BASELINE EMISSIONS INVENTORY

SLIGO DECARBONISATION ZONE

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CONTENTS

Glossary of terms

AR6	Sixth Assessment Report
BEI	Baseline Emissions Inventory
BER	Building Energy Rating
CAP23	Climate Action Plan 2023
CRF	Common Reporting Format
CO_2	Carbon Dioxide
CoR	Certificates of Registration
CSO	Central Statistics Office
EPA	Environmental Protection Agency
GHG	Greenhouse Gas
GVA	Gross Value Added
GWP	Global Warming Potential
$ktCO_2e$	Kilotonne Carbon Dioxide Equivalent
LA	Local Authority
LPG	Liquefied petroleum gas
LULUCF	Land Use, Land Use Change and Forestry
M&R	Monitoring and Reporting
NAEI	National Atmospheric Emissions Inventory
NFR	Nomenclature for Reporting
NIR	National Inventory Report
NTA	National Transport Authority
SEAI	Sustainable Energy Authority Ireland
SECAP	Sustainable Energy and Climate Action Plan
UNFCCC	United Nations Framework Convention on Climate Change
WFP	Waste Facility Permits

1. Executive Summary

Local Authorities (LAs) play a pivotal role in addressing climate change by developing comprehensive Local Authority Climate Action Plans to combat greenhouse gas (GHG) emissions within their jurisdictions. As part of the National Climate Action Plan, these plans are evidence-based and intended to produce measurable impacts over time. To enable this process, Baseline Emissions Inventories (BEI) serve as critical tools for LAs, helping them design climate action plans and assess the effectiveness of emission reduction efforts across targeted sectors and their operations. Under government directives, each local authority has been tasked with selecting a pilot Decarbonisation Zone (DZ) to assess the feasibility and scope of decarbonising the economy and society. In this context, this report delves into the Decarbonisation Zone situated within the South East of Sligo Town, encompassing different portions of the townlands of Abbeyquarter North, Abbeyquarter South, and Cleveragh. The primary objective is to understand the impact of different emissions sources within this DZ, categorising them by sector while offering zone-specific contextual insights related to these sectors. Furthermore, the report also presents the emissions directly under the purview of the Local Authority.

The calculations for this inventory were made primarily using a dataset from 2019 commissioned by the Environmental Protection Agency (EPA) called MapEIre, which is the result of the National Mapping of GHG and non-GHG Emissions Sources project. The project spatially mapped GHG emissions on a square kilometre scale for the entire Irish Exclusive Economic Zone, assigning the emissions to where they were produced.

This dataset was the basis for measuring the emissions of the DZ extending around the South East of Sligo Town for the following sectors: Residential (both electricity consumption and emissions derived from heating), Transport, Agriculture, Land Use, Land Use Change and Forestry (LULUCF), Industrial Processes; Commercial, Waste sectors. In addition, a separate analysis was conducted to distribute electricity emissions to the Residential, and Commercial Services categories. The Central Statistics Office (CSO) has metered electricity consumption available at the county level split between residential and non-residential usage. This consumption data was then converted to carbon dioxide equivalents (CO_2e), the standard unit for measuring the global warming potential of GHGs and assigned to the sectors. Transport emissions were calculated using mainly data from the Central Statistics Office (CSO), and emissions from the local authority's activities from the local authority provided data. An inventory of Fluorinated gases, or F-gases, for the county, was also extracted from the MapEIre dataset.

Emissions Category	DZ Emissions ($ktCO_2e$)	County Sligo Emissions ($ktCO_2e$)	National Emissions ($ktCO_2e$)
Residential	13.2 (44%)	167 (18%)	9,552 (15%)
Non-Residential	2.57 (9%)	92 (10%)	13,622 (21%)
Transport	13.5 (46%)	220 (8%)	12,196 (19%)
Waste	0.308 (1%)	5 (0.6%)	991 (2%)
Agriculture	0.112 (<1%)	429 (46%)	22,134 (33%)
LULUCF	-0.37 (-1%)	119 (13%)	6,899 (10%)
Total	**29.693 (100%)**	**943 (100%)**	**65,394 (100%)**

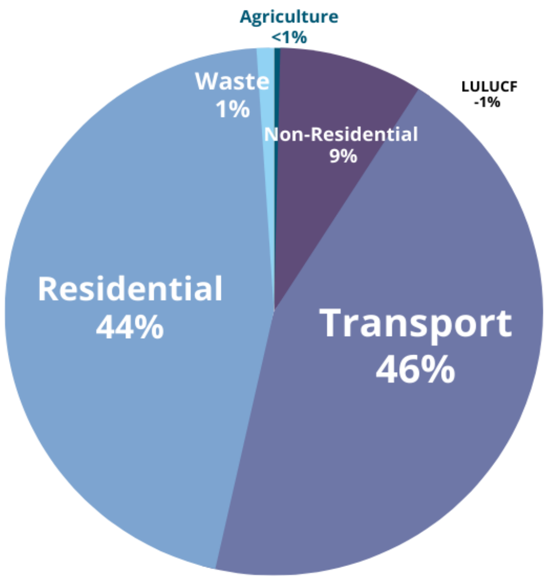

Table 1 and Figure 1 Emissions Breakdown for the Decarbonisation Zone

2. Introduction

Climate Action at the Local Authority level stands as a pillar of Ireland's policy landscape, underscored by such documents as the National Climate Action Plan 2023 (CAP23) and the Climate Action Charter 2019. Efforts to act against climate change and its negative impacts necessitate immediate action, and Local Authorities (LA) are spearheading initiatives within their jurisdictions. As an integral part of CAP23, LAs have a mandate to release Local Authority Climate Action Plans, which will consist of evidence-informed targeted actions. Therefore, it is necessary to have a comprehensive understanding of the current state of emissions in each jurisdiction and to identify which emission sources the Action Plan should target and how.

The European Union aims to be climate-neutral by 2050 as part of its commitment to combating climate change. The 2020 Climate and Energy package and the 2030 Climate and Energy Framework intend to set the EU on the path to achieving the transformation towards a low-carbon economy, as detailed in the 2050 low-carbon roadmap, and set the critical climate and energy targets for Europe.

In Ireland, one element of this plan is the implementation of Decarbonisation Zones (DZ). In DZs, policy experiments to reduce emissions influenced by local contexts in areas delineated by LAs can be performed and scaled up. The guidelines for developing DZs are broad, delegating most decision-making to LAs and allowing for strong stakeholder engagement, especially of marginalised groups. This area in the South East of Sligo has been identified as a DZ. The next step in DZ development is the establishment of a baseline for the zone through a baseline emission inventory (BEI) in the context of local policy to understand which policy experiments are effective and to what degree.

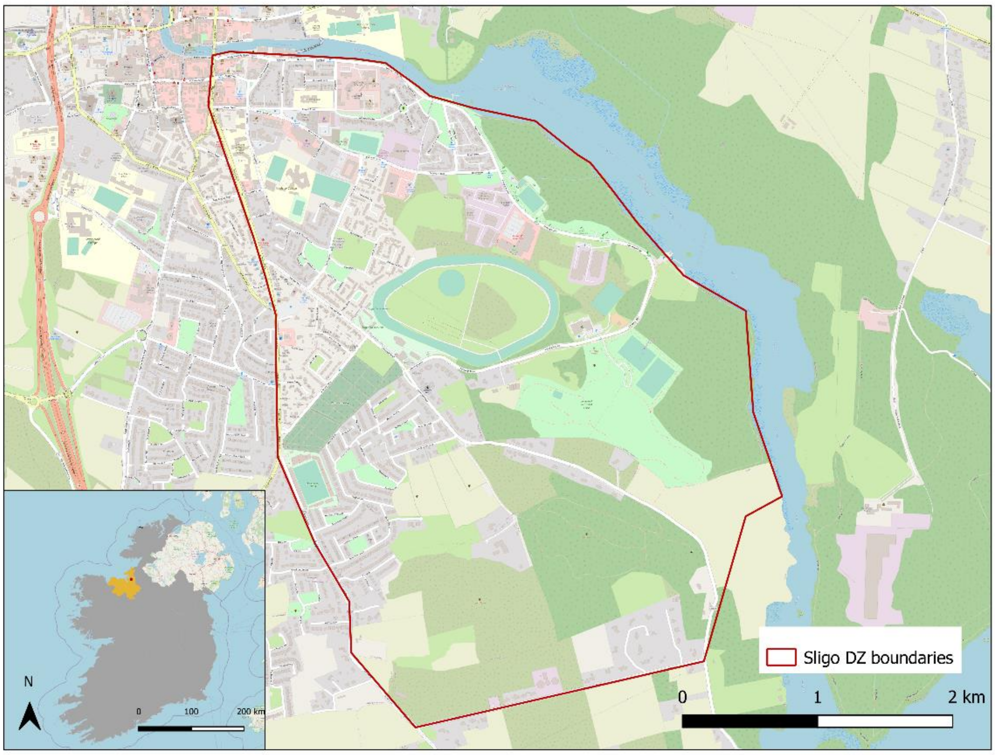

Figure 2 Sligo DZ Boundaries (own elaboration)

3. Methodology

3.1 National Emissions Inventory

The EPA is responsible for completing a national greenhouse gas inventory, which it compiles for Ireland annually. Ireland was legally obligated to submit data from 1990 to 2021 in January, March, and April 2023 to the European Commission and the United Nations Framework Convention on Climate Change (UNFCCC).

In response to developments in climate governance and legislation in 2021, the Environmental Protection Agency (EPA) released provisional inventory data in July 2022, covering the period from 1990 to 2021. These provisional estimates of Ireland's greenhouse gas emissions for the years 1990 to 2021 are based on interim energy balances provided by the Sustainable Energy Authority of Ireland (SEAI) in June 2022. They also incorporate the most recent data from other sources, including the Central Statistics Office and the Department of Agriculture, Food, and the Marine (DAFM). These calculations adhere to methodologies aligned with reporting guidelines outlined by the United Nations Framework Convention on Climate Change (UNFCCC). Emissions data verified from installations within the European Union's Emissions Trading Scheme (ETS) are included.

In 2019, Ireland's total emissions amounted to 64,220 kilotonnes of CO_2 equivalent.[1] It's important to highlight that this figure differs slightly from the national total mentioned in the report's table on page 4, with an approximate variance of 100 kt CO_2e. Various factors contribute to this difference, including emissions in the EPA energy industries category that encompass more than just electricity-related emissions. Another factor is the potential utilisation of different Global Warming Potentials (GWPs) between Assessment Reports 4 (AR4) and 6 (AR6), contributing to this variance. These emissions are categorized as follows: Energy Industries, Residential, Manufacturing Combustion, Commercial Services, Transport, Industrial Processes, F-Gases, Agriculture, Waste, and Land Use/Land Use Change/Forestry (LULUCF). It's important to note that the 'Energy Industries' category is not presented as a standalone category in the final Local Authority inventory, making direct comparisons with individual categories challenging.

[1] https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/Ireland_NIR-2021_cover.pdf

Category	Description
Energy Industries	Includes emissions from fuel combustion in power plants as well as from the extraction, production and distribution of fossil fuels
Residential	Includes emissions from space and water heating in households.
Manufacturing Combustion	Includes emissions from the combustion of fuels used in manufacturing processes, such as food processing.
Commercial Services	Includes emissions from space and water heating in commercial buildings.
Transport	Includes emissions from domestic road, rail, air and maritime transport.
Industrial Processes	Includes emissions from various industrial processes such as in cement production
F-Gases	Includes emissions of fluorinated gases, potent GHGs used in refrigeration, air conditioning and other industrial processes.
Agriculture	Includes emissions from livestock, fertilizer use and agricultural soils.
Waste	Includes emissions from the disposal and treatment of waste.
LULUCF	Includes both emissions and removals of GHGs associated with land use, land-use change, and forestry activities, such as the loss, gain and management of forests, peatlands and grasslands.

Table 1 National Inventory Categories and their respective description (EPA, 2022)[2]

[2] Ireland-NIR-2022_Merge_v2.pdf (epa.ie)

In 2019, agriculture took the lead as the biggest source of national emissions, contributing 33% to the total. Following closely behind were the transport and energy industries, standing at 18% and 14% respectively. Residential and Land Use, Land-Use Change, and Forestry (LULUCF) emissions each accounted for 10% of the overall emissions. Collectively, these five sectors made up a substantial 85% of the nation's total emissions for that year. The remainder of the emissions were distributed across various sectors, with Manufacturing Combustion responsible for 7%, Industrial Processes at 3%, Waste at 2%, F-Gases at 1%, and Commercial Services at 1%.

To present a more precise representation of National Irish Baseline Emissions data, it's important to emphasize that the Energy Industries category stands alone and doesn't align with the figures mentioned in the executive summary table. All emissions related to electricity are categorized under Energy Industries.

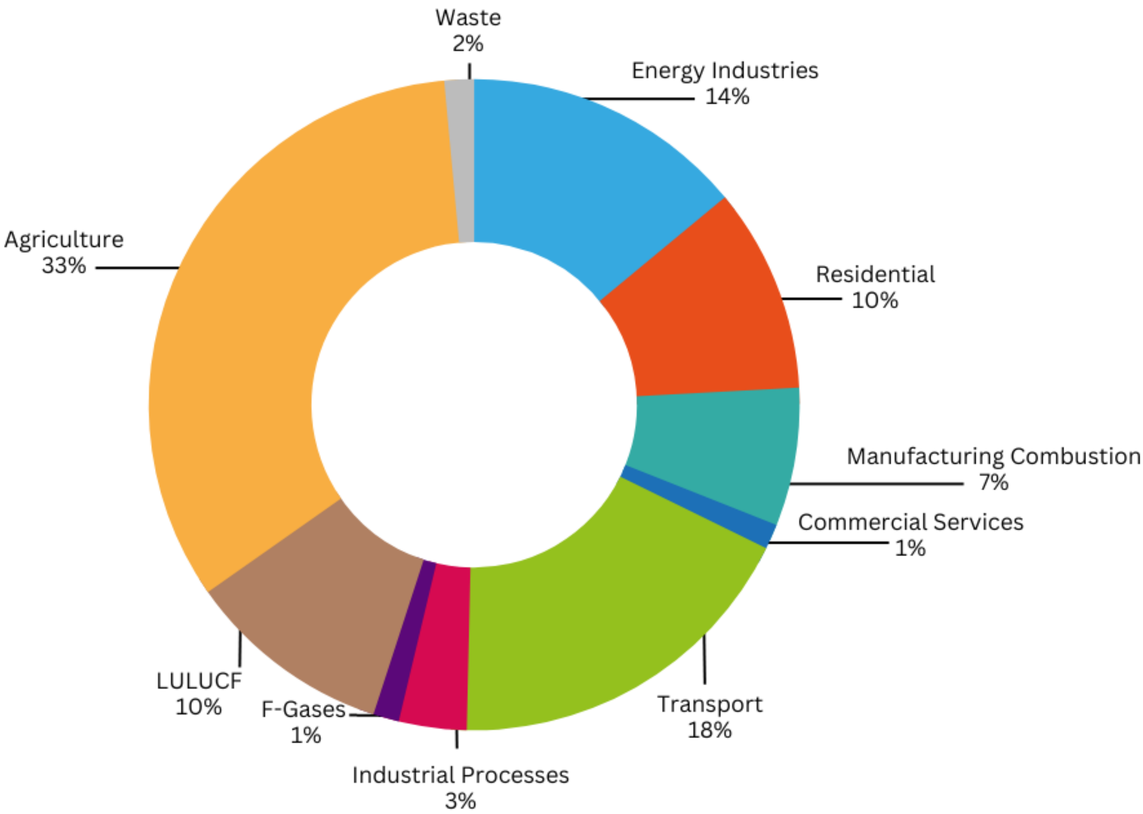

Figure 3 National emissions Inventory (2019)

3.1.1 Reported Greenhouse Gases

Emissions data for carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) are reported on an annual basis. Ireland has relatively high methane and nitrous oxide emissions compared to other EU member states, which can be explained by the fact that Ireland has the highest relative agriculture emissions contribution within the EU.

All gas emission quantities were converted to CO_2 equivalents using the Sixth Assessment Report (AR6) Global Warming Potential (GWP) values over a 100-year time horizon.[3] This conversion was done by multiplying the mass of gas emissions by each gas's corresponding GWP. GWPs assess climate change effects by quantifying the amount of energy that emissions from one tonne of gas will trap over a specific period. There are minor differences between data from the 2019 EPA data and the county- and DZ-level BEIs as the EPA data uses conversion factors from the IPCC Fourth Assessment Report.

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	29,8
Nitrous Oxide (N_2O)	273
Sulphur Hexafluoride (SF_6)	25.200
Hydrofluorocarbons (HFCs)	4 - 14.600
Perfluorinated Compounds (PFCs)	6.630 - 11.100
Nitrogen Trifluoride (NF_3)	17.400

Table 2 Greenhouse Gas Global Warming Potential (IPCC AR6, 2023)

[3] https://report.ipcc.ch/ar6/wg1/IPCC_AR6_WGI_FullReport.pdf

3.1.1.1 Carbon Dioxide

CO_2 is the most common greenhouse gas emitted due to anthropological activities. Due to its presence in all emissions sectors and abundance in comparison to other GHGs, it is used as a reference gas and given a GWP of 1 (regardless of the time period used for calculations). A 100-year time horizon was used in making this report; however, CO_2 stays in the atmosphere for hundreds of years.

3.1.1.2 Methane

CH_4 is another commonly found GHG, primarily emitted in the Agriculture and Waste sectors. The GWP for methane used in this report is 29.8. It absorbs more energy than CO_2 but has a much shorter residence time in the atmosphere at roughly ten years.

3.1.1.3 Nitrous Oxide

N_2O has an assigned GWP of 273 in this report. It is primarily emitted by the agriculture sector and stays in the atmosphere for more than 100 years.

3.1.1.4 F-gases

Fluorinated gases, also known as F-gases, trap much more heat per tonne than CO_2 does. The GWP values used in this report are as follows: Sulphur Hexafluoride (SF_6) has a GWP of 25,200, Hydrofluorocarbons (HFCs) have a GWP ranging from 4-14,600, Perfluorinated compounds (PFCs) range from 6,630 to 11,100, and Nitrogen trifluorides (NF_3) are assigned a GWP of 17,400. SF_6 is mostly present in the industry sector. In the national inventory, there is an F-gases sector that accounts for about 2% of emissions.

3.2 National Grid Fuel Breakdown

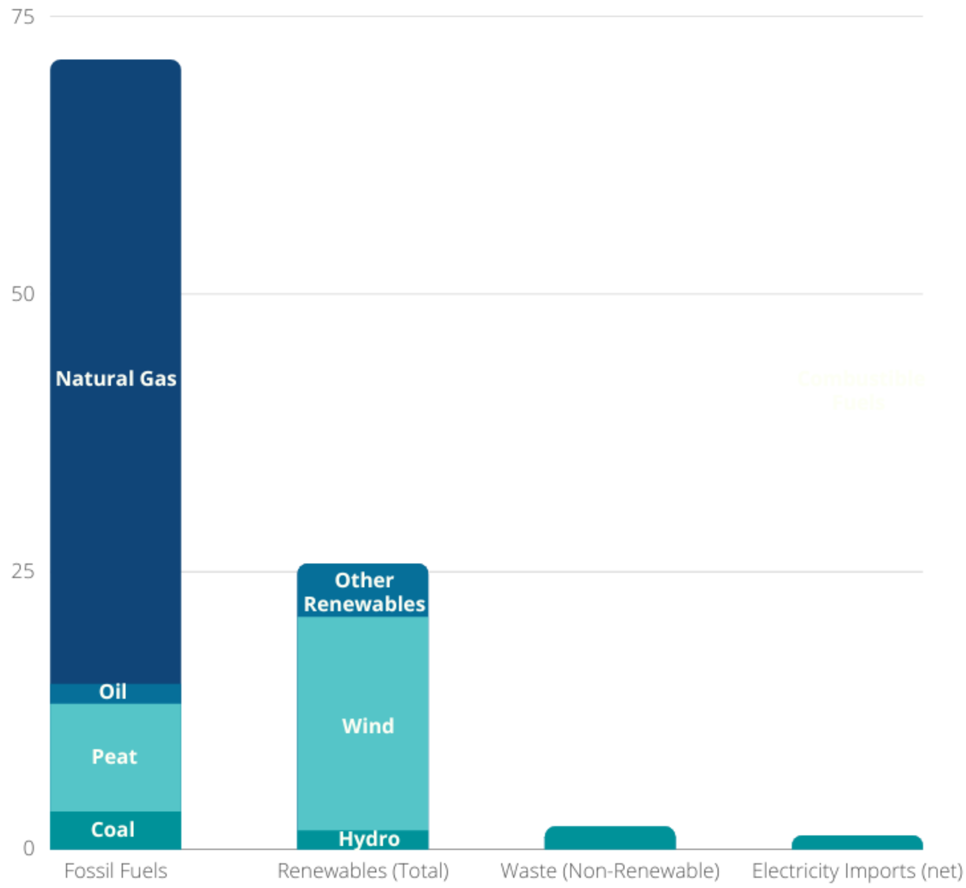

Figure 4 National Grid Fuel Breakdown (SEAI, 2022)

The majority (56%) of Ireland's electricity comes from natural gas. The next largest share is wind energy, which accounts for 19% of electricity fuel. The total share of renewables, including wind, used to fuel the grid is 26%. Ireland's grid has 54% efficiency resulting in 46% of energy lost before it reaches the consumer. The CO_2 intensity of the grid has been decreasing. It was 636 gCO_2/kWh in 2005 and was reduced to 324 gCO_2/kWh by 2019.

3.3 The MapEIre Project

Starting in 2016, the Environmental Protection Agency (EPA), in collaboration with Aarhus University in Denmark, initiated the National Mapping of Greenhouse Gas (GHG) and non-GHG Emissions Sources project, known as MapEIre.[4] The primary objective of this project was to establish a spatial distribution for the national emissions inventory. Consequently, all emissions of greenhouse gases in the Irish emissions inventory were allocated across a square kilometre grid that encompasses the entire Irish Exclusive Economic Zone. These emissions were categorised based on the type of gas and the subsectors corresponding to the Common Reporting Format (CRF) and the Nomenclature for Reporting from the United Nations Framework Convention on Climate Change (UNFCCC). This dataset also enables the calculation of emissions inventories for smaller geographic areas, such as Local Authority areas. It is worth noting that the methodology employed by the MapEIre project varied among different subsectors, and some subsectors may have undergone more robust mapping than others.

The MapEIre data accounts for Scope 1 emissions, meaning it includes only emissions generated in each area for that area but does not necessarily reflect where the outputs resulting in those emissions are consumed.

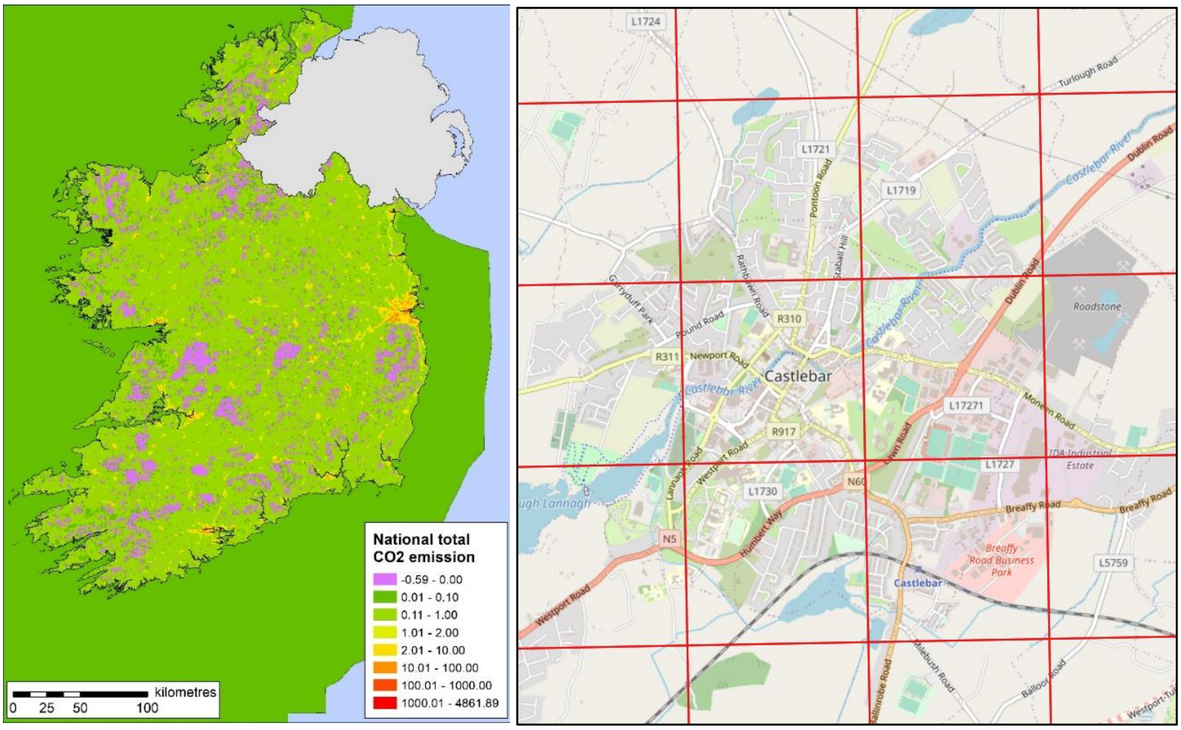

Figure 5 MapEIre Illustration examples

[4] https://projects.au.dk/mapeire/

3.4 Sectoral Emissions Calculations

Emissions within this Decarbonisation Zone have been calculated using a variety of methods and approaches, relying on the highest resolution of data available. Local authorities have contributed a significant portion of the data, while the remainder has been obtained through thorough research, drawing from multiple sources that include recent data at the county, national, and even European levels.

Category	Main data Sources
Agriculture	MapEire
LULUCF	MapEire, Sustainable Energy Authority of Ireland (SEAI) and Environmental Protection Agency (EPA) Ireland's National Inventory Report 2021 & National Land Cover Map 2023
Waste	European Environment Agency and Environmental Protection Agency (EPA), MapEire
Residential Heating	Central Statistics Office (CSO) and Sustainable Energy Authority of Ireland (SEAI)
Residential Electricity	Central Statistics Office (CSO) and Local Authority provided Data
Transport	Central Statistics Office (CSO), CarbonIndepent.org, UK Government Greenhouse gas reporting
Commercial and industrial	Central Statistics Office (CSO), MapEire, Monotoring and Reporting (M&R) data
Local Authority own emissions	Local Authority provided data

Figure 6 Data Usage Summary (Calculations and Supporting information) for the Decarbonisation Zone

3.4.1 Agriculture

Emissions stemming from the agriculture sector were calculated using the MapEIre dataset due to the lack of available data from the Agricultural Census of 2020. The AgriLivestock and AgriOther datasets were filtered to include only data from the Decarbonisation Zone (DZ), which provided information on the levels of CH_4, CO_2, N_2O, NH_3, and NOx gases within the DZ. These gases were converted into CO_2 equivalents to facilitate their aggregation into a single representative value.

According to the emissions data from MapElre, Livestock emissions totalled 0.0694 Kilotonnes. N_2O accounted for the largest share of GHG emissions. Additionally, other agricultural processes were responsible for approximately 0.180 $ktCO_2$ equivalent of emissions, with N_2O again as the most prominent gas. These numbers differ significantly from those reported by the Sligo County Council. This discrepancy is primarily due to the urban and forested nature of the latter area and the absence of cultivated areas.

An estimation of plausible agricultural land was derived from the MapElre dataset, accounting for approximately 17.47% of the total area, considering hedgerows and improved grassland within the Decarbonisation Zone. It is important to note that this estimation is not entirely precise, as it relied on the assumption that all improved grassland within the Decarbonisation Zone constitutes agricultural land, as there is no area labelled as cultivated land in the MapEIre and in the national land use 2023. Due to uncertainties, this estimation was not used in the emissions calculations for the agricultural sector but is provided for informational purposes only.

3.4.3 Land Use, Land Use Change, and Forestry

Emissions from the Land Use, Land Use Change, and Forestry (LULUCF) sector were firstly calculated like that of the agriculture sector, using the MapEIre dataset but focusing on distinct parameters. The pertinent datasets underwent filtration to include only data within the boundaries of the Decarbonisation Zone. The data on the levels of CH_4, CO_2, and N_2O gases were converted into CO_2 equivalents and aggregated. This method delivered negative CO_2 emissions, significantly impacting the overall particle calculations.

Using data from between 1990 and 2019 found in Ireland's National Inventory Report for 2021, emissions factors were derived for assessing the emissions of land use sectors. Reverse calculations were performed after identifying the total area from Ireland within each sector and considering the proportions relative to the Decarbonisation Zone.

The outcome of these calculations supported the negative emissions total from Land Use, Land-Use Change, and Forestry (LULUCF) activities, albeit in a somewhat more approximate manner.

3.4.4 Waste

Waste sector emissions were calculated using the average estimate of kilograms of solid waste per person in 2019[5], the number of inhabitants in the DZ and the emission factor provided by the European Environment Agency referring to the tonnes of CO_2 equivalent per metric tonne of solid waste. This converged in a total estimation of 0.127 $ktCO_2$ of waste emissions on a yearly base.

[5] Household | Environmental Protection Agency (epa.ie)

3.4.5 Residential Emissions

In the context of the Decarbonisation Zone, residential emissions, categorized into heating and electrical emissions, constitute the largest share of emissions. Within this zone, there are a total of 1,756 residential properties, comprised of approximately 1,483 households (some weighting was required for data found in the CSO Small Areas Database as 3 of the 19 areas that constitute the DZ lie partially in the zone), housing 3,970 residents. The cumulative Building Energy Rating (BER) stands at approximately 8,970.1 kWh when computed as the sum of the product of the number of households and the average rating. This calculation yields an average consumption per household of 6.01 kWh.

The calculation process then proceeded by incorporating the SEAI Emission factor for electricity (330.1 kWh), which was multiplied by the total electricity consumption per household, resulting in a total of 2,960, following necessary unit conversions.

A similar procedure was followed for the calculation of heating emissions., The most notable difference was the utilisation of the national average of 15.3 kWh per household to determine the average consumption per household. Additionally, the emissions factor was adjusted to 450 kWh by the SEAI Statistics reference. The result of these calculations is approximately 10.22 $ktCO_2$ equivalents of heating emissions in the residential sector within the Decarbonisation Zone.

For further detailed data and information regarding residences within the Decarbonisation Zone, please refer to the data analysis section of the report.

3.4.5.1 Supporting information

To understand the energy efficiency of a building, the indicator used in this report is the Building Energy Rating (BER). It measures the running costs and carbon emissions associated with heating the building to a comfortable level[6]. The BER rates buildings on a scale from A-G. A-rated buildings are the most cost-saving and energy-efficient, the ones rated G are the least cost-efficient and energy-efficient. There are various ways to calculate the BER of a building. An assessment can follow two calculation methods: the first one is based on the building itself, and the second one, on the other hand, considers the number of occupants[7]. A BER is calculated based on the amount of energy a building requires for space and hot water heating, ventilation, and lighting. The calculation system for BERs in Ireland is defined as DEAP[8] and it is the official method used across the country.

[6] https://www.seai.ie/home-energy/building-energy-rating-ber/understand-a-ber-rating/
[7] https://www.seai.ie/home-energy/building-energy-rating-ber/understand-a-ber-rating/
[8] https://www.seai.ie/home-energy/building-energy-rating-ber/support-for-ber-assessors/software/deap/

3.4.6 Transport Emissions

Transport in 2019 accounted for approximately 19% of Ireland's greenhouse gas (GHG) emissions which is equivalent to 11 $MtCO_2e$.Road transport is responsible for 94% of those emissions. The emissions coming from the transport sector primarily come from the burning of diesel and petrol in combustion engines (passenger cars, light-duty vehicles, heavy-duty vehicles, buses, and machinery vehicles) and are directly responsible for a range of air pollutants that negatively impact both human health and the environment. The Transport sector in County Sligo accounted for 131ktCO_2eq; private cars contributed the most emissions (57%).

Calculating transport emissions at a local level poses various challenges in determining which types of travel should be accounted for and how this accounting should be completed. In the scope of this BEI, a bottom-up approach was used to calculate those emissions generated by any travel inside the DZ. To process these calculations accurately, ideally, it would be possible to obtain a fine level of data acquisition accuracy-travels matrixes with the origin and destination of the travel and the type of transportation used. Due to the lack of this type of dataset, the following methodology was applied using the data gathered.

3.4.6.1 Private cars

Emissions from private cars were calculated by multiplying the total number of kilometres driven by cars[9] owned in the DZ[10], subdivided by fuel split[11] (petrol, diesel, hybrid and electric) multiplied finally by the emissions factors[12] for each fuel type.

3.4.6.2 Motorcycles

All motorcycles were considered petrol-powered. The emissions from motorcycles were calculated by multiplying the total number of kilometres driven by motorcycles[14] owned in the DZ (obtained by relation it to the number of motorcars in the county[8] and the population in the DZ) by the emission factor of petrol motorcycles.

3.4.6.3 Good vehicles

A Goods vehicle is defined as a motor vehicle used or constructed primarily for the carriage of goods, as opposed to the transportation of passengers. The definition of a goods vehicle in Ireland encompasses a range of commercial vehicles used for transporting goods, such as trucks, vans, lorries, and delivery vehicles.

All good vehicles were considered diesel-powered[13]. The emissions from good vehicles were calculated by multiplying the total number of kilometres driven by good vehicles[14] in the DZ (obtained by relating it to the number of good vehicles in the county[8] and the population in the DZ) per the emission factor of diesel trucks and vans[17].

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[9] https://www.cso.ie/en/releasesandpublications/ep/p-tranom/transportomnibus2019/roadtrafficvolumes/

[10] https://visual.cso.ie

[11] https://www.cso.ie/en/releasesandpublications/ep/ptranom/transportomnibus2019/vehiclelicensingandregistrations/

[12] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

[13] https://www.acea.auto/files/ACEA-report-vehicles-in-use-europe-2022.pdf

[14] https://www.cso.ie/en/releasesandpublications/ep/p-tranom/transportomnibus2019/roadtrafficvolumes/

3.4.6.3 Tractors and heavy machinery

Tractors and heavy machinery are vehicles and equipment used in various industries, primarily for agricultural, construction, and industrial purposes.

All tractors and heavy machinery were considered diesel-powered.

3.4.6.4 Small and medium PVS

Small and Medium Passenger Service Vehicles (PSV) are categories of vehicles used for public transportation of passengers. In Ireland, the classification of Small Public Service Vehicles (PSVs) is regulated by the National Transport Authority (NTA).

Small PSVs are typically associated with vehicles that can carry up to eight passengers, including the driver, for hire or reward. This category includes taxis, limousines, and some smaller minivans used for passenger transportation.

Medium PSVs encompass vehicles with a seating capacity ranging from 17 to 30 passengers, including the driver. These vehicles are larger than small PSVs and are often used for slightly larger-scale public transportation, such as local bus routes, school buses, and tourist transportation. They are designed to accommodate more passengers than small PSVs but are still smaller than full-sized buses.

All the PVSs' were considered diesel-powered[15].

3.4.7 Non-residential emissions

Within the Non-residential emissions sector, there are two main categories: Commercial, and Industrial Processes. Each category encompasses a unique set of activities and processes that contribute to greenhouse gas emissions.

3.4.7.1 Industrial

The results for industrial processes emissions were retrieved from the MapEIre dataset by transforming the principal GHGs into CO_2 according to their GWP[21], after clipping the National Dataset with the DZ boundaries.

3.4.7.2 Commercial

The emissions from commercial buildings in the DZ were calculated by locating and counting the commercial activities presented in the area. This was done by using the EIR Code dataset, locating the building on the DZ and then obtaining the corresponding Non-Domestic BER rating[16]. The average BER classification for each area was multiplied by the mean electricity consumption[17] by Energy Rating. The corresponding consumption was then multiplied by the electricity emission factor[18] to obtain the $kgCO_2$ equivalent.

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[15] https://www.acea.auto/files/ACEA-report-vehicles-in-use-europe-2022.pdf
[16] https://gis.seai.ie/ber
[17]https://www.cso.ie/en/releasesandpublications/ep/p-ndecber/non-domesticelectricityconsumptionbybuildingenergyratings2021/
[18] https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/

3.4.7.3 Supporting Information

In Ireland, the Non-Domestic Building Energy Rating (BER)[19] system uses an A to G scale, A is the most energy-efficient and G is the least. This rating is based on an assessment of a building's energy performance, considering factors such as insulation, heating systems, ventilation, and renewable energy sources for residential properties.

For non-residential buildings, energy performance is often evaluated through the Building Energy Performance (BEP) regulations and may involve different metrics and requirements compared to residential buildings. These regulations are designed to promote energy efficiency and reduce carbon emissions in non-residential buildings.

Non-residential buildings may also use Display Energy Certificates (DECs) to indicate their energy performance. DECs provide a visual representation of a building's energy efficiency and are typically required for the public sector and larger non-residential buildings.

3.4.8 Local Authority Own emissions

The analysis of the Local Authority's emissions focused almost exclusively on the information provided by the local authority itself. Within the Decarbonisation Zone, there are approximately nine hundred electricity poles, each with its own emissions influenced by various factors including the energy source and pole type. Additionally, several public, governmental, and local authority buildings are present, including a City Hall, Sligo Borough Council, a fire station, and a sports complex.

The calculations were conducted by determining the kilowatt-hours (kWh) of thermal and electricity usage for all the buildings, utilising specific emission factors corresponding to each building type. These individual totals were then aggregated, and the results were converted into kilotonnes for reporting purposes. Local authority transport emissions were calculated by weighting the total number of emissions directly from Sligo County Council BEIs and assigning it to the percentage of the population in the DZ compared with the total Sligo population. The County Sligo population data was taken from the 2016 Census, as CSO small areas data assumptions were also made in that year.

[19] https://www.seai.ie/home-energy/building-energy-rating-ber/

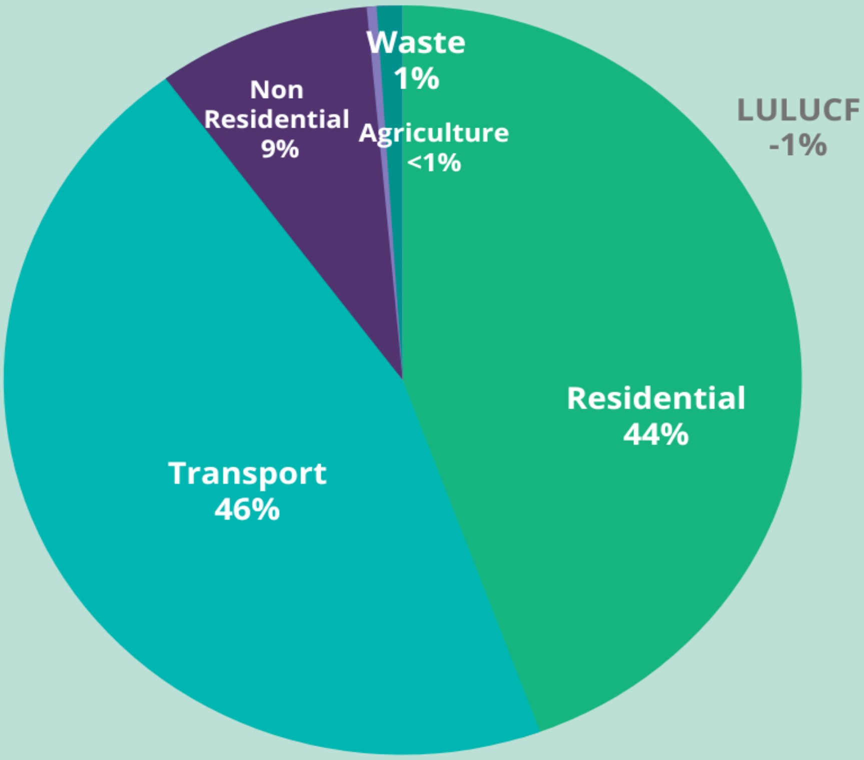
Sligo Decarbonisation Zone

Baseline Emissions Inventory Results 2019

County Sligo Emissions
943ktCO_2equivalent

National Emissions
65,152 ktCO_2equivalent

Total Emissions for Sligo DZ:
29.693 ktCO_2 equivalent



0.12 ktCO_2e **Agriculture**

-0.37 ktCO_2e **LULUCF**

13.188 ktCO_2e **Residential**

13.506 ktCO_2e **Transport**

0.308 ktCO_2e **Waste**

2.58 ktCO_2e **Non residential**

Note: Energy industry emissions have been allocated to the categories where they are consumed.

4. Sligo Decarbonisation Zone Profile

The Decarbonisation Zone encompasses an area of approximately 353 hectares of Land plus approximately 67 hectares of land bodies square kilometres and sustains a population of just under 4,000 residents (approx. 3970). Within this zone, there is a well-balanced mixture of both publicly and privately owned buildings, along with a substantial expanse of parkland and open green space. Notably, the principal administrative offices of Sligo County Council, situated at Riverside, are situated within the confines of this Decarbonisation Zone, as is the Regional Sports Centre, for which SCC bears responsibility.

Inside the zone, we come across several housing estates, including a mix of homes owned by the Local Authority and privately owned houses. One of the standout estates is Cranmore, which is currently getting a major facelift through a Regeneration project. This project has already made a big difference in how energy-efficient both the Local Authority and privately owned homes are in Cranmore. Plus, there are exciting plans to build a new community centre in the area, and it's seen as a prime example of what the Decarbonisation Zone can achieve.

Speaking of Cranmore, it's in the middle of this regeneration project, and it's making homes in both the Local Authority and the private sector more energy efficient. There are also upcoming plans to build a shiny new community centre here, which is seen as a star project for the Decarbonisation Zone. Sligo County Council is also gearing up for a big lighting upgrade project, teaming up with one of the required suppliers under the EEOS scheme.

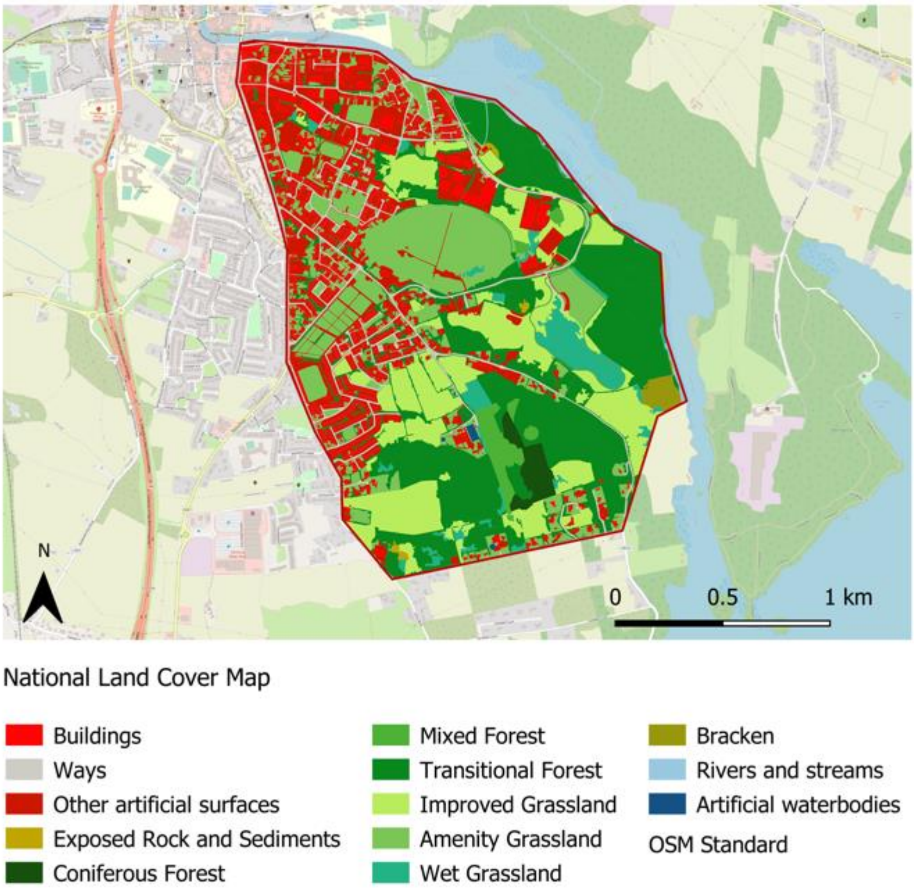


Figure 7 Decarbonisation Zone Land Cover map, National Land Cover map (own elaboration)

Baseline Emissions Inventory Results

Sligo DZ: **13.2 $ktCO_2e$ (41%)**
County Sligo: **167 $ktCO_2e$ (17%)**
National: **9,552 $ktCO_2e$ (15%)**

Residential

5.1 Residential Emissions

The focus of the inventory is Scope 1 emissions in the Residential, Non-residential, Transport, Agriculture, LULUCF, and Waste sectors, and Scope 2 emissions in the Residential and Non-residential sectors regarding electricity usage.

5.1.1 National Context

A comprehensive retrofit programme is a key measure in the CAP23 to reduce Residential emissions. The National Residential Retrofit Plan aims to achieve the equivalent of 500,000 homes retrofitted to a Building Energy Rating of B2/cost optimal or carbon equivalent. Another aim is the installation of 400,000 heat pumps in existing premises to replace older, less efficient heating systems by 2030. A total of 18,400 home retrofits were completed in 2020. However, just 4,000 were to a B2 standard and 1,600 installed a heat pump. Rollout of the Social Housing National Retrofitting Programme in 2021 with retrofitted properties was required to reach BER B2 or equivalent.

The SEAI estimates 17.7 MW of installed solar PV capacity in the Residential sector in Ireland in 2018 and that 44kt oil equivalent of renewable ambient energy from heat pumps was used.[20]

The national emissions ceiling for 2030 for residential buildings is 4$MtCO_2$ equivalent. For electricity, of which residential consumption made up 31% in 2019[21], the ceiling is 3 $MtCO_2$ equivalent.

5.1.2 Background

The Residential sector accounts for emissions from activities in people's homes. On a county level, the Residential sector accounts for about 21% of total energy-related emissions. This includes emissions from space and water heating, as well as from electricity consumption. Non-energy emissions come from sources including cooking, waste management, and other household-related activities. While emissions tied to energy play a substantial role in the Residential sector's overall environmental footprint, both energy and non-energy emissions should be factored into the calculations to assess the environmental impact of the sector more thoroughly. As detailed in the methodology chapter, conversion factors were used to transform the electricity and heating consumption into CO_2 equivalent.

5.1.3 Sectoral Emissions Description

In the Decarbonisation Zone, heating accounted for 77.53% of emissions in the Residential sector, while electricity consumption accounted for 22.47%. For reference, the national split is 76% direct fuels and 24% electricity, and the Sligo County split is 78% heating through direct fuels and 22% electricity. The three Residential emissions splits are shown in the pie charts below.

[20] https://www.seai.ie/publications/2020-Renewable-Energy-in-Ireland-Report.pdf
[21] https://www.cso.ie/en/releasesandpublications/ep/p-mec/meteredelectricityconsumption2021/

5.1.4 Supporting Information

From the CSO Small Area 2016 Census data, and weighting 3 out of the 19 total Small Areas involved, there are an estimated 1483 housing units in the DZ.

33.38% of households consist of one person and an additional 32.37% have two people. Of the total housing stock, 10.30% is vacant compared to 12.3% nationally during the same census. The majority of homes (57.77%) use oil as a heating fuel and the second most common is coal (including anthracite) (25.54%). Oil is also the dominant heating fuel at the county level, but coal is less common at that level and peat is the second most utilized fuel source. It is important to note that the CSO does not always use the same totals for different aspects of housing, so there are some discrepancies between the different tables.

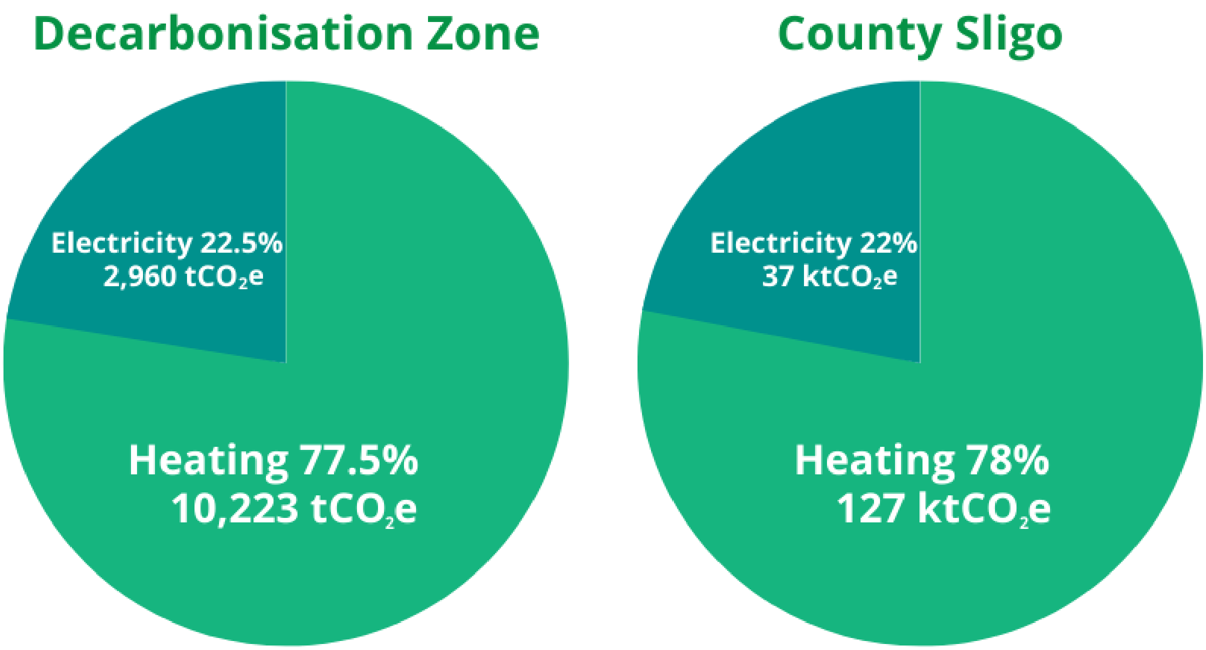


Figure 8 Emissions Split for Residential Sector at the Decarbonisation Zone and County Levels (CSO, 2016)

Household size and housing stock characteristics hold significant influence over the amount of energy consumed in homes for heating, cooling, and electricity. This information can help to contextualize the residential emissions in a Local Authority's jurisdiction.

Oil	Natural gas	Electricity	Wood	Peat	LPG	No central heating	Other/Not stated
911	7	138	14	17	9	841	49
57.77%	0.44%	8.75%	0.89%	0.40%	0.57%	1%	3.10%

Table 4 Share of Heating Fuel Sources within the Decarbonisation Zone (CSO, 2016)

Housing tenure and occupancy type can help provide some of the context behind residential emissions. One of the most prominent of these exists in the split incentives of rented homes, where maintenance such as energy retrofitting is the responsibility of the owner, but the benefits are reaped by the tenant through energy savings and improved living conditions.

Existing Housing Stock

Housing Stock	Holiday Homes	Other Vacant	Temporarily Absent	% Vacancy
1,844	10	190	55	10.3%

Table 5 Existing Housing Stock in the Decarbonisation Zone (CSO, 2016)

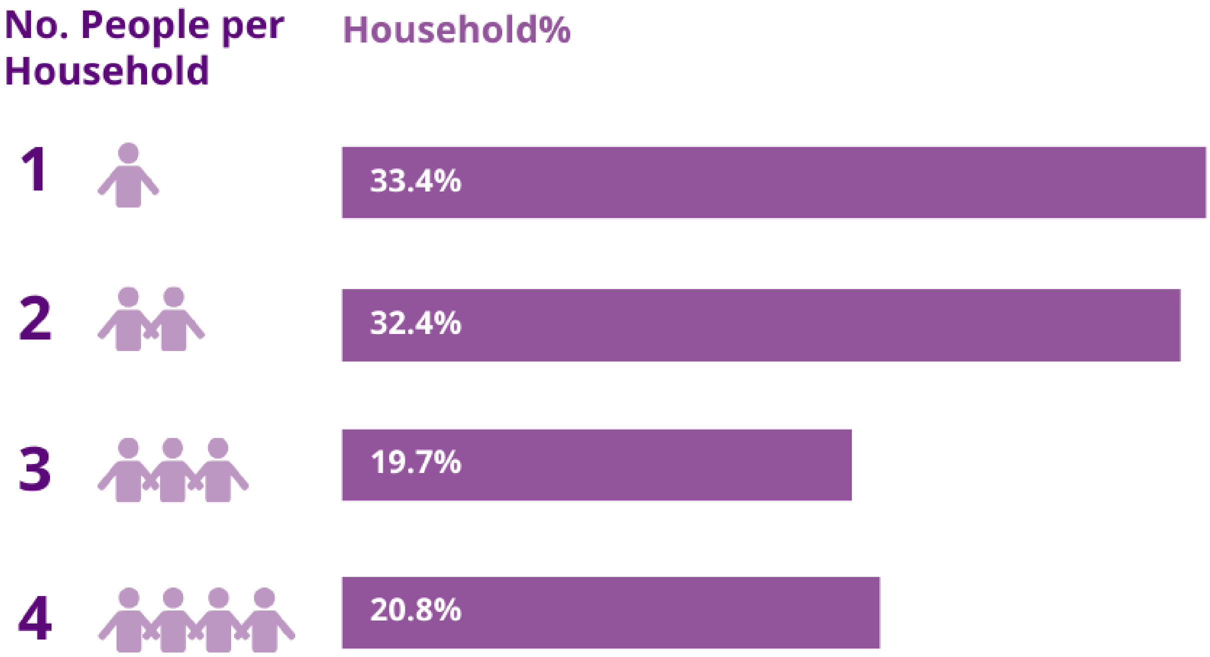


Figure 9 Number of people per household and the respective percentage (CSO, 2016)

5.1.5 Building Energy Ratings

Building Energy Ratings (BERs) measure the energy performance of a given home. They are measured on a scale from A1 to G, where A1 is the most efficient and G is the least. The level is calculated based on the amount of energy required to heat, cool, ventilate, and light a building according to SEAI-registered BER assessors. One of the goals laid out in the National Climate Action Plan is to retrofit 500,000 homes to a minimum BER of B2. Below is a distribution of the most recent BER ratings in the DZ.

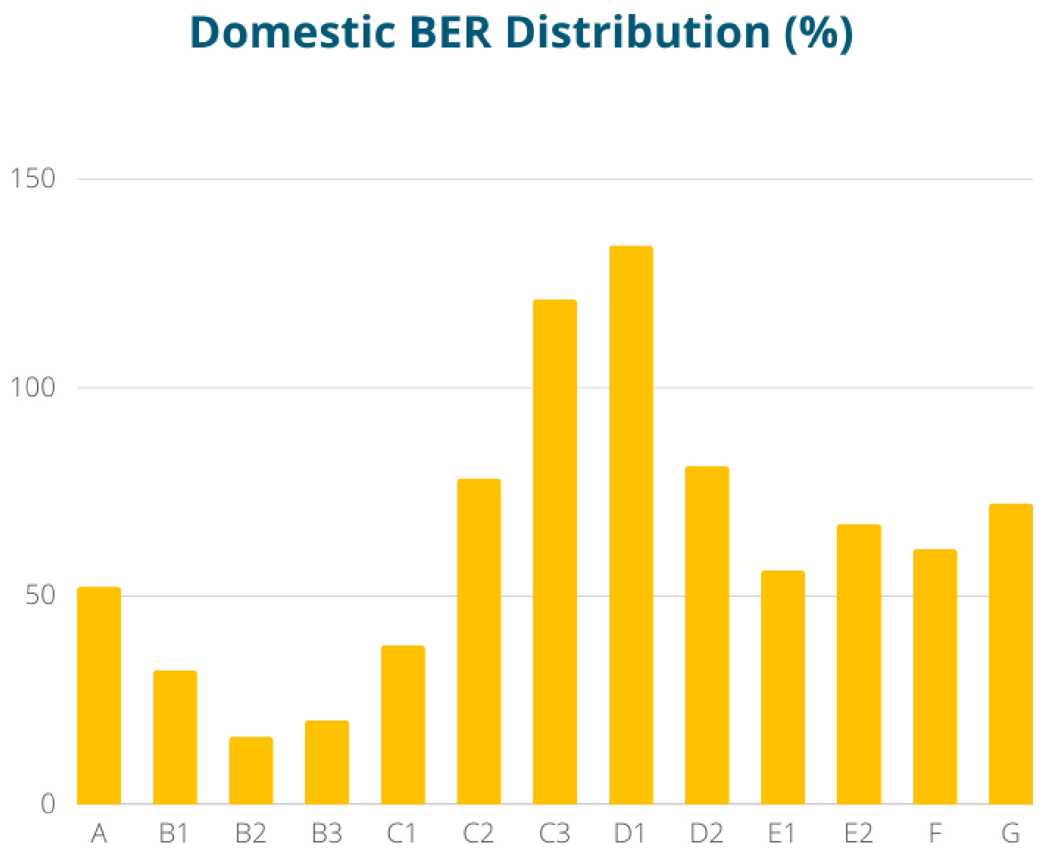


Figure 10 BER Distribution within the Sligo DZ (SEAI,2019)

Baseline Emissions Inventory Results

Sligo DZ: **13.5 $ktCO_2e$ (44%)**
County Sligo: **220 $ktCO_2e$ (8%)**
National: **12,196 $ktCO_2e$ (19%)**

Transport

5.2 Transport

5.2.1 Background

In 2019, the transportation sector in Ireland contributed approximately 19% of the country's greenhouse gas (GHG) emissions, equivalent to 11 million metric tonnes of carbon dioxide equivalent ($MtCO_2e$). Of this, road transport accounted for 94% of the GHG emissions within the sector. These emissions primarily result from the combustion of diesel and petrol in various types of vehicles, including passenger cars, light-duty vehicles, heavy-duty vehicles, and buses. Additionally, the transport sector is directly associated with the emission of various air pollutants that have adverse effects on both human health and the environment.

From 1990 to 2019 of all sectors, the transport sector witnessed the most substantial increase in GHG emissions, amounting to a 112% rise, from 5,143 $ktCO_2e$ in 1990 to 10,915 $ktCO_2e$ in 2019, with road transport emissions experiencing a 115% increase. The surge in emissions until 2007 can be attributed to a combination of economic prosperity, a growing population, a heightened reliance on private car travel, and a rapid expansion in road freight transport.

This sector encompasses emissions arising from the consumption of fuel for all modes of transportation, including domestic aviation, road travel, railways, waterborne navigation, and other forms of transportation, such as gas pipeline transportation. Emissions stemming from road transport remained relatively stable from 2015 to 2019, averaging around 11.6 $MtCO_2eq$. However, in 2020, these emissions decreased to 9.7 $MtCO_2eq$ due to the implications of the COVID-19 pandemic. Domestic aviation emissions are accounted for in the national inventory but contribute less than 1% of total transport emissions. International aviation and maritime navigation emissions are categorized as "memo items" in the national emission inventory, meaning they are reported to the UNFCCC and the EU for informational purposes but are not included in Ireland's national total emissions.

Transportation has been the sector most responsive to fluctuations in economic growth in Ireland. Both transport energy consumption and CO_2 emissions reached their peak in 2007 before declining significantly during the subsequent economic recession. Although there was a resurgence in 2013, by 2019, total transport energy consumption remained 8.5% lower than the 2007 peak, primarily due to heavy goods vehicles remaining 31% below their 2007 levels (refer to Figure 11 below).

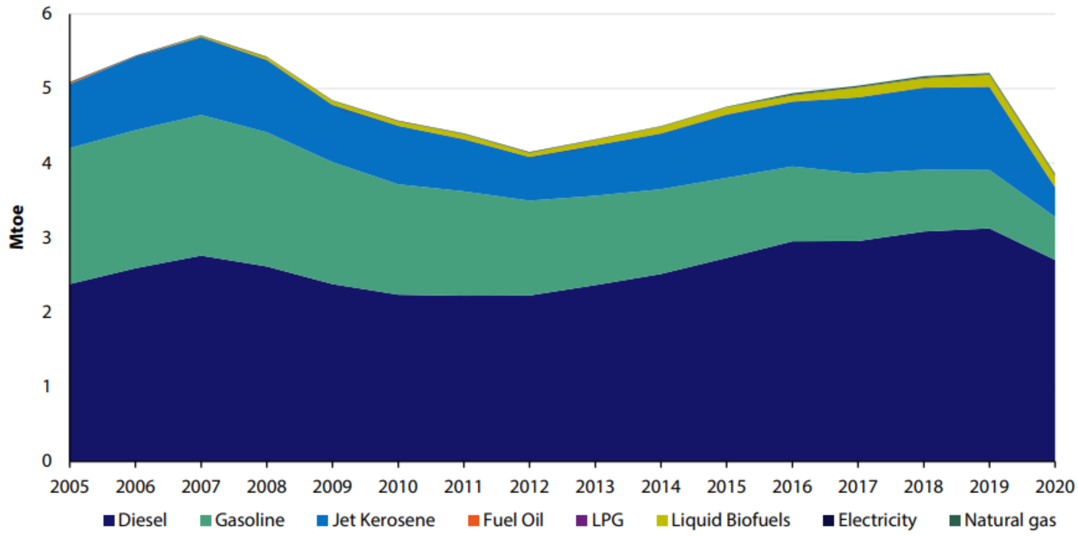


Figure 11 Transport fuel usage over time in Ireland (SEAI, 2020)

Fuel consumption in Transport is often closely aligned to the mode used: jet kerosene is used for air transport, fuel oil for shipping, and petrol and LPG are almost exclusively used for road transport. Diesel consumption is used for road transport, navigation, and rail. Of note, Transport remains almost completely dependent on fossil fuels, particularly oil products. This lack of fuel diversity is unique among the energy-using sectors. Renewables made up just 4% in 2019, which scores very low in comparison with other European Countries.

Type of Fuel	Average consumption per 100km	Average km driver per year	CO_2 emitted per goods vehicle per km	CO_2 emitted per Heavy duty vehicles and buses in a year
Diesel	28 litres	20,000 km	729g CO_2 per km	15t CO_2
Petrol	32 litres	20,000 km	761g CO_2 per km	15t CO_2
Hybrids	21 kWh	20,000 km	565g CO_2 per km	11t CO_2

Table 6 Fuel Split (SEAI, 2019)

This has meant that there has been very little decarbonisation of the Transport fuel mix to date, with Transport CO_2 emissions remaining tightly coupled to energy use. In 2019, Transport CO_2 emissions were the same as they had been in 2005.

A core objective of the National Planning Framework is the need for more sustainable forms of Transport to reduce energy demand and greenhouse gas emissions, such as active modes of travel, and electric vehicles and increase the usage of public transportation. The National Planning Framework for Transport also places a strong emphasis on enhanced regional accessibility in Local Authorities.[22] The national emissions ceiling for Transport for 2030 is 6 $MtCO_2e$.

The levels of noise, accidents, and congestion associated with road transport reduce the quality of life, deter active travel, and cost society hundreds of millions of euros per annum in wasted time. Behavioural change and promoting cleaner, safer, and more sustainable mobility are critical for climate policy, and it also represents an opportunity to improve our health, boost the quality of our lives, meet the needs of our growing urban centres, and connect our rural, urban, and suburban communities.

The recently revised CAP23 sets out the required level of decarbonisation for transport in quantitative terms as summarised in Table 15 below:

2018 Emission $MtCO_2e$	Indicative Target for 2025 Emission $MtCO_2e$	Indicative Target % Reduction for 2025 $MtCO_2e$	2021 Emissions $MtCO_2e$	% Increase (+)/ Reduction (-) to date $MtCO_2e$
12	10	20%	11	-11

Table 7 Required level of decarbonisation for transport (CAP23[23])

In County Sligo, the transport sector accounted for 131 $ktCO_2e$, which makes up 14% of the total emissions within the county. The emissions from passenger cars are the highest emitting subcategory in the transport sector.

5.2.1 DZ: Baseline Inventory for Transport Emissions

County Sligo, similar to numerous counties in the northern region of the Republic of Ireland, has a strong dependence on car transportation, leading to a substantial contribution to emissions and establishing a car-centric culture. The Decarbonisation Zone is notably bordered to the west by a major arterial road crucial to both the county and the country (N4, connecting Dublin and Sligo counties), and it also encompasses a multitude of other urban and local roads, offering excellent accessibility from the suburbs to the centre of Sligo Town. The Sligo railway line does not fall within the Decarbonisation Zone, and improvements are underway[24], especially mentioning the importance of the local link within. Still, the public transportation network remains limited, according to the commuting patterns. A positive development is the presence of numerous bicycle lanes in the local, and the plans for the further development of Cranmore include improvements to the infrastructure that cater to the needs of cyclists and pedestrians, as they make up roughly 29.7% of the population commuting to work/school in the DZ.

[22] https://www.gov.ie/en/press-release/cc07e-new-national-investment-framework-for-transport-in-ireland/#:~:text=The%20National%20Investment%20Framework%20for,and%20the%20National%20Development%20Plan

[23] https://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023

[24] Bus Éireann News - Bus Éireann - View Ireland Bus and Coach Timetables & Buy Tickets (buseireann.ie)

The transport sector accounted for a total of 13.506 $ktCO_2e$, which makes up roughly 37% of the Decarbonisation Zone's total emissions. The main CO_2 emitters are the Goods vehicles (lorries and vans) and private vans* typology, with 8.346 $ktCO_2e$, doubling the number of emissions attributed to private passenger cars, 4.413 $ktCO_2e$, followed by the Buses with 0.722 $ktCO_2e$ and motorcycles with 0.025 $ktCO_2e$. Tractors and agricultural machinery were not included in the equation as cultivated land is not present in the area according to MapElre data for the DZ.

Vehicle Type	$ktCO_2e$
Buses	0.72
Motorcycles	0.025
Goods Vehicles (Vans and Trucks)	8.35
Private Cars	4.41
Total	13.51

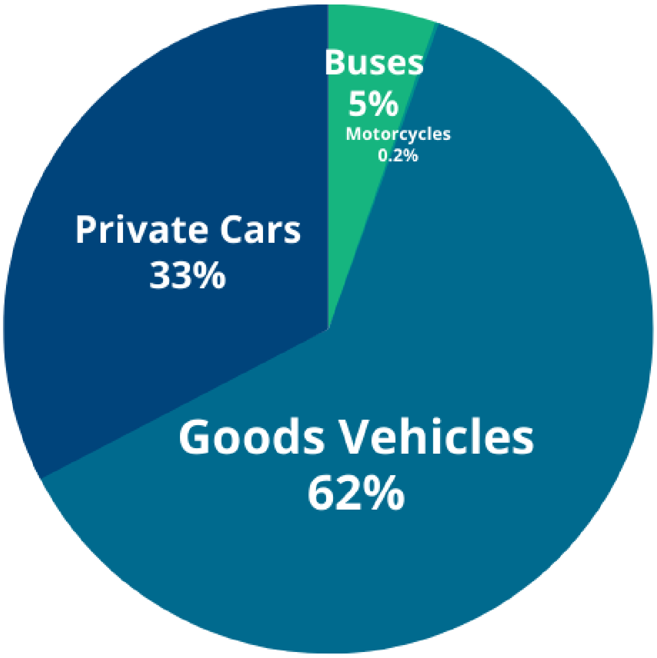


Table 8 and Figure 12 Total Transportation Emissions in the DZ

**Private vans and goods-related vans are in the same calculation as it is not possible to measure it differently without knowing the exact number of vehicles.*

5.2.2 Supporting Information

Calculating transport emissions at a local level poses various challenges in determining which and how travel should be accounted for. In the scope of this BEI, a bottom-up approach was used to calculate those emissions generated by any travel inside the DZ whose final destinations could also be placed outside of the DZ's boundaries. To process these calculations most accurately, it would be ideal to obtain a fine level of data acquisition accuracy-travels matrixes with the origin and destination of the travel and the type of transportation used. Due to the lack of this type of dataset, the following methodology was applied using the data gathered.

The data gathered in this analysis results from a bottom-up approach to capture the emissions that took place within the DZ boundaries by the various transport modes. The Decarbonisation Zone's yearly travel average for passenger cars is 17,054 km travelled/per year. The emissions coming from the passenger cars (excluding vans) account for 32.71% of the total Transport emissions. Give the percentages for each type of transport.

To add value and bring the Decarbonisation Zone's representatives a step closer to taking effective climate action plans, the emissions per type of fuel in the DZ's registered vehicles and type of vehicles were assessed by using local and international data, to make certain assumptions which are explained in detail in the Methodology sector. The two types of vehicles that were broken down considering this approach are the private cars and the goods vehicles, as they are responsible for emitting the largest amount of carbon emissions in the transportation sector. The table below shows the amount of diesel and petrol cars registered in the Decarbonisation Zone. In the following table, we can find the distribution of vehicles.

Private cars	km (million)	Average km
1625	27.7	17,054
Good's vehicles and Vans	km (million)	Average km
341	6.7	19,772
Motorcycles	km (million)	Average km
6	0.01	2.717
PSVs (Buses)	km (million)	Average km
22	0.8	37,200

Table 9 Distribution of Vehicles and Kilometres in the Decarbonisation Zone

5.3 Non-residential

5.3.1 Background

Commercial emissions stem from commercial entities such as businesses, offices, and industrial complexes. The 220 commercial entities in the DZ demand substantial energy for their operations and, being significant contributors to greenhouse gas emissions, tend to be a focal point for emission reduction efforts. They often utilise fossil fuels as an energy source. The combustion of fossil fuels releases greenhouse gases, including carbon dioxide, methane, and nitrous oxide. These gases trap heat in the atmosphere, contributing to climate change via the greenhouse effect. Within the commercial sector, energy consumption is attributed to activities like heating, cooling, ventilation, lighting, cooking, and refrigeration.

Industrial process emissions encompass emissions from processes like cement production, lime production, ceramics, solvent usage, and processes within the food and beverage industry. These emissions are quantified based on non-energy uses of fossil fuels and the use of greenhouse gases in products. This emissions category stands apart from emissions linked to combustion or space and water heating.

In the Irish national inventory, commercial emissions, manufacturing processes, and industrial processes are categorised separately for individual accounting. These categories represent diverse sources of greenhouse gas emissions, reported independently to provide a comprehensive understanding of the country's emissions profile. However, in this instance, these categories are being amalgamated into a broad non-residential category. Emissions originating from commercial, manufacturing combustion, and industrial sources not associated with residential activities are being collectively reported under this category. Manufacturing Combustion is not present in the Decarbonisation Zone and thus will not be considered in this report. This analysis will consider the commercial and industrial sectors.

Electricity emissions are determined based on metered consumption. This implies that the quantity of greenhouse gas emissions linked to electricity usage is computed according to the amount of electricity consumed, as recorded by a meter. The emissions linked to electricity generation are allocated to the end-use sector based on this consumption data.

5.3.2 DZ: Baseline Inventory for Non-residential Emissions

The emissions originating from non-residential sources within the Decarbonisation Zone amount to a collective total of 4 kilotonnes of carbon dioxide equivalent (ktCO_2e). These emissions are approximately evenly distributed between the commercial and industrial sectors, with respective contributions of 2.05 ktCO_2e and 1.87 ktCO_2e. There are three educational Institutions in the area that account for 0.071 ktCO_2e per year when conjoining their electrical and heating emissions. Additionally, there are scant fugitive emissions quantified at 0.002 ktCO_2e, which have minimal influence on the overall emission calculation for this sector.

Sectors	ktCO_2e
Commercial Services	2.06
Industrial Processes	1.87
Fugitive Gases	0.002
Educational Institutions	0.071
Total	4.013

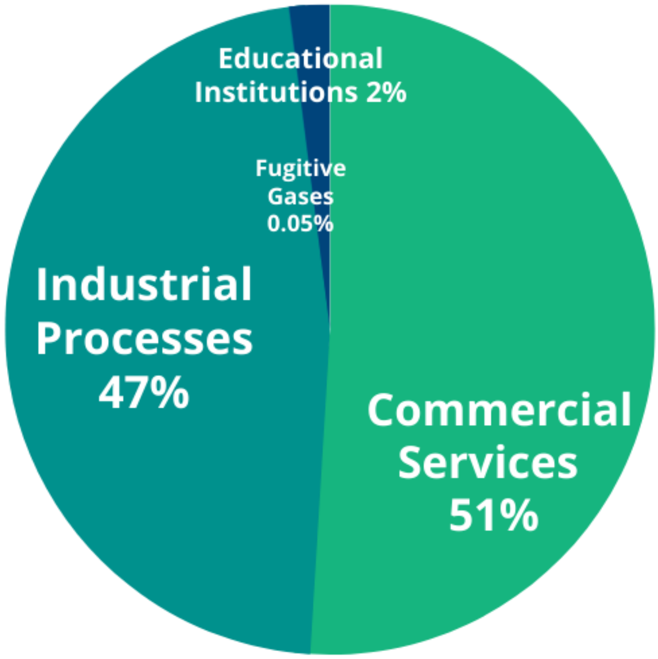


Table 10 and Figure 13 Total Non-Residential Emissions in the Decarbonisation Zone

Baseline Emissions Inventory Results

Sligo DZ **0.1 $ktCO_2e$ (<1%)**
County Sligo: **429 $ktCO_2e$ (46%)**
National: **22,134 $ktCO_2e$ (34%)**

Agriculture

5.4 Agriculture

5.4.1 Background

The Agricultural sector plays an important role in County Sligo. 63% of land is either in agricultural or agriculture-related use. A high proportion of the population lives in rural areas with economies heavily dependent on farming activities, creating both direct and indirect employment. Roughly half of the Sligo Region is rough pasture, which can be further broken down into mountain hills, and peat bogs. The combination of farmable lowlands in the North of the Ox Mountains, scenic lakes, and limestone hills in the area provide conditions for both agriculture and tourism to generate significant income. Furthermore, the county's traditional fishing expertise accounts for another important income pillar.

Farm animals in County Sligo are directly responsible for almost 55% of the carbon emitted over the whole sector. The highest emitting subsector within the county is the non-dairy cattle, responsible for 39% of the total carbon emissions.

The agriculture sector of emissions encompasses the release of greenhouse gases (GHGs) into the atmosphere during farming activities, which encompass livestock rearing, crop cultivation, and changes in land use. These emissions primarily consist of methane (CH_4) and nitrous oxide (N_2O), both of which have considerably higher global warming potential than carbon dioxide (CO_2). The agricultural sector plays a significant role in global GHG emissions and holds a vital responsibility in addressing climate change.[25]

Within Ireland, agriculture is the highest emitting sector, contributing to 34% of the nation's total GHG emissions in 2019. The principal source of emissions within this sector is methane emissions from livestock, accounting for approximately 63% of the overall agricultural emissions. Livestock, including cows, sheep, and pigs, generate methane through a process known as enteric fermentation, which occurs during the digestion of feed in their stomachs.[26]

The use of nitrogen-based fertilisers and the management of animal manure are other substantial sources of agricultural emissions in Ireland. The application of nitrogen fertilisers and the handling of animal waste can lead to the release of nitrous oxide, an exceptionally potent greenhouse gas that has over 300 times the warming potential of CO_2.

[25] https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/agriculture/
[26] https://www.teagasc.ie/rural-economy/rural-economy/agri-food-business/agriculture-in-ireland/

Mitigating agricultural emissions presents a significant challenge for Ireland. Agriculture is a cornerstone of Ireland's economy, contributing 8% to the nation's gross value added and supplying employment for over 8.5% of the national workforce in 2019. To address this challenge, Ireland has set ambitious targets for its agriculture sector, aiming to achieve a 25% reduction in GHG emissions by 2030. The national emissions limit for Agriculture in 2030 is capped at 17.25 million metric tonnes of CO_2 equivalent.[27]

In the context of national agriculture, there have been notable shifts in recent trends, marked by a reduction in synthetic fertilizer usage and a concurrent rise in the dairy cow population. Over the ten-year span from 2012 to 2022, the dairy herd expanded by 42.5%, while dairy production concurrently increased by 68.6%. Furthermore, during this same period, Ireland witnessed an increase of 14.7% in its sheep population.

5.4.2 DZ: Baseline Inventory for Agricultural Emissions

In the Decarbonisation Area, agricultural emissions are not significant when compared to the proportion of agricultural emissions found in County Sligo. There are no notable cultivated or agricultural lands, and the only agricultural activity with potential is livestock farming, which does not significantly contribute to the emissions recorded by MapElre.

It's important to highlight that there is scarcely any available agricultural sector data for the entire Decarbonisation Zone in the 2020 agricultural census, as previously outlined in the methodology. The total number of recorded emissions is 0.112 $ktCO_2e$, with approximately 0.07 $ktCO_2e$ attributed to livestock and the remaining 0.04 $ktCO_2e$ to other sources.

Subsector	$ktCO_2e$
Livestock	0.07
Other	0.04
Total	**0.112**

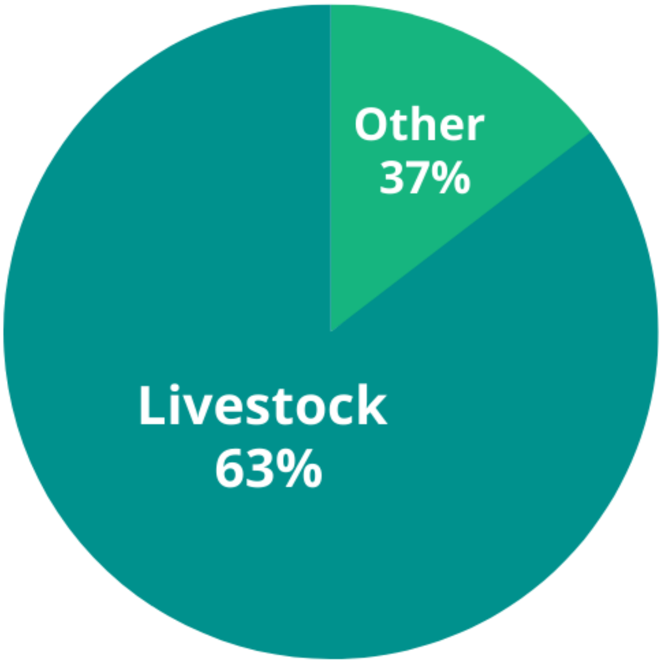


Table 11 and Figure 14 Total Agriculture Emissions for the Decarbonisation Zone

[27] https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/f

Baseline Emissions Inventory Results

Sligo DZ: **-0.37 ktCO_2e (-1%)**
County Sligo: **119 ktCO_2e (13%)**
National: **6,657 ktCO_2e (10%)**

LULUCF

5.5 Land Use, Land Use Change, and Forestry

5.5.1 Background

Land Use, Land Use Change and Forestry (LULUCF) is responsible for GHG emissions and sinks related to land use change and forestry. It involves the emissions and removals from forest land, cropland, grassland, wetlands, settlements, and other land types, as well as through the harvesting of wood products. Land management has a key role in the response to climate change. Ireland has significant and healthy biosystems, including grassland, hedgerows, and forests, which sequester or absorb carbon dioxide (CO_2). This is a separate category from Agriculture because while LULUCF primarily deals with land use and forestry practices to enhance carbon sequestration and mitigate emissions, Agriculture involves the production and management of crops and livestock, and includes emissions and removals associated with agricultural activities such as enteric fermentation, manure management, and soil management.

Since 1990, Ireland's forest area has expanded by approximately 300,000 ha[28]. As these forests grow and mature, they represent an important CO_2 sink and long-term carbon storage in biomass and soil. However, low forest planting rates in recent years are a future risk in terms of national forest estate continuing to act as a significant carbon sink. In 2019 the LULUCF sector accounted for 3,073 ktCO_2 equivalent removed and 9,979 ktCO_2 equivalent emitted. In 2019, the national net emissions for LULUCF accounted for 6,906 ktCO_2.

Land use and land-use change contribute substantially to global greenhouse gas emissions. However, they also offer significant potential to reduce emissions. The natural environment plays a crucial role in absorbing and storing carbon.[29]

5.5.2 DZ: Baseline Inventory for LULUCF Emissions

Total LULUCF emissions in the DY are negative (around -0.37 kt ktCO_2) and decrease the total DY emissions by about 1%. This proportion is significantly lower than in County Sligo and Ireland as a whole, where LULUCF makes up roughly 13% of emissions. This phenomenon can be explained by the percentage of forest (32%) and grassland (38.75%) in the Decarbonisation Zone, which are unusually high and store a significant amount of CO_2. There are also areas bordering the DZ around Lough Gill that flood naturally and could potentially be used to manage stormwater, and where significant carbon sequestration may occur if managed properly. The National Land Cover data shows that the total emissions of (kt$CO_{2)}$ regarding artificial areas are 0.1, 0.21 ktCO_2 for grassland and a retention of -0.69 ktCO_2 in the forest land.

[28] https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/lulucf/
[29] https://unfccc.int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf

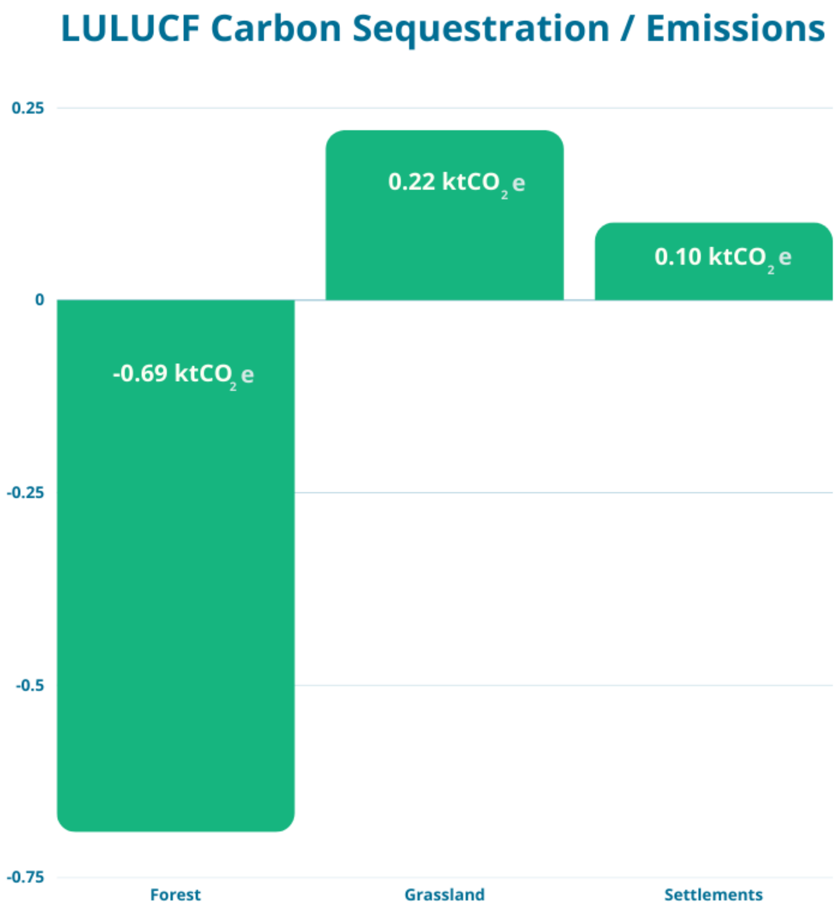


Figure 15 LULUCF Carbon Sequestration

Subcategories	Total area (%)
Cropland	-
Forest, Woodland and Scrub	32
Grassland	38
Peatland	-
Exposed Surfaces	0.1
Settlements	29
Heath and Bracken	0.7
Total	100

Table 12 LULUCF area division by percentage in the Decarbonisation Zone

Baseline Emissions Inventory Results

Sligo DZ: **0.3 ktCO₂e (1%)**
County Sligo: **5 ktCO₂e (1%)**
National: **991 ktCO₂e (1%)**

Waste

5.6 Waste

5.6.1 Background

The Waste sector includes emission estimates from solid waste disposal, composting, waste incineration (excluding waste to energy), open burning of waste and wastewater treatment and discharge. The largest of these sources is solid waste disposal on land (landfills) where methane (CH_4) is the gas concerned. In contrast with the other sectors, the greenhouse emissions coming from Waste have been decreasing rapidly throughout the years due to the improved management of landfill activities, including increased recovery of landfill gas utilised for electricity generation and flaring is a core driver in decreased emissions from the Waste sector. This can be seen in the figure below:

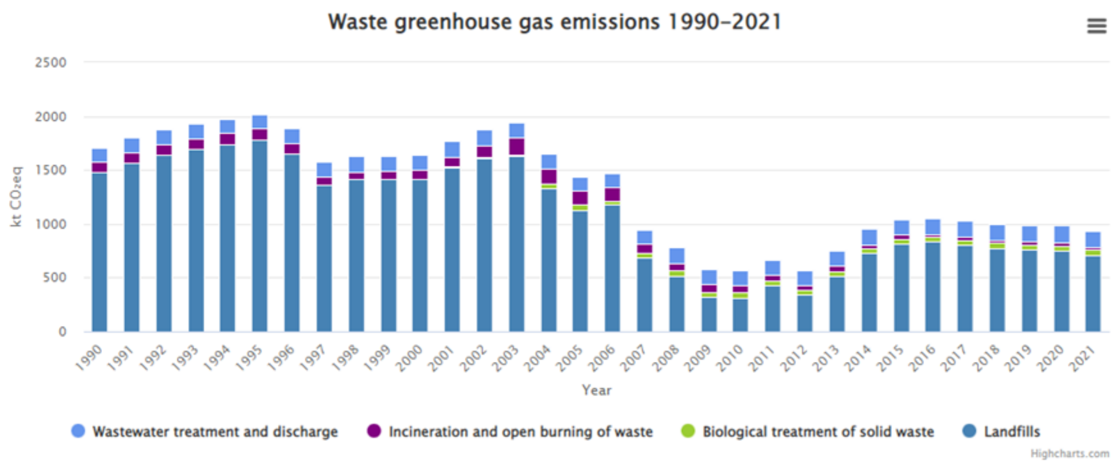


Figure 16 Waste greenhouse gas emissions from EPA (2022) [30]

Approximately 15% of waste was landfilled in 2019, following a downward trajectory of 58% of waste landfilled in 2010 and 80% in 2001[31]. Following the Landfill Directive, the 2035 target for landfilling fraction is 10% or less of municipal waste.

5.6.2 DZ: Baseline Inventory for Waste Emissions

Waste accounts for 0.308 $ktCO_2$, just over 1% of the total emissions in the Decarbonisation Zone. This reflects solid waste, sewage and wastewater based on calculations and weighting reasonable and approximated numbers for the study area.

[30] https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/waste/
[31] https://www.epa.ie/publications/monitoring--assessment/waste/national-waste-statistics/EPA_Nat_Waste_Stats_Report_2019_web.pdf

6. Other Inventories

6.1 Local Authority Own emissions

6.1.1 Background

In Ireland, all public bodies are mandated to achieve a 51% reduction in greenhouse gas emissions related to energy and a 50% enhancement in energy efficiency by the year 2030. This progress is meticulously monitored and documented through the SEAI's Monitoring and Reporting (M&R) system, wherein each public sector entity submits the following information:

- Annual energy consumption data for all types of energy sources.
- Annual data reflecting the extent of activities carried out by the organisation each year. This is known as the activity metric.
- Comprehensive information on energy-saving projects that have been put into action as well as those in the planning stage.
- A summary outlining the methodology employed for reviewing and evaluating the organisation's energy management program.

6.1.2 DZ: Baseline Inventory for Local Authority's Own Emissions

In the Sligo Decarbonisation Zone, there are several public and government buildings. These structures include a City Hall & The Sligo Borough Council, a fire station, and a sports complex. Together with public lighting and transport (fleet), they release approximately 0.598 ktCO_2, constituting roughly 1% of the total emissions within the Decarbonisation Zone. Specifically, electricity contributes 0.12 ktCO_2, accounting for approximately 21% of the overall local authority (LA) emissions. Meanwhile, heating is responsible for 0.46 ktCO_2, making up about 79% of LA emissions. Transport on its hand is entitled to approximately 6.2% of the total, with 0.037 ktCO_2, a number weighted from the County average.

Public social housing is not included in the LA emissions calculation due to a lack of reliable data and because these emissions align more with the residential sector.

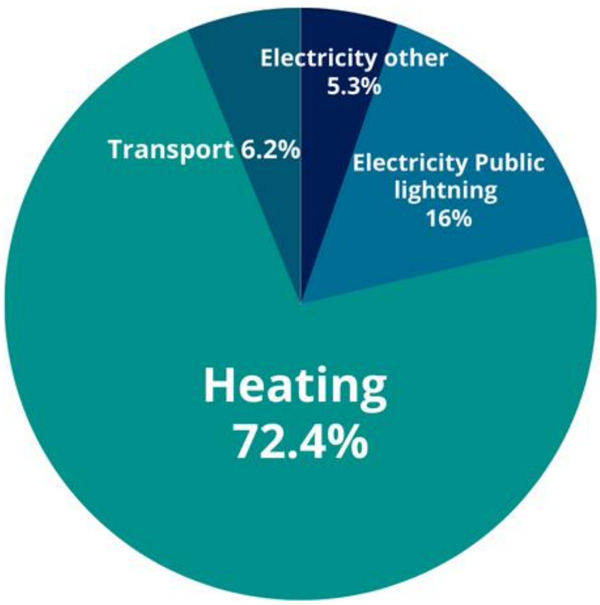


Figure 17 Local authorities emissions Split

6.2 Fluorinated Gases

6.2.1 Background

Fluorinated gases are artificially produced gases used in a range of industrial applications. They are often used to substitute gases that deplete ozone, as they do not damage the atmospheric ozone layer. However, they are greenhouse gases with high GWPs, thus contributing to climate change. They were not included as their sector in the Chapter 3 Inventory but are added here.

Hydrofluorocarbons are typically found in applications such as refrigeration, air-conditioning, aerosols, and foams. SF_6, however, is used primarily in the electricity and electronics supply industries, e.g., the semiconductor industry, where it is used as an electronic insulator due to its inertness. [32]

F-gases in Ireland are controlled by European Regulation (EC) No. 517/2014. This Regulation aims to cut EU emissions of F-gases by two-thirds of 2014 levels by 2030. It is a legal requirement in Ireland that all businesses that install, maintain or service stationary refrigeration, stationary fire protection systems and extinguishers, air conditioning and heat pump equipment containing or designed to contain F-Gas refrigerants, obtain an F-Gas Company Certificate.

6.2.2 Decarbonisation Zone: Baseline Inventory for F-gases

Using the MapEIre CRF Geospatial Dataset, hydrofluorocarbons were the only F-gas identified in the Sligo DZ. Perfluorocarbons (PFCs), nitrogen trifluoride (NF3), and sulphur hexafluoride (SF6) were also measured but not detected. The CO_2 equivalent of the HFCs is not included in the emissions calculations of the other sectors, so it should be included in the total emissions of the DZ. The total mass and CO_2 equivalent value is approximately 1.09 ktCO_2.

[32]https://library.wmo.int/index.php?lvl=categ_see&id=10223#.Y3-3eXaZOUk

7. Conclusion and Next steps

Baseline emissions inventories are not only significant but also essential for addressing the needs and the responsibilities of the public sector in the fight against climate change, as well as the impact it already has in multiple fields in Ireland, such as agriculture[33] and biodiversity[34]. They provide a structured map of symbiotic emissions in a specific area, accounting for data that was collected, analysed, calculated, and projected to be a trustworthy source of evidence to create a foundation to begin the green transformation of a decarbonisation zone, a city, or a country.

In contrast to County Sligo, and due to the fact the area is peri-urban/urban with a significant part of superficial surfaces and forest, agriculture exerts minimal influence on the overall emissions. The same description falls under the LULUCF results, which contribute to the overall emissions count, but in a very positive way, minimising them. Such impact is attributed to the absorption of CO_2 by the forested land in the region. The primary contributors to emissions are residential sources, primarily related to heating, and transportation, primarily due to privately owned cars and goods vehicles (vans and trucks). Additionally, there is a notable impact from non-residential emissions, particularly those of commercial nature, which aligns with expectations given the high concentration of business in the area.

With the results from the Baseline emissions inventory in hand, county Sligo can develop a comprehensive Climate Action Plan for the area, that outlines specific strategies and targets for reducing greenhouse gas emissions. The Decarbonisation Zone will possibly be the first area to be decarbonised in County Sligo and should be a future example of good practices and transformative use cases related to decarbonisation. A future overview would consider an even more sagacious investment in housing retrofit, and a new and more sustainable look at the emissions sources as the heating and electricity take a significant slice in the overall measured emissions. The promotion and establishment of improved accessibility and conditions for public transport in the South East of Sligo Town are readily apparent when taking a brief aerial perspective. This part of Sligo Town is densely populated with parking lots, strongly implying that it is the predominant mode of transportation in the region. This inclination towards private vehicles is somewhat comprehensible, given the daily commutes to Sligo's rural areas and other counties for work, but active modes of travel are welcomed and should be seen as an alternative for future planning thinking. There also can be a need for greater community engagement, raising awareness, and instigating behavioural shifts, encompassing a transition towards more sustainable agricultural practices, and promoting eco-conscious personal choices.

[33] Climate change may 'threaten' sustainability of Irish farms -report - Agriland.ie
[34] Bird species are in decline everywhere - but in Ireland it's worse - Buzz.ie

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