FEHILY TIMONEY

CONSULTANTS IN ENGINEERING, ENVIRONMENTAL SCIENCE & PLANNING

# A FEASIBILITY STUDY ON THE ADOPTION OF ALTERNATIVE FUEL VEHICLES FOR LOCAL AUTHORITIES

## Feasibility Study Report

**Prepared for:**

**Armagh Banbridge and Craigavon Borough Council, Ards and North Down Borough Council, Louth County Council, Monaghan County Council, Newry Mourne and Down District Council & East Border Region.**

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Core House, Pouladuff Road, Cork, T12 D773, Ireland

**T: +353 21 496 4133 | E: info@ftco.ie**

**CORK | DUBLIN | CARLOW**

**www.fehilytimoney.ie**

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## REVISION CONTROL TABLE, CLIENT, KEYWORDS AND ABSTRACT

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**Abstract:** Fehily Timoney and Company is pleased to submit this feasibility study report on the adoption of Alternative Fuel Vehicles to Armagh Banbridge and Craigavon Borough Council, Ards and North Down Borough Council, Louth County Council, Monaghan County Council, Newry Mourne and Down District Council & East Border Region.

# TABLE OF CONTENTS

## LIST OF APPENDICES

## LIST OF FIGURES

# LIST OF TABLES

# LIST OF ABBREVIATIONS

| | |
|---|---|
| ABC | Armagh Banbridge and Craigavon Borough Council |
| AND | Ards and North Down Borough Council |
| BEV | Battery Electric Vehicle |
| CNG | Compressed Natural Gas |
| EV | Electric Vehicles |
| GHG | Greenhouse Gas |
| HDV | Heavy Duty Vehicle |
| HVO | Hydrotreated Vegetable Oil |
| LDV | Light Duty Vehicle |
| LNG | Liquified Natural Gas |
| LPG | Liquified Petroleum Gas |
| LAs | Local Authorities |
| LCC | Louth County Council |
| MCC | Monaghan County Council |
| NMD | Newry Mourne and Down District Council |
| NI | Northern Ireland |
| REL | Rear End Loader |
| RCV | Refuse Collection Vehicle |
| RoI | Republic of Ireland |

# 1. INTRODUCTION

## 1.1 Overview

Armagh Banbridge and Craigavon Borough Council (ABC), Ards and North Down Borough Council (AND), Louth County Council (LCC), Monaghan County Council (MCC) and Newry Mourne and Down District Council (NMD), as a Consortium, have commissioned Fehily Timoney and Company to carry out a feasibility study on the adoption of alternative fuel vehicles for Local Authorities (LAs) in the Republic of Ireland (RoI) and Northern Ireland (NI).

All Consortium members are situated within the 'East Border Region' of the island of Ireland. The 'East Border Region' is a local authority led cross border organization along the east coast of the island of Ireland. Monaghan County Council are the lead Consortium member.

The overall purpose of the study was to identify viable low and no carbon vehicle fleet options for each local authority's vehicle fleet - to support each local authorities broad aim to reduce its organizational Greenhouse Gas (GHG) emissions. Broadly the study involved the following steps:

1. A baseline evaluation of each LA's vehicle fleet.
2. Contextual analysis of the main macro-environmental factors that affect and influence the adoption of alternative fuel vehicles in the East Border region.
3. A programme of stakeholder and industry engagement - to develop a greater understanding of the viability of alternative fuel options for each LA's vehicle fleet.
4. An examination of several case studies involving organizations transitioning their vehicle fleet to alternative fuels.
5. The carrying out of quantitative and qualitative Alternative Fuel Option Analysis.
6. Development of a Sample Strategic Roadmap for Achieving Net Zero Emission Vehicle Fleets - for each LA.
7. Completion of a Feasibility Study Report documenting the above steps.

The following short list of alternative fuel options were considered in this study:

- Hydrotreated Vegetable Oil (HVO)
- Conventional Biofuel (Biodiesel or Bioethanol)
- Battery Electric Vehicle (BEV)
- Biomethane based options (BioCNG, BioLNG or BioLPG).
- Green Hydrogen (Fuel Cell or Internal Combustion Engine)

These are the main types of alternative fuels available and emerging on the island of Ireland that - when used instead of fossil fuels - can contribute to reducing vehicle related GHG emissions.

Compressed Natural Gas (CNG), Liquified Natural Gas (LNG) or Liquified Petroleum Gas (LPG) from fossil fuel sources have been excluded as potential alternative fuel options as their use will not achieve the required GHG emission reductions.

The following key definitions apply in this report:

- **Alternative Fuels** are those fuels or power sources which serve, at least partly, as a substitute for fossil oil sources in the transport sector.
- **Renewable Fuels** are fuels produced from renewable resources.
- **Hydrogenated Vegetable Oil** is another form of renewable diesel which is synthesised and made chemically identical to diesel. HVO can be used as a replacement fuel in higher concentrations than other biodiesel without causing technical issues.
- **Biodiesel** is a diesel substitute made from vegetable oil, animal fats and used cooking oil. Biodiesel is made using a process called transesterification which processes the source materials into a liquid fuel similar to diesel which can then be blended. Ireland currently deploys 7% biodiesel in its fuel supply derived mostly from used cooking oil and tallow.
- **Bioethanol** (alcohol) is a petrol substitute made by fermenting the sugars in cereal grains, sugar beet, cane and other plant matter. Most Bioethanol consumed in Europe is produced from sustainably grown grain and beet with no adverse impacts on land use, biodiversity or the environment due to stringent sustainability criteria set out in European law.
- A **Battery Electric Vehicle or BEV** is a vehicle that uses a battery as the sole means of energy storage for the propulsion of the vehicle. A BEV does not have a fossil fuel engine or generator. It is driven purely by an electric motor with battery energy storage. A BEV is 'refuelled' by plugging into an electrical power source.
- **Biomethane** is gaseous renewable fuel that is made by breaking down organic matter by microbial action using anaerobic digestion technology. Biomethane produced in this way has the qualities as fossil gas (often called natural gas) and can be used to decarbonise a range of sectors such as heat, transport and power generation.
- **Green Hydrogen** is produced from renewable energy such as wind. Green hydrogen can be used to power transport through hydrogen fuel cell technology and can be used in the manufacture of synthetic fuels for transport. Green Hydrogen is distinct from other types of Hydrogen in that it is sourced from renewable energy rather than being sourced from non-renewable energy (e.g., electricity generated by fossil fuel based power stations).

# 2. BASELINE EVALUATION OF LOCAL AUTHORITY VEHICLE FLEETS

The first stage of the study involves the carrying out of a baseline evaluation of each LA's vehicle fleet in consultation with the LA's vehicle fleet managers.

The purpose of this baseline evaluation is to establish a GHG emission and CapEx and OpEx cost baseline for each LAs vehicle fleet for a given 'baseline year.' This will facilitate future measurement of GHG emission reductions and vehicle fleet costs following the implementation of actions and initiatives aimed at transitioning vehicle fleets to alternative fuels. The baseline evaluation also serves to characterize the make-up of each LAs vehicle fleet and vehicle fleet operations.

This evaluation broadly involved the following steps:

1. The type and number of vehicles in each LA's fleet was identified.
2. The distances travelled and fuel usage associated with each vehicle type has been identified.
3. Specific operations associated with each vehicle type were be identified.
4. Direct GHG emissions associated with each LA's vehicle fleet has been quantified using 'Bottom Up' GHG emission quantification methodologies.
5. Where such data is available, CapEx and OpEx costs associated with vehicle fleets has been identified, collated and broken down sensibly. These costs have been quantified across a defined period.

Details of each LA's vehicle fleet baseline evaluation are presented in the sections below in the following order:

- Section 2.1 - Armagh City, Banbridge and Craigavon Borough Council
- Section 2.2 - Ards and North Down Borough Council
- Section 2.3 - Louth County Council
- Section 2.4 - Monaghan County Council
- Section 2.5 - Newry, Mourne and Down District Council

A summary of the baseline evaluation is presented in Section 2.6.

Finally, a brief characterisation of each of the LAs and their respective functional areas was carried out to facilitate an understanding of how the remit, functions and services provided by each LA and the nature and geography of their functional area may affect vehicle related GHG emissions. This characterisation is presented in Section 2.7.

## 2.1 Armagh City, Banbridge and Craigavon Borough Council

### 2.1.1 Vehicle Fleet Baseline Greenhouse Gas Emissions

The GHG emissions for ABC's vehicle fleet were estimated based on annual average figures due to the nature of the data available.

#### *2.1.1.1 Baseline Evaluation Methodology*

- Data on number of vehicles by type, average annual kilometres travelled, fuel type used, and average annual fuel usage were sourced from the LA and used to calculate the GHG emissions from each vehicle type (in the unit tonnes of Carbon dioxide equivalent - $tCO_2$-eq). Preliminary analyses have been conducted with regard to the obtained data.
- Vehicle emission benchmarks for were sourced to calculate the GHG emissions associated with each vehicle type and fuel type. The benchmarks were considered based on varying vehicle weights for each vehicle type. These emission benchmarks have been sourced from the following sources:
    - GOV.UK. (2022). *Greenhouse gas reporting: conversion factors 2022*. *Conversion factors 2022: full set (for advanced users).* Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 (Accessed 27 June 2023).
    - Transport Infrastructure Ireland (2021). *TII Web Application Portal - Carbon Tool*. *Emission Factors*. web.tii.ie. Available at: https://web.tii.ie/ (Accessed 27 June 2023).
- The data obtained from the LA on kilometres travelled and fuel usage represents the figures for one vehicle per vehicle type. The figure for fuel usage or distance travelled was multiplied by the number of each vehicle type, with respect to the type of transport emission benchmark used for the vehicle type, to provide an estimate of the total emissions for the vehicle type.

#### *2.1.1.2 Results*

The LA vehicle fleet is estimated to generate an overall of 1,836.2 $tCO_2$-eq on an average year. Table 2-1 and Figure 2-1 breakdown the average annual GHG emissions from each vehicle type for the entire fleet of the LA.

**Table 2-1: Average Annual GHG Emissions from Each Vehicle Type**

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| RCV 32T | 100.13 | 5% |
| RCV 26T | 983.44 | 54% |
| RCV 18T | 156.26 | 9% |
| Macpac L 12T | 103.53 | 6% |
| Large Cage 7.5T | 80.61 | 4% |
| Small Cage 3.5T | 30.85 | 2% |
| Large Panel Van | 162.09 | 9% |
| Small Panel Van | 120.87 | 7% |

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| Beavertail 7.5T | 28.21 | 2% |
| Large Tractor | 64.82 | 4% |
| Compact Tractor | 5.33 | 0.3% |
| **Total** | **1,836.15** | **100%** |

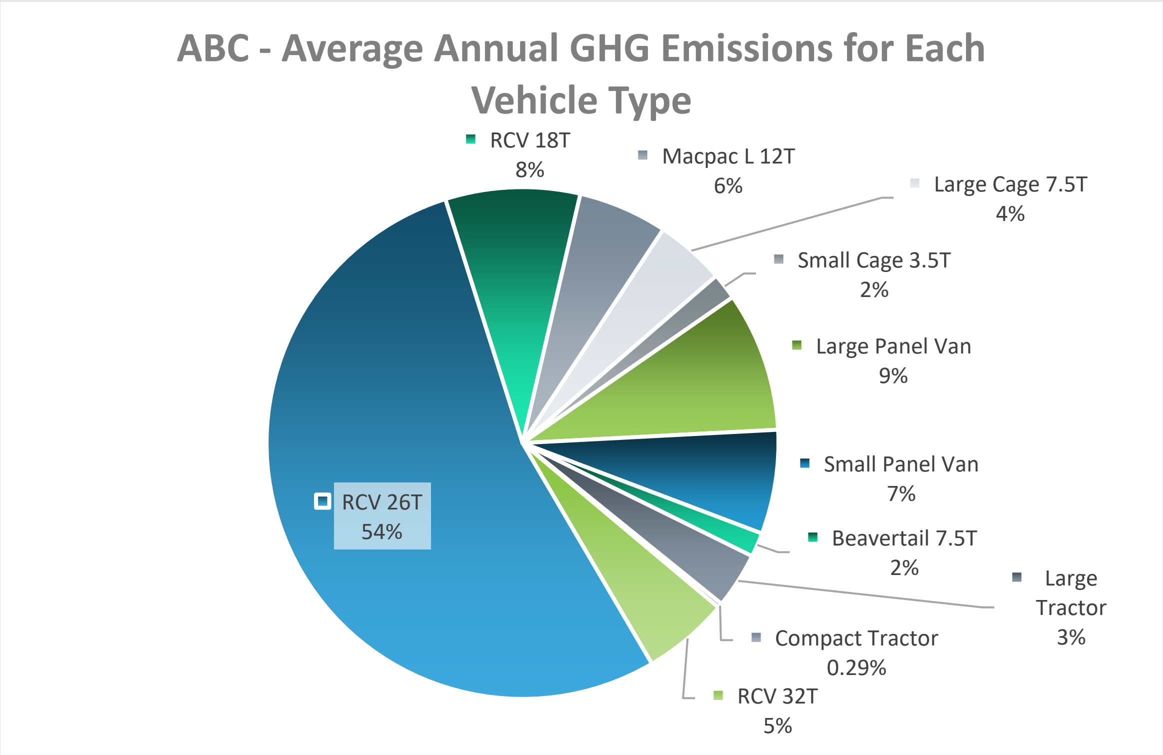


**Figure 2-1: Average Annual GHG Emissions for Each Vehicle Type**

RCV 26T is the primary contributor of GHG emissions among the overall LA vehicle fleet (54%). The high number of this vehicle type and the large average annual distance travelled justify the high amount of GHG emissions produced over a 1-year period (see Table 2-2 and Figure 2-2). Large Panel Van accounts for 9% of total vehicle fleet emissions, followed by RCV 18T (8%) and Small Panel Van (7%).

For further insight, a breakdown of the number of each vehicle type is presented in Table 2-2. A comparison of the average annual distance travelled and the associated fuel usage for each vehicle type is also shown in Figure 2-2.

**Table 2-2: Breakdown of Number of Vehicles by Type**

| Vehicle Type | Number of Vehicle Type | Percentage Breakdown |
|---|---|---|
| RCV 32T | 6 | 2% |
| RCV 26T | 60 | 23% |
| RCV 18T | 13 | 5% |
| Macpac L 12T | 13 | 5% |
| Large Cage 7.5T | 12 | 5% |
| Small Cage 3.5T | 5 | 2% |
| Large Panel Van | 50 | 19% |
| Small Panel Van | 60 | 23% |
| Beavertail 7.5T | 15 | 6% |
| Large Tractor | 9 | 3% |
| Compact Tractor | 20 | 8% |
| Total | 263 | 100% |

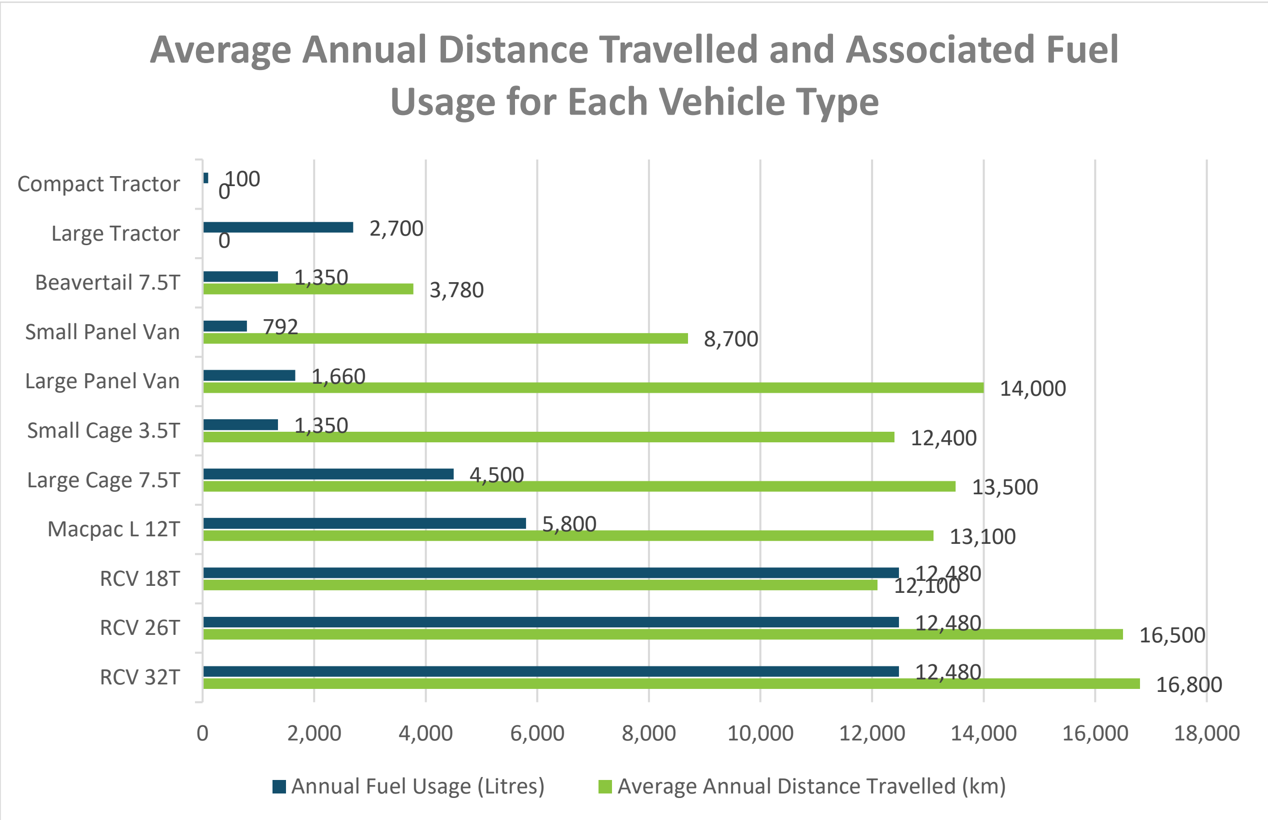


**Figure 2-2: Comparison between Average Annual Distance Travelled and the Associated Fuel Usage for Each Vehicle Type**

The largest number of vehicle types are RCV 26T (23%), Small Panel Van (23%) and Large Panel Van (19%). The top three vehicle types with the highest mileage are RCV 32T, RCV 26T and Large Panel Van. RCVs generally have the highest fuel usage per year among all other vehicle types.

#### *2.1.1.3 Assumptions and Limitations*

- The data obtained from the LA on kilometres travelled and fuel usage represents the figures for one vehicle per vehicle type. Therefore, it is assumed that all vehicles for each vehicle type will have a similar level of use.
- The data obtained from the LA on kilometres travelled and fuel usage is presented as an annual average figure for each vehicle type. Therefore, there is no referenced baseline year for the calculation of the vehicle GHG emissions.
- The vehicles within this LA fleet that do not have a vehicle specific GHG emission benchmark include: large tractor and compact tractor; therefore a general diesel fuel benchmark has been applied to these vehicle types. It is noted that these vehicles have negligible contribution in terms of GHG emissions for the LA.

#### *2.1.1.4 Baseline Year GHG Emission Recalculation Policy*

The following GHG Emission Recalculation Policy has been defined for AB&C Borough Council:

- Making meaningful comparisons of emissions data over time is an integral part of any GHG accounting assessment that aims to be credible, transparent and useful. A prerequisite for such meaningful comparisons is a consistent data set over time, or in other words, comparisons of 'like' with 'like' over time. A baseline year is a reference point in the past with which current emissions can be compared. To maintain the consistency between data sets, baseline year emissions need to be recalculated when new data or methodological approaches become available. As such, baseline year emissions, as calculated in this report, shall be retroactively recalculated when updating the BEI to reflect any future changes in either data set availability or emission accounting methodologies that would otherwise compromise the consistency of emission measurement over time and the integrity of the BEI.

### 2.1.2 Vehicle Fleet Capital Value and Operational Costs

The overall capital values for all vehicles and each vehicle type as well as the associated operational costs have been determined. Table 2-3 and Figure 2-3 show an analysis of the capital values in 2022 and the OpEx for one year for each vehicle type.

Table 2-3: Capital Value in 2022 and OpEx in average year for Each Vehicle Type

| Vehicle Type | Capital Value (£) | 1-year OpEx (£) |
|---|---|---|
| Refuse Collection Vehicle (RCV) 32T | £1,147,303 | £152,814 |
| RCV 26T | £10,788,857 | £1,528,140 |
| RCV 18T | £2,166,543 | £329,667 |
| Macpac L 12T | £1,425,357 | £219,063 |
| Large Cage 7.5T | £621,180 | £170,304 |
| Small Cage 3.5T | £178,500 | £50,640 |
| Large Panel Van | £1,325,300 | £526,400 |
| Small Panel Van | £932,280 | £564,480 |
| Beavertail 7.5T | £822,600 | £156,840 |
| Large Tractor | £626,625 | £109,773 |
| Compact Tractor | £464,167 | £172,500 |
| **Total** | **£20,498,712** | **£3,980,621** |

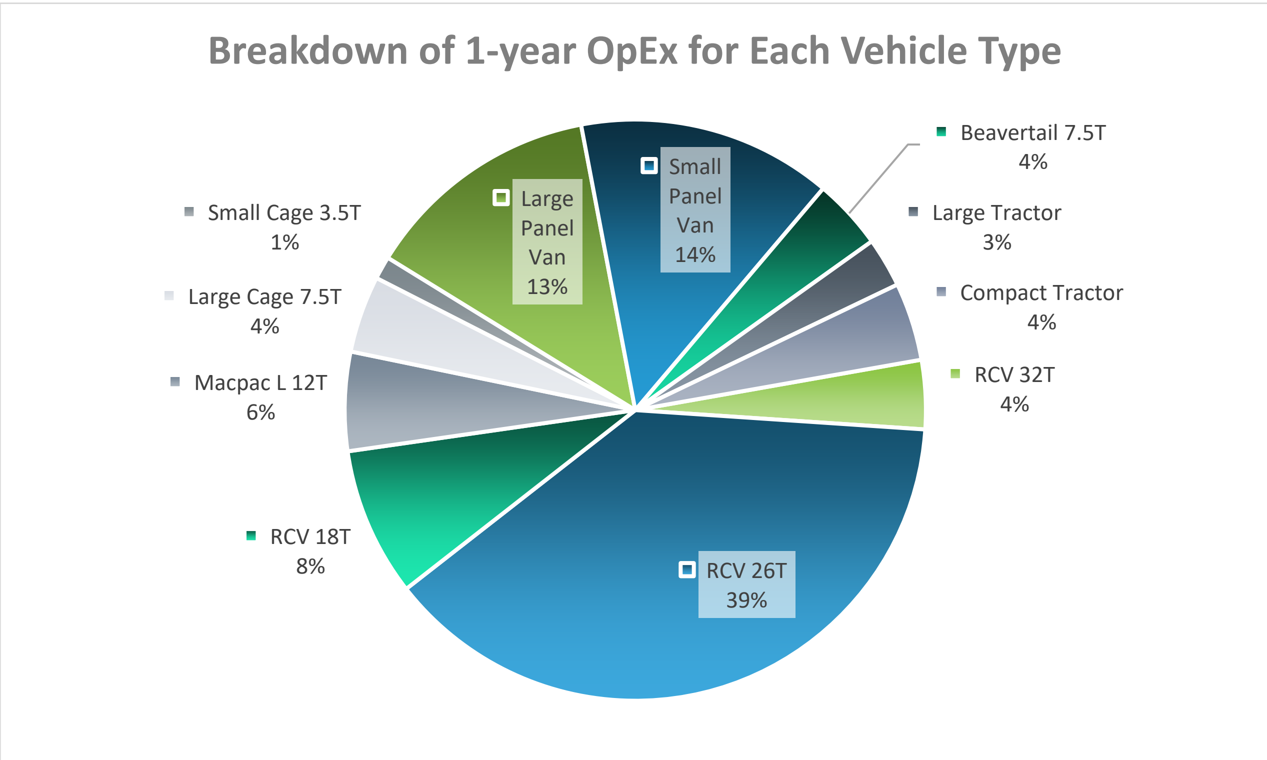


Figure 2-3: Breakdown of Operational Expenditure in 2023 after One Year for Each Vehicle Type

RCV 26T has the highest capital value and operational costs, which is reflective of the number of the vehicle type and level of use by the LA. RCV 18T and Macpac L 12T are the second and third highest respectively in terms of capital value. Small panel vans have the second highest operational costs (14%), followed by large panel vans at 13%.

## 2.2 Ards and North Down Borough Council

### 2.2.1 Vehicle Fleet Baseline Greenhouse Gas Emissions

The GHG emissions for AND's vehicle fleet were estimated for the baseline year of 2022.

#### *2.2.1.1 Methodology*

- Data on number of vehicles by type, kilometres travelled, fuel type used, and fuel usage in 2022 were sourced from the LA and used to calculate the GHG emissions from each vehicle type (in the unit tonnes of Carbon dioxide equivalent - $tCO_2$-eq). Preliminary analyses have been conducted with regard to the obtained data.
- Vehicle emission benchmarks were sourced to calculate the GHG emissions associated with each vehicle type and fuel type. The benchmarks were considered based on varying vehicle weights for each vehicle type. These emission benchmarks have been sourced from
    - GOV.UK. (2022). *Greenhouse gas reporting: conversion factors 2022*. *Conversion factors 2022: full set (for advanced users).* Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 (Accessed 27 June 2023).
    - Transport Infrastructure Ireland (2021). *TII Web Application Portal - Carbon Tool*. *Emission Factors*. web.tii.ie. Available at: https://web.tii.ie/ (Accessed 27 June 2023).
- The figure for fuel usage or distance travelled was multiplied by the relevant transport emission benchmark used for the vehicle type to provide an estimate of the total emissions for the vehicle type.

#### *2.2.1.2 Results*

The LA vehicle fleet generated an overall of 1,138.1 $tCO_2$-eq in the baseline year. Table 2-4 and Figure 2-4 provide a breakdown of GHG emissions in the baseline year for each vehicle type.

**Table 2-4: GHG Emissions in 2022 from Each Vehicle Type**

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| 4x4 | 27.90 | 2% |
| Car | 3.20 | 0.28% |
| Cherry Picker | 0.95 | 0.08% |
| Excavator | 8.53 | 1% |
| Generator | 0.40 | 0.04% |
| Glass Collection | 32.61 | 3% |
| Hook Loader | 52.69 | 5% |
| Lorry | 7.64 | 1% |
| Macpac | 101.82 | 9% |

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| Panel Van | 61.13 | 5% |
| RCV | 357.65 | 31% |
| Rear End Loader (REL) | 88.53 | 8% |
| Rollpacker | 0.10 | 0.01% |
| Street Washer | 0.33 | 0.03% |
| Sweeper | 61.64 | 5% |
| Tipper | 121.02 | 11% |
| Tractor Unit | 77.03 | 7% |
| Tractor | 15.57 | 1% |
| Van | 119.35 | 10% |
| **Total** | **1,138.08** | **100%** |

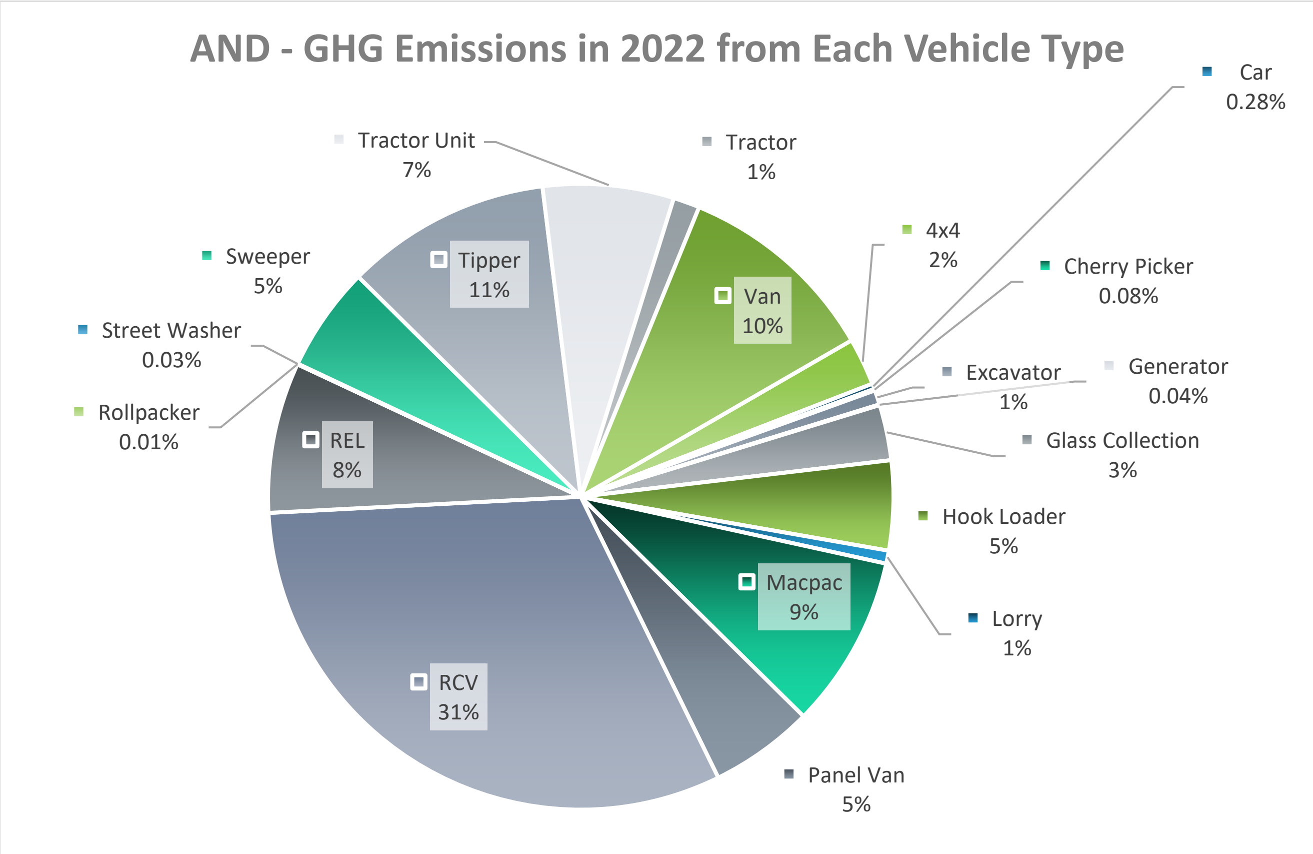


Figure 2-4: GHG Emissions in 2022 from All Vehicles for Each Vehicle Type for the Local Authority

RCVs were the primary contributor of GHG emissions among the overall LA vehicle fleet (31%).

Tippers account for 11% of total vehicle fleet emissions, followed by Vans (10%) and Macpacs (9%). Emissions from cherry pickers, generators, street washers and rollpackers were relatively minor, which reflects the level of use for these vehicle types.

For further insight, a breakdown of the number of each vehicle type in 2022 is presented in Table 2-5. Breakdowns of the distance travelled and the level of fuel usage in the baseline year 2022 for each type of vehicle are also shown in Figure 2-5 and Figure 2-6.

**Table 2-5: Breakdown of Number of Each Vehicle Type in 2022**

| Vehicle Type | Number of Vehicle Type | Percentage Breakdown |
|---|---|---|
| 4x4 | 18 | 7% |
| Car | 3 | 1% |
| Cherry Picker | 4 | 1% |
| Excavator | 2 | 1% |
| Generator | 1 | 0% |
| Glass Collection | 5 | 2% |
| Hook Loader | 3 | 1% |
| Lorry | 2 | 1% |
| Macpac | 11 | 4% |
| Panel Van | 41 | 15% |
| RCV | 43 | 16% |
| REL | 4 | 1% |
| Rollpacker | 1 | 0% |
| Street Washer | 1 | 0% |
| Sweeper | 15 | 6% |
| System Default | 7 | 3% |
| Tipper | 9 | 3% |
| Tractor Unit | 6 | 2% |
| Tractor | 4 | 1% |
| Van | 89 | 33% |
| **Total*** | **269** | **100%** |

* Vehicle count includes hired/leased vehicles for the time period.

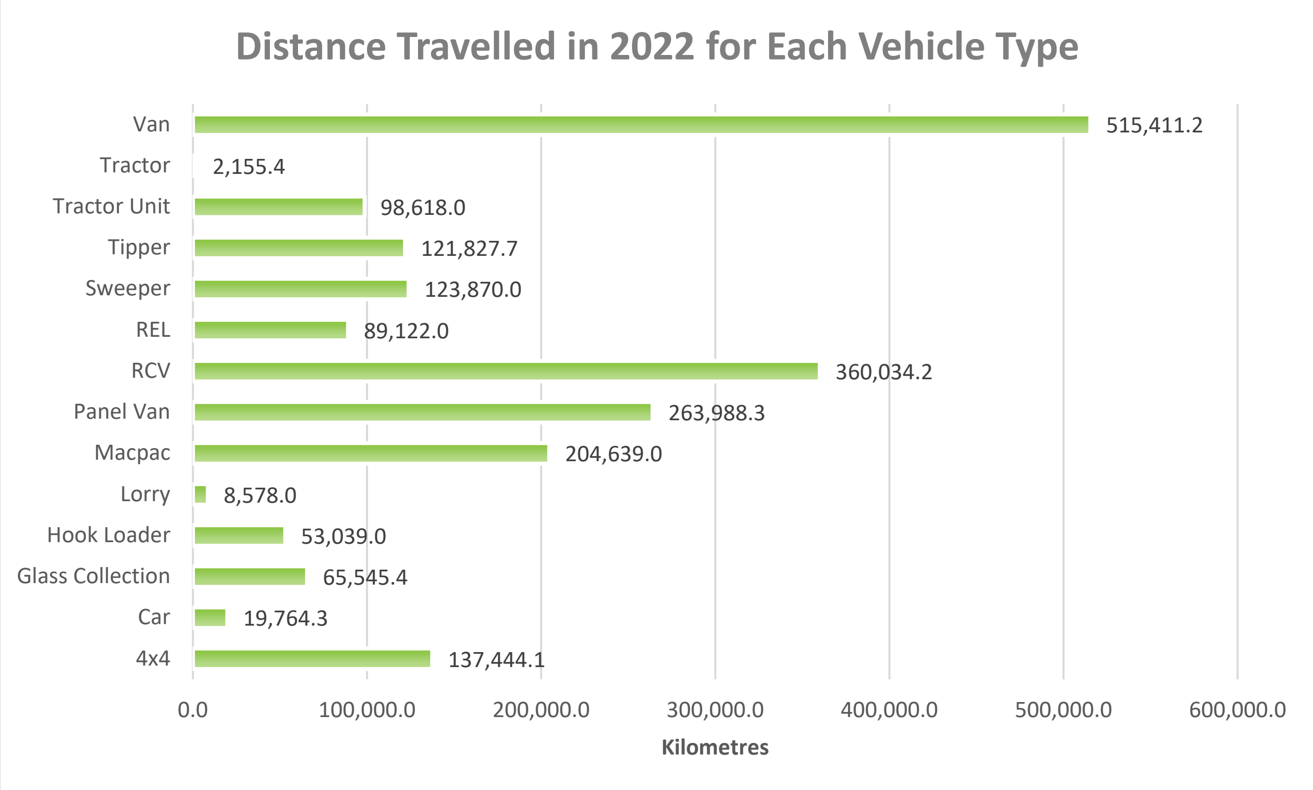


**Figure 2-5: Distance Travelled in 2022 for Each Vehicle Type**

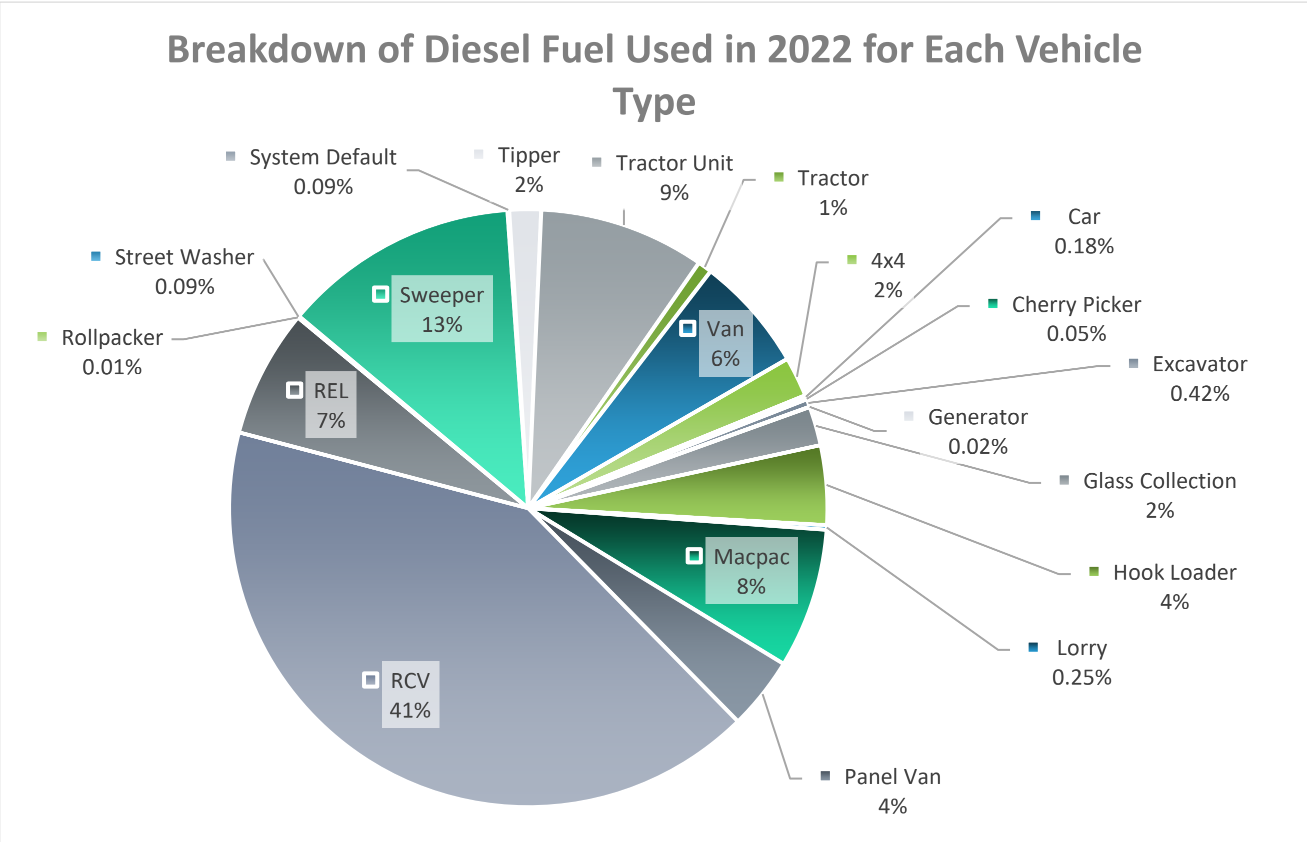


**Figure 2-6: Breakdown of Diesel Fuel Used in 2022 by Each Vehicle Type**

The largest number of vehicle types are Vans (33%), RCV (16%) and Panel Vans (15%). The top three vehicle types with the highest mileage in 2022 were Vans, RCVs and Panel Vans. RCVs had the highest fuel usage in 2022 among all other vehicle types.

Diesel fuel was the only fuel type used for the LA vehicle fleet.

#### *2.2.1.3 Assumptions and Limitations*

- The vehicles within this LA fleet that do not have a vehicle specific GHG emission benchmark include: cherry picker, excavator, generator, and rollpacker; therefore a general diesel fuel benchmark has been applied to these vehicle types. It is noted that these vehicles have negligible contribution in terms of GHG emissions for the LA.

#### *2.2.1.4 Baseline Year GHG Emission Recalculation Policy*

The following GHG Emission Recalculation Policy has been defined for A&ND Borough Council:

- Making meaningful comparisons of emissions data over time is an integral part of any GHG accounting assessment that aims to be credible, transparent and useful. A prerequisite for such meaningful comparisons is a consistent data set over time, or in other words, comparisons of 'like' with 'like' over time. A baseline year is a reference point in the past with which current emissions can be compared. In order to maintain the consistency between data sets, baseline year emissions need to be recalculated when new data or methodological approaches become available. As such, baseline year emissions, as calculated in this report, shall be retroactively recalculated when updating the BEI to reflect any future changes in either data set availability or emission accounting methodologies that would otherwise compromise the consistency of emission measurement over time and the integrity of the BEI.

### 2.2.2 Vehicle Fleet Capital Value and Operational Costs

An analysis of the CapEx and OpEx costs of the vehicle fleet for the LA was not conducted due to a lack of cost data for the LA's vehicle fleet.

## 2.3 Louth County Council

### 2.3.1 Vehicle Fleet Baseline Greenhouse Gas Emissions

The GHG emissions for LCC's vehicle fleet were estimated for the baseline year of 2022.

#### *2.3.1.1 Methodology*

- Data on number of vehicles by type, kilometres travelled, fuel type used, and fuel usage in 2022 were sourced from the LA and used to calculate the GHG emissions from each vehicle type. The data obtained were based on depot location (in the unit tonnes of Carbon dioxide equivalent - $tCO_2$-eq). Preliminary analyses have been conducted with regard to the obtained data.
- Vehicle emission benchmarks were sourced to calculate the GHG emissions associated with each vehicle type and fuel type. The benchmarks were considered based on varying vehicle weights for each vehicle type. These emission benchmarks have been sourced from
  - GOV.UK. (2022). *Greenhouse gas reporting: conversion factors 2022*. *Conversion factors 2022: full set (for advanced users).* Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 (Accessed 27 June 2023).
  - Transport Infrastructure Ireland (2021). *TII Web Application Portal - Carbon Tool*. *Emission Factors*. web.tii.ie. Available at: https://web.tii.ie/ (Accessed 27 June 2023).
- Due to a lack of data on distance travelled and fuel usage based on vehicle type, the GHG emissions for the LA vehicle fleet were estimated using the relevant Total figures.
- The number of each vehicle type was multiplied by the associated transport emissions benchmarks to calculate the total $kgCO_2e/km$ benchmark for all vehicles of all types. An average emissions benchmark was then obtained for all vehicle types based on the total fleet number. The percentage (%) of $kgCO_2e/km$ per vehicle type was then determined based on the fraction of the vehicle type against the overall fleet number.
- Emissions per vehicle type were estimated by multiplying the total distance travelled for the year by the percentage (%) of $kgCO_2e/km$ per vehicle type and the average vehicle benchmark. The greenhouse gas (GHG) emissions for Louth County Council's (LCC) vehicle fleet were estimated for the baseline year of 2022.

#### *2.3.1.2 Results*

The LA vehicle fleet generated an overall of 429.4 $tCO_2$-eq in the baseline year. Table 2-6 and Figure 2-7 breakdown the GHG emissions in 2022 from each vehicle type for the entire fleet of the LA.

**Table 2-6: GHG Emissions in 2022 from Each Vehicle Type**

| Vehicle Type | Vehicle Number | Emissions per vehicle type ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|---|
| 3.5t Pickups | 12 | 42.60 | 10% |
| 7.5t Pickups | 11 | 39.05 | 9% |
| 10-12t Pickups | 1 | 4.34 | 1% |

| Vehicle Type | Vehicle Number | Emissions per vehicle type ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|---|
| 16t Pickup | 2 | 8.67 | 2% |
| 18t Truck | 15 | 106.31 | 25% |
| 26t Truck | 3 | 21.26 | 5% |
| 4x4 Vehicles | 16 | 23.17 | 5% |
| Gritters | 1 | 4.34 | 1% |
| Small Vans | 31 | 38.73 | 9% |
| Large Vans | 24 | 43.63 | 10% |
| Library Trucks | 1 | 3.55 | 1% |
| Patchers (Other) | 4 | 28.35 | 7% |
| Salters (18t) | 4 | 28.35 | 7% |
| Salters (26t) | 3 | 21.26 | 5% |
| Suction Sweepers (Large) | 2 | 8.67 | 2% |
| Suction Sweepers (Small) | 2 | 7.10 | 2% |
| **Total** | **132** | **429.38** | **100%** |

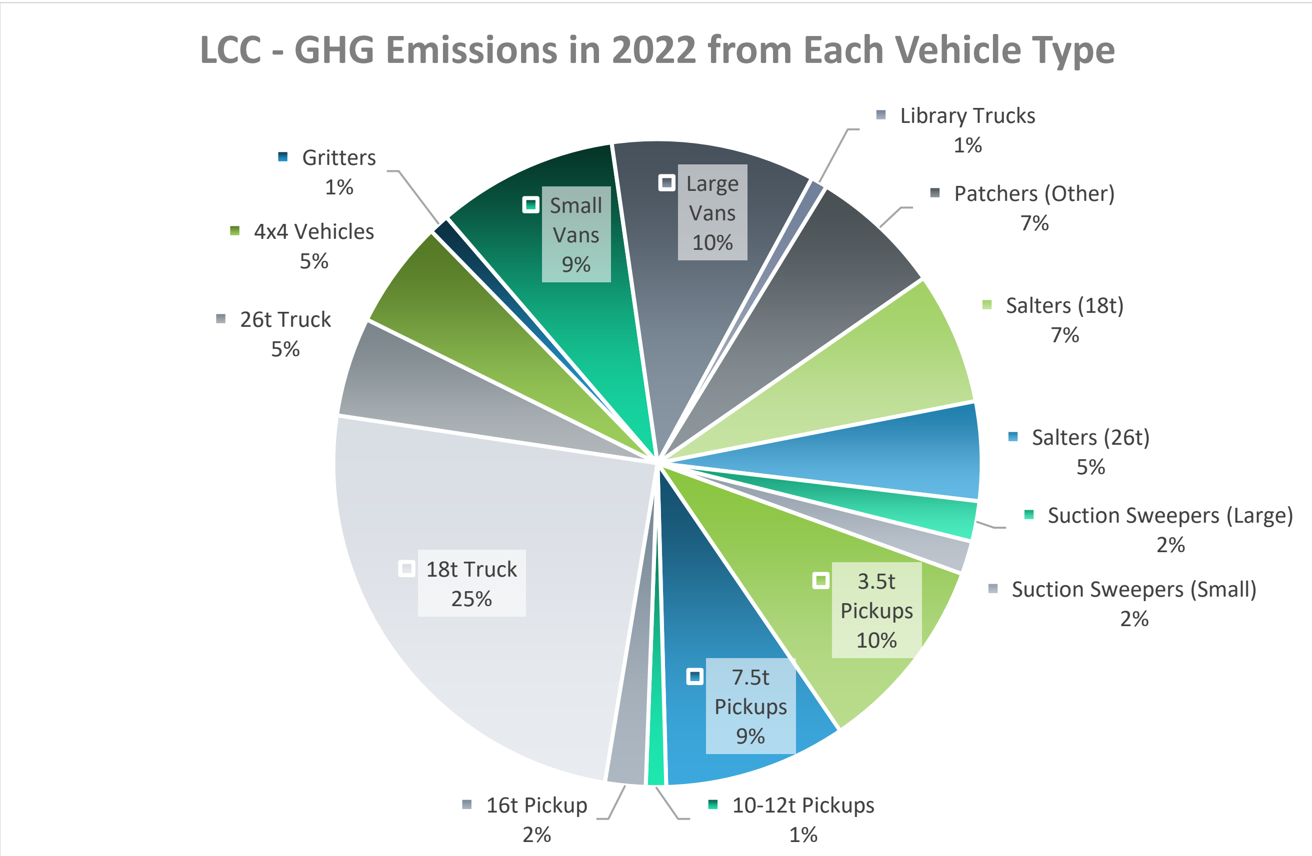


**Figure 2-7: GHG Emissions in 2022 from All Vehicles for Each Vehicle Type for the Local Authority**

18t Trucks were the primary contributor of GHG emissions among the overall LA vehicle fleet (25%).

Large Van accounts for 10% of total vehicle fleet emissions, followed by 3.5t Pickups (10%), 7.5t Pickups (9%) and Small Vans (9%). Emissions from Gritters, 10-12t Pickups and Library Trucks were relatively minor, which reflects the number of the vehicle types.

For further insight, a breakdown of the number of each vehicle type in 2022 by fuel type is presented in Table 2-7:

**Table 2-7: Breakdown of Number of Vehicles by Type of Fuel Used in 2022**

| Vehicle Type | Fuel Type | | Percentage Breakdown of Total Vehicle Number |
|---|---|---|---|
| | Diesel | Electric | |
| 3.5t Pickups | 12 | - | 8% |
| 7.5t Pickups | 11 | - | 8% |
| 10-12t Pickups | 1 | - | 1% |
| 16t Pickup | 2 | - | 1% |
| 18t Truck | 15 | - | 10% |
| 26t Truck | 3 | - | 2% |
| 4x4 Vehicles | 16 | - | 11% |
| Gritters | 1 | - | 1% |
| Small Vans | 27 | 4 | 21% |
| Large Vans | 24 | - | 17% |
| Lawnmowers/Tractors | 13 | - | 9% |
| Library Trucks | 1 | - | 1% |
| Patchers (Other) | 4 | - | 3% |
| Salters (18t) | 4 | - | 3% |
| Salters (26t) | 3 | - | 2% |
| Suction Sweepers (Large) | 2 | - | 1% |
| Suction Sweepers (Small) | 2 | - | 1% |
| **Total*** | **141** | **4** | **100%** |

* Vehicle count includes hired/leased vehicles for the time period.

The largest number of vehicle types are Small Vans (21%), Large Vans (17%) and 4x4 Vehicles (11%).

#### *2.3.1.3 Assumptions and Limitations*

- It is assumed that there is an even spread of vehicle types and level of use at each depot location.
- The vehicles within this LA fleet that have been excluded from the GHG emissions analysis due to the lack of vehicle specific benchmarks that can be used to estimate emissions from these vehicle types include: lawnmowers/tractors.

#### *2.3.1.4 Baseline Year GHG Emission Recalculation Policy*

The following GHG Emission Recalculation Policy has been defined for LCC.

- Making meaningful comparisons of emissions data over time is an integral part of any GHG accounting assessment that aims to be credible, transparent and useful. A prerequisite for such meaningful comparisons is a consistent data set over time, or in other words, comparisons of 'like' with 'like' over time. A baseline year is a reference point in the past with which current emissions can be compared. In order to maintain the consistency between data sets, baseline year emissions need to be recalculated when new data or methodological approaches become available. As such, baseline year emissions, as calculated in this report, shall be retroactively recalculated when updating the BEI to reflect any future changes in either data set availability or emission accounting methodologies that would otherwise compromise the consistency of emission measurement over time and the integrity of the BEI.

### 2.3.2 Vehicle Fleet Capital Value and Operational Costs

An analysis of the CapEx and OpEx costs of the vehicle fleet for the LA was not conducted due to a lack of cost data.

## 2.4 Monaghan County Council

### 2.4.1 Vehicle Fleet Baseline Greenhouse Gas Emissions

The GHG emissions for MCC's vehicle fleet were estimated for the baseline year of 2022.

#### *2.4.1.1 Methodology*

- Data on number of vehicles by type, kilometres travelled, fuel type used, and fuel usage in 2022 were sourced from the LA and used to calculate the GHG emissions from each vehicle type (in the unit tonnes of Carbon dioxide equivalent - $tCO_2$-eq). Preliminary analyses have been conducted with regard to the obtained data.
- Vehicle emission benchmarks were sourced to calculate the GHG emissions associated with each vehicle type and fuel type. The benchmarks were considered based on varying vehicle weights for each vehicle type. These emission benchmarks have been sourced from
  - GOV.UK. (2022). *Greenhouse gas reporting: conversion factors 2022*. *Conversion factors 2022: full set (for advanced users).* Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 (Accessed 27 June 2023).
  - Transport Infrastructure Ireland (2021). *TII Web Application Portal - Carbon Tool*. *Emission Factors*. web.tii.ie. Available at: https://web.tii.ie/ (Accessed 27 June 2023).
- The figure for fuel usage or distance travelled was multiplied by the relevant transport emission benchmark used for the vehicle type to provide an estimate of the total emissions for the vehicle type.

#### *2.4.1.2 Results*

The LA vehicle fleet generated an overall of 447.7 $tCO_2$-eq in the baseline year. Table 2-8 and Figure 2-8 breakdown the GHG emissions in 2022 from each vehicle type for the entire fleet of the LA.

**Table 2-8: GHG Emissions in 2022 from Each Vehicle Type**

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| Library Van | 0.64 | 0.14% |
| Lorry | 185.56 | 41% |
| Pickup (HCV) | 128.83 | 29% |
| Road Gritter | 9.25 | 2% |
| Sprayer | 5.82 | 1% |
| Velocity Patcher | 12.29 | 3% |
| Pickup (LCV) | 27.22 | 6% |
| Pickup & Tipper | 23.80 | 5% |
| Van | 39.26 | 9% |
| Digger | 1.97 | 0.44% |

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| Gritter | 10.38 | 2% |
| Ride on Lawnmower | 1.57 | 0.35% |
| Teleporter | 0.15 | 0.03% |
| Tractor | 0.97 | 0.22% |
| **Total** | **447.71** | **100%** |

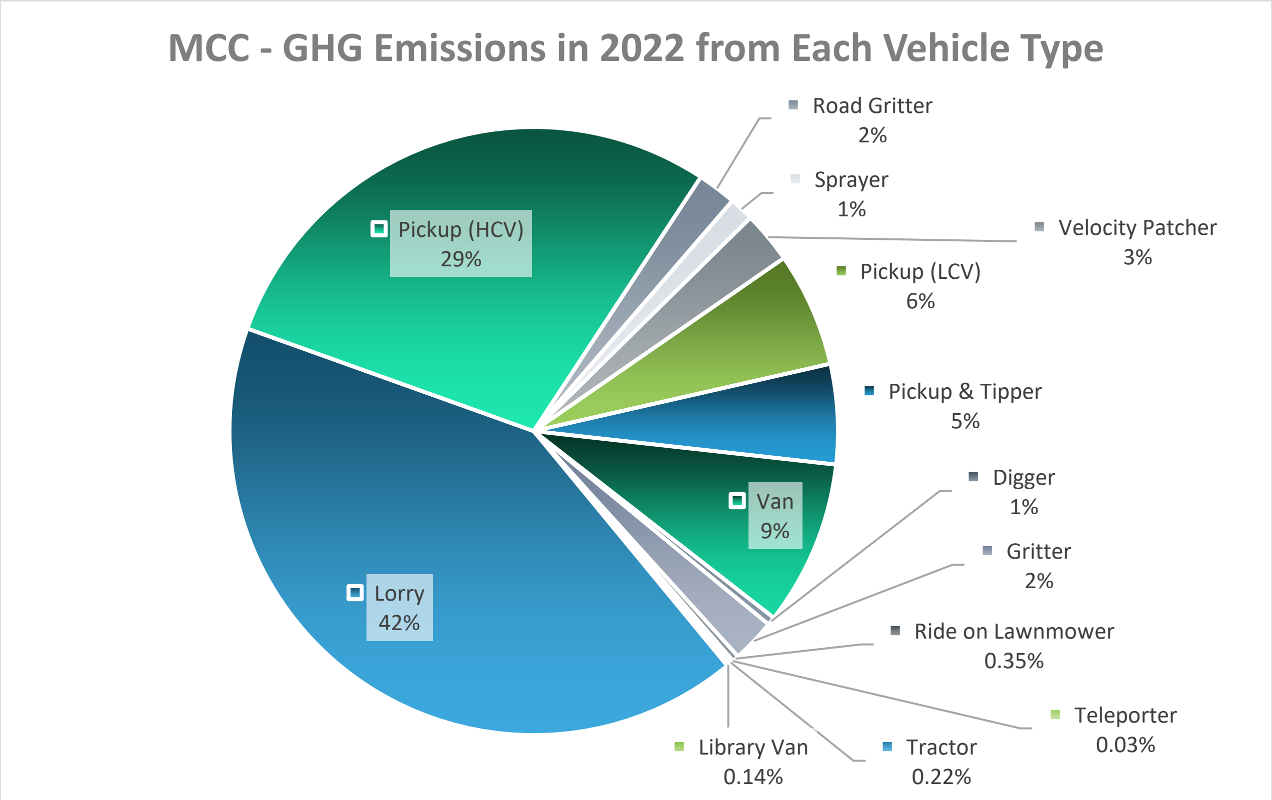


**Figure 2-8: GHG Emissions in 2022 from All Vehicles for Each Vehicle Type for the Local Authority**

Lorries were the primary contributor of GHG emissions among the overall LA vehicle fleet (42%). The high number of this vehicle type, the large distance travelled and amount of fuel used justify the high amount of GHG emissions produced per year (see Table 2-9, Figure 2-9 and Figure 2-10).

This is followed by Pickups (HCV) at 29% and Vans (8%). Emissions from Teleporters, Library Vans, Tractors and Ride on Lawnmowers were relatively minor, which reflects the number and level of use for the vehicle types.

For further insight, a breakdown of the number of each vehicle type in 2022 by fuel type is presented in Table 2-9. Breakdowns of the distance travelled and the level of fuel usage in the baseline year 2022 for each type of vehicle are also shown in Figure 2-9 and Figure 2-10.

**Table 2-9: Breakdown of Number of Vehicles by Type of Fuel Type in 2022**

| Vehicle Type | Fuel Type | | | Percentage Breakdown of Total Vehicle Number |
|---|---|---|---|---|
| | Diesel | Electric | Green Diesel* | |
| Library Van | 1 | 0 | 0 | 2% |
| Lorry | 9 | 0 | 0 | 16% |
| Pickup (HCV) | 8 | 0 | 0 | 14% |
| Road Gritter | 1 | 0 | 0 | 2% |
| Sprayer | 1 | 0 | 0 | 2% |
| Velocity Patcher | 1 | 0 | 0 | 2% |
| 4x4 | 1 | 0 | 0 | 2% |
| Pickup (LCV) | 7 | 0 | 0 | 12% |
| Pickup & Tipper | 2 | 0 | 0 | 3% |
| Van | 11 | 3 | 0 | 24% |
| Digger | 0 | 0 | 1 | 2% |
| Forklift | 0 | 0 | 1 | 2% |
| Gritter | 0 | 0 | 1 | 2% |
| Loader | 1 | 0 | 0 | 2% |
| Ride on Lawnmower | 3 | 0 | 1 | 7% |
| Roller | 0 | 0 | 1 | 2% |
| Teleporter | 0 | 0 | 1 | 2% |
| Tractor | 2 | 0 | 1 | 5% |
| **Total** | **48** | **3** | **7** | **100%** |
| **Percentage Breakdown** | **83%** | **5%** | **12%** | |

* Green diesel is also known as gasoil.

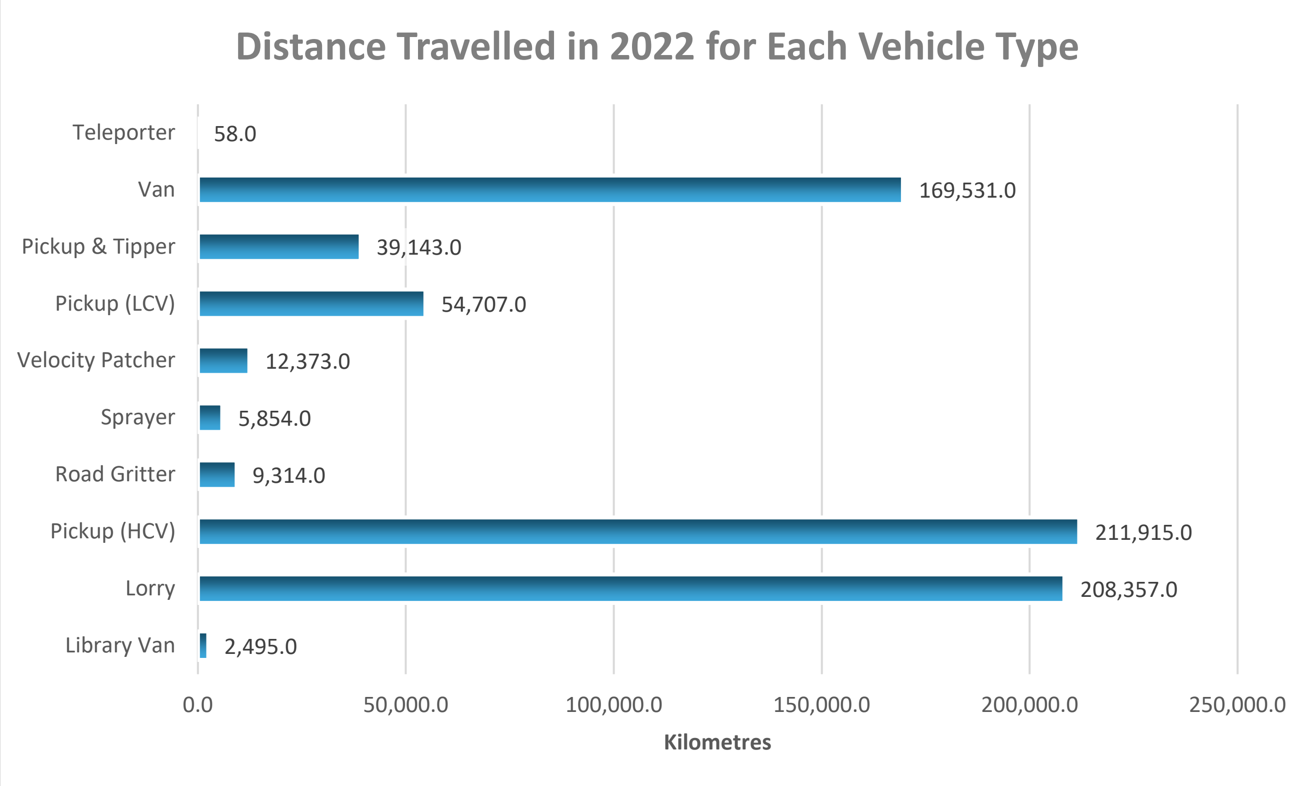


**Figure 2-9: Distance Travelled in 2022 for Each Vehicle Type**

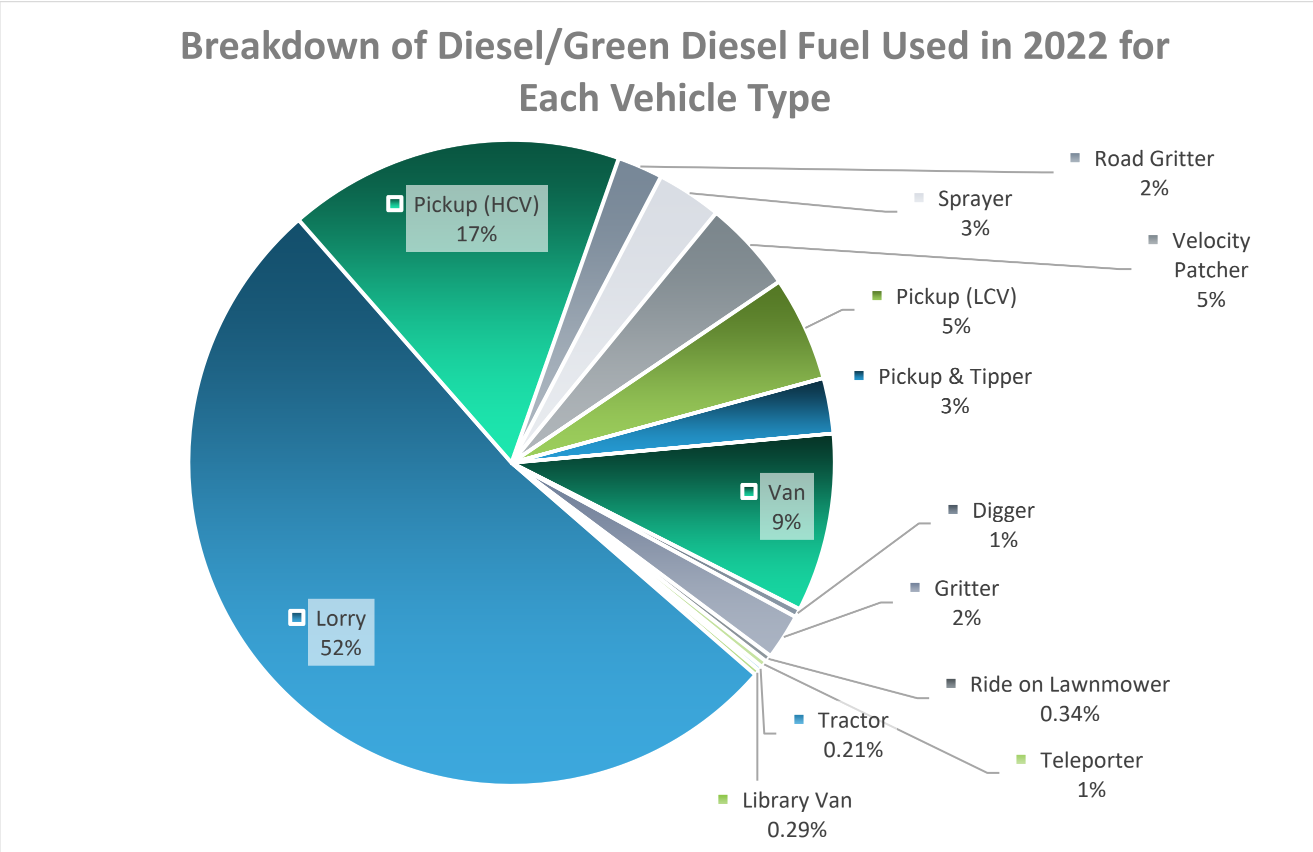


**Figure 2-10: Breakdown of Fuel Used in 2022 by Each Vehicle Type**

The largest number of vehicle types are Vans (24%), Lorries (16%) and Pickups (HCV) (14%). The top three vehicle types with the highest mileage in 2022 were Pickups (HCV), Lorries and Vans. Lorries had the highest fuel usage in 2022 among all other vehicle types.

#### *2.4.1.3 Assumptions and Limitations*

- Electric Vehicles within the fleet are assumed to be net zero in terms of GHG emissions as it is envisaged grid electricity will achieve net zero in the future.
- The vehicles within this LA fleet that do not have a vehicle specific GHG emission benchmark include: digger, forklift, gritter, loader, ride on lawnmower, roller, teleporter, and tractor; therefore a general diesel fuel benchmark has been applied to these vehicle types. It is noted that these vehicles have negligible contribution in terms of GHG emissions for the LA.

#### *2.4.1.4 Baseline Year GHG Emission Recalculation Policy*

The following GHG Emission Recalculation Policy has been defined for MCC.

- Making meaningful comparisons of emissions data over time is an integral part of any GHG accounting assessment that aims to be credible, transparent and useful. A prerequisite for such meaningful comparisons is a consistent data set over time, or in other words, comparisons of 'like' with 'like' over time. A baseline year is a reference point in the past with which current emissions can be compared. In order to maintain the consistency between data sets, baseline year emissions need to be recalculated when new data or methodological approaches become available. As such, baseline year emissions, as calculated in this report, shall be retroactively recalculated when updating the BEI to reflect any future changes in either data set availability or emission accounting methodologies that would otherwise compromise the consistency of emission measurement over time and the integrity of the BEI.

### 2.4.2 Vehicle Fleet Capital Value and Operational Costs

The overall capital values for all vehicles and each vehicle type as well as the associated operational costs have been determined. Table 2-10 and Figure 2-11 show an analysis of the capital values in 2021 and the OpEx for each vehicle type.

Table 2-10: Capital Value in 2021 and OpEx for Each Vehicle Type

| Vehicle Type | Overall Capital Value in 2021 (€) | Overall OpEx (€) |
|---|---|---|
| **Heavy Commercial Vehicle** | | |
| Library Van | €21,000 | €7,977 |
| Lorry | €703,500 | €75,293 |
| Pickup (HCV) | €200,200 | €25,539 |
| Road Gritter | €- | €4,559 |
| Sprayer | €24,500 | €23,056 |
| Velocity Patcher | €270,000 | €5,348 |
| **Total** | **€1,219,200** | **€141,771** |
| **Light Commercial Vehicle** | | |
| 4x4 | €3,500 | €865 |
| Pickup (LCV) | €72,450 | €12,254 |
| Pickup & Tipper | €57,400 | €2,563 |
| Van | €105,350 | €24,028 |
| **Total** | **€238,700** | **€39,711** |
| **Work Vehicle** | | |
| Digger | €17,500 | €4,182 |
| Forklift | €- | €- |
| Gritter | €17,500 | €19,775 |
| Loader | €- | €- |
| Ride on Lawnmower | €26,600 | €3,260 |
| Roller | €18,900 | €- |
| Teleporter | €28,000 | €1,542 |
| Tractor | €21,700 | €14,109 |
| **Total** | **€130,200** | **€42,867** |
| **Overall Total** | **€1,588,100** | **€224,348** |

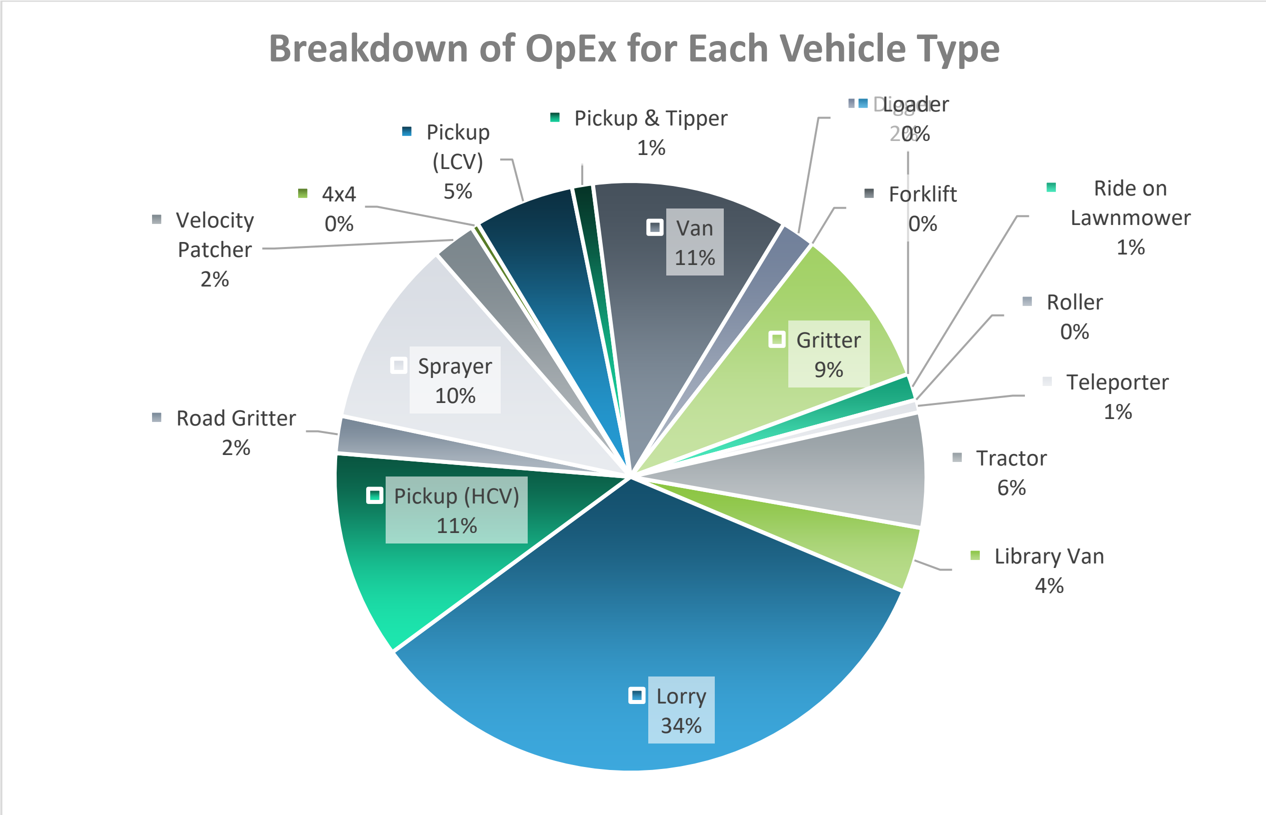


**Figure 2-11: Breakdown of Operational Expenditure for Each Vehicle Type**

Lorries have the highest capital value and operational costs, which is reflective of the number of the vehicle type and level of use by the LA.

## 2.5 Newry, Mourne and Down District Council

### 2.5.1 Vehicle Fleet Baseline Greenhouse Gas Emissions

The GHG emissions for NMD's vehicle fleet were estimated for the baseline year of 2022.

#### *2.5.1.1 Methodology*

- Data on number of vehicles by type, kilometres travelled, fuel type used, and fuel usage in 2022 were sourced from the LA and used to calculate the GHG emissions from each vehicle type (in the unit tonnes of Carbon dioxide equivalent - $tCO_2$-eq). Preliminary analyses have been conducted with regard to the obtained data.
- Vehicle emission benchmarks were sourced to calculate the GHG emissions associated with each vehicle type and fuel type. The benchmarks were considered based on varying vehicle weights for each vehicle type. These emission benchmarks have been sourced from
  - GOV.UK. (2022). *Greenhouse gas reporting: conversion factors 2022*. *Conversion factors 2022: full set (for advanced users).* Available at: https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2022 (Accessed 27 June 2023).
  - Transport Infrastructure Ireland (2021). *TII Web Application Portal - Carbon Tool*. *Emission Factors*. web.tii.ie. Available at: https://web.tii.ie/ (Accessed 27 June 2023).
- The figure for fuel usage or distance travelled was multiplied by the relevant transport emission benchmark used for the vehicle type to provide an estimate of the total emissions for the vehicle type.

#### *2.5.1.2 Results*

The LA vehicle fleet generated an overall of 669.9 $tCO_2$-eq in the baseline year. Table 2-11 and Figure 2-12 breakdown the GHG emissions in 2022 from each vehicle type for the entire fleet of the LA.

**Table 2-11: GHG Emissions in 2022 from Each Vehicle Type**

| Vehicle Type | Emissions ($tCO_2$-eq) | Percentage Breakdown |
|---|---|---|
| 4x4 | 1.47 | 0.2% |
| Digger | 1.11 | 0.2% |
| Hook Loader | 41.94 | 6.3% |
| Mower | 7.12 | 1.1% |
| Pick Up | 2.53 | 0.4% |
| RCV | 370.15 | 55.3% |
| Sweeper | 49.44 | 7.4% |
| Tipper | 122.68 | 18.3% |
| Tractor | 24.94 | 3.7% |
| Van | 48.49 | 7.2% |
| **Total** | **669.88** | **100%** |

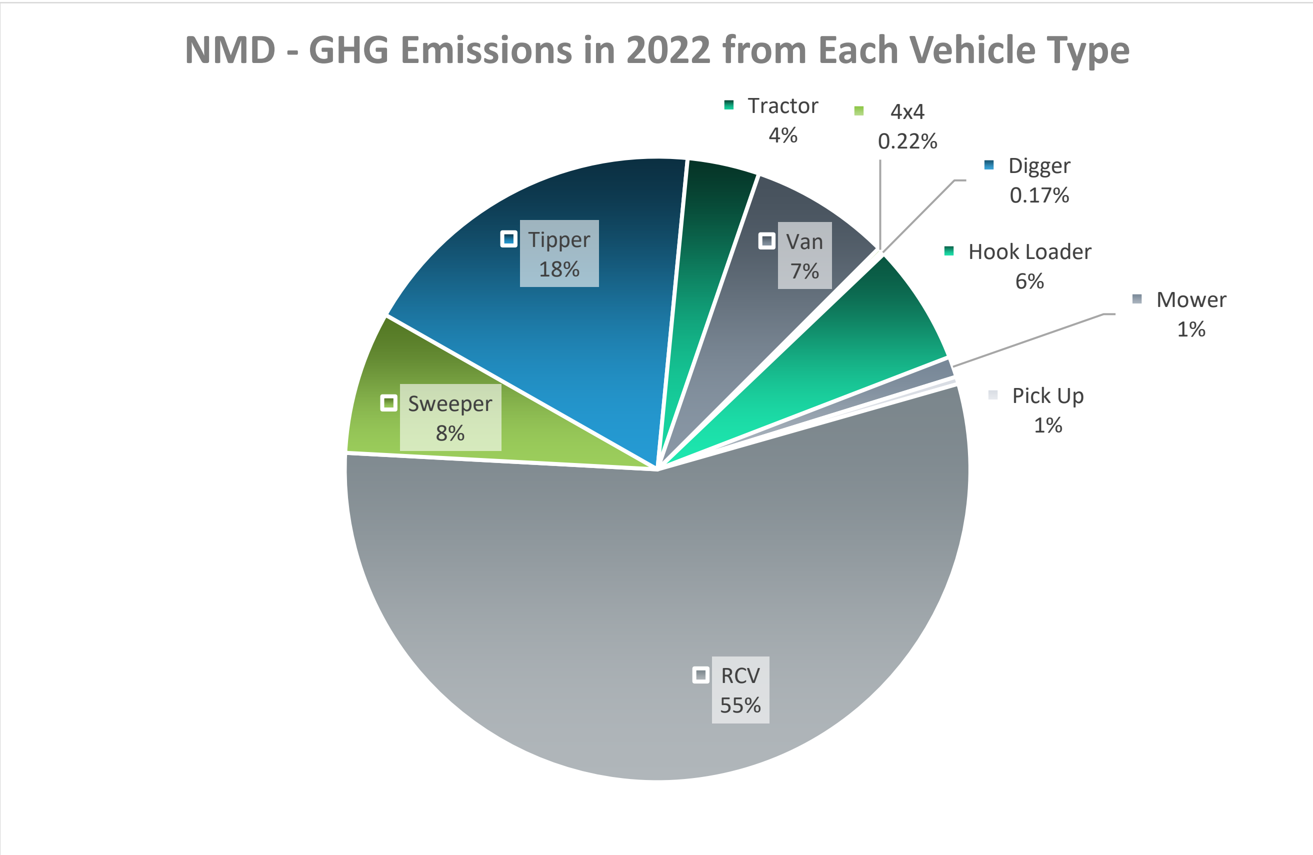


**Figure 2-12: GHG Emissions in 2022 from All Vehicles for Each Vehicle Type for the Local Authority**

RCVs were the primary contributor of GHG emissions among the overall LA vehicle fleet (55%). The high number of this vehicle type and the large distance travelled and level of fuel usage justify the high amount of GHG emissions produced during the baseline year of 2022 (see Table 2-12, Figure 2-13 and Figure 2-14).

This is followed by Tippers at 18%, Sweepers (8%) and Vans (7%). Emissions from 4x4 vehicles and Diggers were relatively minor, which reflects the level of use for the vehicle type.

For further insight, a breakdown of the number of each vehicle type in 2022 is presented in Table 2-12. Breakdowns of the distance travelled and the level of fuel usage in the baseline year 2022 for each type of vehicle are also shown in Figure 2-13 and Figure 2-14.

**Table 2-12: Breakdown of Number of Each Vehicle Type in 2022**

| Vehicle Type | Number of Vehicle Type | Percentage Breakdown |
|---|---|---|
| 4x4 | 3 | 2% |
| Car | 1 | 1% |
| Digger | 2 | 1% |
| Hook Loader | 2 | 1% |
| Mower | 4 | 2% |
| Pick Up | 2 | 1% |
| Quad | 2 | 1% |
| RCV | 54 | 33% |
| Sweeper | 21 | 13% |
| Tipper | 18 | 11% |
| Tractor | 8 | 5% |
| Van | 45 | 28% |
| **Total** | **162** | **100%** |

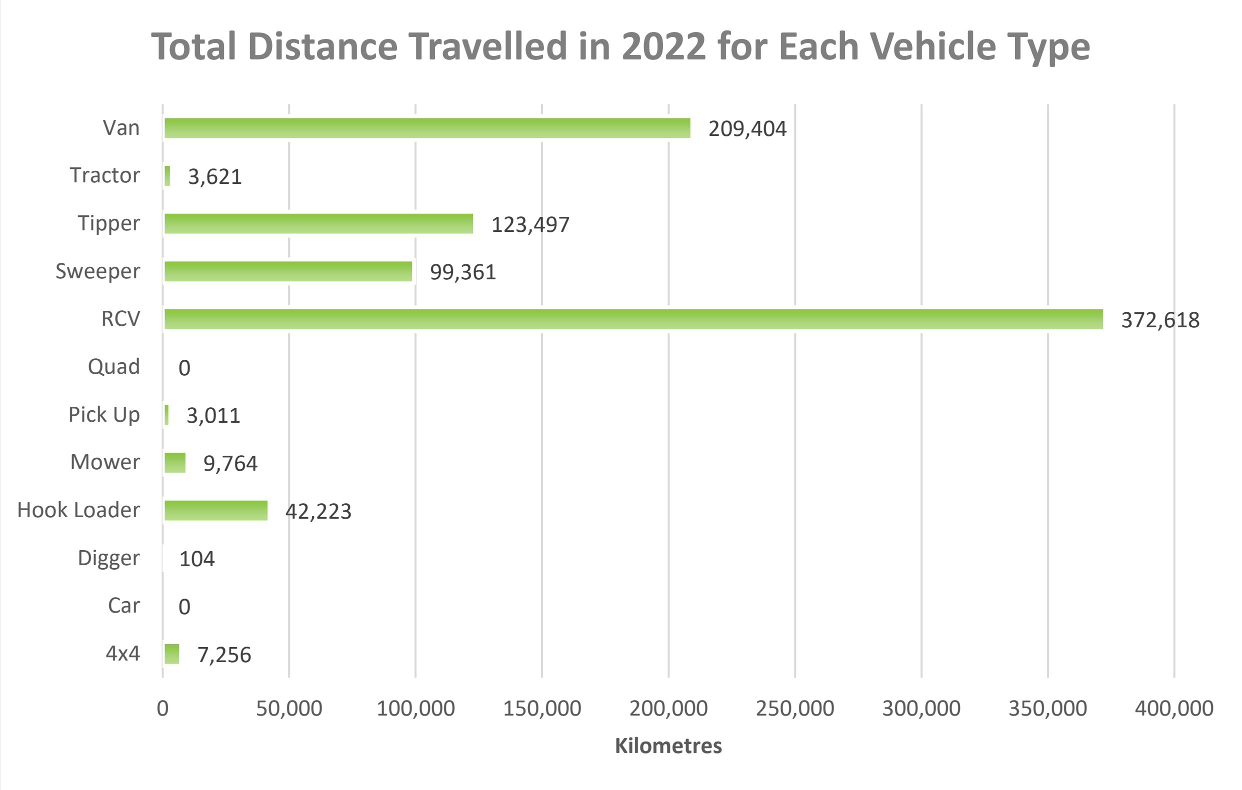


Figure 2-13: Distance Travelled in 2022 for Each Vehicle Type

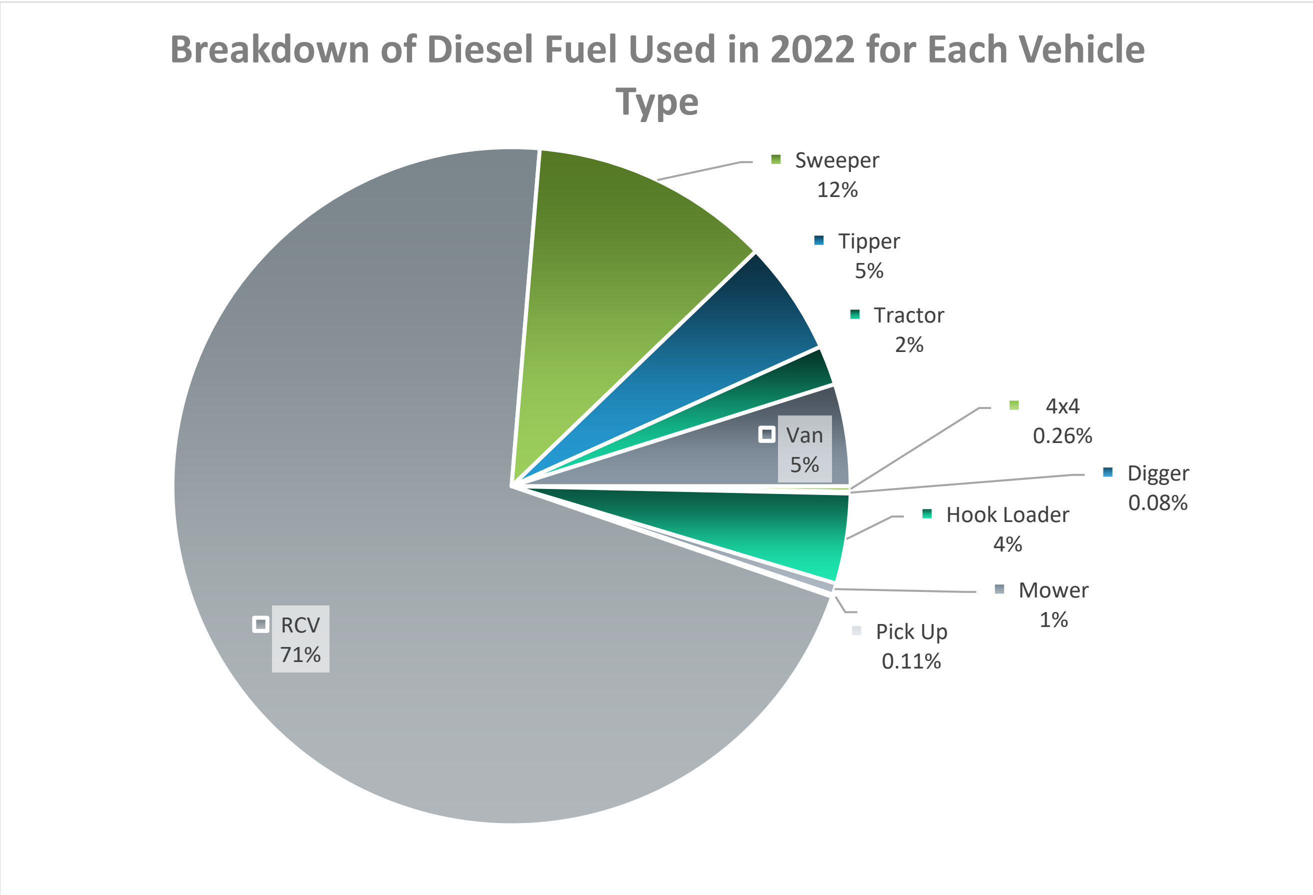


Figure 2-14: Breakdown of Fuel Used in 2022 by Each Vehicle Type

The largest number of vehicle types are RCV (33%), Van (28%) and Sweeper (13%). The top three vehicle types with the highest mileage in 2022 were RCVs, Vans and Tippers. RCVs had the highest fuel usage in 2022 among all other vehicle types.

#### *2.5.1.3 Assumptions and Limitations*

- Electric Vehicles within the fleet are assumed to be net zero in terms of GHG emissions as it is envisaged grid electricity will achieve net zero in the future.
- The vehicles within this LA fleet that do not have a vehicle specific GHG emission benchmark include: digger, mower, quad, and tractor; therefore a general diesel fuel benchmark has been applied to these vehicle types. It is noted that these vehicles have negligible contribution in terms of GHG emissions for the LA.

#### *2.5.1.4 Baseline Year GHG Emission Recalculation Policy*

The following GHG Emission Recalculation Policy has been defined for NM&D District Council:

- Making meaningful comparisons of emissions data over time is an integral part of any GHG accounting assessment that aims to be credible, transparent and useful. A prerequisite for such meaningful comparisons is a consistent data set over time, or in other words, comparisons of 'like' with 'like' over time. A baseline year is a reference point in the past with which current emissions can be compared. In order to maintain the consistency between data sets, baseline year emissions need to be recalculated when new data or methodological approaches become available. As such, baseline year emissions, as calculated in this report, shall be retroactively recalculated when updating the BEI to reflect any future changes in either data set availability or emission accounting methodologies that would otherwise compromise the consistency of emission measurement over time and the integrity of the BEI.

### 2.5.2 Vehicle Fleet Capital Value and Operational Costs

The overall capital values for all vehicles and each vehicle type as well as the associated operational costs have been determined for the financial year of 2022/23. Table 2-13 and Figure 2-15 show an analysis of the total capital values and the OpEx in 2022/2023 for each vehicle type.

RCVs have the highest capital value and operational costs, followed by sweepers, which are reflective of the number of the vehicle types and level of use by the LA. Vans have the third highest capital values, while tippers are third highest in terms of operational costs (5%).

**Table 2-13: Total CapEx and OpEx for Each Vehicle Type**

| Vehicle Type | Capital Value (£) | OpEx in 2022/2023 (£) |
|---|---|---|
| 4x4 | £90,000 | £6,000 |
| Car | £30,000 | £482 |
| Digger | - | £1,200 |
| Hook Loader | £340,000 | £54,000 |
| Mower | £140,000 | £14,000 |
| Pick Up | £48,000 | £3,700 |
| Quad | £40,000 | £800 |
| RCV | £9,306,722 | £1,390,000 |
| Sweeper | £2,435,000 | £259,846 |
| Tipper | £795,000 | £94,500 |
| Tractor | £480,000 | £39,600 |
| Van | £864,000 | £63,700 |
| **Total** | **£14,568,722** | **£1,927,828** |

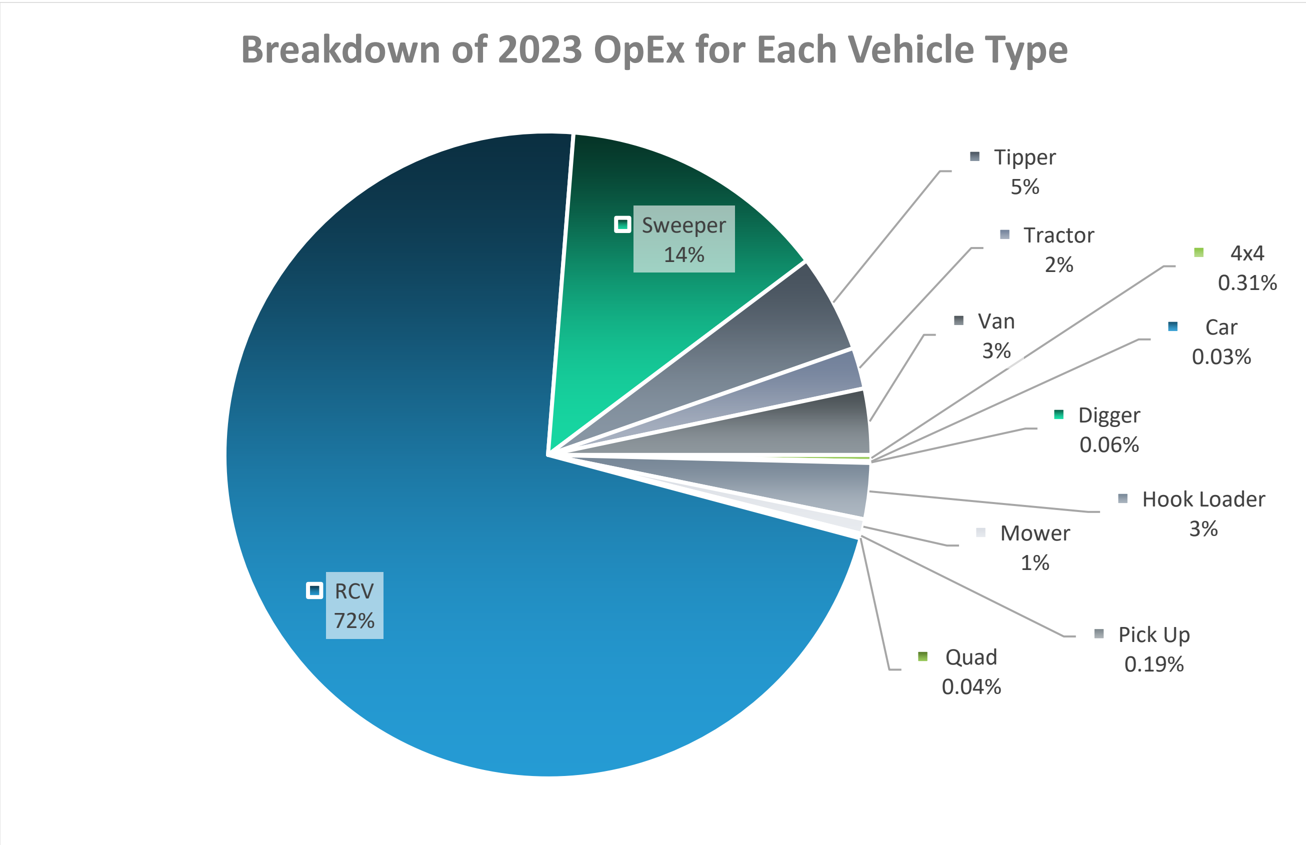


**Figure 2-15: Breakdown of Operational Expenditure for Each Vehicle Type**

## 2.6 Summary of the Baseline Evaluation

### Table 2-14: Summary of Baseline Evaluation Results

| | Average Annual GHG Emissions (%) for vehicle type (Top 5 % Contribution) | | | Fleet Breakdown (Top 5 % of fleet) | | | Average Annual Distance Travelled and Fuel Usage (Top 5 based on Fuel Usage) | | | Capital Value and Operational Costs (All vehicles in fleet) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Local Authority | Vehicle Type | ($tCO_2$-eq) | % Contribution to emissions | Vehicle Type | No. of Vehicles | % of Fleet | Vehicle Type | Distance Travelled (km) | Fuel Usage (Diesel) (L) | Capital Value[1] | Operational Costs (1 year) |
| Armagh City, Banbridge and Craigavon Borough Council | RCV 26T | 983.44 | 54% | RCV 26T | 60 | 23% | RCV 32T | 16,800[2] | 12,480 | £20,498,712 | £3,980,621 |
| | RCV 18T | 156.26 | 9% | Small Panel Van | 60 | 23% | RCV 26T | 16,500 | 12,480 | | |
| | Large Panel Van | 162.09 | 9% | Large Panel Van | 50 | 19% | RCV 18T | 12,100 | 12,480 | | |
| | Small Panel Van | 120.87 | 7% | Compact Tractor | 20 | 8% | Macpac L 12T | 13,100 | 5,800 | | |
| | Macpac L 12 T | 103.53 | 6% | RCV 18T | 13. | 5% | Large Cage 7.5T | 13,500 | 4,500 | | |
| Ards and North Down Borough Council | RCV | 357.65 | 31% | Van | 89 | 33% | RCV | 360,034 | 41% | - | - |
| | Tipper | 121.02 | 11% | RCV | 43 | 16% | Sweeper | 123,870 | 13% | - | - |
| | Van | 119.03 | 10% | Panel Van | 41 | 15% | Macpac | 204,639 | 8% | - | - |
| | Macpac | 101.82 | 9% | 4x4 | 18 | 7% | REL | 89,122 | 7% | - | - |
| | REL | 88.53 | 8% | Sweeper | 15 | 6% | Van | 515,411 | 6% | - | - |

[1] Refers to all vehicles in each fleet (additional to those listed in Table 2-14).
[2] Refers to average annual distance travelled per a single vehicle of each type.

| | Average Annual GHG Emissions (%) for vehicle type (Top 5 % Contribution) | | | Fleet Breakdown (Top 5 % of fleet) | | | Average Annual Distance Travelled and Fuel Usage (Top 5 based on Fuel Usage) | | | Capital Value and Operational Costs (All vehicles in fleet) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Louth County Council | 18T Truck | 106.31 | 25% | Small Vans | 27 (+4 EV)[3] | 21% | - | - | - | - | - |
| | Large Vans | 43.63 | 10% | Large Vans | 24 | 17% | - | - | - | - | - |
| | 3.5t Pickups | 42.6 | 10% | 4x4 Vehicles | 16 | 11% | - | - | - | - | - |
| | 7.5t Pickups | 39.05 | 9% | Lawnmowers/Tractors | 13 | 9% | - | - | - | - | - |
| | Small Vans | 38.73 | 9% | 3.5t Pickups | 12 | 8% | - | - | - | - | - |
| Monaghan County Council | Lorry | 185.56 | 41% | Van | 11 (+3 EV) | 24% | Lorry | 208357 | 52% | €1,588,100 | €224,348 |
| | Pickup (HCV) | 128.83 | 29% | Lorry | 9 | 16% | Pickup (HCV) | 211,915 | 17% | | |
| | Van | 39.26 | 9% | Pickup (HCV) | 8 | 14% | Van | 169,531 | 9% | | |
| | Pickup (LCV) | 27.22 | 6% | Pickup (LCV) | 7 | 12% | Pickup (LCV) | 54,707 | 5% | | |
| | Pickup & Tipper | 23.8 | 5% | Ride on Lawnmower | 3 (+1 GD)[4] | 7% | Velocity Patcher | 12,373 | 5% | | |
| Newry, Mourne and Down District Council | RCV | 370.15 | 55.30% | RCV | 54 | 33% | RCV | 372,618 | 71% | £14,568,722 | £1,927,828 |
| | Tipper | 122.68 | 18.30% | Van | 45 | 28% | Sweeper | 99,361 | 12% | | |
| | Sweeper | 49.44 | 7.40% | Tipper | 18 | 11% | Van | 209,404 | 5% | | |
| | Van | 48.49 | 7.20% | Tractor | 8 | 5% | Tipper | 123,497 | 5% | | |

[3] Unless specified the number of vehicles refers to diesel operated vehicles. The number of EV or GD vehicles are additional to the number of conventional diesel vehicles.
[4] GD = green diesel

| | Average Annual GHG Emissions (%) for vehicle type (Top 5 % Contribution) | | | Fleet Breakdown (Top 5 % of fleet) | | | Average Annual Distance Travelled and Fuel Usage (Top 5 based on Fuel Usage) | | | Capital Value and Operational Costs (All vehicles in fleet) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Hook Loader | 41.94 | 6.30% | Mower | 4 | 2% | Tractor | 3,621 | 2% | | |

## 2.7 Characterisation of Local Authorities and their Functional Area

A brief characterisation of each of the LAs and their respective functional areas was carried out to facilitate an understanding of how the remit, functions and services provided by each LA and the nature and geography of their functional area may affect vehicle related GHG emissions. This characterisation is presented in Table 2-15.

**Table 2-15: Characterisation of Local Authorities and their Functional Area**

| Local Authority | Vehicle Fleet GHG Emissions ($tCO_2$-eq) | Population | Size of Functional Area ($km^2$) | Geography of the Local Authority Functional Area | Likely Effect Local Area has on GHG Emissions |
|---|---|---|---|---|---|
| Armagh Banbridge and Craigavon Borough Council | 1,836.15 | 214,090 | 1,336 | The functional area covers parts of counties Armagh and Down, taking in the upper Bann valley and much of the southern shore of Lough Neagh as well as Armagh city. | The functional area is relatively densely populated. Naturally, the level of LA services would be higher in a densely populated area with more demand for services. As a NI LA, ABC are responsible for the provision of residential and commercial waste management services and therefore have a sizeable fleet of waste collection vehicles which contribute to GHG emissions. The LA functional area is quite large relatively, likely resulting in increased travel distances and associated vehicle GHG emissions. |
| Ards and North Down Borough Council | 1,138.08 | 160,864 | 460.8 | The functional area covers the Ards Peninsula, most of Strangford Lough and the southern shore of Belfast Lough. | The functional area is relatively densely populated. Naturally, the level of LA services would be higher in a densely populated area with more demand for services. As a NI LA, AND are responsible for the provision of residential and commercial waste management services and therefore have a sizeable fleet of waste collection vehicles which contribute to GHG emissions. |
| Louth County Council | 429.38 | 128,884 | 826 | Louth is a small but densely populated county in the north east of the Republic of Ireland. Louth is bordered by four counties – Meath to the south, Monaghan to the west, Armagh to the north, and Down to the northeast. It is bounded to the east by the Irish sea.The significantly sized towns of Drogheda and Dundalk are situated in Louth | The functional area is relatively densely populated. Naturally, the level of LA services would be higher in a densely populated area with more demand for services. LCC are not responsible for residential or commercial waste management services as an NILA, therefore vehicle fleet emissions are substantially lower than GHG emissions associated with NI fleets due to minimal waste collection vehicles being in operation.Vehicle GHG emissions are likely to be less given that vehicle travel distances are lower by comparison to other LAs due to the small size and extent of the county. |

| Local Authority | Vehicle Fleet GHG Emissions ($tCO_2$-eq) | Population | Size of Functional Area ($km^2$) | Geography of the Local Authority Functional Area | Likely Effect Local Area has on GHG Emissions |
|---|---|---|---|---|---|
| Monaghan County Council | 447.71 | 61,386 | 1,295 | The functional area has a land area of 500 square miles and is the most northerly inland county in the Republic of Ireland. Monaghan is bordered by six counties - Louth, Meath and Cavan to the south, and Armagh, Tyrone and Fermanagh to the north. | Monaghan is a relatively small county in Ireland. It has a low population density, with no major cities being present in it. The area is characterized by the presence of drumlins. There are also several mountains in the county, including Slieve Beagh. The level of vehicle fuel use and associated GHG gas emissions is relatively high for MCC, which is likely due to the geography of the area and dispersed nature of settlement in the area by comparison to the more urbanized county of Louth, for example. |
| Newry Mourne and Down District Council | 669.88 | 180,012 | 1,634 | The functional area covers the Southeast of Northern Ireland, including southern County Armagh and large parts of County Down. It incorporates all of the Mourne Mountains and much of the Ring of Gullion, both designated as an Area of Outstanding Natural Beauty. The area has an extensive coastline stretching from Strangford Lough in the north to Carlingford Lough, in the south and borders counties Louth and Monaghan in the Republic of Ireland. The principle population centres are Newry in the south of the district, and Downpatrick in the north. | As a NI LA, NMD are responsible for the provision of waste management services and therefore have a sizeable fleet of waste collection vehicles which contribute to GHG emissions. In contrast to other NI LAs, NMD have fewer vehicle numbers, use less fuel per year and their vehicles travel lower distances. Consequently, their vehicle related GHG emissions are relatively low for a county of its size and population and geographic characteristics. |

# 3. CONTEXT ANALYSIS

A structured assessment of the main macro-environmental factors that affect and influence the adoption of alternative fuel vehicles in the East Border region has been undertaken to inform this study. This has involved the carrying out of focussed PESTLE analysis and SWOT analysis.

PESTLE stands for Political, Economic, Social, Technological, Legal, Environmental. PESTLE analysis involves an examination of macro-environmental relevant to each of these areas. In this case, PESTLE Analysis has been carried out to develop a clear understanding of the main macro-environmental drivers and barriers that affect and influence a LA adopting alternative fuel vehicles in the 'East Border' region of the island of Ireland. A summary of the PESTLE analysis undertaken is provided in Table 3-1.

SWOT stands for Strengths, Weaknesses, Opportunities and Threats. SWOT analysis has taken place to identify the main Strengths, Weaknesses, Opportunities and Threats associated with a LA adopting alternative fuel vehicles in the 'East Border' region of the island of Ireland. A summary of the SWOT analysis undertaken is provided in Table 3-2.

The context analysis presented below is a succinct distillation of a comprehensive literature review undertaken to inform this study generally. It is generally high-level and non-exhaustive in nature. It considers macro-environmental factors relevant to all alternative fuel vehicle options considered under this study. Concise and ordinary language has been used rather than overly technical language for ease of reading and to aid clarity and understanding. Detailed source referencing has not been provided for the same reason; however, all sources of information can be provided upon request.

The context analysis has also been informed by ongoing consultation with the relevant LAs and the Stakeholder and Industry Engagement carried out (as detailed in Section 4 of this report).

## Table 3-1: PESTLE Analysis

| | Drivers | Barriers |
|---|---|---|
| Political | Republic of Ireland<br><br>• EU level policy (e.g., European Green Deal, RePowerEU) supports the accelerated development of clean energy in in the EU and the RoI broadly.<br>• Under the Climate Action and Low Carbon Development Act (as amended) RoI LAs are required to produce Local Authority Climate Action Plans (LACAPs) specifying the adaptation and mitigation measures to be adopted by the Local Authority to ensure a reduction in organizational and sectoral GHG emissions. These plans will have synergies with the ambitions of this study.<br>• The RoI national Climate Action Plan 2023 (CAP23) requires a reduction of public sector GHG emission by 51% by 2030. It will be a key driver in relation to the adoption of alternative fuel. Some key examples of how it will drive the adoption of alternative fuels in LAs are presented below:<br>○ CAP23 requires the development of climate action planning expertize in LAs (e.g., climate action teams, Local Authority Climate Action Training Programme (RoI)).<br>○ CAP23 has an ambition to accelerate the electrification of road transport. It defines 2025 and 2030 in relation to fleet electrification.<br>○ CAP23 proposes developing a regulatory roadmap for green hydrogen use (Action reference: EN/23/7).<br>○ CAP23 requires the biofuel blend rate to be increased successively to E10 (10% Ethanol) and B20 (20% Biodiesel equivalent) in the RoI by 2030. | • Political opinion can act as a barrier to more ambitious climate action initiatives broadly. The lack of political, public or pressure group acceptance of the transition to the use of a particular alternative fuel vehicles may act as a barrier.<br>• Members of the public and/or lobby groups may object to and challenge the roll out of alternative fuel related infrastructure (e.g., the development of a hydrogen plant or an Anaerobic Digestion facility in a locality). |

| | Drivers | Barriers |
|---|---|---|
| | ○ Green Public Procurement processes are being promoted in RoI under CAP23 (e.g., Green Public Procurement (GPP) Criteria Search tool, GPP training).<br>○ Carbon budgets and Sectoral Emission Ceilings have been defined for RoI by CAP23 to spur GHG emission reductions across all sectors of society including the public sector and the transport sector.<br>○ CAP23 targets increasing Biomethane production to 5.7 TWh of Biomethane and the construction of 200 new Anaerobic Digestion (AD) plants in the RoI by 2030.<br>• Climate Action Regional Offices (CARO) in RoI support LA climate action planning and GHG emission reduction initiatives.<br>• Zero Emission Vehicles Ireland (ZEVI) was established in the RoI in July 2022 as a dedicated office to support consumers, the public sector, and businesses to continue to make the switch to zero-emission vehicles.<br>• The RoI national Electric Vehicles Charging Infrastructure Strategy 2022 – 2025 was published in January 2023 to support the roll out of electric charging infrastructure.<br>• The RoI's Office of Government Procurement (OGP) has drawn up fixed price procurement frameworks for the supply of long and medium range battery electric passenger cars and vans to public sector bodies. These Frameworks will greatly assist government departments and bodies to purchase electric cars and vans.<br>• Forward planning is taking place in the RoI to promote alternative fuel sectors (e.g., Renewable Transport Fuel Policy 2023-2025, Bioeconomy Action Plan, National Hydrogen Strategy, National Biomethane Strategy, National Policy Framework on Alternative Fuels Infrastructure for Transport in Ireland 2017 - 2030). | |

| | Drivers | Barriers |
|---|---|---|
| | • Renewable Fuels for Transport Policy Statement (November 2021) - Encourages biofuel incentives and supply. Focusses on: Biofuels produced from User Cooking Oil and Category 1 and 2 Animals fats.<br><br><u>Northern Ireland</u><br>• A Climate Action Plan for NI covering 2023 to 2027 is in the process if being developed. This plan will support the promotion of clean energy across society including in the transport sector.<br>• NI Energy Strategy is supportive of the transition to 'Net Zero' and support investment in Clean Energy in NI. An objective of this strategy is to 'Support the transition to low and zero carbon fuels for vehicles.'<br>• The UK Transport Decarbonization Plan (July 2021) supports vehicle fleet decarbonization in NI.<br>• Forward planning is taking place in the UK/NI to promote alternative fuel sectors (e.g., National Hydrogen Strategy, Biomass Strategy).<br>• It is anticipated that future public body carbon accounting obligations will be introduced by DAERA in the near future. This will require LAs to quantify and report on their GHG emissions including Transport related GHG emissions. | |
| Economic | • Carbon tax increases in both RoI and NI will increasingly compel organizations toward the adoption of alternative fuel vehicles that give rise to less GHG ($CO_2$eq) emissions (e.g., RoI 2020 Finance Act will increase carbon tax in the RoI successively until the carbon tax rate reaches €100/tonne by 2030).<br>• RTFO in RoI and UK/NI will serve to incentive the use of alternative fuels. | • Limited supply of alternative fuel vehicles (e.g., electric HDVs). There is also an increasing demand for such vehicles internationally which limits stock availability.<br>• Limited supply of certain alternative fuels (e.g., biofuels, biomethane). Increasing demand from other, non-transport sectors (e.g., heating) could divert supplies elsewhere.<br>• Current alternative fuel market instability exists. |

| | Drivers | Barriers |
|---|---|---|
| | • In the RoI, under the Electric Vehicles Charging Infrastructure Strategy 2022 – 2025, €100 million is to be spent on charging infrastructure from now until 2025.<br>• The UK Transport Decarbonization Plan commits £1.3 billion investment charging infrastructure in the UK from 2021 to 2025.<br>• A variety of financial supports can be availed of by LAs in RoI to promote the development of alternative fuel vehicles (e.g., SEAI grants for the installation of on-street and site EV charging points).<br>• NI LAs have access to some degree of UK Hydrogen Funding (e.g., Net Zero Hydrogen Fund).<br>• There is a 'cost of doing nothing' associated with the continued use of Diesel as a vehicle fuel. For example, increasing carbon taxes in RoI the cost of diesel will increase in the price of diesel from c.€1.90 to c. €2.06 by 2030 and c. €2.50 per litre by 2050. Failure to achieve sectoral GHG emission reduction targets may also result in non-compliance fines in the future. | • Substantial costs involved in retrofitting existing vehicle fleet or procuring new alternative fuel vehicles, and developing associated, necessary refuelling infrastructure. Significant upfront capital investment required.<br>• Biofuel costs are typically higher than the cost of diesel (e.g., HVO ca. 20c/l dearer than diesel in RoI and ca. 50p/l dearer than diesel in NI).<br>• Lack of price certainty for certain renewable fuels (e.g., Biomethane).<br>• Higher biofuel blending rates may affect vehicle warranties.<br>• Retrofitting of vehicles may affect vehicle warranties generally.<br>• Fleet operators are currently constrained in adopting alternative fuel vehicle due to a lack of sufficient financial incentives.<br>• Limited supply of certain alternative fuels on the island of Ireland currently (e.g., HVO). Strategic planning is required to secure ongoing alternative fuel supply. |
| Social | • There is significant 'buy in' from each East Border region LA covered under this study. Each LA already has firm plans and commitments to implement climate action to reduce organizational and functional area GHG emissions contributions (e.g., prospective Monaghan County CouncilClimate Action Plan 2024 - 2029), prospective Louth County Council Climate Action Plan 2024- 2029, Ards and North Down Roadmap to Sustainability, Armagh City, Banbridge, Craigavon Borough Councils Net Zero Road Map, Newry, Mourne and Down prospective Sustainability & Climate Change Strategy.<br>• Gas network operators in both RoI and NI have ambitions to decarbonize gas networks using Biomethane.<br>• There is a strong AD sector in NI which can support the possible transition to the use of Biomethane has an alternative fuel. | • Efficient activation of efforts at local authority level a challenge.<br>• Local authority organisational barriers may affect the adoption of alternative fuels (staffing, financial resourcing, resistance to change, inter-departmental coordination)<br>• The adoption of alternative fuel vehicles will necessitate the roll out of training on the use, operation, maintenance and servicing of these vehicles within each LA. This will be an organizational challenge.<br>• New skills and training required for alternative fuel deployment across society (e.g., in the area of Hydrogen development).<br>• Need to positively change people's views and behaviours to promote the uptake of alternative fuels , especially the views of those who will have responsibility for rolling out alternative fuel initiatives (e.g., senior management, fleet managers etc.) |

| | Drivers | Barriers |
|---|---|---|
| | • There is strong level of academic research and innovation capability in the area of alternative fuels in the RoI and NI (e.g., at the Belfast Metropolitan College or University of Galway).<br>• Several LAs in NI and RoI have progressed adopting alternative fuel vehicles (e.g., Belfast City Council, Fingal County Council, Cork County Council etc.). Their experience could be leveraged to support this project. | • Negative public perception and fundamental scepticism may need to be overcome. Negative perception may be linked to perceived lack of feasibility and sustainability associated with transitioning to a particular alternative fuel, for example.<br>• Uncertainty about operational performance - organizational hesitance in switching to certain alternative fuels.<br>• Limited experience and safety concerns about more novel technologies such as hydrogen fuels. |
| Technological | • Existing diesel storage and supply systems and infrastructure can be more readily utilized to facilitate the storage and supply of liquid biofuels (such as HVO).<br>• The Electric Vehicles Charging Infrastructure Strategy 2022 – 2025 (RoI) and Action Plan for Electric Vehicle Charging (NI) support the roll out of charging technology and infrastructure across the island of Ireland (e.g., in RoI - high-powered chargers every 60 km on our motorway network as well as home/apartment charging, residential neighborhood charging (including new mobility hubs), destination charging and en-route charging).<br>• The FASTER Project is a joint initiative by partners in Scotland, Ireland and Northern Ireland to support the overarching ambition to transition to low carbon transport systems. The project partnership will implement the physical roll out and installation of 73 rapid (50KW capacity) electric vehicle charging stations, some of which will be in the Easter Border area.<br>• Existing gas network infrastructure can be more readily re-utilized for the supply of Biomethane and Hydrogen in the long term.<br>• Gas network providers in both RoI and NI have firm plans to decarbonize their gas supply networks using AD. | • Limited supply of people and organizations capable of maintaining and servicing alternative fuel vehicles.<br>• Further technological advances required to better promote use of alternative fuel HDVs.<br>• The mixed nature of LA fleets means that there are no scalable technological solutions for fleet decarbonization. A mix of appropriately tailored technological solutions will be required to successfully achieve LA fleet decarbonization. This adds complexity to the process of transitioning LA vehicle fleets to net zero GHG emissions.<br>• Grid energy supply capacity and infrastructure in RoI and NI will need to increase to accommodate the roll out of electric vehicles.<br>• Infrastructural upgrades will be required at LA sites to facilitate storage/refuelling of alternative fuel based vehicles (e.g., HVO storage tank development, sub-station upgrades to facilitate electric charging infrastructure).<br>• Potentially more maintenance required for certain alternative fuel systems - (E.g., Biodiesel tanks need to be cleaned for bugs and bacteria regularly (less so if used regularly)). |

| | Drivers | Barriers |
|---|---|---|
| | • A rapidly expanding wind energy sector and a growing solar sector in both RoI and NI will result in the decarbonization of grid electricity in the medium to long term. This will also create further opportunities to produce 'green' hydrogen using electrolysers at wind farm installations.<br>• Energy providers are supporting the uptake of EV use by providing energy supply price plans that support EV use (e.g., lower night-time tariffs for charging vehicles overnight).<br>• The existing Gencomm Hydrogen may compliment of support the planning, adoption and roll out of future Hydrogen related projects on the island of Ireland.<br>• The prospective banning of new fossil fuel based in the 2030s is compelling vehicle manufacturers to transition to producing alternative fuel based vehicles, including net zero emission vehicles. | • Current absence of adequate public refuelling infrastructure for alternative fuel vehicles (e.g., BioCNG, electric and hydrogen related infrastructure). Still very few CNG fuelling stations in the country. Not many of these stations in or around the East Border region.<br>• Developers need undertakings from organizations to expand their alternative fuel vehicle fleets and to continually purchase a particular alternative fuel over the long-term before committing to developing refuelling installations.<br>• Electric vehicles can be significantly limited by distance they can travel and route topography conditions (especially electric HDVs).<br>• Further research and efforts are required to determine the feasibility of upgrading existing internal combustion engine vehicles to EV, for example. |
| Legal | <u>Republic of Ireland</u><br>• EU law broadly supportive of transition to alternative fuels (e.g., Fit for 55).<br>• Prospective EU law requiring the phase out of internal combustion engines in new cars and vans to be adopted by 2035, with a possible phase out of ICEs in HDVs by 2040.<br>• The Climate Action and Low Carbon Development Act (as amended) provides a statutory underpinning to climate action in the RoI. It sets out actions that must be taken to ensure delivery of commitments and a target to reduce GHG by 51% by 2030 and to achieve net zero GHG emissions by 2050. It is supportive of decarbonization initiatives. | • Certain Alternative Fuel industries will be subject to strict planning, environmental, waste management, health and safety, major accident and animal-by-product related legislation and regulation. Ensuring compliance with such regulations (e.g., for an Anaerobic Digestion facility producing Biomethane) will require significant resources and will incur significant cost. |

| | Drivers | Barriers |
|---|---|---|
| | • Renewable Transport Fuel Regulations 2023 supports increasing biofuel blend rates in RoI. The Regulations incentivise certain renewable transport fuels including HVO and Biomethane (which can be more readily used for HDV decarbonization). The Regulations support the Climate Action Plan E10/B20 target by 2030 and complement further targets for the production of Biomethane and the use of green hydrogen in transport into the future.<br>• The current RoI Renewable Transport Fuel Obligation (RTFO) scheme in RoI places an obligation on suppliers of mineral oil to ensure that 16.985% (by energy content) of the motor fuel (gasoline and motor diesel) placed on the market is renewable i.e., bioethanol and biodiesel. The RTFO is provided with a statutory underpinning by the RoI Renewable Energy Regulations.<br>• The European Clean Vehicles Directive promotes the uptake of low and zero-emission vehicles by setting legally binding targets that public sector bodies must achieve through public procurement processes. These targets also apply to the purchase, lease, rent, hire-purchase and relevant services contracts also. The targets will become more stringent from 2026. The European Clean Vehicles Directive reinforces and gives impetus to the achievement of emission reductions targets under national climate policy.<br><br><u>Northern Ireland</u><br><br>• UK Government has proposed a complete phasing out of new diesel, petrol cars by 2030, GHG emitting hybrids LGVs by 2035 and GHG emitting HDVs by 2040. | |

| | Drivers | Barriers |
|---|---|---|
| | • UK Climate Change Act 2008 - requires a UK Climate Change Risk Assessment every five years and informs the Northern Ireland Climate Change Adaptation Programme (NICCAP). NICCAP2 (2019-2024) currently in place sets out NI's climate change adaptation approach.<br>• The Climate Change Act (Northern Ireland) 2022 (Act) sets a target of an at least 100% reduction in net zero greenhouse gas (GHG) emissions in NI by 2050. There is a legal requirement on all NI departments to exercise their functions, as far as is possible to do so, in a manner consistent with the achievement of the targets of the Act and carbon budgets set under it.<br>• The UK Alternative Fuels Infrastructure Regulations 2017 (AFIR) supports and promotes the development of electric and hydrogen charging infrastructure in NI.<br>• The UK Renewable Transport Fuel Obligation (RTFO) is the UK Government's key measure to incentivise the supply of low carbon fuel in the UK/NI. The RTFO has set a 2032 target for 14.6% of road transport fuel to be low carbon fuel. | |
| Environmental | • Policies supporting and promoting the development of sustainable transportation are increasingly being embedded in national, regional and local land use planning frameworks (e.g., the use of electric charging infrastructure related development management standards, RoI National Development Plan 2021-2030 Policy NSO 4: Sustainable Mobility).<br>• In addition to reducing GHG emissions associated with transport, the development of alternative fuel sectors has the potential to promote resource efficiency and the circular economy (e.g., the recycling of used cooking oil to produce HVO). | • Certain alternative fuels could potentially result in significant lifecycle GHG emissions (e.g., if importing biofuel feedstocks from abroad).<br>• The development of the alternative fuels sector in both RoI and NI is limited by planning and environmental constraints and challenges (relating to bioenergy facilities, for example). Grants of planning consent for infrastructural development are often subject to planning appeals and legal challenge in the form of judicial review. This is a significant constraint for the alternative fuels sector. |

| | Drivers | Barriers |
|---|---|---|
| | | • The production of certain alternative fuels may result in adverse environmental upstream or downstream environmental impacts (e.g., traffic or odour at an anaerobic digestion facility, improper disposal of waste electric vehicle batteries, adverse land use change associated with bioenergy feedstock production). |

## Table 3-2: SWOT Analysis

| | |
|---|---|
| **Strengths** | • LA organizational 'Buy In' and commitment to climate action and transitioning to alternative fuel vehicles.<br>• LA resourcing availability and in-kind contribution in support of this project and the transition to alternative fuels generally.<br>• In-house sustainability, engineering, energy and vehicles fleet management expertise and knowledge within each LA.<br>• East Border Region support and in-kind contributions.<br>• Belfast Metropolitan University support and in-kind contributions.<br>• Extensive policy support.<br>• Extensive forward planning taking place in support of transitioning to alternative fuels.<br>• Extensive legislative and regulatory support in support of the transition.<br>• Wide network of supporting stakeholders.<br>• Increasing financial incentives to transition to alternative fuel vehicles (e.g., carbon tax, RTFO).<br>• Some level of funding support available in both RoI and NI for pilot projects and capital investment.<br>• Significant alternative fuel infrastructural investment taking place (especially in the UK currently).<br>• Access to significant UK Hydrogen funding (NI LAs only).<br>• Strong level of academic research and innovation capability in the area of alternative fuels in the RoI and NI.<br>• Planning and land use policy is becoming more supportive of alternative fuel sector development and sustainable transportation generally. |
| **Weaknesses** | • Substantial capital and operational costs involved in transitioning to alternative fuel vehicles. Cost of running a vehicle fleet based on alternative fuel likely to be significantly higher than running a vehicle fleet based on diesel in the present climate.<br>• In the absence of funding to support with these capital and operational costs, costs associated with the decarbonisation of LA vehicle fleets will need to be borne by the LAs themselves. This may lead to higher rates being passed on to the public and may create 'just transition' issue and political issues, such as elected representatives being reluctant to approve initiatives due to the costs.<br>• Alternative fuel market instability.<br>• Limited supply of alternative fuel vehicles. Growing international demand for such vehicles further restricting supply<br>• Limited supply of alternative fuel (e.g., limited HVO availability in the island of Ireland).<br>• Often a lack of sufficient financial incentives to transition.<br>• Lack of knowledge and training relating to the use and maintenance/servicing of alternative fuel vehicles.<br>• The mixed nature of LA fleets means that there are no scalable technological solutions for fleet decarbonization.<br>• Current lack of public refuelling infrastructure.<br>• Need for the alternative fuel production and supply sector to comply with other stringent regulation (planning, environmental, health and safety etc.).<br>• For some LA, there is currently a lack of vehicle tracking data, which would allow for the establishment of accurate GHG emission or cost baselines. |

| | |
|---|---|
| **Opportunities** | • Extensive network of stakeholders who share an interest in transitioning to alternative fuel vehicle technology in both RoI and NI currently, including developers, fuel producers, suppliers and other users. Potential to connect with and partner such stakeholders exists. Potential to connect with suppliers and carry out pilot projects.<br>• Potential for partnership or synergies with organizations responsible for rolling out charging infrastructure.<br>• The promotion of the alternative fuel sector has the potential to lead to economic development and job creation.<br>• The existing Gencomm Hydrogen may compliment of support the planning, adoption and roll out of future Hydrogen related projects on the island of Ireland. |
| **Threats** | • Current grid infrastructure capacity will not facilitate the widespread adoption of EVs, especially HDV EVs.<br>• Planning and legal challenge to alternative fuel related infrastructure development.<br>• Political opinion can act as a barrier to more ambitious climate action initiatives broadly. The lack of political, public or pressure group acceptance of the transition to the use of a particular alternative fuel vehicles may act as a barrier.<br>• Uncertainty about operational performance - organizational hesitance in switching to certain alternative fuels.<br>• Health and safety concerns relating to a particular alternative fuel (e.g., storage and use Hydrogen).<br>• Certain alternative fuels may have unintended, negative environmental impacts.<br>• Risk of certain alternative fuels being unsustainable. |

# 4. STAKEHOLDER ENGAGEMENT

In parallel with carrying out the baseline evaluation of each LAs vehicle fleet and contextual analysis, a highly focussed programme of Stakeholder Engagement in the area of Alternative Fuel development has been carried out.

## 4.1 Approach and Methodology

The Stakeholder Engagement process involved the following steps:

1. Completion of stakeholder analysis and initial engagement with stakeholders.
    a. A variety of stakeholder categories were identified. Stakeholders were categorized under the following headings:
        - Organizations who have adopted Alternative Fuel technology
        - Government Departments and Public Bodies
        - Vehicle Providers
        - County andCity Councils
        - Fuel andEnergy Providers
        - Industry Bodies
    b. Desktop research was undertaken to identify stakeholder contact details.
    c. Initial engagement with stakeholders was carried out to determine interested in partaking in stakeholder phone consultation surveys. Stakeholders relevant to both the RoI and NI were consulted. Best endeavours were made to contact stakeholders, particularly public bodies.
    d. The phone contact details for stakeholders were recorded.
2. Completion of stakeholder phone consultation surveys:
    a. Phone consultation surveys with relevant, interested stakeholders were carried out. The surveys focussed on questioning and surveying stakeholder attitudes and views on - their understanding of Alternative Fuel technology and possible benefits associated with such; their interest in Alternative Fuel technology; Alternative Fuel related policy and legislation, their willingness to adopt Alternative Fuel technology for their vehicle fleet (if an end user); and their experience rolling out Alternative Fuel technology / their Alternative Fuel roll out ambitions and plans.
3. Recording and Analysis of Stakeholder Feedback.
    a. Stakeholder engagement feedback and insights was carefully distilled, recorded and analysed.
4. Completion of Knowledge Awareness Events.
    a. A select number of highly responsive and engaged ‘key’ stakeholders were identified. FT identified synergies between the goals of these stakeholder and the goals of this project and engaged with these key stakeholders with a view toward carrying out several knowledge awareness events.

b. Knowledge awareness events were carried out to develop an understanding of Alternative Fuel options. The following knowledge awareness events were carried out:
   - Attendance at an organised conference on Hydrogen development on the island of Ireland on 31/05/2023 run by Gencomm - a body that supports the development of Hydrogen.
   - A site visit to and walkaround of Gas Network Ireland's CNG refuelling station situated in Virginia, Co. Cavan on 23/06/2023
   - Attendance at a remote meeting with Indaver on 28/06/2023 on proposed Hydrogen production/refuelling station development at for their Waste to Energy site in Duleek, Co. Meath.
   - A meeting with Nicholl Oils on 26/07/2023 - one of Northern Ireland's largest fuel distributors - to develop an understanding of their alternative fuel products, and transiting vehicle fleets to be powered by these alternative fuels.
   - A remote meeting with Dr Andrew Hagan, Director of Element 2, a Hydrogen refuelling station development company - to discuss the approach and processes involved in developing regional Hydrogen Hubs.

A summary of the stakeholder consultation and knowledge awareness events is presented below.

## 4.2 Stakeholder Phone Consultation Surveys

In total, 116 stakeholders were contacted. Phone consultation surveys were carried out with 29 stakeholders who expressed an interest in participating. A detailed record of stakeholder phone consultation survey feedback has been maintained and has been provided to each participating LA. The feedback is opinion/belief based in nature and should be considered as inherently factual.

For confidentiality reasons, only a distilled summary of this feedback has been provided in this report. This summary is presented below. The feedback from these phone consultation surveys has served to inform the Alternative Fuel Option Analysis carried out for this study (which is documented in Section 6 of this report) and the development of sample strategic roadmaps for each LA for achieving a net zero vehicle fleet (which is discussed in Section 7 of this report).

**Table 4-1: Summary of Phone Consultation Feedback**

| Category of Organization | Summary of Phone Consultation Feedback |
|---|---|
| Organization who has adopted Alternative Fuel technology | • EV charging infrastructure viewed as an important consideration.<br>• Some organizations advised against the practice of retrofitting vehicles. This presents challenges around warranty.<br>• Vehicle manufacturers and suppliers should be responsible for driving the choice of alternative fuel vehicles in the market.<br>• Electrification of RCVs is possible. Some challenges in relation to RCVs. Distance to waste destination and range of vehicle are an important consideration. Double shifts are a challenge for EV RCVs.<br>• Electric RCVs are ca. double the price of diesel RCVs and the cost of infrastructure is also significant.<br>• Local air quality impacts are a potential constraint. This is a downside of using Biodiesel or HVO as a fuel source. |

| Category of Organization | Summary of Phone Consultation Feedback |
|---|---|
| | • Where an organization develops a large fleet of electric vehicles this leads to a significant power demand. This may require the development of additional supporting infrastructure.<br>• Driver training is crucial.<br>• Suppliers not educated enough about EVs<br>• Electric trucks not suitable for motorways or hilly areas. Specific route needs to be worked out – less intensive.<br>• EV RCV won't be as productive or flexible as a diesel vehicle.<br>• Organizations also exploring gas powered vehicles but may not have access to supply depots and too expensive to install their own supply infrastructure. |
| Government Department and Public Body | • Renewable Transport Fuel Obligation in RoI and UK/NI supports AF transition.<br>• Hydrogen will most likely be not widely available until post 2030. Likely that there will be a focus on electric until 2030 then hydrogen after that.<br>• The use of CNG/BioCNG for internal combustion engines is considered to be transitionary in nature.<br>• New Internal Combustion Engines vehicles will no longer be on sale by the 2030s.<br>• Biomethane can be used in existing vehicles with some retrofitting.<br>• Main barrier to electric is that charging infrastructure needs to be in place.<br>• Alternative Fuel HDV Grant is available and is Administered through TII. It currently promotes a transition to CNG, NG, Electric and Hydrogen vehicles. Aimed at the private sector. This grant makes up some of the cost difference. (Relevant to RoI only)<br>• Toll reduction scheme for AF vehicles - Electric and Hydrogen. (Relevant to RoI only)<br>• Road Haulage Strategy 2022 - 2031: targets - 30% of HDV sales to be net zero by 2030. 100% by 2040/2050. These targets originate from a global Memorandum of Understanding. (Relevant to RoI only)<br>• Re. EU Proposal for $CO_2$ emission from HDVs. Current proposal - $CO_2$ emission to reduce by 90% by 2040. (Relevant to RoI only)<br>• Regarding Alternative Fuel Infrastructure Regulations. These define what will need to be provided in Ireland in terms of high-powered infrastructure charging. (Relevant to RoI only)<br>• Substantial supports for Hydrogen in UK/NI. Less support for biofuels (Relevant to NI only) |
| Vehicle Provider | • Varying degree of motivation to promote alternative fuel vehicles. May only be driven by customer demand and inquiries.<br>• There is a legal motivation to ensure that a percentage of sales are EV and alternative fuels.<br>• Still considerable apprehension among customers to adopt alternative fuels.<br>• EV HDVs are in their infancy. There are already EV HDVs on the market, but limited availability.<br>• LNG HDV options are also available but limited availability on the Irish market.<br>• There is some movement towards HVO. |

| Category of Organization | Summary of Phone Consultation Feedback |
|---|---|
| | • Commercial EV vehicles aren't going to work as well with every type of operations and function.<br>• EV RCVs are available on the market - but limited availability.<br>• Many providers still only have conventional diesel engines on the market. |
| County and City Councils | • Knowledge of alternative fuels may be limited.<br>• Have made some investment in EV vehicles but entirely successful due to distance limitations.<br>• Mixture of alternative fuels will be required with HVO as a stop gap, hydrogen for heavy goods and electric for lighter vehicles.<br>• Investigating electrical requirements e.g. power bank requirements.<br>• There are logistical issues and concerns with them being close to residential areas. May be limited by old infrastructure e.g. insufficient electrical supply.<br>• HVO is preferred short-term option.<br>• CNG not an option due to significant cost increase, no policy support, insufficient infrastructure.<br>• Preferred approach is to trial options and monitor progress.<br>• Already use fuel management systems to track fuel use |
| Fuel and Energy Provider | • Several companies involved in developing AD facilities throughout Ireland.<br>• Significant portion of biomethane produced may be sold for use as an alternative fuel. This will be driven by the RTFO.<br>• Developing fuel supply stations at AD facilities not viable due to logistical and operational challenges including planning and environmental constraints.<br>• AD facility operators may just sell fuel to already established market operators, at their own depots.<br>• There is interest in the development of CNG hubs between fuel providers and service stations operators.<br>• Means to make development and supply of biomethane more financially viable is to establish supply contracts with users.<br>• Barriers to roll out of biomethane include:<br>    ○ Not competitive enough compared to other fuels.<br>    ○ Limited number of biomethane suppliers and CNG fuelling stations in the country is a significant limitation.<br>    ○ More stations and injection plants needed to facilitate roll-out.<br>• Higher incentives needed for hauliers to drive adoption of alternative fuels in the sector.<br>• EVs for HDV is not a viable option.<br>• Fuel providers are keen to get biomethane into the network and there is a degree of promoting and incentivizing happening.<br>• Development of Biomethane slow due to lack of policy support.<br>• Government targets around Biomethane in RoI Climate Action plan will however support development. RoI Government developing Renewable Heat Obligation and Biomethane Strategy, which will also support development of Biomethane. To be completed in 2030. |

| Category of Organization | Summary of Phone Consultation Feedback |
|---|---|
| | • A renewable gas certification scheme was set up in RoI. Supported by legislation with S.I. No. 350/2022 - European Union (Renewable Energy) Regulations. The CRU has a review/validation function under the legislation.<br>• More public CNG stations are being rolled out. Locations are often in the vicinity of main motorway networks.<br>• Some focus on promoting CNG and BioCNG in the commercial sector.<br>• Connections are being developed with some L.As such as Kildare County Council.<br>• HVO is supplied at several forecourts.<br>• HVO is the focus for many fuel providers at the moment.<br>• May be limitation on the sale of HVO in NI by fuel providers based in the Rep. of Ireland due to customs and revenue restrictions and rules.<br>• HVO is regarded as a transition fuel to help with carbon/climate targets but isn't not a long-term solution.<br>• Proof of sustainability is supported by using Proof of Sustainability Certificates in accordance with the Biofuel Obligations Scheme.<br>• HVO is primarily sourced from refineries in Europe primarily created in Finland (Neste company), and shipped from Rotterdam.<br>• BP are constructing a HVO plant in the UK.<br>• Don’t feel like there are any significant barriers to the adoption of HVO for LAs.<br>• There are also facilities established that accept and process HVO.<br>• Some minor maintenance issues associated with HVO e.g., reset injectors, filter changes. Increased filter changes can be attributed to cleaning agent added to HVO which causes increased frequency of filter changes but will return to normal after ca. 6 months, depending on use.<br>• HVO price is an issue, especially in NI where cost is significantly higher than diesel<br>• Energy providers are proposing to use excess energy to generate hydrogen gas for fuel.<br>• Hydrogen policy is unclear.<br>• Approach toward developing Hydrogen - Identify demand areas and synergies between possible end users.<br>• Need to build economy of scale around hubs. Joint venture approach typically necessary.<br>• The EU are more supportive of Hydrogen projects. Provide better funding supports.<br>• Hydrogen powered vehicle options – Mercedes and Volvo have a joint venture to develop a fuel cell truck. Lots of companies just doing left hand vehicles in Europe which is a constraint.<br>• Alternative fuels is becoming a more core aspect of fuel providers businesses. |

| Category of Organization | Summary of Phone Consultation Feedback |
|---|---|
| Industry Bodies | • Would consider AD to be a prominent source of alternative fuel i.e. biomethane in the East Border Region.<br>• Blended biodiesel is an immediate option for reducing GHG emissions from a vehicle fleet. Benefit of Biodiesel – Organizations do not have to modify their existing vehicle fleets based on diesel<br>• Blending issues - Blend limits – Biodiesel. Can't blend above 7% into regular diesel without affecting quality specifications. Higher blend of biodiesel - Fuel problems won't be covered under warranty.<br>• Biodiesel tanks – need to be cleaned for bugs and bacteria regularly. Less of an issue if used regularly.<br>• Blended HVO is also an immediate option that can be looked at also.<br>• Common issues for fleet operators in relation to adopting alternative fuels – Financial incentives aren't there.<br>• Use of Biomethane as an AF less constrained than biodiesel. Not as much choice when it comes to Biomethane vehicles, however.<br>• AFs e.g., Biomethane feasible for vehicles that use dedicated depots and routes. Less possibility of unforeseen excessive fuel use due to travel on high speed roads or in hilly areas.<br>• Opportunities in NI to utilize wind farms to produce Hydrogen (using Electrolyzer technology). Electrolyzing stations no longer need to beside windfarms and can be located closer to urban centres to facilitate fuel supply.<br>• Not enough of an uptake in EVs (too expensive)<br>• Not enough financial support to adopt alternative fuels |

## 4.3 Knowledge Awareness Events

As part of this study FT conducted several knowledge awareness events to gain valuable insight and understanding of Alternative Fuel technology and possible benefits associated with such. The visits also had the added benefit of assisting in steering further stakeholder engagement and identifying additional interested parties that may provide added value to the stakeholder engagement process.

A summary of key findings and insights gained from this engagement is presented in Table 4-2:

**Table 4-2: Summary of Knowledge Awareness Events and Key Learnings**

| Event Description | Summary of Event and Knowledge Gained |
|---|---|
| Nicholl Oils -<br>Presentation provided to project work group by NO, one of Northern Ireland largest fuel distributors.<br>Presentation was made to | <u>Background</u><br>• Nicholl Oils rolling out HVO at depot sites across NI.<br>• Can accommodate trial at LA sites and provide infrastructure support (i.e. bunded storage tanks).<br><br><u>Key Knowledge and Insights</u><br>• No 'silver bullet' for decarbonization. A mixture of Alternative Fuel (AF) options will be needed. |

| Event Description | Summary of Event and Knowledge Gained |
|---|---|
| representatives of the five Local Authorities and FT. | • Ban on the purchase of internal combustion engines (ICE) in the 2030s. Important to note the German derogation in connection to this – as long as low carbon fuels are used in ICEs. Not the case in the UK, but they are likely to follow suit.<br>• Tailpipe and lifecycle emissions need to be considered when evaluating AF options.<br>• Battery Electric Vehicles (BEV) – Substantial embedded GHG emissions. BEVs must drive a certain mileage before achieving a 'payback.'<br>• UK and EU policy – Only focusses on tailpipe GHG emissions.<br>• Some EV options:<br>• Option 1 – BEV – 'Emission Elsewhere Vehicles.' Can only be used for light duty and short distance applications.<br>• Option 2 - Fuel Cell Electric – Noted that gas infrastructure can be used to facilitate Hydrogen in the future. Hydrogen is similar in appearance and function to CNG/LNG.<br>• Option 3 – H2 Gas ICE Vehicle – Good for long distance and heavy duty applications.<br>• Noted that Biodiesel and HVO are different – Biodiesel is a blend of biodiesel and diesel. HVO based on animal fats and cooking oil.<br>• Emission specific solutions required for organizations. Eclectic approach required.<br>• NO recommend using 100% HVO but blending can take place to reduce price.<br>• Concern about HVO sources and sustainability credentials. There should be no palm oil input or ILUC impact – this is controlled by EU Biofuel related legislation – REDII.<br><br>• HVO Advantages:<br>  ○ 90% GHG emission reductions seemingly with HVO – when considering tailpipe and lifecycle GHG emissions.<br>  ○ 'Drop in' diesel replacement.<br>  ○ Blends naturally with diesel.<br>  ○ Endorsed by all truck manufacturers for all 'E6' engines.<br>  ○ No warranty issues.<br>  ○ HVO less environmentally toxic.<br>  ○ Biodegradable.<br>  ○ HVO has better cold start characteristics than diesel.<br>  ○ Results in reduced Ad Blue usage.<br>  ○ HVO is a cost saver compared to other AFs – no CapEx.<br>  ○ 'Buys time' for organization to consider long-term options.<br>  ○ HVO has EN Certification.<br>  ○ Tailpipe GHG emission reductions measured between 7 – 30%.<br>  ○ Stable supply of HVO<br>  ○ Possible removal of HVO excise in Northern Ireland in Autumn budget.<br>  ○ Possible duty breaks on HVO in the UK.<br>  ○ HVO can also be used for home heating and on-site power. |

<table>
<tr><th>Event Description</th><th>Summary of Event and Knowledge Gained</th></tr>
<tr><td></td><td>
<ul><li>HVO Disadvantages:
<ul><li>price per litre. 20 cent/l dearer than diesel in RoI. 50 p/litre dearer than diesel in the UK (taxed as a mineral oil).</li>
<li>Fuel filters changed slightly more regularly.</li>
<li>HVO is only imported (no domestic production).</li></ul></li></ul>
<u>Transition Constraints</u>
<ul><li>EV – substantial level of infrastructure required. Sub-station upgrades required – Costly.</li>
<li>EU tariff on Biofuels from outside Europe.</li></ul>
</td></tr>
<tr><td>GenComm - Organised conference on Hydrogen development on the island of Ireland.<br>FT attended a public event which took place on the 31s of May 2023 in Belfast.</td><td>
<u>Background</u><br>
GenComm has implemented 3 pilot H2 Ecosystems using the main European renewable sources (Solar, Wind, and Bioenergy) with energy storage. The project has also developed integrated technical and financial simulation models, the Enabling Support Tool (EST) that provides a roadmap for communities to transition to renewable, hydrogen-based energy matrixes.<br>
The GenComm model is now used as the blueprint for the development of Hydrogen Valleys with the Clean Hydrogen Partnership investing EUR 105.4 million for funding 9 Hydrogen Valleys across Europe in early 2023.<br>
GenComm is also utilised as a key support exemplar recommended to allow less advanced regions to replicate the Hydrogen Valleys projects being developed in more “hydrogen mature” countries.<br><br>
<u>Key Knowledge and Insights</u>
<ul><li>Network transition in Northern Ireland → Natural Gas to Biomethane and renewable fuel</li>
<li>Sizable AD sector in Norther Ireland and various other AD plants being developed → supports a transition to further biomethane use.</li>
<li>Some zones are being full supplied by biomethane.</li>
<li>Network should be largely decarbonised by 2030.</li>
<li>Added carbon/sustainability benefit through use of AD digestate as fertilizer (reducing reliance on imported fertiliser) and diversion of food waste from landfill (reducing landfill associated methane emissions).</li>
<li>A portion of existing gas infrastructure will support hydrogen fuel use in the future.</li>
<li>Existing electrolyser in Northern Ireland for production of hydrogen, operated by Bosch. Bosch produce, store, distribute and use hydrogen.</li>
<li>BHF2 website/tool → supports identification of fleet mix i.e. hydrogen vs electric. Identifies cost of ownership and abatement.</li>
<li>Community Hydrogen Forum → decision support to develop a roadmap towards hydrogen. Provides insights, discussion points, case studies, roadmaps, promotes connections, demonstrates hydrogen production potential, calculate diesel offsets.</li>
<li>Constraints to hydrogen transition include:
<ul><li>Planning</li>
<li>Safety</li>
<li>ATEX (fire safety)</li></ul></li></ul>
</td></tr>
</table>

| Event Description | Summary of Event and Knowledge Gained |
|---|---|
| | ○ Lack of firm standards and regulation<br>○ Limited-service providers in hydrogen operation and maintenance<br>○ Training for workers<br>○ ADR<br>○ Cost<br>○ Technical challenges<br>• Motivations for Transition include:<br>○ Carbon tax (financial incentive)<br>○ Phase out of purchase of diesel vehicles<br><br><u>Other Relevant Stakeholders Identified</u><br>• SGN<br>• Energia<br>• BOC Gases<br>• HY Energy<br>• Hydrogen Ireland<br>• Hydrogen Mobility Ireland |
| Indaver - Hydrogen development proposed for their Duleek site | <u>Background</u><br>An online meeting took place with project working group and representatives from Indaver to discuss their proposed hydrogen development and their Duleek waste to energy facility.<br><br><u>Key Knowledge and Insights</u><br>• HVO may be a better transitionary fuel than CNG/BioCNG and more feasible.<br>• Use of CNG requires more retrofitting.<br>• There is only a ca.20% reduction in GHG emissions associated with CNG vs diesel.<br>• There is a greater reduction if using BioCNG, however the level of reduction is dependent on the GHG emission mass balance associated with production, supply and use.<br>• GHG emission reductions associated with BioCNG will need to be supported by analysis and verified.<br>• Electrical infrastructure upgrades required to facilitate roll out of EV.<br>• NI Green Paper on Decarbonization is in the process of being developed.<br>• NI LAs have access to Hydrogen funding in the UK. There is better Hydrogen funding in the UK compared to the RoI.<br>• Funding for pilot projects required followed by CapEx funding.<br>• Indaver is looking to secure pilot projects over the next 2 – 5 years. Looking for first movers. Looking to invest in their Hydrogen infrastructure.<br>• Hydrogen technology efficiency is advancing quickly.<br>• Indaver proposed Hydrogen development - Largest planning approved Hydrogen electrolyser on the island.<br>• Large Hydrogen electrolysers will be developed at offshore wind farms being developed. |

| Event Description | Summary of Event and Knowledge Gained |
|---|---|
| | • Open to discussion about pilot projects.<br>• Possibility to use AD to produce Hydrogen. |
| Meeting with Dr Andrew Hagan of Element 2 | Background<br>• Dr Andrew Hagan is a Director of Element 2, a Hydrogen refuelling station development company. This meeting was held to discuss the approach and processes involved in developing regional Hydrogen Hubs.<br><br>Key Knowledge and Insights<br><br>• UK government incentives generally supportive of Hydrogen<br>• St Helens Council – Operate Hydrogen RCVs. Relevant to NI LAs that have sizeable RCV fleets.<br>• There needs to be a demand for Hydrogen to justify the development. Needs to a market and a body of vehicles. Capital investment made back through Hydrogen sales.<br>• Hydrogen supply being addressed in Ireland. Capacity being developed.<br>• Excess wind energy during curtailment – which is common in Ireland - can be used for Hydrogen production instead.<br>• Collaborative approach needed to develop a market.<br>• Hydrogen the definite choice for HGVs.<br>• Hydrogen in Ireland sourced from Belfast by road tanker currently.<br>• Can convert existing engines to hydrogen ICE or dual engine or can buy new Fuel Cell.<br>• Recommended to engage with vehicle manufacturers as a group.<br>• Joint procurement – the best approach.<br>• Proceed as the one group. Creates confidence. Share costs.<br>• Organizations interested in Hydrogen: Van market &HDV fleets.<br>• Maintenance of Hydrogen vehicles: Training for mechanics required Fuel cell different to combustion engine.<br>• Conversion to ICE or dual fuel – change in maintenance requirements not as significant.<br>• Health and safety risk – Manageable.<br>• Logistics of hubs: Develop hubs then spokes.<br>• Temporary refuelling stations initially – Do not typically require planning permission (based on UK experience).<br>• Mobile solution first. Then permanent solution once demand is established and grown.<br>• Trials should be carried out initially. Need to establish hub is workable.<br>• COMAH Regulations could apply. Storage below COMAH thresholds preferred. Mobile fillers – 750 kg. Less storage.<br>• Synergies with other organizations need to be identified – Translink looking to roll out Hydrogen across NI.<br>• Government supports - ZERF and ZERF2 funding in the UK. |

| Event Description | Summary of Event and Knowledge Gained |
|---|---|
| | • Huge European funding – Advantage for RoI. Zebra funding. Aberdeen and Birmingham projects availed of this funding.<br>• Mobile tankers for transferring Hydrogen.<br>• Gas networks can be used for transferring Hydrogen<br>• Investment needed – greater level of advocacy needed.<br>• Dublin Bus will be relying on BOC Gases for Hydrogen supply.<br>• Hydrogen haulage to Belfast – will have carbon footprint.<br>• Distributors need to decarbonize at the same time. |

# 5. CASE STUDIES

Several case studies of other organizations transitioning to the use of Alternative Fuel technology for their vehicle fleet have been carried out to support this study. The purpose of carrying out these case studies was to examine and gain a detailed 'real world' understanding of other relevant Alternative Fuel adoption projects.

The case study analysis has been appropriately informed by the contextual analysis and stakeholder engagement carried out for this study (documented in Section 3 and Section 4 of this report). Desktop research has been undertaken to support case study analysis.

The findings and insights from these case studies has served to inform the Alternative Fuel Option Analysis carried out for this study (which is documented in Section 6 of this report) and the development of sample strategic roadmaps for each LA for achieving a net zero vehicle fleet (which is documented in Section 7 of this report).

A list of the case studies developed for this project is provided below. For confidentiality reasons, the names of organizations and identifying detail (e.g., such as specific geographic detail or dates) has been omitted.

- Case Study 1: The adoption of a Battery Electric Refuse Collection Vehicle by a Waste Management Company in the Republic of Ireland.
- Case Study 2: The adoption of Compressed Natural Gas Heavy Duty Vehicles by a Haulage Company in the Republic of Ireland and Northern Ireland.
- Case Study 3: The adoption of Compressed Natural Gas Refuse Collection Vehicles by a City Authority in the United States.
- Case Study 4: The adoption of Fuel Cell Electric Buses by a Transport Authority in partnership with Private Sector Bodies in Northern Ireland.
- Case Study 5: The adoption of Fuel Cell Electric Buses by a City Authority in partnership with Private Sector Bodies in Iceland.
- Case Study 6:The use of Hydrotreated Vegetable Oil as an Alternative Fuel for Boards by a Port Authority in the Republic of Ireland
- Case Study 7: The use of Hydrotreated Vegetable Oil as an Alternative Fuel for Heavy Duty Vehicles by a Local Authority in the United Kingdom.

Each case study analysis focussed on the following aspects:

- Approaches and strategies adopted
- Costs
- Advantages and disadvantages of the Alternative Fuel option
- Successes
- Failures
- Learnings and opportunities for improvement

**Case Study 1: The adoption of a Battery Electric Refuse Collection Vehicle by a Waste Management Company in the Republic of Ireland.**

**Approaches and strategies adopted:**

- Have commenced use of an electric Refuse Collection Vehicle (RCV) on a trial basis.
- Provided supporting infrastructure i.e., a designated parking space with an electric charging unit (internal)
- Specific training for drivers on its use
- Capital cost of ca. €700,000 including VAT.
- A supporting grant of €140,000 was provided by SEAI.

**Disadvantages:**

- Suppliers are not educated enough on the electric RCV.
- EV RCV not suitable for motorway driving or particularly hilly landscape.
- EV RCV cannot completely replace a diesel RCV in terms of how its operated. Consideration needs to be given to developing specific routes that suit use of an EV i.e. their use has to be bespoke. EV RCV not as flexible as diesel engine vehicles. Limited to shorter, more local routes. EV not as robust as conventional diesel.
- Significant capital investment. Could purchase two conventional diesel engine vehicles for the cost of one EV.
- Vehicle needs to be inspected every 13 weeks in accordance with legislation.

**Advantages:**

- Truck is much more advanced technologically.
- Simpler vehicle servicing requirements e.g. no requirement for oil and fuel filter changes, just tyres and brakes requiring routine servicing.
- EV less expensive to operate.
- Environmental benefits with respect to pipe emissions and lower noise generation.
- Cost of diesel is increasing, and EV will be less expensive to operate, long term.

**Learnings and Opportunities for Improvement:**

- Use of the EV RCV is continuing, and they will continue to monitor its use with the aim of rolling out more vehicles
- Had also researched possibility of natural gas-powered vehicles but no there is no access to supply depots. Installation of private supply infrastructure would be too costly.
- Learning with respect to the EV RCVs use, efficiency and feasibility for expansion of EV fleet is ongoing.

**Case Study 2: The adoption of Compressed Natural Gas Heavy Duty Vehicles by a Haulage Company in the Republic of Ireland and Northern Ireland**

**Approaches and strategies adopted:**

- Pilot project on dual fuels was carried out initially.
- Company buys, an average of twenty trucks a year. A proportion of these will be CNG so some expansions to take place.
- Testing is still taking place.

**Disadvantages:**

- Issues with range of vehicles and carbon fibre tanks
- Lack of supporting infrastructure - difficult to get to locations further afield (ca. 200 km +)
- Fire safety protocol around refuelling stations is a constraint. Extensive consultations between local fire authorities and GNI is required and delays developing the safety case for the site thereby delaying installation of stations.
- Risk of operators developing a monopoly on supply.
- CNG more expensive than diesel at the pump e.g., €1.389 per kg in ROI as of 25/7/23.
- Lack of support is a general problem. There is no state funding support or grants which inhibits roll out and the development of an economy of scale.
- Costs approximately €20,000 more per truck.
- Requires approximately 100,000 km per year to get a payback.

**Advantages:**

- 250 bar pressure used means there is no 'range anxiety' at a local level
- No AdBlue is required which eliminates cost.
- Cleaner burning fuel, reducing tailpipe emissions.
- Vendors provide an adequate level of maintenance service.

**Learnings and Opportunities for Improvement**

- Trial is still ongoing.
- 6.6 GWh of CNG used per annum by company. This displaces the same level of diesel ensuring greenhouse gas emission reductions.
- Use of CNG vehicles is still ongoing and there is a positive outlook for continued use and expansion of CNG fleet.
- Reduction in tailpipe emissions
- BioCNG needs more support to bring the cost of CNG fuel down and the price point needs to be more attractive.
- Anaerobic Digestion for BioCNG has expensive overheads limiting is generation and greater roll out.
- Increased demand could drive cost reductions.
- Company may continue to expand CNG fleet.

**Case Study 3: The adoption of Compressed Natural Gas Refuse Collection Vehicles by a City Authority in the United States.**

**Approaches and strategies adopted:**

- Use of CNG heavy-duty refuse vehicles by three different organizations, a national waste and recycling services company (Republic Services (RS)), a smaller residential pick up and disposal company (Groot Industries Inc (GII)) and a municipal agency (City of Milwaukee's Department of Public Works (DPW)).
- Received federal funding for the implementation.
- General motivation for adopting CNG across the organizations was to help meet corporate and municipal financial, environmental and energy sustainability goals.
- Training for technicians and drivers.
- Across the three fleets a total of 70 no. CNG refuse vehicles were purchased.

| Groot Industries Inc |
|---|
| • experience with alternative fuels started in 2005 with a biodiesel program which expanded to CNG in 2008. |
| • committed to converting its fleet to CNG to reap emissions and noise benefits. |
| • purchased 20 no. new CNG refuse trucks. |
| • upgraded an existing CNG station and constructed one new station. Both stations can be used by other fleets with advance arrangements being made. |
| • re. training → orientation of the drivers was critical to deployment success. Provided safety training to ensure drivers aware of safety features and to operate them and address any concerns. They also provided operational training to drivers. |
| • received $2.6 million in funding and used ca. $1 million to help cover incremental cost of 20 no. new CNG refuse trucks. |
| **Republic Services** |
| • converted to CNG based on a lower cost relative to diesel fuel. Cost savings could then be passed to customers. |
| • had a target to have 3,100 trucks nationwide running on NG or other alternative fuels by the end of 2015. |
| • a fuelling facility was constructed as part of the project. |
| • purchase of 29 no. new CNG vehicles. |
| • Constructed two public fast-fill and two private time-fill NG fuelling stations. Infrastructure provider also provided operation and maintenance services. |
| • re. training → started mechanics training one month prior to arrival of first trucks. Used natural maintenance classes from and two technicians were certified to perform tank inspections. Trained drivers using practical training and video resources about vehicle operation and safe fuelling practices. CNG trucks are only assigned to drivers with good safety records and longer service with the company. |
| • received ca. $5.5 million in funding and spent ca. $900,000 on the purchase of 29 no. new CNG vehicles. |
| • garage upgrades (methane alarms, ventilation systems etc.) cost ca. $90,000 to $95,000. |

**Case Study 3: The adoption of Compressed Natural Gas Refuse Collection Vehicles by a City Authority in the United States.**

| City of Milwaukee's Department of Public Works |
|---|
| Mayor appointed a 'Green Team' to oversee the city's sustainability initiative. |
| adoption of CNG fuel was one of several fronts to respond to challenge to reduce dependency on foreign fuel sources and reduce emissions. |
| placed 21 no. CNG refuse vehicles in service. |
| re. training → improved understanding and acceptance of the vehicles through training. Included extnsive outreach component and training for vehicle operators, technicians, fuelling site supervisors and users. |
| received $4.4 million to purchase vehicles and construct CNG fuelling stations. They used ca. $750,000 of the funding to place 21 no. CNG trucks in service. |

- Average incremental cost per CNG vehicle ass $38,200 (ca. €35,000) and $1.1 million per station (ca. €1,009,400)

**Advantages:**

- Emissions and noise benefits compared to conventional diesel engines.
- Lower cost of CNG relative to diesel fuel
- Fuel cost savings passed on to customers to control rates.
- CNG trucks are quieter.
- Can save time for drivers because truck fuelling is done overnight with an automated time-fill system (RS). Reducing labour costs.
- Trucks are efficient.
- Didn't break down as often as the some of the older diesel vehicles.
- Vehicles provided sufficient power for their function (according to drivers).
- Brings community and environmental group support.

**Disadvantages:**

- Required modifications to maintenance facility, workshop including added safety systems e.g. audible methane alarms.
- Difficulty in finding suitable contractors to perform work due to limited familiarity and experience contractors in the area with CNG technology.
- Some difficulty in local/state regulations on the resale of fuel for public stations and calibration of dispensers. Responsible authority had to be educated by company and project partners.
- Some difficulty with DWP project with establishing a payment mechanism for customers other than city fleets (how to price and tax the CNG for sale for the public).
- Difficulty in constructing fuelling stations - getting permission from authorities not familiar with the technology and setup and what facilities needed to be provided. Required negotiation with the relevant permitting authorities.
- GII - construction delays due to lead in time for compressor equipment.
- Required upgrades to existing natural gas and electricity supplies.
- DWP - as a public authority there were significant delays in agreeing truck configuration which almost jeopardized the projects funding. Members of the city's council couldn't agree on single or dual-stream recycling.

| Case Study 3: The adoption of Compressed Natural Gas Refuse Collection Vehicles by a City Authority in the United States. |
|---|
| **Learnings and Opportunities for Improvement**<br>• On average the fleets in this study saved approximately 50% on fuel costs.<br>• Data gather demonstrated that in general, the CNG trucks operated in much the same way as the conventional diesel trucks, achieved similar fuel economy performance and provided notable petroleum displacement and GHG emission reduction. Fuel cost savings produced a quick payback of the upfront capital costs for the CNG vehicles.<br>• GII was won awards for its commitment to establishing a CNG fleet.<br>• Rollout of the trucks were largely accepted by drivers, particularly citing the quieter operations.<br>• Produced significant labour cost savings (for RS) due to the overnight time-fill fuelling which allowed drivers to spend less time fuelling the vehicles. The drivers only need to return to their vehicles to do a post-trip inspection and can finish their working day.<br>• Public investment has led to greater private investment in natural gas for refuse vehicles.<br>• Need to identify required equipment early on to take account of lead in times and maintain timelines.<br>• There was some modification to vehicle configurations needed e.g. supplementary fuel tanks need to facilitate longer routes.<br>• At a minimum a favourable business case for a CNG project would require yearly fuel cost savings that are sufficient to repay initial cost of vehicles, stations etc. in a relatively short timeframe.<br>• All fleets included in the study made plans to continue deployment of CNG.<br>• RS aimed to operate its Boise fleet solely on CNG within five years. |

| Case Study 4: The adoption of Fuel Cell Electric Buses by a Transport Authority in partnership with Private Sector Bodies in Northern Ireland. |
|---|
| **Approaches and strategies adopted:**<br>• As part of the programme to introducing zero emissions vehicles, the Dept. of Infrastructure funded three hydrogen fuel cell electric buses which have entered service with in December 2020.<br>• Compressed hydrogen is generated using renewable wind energy<br>• Hydrogen fuel is transported to a bus depot in Belfast for fuelling buses.<br>• In November 2020 funding was announced for 100 zero emission buses made up of a further 20 fuel cell electric buses and 80 battery electric buses.<br>• Roll-out took place in 2022.<br>• First batch of zero emission, electric double decker buses entered passenger service in Belfast in March 2022<br>• New vehicles will account for ca. 33% of all metro services.<br>• Entire Foyle Metro Fleet in Derry-Londonderry will also become emissions free with the introduction of a further 38 battery electric buses, making the City among the first in Europe to have a fully zero-emission urban bus fleet.<br>• Two EV buses operating at the Giant’s Causeway on the shuttle service between the visitor centre and the stones.<br>• Transport body aims to reduce GHG emissions by 50% by 2030 and operate a zero emission fleet across Northern Ireland by 2040. |

**Case Study 5: The adoption of Fuel Cell Electric Buses by a City Authority in partnership with Private Sector Bodies in Iceland.**

**Approaches and strategies adopted:**

- Main driver was price fluctuations in imported oil-based fossil fuels. Need to develop an energy system less dependent on imports.
- Strong cohesion between municipalities, government, and the public.
- The Climate Action Plan (CAP) is Iceland's main instrument to reach its commitment in the Paris Agreement, more specifically its emissions goals for 2030.
- Within the CAP the Icelandic government have set an emission reduction target of 35% by 2030 with an aim to be carbon neutral by 2040
- The Icelandic Hydrogen and Fuel Cell Company Ltd was established ca. 1998 with the sole purpose of investigating the potential for the replacement of the use of fossil fuels with hydrogen.
- Iceland has been a key partner in several hydrogen projects.
- The Ecological City Transportation System (ECTOS) project was launched in 2001 → to demonstrate and evaluate hydrogen-based infrastructure for public transport and demonstrate the benefits for the society at large to operate the future transport system on hydrogen.
- Introduction of three fuel cell buses brought into commercial operation in Reykjavik and the installation of a hydrogen refuelling station to support the fleet.
- HyFLEET:CUTE demonstration project: is the world's largest hydrogen powered bus project
- → aimed to facilitate the development of hydrogen powered bus technology and associated infrastructure using the lessons learnt from the previous hydrogen bus projects.
- The project introduced 47 hydrogen powered buses (both fuel cell and internal combustion engine) in regular public transport services in the following cities: Amsterdam, Barcelona, Beijing, Berlin, Hamburg, London, Luxemburg, Madrid, Perth and Reykjavik

**Learnings and Opportunities for Improvement**

- Buses operated much more effectively than anticipated.
- More than 90% of the public surveyed in Reykjavik indicated that they had a 'positive' or 'very positive' attitude towards hydrogen as an alternative fuel source for transportation.
- successful demonstration of 10 hydrogen station units with no accidents associated with operation/maintenance of the stations.
- There were unanticipated small technical issues such as failures of the CVM (cell voltage monitor) board, pumps, and inverters (but were quickly resolved)
- The project provided a valuable insight into the practicality of a hydrogen economy in Iceland.
- Successful demonstration had taken place in Reykjavik, proving that the current state of technology and infrastructure in the early 2000s, could be integrated into modern society.
- the project deemed the current stage of technology at the end of the ECTOS project, as not commercially economical for Iceland, but highlighted the potential for a hydrogen economy to become a reality for Iceland within the next few decades.
- ECTOS became a forerunner to simi-lar tests in other European cities under the Clean Urban Transportation for Europe (CUTE) project (2001-2006).
- HyFLEET:CUTE project successfully demonstrated the performance of both fuel cell and in-ternal combustion engine hydrogen powered buses within public transportation systems throughout Europe.
- HyFLEET:CUTE project also demonstrated that the infrastructure to produce, supply and dis-tribute hydrogen for transportation purposes can be implemented efficiently and with no fundamental obstacles

| Case Study 5: The adoption of Fuel Cell Electric Buses by a City Authority in partnership with Private Sector Bodies in Iceland. |
|---|
| • the hydrogen bus technology must be able to operate with minimal special support within a standard public transport bus fleet.<br>• For hydrogen to be as cheap and clean as possible it should be produced using renewable electricity.<br>• The project high-lighted the need for progression of hydrogen transport projects from development to demonstration involving large fleets of buses.<br>• Also refer to successes and failures presented above as learning outcomes. |

| Case Study 6: The use of Hydrotreated Vegetable Oil as an Alternative Fuel for Boats by a Port Authority in the Republic of Ireland |
|---|
| **Approaches and strategies adopted:**<br>• Commenced a pilot exercise using a pilot boat in April 2023. This has been completed.<br>• Partly motivated by Public Sector Energy target of 50% improvement in energy efficiency by 2030.<br>• Organization targets a greener future in accordance with the Governments Climate Action Plan 2023 which aims to halve national emissions by 2030.<br>• HVO was supplied by Certa<br>• One of Organizations Pilot Boats was operated using 100% HVO fuel.<br>• Organization has begun Phase 2 of the trial which is testing biofuel in the Liffey and Camac Pilot Boats.<br><br>**Advantages:**<br>• HVO is a low emission alternative fuel<br>• Demonstrated to significantly reduce fuel-related carbon emissions with no modifications needed to existing engines.<br><br>**Learnings and Opportunities for Improvement:**<br>• There were ca. 200 pilot transfers completed on the pilot boat using 100% HVO.<br>• Initial results indicate that the use of HVO in the Pilot Boat cuts emissions between 80-90%.<br>• Operators of the Pilot Boat noted that there were no obvious issues in handling or performance of the pilot boat and that exhaust fumes had reduced significantly.<br>• If trials are successful moving all four Pilot Boats to HVO could reduce the organizations $CO^2$ emissions between 10-15% ahead of the 51% $CO_2$ emissions reduction target for 2030. |

**Case Study 7: The use of Hydrotreated Vegetable Oil as an Alternative Fuel for Heavy Duty Vehicles by a Local Authority in the United Kingdom.**

**Approaches and strategies adopted:**

- Since 2008 the Council has run vehicles on fatty acid methyl ester biodiesel from waste cooking oil.
- Had conducted initial trials of B30 FAME and higher blend B85 fuel, eventually securing a 100% biodiesel at below market price.
- Trialled HVO use
- Operates 150 vehicles (ca. 1/3 of a 470-vehicle fleet) on some form of biodiesel.
- Also operates 47 electric vehicles.
- Has signed up to the Go Ultra Low Company commitment and become a 'LoCity Champion.
- Exploring possibility of operating electric HDVs but realises this is a longer-term project. Sees use of HVO as a transitional step.
- Has conducted formal emissions testing of HVO.
- Stopped using FAME biodiesel

**Advantages/disadvantages of the Alternative Fuel option**

Advantages:

- HVO is cleaner and more stable than FAME fuel.

Disadvantages:

- HVO is more expensive.

**Learnings and Opportunities for Improvement**

- Emissions testing has shown HVO fuel can reduce NOx emissions at the tailpipe by 69% and 28%, depending on the operating cycle.
- $CO_2$ emissions at the tailpipe fell by 10%.
- As the fuel is made from waste vegetable oil its already >80% $CO_2$ efficient.

# 6. ALTERNATIVE FUEL OPTION ANALYSIS

A structured evaluation of all Alternative Fuel Options has taken place.[5] This analysis has been informed by the baseline evaluation of LA vehicle fleets documented in Section 2 of this report, the context analysis documented in Section 3 of this report, the stakeholder engagement documented in Section 4 of this report and the case study examination documented in Section 5 of this report. The analysis has also been supported by an additional body of research relating to the alternative fuel options. A list of reference sources used to inform the analysis is provided in Appendix 1.

## 6.1 Approach and Methodology

The following short list of alternative fuel options were considered by the project team in the alternative fuel analysis undertaken.

- Hydrotreated Vegetable Oil (HVO)
- Conventional Biofuel (Biodiesel or Bioethanol)
- Battery Electric Vehicle (BEV)
- Biomethane based options (BioCNG, BioLNG or BioLPG).
- Green Hydrogen (Fuel Cell or Internal Combustion Engine)

Having carried out the baseline evaluation of each LAs vehicle (documented in Section 2 of this report), it was determined that two broad categories of vehicle were present in the fleets. These were as follows:

- Heavy Duty Vehicles (HDVs), including heavy duty mobile plant and heavy duty tractors - which have a gross vehicle weight or maximum authorized mass greater than 3.5 tonnes and tractors.[6]
- Light Duty Vehicles (LDVs), including light duty mobile plant - which have a gross vehicle weight or maximum authorized mass less than 3.5 tonnes.[7]

A different alternative fuel strategy is required for HDVs and LDVs given their differing weight, operational requirements and power demand. As such, separate analysis has been carried out for each vehicle category.

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[5] Note on Scope of the Alternative Fuel Option Analysis:
Initially, it was envisaged that separate Alternative Fuel Option Analysis exercises would be carried out for each RoI and NI LA, however upon in-depth consideration, given the commonalities between each LA with respect to geographic location, vehicle fleet characteristics and operational requirements, and the alternative fuels sectors and guiding policy and legislation broadly in both RoI and NI; it was determined that the results of the analysis and the conclusions drawn would not differ between LAs if separate analysis was done. It was therefore decided to carry out one Alternative Fuel Option Analysis exercise for all LAs taking part in this study. Importantly however, both RoI and NI factors have been examined when carrying out the analysis (e.g., policy, legislation and market characteristics specific to each jurisdiction) - these factors are reported upon separately, where appropriate.
[6] E.g., 'RCV,' 'Lorry,' 'Truck,' 'Tractor.'
[7] E.g., 'Pick Ups,' '4x4s,' 'Cars,' 'Vans,' 'Forklifts,' 'Ride On Mowers.'

### 6.1.1 Methodology for Evaluating Alternative Fuel Options for Heavy Duty Vehicles

Multi-criteria analysis has been undertaken to determine the preferred alternative fuel option for HDVs. An option analysis scoring matrix has been developed to evaluate the alternative fuel options for HDVs. This scoring matrix considers the following aspects:

- **Policy Support (PS)** - Level of policy support for the alternative fuel option.
- **Market Supply (MS)** - Availability and adequacy of supply of the alternative fuel or energy source on the market.
- **Vehicle Technology (VT)** - The availability of suitable vehicle technology to facilitate the transition of HDVs to the alternative fuel option, having regard to vehicle operational requirements and power demand.
- **Infrastructure Provision(IP)** - Level and adequacy of infrastructure required to support an alternative fuel option, including public infrastructure and site infrastructure.
- **Operational Viability (OV)** - A measure of how feasible an alternative fuel option is considering the operational and maintenance requirements and constraints associated with that option.
- **CapEx** - Capital expenditure required to transition a HDV fleet to the alternative fuel option, including expenditure on infrastructure and vehicles
- **OpEx** - Operational expenditure associated with operating a HDV based on the alternative fuel option, including ongoing fuel/energy costs and maintenance costs.
- **GHG Emissions (GHG)** - Level of GHG emission reductions that can be achieved transitioning a HDV fleet to the alternative fuel option.
- **Environmental Impact (EI)** - Nature and magnitude of potential, intended environmental impacts associated with the alternative fuel option.
- **Economic Benefits (EB)** - Potential for the alternative fuel option to provide broader economic benefits, including benefits to other potential commercial and industrial users of the alternative fuel, job creation and benefits to the wider economy generally.
- **Complexity (C)** - The overall complexity associated with transitioning HDVs to the alternative fuel option.
- **Future Potential (FP)** - Future potential associated with the alternative fuel option, having regard to policy direction, prospective legislation and market direction.
- **Risk (R)**- The level of risk associated with pursuing an alternative fuel option, including market risk, health and safety risk, risk associated with technological advances that may make the alternative fuel option redundant, and the risk of a change in policy direction or legislative support making the alternative fuel option less viable.

Each of the above factors have been assigned a rating score of between 1 to 5. The scoring criteria used in the matrix is defined in Table 6-1. The successful implementation of an alternative fuel strategy by a vehicle fleet operator in a 'real word' scenario requires a multi-pronged and balanced approach which has equal regard to all of the above aspects. For this reason, each of the aspects scores have been assigned the same weighting in the analysis.

**Table 6-1: Scoring Criteria for Heavy Duty Vehicle Alternative Fuel Option Analysis Scoring Matrix**

| Rating Score | Meaning of Rating Score |
|---|---|
| 1 | Performs very poorly in relation to the aspect. |
| 2 | Performs poorly in relation to the aspect. |
| 3 | Performs marginally in relation to this aspect. |
| 4 | Performs good in relation to the aspect |
| 5 | Performs excellently in relation to the aspect |

The Alternative Fuel Option Analysis for HDVs is presented in Section 6.2.

### 6.1.2 Methodology for Evaluating Alternative Fuel Options for Light Duty Vehicles

Qualitative research and analysis has been undertaken to determine the preferred alternative fuel option for LDVs. The analysis carried out has been suitably informed by the context analysis and stakeholder engagement carried out for the study. The output of this analysis is presented in Section 6.3 of this report.

## 6.2 Alternative Fuel Option Analysis - Heavy Duty Vehicles

### 6.2.1 Analysis

An alternative fuel option scoring matrix has been prepared for the alternative fuel options being considered. This matrix is presented in Table 6-2. Each alternative fuel option considered has been assigned a total rating score. Discussion on the basis for the aspect scoring is provided for each alternative fuel option in Table 6-3, Table 6-4, Table 6-5, Table 6-6 and Table 6-7. A succinct summary of the advantages and disadvantages associated with each alternative fuel option for HDVs has been provided in Table 6-8. The main conclusions drawn as a result of the analysis are presented Section 6.2.2. Where appropriate, supporting cost analysis associated with an alternative fuel options has been carried out. Cost projections have been prepared for alternative fuel options, where appropriate cost data is available. This supporting analysis is presented in Appendix 2.

## Table 6-2: Alternative Fuel Option Analysis Scoring Matrix

| Alternative Fuel Option | Rating Score | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MS | PS | VT | IP | OV | CapEx | OpEx | GHG | EI | EB | C | FP | R | Total Score |
| HVO (Hydrotreated Vegetable Oil) | 3 | 3 | 5 | 5 | 5 | 5 | 2 | 4 | 3 | 3 | 5 | 3 | 3 | **49** |
| Conventional Biofuel (Biodiesel or Bioethanol) | 3 | 3 | 3 | 5 | 3 | 5 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | **43** |
| BEV (Battery Electric Vehicle) | 2 | 4 | 2 | 2 | 2 | 2 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | **35** |
| Biomethane based options (BioCNG, BioLNG or BioLPG). | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 4 | 4 | 4 | 2 | 2 | 2 | **38** |
| Green Hydrogen (Fuel Cell or Internal Combustion Engine) | 2 | 5 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 5 | 3 | 5 | 4 | **45** |

Key: Market Supply - MS, Policy Support - PS, Vehicle Technology - VT , Infrastructure Provision - IP, Operational Viability - OV, CapEx, OpEx, GHG Emissions - GHG, Environmental Impact - EI, Economic Benefits - EB, Complexity - C, Future Potential - FP, Risk - R.

Meaning of Rating Score:

| Rating Score | Meaning of Rating Score |
|---|---|
| 1 | Performs very poorly in relation to the aspect. |
| 2 | Performs poorly in relation to the aspect. |
| 3 | Performs marginally in relation to this aspect. |
| 4 | Performs good in relation to the aspect |
| 5 | Performs excellently in relation to the aspect |

**Table 6-3: Basis of Alternative Fuel Option Analysis Scoring for Hydrotreated Vegetable Oil (HVO)**

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Market Supply | 3 | Current market supply is stable. Several refineries in Europe currently producing HVO (E.g., Neste, Total, ENI, Cepsa, Shell). Additional refineries are being built (E.g., Neste are constructing a second refinery in Rotterdam). Market supply is very small relative to fossil fuel market supplies, however. Ongoing, increasing demand at scale may affect market supply. Future competing demand (e.g., from the Aviation sector) may affect supply. |
| Policy Support | 3 | Some policy support - as demonstrated by HVO being regarded as a renewable fuel under the RTFO scheme in RoI and NI. Long-term policy less supportive of HVO and more supportive of alternative fuels that do not generate tailpipe emissions (E.g., EV Green Hydrogen) |
| Vehicle Technology | 5 | Existing diesel based vehicles can be fuelled/powered using HVO |
| Infrastructure Provision | 5 | Existing fossil fuel storage and supply infrastructure can be used to store/supply HVO. |
| Operational Viability | 5 | HVO is a 'drop in' diesel replacement and scores highly in terms of operational viability. |
| CapEx | 5 | Existing vehicle fleet and fuel infrastructure do not have to be upgraded to facilitate HVO adoption. There is minimal capital cost associated with transitioning to fuelling a vehicle fleet on HVO. |
| OpEx | 2 | HVO is more expensive than diesel. 20 cent/l dearer than diesel in RoI. 50 p/litre dearer than diesel in the UK/NI (taxed as a mineral oil).This is a significant disadvantage. The additional 1 year OpEx cost associated with Monaghan County Council and Armagh, Banbridge and Craigavon Borough Council using HVO instead of diesel is shown in Appendix 2 (assuming HVO being 20 cent/l dearer than diesel in RoI and 50 p/litre dearer than diesel in NI).<br><br>The use of HVO is incentivized to a degree by the RTFO schemes in RoI and NI. |
| GHG Emissions | 4 | HVO - if sourced from producers/production facilities that comply with the relevant sustainability and GHG emission saving criteria (E.g., Renewable Energy Directive II, RTFO (in UK/NI) - has the potential to reduce lifecycle GHG emissions by 50 - 90%. (I.e., 'Well to wheel' GHG emissions associated with cultivation, raw material, transport, all processing steps, fuel transport, distribution and final use of the fuel).<br><br>Tailpipe GHG emission reductions caused by HVO combustion are more marginal when compared to diesel (measured between 7 – 30%). Emissions testing has shown HVO fuel can reduce $NO_x$ emissions - which has a higher Global Warming Potential) than $CO_2$. |
| Environmental Impact | 3 | The combustion of HVO generates tailpipe emissions from vehicles that can have some degree of negative effect on local, ambient air quality.<br><br>The production and supply of HVO - if not carried out sustainably - can potentially lead to Indirect Land Use Change (ILUC), where agricultural land previously used for food production; or natural land such as forests, wetlands and peatlands are converted to producing biomass |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| | | for HVO production. ILUC can result in negative environmental effects (i.e., reducing food production levels, reducing carbon stock and sequestration potential associated with land, biodiversity impacts). |
| Economic Benefits | 3 | Scalable adoption of HVO on the island of Ireland has some potential support the development of an indigenous HVO production sector - including the development of facilities that can process waste cooking and animal fats oil to produce HVO, which can lead to some economic benefits and job creation. There may also be synergies between users of HVO and the existing meat processing/animal rendering sectors in RoI and NI which generate a significant amount animal fat by-product (e.g., tallow). |
| Complexity | 5 | There would be a low degree of complexity associated with transitioning a vehicle fleet to HVO given it is a 'drop in' fuel replacement and no infrastructural updates or vehicle upgrades would be required to accommodate its storage, supply and use in vehicles. |
| Future Potential | 3 | HVO has potential in the short-term. Its use has the potential to create a significant reduction in lifecycle GHG emissions. Its use, however, will not facilitate an organization reducing its vehicle fleet related GHG emissions to Net Zero - in line with national emission reduction targets in RoI and NI. HVO production and supply and the combustion of HVO in vehicles will continue to generate GHG emissions.<br><br>HVOs future potential - in the long-term - is significantly limited by the lack of policy support for its use. It is seen by policy makers and some in industry as a transitioning short-term option for achieving GHG emission reductions. |
| Risk | 3 | There is minimal financial risk associated with adopting HVO given it is a 'drop in' fuel replacement - no infrastructural updates or vehicle upgrades would be required to accommodate its storage, supply and use in vehicles. There is some degree of supply chain risk given the potential for a substantial increase in demand for HVO relative to production and supply levels. There is some degree of environmental risk associated with the potential for HVO to be sourced from unsustainable sources causing a negative, upstream environmental impact. |
| **Total** | **49** | |

**Table 6-4: Basis of Alternative Fuel Option Analysis Scoring for Conventional Biofuel (Biodiesel or Bioethanol)**

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Market Supply | 3 | Some degree of market supply. Market supply is very small relative to fossil fuel market supplies, however. Ongoing, increasing demand at scale may affect market supply. |
| Policy Support | 3 | Some policy support - supported by the RTFO in RoI and NI. Long-term policy less supportive however, more supportive of alternative fuels that do not generate tailpipe emissions (E.g., EV or Green Hydrogen). |
| Vehicle Technology | 3 | Existing diesel based vehicles can be fuelled/powered using conventional biofuels - but only at low blending rates. The use of biofuels at higher blending rates may affect vehicle performance and warranty. |
| Infrastructure Provision | 5 | No significant infrastructural upgrades required to accommodate a transitioning to the use of conventions biofuels in vehicle fleets. |
| Operational Viability | 3 | Conventional biofuel tanks require more maintenance (cleaning for bugs and bacteria).<br>Can only be used at low blending rates without affecting vehicle performance and warranty however. |
| CapEx | 5 | Existing vehicle fleet and fuel infrastructure do not have to be upgraded significantly to facilitate conventional biofuel adoption. There is minimal capital cost associated with transitioning to fuelling a vehicle fleet on biofuel. |
| OpEx | 2 | Conventional biofuel costs are currently significantly higher than diesel costs on the market.<br>The use of biofuel is incentivized to a degree by the RTFO schemes in RoI and NI. |
| GHG Emissions | 3 | Conventional biofuels - if sourced from producers/production facilities that comply with the relevant sustainability and GHG emission saving criteria (E.g., RED II, RTFO (in UK/NI) - have the potential to reduce lifecycle GHG emissions to some degree, however biofuel tailpipe GHG emission reductions are more marginal when compared to diesel. Less GHG emission reduction would be achieved compared to the use of HVO as Biofuels can only be used at low blend rates however. |
| Environmental Impact | 3 | The combustion of conventional biofuel generates tailpipe emissions from vehicles that can have some degree of negative effect on local, ambient air quality.<br>The production and supply of conventional biofuel - if not carried out sustainably - can potentially lead to ILUC, where agricultural land previously used for food production; or natural land such as forests, wetlands and peatlands are converted to producing biomass for HVO production. ILUC can result in negative environmental effects (i.e., reducing food production levels, reducing carbon stock and sequestration potential associated with land, biodiversity impacts). |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Economic Benefits | 3 | Scalable adoption of conventional biofuel on the island of Ireland has some potential support the development of an indigenous biofuel production sector - including the development of facilities that can process waste cooking and animal fats oil to produce biofuel, which can lead to some economic benefits and job creation. There may also be synergies between users of biofuel and the existing meat processing/animal rendering sectors in RoI and NI which generate a significant amount animal fat by-product (e.g., tallow). |
| Complexity | 3 | There would be some degree of complexity associated with transitioning a vehicle fleet to conventional biofuels. The use of biofuels at low blending rates would need to be carefully managed. Additional infrastructural maintenance is required. Biodiesel is more likely to affect engine performance compared with HVO. |
| Future Potential | 3 | Conventional biofuels have some potential in the short-term. Their use has the potential to create a significant reduction in lifecycle GHG emissions. Their use, however, will not facilitate an organization reducing its vehicle fleet related GHG emissions to Net Zero - in line with national emission reduction targets in RoI and NI. Biofuel production and supply and the combustion of biofuel in vehicles will continue to generate GHG emissions. |
| Risk | 3 | There is a low level of financial risk associated with adopting biofuel - no infrastructural updates or significant vehicle upgrades would be required to accommodate its storage, supply and use in vehicles. There is some degree of supply chain risk given the potential for a substantial increase in demand for biofuel relative to production and supply levels. There is some degree of environmental risk associated with the potential for biofuel to be sourced from unsustainable sources causing a negative, upstream environmental impact. |
| **Total** | **42** | |

**Table 6-5: Basis of Alternative Fuel Option Analysis Scoring for Battery Electric Vehicle (BEV)**

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Market Supply | 2 | A very significant increase in grid capacity would be required in both RoI and NI to accommodate the scalable roll out of BEV for HDVs. |
| Policy Support | 4 | Generally, policy in RoI and NI is supportive of alternative fuel options that will result in zero tailpipe GHG emissions. |
| Vehicle Technology | 2 | There is a broad consensus among policy makers, industry and those who have adopted BEV for HDVs that the use of BEV for heavy duty applications presents multiple challenges (i.e., limited travel distances, performance impacted by topography and any heavy operational requirements, significantly reduced battery performance over time).<br>The supply of BEV HDVs to the Irish market is significantly constrained. Currently, it can take an organization up to 2 years to procure a BEV HDV. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Infrastructure Provision | 2 | Both the RoI and NI electricity grids are under pressure currently due to existing demand. A very significant increase in grid capacity would be required in both RoI and NI to accommodate the scalable roll out of BEV for HDVs. This will necessitate the development of a substantial level of additional power generation and grid infrastructure.<br><br>A very substantial and ongoing, secure supply of electricity to local authority vehicle depot sites would be required to facilitate charging of sizeable BEV HDV fleets. This will likely necessitate the development of a significant level of additional on-site infrastructure (e.g., sub-stations) to facilitate electricity transmission to on-site charging points. |
| Operational Viability | 2 | There is a broad consensus among policy makers, industry and those who have adopted BEV for HDVs that the use of BEV for heavy duty applications presents multiple challenges (i.e., limited travel distances, performance impacted by topography and any heavy operational requirements, long charging times, significantly reduced battery performance over time).<br><br>A significant amount of internal upskilling and training would be required to ensure vehicles operators and mechanics were sufficiently competent in the use/maintenance of BEVs. |
| CapEx | 2 | The development of additional on-site electrical infrastructure at local authority sites - to facilitate electricity transmission for vehicle charging - would necessitate a very substantial capital investment.<br><br>The procurement of BEV HDVs would also require a very substantial capital investment. For example, the capital cost of a new EV RCV in RoI is currently ca. €700,000 (based on the recent experience of waste management company), whilst the average capital cost of a new diesel based RCV in RoI is currently estimated at €175,000. Similar cost differentials exist between BEV and Diesel trucks.<br><br>A comparison between the total cost of replacing diesel RCVs in Armagh, Banbridge and Craigavon Borough Council's vehicle fleet with new diesel RCVs (assuming all new diesel RCVs of varying sizes are valued on average at ca. £150,000) and replacing existing diesel RCVs with new BEV RCVs (assuming all new BEV RCVs of varying sizes are valued on average at ca. £600,000) is provided in Appendix 2. |
| OpEx | 4 | According to the Sustainable Energy Authority of Ireland powering an BEV is significantly cheaper than fuelling a diesel based vehicle of the same size in an Irish context. |
| GHG Emissions | 4 | BEVs generate zero tailpipe emissions. A significant level of lifecycle GHG emissions can be generated during BEV manufacturing and supply processes (e.g., during raw material extraction, transport and processing, the vehicle production process and finished vehicle product transport). These lifecycle GHG emissions will be offset however by the GHG emission savings realized by BEVs over their operational lifetime. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Environmental Impact | 4 | BEVs generate zero tailpipe emissions, which results in climate change related and local air quality benefits.<br>Production processes involved in the manufacture of BEVs have the potential to have negative environmental effects (e.g., resource usage, raw material and finished product transport related emissions, environmental pollution risk).<br>The use of BEVs can impact local air quality due to the generation of particulates (i.e., brake dust, tyre dust airborne road dust).<br>At end-of-life, the improper disposal of BEV components (such as Lead-acid or Lithium ion batteries) has the potential to cause environmental pollution. |
| Economic Benefits | 3 | Scalable adoption of BEVs on the island of Ireland has the potential support the development of a BEV supply chain economy in RoI and NI. |
| Complexity | 2 | There would be a high degree of complexity associated with transitioning a diesel HDV fleet to BEV due to the cost, grid connection and planning and environmental complexities associated with infrastructural upgrades; the capital investment required to replace diesel HDVs with BEV HDVs - and associated organizational budgetary implications; the current operational limitations of BEV HDVs, and the level and range of internal upskilling required to facilitate with a transition to BEV). |
| Future Potential | 2 | It is unlikely the scalable adoption of BEV HDVs will take place given the limitations, challenges and complexities associated with BEV HDV adoption. |
| Risk | 2 | There is a significant risk to organizations that BEV HDVs may not be able to perform to the required standard operationally given current operational limitations associated with BEV HDVs.<br>There is a significant level of financial risk associated with investing in developing BEV supporting infrastructure and procuring BEV HDVs - when those vehicles may not be perform operationally.<br>There is a risk that BEV HDVs will receive less policy and funding support than Hydrogen-based HDVs in the long-term - given the challenges, constraints and challenges associated with adopting BEV HDVs, in comparison to the potential viability of adopting Hydrogen-based HDVs. |
| **Total** | **35** | |

**Table 6-6: Basis of Alternative Fuel Option Analysis Scoring for Biomethane based options (BioCNG, BioLNG or BioLPG).**

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Market Supply | 3 | Both jurisdictions potentially have the capacity to indigenously produce and supply Biomethane as a renewable transport fuel.<br><br>NI has a sizeable and well-developed Biomethane production sector relative to its size.<br><br>RoI has a relatively small Biomethane production sector by comparison, however it has established national targets for developing the sector which will likely spur Biomethane production nationally - the Climate Action Plan (2023) increased the target for Anaerobic Digestion in RoI to 5.7 TWh Biomethane by 2030 (which will require in the region of 150 to 200 Anaerobic Digestion plants).<br><br>A substantial volume of Biomethane produced in RoI and NI however is likely to be used for heating applications in the residential, power generation, commercial and industrial sectors (displacing natural gas usage) - which would reduce the potential for scalable supply of Biomethane as a renewable transport fuel. |
| Policy Support | 3 | There is marginal policy and funding support for the adoption of Biomethane in both RoI and NI, mainly due to long-term proposals to phase out ICEs in both the EU and UK in the 2030s. The use Biomethane in ICEs is considered to be a transitionary step toward achieving the required Transport sector GHG emission reductions by policy makers. |
| Vehicle Technology | 3 | Existing diesel based HDVs will need to be retrofitted to facilitate being powered by a gas such as Biomethane or new gas powered HDVs will need to be procured.<br><br>Recent experience in an Irish context has shown that gas powered HDVs experience range issues and have limited travel distances. Gas powered HDVs can operate successfully across local and regional areas; however, they have difficulty travelling longer distances nationally and internationally.<br><br>The supply of gas powered HDVs to the Irish market is significantly constrained. Currently, it can take an organization up to 2 years to procure a gas powered HDV. |
| Infrastructure Provision | 2 | Generally, there is a lack of gas refueling stations across the island of Ireland to some degree. Some regions are served reasonably well by gas refuelling infrastructure (e.g., the Dublin region, the border region), however other regions are less well served (e.g., the south-east of RoI).<br><br>Gas network operators and private operators in both RoI and NI (E.g., GNI, Firmus, Flogas Ireland Ltd.) have ambitions to decarbonize gas supply networks/chains using Biomethane and develop additional CNG/Biomethane refuelling stations - contingent on their being an adequate level of ongoing demand for CNG/Biomethane as a transport fuel in a particular region. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| | | The functional area of each LA participating in this study is reasonably well served by a gas network. The development of on-site gas refueling stations at LA depots is possible on this basis, although additional parallel development of anaerobic digestion facilities locally may be required to ensure an adequate supply of sustainable Biomethane to LA depot sites for vehicle refuelling. |
| Operational Viability | 3 | The use of Biomethane powered HDVs in LA vehicle fleets is considered to be marginally viable. Gas powered HDVs are limited in terms of the distances they can travel; however, this could be overcome with good fleet and route management, where the vehicles are needed to travel short-moderate distances, such as across a local authority functional area.<br><br>A significant amount of internal upskilling and training would be required to ensure HDV operators and mechanics were sufficiently competent in the use/maintenance of HDVs powered by Biomethane and any associated refuelling infrastructure.<br><br>The use of biomethane as a transport fuel will necessitate the adoption and ongoing implementation of robust fire safety controls at a site. Fire safety protocol around refuelling stations can be a significant constraint during the development and operation of a refueling stations. A detailed Safety Gas must be prepared for stations in consultation with local fire authorities. |
| CapEx | 3 | Existing diesel based HDVs will need to be retrofitted to facilitate being powered by Biomethane or new gas powered HDVs will need to be procured. Both HDV retrofitting and the procurement of new gas powered HDV have the potential to generate significant capital costs. Currently, a gas powered truck can cost between €20,000 and €40,000 more than a similar type of diesel truck in the RoI, for example.<br><br>A comparison between the total cost of replacing diesel lorries in Monaghan County Council's vehicle fleet with new diesel lorries (assuming all new diesel lorries of varying sizes are valued on average at ca. €175,000) and replacing diesel lorries with new gas powered lorries (assuming all new gas powered lorries are valued at an average of €205,000) is provided in Appendix 2.<br><br>In addition to the cost of upgrading HDVs/purchasing new HDVs, depending on the availability of local gas refuelling stations that can be used by LA vehicle fleets, LAs may need to develop on-site Biomethane connection and refuelling infrastructure, which will necessitate significant capital investment. |
| OpEx | 3 | The future cost of Biomethane being supplied as a transport fuel is dependent on a variety of factors. The use of Biomethane as a renewable fuel is incentivized by the RTFO in RoI and UK/NI. It is the view of many that more policy and funding support is and will be needed to reduce costs to a point that transitioning a HDV fleet to being powered by Biomethane is economical however. |
| GHG Emissions | 4 | The combustion of Biomethane generates significantly less GHG emissions than diesel combustion, however it still generates some levels of GHG emissions. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| | | Lifecycle GHG emissions associated with indigenously produced Biomethane are generally substantially lower than lifecycle GHG emissions associated with diesel extraction, refining and transport. |
| Environmental Impact | 4 | The combustion of Biomethane generates significantly lower emissions than diesel combustion (e.g., no particulate or $SO_2$ emissions, reduced $CO_2$ and $N_2O$ emissions) leading to reduced local air quality impacts.<br><br>The diversion of agricultural by-product such as slurry to anaerobic digestion facilities has the potential to have a significant positive environmental effect by reducing the quantum of slurry being used for agricultural landspreading and in turn being released to the receiving soils, groundwater or surface water environment – causing environmental pollution.<br><br>The production of Biomethane at Anaerobic Digest–on facilities has the potential to have negative environmental effects on the local areas and receiving environments those facilities are situated in (without proper control and management of the facility), including noise, nuisance and odour impacts. |
| Economic Benefits | 4 | The scalable adoption of Biomethane as a transport fuel has significant potential to support and underpin the development of the Biomethane production and supply sector – in combination with RoI's and NI's strong agriculture sectors, which have the capacity to supply Anaerobic Digestion facilities with feedstock needed to produce Biomethane. |
| Complexity | 2 | Transitioning a HDV fleet to being fuelled on Biomethane presents several challenges and is likely to be complex (E.g., secure, ongoing market supply required, lack of long-term policy supports, range limitations, significant infrastructural development required, operational complexities and challenges, substantial capital investment). |
| Future Potential | 2 | The future potential of using Biomethane as a transport fuel is significantly limited by the lack of policy support for its use. It is seen by policy makers and some in industry as a transitionary, short-term option for achieving GHG emission reductions in the transport sector – having regards to ambitions to phase out ICEs in the EU and UK in the 2030s.<br><br>In addition, it is likely that a substantial quantity of Biomethane produced in RoI and NI will be diverted for use in the residential, commercial, industrial and power generation sectors (e.g., in heating applications), which would limit its availability for use as a transport fuel. |
| Risk | 2 | There is some degree of risk to organizations that Biomethane powered HDVs may not be able to perform to the required standard operationally given current range limitations experienced by users of the vehicles in and Irish context. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| | | There is a a degree of financial risk associated with investing in developing supporting Biomethane connection and refuelling infrastructure and procuring gas powered HDVs - when those vehicles may not perform operationally.<br><br>This financial risk is magnified by the lack of policy support - given the anticipated phase out of ICE in the RoI and NI in the 2030s - which is likely to inhibit the scalable adoption of Biomethane powered vehicles.<br><br>There is also some degree financial risk associated making substantial capital investment to transition to a Biomethane powered vehicle fleet - when long-term infrastructural and technological advances relating to the use of Hydrogen as a transport fuel for HDVs may make the use of Biomethane powered HDVs redundant in the long-term.<br><br>The use of Biomethane as a transport fuel also presents obvious health and safety and fire safety risks that would need to be carefully managed by any organization adopting Biomethane based HDVs and developing associated refuelling infrastructure. |
| **Total** | **38** | |

**Table 6-7: Basis of Alternative Fuel Option Analysis Scoring for Green Hydrogen (Fuel Cell or Internal Combustion Engine)**

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Market Supply | 2 | There is a relatively small indigenous supply of Hydrogen in RoI and NI currently. Two sites on the island of Ireland are currently involved in the production of Hydrogen - Energia Group's North Antrim Wind Farm Electroylser, which produces Green Hydrogen and BOC Gases Gas Storage and Produciton Facility in Blueball, Dublin 11. Most Hydrogen supplied to the RoI and NI markets is either imported from mainland UK and/or Europe.<br><br>Hydrogen is an abundant element and there is significant investment potential for the sector however. |
| Policy Support | 5 | The use of Hydrogen as an alternative fuel for HDVs is well supported by policy in RoI and UK/NI (E.g., UK Transport Decarbonization Plan, RoI CAP23 proposes developing a regulatory roadmap for green hydrogen use (Action reference: EN/23/7), National Hydrogen Strategy in both RoI and NI). There is a good degree of funding support for Hydrogen in both jurisdictions also (NI LAs have access to extensive UK Hydrogen Funding (e.g., Net Zero Hydrogen Fund), RoI Alternative Fuel HDV Grant). Generally, there is a good degree of funding for pilot Hydrogen projects. |
| Vehicle Technology | 3 | Hydrogen powered trucks have proven to be effective for heavy duty applications elsewhere (E.g., Iceland's Ecological City Transportation System (ECTOS)). |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| | | Hydrogen powered trucks are not widely available on the market, however. There are currently significant lead in times for procuring right hand Hydrogen powered trucks. |
| Infrastructure Provision | 3 | There is a relatively low level of Hydrogen infrastructure on the island of Ireland currently, with only two facilities producing Hydrogen. Most Hydrogen supplied to the RoI and NI markets is either imported from mainland UK and/or Europe.<br><br>There is significant potential for the development of a Hydrogen production sector, however. Numerous on-shore and offshore wind farms are in the process of being developed in RoI and NI. This will create further opportunities to produce 'green' hydrogen using electrolysers at wind farm installations. During periods of low demand and grid curtailment - which are common on the island of Ireland - the energy produced by the wind farm sector can be reutilized for Hydrogen production.<br><br>Existing gas network infrastructure can be more readily re-utilized for the supply of Hydrogen in the long term, which can facilitate a better transition to the widespread use of Hydrogen. |
| Operational Viability | 3 | Hydrogen based HDVs are generally more operationally effective than BEV or Biomethane based alternatives. The transition of a vehicle fleet to Hydrogen is operationally feasible, however there are several challenges and constraints associated with its storage and use as a transport fuel that need to be carefully managed (E.g., vehicle operator and mechanic upskilling, ATEX risk, planning and environmental constraints, Limited-service providers in hydrogen operation and maintenance). |
| CapEx | 2 | The capital cost of a fuel cell Hydrogen based HDV is substantially higher than the cost of a similar diesel based vehicle. The cost of converting diesel based HDVs to ICE based hydrogen is less but still significant<br><br>In addition to the cost of upgrading HDVs/purchasing new HDVs, depending on the availability of local Hydrogen refuelling stations that can be used by LA vehicle fleets, LAs may need to develop on-site Hydrogen refuelling infrastructure, which will necessitate significant capital investment. |
| OpEx | 2 | Recent analysis has shown that the current cost of operating a vehicle based on hydrogen is significantly greater than the cost of operating the same type and size of vehicle on diesel. It would cost £11.40 to cover 100km (at a cost of £12 per kg) in a hydrogen based Hyundai Nexo. An equivalent diesel with economy of 55mpg (5.1l/100km) will cost around £6.72 to cover the same distance. It can be assumed a similar price differential between hydrogen and diesel would currently exist for HDVs. Generally, the price of Hydrogen corresponds to the price of electricity in the market, and it can be assumed Hydrogen prices will decrease where Hydrogen supply increases and the price of electricity decreases. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| GHG Emissions | 4 | Hydrogen based vehicles generate zero tailpipe emissions. Some level lifecycle GHG emissions can be generated during the manufacture and supply of Hydrogen based vehicles. These lifecycle GHG emissions will be offset however by the GHG emission savings realized by hydrogen based HDVs over their operational lifetime. |
| Environmental Impact | 4 | The use of Hydrogen as a transport Fuel is generally positive from an environmental perspective. Hydrogen based vehicles generate zero tailpipe emissions and will not have a direct impact on the climate environment or local air quality.<br><br>Similar to BEVs, the manufacture of Hydrogen based vehicles and end-of-life waste management have the potential to create negative environmental effects. The development of Hydrogen production and refuelling infrastructure as the potential to create localized negative environmental effects (e.g., local HDV traffic generation, visual impacts), however such impacts can be readily managed and mitigated. |
| Economic Benefits | 5 | The scalable adoption of Hydrogen as a transport fuel has significant potential to support and underpin the development of the Hydrogen production and supply sector - in combination with RoI's and NI's strong wind farm sectors, which will likely have the capacity to produce Green Hydrogen. |
| Complexity | 3 | Transitioning a HDV fleet to being fuelled on Hydrogen presents several challenges and is likely to be complex (E.g., operational complexities and challenges, substantial capital investment). The complexity of this has been scored less than other comparable alternative fuel options however given the level of policy supported associated with the long-term transition to Hydrogen as a transport fuel and given the reported operational effectiveness of Hydrogen based HDVs.<br><br>The Control of Major Accident Hazard Regulations applicable to RoI and NI respectively require that sites storing greater than 5 tonnes of Hydrogen on-site register as a Lower Tier Seveso site and sites storing greater than 50 tonnes of Hydrogen register as a Higher Tier Seveso site - with the Health and Safety Authority (RoI) or the Health and Safety Executive (NI). This creates a greater degree of operational complexity, with any sites qualifying as a Seveso site needing to introduce additional health and safety controls to manage major accident risks associated with bulk Hydrogen storage (E.g., the development of a Major Accident Prevention Policy or an External Emergency Response Plan). The adequate management of such risk is considered to be achievable however. |
| Future Potential | 5 | The use of Hydrogen as a transport fuel as substantial future potential given the long-term policy support and associated funding supports available, the operational effectiveness of Hydrogen based HDVs, the environmental benefits associated with its use as a Hydrogen sector, and the synergies between the emerging Hydrogen sector and the strong and developing wind sectors in both RoI and NI. |

| Aspect | Rating Score | Basis of Alternative Fuel Option Analysis Scoring |
|---|---|---|
| Risk | 4 | Given the future potential of the use of Hydrogen as a transport fuel for HDVs, the level of financial risk is lesser than other comparable alternative fuel options.<br><br>Given the likely operational effectiveness of Hydrogen based vehicles, the level of operational risk is lesser than other comparable alternative fuel options.<br><br>The storage and use of Hydrogen - which is a colourless and odourless gas - creates ATEX risk that will need to be carefully management by an organization adopting Hydrogen based HDVs and developing associated refuelling infrastructure. |
| **Total** | **45** | |

**Table 6-8: Summary of the Advantages and Disadvantages associated with each Alternative Fuel Option for HDVs**

| Alternative Fuel Option | Advantages | Disadvantages |
|---|---|---|
| Hydrotreated Vegetable Oil (HVO) | Existing diesel based vehicles can be fuelled/powered using HVO. No significant changes needed to support its use.<br>Doesn't need significant additional supporting infrastructure for its implementation. Can utilise existing fuel storage, transport and market systems.<br>Operationally comparable to diesel engines, no significant disruption to existing vehicle functionality. Is a 'drop-in' option.<br>Minimal capital expenditure (can use existing diesel fleet).<br>Simple technology and option with no significant complexities for its introduction.<br>Reports high reduction in lifecycle GHG emissions (50% - 90%) compared to standard diesel fuel. Reduction in tailpipe emissions are reported to be (7% - 40%). | Higher operational costs primarily due to higher fuel price compared to conventional diesel. Ca. 20c/l dearer than diesel in RoI and 50p/l dearer than diesel in the UK. |
| Conventional Biofuel (Biodiesel or Bioethanol) | Doesn't need significant additional supporting infrastructure for its implementation.<br>Minimal capital expenditure required as existing fleet will only need minimal upgrading and modification to facilitate its use.<br>Potentially significant reduction in GHG emissions (on a lifecycle basis) compared to standard diesel fuel provided fuel is produced in a sustainable manner. | Relatively high operational costs due to higher fuel price and potentially increased maintenance requirements.<br>There would be some degree of complexity associated with transitioning a vehicle fleet to conventional biofuels. The use of biofuels at low blending rates would need to be carefully managed.<br>Less GHG emission reduction would be achieved compared to the use of HVO as Biofuels can only be used at low blend rates however. |

| Alternative Fuel Option | Advantages | Disadvantages |
|---|---|---|
| Battery Electric Vehicle (BEV) | Current policies are in support of a transition to EV technology, whilst discouraging increased use of conventional, combustion engines.<br><br>Decreased operational costs through fuel savings.<br><br>Significant reduction in tailpipe GHG emissions which offsets manufacturing related emissions. Will ultimately being a net reduction in emissions over their operational lifetime.<br><br>Positive environmental impact particularly in terms of tailpipe emissions. Climate and local air quality benefits. | Inadequate market supply, fewer options available.<br><br>Requires significant new supporting infrastructure. Lack of infrastructure currently is a constraint.<br><br>Operationally constrained i.e., cannot operate an EV HDV in exactly the same manner as an equivalent diesel engine.<br><br>Significant capital investment required. EV HDVs can be significantly more expensive that their conventional or other alternative fuel counterparts.<br><br>Vehicles are more complex (operation and maintenance). Greater degree of complexity to make the transition particularly in terms of putting the required infrastructure in place.<br><br>Lower probability of scalability i.e., EVs accounting for majority of fleets sue to their current operational limitations.<br><br>Presents a risk to users as their use may cause operational constraints. Financial risk by investing in infrastructure and vehicles which may then not be fit for purpose. |

| Alternative Fuel Option | Advantages | Disadvantages |
|---|---|---|
| Biomethane based options (BioCNG, BioLNG or BioLPG). | The combustion of Biomethane generates significantly less GHG emissions than diesel combustion. Lifecycle GHG emissions associated with indigenously produced Biomethane are generally substantially lower than lifecycle GHG emissions associated with diesel extraction, refining and transport.<br>Potential additional environmental benefits e.g., through alternative use for slurry in anaerobic digestion as opposed to land spreading.<br>Economically beneficial and scalable. Increased adoption as a transport fuel can be an underpinning driver for the AD and biomethane industry. Can utilise an already strong agricultural sector. | There is a lack of supporting infrastructure at present. Increased infrastructure is likely to be very dependent on consumer demand.<br>Potentially significant capital expense due to retrofitting requirements.<br>Transition to biomethane fleet is more complex and presents some challenges e.g. infrastructure requirements, lack of long term policy supports, range limitations etc.<br>Limited future potential due to lack of policy support . May not be a long term option. Some uncertainty on availability of supply with biomethane prioritised for residential, commercial, industrial and power generation sectors.<br>Degree of risk to organizations in terms of operational impacts i.e., biomethane vehicles not as functional or practical as conventional diesel. Financial risk of investing in vehicles and infrastructure if vehicles may not be viable option long term.<br>Health and Safety risks. |

| Alternative Fuel Option | Advantages | Disadvantages |
| --- | --- | --- |
| Green Hydrogen (Fuel Cell or Internal Combustion Engine) | Good policy support, initiatives and financial aid.<br>Zero tailpipe GHG emissions. Manufacturing associated emissions can be offset zero tailpipe emissions.<br>Generally positive environmental impact particularly in terms of tailpipe emissions. Climate and local air quality benefits.<br>Economically beneficial and scalable. Increased adoption as a transport fuel can be an underpinning driver for hydrogen generation industry. Can utilise existing sources of renewable energy to power hydrogen generation facilities.<br>Are less constrained operationally, compared some other options.<br>Has substantial future potential given long-term policy support and funding. It is an emerging and growing option.<br>Lower risk to make the transition due to the likely long-term support for hydrogen transition. | Only very small supply available.<br>Substantially higher capital investment required for both vehicles and potentially on dedicated fuelling equipment.<br>Operational costs are significantly higher that operating equivalent vehicle on diesel. |

### 6.2.2 Main Conclusions

The following main conclusions have been drawn following completion of the alternative fuel option analysis for HDVs:

- HVO has been assigned the highest rating score (**49**). Hydrogen has been assigned the second highest rating score (**45**). These alternative fuel options have been identified as the two most viable alternative fuel options for each LAs vehicle fleet.
- It is clear that HVO is a readily achievable, short-term solution that can contribute to significantly reducing an organizations vehicle fleet related GHG emissions (provided the HVO is sustainably sourced).
- Hydrogen – which is more underpinned by long-term policy and legislative support - is a more long-term viable solution that can result in the reduction of an organization's vehicle fleet related GHG emissions to Net Zero.
- Biofuel, which was assigned a score of **42**, is a viable option in theory, however, it is less preferred than HVO as an alternative fuel as it is not a 'drop in' replacement for diesel and therefore less operationally viable generally. Its use at low blend rates also limits the potential level of GHG emissions reductions that can be achieved through its use.

- Biomethane, which was assigned a score of **38**, and BEV, which was assigned a score of **35**, and are less viable solutions generally. There are significant fundamental constraints associated with each of these options.
  - There is a significant risk BEVs in particular won't perform operationally when being used for heavy duty applications required of a LA vehicle fleet.
  - Biomethane does not have long-term policy or legislative support. This lack of long-term support is underpinned by EU and UK plans to phase out ICEs in the 2030s. It is important to note that this may change however depending on policy changes and future policy direction.
  - Biomethane also has less future potential generally, mainly due to this lack of policy and legislative support, but also in part due to likely competing demand for Biomethane from other sectors. It is noted HVO supply may also be affected by competing demand.
  - Overall, there is a significant risk associated with attempting a transition to Biomethane based vehicles when there is lack of policy support and future potential for a scalable roll out of Biomethane as a transport fuel. There is also some degree of risk associated with Biomethane based vehicles not performing to the required standards operationally, although the risk of this is considered less than the risk of BEV based HDVs not performing operationally.
- All options have the potential to incur significant costs.
  - HVO is recognized as the least cost option – the OpEx associated with HVO substantially less than the CapEx associated with BEV for example. The adoption of HVO will not incur any significant CapEx, however.
  - The BEV, Biomethane and Hydrogen options will all incur significant CapEx costs.

Overall, it has been completed and has concluded that the most viable short-term option for reducing GHG emissions associated with HDVs is to advance the use of HVO within each LAs vehicle fleet. This is considered to be a short-term, transition option that will serve to reduce each LAs vehicle fleet emissions in a manner broadly commensurate with the current RoI and NI national GHG reduction targets for 2030.

A variety of organizations across the island of Ireland have commenced using HVO in their HDV fleets, including the organizations listed in Table 6-9.

**Table 6-9: Irish Organizations that have commenced the use of HVO**

| | |
|---|---|
| **Certa** | Certa's fuel delivery vehicles now running on Hydrotreated Vegetable Oil (HVO) - Fleet Transport |
| **Musgrave** | Musgrave to rollout Hydrotreated Vegetable Oil (HVO) fuel for its truck fleet - Fleet Transport |
| **DPD Ireland** | DPD Ireland switches truck fleet to 100% HVO biofuel to reduce carbon emissions - Fleet Transport |
| **Circle K** | Circle K Ireland's fuel delivery fleet to be powered by 100% HVO renewable diesel - Fleet Transport |
| **Lidl Ireland** | Picture of the Week: Lidl Ireland - First food retailer to launch Electric & HVO powered trucks into Logistic Fleet - Fleet Transport |

The most viable long-term option for reducing GHG emission to acceptable levels by 2050 is to support the development of Hydrogen infrastructure and advance the use of Hydrogen based vehicles within each LA's vehicle fleet. This is considered to be a long-term option that will serve to support the development of a 'Net Zero' GHG emission vehicle fleets for each LAs - in accordance with the RoI and NI national GHG reduction targets of achieving 'Net Zero' GHG emissions by 2050

## 6.3 Alternative Fuel Option Analysis - Light Duty Vehicles

The most viable solution for reducing GHG emissions associated with LDVs is to advance the use of HVO in LDVs as a transitionary solution in parallel with the adoption of BEV LDVs as a longer term solution.

HVO is a preferred transitionary option for LA LDV vehicle fleets for the same reasons outlined in the case of HDVs in Section 6.2 (I.e., least cost, a 'drop in' fuel, operationally viable, least amount of complexity, GHG emissions reductions). Naturally, there are synergies between the roll out of HVO for use in LDVs and HDVs, which support HVO being a transitionary option for LDVs also.

The most viable longer term option for LA vehicle fleets is BEV. The reasons for this are as follows:

- A very significant level of policy and funding support exists in both RoI and NI for transitioning private cars and LDVs to BEV (E.g., under the UK Transport Decarbonization Plan, NI Energy Strategy, RoI CAP23, RoI National Policy Framework on Alternative Fuels Infrastructure for Transport in Ireland 2017 – 2030).
- It is widely acknowledged that BEV is the best longer term solution for smaller vehicles such as private cars or LDVs.
- Public EV charging infrastructure is in the early stages of being developed across RoI and NI. For example, the new Electric Vehicles Charging Infrastructure Strategy 2022 – 2025 in RoI will see €100 million spent on public charging infrastructure over the next three years. Such infrastructure can be availed of by LAs. Electric Vehicle Infrastructure Action Plan 2022 will support the development of EV charging infrastructure in NI. It is noted there are grid infrastructure capacity limitations in both RoI and NI which will constrain the widespread adoption and use of EVs.
- It is expected the East Border Region FASTER project will facilitate the roll out of an extensive network EV charging infrastructure in the East Broder Region, which can potentially be utilized by the LDVs in each LA vehicle fleet. This infrastructural development will underpin the scalable roll out of EV in the region generally.
- National, regional and local development policy in both RoI and NI also provides extensive support to the development of EV charging.
- Generally, the task of transitioning LDV fleets to an alternative fuel is more straightforward given that these lighter vehicles will require less power to operate and are only used for light duty applications.
- The scalable adoption of BEV LDVs would not require the same quantum of electricity demand as the adoption of BEV HDVs. A reduced degree of on-site electrical infrastructure would be required given the less demand associated with BEV LDVs and given the likely presence of a good network of EV charging infrastructure in the future.
- LDVs are not affected by the operational challenges faced by BEV HDVs. Modern BEV LDVs are less constrained in terms of range. BEV LDVs would be particularly suited for LA vehicles that travel within the boundary of a local authority functional area.
- BEV LDVs are widely available on the market.

- According to the SEAI, the cost of powering an EV is significantly less than powering a diesel based vehicle of the same type and size. This OpEx 'gain' could potentially offset the CapEx cost associated with adopting BEV LDVs.
- The roll out of BEV LDVs faces a decreased level of complexity and has a greater level of future potential for the reasons defined above.

BEV LDVs face some challenges that are similar in nature to the challenges faced by BEV HDVs which would need to be carefully managed and overcome (E.g., electricity demand, on-site infrastructural requirements potentially, operator and mechanic training, CapEx cost associated with BEV LDV procurement, potential upstream and downstream environmental impacts etc.), however, importantly overcoming these challenges is more achievable given the reduced operational requirements and electricity demand associated with lighter vehicles.

A variety of organizations across the island of Ireland have progressed transitioning their car/LDV fleets to BEV, including the organizations listed in Table 6-10:

**Table 6-10: Irish Organizations that have adopted BEV LDVs**

| | |
|---|---|
| **DPD Ireland** | DPD Ireland plans to utilise another 100 electric vans - electrive.com |
| **AnPost** | Industry, Innovation, and Infrastructure \| An Post |
| **Wexford Gardai** | https://www.independent.ie/regionals/wexford/news/wexford-gardai-unveil-new-additions-to-their-fleet-of-electric-vehicles/a1458974606.html |
| **SDCC** | South Dublin County Council going green with Citroen Electric vans - Fleet Transport |
| **Key Guard** | PICTURE OF THE WEEK: Key Guard Patrol Fleet Switch to Electric with 10 Renault ZOE Commercial Vans - Fleet Transport |
| **BWG Foods** | BWG Foods takes delivery of the first electric-powered Mercedes-Benz eSprinter van - Fleet Transport |

# 7. ACHIEVING A NET ZERO EMISSION VEHICLE FLEET

A sample Strategic Roadmap for achieving a net zero emission vehicle fleets has been prepared for each LA participating in this study. Each sampleStrategic Roadmap provides information on the following:

- Introduction and Overview
- Strategic Approach
- Vision for achieving a Net Zero Emission Vehicle Fleet
- Mission
- Strategic Roadmap 2024 - 2030

The sample Strategic Roadmaps have been informed by the conclusions drawn from the Alternative Fuel Option Analysis undertaken in Section 6. The Strategic Roadmaps are presented in Appendix 3.

The sample Strategic Roadmaps presented in Appendix 3 have been produced in first draft and are consistent between each LA. If progressing the Strategic Roadmaps, it is recommended each local authority review and finalize each their Strategic Roadmaps, with a view toward making their RoadMap more implementable and specific to their organization (considering their own organizational understanding and organizational factors, including resourcing and budgetary related factors).

The following general recommendations are also proposed:

- Each LA should review and finalize their sample Strategic Roadmap for achieving a net zero emission vehicle fleets. This roadmap should also have regard to other organizational factors, apart from technological solutions, that can support achieving vehicle fleet related GHG emission reductions, including operational, fleet management and behavioural related factors and opportunities to avoid vehicle use and shift to sustainable travel. This roadmap should be supported by the development of subsequent phased implementation plans.
- Record vehicle related data each year to allow for accurate and ongoing quantification of vehicle fleet GHG emissions, and an estimation of costs associated with vehicle fleet decarbonisation, including data on vehicle type and number, fuel use, capital cost and operational cost.
- Establish lifecycle GHG emissions for their vehicle fleet, rather than quantifying direct vehicle related GHG emissions only, to allow for quantification of lifecycle GHG emission reductions associated with the adoption of HVO as an alternative fuel in particular.
- Establish a long-term business case for the vehicle fleet transition.
- Explore funding supports for the vehicle fleet transition.
- Work as a partnership with other East Border Region Local Authorities and other public sector organizations, where appropriate, to progress the alternative fuel transition. A joint approach may create more 'buying power' and an 'economy of scale' for a partnership.
- Progress alternative fuel pilot projects
- Carry out ongoing stakeholder engagement with the Alternative Fuels sector (e.g., join and participate in events held by Hydrogen Mobility Ireland).

FEHILY TIMONEY

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# APPENDIX 1

Reference Sources for the Alternative Fuel Option Analysis

1. Abbott, G. (2023). JCB Hydrogen engine on the brink of commercial production. [online] www.farmersjournal.ie. Available at: https://www.farmersjournal.ie/jcb-hydrogen-engine-on-the-brink-of-commercial-production-742012 [Accessed 17 Apr. 2023].
2. Aberdeen City Council. (2021). Press Archive | Update on the council’s fleet replacement programme. [online] Available at: https://www.aberdeencity.gov.uk/News/Press-Archive/Article?title=Update%20on%20the%20council%E2%80%99s%20fleet%20replacement%20programme [Accessed 21 Jun. 2023].
3. Aberdeen City Council. (2022). Fleet replacement programme continues to help council with net zero targets | Aberdeen City Council. [online] Available at: https://www.aberdeencity.gov.uk/news/fleet-replacement-programme-continues-help-council-net-zero-targets [Accessed 21 Jun. 2023].
4. Advanced Propulsion Centre UK and Automotive Council UK (2021). Heavy Goods >3.5t and Off-highway Vehicle Roadmap 2020 - Narrative Report. [online] Advanced Propulsion Centre UK. Available at: https://www.apcuk.co.uk/wp-content/uploads/2021/09/https___www.apcuk_.co_.uk_app_uploads_2021_02_Exec-summary-Product-Roadmap-HGV-and-Off-highway-final.pdf.
5. An Post. (2023). The journey so far - Industry, Innovation and Infrastructure. [online] Available at: https://www.anpost.com/Sustainability/Industry-Innovation-and-Infrastructure/The-journey-so-far [Accessed 4 Jul. 2023].
6. André, K. and Degerstedt, W. (2021). Greenhouse Gas Emissions Reduction in the Heavy-Duty Transport Sector - A Case Study of Renewable Energy Carriers in Sweden.
7. Balfour Beatty (n.d.). Position paper Hydrotreated Vegetable Oil (HVO) and Gas to Liquid (GTL). [online] Available at: https://balfourbeatty.com/media/319619/hvo-positioning-paper.pdf [Accessed 26 Jul. 2023].
8. Ballard Power Systems (2021). Case Study - Fuel Cell Zero-Emission Buses for Aberdeen, Scotland. Ballard Power Systems.
9. Belfast City Council. (2022). Sustainable fuel switch for Belfast City Council vehicles gets go ahead. [online] Available at: https://www.belfastcity.gov.uk/news/sustainable-fuel-switch-for-belfast-city-council-v [Accessed 13 Jun. 2023].
10. Byrne Ó Cléirigh (2022). A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets. [online] Department of Transport. Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/236620/2bc87dee-edf4-45e6-a342-b74cf71d5e21.pdf#page=null [Accessed 27 Apr. 2023].
11. Cambridgeshire & Peterborough Combined Authority, NewAnglia and Element Energy (2022). East Anglian Alternative Fuels Strategy. [online] Cambridgeshire & Peterborough Combined Authority. Available at: https://cambridgeshirepeterboroughcagov.cmis.uk.com/Document.ashx?czJKcaeAi5tUFL1DTL2UE4zNRBcoShgo=xhWIOh9taNYMgxxUhQWxyxyubdn6eOJLU7r5mpa3gL7os2NHe7uv9Q%3D%3D&rUzwRPf%2BZ3zd4E7Ikn8Lyw%3D%3D=pwRE6AGJFLDNlh225F5QMaQWCtPHwdhUfCZ%2FLUQzgA2uL5jNRG4jdQ%3D%3D&mCTIbCubSFfXsDGW9IXnlg%3D%3D=hFflUdN3100%3D&kCx1AnS9%2FpWZQ40DXFvdEw%3D%3D=hFflUdN3100%3D&uJovDxwdjMPoYv%2BAJvYtyA%3D%3D=ctNJFf55vVA%3D&FgPlIEJYlotS%2BYGoBi5olA%3D%3D=NHdURQburHA%3D&d9Qjj0ag1Pd993jsyOJqFvmyB7X0CSQK=ctNJFf55vVA%3D&WGewmoAfeNR9xqBux0r1Q8Za60lavYmz=ctNJFf55vVA%3D&WGewmoAfeNQ16B2MHuCpMRKZMwaG1PaO=ctNJFf55vVA%3D.
12. CARO. (n.d.). Cork City Council’s switch to Electric Vehicle (EV) Fleet. [online] Available at: https://www.caro.ie/projects-research/case-studies/cork-city-council-s-switch-to-electric-vehicle-(ev [Accessed 15 Jun. 2023].

13. CARO. (n.d.). Installation of EV Charging in Partnership with eir and EasyGo | Carlow County Council. [online] Available at: https://www.caro.ie/projects-research/case-studies/installation-of-ev-fast-charging-and-destination-c [Accessed 12 Jun. 2023].
14. CARO. (2019). Local Authority EV Fleet | Dún Laoghaire Rathdown County Council. [online] Available at: https://www.caro.ie/projects-research/case-studies/local-authority-electric-vehicle-fleet [Accessed 20 Jun. 2023].
15. Cenex. (n.d.). Low Emission Projects & Case Studies from Cenex. [online] Available at: https://www.cenex.co.uk/projects-case-studies/ [Accessed 24 May 2023].
16. Certa Ireland (n.d.). Gd+ HVO - Feedstocks used to make Advanced Fuels. Certa Ireland.
17. Certa Ireland (n.d.). Gd+ HVO - Fuel specification. Certa Ireland.
18. Certa Ireland (n.d.). Hydrotreated Vegetable Oil - The Low-Carbon Commercial Diesel Alternative. Certa Ireland.
19. Climate Action Plan for Northern Ireland Councils. (2020). [online] Friends of the Earth UK. Available at: https://groups.friendsoftheearth.uk/sites/default/files/documents/2020-10/October_2020_Climate_Action_Plan_Northern_Ireland.pdf.
20. Climate Change Act (Northern Ireland) 2022. Available at: https://www.legislation.gov.uk/nia/2022/31/enacted.
21. Climate Change Act 2008. Available at: https://www.legislation.gov.uk/ukpga/2008/27/contents.
22. Cork County Council. (2023). Cork County Council Welcomes New Electric Sweepers for Pedestrian and Cycle Routes. [online] Available at: https://www.corkcoco.ie/en/news/cork-county-council-welcomes-new-electric-sweepers-for-pedestrian-and-cycle-routes [Accessed 15 Jun. 2023].
23. Department for Transport (2012). Renewable Transport Fuel Obligation. [online] GOV.UK. Available at: https://www.gov.uk/guidance/renewable-transport-fuels-obligation [Accessed 17 May 2023].
24. Department for Transport (2021). Decarbonising Transport: A Better, Greener Britain. Department for Transport.
25. Department of Public Expenditure and Reform (2021). National Development Plan 2021-2030. [online] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/200358/a36dd274-736c-4d04-8879-b158e8b95029.pdf#page=null.
26. Department of the Environment, Climate and Communications (2019). National Policy Framework - Alternative Fuels Infrastructure for Transport in Ireland 2017 to 2030. [online] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/27463/6ce8a48a99c44e1dbf40a59a073cb06d.pdf.
27. Department of the Environment, Climate and Communications (2022). Climate Action Plan 2023. [online] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/256997/b5da0446-8d81-4fb5-991e-65dd807bb257.pdf#page=null.
28. Department of Transport (2021). Renewable Fuels for Transport Policy Statement. [online] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/205285/331035ce-e45c-493d-99be-7b8bad6a9ba8.pdf.
29. Department of Transport (2022). Ireland's Road Haulage Strategy 2022–2031. [online] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/242639/3ae11fc7-5e78-4057-9721-65554521d0a8.pdf#page=null.
30. Department of Transport (2023). Renewable Transport Fuel Policy 2023-2025. [online] Available at: https://www.gov.ie/pdf/?file=https://assets.gov.ie/262016/0f9661c4-30d8-4ecd-ae1d-eaa5b313d225.pdf#page=null.

31. Department of Transport, Tourism and Sport (2022). Report on the Implementation of the Alternative Fuels Infrastructure Directive (2014/94/EU). [online] Available at: https://alternative-fuels-observatory.ec.europa.eu/system/files/documents/2022-12/2019%20Ireland%20NIR.pdf [Accessed 18 May 2023].
32. Donegal County Council. (2021). Donegal County Council adds Electric Vehicles to its Transport Fleet. [online] Available at: https://www.donegalcoco.ie/yourcouncil/communicationsoffice/pressreleasefromjan2021/donegal%20county%20council%20adds%20electric%20vehicles/ [Accessed 12 Jun. 2023].
33. dpd.ie. (n.d.). Our Vision For Sustainability. [online] Available at: https://dpd.ie/Sustainability [Accessed 26 Jun. 2023].
34. Electric Vehicle Association Northern Ireland (n.d.). EVANI. [online] EVANI. Available at: https://evani.uk/ [Accessed 17 Apr. 2023].
35. Electromaps. (n.d.). List of charging stations for electric vehicles in Ireland. [online] Available at: https://www.electromaps.com/en/charging-stations/ireland.
36. Energia Group (n.d.). Energia Group To Power Hydrogen-Fueled Bus Pilot. [online] www.energiagroup.com. Available at: https://www.energiagroup.com/news-media/energia-group-to-power-hydrogen-fueled-bus-pilot/ [Accessed 17 Apr. 2023].
37. EPA Ireland (2022). Irish GPP Criteria: Road Transport Vehicles & Services. [online] EPA Ireland. Available at: https://www.epa.ie/publications/circular-economy/resources/EPA_GPP_Criteria_Transport_2022_03.pdf [Accessed 27 Apr. 2023].
38. FASTER (n.d.). Supporting the transition to low carbon transport - FASTER Project. [online] FASTER. Available at: https://www.fasterevcharge.com/about-us/ [Accessed 21 Apr. 2023].
39. Freight Transport Association Ireland (n.d.). Alternative Fuels Working Group. [online] FTA Ireland. Available at: https://www.ftai.ie/alternative-fuels-working-group [Accessed 17 Apr. 2023].
40. gasnetworks.ie. (n.d.). Compressed Natural Gas refuelling stations. [online] Available at: https://www.gasnetworks.ie/business/natural-gas-in-transport/cng-refuelling-stations/#:~:text=Public%20CNG%20stations&text=This%20is%20provided%20by%20Gas.
41. Green Biofuels Ireland. (n.d.). OUR PRODUCTS. [online] Available at: https://gbi.ie/our-products/ [Accessed 16 Jun. 2023].
42. Green Planet and University of Groningen (2021). Hydrogen Applications in Heavy-Duty Transportation. Green Planet.
43. Hydrogen Mobility Ireland (2019). A Hydrogen Roadmap for Irish Transport, 2020-2030. [online] Hydrogen Mobility Ireland. Available at: https://h2mi.ie/wp-content/uploads/2019/12/20190930-Hydrogen-Mobility-Ireland-Final-External-Report-1.pdf.
44. Hydrogen Mobility Ireland (2022). White Paper: Policy to Enable Green Hydrogen in Ireland. [online] Hydrogen Mobility Ireland. Available at: https://h2mi.ie/wp-content/uploads/2022/08/HMI-White-Paper-Policy-to-Enable-Green-Hydrogen.pdf.
45. Hydrogen NI (n.d.). Delivering a Clean Hydrogen Economy in Northern Ireland. [online] Hydrogen NI. Available at: https://www.hydrogen-ni.com/ [Accessed 17 Apr. 2023].
46. Interreg North-West Europe | GenComm. (n.d.). GENCOMM: GENerating energy secure COMMunities through Smart Renewable Hydrogen. [online] Available at: https://vb.nweurope.eu/projects/project-search/gencomm-generating-energy-secure-communities/ [Accessed 9 Jun. 2023].
47. IrBEA. (n.d.). IrBEA | Irish BioEnergy Association. [online] Available at: https://www.irbea.org/ [Accessed 17 Apr. 2023].

48. Irish EV Association (n.d.). Irish EV Association – IEVA – For Electric Vehicle Owners & Drivers in Ireland. [online] www.irishevassociation.ie. Available at: https://www.irishevassociation.ie/ [Accessed 17 Aug. 2023].
49. Local Government Management Agency, County and City Association Management and CARO (2022). Local Authority Reimagining Transport - Early Interventions. [online] LGMA. Available at: https://www.lgma.ie/en/publications/local-authority-sector-reports/local-authority-reimagining-transport-early-interventions-june-2022.pdf.
50. Local Government Management Agency, County and City Management Association and Local Authorities Ireland (2021). Local Authority - Electrification of Fleet and EV Charging Guidance Document. [online] CARO, p.42. Available at: https://www.caro.ie/getattachment/5da7713a-b50a-4156-95ac-a946b1ca6574/LA-electrification-of-fleet-and-ev-charging-guidance.pdf.aspx?lang=en-GB.
51. McKenna, E. (2021). Bus Éireann Trials Hydrogen Buses. [online] Business Plus. Available at: https://businessplus.ie/news/bus-eireann-trials-hydrogen-buses/ [Accessed 15 Jun. 2023].
52. Nicholl Oils. (n.d.). Clean Air HVO Renewable Diesel/Gas Oil. [online] Available at: https://www.nicholloils.com/products/clean-air-hvo-renewable-dieselgas-oil [Accessed 13 Jun. 2023].
53. Northern Ireland World. (2022). Antrim and Newtownabbey vegetable oil pilot set to continue despite fuel cost. [online] Available at: https://www.northernirelandworld.com/news/politics/council/antrim-and-newtownabbey-vegetable-oil-pilot-set-to-continue-despite-fuel-cost-3944296 [Accessed 21 Jun. 2023].
54. Orion Clean Energy Project. (n.d.). Orion Clean Energy Project | Building a world-leading clean energy island. [online] Available at: https://www.orioncleanenergy.com/ [Accessed 26 Jun. 2023].
55. Parliamentary Budget Office (2022). An Overview of Ireland's Electric Vehicle Incentives and a Comparison With International Peers. [online] Houses of the Oireachtas. Available at: https://data.oireachtas.ie/ie/oireachtas/parliamentaryBudgetOffice/2022/2022-06-02_an-overview-of-ireland-s-electric-vehicle-incentives-and-a-comparison-with-international-peers_en.pdf.
56. Roadmap to Sustainability 2021-2028. (n.d.). [online] Ards and North Down Borough Council. Available at: https://www.ardsandnorthdown.gov.uk/resident/stand-for-sustainability/roadmap-to-sustainability.
57. Robb, S. (2023). Woodchip and biogas in the heart of Tyrone. [online] www.farmersjournal.ie. Available at: https://www.farmersjournal.ie/woodchip-and-biogas-in-the-heart-of-tyrone-759764 [Accessed 17 Apr. 2023].
58. S.I. No. 339/2011 - European Communities (Clean and Energy-Efficient Road Transport Vehicles) Regulations 2011. Available at: https://www.irishstatutebook.ie/eli/2011/si/339/made/en/print.
59. Scania Ireland. (n.d.). Renewable Fuels. [online] Available at: https://www.scania.com/ie/en/home/products/attributes/renewable-fuels.html [Accessed 14 Jun. 2023].
60. Sustainable Energy Authority Of Ireland | SEAI. (2023). EV Fleet Trial | Mayo County Council. [online] Available at: https://www.seai.ie/blog/mayo-ev-trial/ [Accessed 21 Jun. 2023].
61. The Association for Renewable Energy & Clean Technology (n.d.). A FUTURE BUILT ON RENEWABLE ENERGY AND CLEAN TECHNOLOGY. [online] REA. Available at: https://www.r-e-a.net/.
62. Transport & Environment (2019). High & low ILUC Risk Biofuels. [online] Available at: https://www.transportenvironment.org/wp-content/uploads/2021/07/2019_01_High_low_ILUC_TE_briefing_final.pdf.
63. U.S. Department of Energy (2014). Case Study - Compressed Natural Gas Refuse Fleets. [online] https://cleancities.energy.gov/. U.S. Department of Energy. Available at: https://afdc.energy.gov/files/u/publication/casestudy_cng_refuse_feb2014.pdf?f418a58254.

64. Vehicle Certification Agency. (2021). Fuel Consumption and CO2. [online] Available at: https://www.vehicle-certification-agency.gov.uk/fuel-consumption-co2/ [Accessed 17 May 2023].
65. Wrightbus, Ryze Hydrogen and HyGen Energy (n.d.). Written evidence submitted by Wrightbus, Ryze Hydrogen and HyGen Energy (FTF0052). [online] UK Parliament. Available at: https://committees.parliament.uk/writtenevidence/43233/pdf/.
66. wrightbus.com. (2023). Plans announced for state-of-the-art green hydrogen project at Wrightbus Ballymena. [online] Available at: https://wrightbus.com/en-gb/plans-for-green-hydrogen-project-at-wrightbus-site-ballymena [Accessed 26 Jun. 2023].
67. www.tii.ie. (n.d.). Alternatively Fuelled HDV Purchase Grant Scheme -. [online] Available at: https://www.tii.ie/roads-tolling/tolling-information/afhdv-scheme/ [Accessed 16 Jun. 2023].
68. Zemo Partnership (2022). Decarbonising Heavy Duty Vehicles and Machinery. Zemo Partnership.
69. Zemo Partnership (2023a). DfT Low Carbon Fuels Strategy Development - Stakeholder Workshop Engagement Report. Zemo Partnership.
70. Zemo Partnership (2023b). The Renewable Fuels Guide. [online] Available at: https://www.zemo.org.uk/news-events/news,zemos-new-renewable-fuels-guide-shows-operators-the-way-to-cut-carbon-emiss_4545.htm#:~:text=Zemo%E2%80%99s%20new%20Renewable%20Fuels%20Guide%20is%20intended%20to,covered%20include%20biodiesel%2C%20renewable%20diesel%2C%20biomethane%20and%20bio-propane. [Accessed 26 Jul. 2023].

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# APPENDIX 2

## Supporting CapEx/OpEx and GHG Emission Reduction Analysis

The additional 1 year OpEx cost associated with Monaghan County Council using HVO instead of diesel (assuming HVO being 20 cent/l dearer than diesel in RoI)

| Vehicle Type | Overall Diesel OpEx (€) | Overall HVO OpEx (€) |
|---|---|---|
| **HCV** | | |
| Library Van | € 7,977 | € 8,075 |
| Lorry | € 75,293 | € 93,056 |
| Pickup | € 25,539 | € 31,272 |
| Road Gritter | € 4,559 | € 5,332 |
| Sprayer | € 23,056 | € 24,164 |
| Velocity Patcher | € 5,348 | € 6,918 |
| Total | € 141,771 | € 168,817 |
| **LCV** | | |
| 4x4 | € 865 | € 1,044 |
| Pickup | € 12,254 | € 14,257 |
| Pickup & Tipper | € 2,563 | € 3,510 |
| Van | € 24,028 | € 28,336 |
| Total | € 39,711 | € 47,147 |
| **WV** | | |
| Digger | € 4,182 | € 4,330 |
| Forklift | € - | € - |
| Gritter | € 19,775 | € 20,553 |
| Loader | € - | € - |
| Ride on Lawnmower | € 3,260 | € 3,682 |
| Roller | € - | € - |
| Teleporter | € 1,542 | € 1,659 |
| Tractor | € 14,109 | € 16,363 |
| Total | € 42,867 | € 46,587 |
| | | |
| **Overall Total** | **€ 224,348** | **€ 262,551** |

The additional 1 year OpEx cost associated with Armagh and Banbridge and Craigavon Borough Council using HVO instead of diesel (assuming HVO being 50 p/litre dearer than diesel in NI)

| Vehicle Type | 1-year Diesel OpEx (£) | 1-year HVO OpEx (£) |
|---|---|---|
| RCV 32T | £ 152,814 | £ 190,254 |
| RCV 26T | £ 1,528,140 | £ 1,902,540 |
| RCV 18T | £ 329,667 | £ 410,787 |
| Macpac L 12T | £ 219,063 | £ 256,763 |
| Large Cage 7.5T | £ 170,304 | £ 197,304 |
| Small Cage 3.5T | £ 50,640 | £ 54,015 |
| Large Panel Van | £ 526,400 | £ 567,900 |
| Small Panel Van | £ 564,480 | £ 588,240 |
| Beavertail 7.5T | £ 156,840 | £ 166,965 |
| Large Tractor | £ 109,773 | £ 121,923 |
| Compact Tractor | £ 172,500 | £ 173,500 |
| | | |
| Total | £ 3,980,621 | £ 4,630,191 |

A comparison between the total cost of replacing diesel RCVs in Armagh, Banbridge and Craigavon Borough Council's vehicle fleet with new diesel RCVs (assuming all new diesel RCVs of varying sizes are valued on average at ca. £150,000) and replacing existing diesel RCVs with new BEV RCVs (assuming all new BEV RCVs of varying sizes are valued on average at ca. £600,000)

| Vehicle Type | Number of Vehicle Type | Cost of Replacement (per single vehicle) (Diesel) (£) | Cost of Replacement (all vehicles) (Diesel) (£) | Cost of Replacement (per single vehicle) (BEV) (£) | Cost of Replacement (all vehicles) (BEV) (£) |
|---|---|---|---|---|---|
| RCV | 79 | £ 150,000 | £ 11,850,000 | £ 600,000 | £ 47,400,000 |

A comparison between the additional 15 year OpEx cost associated with Armagh, Banbridge and Craigavon Borough Council using HVO in the RCVs (assuming HVO being 50 p/litre dearer than diesel in NI), and the total cost of replacing existing diesel RCVs in Armagh, Banbridge and Craigavon Borough Council's vehicle fleet with new BEV RCVs (assuming all new BEV RCVs of varying sizes are valued on average at ca. £600,000)

| Vehicle Type | 15-year Diesel OpEx (£) | 15-year HVO OpEx (£) | Additional 15-year HVO OpEx | Cost of Replacement (all vehicles) (BEV type) (£) |
|---|---|---|---|---|
| RCV 32T | £ 2,292,210 | £ 2,853,810 | £ 561,600 | £ 3,600,000 |
| RCV 26T | £ 22,922,100 | £ 28,538,100 | £ 5,616,000 | £ 36,000,000 |
| RCV 18T | £ 4,945,005 | £ 6,161,805 | £ 1,216,800 | £ 7,800,000 |
| **Total** | **£ 30,159,315** | **£ 37,553,715** | **£ 7,394,400** | **£ 47,400,000** |

A comparison between the total cost of replacing diesel lorries in Monaghan County Council's vehicle fleet with new diesel lorries (assuming all new diesel lorries of varying sizes are valued on average at ca. €175,000) and replacing diesel lorries with new gas powered lorries (assuming all new gas powered lorries are valued at an average of €205,000)

| Vehicle Type | Number of Each Vehicle Type | Cost to Replace Single Vehicle | Cost to Replace Fleet |
|---|---|---|---|
| Lorry (Diesel) | 9 | € 175,000 | € 1,575,000 |
| Lorry (Gas powered) | 9 | € 205,000 | € 1,845,000 |

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# APPENDIX 3

Local Authority Sample Strategic Roadmaps for Achieving Net Zero Emission Fleets

**Appendix 3.1 Sample Strategic Roadmap for Achieving Net Zero Emission Vehicle Fleets - Monaghan County Council**

<u>Introduction and Overview</u>

A key element of the Climate Action and Low Carbon Development Act (as amended) relevant to Local Authorities (LAs) is the requirement for LAs to prepare individual Local Authority Climate Action Plans (LACAPs) for their functional area and to adopt climate mitigation and adaption measures.

LAs are key drivers in advancing climate policy at the local level and the development and adoption of the LACAPs is considered to be key in facilitating delivering effect climate action at local level. LACAPs will have an 'Inward' focus (i.e., a focus on organizational Greenhouse Gas (GHG) which they have full control over) and an 'Outward' focus (i.e., a focus on local community GHG emission that they can reasonably exert influence on).

A key theme of Monaghan County Council's (MCC) LACAP therefore will be to reduce its organizational GHG emissions. A large fraction of LA GHG emissions in the Republic of Ireland are caused by the operation of their vehicle fleet. This is the case for MCC also.

MCC's vehicle fleet consists of a mix of Heavy Duty Vehicles (HDVs), Light Duty Vehicles (LDVs) and mobile plant of varying types and sizes. These vehicles are used for a wide variety of operations connected to the typical functions of a local authority (e.g., transport, haulage, landscaping, maintenance activities and works). A baseline evaluation of vehicle fleet related GHG emissions has been undertaken for MCC and showed that HDVs are the primary contributor of GHG emissions in the fleet, although LDVs also contribute significantly to fleet GHG emissions. Mobile plant only have a marginal GHG emission contribution.

LAs in Ireland, including MCC, are compelled to deliver effective climate mitigation and reduce their organizational GHG emissions, including vehicle fleet related GHG emissions. To do this, MCC will have to transition the vehicles in their fleet to alternative fuels that generate a reduced level of GHG emissions.

MCC have procured Fehily Timoney and Company to carry out a study into the various alternative fuel options available on the market. The purpose of this study was to identify viable alternative fuel options for MCC's vehicle fleet- considering the make-up of the fleet and the nature of fleet operations - that will serve to suitably reduce fleet related GHG emissions.

This study has been completed and has concluded that the most viable short-term option for reducing GHG emissions associated with HDVs is to advance the use of Hydrotreated Vegetable Oil (HVO) within the fleet. This is considered to be a short-term, transitionary option that will serve to reduce MCCs vehicle fleet emissions in a manner broadly commensurate with the national GHG reduction target to reduce GHG emission by 51% by 2030. At the same time, it is considered that the use a Biomethane based alternative fuel option may be feasible in the short to medium term in the local context of Co. Monaghan given the current progression of an Anaerobic Digestion facility development project supported by Monaghan County Council and Gas Network Ireland.

The most viable long-term option for reducing GHG emission associated with HDVs is to support the development of Hydrogen infrastructure and advance the use of Hydrogen based vehicles within the fleet. This is considered to be a long-term option that will serve to support the development of a 'Net Zero' GHG emission vehicle fleet for MCC - in accordance with the national GHG reduction target of achieving 'Net Zero' GHG emissions by 2050.

The most viable solution for reducing GHG emissions associated with LDVs is to advance the use of HVO in LDVs as a transitionary solution in parallel with the adoption of BEV LDVs as a longer term solution.

As part of this study, the project team have developed a sample strategic roadmap for MCC for achieving the transition of its vehicle fleet to Net Zero GHG emissions by 2050. MCC will consider the proposals within this strategic roadmap as part of their wider commitments to reduce emissions.

Strategic Approach

The broad strategic approach toward reducing vehicle fleet related GHG emissions is as follows:

1. Develop a robust Alternative Fuel Transition Implementation Plan 2024 – 2030 that defines a path to a substantial reduction in vehicle fleet GHG emissions through the adoption of HVO for HDVs and BEV for LDVs. Ensure the progress of this plan is reviewed annually.
2. Carry out HVO, BEV, Biomethane and Hydrogen Vehicle Pilot Projects across 2024 to 2030 to develop an in-depth understanding of critical success factors and clearly define the way forward in relation to transitioning to these alternative fuel types.
3. Work as a partnership with other East Border Region Local Authorities to progress the alternative fuel transition.
4. Work in a collaborative manner with other Local Authorities, other public sector organizations and industry to progress the alternative fuel transition.
5. Join Hydrogen Mobility Ireland and participated in and contribute to events and meetings run by the organization.
6. Ensure the alternative fuel transition is underpinned by the need to deliver credible and verifiable GHG emission reductions by establishing a framework for reviewing, monitoring and measuring sustainability and GHG emission reduction performance.
7. Develop an updated Alternative Fuel Transition Implementation Plan 2030 - 2040 that defines a path to Net Zero vehicle fleet GHG emissions through the adoption of Hydrogen HDVs.

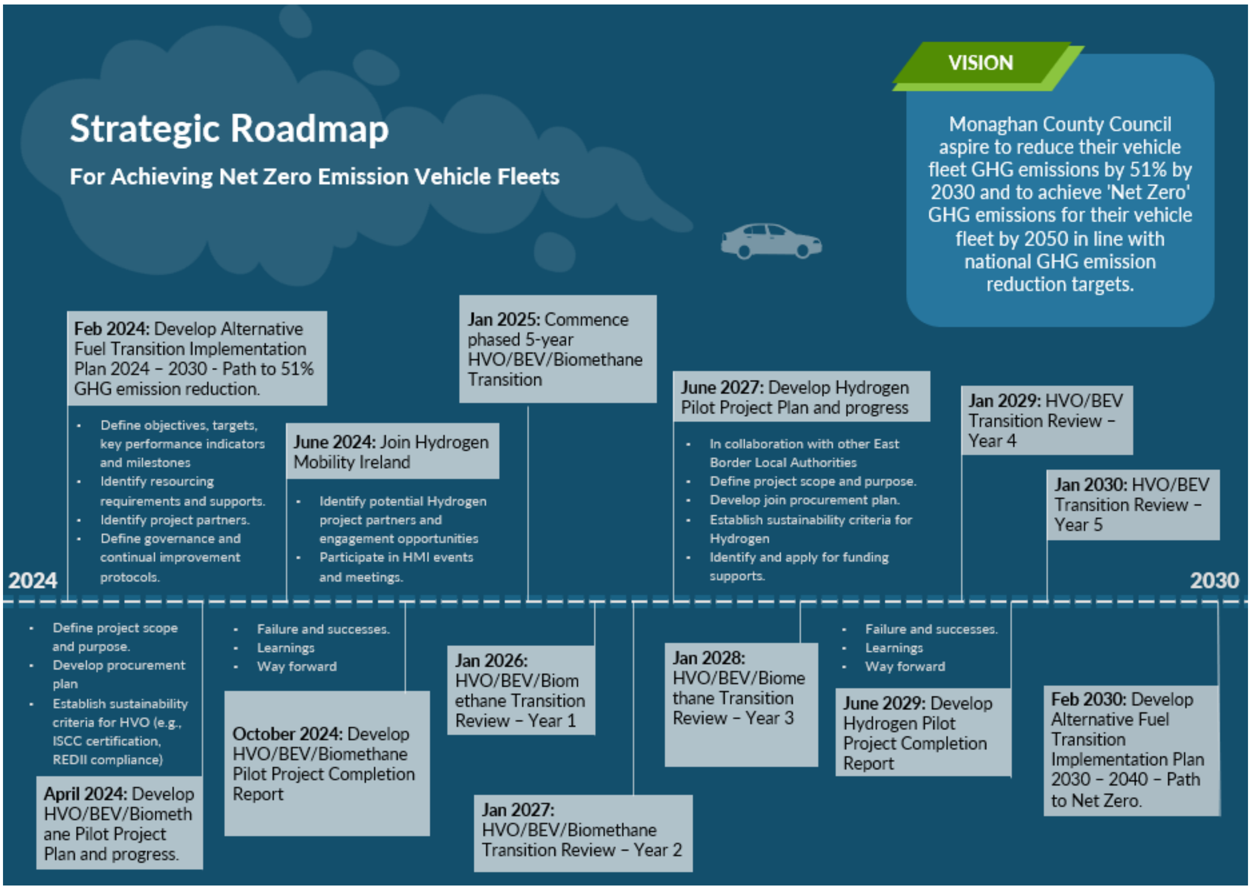
Vision for achieving a Net Zero Emission Vehicle Fleet

Monaghan County Council aspire to reduce their vehicle fleet GHG emissions by 51% by 2030 and to achieve 'Net Zero' GHG emissions for their vehicle fleet by 2050 in line with national GHG emission reduction targets.

Strategic Mission

- Foster organizational innovation to address the challenge of achieving a substantial reduction in vehicle fleet related GHG emissions and achieving 'Net Zero' vehicle fleet GHG emissions by 2050.
- Support and fund the transition to a 'Net Zero' GHG emission vehicle fleet.
- Partner and collaborate with other public sector organizations and industry leaders to facilitate the wider delivery of effective climate mitigation in the transport sector.
- Share our learnings and understandings with others.
- Make a positive impact and contribution by substantially reducing vehicle fleet GHG emissions and achieving 'Net Zero' vehicle fleet GHG emission by 2050.
- Lead the way in delivering a 'Net Zero' vehicle fleet GHG emission by 2050.
- Foster and support the development of an alternative fuel economy in the county.
- Promote organizational training and skills development to support the transition to alternative fuel vehicles.
- Drive continual vehicle fleet GHG emission reduction performance improvements.

## Strategic Roadmap



**Appendix 3.2 Sample Strategic Roadmap for Achieving Net Zero Emission Vehicle Fleets - Louth County Council**

Introduction and Overview

A key element of the Climate Action and Low Carbon Development Act (as amended) relevant to Local Authorities (LAs) is the requirement for LAs to prepare individual Local Authority Climate Action Plans (LACAPs) for their functional area and to adopt climate mitigation and adaption measures.

LAs are key drivers in advancing climate policy at the local level and the development and adoption of the LACAPs is considered to be key in facilitating delivering effect climate action at local level. LACAPs will have an 'Inward' focus (i.e., a focus on organizational Greenhouse Gas (GHG) which they have full control over) and an 'Outward' focus (i.e., a focus on local community GHG emission that they can reasonably exert influence on).

A key theme of Louth County Council's (LCC) LACAP therefore will be to reduce its organizational GHG emissions. A large fraction of LA GHG emissions in the Republic of Ireland are caused by the operation of their vehicle fleet. This is the case for LCC also.

LCC's vehicle fleet consists of a mix of Heavy Duty Vehicles (HDVs), Light Duty Vehicles (LDVs) and mobile plant of varying types and sizes. These vehicles are used for a wide variety of operations connected to the typical functions of a local authority (e.g., transport, haulage, landscaping, maintenance activities and works). A baseline evaluation of vehicle fleet related GHG emissions has been undertaken for LCC and showed that HDVs are the primary contributor of GHG emissions in the fleet, although LDVs also contribute significantly to fleet GHG emissions. Mobile plant only have a marginal GHG emission contribution.

LAs in Ireland, including LCC, are compelled to deliver effective climate mitigation and reduce their organizational GHG emissions, including vehicle fleet related GHG emissions. To do this, LCC will have to transition the vehicles in their fleet to alternative fuels that generate a reduced level of GHG emissions.

LCC have procured Fehily Timoney and Company to carry out a study into the various alternative fuel options available on the market. The purpose of this study was to identify viable alternative fuel options for LCC's vehicle fleet- considering the make-up of the fleet and the nature of fleet operations - that will serve to suitably reduce fleet related GHG emissions.

This study has been completed and has concluded that the most viable short-term option for reducing GHG emissions associated with HDVs is to advance the use of Hydrotreated Vegetable Oil (HVO) within the fleet. This is considered to be a short-term, transitionary option that will serve to reduce LCCs vehicle fleet emissions in a manner broadly commensurate with the national GHG reduction target to reduce GHG emission by 51% by 2030.

The most viable long-term option for reducing GHG emission associated with HDVs is to support the development of Hydrogen infrastructure and advance the use of Hydrogen based vehicles within the fleet. This is considered to be a long-term option that will serve to support the development of a 'Net Zero' GHG emission vehicle fleet for LCC - in accordance with the national GHG reduction target of achieving 'Net Zero' GHG emissions by 2050.

The most viable solution for reducing GHG emissions associated with LDVs is to advance the use of HVO in LDVs as a transitionary solution in parallel with the adoption of BEV LDVs as a longer term solution.

As part of this study, the project team have developed a sample strategic roadmap for LCC for achieving the transition of its vehicle fleet to Net Zero GHG emissions by 2050. LCC will consider the proposals within this strategic roadmap as part of their wider commitments to reduce emissions.

Strategic Approach

The broad strategic approach toward reducing vehicle fleet related GHG emissions is as follows:

1. Develop a robust Alternative Fuel Transition Implementation Plan 2024 – 2030 that defines a path to a substantial reduction in vehicle fleet GHG emissions through the adoption of HVO for HDVs and BEV for LDVs. Ensure the progress of this plan is reviewed annually.
2. Carry out HVO, BEV and Hydrogen Vehicle Pilot Projects across 2024 to 2030 to develop an in-depth understanding of critical success factors and clearly define the way forward in relation to transitioning to these alternative fuel types.
3. Work as a partnership with other East Border Region Local Authorities to progress the alternative fuel transition.
4. Work in a collaborative manner with other Local Authorities, other public sector organizations and industry to progress the alternative fuel transition.
5. Join Hydrogen Mobility Ireland and participated in and contribute to events and meetings run by the organization.
6. Ensure the alternative fuel transition is underpinned by the need to deliver credible and verifiable GHG emission reductions by establishing a framework for reviewing, monitoring and measuring sustainability and GHG emission reduction performance.
7. Develop an updated Alternative Fuel Transition Implementation Plan 2030 - 2040 that defines a path to Net Zero vehicle fleet GHG emissions through the adoption of Hydrogen HDVs.

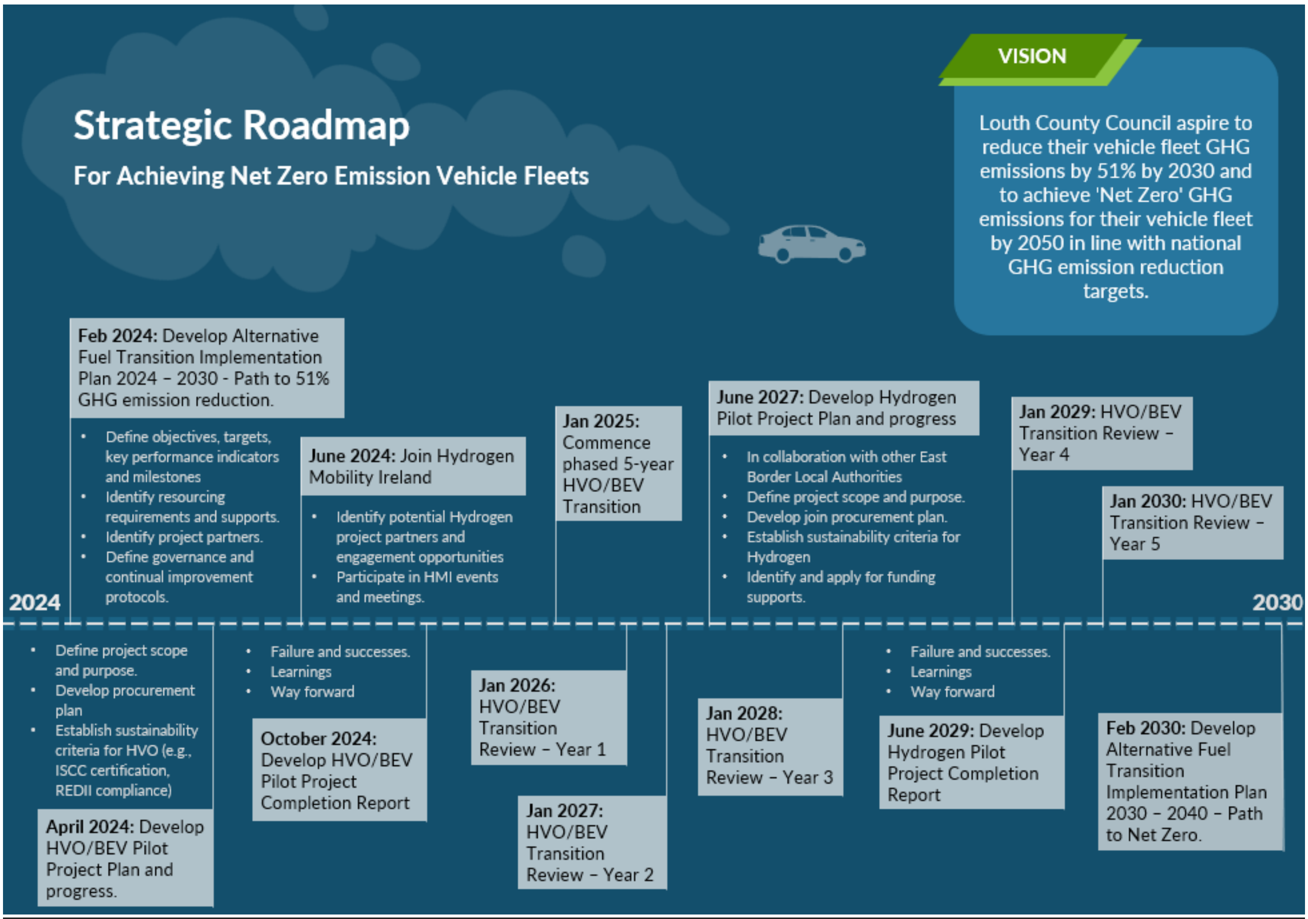
Vision for achieving a Net Zero Emission Vehicle Fleet

Louth County Council aspire to reduce their vehicle fleet GHG emissions by 51% by 2030 and to achieve 'Net Zero' GHG emissions for their vehicle fleet by 2050 in line with national GHG emission reduction targets.

Strategic Mission

- Foster organizational innovation to address the challenge of achieving a substantial reduction in vehicle fleet related GHG emissions and achieving 'Net Zero' vehicle fleet GHG emissions by 2050.
- Support and fund the transition to a 'Net Zero' GHG emission vehicle fleet.
- Partner and collaborate with other public sector organizations and industry leaders to facilitate the wider delivery of effective climate mitigation in the transport sector.
- Share our learnings and understandings with others.
- Make a positive impact and contribution by substantially reducing vehicle fleet GHG emissions and achieving 'Net Zero' vehicle fleet GHG emission by 2050.
- Lead the way in delivering a 'Net Zero' vehicle fleet GHG emission by 2050.
- Foster and support the development of an alternative fuel economy in the county.
- Promote organizational training and skills development to support the transition to alternative fuel vehicles.
- Drive continual vehicle fleet GHG emission reduction performance improvements.

Strategic Roadmap



**Appendix 3.3 Sample Strategic Roadmap for Achieving Net Zero Emission Vehicle Fleets - Newry Mourne and Down District Council**

Introduction and Overview

A key element of the Climate Change Act (Northern Ireland) 2022 (Act) is the requirement for Northern Ireland to achieve a 48% Greenhouse Gas (GHG) emission reduction by 2030 and Net Zero GHG emission by 2050.

Newry Mourne and Down District Council (NMD) is required to reduce its organizational GHG emissions. A large fraction of LA GHG emissions in Northern Ireland are caused by the operation of their vehicle fleet. This is the case for NMD also.

NMD's vehicle fleet consists of a mix of Heavy Duty Vehicles (HDVs), Light Duty Vehicles (LDVs) and mobile plant of varying types and sizes. These vehicles are used for a wide variety of operations connected to the typical functions of a local authority (e.g., waste management transport, haulage, landscaping, maintenance activities and works). A baseline evaluation of vehicle fleet related GHG emissions has been undertaken for NMD and showed that HDVs are the primary contributor of GHG emissions in the fleet, although LDVs also contribute significantly to fleet GHG emissions. Mobile plant only have a marginal GHG emission contribution.

LAs in Northern Ireland, including NMD, are compelled to deliver effective climate mitigation and reduce their organizational GHG emissions, including vehicle fleet related GHG emissions. To do this, NMD will have to transition the vehicles in their fleet to alternative fuels that generate a reduced level of GHG emissions.

NMD, in partnership with several other local authorities, have procured Fehily Timoney and Company to carry out a study into the various alternative fuel options available on the market. The purpose of this study was to identify viable alternative fuel options for NMD's vehicle fleet- considering the make-up of the fleet and the nature of fleet operations - that will serve to suitably reduce fleet related GHG emissions.

This study has been completed and has concluded that the most viable short-term option for reducing GHG emissions associated with HDVs is to advance the use of Hydrotreated Vegetable Oil (HVO) within the fleet. This is considered to be a short-term, transitionary option that will serve to reduce NMD's vehicle fleet emissions in a manner broadly commensurate with the national GHG reduction target to reduce GHG emission by 48% by 2030.

The most viable long-term option for reducing GHG emission associated with HDVs is to support the development of Hydrogen infrastructure and advance the use of Hydrogen based vehicles within the fleet. This is considered to be a long-term option that will serve to support the development of a 'Net Zero' GHG emission vehicle fleet for NMD - in accordance with the national GHG reduction target of achieving 'Net Zero' GHG emissions by 2050.

The most viable solution for reducing GHG emissions associated with LDVs is to advance the use of HVO in LDVs as a transitionary solution in parallel with the adoption of BEV LDVs as a longer term solution.

As part of this study, the project team have developed a sample strategic roadmap for NMD for achieving the transition of its vehicle fleet to Net Zero GHG emissions by 2050. NMD will consider the proposals within this strategic roadmap as part of their wider commitments to reduce emissions.

Strategic Approach

The broad strategic approach toward reducing vehicle fleet related GHG emissions is as follows:

1. Develop a robust Alternative Fuel Transition Implementation Plan 2024 – 2030 that defines a path to a substantial reduction in vehicle fleet GHG emissions through the adoption of HVO for HDVs and BEV for LDVs. Ensure the progress of this plan is reviewed annually.
2. Carry out HVO, BEV and Hydrogen Vehicle Pilot Projects across 2024 to 2030 to develop an in-depth understanding of critical success factors and clearly define the way forward in relation to transitioning to these alternative fuel types.
3. Work as a partnership with other East Border Region Local Authorities to progress the alternative fuel transition.
4. Work in a collaborative manner with other Local Authorities, other public sector organizations and industry to progress the alternative fuel transition.
5. Join Hydrogen Mobility Ireland and participated in and contribute to events and meetings run by the organization.
6. Ensure the alternative fuel transition is underpinned by the need to deliver credible and verifiable GHG emission reductions by establishing a framework for reviewing, monitoring and measuring sustainability and GHG emission reduction performance.
7. Develop an updated Alternative Fuel Transition Implementation Plan 2030 - 2040 that defines a path to Net Zero vehicle fleet GHG emissions through the adoption of Hydrogen HDVs.

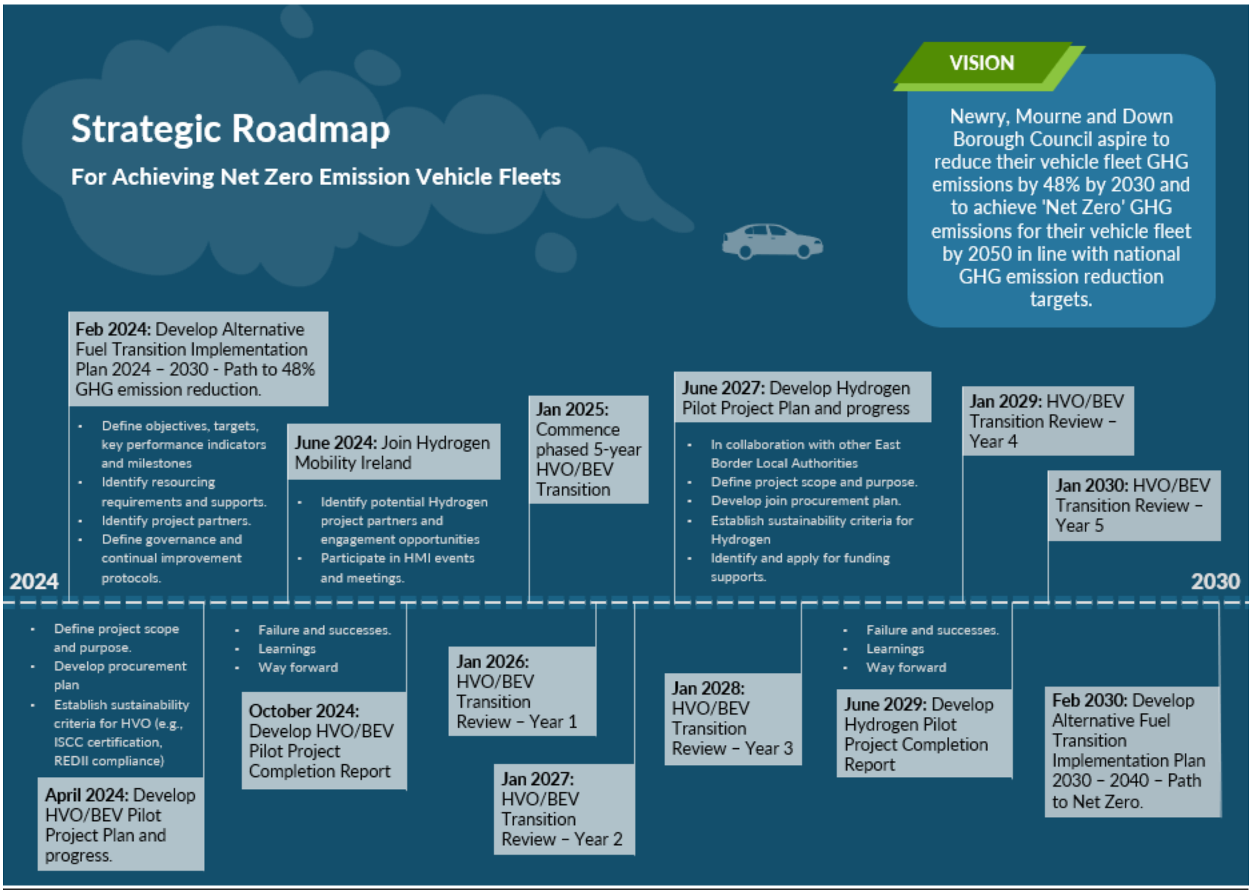
Vision for achieving a Net Zero Emission Vehicle Fleet

Newry Mourn and Down District Council aspire to reduce their vehicle fleet GHG emissions by 48% by 2030 and to achieve 'Net Zero' GHG emissions for their vehicle fleet by 2050 in line with national GHG emission reduction targets.

Strategic Mission

- Foster organizational innovation to address the challenge of achieving a substantial reduction in vehicle fleet related GHG emissions and achieving 'Net Zero' vehicle fleet GHG emissions by 2050.
- Support and fund the transition to a 'Net Zero' GHG emission vehicle fleet.
- Partner and collaborate with other public sector organizations and industry leaders to facilitate the wider delivery of effective climate mitigation in the transport sector.
- Share our learnings and understandings with others.
- Make a positive impact and contribution by substantially reducing vehicle fleet GHG emissions and achieving 'Net Zero' vehicle fleet GHG emission by 2050.
- Lead the way in delivering a 'Net Zero' vehicle fleet GHG emission by 2050.
- Foster and support the development of an alternative fuel economy in the county.
- Promote organizational training and skills development to support the transition to alternative fuel vehicles.
- Drive continual vehicle fleet GHG emission reduction performance improvements.

Strategic Roadmap



**Appendix 3.4 Sample Strategic Roadmap for Achieving Net Zero Emission Vehicle Fleets - Ards and North Down Borough Council**

Introduction and Overview

A key element of the Climate Change Act (Northern Ireland) 2022 (Act) is the requirement for Northern Ireland to achieve a 48% Greenhouse Gas (GHG) emission reduction by 2030 and Net Zero GHG emission by 2050.

Ards and North Down Council's (AND) is required to reduce its organizational GHG emissions. A large fraction of LA GHG emissions in Northern Ireland are caused by the operation of their vehicle fleet. This is the case for AND also.

AND's vehicle fleet consists of a mix of Heavy Duty Vehicles (HDVs), Light Duty Vehicles (LDVs) and mobile plant of varying types and sizes. These vehicles are used for a wide variety of operations connected to the typical functions of a local authority (e.g., waste management transport, haulage, landscaping, maintenance activities and works). A baseline evaluation of vehicle fleet related GHG emissions has been undertaken for AND and showed that HDVs are the primary contributor of GHG emissions in the fleet, although LDVs also contribute significantly to fleet GHG emissions. Mobile plant only have a marginal GHG emission contribution.

LAs in Northern Ireland, including AND, are compelled to deliver effective climate mitigation and reduce their organizational GHG emissions, including vehicle fleet related GHG emissions. To do this, AND will have to transition the vehicles in their fleet to alternative fuels that generate a reduced level of GHG emissions.

AND have procured Fehily Timoney and Company to carry out a study into the various alternative fuel options available on the market. The purpose of this study was to identify viable alternative fuel options for AND's vehicle fleet- considering the make-up of the fleet and the nature of fleet operations - that will serve to suitably reduce fleet related GHG emissions.

This study has been completed and has concluded that the most viable short-term option for reducing GHG emissions associated with HDVs is to advance the use of Hydrotreated Vegetable Oil (HVO) within the fleet. This is considered to be a short-term, transitionary option that will serve to reduce AND's vehicle fleet emissions in a manner broadly commensurate with the national GHG reduction target to reduce GHG emission by 48% by 2030.

The most viable long-term option for reducing GHG emission associated with HDVs is to support the development of Hydrogen infrastructure and advance the use of Hydrogen based vehicles within the fleet. This is considered to be a long-term option that will serve to support the development of a 'Net Zero' GHG emission vehicle fleet for AND - in accordance with the national GHG reduction target of achieving 'Net Zero' GHG emissions by 2050.

The most viable solution for reducing GHG emissions associated with LDVs is to advance the use of HVO in LDVs as a transitionary solution in parallel with the adoption of BEV LDVs as a longer term solution.

As part of this study, the project team have developed a sample strategic roadmap for AND for achieving the transition of its vehicle fleet to Net Zero GHG emissions by 2050. AND will consider the proposals within this strategic roadmap as part of their wider commitments to reduce emissions.

Strategic Approach

The broad strategic approach toward reducing vehicle fleet related GHG emissions is as follows:

1. Develop a robust Alternative Fuel Transition Implementation Plan 2024 – 2030 that defines a path to a substantial reduction in vehicle fleet GHG emissions through the adoption of HVO for HDVs and BEV for LDVs. Ensure the progress of this plan is reviewed annually.
2. Carry out HVO, BEV and Hydrogen Vehicle Pilot Projects across 2024 to 2030 to develop an in-depth understanding of critical success factors and clearly define the way forward in relation to transitioning to these alternative fuel types.
3. Work as a partnership with other East Border Region Local Authorities to progress the alternative fuel transition.
4. Work in a collaborative manner with other Local Authorities, other public sector organizations and industry to progress the alternative fuel transition.
5. Join Hydrogen Mobility Ireland and participated in and contribute to events and meetings run by the organization.
6. Ensure the alternative fuel transition is underpinned by the need to deliver credible and verifiable GHG emission reductions by establishing a framework for reviewing, monitoring and measuring sustainability and GHG emission reduction performance.
7. Develop an updated Alternative Fuel Transition Implementation Plan 2030 - 2040 that defines a path to Net Zero vehicle fleet GHG emissions through the adoption of Hydrogen HDVs.

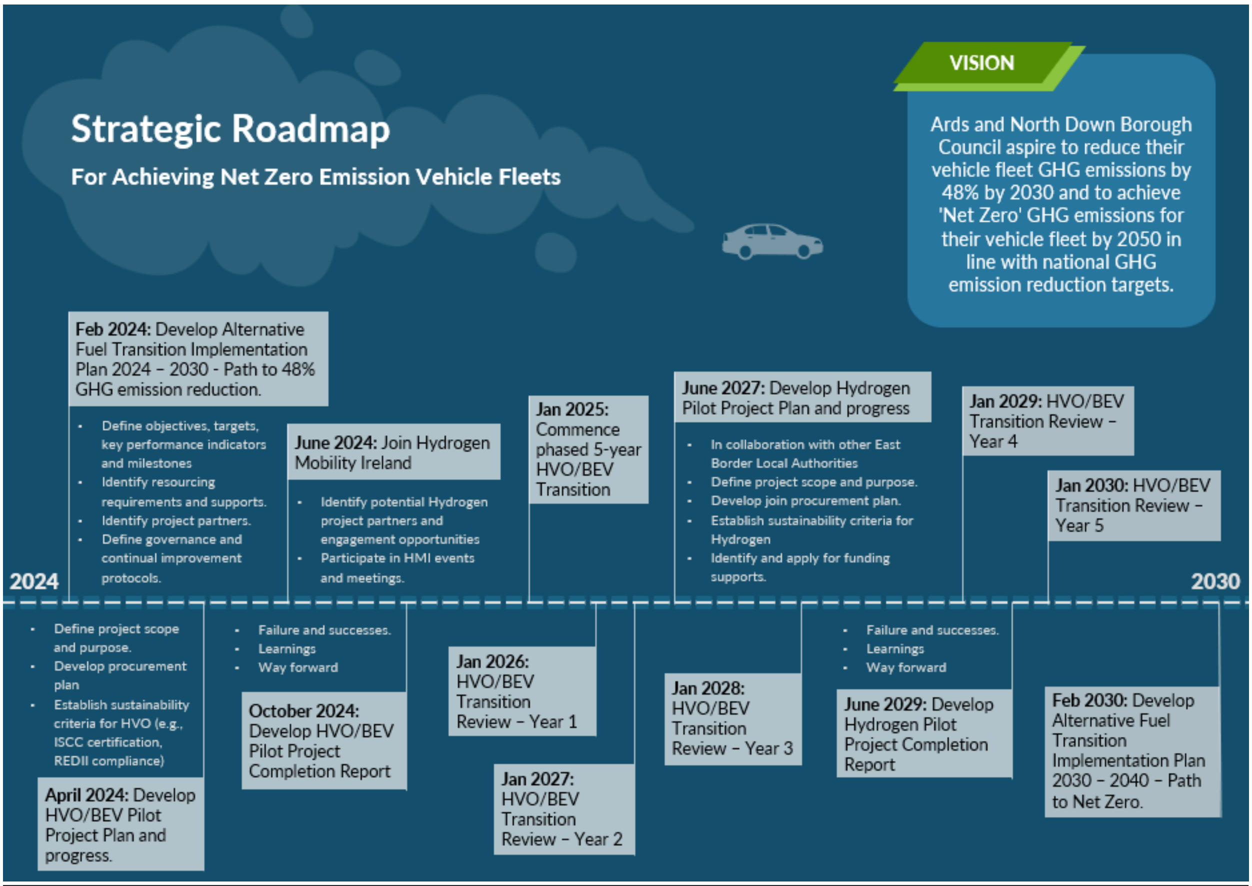
Vision for achieving a Net Zero Emission Vehicle Fleet

Ards and North Down Borough Council aspire to reduce their vehicle fleet GHG emissions by 48% by 2030 and to achieve 'Net Zero' GHG emissions for their vehicle fleet by 2050 in line with national GHG emission reduction targets.

Strategic Mission

- Foster organizational innovation to address the challenge of achieving a substantial reduction in vehicle fleet related GHG emissions and achieving 'Net Zero' vehicle fleet GHG emissions by 2050.
- Support and fund the transition to a 'Net Zero' GHG emission vehicle fleet.
- Partner and collaborate with other public sector organizations and industry leaders to facilitate the wider delivery of effective climate mitigation in the transport sector.
- Share our learnings and understandings with others.
- Make a positive impact and contribution by substantially reducing vehicle fleet GHG emissions and achieving 'Net Zero' vehicle fleet GHG emission by 2050.
- Lead the way in delivering a 'Net Zero' vehicle fleet GHG emission by 2050.
- Foster and support the development of an alternative fuel economy in the county.
- Promote organizational training and skills development to support the transition to alternative fuel vehicles.
- Drive continual vehicle fleet GHG emission reduction performance improvements.

Strategic Roadmap



**Appendix 3.5 Sample Strategic Roadmap for Achieving Net Zero Emission Vehicle Fleets - Armagh Banbridge and Craigavon Borough Council**

Introduction and Overview

A key element of the Climate Change Act (Northern Ireland) 2022 (Act) is the requirement for Northern Ireland to achieve a 48% Greenhouse Gas (GHG) emission reduction by 2030 and Net Zero GHG emission by 2050.

Armagh Banbridge and Craigavon Borough Council (ABC) is required to reduce its organizational GHG emissions. A large fraction of LA GHG emissions in Northern Ireland are caused by the operation of their vehicle fleet. This is the case for NMD also.

ABC's vehicle fleet consists of a mix of Heavy Duty Vehicles (HDVs), Light Duty Vehicles (LDVs) and mobile plant of varying types and sizes. These vehicles are used for a wide variety of operations connected to the typical functions of a local authority (e.g., waste management transport, haulage, landscaping, maintenance activities and works). A baseline evaluation of vehicle fleet related GHG emissions has been undertaken for ABC and showed that HDVs are the primary contributor of GHG emissions in the fleet, although LDVs also contribute significantly to fleet GHG emissions. Mobile plant only have a marginal GHG emission contribution.

LAs in Northern Ireland, including ABC, are compelled to deliver effective climate mitigation and reduce their organizational GHG emissions, including vehicle fleet related GHG emissions. To do this, ABC will have to transition the vehicles in their fleet to alternative fuels that generate a reduced level of GHG emissions.

ABC have procured Fehily Timoney and Company to carry out a study into the various alternative fuel options available on the market. The purpose of this study was to identify viable alternative fuel options for ABC's vehicle fleet- considering the make-up of the fleet and the nature of fleet operations - that will serve to suitably reduce fleet related GHG emissions.

This study has been completed and has concluded that the most viable short-term option for reducing GHG emissions associated with HDVs is to advance the use of Hydrotreated Vegetable Oil (HVO) within the fleet. This is considered to be a short-term, transitionary option that will serve to reduce ABC's vehicle fleet emissions in a manner broadly commensurate with the national GHG reduction target to reduce GHG emission by 48% by 2030.

The most viable long-term option for reducing GHG emission associated with HDVs is to support the development of Hydrogen infrastructure and advance the use of Hydrogen based vehicles within the fleet. This is considered to be a long-term option that will serve to support the development of a 'Net Zero' GHG emission vehicle fleet for ABC - in accordance with the national GHG reduction target of achieving 'Net Zero' GHG emissions by 2050.

The most viable solution for reducing GHG emissions associated with LDVs is to advance the use of HVO in LDVs as a transitionary solution in parallel with the adoption of BEV LDVs as a longer term solution.

As part of this study, the project team have developed a sample strategic roadmap for NABC for achieving the transition of its vehicle fleet to Net Zero GHG emissions by 2050. ABC will consider the proposals within this strategic roadmap as part of their wider commitments to reduce emissions.

Strategic Approach

The broad strategic approach toward reducing vehicle fleet related GHG emissions is as follows:

1. Develop a robust Alternative Fuel Transition Implementation Plan 2024 – 2030 that defines a path to a substantial reduction in vehicle fleet GHG emissions through the adoption of HVO for HDVs and BEV for LDVs. Ensure the progress of this plan is reviewed annually.
2. Carry out HVO, BEV and Hydrogen Vehicle Pilot Projects across 2024 to 2030 to develop an in-depth understanding of critical success factors and clearly define the way forward in relation to transitioning to these alternative fuel types.
3. Work as a partnership with other East Border Region Local Authorities to progress the alternative fuel transition.
4. Work in a collaborative manner with other Local Authorities, other public sector organizations and industry to progress the alternative fuel transition.
5. Join Hydrogen Mobility Ireland and participated in and contribute to events and meetings run by the organization.
6. Ensure the alternative fuel transition is underpinned by the need to deliver credible and verifiable GHG emission reductions by establishing a framework for reviewing, monitoring and measuring sustainability and GHG emission reduction performance.
7. Develop an updated Alternative Fuel Transition Implementation Plan 2030 - 2040 that defines a path to Net Zero vehicle fleet GHG emissions through the adoption of Hydrogen HDVs.

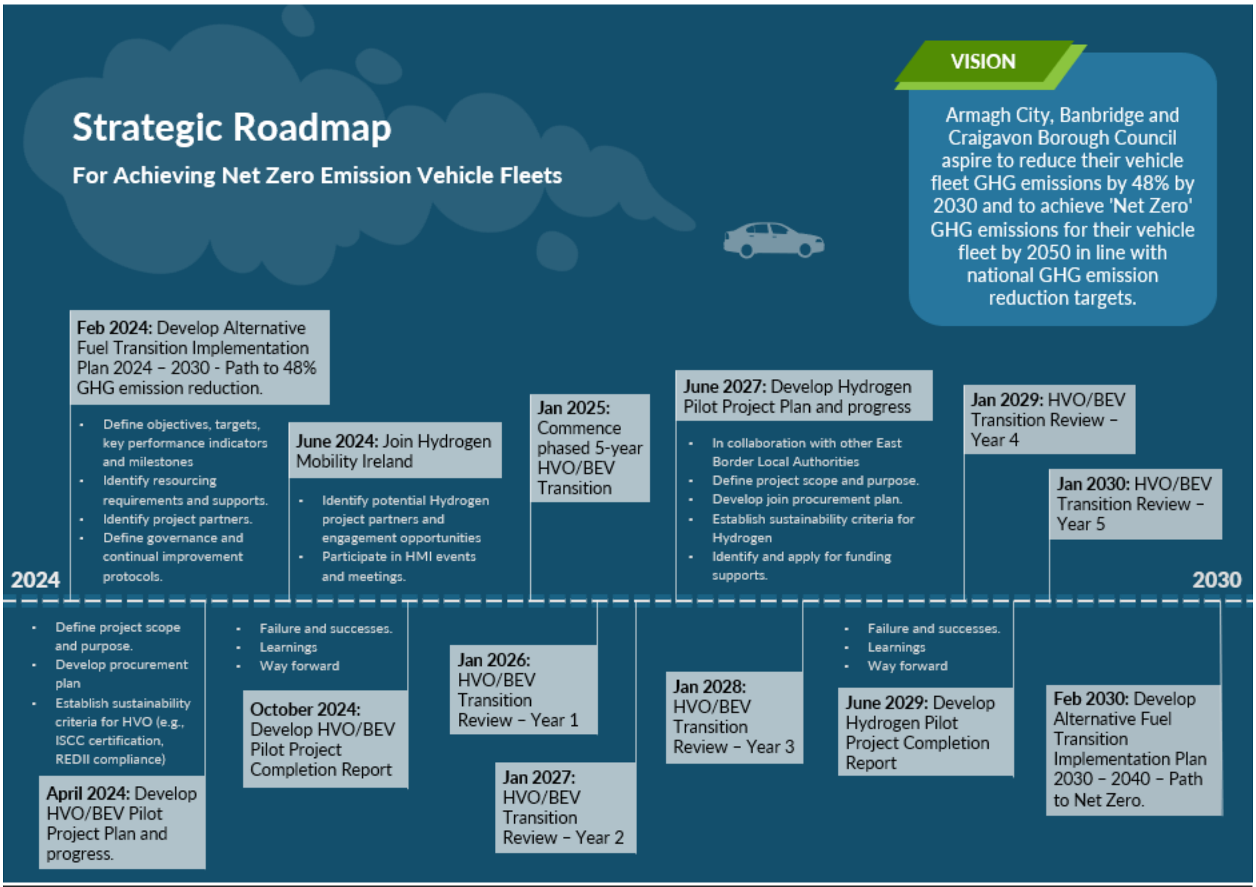
Vision for achieving a Net Zero Emission Vehicle Fleet

Armagh Banbridge and Craigavon Borough Council aspire to reduce their vehicle fleet GHG emissions by 48% by 2030 and to achieve 'Net Zero' GHG emissions for their vehicle fleet by 2050 in line with national GHG emission reduction targets.

Strategic Mission

- Foster organizational innovation to address the challenge of achieving a substantial reduction in vehicle fleet related GHG emissions and achieving 'Net Zero' vehicle fleet GHG emissions by 2050.
- Support and fund the transition to a 'Net Zero' GHG emission vehicle fleet.
- Partner and collaborate with other public sector organizations and industry leaders to facilitate the wider delivery of effective climate mitigation in the transport sector.
- Share our learnings and understandings with others.
- Make a positive impact and contribution by substantially reducing vehicle fleet GHG emissions and achieving 'Net Zero' vehicle fleet GHG emission by 2050.
- Lead the way in delivering a 'Net Zero' vehicle fleet GHG emission by 2050.
- Foster and support the development of an alternative fuel economy in the county.
- Promote organizational training and skills development to support the transition to alternative fuel vehicles.
- Drive continual vehicle fleet GHG emission reduction performance improvements.

Strategic Roadmap



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