Assessment of the Availability of HVO for the Irish Heavy Goods Freight Sector

Report

Submitted to

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Indecon International Economic and Strategic Consultants

Indecon

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Glossary of Terms and Abbreviations

BEV	Battery Electric Vehicles
CAP	Climate Action Plan
C-HVO	Co-Processed HVO
FAME	Fatty Acid Methyl Ester
HVO	Hydrotreated Vegetable Oil
HGV	Heavy Goods Vehicle
ICE	Internal Combustion Engine
ILUC	Indirect Land Use Change
MOT	Mineral Oil Tax
NORA	National Oil Reserves Agency
POME	Palm Oil Mill Effluent
RED	Renewable Energy Directive
RES-T	Renewable Energy Share - Transport
RFNBO	Renewable Fuels of Non-Biological Origin
RTFO	Renewable Transport Fuel Obligation
SAF	Sustainable Aviation Fuel
SEAI	Sustainable Energy Authority of Ireland
UCO	Used Cooking Oil

Executive Summary

Introduction

This report was commissioned by the Department of Transport to assess the potential role of Hydrotreated Vegetable Oil (HVO) as a transitional fuel for decarbonising Ireland's Heavy Goods Vehicle (HGV) sector, in line with the objectives of Ireland's Road Haulage Strategy 2022–2031. While full electrification remains the preferred pathway to Zero emission for the Heavy Duty sector, the analysis explores whether increased HVO use can offer substantial emissions reductions in the medium term and what policy instruments may support this shift without undermining longer-term goals.

HGVs account for nearly one fourth of total road transport emissions due to their size and current dependence on fossil diesel[1]. Electrification of the HGV fleet is progressing slowly, with electric vehicles (EVs) expected to account for less than 0.4% of the sector's energy demand by 2030. Given this limited EV uptake, decarbonising existing freight fleets using renewable fuels such as HVO may offer a viable interim solution.

HVO Availability and Usage

The potential use of HVO for the road freight sector are prompted in part by several European policies that impose emission targets for the decarbonisation of different sectors. The most recent Renewable Energy Directive (REDIII) binds Ireland to achieving a 29% renewable energy share in the transport sector by 2030. As Ireland's crop-based biofuel is below the cap in the RED, under Article 26(1) an energy share (RES-T) target of 24% by 2030 applies. This has been set out in Ireland's National Energy Climate Plan (NECP).

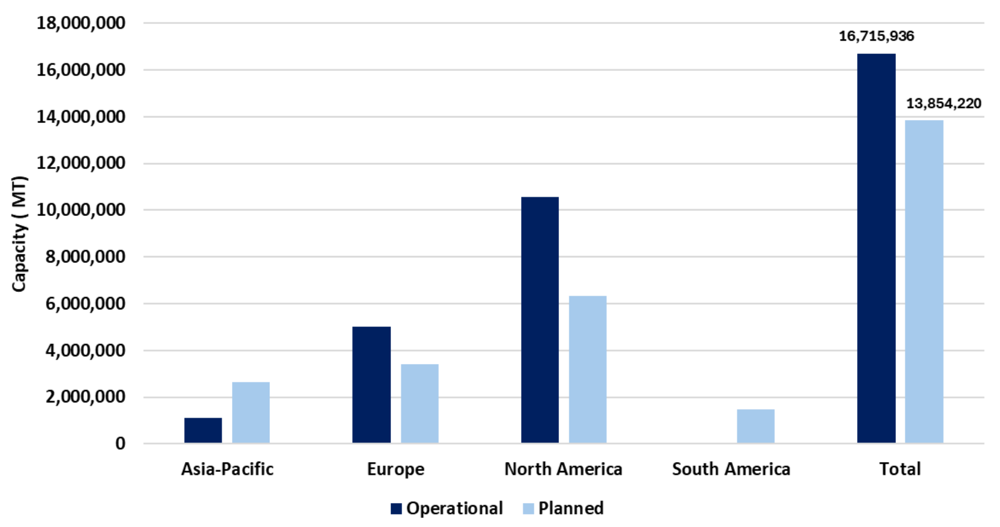
A significant part of the policy focuses on the use of renewable fuels and mandates a minimum of 1% in 2025, rising to 5.5% in 2030), for the share of biofuels produced from feedstocks listed in Annex IX Part A of REDIII and a 1.7% minimum share for fuels produced from feedstocks listed in Part B of Annex IX of the Directive.

Ireland's Climate Action Plan (CAP) 2024 sets indicative targets for renewable fuel use in the transport sector, including achieving a 20% share of biodiesel (B20) and a 10% share of bioethanol (E10) in road transport fuel consumption by 2030. These targets are expected to be achieved through the requirements of the Renewable Transport Fuel Obligation (RTFO). The RTFO places an obligation on fuel suppliers to ensure that a specified share of the fuel they place on the market is from renewable sources. It incentivises compliance by awarding certificates for renewable fuels, with multiple certificates granted for certain waste-based or advanced biofuels, as defined under Annex IX of the RED III.

HVO is a type of biofuel produced through the hydrogenation process of various feedstocks including vegetable oils, animal fats, and waste oil. HVO, along with FAME (Fatty Acid Methyl Ester), is one of the main biofuels used as a substitute for road diesel. This means that it can be blended with diesel or can fully replace road diesel (HVO100). Europe is expected to account for 25% of global planned HVO production capacity, estimated at approximately 13.8 million metric tonnes (MT). Germany is the largest producer of biodiesel, followed by France and Spain.

[1] Climate Change Advisory Council (2024), Transport Sectoral Review: Annual Review 2024. https://www.climatecouncil.ie/ councilpublications/

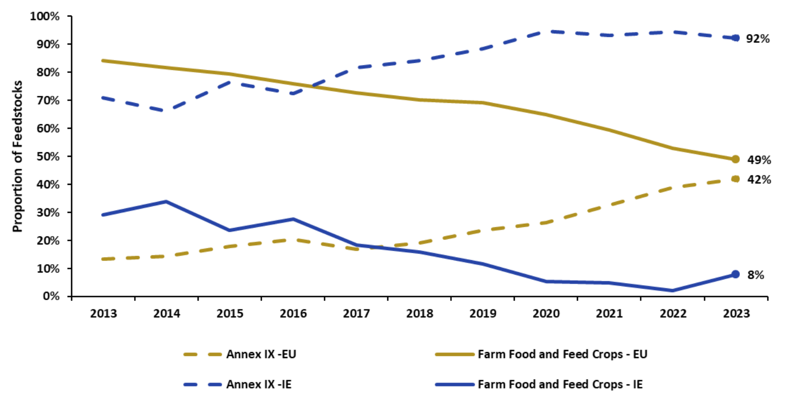
Global Operational and Planned Capacity for HVO



Source: Indecon Analysis of Argus data
HVO Capacity Map, 2024

Recent years have seen a strong shift from food and feed crop-based biofuel feedstocks toward waste-based and advanced feedstocks (Annex IX of REDIII), driven by EU policy. In 2023, 92% of Ireland's biofuels was derived from Annex IX feedstocks, compared to 42% in the EU, reflecting a major shift toward better sustainability of waste-based feedstocks.

Biofuel Consumption in EU and IE



Source: Indecon Analysis of SHARES Data

In 2023, total energy consumption in road transport was 38,161 GWh. Energy consumption for HGVs was 9,532 GWh. Diesel was the predominant fuel used in road transport in Ireland, accounting for 72% of total energy consumption (the equivalent of approximately 3 billion litres of diesel). The share was higher in the HGV sector, where diesel represented 92% of total fuel use in HGV (the equivalent of approximately 848 million litres of diesel).

Although there is no specific data on HVO usage by freight operators, SEAI estimates indicate that HGVs accounted for approximately 32% of total biodiesel consumption in road transport, while private cars accounted for around 52%.

Energy Demand by Road User Type and Fuel Type (GWh), 2023					
Fuel Type	**Public Passengers**	**Private Cars**	**LGVs**	**HGVs**	**Total**
Biogas	1	344	-	**-**	**345**
Biodiesel	100	1,237	285	**759**	**2,381**
% of Total Biodiesel Use	*4%*	*52%*	*12%*	***32%***	***100%***
Diesel	1,156	14,295	3,292	**8,766**	**27,509**
Electricity	8	256	41	**3**	**308**
LPG/Butane/Other	-	19	-	**-**	**19**
Petrol/Gasoline	17	7,564	13	**-**	**7,594**
Natural Gas	-	-	-	4	**4**
Total (GWh)	**1,282**	**23,715**	**3,631**	**9,532**	**38,161**
Source: Indecon Analysis of SEAI National Energy Projections (provided upon special request)					

According to NORA data, total HVO/CHVO placed on the Irish market in 2023 amounted to 84 million litres. HVO was primarily derived from UCO (54%) and POME (45%). The majority originated from Indonesia (43%), followed by China (20%), UK (14%) and Ireland (6%).

Quantity of HVO (Million Litres) by Country of Origin, 2023				
Country of Origin	**Total HVO**	***Of which POME***	***Of Which UCO***	**Share**
Indonesia	**36.1**	*34.5*	*1.7*	**42.9%**
China	**17.2**		*17.2*	**20.4%**
Great Britain	**11.4**		*10.3*	**13.5%**
Malysia	**7.0**	*3.3*	*3.7*	**8.3%**
Ireland	**5.0**		*5.0*	**5.9%**
Others	**7.5**		***7.4***	**8.9%**
Total	**84.2**	***37.8***	***45.2***	**100.0%**
% Feedstock		***44.9%***	***53.7%***	
Source: Indecon Analysis of NORA Sustainability Data				

While HVO and biofuel use in Ireland is largely focused on road transport, uptake in non-road sectors is beginning to grow, driven by EU policy and early industry initiatives. In aviation, Sustainable Aviation Fuel (SAF) targets under ReFuelEU are expected to rise significantly, creating future competition for feedstocks shared with HVO. Increases in the required minimum share of SAF is expected to drive up the prices of feedstocks, which are also used for HVO. Industry stakeholders, during the consultation process, emphasised that the aviation sector's significant purchasing power could potentially withstand such price increases, relative to the road freight sector, diverting supply of feedstocks away from road freight. However, this effect is expected to remain limited until 2030, with more significant impacts likely to emerge in the following decade as minimum SAF share requirements increase substantially.

In shipping, biofuel use is emerging, with Ireland's first marine HVO terminal opened in 2023 and pilot programmes underway at key ports. In home heating, HVO has potential but is not yet supported by a sustainability verification system, raising concerns about traceability. Data centres primarily use electricity, where all-Ireland Grid electricity is increasingly RE based, but several major operators, including Amazon, have begun using HVO for back-up generators, highlighting potential future demand in this sector.

Policy and Incentive Mechanisms

This section assesses a range of policy instruments aimed at increasing HVO uptake in Ireland's HGV sector. Using an optimisation model built by Indecon which modelled meeting the RTFO at least cost given demand, prices and fuel constraints, fuel use was projected under different policy scenarios, while ensuring compliance with the 2030 RTFO obligation of 49%(as per the existing Renewable Transport Fuel Policy 2023-2025) renewable:fossil ratio (with multi (2.5x) counting for Annex IX feedstocks). Three categories of policy instruments were examined:

- Option 1: Mandated HVO minimum requirement for HGVs (30% and 60%);
- Option 2: Adjustments in the RTFO certificate multi-counting rates (increase to HGV HVO to 3.5x or decrease all to 1.25x); and
- Option 3: Full transition to HVO100 supported by a subsidy.

The analysis finds that, under a no-policy-change baseline, HVO is projected to meet 15% of non-electric HGV energy demand, with overall biofuel use in road transport reaching 17%. The existing RTFO is the primary driver of this. In addition:

Introducing HVO mandates (Option 1): a 30% or 60% HVO mandate in the HGV sector would raise HVO penetration but result in limited additional biofuel use across the wider road sector. This is because a mandatory increase in HVO in HGV is sufficient to meet the RTFO obligation. Once the obligation is met, suppliers choose cheaper options to minimise the total cost of meeting their sub-sectoral demand. The result is that biofuel use is redirected to the HGV sector, while other sectors use less.

Adjusting RTFO Multi-counting (Option 2): Increasing the number of certificates awarded for every unit of biofuel placed on the market weakens the obligation and reduces blending of biofuels. On the other hand, reducing multi-counting rates (across biofuels) to 1.25x makes the RTFO more stringent, resulting in higher HVO and overall biofuel use, particularly in the HGV sector. It should be noted that while the latter option serves as an incentive to increase biofuel use in road transport, the double counting of Annex IX biofuels is established in primary legislation making it legally challenging to reduce the multi-counting rates below 2. Therefore, the inclusion of a reduced multi-counting rate below 2 in this analysis is for illustrative purposes only, intended to explore the potential direction of impact of such a policy change.

HVO Subsidy (Option 3): Subsidising HVO to support a full transition to HVO100 in the HGV sector would generate the largest impact, increasing HVO use in the sector to 100% and raising total biofuel use in road transport to 40%. However, this scenario would require public financial support and would have a significant cost to the Exchequer.

Overall, the results indicate that decreasing the number of certificates for every unit of biofuel placed on the market would increase the stringency of the RTFO obligation, requiring suppliers to blend more renewables to remain compliant with the RTFO obligation. However, as stated above, the reduction of the number of certificates below 2 is legally challenging since the double counting of Annex IX biofuels is bound by legislation. As a result, both HVO use in the HGV sector and overall biofuel use in the road sector increase. However, there is always a possibility that fuel suppliers would opt to buy out of the obligation by paying a buy-out charge, if blending biofuels becomes too expensive.

Summary of Policy Options					
Options	**Type of Incentive**	**Scenario**	**N. of RTFO Certificates**	**% HVO in HGV**	**% of Biofuel in Road Transport**
Baseline	No Policy Change	Baseline	2.5X	15%	17%
Option 1	HVO Mandate	Mandated 30% HVO	2.5X	30%	17%
		Mandated 60% HVO	2.5X	60%	25%
Option 2	Adjust RTFO multi-counting rate	Increase RTFO cert rate to 3.5x in HGV	3.5x (HGV)	11%	16%
		Decrease RTFO certs rate to 2x	2x	19%	20%
		Decrease RTFO certs rate to 1.25x	1.25	40%	26%
Option 3	Subsidise HVO	HVO subsidy	2.5x	100%	40%

Source: Indecon analysis
Note: % of HVO use is the percentage of projected demand met by HVO. % biofuel use is the percentage of projected demand met by biofuel (including HVO, FAME, Bioethanol).

Cost to Industry and Exchequer

This section assesses the expected cost implications of the policy options identified in Section 3 aimed at increasing the uptake of HVO in the HGV sector, as well as the resulting fiscal impact on the Exchequer. The analysis highlighted the significant price volatility and supply-side uncertainties associated with HVO, particularly due to EU biofuel policy changes, aviation sector demand for SAF, and trade-related constraints on imported HVO.

The baseline scenario, assuming full compliance with the 2030 RTFO obligation and current multi-counting rates, projects a total fuel cost to the HGV sector of approximately €1.669 billion, with €706 million in Exchequer revenue from excise duties (mineral oil tax). Options that increase the share of HVO in the fuel mix result in higher costs for the industry, due to the premium price of HVO compared to diesel. For example, mandating 60% HVO use (Option 1) would increase industry costs by €236 million and reduce Exchequer revenue by €134 million. Since biofuels produced from biomass qualify for relief from the carbon tax, increased use of HVO results in lower Exchequer revenue due to the reduction in diesel consumption, which is subject to higher taxation.

Lowering the multiplier to 1.25 would substantially raise industry costs (+€128 million) and reduce Exchequer revenue (-€73 million), reflecting the increased volume of HVO needed to meet compliance.

Option 3, a full transition to HVO100 supported by a subsidy, would lower industry costs by €87 million but impose a significant fiscal burden, with a net cost to the Exchequer of €759 million.

The table below presents the net impact of each policy option on both the cost to industry and the Exchequer, shown as deviations from the baseline scenario (full compliance with RTFO with no policy change). The impact on the Exchequer is estimated as the revenue collected from excise duties minus any costs of a subsidy incurred by the Exchequer.

Cost to Industry and Impact on Exchequer (Net Impact, €m)							
Options	**Baseline (RTFO obligation)**	**Option 1: Mandated 30% HVO**	**Option 1: Mandated 60% HVO**	**Option 2: Increase RTFO certs to 3.5x in HGV**	**Option 2: Decrease RTFO certs to 2x**	**Option 2: Decrease RTFO certs to 1.25x**	**Option 3: Subsidise HVO**
Cost to industry vs Baseline	**1,669**	+78	+236	-20	+21	+128	-87
Exchequer Impact vs Baseline	**706**	-44	-134	+11	-12	-73	-759

Source: Indecon analysis

Note: Under Option 3, the Exchequer impact is defined as the revenue collected by the Exchequer minus any subsidy costs.

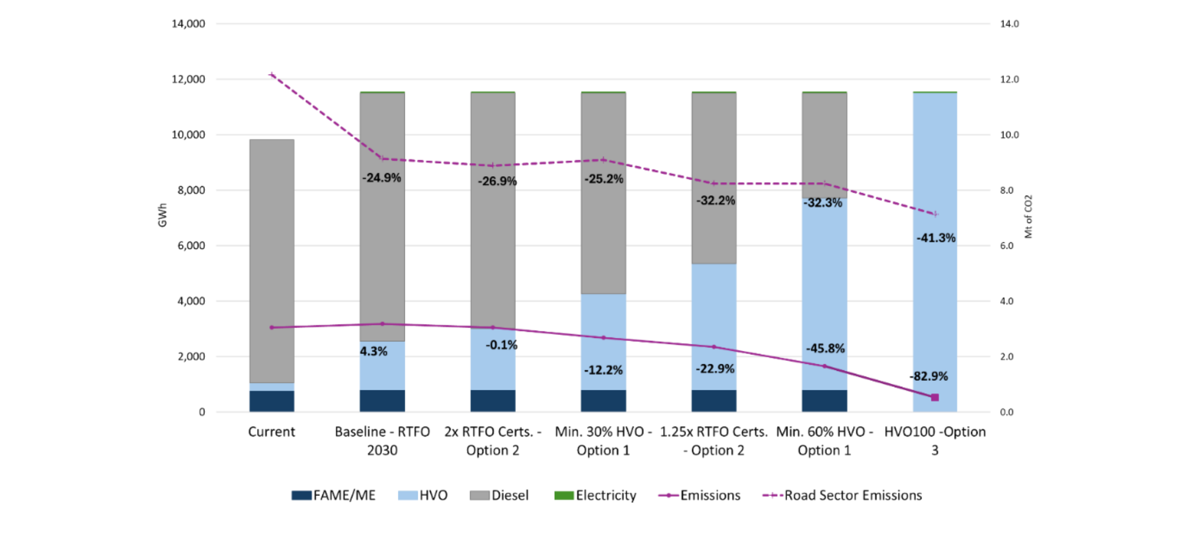
Emissions Savings

This section assessed the potential for GHG emissions reduction in the HGV sector through increased use of HVO under the policy options identified in Chapter 3. Overall, the findings suggest that incentives for HVO adoption in HGVs can play a significant role in reducing transport emissions in the medium term (2030). Compared to current levels, the baseline RTFO obligation is not expected to reduce absolute emissions for the HGV sector, due to growing energy demand projected for 2030. However, increased HVO penetration can deliver substantial reductions. These outcomes depend heavily on the GHG intensity of the HVO used, which varies by feedstock and source.

The figure overleaf illustrates projected emissions under the policy options identified in this study. Emissions reductions are calculated based on the total energy demand in the HGV sector projected for 2030 (11,554 GWh, based on the SEAI WAM scenario). Estimated fuel use under each scenario was estimated using the optimisation model developed by Indecon. Emission reductions are presented relative to current levels: 3.1 Mt CO_2e for HGVs and 12.2 Mt CO_2e for total road transport.

As expected, HVO100 (Option 3) delivers the highest emissions reduction, with estimated savings of 82.9% compared to current level of emissions. When we examine emissions for the overall road sector under Option 1, we find that there is no significant improvement beyond what is projected under the RTFO baseline scenario. Option 1 models a mandated increase in HVO use within the HGV sector, but this does not lead to additional biofuel use in other sectors of road transport. Emissions savings for the road sector under Option 1 range from 25.2% to 32.3%, only slightly above the 24.9% estimated under the baseline.

Emission Savings in HGV and Road Transport by Policy Option



Source: Indecon Analysis

The analysis also highlighted the importance of feedstock sustainability. While most HVO used in Ireland is derived from waste-based feedstocks such as UCO and POME, for imports from certain countries these may face traceability and fraud issues. These risks highlight the need for strengthened transparency in biofuel supply chains, particularly as demand for waste-based biofuels grows from EU regulation. In Ireland, regulations to exclude POME-derived biofuel from eligibility for the additional 0.5 certificate under the RTFO came into effect in July 2025.

Policy Options

Three categories of policy tools that may be used as mechanisms to increase HVO penetration in the HGV sector were identified:

- Mandated minimum HVO in HGVs;
- Changes to RTFO certificate multi-counting rates; and
- HVO subsidy to enable a full transition to HVO100.

A new optimisation model was also developed to assess any implications the policy tools listed above may have for the HGV and wider road sector. The model developed ensures that these policy tools fully meet the RTFO obligation. The model assumes that fuel suppliers will minimise the total cost of meeting each of the sub-sectoral demand subject to the RTFO obligation for 2030, and additional technical constraints. The fuel mix was determined as an endogenous outcome to the cost minimisation.

Conclusions	
Baseline	RTFO baseline (49% by 2030, under RTFP 2023 - 2025)[2] on its own is not expected to reduce absolute emissions in the HGV sector due to growing energy demand by 2030.
Option 1 (HVO Mandate)	Without RTFO reform, increasing HVO in HGV: ■ Shifts biofuel use towards HGV ■ Limits any increase of biofuel use in non-HGV road sectors ■ Which results in modest additional emissions reductions in road sectors (compared to baseline) ■ It would not be possible to administer a blending mandate specific to fuel supply for HGV consumption as there is an extant blending obligation on diesel supply in the road transport sector generally. This obligation implements Article 25 of the Renewable Energy Directive, which is not sector specific.
Option 2 (Adjusting RTFO certs)	Changing the RTFO by decreasing RTFO certs across all sectors: ■ Incentivises more blending of renewables and increases biofuel use in HGV and across all sectors ■ Noting that there is already broad application of the double counting of biofuel from Annex IX feedstock across the EU regarding the RED Article 25(1) obligation, including in Ireland since 2010, the inclusion of a reduced multi-counting rate below 2 in this analysis is for illustrative purposes only, intended to explore the potential direction of impact of such a policy change.
	Opposite effect if RTFO certs increased for HGV: ■ Reduces biofuel use in HGV, as suppliers meet RTFO obligation more easily with less biofuel ■ However, it could not be possible to adjust the number of RTFO certs for a specific sector within road transport, as the RTFO obligation applies to the entire road transport sector and relates to the supply of fuel rather than its consumption.
Option 3 (Subsidise HVO)	Subsidising HVO alone would carry a significant cost to the Exchequer ■ While cost reduced if subsidy modelled after-tax, remains significant

Source: Indecon

The analysis showed that the greatest emissions savings can be achieved through HVO100 consumption in HGVs supported by a subsidy. However, HVO remains more expensive than conventional diesel. A full switch to HVO100 without financial support would therefore impose significant cost burdens on the HGV sector. However, with financial support, it may impose a significant fiscal burden, with a net cost to the Exchequer of €759 million. A subsidy may require specific State-aid consideration and should be assessed against the potential cost of not meeting Ireland’s carbon emissions reduction targets in 2030. This could include future penalties at EU level, which would increase the overall financial burden on the Exchequer, although the precise mechanism

[2] Modelling was based using the RTFO baseline under the RTFP policy 2023 – 2025. The RTFP 2025 – 2027 was approved in July 2025, and increased the RTFO obligation from 49% to 54%.

for applying such fines has not yet been finalised. The expense of a HVO subsidy would also need to be compared to other options for reducing carbon emissions in the sector, i.e., using the funds to increase the uptake of electric HGVs.

Option 3 would require careful design to avoid undermining the transition to zero-emission vehicles. Instruments to avoid undermining the transition to ZEHDVs include setting a clear phase-out date for new ICE HGVs, although the exact timing would depend on the readiness of zero-emission technologies and infrastructure, combined with time-limited support and incentives. Currently, the transition to ZEHDVs depends largely on three factors: the relative purchase cost of ZEHDVs versus ICE vehicles, the availability and size of grants for ZEHDVs, and fuel costs (prices of HVO, diesel, and electricity). Grant amounts are typically calculated as a percentage of the price difference between a ZEHDV and its diesel equivalent. However, any policy support that reduces the cost of using HVO, such as a subsidy (Option 3), risks delaying the transition to ZEHDVs by making the total cost of operating an ICE vehicle more attractive despite the availability for purchase grants for ZEHDVs, thereby reducing the relative cost-effectiveness of electrification. Therefore, any such policy should be time-limited and regularly reviewed, taking into account progress in ZEHDV technology, availability of charging refuelling infrastructure, and battery performance.

Feedstock sustainability is also central to the viability of HVO as a decarbonisation strategy. While most HVO used in Ireland is derived from waste oils such as UCO and POME, these feedstocks are subject to traceability challenges and growing concerns over fraud. Both have been linked to issues of mislabelling, especially in cases where palm oil may be mislabelled as waste oil. Ensuring robust verification and traceability under REDIII and RTFO will be essential, particularly as demand for HVO rises.

Limitations and Future Research

This analysis focused specifically on the HGV sector, but future work could be expanded to incorporate additional transport sectors that are hard to abate such as maritime and aviation into the detailed modelling and optimisation model developed by Indecon to account for national obligations and constraints outside the RTFO. This would help prioritise biofuel allocation where alternatives like electrification are least feasible in the medium term. Future research should also consider glide paths for ZEHDV adoption, while monitoring the advancement in new technologies including the timing and scale of charging infrastructure, progress in battery performance, and technology costs. The timeframe of analysis could be extended beyond 2030, in line with EU targets for 2035 or 2040, and to account for increasing bioliquid demand from ReFuelEU and FuelEU Maritime. Finally, improvements in data collection and monitoring of feedstock-specific bioliquid consumption, especially for sectors outside the RTFO, will be needed to accurately track demand and consumption, and enable a better estimation of emissions savings.

Data Collection

While Ireland collects feedstock-specific biofuel data through NORA, this is limited to volumes placed on the market and does not reflect actual sales or end use by sector. For example, in 2023, 84 million litres of HVO were reported as placed on the market for road transport, but no direct data is available on the share used specifically by freight operators. In addition, there is very limited data on HVO use in other sectors outside the RTFO such as home heating, aviation, navigation, or data centres.

The implementation of ReFuelEU Aviation and the FuelEU Maritime regulation is expected to improve data collection in the aviation and maritime sectors by imposing clearer reporting obligations on fuel suppliers and operators. However, gaps may remain for home heating and data centres. The Revenue Commissioners collect and hold data according to its function, and additional data could be considered in support of any future policy initiative for fuel taxation and biofuels related to MOT, or such as that suggested under Option 3, to monitor taxed HVO consumption.

Another area of improvement in data collection relates to how fuel is allocated, blended, and delivered across sectors and sub-sectors. Importantly, one gap in this study is that, aside from the modelling of the RTFO obligation and additional technical constraints (i.e., 7% limit on FAME), no physical blending assumptions were made. Future work could benefit from insights into how blends and uses vary between wholesale and retail, and from the incorporation of these data into the modelling framework. This would allow for more accurate estimates of emissions savings and costs, and improve the overall accuracy of the model.

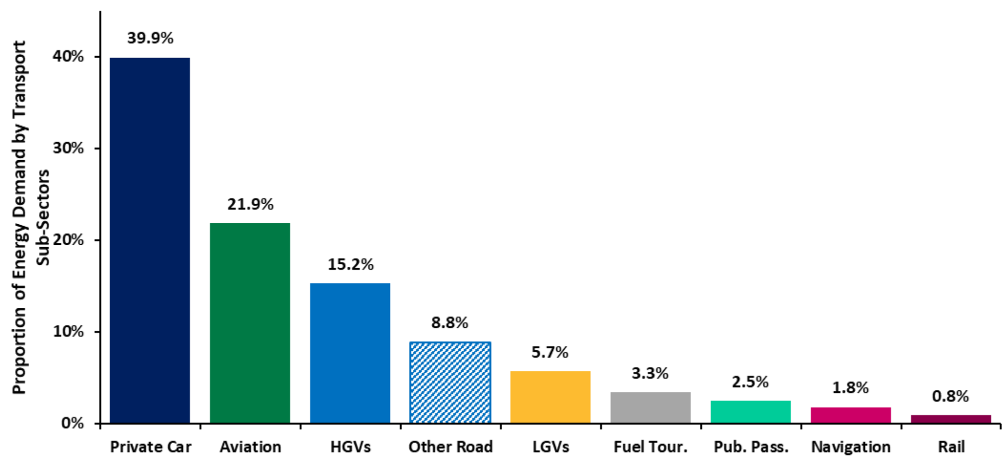
1 Introduction

Indecon International Economic and Strategic Consultants Ltd (Indecon) were appointed by the Department of Transport (DoT) for the provision of a report to assess the availability and use of HVO100 in the heavy goods freight sector and its potential for emission reduction in the Heavy Goods Vehicles (HGV) fleet, beyond those already expected to be achieved by the existing B20 mandate.

1.1 Background and Scope

In December 2022, the Department of Transport published Ireland's 10-year Road Haulage Strategy 2022-2031.[3] This was the first dedicated strategy for the road haulage and heavy goods road freight sector in Ireland and set out the strategic and policy direction for the sector for the next decade. The significance of this strategy is underscored by the sector's substantial energy demand as outlined in Figure 1.1. In 2023, HGVs accounted for 15% of total transport energy consumption, making the road freight sector the third largest consumer of energy within transport.

Figure 1.1: Transport Energy Demand by Sub-Sectors, 2023



Source: SEAI, Energy in Ireland

As a result, significant focus has been centred around increasing the sustainability of the road sector, and a central pillar of the Road Haulage Strategy is Sustainability and Decarbonisation. Road transport accounts for 94% of all emissions in the transport sector and 20% of this is emitted by HGVs. A total of 2,401 kilotonnes of CO_2 were emitted by HGVs on Irish roads in 2023.[4] As a result, many efforts are underway to reduce emissions from the sector. The Climate Action Plan binds Ireland to reducing 50% of road transport emissions by 2030 and reducing emissions in the road freight sector will help contribute to reaching this target.

In line with its commitment to decarbonising transport, the DoT recognises that while Battery Electric Vehicles (BEVs) represent the long-term solution, widespread availability and affordability across

[3] Department of Transport, 2022, Ireland's Road Haulage Strategy.
[4] Department of Transport (2024) Road Haulage Strategy Annual Progress Report 2024

Europe will take time. Recent data[5] shows that electrically chargeable trucks grew by 50.6% across the EU in Q1 2025, increasing their market share from 2% to 3.5%. The Netherlands led this growth, with a 342.7% increase, accounting for 25% of the EU's electrically chargeable truck sales. During the same period Ireland's uptake of electrically chargeable trucks represented 0.5% of all new commercial trucks. In the short to medium term, interim non-technological measures will be needed to reduce emissions in the HGV sector and support Ireland in meeting its transport emissions targets.

Blending renewable fuels is recognised under EU legislation, such as the Renewable Energy Directive, as an effective transitional measure. Ireland already supports the use of biofuels in road transport through the Renewable Transport Fuels Obligation (RTFO) Scheme administered by the National Oil Reserves Agency (NORA). This scheme mandates that a proportion of motor fuels placed on the market be derived from renewable sources. According to NORA, diesel in Ireland contained approximately 10.3% biofuel blended in 2024. This is expected to increase with a government target to increase this blend to 20% (B20) by 2030 (for biodiesel and HVO in diesel).

One of the key biofuels that is expected to support higher biofuel rates in diesel is HVO. HVO is a renewable diesel derived from different types of feedstocks, processed with hydrogen to create a diesel substitute product. One of the key benefits of using HVO is its potential to significantly reduce greenhouse gas emissions. HVO is typically produced from a range of feedstocks, and its overall emission reduction potential depends largely on the feedstock used. Crop-based feedstocks such as palm oil or other types of vegetable oil may cancel out any emissions savings relative to conventional fossil fuels. In contrast, waste-based feedstocks such as used cooking oil or animal fats, have lower emissions, making them a more sustainable option[6]. This report represents a detailed analysis of HVO availability and its potential to reduce emissions in the road freight sector.

1.2 Structure of Report

The remainder of this Report is structured as follows:

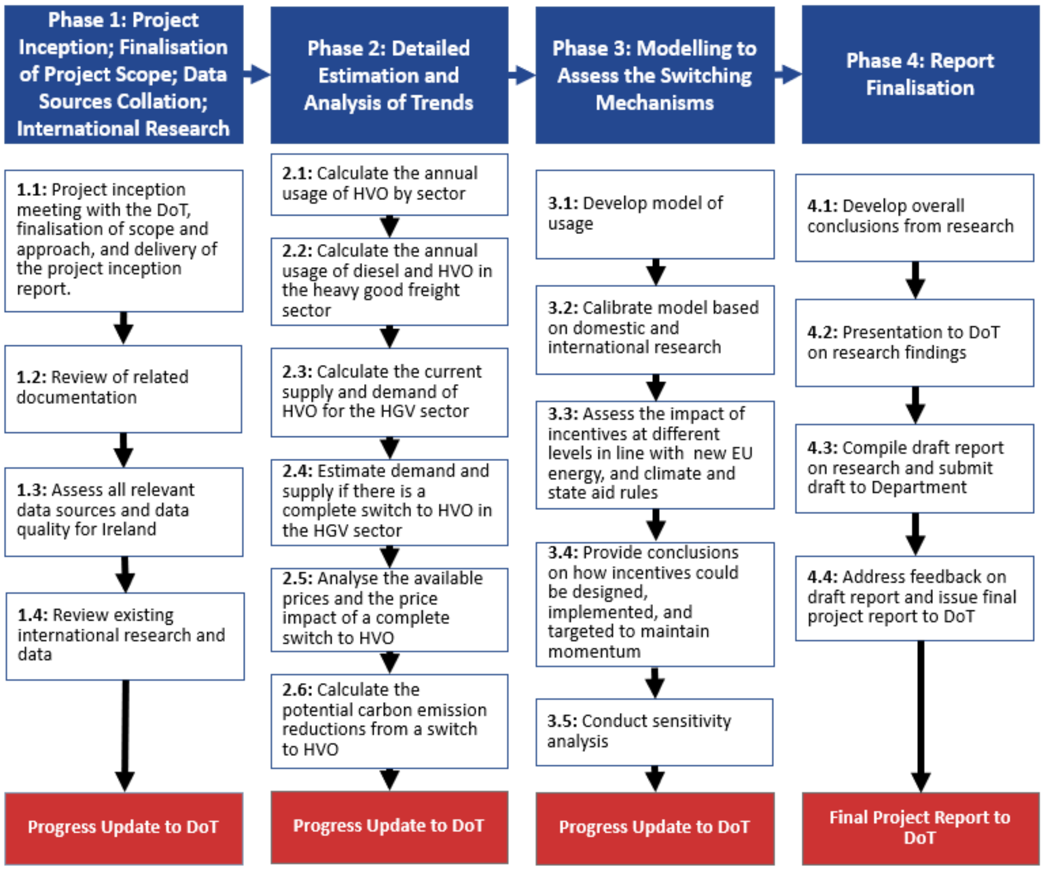
- Section 2 assesses the availability and usage of HVO in Ireland for the HGV sector, the wider road sector and other specific sectors.
- Section 3 examines future energy demand and available policy incentives to increase HVO penetration in the HGV sector.
- Section 4 presents costs to the HGV sector and the fiscal impact on the Exchequer under the policy options identified in Section 3.
- Section 5 estimates carbon emissions savings in the HGV sector under the policy mechanisms identified in Section 3.
- Finally, Section 6 presents the conclusions of this study.

1.3 Methodology of Report

Indecon's evidence-based methodology, as summarised in Figure 1.2, is broken down into four phases: collation of data sources and review of existing international research; stakeholder consultation and initiating data analysis; modelling to assess incentive mechanisms; and the preparation of final report.

[5] ACEA (2025), Press Release: New Commercial Vehicle Registrations.
[6] EEA (2023), Greenhouse gas intensities of transport fuels in the EU in 2021 Monitoring under the Fuel Quality Directive

Figure 1.2: Proposed Methodology



Source: Indecon Analysis

Stakeholder Consultation

The project involved extensive engagement with industry stakeholders to inform the report's findings. This consultation process aimed to ensure that the modelling reflected the realities of the sector as accurately as possible. Several stakeholders from relevant government departments, national agencies, and transport bodies contributed to the consultation, either through written submissions to the Indecon team or via meetings.

Table 1.1: List of Stakeholders

■ TII	■ D/Transport Sustainable Aviation Division
■ DCEE	■ CSO
■ NORA	■ FTAI
■ CERTA	■ Fuels for Ireland
■ SEAI	■ Irish Road Haulage Association

Source: Indecon

1.4 Acknowledgements and Disclaimer

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The usual disclaimer applies and responsibility for the analysis and findings in this independent report remains the sole responsibility of Indecon.

2 HVO Availability and Usage

2.1 Introduction

This chapter first outlines the key EU and national policies driving the use of renewable energy in Ireland's transport sector. It then provides an overview of biofuels and HVO availability at both global and national levels, before examining HVO and biofuel use across the road transport and other sectors.

2.2 Policy Context

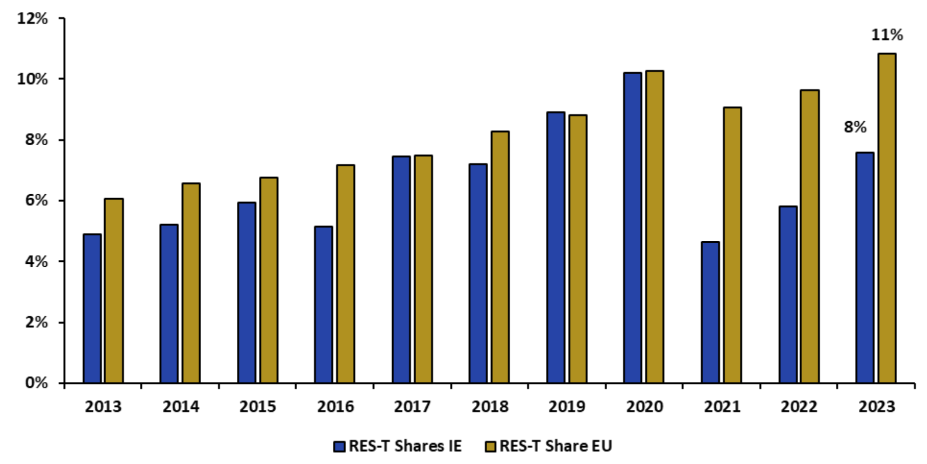
This chapter outlines the key EU and national policies driving the use of renewable energy in Ireland's transport sector. It focuses on the Renewable Energy Directive (RED), the Renewable Transport Fuel Obligation (RTFO), and supporting national strategies, highlighting their targets, mechanisms, and implications for decarbonising transport, particularly the road freight sector.

Renewable Energy Directive

The RED[7] is a key component of the EU's 'Fit for 55' package which was introduced in 2021 to help EU reduce greenhouse gas (GHG) emissions by at least 55% by 2030 and reach climate neutrality by 2050. Formally introduced in 2009, the RED has been subject to three revisions. The most recent revision, REDIII, entered into force in 2023 and set a binding target for the EU to achieve at least 42.5% renewable energy in gross final energy consumption by 2030, with an indicative target of 45%.

With regards to the transport sector, the RED established a target of at least 29% share of renewable energy in final consumption of all energy used in transport or a minimum of 14.5% reduction in GHG compared to emissions that would have been created by fossil fuel use. Currently, the Renewable Energy Share for Transport (RES-T) for Ireland stands at 8% compared to the EU average of 11%, as presented in Figure 2.1 below. Despite significant increases in the past decade, a further 21% increase in needed to meet the EU's 2030 target.

Figure 2.1: RES-T Shares for Ireland and EU



Source: EU SHARES data

[7] European Commission, Renewable Energy Directive

REDIII also promotes the greater use of waste-based biofuels by introducing specific sub-targets and limits. The Directive mandates a minimum of 1% (in 2025, rising to 5.5% in 2030) for the combined share of advanced biofuels and biogas produced from feedstocks listed in Annex IX Part A, together with renewable fuels of non-biological origin (RFNBOs). Furthermore, the contribution of biofuels and biogas derived from feedstocks listed in Annex IX Part B is capped at 1.7% of the energy content of fuels and electricity supplied to the transport sector. In the event that ongoing supply constraints for advanced biofuels persist, the Irish Government may consider applying to the European Commission for a relaxation of the current EU-wide 1.7% cap on the contribution of certain biofuels made from feedstocks listed in Annex IX Part B of the RED.

Annex IX of the Directive[8] provides a list of approved sustainable feedstocks, for the production of biofuels and biogas to help Member States meet their renewable energy targets. The energy content of biofuels produced from Annex IX feedstocks can be double counted for the purpose of the calculation of the share of renewable energy in transport under the RED. Advanced biofuels, as defined in the Directive, refer specifically to fuels made from the 22 feedstocks listed in Part A of Annex IX. Importantly, all fuels produced from feedstocks listed in Annex IX are eligible for energy content multipliers, meaning their contribution to the renewable energy targets can be counted twice. These multipliers aim to incentivise the use of non-food and non-feed-based biofuels and to support the market entry of emerging fuel technologies. There are six feedstocks listed in Part B of Annex IX including Used Cooking Oil (UCO) and animal fats. The latest Annex also differentiates between feedstocks produced for the aviation sector (Part A) and feedstocks used for the transport sector (Part B)[9].

To further ensure sustainability of biofuels, the Directive imposes strict limits on biofuels, bioliquids, and biomass fuels associated with a high risk of Indirect Land Use Change (ILUC). ILUC refers to the clearance of land to allow for the expansion of overall agricultural area, possibly including areas with high carbon stock, such as forests, wetlands and peatlands to meet additional demand for feedstocks used in biofuel production.[10] This land conversion can release large amounts of CO_2 stored in vegetation and soil, thereby offsetting any GHG savings that biofuels can potentially deliver. A common example of high ILUC-risk feedstock includes palm oil, and other crop-based oils. As a result, REDIII caps the contribution of high ILUC-risk feedstocks at 2019 levels for the period 2021 to 2023. From 2024 onward, biofuels derived from palm oil are subject to a gradual phase-out, reaching zero by 2030. While Member States may continue to use such fuels, they are no longer permitted to count them toward their renewable energy targets. Table 2.1 summarises the main targets for the transport sector outlined under the RED.

[8] See Annex 1 in report for a full list of Feedstocks in Annex IX REDIII.

[9] This is specifically in relation to crops grown on severely degraded land, except food and feed crops, and intermediate crops such as catch crops and cover crops which when used for the production of biofuel for the aviation sector are considered Part A and are otherwise considered Part B.

[10] European Commission - Biofuels

Table 2.1: Summary of RES-T Targets under the RED		
Category	**Target - 2030**	**Note**
RES-T	29% share of renewable energy OR 14.5% reduction in GHG emissions	Member States can choose which target to follow
Advanced biofuels (Annex IX Part A)	5.5% in 2030	Eligible for double-counting; Includes POME
Biofuels (Annex IX Part B)	1.7% limit (for RES-T target); no limit on overall RES	Eligible for double-counting; Includes UCO, animal fats
High ILUC-Risk Biofuels	Capped at 2019 levels, phased out to 0%	Amended annually to ensure a reduction each year in the amount of high ILUC-risk biofuels supplied to achieve 0% supply by 2030. Implemented through the RTFO
Crop-Based Biofuels	Contribution capped at 2020 share + 1%, up to a maximum of 7%	-
Source: RED		

Climate Action Plan

Ireland's Climate Action Plan (CAP)[11] is aligned with Ireland's obligations under the Paris Agreement and EU's "Fit for 55" package, paving a path for national decarbonisation. The plan sets out strategic actions to reduce GHG emissions by 51% by 2030 and achieve net zero emissions by 2050. These emissions reduction targets are supported by enhanced climate governance and reporting frameworks, as well as annual Climate Action Plans, carbon budgets and sectoral emissions ceilings. For the transport sector the targets include 20% reduction in total vehicle kilometres travelled relative to business-as-usual, 50% reduction in fuel usage, and significant increases to sustainable transport trips and modal share.

Renewable fuels are identified as a core medium-term measure for the reduction of GHG emissions in transport. The CAP24 sets non-binding targets, set to be achieved via the Renewable Transport Fuel Obligation (discussed in the next sub-section):

- Achieve at least a 20% sectoral share consumption of biodiesel (B20) by 2030;
- Reach a 10% bioethanol sectoral share consumption (E10) by 2030.

Renewable Transport Fuel Obligation (RTFO)

The RTFO, formerly known as the Biofuels Obligation Scheme, is a key policy instrument to support the decarbonisation of the transport sector in Ireland. It was introduced to help Ireland meet its commitments under the RED which, as stated above, requires Member States to ensure that at least 29% of their final energy consumption in the transport sector comes from renewable sources by 2030.

Through the administration of the National Oil Reserves Agency (NORA), the RTFO places an obligation on fuel suppliers that are subject to a NORA levy, to ensure that a specified portion of the transport fuel they supply is renewable. The obligation is currently set at 25%. This proportion is subject to annual increases every year to meet CAP and RED targets (the RTFO trajectory is discussed

[11] Climate Action Plan 2024

in the next sub-section). Obligated parties are required to pay a levy of €0.001 per litre (biofuel levy) on their renewable fuel disposals and may then apply for RTFO certificates which are awarded for each megajoule (MJ) of renewable fuel they place on the market.

RTFO certificates are used as an incentive mechanism to demonstrate compliance with the RTFO obligation. Also referred as the RTFO multi-counting rate, if suppliers receive two certificates for each unit of biofuel that is placed on the market, their contribution is counted twice towards the RTFO obligation. In some cases, additional certificates are granted for specific fuel types, sector and feedstocks used to derive the renewable fuels. The current obligation means that the ratio of biofuels-to-fossil fuels must be 25% by energy (including the double-counting and the possibility for fuel suppliers to carry over 15% of their certificates from the previous obligation period). For instance, advanced biofuels listed in Annex IX receive a higher number of certificates, as shown in Table 2.2.

Table 2.2: RTFO Multi-Counting Rate

Fuel Type	Use Sector	Feedstock	Additional Certificates per MJ	Total Certificates per MJ
BioCNG	Road, rail & NRMM	Any Annex IX	1.4	3.4
		Not Annex IX	0.7	1.7
HVO/CHVO	**Road, rail & NRMM**	**Any Annex IX**	**0.5**	**2.5**
		Not Annex IX	**0.25**	**1.25**
Biodiesel (FAME)	**Road, rail & NRMM**	**Category 1 tallow**	**0.5**	**2.5**
		Any Annex IX	**0.4**	
Any	Aviation	Annex IX	0.4	2.4
		Not Annex IX	0.2	1.2
Any	Marine	Annex IX	0.4	2.4
		Not Annex IX	0.2	1.2
RFNBO	Road, rail & NRMM	Not Annex IX	0.2	4
		Any	3	

Source: RTFO Annual Report, 2023
Note: Non-Road Mobile Machinery (NRMM). Renewable Fuel of Non-Biological Origin (RFNBO).

At the end of each year, obligated parties must surrender a sufficient number of certificates to NORA to demonstrate compliance. If they fail to meet their obligation, they are subject to a buy-out charge, which was set at €0.05 per MJ in 2023.

In 2023, the Advanced Biofuel Obligation also came into effect, introducing a 1.5% target for advanced biofuels by energy content. This obligation is fulfilled by surrendering Green Certs, which are awarded for fuels made from feedstocks listed in Annex IX Part A of REDIII. These certificates also are subject to a buyout charge which is set at €0.08 per MJ.

Renewable Transport Fuel Policy

The Renewable Transport Fuel Policy (RTFP) outlines Ireland's roadmap for increasing the use of renewable fuels in the transport sector in order to reduce GHG emissions and meet EU renewable energy targets. The previous RTFP covered the period 2023 – 2025. In July 2025, an updated RTFP for the period 2025-2027 was approved. The RTFO is implemented under the RTFP.

The policy highlights specific actions intended to be implemented for the following two years. Among the actions outlined, a focus is given on the evaluation of sustainability criteria for renewable fuels including the assessment of lifecycle GHG emissions, ILUC effects, biodiversity impacts and improving transparency and fraud, particularly in relation to UCO and other feedstocks.

The updated Renewable Transport Fuel Policy must align with the revised EU targets for renewable energy in the transport sector as well as achieving a sectoral share of 10% ethanol (E10) in gasoline and 20% biodiesel (B20) in diesel. An indicative increase in the RTFO rate to achieve this over the period 2025-2030 under the RTFP 2023 - 2025 is set out in the Table 2.4 below. It should be noted that all modelling undertaken in this study is based using the RTFO rates under the RTFP 2023 – 2025 illustrated below.

Table 2.3: RTFO Obligation (RTFP 2023 – 2025)

	2025	2026	2027	2028	2029	2030
RTFO Obligation	25%	29%	34%	39%	44%	49%

Source: Renewable Transport Fuel Policy 2023-2025

As of July 2025, updated RTFO figures have been approved under the RTFP 2025 - 2027. The RTFO obligation for 2030 was increased from 49% (RTFP 2023 - 2025) to 54% (under the RTFP 2025 – 2027). The updated trajectory in the RTFO rate under RTFP 2025 – 2027 is illustrated below.

Table 2.4: RTFO Obligation (RTFP 2025 – 2027) – Current

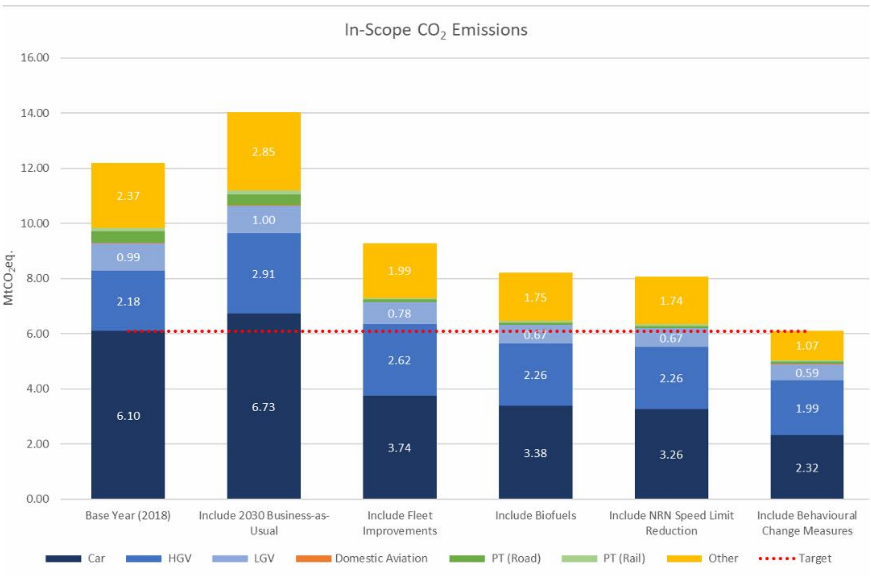
		2026	2027	2028	2029	2030
RTFO Obligation		32%	36%	40%	44%	54%

Source: DoT Public Consultation Report for Revised Renewable Transport Fuel Policy 2025-2027

Ireland's Road Haulage Strategy 2022–2031

Ireland's Road Haulage Strategy 2022-2031 is the first dedicated road haulage strategy that covers the measures needed to deliver the objectives planned for the industry across the various policies such as the CAP and RTFO. The strategy sets out that GHG emissions are required to decrease from 12 mega tonnes (Mt) per year to 6Mt per year by 2030 to achieve the binding target of a 50% reduction in GHG emissions for the transport sector. The total transport sector emitted approximately 10.9Mt of CO2 in 2021, of which 20% were emitted by the HGV sector. While it is acknowledged that the majority of emissions reductions are expected to come from private cars, the strategy underlines that the required scale of reduction in the HGV sector is proportionally much greater, highlighting the significant challenges the freight sector faces in decarbonisation. The figure below shows the scale of reductions required by the HGV sector to reach the 2030 target.

Figure 2.2: Required Reduction in Emissions by Road Transport Sector



Source: Road Haulage Strategy 2012-2031

2.3 Availability of HVO

HVO is a renewable fuel produced through the hydrogenation process of various feedstocks including vegetable oils, animal fats and waste oil.[12] HVO, along with Fatty Acid Methyl Ester (FAME), is one of the main biofuels used as a substitute for road diesel. One key advantage of HVO over FAME-based biodiesel is its compatibility with conventional diesel engines, allowing it to fully or partially replace road diesel while contributing to emissions reductions. FAME is typically limited to a maximum blend of 7% to 10% by volume in diesel, depending on the regulatory framework. In Ireland, the EN590 diesel standard permits a maximum of 7% FAME in diesel. The EU Fuel Quality Directive allows up to 10%. The revised RTFP 2025–2027 will include an action to undertake a discussion paper on the risks and merits of promoting within the RTFO the new maximum B10 specification from the revised Fuel Quality Directive. While there is no EU-wide legislative limit on HVO blending with diesel, its use in higher blends depends on engine manufacturers and national standards. In some cases, blends above 30% may require engine calibration adjustments due to HVO’s lower density and different combustion properties. Blends of HVO in diesel above 30% may not fulfil the technical specifications of the EN590 diesel standard for the purposes of fuel quality monitoring under the Fuel Quality Directive. HVO can also be used as a pure fuel (HVO100), conforming to the European standard EN15940.

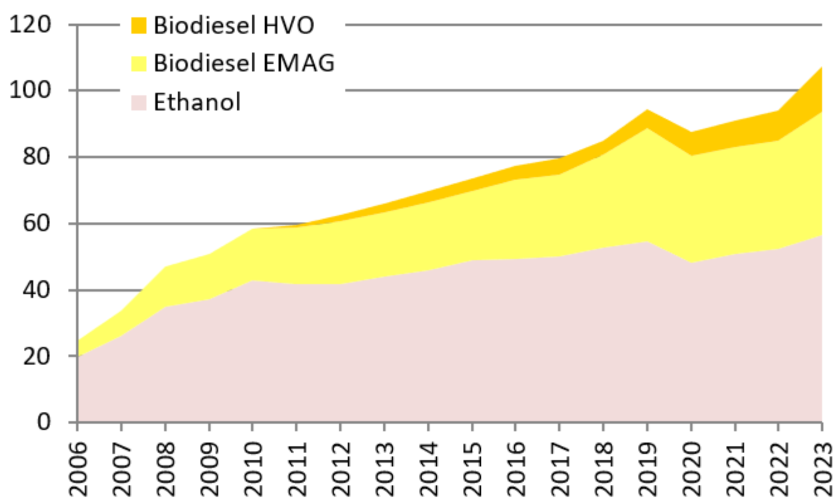
The sustainability of HVO varies according to the feedstocks used. Common feedstocks from which it can be produced include vegetable oils, animal fats (tallow) and waste oils such as UCO and Palm Oil Mill Effluent (POME). While it can be produced from raw vegetable oils such as rapeseed oil, palm oil etc., its environmental benefits are maximised when derived from waste-based feedstocks.

Global Use and Supply of Biofuels

[12] SEAI (2024), HVO Can Be Part of Our Clean Energy Transition.

Global energy consumption of biofuels (including HVO) in road transport represented over 53% (107 Mtoe[13]) of alternative fuels (including biofuels, LPG, and electricity) and 4.8% of total fuel consumption in road transport in 2023. Between 2022 and 2023 alone, biofuel use grew by 14%. With regards to biofuels use in road transport as replacement for diesel, they grew by 22%, an increase largely driven by demand for HVO (up by 50% between 2022 and 2023).[14] As of 2023, HVO represented 27% of global biofuel use. In the EU, demand for biofuels in road transport is driven mainly by the regulatory landscape such as blending mandates and incentives (RED). In the EU, biofuel use was recorded at around 17 Mtoe in 2023.[15]

Figure 2.3: Global Biofuel Consumption in Road Transport (Mtoe), 2006-2023

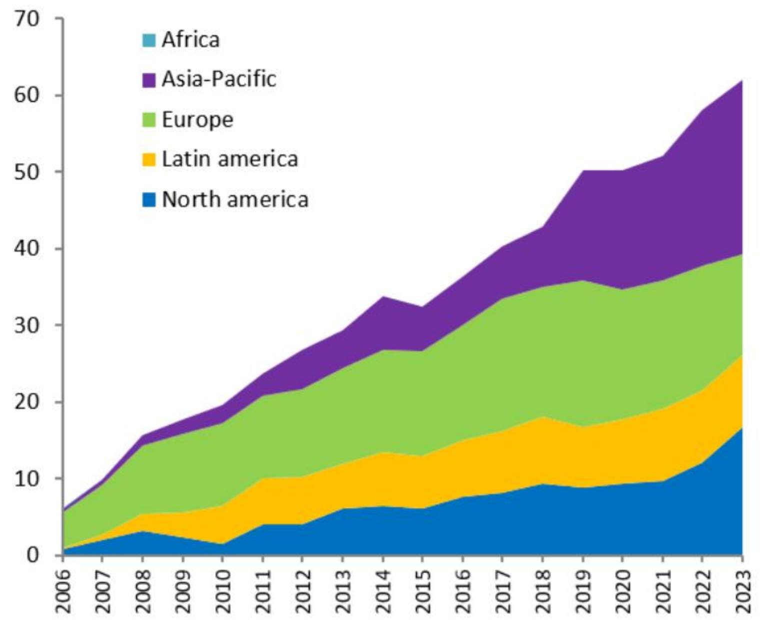


Source: IFPEN, S&P500

Looking at global production of biodiesel (FAME and HVO), the Asia-Pacific region is the world's leading producer of biodiesel, reaching 22.7 Mtoe in 2023. Meanwhile, North America's biodiesel production matched that of Europe for the first time in 2023, both producing 15 Mtoe. The United States currently stands out as the world's top producer of HVO, with 7 Mtoe produced in 2023.[16]

[13] Million Tonnes of Oil Equivalent.
[14] IFPEN (2025), Economic Outlook Biofuels Dashboard, 2024
[15] IFPEN (2025), Economic Outlook Biofuels Dashboard, 2024
[16] IFPEN (2025), Economic Outlook Biofuels Dashboard, 2024

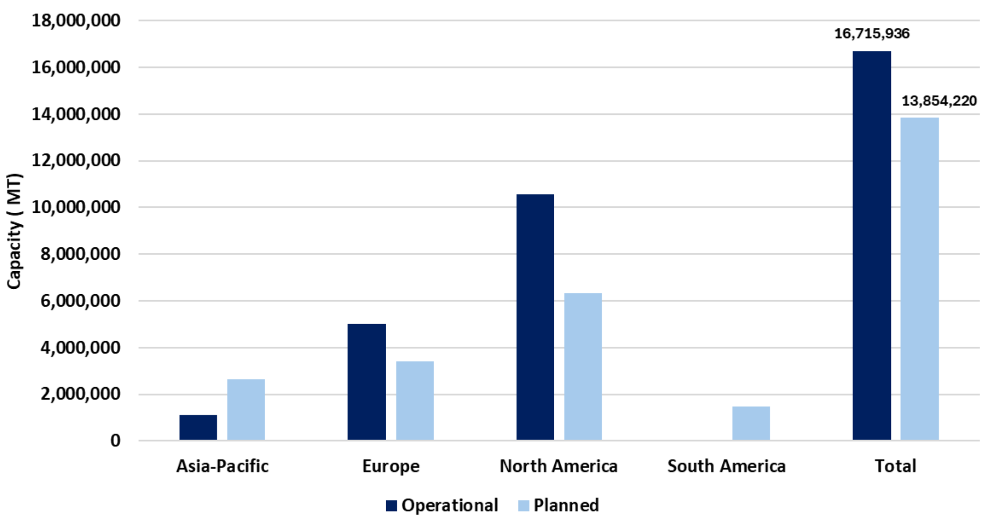
Figure 2.4: Global Production of Biodiesel (FAME and HVO) (Billion Litres)



Source: IFPEN, S&P500

Recent data from Argus indicates that Europe is expected to account for 25% of global planned HVO capacity, estimated at approximately 13.8 million metric tonnes (MT). By 2028, total global capacity, both operational and planned, is projected to reach 30.6 million MT, with the EU representing 27%. Germany is the largest producer of biodiesel, followed by France and Spain.[17] Major players in Europe include Neste, ENI, and TotalEnergies.

Figure 2.5: Global Operational and Planned Capacity for HVO



Source: Indecon Analysis of Argus data
HVO Capacity Map, 2024

[17] European Biodiesel Board (2023), Statistical Report 2023.

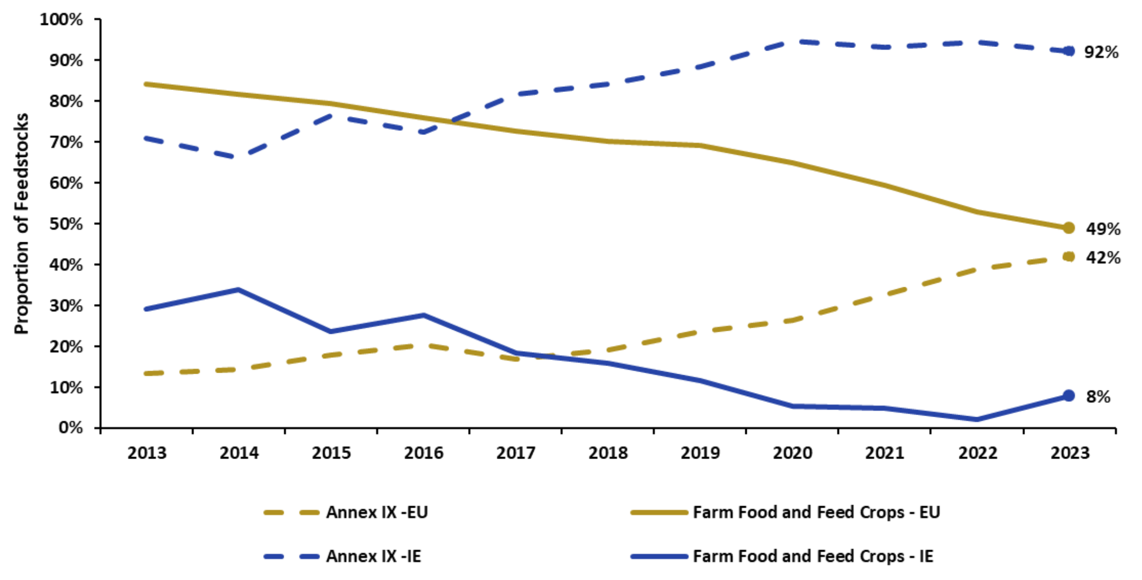
Biodiesel production in Ireland was estimated at 185 million litres, with most of the installed capacity dedicated for the production of FAME (115 million litres). The installed capacity for co-processed HVO (CHVO) was estimated at 70 million litres. Plans are underway for a new biodiesel production facility in Wicklow with a proposed capacity of 120 million litres.[18] However, not all biodiesel or HVO can be produced from domestic feedstocks. Indigenous availability of UCO could support production of 10–20 million litres, while Category 1 tallow could yield up to 51 million litres, giving a maximum of around 70 million litres of HVO produced from indigenous sources.

Feedstock Availability

In recent years, there has been a notable increase in the use of biofuels in general but also in the use of advanced and waste-based feedstocks (those outlined in Annex IX of REDIII) gradually displacing biofuels derived from food and feed crops. Through its policies, the EU is incentivising more sustainable, waste-based, biofuels and this is evident from the increase in Annex IX feedstocks in Ireland and the EU. Annex IX feedstocks, contributed to nearly 60% of the total biofuel share counted toward the EU's transport energy target.[19]

In 2023, Annex IX feedstocks accounted for 42% of total biofuel consumption in the EU compared to a much higher percentage for Ireland at 92% in the same year, as shown in Figure 2.6. At the same time, a decrease in farm and feed crops is noted. In Ireland only 8% of all biofuels were derived from farm and feed crops compared to 49% in the EU. The increased targets in the REDIII are expected to triple the demand for Part A feedstocks by 2030.[20]

Figure 2.6: Biofuel Consumption in EU and IE



Source: Indecon Analysis of SHARES Data

Note: data only include biofuels that are compliant with sustainability and GHG savings criteria under RED.

[18] *Ibid.*

[19] Transport & Environment (2024), The Advanced and Waste Biofuels Paradox: Availability and Sustainability of Advanced and Waste Biofuels.

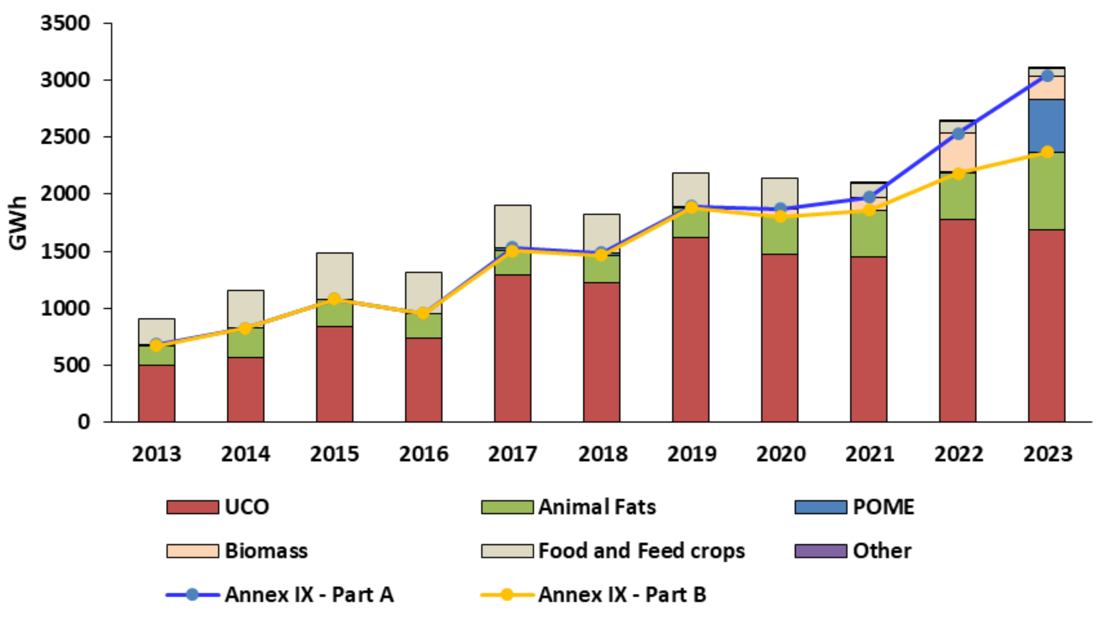
[20] Transport & Environment (2024), The Advanced and Waste Biofuels Paradox: Availability and Sustainability of Advanced and Waste Biofuels.

The future availability of sustainable feedstocks is limited in the EU. In 2030, the availability of sustainable advanced and waste biofuels is estimated to be around 7.4 Mtoe, declining to 5 Mtoe in 2050.[21]

In Ireland, UCO, has been the main feedstock from which biofuels were derived, representing more than half of the feedstocks used in 2023. The use of POME also increased significantly in 2023. This increase in POME is aligned with trends noticed in other EU countries such as Belgium, Spain, Italy which all note an increase in POME in 2023, driven by a general increase in the use of biofuels but also the EU's decision to disincentivise the use of food and feed crops such as palm oil for the production of biofuels. This rapid increase in POME use has led to concerns about potential fraud and misrepresentation of waste-based biofuel, potentially including palm oil being passed off as more sustainable POME-derived fuel. The European Commission has been asked to investigate these concerns, and some member states, including Ireland, are advocating for appropriate measures to be taken.[22] In fact, Ireland has asked the European Commission to conduct further analysis to take account of these concerns raised about POME and other palm oil derivatives in EU biofuel supply within the scope of investigation of potential fraud with imports of biofuels and to take appropriate measures.

Conversely, the use of farm and feed crops have declined considerably in line with EU policies. Since 2019, Annex IX Part A feedstocks have surpassed the use of UCO and animal fats in Ireland (Annex IX Part B).

Figure 2.7: Biofuel Consumption by Feedstock in Ireland



Source: Indecon Analysis of SHARES Data

[21] *Ibid.*
[22] Transport & Environment (2025) Palm Oil in Disguise? - How Recent Import Trends of Palm Residues Raise Concerns Over a Key Feedstock for Biofuels

Ireland's indigenous supply of UCO is estimated to be up to 29,000 tonnes, with only 10,000 to 20,000 tonnes considered as recoverable. This is equivalent to 10 million to 20 million litres of biodiesel that could be produced domestically from UCO. Despite this potential, there are no expectations for significant growth in domestic UCO supply in the coming years in Ireland.[23]

European supply of UCO is mostly collected from restaurants and food manufacturers, with Germany, Italy and Spain having the biggest available and potential supply of the feedstock[24]. However, the increasing demand for UCO already exceeds the available supply in Europe. Countries such as China Indonesia and Malaysia have a greater availability of supply, from which most of the UCO is imported from.[25] As of 2023, the majority of UCO in Ireland was sourced from China (36%), followed by the UK (16%).[26] The strong demand for UCO has increased the risk of fraudulent practices, with concerns that virgin oils, such as palm oil, may be falsely labelled as UCO in order to benefit from the higher market value associated with sustainable fuels.[27]

Ireland also has an indigenous supply of Category 1 tallow,[28] estimated between 35,000 and 51,000 tonnes, equivalent to roughly 35 million to 51 million litres of biodiesel. When combined with domestic UCO supply, this brings the total potential biodiesel production from indigenous category 1 feedstocks to between 45 million and 71 million litres. Similar to UCO, there are no anticipated increases in domestic tallow availability that would significantly alter this capacity.[29]

There is some possibility of using Category 3[30] tallow which is currently exported or used for heat generation and other non-energy purposes due to its ineligibility for double-counting under current rules. If redirected to biodiesel production, it could add up to 74 million litres to domestic output, bringing the total potential from all indigenous tallow sources to between 119 million and 145 million litres.

2.4 HVO Use in Road Transport

This section examines energy demand and HVO use in road transport in Ireland, drawing on the latest data from the NORA and the SEAI. It also includes on information into sources of biodiesel placed on the market in Ireland (with a focus on HVO), and biofuel and fossil fuel consumption in the road transport sector.

Total energy use in road transport in Ireland was estimated at 38,161 GWh, according to SEAI National Energy Projections data for 2023.[31] The table below illustrates energy consumption in road transport across the following categories: HGVs, public passengers, private cars, and light goods vehicles.

[23] Byrne O'Cléirigh (2022) A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets.

[24] Transport & Environment (2024), The Advanced and Waste Biofuels Paradox: Availability and Sustainability of Advanced and Waste Biofuels.

[25] *Ibid.*

[26] NORA Sustainability Data

[27] Transport & Environment (2023) 80% Of Europe's 'Used' Cooking Oil Now Imported Raising Concerns Over Fraud: Study

[28] Animal by-products such as tallow are classified into three categories as per the EU Animal By-Product Regulation according to the level of risk of transmitting diseases to humans or animals, if not processed correctly. Category 1,2 and 3 represent high, intermediate and low risk respectively.

[29] Byrne O' Cléirigh (2022) A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets.

[30] Animal by-products such as tallow are classified into three categories as per the EU Animal By-Product Regulation according to the level of risk of transmitting diseases to humans or animals, if not processed correctly. Category 1,2 and 3 represent high, intermediate and low risk respectively.

[31] Data from the SEAI Energy Balance were initially expressed in Ktoe and converted into GWh using a conversion factor of 1 Ktoe = 11.63 GWh.

Private cars represented the highest amount of energy use in 2023 (23,716 GWh or 62% of the total road energy consumption). HGVs represented the second largest share of energy consumed (25%).

Table 2.5: Energy Demand by User Type for the Road Sector, 2023		
Road Sector	**Energy Use (GWh)**	**% from Road Sector Energy**
HGVs	**9,532**	**25%**
Public Passengers	1,283	3%
Private Cars	23,716	62%
Light Goods and Passengers (LGVs)	3,631	10%
Total	**38,161**	**100%**
Source: Indecon Analysis of SEAI National Energy Projections (provided upon special request)		

We next look at energy consumption in the road sector by type of fuel. Diesel is the predominant fuel used in road transport in Ireland, accounting for 72% (27,509 GWh which is the equivalent of approximately 3 billion litres[32] of diesel) of total energy consumption in 2023. The share is higher in the HGV sector, where diesel represented 92% of total fuel use in HGV (8,766 GWh which is the equivalent of approximately 848 million litres[33] of diesel). Private cars consumed the highest amount of biodiesel[34] (52%), followed by HGVs (32%). Other energy sources used in road transport include electricity, biogas, LPG, though their contribution remains relatively small.

Table 2.6: Energy Demand by Road User Type and Fuel Type (GWh), 2023					
Fuel Type	**Public Passengers**	**Private Cars**	**LGVs**	**HGVs**	**Total**
Biogas	1	344	-	**-**	**345**
Biodiesel	100	1,237	285	**759**	**2,381**
% of Total Biodiesel Use	*4%*	*52%*	*12%*	***32%***	***100%***
Diesel	1,156	14,295	3,292	**8,766**	**27,509**
Electricity	8	256	41	**3**	**308**
LPG/Butane/Other	-	19	-	**-**	**19**
Petrol/Gasoline	17	7,564	13	**-**	**7,594**
Natural Gas	-	-	-	4	**4**
Total (GWh)	**1,282**	**23,715**	**3,631**	**9,532**	**38,160**
Source: Indecon Analysis of SEAI National Energy Projections (provided upon special request)					

[32] It uses the conversion rate of 1 Litre = 37.23 MJ for diesel.
[33] It uses the conversion rate of 1 Litre = 37.23 MJ for diesel.
[34] Biodiesel blended into diesel.

We next examine detailed biodiesel data from the latest NORA Sustainability Reports, which provide disaggregated figures for HVO and FAME placed on the market, along with their respective feedstocks. In 2022, most of the HVO placed on the market was derived from UCO (81%), followed by tallow (18%), and crop-based vegetable oils (1%).[35] According to the most recent data, nearly all of the HVO placed on the market in 2023 was derived from both UCO and POME.

Table 2.7: HVO/CHVO and FAME by Feedstock (Million Litres), 2023

	HVO/CHVO	FAME/ME	Total	*% HVO Road*
UCO	45.2	138.6	**179.5**	*54%*
POME	37.8	17.9	**49.9**	*45%*
Tallow	-	73.8	**73.8**	*0%*
Food Waste	1.1	0.8	**1.9**	*1%*
Other	-	5.0	**5.0**	*0%*
Total	**84.1**	**236.1**	**310.1**	***100%***

Source: Indecon Analysis of NORA Sustainability Data, 2023

The table below shows the country of origin of the HVO placed on the Irish market in 2023. The largest share came from Indonesia, primarily derived from POME. China accounted for 20.4%, all derived from UCO, while Ireland's domestic contribution was 5.9%, also derived from UCO. This distribution is likely to change, following the EU's imposition of anti-dumping duties on biodiesel imports from China, which came into effect in 2025,[36] and Indonesia announcing export permit restrictions of feedstocks such as POME and UCO.

Table 2.8: Quantity of HVO (Million Litres) by Country of Origin, 2023

Country of Origin	**Total HVO**	***Of which POME***	***Of Which UCO***	**Share**
Indonesia	**36.1**	*34.5*	*1.7*	**42.9%**
China	**17.2**		*17.2*	**20.4%**
Great Britain	**11.4**		*10.3*	**13.5%**
Malysia	**7.0**	*3.3*	*3.7*	**8.3%**
Ireland	**5.0**		*5.0*	**5.9%**
Others	**7.5**		***7.4***	**8.9%**
Total	**84.2**	***37.8***	***45.2***	**100.0%**
% Feedstock		***44.9%***	***53.7%***	

Source: Indecon Analysis of NORA Sustainability Data

[35] Byrne Ó Cléirigh (2022), A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets.
[36] European Commission (2025), Commission Protects EU Biodiesel Industry From Dumped Chinese Imports

2.5 Use of HVO in Non-Road Sectors

In this section, we examine use of HVO and biofuels in the following non-road sectors:

- Aviation,
- Navigation,
- Home heating, and
- Data centres.

In Ireland, the use of biofuel and HVO is currently concentrated in the road transport sector, largely driven by the RTFO. Data on biofuel use including HVO in non-road sectors remains scarce. For instance, the SEAI Energy Balance data and National Energy Projections data does not outline any usage of biodiesel for the sectors listed above.

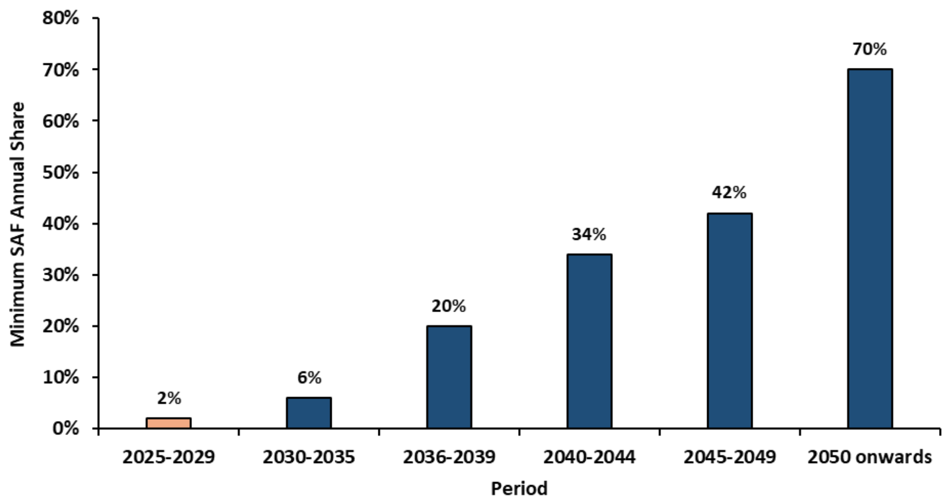
The Irish government has acknowledged the potential for advanced biofuels in these areas but has not yet implemented specific mandates or widespread usage.[37] This lack of comprehensive data highlights a significant information gap regarding the deployment of biofuels and HVO beyond the road sector. Nonetheless, emerging trends, EU mandates, and isolated initiatives suggest growing demand for biofuels in hard-to-abate sectors such as aviation and navigation, to meet EU emissions targets.

Aviation

The aviation sector in Ireland is at the early stages of adopting biofuels, particularly Sustainable Aviation Fuel (SAF). The decarbonisation of the aviation sector is primarily driven by EU policy, including the EU Emissions Trading Scheme, REDIII, and ReFuelEU Aviation. The ReFuelEU sets out a gradual increasing of minimum SAF blending requirements for fuel suppliers, with targets rising through to 2050, as outlined in Figure 2.8. From 2025, EU airports will be required to supply a minimum of 2% SAF, increasing to 6% in 2030 and reaching 70% by 2050. However, decarbonisation in the aviation sector falls within the early phase of implementation, when blending requirements are still low. Therefore, any impact on the road freight sector, particularly through competition for biofuel feedstocks, is expected to remain limited before 2030.

[37] Department of Transport (2023) Renewable Transport Fuel Policy 2023-2025.

Figure 2.8: Minimum Required Share of SAF for Aviation



Source: ReFuel EU

SAF is a broad category that includes fuels derived from UCO, animal fats, and other waste-based feedstocks. These fuels are typically produced through the Hydroprocessed Esters and Fatty Acids (HEFA) pathway, which remains the only commercially deployed method for SAF production to date.[38] Argus Media reports that HEFA-SPK is the most mature and widely used SAF technology.[39] This similarity in production pathways suggests that existing HVO production infrastructure could be adapted for HEFA, potentially accelerating SAF supply in the coming years.

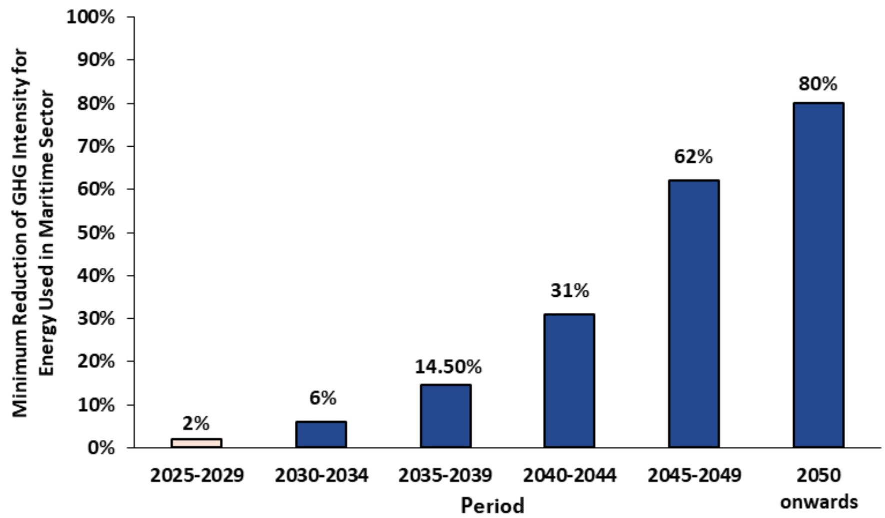
Although the terms HVO and HEFA are sometimes used interchangeably, they serve different markets with HVO primarily used in road transport and HEFA used for aviation. Nonetheless the feedstocks used for the production of both fuels are the same and therefore face competing demands from these two industries. As such, future production of HVO for road transport will likely face increasing competition from the aviation sector for the same feedstocks, especially beyond 2030. The significant increases in the required minimum share of SAF for aviation fuel suppliers is expected to drive up the prices of feedstocks used for HVO. Industry stakeholders, during the consultation process, emphasised that the aviation sector's significant purchasing power could potentially withstand such price increases, relative to the road freight sector, diverting supply of feedstocks away from road freight to the more profitable aviation sector. However, as stated earlier, this effect is expected to remain limited until 2030, with more significant impacts likely to emerge in the following decade as minimum SAF share requirements increase substantially.

[38] MVO Different types of Biofuels
[39] SkyNRG Sustainable Aviation Fuel

Maritime Navigation

The FuelEU Maritime[40] Initiative imposes limits on the maximum GHG emissions that vessels over 5,000 gross tonnes in the maritime sector can emit. Starting from 2025, the regulation sets a target of a 2% reduction in the GHG intensity of the energy used on vessels. This target increases every five years, reaching an 80% reduction by 2050 as outlined in the figure below FuelEU does not mandate the use of specific fuels; instead, any fuel type may be used provided it meets the required GHG intensity reduction targets for the relevant period. If sustainable fuels are used, they must comply with the sustainability and greenhouse gas savings criteria set out in REDIII.

Figure 2.9: Minimum Required GHG Intensity Reduction for Energy Used in Maritime



Source: ReFuel EU

A study by T&E[41] shows that biodiesel is projected to play only a minor role in meeting projected shipping fuel demand under the FuelEU Maritime baseline scenario, while demand for fossil LNG is expected to continue growing over the next decade before a rapid uptake of e-ammonia begins from 2035 onward.

Although there is no comprehensive national dataset on biofuel use in Ireland's navigation sector, there is growing evidence of adoption through specific port and company-led initiatives. In 2023, Green Biofuels opened Ireland's first biofuel terminal at Cork Harbour, initially aiming to supply 38 million litres of HVO, with plans to expand capacity to 53 million litres.[42] This marks a significant milestone in making marine-grade HVO more accessible.

Other examples of biofuel uptake in the sector include the Port of Waterford's 2024 pilot programme, where HVO was used for maintenance and dredging operations over a two-week period.[43]

[40] European Commission (2023), Regulation (EU) 2023/1805 FuelEU Maritime
[41] T&E (2023), The impact of FuelEU Maritime on European Shipping
[42] Fleetpoint (2023), Green Biofuels launches Ireland's first low-carbon fuel terminal.
[43] IMDO (2024), Port of Waterford are First Port in Ireland to use HVO for Maintenance Dredging

Additionally, in early 2025, Dublin Bay passenger cruises used HVO for one of their vessels, becoming the first Irish passenger ship operator to do so. The company has expressed interest in expanding HVO usage as part of its long-term emissions reduction strategy.[44]

Home Heating

The SEAI National Heat Study projected that by 2030, HVO and other biofuels used in heating could provide 400 GWh of renewable energy in 2023 and 1,100 GWh of heating in 2050. The availability figures are based on data from the International Energy Agency. This represents only 1% to 4% of Ireland's projected heat demand.[45]

The obligation scheme for transport means the sustainability of HVO in that sector is currently verified. There is no such scheme for sustainability certification of HVO use for heat currently. There is however a concern that some imported HVO might be sourced from unsustainable feedstocks, such as palm oil. This concern is highlighted by the Byrne Biofuels report, which points to potential fraud in the supply chain of some HVO feedstocks and quotes the European Court of Auditors as questioning the reliability of the EU's biofuel certification system.[46]

Data Centres

Data centres in Ireland primarily rely on electricity for their operations. Annual electricity consumption in GWh for data centres in Ireland, stood at 6,334 GWh in 2023 and this represented a 21% proportion from total electricity consumption for the same year. This marks a significant increase from 2015, when data centres accounted for just 5% of national electricity use.

While their primary energy use is electrical, large-scale data centres typically maintain on-site backup power systems, which may run on diesel, natural gas, or increasingly HVO. However, HVO in this context is used strictly for backup generation and not for continuous operation. No aggregate data currently exists on the volume of HVO used across the sector. For example, Amazon Web Services[47] partnered with Certa Ireland to transition all backup generators in its Irish data centres from diesel to HVO. Additionally, Vantage Data Centres is also using HVO in its Dublin data centre campus through the use of a multi-fuel generation plant powered by HVO and gas.[48]

According to the CSO, detailed electricity consumption data is available, and EirGrid has identified data centres as a major driver of future electricity demand, suggesting increasing potential usage of HVO. EirGrid's Generation Capacity Statement 2023–2032 notes that by 2032, data centres and other large new energy users could account for up to 30% of total electricity demand.[49]

2.6 Summary

This section discussed key EU and national policies that are driving the use of renewable energy in Ireland’s transport sector, with a focus on sustainable fuels. It further examined the global and

[44] Irish Continental Group (2023), Annual Report and Financial Statements
[45] SEAI (2024), HVO can be part of our clean energy transition, but not for heating homes
[46] *Ibid*
[47] Certa Ireland (2023), Amazon’s Irish Data Centers to Power Back-Up Generators with HVO Fuel
[48] Vantage Data Centres (2024), Dublin Data Centre Campus Overview
[49] EirGrid (2024) Ten-Year Generation Capacity Statement 2023-2032.

national availability of HVO and biofuels (including the availability of feedstocks) and analysed energy demand in road transport.

- The RED forms the basis of renewable energy policies in Ireland and Europe and sets the RES-T target and the list of sustainable biofuels for reaching this target. Renewable fuels are recognised as a key medium-term alternative for the decarbonisation of hard-to-abate sectors such as the road freight sector.
- The CAP24 targets of achieving sectoral share of 20% biodiesel (B20) in diesel and 10% ethanol (E10) in gasoline across all road sectors are to be achieved via the RTFO.
- Under the RTFO, fuel suppliers must ensure that 49% (by energy) of road fuel placed on the market is renewable by 2030. This is based on the indicative trajectory of rates to 2030 set out in the RTFP 2023-2025. This policy was recently updated (in July 2025) under the RTFP 2025 – 2027, which increased the RTFO rate for 2030 from 49% to 54%. The obligation rate is updated in legislation annually. Suppliers receive certificates for renewable fuels, with multiple certificates awarded for biofuels derived from Annex IX feedstocks of REDIII that are either blended with or replacing diesel or petrol. This obligation means that the ratio of biofuels-to-fossil fuels must be 49% (including the double-counting with the possibility to carry over 15% of certs from the previous obligation period).
- HVO is one of the main biofuels used as a substitute for road diesel. Europe is expected to account for 25% of global planned HVO capacity, estimated at approximately 13.8 million MT. Germany is the largest producer of biodiesel, followed by France and Spain.
- A shift towards advanced feedstocks (listed in Annex IX Part A of RED) is noted across the EU. These feedstocks make up 42% of all EU and 92% of Irish biofuel consumption.
- As of 2023, total energy consumption in road transport was 38,161 GWh. Energy consumption for HGVs was 9,532 GWh. HGVs consumed 32% of all road biodiesel.
- Diesel is the predominant fuel used in road transport in Ireland, accounting for 72% of total energy consumption in 2023. The share is higher in the HGV sector, where diesel represented 92% of total fuel use in HGV.
- According to NORA, total HVO/CHVO placed on the market in 2023 amounted to 84 million litres. HVO was primarily derived from UCO (54%) and POME (45%). The majority originated from Indonesia (43%), followed by China (20%), UK (13.5%) and Ireland (5.9%).
- Biodiesel and HVO consumption is mainly limited to road transport however there is some adoption in other sectors as summarised below:

Table 2.9: Summary of Non-Road Sector's Adoption of HVO

Aviation	SAF use in aviation sector can compete with HVO usage in road sector. However, SAF blending mandates commenced in 2025 at 2% and start increasing substantially after 2030, increasing to 70% by 2050.
Navigation	Minimal adoption of HVO visible through initiatives such as Cork Harbour HVO terminal, and adoption of HVO in Port of Waterford terminal.
Home Heating	SEAI projects HVO and biodiesel could meet up to 4% of projected domestic demand in 2050.
Data Centres	Usage of HVO is increasing, however this is only being used for back-up power systems.

Source: Indecon Analysis

3 Policy and Incentive Mechanisms

3.1 Introduction

This section assesses a range of policy instruments that could be used to increase the uptake of HVO in the HGV sector. While the overarching objective remains the electrification of the HGV fleet, sustainable fuels are recognised as important medium-term solutions for decarbonising HGVs until zero-emission vehicles become more viable. For this reason, the period of study is 2030.

The chapter begins with a review of available energy demand forecasts for the HGV sector in 2030, followed by a description of the methodological approach and key assumptions underpinning a new optimisation model developed by Indecon. The model estimates fuel use under the policy options that are identified in this section, assuming full compliance with the RTFO obligation. The section concludes with the model's findings on fuel use and their implications for the HGV and road transport sector.

3.2 Projected Demand in HGV

Estimates on future demand in the HGV sector were obtained from the SEAI National Energy Projections.[50] Projections on energy demand in the road transport sector were disaggregated into the following user types – HGVs, public passengers, private cars, and LGVs. These were presented under two scenarios, namely a WEM ("With Existing Measures") and a WAM ("With Additional Measures") scenarios:

- The WEM scenario includes policies that are already being implemented by the Government. It assumes biofuels blending levels of B12 and E10, and an increase in HGV BEVs of 1,750.
- The WAM scenario is a more ambitious scenario based on the WEM, including additional demand reduction measures and full implementation of CAP24 targets of B20 and E10. It also includes an increase in HGV BEVs of 3,500.

The table below presents forecasted growth in energy demand in the road sector for 2030. In the most ambitious SEAI WAM scenario, projected energy demand in the HGV sector is forecast to increase by 20.9%. The projected growth under the WEM scenario is very similar, estimated at 21.6%. Under the WAM scenario, a reduction in the forecast energy demand in road transport is mostly attributed to the demand reduction measures.

Table 3.1: Forecast Growth in Energy Demand by Road User Type

Road User Types	2023 (GWh)	*Forecast Growth WEM - 2030*	*Forecast Growth WAM - 2030*
HGVs	**9,532**	***21.6%***	***20.9%***
Public Passengers	1,283	*-0.7%*	*-0.7%*
Private Cars	23,716	*-7.7%*	*-31.2%*
LGVs	3,631	*18.2%*	*5.3%*
Total	**38,161**	***2.3%***	***-13.7%***

Source: SEAI National Energy Projections (provided upon special request)
Note: figures presented in this table were originally expressed in Ktoe units. These were converted into GWh using the conversion rate 1 Ktoe = 11.63 GWh.

[50] https://www.seai.ie/sites/default/files/publications/National-Energy-Projections-Report-2024.pdf

Because the SEAI projections provide only aggregate figures for biodiesel consumption, additional analysis was conducted to refine the energy demand projections for the road transport sector. Specifically, detailed data were sourced from the most recent NORA Sustainability Reports (presented in Chapter 2), which include disaggregated biodiesel data by fuel sub-type, such as FAME and HVO, as well as information on the feedstocks from which these fuels are derived.

To leverage this granularity, NORA data were integrated with SEAI projections. It is important to note that NORA reports the volume of HVO and FAME placed on the market or made available for sale/distribution in Ireland. In this analysis, we assume that biodiesel supplied is equivalent to biodiesel consumed, on the basis that fuel suppliers typically place on the market what they expect to sell. Due to the lack of disaggregated data on biodiesel use in road transport, NORA figures are used as a close approximation of national consumption.

Firstly, the total biodiesel placed on the market reported by NORA was proportionally distributed across SEAI's road transport user categories, based on their relative shares of energy demand. These baseline estimates were then projected forward to 2030 by applying the growth rates for biodiesel use under SEAI's WEM and WAM scenarios:

- In 2023, the HGV sector accounted for 32% of biodiesel use in road transport, equivalent to 1,056 GWh.
- Under the WAM scenario, this is projected to increase by 102%, reaching 2,130 GWh by 2030.

Table 3.2: Forecast Growth in Biodiesel Demand

Road User Types	Share of Biodiesel Use (2023)	Biodiesel (GWh) (2023)	*Biodiesel Forecast Growth WEM - 2030*	*Biodiesel Forecast Growth WAM - 2030*	Biodiesel (GWh) WEM - 2030	Biodiesel (GWh) WAM - 2030
Public Passengers	4%	139	*31%*	*83%*	183	255
Private Cars	52%	1,721	*1%*	*17%*	1739	2,010
Light Goods and Passengers	12%	396	*45%*	*78%*	576	704
HGV	**32%**	**1,056**	***51%***	***102%***	**1,590**	**2,130**
Total	**100%**	**3,313**	-	**-**	**4,088**	**5,100**

Source: SEAI National Energy Projections (provided upon special request); NORA Sustainability Data
Note: biodiesel figures obtained from NORA presented in this table were expressed in litres. These were converted into GWh using the HVO conversion rate 1Litre = 37.23 MJ, and 1MJ = 2.78E-07GWh.

Having complemented the SEAI forecasts with detailed biodiesel data from NORA, the table below shows the projected share of demand for each user type in the road transport sector. Under the WAM scenario, 34% of total energy demand for 2030 is attributed to the HGV sector; this share increases to 37% when considering only non-electric energy demand. Private cars are projected to retain the highest share of total energy consumption within road transport.

Table 3.3: Share of Demand by User Type - Adjusted				
Road User Types	**WEM - 2030**		**WAM - 2030**	
	Incl. Electric	**Excl. Electric**	**Incl. Electric**	**Excl. Electric**
Public Passengers	3%	3%	4%	4%
Private Cars	56%	54%	50%	48%
Light Goods and Passengers	11%	11%	12%	11%
Heavy Goods	30%	31%	34%	37%
Total (GWh)	**40,048**	**38,017**	**33,619**	**31,268**
Source: SEAI Energy Forecasts; NORA Sustainability Data				

The HGV fleet in Ireland is currently dominated by internal combustion engine (ICE) vehicles powered primarily by diesel, with only a negligible share of battery-electric vehicles (BEVs). SEAI projections indicate that electric HGVs will represent less than 0.4% of energy demand in the sector by 2030 under the most ambitious scenario, with expected fleet penetration reaching 1,750 (under the WEM) and 3,500 BEVs (under the WAM scenario). If the sector were to fully transition to HVO100 to meet its projected non-electric energy demand in 2030, it would require between 1.1 and 1.2 billion litres of HVO.

Table 3.4: Projected Energy Demand in HGV - Adjusted			
	Current	**WEM - 2030**	**WAM - 2030**
Total Energy Demand	9,821 GWh	11,924 GWh	11,554 GWh
Of which Electric	*3 Gwh*	*28 GWh*	*46 GWh*
Litres of HVO required		1,149m Litres	1,113m Litres
Source: Indecon analysis			

3.3 Data and Modelling Assumptions

In order to further study and model the implications of HVO standards or uptake requirements within the contexts of the RTFO and CAP, Indecon developed an optimisation model. This was done via a modelling framework with a linear and nonlinear optimisation engine, where the user can develop an objective function (such as minimise cost, maximise profits, etc), subject to constraints, e.g., total fuel demand, the RTFO, etc.

Fundamental to this process and the need to model using optimisation tools was the RTFO. The RTFO requires that the road sectors satisfy a constraint that is the ratio of biofuels to fossil fuels within the sector. As per the RTFP 2023 – 2025, this ratio should be equal to 0.49 in 2030. While this rate was recently increased to 0.54 under the new RTFP 2025 – 2027 (approved in July 2025), all modelling in this study is based on the RTFP 2023 – 2025. Given the non-substitutability of diesel-type fuels (biodiesel and fossil), and gasoline-petrol-type (bioethanol, petrol, etc.), the RTFO implies certain constraints on % biodiesel and % bio-petrol (e.g., ethanol).

Finally, a feature of the RTFO is that it is designed to allow differential rates of certificate counting, that is to say, different fuels can be given different "rates" of credits towards meeting the RTFO, thus making it "easier" to satisfy the RTFO with certain types of fuel; for example, HVO is given 2.5x certificates, in other words a unit of HVO is given 2.5x the units towards meeting the minimum requirements of the RTFO (49% (by energy) renewable transport fuels in 2030).

The optimisation model developed by Indecon is based on several key assumptions related to:

- Energy Demand:
  - The total projected energy fuel demand for each fuel type and for each major class of users.
- Fuel Prices:
- The fuel prices per unit of energy for the major fuel types:
  - HVO;
  - HVO from differential feedstock;
  - FAME;
  - Ethanol;
  - Petrol; and
  - Diesel.
- RTFO Obligation:
  - The ratio total biofuels-to-fossil fuels >= 0.49; and
  - The counting ratio for the certs by fuel type.
- Technical Constraints:
  - 7% max FAME in diesel; and
  - 10% max ethanol in petrol.

The model is then a cost minimisation problem: minimise the total cost of meeting each of the sub-sectoral demand subject to the RTFO, the technical constraints, and fuel prices. The remainder of this section provides a more detailed examination of each of these assumptions underlying the optimisation model. The fuel mix was determined as an endogenous outcome to the cost minimisation.

Energy Demand

The optimisation model uses energy demand projections from the SEAI WAM scenario, disaggregated by user type - HGVs, private cars, public passengers, and LGVs, and by fuel type. These projections serve as the initial inputs to the model, which then determines the optimal allocation of fuels across the road transport sector. The solution is subject to various constraints, including full compliance with the RTFO obligation.

Fuel Prices

The cost of fuel inputted in the model is estimated using European prices, under the assumption that Ireland is a price taker, and that Irish fuel prices are equal to European fuel prices. The model does not differentiate between sourcing fuel domestically or internationally, as it assumes that suppliers will minimise costs by selecting the most cost competitive option available, subject to technical constraints (i.e., a 7% blending limit for FAME). Additionally, the model does not distinguish between retail (forecourts) and wholesale prices, as relative price margins between HVO and diesel in retail and wholesale were tested and had no impact on model outcomes. The table below presents fuel price data used in the model. All prices are shown before tax, except for electricity, which includes the PSO levy and household rebate rates (as per the Government Electricity Costs Emergency Benefit Scheme).

The model was built to allow alternative feedstocks. This was implemented by allowing differential prices for the feedstock versus the alternative (e.g., HVO feedstock low land use impact), and then allowing constraints on the lower priced feedstock (e.g., HVO high land use impact/low price cannot be more than 10% of mix).

Table 3.5: Data on Fuel Prices

Fuel	Value	Source
FAME B100	0.95 €/Litre	Vesper (as of 12/2/25)
HVO UCO	1.53 €/Litre	Vesper (as of 12/2/25)
HVO Vegetable	1.38 €/Litre	Vesper (as of 12/2/25)
Diesel	0.70 €/Litre	EC Weekly Oil Bulletin (as of 17/10/24)
Petrol	0.74 €/Litre	EC Weekly Oil Bulletin (as of 1/1/2024)
Ethanol	0.79 €/Litre	Argus EU (average, 2023)
LPG	0.50 €/Litre	EC weekly oil bulletin (EU Average, Jan – March 2025)
Electric	0.188 €/kWh	SEAI (average, 2024)

Source: Vesper, EC, Argus, SEAI

To estimate fuel prices after tax, we use mineral oil tax (MOT) rates on liquid-substituted fuels presented in the table below.[51] The MOT is the sum of a non-carbon (MOTNC) and carbon (MOTCC) tax. All liquid biofuels used for motor or heating purposes, along with biogas used for propellant purposes, are relieved from the MOT carbon component. This means that the effective MOT rate on such biofuels/biogas is the same as the MOT non-carbon component rate. In addition, estimates for fuel prices after tax include the NORA levy (only relevant for fossil fuel) and the biofuel levy.[52]

[51] https://www.revenue.ie/en/companies-and-charities/excise-and-licences/mineral-oil-tax/liquid-substitute-fuels/index.aspx
[52] See Chapter 5 for prices after tax.

Table 3.6: Mineral Oil Tax and Levies (€/1,000 Litres)					
Fuel	**Non-Carbon (MOTNC)**	**Carbon (MOTCC)**	**Total MOT**	**NORA Levy**	**Biofuel Levy**
Auto-diesel	425.72	169.96	**595.68**	20	0
Biofuel substituted for auto-diesel	425.72	0	**425.72**	0	1
Petrol	541.84	146.94	**688.78**	20	0
Biofuel substituted for auto-petrol	541.84	0	**541.84**	0	1
LPG (for propellant use)	63.59	91.42	**155.01**	20	0

Source: Revenue; NORA
Note: Rates included in this table refer to MOT rates effective from 9 October 2024 to 30 April 2025.

RTFO Obligation

The RTFO obligation is an obligation placed on fuel suppliers. Every year, suppliers must ensure that a percentage of the road fuel they place on the market is renewable. The modelling framework uses the 2030 target set at 49% under the RTFP 2023-2025. This obligation means that the ratio of biofuels-to-fossil fuels must be 49%.

When a supplier places renewable fuel on the market, they receive certificates that are redeemed against the obligation. Two or more certificates are awarded for all biofuels that are either blended with diesel or sold as a replacement for diesel (and likewise for petrol), provided that they are produced from feedstocks listed in Annex IX of RED. Currently, HVO derived from Annex IX feedstocks receive 2.5 certificates; while those derived from any other feedstock not listed in Annex IX receive 1.25 certificates. From 1st July 2025, HVO derived from POME will not be eligible for the additional 0.5 certs, but will receive 2 certificates. The objective is to incentivise waste-based or biofuels from more renewable feedstocks across the EU (included in Annex IX of RED) by allowing double counting in meeting the obligation.

Specific assumptions used in the model are listed below:

- Biofuel use is subject to the **2030** RTFO obligation and must not fall below **49%** of all road fossil fuels demand (diesel and gasoline), after double counting.
- Full compliance with the RTFO obligation is always assumed: no supplier buys out of the obligation.
- Biofuels placed on the market are derived from Annex IX feedstocks of RED and, under a do-nothing scenario (baseline), they are all eligible for double counting (2.5x certificates for each unit of biofuel that is placed on the market).

Technical Constraints

Based on our research and consultation with NORA, our understanding was that technical constraints limit certain fuel types in the mix; for FAME, 0-7% was used, while for ethanol, the range of 5-10% was used; in other words, the model's constraints required the fuel mix for any user type to respect these constraints. The table below provides a summary of the assumptions underlying Indecon's optimisation model.

Table 3.7: Modelling Assumptions		
Type	**Description**	**Model Assumption**
Fuel Prices	**Fuel Prices**	All fuel prices are European. Biofuels: HVO, FAME, Ethanol Fossil Fuels: Diesel, Petrol, LPG
RTFO Obligation	**RTFO and multi-counting**	Ratio of biofuels / road fossil fuels = 49% in 2030 (under RTFP 2023-2025). Biofuels are double counted in the ratio using a multiplier of 2.5x.
RED	**Advanced Biofuel Target**	1.5% advanced biofuels target for RES-T. Must be derived from the feedstocks listed in Annex IX Part A of RED II.
Technical Constraints	**FAME, Ethanol**	7% technical constraint on FAME Ethanol blend within diesel is constrained between 5.5% to 10% (E5.5 – E10).
Source: Indecon Analysis		

3.4 Policy Options

In this section we assess policy tools that could be used as mechanisms to increase HVO penetration in the HGV sector. While the main objective remains the full electrification of the HGV fleet, these options may be considered as interim incentives needed to assist in the decarbonisation of the sector. Our optimisation model is used to assess any implications these policy tools may have within the HGV and wider road sector. The model ensures that these policy tools fully meet the RTFO obligation.

We have modelled three main types of policy tools, namely: a minimum standard blend % for HVO, changes in the RTFO counting rate, and subsidy; and under each policy tool we model a set of scenarios.

Baseline – No Policy Change Scenario

The baseline scenario is a “do-nothing” scenario, with no changes in policy or incentives modelled. It assumes full compliance with the RTFO obligation for 2030, and all biofuels are double counted (they receive 2.5x certificates) in meeting the 49% RTFO obligation.

The table overleaf shows the findings from the optimisation model. It presents the estimated fuel use in road transport required to meet the projected non-electric energy demand for 2030. Fuel use is the result of an optimal allocation, where suppliers minimise total costs of meeting sub-sectoral non-electric demand while also ensuring compliance with the RTFO obligation and other technical constraints. Importantly, no specific assumptions about blending fuels are made; instead, fuel use is expressed as a percentage of the overall road transport fuel mix.

In the baseline, HVO is projected to account for 15% of non-electric energy demand in the HGV sector. The share of biofuel use within the wider road sector is estimated at 17%. Conceptually, the latter figure represents the CAP24 target of B20 for biofuels. The Indecon optimisation model projects a slightly lower use of biofuel, corresponding to what would be achieved under the 2030 RTFO obligation.

Table 3.8: Baseline – No Policy Change Scenario

Scenario	N. of RTFO Certs	% of Total Non-Electric Energy Demand		
		% HVO use in HGV	% HVO use in Road	% Biofuel use in Road
Baseline	2.5x	15%	7%	17%

Source: Indecon analysis
Note: % of HVO use is the percentage of projected demand met by HVO. % biofuel use is the percentage of projected demand met by biofuel (including HVO, FAME, Bioethanol).

The table below presents estimated fuel use across user types under the baseline scenario. It also highlights the sectoral breakdown, with private cars and HGVs representing the largest users based on their relative shares of demand. The estimates reflect demand for non-electric only. Under the 2030 RTFO obligation and no policy change, biofuel demand in the road sector is estimated to be primarily driven by HGVs and private cars. While public passengers also represent a high share of biofuel use, their overall sectoral contribution remains relatively small at just 4%.

Table 3.9: Estimated Fuel Use by Road User Type – Baseline

Fuel	HGV	LGV	Private Cars	Public Passengers	Road
Biofuel	**22%**	**7%**	**13%**	**44%**	**17%**
Of which HVO	***15%***	*7%*	*0%*	*36%*	*7%*
Fossil	78%	93%	87%	56%	83%
Sectoral Share	**37%**	**11%**	**48%**	**4%**	**100%**

Source: Indecon analysis
Note: the figures represent the percentage of non-electric energy demand met by each fuel. Biofuel includes HVO, FAME, and ethanol. Fossil includes diesel, gasoline, and LPG. The sectoral share shows how much of the total non-electric road transport demand is attributed to each road user type; it is estimated under the WAM scenario.

1. Introduce a blend mandate in the HGV sector

The first option that we examine is the introduction of a blend mandate to increase the use of HVO in the HGV sector. This mandate would legislate a minimum required use of HVO to meet a proportion of the non-electric energy demand projected for the HGV sector. Two scenarios are modelled:

- A mandated minimum requirement of 30% HVO; and
- a mandated minimum requirement of 60% HVO.

The RTFO obligation and model constraints remain unchanged. The road sector is still required to meet the obligation of 49% biofuels placed on the market by 2030. Biofuels continue to be double counted under the RTFO, and suppliers receive 2.5 times the number of certificates for each unit of biofuel from Annex IX feedstocks that is supplied.

The table below illustrates the impact of introducing a mandatory increase in HVO use in the HGV sector. If HVO use was mandated to reach 30% (or 60%) of the total fuel mix in the HGV sector, the share of renewables in the road sector would increase to 17% (or 25%). This does not represent a significant increase compared to the estimated biofuel use under the baseline scenario (17%). This is because a mandatory increase in HVO in HGV is sufficient to meet the RTFO obligation. Once the obligation is met, suppliers choose cheaper options in order to minimise the total cost of meeting their sub-sectoral demand. The result is that biofuel use is redirected to the HGV sector, while other sectors use less.

Table 3.10: Option 1 – Introduce HVO Mandate for HGV

Scenario	Counting rate RTFO Certs	% of Non-Electric Energy Demand		
		% HVO use in HGV	% HVO use in Road	% Biofuel use in Road
Baseline	2.5x	15%	7%	17%
HVO Mandate	2.5x	**30%**	13%	17%
	2.5x	**60%**	24%	25%

Source: Indecon analysis
Note: the figures represent the percentage of non-electric energy demand met by each fuel. Biofuel includes HVO, FAME, and ethanol.

A 60% HVO mandate in the HGV sector results in a 25% biofuel share across the road sector. While this is an increase from the baseline, it is largely driven by the concentrated uptake of HVO within the HGV sector, rather than a broader distribution across all users, as presented in the table below.

Table 3.11: Estimated Fuel Use by Road User Type – Option 1

Fuel	Mandated 30% HVO in HGV					Mandated 60% HVO in HGV				
	HGV	LGV	Private Cars	Public Passengers	Road	HGV	LGV	Private Cars	Public Passengers	Road
Biofuel	**36%**	**0%**	**2%**	**44%**	**17%**	**60%**	**0%**	**2%**	**37%**	**25%**
Of which HVO	***30%***	*0%*	*0%*	*36%*	*13%*	***60%***	*0%*	*0%*	*36%*	*24%*
Fossil	64%	100%	98%	56%	83%	40%	100%	98%	63%	75%
Sectoral Share	**37%**	**11%**	**48%**	**4%**	**100%**	**37%**	**11%**	**48%**	**4%**	**100%**

Source: Indecon analysis
Note: the figures represent the percentage of non-electric energy demand met by each fuel. Biofuel includes HVO, FAME, and ethanol. Fossil includes diesel, gasoline, and LPG. The sectoral share shows how much of the total non-electric road transport demand is attributed to each road user type; it is estimated under the WAM scenario.

2. **Adjust RTFO multi-counting rate**

The second option considers adjusting the number of extra certificates suppliers receive via the RTFO for each unit of biofuel that is blended and used in the road sector. These certificates count as multipliers that are applied to actual volumes placed on the market. The number of certificates awarded determines the extent of multi-counting, which is used to measure compliance with the RTFO obligation and serves as a mechanism to incentivise suppliers to increase the blending of renewables. Currently, each supplier receives 2.5 certificates for every unit of biofuel placed on the market when it is derived from feedstocks listed in Annex IX of RED (see Section 2.2). Three scenarios are modelled under Option 2:

- An increase in the multi-counting rate from 2.5 to 3.5 certificates per unit of biofuel placed on the market, but only for the HGV sector.
- A decrease in the multi-counting rate from 2.5 to 2 certificates per unit of biofuel across all sectors.
- A further decrease in the multi-counting rate from 2.5 to 1.25 certificates per unit of biofuel across all sectors.

While it may not be possible to implement some of the scenarios included under Policy Option 2, they are presented here to explore the potential direction of a policy change in the multi-counting rate. For instance, it could not be possible to adjust the number of RTFO certs specifically for the HGV sector only, as the RTFO obligation applies to the entire road transport sector. Additionally, the double counting of Annex IX biofuels is established in EU legislation, making it legally challenging to reduce the multi-counting rate below 2 certs.

The table below presents the impact of adjusting the RTFO multi-counting rate on the road sector. Increasing the multi-counting rate only for the HGV sector results in a reduction in the use of HVO in HGVs. This is because the RTFO obligation becomes less stringent when suppliers receive extra certificates, as it allows them to meet the obligation more easily by blending less renewable fuel. Conversely, decreasing the multi-counting rate for the overall road sector, as explored in the second and third scenario, has the opposite effect. With fewer certificates awarded per unit, the RTFO obligation becomes more stringent, requiring suppliers to blend more biofuel to remain compliant (unless they opt to buy out of the obligation by paying a buy-out charge, if blending biofuel results too expensive). As a result, both HVO use in the HGV sector and overall biofuel use in the road sector increase.

For instance, reducing the multi-counting rate to 1.25 leads to HVO accounting for 40% of non-electric demand for HGVs and 26% biofuel use in the overall sector. By comparison, reducing the rate from 2.5 to 2 certificates increases biofuel use in the road sector to 20%, up from 17% in the baseline scenario. However, as noted previously, while this option serves as an incentive to increase biofuel use in road transport, the double counting of Annex IX biofuels is established in EU legislation and it would be legally difficult to reduce the multi-counting rates below 2.

Table 3.12: Option 2 – Adjust RTFO multi-counting rate				
Scenario	**Counting rate RTFO Certs**	**% of Non-Electric Energy Demand**		
		% HVO use in HGV	**% HVO use in Road**	**% Biofuel use in Road**
Baseline	2.5x	15%	7%	17%
Adjust RTFO multi-counting rate	3.5x (for HGV)	11%	6%	16%
	2x	19%	10%	20%
	1.25x	40%	16%	26%

Source: Indecon analysis
Note: the figures represent the percentage of non-electric energy demand met by each fuel. Biofuel includes HVO, FAME, and ethanol.

The table below breaks down estimated fuel use by road user type. Fuel use in non-HGV road sectors remains largely consistent with the estimates under the no policy-change scenario. This allows the RTFO obligation to be met by other user types, even when biofuel use in the HGV sector declines after an increase in the number of certificates. On the other hand, when the multi-counting rate is reduced to 1.25 certificates, biofuel use in the HGV sector increases significantly relative to the baseline. As a result, total biofuel use across the road sector exceeds the level estimated under the baseline RTFO obligation scenario.

Table 3.13: Estimated Fuel Use by Road User Type – Option 2															
Fuel	**Increase RTFO certs to 3.5x (for HGV)**					**Decrease RTFO certs to 2x**					**Decrease RTFO certs to 1.25x**				
	HGV	**LGV**	**Private Cars**	**Public Passengers**	**Road**	**HGV**	**LGV**	**Private Cars**	**Public Passengers**	**Road**	**HGV**	**LGV**	**Private Cars**	**Public Passengers**	**Road**
Biofuel	**18%**	**7%**	**13%**	**44%**	**16%**	**26%**	**7%**	**13%**	**69%**	**20%**	**47%**	**7%**	**16%**	**8%**	**26%**
Of which HVO	*11%*	*0%*	*0%*	*36%*	*6%*	*19%*	*0%*	*0%*	*61%*	*10%*	***40%***	*0%*	*3%*	*0%*	*16%*
Fossil	82%	93%	87%	56%	84%	74%	93%	87%	31%	70%	53%	93%	84%	92%	74%
Sectoral Share	**37%**	**11%**	**48%**	**4%**	**100%**	**37%**	**11%**	**48%**	**4%**	**100%**	**37%**	**11%**	**48%**	**4%**	**100%**

Source: Indecon analysis
Note: the figures represent the percentage of non-electric energy demand met by each fuel. Biofuel includes HVO, FAME, and ethanol. Fossil includes diesel, gasoline, and LPG. The sectoral share shows how much of the total non-electric road transport demand is attributed to each road user type; it is estimated under the WAM scenario.

4. Subsidise HVO

Lastly, Option 3 examines the impact on the road sector if all non-electric demand from HGVs was met entirely by HVO. It assumes a full transition to HVO in the HGV sector, supported by a subsidy that would make HVO cost-competitive with conventional fuel such as diesel. Chapter 4 will assess the cost of subsidising HVO, including the fiscal impact on the Exchequer. Before that, we examine the broader impact on the road sector resulting from a full switch to HVO in HGVs and compliance with the RTFO obligation. A full transition to HVO in the HGV sector would result in biofuels accounting for 40% of total fuel use across the road sector.

Table 3.14: Option 3 – Subsidise HVO

Scenario	Counting rate RTFO Certs	% of Non-Electric Energy Demand		
		% HVO use in HGV	% HVO use in Road	% Biofuel use in Road
Baseline	2.5x	15%	7%	17%
Subsidise HVO	2.5x	**100%**	38%	40%

Source: Indecon analysis
Note: % of HVO use is the percentage of total projected demand met by HVO. % biofuel use is the percentage of total projected demand met by biofuel (including HVO, FAME, Bioethanol).

However, the model estimates that the entire increase in biofuel use would be driven by the HGV sector, whose relative share of demand is estimated at 37%. This outcome is very similar to the model findings under Option 1.

Table 3.15: Estimated Fuel Use by Road User Type – Option 3

Fuel	HGV	LGV	Private Cars	Public Passengers	Road
Biofuel	**100%**	**0%**	**2%**	**38%**	**40%**
Of which HVO	*100%*	*0%*	*0%*	*36%*	**38%**
Fossil	0%	100%	98%	62%	**60%**
Sectoral Share	**37%**	**11%**	**48%**	**4%**	**100%**

Source: Indecon analysis
Note: the figures represent the percentage of non-electric energy demand met by each fuel. Biofuel includes HVO, FAME, and ethanol. The sectoral share shows how much of the total non-electric road transport demand is attributed to each road user type; it is estimated under the WAM scenario.

3.5 Summary

This section assessed three categories of policy tools aimed at increasing HVO uptake in the HGV sector, recognising the sector's limited electrification expected by 2030 and the urgency of identifying viable low-carbon alternatives. Using an optimisation model, fuel use was projected under different policy scenarios, while ensuring compliance with the 2030 RTFO obligation. The analysis finds that, under a no-policy-change baseline, HVO is projected to meet 15% of non-electric HGV energy demand, with overall biofuel use in road transport reaching 17%. Three policy options were explored to increase HVO uptake:

- **Introducing HVO mandates (Option 1):** a 30% or 60% HVO mandate in the HGV sector would raise HVO penetration in HGVs but deliver limited additional biofuel use across non-HGV road sectors. This is because a mandatory increase in HVO in HGVs is sufficient to meet the RTFO obligation. Once the obligation is met, suppliers choose cheaper options to minimise the total cost of meeting their sub-sectoral demand. The result is that biofuel use is redirected to the HGV sector, while other sectors use less.
- **Adjusting RTFO Multi-counting (Option 2):** Increasing the number of certificates awarded for every unit of biofuel placed on the market weakens the obligation and reduces blending of biofuels. On the other hand, reducing multi-counting rates makes the RTFO more stringent, resulting in higher HVO and overall biofuel blending to remain compliant with the RTFO. Although there is always a possibility that fuel suppliers would opt to buy out of the obligation by paying a buy-out charge, if blending biofuels results too expensive.
- **HVO Subsidy (Option 3):** Subsidising HVO to support a full transition to HVO100 in the HGV fleet would generate the largest impact, increasing HVO use in the sector to 100% and raising total biofuel use in road transport to 40%. However, this scenario requires public financial support and is expected to have a significant cost to the Exchequer unless the price premium of HVO-to-diesel substantially decreases (see Chapter 4).

Table 3.16: Summary of Policy Options

Options	Incentive Type	Scenario	N. of RTFO certs	% HVO in HGV	% of Biofuel in Road
Baseline	No Policy Change	Baseline	2.5X	15%	17%
Option 1	HVO Mandate	Mandated 30% HVO	2.5X	30%	17%
		Mandated 60% HVO	2.5X	60%	25%
Option 2	Adjust RTFO multi-counting rate	Increase RTFO certs to 3.5x in HGV	3.5x (HGV)	11%	16%
		Decrease RTFO certs to 2x	2x	19%	20%
		Decrease RTFO certs to 1.25x	1.25	40%	26%
Option 3	Subsidise HVO	HVO subsidy	2.5x	100%	40%

Source: Indecon analysis

4 Cost to Industry and Exchequer

4.1 Introduction

In this section, we examine the expected cost for the HGV sector of each the policy options identified in Chapter 3, along with the associated fiscal impact on the Exchequer. The analysis begins with a review of trends in the price of HVO, followed by an outline of the methodological approach and key assumptions underpinning the cost analysis and findings of the analysis. The section concludes with a set of sensitivity scenarios, which explore how changes in the price of HVO could affect costs to the HGV sector.

4.2 Price Evolution of HVO

There is significant uncertainty around fuel costs facing the HGV sector, particularly in relation to HVO. HVO prices in Europe have exhibited significant volatility as highlighted in recent market trends outlined below. In November 2024, Class II HVO prices (derived from waste-based feedstocks such as UCO and POME), peaked at $2,653 per tonne, before falling below $2,000 per tonne by the end of the year. This market volatility was attributed to supply imbalances. Before the rise, the average price for Class II HVO was approximately $1,625 per tonne, down by around $580 per tonne compared to the same period in 2023. This drop was mostly influenced by regulatory changes in EU Member States (Sweden and Germany).[53]

The figure below illustrates historical price of HVO and FAME between 2023 and 2025. During this period, HVO West EU import prices have consistently exceeded those of FAME and China-sourced UCO. Prices for HVO derived from various feedstocks, such as UCO and tallow, also tend to be highly correlated, and highly sensitive to underlying trends in feedstock markets.

Figure 4.1: Price of HVO, 2023- 2025

Source: Vesper

[53] https://www.argusmedia.com/en/news-and-insights/latest-market-news/2641460-viewpoint-european-hvo-demand-to-rise-in-2025

The price of HVO is also at a premium over diesel that is unlikely to narrow significantly in the short term, as available supply remains insufficient to replace diesel at large scale.[54]

Feedstock markets have also experienced high volatility. In 2025, UCO prices in northwest Europe reached a two-year high of $1,250 per tonne, driven by seasonal constraints on supply. Europe may see increased UCO imports from China, as weakening U.S. demand, due to regulatory uncertainty and higher tariffs, redirects supply. However, logistical issues like high freight rates from Red Sea disruptions and the need to re-process Chinese UCO to meet European standards may limit volumes. Additionally, China's removal of export incentives has tightened global availability.[55] Despite these factors, an oversupply of UCO in the EU emerged in May 2025, largely due to increased imports following higher US tariffs.[56] Indonesia also recently announced export permit restrictions for UCO and POME at the beginning of 2025. This has further tightened global supply of waste oils like POME, pushing the prices of POME.[57]

Listed below is a summary of the main factors that are expected to influence demand and supply dynamics, and affect the price of HVO:

- **Regulation:** until 2030, the adoption of HVO will largely be driven by existing regulatory measures, particularly the revised REDIII, which targets a 29% share of renewables in transport energy use by 2030. The directive also mandates the phase-out of high ILUC-risk crop-based biofuels, such as palm oil, by 2030, prompting a shift towards HVO produced from waste-based feedstocks like UCO and POME. These waste-based biofuels are further incentivised through double-counting toward EU targets.
- **Feedstock availability**: Projected demand for advanced and waste biofuels (including feedstocks listed in Annex IX Part A and Part B) required to comply with existing EU mandates for biofuels are expected to exceed EU feedstock availability due to limited supply.[58] Supply constraints may place upward pressures on the prices of waste feedstocks, which in turn can affect the price of HVO.
- **Trade barriers**: In February 2025, the EU imposed anti-dumping duties on biodiesel and HVO imported from China, in addition to the existing anti-dumping and anti-subsidy duties for HVO and biodiesel of US and Canadian origin. Indonesia also introduced export permit restrictions for UCO and POME further constraining availability for waste feedstocks from main exporters.
- **Demand from other sectors**: Strong growth in demand for biofuels in hard-to-abate sectors such as aviation (i.e., SAF) and shipping may limit availability for the road sector and drive up HVO prices. However, decarbonisation in the aviation sector falls within the early phase of implementation, when blending requirements are still low. Therefore, any impact on the road freight sector, particularly through competition for biofuel feedstocks, is expected to remain limited before 2030.

[54] https://www.argusmedia.com/en/news-and-insights/market-opinion-and-analysis-blog/hvo-in-germany-beyond-the-hype

[55] https://www.argusmedia.com/en/news-and-insights/latest-market-news/2671363-waste-based-biofuel-feedstock-prices-at-multi-year-high

[56] https://vespertool.com/news/biodiesel-market-watch-week-20-uco-prices-under-pressure-on-higher-supply-to-eu/

[57] https://www.argusmedia.com/en/news-and-insights/latest-market-news/2671363-waste-based-biofuel-feedstock-prices-at-multi-year-high

[58] https://www.transportenvironment.org/uploads/files/202407_TE_advanced_biofuels_report-1.pdf

4.3 Methodological Approach

A brief outline of price data used to estimate the expected cost to the HGV sector and other underlying assumptions follows.

Fuel Price Data

The projected prices for auto-diesel are based on future MOT carbon tax rates, introduced by Finance Act 2020, and set out in Schedule 2A of Finance Act 1999 (as amended)[59]. Each October up to and including 2028, the carbon tax rates on auto-diesel will increase by €20.07 or €20.08 per 1,000 litres, with a final increase of €17.40 per 1,000 litres legislated to come into effect on 10 October 2029. Under the remainder of the carbon tax trajectory as provided for in legislation, the current MOT carbon component rate, €169.96 per 1,000 litres effective from 9 October 2024, is set to increase to €267.66 per 1,000 litres. Expressed in gigawatt hours (GWh), this equates to a current rate of €16,434 per GWh increasing to €25,915 per GWh. In contrast, biofuels such as HVO are exempt from the carbon tax and annual increases in the carbon tax.

Forecasting commodity prices is difficult, particularly given the high volatility of HVO spot prices observed on platforms such as Vesper. HVO prices can fluctuate significantly due to daily spot market volatility, supply-demand imbalances, and seasonal constraints, which can cause pump prices to be higher or lower from spot market prices. For this reason, in this analysis prices in 2030 are only driven by future MOT rates as set out in Finance Act 1999 (as amended) [60]. It is further assumed that the current tax treatment of biofuels will remain unchanged by 2030. We then adopt a sensitivity analysis approach and develop scenarios that assess the impact of potential increases or decreases in the price of HVO (see sub-section 4.5).

The present analysis also relies on the assumption that HVO will continue to be produced from three feedstocks – UCO, POME, and a small proportion from other feedstocks (we assume this is tallow). According to the NORA, most of the HVO placed on the market in Ireland in 2023 was derived mostly from UCO (54%) and POME (45%) (see Section 2.4). We assume that the HVO consumed in the HGV sector by 2030 will be derived from the same feedstock distribution, although it is very likely that future distribution will change due to various factors discussed in Section 4.2, including the introduction of trade barriers on HVO imports.

Cost estimates are calculated using feedstock-specific HVO prices obtained from Vesper. However, price data on HVO derived from POME was limited, for this reason we used price data on HVO vegetable instead. This is based on the assumption that HVO from POME may become the cheapest HVO option due to increased regulatory scrutiny in the EU (discussed in Section 5.3). The table below presents fuel prices after tax used in the analysis, excluding VAT. VAT was excluded as businesses providing taxable services may reclaim VAT on certain business expenses. The Diesel Rebate Scheme was also excluded, as the cost to industry is estimated based on the fuel placed on the market to meet demand from HGVs after suppliers have optimised and minimised costs while complying with the RTFO obligation. In addition, only a proportion of truck operators choose to participate in the Diesel Rebate Scheme.

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[59] https://www.revenue.ie/en/companies-and-charities/documents/excise/legislation/mot-primary-law.pdf

[60] Future national carbon tax policies may be impacted by the extension of the EU Emissions Trading System to buildings, road transport and additional sectors as provided for in the EU ETS Directive 2003/87/EC.

Table 4.1: Fuel Prices After Tax (€/GWh) - 2030							
Fuel	**Price**	**Non-Carbon (MOTNC)**	**Carbon (MOTCC)**	**MOT**	**NORA Levy**	**Biofuel Levy**	**Price After Tax**
FAME	104,031	41,166	0	41,166	0	97	**145,293**
HVO UCO	147,826	41,166	0	41,166	0	97	**189,088**
HVO Tallow	140,872	41,166	0	41,166	0	97	**182,134**
HVO Vegetable	133,428	41,166	0	41,166	0	97	**174,690**
Diesel	67,687	41,166	25,915	67,080	1,934	0	**136,701**

Source: Indecon analysis
Note: VAT and diesel rebate rates are excluded from the analysis. Fuel prices in Table 3.5 were converted from €/Litre to €/GWh using the conversion rates listed in Annex 2.

Energy Demand

The energy demand used to estimate the cost to industry and impact on the Exchequer is based on projections under the SEAI WAM scenario for the HGV sector, complemented by biodiesel data from the NORA. Total energy demand is 11,553 GWh projected for 2030 (see sub-section 3.2).

Cost to Industry

The cost to industry is estimated by multiplying the price of fuels (shown in Table 4.1) to the estimated fuel mix in the HGV sector under the policy scenarios identified in Section 3.4. For any estimated use of HVO, it is assumed that the fuel is sourced according to the observed feedstock distribution: UCO (54%), vegetable (45%), and tallow (1%).

Impact on the Exchequer

The revenue to the Exchequer is estimated by multiplying MOT rates to the estimated fuel use in the HGV sector under the policy scenarios outlined in Section 3.4. The cost to the Exchequer is estimated by multiplying any cost of subsidy to the estimate fuel use under Option 3 (see Section 3.4). Taxes such as the NORA and biofuel levy are excluded when estimating the fiscal impact to the Exchequer. VAT rates are also excluded.

4.4 Cost to Industry and Impact on Exchequer

The table below presents the estimated cost to the HGV sector and the revenue to the Exchequer associated with 9,821 GWh of energy demand in 2023. The initial columns show the current fuel mix and prices after tax. The final columns (highlighted in blue) report the cost to industry and revenue to the Exchequer (from current MOT rates). Most of the Exchequer revenue is from higher taxation on diesel, which accounts for approximately 89% of total energy demand from the HGV sector.

Table 4.2: Cost to Industry and Impact on Exchequer - Current					
Fuel	**Demand (GWh)**		**Price (€/GWh)**	**Cost and Revenue (€m)**	
	Volume Supplied	**% of Fuel Use**	**Price After Tax**	**Cost to Industry**	**Revenue to Exchequer**
FAME	778	8%	145,293	113	32
HVO UCO	149	3%	189,088	28	6
HVO Tallow	4		182,134	0.7	0.2
HVO Vegetable	125		174,690	22	5
Diesel	8,766	89%	127,221	1,115	505
Total	**9,821**	**100%**		**1,279**	**548**

Source: Indecon analysis
Note: price for auto-diesel and biofuels are estimated using MOT rates effective from 9 October 2024 to 30 April 2025. In addition to MOT, fuel prices after tax additionally include the NORA levy and biofuel levy. Revenue to the Exchequer is from MOT. Total demand in 2023 for HGV was 9,532 GWh (estimated by the SEAI, see Table 3.1). This figure was later adjusted to 9,821 GWh after the SEAI data were complemented with detailed biodiesel data from NORA (see Table 3.4).

By 2030, the cost to the HGV sector is projected to rise to €1,688 million to meet an increase in energy demand to 11,554 GWh, with 15% of this non-electric demand supplied by HVO. This represents the baseline scenario, which assumes full compliance with the 49% RTFO obligation for 2030 and no additional policy interventions.

Table 4.3: Cost to Industry and Impact on Exchequer – 2030 Baseline					
Fuel	**Demand (GWh)**		**Price (€/GWh)**	**Cost and Revenue (€m)**	
	Volume Supplied	**% of Fuel Use**	**Price After Tax**	**Cost to Industry**	**Revenue to Exchequer**
FAME	806	7%	145,293	117	33
HVO UCO	940	15%	189,088	178	39
HVO Tallow	25		182,134	5	1
HVO Vegetable	786		174,690	137	32
Diesel	8,951	78%	136,701	1,224	600
Electric	46	-	188,370	9	-
Total	**11,554**	**100%**		**1,669**	**706**

Source: Indecon analysis
Note: prices for auto-diesel and biofuels are estimated using future MOT rates as set out in Finance Act 1999 (as amended). In addition to MOT, fuel prices after tax additionally include the NORA levy and biofuel levy. Revenue to the Exchequer is from MOT.

If the use of HVO was mandated to cover 30% or 60% of total non-electric energy demand in the HGV sector (Option 1), the cost to the industry would rise to €1,747 million and €1,905 million, respectively. These figures exceed the baseline scenario because of higher use of HVO, which is priced at a premium to diesel. Increasing the minimum mandatory share of HVO to 60% would reduce Exchequer revenue by approximately 14%, due to the lower taxes on biofuels which are exempt from carbon taxation.

Table 4.4: Cost to Industry and Impact on Exchequer – Option 1

Fuel	Price (€/GWh)	Mandated 30% HVO in HGV				Mandated 60% HVO in HGV			
		Demand (GWh)		Cost and Revenue (€m)		Demand (GWh)		Cost and Revenue (€m)	
		Volume Supplied	*% of Fuel Use*	Cost to Industry	Revenue to Exchequer	Volume Supplied	*% of Fuel Use*	Cost to Industry	Revenue to Exchequer
FAME	145,293	806	*7%*	117	33	806	*7%*	117	33
HVO UCO	189,088	1,854	*30%*	350	76	3,707	*60%*	701	153
HVO Tallow	182,134	49		9	2	98		18	4
HVO Vegetable	174,690	1,549		271	64	3,099		541	128
Diesel	136,701	7,250	*63%*	991	486	3,797	*33%*	519	255
Electric	188,370	46	-	9	-	46	-	9	-
Total		**11,554**		**1,747**	**662**	**11,554**		**1,905**	**572**

Source: Indecon analysis

Note: prices for auto-diesel and biofuels are estimated using future MOT rates as set out in Finance Act 1999 (as amended). In addition to MOT, fuel prices after tax additionally include the NORA levy and biofuel levy. Revenue to the Exchequer is from MOT.

Adjusting the RTFO multi-counting rate by increasing the number of certificates awarded per unit of biofuel placed on the market from 2.5 to 3.5 (Option 2) would not result in significant cost changes relative to the baseline (do-nothing scenario). On the other hand, reducing the multi-counting rate to 1.25 across the entire road sector would increase the cost to industry and reduce revenue to the Exchequer. This is primarily driven by increased use of HVO, 40% of non-electric demand under a more stringent RTFO obligation, which requires suppliers to blend a higher volume of biofuels to meet the RTFO obligation for 2030.

Table 4.5: Cost to Industry and Impact on Exchequer – Option 2

Fuel	Price (€/GWh)	Increase RTFO certs to 3.5x (for HGV)				Decrease RTFO certs to 2x				Decrease RTFO certs to 1.25x			
		Demand (GWh)		Cost and Revenue (€m)		Demand (GWh)		Cost and Revenue (€m)		Demand (GWh)		Cost and Revenue (€m)	
		Volume Supplied	*% Fuel Use*	Cost to Industry	Revenue to Exchequer	Volume Supplied	*% of Fuel Use*	Cost to Industry	Revenue to Exchequer	Volume Supplied	*% of Fuel Use*	Cost to Industry	Revenue to Exchequer
FAME	145,293	806	*7%*	117	33	806	*7%*	117	33	806	*7%*	117	33
HVO UCO	189,088	704	*11%*	133	29	1,186	*19%*	224	49	2,444	*40%*	462	101
HVO Tallow	182,134	19		3	1	31		6	1	65		12	3
HVO Vegetable	174,690	589		103	24	992		173	41	2,043		357	84
Diesel	136,701	9,390	*82%*	1,284	630	8,494	*84%*	1,161	570	6,150	*53%*	841	413
Electric	188,370	46	-	9	-	46		9	-	46	-	9	-
Total		**11,554**		**1,649**	**717**	**11,554**		**1,690**	**694**	**11,554**		**1,797**	**633**

Source: Indecon analysis

Note: prices for auto-diesel and biofuels are estimated using future MOT rates as set out in Finance Act 1999 (as amended). In addition to MOT, fuel prices after tax additionally include the NORA levy and biofuel levy. Revenue to the Exchequer is from MOT.

If the HGV sector were to fully transition to HVO100 to meet its projected non-electric energy demand in 2030, approximately 1.2 billion litres of HVO would be required to meet their non-electric demand. Option 3 explores this full transition, assuming the introduction of a subsidy on HVO, which would make HVO equally cost competitive with diesel.

The subsidy is equal to the price differential between HVO and diesel (after tax, including excise duties and NORA levy, but excluding VAT). It also assumes that all feedstocks are subsidised. Under this scenario, the cost of subsidising HVO to the Exchequer (€527 million) would slightly exceed the total revenue collected (€474 million) in taxes and charges on fuel used by the HGV sector. Option 3 would result in a higher net cost to the Exchequer, including the loss of revenue associated with no demand for diesel.

Table 4.6: Cost to Industry and Impact on Exchequer – Option 3

Fuel	Demand (GWh)		Price (€/GWh)			Cost and Revenue (€m)		
	Volume Supplied	% of Fuel Use	Price After Tax	Subsidy	Price Subsidised	Cost to Industry	Revenue to Exchequer	Cost of Subsidy
FAME	0	0%	145,293	0	145,293	0.0	0	0
HVO UCO	6,179	100%	189,088	52,387	136,701	845	254	324
HVO Tallow	164		182,134	45,433	136,701	22	7	7
HVO Vegetable	5,165		174,690	37,989	136,701	706	213	196
Diesel	0	0%	136,701	0	136,701	0	0	0
Electric	46	-	188,370	0	188,370	9	0	0
Total	**11,554**	**100%**				**1,582**	**474**	**527**

Source: Indecon analysis

Note: prices for auto-diesel and biofuels are estimated using future MOT rates as set out in Finance Act 1999 (as amended). In addition to MOT, fuel prices after tax additionally include the NORA levy and biofuel levy. Revenue to the Exchequer is from MOT.

The table below presents the net impact of each policy option on both the cost to industry and the Exchequer, shown as deviations from the baseline scenario (full compliance with RTFO with no policy change). The impact on the Exchequer is estimated as the revenue collected from excise duties minus any costs of a subsidy incurred by the Exchequer (only relevant for Option 3).

Option 3, which assumes a full transition to HVO100 supported by a subsidy, reduces industry costs by €87 million but results in the highest fiscal impact, with a net cost to the Exchequer of €759 million. Option 1, which increases HVO use to 60% of non-electric demand, is also projected to have a significant impact on both the industry and the Exchequer. Under this option, additional costs to the HGV sector would equate to €236 million and a €134 million reduction in Exchequer revenue, primarily due to forgone tax revenue from reduced demand for diesel.

Table 4.7: Cost to Industry and Impact on Exchequer (Net Impact, €m)							
Options	**Baseline (RTFO obligation)**	**Option 1: Mandated 30% HVO**	**Option 1: Mandated 60% HVO**	**Option 2: Increase RTFO certs to 3.5x in HGV**	**Option 2: Decrease RTFO certs to 2x**	**Option 2: Decrease RTFO certs to 1.25x**	**Option 3: Subsidise HVO**
Cost to industry vs Baseline	**1,669**	+78	+236	-20	+21	+128	-87
Exchequer Impact vs Baseline	**706**	-44	-134	+11	-12	-73	-759

Source: Indecon analysis
Note: Under Option 3, the Exchequer impact is defined as the revenue collected minus subsidy costs.

4.5 Sensitivity Analysis

Due to the high volatility in HVO prices, sensitivity tests were conducted to assess how price increases could affect costs for the HGV sector under each policy option:

- Sensitivity 1: price of HVO increases by 20%; and
- Sensitivity 2: price of HVO increases by 40%; and
- Sensitivity 3: price of HVO decreases by 20%.

Given the strong correlation in prices across different HVO feedstocks, these increases are applied uniformly to all feedstocks.

Any Exchequer revenue from excise duties, specifically the MOT, is not directly affected by changes in fuel prices, as MOT applies volumetrically and is levied at a fixed rate expressed in euros per 1,000 litres. However, tax revenue may be indirectly impacted if higher prices lead to reduced fuel use. This latter effect is not considered in the present analysis, as industry costs are calculated based on the fuel use estimated under each of the incentive mechanisms (policy options) presented in Section 3.4.

The table below illustrates how changes in the price of HVO affect overall costs to the HGV sector. Cost estimates from Section 4.4 are highlighted in grey. Results from the sensitivity analysis are presented as percentage changes relative to the cost estimates presented in the previous section, providing a comparison of how rising HVO prices may impact industry costs under each policy option.

Assuming diesel prices remain constant, any increase in HVO prices would not affect the HGV sector under Option 3, as the subsidy fully covers the price differential between HVO and diesel. On the other hand, the largest impact on the HGV sector occurs under a 60% mandatory HVO use (Option 1), where a 40% increase in the price of HVO would raise industry costs by approximately 20%.

Table 4.8: Sensitivity Analysis on Cost to Industry							
		Option 1		Option 2			Option 3
	Baseline	Mandated 30% HVO	Mandated 60% HVO	Increase RTFO certs to 3.5x in HGV	Decrease RTFO certs to 2x	Decrease RTFO certs to 1.25x	Subsidise HVO
No Price Change	**1,669**	**1,747**	**1,905**	**1,649**	**1,690**	**1,797**	**1,582**
Sensitivity 1: Price HVO +20%	+3%	+6%	+10%	+2%	+4%	+7%	0%
Sensitivity 2: Price HVO +40%	+6%	+11%	+20%	+4%	+7%	+14%	0%
Sensitivity 3: Price HVO -20%	-3%	-6%	-10%	-2%	-4%	-7%	0%
Source: Indecon analysis							

4.6 Summary

This section assessed the expected cost to the HGV sector associated with the policy options identified in Chapter 3, as well as the resulting fiscal impact on the Exchequer. The analysis also discussed the significant price volatility and supply-side uncertainties associated with HVO.

- The baseline scenario, which assumes full compliance with the 2030 RTFO obligation and current multi-counting rates, projects a cost to the HGV sector of approximately €1.669 billion, with €706 million in Exchequer revenue.
- Options that increase the share of HVO in the fuel mix result in higher costs for the industry, due to the premium price of HVO compared to diesel. For example, mandating 60% HVO use (Option 1) would increase industry costs by €236 million and reduce Exchequer revenue by €134 million.
- Increasing the multiplier to 3.5 certificates per unit of HVO use would slightly reduce costs to industry and increase fiscal revenue, while lowering the multiplier to 1.25 would substantially raise industry costs (+€128 million) and reduce Exchequer revenue (-€73 million), reflecting the increased volume of HVO needed to meet compliance.
- Option 3, a full transition to HVO100 supported by a subsidy, would lower industry costs by €87 million but impose a significant fiscal burden, with a net cost to the Exchequer of €759 million.
- Sensitivity analyses further show that evolving fuel prices, particularly for HVO, will remain a critical variable influencing these outcomes.
- However, there is significant uncertainty around fuel costs facing the HGV sector, particularly in relation to HVO. For instance, a 40% price increase in HVO could raise costs by up to 20% under a 60% HVO mandate (Option 1).

Table 4.9: Summary of Cost to Industry and Impact on Exchequer (€m)						
Options	**Type of Incentive**	**Scenario**	**Cost to Industry**	**Revenue to Exchequer**	**Cost of Subsidy**	**Net Impact on Exchequer (Revenue - Cost)**
Current			1,279	548	-	-
Baseline	No Policy Change	Baseline	1,669	706	-	-
Option 1	HVO Mandate	Mandated 30% HVO	1,747	662	-	-
		Mandated 60% HVO	1,905	572	-	-
Option 2	Adjust RTFO multi-counting rate	Increase RTFO certs to 3.5x in HGV	1,649	717	-	-
		Decrease RTFO certs to 2x	1,690	694	-	-
		Decrease RTFO certs to 1.25x	1,797	633	-	-
Option 3	Subsidise HVO	HVO subsidy	1,582	474	527	-53

Source: Indecon analysis
Note: figures are exclusive of VAT.

5 Emissions Savings

5.1 Introduction

This section assesses the GHG reduction potential from increased HVO penetration in the HGV sector. It estimates carbon emissions for both the HGV and wider road transport sector, based on the estimated fuel mix under the policy options identified in Section 3.4. Any resulting emissions reductions are then compared with current levels and those that would be expected under the RTFO in 2030. It also includes a discussion on the sustainability of the most common feedstocks used to produce HVO, UCO and POME.

5.2 Carbon Emissions

Road transport accounted for 94% of emissions in the transport sector, with HGVs responsible for 20% of that total.[61] The HGV fleet in Ireland is currently dominated by internal combustion engine (ICE) vehicles powered primarily by diesel, with only a negligible share of battery-electric vehicles (BEVs). Electricity is forecast to account for only 0.4% of energy demand in HGVs in 2030 under the most ambitious SEAI WAM scenario. In this context, the REDIII recognises sustainable biofuels, particularly those derived from waste and advanced feedstocks, as a transitional measure to reduce emissions. Reflecting Ireland's Road Haulage Strategy 2022–2031, which emphasises near-term decarbonisation options while supporting long-term electrification, sustainable fuels such as HVO are recognised as a key medium-term solution for reducing emissions in the HGV sector.

Data on carbon emissions used in this analysis are based on GHG intensities, expressed in $gC0_2$ equivalent per MJ, for the relevant fuels used in road transport, including biodiesel, bioethanol, HVO, diesel and gasoline. For fossil fuels (diesel and gasoline), we use the RED fossil fuel comparator values.[62] Data on biofuels are those reported on NORA sustainability statements. Data collected from NORA on carbon intensities are based on the reported life cycle GHG emissions from fuel suppliers. These data offer a range of reported GHG intensities by suppliers from countries of origin,[63] allowing the construction of a representative range of GHG intensities. The table below presents the weighted average GHG intensity for each biofuel (weighted by the volume of fuel supplied).

Where a distribution of HVO feedstocks is assumed, we apply feedstock-specific GHG intensities. In cases where HVO is assumed to be derived from tallow and no specific intensity is available, we use the average GHG intensity for HVO (14.1 gCO_2e/MJ). Similarly, for FAME and bioethanol, we use average values when no feedstock distribution is assumed.

[61] DoT (2024) Road Haulage Strategy Annual Progress Report 2024
[62] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1185
[63] Article 23 paragraph 5(f) of the RED(23)

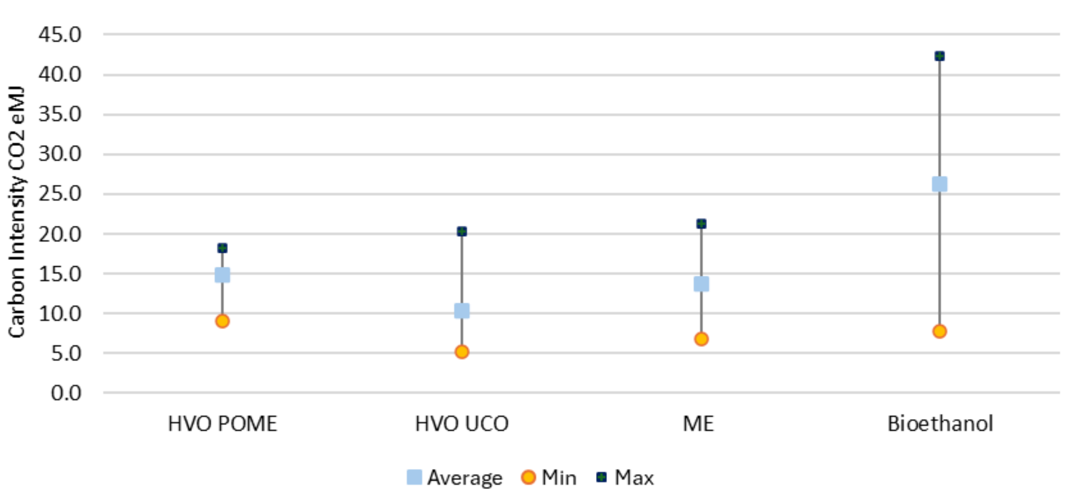
Table 5.1: Average GHG Intensity by Fuel (gCO_{2eq}/MJ)			
Fuel	**Feedstock**	**GHG**	**Source**
FAME		13.7*	NORA Sustainability Statements 2023
HVO	POME	17.1*	NORA Sustainability Statements 2023
	UCO	8.8*	NORA Sustainability Statements 2023
	Average	14.1*	NORA Sustainability Statements 2023
Bioethanol		27.7*	NORA Sustainability Statements 2023
Diesel		95.1	RED fossil fuel comparator
Gasoline		93.3	RED fossil fuel comparator
LPG		63.1	RED

Source: NORA; RED
Note: *Weighted average.

Overall, calculating the GHG intensity of biofuels is subject to significant uncertainty, largely due to variations in methodologies, underlying assumptions, and the data used. A study conducted by the IEA[64] found that reported emissions for biofuels differed widely across the available literature, owing to discrepancies in data for biofuel production including upstream emission factors that can significantly affect the GHG estimates.

The figure below illustrates variation in the range of carbon intensities for relevant biofuels used in road transport reported in the NORA sustainability statements in 2023. For instance, the reported carbon intensity of HVO UCO shows a wide range from 5.3 gCO_2e/MJ to 20.3 gCO_2e/MJ. The widest range is reported for bioethanol.

Figure 5.1: Range of Carbon Intensities reported on NORA Sustainability Statements



Source: NORA Sustainability Data, 2023

64 https://iea.blob.core.windows.net/assets/79f31c02-0efe-41ca-ac15-9d076bf2cd29/CarbonAccountingforSustainableBiofuels.pdf

Another important factor that has a significant impact on the carbon intensity of biofuels are indirect land use changes emissions (ILUCs). Including ILUCs in the calculation of GHG emissions of biofuels can have a significant impact and, in some cases, may cancel out any expected savings from using biofuels. ILUCs are emissions indirectly caused by land use changes resulting from increased demand for feedstocks used in biofuel production. These emissions are complex to estimate, as they cannot be directly observed.

Due to the complexity of estimating ILUCs, the EU adopts a risk-based approach, identifying certain crop-based feedstocks, such as palm oil, as high-risk, rather than providing definite estimates for ILUCs. For instance, estimates from the EEA show that when ILUC emissions are included, HVO derived from oil crops offers no net GHG savings compared to diesel or petrol. The data presented in the table below is obtained from the European Environmental Agency (EEA). For biofuels, data on their GHG intensities include both values with and without indirect land use change emissions, by different feedstocks categories.

Table 5.2: Average GHG Intensity of Biofuels including ILUC ($gC0_2$/MJ)

Fuel	Feedstock	Excl. ILUC	Incl. ILUC
Biodiesel	Cereals and other starch-rich crops	10.6	22.6
	Oil crops	30.6	85.0
	Other	11.9	11.9
HVO	Cereals and other starch-rich crops	7.6	19.6
	Oil crops	22.7	73.2
	Other	7.9	7.9
Bioethanol	Average	15.3	40.6

Source: EEA

In the case of HVO, the majority is produced from waste oils such as UCO and POME. Because they are not primary oil crops, there should be no ILUC value associated. On the other hand, including ILUCs in the estimation of HVO derived from oil crops (such as palm oil), increases its carbon intensity from 22.7 gCO2e/MJ to 73.2 gCO2e/MJ. While there is technically no ILUC associated with UCO or POME, there are some growing sustainability concerns associated with both feedstocks which are discussed in the next section.

5.3 Sustainability

As mentioned in earlier chapters, the EU incentivises the use of waste-based biofuels in road transport through Article 25 of the RED by allowing double counting in meeting EU transport energy targets. In Ireland, the EU obligation is implemented through annual increases in the road transport fuel obligation (RTFO). Crop-based biofuels that may involve high ILUCs are being phased out in the EU. Currently, only palm oil has been identified by the EU Commission (in 2019) as a high ILUC-risk feedstock[65] unless it is certified as low ILUC-risk.

[65] ILUC refers to the clearance of land to allow for the expansion of overall agricultural area, possibly including areas with high carbon stock, such as forests, wetlands and peatlands to meet additional demand for land for energy. This land conversion can release large amounts of CO2 stored in vegetation and soil, thereby offsetting the GHG savings that biofuels are intended to deliver.

In Ireland, most of the biofuels (including HVO) used in road transport were derived from UCO and POME (see Section 2.5). Both are feedstocks listed under RED Annex IX, but with a distinction:

- Biofuels made from POME, which is listed in Part A, are considered advanced biofuels, subject to the RED advanced biofuel sub-target of 5.5% by 2030.
- Biofuels made from UCO, which is listed in Part B, fall within the RED 1.7% limit for the purpose of calculation of the RES-T target (there is no limit on UCO-derived biofuel when calculating the overall RES).
- The energy content of biofuel produced from both feedstocks can be double counted for the purpose of calculation of the RES-T under the RED.

POME being a "Part A" biofuel is incentivised through the RED advanced biofuel sub-target and double counting. However, analysis carried out by the NORA indicates fraud concerns regarding supply of POME based biofuel into the EU in recent years, owing to linkages with palm oil. Ireland is taking steps within its jurisdiction to safeguard against this risk in future supply. This will involve removing additional (to RED) incentive award of RTFO certificates for supply of POME-based biofuel and further could involve limiting the future volume supply of POME based biofuel to Ireland. Germany has already announced that it will remove POME from its double counting.[66]

On the other hand, UCO, a waste feedstock listed in Part B of Annex XI, is the largest feedstock consumed in the EU. Around 80% of UCO volumes used to produce biofuels were sourced from outside the EU (with China accounting for 60% of the imports).[67] The EU recently introduced anti-dumping duties (February 2025) on biodiesel imported from China, including biodiesel derived from UCO, citing sustainability fraud concerns such as the mislabelling of palm oil as UCO.

The traceability of UCO is a well-known issue for the feedstock particularly due to the difficulty in ensuring transparency across the various supply chains of the feedstock.[68] The REDIII introduced a "union-wide" database to improve the traceability of feedstocks and ensure transparent tracking across supply chains.[69] In response to concerns of such feedstocks, the REDIII also strengthened the requirements on voluntary schemes and requires Member States to cooperate in overseeing certification bodies and investigating supply chain irregularities, reducing the risk of fraudulent activity for feedstocks in high demand such as UCO.

5.4 Emissions Savings by Policy Option

In this section we estimate carbon emissions using the GHG intensities reported in Table 5.1, under each of the policy option presented in Section 3.4. To estimate emissions, we apply the corresponding GHG intensity values (converted from gCO_{2e}/MJ to gCO_{2e}/GWh[70]) to the estimated fuel use (in GWh) under each of the policy incentives. Emissions are calculated for both the HGV sector and the broader road transport sector, and final values are expressed in mega tonnes of CO_2 equivalent (Mt CO_{2e}).

Below is a summary of the policy options that were modelled in Section 3.4. We have modelled three main types of policy tools, and under each policy tool we modelled a set of scenarios:

- **Option 1**: A blend mandate % for HVO in HGV:

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[66] https://scholar.harvard.edu/files/csgoh/files/yeoh_and_goh_2022_hvo.pdf

[67] https://www.transportenvironment.org/uploads/files/202407_TE_advanced_biofuels_report-1.pdf

[68] Byrne Ó Cléirigh (2022), A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets.

[69] European Commission (2024), EU Database for Biofuels becomes Operational.

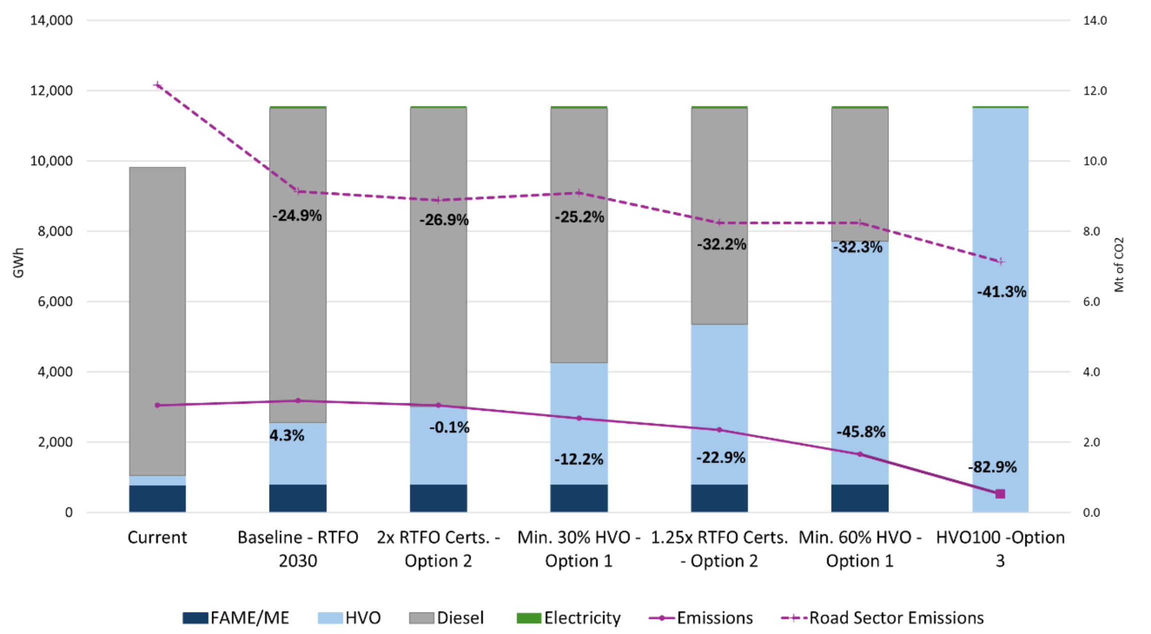
[70] Conversion factor used is 1MJ = 2.7777777777778E-07 GWh.

  - a minimum requirement of 30% HVO; and
  - a minimum requirement of 60% HVO.
- **Option 2**: Adjustments in the RTFO multi-counting rate:
  - increase multi-counting rate from 2.5 to 3.5 certs. for the HGV sector;
  - decrease multi-counting rate from 2.5 to 2 certs. across all sectors; and
  - a further decrease in the multi-counting rate from 2.5 to 1.25 certs. across all sectors.
- **Option 3**: Full transition to HVO100 supported by a subsidy.

The figure below illustrates projected emissions under the policy options outlined in Chapter 3. The bars represent the total energy demand in the HGV sector for 2030 (11,554 GWh, based on the SEAI WAM scenario), broken down by estimated fuel use under each policy option. The solid purple line indicates emissions in the HGV sector, while the dashed purple line shows emissions for the overall road transport sector. Emission reductions are presented relative to current levels: 3.1 Mt CO_2e for HGVs and 12.2 Mt CO_2e for total road transport. Note that the option where RTFO certificates were increased from 2.5 to 3.5 in the HGV sector only (Option 2) was not included because it represented a decrease in the overall biofuel use in both HGV and road transport.

As expected, HVO100 (Option 3) delivers the highest emissions reduction, with estimated savings of 82.9% compared to current level of emissions. When we examine emissions for the overall road sector under Option 1, we find that there is no significant improvement beyond what is projected under the RTFO baseline scenario. Option 1 models a mandated increase in HVO use within the HGV sector, but this does not lead to additional biofuel use in other sectors of road transport. Emissions savings for the road sector under Option 1 range from 25.2% to 32.3%, only slightly above the 24.9% estimated under the baseline. This is primarily because the mandated increase in HVO use within the HGV sector under Option 1 is sufficient to meet the RTFO obligation, thereby "crowding out" further biofuel use in other vehicle categories.

Figure 5.2: Emission Savings in HGV and Road Transport by Policy Option

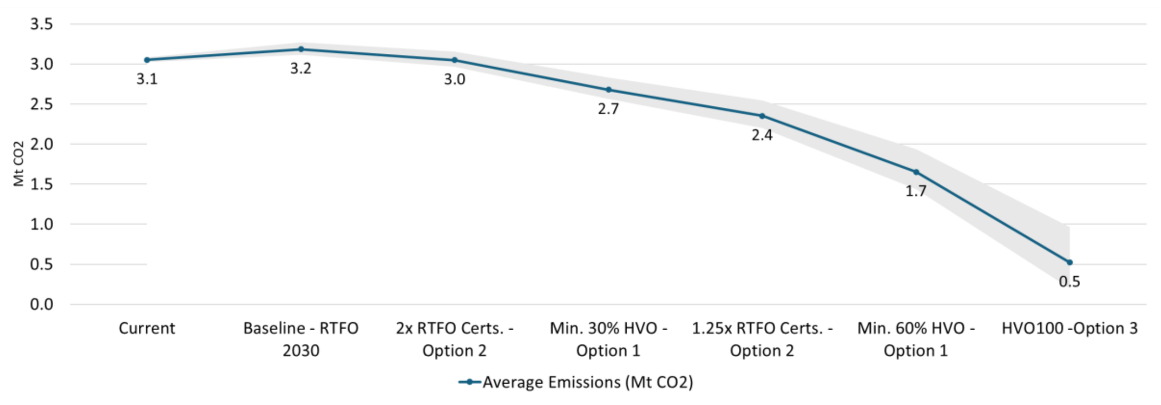


Source: Indecon Analysis

The figure below presents estimated carbon emissions under different policy options, by also illustrating the uncertainty range associated with the GHG intensities of the fuels used (shaded area). The blue line represents average emissions under each scenario. The representative range is constructed by using minimum and maximum values on GHG emissions reported from NORA sustainability statements.

Due to greater variability in the reported GHG lifecycle of HVO, Option 3, which assumes a full transition to HVO100 in HGV, shows the widest uncertainty, highlighting the sensitivity of emissions outcomes to the carbon intensity of HVO.

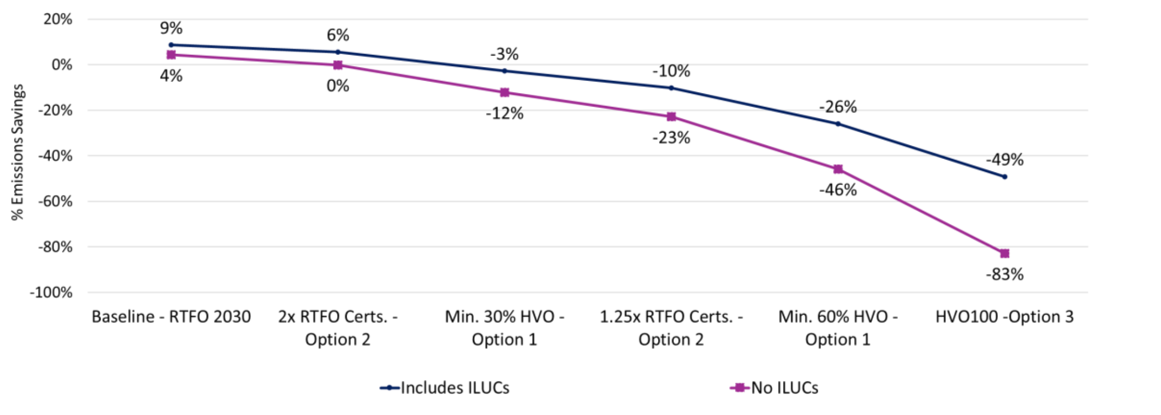
Figure 5.3: Range of Carbon Emissions in HGV by Policy Option



Source: Indecon Analysis

Lastly, as an additional sensitivity, we created a scenario on emissions savings in HGVs that accounts for potential ILUC impacts. In this scenario, it is assumed that 50% of the HVO consumed in the HGV sector comes from high-ILUC-risk feedstocks, such as oil crops, with an associated emission intensity of 73.2 gCO_2/MJ (reported in Table 5.2). The results show a significant reduction in emissions savings compared to the baseline case without ILUC.

Figure 5.4: Emission Savings in HGV – Sensitivity incl. ILUCs



Source: Indecon Analysis

5.5 Summary

This chapter assessed the potential for GHG emissions reduction in the HGV sector through increased use of HVO under the policy options identified in Chapter 3.

- Overall, the findings suggest that incentives for HVO adoption in HGVs can play a significant role in reducing transport emissions in the medium term (2030).
- Compared to current emission levels, no reduction is expected under the baseline scenario, which reflects the 2030 RTFO trajectory[71]. However, this outcome is primarily due to higher energy demand in the HGV sector forecast for 2030 under the SEAI WAM scenario.
- Option 3, which supports a full transition to HVO100 via a subsidy, presents the highest savings, with emissions reductions up to 93% compared to current levels. However, this option also carries the greatest uncertainty due to variation in the reported GHG intensity of HVO, particularly from different feedstocks.
- Option 1, which mandates 30–60% HVO use in HGVs, delivers moderate emissions savings for road transport as can limit biofuel use in other vehicle categories in road transport.
- Under Option 2, which adjusts the RTFO multi-counting rate, emissions savings depend on the multi-counting rate or number of certificates that fuel suppliers receive to meet the RTFO obligation. Reducing the number of certificates to 2x would result in minimal emission savings, while a further reduction to 1.25x across all sectors in road transport could lead to moderate emissions reductions of up to 27%.
- The analysis also highlighted the importance of feedstock sustainability. While most HVO used in Ireland is derived from waste-based feedstocks like UCO and POME, both face traceability and fraud concerns. This risk applies to all the above options.

Table 5.3: Summary of Emissions Savings in HGV by Policy Option

Options	Type of Incentive	Scenario	Average Emissions (Mt of CO2)	Range (Mt of CO2)	% Savings (vs Current)
Current			3.1	3.0 – 3.1	
Baseline	No Policy Change	Baseline	3.2	3.1 – 3.3	Increases by 3% - 6%
Option 1	HVO Mandate	Mandated 30% HVO	2.7	2.6 – 2.8	Reduces by 8% - 15%
		Mandated 60% HVO	1.7	1.4 – 1.9	Reduces by 37% - 52%
Option 2	Adjust RTFO multi-counting rate	Decrease RTFO certs rate to 2x	3.0	3.0 – 3.2	Reduces by 1.9% or increases to 2.3%
		Decrease RTFO certs rate to 1.25x	2.4	2.2 – 2.5	Reduces by 17% - 27%
Option 3	Subsidise HVO	HVO subsidy	0.5	0.2 - 1	Reduces by 69% - 93%

Source: Indecon Analysis

[71] The RTFO trajectory is established to achieve a 20% biofuel blend in road transport by 2030, representing over 18% of the carbon emission reduction required in the transport sector. Other CAP measures to achieve the 50% emission reduction by 2030 required by the transport sector include an increase in electric vehicles, public transport, and active travel modes.

6 Conclusions

6.1 Introduction

This study has assessed the current and potential role of HVO in supporting the decarbonisation of Ireland's Heavy Goods Vehicle (HGV) sector, in line with the objectives of Ireland's Road Haulage Strategy 2022–2031 and the requirements set out by the Department of Transport. While electrification remains the preferred pathway to zero emission, the analysis supports the conclusion that HVO can serve as a near-term option to reduce transport emissions from a sector that is otherwise difficult to decarbonise.

Energy demand in the HGV sector was estimated at 9,532 GWh in 2023, and is projected to increase by 21% to 11,553 GWh under the most ambitious SEAI WAM scenario. If the sector were to fully transition to HVO100 to meet its projected non-electric energy demand in 2030, it would require between 1.1 and 1.2 billion litres of HVO. The electrification of the HGV sector in Ireland remains limited and is projected to account for 0.4% of total energy demand of the HGV sector in 2030 under the SEAI WAM scenario.

As of 2023, diesel was the predominant fuel used in road transport in Ireland, accounting for 72% of total energy demand (the equivalent of approximately 3 billion litres of diesel). The share is higher for the HGV sector, where diesel represented 92% of total fuel mix (the equivalent of approximately 848 million litres of diesel). In 2023, 84 million litres of HVO were placed on the market in Ireland for road transport according to the NORA. While precise data on HVO usage by freight operators is limited, SEAI reports that the HGV sector consumed 32% of all road biodiesel (including HVO and FAME).

6.2 Policy Options

Three categories of policy tools that may be used as mechanisms to increase HVO penetration in the HGV sector were identified:

- Mandated minimum HVO in HGVs;
- Changes to RTFO certificate multi-counting rates; and
- HVO subsidy to enable a full transition to HVO100.

An optimisation model was also developed to assess any implications the policy tools listed above may have for the HGV and wider road sector, which ensures that these policy tools fully meet the RTFO obligation. The model assumes that fuel suppliers will minimise the total cost of meeting each of the sub-sectoral demand subject to the RTFO obligation for 2030, and additional technical constraints. The fuel mix was determined as an endogenous outcome to the cost minimisation.

Table 6.1: Conclusions	
Baseline	RTFO baseline (49% by 2030 under RTFP 2023 - 2025) on its own is not expected to reduce absolute emissions in the HGV sector due to growing energy demand by 2030.
Option 1 (HVO Mandate)	Without RTFO reform, increasing HVO in HGV: ▪ Shifts biofuel use towards HGV ▪ Limits any increase of biofuel use in non-HGV road sectors ▪ Which results in modest additional emissions reduction in road sectors (compared to baseline) ▪ It would not be possible to administer a blending mandate specific to fuel supply for HGV consumption as there is an extant blending obligation on diesel supply in the road transport sector generally.
Option 2 (Adjusting RTFO certs)	Reforming the RTFO by decreasing RTFO certs across all sectors: ▪ Incentivises more blending of renewables and increases biofuel use in HGV and across all sectors ▪ Noting that there is already broad application of the double counting of biofuel from Annex IX feedstock across the EU regarding the RED Article 25(1) obligation, including in Ireland since 2010, the inclusion of a reduced multi-counting rate below 2 in this analysis is for illustrative purposes only, intended to explore the potential direction of impact of such a policy change.
	Opposite effect if RTFO certs increased for HGV ▪ Reduces biofuel use in HGV, as suppliers meet RTFO obligation more easily with less biofuel ▪ However, it could not be possible to adjust the number of RTFO certs for a specific sector within road transport, as the RTFO obligation applies to the entire road transport sector and relates to the supply of fuel rather than its consumption.
Option 3 (Subsidise HVO)	Subsidising HVO alone would carry a significant cost to the Exchequer ▪ While cost reduced if subsidy modelled after-tax, remains significant

Source: Indecon

The analysis showed that the greatest emissions savings can be achieved through a full transition to HVO100 supported by a subsidy. However, HVO remains more expensive than conventional diesel. A full switch to HVO100 without financial support would therefore impose significant cost burdens on the HGV sector. However, with financial support, it may impose a significant fiscal burden, with a net cost to the Exchequer of €759 million. A subsidy may require specific State-aid consideration and should also be assessed against the potential cost of not meeting Ireland’s carbon emissions reduction targets in 2030. This could include future penalties at EU level, which would increase the overall financial burden on the Exchequer, although the precise mechanism for applying such fines has not yet been finalised. The expense of a HVO subsidy would also need to be compared to other options for reducing carbon emissions in the sector, i.e., using the funds to increase the uptake of electric HGVs.

Option 3 would require careful design to avoid undermining the transition to ZEHDVs include setting a clear phase-out date for new ICE HGVs, although the exact timing will depend on the readiness of zero-emission technologies and infrastructure, combined with time-limited support and incentives. Currently, the transition to ZEHDVs depends largely on three factors: the relative purchase cost of ZEHDVs versus ICE vehicles, the availability and size of grants for ZEHDVs, and fuel costs (prices of HVO, diesel, and electricity). Grant amounts are typically calculated as a percentage of the price difference between a ZEHDV and its diesel equivalent. However, any policy support that reduces the cost of using HVO, such as a subsidy (Option 3), risks delaying the transition to ZEHDVs by making the total cost of operating an ICE vehicle more attractive despite the availability for purchase grants for ZEHDVs, thereby reducing the relative cost-effectiveness of electrification. Therefore, any such policy should be time-limited and regularly reviewed, taking into account progress in ZEHDV technology, availability of charging refuelling infrastructure, and battery performance.

Feedstock sustainability is also central to the viability of HVO as a decarbonisation strategy. While most HVO used in Ireland is derived from waste oils such as UCO and POME, these feedstocks are subject to traceability challenges and growing concerns over fraud. Both have been linked to issues of mislabelling, especially in cases where palm oil may be mislabelled as waste oil. Ensuring robust verification and traceability under RED III and RTFO will be essential, particularly as demand for HVO rises.

6.3 Limitations and Future Research

This analysis focused specifically on the HGV sector, but future work could be expanded to incorporate additional transport sectors that are hard to abate such as maritime and aviation into the detailed modelling and optimisation model developed by Indecon to account for national obligations and constraints outside the RTFO. This would help prioritise biofuel allocation where alternatives like electrification are least feasible in the medium term. Future research should also consider glide paths for ZEHDV adoption, while monitoring the advancement in new technologies including the timing and scale of charging infrastructure, progress in battery performance, and technology costs. The timeframe of analysis could be extended beyond 2030, in line with EU targets for 2035 or 2040, and to account for increasing bioliquid demand from ReFuelEU and FuelEU Maritime. Finally, improvements in data collection and monitoring of feedstock-specific bioliquid consumption, especially for sectors outside the RTFO, will be needed to accurately track demand and consumption, and enable a better estimation of emissions savings.

Data Collection

While Ireland collects feedstock-specific biofuel data through NORA, this is limited to volumes placed on the market and does not reflect actual sales or end use by sector. For example, in 2023, 84 million litres of HVO were reported as placed on the market for road transport, but no direct data is available on the share used specifically by freight operators. In addition, there is very limited data on HVO use in other sectors outside the RTFO such as home heating, aviation, navigation, or data centres.

The implementation of ReFuelEU Aviation and the FuelEU Maritime regulation is expected to improve data collection in the aviation and maritime sectors by imposing clearer reporting obligations on fuel suppliers and operators. However, gaps may remain for home heating and data centres. The Revenue

Commissioners collect and hold data according to its function, and additional data could be considered in support of any future policy initiative for fuel taxation and biofuels related to MOT, or such as that suggested under Option 3, to monitor taxed HVO consumption.

Another area of improvement in data collection relates to how fuel is allocated, blended, and delivered across sectors and sub-sectors. Importantly, one gap in this study is that, aside from the modelling of the RTFO obligation and additional technical constraints (i.e., 7% limit on FAME), no physical blending assumptions were made. Future work could benefit from insights into how blends and uses vary between wholesale and retail, and from the incorporation of these data into the modelling framework. This would allow for more accurate estimates of emissions savings and costs, and improve the overall accuracy of the model.

Annex 1 List of Feedstocks in Annex IX of RED III

The below table presents the latest list of Annex IX Feedstocks as referenced in REDIII.

List of REDIII Annex IX Feedstocks, 2025	
Annex IX Part A – Advanced Biofuels	
Algae cultivated on land in ponds or photobioreactors	Cobs cleaned of kernels of corn
Biomass fraction of mixed municipal waste (excluding separated household waste subject to recycling)	Biomass residues from forestry and forest-based industries (e.g., bark, branches, sawdust)
Biowaste from private households (separately collected as per Directive 2008/98/EC)	Shells/husks and derivatives, soy hulls
Drink waste	Agricultural harvesting residues
Fruit/vegetable residues and waste (tails, leaves, stalks, husks)	Unused feed/fodder from ley
Bean shells, silverskin, and dust from cocoa and coffee	Other ligno-cellulosic material (excluding saw logs and veneer logs)
Residues from hot beverage production (spent coffee grounds, tea leaves)	Palm fronds, palm trunk
Dairy waste scum	Damaged trees
Food waste oil from industry	Recycled/waste wood
Non-edible cereal residues and waste from grain milling (wheat, corn, barley, rice)	Fusel oils from alcoholic distillation
Olive oil extraction residues (olive stones)	Raw methanol from kraft pulping (wood pulp production)
Other slaughterhouse waste (non-fat animal residues, Category 1)	Intermediate crops (e.g., catch and cover crops) grown in areas with limited harvests (for aviation use)
Industrial wastewater and derivatives	Crops grown on severely degraded land (excluding food/feed crops; for aviation use)
Industrial storage settlings	Cyanobacteria
Biogenic fraction of end-of-life tyres	
Humins	**Annex IX Part B – Waste-Based Biofuels**
Spent bleaching earth	Used cooking oil
Straw	Animal fats classified as categories 1 and 2 (per Regulation (EC) No 1069/2009)
Animal manure and sewage sludge	Damaged crops not fit for food or feed use (excluding intentionally modified or contaminated substances)
Palm oil mill effluent and empty palm fruit bunches	Municipal wastewater and derivatives (excluding sewage sludge)
Palm sludge oil (PSO)	Crops grown on severely degraded land (excluding food/feed crops and Part A feedstocks; not for aviation)
Tall oil pitch	Intermediate crops (e.g., catch and cover crops) grown in areas with limited harvests (not for aviation)
Crude glycerine	
Bagasse	
Grape marcs and wine lees	
Nut shells	
Husks	

Source: *European Commission UDB, Raw materials & intermediate products (Revision April 2025)*

Annex 2 Conversion Rates

Conversion Rates		
Fuel	**Tonne**	**Liter**
HVO	1	1182
	Litres	**MJ**
Diesel	1	36.61
Gasoline	1	33.03
Bioethanol	1	21.2
Biodiesel ME	1	32.79
BioLPG	1	24.62
HVO	1	37.23
	MJ	**GWh**
	1	2.7777777777778E-07
Source: SEAI Conversion Factors (2023)		