastructure for zero emission HGVs |
| --- |
| The AFIR targets will provide for an initial network of en route recharging/refuelling infrastructure, but this should be continuously monitored, especially if any additional measures introduced by Ireland hastens the deployment of zero emission HGVs. This monitoring should therefore cover not only public infrastructure but also private, depot-based or destination-based infrastructure.<br>Timescale: 2024-30 |

| Support for the development of private recharging/refuelling infrastructure for zero emission HGVs |
| --- |
| Consideration should be given to grants being made available to road hauliers and other commercial operators such as warehouse developers/operators, ports and large-scale manufacturers, to reduce the cost of developing depot-based and destination recharging/refuelling infrastructure for zero emission HGVs.<br>Timescale: 2024-30 |

Zero emission HGVs are more costly than diesel HGVs and, given that road haulage is highly competitive and the industry is in a slow transition towards zero emission fleets, any road hauliers switching to a zero emission fleet would be subject to lower cost competition from hauliers using diesel vehicles. This means there is a policy justification for public sector support for the purchase of zero emission HGVs during the transition period and for the public sector to seek to minimise the capital cost. In addition, a system of differential road pricing for HGVs would provide a further market-based incentive to switch to zero emission vehicles.

| Support for the purchase of zero emission HGVs |
| --- |
| Consideration should be given to grants being made available to road hauliers for the purchase of zero emission HGVs. The level of grant should seek to share the difference in cost between a zero emission and a diesel HGV, with the public sector potentially paying for a high proportion of that differential during the early stages of the transition to zero emission HGVs when there would be a large residual (and cost competitive) fleet of diesel HGVs .<br>Timescale: 2024-30 |

| Public sector procurement of zero emission HGVs |
| --- |
| Consideration should be given to the public sector acting as a bulk purchaser of zero emission HGVs from relevant manufacturers in order to secure priority for the production of right hand drive vehicles for use in Ireland and to reduce the unit cost for the operators and the taxpayer. The orders, |

which could be secured at public sector interest rates, should only be made based on back-to-back financing/leasing agreements with the operators.
Timescale: 2024-30

**Road pricing for HGVs**

Consideration should be given to the introduction of road pricing for HGVs, which would result in a charge being levied per HGV km and perhaps per journey, but with higher charges for diesel HGVs compared to zero emission HGVs. This would have the effect of encouraging a switch to zero emission propulsion, while also maintaining tax revenue for use of public highways from all vehicles even as the HGV fleet decarbonises. It would also involve a thorough review of the taxation of HGVs to adopt the principle of "user and polluter pays", taking into account the carbon tax element of Mineral Oil Tax and the end of the Diesel Rebate Scheme.
Timescale: by 2030

## Areas for consideration and further evaluation: regional/urban freight

As explained above, Ireland's policy towards HGV decarbonisation should make a clear distinction between regional/urban freight transport and longer distance freight transport, with 'stronger' measures being more appropriate for the former. Interim measures for the larger and heavier HGVs used for inter-regional and international movements may be required to allow these sectors to contribute to decarbonisation, without a particular zero emission technology being specified.

**Packages of decarbonisation measures for urban logistics**

Consideration should be given to developing packages of measures to achieve $CO_2$ reduction objectives from HGVs for each city in Ireland. These packages of measures, while designed to encourage – or even require - the use of zero emission HGVs, need to take account of the specific transport geography, demographics and economy of each city. The packages could include a mix of relatively strong regulatory measures to incentivise the use of zero emission HGVs, accompanied by mitigation measures to ensure that deliveries can be made, if necessary, using diesel HGVs for some of the door-to-door transport chain.
Timescale: by 2030

## Areas for consideration and further evaluation: inter-regional & international freight

For longer distance freight movements in larger HGVs, policy-makers should monitor the market closely to follow developments in the technology that might be most appropriate for the decarbonisation of HGVs in Ireland, given the EU's requirement in the AFIR for the provision of hydrogen refuelling infrastructure and the extent to which HGV battery costs may fall and higher-powered charging technology may improve to match existing HGV driver breaks. Consideration should also be given to allowing longer semi-trailers to be operated by hauliers on appropriate routes.

| Market monitoring |
| --- |
| Policy-makers should monitor the market closely to follow developments in the technology that might be most appropriate for the decarbonisation of the larger HGVs required for inter-regional and international road freight movements, taking into account Ireland's freight transport geography and logistics.<br>Timescale: 2025-28 |

| Longer semi-trailers |
| --- |
| Consideration should be given to allowing road hauliers to deploy longer semi-trailers to transport lighter cargoes on door-to-door trunking routes using appropriate roads and following risk assessments. This might require practical trials in Ireland, but key lessons could also be learned from the experience in Great Britain in order to speed up their deployment in Ireland.<br>Timescale: 2025-28 |

Given the importance of ports in Ireland's freight transport network, some specific measures should be considered for the sector to encourage the decarbonisation of freight flows between the ports and their hinterlands.

| Rail freight at Dublin Port |
| --- |
| Consideration should be given to the development of a more efficient rail connection and terminal at Dublin Port, subject to technical and commercial feasibility and therefore an appropriate demand-side assessment, to facilitate a degree of modal switch of international traffic directly to rail at the port.<br>Timescale: 2025 onwards |

| Tolls on diesel HGVs |
| --- |
| Consideration should be given to the tolling of diesel HGVs moving in and out of ports to encourage the greater use of zero emission traction for what can be relatively short distance inland movements. This should be applied to all of Ireland's Core TEN-T and unitload ports (Dublin, Cork, Shannon Foynes, Waterford, Rosslare and Drogheda) to avoid any potential distortion of competition.<br>Timescale: by 2030 |

# 1 INTRODUCTION

## 1.1 Study objective

Following on from its recommendations in the Annual Review 2023 on the transport sector, the Climate Change Advisory Council (CCAC) commissioned MDS Transmodal, in association with SYSTRA, to undertake research on decarbonisation of the freight sector in Ireland, to inform detailed discussion on this topic with the Council and in future Annual Reviews.

The overall aim of this study is to apply the Avoid-Shift-Improve (ASI) framework to identify and characterise specific measures for emissions reduction in inland road freight in Ireland with a scope to include primarily heavy goods vehicles (HGVs), including ways to measure the impact of such measures in terms of emissions reductions where possible[5]. This is intended to support the implementation of emission reduction measures, setting out clear actions and support the development of a pathway to achieve decarbonisation in the freight sector.

The ASI framework in relation to road haulage and the freight sector more generally can be characterised as follows:

- Avoid: reducing road freight vehicle kilometres travelled, principally by securing efficiencies in the sector;
- Shift: switching road freight to other modes, principally rail in Ireland;
- Improve: improving the emission level of freight trips that remain essential on the road network, principally by switching to zero emission HGVs.

In addition, some individual measures by their very nature encompass more than a single element of the ASI framework and these can be categorised as “hybrid” measures.

The focus of the research study was on domestic freight movements within Ireland rather than international movements to and from Ireland, essentially because the public sector in Ireland is less able to have a direct influence on international maritime and air transport. Within Ireland the focus is therefore principally on the road and rail modes of freight transport.

The focus was also on the movement of ‘heavy’ road freight transported in HGVs or by rail, as opposed to lower volume/lighter road freight transported in light goods vehicles (LGVs). This reflects the type of freight that is more difficult to decarbonise (transported in HGVs) because of the gross weight of the vehicles.

[5] For this reason, sources of data presented in section 2.2 have been referenced.

## 1.2 Structure of the report

The three main tasks in the project were to:

- Set out the freight transport context in Ireland in terms of historic road and rail freight volumes, existing national policy and the impact of Brexit on the market (section 2);
- Set out the likely future impact of EU legislation and technology on Ireland's road freight market (section 3);
- Describe and evaluate potential measures that Ireland could take to decarbonise 'heavy' freight flows, including setting out key areas for consideration and further evaluation (sections 4 and 5). In addition, four illustrative scenarios were run using the Ireland Freight Model (IFM)[6] to demonstrate the potential impact of some measures.

[6] A new multi-modal freight transport demand simulation model, which was developed by MDS Transmodal for the National Transport Authority in 2023-24.

# 2 FREIGHT TRANSPORT IN IRELAND

## 2.1 The freight transport market

### Introduction

Freight transport is needed because goods available at one geographical location are required at another location for processing, sorting or consumption. It is therefore an example of what economists call a derived demand as the transport is not required in itself, but only to satisfy another demand.

As a derived demand, the demand for freight transport does not come directly from consumer needs or wants but from private sector companies such as retailers, manufacturers and processors. However, such organisations are ultimately responding to consumer demand for goods and the level of demand for goods will be influenced by a range of factors, including the size of the population, the performance of the wider economy and changes in tastes and fashions over time.

Freight transport services are delivered almost exclusively by private sector companies which invest heavily in fixed infrastructure, such as port facilities, rail terminals, distribution centres, and mobile equipment such as trucks, vans, forklift trucks, ships and railway locomotives and wagons.

The private sector freight transport services need, however, to use publicly owned infrastructure such as road and rail networks.

The freight transport market in Ireland therefore includes three general types of operators:

- Users of freight transport services, which are (almost always private sector) shippers and receivers of cargo;
- Freight transport and logistics service providers (mainly in the private sector) and;
- The infrastructure networks which the freight transport services use, which are provided by public sector agencies such as Transport Infrastructure Ireland (TII) and Irish Rail.

### Road freight sector

The road freight transport market in Ireland provides an example of near perfect competition as there are many buyers and sellers operating in the market, road haulage costs are well-understood by buyers and sellers and there are few barriers to entry, particularly in terms of capital investment and regulation. In this environment, third party road haulage operators must be highly efficient and cost-

effective to remain profitable. The average return on sales is often reported as being 1-3% in any given year[7].

54% of the registered and taxed HGVs in Ireland are operated by 3,847 licensed road haulage operators that are allowed to offer haulage work for third parties; these are often referred to as road hauliers or, particularly if they also offer storage in warehouses, third party logistics providers (3PLs). While the average fleet size for third party operators is 5.9 vehicles, 70% of licensed operators have no more than three HGVs and 49% have only a single HGV[8]. This suggests that the third-party road haulage industry is fragmented and, although there are some hauliers whose fleets offer economies of scale, there are many family-owned businesses and owner drivers.

As well as the third-party operators, 46% of the total taxed fleet is operated by own account operators who are generally shippers or receivers (retailers, wholesalers, manufacturers, builder's merchants) who choose to operate their own HGVs but can only transport their own goods.

Shippers and receivers choose to out-source their road haulage requirements for several reasons:

- Economies of scale: larger 3rd party logistics providers (3PLs) can operate more efficiently due to, amongst other factors, managing large distribution centres shared between multiple shippers, more efficient HGV deployment (including greater opportunities to obtain return loads), shared back-office costs and the use of sophisticated IT inventory systems;
- Quality: 3PLs are perceived as offering a higher quality of service than in-house transport operations due to competition to win and retain business;
- Innovation: they can introduce new ideas and working practices, overcoming in-house management inertia, and removing restrictive working practices.

Information on the fleet of HGVs is provided in section 3.3 below.

### Rail freight sector

Rail freight in Ireland is a state-owned monopoly, with Irish Rail being the only rail freight traction provider in the country. Furthermore, Irish Rail is a vertically integrated operator, controlling both traction and the rail network infrastructure. This means there is no on-rail competition for traffic, only competition with the road freight industry.

Shippers or their logistics providers can decide to use rail where the freight flow is large enough to justify a regular trainload and where the mode can meet the required service levels such as transit time and frequency of service. If the freight flow is suitable for rail freight and an adequate level of

[7] *Road Haulage Industry: A Summary Report of UK M&A Activity.* The Corporate Finance Network in association with Hunter Gee Holroyd Chartered Accountants, 2019, page 6.
[8] Quoted in *Ireland's Road Haulage Strategy 2022-2031*, based on data from Road Transport Operator Licensing (RTOL)

service can be provided by rail, then the key decision-making factor has generally been cost. Rail is likely to have to be cheaper than road when the shipper is accepting service levels that are lower than could be provided by road.

## The political economy of freight transport

As well as using publicly owned and funded transport infrastructure, freight transport service providers (both road and rail) are also subject to the taxation and regulatory regimes that the public sector puts in place. Changes in taxation and regulation may lead to more efficient outcomes for the wider economy and society but will also affect the value of private sector investments that have been predicated on the existing fiscal and regulatory position. It follows that the public sector needs to understand the current landscape for freight transport, as future interventions to achieve the decarbonisation of road freight are likely to require a combination of fiscal incentives, public investment in infrastructure, changes in the regulatory framework and the application of appropriate planning policies.

Freight transport movements are meeting essentially an economic need, and the associated costs are driven by market forces that the users and providers of freight transport services experience. Transport economists call these user costs.

The same freight transport movements also have impacts on the environment, on other road users due to traffic congestion and on the quality of life and health of citizens. This means that an appropriate balance needs to be found between, on the one hand, economic objectives and, on the other hand, quality of life and environmental objectives. These wider impacts on society which are not fully incorporated into the process paid by shippers and receivers in the marketplace are known as externalities or non-user costs. The key externality in the context of this report are the cost of greenhouse gas emissions and their impact on climate change, while the other main environmental externalities are the impact on noise levels, air quality and biodiversity. In addition, economists also refer to other externalities such as the cost of traffic congestion, the cost of wear and tear on the highways infrastructure and the societal cost of road traffic accidents.

The freight transport industry is highly competitive, facilitated by the relative ease of entry into the road haulage market, which is the dominant mode of freight transport. This means that most individual providers of freight transport services have low margins and generally seek to minimise their costs to remain competitive in the marketplace. Any interventions by the public sector to seek the objective of decarbonisation will lead to a response from the private sector operators and any resulting changes in costs will be passed on, in the medium to long-term, to the industry's customers (shippers and receivers) and, ultimately, to the wider economy.

## 2.2 A statistical picture of freight transport in Ireland

### Definitions

Freight transport is usually measured in terms of freight tonnes lifted or freight tonnes moved. Tonne kilometres is generally regarded as the most relevant measure for defining modal share as it provides a measure of the amount of freight transport required irrespective of mode.

The combination of tonne kilometres and tonnes lifted allows the length of haul to be derived, as follows:

*Tonne Kilometres / Tonnes Lifted = Average Length of Haul in Kilometres*

Average length of haul (and the variation around the mean) is important in the context of policy development because longer hauls are more likely to be commercially viable for rail freight, which has, in general terms, a lower variable cost per tonne kilometre but a higher fixed cost (irrespective of distance) than road freight. In addition, length of haul is important in relation to the decarbonisation of road freight as the range of battery electric HGVs that are available on the market now have a more limited range (before recharging is required) than a diesel HGV. From a technological point of view, a zero-emission alternative to decarbonise the heaviest HGVs for the longer distance movements is also available using hydrogen fuel cells, assuming the electricity required to produce the hydrogen is from renewable sources.

As the tailpipe carbon emissions from HGVs are related to the distance travelled, a key measure of road freight transport is HGV kilometres.

### Total freight transport

Freight transport is often measured in terms of the mode of freight transport because this determines the impact in terms of carbon emissions and other externalities, the impact on transport networks and the relative economics of the freight transport movements by mode. As Ireland has no inland waterway network for the transport of freight, coastwise shipping between Irish ports is likely to be focused on bulk traffics such as oil products and construction materials, and there are only very low volumes of domestic air freight, the two main domestic modes are road and rail.

Tables 1 and 2 below show the modal shares for road and rail in tonnes lifted and tonnes moved respectively between 2017 and 2022. They show that 165 million tonnes were lifted by Irish registered vehicles in 2022, requiring 12.4 billion tonne kilometres (tkm) of freight transport (mainly in Ireland, but also overseas)

The modal share for rail in 2022 was 0.2% in terms of tonnes lifted and 0.7% in terms of tonnes moved, with road transporting the remainder. This is the lowest modal share for rail freight in the EU for any member state with a rail network.

**Table 1: Freight lifted by road and rail, 2017-2022**

Thousand tonnes

| Mode | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Modal Share 2022 |
|---|---|---|---|---|---|---|---|
| Road freight (HGVs) | 147,228 | 150,037 | 159,414 | 140,997 | 154,900 | 164,258 | 99.8% |
| Rail freight | 546 | 516 | 346 | 449 | 415 | 419 | 0.2% |
| Total | 147,774 | 150,553 | 159,760 | 141,446 | 155,315 | 164,677 | 100% |

Source: CSO (Tables TFA06 Road Freight Transport Activity and TCA02 Rail Traffic)

**Table 2: Freight moved by road and rail, 2017-2022**

Million tonne kilometres

| Mode | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Modal Share 2022 |
|---|---|---|---|---|---|---|---|
| Road freight (HGVs) | 11,760 | 11,538 | 12,405 | 11,383 | 12,484 | 12,383 | 99.3% |
| Rail freight | 100 | 89 | 72 | 74 | 70 | 81 | 0.7% |
| Total | 11,860 | 11,627 | 12,477 | 11,457 | 12,554 | 12,464 | 100% |

Source: CSO (Tables TFA06 Road Freight Transport Activity and TCA02 Rail Traffic)

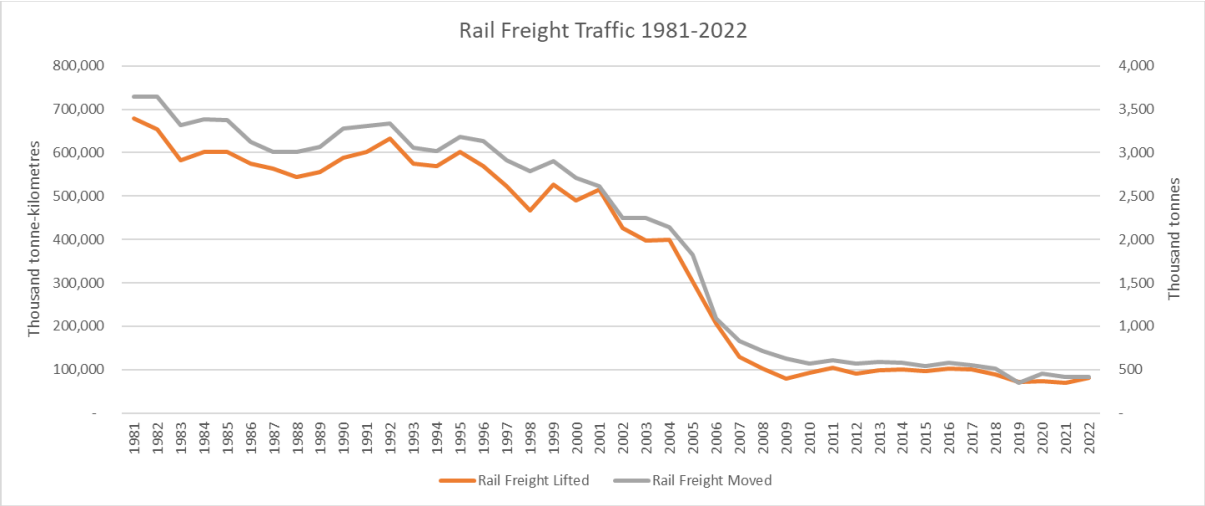
Road freight in Irish-registered HGVs amounted to 12,383 million tkm in 2022, lifting 164.3 million tonnes of goods. The average length of road haul was 75km.

By comparison, rail freight amounted to 81 million tkm in 2022, lifting 0.4 million tonnes of goods. The average length of haul was 193 km, about 2½ times that of road.

The mean length of haul for the two modes shows that:

- Rail freight, with its lower variable cost per kilometre but higher fixed costs (locomotive, wagons, specialist handling at terminals), is more likely to be competitive over longer distances;
- The average length of haul for HGVs is well within the effective range of some modern battery electric tractor units which are advertised as being “up to 300km”.

The chart below shows dramatic decline in rail freight tonnes lifted and moved since 1981, even if the mode has generally managed to maintain its traffic volumes over the last 15 years.




Source: CSO Table TCA02 Rail Traffic

The low modal share for rail is likely to reflect several factors:

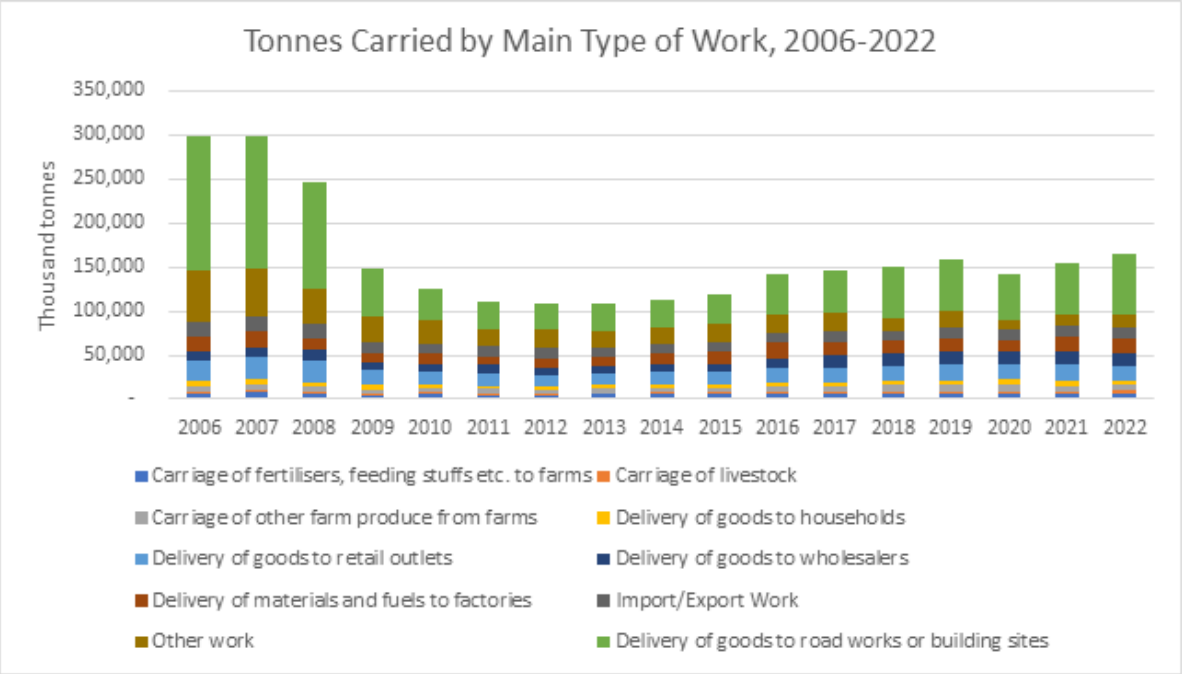
- The development of an extensive high quality motorway network in Ireland since the 1990s, but little parallel development of rail network capacity and capability, rail freight terminals, rolling stock and rail freight services in Ireland;
- Relatively high track access charges compared to other European railways for use of the network by freight trains (although these have been reduced by 75% in 2024) and much shorter trains are operated than are possible in continental Europe and Great Britain which affects the economics in competition with road transport;
- The road mode's inherent flexibility and cost-effectiveness, particularly over short distances and for smaller payloads;
- The ease of entry into the road haulage sector due to lower start-up costs and lower level of institutional and regulatory complexity compared to the railway industry, whereas there is only a single rail freight provider in Ireland;
- Distribution centre sites are not directly connected to the rail network, which necessitates a road haul between a rail terminal and a distribution centre (reducing the competitiveness of rail-based transport chains);
- Ports, which are a major source of traffic in a single location and already require a switch from the maritime to a land-based mode (which could be to rail rather than road) are either poorly connected to the rail network or not connected at all;
- Only relatively short distances are available in Ireland compared to the European continental mainland or even in Great Britain, whereas longer distances tend to favour the 'natural' economics of road freight.

## Road freight transport: introduction

Most road freight lifted and moved is carried in heavy goods vehicles (HGVs), which are defined as vehicles over 3.5 tonnes gross vehicle weight (i.e. the weight of the vehicle plus its maximum load)[9]. Although there are a variety of types and sizes of HGV, the main distinction is between a rigid vehicle (mainly used for deliveries in urban areas and in the construction industry) and an articulated tractor and trailer combination. The main type of HGV used for long distance road haulage (and therefore seen on motorways in Ireland) is the articulated combination of a tractor and 13.6-metre trailer.

## Road freight by main work done

The following chart shows the breakdown of tonnes lifted by HGVs by type of work between 2006 and 2022. It shows how important the construction industry is to the haulage industry, particularly until the financial crash in 2008-09, with the delivery of goods such as sand, gravel, cement and concrete to road works or building sites amounting to 67.3 million tonnes (41% of the total). The delivery of consumer goods to retail outlets (17.3 million tonnes or 11% of the total) and the delivery of materials and fuels to factories (17.0 million tonnes or 10% of the total) were also significant.

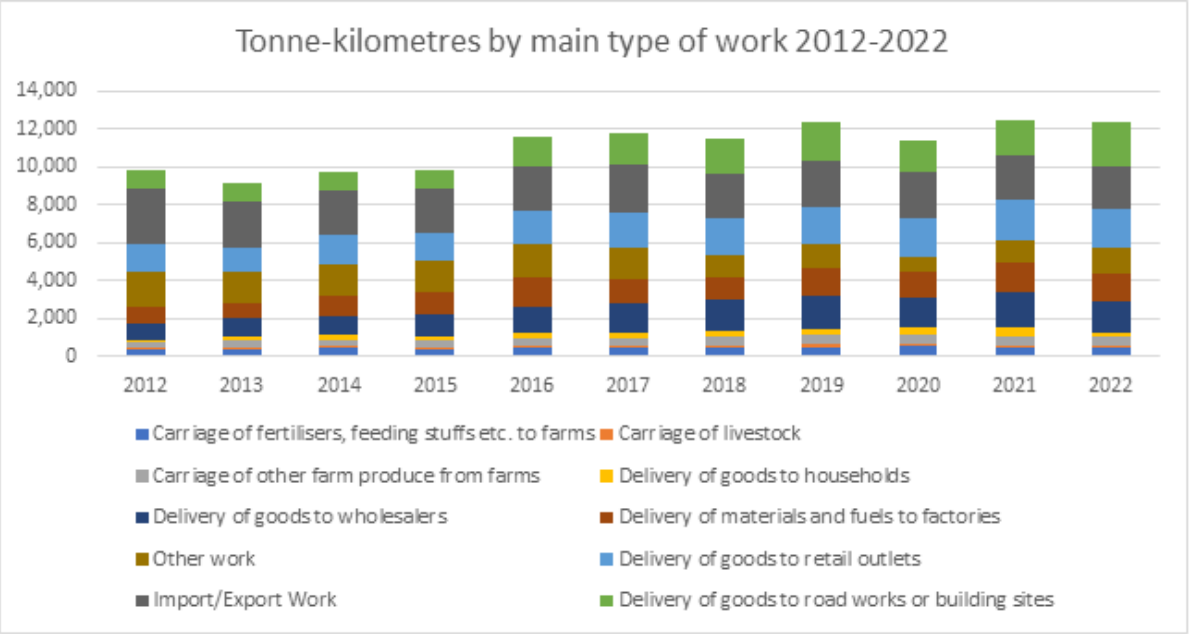



Source: CSO Table TFA06 Road Freight Transport Activity

The importance of the delivery of goods to roadworks or building sites is, however, less significant in terms of freight moved, representing only 19% of the total, but was still the most important at 2.3 billion tkm. Vehicles involved in import/export work (2.2 billion tkm) were the second largest

[9] This is, in general terms, the equivalent of an unladen weight of 2 tonnes or 2,000 kg (i.e. the weight of the vehicle without its payload, as used by the CSO in its Road Freight Statistics) assuming a permissible payload of up to1.5 tonnes.

contributors, representing 18% of the total freight moved, while those involved in the delivery of goods to retail outlets were third with 2.0 billion tkm or 16% of the total.




Source: CSO Table TFA06 Road Freight Transport Activity

The average length of haul by type of work is shown in Table 3 below. It shows how the longest hauls are for the relatively high value goods for import/export work via ports (181km in 2022) and the delivery of goods to wholesalers and retailers (122km and 117km respectively). Freight transport demand from agricultural and construction activities (often transporting lower value commodities that will not support high transport costs compared to the value of the goods themselves) require shorter hauls, with the latter being only, on average, 35km.

**Table 3: Average length of haul by main type of work 2017-2022**

Kilometres

| Main type of work | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| Import/Export Work | 201 | 215 | 209 | 217 | 183 | 181 |
| Delivery of goods to wholesalers | 118 | 114 | 122 | 123 | 129 | 122 |
| Delivery of goods to retail outlets | 110 | 107 | 103 | 111 | 119 | 117 |
| Delivery of materials and fuels to factories | 86 | 85 | 92 | 92 | 90 | 88 |
| Other work | 76 | 81 | 74 | 82 | 87 | 85 |
| Carriage of fertilisers, feeding stuffs etc. to farms | 68 | 64 | 73 | 77 | 66 | 69 |
| Delivery of goods to households | 62 | 53 | 55 | 61 | 66 | 65 |
| Carriage of other farm produce from farms | 65 | 65 | 67 | 65 | 80 | 58 |
| Carriage of livestock | 82 | 83 | 80 | 81 | 89 | 49 |
| Delivery of goods to road works or building sites | 34 | 34 | 34 | 32 | 33 | 35 |
| **Total** | **80** | **77** | **78** | **81** | **81** | **75** |

Source: CSO Table TFA06 Road Freight Transport Activity

The HGV km by main type of work done in 2021 and 2022 is set out in Table 4 below. 41% of vehicle km are involved in delivering final goods to retailers or wholesalers, whereas a further 6% relates to the delivery of final goods to households. 8% of vehicle km are related to the delivery of raw materials or semi-processed goods to factories and a total of 7% is related to agricultural activities. 16% relates to construction activity. Finally, about 12% of the total is related to generally longer distance international haulage (but also including to/from Northern Ireland).

**Table 4: Vehicle kilometres by main type of work done 2021-2022**

Million vehicle km

| Main work done | 2021 | 2022 | % change |
|---|---|---|---|
| Delivery of goods to retail outlets | 405 | 452 | 12% |
| Delivery of goods to road works or building sites | 253 | 277 | 9% |
| Delivery of goods to wholesalers | 269 | 264 | -2% |
| Import/Export Work | 194 | 211 | 9% |
| Other work | 197 | 211 | 7% |
| Delivery of materials and fuels to factories | 142 | 145 | 2% |
| Delivery of goods to households | 121 | 104 | -14% |
| Carriage of fertilisers, feeding stuffs etc. to farms | 47 | 47 | 0% |
| Carriage of other farm produce from farms | 37 | 44 | 19% |
| Carriage of livestock | 20 | 32 | 60% |
| Grand Total | 1,685 | 1,787 | 6% |

Source: CSO Table TFA06 Road Freight Transport Activity

The major changes between 2022 and 2021 both relative and absolute terms appear to involve a switch from home deliveries to retailers, which may indicate some return of demand from final consumers to traditional retailers after the Covid-19 pandemic.

## Road freight: empty running

Empty running – where HGVs are moving without any load – is often regarded as a key indicator of road freight efficiency because the movements appear to be "unnecessary". However, in practice, some empty movements of HGVs are necessary and are not indicative of inefficiency. For example, a truck delivering aggregates from a quarry to a construction site is likely to deliver its load of aggregates and then return to the quarry empty for another load. A road tanker is likely to start its deliveries of fuel to petrol stations completely full but will return empty to base.

Based on the statistics available from the CSO (Table 5), empty running for HGVs by Irish registered vehicles amounts to just over one-third of total HGV km. The fluctuations between years, from 34-37%, are likely to represent changes in the mix of trips by types of work in any given year, with the amount of construction activity (involving a higher degree of largely unavoidable empty running) likely to be particularly important.

**Table 5: Empty running, 2012-2022**

% HGV km

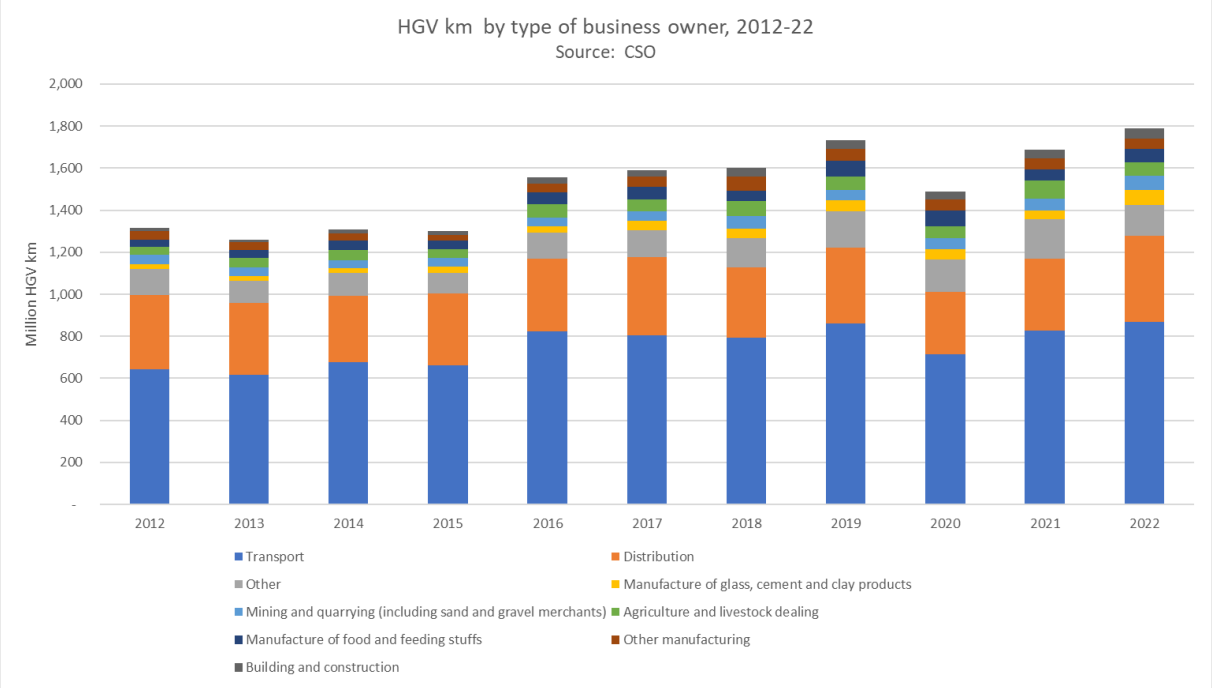
| Year | Empty running |
|---|---|
| 2012 | 34% |
| 2013 | 34% |
| 2014 | 34% |
| 2015 | 34% |
| 2016 | 34% |
| 2017 | 35% |
| 2018 | 36% |
| 2019 | 35% |
| 2020 | 33% |
| 2021 | 35% |
| 2022 | 37% |

Source: MDS Transmodal, based on CSO data (Table TFA01 Road Freight Transport Activity)

Own account operators may be more prone to empty running, mainly because of the nature of the operations but also because they are not subject to direct competition. Third party road hauliers will experience significant competition and so have a strong incentive to operate their vehicles as efficiently as possible to minimise their costs and maintain their competitiveness.

## Road freight by business owner

Total HGV km by Irish registered vehicles have increased from 1.32 billion HGV km in 2012 to 1.79 billion HGV km in 2022 due to a gradual recovery in economic activity after the 2008-09 financial crisis. The chart below shows the split of HGV km by business owner that is providing the haulage, with third party providers (called "Transport" and "Distribution" in the data) providing about 70% of all haulage in terms of HGV km. This suggests that most long-distance haulage, typically using articulated HGVs, is provided by third party hauliers.

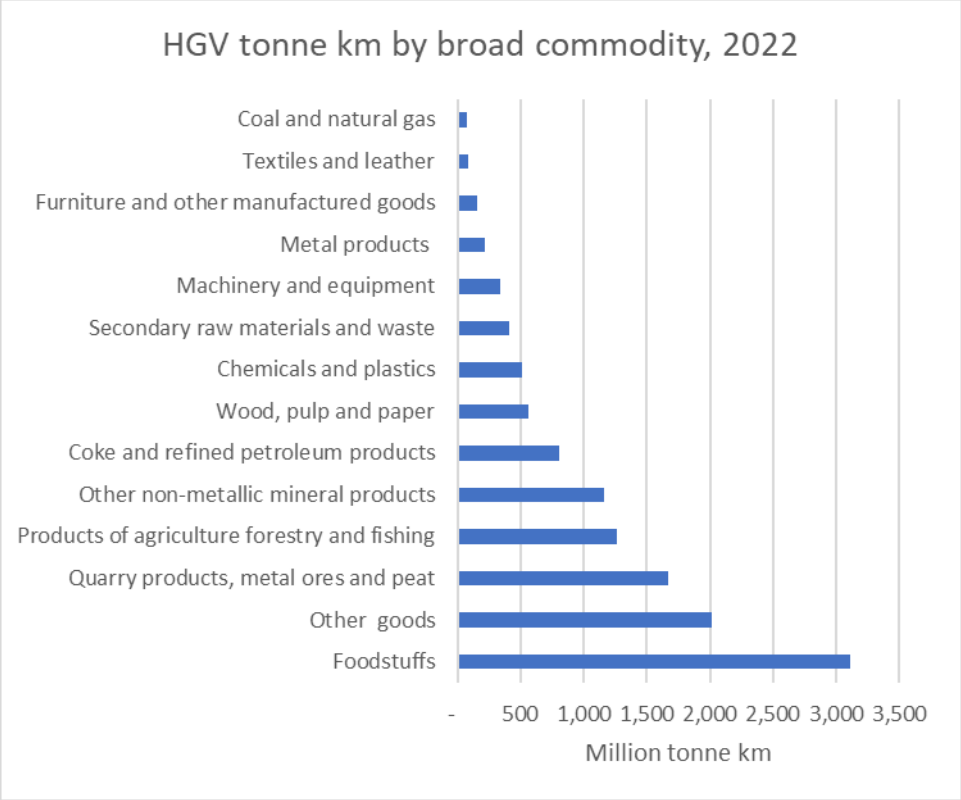



Source: CSO Table TFA01 Road Freight Transport Activity

Some of the business owners operating in the agricultural, construction and some manufacturing sectors, may require relatively specialised or high frequency haulage services which justify an investment in their own fleet of vehicles rather than hiring third party haulage.

## Road freight by commodity

The following chart shows the breakdown of HGV tkm in 2022 by broad commodity transported. It shows that the most important broad commodity is foodstuffs for final consumption, followed by "other" goods (which are likely to be a broad range of retail goods for final consumption) and then primary construction materials.




Source: CSO Table TFA20 Road Freight Transport Activity

## Road freight region of origin

Of the 164 million tonnes of freight lifted by Irish registered vehicles in 2022, 97.6% was domestic freight, 1.6% was to/from the UK (including Northern Ireland) and the remaining 0.8% was to/from the rest of Europe (see Table 6 below).

**Table 6: Tonnes lifted by country of origin and destination, 2022**

Thousand tonnes

| **Country of Origin/ Country of Destination** | Ireland | Non-EU countries | Other EU countries | United Kingdom | Grand Total |
|---|---|---|---|---|---|
| Ireland | 157,236 | 8 | 345 | 2,641 | 160,230 |
| Non-EU countries | 7 | 12 | 2 | 5 | 26 |
| Other EU countries | 314 | 7 | 918 | 93 | 1,332 |
| United Kingdom | 1,536 | - | 104 | 956 | 2,596 |
| Grand Total | 159,093 | 27 | 1,369 | 3,695 | 164,184 |

Source: CSO Table TFQ05 Road Freight Transport Activity

The average length of haul overall in 2022 was 75km (Table 7) but falls to an average of 65km for purely domestic movements within Ireland.

**Table 7: Average length of haul by country of origin and destination, 2022**

Kilometres

| Country of Origin/ Country of Destination | Ireland | Non-EU countries | Other EU countries | United Kingdom | Grand Total |
|---|---|---|---|---|---|
| Ireland | 65 | 1250 | 974 | 195 | 69 |
| Non-EU countries | 1,143 | 250 | - | 800 | 577 |
| Other EU countries | 1,000 | 429 | 461 | 806 | 612 |
| United Kingdom | 183 | - | 577 | 168 | 193 |
| Grand Total | 68 | 593 | 598 | 204 | 75 |

Source: MDS Transmodal, based on CSO Table TFQ05 Road Freight Transport Activity[10]

Table 8 shows the origins of road freight lifted by Irish hauliers in the period 2012-22 by NUTS3 region[11] and highlights the importance of traffic from the Dublin area to the rest of Ireland.

**Table 8: Tonnes lifted by region of origin, 2012-2022**

Thousand tonnes

| Region of Origin | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Dublin | 24,089 | 25,187 | 27,973 | 29,152 | 36,986 | 37,668 | 36,994 | 40,220 | 34,955 | 39,093 | 42,222 |
| Mid-East | 12,700 | 12,787 | 14,356 | 15,090 | 18,108 | 20,161 | 23,645 | 26,083 | 22,482 | 25,839 | 25,726 |
| South-West | 17,758 | 17,980 | 16,202 | 18,499 | 21,330 | 21,888 | 21,280 | 22,938 | 20,511 | 23,627 | 25,358 |
| Mid-West | 13,042 | 13,634 | 13,710 | 13,360 | 15,197 | 15,782 | 16,025 | 15,716 | 14,319 | 15,101 | 14,783 |
| South-East | 11,366 | 10,665 | 11,702 | 11,941 | 13,150 | 14,087 | 14,147 | 14,671 | 12,108 | 13,296 | 14,003 |
| Border | 8,147 | 8,269 | 7,431 | 8,785 | 12,144 | 9,592 | 10,258 | 9,912 | 9,918 | 9,613 | 13,186 |
| West | 8,625 | 8,249 | 8,408 | 7,825 | 9,011 | 11,958 | 11,759 | 12,399 | 10,608 | 12,600 | 11,169 |
| Midland | 5,425 | 5,990 | 6,432 | 6,538 | 7,871 | 8,377 | 8,830 | 9,379 | 9,174 | 8,497 | 10,789 |
| **Total** | **101,152** | **102,761** | **106,214** | **111,190** | **133,797** | **139,513** | **142,938** | **151,318** | **134,075** | **147,666** | **157,236** |

Source: CSO Table TFQ04 Domestic Road Freight Transport Activity

The Dublin NUTS3 area (Dublin City, Dun Laoghaire-Rathdown, Fingal and South Dublin) was the most significant origin zone for freight in Ireland, with 42 million tonnes lifted in 2022 (27% of the total). This is likely to reflect the concentration of population and consumption in the Greater Dublin Area, the concentration of distribution centres around the M50, and traffic from the Port of Dublin which is Ireland's largest port in terms of traffic handled.

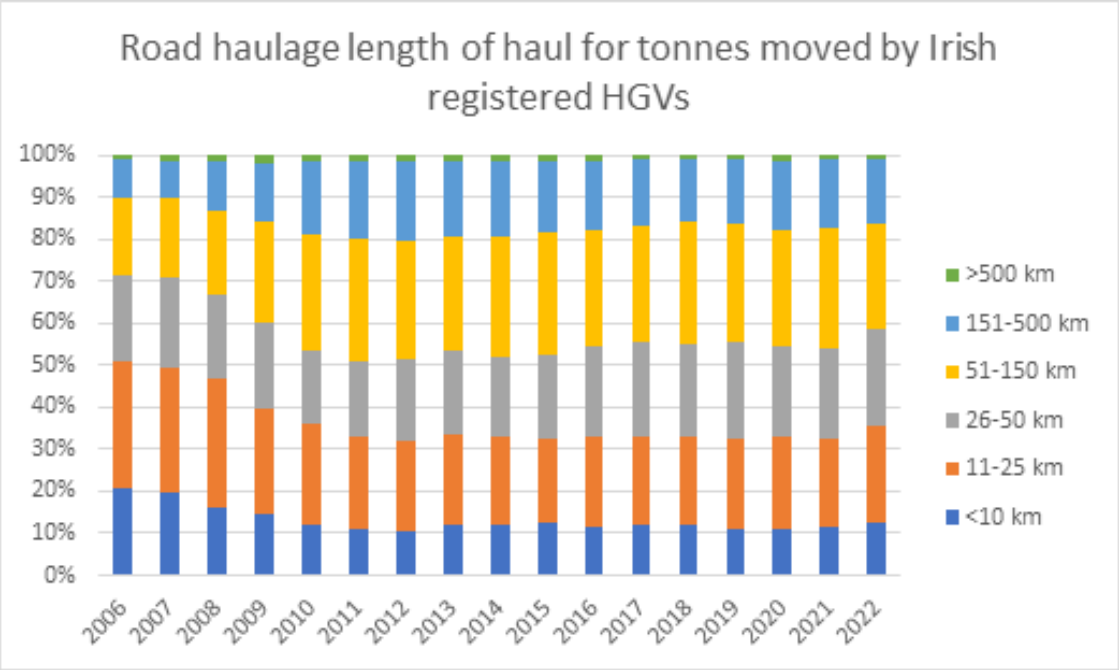
[10] The average length of haul has been calculated by dividing tonne kilometres by tonnes lifted from CSO table TFQ05

[11] This refers to the Nomenclature of Territorial Units for Statistics which was established by the EU as a common geographical classification that divides the territory of its Member States into geographical areas for statistical purposes. The classification is hierarchical, with NUTS3 corresponding to the Regional Authority Areas.

## Road freight be length of haul

While the average length of haul for an HGV by Irish-registered vehicles of 75km (and only 65km within Ireland) is well within the effective range of a modern battery electric HGV, the deviation around this mean has an important impact on the feasibility of using electric HGVs.

The chart below shows that over 80% of all tonnes moved was over distances up to 150km, which is well within the effective range of (say) 225km[12]. Almost 60% of tonnes moved were transported only up to 50km and would therefore allow a round trip back to a depot to be achieved with a single battery charge. This suggests that a high proportion of Ireland's road freight trips could switch to battery electric traction using existing technology, if there is an adequate supply of electric HGVs and charging infrastructure (high-capacity chargers at locations such as haulage depots, distribution centres and ports as well as at public service stations) on the National Roads Network.




Source: CSO Table TFA05 Road Freight Transport Activity

## Size and age of the registered HGV fleet

In 2023 Ireland has a total registered fleet of 2,191,000 road vehicles, of which 77,000 are HGVs (3.5% of the total). Of this total number of HGVs, 58,000 (75% of the total) are smaller rigid vehicles (up to three axles) used for local and regional distribution and 19,000 are the largest rigid vehicles (4 axles or more) and all articulated HGVs that are mainly used for longer distance trunking of goods within Ireland and for international transport[13].

[12] 75% of the maximum range stated by manufacturers on a single charge.
[13] Data compiled for the Greater Dublin Area Demand Management Study from Department of Transport data.

The average age of a car in the Irish fleet of road vehicles in 2023 is 8.6 years, whereas that of the average HGV is 11.5 years for smaller HGVs and 9.3 years for larger articulated HGVs (compared to 7.9 years in the UK for all HGVs). The greater age on average of the Irish registered fleet may be due to the structure of the Irish road haulage market, which has a large number of owner drivers and small family run/owned businesses; in addition, Ireland is a natural second-hand market for HGVs that were bought and operated from new in Great Britain by some of the major 3PLs. These large operators, particularly those working on high profile retailer or supplier contracts, will lease/buy new vehicles given the need for reliability (contracts will have reliability/non-delivery penalties) and these will then be disposed of after 3-4 years. After the British domestic market, Ireland offers a good market for second hand HGVs from the UK, given the structure of the road haulage sector and its position as the largest right hand drive market in Europe after the UK. The 3PLs will maintain the vehicles to a high standard to ensure reliability, so for a small Irish haulier they are able to acquire vehicles that are 3-4 years old and still in good condition but at a significant discount compared to new.

### Size of the operational HGV fleet

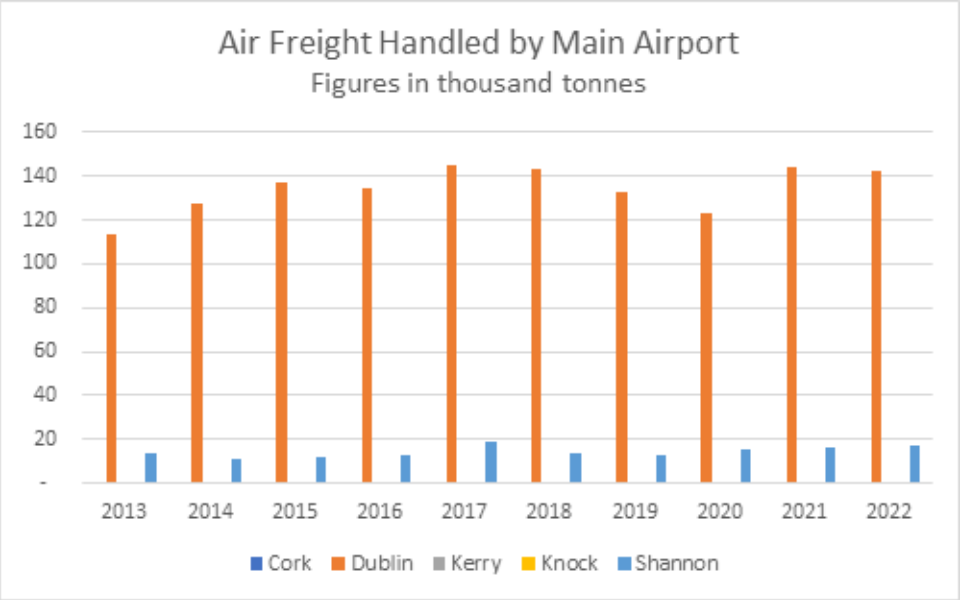
Having said that, a distinction needs to be made between HGVs that are registered and those that are also taxed for operation on the public highway. At the end of July 2022 there were only 42,000 HGVs that were taxed in Ireland (and therefore likely to be operationally active), which is only just over 50% of the total registered HGV fleet. This suggests there are many (probably older) HGVs which are either inactive or being used for movements off the highways network, such as on farms and in quarries. Of these 42,000 active HGVs, about 23,000 (54%) were operated by 3,847 licensed road haulage operators that can carry out haulage work for third parties, whereas the remaining 19,000 (46%) are operated by own account operators.

## Port and airport traffic

As an island which is relatively peripheral from the economic core of the EU and which has a very open economy, Ireland has a high propensity to trade, and a high proportion of its freight traffic will have passed at some point through a port or airport as international freight traffic.

## International freight via airports

Air freight is a specialist mode of freight transport, mainly for the inter-continental transport of relatively low volumes of very high value or urgent goods and documents. It is much more expensive per tonne than other freight transport modes and is therefore only used where the cargo needs to be transported very quickly (in days rather than weeks, for example, between China and Ireland).




Source: CSO Table TAA03 Passengers, Freight and Commercial Flights

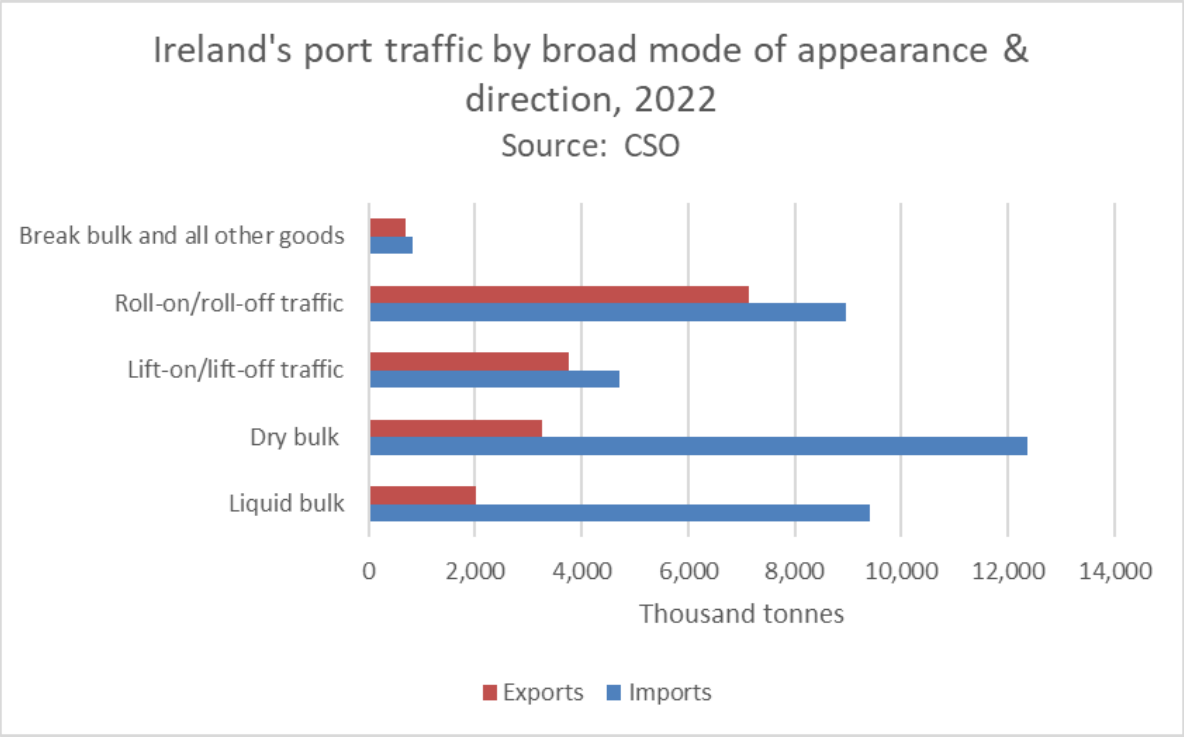
In 2022 all Irish airports handled some 0.15 million tonnes of international air freight, compared to 53.16 million tonnes of traffic via Ireland's sea ports. Air freight therefore represents only about 0.3% of Ireland's international freight traffic by weight and this is more relevant than value for freight transport because the weight of cargo determines the amount of freight transport required for inland distribution.

Most air freight handled at Irish airports is carried in specialised containers in the belly holds of wide-bodied aircraft operating on inter-continental routes. For this reason, Dublin Airport, with its network of intercontinental services, is by far the most important Irish airport for freight with 137,000 tonnes

and a market share of 90% in 2022. Otherwise, only Shannon Airport (with 15,000 tonnes) handles any significant freight volumes.

## International freight via ports

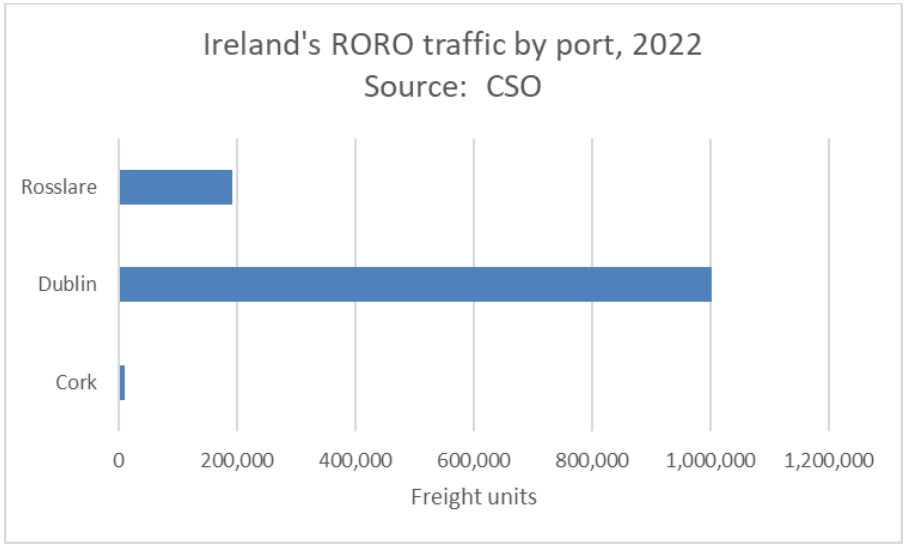
In 2022 Ireland's ports handled 36.3 million tonnes of inwards freight and 16.9 million tonnes of outwards freight or 53.2 million tonnes in total. Ireland's port traffic by broad commodity in 2022 is shown below.



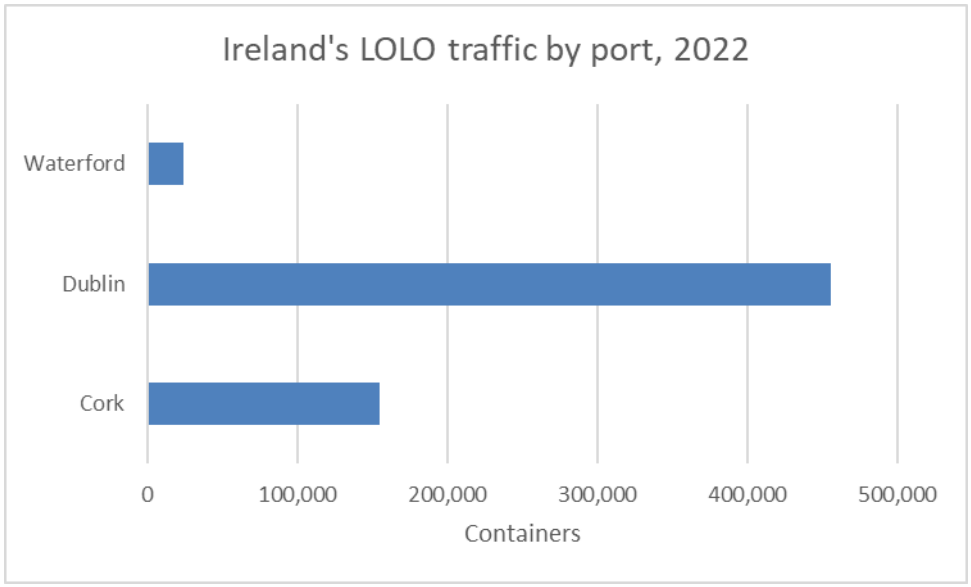

Source: CSO Table TBA02 Tonnage of Goods Handled at Irish Ports

In general terms, bulk traffics (both liquid and dry) either do not leave the vicinity of the port at all (e.g. crude oil imported as feedstock for an oil refinery) or are not distributed far inland. Less bulky goods are often transported in trailers or in containers and handled at ports as roll-on roll-off (RORO) and load on load off (LOLO) cargo respectively and it is this unitised cargo which is more likely to be distributed some distance inland.

The following charts show the volumes of RORO and LOLO traffic in units handled at each Irish port in 2022.




Source: CSO Table TBA12 Passenger and Commercial Vehicles (Roll On/Roll Off) Handled




Source: CSO Table TBA05 Maritime Container Cargo (Lift On/Lift Off) Handled

These unitised cargoes are almost always distributed inland by road, but Ireland's international freight connections by sea are relatively sustainable because the cargo arrives mainly by either:

- LOLO in feeder container ships from (say) Rotterdam to a port reasonably close to its inland origin/destination (mainly Dublin or Cork); or
- RORO vessels to east coast ports such as Dublin Port and Rosslare, which are located close to the major population centre and the largest concentration of distribution centres in Ireland.

### Emissions from road freight

According to Ireland's Road Haulage Strategy, the transport sector is responsible for 17.7% of Ireland's overall GHG emissions. In 2021, this was approximately 10.9 megatonnes (Mt) of carbon dioxide equivalent ($CO_2e$). A large majority (94%) of transport emissions are from road transport, about half of which are from private cars. HGVs make up the second largest share of emissions by mode at 20%, while LGVs make up 18% of road transport emissions.

Table 9 below shows a breakdown of $CO_2$ emissions by commercial vehicle sub-sector. Even though LGVs make up a larger portion of the fleet of commercial vehicles, HGVs contribute more to $CO_2$ emissions.

**Table 9: Commercial vehicle $CO_2$ emissions for HGVs and LGVs in $MtCO_2$**

| Mode | 2012 | 2018 | 2021 | 2022 |
|---|---|---|---|---|
| Road freight (HGV) | 1.882 | 2.160 | 2.309 | 2.281 |
| Road light goods vehicle | 0.982 | 1.005 | 0.798 | 0.877 |
| Total | 2.864 | 3.165 | 3.017 | 3.158 |

Source: SEAI Energy in Ireland 2023 Report

## 2.3 Existing national freight transport policy

### Introduction

This section of the report focuses on the extent to which existing policy at a national level is seeking to reduce carbon emissions from freight transport in Ireland. It sets out the key policies that are relevant to the freight sector and seeks to highlight those which are most relevant to decarbonisation.

### Ireland's Road Haulage Strategy 2022-2031

The most important and directly relevant policy document is **Ireland's Road Haulage Strategy 2022-2031** (Department of Transport, 2022), which sets out the strategic and policy direction for the haulage and heavy goods road freight sector from 2022 to 2031. In line with the Programme for Government, the key objectives of the strategy are:

- Generating efficiencies and improving standards;
- Creating secure employment; and
- Assisting the sector to move to a low carbon future.

The strategy sets out the measures and supporting policies which are needed to deliver these objectives and conforms with Ireland's Climate Action Plan and decarbonisation action plan.

Under *Sustainability and decarbonisation*, the strategy highlights that the transport sector is responsible for 10.9 megatonnes of carbon dioxide equivalent in 2021, which represented 17.7% of Ireland's total greenhouse gas (GHG) emissions. Of these total transport emissions, GHG emissions from HGVs and LGVs account for 20% and 18% of total transport GHG emissions respectively[14].

The strategy argues that the road freight sector faces considerable challenges in abating emissions in the short to medium term (due to alternatives to diesel powertrains not yet being widely available), which means that the overall burden will therefore fall mainly on the private car sector during the period up to 2031 and a *avoid-shift-improve* approach will be required from the road freight sector in the interim.

The Climate Change Action Plan 2021 (CAP21) set a target of 3,500 low emission HGVs operating by 2030, which would represent just under 9% of the number of HGVs taxed in Ireland[15]. The strategy states that, "This target recognised that a large majority of the fleet in Ireland will still be (ICE) vehicles in 2030".

In CAP23 a complementary target of 30% of all sales of Medium and Heavy-Duty Vehicles (i.e. HGVs and buses) should be zero emission by 2030 was added and the strategy concludes that, "While this is an ambitious target, it recognises that in 2030 the majority of sales of new HGVs will likely still be internal combustion engine ICE vehicles". In CAP23 it was agreed that the transport sector would be required to deliver a 50% reduction in emissions from the 2018 baseline, but respondents to a public consultation "emphasised that the road freight is a sector which will be harder to abate and requested realistic transition deadlines in which to make the necessary changes".

While there has been a high level of uncertainty over the technological pathway for the decarbonisation of HGVs, the strategy states that, "this pathway is now becoming clearer, with electric trucks emerging as the preferred technology" and that, "Hydrogen as a fuel is not expected to play a significant role in the decarbonisation of the road freight sector before 2030".

Announcements by truck manufacturers about their projected sales of electric HGVs and reported in the strategy are that:

- Scania expects 50% of its sales to be electric in 2030 (with 10% in 2025);
- Renault Trucks expects 35% of its sales to be electric in 2030 (with 10% in 2025);
- Daimler expects 60% of its sales to be electric in 2030.

[14] By comparison private cars account for 54% of emissions from transport. In addition, some of the emissions from LGVs would relate to servicing activities and private use rather than for the movement of freight.
[15] Concerning HGVs, The Climate Action Plan 2024 reinforces the target of 3,500 HGVs as well as a target of a 30% zero-emission share of new heavy duty vehicle registrations.

Based on these announcements, the European Federation for Transport and Environment has estimated that the worst-case scenario for the number of zero emission HGVs on European roads in 2030 is 480,000, while the best case is 630,000.

The pace of transition to zero emission HGVs in Ireland is less clear, but the strategy concludes that diesel HGVs are still expected to make up most of the HGV fleet in 2030 and it notes that it will take time for battery-electric HGVs to become widely available and affordable. Therefore, "interim non-technological solutions and complementary measures will need to be implemented in the short- to medium-term to meet the required emissions abatement targets".

The strategy states that the right mix of policy, regulatory and incentive measures will need to be put into place to support the transition to battery-electric HGVs and the following interim measures will be needed to reduce GHG emissions:

- Biofuel blending, where renewable fuels are mixed with liquid fossil fuels, will be an important measure in the short-term;
- Biofuels – principally in the form of hydrotreated vegetable oils (HVO) and biomethane – will remain a core transitional measure for the medium-term reduction of GHG emissions, but there are affordability and availability issues in relations to these fuels;
- Reducing demand for freight transport;
- Mode shift;
- Increasing logistics efficiency by reducing traffic congestion;
- Eco-driving to reduce emissions per HGV kilometre.

The strategy notes that "switching from heavy-duty to sustainable mobility transport options such as electric LGVs, e-cargo bikes and shared delivery service" via consolidation centres can reduce emissions of all types in urban areas.

While consultation with the road freight industry showed that it regards decarbonisation as a high priority there was a "need for further Government support and for the creation of a roadmap detailing the steps necessary to help decarbonise the sector in a way that provides greater levels of business certainty".

**What has already been achieved?**

At the end of 2021 there were 90 low emission HGVs within the overall Irish fleet[16], representing 2.6% of the target of 3,500 low emission vehicles by 2030. The strategy recognised that "significant uptake will be required over the coming years".

[16] Based on vehicle registration data available to the Department of Transport.

Measures already introduced include the following:

- Biofuels, which in 2022 were 7% of the fuel used by HGVs (B7) but are required to reach 20% (B20) by 2030 (requiring the use of HVOs); a report for the DoT and published in October 2022 suggested that the B20 target should be achieved and could even be surpassed[17].
- Eco-driving, implemented through driver training supported by telematics can achieve 2-15% savings in carbon emissions. The Climate Action Fund is providing a grant of up to 30% of the cost of installing smart telematics hardware and software in eligible vehicles.
- The Alternative Fuels Heavy Duty Vehicle (AFHDV) Purchase Grant Scheme: since March 2021 this scheme incentivises the purchase of low emission HDVs, providing 40-60% of the price differential between the alternative fuel vehicle and its diesel equivalent. Some €3 million per annum has been provided between 2021 and 2022 and a total of 57 HGVs have been purchased with support from the scheme. The scheme is available for CNG, LNG, battery electric, PHEV and hydrogen fuel cell electric vehicles, but it is likely that grants for CNG and LNG HGVs will be phased out.
- The Low Emission Vehicle Toll Incentive (LEVTI) Scheme: CNG, fuel cell electric and battery electric HGVs have been given a 50% reduction in tolls up to an annual cap of €1,000 per vehicle[18].
- The Zero Emission Vehicles Ireland (ZEVI) office was launched in July 2022 with the objective of incentivising the uptake of electric vehicles, including HGVs, and delivering the infrastructure to support the uptake of EVs, including the development of high-capacity charging points along the Irish road network.
- Global Memorandum of Understanding on Zero Emission Medium and Heavy-Duty Vehicles: a global commitment, including Ireland, to achieve a minimum of 30% of all new MHDV sales (bus and HGV) to be zero emission in 2030 and 100% in 2040. This would mean that 900 new MHDVs (HGVs and buses) would need to be zero emission in out of a total of about 3,000 vehicle sales in 2030; this commitment is designed to give a clear market signal to Irish hauliers and the manufacturers on the switch to zero emission HGVs.
- Improving Urban Logistics and Last Mile Delivery: encouraging a switch from HGVs to sustainable transport options such as electric LGVs, e-cargo bikes and shared delivery services which can reduce emissions but also "reduce unnecessary delays for drivers (whether with

[17]Byrne O'Cleirigh for Department of Transport & The National Oil Reserves Agency. *A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets*, 2022. https://www.gov.ie/en/publication/89e44-report-a-review-of-requirements-and-constraints-on-biofuels-in-ireland-arising-from-red-ii-and-national-targets-prepared-by-byrne-ocleirigh-for-department-of-transport-the-national-oil-reserves-agency/#

[18] This scheme was to conclude on 31st of December 2023. It was introduced in 2018 as an extension to the previous Electric Vehicle Toll Incentive Scheme. Eligible fuel types depended on the vehicle; LGVs were eligible if they were BEV, FCEV, or PHEV while for HGVs this was extended to CNG and LNG fuelled vehicles. Upon its conclusion, investments will continue but will instead focus on supporting EV charging infrastructure.

loading/unloading or being stuck in congestion". The strategy regards electrification as already being commercially viable for urban deliveries and collections[19].

**Actions proposed in the strategy in relation to decarbonisation**

The actions proposed in the strategy in the short and medium terms are summarised in Tables 10 and 11 below.

**Table 10: Short term actions relevant to decarbonisation**

| Action numbers | Action | Comment |
|---|---|---|
| 4 | Advocate for and support EU regulations that promote more stringent HGV emissions | Provides regulatory safeguards to ensure that manufacturers produce a proportion of zero emission vehicles (EU level) |
| 5 | Certification of eco-driving schemes | Sets standard for and validates the approach of courses, which should encourage take-up. |
| 6 | Feasibility study on freight consolidation centres | Need to demonstrate the benefits and costs of the consolidation centre concept and consider whether the state should be involved. |
| 7 | Study on taxation of fuel | Considering feasibility of a 'green rebate' for tax on biofuels. |
| 8 | Consider introduction of Longer Semi-Trailers | Increases the payload and can reduce vehicle km, particularly on trunk routes. |
| 9 | Consider funding for digital route optimisation and consolidation technologies | Likely to be available already for larger-scale operators but uptake probably lower for small-scale operators. |

**Table 11: Medium term actions relevant to decarbonisation**

| Action no. | Action | Comment |
|---|---|---|
| 10 | Support ambitious EU Green Deal | EU level measure, so not within the complete control of Ireland |
| 11 | Support ZEVI office from the perspective of HGVs, leading to 2025 EV Infrastructure Strategy Review | Short term focus on cars and LGVs up to 2025, so more emphasis needed on HGV charging infrastructure from 2025 |
| 12 | Update National Policy Frameworks on the use of alternative fuels in transport | Provides policy support for measures |
| 13 | Maintain AFHDV Purchase Grant Scheme | Maintain scheme until at least 2027 and look to increase funding available to support fleet renewal |
| 14 | Develop national Hydrogen Strategy | Including consideration of how this fuel can play a role in the decarbonisation of long-distance road haulage, particularly after 2030 when offshore renewable energy is more likely to be available to produce green hydrogen. |

[19] This has been identified as an approach that can offer pollution-reducing benefits as well as efficiency improvements. Existing initiatives include e-cargo bike pilot schemes by local authorities, and An Post's investments in its electric fleet establishing it as the first postal service to operate zero-emission delivery in a capital city. Shared deliveries may, in practice, be more difficult to implement due to commercial sensitivities.

**Road infrastructure and user charging**

Existing HGV traffic (and projected HGV traffic from the TII National Transport Model), suggests there is expected to be growth in traffic around Dublin, Cork, Limerick and connections to/from Ireland's

ports. The important role of HGV rest stops, parking areas and refuelling/recharging points is noted, which will be particularly important in the future given the need for an EV recharging network and the proposed hydrogen strategy.

The strategy argues that road user charging has two important goals, namely generating income to support maintenance/investment and managing demand. It points out that, as excise duties from diesel vehicles fall, road user charging may form part of a future funding system therefore further phases of the Better Road User Charging Evaluation (BRUCE) project should be advanced from the end of 2023 to post 2030[20].

**Integrated transport planning and intermodal transport**

The strategy emphasises that transport planning and intermodal transport have a key role to play in ensuring that national decarbonisation commitments are met. There should be a strong incentive to encourage a shift away from road-based modes. The strategy notes that Ireland is particularly dependent on the road network which accounts for 99% of freight movements, with only Cyprus and Malta having a higher share, while lacking railway networks.

Suggested measures include the NTA leading the development of Strategies for Sustainable Freight Distribution for the Five Cities (Dublin, Cork, Galway, Limerick and Waterford) and carrying out market analysis of multimodal freight terminals to ensure the development of at least one terminal in each urban node.

## Rail freight in Ireland

Two key policy documents have been published about rail freight in the last two years, namely the All-Island Strategic Rail Review and the Rail Freight 2040 Strategy.

**The All-Island Strategic Rail Review**

The All-Island Strategic Rail Review (Arup and MDS Transmodal on behalf of the Department for Transport and the Northern Ireland Department for Infrastructure, 2023) was developed to inform

[20] The BRUCE project is being undertaken by TII as current PPP-operated tolled roads will expire in the coming decades leading to a gap in funding. This project is cited as "a decision-making process to determine future options for user charging, operation and maintenance of the National Road Network in Ireland" (Road Haulage Strategy, 2022-2031).

policy and future strategy for the railways on the island of Ireland. It examined how the island's railways are currently used, what role rail could play in the future, and how the island's railways could better serve its people. The Review also set out to show how the railways can contribute to decarbonisation and greater use of sustainable transport, as well as improving accessibility and securing balanced economic development.

The strategy concluded that the railways in Ireland are currently unable to achieve high passenger and freight mode share compared to other comparable European countries. This is because there are significant gaps in the rail network's coverage and Ireland has the lowest level of electrified railway in the EU, which limits the potential for more cost effective as well as less carbon intensive rail freight services. Current infrastructure limits opportunities to deliver cost-effective rail freight services in competition with road freight. The Review suggested a range of measures that would increase the capacity and capability of the network to accommodate additional rail freight services, but also made recommendations specifically on freight, as follows:

- Develop a sustainable solution for the first mile/last mile rail access to Dublin Port, as without this connection there are limited options for growing rail freight in Ireland; this is due to the port having the latest volume of unit load freight in Ireland at an individual location.
- Reduce track access charges for freight services, which are relatively high and represent a major barrier to growth;
- Strengthen rail connectivity to the island's busiest ports, including Rosslare; and
- Develop a network of inland terminals close to major cities on the rail network.

**Rail Freight 2040 Strategy**

The Rail Freight 2040 Strategy (Irish Rail with AECOM, 2021) sets out a strategy, following extensive stakeholder consultation and analysis of potential demand, to bring about a sustainable rail freight system for Ireland while also achieving wider societal and economic benefits. It aims to deliver growth in both rail freight volumes and market share, while also contributing towards Ireland meeting its environment and sustainability goals (51% reduction in GHG emissions by 2030 and net-zero by 2050). While it only covers Ireland, its implementation will impact on the viability of rail freight across the island of Ireland and is described in the Foreword as 'an ambitious vision positioning rail at the centre of Ireland's freight transport system'.

The document notes that Irish Rail's rail freight business is required to operate on commercial terms without state subsidy (though current annual losses have averaged around €1.5 million since 2011). The current rail freight business was based on three flows in 2021, as follows:

- Zinc and lead concentrates from Tare Mines to Dublin Port (3 trains per day);
- Intermodal traffic from Ballina to Dublin Port (6 trains per week); and
- Bulk wood from Ballina to Westport and Waterford (2-3 trains per week).

A new intermodal service for XPO Logistics from Ballina to Waterford subsequently commenced in July 2021.

The strategy argues that a new approach is needed because:

- The transport and logistics sector in Ireland is of operational and strategic importance. It was the fastest growing sector in 2018 (growing by 11%) and is the enabler of success of other businesses and sectors.
- Project Ireland 2040 forecasts a population increase of 1 million with an additional 600,000 people in employment. This level of growth will place significant demand on transport systems, logistics services and existing infrastructure.
- HGVs and LGVs account for 20% of all GHG emissions from transport in Ireland (with rail being just 1%).
- GHG emissions from HGVs are 112g per tonne-km, whereas rail is only 18g per tonne-km.

Despite the sustainability advantages of rail freight, the strategy notes that rail freight volumes have fallen from just under 4 million tonnes in 1981 to around 0.3 million tonnes currently.

The vision for rail freight included in the strategy is that by 2040 Ireland will have a thriving rail logistics system which supports supply chains, the economy, society and the environment. The key strategic objectives are stated as being to:

- Ensure economic benefit – moving away from a short-term model, with Government support where a sound economic case can be made.
- Reduce environmental impacts – as per benefits noted above
- Encourage intermodal rail – convert large trunking flows to rail and grow modal share.
- Develop bulk traffics.
- Enhance the quality of life and well-being.
- Increase the safety of freight movements.
- Achieve financial stability – to allow for investment in new facilities, rolling stock and infrastructure.

A fundamental step in the development of the strategy was exploring the challenges faced by Ireland and how rail may contribute to addressing them. In general terms under Project Ireland 2040, the railway is required to take a leading role in the fulfilment of economic growth. However, through a combination of high track access charges (Ireland has the highest track access charges in Europe at €0.0077 per gross tone-km), low payloads, the absence of distance-based road charging and low HGV taxes, most journeys are more cost competitive by road.

The strategy recognises that future rail freight growth will need to be generated from modal shift from the road haulage sector. An analysis of current road freight activity within Ireland and the level of traffic at the Tier 1 ports was conducted (using CSO freight statistics and port O-D data) to quantify current and estimated future road-based freight demand. This analysis has identified those corridors

where demand could justify future rail-based services. It subsequently established that demand for future rail freight services is likely to be focused at the Tier 1 ports (Dublin, Cork and Foynes) and along the following region-to-region pairs (where current road freight flows are the greatest):

- Greater Dublin area – South West (Cork);
- Greater Dublin area – Mid West (Limerick);
- Greater Dublin area – West (Galway);
- Greater Dublin area – Border (Sligo).

Dublin is identified as a key source of demand, both in terms of domestic demand and because it also has the busiest port in the country.

The document concludes that the potential for an increase in intermodal traffic in Ireland is significant based on the projections for growth at Ireland's Tier 1 Ports, projected increases in HGV traffic up to 2040 and an increased focus on more sustainable modes of transport. To support and facilitate rail freight growth (at the locations and corridors identified above), the strategy outlines actions in the following five key areas:

Enhancing connections with seaports:

- A more modern and efficient facility within the Dublin port estate (it recommends a study on the bast way of enhancing rail services) and new connections to the ports of Cork (Marino Point) and Foynes (to be led by Iarnrod Eireann).
- The existing active intermodal terminal within Waterford port is noted.

Developing a network of intermodal terminals:

- The development of new 'Strategic Rail Freight Terminals' at Dublin (Eastern Gateway) and Limerick Junction (Western Gateway). These will be similar to developments elsewhere in Europe, combining large scale warehousing, intermodal terminal facilities and access to the main road network at one location.
- Smaller scale 'Tactical Rail Freight Terminals' or 'TRFTs' are proposed for Cork, Galway and Sligo to enable sustainable intermodal rail freight services to/from their respective regions. TRFTs are intended to be smaller than SRFIs, being stand-alone intermodal terminals located close to industrial areas.
- A construction materials terminal in Dublin.

Addressing rolling stock requirements:

- Investing in a fleet of new intermodal and bulk wagons (the intermodal wagons will be capable of conveying 45ft pallet-wide shipping containers and reefer boxes, and capable of running at 120km/h) and;
- New bi-mode electric-diesel locomotives to replace the existing but ageing traction (Class 071).

Network developments:

- Development of passing loops – growing passenger and freight volumes on a predominantly single-track network will be increasingly difficult. More extensive double-tracking and new passing loops will therefore be developed at key points on the network.
- Dedicated freight paths will be developed within the working timetable to support intermodal freight services.
- Connecting the rail network to industrial premises.

Policy initiatives:

- Lowering track access charges (TACs) – the document notes that Ireland has some of the highest track access charges in Europe (€0.0077 per gtkm). A review of track access charges will be undertaken, including identifying the funding required to lower charges for freight services[21].
- Funding will be sought from domestic Government budgets to meet the cost of capital investments. This will be supported by contributions from the European Commission and private sector funding will also be secured for new facilities and rolling stock.
- Seek to establish a Mode Shift Benefits scheme (to provide an operating subsidy for rail freight services).
- Establish cross-border rail services with Northern Ireland.

## Electric Vehicle Charging Infrastructure Strategy 2022-2025

This strategy outlines a minimum provision of motorway charging infrastructure dedicated to HGVs by 2025. Collaboration and engagement with the haulage sector and other key stakeholders (including ESBN and EirGrid) will be key to planning the decarbonisation pathway for this sector beyond 2025.

**The Scale of the Charging Network Required by 2025**

The EU, through the Alternative Fuels Infrastructure Regulation (AFIR), will require a minimum deployment of public charging infrastructure to be established for each state in the EU. Member States are expected to be mandated by law to:

- Ensure that, at least a minimum coverage of publicly accessible charging points (dedicated to heavy goods vehicles) is in place by the end of 2025. For example, charging pools with a total capacity of 1400 kW every 120 km on 15% of the TEN-T Network, with at least one charger sized 350 kW (minimum of 8 such charging pools).
- Each urban node (Irish examples being Dublin, Cork, and Shannon) has a 600-kW charging pool for HGVs, with at least one charger of 150 kW in each pool. These pools must be in place by the end of 2025.

[21] Irish Rail has subsequently reduced its track access charges for freight by 75%, as shown in its 2024 Network Statement.

Charging technologies being trialled include high-powered EV charge points (e.g. 350 kW to 2 MW capacity charging points for HGVs). These build on technological breakthroughs and lessons learned during the development of charging infrastructure for heavy-duty buses.

The strategy characterises the network for electric charging (mainly for cars) as being either home charging, destination charging or en route charging. While not being considered in detail in the strategy, this can be applied to the freight sector as follows:

- Home charging: chargers being available at privately owned road haulage depots where HGVs are parked overnight;
- Destination charging: chargers being available at privately owned locations where HGVs are loading or unloading cargo, such as distribution centres, ports and manufacturing sites; and
- En route charging: chargers being available at public locations where HGV drivers stop for statutory breaks, such as motorway services stations and truck stops.

**Heavy-duty vehicle charging hubs**

The transition of heavy-duty vehicles from fossil fuel to electricity has been slower than in the light-vehicle industry. However, truck manufacturers have either already started or are about to start series production of new zero-emission HGVs. The transition to electric buses is also significant across Europe, particularly in the city-bus sector, where 21% of all new registrations were electric in 2021.

The Climate Action Plan has called for 700 HDVs and 300 electric buses by 2025, growing to 3,500 low emission trucks and 1,500 electric buses by 2030. It is expected that the speed of adaptation of HDVs to electricity will take off significantly in the latter half of this decade[22].

In addition to catering for Irish vehicles, charging infrastructure must also cater for the international haulage business which will be dependent on public charging infrastructure in Ireland. The Alternative Fuels Infrastructure Regulation (AFIR) is expected to call for a skeleton infrastructure to be installed by 2025, with this to be rapidly increased by 2030 and 2035. By the end of 2025 at least 8 charging pools, dedicated to infrastructure for HDVs (including buses), should be installed across the TEN-T Network (essentially the motorway network). Each motorway charging pool will consist of an aggregate charging capacity of 1,400 kW with at least one 350 kW charger. In addition to this, by 2025, a dedicated HDV charging pool of at least 600 kW should be present at each of Dublin, Cork, and Shannon airports. To deliver this infrastructure, ZEVI will work with private sector providers, as well as TII, ESBN, and local authorities to develop a National EV Charging Network Plan (En-Route Charging) for HGVs.

[22] Targets are similarly adopted in CAP24, although the target for LGVs has increased from 95,000 to 150,000.See section 4.6 below.

**Key risks**

Delivery of the EV Charging Infrastructure Strategy (particularly the AFIR infrastructure targets) will be highly challenging and require transformation of existing systems and processes. The strategy recognised there are associated risks that will need to be managed and mitigated by ZEVI and key stakeholders to enable the delivery of the overall strategy, whether for light or heavy vehicles. The key risks are:

- Lack of available grid capacity to meet demand within the timelines;
- Lack of site availability for implementation of charge points across schemes;
- Lack of available staff and resources for delivery; and
- Lack of adequate public and private funding in the years up to 2025.

The strategy warns that the above key risks and dependencies are particularly pertinent in relation to charge point infrastructure for HGVs. The National EV Charging Network Plan (En-Route Charging) for HGVs will consider what mitigation measures can be put in place, as well as considering how the supply of enabling services can be delivered. As well as this, ZEVI will engage with haulage industry stakeholders and other stakeholders to deliver this goal.

## Draft National En-Route EV Charging Network Plan 2023-2030

The draft Network Plan explains that the AFIR requires certain amounts of en route charging infrastructure to be developed in Ireland on highway routes on the TEN-T Core and Comprehensive Networks, although derogations may be available for routes on these networks with very light traffic (defined as less than 2,000 HGVs per day).

The key requirements for alternative fuels infrastructure in Ireland are as follows:

**Table 12: Alternative Fuels Infrastructure Requirements in Ireland**

| | 2025 | 2027 | 2030 | 2050 |
|---|---|---|---|---|
| Core | 1,400kW every 120km | 2,800kW every 120km | 3,600kW every 60km | 3,600kW every 60km |
| Comprehensive | 1,400kW every 120km | 1,400kW every 120km | 1,500kW every 100km | 1,500kW every 100km |
| Urban Nodes | 900 kW at each of Dublin, Cork, Limerick & Galway | 900 kW at each of Dublin, Cork, Limerick & Galway | 1,800 kW - provided by stations with an individual power output of 150 kW | 1,800 kW - provided by stations with an individual power output of 150 kW |
| HGV parking & rest areas | - | 2 recharging stations dedicated to heavy-duty vehicles (minimum 100 kW each) | At each safe and secure parking area 4 recharging stations dedicated to heavy-duty vehicles (minimum 100 kW each) | At each safe and secure parking area 4 recharging stations dedicated to heavy-duty vehicles (minimum 100 kW each) |

In relation to heavy duty vehicles (HDVs), which includes buses as well as HGVs, the Alternative Fuel Infrastructure Regulation (AFIR) requires that dedicated charging bays are made available for these vehicles. The sites should allow ad-hoc charging (i.e. without prior commercial arrangements being in place), accept electronic payments and clearly inform the user about pricing options. To date in Ireland, there is only one initiative (by SSE in Mullingar) in development for public charging infrastructure for some of these heavier classes of vehicles.

The draft Network Plan states that the transition of heavy-duty vehicles (HDVs) to electric power is currently in early stages of development. However, this will start to gather pace towards 2030 as the total cost of ownership (TCO) of electric vehicles reduces to lower than the equivalent ICE vehicles.

The draft Network Plan adds that studies are already showing that for many classes of HDVs this is already the case in 2023 and by 2030 the TCO for almost all classes of truck will have reached parity with ICE vehicles.

The Draft Plan regards the road haulage sector as being a crucial sector that requires decarbonisation efforts. The Draft Network Plan argues it is reasonable to expect that first adopters will be businesses whose charging needs will be satisfied by depot charging, and may not rely heavily on public charging infrastructure. However, the development of dedicated public charging infrastructure for heavy-duty vehicles will enable a broader range of industries to consider transitioning their fleets to electric vehicles (such as longer distance domestic and international trunk hauls by tractor and trailer articulated HGVs up to 46 tonnes gross vehicle weight).

The draft Network Plan states that implementation of the AFIR will impose a substantial infrastructure rollout obligation on Ireland for heavy-duty vehicles (HDVs). According to the document, it is expected that this infrastructure will in itself be sufficient to meet the requirements in 2030[23]. In fact, it is expected to surpass the actual demand for en route charging. A comprehensive analysis commissioned by ACEA in 2022, which examined the GPS coordinates of approximately 400,000 trucks operating throughout Europe over a 12-month period, focused on the duration of stops at individual locations. The findings indicated that Ireland would only require three locations on the TEN-T network for the en route charging of HGVs to be operational by 2027, along with two additional sites outside of the TEN-T network.

This analysis indicates that only a limited section of the road network – mainly the Dublin-Cork, Dublin-Limerick and Dublin-Belfast TEN-T Core Network – could experience annual average daily traffic figures exceeding 2,000 heavy-duty vehicles (HDVs) by 2030. If this is accurate, Ireland could take advantage of the derogation that permits 50% of the necessary dedicated charging capacity for HDVs to be distributed across the majority of the TEN-T comprehensive network.

The process of identifying appropriate locations for the infrastructure outlined in Table 12 for 2025 (i.e. to ensure dedicated EV charging requirements for HDVs for 15% of the TEN-T network) will need to consider several key factors:

- The availability of ESB Networks grid connection or smart technology capable of supporting the necessary power requirements.
- Geographical location to deliver required coverage.
- Environmental considerations.
- Understanding of existing HDV movements (and distance travelled) and projected future.
- Movements on the TEN-T network will also inform optimal site locations.

[23] Which the authors of this report assume would be designed to cater for the fleet of 3,500 low emission HGVs envisaged by CAP23 to be in the fleet by 2030.

The critical path timeline for delivery of sites for HDVs is almost 4 years (including 20% contingency). The timelines outlined would result in the delivery of the programme being outside the 2025 target for the HDV sites required under AFIR and indicates the possibility of non-delivery of the target date of 2027 for HDVs as well. To provide a possible solution to this, a number of measures will therefore be taken to plan earlier for HDV sites.

The draft Network Plan highlights a number of key risks to delivery, which are as follows:

- Lack of available grid capacity when needed to meet demand within the timelines: mitigated by increased planning activity, early applications for grid connections, accelerating plans of operators with an existing grid connection and use of battery technology to provide power instead of grid connection; engagement with ESB Networks and other regulatory stakeholders.
- Site availability for implementation of charge points: market assessment with supports to improve the business case of installing charging infrastructure should ensure adequate site provision.
- Lack of available staff and delivery resources: mitigated by resourced stakeholder recruitment plans but accepts that there is a challenge to secure the number of skilled staff that will be required to roll out the accelerated plan.
- Adequate public and private funding in the years up to 2025: mitigated by ZEVI funding plan within Department of Transport planning process and available private funding for investment.
- Legal challenges to schemes launched: mitigated by having a procurement process that is clear and non-discriminatory.
- Lack of confidence of vehicle purchasers that charging infrastructure will be delivered, thereby slowing the transition from ICE to electric: mitigated by delivery of proposed plan along the timelines outlined in order to accelerate the speed of charging infrastructure delivery.
- Risk of under/over specifying level of infrastructure called for in 2025 and 2030: mitigated by delivery of AFIR targets being ahead of demand and revision of 2030 targets for 2030 based on usage data of existing charge points.

## ESB Networks: timescale for new connection

Given the assumption by ZEVI that the main requirement for charging of HGVs will be at depots and opportunity charging at other industrial premises, the timescale for a connection to an industrial site such as a new distribution centre or road haulage depot becomes relevant. The ESB Networks website states that: "For a large load, a considerable lead time can occur from application to connection, relating to investigating the connection method, establishing costs and when the contribution is paid, carrying out work to provide the connection. Connection times vary considerably from one installation to the next. Large LV or smaller MV loads, typically over 200kVA, involving a substation can take 6 to 9 months from application to connection; major business loads, e.g. over 4MVA, requiring a high voltage 110kV connection can take over 2 years".

## Climate Action Plan 2024

Climate Action Plan 2024 (CAP24) follows on from the previous CAP23 Plan by similarly adopting the Avoid-Shift-Improve framework to categorise key measures that are being considered to deliver the required 50% emissions reduction in 2030 compared to 2018.

In the year prior to 2022, 41.9% of the sectoral carbon budget up to 2030 was used up. This means that, from 2023, a consistent decrease is required from 2022 levels each year leading up to 2025 if the emissions abatement targets are to be met.

Key performance indicators in the transport sector, such as vehicle kilometres travelled and fuel usage, are as outlined in CAP23, where the most significant contributions are expected from fleet electrification and biofuels.

Among its recommendations, the Climate Change Advisory Council (CCAC) referenced the implementation of the National Demand Management Strategy measures such as road pricing and parking restraints. Moreover, it is recommended that the target for commercial electric vehicles be increased from 95,000 to 150,000 by 2030, alongside providing additional incentives to facilitate meeting the higher target.

Recommendations also include establishing a national certification/accreditation system for eco-driving programmes as per the Road Haulage Strategy of 2022, in addition to supporting the rail network so that an increase in the freight tonnage carried by rail can take place.

The Plan highlights current efforts by the Department of Transport to establish this certification/accreditation system for eco-driving, which has been shown to benefit operators, the environment, and improve road safety.

In the areas expected to make the most contribution, initial progress is reported. The Renewable Transport Fuel Obligation necessitates a percentage of renewable sources in the motor fuel provided by suppliers of mineral oil. In 2022, this percentage was 7% of diesel fuel. The aim is to achieve a 20% biodiesel blend used in transport by 2030. Moreover, as the provision of charging infrastructure is a major determinant of zero-emission vehicle adoption, the Draft National En-route EV Charging Network Plan shows promise as its targets are in line with the requirements set out in the AFIR.

Additional measures are outlined, such as the progression of a study in 2024 examining the potential for logistics consolidation hubs and the promotion of digital and operational efficiencies. Similarly, the All-Island Strategic Rail Review set out recommendations to enhance the rail network and to develop sustainable solutions for first and last mile rail freight. An implementation strategy is expected to be submitted for approval to Government in the first half of 2024.

Under Avoid and Shift, the Demand Management Strategy lists freight as a generator of demand to which measures are to be developed in accordance with national and international best practice, and based on the benefits it would bring.

As such, progress thus far indicates initial steps and an overall willingness to implement necessary measures in the transport sector.

### Moving Together – A Strategic Approach to the Improve the Efficiency of the Transport System in Ireland

This draft strategy was published by the Department of Transport in April 2024 and was developed to make the transport system more efficient and alleviate the impacts of car dependency on the economy, the environment and the health of society. As such, the draft strategy is mainly focused on passenger transport but does include a discussion of issues and potential measures related to freight transport , as well as four specific recommendations to drive greater efficiency in the freight sector, namely:

- Recommendation 10: Develop policy for Strategic Rail Freight Interchanges – to consider locational criteria and funding supports towards rail-connected sites with associated warehousing and intermodal rail terminal.
- Recommendation 11: Develop Sustainable Freight Distribution Strategies for 5 Cities
- Recommendation 12: Improve opportunities for freight consolidation, last mile green delivery and use of technology by establishing working groups to consider a range of areas and bring forward proposals for consideration by government.
- Recommendation 13: Support additional energy efficiency measures, including implementing measures towards widespread eco driving certification and vehicle-fuel efficiency labelling.

These recommendations which focus on freight would, if implemented, be generally 'soft' measures which would prepare the way for 'hard' measures involving practical interventions in the market or the development of infrastructure.

Other recommendations which are directly relevant to freight are as follows:

- Recommendation 2: Develop a pathway for the development of a cohesive, equitable and future-proofed taxation approach on transport based on a user and polluter pays" approach. This would consider how net externalities related to HGV movements should be incorporated in the charges/taxes paid by road hauliers.
- Recommendation 15: Review existing incentives for encouraging uptake of EVs, with a focus on targeted supports for Captive Car Usages (but also includes supporting transition in Heavy Duty Vehicles such as HGVs).

These measures would consider the financial incentives for road hauliers (along with other road users) to make the switch to zero emission vehicles.

## 2.4 The impact of Brexit

### Introduction

This section of the report seeks to highlight the key impacts of Brexit on the Irish road freight market. It considers the impact on how Ireland trades with the rest of the EU (using direct links or the landbridge across Great Britain), the extent to which Ireland's traditional supply chain links with Great Britain have been disrupted and the impact on movements across the land border with Northern Ireland.

It also considers the extent to which imports of second hand vehicles to Ireland from the UK may have been affected by Brexit. It concludes on how and to what extent Brexit will continue to affect Ireland's ability to decarbonise its road haulage movements.

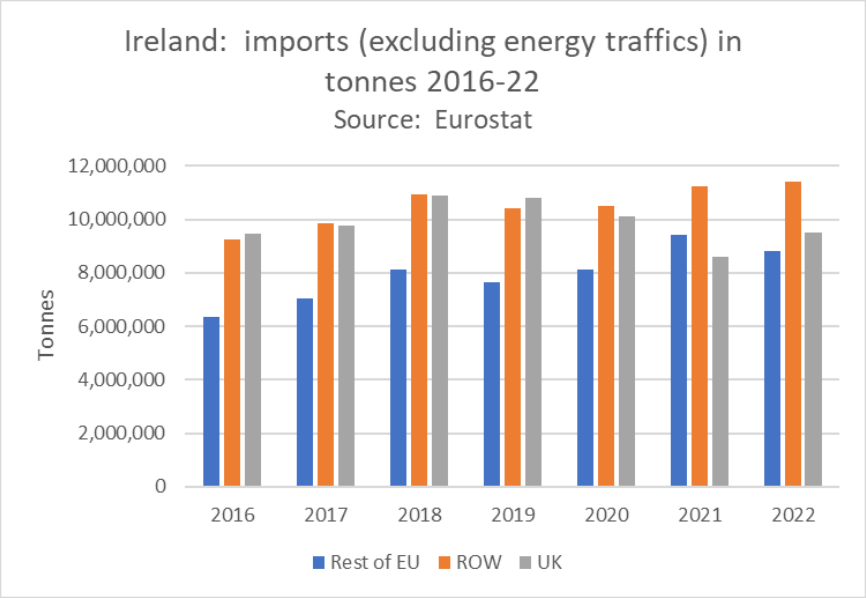
### Ireland's supply chain links

Ireland's economy and supply chains have been integrated with those of Great Britain for many years. This was due to the physical proximity of, and cultural links between, the two countries, combined with both countries being within the EU's Customs Union and Single Market so that administrative procedures related to trade were minimised. This allowed retailers such as Tesco to serve its Irish

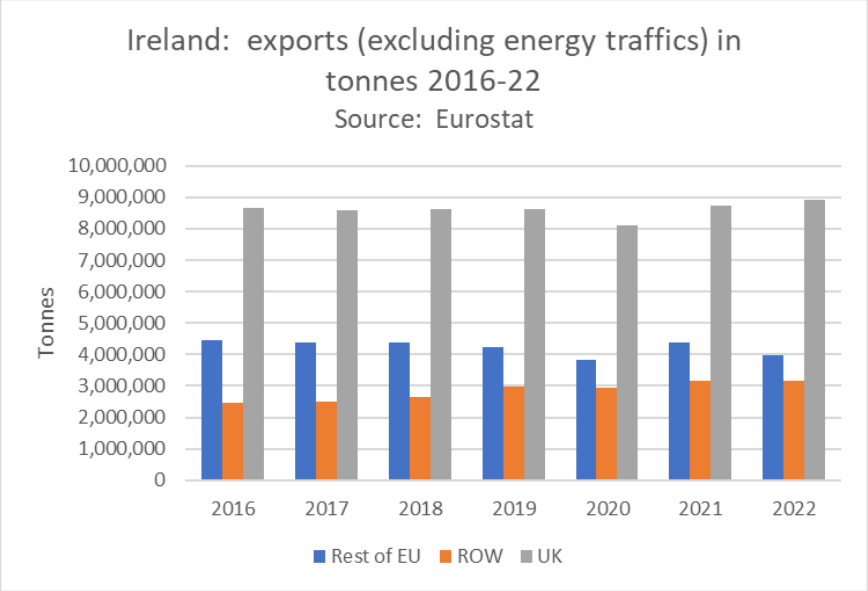
supermarkets from distribution centres in the North of England, taking advantage of frequent overnight RORO services across the Irish Sea on what is known as the Central Corridor between Dublin and Holyhead/Liverpool.

The departure of Great Britain (if not Northern Ireland) from the EU's Customs Union and Single Market on 31 January 2021 led to the overnight introduction of customs procedures and other administrative checks on goods traded between Ireland and Great Britain. This was because, although the UK has still not introduced full checks on imported goods from the EU, Ireland introduced checks on imports from Great Britain straightaway. As Northern Ireland remained in the Single Market and Customs Union, trade across the land border should not have been affected to any significant extent.

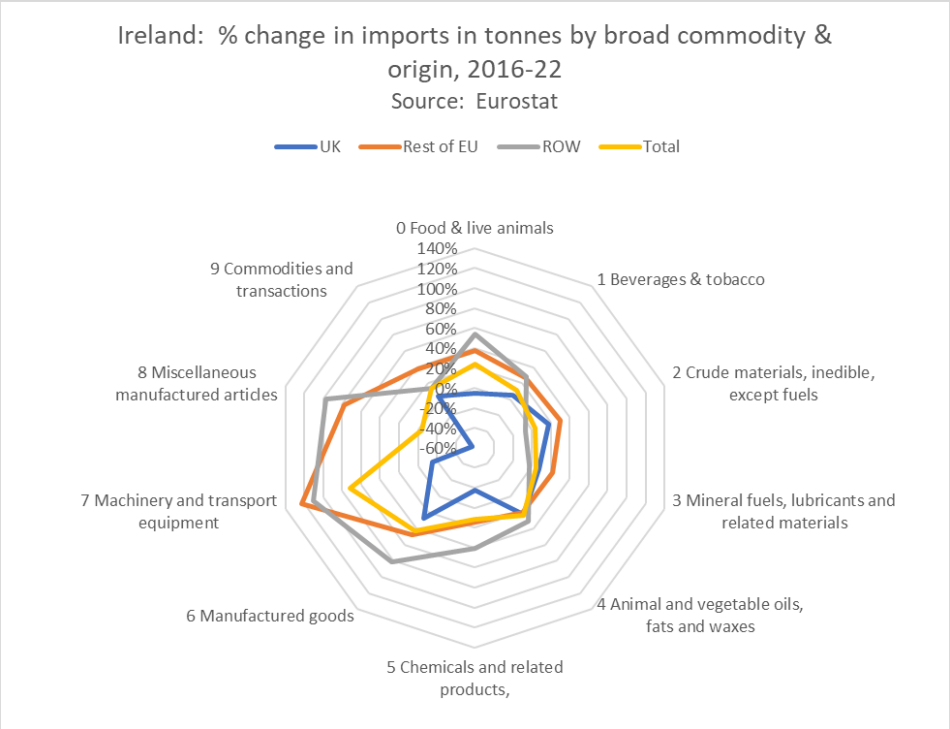
Any potential impact on trade between Great Britain and Ireland can, to some extent, be assessed by analysing trade between Ireland and the UK. Excluding trade in bulk energy goods, which can distort trade volumes, Ireland's total imports of physical goods increased from 25.0 million tonnes in 2016 to 29.7 million tonnes in 2022. While imports from the UK represented 38% of the total in 2016, they were only 32% in 2022, whereas imports from the rest of the EU have increased from 25% to 30% of the total over the same period. This suggests that, although the UK remains the largest single source of imports and trade across the Irish land border is largely unaffected, Ireland's economy may be beginning to de-integrate with that of Great Britain, with Irish companies choosing to source a greater proportion of their goods directly from the continental mainland rather than via Great Britain.




There has, however, been little change in Ireland's (non-energy bulk) exports to the UK, which have largely stayed the same in proportional terms. Ireland's total exports of physical goods increased from 15.6 million tonnes in 2016 to 16.1 million tonnes in 2022. Throughout this period the UK represented about 55% of total exports, while exports to the rest of the EU gradually fell from 29% of the total to 25%. This suggests that exports to the UK have remained very significant to Ireland, probably due to the trade across the land border being largely unaffected and there being no import checks on Irish goods (as yet) at British ports.




The effect of Brexit on Ireland's imports from the UK are clearer when analysis is carried out by broad commodity. The following chart shows the percentage change in goods traded in tonnes by broad commodity between 2016 and 2022, showing the results for imports from the UK, from the rest of the EU, the rest of the world and in total. This suggests that in almost every category, but particularly in categories such as food, manufactured goods, machinery and transport equipment, imports from the UK have either fallen or grown at a slower rate than the rest of Europe and the rest of the world.



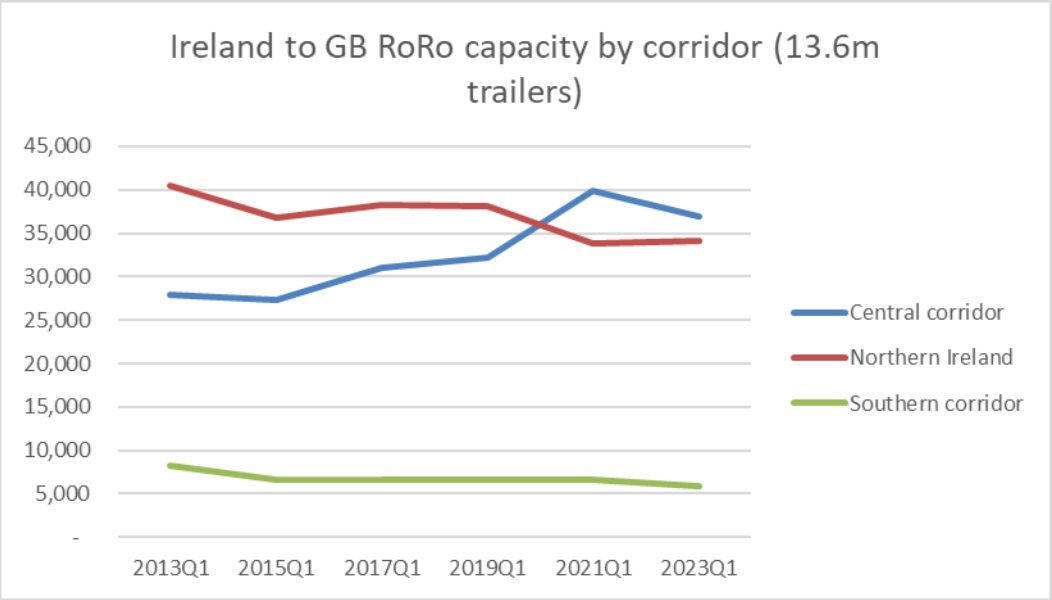
## Routing of international freight traffic

Due to its historic supply chain links with the British economy, the most important RORO market for Ireland has been with Great Britain. This market is generally analysed by splitting it between three geographic corridors, as follows:

- Central Corridor: routes to/from Dublin
- Southern Corridor: routes to/from Rosslare
- Northern Corridor: routes to/from Northern Irish ports

The capacity offered in the market each week by corridor between Ireland and Great Britain between 2013 and 2023 is shown below.

**Ireland-Great Britain RoRo shipping capacity by corridor 2013-23**




*Source: MDS Transmodal*

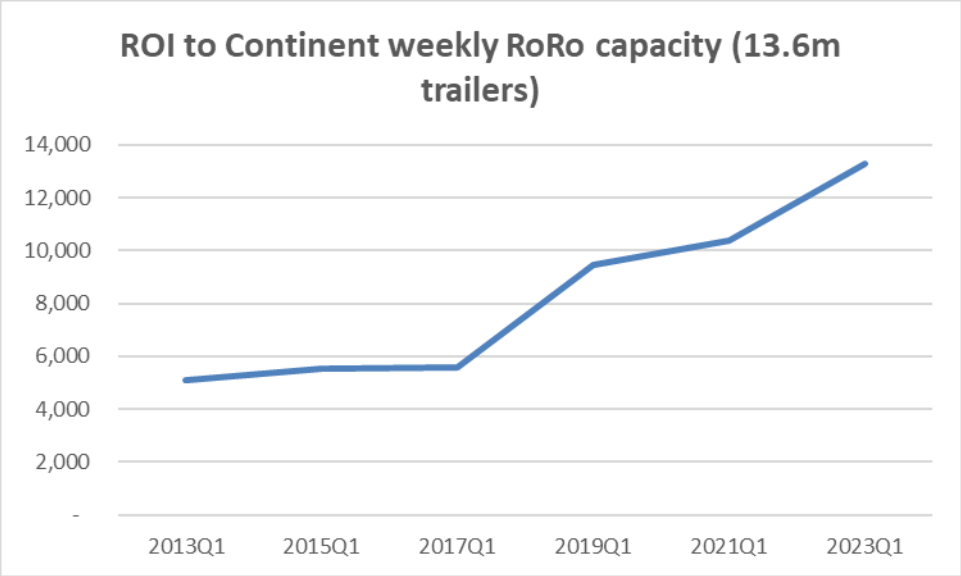
The Central Corridor increased its share of total capacity offered from 42% to 48% between 2019 and 2023 and in the process overtook the Northern Corridor as the most important RORO corridor on the Ireland – GB trade lane. The Southern Corridor has remained the smallest of the three corridors on the trade lane, whilst also seeing its market share decline from 11% in 2013 to 8% in 2023.

Trade between Ireland and the continental mainland in relatively fast-moving goods such as perishables tends to be transported as RORO traffic either on direct services to/from Dublin/Rosslare or via the landbridge route via Great Britain, the latter involving crossings of both the Irish Sea and the English Channel. Until 31st January 2021 the landbridge tended to be favoured by Irish hauliers because it provided the highest frequency of service for the two crossings and therefore greater reliability on a door-to-door basis; it also allowed the hauliers to triangulate by taking an outbound load to the continental mainland, pick up a backload from the continent to Great Britain (as the UK

imports more from the continent than it exports) and then pick up a load from (say) the North West of England to take back to Ireland. However, this situation has changed to some extent since 2016.

The capacity offered in the RORO market each week between Ireland and the continental mainland between 2013 and 2023 is shown below.

**Ireland-continental direct RoRo shipping capacity by corridor 2013-23**




Source: MDS Transmodal

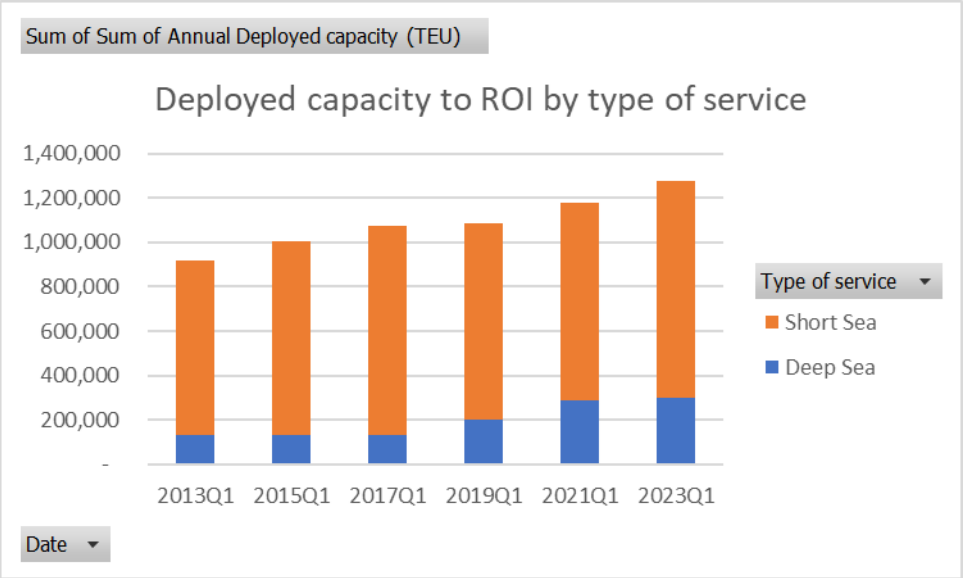
Weekly RORO capacity deployed on these direct routes to the European continental mainland has increased rapidly by over 160% between 2013Q1 and 2023Q1. The market was relatively stable until the UK's decision to leave the EU in 2016, when operators started to launch new direct services (or increased capacity on existing services) on the direct routes to the continental mainland that could avoid the administrative burdens involved in making two crossings of the EU/UK border. However, the most notable switch of capacity was just after 31st January 2021, when capacity was taken out of the Central and Southern Corridors ships and additional capacity was deployed on direct services to the continental mainland.

This development was, overall, probably beneficial from a sustainability point of view because cargo was being transported closer to its inland origins and destinations by sea without a long road haul via Great Britain.

Figure 12 below shows the trends in LoLo capacity deployed to and from Irish ports between 2013 and 2023. Overall deployed capacity in twenty foot equivalent units (TEU) to Irish ports has increased by 39% between 2013Q1 and 2023Q1. Ireland has generally been regarded as being too small a market for the major deep sea container shipping lines to make direct calls with large deep sea container vessels and has been served by transhipment to smaller 'feeder' vessels at continental European ports such as Rotterdam or at a British deep sea container port.

The proportion of deep sea capacity to overall capacity has, however, increased from 17% to 30% between 2013Q1 to 2023Q1. This is largely a result of a second direct deep sea service being attracted to Cork, Ireland's only deep sea container port, in 2021.

LoLo deployed capacity to/from Ireland 2013-23

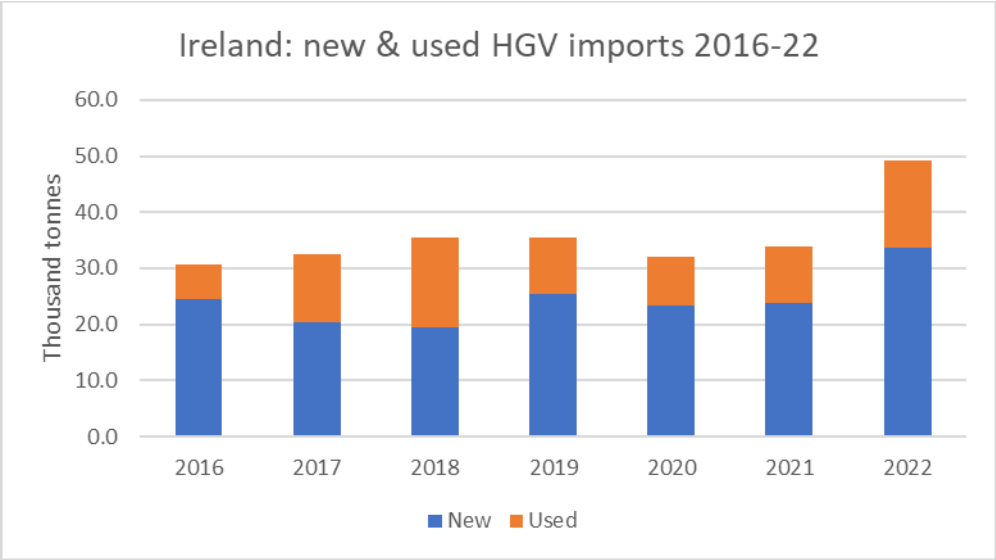



In the context of the LoLo sector, the Port of Dublin is acting as a short sea/feeder port, handling containerised trade directly on short sea services with the rest of Europe or, indirectly, on feeder services with the rest of the world.

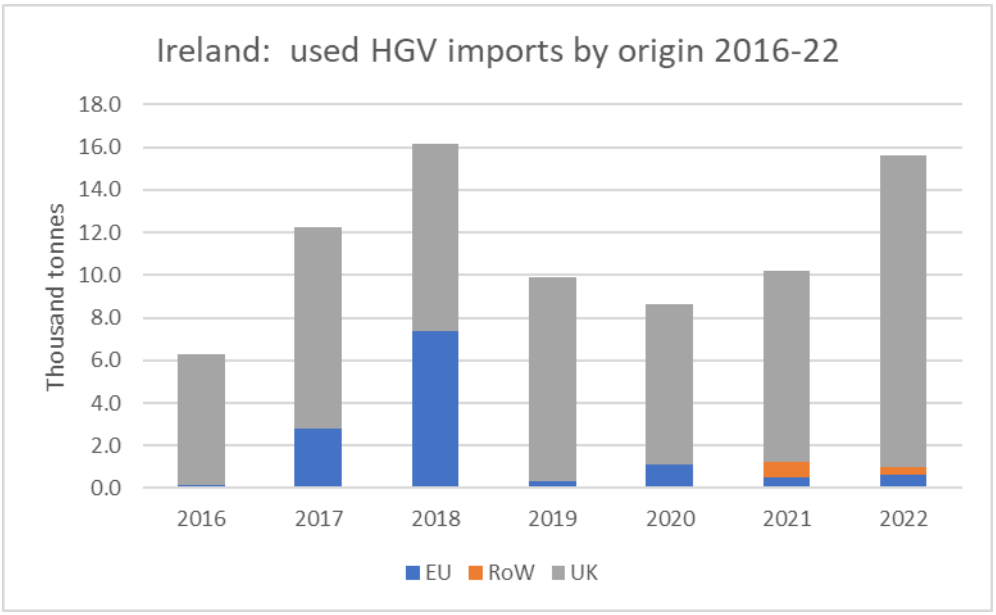
## Imports of new & second hand HGVs to Ireland

As the UK is the largest market for HGVs in Europe, Ireland has tended to be a major market for second hand HGVs from the UK. Following Brexit the export of second hand cars from the UK to Ireland (a business to consumer, B2C, market) has been reported to have been affected by changes in VAT on imported cars from outside the EU, leading to a fall in the number of cars imported into Ireland from the UK. However, it is less clear whether the market for second hand HGVs (a business-to-business, B2B, market) has been affected to the same extent.

The following chart shows the total imports of HGVs into Ireland (in tonnes) during the period 2016-22 with the analysis based on a detailed examination of Eurostat trade data by weight. Since 2018 about 30% of Ireland's imports by weight have been second hand rather than new and, following a slump in imports during the Covid-19 pandemic of 2020-21, imports of both new and used HGVs recovered strongly in 2022.




The following chart shows the imports of second hand HGVs into Ireland (in tonnes) by broad origin during the period 2016-22. Since 2018 the proportion of Ireland's second hand imports by weight from the UK have been about 90% in each year. The UK therefore remains by far the most important source of imports of second hand HGVs and there does not appear to have been a significant impact on the second hand market in Ireland due to the UK's departure from the EU.



## 2.5 Taxation of road haulage

### Taxes on road haulage in Ireland

With the exception of Value Added Tax (which is passed on by road hauliers to their customers) the ownership and operation of HGVs is taxed in three main ways:

- Vehicle Registration Tax: a one-off tax paid when the vehicle is first registered in Ireland;
- Motor Tax: an annual tax on the vehicle if it is used on the road network; and
- Mineral Oil Tax: a tax on each litre of diesel sold.

Vehicle Registration Tax on HGVs and LGVs is €200 per vehicle and this is relatively low compared to private vehicles which, for a car that emits 140g of $CO_2$ per km, is at least €430. This suggests that the taxation system is seeking to assist the purchase of vehicles for commercial rather than private use. The amount of €200 per registration is almost de minimis for a road haulage business, give the annual operating costs of the vehicle.

The Motor Tax of €900 per annum is a fixed cost of operating an HGV, but is relatively small, representing €0.30 per hour out of a total fixed operating cost of about €55 per hour.

Mineral Oil Tax on diesel purchased by hauliers is about €0.55 per litre in 2024 (and therefore a variable cost per km of road haulage), of which about €0.15 per litre is related specifically to the cost of carbon. This carbon tax element per litre of diesel is the equivalent of €56 per tonne of carbon; the carbon tax element is due to increase to €100 per tonne by 2030 so that the tax on fuel will increase to €0.67 per litre. Mineral Oil Tax, including the carbon tax element, is a high proportion of the variable cost of road haulage per kilometre and provides an incentive for hauliers to increase fuel efficiency.

### Diesel Rebate Scheme (DRS)

While the tax on diesel is by far the most significant source of taxation of road haulage, this has been reduced since 2013 by a Diesel Rebate Scheme (DRS) which allows road hauliers to receive some rebate on the Mineral Oil Tax on a sliding scale depending on the pump price. When the pump price is €1.23 per litre (including VAT) there is no rebate, but it gradually increases to a maximum of 7.5 cents per litre when the pump price (including VAT) is over €1.43 per litre (including VAT). The DRS rate has been 7.5 cents per litre since Q4 2021.

While providing some relief for road hauliers from higher fuel prices (which would otherwise be passed on to consumers), the DRS also reduces the incentive to adopt measures to enhance fuel efficiency and reduces the extent to which externalities related to fossil fuels are included in road hauliers' costs.

## Fuel tourism

There can be differences between the pump price of diesel in Ireland compared to Northern Ireland and, given that HGVs are able to cross the border without any restriction, there is an incentive for hauliers to minimise their costs by seeking the lowest cost fuel. While the resource cost should be similar in both jurisdictions, any differences between the taxation per litre and changes in the exchange rate between the euro and sterling can lead to differences in the effective pump price. The greater the differential between the pump price in the two jurisdictions, the greater the distance the hauliers will be prepared to travel to obtain cheaper diesel.
The extent of this phenomenon may be exaggerated in practice because the cheapest source of diesel for haulage companies of any significant scale is to receive their own bulk deliveries and bunker their HGVs from their own fuel tank. In addition, road hauliers are not incentivised to drive long distances to obtain cheaper fuel unless there is a significant difference in the pump price.

Historically, levels of diesel fuel taxation have been lower in Ireland than in Northern Ireland, leading to Northern Irish hauliers purchasing fuel south of the land border. In 2022 both the UK and Irish Governments reduced the taxation of diesel due to an increase in the resource cost after the Russian invasion of Ukraine. In early 2024, press reports suggest that the cost of diesel at the pump was about the same on both sides of the border. However, in March 2024 the UK announced a continuation of its freeze on Fuel Duty, whereas the Irish Government has increased the non-carbon element of Mineral Oil Tax from €377 per tonne to €401 per tonne. This may result in a small incentive for Irish hauliers, particularly if their depots are reasonably close to the border, to divert to purchase fuel in Northern Ireland.

# 3 THE IMPACT OF EUROPE AND TECHNOLOGY

## 3.1 Introduction

External factors will influence the decarbonisation of Ireland's road freight sector. European legislation will have an impact on Ireland's road freight decarbonisation in terms of emission reductions, and vehicle technology trends in the EU will influence the technologies that are deployed in HGV fleets In Ireland. Vehicle technology trends must be considered from the perspective of Ireland's current market and policies, strategies and technologies supported in other EU countries and how these might impact Ireland.

This section of the report is focused on an assessment of external factors influencing road freight emissions in Ireland. This objective is broken down into three sub-tasks, covering the following:

- Assessment of new EU legislation under the Fit for 55 Package, and other legislation introduced since the Fit for 55 Package.
- Vehicle technology trends in the EU, including factors impacting the pace of HGV decarbonisation in Ireland.
- Impacts on emission reductions for the Irish freight sector, combining the analysis from the previous two sub-tasks.

Whilst the UK is now outside of the EU, the UK's efforts in road freight decarbonisation will also have an impact on Ireland's road freight sector. As such, the analysis also draws upon relevant developments in the UK.

## 3.2 Assessment of EU legislation

New and revised EU legislation will impact Ireland, with direct or indirect impacts on Ireland's road freight sector and emissions from road freight. The European Green Deal[24], proposed in 2019 and approved in 2020, committed the EU to tackling climate and environmental-related challenges, with an aim to be net zero across the EU by 2050. In particular, the Fit for 55 Package[25], proposed in 2021 and adopted in 2023, comprises a package of legislative proposals to achieve the policy goals first proposed in the European Green Deal. The Fit for 55 Package's policy proposals aim to achieve an interim target to reduce $CO_2$ emissions in the EU by 55% by 2030.

The scope of the Fit for 55 Package includes transportation $CO_2$ emissions, sustainable and smart mobility, and clean, affordable, and secure energy, all of which will have direct and indirect impacts on the decarbonisation of Ireland's road freight. There is a large legislative revision process currently

[24] European Commission (2020), The European Green Deal, https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en
[25] European Commission (2023), Fit for 55, https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

happening in the European Commission, where existing legislation is being reviewed and updated and new policies are being created to achieve the ultimate 2050 target. As such, there are new targets and rules for economic sectors to comply with, which apply to the European Union irrespective of place of origin or manufacture. The Fit for 55 Package is also supported by the Net Zero Industry Act[26], which offers a range of incentives and support to industry to navigate the transition to net zero.

This section provides an analysis of new and developing EU legislation that has both direct and indirect impacts on Ireland's road freight emissions. Of note, some legislation is now in effect, whilst other legislation is currently in development or proposed at time of writing. Additionally, some legislation analysed within this section does not strictly fall within the Fit for 55 Package. The legislation that is considered within this analysis includes:

- EU Emissions Trading System (EU ETS) – revised.
- $CO_2$ emission performance standards for new passenger cars and new light commercial vehicles – revised.
- Energy Taxation Directive (ETD) – proposed.
- Alternative Fuels Infrastructure Regulation (AFIR) – revised.
- $CO_2$ emission performance standards for new heavy-duty vehicles and integrating reporting obligations - agreed..
- EU Sustainable Batteries Regulation (SBR).

Within this section, fact sheets are provided covering each piece of EU legislation outlined above. These fact sheets cover:

- Name of legislation and date it took effect, or when it is expected to take effect.
- Summary of the overall legislation.
- Summary of aspects relevant to Ireland's road freight sector.
- Qualitative review of how the legislation is expected to impact Ireland's road freight emissions.
- Critical review of legislation – how "far" the legislation goes, whether it's sufficient to cater for Ireland's road freight sector, any other critical remarks.
- Whether Ireland could or should go further.

Following the fact sheets, a brief section is provided on what is coming next in terms of expected changes to the EU legislation landscape. As UK legislation related to the decarbonisation of road freight is likely to have an impact on Ireland's road freight sector, this section also includes an overview of some relevant UK legislation and policy developments. The information within the fact sheets is summarised in Table 13 below.

[26] European Commission (2023), Net Zero Industry Act, https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en

**Table 13: Summary of EU legislation**

| Legislation | Adopted? | Relevant to Ireland's road freight sector? | Impact on Ireland's road freight emissions? | Scope for Ireland to go further? |
|---|---|---|---|---|
| **EU Emissions Trading System – ETS 2** | **Yes** – ETS 2 operational in 2027 or 2028 | **Yes** – new system to cover fuel supply in transport | **Medium** – likely to benefit TCO** of ZE HGVs | **Somewhat** – use of levers to further increase fuel costs |
| **CO2 emissions performance standards – cars and vans** | **Yes** – stricter targets from 2030 onwards | **Somewhat** – limited to freight carried in LGVs | **Medium** – limited to freight carried in LGVs (relatively small proportion) | **Somewhat** – continue to offer incentives for cars and LGVs |
| **Energy Tax Directive (ETD)** | **No** – still in development | **Likely** (once agreed) – varying taxes for fuel types | **Likely medium** – specifies minimum tax rates | **Unclear** – in theory, Ireland can have higher tax rates |
| **Alternative Fuels Infrastructure Regulation** | **Yes** – stricter targets from 2025 | **Yes** – new targets stipulated for HDV infrastructure | **High** – creates enabling conditions for infrastructure | **Yes** – continued monitoring of ZE HGV infrastructure |
| **CO2 emissions performance standards – HDVs** | **Yes** – political agreement reached | **Yes** – much stricter emission targets for new HDVs from 2030 | **High** – impacts new HDVs, but not until after 2030 | **Somewhat** – continue to offer incentives for HDVs |
| **EU Sustainable Batteries Regulation (SBR)** | **Yes** – implementation by mid-2025 | **Yes** – batteries manufactured for HDVs | **Medium** – emissions from a lifecycle perspective | **No** – legislation is evolving |

***TCO = total cost of ownership, which is an estimation of the expenses associated with purchasing, deploying, using, and retiring a HGV. TCO is particularly important in the context of zero emission HGVs, as whilst the higher upfront costs can be a deterrent to purchase, the costs of using and operating a zero emission HGV can be lower than for comparable internal combustion engine (ICE) vehicles, due to aspects such as lower fuelling costs and possibly lower maintenance and repair costs.*

**Fact sheet: EU Emissions Trading System**

| Legislation | Revision to the EU's Emissions Trading System (ETS) to include road transport, buildings, and additional sectors (ETS 2) |
|---|---|
| **Date of effect / status** | Adopted April 2023; Directive 2023/959/EU amending Directive 2003/87/EC (establishment of ETS) and Decision 2015/1814/EU (market stability reserve) |
| **Summary of legislation** | The EU Emissions Trading System (ETS) is a 'cap and trade' system, where caps are placed on the total greenhouse gas (GHG) emissions that can be emitted from more than 10,000 installations in the energy sector and manufacturing industry as well as aircraft operators flying within the EU and departing to Switzerland and the UK (i.e., around 45% of the EU's GHG emissions are covered). The cap is reduced annually in line with the EU's climate target.<br><br>Companies must purchase allowances on the EU carbon market to fully account for their emissions, otherwise heavy fines are imposed. Allowances can be traded amongst companies; and if an installation or operator reduces their emissions, they can keep spare allowances or sell them. EU Member States use revenues from the EU ETS to feed into national budgets and to support investment in renewable energy, energy efficiency, and low-carbon technologies. From 2024, the EU ETS also covers emissions from maritime transport.<br><br>The ETS was revised in 2023 – as part of the revision, a new emission system was created called **ETS 2**, which is separate from the existing EU ETS. The new ETS 2 will cover $CO_2$ emissions from fuel combustion in road transport, buildings, and 'additional sectors' (i.e., small industry not covered by the existing ETS). The carbon price set by ETS 2 is intended to provide a market incentive for investments in low-emissions mobility and building renovations. The ETS 2 covers emissions upstream – i.e., it will be fuel suppliers that are required to purchase and surrender allowances to cover their emissions rather than end users. The ETS 2 cap will be set to bring emissions down by 42% from these sectors by 2030, compared to 2005; revenues will be used to support vulnerable households and micro-enterprises, along with climate action and other social measures.<br><br>Monitoring and reporting of emissions under ETS 2 will begin in 2025, and the ETS 2 will become operational in 2027. There is a delay clause within ETS 2 to start the scheme one year later (2028) if oil and gas prices are exceptionally high in 2026. Additionally, under Article 30e of the legislation, by way of derogation, an exemption until the end of 2030 can be provided to Member States that are subject to a national carbon tax in force between 2027 and 2030 covering ETS 2 activities, provided certain conditions are met as outlined in Article 30e, including notification to the Commission by the end of 2023 that a national carbon tax is in place that sets the tax rates applicable between 2027 and 2030[27]. |
| **Summary of aspects relevant to Ireland's road freight sector** | The EU ETS 2 is highly relevant to Ireland's road freight sector – the ETS 2 scheme covers 'commercially-used fuels', which distinguishes between private and professional road use. The $CO_2$ charges will be levied through oil suppliers, meaning that whilst end users are not covered by the scheme, drivers and transport companies can expect higher fuel prices at the pump. The Belgian industrial group TLV estimates that the ETS 2 will translate to an ETS cost of 12c per litre of diesel[28]. |

[27] EUR-Lex - 02003L0087-20230605 - EN - EUR-Lex (europa.eu), Article 30e, Transfer, surrender and cancellation of allowances
[28] Kardinal (2022), What are the environmental regulations that apply to road transport?, https://kardinal.ai/what-are-the-environmental-regulations-that-apply-to-road-transport/

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| **Qualitative review of impact of legislation on Ireland's road freight emissions** | The ETS 2 is expected to have a positive impact on Ireland's road freight emissions by enabling the total cost of ownership (TCO) comparisons between zero emission and ICE HGVs to be more cost-effective. The ETS 2 aligns with other recently revised regulations, such as the Alternative Fuels Infrastructure Regulation and the revision to the HDV $CO_2$ emission performance standards regulation, in terms of emission reduction targets. This combination of regulations is expected to further enable the zero emission HGV market, with the ETS 2 contribution being to price the $CO_2$ emissions from transport energy carriers appropriately. However, the impacts of ETS 2 are not expected to be felt until close to 2030, particularly if the delay clause is implemented. Additionally, Ireland could potentially make use of the exemption derogation for ETS 2, delaying implementation up until the end of 2030. |
| **Critical review of legislation** | Critics of ETS 2 have highlighted that the implementation of ETS 2 is less ambitious than the existing ETS, with a lower price cap on a euro-per-tonne basis, and the structure of ETS 2 is unlikely to drive decarbonisation under the sectors until 2030. However, the ETS 2 will provide a common ground for pricing emissions in these sectors in the EU, and it will bring about 75% of EU Member States' emissions under a pricing scheme[29]. One of the key concerns about the implementation of ETS 2 was that it may primarily affect economically weaker states and citizens; as such, the agreement allocates 50% of the revenue from ETS 2 to a newly introduced Social Climate Fund, which intends to support vulnerable households and small businesses to cope with the price increase of fuels. The remaining 50% of the income passes to the EU Member States – the EU Member States must use the money for social climate measures in the building and transport sectors, which may provide further funding towards measures focused on HGV decarbonisation. ETS 2 also needs to be implemented in the context of technological maturity of zero emission HGVs, where vehicles and the supporting infrastructure need to be in place to avoid unfairly penalising transport companies – other EU legislation is addressing these aspects. |
| **Is there scope for Ireland to go further?** | Somewhat – the structure of ETS 2 brings $CO_2$ from fuel suppliers under the cap-and-trade system; Irish Government could nevertheless use levers such as carbon tax and fuel duty to further increase the cost of fossil fuels for transport to make the TCO for zero emission HGVs more attractive compared to ICE vehicles, should this be desirable and at an appropriate time in the context of the maturity of the market. It should be noted that the carbon tax in Ireland is currently higher than the ETS price. |

[29] Energy Post (2023), Understanding the new EU ETS (Part 2): Buildings, Road Transport, Fuels. And how revenues will be spent, https://energypost.eu/understanding-the-new-eu-ets-part-2-buildings-road-transport-fuels-and-how-the-revenues-will-be-spent/

**Fact sheet: $CO_2$ emission performance standards for new cars and vans**

| Legislation | Revision to the Regulation for $CO_2$ emission performance standards for new passenger cars and new light commercial vans |
|---|---|
| **Date of effect / status** | Adopted in March / April 2023; Regulation 2023/851/EU (new regulation) amending Regulation 2019/631/EU (old regulation) |
| **Summary of legislation** | The 2019 Regulation enforced $CO_2$ emission performance standards for new passenger cars and vans on original equipment manufacturers (OEM). It replaced previous separate regulations on cars and vans. The targets stipulated within the Regulation pertain to the mean emissions per vehicle sold – individual OEMs can reach the targets by reducing emissions from new ICE vehicles (i.e. making engines more efficient), developing and selling more smaller vehicles with lower emissions, and / or developing and selling more zero emission vehicles.<br><br>As part of the Fit for 55 Package, the regulation was amended to strengthen $CO_2$ emission performance standards for new cars and vans in line with the EU's increased climate ambition. The main amendment was in terms of strengthening emission targets applying from 2030, and the stipulation of a 100% reduction target for both cars and vans from 2035 onwards.<br><br>The updated targets from the revised regulation are as follows:<br>**2020-2024**: no change from previous targets:<br>• Cars: 95 $gCO_2$/km<br>• Vans: 147 $gCO_2$/km<br>**2025-2029**: no change from previous targets:<br>• Cars: 93.6 $gCO_2$/km<br>• Vans: 153.9 $gCO_2$/km<br>**2030-2034**: new targets for 55% $CO_2$ emission reductions for new cars and 50% emission reductions for new vans, compared to 2021 levels:<br>• Cars: 49.5 $gCO_2$/km<br>• Vans: 90.6 $gCO_2$/km<br>**2035 onwards**: 100% $CO_2$ emission reductions for both new cars and new vans, i.e. 0 $gCO_2$/km.<br><br>The new targets encourage a much greater proportion of zero emission cars and vans to be developed and sold, compared with other methods of achieving the targets. The $CO_2$ emissions regulation is coupled with an incentive mechanism for zero- and low-emission vehicles (ZLEV), applying to cars and vans manufactured from 2025 until 2029. The ZLEV crediting system will apply to both car and van manufacturers which relaxes a manufacturer's specific emission target if its share of new ZLEVs (vehicles with emissions between 0 and 50 $gCO_2$/km) registered in a given year exceeds the benchmarks of 25% ZLEVs for cars and 17% ZLEVs for vans. A one percentage point exceedance of the ZLEV benchmark will increase the manufacturer's $CO_2$ target (in $gCO_2$/km) by one percent, with target relaxation capped at a maximum of 5% to safeguard environmental integrity.<br><br>The regulation is coupled with penalties for excess emissions, pooling of manufacturers, exemptions, and derogations. |

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| **Summary of aspects relevant to Ireland's road freight sector** | The focus of this specific regulation is on $CO_2$ emission performance standards for new passenger cars and new light commercial vans; as such, the interaction with Ireland's road freight sector is limited to low volume freight carried within light commercial vans[30]. The regulation remains unchanged from the previous version in terms of emission targets up until 2029; however, the incentive mechanism can encourage OEMs to manufacture additional ZLEV light commercial vans. The main changes for the light commercial van sector will be experienced from 2030 onwards, when the stricter targets come into force and more ZLEV vans are deployed. |
| **Qualitative review of impact of legislation on Ireland's road freight emissions** | Due to the reasons outlined above, the impact of this legislation on Ireland's aggregate road freight emissions is expected to be relatively minor, as it is limited to low volume freight carried within light commercial vans. The revisions to the $CO_2$ emission performance standards for new heavy-duty vehiclest are expected to deliver a much greater impact on reductions in Ireland's aggregate road freight emissions. |
| **Critical review of legislation** | The updated Regulation addresses misaligning targets resulting from defining proposed phase out dates for new petrol and diesel cars and vans. The incentive mechanism is positive in that it encourages OEMs to go beyond the requirements of the regulation whilst also recognising the challenges of developing ZLEVs for cars and vans. The stricter targets are also expected to encourage OEMs to develop zero emission vehicles more rapidly. The real benefits of the updated Regulation will be seen from 2030 onwards, when the emission targets are greatly reduced and leading up to the 100% emission reductions from 2035, aligning with proposed phase out dates. The updated regulation will be very beneficial for emission reductions from cars and vans, but with more limited benefits for road freight more broadly. |
| **Is there scope for Ireland to go further?** | Somewhat – Ireland can continue to enable consumers to purchase new ZLEV cars and vans through incentive mechanisms (though noting the limited impact on road freight emissions in the context of this study); however, from the context of incentivising / penalising OEMs, there is a limited additional role for Ireland to play. |

[30] Exact figures for the quantity of freight carried in light commercial vans, compared to larger HGVs, are not available because no national surveys of LGVs have been carried out in Ireland. Similarly, information on the quantity of light commercial vans carrying freight rather than being used as service vans is not available. In tonnage terms, it is likely that a relatively small proportion of freight is carried in light commercial vans in Ireland, when compared with larger HGVs. Great Britain may be a reasonable comparator where, in 2019-20, only 16% of light commercial van kilometres were related to freight deliveries and collections compared to 54% involved in carrying equipment, tools or materials (based on a national survey by the UK Department for Transport).

## Fact sheet: Energy Tax Directive

| Legislation | Revision to the Energy Tax Directive |
|---|---|
| **Date of effect / status** | **Not yet adopted** at time of writing; proposed to amend Energy Tax Directive (2003/96/EC); positions amongst EU delegations are still divergent on several crucial issues; last discussions held November 2023 |
| **Summary of legislation** | The Energy Taxation Directive (ETD) is the EU's framework for the taxation of energy products including electricity, motor fuels, and most heating fuels. It sets minimum rates of excise duty with the intention of encouraging a low-carbon and energy efficient economy. EU Member States can design their own taxes within the framework, and can determine domestic rates if they meet the ETD minimum. There has been growing criticism of the current ETD in terms of its failure to discourage use of fossil fuels and to encourage energy-intensive customers to adopt newer energy efficient technologies. Aviation and shipping are also exempt under the current ETD.<br><br>Proposed reforms to the ETD were announced in July 2021. The aim of the revision is to align the taxation of energy products with EU energy and climate policies, promote clean technologies, and remove outdated exemptions and reduced rates. The revision aims to ensure that taxation of motor and heating fuels and electricity in the EU reflects their impact on the environment. The proposed revision focuses on two main areas: the structure of tax rates; and broadening the taxable base to include more products and remove some current exemptions and reductions.<br><br>The specific proposed reforms comprise the following:<br>• Introduction of a new structure of tax rates based on energy content and environmental impact of energy rather than on volume.<br>• A widening of the tax base to include energy contents and processes not previously in scope.<br>• The recognition of new energy products such as hydrogen.<br>• Measures to prevent double taxation of stored electricity.<br>• Reduction in ability for EU Member States to exempt or reduce the rate applicable to products, processes, and sectors.<br>  ○ Exemptions for certain products and home heating to be phased out, so fossil fuels cannot be taxed below minimum rates.<br>  ○ Fossil fuels used as fuel for intra-EU air transport, maritime transport, and fishing no longer fully exempt.<br>• An increase in the minimum rates of tax to reflect current pricing, in addition to annual adjustments.<br>• Five-yearly reviews to keep the ETD up to date.<br><br>One of the core proposed reforms is to rank fuels and electricity according to their energy content and environmental performance. This ranking from most to least taxed is as follows:<br>1. Conventional fossil fuels and non-sustainable biofuels (e.g., gas, oil, petroleum).<br>2. Fossil-based fuels supportive of decarbonisation in the short term (e.g., natural gas, LPG).<br>3. Sustainable but not advanced biofuels (e.g., food crop derived biofuels, wood mass derived biofuels).<br>4. Electricity, advanced sustainable biofuels, biogas, and renewable non-biological fuels (e.g., green hydrogen). |
| **Summary of aspects relevant to Ireland's road freight sector** | The proposed reforms to the ETD, if approved, are relevant to Ireland's road freight sector from the perspective of minimum fuel taxing. Motor fuels are covered by the ETD, which may have an impact on fuel prices – the newly 'ranked' fuels in term of their energy content and environmental performance will affect the comparative total costs of ownership for both alternative fuel vehicles and ICE vehicles. The proposed ETD minimum tax rates (as of 2021, and subject to change) are |

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| | €10.75/GGJ for conventional fossil fuels, reducing to €0.15/GGJ for electricity and renewable hydrogen[31]. Of note, the current ETD sets minimum tax rates, but most EU Member States already provide more stringent tax rates as individual Member States are free to set their own rates if minimum EU rates are respected[32]. |
| **Qualitative review of impact of legislation on Ireland's road freight emissions** | The reform to the ETD, once agreed, would be expected to have a positive impact on Ireland's road freight emissions by making the TCO comparisons between battery electric and hydrogen-fuelled HGVs and ICE HGVs more competitive, thereby reducing TCO calculations for zero emission HGVs and facilitating their adoption; however, this is dependent on existing rates of excise duty. The proposed ETD reforms align with other recently revised regulations, such as the Alternative Fuels Infrastructure Regulation, ETS 2, and the proposed revision to the HDV $CO_2$ emission performance standards regulation, and it is expected the regulations would work in tandem to make zero emission HGVs more attractive to transport operators. The scale of the impact on Ireland's road freight emissions is dependent on the final agreed ETD, and whether Ireland chooses to go beyond the targets stipulated in the ETD. |
| **Critical review of legislation** | As the reforms to the ETD are not yet agreed, it is not yet possible to provide a full critical review of the legislation. The proposed reforms to the ETD send the right message, in the context of removing exemptions for fossil fuels and through ranking different motor fuels on a tax basis, dependent on their energy content and environmental performance. The proposed reforms also align with wider policy developments under the Fit for 55 Package and beyond, which should be viewed as a positive. |
| **Is there scope for Ireland to go further?** | Unclear – the scope for Ireland to go beyond the reformed ETD will depend on the final agreement of the ETD. In theory, Ireland will be able to go further as the ETD is intended to specify minimum rates, allowing Member States to go beyond these minimum rates. |

[31] KPMG (2021), Energy Taxation Directive – The European Union's framework for the taxation of energy products including electricity, motor and most heating fuels, https://kpmg.com/xx/en/home/insights/2021/08/energy-taxation-directive.html

[32] Current Irish excise duty rates are available here: https://www.revenue.ie/en/tax-professionals/tdm/excise/excise-duty-rates/energy-excise-duty-rates.pdf

## Fact sheet: Alternative Fuels Infrastructure Regulation

| Legislation | Revision to the Alternative Fuels Infrastructure Regulation (AFIR) |
|---|---|
| **Date of effect / status** | Adopted in July 2023; supersedes the Alternative Fuels Infrastructure Directive (AFID) (2014/94/EU) |
| **Summary of legislation** | The former AFID required EU Member States to develop National Policy Frameworks (NPF) to support market development of alternative fuelled vehicles and the supporting infrastructure; to implement common technical specifications for recharging and refuelling infrastructure; and to address consumer information for alternative fuels, including standardised pricing. The AFID also contained mandatory targets for infrastructure for EV passenger cars / vans, CNG vehicles, and LNG vehicles and vessels; and optional targets for hydrogen refuelling stations (HRS).<br><br>The **updated AFIR** developed the Directive into a Regulation, setting more stringent requirements and infrastructure deployment targets that must be met by 2025, 2030, or 2035, depending on the category of infrastructure and the vehicles it serves. The updated AFIR includes new targets and requirements, including mandatory charging provision for HDVs (where HDVs had previously not been considered in the AFID), mandatory requirements for HRSs, and further requirements to ease payment and information provision, especially for fuel pricing. NPFs are also required in the updated AFIR. |
| **Summary of aspects relevant to Ireland's road freight sector** | The AFIR introduces new targets for EU Member States for infrastructure for alternative fuelled HDVs. For **electric HDVs**, the targets are below.<br>**By end of 2025**:<br>• At least 15% of the trans-European transport (TEN-T) network[33] to have publicly accessible charging for HDVs in each direction of travel, with each location having at least 1,400kW of power with at least one charger with a power output of 350kW[34].<br>• In each urban node, publicly accessible charging for HDVs with at least 900kW of power with an individual power output of at least 150kW.<br>**By end of 2027**:<br>• At least 50% of TEN-T network to have publicly accessible charging for HDVs in each direction of travel:<br>  ○ Core network: each location to have at least 2,800kW of power with at least two chargers of 350kW power.<br>  ○ Comprehensive network: each location to have at least 1,400kW of power with at least one charger of 350kW power.<br>• In each safe and secure HDV parking area, at least two publicly accessible chargers for HDVs installed with an individual power output of at least 100kW.<br>**By end of 2030**:<br>• For TEN-T Core network, publicly accessible charging for HDVs in each direction of travel every 60km maximum, with each location having at least 3,600kW of power with at least two chargers with a power output of 350kW. |

[33] The Trans-European Transport (TEN-T) Network is a key instrument for the development of coherent, efficient, multimodal, and high-quality transport infrastructure across the EU. It comprises railways, inland waterways, short sea shipping routes and roads linking urban nodes, maritime and inland ports, airports, and terminals. The TEN-T road networks consist of the Core network and the Comprehensive network, with the Core network in Ireland linking Dublin with Cork, Shannon Airport and Northern Ireland. The Comprehensive network links these areas with many more nodes and airports in Ireland. The Core and Comprehensive networks are also supplemented some 'urban nodes' (Dublin, Cork, Foynes, and Galway) in Ireland. The TEN-T Network is currently being reviewed. Further information on TEN-T is available here; further information on Ireland's TEN-T network (with a focus on roads) and impacts of a revised TEN-T network is available here.

[34] Calculations for percentage of distance of TEN-T network (e.g. 'at least 15% of the TEN-T network') are stipulated within the AFIR. A single location can be dedicated to HDVs for both directions of travel if the recharging location is accessible from both directions and adequately signposted; however, in the case of a single location being allocated to both directions, the power capacity must be doubled for that single location.

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| | • For TEN-T Comprehensive network, publicly accessible charging for HDVs in each direction of travel every 100km, with each location having at least 1,500kW of power with at least one charger with a power output of 350kW.<br>• In each safe and secure HDV parking area, at least four publicly accessible chargers for HDVs installed with an individual power output of at least 100kW.<br>• In each urban node, publicly accessible charging for HDVs with at least 1,800kW of power with an individual power output of at least 150kW.<br><br>For **hydrogen-fuelled HDVs**, the targets are as follows:<br>**By end of 2030**:<br>• Minimum number of publicly accessibly HRSs deployed, designed for a minimum cumulative capacity of 1 tonne per day and equipped with at least a 700 bar dispenser, with a maximum distance of 200km between them along the TEN-T Core network.<br>• At least one publicly accessible HRS deployed in each urban node, with analysis to be carried out to determine optimum location and whether HRSs can be situated in multimodal hubs.<br>• Provide a linear trajectory within the NPF towards meeting the 2030 targets, along with indicative target for 2027 that delivers sufficient coverage of the TEN-T Core network for anticipated demand.<br><br>Derogations apply to some of the targets above. The updated AFIR also places requirements for payment card readers and / or devices with contactless functionality for payment. Requirements are also stipulated for pricing of electricity and hydrogen fuel. Requirements for liquefied methane for road transport vehicles are optional.<br><br>Requirements for NPFs and national progress reporting remain within the AFIR, obliging Member States to report on progress and implementation. |
| **Qualitative review of impact of legislation on Ireland's road freight emissions** | The AFIR requires EU Member States to deliver alternative fuel infrastructure for HDVs, which will provide a base-level network of recharging and refuelling for battery electric and hydrogen-fuelled HDVs. The minimum requirements of the AFIR are expected to facilitate the movement of both vehicle technologies for HDVs, by providing this initial network of recharging and refuelling infrastructure. As such, the AFIR overall will have a positive impact on enabling the movement of zero emission HGVs, which is expected to result in a net reduction in emissions from Ireland's road freight by enabling the transition from fossil fuel HGVs to zero emission HGVs. |
| **Critical review of legislation** | In Ireland's context, the TEN-T Core network is a relatively short road network (500 km). The Comprehensive network is longer (1,700 km) and connects more of Ireland's urban nodes, but it is less well-travelled than the Core network. The new AFIR infrastructure targets are underpinned by an extensive analysis exercise; however, they are intended to provide a minimum level of infrastructure to support an expected number of HDVs. Additionally, targets for charging infrastructure for the Core network (and urban nodes) begin at the end of 2025, with targets for charging infrastructure for the Comprehensive network and safe and secure parking areas beginning at the end of 2027. Targets for HRSs begin at the end of 2030. As such, whilst the targets provide for an initial network for en route zero emission HDV recharging and refuelling, much more additional infrastructure may be necessary dependent on how the market evolves. Additionally, private and depot-based infrastructure is not addressed by the AFIR – private infrastructure is essential to the rollout of zero emission HGVs[35]. |

[35] The Alternative Fuels Observatory is a good source for tracking charging infrastructure deployment. Zap Map, which is considered the most robust source for charging infrastructure data in the UK, is currently expanding its rollout across Ireland. Open data regulations are assisting with provision of charging infrastructure data, though there are no obligations to report private charging locations.

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| **Is there scope for Ireland to go further?** | Yes – there is scope for Ireland to go further. Ireland's Draft National En-Route EV Charging Network Plan explicitly addresses the AFIR targets for HDV infrastructure[36]. The draft Plan highlights that the targets are expected to be sufficient to cater for Ireland's expected zero emission HDV uptake up until 2030, and that Ireland can take account of some derogations within the AFIR. Nevertheless, Irish Government can choose to continuously monitor the market and assess how much infrastructure is likely to be required for a fully zero emission HGV fleet, and can strategically plan where this infrastructure would best serve battery electric and hydrogen-fuelled vehicles, once the requirements of the AFIR for the Core and Comprehensive network have been considered. This is especially important if any new measures targeting road freight emissions are implemented, resulting in an increased zero emission road freight fleet This work is already alluded to in the draft Plan, and will be dependent on the development of the market. It aligns with what other countries are doing in terms of infrastructure provision for zero emission HGVs – for example, the UK[37]. |

[36] Department of Transport (2023), Draft National En-Route EV Charging Network Plan 2023-2030, https://assets.gov.ie/271453/27a5fef0-582c-46df-a16c-acfa2ea1df48.pdf

[37] UK Department for Transport (2023), Closed call for evidence: Infrastructure for zero emission heavy goods vehicles and coaches, https://www.gov.uk/government/calls-for-evidence/infrastructure-for-zero-emission-heavy-goods-vehicles-and-coaches/infrastructure-for-zero-emission-heavy-goods-vehicles-and-coaches

## Fact sheet: $CO_2$ emission performance standards for new heavy duty vehicles

| Legislation | Revision to the Regulation for $CO_2$ emission performance standards and reporting obligations for new heavy-duty vehicles |
|---|---|
| **Date of effect / status** | **Political agreement** on 13th May 2024; amending Regulation 2019/1242/EU , and repealing 2018/956/EU |
| **Summary of legislation** | The 2019 Regulation enforced $CO_2$ emission performance standards for new heavy-duty vehicles (HDV) on OEMs. Similar to the $CO_2$ emission performance standards for cars and vans, the HDV $CO_2$ emission performance standards pertain to fleet-wide average $CO_2$ emission targets for new HDVs registered by an OEM in a given calendar year, with the targets expressed as a percentage reduction of emissions compared to the EU average in the reference period (July 2019 – June 2020). As such, individual OEMs can reach targets by making ICE engines more efficient and / or by developing and selling more zero and low emission vehicles.<br><br>As of 14th May 2024 there is an agreed amendment to the existing regulation (2019/1242/EU), which proposes new targets for stronger $CO_2$ emission standards for HDVs from 2030 onwards and extending the scope of the regulation to cover smaller trucks, city buses, long-distances buses, and trailers. The amendment is in place to assist with reaching the EU's 2050 net zero target, in consideration of the difficulties in decarbonising road freight; it therefore falls outside of the Fit for 55 Package definition.<br><br>The updated targets from the revised regulation are as follows (all compared to 2019 levels):<br>• **2025**: 15% reduction in emissions – no change from previous targets.<br>• **2030**: previous target of 30% reduction in emissions; updated target of 45% reduction in emissions.<br>• **2035**: new target of 65% reduction in emissions.<br>• **2040**: new target of 90% reduction in emissions.<br><br>The Regulation is to apply to HGVs over 7.5t. There are some exemptions to the targets, including:<br>• Small-volume manufacturers and vehicles used for mining, forestry and agriculture.<br>• Vehicles for use by the armed forces and fire services.<br>• Vehicles for use in civil protection, public order and medical care.<br><br>The Regulation amendments also introduces a 100% zero emission target for urban buses by 2035, with an intermediate target of 90% by 2030. There is a review clause for the amendment in 2027. |
| **Summary of aspects relevant to Ireland's road freight sector** | The amendment to the Regulation is very highly relevant to Ireland's road sector in its entirety, as it directly addresses $CO_2$ emissions from road freight vehicles. The proposed amendment places stipulations on HDV OEMs to progressively reduce emissions from heavy vehicles; as such, any new HGVs entering Ireland's fleet will have to comply with the Regulation. |
| **Qualitative review of impact of legislation on Ireland's road freight emissions** | The amendment to the Regulation, if approved, will have a very large impact on Ireland's road freight emissions in the mid- to long-term. The progressive emission reduction targets for new HDVs will coincide with corresponding emission reductions from all new vehicles entering Ireland's HGV fleets. The impacts of the legislation on Ireland's road freight emissions will take some time to materialise – the stricter targets only come in from 2030 onwards, and they will also need to consider:<br>• The existing fleet replacement cycle of vehicles. |

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| | • Technological availability of zero emission HGVs, along with costs, policy and fiscal landscape, and infrastructure availability.<br>• The availability of right-hand drive zero emission HGVs (in consideration of Ireland's left-hand drive system).<br>However, once in place, the Regulation will have a large impact on Ireland's road freight emissions. |
| **Critical review of legislation** | The amendment to the Regulation is likely to be the legislative change that will have the greatest impact on Ireland's road freight emissions. The legislation falls outside the strict Fit for 55 Package definition, and as such it will take some time for the impacts of the Regulation to impact Ireland's road freight emissions. However, it nevertheless gets OEMs considering the Regulation at this stage and obliges them to put plans in place to significantly reduce the emissions from their new vehicles, thereby contributing to interim targets. The legislation sends the correct message to industry and aligns with other targets proposed in new EU legislation. |
| **Is there scope for Ireland to go further?** | Somewhat – it is not considered strictly necessary for Ireland to go further in the context of the legislation and the maturity of the market; however, the Irish Government can continue to provide support to industry in the form of incentives for zero emission HDVs and can continue to assess the market in the lead up to the new targets being implemented. Ireland can also seek to develop enabling conditions for zero emission HGVs through trials and R&D funding. However, in the context of the purpose of the legislation, Ireland does not need go for further. |

## Fact sheet: EU Sustainable Batteries Regulation

| Legislation | EU Sustainable Batteries Regulation |
|---|---|
| **Date of effect / status** | Adopted August 2023; repeals the Battery Directive (2006/66/EC) and amends Regulation (EU) No. 2019/1020. |
| **Summary of legislation** | The EU Sustainable Batteries Regulation sets requirements and targets for all batteries placed or put into service in the EU. The new legislation changes the policy landscape for batteries: it affects all batteries, covers all stages of a battery lifecycle, and increases the number of requirements place on battery manufacture. There are four main areas covered by the Regulation:<br>• Management of waste batteries<br>• Sustainability and safety (reducing social impacts)<br>• Due diligence<br>• Labelling and information, improving transparency of information.<br><br>The Sustainable Batteries Regulation is the first piece of EU legislation that takes a full lifecycle approach, covering sourcing, manufacturing, use, and recycling. It aims for battery manufacturing to have a reduced carbon footprint, use minimal harmful substances, need less raw materials from non-EU countries, and stipulates that batteries must be collected, reused, and recycled to a high degree in Europe.<br><br>The main regulation has been adopted; it is expected to be supplemented with more than 40 pieces of legislation developed in the near future to assist with implementation of the requirements of the regulation. The provisions begin to come in in August 2024, with a phased approach and an evolving route to compliance. |
| **Summary of aspects relevant to Ireland's road freight sector** | The Sustainable Batteries Regulation applies to all categories of batteries, including electric vehicle batteries (for BEVs or FCEVs). As such, the regulation will interact with electric HGVs deployed within Ireland's fleets.<br><br>The Regulation introduces labelling and information requirements on battery components and recycled content, with an electronic "battery passport" and a QR code, allowing a more robust understanding of a battery's manufacture / use. For EV batteries (and all batteries over 2kWh), a carbon footprint declaration is required.<br><br>All other aspects of the Regulation (sustainability and safety, due diligence for raw materials used for batteries, recycling targets, etc.) will apply to batteries located within zero emission HGVs in Ireland, with the onus on the entire battery industry and for manufacturers of all battery-operated products, including vehicles. |
| **Qualitative review of impact of legislation on Ireland's road freight emissions** | The introduction of the Sustainable Batteries Regulation assists with reducing the lifecycle emissions of zero emission HGVs, whether they are battery electric or hydrogen fuel cell vehicles. As such, the requirements of the Regulation should be viewed as having an overall positive impact on the sustainability of the battery supply chain, whilst not necessarily having a large impact on on-the-road freight emissions – it is currently unclear whether the Regulation will have impacts in terms of reducing the costs of batteries or making zero emission HGVs more attractive to hauliers from a TCO perspective. |
| **Critical review of legislation** | The principles of the Regulation should be viewed as a positive – one primary criticism of vehicles with batteries is that the manufacture of the batteries introduces harmful environmental impacts from a lifecycle perspective and utilises scarce materials sourced from non-EU countries. The Regulation addresses some of these criticisms and sets new targets for sustainable battery manufacture. The manufacture of batteries for Ireland's HGVs will therefore benefit from the introduction of |

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| | the Regulation from a lifecycle emissions perspective. Of note, it is unclear whether the Regulation will make zero emission HGVs more attractive from a TCO perspective.<br><br>The Sustainable Batteries Regulation is a relatively new piece of legislation and is set to be supported by numerous new pieces of underlying legislation. There is current confusion with respect to who is responsible for the various aspects of the Regulation. Affected companies are being recommended to prepare for the phased introduction of Regulation requirements, through aspects such as mapping out the requirements, developing strategies, and identifying solutions to meet the requirements of the Regulation. |
| **Is there scope for Ireland to go further?** | No – the Sustainable Batteries Regulation is an evolving piece of legislation and is supported by the European Battery Alliance. The Regulation will have a significant impact on manufacturers of battery-operated vehicles along with the battery industry as a whole (including manufacturers of small batteries and products and appliances using batteries) and preparing for the Regulation will be paramount to satisfying its requirements. However, there does not appear to be scope for Ireland to have to go beyond the Regulation currently, in the context of the aims of the Regulation. |

## EU legislation – what's next?

The Fit for 55 Package of legislation has been committed and EU Member States are currently implementing their requirements. In terms of developing an understanding of further legislative changes that may follow the Fit for 55 Package, focusing on legislation relevant to Ireland's road freight sector:

- European Parliamentary elections are due to be held in June 2024. The outcomes of the elections are likely to have an influence on the EU's pace and consideration of further legislative changes focused on the EU's net zero target.
- There are review clauses built into some of the EU legislation mentioned in the fact sheets above – for example, the $CO_2$ emission performance standards for both new heavy-duty vehicles and new cars and vans have review clauses for 2027.
- ETS 2 is not yet live; however, fuel suppliers will have to begin monitoring and reporting of emissions by 2025, with a view to having ETS 2 fully operational by 2027 (or 2028 dependent on the costs of oil).
- The ETD is not yet formally approved, with unanimity required in the European Council for its adoption to proceed. A majority of Member States have expressed a positive opinion on the suggested changes and the way forward (as of 2021); however, as of November 2023, there are still issues where some Member States are not yet in support of the text and / or scrutiny reservations. Work on agreeing the ETD text continues[38].
- The AFIR text was written to include a specific review of the legislation in the context of infrastructure provision for heavy-duty vehicles in the short-term, with the whole regulation being reviewed in the medium term. EU Member States are due to publish their NPFs in support of the AFIR by 2025.
- The Sustainable Batteries Regulation is a new regulation that will be supported by numerous additional in-development pieces of legislation, with over 40 pieces of legislation being developed in support of the Sustainable Batteries Regulation.
- The TEN-T Regulation is currently being reviewed, which includes considerations for cutting transport sector emissions whilst increasing connectivity across Europe. The revision of the TEN-T Regulation may have impacts on the composition of Ireland's TEN-T road network and the associated minimum requirements for charging infrastructure rollout for HGVs (e.g., if the lengths of the Core and Comprehensive networks are increased, this will require additional infrastructure rollout).

[38] European Parliament (2024), Revision of the energy taxation directive (ETD), https://www.europarl.europa.eu/legislative-train/spotlight-JD22/file-revision-of-the-energy-taxation-directive

## UK HGV policy developments – ICE HGV phase out dates

Whilst the UK is not a part of the EU, it is likely that policy developments related to decarbonisation of the UK's road freight sector will have an influence on Ireland's road freight emissions. This is because of the land border with Northern Ireland and the important trading relationships between the two countries (so that-UK registered HGVs are likely to operate within Ireland) and because the UK is the only relatively large right-hand drive market in Europe and is a source of second-hand HGVs for Ireland. In November 2021, the UK Government committed to all new HGVs in the UK being zero emission by 2040. The announcement coincided with the UK hosting COP26. The phase out targets are specifically for new non-zero emission HGVs weighing under 26t by 2025, and for all new HGVs sold in the UK to be zero emission by 2040.

In support of the phase out dates for ICE HGVs, the UK launched a Call for Evidence[39] in 2023, which sought feedback on infrastructure for zero emission heavy goods vehicles and coaches. The call for evidence sought information about the current and future supply, uptake, and use of zero emission HGVs and coaches across the UK, and their refuelling and recharging requirements. The intention is to use the outputs to inform the development of a data-led infrastructure strategy for zero emission HGVs, supporting the UK's Future of Freight Plan[40]. The consultation has since closed, with the outputs pending.

[39] UK Department for Transport (2023), Closed call for evidence: Infrastructure for zero emission heavy goods vehicles and coaches, https://www.gov.uk/government/calls-for-evidence/infrastructure-for-zero-emission-heavy-goods-vehicles-and-coaches/infrastructure-for-zero-emission-heavy-goods-vehicles-and-coaches

[40] UK Department for Transport (2022), Future of Freight: a long-term plan, https://assets.publishing.service.gov.uk/media/62b9a2ec8fa8f53572e3db68/future-of-freight-plan.pdf

### Vehicle technology trends

The decarbonisation of HGVs will comprise different alternative fuel types. It is likely that the zero emission fleet of HGVs will comprise a mixture of battery electric and hydrogen-fuelled vehicles, and both technology types are actively being developed by OEMs. Vehicle technology trends in the EU are likely to have an impact on Ireland's market – for example, support for a particular technology will have an influence on the technological development of that technology. To assess this, four aspects are analysed within this section:

- Factors that may have an impact on the pace of HGV decarbonisation in Ireland with respect to the current zero emission HGV market in Ireland, and potential influences in an EU context, looking at policy & fiscal landscape, technological development / vehicle availability, and infrastructure considerations.
- Review of trajectories for zero emission HGV technologies, in consideration of what zero emission technologies are being developed / adopted now, and an overview of some research into policy impacts and trajectories for future zero emission HGV deployment.
- Analysis of battery electric and hydrogen-fuelled HGV adoption in other European countries, assessing policies, funding streams, and infrastructure provision.
- UK vehicle technology trends, assessing developments and funding streams for UK zero emission HGV adoption in consideration of the UK's likely impact on the Irish market.

## 3.3 Factors impacting pace of HGV decarbonisation in Ireland

Table 14 below analyses factors that may impact the pace of HGV decarbonisation in Ireland. The factors are broken down under three headings: policy & fiscal landscape; technological readiness & vehicle availability; and infrastructure considerations. Each factor is described in the context of the zero emission HGV market, followed by providing contextual commentary on the current Irish HGV market and potential interactions with the EU and UK markets.

**Table 14: Factors impacting pace of HGV decarbonisation in Ireland and interaction with EU market**

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| **POLICY & FISCAL LANDSCAPE** | | | |
| **Initial ZE HGV purchase costs** | The higher purchase costs of zero emission (ZE) HGVs are a significant barrier to their adoption. The higher costs are primarily driven by the higher costs of batteries and fuel cell components, and the nascency of the technologies. Costs of ZE HGVs are expected to decline due to economies of scale, advancements in technology, and increased competition amongst manufacturers; however, in 2024, ZE HGVs can be approximately twice the cost of comparative diesel HGVs. The trajectory of further cost reductions is less certain due to recent political events and availability of materials. Future technological advancements and cost reductions are expected to occur. | The higher costs of ZE HGVs will continue to be a prominent barrier in adopting ZE HGVs in Ireland. There is little to no HGV manufacturing capacity in Ireland, and as such costs will be dictated by imported ZE HGVs from EU or globally. | It is expected that many of Ireland's ZE HGVs will be imported from the EU and globally, and as such costs will be influenced by these markets. The manufacture of right-hand drive vehicles (for Ireland's left-hand drive system) also needs to be considered, particularly in the short-term. This is likely to link the Irish market with the much larger UK market. |
| **Policy and political certainty** | Development of government policy and strategy addressing ZE HGVs and infrastructure has a strong influence on the decarbonisation of the HGV market. Governments can pursue policies such as phase out dates and sales bans for ICE HGVs, mandates for zero emission vehicles, implementation of $CO_2$ regulations, and by developing strategies for infrastructure for ZE HGV deployment. An uncertain political direction for the decarbonisation of HGVs, in terms of technological choice or focus, has been cited as a barrier to ZEV deployment in HGV fleets[41][42]. | The Irish Government has released several strategies, including the Road Haulage Strategy, the Hydrogen Strategy, and the draft En-Route EV Charging Network Plan 2023-2030. There is scope for further Government action in HGV decarbonisation. | EU legislation heavily impacts the Irish market, including ETS 2, the $CO_2$ emission performance standards for HDVs and the AFIR. The UK has also announced a phase out date for non-zero-emission HDVs. |
| **Incentives and fiscal policies** | Incentives and fiscal policies (e.g. tax reductions) remain one of the strongest tools to reduce the upfront capital costs of ZE HGVs, and to help total cost of ownership (TCO) comparisons between ZE HGVs and ICE HGVs. Incentives in general are frequently positively linked to increasing ZEV adoption in all fleets. When considering differential vehicle taxes by fuel type, it is important to distinguish between a one-off vehicle registration tax (which affects the initial decision to add an additional vehicle (new or second-hand import) to the Irish fleet) and annual vehicle tax (which affects ongoing TCO calculations). | Ireland currently offers the Zero-Emission Heavy Duty Vehicle Purchase Grant Scheme, along with several tax benefits for zero emission vehicles more broadly. In the context of HGVs, incentivisation is likely to be needed far into the future due to the much higher upfront purchase costs of ZE HGVs. | Relevant EU legislation includes the ETS 2 and the ETD (once agreed). Many European countries offer incentives and tax benefits for ZE HGVs. The European Automobile Manufacturers' Association (ACEA) maintains a fact sheet[43] for tax benefits and purchase incentives for electric commercial vehicles. The UK also |

[41] ITF (2023), How governments can bring low-emission trucks to our roads – and fast, https://www.itf-oecd.org/low-emission-trucks

[42] Road Haulage Association (2023), 'Prioritise operators' needs to help meet net zero ambitions, says RHA', https://www.rha.uk.net/news/news-blogs-and-press-releases/press-releases/detail/prioritise-operators-needs-to-help-meet-net-zero-ambitions-says-rha

[43] ACEA (2023), Electric commercial vehicles: Tax benefits and purchase incentives, https://www.acea.auto/fact/electric-commercial-vehicles-tax-benefits-and-purchase-incentives-2023/

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| | Incentives and fiscal policy will be necessary for ZE HGVs far beyond those offered for ZE cars and vans. | | offers purchase incentives and tax benefits. |
| **ZE HGV fuelling costs** | Fuel costs have a very strong impact on vehicle choice and on ZE HGV adoption, especially when considering TCO comparisons between ZE HGVs and ICE HGVs. EVs tend to be cheaper to fuel than ICEVs, especially when recharging is undertaken in private locations such as depots. The cost of hydrogen as a fuel has been cited as one of the most prominent current barriers to FCEV adoption (along with the availability of hydrogen as a fuel). The ZE HGV market is particularly sensitive to fuelling costs due to the distances travelled by the vehicles. Cheaper electricity and hydrogen costs would make ZE HGVs more attractive from a TCO perspective. | For electricity, generation and supplier charges are open to competition, whilst transmission and distribution charges are regulated by the Commission for Regulation of Utilities (CRU), in addition to taxes and the Public Service Obligation (PSO) levy. Recharging in private locations is cheaper than public locations. No current hydrogen cost information is available. | For electricity costs, they can be influenced by global geopolitical events. Hydrogen for transport should ideally be produced within Ireland, due to the cost of hydrogen fuel and the difficult in transporting hydrogen fuel. One study[44] found favourable costs for Irish green hydrogen production in a European context. ETS 2 and ETD (once agreed) will also have an impact on fuelling costs. |
| **Carbon tax and fuel duty** | Rising costs of petrol and diesel fuels would be expected to have a corresponding effect on ZE HGV adoption. The use of carbon tax and fuel duty to disincentivise vehicle purchase and / or use of ICEVs can therefore have a strong impact on ZE HGV adoption. Leveraging the cost of petrol and diesel fuel amongst certain user groups can enable the TCO of ZE HGVs to reduce and accelerate their deployment in the wider Irish fleet. | The Irish Government controls a significant proportion of fuel prices in Ireland. The Government could seek to raise the price of petrol and diesel in Ireland to make ZE HGVs more attractive. | The price of petrol and diesel is significantly influenced by global geopolitical events and oil market trends, as Ireland heavily relies on imported oil. The ETD, once agreed, will have an impact on fuel costs. |
| **TECHNOLOGICAL READINESS & VEHICLE AVAILABILITY** | | | |
| **Technological readiness & powertrain efficiency** | The technological readiness of battery electric and hydrogen-fuelled HGVs will influence when they begin to achieve mass adoption into HGV fleets. EVs have had a relative advantage over FCEVs as they are well-developed and technologically mature in the passenger car and van markets. The technological maturity of ZE HGVs is lagging behind passenger car and van fleets, especially for larger and long-haul freight and for more challenging duty cycles, where ZE HGVs are typically still being trialled rather than being adopted broadly by the market. Investment in and facilitation of research and development programmes can assist with accelerating the technological readiness of ZE HGVs. Fuel efficiency also has an impact on ZE HGV adoption, | The Irish market has little influence on the technological readiness of ZE HGVs due to the lack of HGV manufacturing capacity in Ireland. Ireland can seek to get involved in or administer funding or research and development programmes focused on ZE HGV deployment. | The technological readiness and powertrain efficiency of ZE HGVs is heavily influenced by technological development of other countries that are developing and trialling the vehicle. Funding programmes and R&D funding focused on ZE HGVs has an influence on the development of the market, along with OEM plans for development. |

[44] Ryze Hydrogen (2023), By 2030, Ireland could manufacture the most affordable green hydrogen in Europe, https://www.ryzehydrogen.com/2023/03/14/by-2030-ireland-could-manufacture-the-most-affordable-green-hydrogen-in-europe/.

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| | where electricity as a fuel is much more efficient on an energy basis compared to hydrogen. | | |
| **Suitability of ZE HGVs EVs to vehicle duty cycles** | The operation of ZE HGVs is currently more well-suited to some vehicle categories than others. HGV duty cycles and payload requirements may be too onerous for current ZE HGV technologies, especially for long-haul freight if payloads and ranges that are the same as ICE vehicles are required by the market. Battery electric technology is currently being deployed for smaller HGVs for regional and urban distribution, with both battery and hydrogen technologies being considered for long-haul freight. Vehicles with more defined duty cycles and distances are considered as better suited to adoption of ZE HGVs, as infrastructural requirements are better understood. Some vehicle types are more difficult to transition than others, e.g., construction vehicles, where there is a requirement for in-duty energy supply. Whilst current ZE HGV technologies may be more challenging for higher mileage fleets, these fleets will nevertheless access greater benefits from reduced fuel costs. | Ireland's road freight sector is well-suited to ZE HGV adoption from a distance and duty cycle perspective. Ireland has a lot or urban and regional distribution – the average length of haul for an Irish-registered HGV is 75km for longer distance journeys overseas and to / from Northern Ireland, and 65km for domestic movements[45] (noting there is large variation around this average), which falls well within the range of many ZE HGVs. ZE HGV movements need to be accompanied by a suitable infrastructure network. | Despite Ireland's road freight sector being well-suited to some ZE HGVs, availability of ZE HGVs is influenced by the EU and global markets, where Ireland is reliant on ZE HGVs coming from abroad. |
| **Age profile & scrappage rate** | The age profile of Ireland's HGVs, and the associated fleet replacement cycle and vehicle scrappage rate, has an impact on the transition of Ireland's HGV fleet to ZE HGVs. Implementation of incentivisation and scrappage policies can have an impact in amending age profiles. The age profile of Ireland's HGVs is also impacted by sales of HGVs to other countries. | The average age of vehicles in Ireland is 7.9 years for LGVs, 12.0 years for HGVs <26t, and 10.6 years for HGVs >26t[46]. The age profile of Ireland's HGV fleet can be amended through suitable policy / incentives. | The age profile and fleet replacement cycle, specific to ZE HGVs, is influenced by sales of ZE HGVs into Ireland from the EU, the UK, and globally, along with sales of Irish vehicles into other countries. |
| **Proportion of new sales that is ZE HGVs** | The proportion of new HGV sales that is ZE HGVs has a direct impact on the trajectory of ZE HGVs into both the new fleet and into the second-hand market. The proportion of ZEVs in passenger car and van fleets has been increasing in recent years and is expected to continue to have an upwards trajectory. ZE HGVs still make up a very small proportion of overall HGVs sales, | The draft Climate Action Plan has targets of 700 HDVs and 300 buses to be electric by 2025, and 3,500 low-emission HGVs and 1,500 electric buses | The amendment to the HDV $CO_2$ emission standard will have a large impact on Ireland's fleet in the mid- to long-term. Ireland's left-hand drive system may also act as a barrier to ZE HGV delivery |

[45] Based on analysis undertaken by MDS Transmodal.

[46] Fleet age figures originate from a SYSTRA analysis of vehicle registration data for Ireland at the end of 2022. The figures exclude agricultural and construction vehicle types, but the figures include vehicles that are registered but not used frequently on roads. Please also note that this analysis does not include vehicles registered in the UK (Great Britain and Northern Ireland) or mainland Europe that are driving on Irish roads, which may be significant for HGVs >26t.

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| | and as such there will be a corresponding delay in ZE HGVs hitting the second-hand market. | by 2030[47]. Policy levers could increase this proportion more rapidly. | (mitigated to some extent by the UK providing a large market in close proximity to Ireland). |
| **Supply-side constraints** | Supply-side constraints can also have an impact on the ability of ZE HGVs to enter Ireland's HGV fleet. There are several potential supply side constraints that may impact deployment of new ZE HGVs in Ireland, including:<br>• **Availability of raw materials**: raw materials such as lithium, cobalt and nickel are not always available in sufficient quantities, with fluctuating prices. Global supply chain pressures may hold back demand. Other innovative battery chemistries may have an impact on availability of raw materials also, though many are still in trial phase.<br>• **Capacity of manufacturing plants**: requirement for specialised manufacturing plans, which can take significant time to build.<br>• **Regulation**: emission standards may affect OEM plans to produce ZE HGVs.<br>• **Global political environment**: recently, the energy crisis, the war in Ukraine and their impacts on European manufacturing can affect supply of materials. | Ireland's market does not have a major influence in the supply of ZE HGVs, as Ireland is reliant on the global supply chain and on global policy, with little to no HGV manufacturing capacity within Ireland. | Ireland is heavily reliant on both EU and global supply chains for ZE HGVs entering Ireland's fleet. The new EU Sustainable Batteries Regulation introduces an array of new requirements on batteries placed or put into service in the EU, including management of waste batteries, sustainability and safety, due diligence, and labelling and information. |
| **Second-hand market** | The age profile of second-hand imports, and the split of new vehicle registrations between 'new' and 'second-hand' imports can impact the trajectories of ZE HGVs into Ireland's overall HGV fleet. Vehicle purchasing behaviours will have an impact, particularly in consideration of existing age profiles of Ireland's HGV fleets. There is general uncertainty over the second-hand market for ZE HGVs, with variable paces for different vehicle categories and powertrain technologies. Small to medium sized enterprises (SME) will be particularly reliant on the second-hand market to purchase ZE HGVs. Additionally, Ireland's left-hand drive system may have an impact on sales of second-hand vehicles. | The second-hand ZE HGV market in Ireland will take some time to materialise. Ireland can seek to facilitate the second-hand market in Ireland in the future, such as through provision of targeted incentives / policies. For current freight vehicles, the average age of a second-hand import in the Greater Dublin Area is 4.3 years for LGVs, 5.8 years for HGVs <26t, and 6.7 years for HGVs >26t[48]. | Ireland's second-hand market will be heavily influenced by vehicle imports from the EU, UK, and globally. Ireland's left-hand drive system also has an impact on vehicle imports. Brexit has not had a major impact on Ireland's second-hand HGV market. |
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[47] Government of Ireland (2023), Climate Action Plan 2024, https://www.gov.ie/en/publication/79659-climate-action-plan-2024/

[48] Second-hand vehicle age figures originate from a SYSTRA analysis of ANPR survey data undertaken at a number of sites in central Dublin in February 2020. Please note that these figures apply solely to the Greater Dublin Area, and as such they are a proxy for the Irish fleet as a whole. Please also note that this analysis does not include vehicles registered in the UK (Great Britain and Northern Ireland) or mainland Europe that are driving on Irish roads, which may be significant for HGVs >26t.

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| | | | |
| **Maintenance of zero emission HGVs** | Both battery electric and hydrogen-fuelled HGVs will require unique skills and workshops to inspect, maintain and repair the vehicles. Battery electric and hydrogen-fuelled HGVs introduce new requirements and skills for inspection, maintenance and repair, including maintenance of batteries and fuel cells. Workshops will require additional considerations in terms of the safety of both vehicle types, with risk assessments required to identify any dangers associated with maintenance and repair. Skills shortages and a lack of dedicated workshops (or retrofitting of workshops) can inhibit the maintenance and repair of ZE HGVs. | Availability of skills in Ireland to inspect, maintain and repair ZE HGVs may act as a barrier. ZE HGVs are manufactured abroad, so there is a need to consider how vehicles will be maintained and repaired. Some OEMs are currently undertaking these tasks themselves. Skills are being developed by the UK Institute of Motor Industry. One source notes Ireland's current issues with HGV mechanics[49]. | As a relatively new industry, maintenance and repair of ZE HGVs is currently evolving. Standards are being developed (for example by the BSI); and the UK Institute for Motor Industry (IMI) qualifies mechanics, including the Irish workforce. Many European OEMs are leading on this development. The National Standards Authority of Ireland (NSAI) is not known to be undertaking any work in the area of HDV decarbonisation. |
| **INFRASTRUCTURE CONSIDERATIONS** | | | |
| **Infrastructure availability – en-route / public** | The availability of recharging and refuelling infrastructure has both a direct and indirect impact on ZE HGV uptake. A large majority of fleet operators prefer depot-based infrastructure for ZE HGVs; however, en-route infrastructure will also be necessary for some operations including long-haul freight. Fleet operators may only consider purchase of ZE HGVs if they perceive the supporting infrastructure to be in place, giving them confidence in their ability to fuel their vehicles. An underdeveloped infrastructure network can act as a significant barrier to ZE HGV adoption. ZE HGVs may require dedicated public infrastructure – for battery electric, very high-powered charging will be necessary due to the larger vehicle batteries; for both fuel types, the infrastructure needs to be situated in strategic locations that support current duty cycles of ZE HGVs, such as motorway service areas, with dedicated infrastructure to reduce wait times. | The Irish Government has released its draft En-Route EV Charging Network Plan 2023-2030, which commits to AFIR targets and states that the AFIR targets should be sufficient for expected electric HGV uptake up until 2030. Ireland's National Hydrogen Strategy commits to the AFIR's targets for HRS deployment, though limited further information is provided. There is currently only one privately located HRS in Ireland. Required infrastructure for ZE HGVs should be monitored. | The EU's AFIR stipulates targets for charge points and HRSs for ZE HGVs. All EU Member States are obliged to provide a network of infrastructure, and some EU countries are currently developing infrastructure. There is a need for a skilled workforce to deploy the infrastructure, especially due to the quantity of infrastructure required. The UK is also providing funding for ZE HGV infrastructure, including a call for evidence for ZE HGV infrastructure. |
| **Infrastructure availability – depot-based / private** | Infrastructure for ZE HGVs needs to be considered for both depot-based and en-route infrastructure. For depot-based charging infrastructure, chargers with a sufficiently high-power rating will be required to recharge the large batteries within BEV HGVs, likely for overnight charging, and depots will have to be suitably designed to facilitate vehicle movements along with the | Depot-based infrastructure for ZE HGVs is by far preferred by fleet operators over en-route infrastructure. The distances travelled by most HGVs in Ireland are well-suited to depot-based | There is little interaction with the EU market for private infrastructure. Some ZE HGVs are currently being deployed across Europe – Ireland can seek to learn lessons from current deployment on an EU basis. |

[49] HGV Ireland (2023), Shortage of HGV mechanics causing industry concerns, https://www.hgvireland.com/shortage-of-hgv-mechanics-causing-industry-concerns/

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| | chargers. For depot-based hydrogen-fuelled vehicles, consideration needs to be given to hydrogen fuel output of HRSs, along with how the hydrogen will be manufactured or transported to the vehicles. Both infrastructure types come with high costs and a necessity for grid connections. Vehicle to grid (V2G) charging may also be beneficial to private infrastructure for battery electric HGVs[50]. | infrastructure. Fleet operators will need to upgrade their depots / fleet locations with supporting infrastructure. | Skills may also be leveraged from the EU. V2G is still developing as a technology; the website V2G Hub maintains a database of global V2G projects[51]. |
| **Infrastructure costs** | The costs of infrastructure for ZE HGVs can impact the deployment of ZE HGVs into Ireland's fleet. Public funding is likely to be required for early en-route infrastructure rollout for both battery electric and hydrogen-fuelled HGVs due to the excessively high costs associated with en-route infrastructure deployment. Private depot-based infrastructure can also be prohibitively expensive for fleet operators whilst being operationally necessary for the operators. Incentives and funding can also benefit the deployment of private infrastructure. | The costs of infrastructure provision for ZE HGVs in Ireland are very high, irrespective of whether the infrastructure is public or private. The costs of infrastructure may act as a barrier to ZE HGV uptake in Ireland – funding specifically for depot-based infrastructure may be necessary. | The AFIR is accompanied by funding to facilitate provision of alternative fuels infrastructure in EU Member States – this is solely for public en-route infrastructure. Infrastructure costs for ZE HGVs are similarly high across Europe, and further funding support is likely required to facilitate widespread adoption. |
| **Infrastructure build rates** | The build rates of infrastructure, and the availability of a suitably skilled workforce, can also impede the deployment of infrastructure supporting ZE HGVs. Whilst installation of EV charging is becoming well-established, there may be skills shortages in terms of deployment of higher-powered charge points and HRSs. Build rates are also affected by planning and consents, and on development of strategies to support ZE HGV refuelling / recharging. | There is no known current public infrastructure dedicated to ZE HGVs in Ireland, and as such it is difficult to comment on build rates. Government can seek to leverage the planning system to hasten the pace of infrastructure installations. | The availability of skills across the EU to install the necessary infrastructure for ZE HGVs is currently unknown. There is a possibility of importing skills from the EU to facilitate the Irish market. |
| **Location of ZE HGVs and infrastructure** | The locations of both ZE HGV fleets and supporting infrastructure can impact ZE HGV adoption rates. Rural areas poorly served by charging infrastructure and HRSs may experience slower adoption rates of ZE HGVs. Urban areas where there is limited space to install infrastructure and the associated grid capacity upgrades can also impede infrastructure deployment for ZE HGVs. | There is a large rural geographic area of Ireland, which may result in uneven infrastructure provision. Urban areas, where depots may currently be | The AFIR is intended to provide a base-level network of infrastructure to support ZE HGVs across Ireland. There is no major interaction with the EU market beyond the AFIR for this aspect. |

[50] V2G (also called V2X, standing for vehicle-to-everything) is a technology that enables energy to be pushed back to the electrical grid from the battery of an electric vehicle. This can provide flexibility services to the electrical grid, such as additional grid support when demand on the grid is high. The effectiveness of V2G is dependent on the downtime / parking routines of vehicles – for example, if vehicles are connected to a V2G aggregator in the evening hours when overall demand on the grid is high, then the vehicle batteries can be used to cost-effectively support the grid; however, vehicles only parked overnight are less effective for V2G as demand on the grid is low during nighttime hours. V2G is typically incentivised, as the electrical grid makes use of the EV battery.

[51] V2G Around the World, https://www.v2g-hub.com/

| Factor | Description | Commentary on Irish market | Interaction with EU & UK market |
|---|---|---|---|
| | Depots may also have existing space constraints which add difficult to installing infrastructure supporting ZE HGVs. | located, can also experience difficulties in terms of space availability. | |
| **Grid capacity** | All infrastructure supporting ZE HGVs will require grid connections, which can come with very high costs and additional spatial installation considerations. Higher-powered charging for electric HGVs will necessitate very large grid capacity connections to support the power requirements, for depots, destination and en-route charging. HRSs will also necessitate high-capacity grid connections, especially where green hydrogen is produced via electrolysis. Rural areas of Ireland may experience difficulty, or excessively high costs, associated with grid connections and additional grid capacity. Smart charging and possibly V2G can assist with grid capacity constraints and high costs of grid connections. | ESB Networks is responsible for grid connections and upgrades in Ireland at the distribution level. Urban areas can experience barriers in terms of space availability, whilst rural areas can have barriers in terms of excessively high costs for connection due to distance from the existing network. Grid connections must be assessed on a case-by-case basis. | The AFIR is intended to provide a base-level network of public en route recharging and refuelling infrastructure to support ZE HGVs across Ireland. The UK has provided funding for the costs of grid connections at motorway service areas for charging infrastructure, in consideration of the prohibitively high costs of grid connections. |

## Trajectories for zero emission HGV technologies

There are very few zero emission HGVs currently deployed across the EU. In order to inform future deployment from a technological perspective, technology development and potential policy impacts can be investigated.

## Battery electric and hydrogen-fuelled HGVs – competition or co-existence?

A frequent topic of debate is whether battery electric or hydrogen-fuelled HGVs will become the technology of choice for zero emission road freight. Different HGV OEMs are putting varying emphasis on battery electric or hydrogen technologies, though a majority of OEMs are actively looking into developing both technology types.

SYSTRA analysis indicates that there has been a shift in recent years in terms of development of both battery electric and hydrogen-fuelled HGVs. In 2020/21, OEM development plans and support were assessed to be skewed towards hydrogen-fuelled vehicles across most vehicle classes; however, development plans and support for battery electric HGVs is now assessed to supersede hydrogen-fuelled HGVs, particularly across smaller HGV classes.

The number of models on offer for zero emission HGVs have continued to expand which will assist with making the vehicles more attractive and improve price competitiveness with their ICE counterparts (from 94 in 2021 to 129 in 2023). The total number of OEMs working in the zero emission HGV space has also increased from 37 in 2021 to 47 in 2023. Most current battery electric HGV models have ranges between 200km and 500km, with the exception of Tesla's developing electric HGV which has a stated range of 800km. Hydrogen-fuelled HGV models are very limited in number as per analysis carried out for the end of 2023, primarily as fuel cell truck markets are less mature. Only four OEMs currently have their models in operation with range from 100km to 800km[52].

In reality, it is very likely that both technology types will co-exist, with battery electric being used for applications and duty cycles where batteries are a suitable replacement for diesel, and hydrogen being explored where battery electric is considered infeasible. There is growing recognition that different classes of HGVs will need to be considered differently from a technological perspective, with smaller HGVs undertaking regional / urban distribution being well-suited to battery electric vehicles, and with longer haul potentially being suited to both technology types.

[52] IEA (2023), Global EV Outlook 2023: Trends in electric heavy-duty vehicles, https://www.iea.org/reports/global-ev-outlook-2023/trends-in-electric-heavy-duty-vehicles

A report[53] from the International Transport Forum (ITF) of the Organisation for Economic Co-operation and Development (OECD) found that the technological readiness of EVs for HGVs is more advanced than for hydrogen-fuelled vehicles from a technology readiness level (TRL) perspective of both the vehicles and the supporting infrastructure. The report strongly recommends that governments should not postpone investment decisions due to technological uncertainty, and that governments should support a limited number of solutions to guide the market. In particular, the report highlights that support for battery electric HGVs is a 'low regret' policy and advises that support should be provided for the 'most likely' technology, which is currently BEVs for smaller HGVs and regional and urban distribution. Supporting battery electric HGVs now can have further positive impacts on the development of battery electric technology for larger vehicle categories.

### Research assessing future trajectories of zero emission HGV technologies

Research and assessments of fleet trajectories of zero emission HGV technologies are an indicator of what we may expect in terms of future zero emission HGV deployment. Current research tends to focus on technology trajectories in the context of resulting from policy implementation. Table 15 below presents some research efforts assessing trajectories for zero emission HGV technologies, with a summary of each study provided.

[53] ITF (2023), How governments can bring low-emission trucks to our roads – and fast, https://www.itf-oecd.org/low-emission-trucks

**Table 15: Research sources assessing trajectories for zero emission HGV technologies**

| Source | Summary |
|---|---|
| **Insights from Irish energy systems modelling on decarbonising road freight and the impact of intangible costs** | Ireland-specific analysis[54] was carried out from the perspective of energy systems modelling of the road freight sector using the TIMES-Ireland model. The analysis investigated "intangible costs" of recharging time, cargo capacity, and hurdle rate in a comparison of battery electric and hydrogen-fuelled HGVs. The results found battery electric technology preferable across all HGV weight categories from a system modelling perspective; but that hydrogen fuel cell HGVs may be preferable in larger HGV categories when intangible costs are considered. |
| **The European heavy-duty vehicle market until 2040: Analysis of decarbonisation pathways** | This research[55] assesses the cost-effectiveness of different $CO_2$ reduction strategies for the HDV sector. Required HDV technology market shares to meet mandated $CO_2$ reduction targets are examined along with the corresponding decarbonisation cost. In addition, HDV $CO_2$ reduction targets up to 2040 are proposed. The study focuses on four main truck technologies: diesel, liquified-natural gas, battery-electric, and hydrogen fuel-cell trucks. Manufacturers' compliance costs are quantified, along with the impact of different decarbonisation strategies on the consumer and society by conducting a cost-benefit analysis. |
| **Analysis to provide costs, efficiencies and roll-out trajectories for zero-emission HGVs, buses and coaches** | This Element Energy study for the UK's Climate Change Committee[56] considered decarbonisation pathways based on three technology options: battery-electric vehicles with ultra-rapid charge points, hydrogen fuel-cell vehicles with hydrogen refuelling stations, and pantograph-electric vehicles with overhead electric catenary charging. The report provides recommendations for government support for each technology type. |

[54] MaREI (2023), Insights from Irish energy systems modelling on decarbonising road freight and the impact of intangible costs, https://iea-etsap.org/workshop/summer_semi-annual_meeting_june_23/06%20-%20ETSAP%20presentation-VA.pdf

[55] ICCT (2023), The European heavy-duty vehicle market until 2040: Analysis of decarbonisation pathways, https://theicct.org/wp-content/uploads/2023/01/hdv-europe-decarb-costs-jan23.pdf

[56] Climate Change Committee (2020), Analysis to provide costs, efficiencies and roll-out trajectories for zero-emission HGVs, buses and coaches (Element Energy), https://www.theccc.org.uk/publication/analysis-to-provide-costs-efficiencies-and-roll-out-trajectories-for-zero-emission-hgvs-buses-and-coaches-element-energy/

| Source | Summary |
|---|---|
| **How to decarbonise long-haul trucking in Germany** | This study[57] analyses the system costs and total cost of ownership (TCO) of those vehicle technologies which might be used to decarbonise Germany's long-haul truck fleet (where 'long-haul' is defined as freight movements on single vehicle trips longer than 400km). In Germany, 76% of the total road freight activity is performed on single trip distances of up to 800 km which constitutes the minimum range of the vehicle technologies examined in this study. |
| **Techno-economic uptake potential of zero-emission trucks in Europe** | This study[58] assesses the techno-economic feasibility and market uptake potential of zero-emission trucks for the European Union (EU) and the United Kingdom (UK) over the timeframe 2020 – 2040. The analysis is carried out for four different vehicle segments, i.e. rigid trucks for urban delivery and three different articulated tractor trailers for regional delivery, long haul and construction. |
| **Zero Emission HGV Infrastructure Requirements** | This research[59] investigates the expected infrastructure costs and requirements to support a fully zero emission HGV fleet in the UK under various technology focused scenarios, considering battery electric, hydrogen fuel cell, electric road system, and hybrid technologies. The study found that provision of hydrogen infrastructure is the most cost-effective option; **however**, this study solely considers infrastructure and does not analyse vehicle costs, which change the analysis. |

[57] Transport & Environment (2021), How to decarbonisation long-haul trucking in Germany: An analysis of available vehicle technologies and their associated costs, https://www.transportenvironment.org/wp-content/uploads/2021/07/2021_04_TE_how_to_decarbonise_long_haul_trucking_in_Germany_final.pdf

[58] TNO (2022), Techno-economic uptake potential of zero-emission trucks in Europe, https://www.transportenvironment.org/wp-content/uploads/2022/10/202210_TNO_-techno_economic_uptake_potential_of_zero_emission_trucks_in_Europe.pdf

[59] Climate Change Committee (2019), 'Zero Emission HGV Infrastructure Requirements', https://www.theccc.org.uk/publication/zero-emission-hgv-infrastructure-requirements/

## 3.4 Vehicle technology trends in the EU

### Introduction

The broader European market is likely to have an impact on the Irish market in terms of efforts in HGV decarbonisation, including many of the aspects mentioned in the preceding section. EU countries can develop their own policies and strategies, informed by wider EU policy. This section provides further information on some EU trends in terms of HGV decarbonisation, assessing aspects such as policies and strategies, funding streams, and infrastructure deployment. Of note, due to the nascency of the zero emission HGV market, research and data regarding deployment of zero emission HGVs in Europe is currently limited.

### General trends

Many EU countries are currently maintaining a technology neutral stance on HGV decarbonisation, noting that both technology types are likely to have their place in overall HGV decarbonisation. However, battery electric HGVs have a relative advantage over hydrogen-fuelled HGVs due to the fact the technology is well-developed for car, van, and bus fleets. The IEA Global EV Outlook[60] identifies an increasing trend of electric HGV registrations in Europe. Battery electric HGV registrations are now around 4.4% of total HGVs registered in Europe (2022 statistics), up from approximately 2% in 2020. However, the data points out that overall, compared to electric buses and cars, electric HGV sales shares remain low across Europe[61].

The IEA Global Hydrogen Review[62] has found that efforts to stimulate low-emission hydrogen demand are lagging behind what is needed to meet climate ambitions, which aligns with efforts to support hydrogen-fuelled HGVs and supporting infrastructure across the EU. Further technological development and infrastructure provision are necessary to facilitate deployment of hydrogen-fuelled HGVs.

In terms of general support for developing zero emission vehicles, Norway is frequently considered as a pioneer for enabling EV deployment, whilst Germany is considered ahead of the curve in terms of their support for hydrogen, though neither country is considered very far advanced specifically in terms of zero emission HGV deployment. The information in subsequent sub-sections within this

[60] IEA (2023), Global EV Outlook 2023, https://www.iea.org/reports/global-ev-outlook-2023
[61] The Alternative Fuels Observatory is a useful source for tracking uptake of zero emission vehicles. National Governments typically also collect more robust data and information (e.g. in-depth information about vehicle type).
[62] IEA (2023), Global Hydrogen Review 2023, https://www.iea.org/reports/global-hydrogen-review-2023/executive-summary

section draws upon information for Germany and Norway in particular, whilst also providing general commentary on trends.

Electric road systems (ERS) have also been considered by various EU countries to decarbonise the HGV fleet. ERS comprises in-motion charging of vehicles, via overhead catenaries, in-road conductive power transfer, or in-road inductive power transfer. Some countries including Sweden and Germany have developed trials of ERS; however, ERS has yet to make a prominent impact in the conversation surrounding HGV decarbonisation, primarily due to infrastructural requirements. The UK's Climate Change Committee has considered the challenges and costs of ERS, focusing on overhead catenaries[63].

### Development of policies and strategies

Many EU countries are currently developing policies and strategies focused on decarbonisation of HGVs and transport more broadly. Germany has implemented a country-wide policy which is effective from 1st December 2023, which sees all HDVs being taxed based on their $CO_2$ emissions. This has been administered with a view to motivate HDV owners to adopt new technologies, such as battery electric vehicles and / or hydrogen fuel cell vehicles.

In 2020, Germany launched its National Hydrogen Strategy[64], outlining steps to make the country a global leader in hydrogen technologies. The strategy emphasises the importance of green hydrogen for a variety of sectors, including transport, and sets out a roadmap for its adoption, including the construction of a 1,800 km core-grid for hydrogen until 2027/2028 with further distribution grid to follow. The German Hydrogen Strategy lists goals for short, medium and long term, all to be completed by 2030. The policy focuses on the supply of hydrogen in achieving Germany's climate neutrality goal by 2045. The increased hydrogen supply as result of policy measures is deemed important to ensure the increased use of hydrogen in industry, heavy commercial vehicles and in air and sea transport by 2030.

Through the National Innovation Programme for Hydrogen and Fuel Cell Technology, the German Federal Ministry of Transport is supporting projects that utilise hydrogen for transport, especially in the areas of road, rail, water and air transport.

[63] Climate Change Committee (2019), Zero Emission HGV Infrastructure Requirements, https://www.theccc.org.uk/publication/zero-emission-hgv-infrastructure-requirements/

[64] Bundesregierung (2023), National Hydrogen Strategy: Energy from climate-friendly gas, https://www.bundesregierung.de/breg-en/news/hydrogen-technology-2204238

Similarly, Norway, leading the world in terms of EVs uptake, has revised its set policy goal from 50% HGVs to be emission-free to every HGV to be zero-emission by 2030[65]. The immediate aim is to raise the electric share of new heavy vehicles from 10% to 20% by 2024.

### Funding streams, incentives, and R&D funding

EU countries have provided funding streams above and beyond funding packages administered by the European Commission. The European Automobile Manufacturers' Association (ACEA) has produced an electric commercial vehicle tax benefit and purchase incentive guide[66] (the guide also considers hydrogen fuel cell vehicles). The guide stipulates that:

- 22 EU Member States (approximately 80%) do not offer incentives for infrastructure development or installation.
- Almost 33% of EU Member States do not offer incentives for purchasing electric commercial vehicles.
- Three Member States (Estonia, Hungary, and the Netherlands) do not offer tax benefits.
- In general, EU Member States offer a lower number of tax benefits and purchase incentives for electric commercial vehicles compared to electric passenger cars.

In 2021, the German government pledged €6.6 billion to boost commercial fleets' uptake of zero emission powertrains, including retrofitting vehicles to replace the diesel power units[67]. The government announced payment of up to 80% of the additional investment costs of electrifying current vehicles compared to replacing vehicles with diesel equivalents. The Federal Ministry of Transport funding programme has covered both purchase of new zero-emission commercial vehicles of classes N1 (up to 3.5 metric tons), N2 (up to 12 metric tons) and N3 (more than 12 metric tons) and conversions to alternate drives in classes N2 and N3. With respect to charging infrastructure, the German government is providing €300 million towards expanding the charging infrastructure, with €200 million available for rapid charging infrastructure[68].

The German federal government in total has provided over €2.2 billion for research and development for zero-emission mobility since 2009. Four federal ministries are involved in providing the funding including the Federal Ministry for Economic Affairs and Climate Action with funding focused on electric

[65] Mobility Portal Europe (2023), Norway sets ambitious zero-emissions goal for trucks by 2030, https://mobilityportal.eu/norway-zero-emissions-goal-trucks-2030/

[66] ACEA (2023), Electric commercial vehicles: Tax benefits and purchase incentives, https://www.acea.auto/fact/electric-commercial-vehicles-tax-benefits-and-purchase-incentives-2023/

[67] Wards Auto (2021), Germany to help commercial fleets go electric, https://www.wardsauto.com/vehicles/germany-help-commercial-fleets-go-electric

[68] Transport & Environment (2021), How to decarbonise long-haul trucking in Germany: An analysis of available vehicle technologies and their associated costs, https://www.transportenvironment.org/wp-content/uploads/2021/07/2021_04_TE_how_to_decarbonise_long_haul_trucking_in_Germany_final.pdf

mobility systems, including drivetrain technology, battery storage, standardisation, fleet and logistics strategies, grid integration and infrastructure[69].

Norway's economic development agency, Enova, has launched a funding programme to build charging infrastructure for heavy-duty electric commercial vehicles in the country. Funding is available for the construction of charging locations with at least four connections, each offering 350 kW of power.

Support can be up to 80% of the approved costs, limited to ten million NOK (equivalent to €856,000). Enova plans for the support programme to run until the summer of 2025.

### Infrastructure networks

With respect to infrastructure, no European countries can currently be classed as 'good examples' of robust infrastructure provision for zero emission HGVs, primarily due to the current early stage of the market and the relative impracticality of deploying battery electric and hydrogen-fuelled HGVs in terms of their higher purchase costs. In a competitive market environment for road haulage where diesel HGVs can be bought for so much less, this results in little commercial interest on the part of hauliers in developing or planning for infrastructure for zero emission HGVs across the EU. Infrastructure for zero emission HGVs also has different design requirements, which can also act as a barrier to further zero emission HGV deployment.

The Alternative Fuels Infrastructure Regulation (AFIR, as outlined under Task 2.1) aims to provide a base-level of en route public infrastructure for battery electric and hydrogen-fuelled HGVs on the Core and Comprehensive TEN-T networks by 2030 at the latest. EU Member States must develop National Policy Frameworks (NPF) to outline how they plan to install the infrastructure to support zero emission HGVs. The AFIR is supported by the Alternative Fuels Infrastructure Facility (AFIF), which is an ongoing financing instrument to support innovation and improvements in the European alternative fuel infrastructure market. Of note, private infrastructure is not addressed by the AFIR or AFIF – private infrastructure is considered vital to the successful rollout of zero emission HGVs.

EU countries also develop their own funding packages to support further deployment of infrastructure for zero emission vehicles. Germany announced support for expansion of charging infrastructure required for battery-electric vehicles in conjunction with vehicle purchase / conversion at 80% of the expenditure, with its pledge of €6.6 billion to boost commercial fleet uptake.

Whilst a literature review suggests that although Norway is known as a pioneer in the adoption of electric cars and charging infrastructure, the infrastructure network for HGVs is considered

[69] Federal Ministry for Economic Affairs and Climate Action (2022), Electric mobility in Germany, https://www.bmwk.de/Redaktion/EN/Dossier/electric-mobility.html

underdeveloped in Norway in relative terms compared to that provided for cars and vans – Enova has acknowledged the underdeveloped network for charging electric HGVs. However, according to Enova, the lack of charging infrastructure for HGVs is also due to the market, which has so far relied on electric HGVs to a small extent, because diesel trucks still have a lower TCO[70]. Battery electric HGVs have different requirements for charging than cars. Since manoeuvring requires a lot of space, the charging stations common with cars are impractical at the head of the parking space. As such, it is trickier to develop charging infrastructure for HGVs, especially when electric and hydrogen-fuelled HGVs are significantly more expensive than ICE HGVs. It will only become economically attractive for charging operators to invest in their own electric HGV charging parks as the market share of battery electric HGVs increases.

Denmark plans to establish 25 new electric HGV charging parks across the country, strategically located within 60 km of each other, bringing a total of 175 charging points, aligning with updated AFIR targets. Denmark currently only has two public charging areas for electric HGVs at present, in contrast with diesel HGVs, which can fuel at over 2,200 fuelling stations[71].

## UK vehicle technology trends

The UK's efforts in road freight decarbonisation can also be analysed due to their likely influence on Ireland's road freight sector. This section provides information on some developments and funding streams in the UK.

### Zero Emission HGV and Infrastructure Demonstrator Programme

The UK Government has launched a funding programme aimed at supporting the deployment of zero emission HGVs and the supporting infrastructure. The programme is called the Zero Emission HGV Infrastructure Demonstrator programme (ZEHID, formerly called the Zero Emission Road Freight Demonstrator (ZERFD)) and was preceded by the Zero Emission Road Freight Trial (ZERFT) funding, which was focused on limited vehicle deployment and data collection mechanisms.

The £200m of funding is aimed at supporting deployment of zero emission HGVs and infrastructure across three strands: battery electric truck demonstration; hydrogen fuel cell truck demonstration; and battery and hydrogen demonstration. The funding award was announced in 2023, and the successful projects will deploy over 300 battery electric HGVs and over 60 hydrogen fuel cell HGVs, along with 57 recharging and refuelling sites specifically for zero emission HGVs. The announcement

[70] Electrive (2023), Enova to fund truck charging infrastructure in Norway, https://www.electrive.com/2023/07/03/enova-to-fund-truck-charging-infrastructure-in-norway/
[71] Trans Info (2023), Denmark to invest millions in electric truck charging stations, https://trans.info/denmark-to-invest-millions-in-electric-truck-charging-stations-371655

was coupled with a Freight Innovation Fund (FIF), which is a £2.4m fund to pioneer green technology in freight, specifically for SMEs. Four projects were successful in obtaining ZEHID funding[72], with deployment expected to begin in 2025.

**Development of standards for zero emission HGVs**

As part of the ZEHID programme, funding is being allocated to the development of standards to support the deployment of zero emission HGVs in the UK. The British Standards Institution (BSI) delivered a Prioritisation Report for the ZERFD (now ZEHID) Standards Programme[73], which analysed the landscape for technical standards in the context of deployment of zero emission HGVs, particularly in the context of where there may be gaps in standards on an international basis. The report found that many standards are being developed that directly or indirectly support zero emission HGV deployment, but that there are gaps in the standards being developed.

The ZEHID programme is currently funding the development of two new British Standards with a view to fill the gaps identified in international standards. The first standard is focused on developing a charging taxonomy / classification for charging infrastructure specifically for HGVs, aiming to standardise charging provision at service areas, along with considering safety of charging. The second standard is focused on maintenance and inspection of battery electric and hydrogen-fuelled HDVs, focusing on vehicle workshops and safety protocols. Further standards may also be funded via the programme. The first drafts of the current standards are expected to be funded in 2024[74].

**Infrastructure funding for zero emission HGVs**

In addition to the ZEHID programme, the UK Government is administering the Rapid Charging Fund (RCF)[75], which is a £950m fund intended to support the development of rapid charging infrastructure at motorway service areas (MSA) by funding the expensive grid connections at MSA sites. The primary intention of the RCF is to fund infrastructure for cars and light-duty commercial vehicles, though the

[72] Zemo Partnership (2023), Government announces £200m investment in zero emission trucks – Zemo response, https://www.gov.uk/government/calls-for-evidence/infrastructure-for-zero-emission-heavy-goods-vehicles-and-coaches/infrastructure-for-zero-emission-heavy-goods-vehicles-and-coaches

[73] British Standards Institution (2023), ZERFD Standards Programme – Prioritisation Report, https://www.bsigroup.com/siteassets/pdf/en/capabilities/bsi23_003_zerfd_phase2_report_a4_v4-1.pdf

[74] Whilst these standards are being developed in the UK, they may still be adopted in Ireland with minor modifications (e.g., considering Irish / EU legislation rather than UK legislation). British Standards can later be developed into European standards as part of the standards development process. There are many other standards either in development or fully developed that relate to battery electric and hydrogen-fuelled HDVs – many of these are listed in the ZERFD Standards Programme – Prioritisation Report, https://www.bsigroup.com/siteassets/pdf/en/capabilities/bsi23_003_zerfd_phase2_report_a4_v4-1.pdf.

[75] UK Department for Transport (2021), Rapid charging fund, https://www.gov.uk/guidance/rapid-charging-fund

design of the fund (currently in development[76]) is also intended to support installation of grid capacity for HGVs at MSAs to future proof the grid capacity upgrades. The UK's National Grid released a study[77] that found that a relatively small increase in the RCF funding stream would future proof expected demand from HGVs in the future.

## 3.5 Impacts on emission reductions for the Irish freight sector

### Introduction

This section brings together the prior analysis to provide a qualitative view of the impacts of new EU legislation and zero emission vehicle technology trends in the EU on emission reductions for the Irish freight sector. Each aspect is addressed sequentially.

### Impacts of EU legislation

With respect to the impacts of EU legislation on Ireland's road freight sector emissions:

- The combined Fit for 55 Package is designed to achieve net GHG emission reductions of at least 55% by 2030. The Fit for 55 Package (and subsequent legislative developments) include road transport and road freight within its scope.
- For the road freight sector, the full impacts of emission reductions resulting from EU legislative developments may not be felt until close to 2030 and beyond, in consideration of the early stage of the market and the difficulty of decarbonising heavy road freight.
- This is evidenced through the proposed dates for the introduction of many of the aspects within the Fit for 55 Package that are relevant to road freight. For example, infrastructure under AFIR has targets between 2025 and 2030; ETS 2 will not be live until 2027 at the earliest; the changes to the HDV $CO_2$ emissions performance standards will only take effect from 2030; the SBR is still in development and has a phased approach; and full agreement on ETD is yet to occur.
- The amended HDV $CO_2$ emission performance standards regulation is likely to drive the biggest impacts on Ireland's road freight emissions through stipulating more stringent targets for emissions from new HDVs, with the stricter emissions targets beginning in 2030. The

[76] UK Department for Transport, Rapid charging fund: scheme design, https://www.gov.uk/government/consultations/rapid-charging-fund-scheme-design

[77] National Grid (2022), Supporting the growth of clean transport: Decarbonising Heavy Goods Vehicles on the Strategic Road Network, https://www.nationalgrid.com/document/146441/download

updated regulation will work in tandem with other regulations (e.g., ETS 2, ETD) to make the TCO more attractive for fleet operators[78].

- The targets in the AFIR, and the associated financial support from the AFIF, are essential to create the enabling conditions for zero emission HGVs. The necessary infrastructure to support further zero emission HGVs should be continuously monitored.
- The UK's influence on Ireland's road freight emissions should be recognised, especially in the context of the UK announcing phase out dates for new non-zero emission HGVs (2035 for <26t and 2040 for >26t). The EU has yet to formally commit to phase out dates.
- In Ireland's context, the Fit for 55 Package and subsequent legislation is a suitable package of legislation to reduce Ireland's road freight emissions – the legislation works in combination, sends the right unified message, and addresses some criticisms from existing legislation, updating the legislation in the context of net zero targets. There is large scope for Ireland to introduce measures above and beyond the Fit for 55 Package.
- Beyond stated commitments in each piece of EU legislation, it is difficult to predict what new legislation may be developed in the coming years, primarily due to the European Parliamentary elections taking place in June 2024, which are likely to have an influence on further emphasis on new zero legislation.

### Impacts of EU technology trends

- In consideration of the impacts of EU technology trends on Ireland's road freight sector emissions:
- There are many factors that impact the pace of HGV decarbonisation in Ireland, and many of these factors have a strong interaction with the EU market beyond EU legislation, and the UK market.
- In particular, Ireland is reliant on imported zero emission HGV technology, along with the global supply chain for zero emission vehicles. In the short-term, Ireland's right-hand drive vehicles (for Ireland's left-hand drive system) may pose difficulties in obtaining zero emission HGVs in Ireland, though this is mitigated to some extent by the UK providing a large market in close proximity to Ireland which OEMs will want to supply.
- Many European countries are developing policies, strategies, incentives and fiscal measures, and providing funding for vehicles, infrastructure and R&D in the HGV decarbonisation space, with a view to developing the enabling conditions for road freight emission reductions. Ireland

[78] The total cost of ownership is an estimation of the expenses associated with purchasing, deploying, using, and retiring a HGV, and is particularly important in the context of zero emission HGVs – whilst the higher upfront costs can be a deterrent to purchase, the costs of using and operating a zero emission HGV can be lower than for comparable ICE vehicles, due to aspects such as lower fuelling costs and possibly lower maintenance and repair costs.

could seek to learn from other European countries and / or develop trials focused on zero emission HGV and supporting infrastructure deployment.

- It is too early to assess whether Ireland has the necessary skills to deploy zero emission HGVs and infrastructure, or whether these skills will need to be imported. Skills need to be considered from the contexts of infrastructure deployment and vehicle management and maintenance.
- Across Europe, battery electric vehicles have had a relative head start over hydrogen-fuelled vehicles, as it is a more established market due to EVs being deployed in passenger car and van markets.
- In the context of HGVs, there is growing agreement that there is a need to distinguish between classes of HGVs from a technological perspective. Battery electric technology is currently being deployed for smaller HGVs for regional and urban distribution, and one study highlighted it is a "low regret" investment that could benefit larger HGV categories in terms of technological development.
- For longer haul road freight, technological development is not as well-advanced, and as such both battery electric and hydrogen-fuelled HGVs are still being considered.
- Ireland's road system is well-suited to current battery electric HGV ranges, with the average length of haul for an Irish-registered HGV being 75km for longer distance journeys overseas and to / from Northern Ireland, and 65km for domestic movements (though with large variation around this average); the primary dependency on the EU market is availability of vehicles.
- The UK is also supporting development of zero emission HGVs, through designated funding for demonstrating zero emission HGV and infrastructure deployment, development of technical standards, and expanding current funding streams. These aspects may also influence Ireland's road freight emissions.

### What can Ireland do next?

A key question is what Ireland can do beyond the influence of EU legislation and EU technology trends to support the deployment of zero emission HGVs. At this stage, Ireland can seek to create the enabling conditions to allow the market to develop, in consideration of the policy & fiscal landscape, technological readiness and availability of vehicles, and provision of supporting infrastructure.

Measures that Ireland can implement to reduce road freight emissions are explored in detail in the next section of this report, under the Avoid-Shift-Improve framework.

# 4 DEVELOPING POTENTIAL MEASURES

## 4.1 Introduction

This section of the report focuses on developing a 'long list' of potential measures that the public sector in Ireland, in partnership with the private sector, could pursue to reduce carbon emissions from HGVs by 2030 over and above what is already being done at a national level and what Ireland will be required to do by the EU.

It then sets out the results of a high-level and qualitative evaluation of the measures in an attempt to highlight those which are most likely to be effective in reducing carbon emissions (as quickly as possible) while also taking account of potential economic impacts and practical (if not political and legal) deliverability issues.

## 4.2 Methodology

This section of the report sets out the criteria which have been used to determine whether measures should be included in a 'long list' of Avoid-Shift-Improve (ASI) measures to encourage the decarbonisation of HGVs and then goes on to set out how the measures have been evaluated using high-level multi-criteria analysis.

### Criteria for selection of measures for the long list

The following criteria, all of which have to be met, have been used to determine whether individual measures should be included in the 'long list':

- The measure should lead to a reduction in $CO_2$ emissions from HGVs by 2030;
- The measure should be over and above what Ireland is currently committed to implementing by 2030, as set out in the *Irish Road Haulage Strategy 2022-31* and the *Moving Together* Draft Strategy or as required by EU law;
- The measure is believed to be within the legal competence of Ireland and therefore not requiring supra-national or international agreement; and
- It is believed to be possible to implement the measure without requiring a radical re-structuring of the Irish economy and existing market mechanisms.

The 'long list' that was developed consists therefore of measures that would reduce carbon emissions and be additional to what is already planned, and without Ireland being required to restructure its economy to a radical extent.

## Categorisation of measures

The measures have then been categorised in terms of the Avoid-Shift-Improve (ASI) framework, using the following broad definitions:

- **Avoid/Reduce:** avoid trips by reducing the number of trips required to transport the same quantity of goods;
- **Shift:** switch as many of the remaining 'necessary' trips from road to more sustainable non-road modes of transport; and
- **Improve:** switch the remaining road freight movements to a technology/fuel which minimises carbon emissions.

The measures have also been classified according to an alternative categorisation (originally developed for a study of urban freight transport for DG MOVE of the European Commission), which is more focused on what the measures are, rather than specifically on how they reduce carbon emissions. The six categories, along with their definitions, are as follows:

- **Regulatory:** Rules and prohibitions, supported by a control/enforcement system, that are designed, at least in theory, to control private activity for the wider benefit of society. They require an accurate enforcement system to prevent possible infractions. Most regulatory measures are implemented by introducing some degree of differentiation between 'virtuous' and 'less virtuous' vehicles, particularly in an attempt to promote more sustainable distribution of goods.
- **Market-based/fiscal:** Measures such as taxes and tolls are usually defined as 'market-based' measures because their aim is to modify the market prices of freight transport that generates the negative externalities. Changes in prices usually have a direct impact on the behaviour of the freight industry, as individual operators have to respond to changes in their costs to remain competitive.
- **Land use planning:** Measures that relate to changing the use of space, such as developing specialist logistics zones; these measures can generally only be effective with a consistent policy over a long period due to the time it takes to change existing land use patterns.
- **Technology (data and transport equipment):** Measures to encourage the take-up of zero emission HGVs and the application of digital technologies to improve the efficiency of freight operations.
- **Infrastructure:** Measures that develop new links and nodes in the freight transport network to facilitate more sustainable freight transport movements. Infrastructure, particularly when it relates to road and rail network links, is often regarded as being a 'public good', so that the public sector makes the requisite investment. However, the freight transport industry also invests on a commercial basis in fixed infrastructure such as warehousing and port terminals.

- **Management/other:** Measures that are not covered by the other categories. These are usually 'bottom-up' measures that are 'softer' in nature, often requiring some kind of collaboration between actors to achieve more sustainable distribution while reducing costs or adding value for freight transport operators and/or their customers.

## Evaluation of the measures using Multi-Criteria Analysis

Each ASI measure in the 'long list' was then analysed qualitatively using the following criteria (see Table 16 below), which reflect the fact that the main objective is reduce carbon emissions (and wherever possible other negative externalities) related to road freight, while also focusing on economic impacts which are relevant to freight transport as a mainly private sector, market-based activity.

**Table 16: Criteria for high level multi-criteria analysis**

| Broad type of criterion | Criterion | Scoring ("good", "quite good", "not so good") |
|---|---|---|
| Environment | Potential to reduce aggregate carbon emissions from 'heavy' road freight (overall reduction in tonnes of carbon emitted) | High, Medium, Low |
| Environment | Potential speed of impact on carbon emissions | Fast, Neither fast nor slow, Slow |
| Environment | Potential to reduce other externalities from 'heavy' road freight (NOx, PMs, noise, accidents, infrastructure wear & tear, congestion) | High, Medium, Low |
| Economy | Direct cost impact on freight transport industry | Reduction, Little change, Increase |
| Economy | Wider economic impact (inflation, employment, GDP) | Positive, Little change, Negative |
| Economy | Impact on public finances (subsidy, grants, tax gain) | Positive, Little Change, Negative |
| Deliverability | Extent to which the measure can be delivered from a practical point of view (excluding political & legal issues) | Relatively easy, Neither easy nor difficult, Difficult |

There are three environmental criteria, focused on the extent and speed of potential reductions in carbon emissions and the impact on other negative externalities. There are three economic criteria, namely the direct impact on the freight transport industry's costs, the wider impact on the Irish economy and the impact on the public purse. Finally, there is consideration of the practical issue of deliverability of the measure. The latter avoids making judgments about political acceptability and the extent to which new legislation would be required, which are both regarded as being beyond the scope of a relatively 'technical' research study on how to decarbonise road freight transport movements.

The evaluation of the 'long list' was split between 'Avoid' measures (section 3), 'Shift' measures (section 4), 'Improve' measures (section 5) and what have been called 'Hybrid' measures, where individual measures by their very nature encompass more than a single element of the ASI framework.

## 4.3 Avoid measures

### Introduction

The 'long list' of additional 'Avoid' measures includes six individual measures that would avoid (or at least reduce) the need for trips by HGVs. Each measure is described in terms of what it is and how it would reduce the number of HGV trips required. The descriptions assume that the measure is applied on its own to achieve the objective of reducing carbon emissions, rather than as a package of measures. The measures are then evaluated using the MCA methodology set out in section 2.4 above.

### The 'Avoid' measures

As freight transport is a derived demand, it is inherently difficult to avoid the movement of freight without assuming a reduction in economic activity. The avoid measures shown in Table 17 below are therefore generally designed to reduce the number of HGV trips (and HGV km) required to transport a given quantity of goods by increasing the efficiency of the demand for, or the supply of, road haulage.

**Table 17: Long list of potential 'Avoid' measures**

| Reference | Measure | Type of measure |
|---|---|---|
| A1 | Retail Consolidation Centres | Infrastructure & Management |
| A2 | Construction Consolidation Centres | Infrastructure & Management |
| A3 | Port-centric distribution | Infrastructure |
| A4 | Longer HGV semi-trailers | Regulatory & Market-based |
| A5 | Delivery & Servicing Plans (DSPs) | Management |
| A6 | Supply chain collaboration | Regulatory & Technology |

### Evaluation of measures

Each of the above six avoid measures was evaluated on a judgmental basis against the seven criteria and the results for each are described below. A summary of the results of the evaluation for all the measures is provided at the end of the section in Table 18.

## A1: Retail consolidation centres

| Infrastructure & management measure |
| --- |
| **Description:** Develop a network of retail consolidation centres on the edge of major urban areas for 'last mile' urban deliveries. This involves the physical transfer of retail goods between inbound (partially laden) vehicles into outbound (full) vehicles in a warehouse called a consolidation centre. The concept is based on the assumption that inbound vehicles are not "full", either by weight or volume, and therefore efficiencies can be achieved by consolidating final deliveries into a smaller number of outbound vehicles and therefore saving vehicle kilometres, fuel and reducing carbon emissions. When the outbound vehicles are zero emission, this can also be an Avoid/Improve hybrid measure. |

Retail consolidation centres are not generally commercially viable in their own right because they add cost and time to the transport chain due to the need to transfer goods between vehicles in a physical warehouse and the transfer of liability for making final deliveries to a specialist "last mile" logistics company. In addition, the rationale for the use of a consolidation centre is based on the assumption that inbound HGVs are only partially laden, which is not necessarily the case. They are most likely to be used by hauliers if there is a strong incentive or an obligation to use them - as is the case for any retail goods that are delivered airside at Dublin and Heathrow Airports for security reasons – and where they provide some form of mitigation when strong regulatory measures are introduced, perhaps to reduce carbon emissions in urban areas.

There are limited commercial benefits to hauliers from retail consolidation centres in their own right and therefore they are unlikely to be used (without a strong incentive) and therefore the impact on carbon and other negative externalities is limited. They add cost to transport chains and therefore have a negative impact on industry costs and would have little impact on the wider economy. They are relatively difficult to deliver because they require not only a physical warehouse, but also an IT system which can be integrated with those of numerous inbound hauliers and their shippers/receivers. Furthermore, the warehouses need to be as automated as possible to minimise the time and cost for the consolidation process.

## A2: Construction Consolidation Centre (CCC)

| Infrastructure & management measure |
| --- |
| **Description:** Specialist distribution site with both open and covered storage on the periphery of an urban area to which suppliers to construction sites are required to deliver materials (bricks, bagged cement, timber etc.). Instead of an HGV from each supplier entering a city to make deliveries to an individual site, a single consolidated load can be delivered to each construction site. The return trip can also be used to transport waste and unused materials from the site, again minimizing vehicle movements to each individual site. CCCs are usually developed to alleviate congestion in city centres due to the number of HGV movements to individual construction sites and can be operated to meet the requirements of construction logistics plans for individual developments. The centres also act as a location for buffer storage of construction materials away from the construction sites, so that materials can be delivered on a just-in-time basis to sites which are often space-constrained. When the outbound vehicles are zero emission, this can also be an Avoid/Improve hybrid measure. |

These are likely to be only marginally commercially viable (if at all) in their own right because they may add cost and time to the transport chain due to the need to transfer goods between vehicles in a physical consolidation centre and the transfer of liability for making final deliveries to a specialist 'last mile' construction logistics company. In addition, the rationale for the use of a consolidation centre is based on the assumption that deliveries to construction sites will only be of fragmented part-loads, which is not necessarily the case if a haulier is operating a 'milk round' to deliver construction materials to different sites in the same urban area. However, these additional costs can be partially offset by the logistics benefits of holding some off-site buffer stock, with deliveries on a 'just-in time' basis each day and minimising the storage space required for materials at the construction site; the inbound haulier also benefits from not having to enter the city centre and make the final delivery. They are most likely to be used by hauliers and developers/construction contractors if there is a strong incentive or an obligation to use them, perhaps with a planning condition attached to the construction site.

There may be some operational (and even marginal commercial) benefits for developers and contractors at construction sites and so they may be prepared to pay some additional costs related to their use of CCCs and could therefore lead to some moderate reductions in HGV km and therefore carbon emissions and other negative externalities.

They probably add cost to transport chains and therefore have a negative impact on industry costs (which may be mitigated by other benefits) and, given the scale of movements, would probably have only a limited impact on the wider economy. They are relatively difficult to deliver because they

require not only a physical warehouse, but also an IT system which can be integrated with those of numerous inbound hauliers and their shippers/receivers. Any changes in planning guidance and their application to construction sites by local authorities via planning conditions and the requirement for formal logistics plans is likely to make the impact quite slow and also increase the complexity of delivery.

### A3: Port-centric distribution (PCD)

| Infrastructure & management measure |
| --- |
| **Description:** Develop distribution centres at ports for traffic that passes 'across the quay' at the relevant port. This moves the origin or destination of the international cargo to the port estate and so removes the need for a road leg for international cargo between the port and an inland warehouse (the final destination or first origin of the cargo) and therefore reduces carbon emissions. When the outbound vehicles are zero emission, this can also be an Avoid/Improve hybrid measure. |

Port-centric distribution is generally developed on a commercial basis within a port estate for use by shippers of goods which have mainly been imported across the quay at the relevant port, so they can remove the need for haulage legs to inland destinations. These savings would need to be balanced against the (likely) higher rents that would apply in a port estate and the port-centric distribution centres can only be developed in ports that are not space constrained. Further commercial barriers for shippers/receivers include historic industrial relations issues in ports (with the fear of goods being 'trapped') and wanting the flexibility of not being tied to a single port (and being subject to increasing levels of economic rent).

However, the potential cost savings mean that industry costs and HGV km and other net externalities can all be reduced, even if the scale of the contribution to reducing Ireland's overall emissions would be limited and there would be little impact on the wider economy. They can be delivered by the private sector relatively quickly (particularly if the planning system is supportive), but cannot be implemented easily in a space-constrained port without the port reorganising land use or even ejecting existing tenants.

## A4: Longer HGV semi-trailers

| Regulatory & market-based measure |
| --- |
| **Description:** Regulatory approval of longer HGVs (probably, for safety reasons, on selected routes) to transport higher volumes (not weight) of freight. This reduces the number of HGV trips and HGV km required to transport a given volume of goods. |

Longer semi-trailers can be operated by hauliers on a commercial basis when transporting goods that are voluminous in nature and can reduce, to some extent, the number of HGV trips and HGV km required to transport a given quantity of freight. This therefore leads to some moderate reductions in carbon emissions and other negative externalities. However, there are likely to be concerns about the safety of the use of longer semi-trailers and this may lead to a requirement for pilots to examine the wider impacts, as well as their potential to reduce carbon emissions; this will slow down their implementation by road hauliers.

The longer semi-trailers are available (and are already operating in the UK) and so can be implemented quite quickly by the hauliers, but there are likely to be regulatory issues that need to be addressed, such as specifying the appropriate trunk routes with detailed plans to ensure the safe access to, and egress from, individual distribution centres.

## A5: Delivery & Servicing Plans (DSPs)

| Management measure |
| --- |
| **Description:** Collaborative procurement by public sector (and large private sector) organisations so that the demand for deliveries for an organisation or to a particular site is consolidated into fewer deliveries than would be the case with less-coordinated procurement. This involves the organisation developing and then following procurement procedures which centralise the purchase of goods to "fill" inbound vehicles rather than buying goods in small quantities as and when required. |

DSPs are used to reduce the demand for deliveries from individual offices and other locations where the sources of orders for deliveries can be uncoordinated and therefore inefficient. More coordinated procurement processes can consolidate order quantities and help to increase the fill of HGVs making the deliveries. However, this assumes that the hauliers are making single small deliveries to an individual location rather than seeking to minimise their own costs by following multi-drop 'milk round' itineraries.

This means that the potential impact on carbon emissions (and other negative externalities) is likely to be minimal and can be achieved only slowly. There is likely to be only a small impact on haulier

costs and a negligible impact on the wider economy. Deliverability requires action by a large number of different buyer organisations making it difficult to achieve any significant impact.

### A6: Supply chain collaboration

| Regulatory & technology measure |
| --- |
| **Description:** Public sector allows/encourages shippers and road hauliers to share information on flows using digital technology for planning purposes and then collaborate operationally to share loads. This can allow hauliers to better balance loads in both directions and avoid 'empty running', therefore reducing the number of HGV trips and HGV km. |

Supply chain collaboration involves two or more shippers/receivers and/or road hauliers sharing data on road freight flows to assess whether there are opportunities to reduce 'empty running'. This is already achieved in practice by third party logistics providers (3PLs) who, with the permission of their customers, seek to balance compatible flows and pass on some of the cost savings. However, many shippers and receivers want to have a bespoke service for their freight flows, do not want to share their traffic flows (and therefore sales volumes) with other companies and also fear that collaboration would lead to concern from the competition authorities. The matching of flows would generally require the use of an IT system, which involves sometimes complex and time-consuming integration between different companies' own systems and negotiations about how to share the cost savings.

This means that the potential impact on carbon emissions (and other negative externalities) is likely to be minimal and be achieved only slowly. There is likely to be only a small impact on haulier costs when aggregated at a national level and a negligible impact on the wider economy. Deliverability requires action by a number of different shippers/receivers which will have concerns about data confidentiality, a deterioration in the reliability of supply chains and attention from the competition authorities.

**Table 18: Evaluation of potential 'Avoid' measures**

| Measure | Impact on carbon emissions | Potential speed of impact on carbon emissions | Potential to reduce other externalities | Extent of direct cost impact on freight transport industry | Extent of wider economic impact (inflation, employment, GDP) | Impact on public finances (subsidy, grants, investment, tax gain) | Extent to which the measure can be delivered from a practical point of view |
|---|---|---|---|---|---|---|---|
| A1: Retail Consolidation Centres | Low | Slow | Low | Increase | Little change | Negative | Relatively difficult |
| A2: Construction Consolidation Centres (with accompanying construction logistics plans) | Medium | Slow | Medium | Little change | Little change | Little change | Relatively difficult |
| A3: Port-centric distribution | Medium | Slow | Medium | Reduction | Little change | Little change | Neither easy nor difficult |
| A4: Longer HGV semi-trailers | Medium | Slow | Medium | Reduction | Little change | Little change | Neither easy nor difficult |
| A5: Delivery & Servicing Plans (DSPs) | Low | Slow | Low | Little change | Little change | Little change | Relatively difficult |
| A6: Supply chain collaboration | Low | Slow | Low | Little change | Little change | Little change | Relatively difficult |

## 4.4 'Shift' measure

### Introduction

Given the time horizon for the report of 2030, the 'long list' of additional Shift measures includes a single measure that might assist in shifting some freight movements from road to rail by 2030. The measure has then been evaluated using the MCA methodology set out in section 2.4 above.

### The 'Shift' Measure

The Shift measure shown in Table 19 below involves seeking to transfer freight movements from what would otherwise be road freight movements to rail at Dublin Port, as the main alternative mode for domestic transport within Ireland. However, there is also an opportunity to encourage maritime cargo to be transported as close to the inland origin or destination as possible by sea and therefore minimise inland HGV km, which is also related to Dublin Port.

**Table 19: Long list of potential 'Shift' measures**

| Reference | Measure | Type of measure |
|---|---|---|
| S1 | Enhance rail connection to Dublin Port | Infrastructure |

### Evaluation of measures

The Shift measure was evaluated on a judgmental basis against the seven criteria and the results for each are described below. A summary of the results of the evaluation for all the measures is provided at the end of the section in Table 20.

### S1: Enhance rail connection to Dublin Port

| Infrastructure |
|---|
| **Description:** Enhance the rail connection at Dublin Port to allow rail freight services to operate efficiently to and from the Port. Where sufficient traffic for full trainloads is available on a regular basis, a small regional intermodal terminal or bulk rail terminal would also be required. |

Assuming that commercial analysis of demand shows there is sufficient demand on a point-to-point basis, the development of an enhanced rail connection at Dublin Port could have some (if limited) benefits in terms of catering for a shift of containerised traffic to rail over longer distances and, particularly if new zero emission locomotives are deployed, reduce carbon emissions and other negative externalities from road freight (if only to a limited extent). Such a measure would also

encourage the use of containers for maritime transport, which are transported on longer distance RORO or LOLO services (rather than short distance accompanied HGVs on the shortest crossings of the Irish Sea). Some subsidy might be required to support the development of new or enhanced rail facilities at Dublin Port. Deliverability will depend on market demand on a point-to-point basis and the location, topography and space constraints of Dublin Port; Dublin's rail access, for example, is currently across a major road which leads to the entrance to the Dublin Port Tunnel.

**Table 20: Evaluation of potential 'Shift' measures**

| **Measure** | Impact on carbon emissions | Potential speed of impact on carbon emissions | Potential to reduce other externalities | Extent of direct cost impact on freight transport industry | Extent of wider economic impact (inflation, employment, GDP) | Impact on public finances (subsidy, grants, investment, tax gain) | Extent to which the measure can be delivered from a practical point of view |
|---|---|---|---|---|---|---|---|
| S1: Enhance rail connection at Dublin Port | Low | Neither fast nor slow | Low | Little change | Little change | Negative | Relatively difficult |

## 4.5 'Improve' measures'

### Introduction

The 'long list' of additional Improve measures shown in Table 21 below includes 14 individual measures that generally involve reducing the carbon emissions per HGV km or switching to lower or zero emissions technologies and fuels where the necessary road freight transport cannot be avoided completely or shifted to another mode. The descriptions assume that the measure is applied on its own to achieve the objective of reducing carbon emissions, rather than as a package of measures.

The measures are then evaluated using the MCA methodology.

**Table 21: Long list of potential 'Improve' measures**

| Reference | Measure | Type of measure |
|---|---|---|
| I1 | Decoupling points | Infrastructure & Management |
| I2 | Increased subsidy for the purchase of ZE HGVs | Market-based |
| I3 | Increased subsidy for the purchase of charging infrastructure | Market-based |
| I4 | Increase HGV registration tax differential | Market-based |
| I5 | Public sector procurement | Management |
| I6 | Faster phase-out of sale of diesel HGVs | Regulatory & Market-based |
| I7 | Shorten planning processes for HGV charging/refuelling sites | Land use planning & Infrastructure |
| I8 | Clear policy signalling on preferred ZE HGV technology for Ireland | Market-based |
| I9 | Public sector lessor of ZE HGVs | Market-based |
| I10 | Lower speed limits for HGVs | Regulatory |
| I11 | Platooning of HGVs | Regulatory & Technology |
| I12 | Out of hours deliveries | Regulatory & Technology |
| I13 | Zero Emission Zone (ZEZ) for HGVs | Regulatory |
| I14 | Ultra-Low Emission Zone (ULEZ) for HGVs | Regulatory & Market-based |

### Evaluation of measures

Each of the above 14 improve measures was evaluated on a judgmental basis against the seven criteria and the results for each are described below. A summary of the results of the evaluation for all the measures is provided at the end of the section in Table 22.

## I1: Decoupling points

| Infrastructure & management measure |
| --- |
| **Description:** Locations on the edge of major urban areas to allow a switch from an Internal Combustion Engine (ICE) to a Zero Emission (ZE) tractor unit for 'last mile' deliveries of "full" loads in semi-trailers to retail outlets or other destinations. The decoupling point would be an area of open ground where a semi-trailer can be uncoupled safely from the ICE tractor unit, perhaps stored securely for a relatively short period of time, and then attached to a ZE tractor unit for the "last mile" delivery to the final destination in the urban area. |

Decoupling points are not generally commercially viable in their own right because they add cost and time to the transport chain due to the need to have two tractor units (one diesel tractor unit for the inbound movement and one ZE for the onward delivery) and a secure area of hardstanding and, if a second operator is involved, the transfer of liability for making final deliveries to a specialist "last mile" logistics company. The concept has the advantage over a consolidation centre that the cargo does not have to be unloaded but remains in the same semi-trailer and this is particularly suitable for larger shippers and receivers of cargo (such as supermarket chains) that have sufficient volume to use articulated tractor and trailer combinations. The concept is most likely to be used if there is a strong incentive or an obligation to use ZE HGVs for urban deliveries and where they provide some form of mitigation when required to address regulatory measures, perhaps to reduce carbon emissions in urban areas.

There are no direct commercial benefits to hauliers from decoupling points, although they are not as costly as consolidation centres because the infrastructure required is effectively a secure area of hardstanding rather than a warehouse and no additional staff are required for the transfer itself as the switching of the trailers between tractor units can be carried out by the drivers. Decoupling points are unlikely to develop in their own right (without a strong incentive) and therefore the impact on carbon and other negative externalities would be limited. They would add cost to transport chains and therefore have a negative impact on industry costs and would have little impact on the wider economy. If they were delivered by the public sector they would be relatively low cost interventions, requiring an area of hardstanding, but the cost would increase if a (probably small) fleet of ZE HGVs were required. They are easier to deliver than a consolidation centre because they only require a secure area of hardstanding but would require some planning input from the public sector to locate the most appropriate locations on the edge of urban areas. They are more likely to develop as a mitigation measure within a wider package of measures for hauliers that are not able to transition quickly from diesel to ZE propulsion.

## I2: Increased subsidy for the purchase of ZE HGVs

| Market-based measure |
| --- |
| **Description:** Increased subsidy for up to (say) 80% of the capital cost differential between ZE and ICE HGVs, so that the additional capital cost of zero emission HGVs is reduced. This helps hauliers that adopt ZE technology to compete in the market with operators that choose to retain fleets of residual diesel HGVs. |

This measure, if adopted consistently over the required transition period, would reduce the risk for hauliers of rapidly adopting ZE HGVs, by reducing the up-front cost of renewing their fleet and allowing them to compete in the market with fleets that have retained diesel HGVs. This could secure significant reductions in carbon and other environmental emissions and help speed up the transition to zero emission road haulage in Ireland. The main negative impact would be the cost to the public purse, although the proportion of the differential could gradually be reduced as the cost of ZE HGVs falls and the deadline for the end of sales of diesel HGVs approaches. Deliverability should be relatively straightforward as it would be an extension of an existing scheme[79]; it would however have greater resources and a ring-fenced budget for the required transition period to ensure that the industry can develop investment strategies to make the transition based on a clear and consistent grant scheme.

[79] The Alternatively-Fuelled Heavy Duty Vehicles (AFHDV) Purchase Grant Scheme

### I3: Increased subsidy for the purchase of charging infrastructure

| Market-based measure |
| --- |
| **Description:** Subsidy available for the development of private (depot and destination) battery charging infrastructure to complement the planned en route charging infrastructure. These are likely to be a combination of standard and fast chargers so that fleets can be charged (say) overnight at their depots but also have their batteries re-charged quickly at locations such as distribution centres and manufacturing sites while goods are being loaded or unloaded and therefore the HGVs and drivers would have 'downtime' in any case. This would subsidise the new charging infrastructure required by the road haulage industry and allow fleets of ZE HGVs to compete with operators that choose to retain fleets of residual diesel HGVs. |

This measure, if adopted consistently over the required transition period, would reduce the risk for hauliers of rapidly adopting ZE HGVs, by reducing the up-front cost of the required infrastructure and allowing them to compete in the market with fleets that have retained diesel HGVs. This is very closely linked to Measure I2 and would help to secure significant reductions in carbon and other environmental emissions and help speed up the transition to zero emission road haulage in Ireland. The main negative impact would be the cost to the public purse, although, as with the zero emission HGVs, the proportion of the cost could gradually be reduced in percentage terms over time to incentivise early adoption of charging infrastructure for ZE HGVs. Deliverability for the public sector would be more difficult than for ZE HGVs because a new scheme would have to be developed. As with the potential ZE HGV scheme (Measure I2), the industry would need to develop investment strategies to make the transition based on a clear and consistent grant scheme.

### I4: Increase HGV registration tax differential

| Market-based measure |
| --- |
| **Description:** Differential registration taxation for ICE HGVs compared to ZE HGVs would provide an additional incentive for hauliers to purchase ZE HGVs rather than diesel HGVs. |

This measure would provide an additional incentive for hauliers to purchase ZE HGVs rather than diesel HGVs and could be designed to be neutral for the public purse, implying a gradual reduction in the differential as the deadline for the end of sales of diesel HGVs approaches. This could incentivise the transition to a ZE HGV fleet in Ireland and lead to significant reductions in carbon and other environmental emissions. Deliverability should be relatively straightforward as it would be an adjustment to existing rates of taxation for different types of HGV.

### I5: Public sector procurement

| Management measure |
| --- |
| **Description:** Public sector bodies would be required to stipulate that contractors need to use ZE HGVs from a certain date when providing goods and services to the public sector in Ireland. This would stimulate the market for the purchase of ZE HGVs in a significant sector of the economy. |

This measure involves the public sector discriminating in public procurement exercises in favour of goods and service providers which use zero emission rather than diesel HGVs. This would affect the provision of goods and services to a significant proportion of the economy, but would take effect only relatively slowly as the measure would need to be subject to a transition period. The requirement to use ZE HGVs to provide goods and services to the public sector would increase industry costs in the short to medium term and might have a negative impact on the wider economy. As the additional cost would need to be passed on by suppliers, there would be a negative impact on the public purse. Deliverability could be fairly complex, given the need to change procurement rules in line with EU law

and the need to ensure that suppliers cannot avoid the rules by, for example, sub-contracting haulage services rather than providing them directly.

### I6: Faster phase-out of sale of diesel HGVs

| Market-based & regulatory measure |
| --- |
| **Description:** The Irish Government decides to bring forward the phase out of non-ZE HGVs at a faster rate than required by EU legislation. This would provide a clear signal to the manufacturers that a certain proportion of HGVs need to be zero emission at a faster rate than at present and therefore speed up the transition. |

This measure involves the public sector accelerating the phase-out of the sale of diesel HGVs and therefore pursuing the objective at a faster rate than required by EU law[80]. This would lead to lower carbon (and other environmental) emissions and, in particular, at a faster rate. The measure would increase industry costs (but only accelerating a cost which would be incurred in any case) and would have a moderate negative impact on inflation and the wider economy, while having no significant impact on the public purse. Deliverability should be reasonably straightforward as it would mainly involve an acceleration of the timescale for the implementation of existing legislation.

[80] CO2 emissions performance standards for new heavy duty vehicles, for which there is provisional political agreement to amend Regulation 2019/1242/EU and repeal Regulation 2018/956/EU.

### I7: Shorten planning processes for HGV charging/refuelling sites

| Land use planning & infrastructure measure |
| --- |
| **Description:** Speed up the planning process for ZE HGV recharging infrastructure, both for the en route charging infrastructure required under the AFIR and, where necessary, for depot and destination charging infrastructure. |

This measure involves the public sector accelerating the planning processes required to develop the infrastructure for refuelling or recharging of zero emission HGVs. This would help to speed up the development of the infrastructure required for a reduction in carbon (and other environmental) emissions from HGVs, even if the speed of implementation may not in itself be rapid. The measure in itself would have no significant impact on industry costs nor have a significant impact on the wider economy or the public purse. The extent to which this measure can be delivered relatively easily will depend on a detailed assessment of existing planning regulations and specific sites.

### I8: Clear policy signalling on preferred ZE HGV technology for Ireland

| Market-based measure |
| --- |
| **Description:** Ireland 'picks a winner' in terms of ZE HGV technology and chooses to focus on battery electric, while meeting the minimum EU requirements for hydrogen refuelling. |

This measure (recently recommended by the OECD[81]) involves the Government providing greater certainty to the road haulage sector by making it clear that a single technology (probably battery electric in Ireland) is its favoured technology for the transition from diesel to zero emission HGVs. This would help to speed up the transition to zero emission HGVs by focusing the transition on a single technology for which the essential network infrastructure (the electricity supply network) already exists and for which battery ranges are already viable for LGVs and smaller HGVs without significant changes to operations. This would therefore reduce carbon (and other environmental) emissions faster than would otherwise be the case. The measure would, in itself, probably reduce industry costs as it would provide greater certainty but would otherwise have little direct impact on the wider economy or the public purse. It should, in itself, be relatively easy to deliver, although consultation with the industry and the electricity supply industry would be essential before implementation.

[81] How governments can bring low-emission trucks to our roads – and fast, The International Transport Forum, OECD, 2023

### I9: Public sector lessor of ZE HGVs

| Market-based measure |
| --- |
| **Description:** The public sector procures a fleet of ZE HGVs to secure orders on behalf of Irish hauliers and at a discount (as it has done for electric buses). This would allow the fleet to be purchased (based on a back-to-back agreement with hauliers) at both a discounted capital cost and lower interest rates than would be possible by private sector operators. The HGVs would then be leased to the hauliers at commercial interest rates, but based on a lower purchase cost. |

This measure involves the Government making a bulk order of battery electric HGVs at relatively low interest rates and then leasing them on finance leases to road hauliers on a back-to-back basis. This would speed up the transition to the deployment of the ZE HGVs and therefore reduce carbon (and other environmental emissions, but not the impact of HGV trips on traffic congestion) from the sector and would reduce industry costs and the impact on the wider economy. As the bulk order would be based on back-to-back orders by haulage operators, there should be no significant impact on the public purse. The measure would be a significant and innovative intervention in the market, which might make it relatively difficult to implement from a legal point of view; financial advice would be needed to develop the scheme.

### I10: Lower speed limits for HGVs

| Regulatory measure |
| --- |
| **Description:** Lower speed limits are introduced for HGVs on motorways and national roads to reduce emissions per km for road freight. |

This measure involves a reduction in the maximum speed limit for HGVs on the strategic road network in order to reduce fuel consumption per km and therefore reduce carbon emissions. It is the equivalent of 'slow steaming' which is an approach taken by the shipping industry to reduce transport costs (and, indirectly, carbon emissions) when bunker fuel prices are relatively high. This would reduce carbon (and other environmental) emissions from road haulage 'overnight' but might also increase road traffic congestion as other traffic was affected by slower-moving HGVs. The major negative impact would be on overall industry costs because, although fuel costs may be marginally lower, this may be negated by the fixed costs associated with the longer time required to make trips and the knock-on impact on inventory and the rest of the supply chain; this may have some significant negative impact on the wider economy. The impact on the public purse would probably be minimal unless changes to physical signage was required for implementation. Apart from the issue of signage, the measure could be implemented relatively easily as a change in the regulatory regime for HGVs on highways which are subject to the national speed limit (while also taking account of on-going reviews of national speed limits).

## I11: Platooning of HGVs

| Regulatory & technology measure |
| --- |
| **Description:** Several HGVs travel very close to each other (probably on motorways) using automation technology to avoid collisions, which would reduce wind resistance and therefore reduce fuel consumption. |

This measure involves allowing the use of automation technology to 'platoon' several HGVs together to move as a single 'unit' (probably) only on motorways due to safety issues. This would reduce carbon (and other environmental) emissions, if only marginally, due to the reduced drag on the vehicles following the first HGV, but it might increase road traffic congestion as other traffic was affected by the need to overtake long platoons of HGVs. The measure would only be commercially viable if the reduction in fuel costs was greater than the cost of the automation technology over the useful economic life of the vehicles and would only be appropriate for regular trunk movements. There is unlikely to be any significant impact on the wider economy or on the public purse, but the required change in the regulatory regime would have to be subject to piloting to ensure that the operation of platooning would be safe both for the road haulage operators and other road users. Furthermore, agreements would need to be in place to ensure that all the hauliers involved in a platoon would benefit from the reduced fuel costs - not just the ones following the lead HGV.

## I12: Quiet out of hours deliveries

| Regulatory & technology measure |
| --- |
| **Description:** Deliveries to some major retailers, and potentially other major attractors of freight with staff available on-site to receive the goods 'out of hours', are re-scheduled to the evenings and during the night to avoid peak time congestion and reduce fuel consumption. Given concerns from residents located close to the delivery locations about noise from deliveries during the night, this often involves the hauliers and the receivers of the goods (typically supermarkets) using low noise handling equipment (loading bays, roll cages etc.) and adopting low noise handling procedures to minimise noise disturbance. |

This measure involves the public sector facilitating (or at least not preventing) the adoption of low noise deliveries outside normal working hours, including during the night. This would allow road hauliers to make deliveries to locations which are able to receive deliveries outside normal working hours (e.g. large supermarkets) and therefore allow the hauliers to avoid congested times on the highways network. This reduces fuel consumption and therefore carbon emissions and other negative externalities (including road congestion) as long as low noise technology is used to avoid sleep disturbance. There is unlikely to be any significant impact on the wider economy or on the public

purse and the schemes can be reasonably easily adopted as long as there is local political support and no complaints from local residents. However, even the cumulative impact of lots of individual schemes is unlikely to have a significant impact in reducing overall carbon emissions.

### I13 Zero Emission Zone for HGVs

| Regulatory measure |
| --- |
| **Description:** An effective ban on ICE HGVs entering designated zones (probably within urban areas) and thereby providing a financial incentive for hauliers to switch to ZE HGVs for the end-to-end journeys. |

This measure involves the public sector effectively banning ICE HGVs from entering designated zone, probably related to urban areas. In the event that an ICE HGV entered the area it would be subject to a significant fine which would make it uneconomic to operate on a daily basis. This would provide a very strong incentive for hauliers that need to enter the ZEZ to transition their fleet to ZE HGVs. This would therefore reduce carbon and other environmental emissions and might have a modest impact on road congestion. There would be a negative impact on the costs of the road haulage industry, which would need to pass these costs on to the wider economy, but these would only relate to traffic to and from the ZEZs. The public purse would be unaffected. In practical terms this measure would not be easy to deliver in that it would require a network of ANPR cameras to ensure enforcement.

### I14 Ultra-Low Emission Zone for HGVs

| Regulatory & market-based measure |
| --- |
| Differential charging for ICE HGVs compared to ZE HGVs entering designated zones (probably within urban areas) and thereby providing a financial incentive for hauliers to switch to ZE HGVs for the end-to-end journeys. |

This measure involves the public sector charging ICE HGVs entering designated zones at a higher rate than for ZE HGVs. This would provide a strong incentive for hauliers that need to enter the ULEZ to transition their fleet to ZE HGVs. This would therefore reduce carbon and other environmental emissions and might have a modest impact on road congestion. There would be a negative impact on the costs of the road haulage industry, which would need to pass these costs on to the wider economy, but these would only relate to traffic to and from the ULEZs. The public purse would benefit from some additional revenue. In practical terms this measure would not be easy to deliver in that it would require a network of ANPR cameras to ensure enforcement.

**Table 22: Evaluation of potential 'Improve' measures**

| Measure | Impact on carbon emissions | Potential speed of impact on carbon emissions | Potential to reduce other externalities | Extent of direct cost impact on freight transport industry | Extent of wider economic impact (inflation, employment, GDP) | Impact on public finances (subsidy, grants, investment, tax gain) | Extent to which the measure can be delivered from a practical point of view |
|---|---|---|---|---|---|---|---|
| I1: Decoupling points | Low | Slow | Low | Little change | Little change | Little change | Neither easy nor difficult |
| I2: Increased subsidy for the purchase of ZE HGVs | High | Fast | High | Reduction | Little change | Negative | Relatively easy |
| I3: Increased subsidy for the purchase of charging infrastructure | High | Neither fast nor slow | High | Reduction | Little change | Negative | Neither easy nor difficult |
| I4: Increase HGV registration tax differential | High | Fast | High | Little change | Little change | Little change | Relatively easy |
| I5: Public sector procurement | Medium | Neither fast nor slow | Medium | Increase | Negative | Negative | Relatively difficult |
| I6: Faster phase-out of sale of diesel HGVs | High | Fast | High | Increase | Negative | Little change | Relatively easy |

| **Measure** | Impact on carbon emissions | Potential speed of impact on carbon emissions | Potential to reduce other externalities | Extent of direct cost impact on freight transport industry | Extent of wider economic impact (inflation, employment, GDP) | Impact on public finances (subsidy, grants, investment, tax gain) | Extent to which the measure can be delivered from a practical point of view |
|---|---|---|---|---|---|---|---|
| I7: Shorten planning processes for HGV charging/refuelling sites | Medium | Neither fast nor slow | Medium | Little change | Little change | Little change | Neither easy nor difficult |
| I8: Clear policy signalling on preferred ZE HGV technology for Ireland | High | Fast | Medium | Reduction | Little change | Little change | Neither easy nor difficult |
| I9: Public sector lessor of ZE HGVs | High | Fast | Medium | Reduction | Little change | Little change | Relatively difficult |
| I10: Lower speed limits for HGVs | Medium | Fast | Medium | Increase | Negative | Little change | Neither easy nor difficult |
| I11: Platooning of HGVs | Low | Slow | Low | Little change | Little change | Little change | Relatively difficult |
| I12: Quiet out of hours deliveries | Low | Slow | Low | Reduction | Little change | Little change | Neither easy nor difficult |
| H13: Zero Emission Zone (ZEZ) for HGVs | High | Fast | High | Increase | Little change | Little change | Relatively difficult |

| **Measure** | Impact on carbon emissions | Potential speed of impact on carbon emissions | Potential to reduce other externalities | Extent of direct cost impact on freight transport industry | Extent of wider economic impact (inflation, employment, GDP) | Impact on public finances (subsidy, grants, investment, tax gain) | Extent to which the measure can be delivered from a practical point of view |
|---|---|---|---|---|---|---|---|
| H14: Ultra-Low Emission Zone (ULEZ) for HGVs | High | Fast | High | Increase | Little change | Positive | Relatively difficult |

## 4.6 'Hybrid' measures

### Introduction

The 'long list' of additional 'hybrid' measures shown in Table 23 below includes four individual measures that involve more than a single element of the ASI framework. Each measure is described in terms of what it is and how it would reduce carbon emissions.

**Table 23: Long list of potential 'Hybrid' measures**

| Reference | Measure | ASI categories | Type of measure |
|---|---|---|---|
| H1 | Road pricing for HGVs | Avoid, Shift & Improve | Market-based |
| H2 | Increase in tax on diesel | Avoid, Shift & Improve | Market-based |
| H3 | Differential toll on ICE HGVs leaving/accessing ports | Improve & Shift | Market-based |
| H4 | Logistics zoning | Avoid & Shift | Land use planning |

### Evaluation of 'hybrid' measures

Each of the above four 'hybrid' measures was evaluated on a judgmental basis against the seven criteria and the results for each are described below. A summary of the results of the evaluation for all the measures is provided at the end of the section in Table 24.

### H1: Road pricing (Avoid, Shift & Improve)

| Market-based measure |
|---|
| **Description:** HGVs are charged on a per km basis and, perhaps, per journey basis for the use of the highways network (in addition to existing taxation), but with higher charges for diesel HGVs compared to ZE HGVs. The higher charges for use of the network would be designed to encourage greater take-up of ZE HGVs and also encourage hauliers to find efficiencies to reduce empty running. |

This measure involves the public sector introducing a charge per kilometre for use of the highways network by HGVs (with no requirement necessarily to introduce a similar charge for passenger cars), with significantly higher charges for diesel HGVs compared to ZE HGVs. This would provide an incentive for hauliers to transition their fleet to ZE HGVs to reduce the charge per km. It should also improve the economics of rail freight compared to road haulage and would provide some additional incentive to operators of diesel HGVs to seek to increase the efficiency of their loadings in order to remain competitive. Overall, this would therefore reduce carbon and other environmental emissions and might have a modest impact on road congestion for other road users caused by HGVs. There would be a negative impact on the costs of the road haulage industry, which would need to pass these costs on to the wider economy. The public purse could benefit from additional revenue, over and

above fuel duty, and the public sector is likely, in any case, to have to adopt road pricing in some form in the future in order to recoup lost revenues from fuel duty. Road pricing schemes can be very complex to deliver, but, given the satellite-based technology that is already deployed by insurance companies to track the movements of drivers, the required technology is already available.

### H2: Increase in tax on diesel (Avoid, Shift & Improve)

| Market-based measure |
| --- |
| **Description:** Increasing the differential taxation of diesel by fuel duty for ICE HGVs compared to ZE HGVs and phasing out the Diesel Rebate Scheme (DRS). Higher charges per HGV km would be designed to encourage greater take-up of ZE HGVs and also encourage hauliers to find efficiencies to reduce empty running. |

This measure involves the public sector increasing the taxation of diesel to a significant extent, which therefore increases the haulage cost per km for the operation of ICE HGVs. This would provide an incentive for hauliers to transition their fleet to ZE HGVs to reduce the charge per km and provide some additional incentive to operators of diesel HGVs to seek to increase the efficiency of their loadings in order to remain competitive. Overall, this would therefore reduce carbon and other environmental emissions and might have a modest impact on road congestion. There would be a negative impact on the costs of the road haulage industry, which would need to pass these costs on to the wider economy. The public purse could benefit from additional revenue, over and above existing fuel duty. In practical terms this measure is very easy to deliver for the Government, as it just requires an increase in the level of duty charged on a litre of diesel.

This measures implies that the Diesel Rebate Scheme (DRS) should be phased out, as it encourages continued use of diesel HGVs and reduces the extent to which diesel HGVs are paying for their externalities. It also suggests that the Government's existing policy of increasing the element of the taxation of diesel which relates to carbon from €56 per tonne in 2024 to €100 per tonne in 2030 should be pursued without reducing elements of the taxation of diesel.

### H3 Differential toll on ICE HGVs leaving/accessing ports (Improve & Shift)

| Market-based measure |
| --- |
| **Description:** Increasing the differential taxation of diesel for ICE HGVs compared to ZE HGVs. Higher charges per HGV km would be designed to encourage greater take-up of ZE HGVs for port-based haulage and help to encourage modal shift to rail to/from the ports. |

This measure involves the public sector applying a toll on each movement in and out of ports by ICE HGVs, which therefore adds a fixed cost for the operation of ICE HGVs compared to ZE HGVs. This

would provide an incentive for port-based hauliers to transition their fleet to ZE HGVs to maintain their competitiveness and would also incentivise the greater use of rail freight services (where available) to and from the ports. This would therefore reduce carbon and other environmental emissions and might have a modest impact on road congestion. There would be a negative impact on the costs of the road haulage industry, which would need to pass these costs on to the wider economy, but these would only relate to traffic to and from ports. The public purse could benefit from additional revenue. In practical terms this measure would be relatively easy to deliver at Dublin because of the ability to toll vehicles using the Port Tunnel, but at other ports tolling equipment - at least ANPR to log movements and allow subsequent enforcement of the payment of tolls - would be required.

### H4: Logistics zoning (Avoid, Shift & Improve)

| Land use planning measure |
| --- |
| Planning for the co-location of distribution parks, rail terminals and shared HGV depot/destination charging in specific locations, probably on the outskirts of major urban areas. This minimises the HGV km required overall because some of the origins and destinations of road freight movements are effectively co-located. |

This measure, if adopted consistently over a long period of time, can gradually provide reductions in carbon emissions and reductions in other negative externalities, by reducing HGV trips and HGV km due to the co-location of logistics businesses and, in particular, the availability of distribution centres adjacent to haulage depots, HGV parking/charging and rail terminals. However, the associated reductions of emissions would be achieved only very slowly because of the time that is required to re-locate all the relevant businesses to the required locations. There would be relatively limited impacts on industry costs and wider economic impacts or on the public purse, but logistics zones would probably be difficult to deliver because of the need to move different activities to common locations over a long period of time.

**Table 24: Evaluation of potential 'Hybrid' measures**

| Measure | Impact on carbon emissions | Potential speed of impact on carbon emissions | Potential to reduce other externalities | Extent of direct cost impact on freight transport industry | Extent of wider economic impact (inflation, employment, GDP) | Impact on public finances (subsidy, grants, investment, tax gain) | Extent to which the measure can be delivered from a practical point of view |
|---|---|---|---|---|---|---|---|
| H1: Road pricing for HGVs | High | Fast | High | Increase | Negative | Positive | Relatively difficult |
| H2: Increase in tax on petrol & diesel | High | Fast | High | Increase | Negative | Positive | Relatively easy |
| H3: Differential toll on ICE HGVs leaving/accessing ports | High | Medium | High | Medium | Little change | Positive | Neither easy nor difficult |
| H4: Logistics zoning | Low | Slow | Low | Little change | Little change | Little change | Relatively difficult |

# 5 CONCLUSIONS & AREAS FOR CONSIDERATION

## 5.1 Conclusions

### Avoid measures

As demand for freight transport is, in economic terms, a derived demand, there are relatively few avoid measures which are effective in reducing carbon emissions. In general terms, it is during an economic recession that the quantity of freight tonnes moved reduces to any significant extent.

The frequently quoted concept of consolidation can in theory reduce the quantity of HGV km, but it adds cost to the transport chain. As a general rule therefore, road hauliers will only use consolidation centres if there is a strong regulatory requirement to do so. Consolidation centres can, however, be used to mitigate against the impact on hauliers using diesel HGVs when a strong regulatory measure (such as a ZEZ or ULEZ with significant charges) is introduced in an urban area, as it allows diesel vehicles to be used for inbound vehicles but "last mile" deliveries can then be carried out by ZE vehicles following the transfer of cargo via a consolidation centre on the edge of the ZEZ/ULEZ. The Government is intending to carry out further research related to improving opportunities for freight consolidation between road haulage operators.

As the road freight transport industry is highly competitive, the most effective avoid measures are those which allow road hauliers to reduce their costs. The widespread deployment of longer semi-trailers on longer distance trunk hauls, for example, would therefore make a contribution to reducing carbon emissions at little or no cost to the public purse.

Many of the avoid measures set out in this report involve the development of some infrastructure, require some regulatory approvals or involve collaboration between economic operators (who usually compete with each other). This makes them difficult to implement and slow to take effect.

### Shift measures

Shift measures in Ireland generally relate to the potential to switch some road freight traffic from road to rail and, given the historic lack of investment in the rail network in Ireland and the relatively short distances that are available for rail freight, the opportunities are likely to be limited up to 2030.

In the shorter term up to 2030, Dublin Port with its high concentration of unitload traffic, may offer the greatest opportunity for the development of additional rail freight traffic as long as there is

sufficient demand on a point-to-point basis to support a trainload on a regular and reasonably frequent basis. Dublin Port is important in the context of modal shift away from road because so much of Ireland's unitload freight passes through the port, where a change of mode is, in any case, required and this provides an opportunity, at least in theory, to switch to rail rather than road for inland distribution. In addition, the mode of appearance at the port is, itself, important as traffic in containers (transported either on container ships or as unaccompanied RORO traffic), is particularly suitable for distribution inland by intermodal rail freight services.

### Improve measures

As 'avoid' and 'shift" measures are unlikely to have a significant impact by 2030, the main requirement is for road freight to be 'improved' by making as rapid a transition from ICE to ZE propulsion. The major concern within the road freight industry is likely to relate to how to make the technological transition to ZE vehicles without losing competitiveness and this leads to inertia. Greater investment certainty is therefore likely to be welcomed by the industry. The public sector has a key role to play therefore in reducing the investment risk by, for example, providing a clear 'road map' in terms of the most appropriate technology and reducing the financial risk by maintaining or introducing grant schemes to provide grant schemes for the purchase of ZE HGVs and public and private recharging/refuelling infrastructure.

Given its geography and the relatively short haulage distances and improving battery technology, battery electric HGVs appear to be the best option for Ireland in terms of technology and the Government could choose to emphasise its support for this technology – even if in some cases it would require the hauliers to change some of their operational practices which are based, in effect, on 'instant' refuelling. LGVs and most rigid HGVs used for urban and regional deliveries and collections can already be operated effectively using battery technology and, as an interim measure (and perhaps as a last resort), greater use of HVO and other bio-fuels could be used to a greater extent within the transport sector while the battery technology for larger articulated HGVs improves. The key concern in Ireland, as elsewhere in relation to the use of battery electric HGVs, could be the ability of the electricity grid to provide the required power on a reliable basis in suitable locations for the road haulage industry (haulage depots, distribution centres, ports, major manufacturing plants, motorway service stations).

Another potential barrier to the take-up of ZE HGVs would be the supply of right hand drive vehicles, give that Ireland is a relatively small market for the manufacturers. This could be addressed by the public sector acting as the customer for large orders from the manufacturers, based on back-to-back leasing or debt finance agreements with Irish road hauliers.

### Hybrid measures

The main hybrid measures are market-based measures which change the costs incurred by the road haulage industry and, by generally increasing costs (particularly for ICE vehicles) and for the whole market, provide a clear incentive to switch to ZE vehicles, switch to another mode (where this is feasible) and secure some efficiencies by a (probably marginal) reduction in empty running.

These measures would generally redistribute costs for the road haulage industry to operators of ICE vehicles, but would provide strong incentives through market mechanisms to reduce costs by switching to ZE HGVs. These measures would also, at least in the short to medium term, have less impact on the public purse than improve measures.

### Packaging of measures

The individual measures have been assessed in isolation but should be implemented as cohesive packages of complementary measures which include both 'carrot' and 'stick' measures. For example, a Zero Emission Zone (ZEZ) in an urban area centre could be effective in reducing carbon emissions if a sufficiently long transition period was provided and some mitigation measures (such as consolidation centres and decoupling points) were provided to allow hauliers using fleets of residual ICE HGVs to continue to make deliveries by switching propulsion technology on the edge of the urban area. A road pricing strategy could be accompanied by a subsidy scheme for ZE HGVs and for the associated recharging infrastructure at depots and destinations. Port-based measures could include tolling access and egress for ICE vehicles and developing port-centric distribution.

## 5.2 Areas for consideration and further development: enabling conditions

### Areas for consideration and further development: enabling conditions

At a national level there needs to be a strong focus on enabling conditions for the transition to zero emission HGVs, due to the nascency of the HGV decarbonisation market. Any measures should take account of the competitive nature of the road haulage industry and therefore seek to reduce the uncertainty and risk of introducing zero emission HGVs during a transition period in which diesel HGVs would be able to continue to operate - without additional measures – at a lower cost. This focus on enabling conditions needs to extend beyond physical infrastructure and vehicles.

| Road map for HGV decarbonisation |
| --- |
| Ireland should develop a road map for HGV decarbonisation which makes a clear distinction between classes of HGVs. It should express a preference for smaller HGVs – used for regional and urban logistics – to be battery electric. It should also explain that, although some shorter distance movements of larger HGVs are already suitable for battery electric operation, there remains some uncertainty about the most appropriate technology for the decarbonisation of longer distance movements by the largest articulated HGVs. Further measures to support HGV decarbonisation will therefore encourage relatively rapid decarbonisation of regional and urban freight flows, while allowing operators of larger HGVs a longer period of time to make the transition to zero emission vehicles.<br>Timescale: 2024-25 |

| Research and development (R&D) and standardisation |
| --- |
| Ireland should establish or engage in R&D programmes on the decarbonisation of HGVs by seeking to get involved as much as possible in existing EU-level HGV decarbonisation programmes or provide dedicated funding for zero emission HGV R&D. Developing standards for HGV decarbonisation on issues such as fast charging technology for HGVs and vehicle and battery maintenance should also be monitored and, where appropriate, adopted in Ireland.<br>Timescale: 2024-30 |

| Skills requirements for HGV decarbonisation |
| --- |
| Ireland should seek to get ahead of the skills requirements, as the large-scale deployment of zero emission HGVs is likely to require specialist skills for the implementation of the AFIR (when the required infrastructure will be developed throughout the EU) and additional deployment of recharging/refuelling infrastructure and for vehicle management and maintenance. An understanding of the skill requirements should start with an immediate assessment of the required skill quantities and skill gaps.<br>Timescale: 2024-25 |

In order for road hauliers to feel confident that they can make the transition to purchasing zero emission HGVs, there will need to be sufficient recharging or refuelling infrastructure in place. As well as public en route recharging/refuelling for longer distance movements (as required by the AFIR), there will mainly be a need for private depot-based and destination recharging/refuelling infrastructure. In order to assess the scale of need, there is also likely to be a need for the public sector to monitor the uptake of public and private infrastructure for zero emission vehicles.

| Monitor the required infrastructure for zero emission HGVs |
| --- |
| The AFIR targets will provide for an initial network of en route recharging/refuelling infrastructure, but this should be continuously monitored, especially if any additional measures introduced by Ireland hastens the deployment of zero emission HGVs. This monitoring should therefore cover not only public infrastructure but also private, depot-based or destination-based infrastructure.<br>Timescale: 2024-30 |

| Support for the development of private recharging/refuelling infrastructure for zero emission HGVs |
| --- |
| Consideration should be given to grants being made available to road hauliers and other commercial operators such as warehouse developers/operators, ports and large-scale manufacturers, to reduce the cost of developing depot-based and destination recharging/refuelling infrastructure for zero emission HGVs.<br>Timescale: 2024-30 |

Zero emission HGVs are more costly than diesel HGVs and, given that road haulage is highly competitive and the industry is in a slow transition towards zero emission fleets, any road hauliers switching to a zero emission fleet would be subject to lower cost competition from hauliers using diesel vehicles. This means there is a policy justification for public sector support for the purchase of zero emission HGVs during the transition period and for the public sector to seek to minimise the capital cost. In addition, a system of differential road pricing for HGVs would provide a further market-based incentive to switch to zero emission vehicles.

| Support for the purchase of zero emission HGVs |
| --- |
| Consideration should be given to grants being made available to road hauliers for the purchase of zero emission HGVs. The level of grant should seek to share the difference in cost between a zero emission and a diesel HGV, with the public sector potentially paying for a high proportion of that differential during the early stages of the transition to zero emission HGVs when there would be a large residual (and cost competitive) fleet of diesel HGVs .<br>Timescale: 2024-30 |

| Public sector procurement of zero emission HGVs |
| --- |
| Consideration should be given to the public sector acting as a bulk purchaser of zero emission HGVs from relevant manufacturers in order to secure priority for the production of right hand drive vehicles for use in Ireland and to reduce the unit cost for the operators and the taxpayer. The orders, which could be secured at public sector interest rates, should only be made based on back-to-back financing/leasing agreements with the operators.<br>Timescale: 2024-30 |

| Road pricing for HGVs |
| --- |
| Consideration should be given to the introduction of road pricing for HGVs, which would result in a charge being levied per HGV km and perhaps per journey, but with higher charges for diesel HGVs compared to zero emission HGVs. This would have the effect of encouraging a switch to zero emission propulsion, while also maintaining tax revenue for use of public highways from all vehicles even as the HGV fleet decarbonises. It would also involve a thorough review of the taxation of HGVs to adopt the principle of "user and polluter pays", taking into account the carbon tax element of Mineral Oil Tax and the end of the Diesel Rebate Scheme.<br>Timescale: by 2030 |

## 5.3 Areas for consideration and further evaluation: regional/urban freight

As explained above, Ireland's policy towards HGV decarbonisation should make a clear distinction between regional/urban freight transport and longer distance freight transport, with 'stronger' measures being more appropriate for the former. Interim measures for the larger and heavier HGVs used for inter-regional and international movements may be required to allow these sectors to contribute to decarbonisation, without a particular zero emission technology being specified.

| Packages of decarbonisation measures for urban logistics |
| --- |
| Consideration should be given to developing packages of measures to achieve $CO_2$ reduction objectives from HGVs for each city in Ireland. These packages of measures, while designed to encourage – or even require - the use of zero emission HGVs, need to take account of the specific transport geography, demographics and economy of each city. The packages could include a mix of relatively strong regulatory measures to incentivise the use of zero emission HGVs, accompanied by mitigation measures to ensure that deliveries can be made, if necessary, using diesel HGVs for some of the door-to-door transport chain.<br>Timescale: by 2030 |

## 5.4 Areas for consideration and further evaluation: inter-regional & international freight

For longer distance freight movements in larger HGVs, policy-makers should monitor the market closely to follow developments in the technology that might be most appropriate for the decarbonisation of HGVs in Ireland, given the EU's requirement in the AFIR for the provision of hydrogen refuelling infrastructure and the extent to which HGV battery costs may fall and higher-powered charging technology may improve to match existing HGV driver breaks. Consideration should also be given to allowing longer semi-trailers to be operated by hauliers on appropriate routes.

| Market monitoring |
| --- |
| Policy-makers should monitor the market closely to follow developments in the technology that might be most appropriate for the decarbonisation of the larger HGVs required for inter-regional and international road freight movements, taking into account Ireland's freight transport geography and logistics.<br>Timescale: 2025-28 |

| Longer semi-trailers |
| --- |
| Consideration should be given to allowing road hauliers to deploy longer semi-trailers to transport lighter cargoes on door-to-door trunking routes using appropriate roads and following risk assessments. This might require practical trials in Ireland, but key lessons could also be learned from the experience in Great Britain in order to speed up their deployment in Ireland.<br>Timescale: 2025-28 |

Given the importance of ports in Ireland's freight transport network, some specific measures should be considered for the sector to encourage the decarbonisation of freight flows between the ports and their hinterlands.

| Rail freight at Dublin Port |
| --- |
| Consideration should be given to the development of a more efficient rail connection and terminal at Dublin Port, subject to technical and commercial feasibility and therefore an appropriate demand-side assessment, to facilitate a degree of modal switch of international traffic directly to rail at the port.<br>Timescale: 2025 onwards |

| Tolls on diesel HGVs |
| --- |
| Consideration should be given to the tolling of diesel HGVs moving in and out of ports to encourage the greater use of zero emission traction for what can be relatively short distance inland movements. This should be applied to all of Ireland's Core TEN-T and unitload ports (Dublin, Cork, Shannon Foynes, Waterford, Rosslare and Drogheda) to avoid any potential distortion of competition.<br>Timescale: by 2030 |

## 5.5 Modelling of selected potential measures

As a way to illustrate some of the potential impacts of measures that could be adopted to reduce carbon emissions from HGVs, three potential scenarios have been modelled for 2030 using the Ireland Freight Model (IFM). This is a new multi-modal freight demand model which has been developed for the National Transport Authority (NTA) in 2023-24 by MDS Transmodal to represent freight transport movements to, from and within the island of Ireland. As freight transport movements are operated in a highly competitive haulage market, where minimising cost is normally the main focus for most cargo shippers, the model uses generalised cost[82] as the main driver of the model's responses.
The model has a baseline of 2022, for which freight data was collected from various official sources. The freight movements within the model are then "explained" in terms of generalised cost for 2022, so that scenarios can be developed for future years such as 2030 by changing the assumptions for costs in that future year.

As the IFM is a demand model it does not have any capacity constraints, whether related to the fleet of vehicles, its breakdown by propulsion type or to network infrastructure such as the capacity of road and rail networks or the availability of recharging or refuelling infrastructure. The IFM is therefore particularly useful to ask the following question: "How much demand for zero emission HGVs would there be in 2030 if measure XYZ was introduced?"

Three illustrative scenarios were developed for this study, although a wide variety of additional scenarios could be tested using the model. These three scenarios, all for 2030, were:

**2030 Business as Usual Scenario:** domestic freight and international bulk freight traffic grows in line with population and international unitload freight grows in line with Ireland's recent historic trends in trade; the cost of battery electric and hydrogen HGVs falls to some extent due to manufacturing economies of scale.

**2030 Zero Emission HGV Subsidy Scenario:** as for the Business as Usual Scenario but, in addition, a subsidy scheme is introduced to halve the differential in the total cost of ownership between diesel and zero emission HGVs in 2030. This provides an additional incentive for hauliers to switch from diesel to zero emission HGVs by reducing their investment risk.

[82] The full cost of operating an HGV to complete a door-to-door movement, including both direct monetary costs such as the cost of the fuel consumed, but also fixed costs such as the cost of the vehicle and the driver which are allocated to the movement based on a fixed cost per operating hour.

**2030 Road Pricing Scenario:** as for the Business as Usual Scenario but, in addition, a system of road pricing road pricing - with relatively high charges compared to existing tolls - is introduced which charges all vehicles for each journey but also charges only diesel vehicles for every kilometre they travel. This additional charge on diesel HGVs, which would be in addition to existing taxation of diesel fuel, would provide an additional incentive for hauliers to switch from diesel to zero emission HGVs.

**2030 Road Pricing & Rail Freight Scenario:** as for the Road Pricing Scenario but, in addition, track access charges are reduced by 75% and a more extensive network of intermodal rail freight services is available to the market between the Port of Dublin and the 5 Cities plus Belfast.

The results of the modelling are provided in Table 25 and show total carbon emissions for each scenario. The table also highlights the HGV kilometres of freight transport required by both small/medium-sized HGVs (called OGV1 for transport modelling purposes and typically used for intra-regional and local distribution) and the larger HGVs (called OGV2 and typically used for inter-regional and international distribution), along with the percentage of each HGV type which would be zero emission in 2030 under each scenario if the demand-side economics take effect without any supply-side constraints.

**Table 25: Results of modelling using the Ireland Freight Model (IFM)**

| | 2018 Base Case | 2022 Base Case | 2030 Business as Usual Scenario | 2030 Zero Emission HGV Subsidy Scenario | 2030 Road Pricing Scenario | 2030 Road Pricing & Rail Freight Scenario |
|---|---|---|---|---|---|---|
| Carbon emissions from HGVs (billion kg $CO_2e$) | 1.32 | 1.51 | 1.62 | 1.56 | 0.64 | 0.65 |
| OGV1 (small/medium HGV) km (million) | 698 | 814 | 868 | 868 | 868 | 868 |
| OGV1 zero emission HGV km % | 2.0% | 2.0% | 3.0% | 7.8% | 88.0% | 88.0% |
| OGV2 (large HGV) km (million) | 1,011 | 1,151 | 1,246 | 1,246 | 1,228 | 1,225 |
| OGV2 zero emission HGV km % | 0.3% | 0.3% | 0.7% | 3.7% | 47.8% | 47.7% |

The results show how carbon emissions from HGVs would grow by about 23% between 2018 and 2030, despite some assumed manufacturing economies of scale which would lead to a relatively small reduction in the cost of zero emission HGVs. This is due to overall growth in the demand for freight transport, but only very limited take-up of zero emission HGVs with 3.0% of OGV1 and 0.7% of OGV2 kilometres being carried out by battery electric or hydrogen HGVs in 2030.

The introduction of some subsidy towards the purchase of zero emission HGVs (the 2030 Zero Emission HGV Subsidy Scenario) leads to a 4% reduction in carbon emissions as it encourages greater (if limited) take-up of zero emission HGVs with 7.8% of OGV1 and 3.7% of OGV2 kilometres being carried out by battery electric or hydrogen HGVs.

The introduction instead of a form of road pricing by 2030, with charges both per vehicle for all HGVs and per kilometre for diesel HGVs provides a much greater financial incentive to switch to zero emission vehicles. This scenario leads to a 60% reduction in carbon emissions with 88% of OGV1 and 48% of OGV2 kilometres being carried out by battery electric or hydrogen HGVs. However, this would require sufficient zero emission HGVs to be available on the market to be purchased and then operated by the road hauliers and with sufficient charging/refuelling infrastructure in place for both en route, depot and destination charging in 2030.

In addition to the Road Pricing Scenario, the reduction in track access charges and the availability of a network of additional intermodal rail freight services to/from Dublin Port generated only limited additional rail freight traffic, with a service to Belfast (where there is no existing intermodal terminal) being the most likely to generate sufficient traffic to justify an actual service. The modelling suggests that additional operating subsidy and capital investment – particularly to allow much longer and heavier trains to use the network and with the deployment of zero emission locomotives – would be required beyond 2030 to secure some additional traffic and allow rail to contribute (if only to a limited extent) to the decarbonisation of freight flows in Ireland.