KPMG

Westmeath County Council

Decarbonisation Zone

Report
May 2023

WESTMEATH COUNTY COUNCIL
Comhairle Chontae na hIarmhí

KPMG Sustainable Futures

KPMG Future Analytics

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Executive Summary

1.1 Executive Summary

A **Decarbonisation Zone (DZ)** is a spatial area, identified by each local authority in Ireland, in which a range of climate change mitigation measures are identified to contribute to meeting national climate action targets. DZs are a demonstration and testbed of what is possible for decarbonisation and climate action at a local and community level. Through a feedback loop of experimentation and evaluation, the DZ enables a flexible, incremental and community-driven approach to ensure that its objectives are delivered.

Mullingar has been designated as the DZ for Westmeath County Council based on its socioeconomic and physical environmental characteristics which have been deemed an appropriate fit against a set of defined DZ criteria. The DZ area is shown on the map below.

Once a DZ area is identified and the associated overarching vision and objectives are set, each local authority must kickstart the next stage of the DZ - the development of the DZ area's **Baseline Emissions Inventory (BEI)**.

The BEI is an overview of the area's total carbon emissions at a point in time. It is a key instrument to support and enable a local authority to measure the impact of planned actions relating to emission reductions across its own operations as well as relevant sectors of society.

Westmeath County Council's BEI for the DZ area is informed by the guidance document Technical Annex C: Climate Mitigation Assessment and Technical Annex D Decarbonising Zones and follows a **Tier 3 approach**, i.e. a 'bottom-up, spatially led' approach.

2018 is used as the baseline year for the BEI assessment. This year has been purposefully chosen to align with Ireland's national targets which are set against a 2018 baseline year.

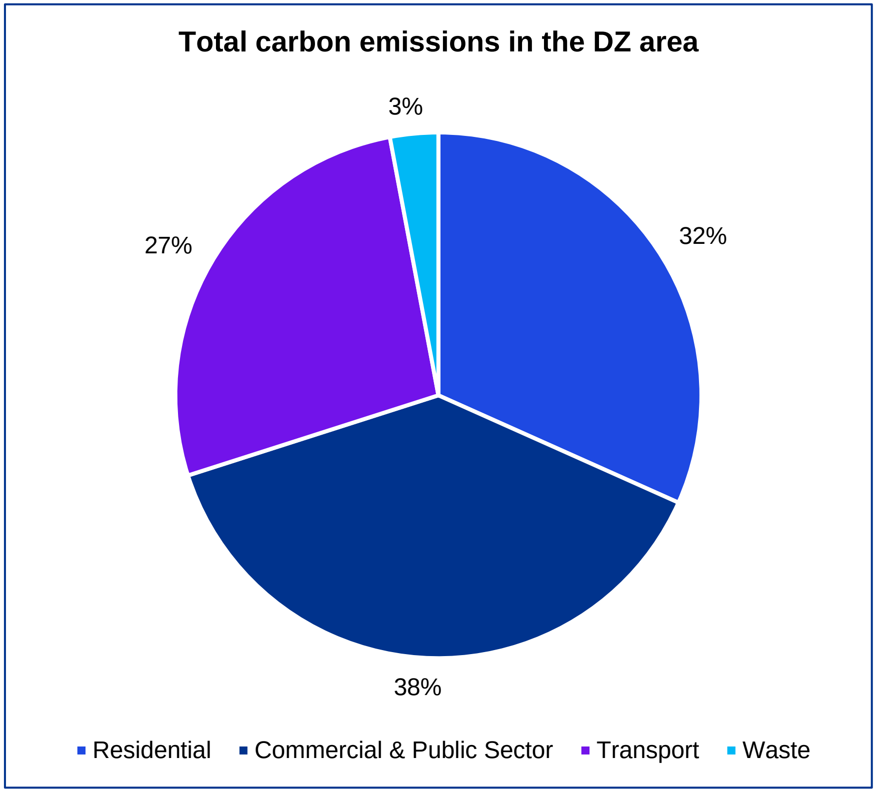
Emissions associated with the following sectors are considered in this BEI assessment due to their relevance in the DZ area: **Residential, Commercial & Public Sector, Transport and Waste.**

A summary of the results of the DZ area BEI assessment is provided on the next page.

1.2 Executive Summary

The results of the 'bottom-up' Tier 3 assessment are presented on the table and chart below. Total carbon emissions in the DZ area equate to approximately **138,421 tCO_2e**.

	Carbon emissions (tCO_2e)
Residential	45,091
Commercial & Public Sector	52,432
Transport	36,855
Waste	4,043
Total carbon emissions	**138,421**
Total carbon emissions per capita (tCO_2e/capita)	**7.19**



02

Introduction

2.1 Global & National Response to Climate Change

Global responses to climate change are accelerating as exemplified by the signing of the COP21 Paris Agreement by 195 countries in 2015. Ireland's climate policies are evolving in line with national and international requirements and aims to "pursue and achieve, by no later than the end of 2050, the transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy."

Climate change has become one of the most pressing global public policy challenges facing governments today.

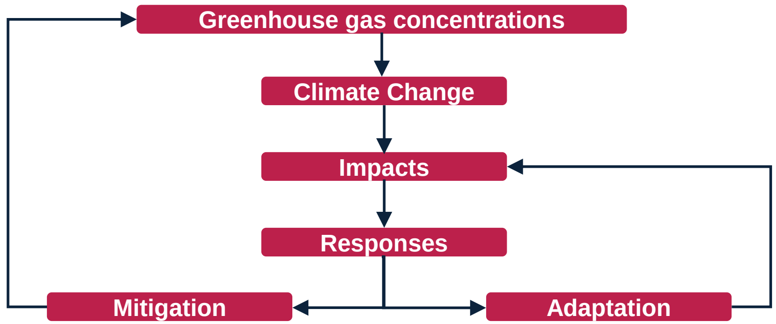
International organisations, national and local governments are increasingly compelled to take ambitious action through mitigation (decreasing emissions that cause climate change) and adaptation (enhancing resilience to climate change impacts and risks).

Ireland's Local Authorities are developing Local Authority Climate Action Plans (LACAPs) to play their part in meeting national emissions objectives and to transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy. These plans need to be underpinned by a robust evidence base detailing sources of emissions as well as the current and future climate-related risks faced by the Local Authority.

In response to the challenges posed by climate change, two complementary approaches are being adopted.

Mitigation: ensuring the impacts of climate change are less severe by preventing or reducing carbon emissions. Mitigation is achieved either by reducing the sources of these gases (e.g. by increasing the share of renewable energies, or establishing a cleaner mobility system), or by enhancing the storage of these gases (e.g. by increasing the size of forests).

Adaptation: anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise. Examples of adaptation measures include large-scale infrastructure changes, such as building defences to protect against sea-level rise, as well as behavioural shifts, such as individuals reducing their food waste.



2.2 Global & National Response to Climate Change

Paris Agreement, 2015

The Paris Agreement, adopted in 2015 provides an internationally accepted and legally binding global framework to addressing climate change challenges. It has two clearly defined goals aimed at supporting progressive and ambitious climate action to avoid dangerous climate change:

I. holding global average temperature increase to well below 2°C and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels (i.e. **mitigation**);

II. increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience (i.e. **adaptation**).

European Climate Law, 2021

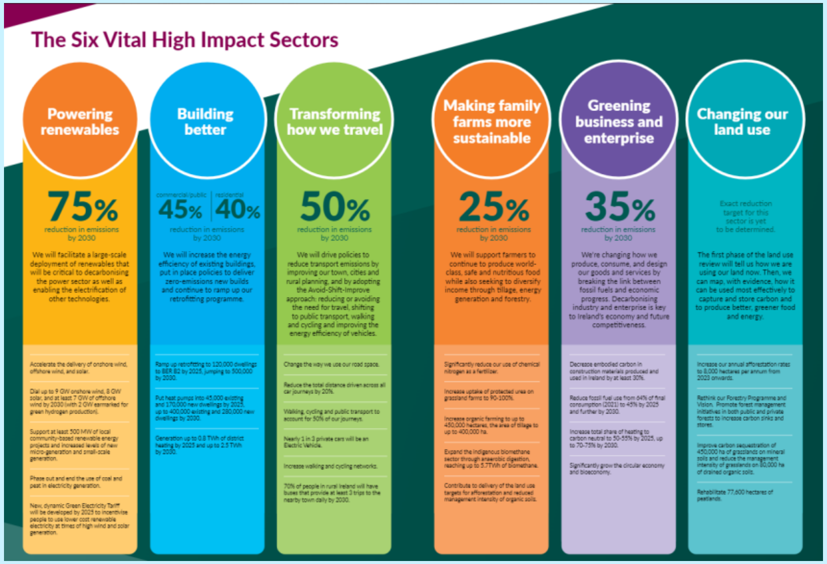
The EU adopted a legislative proposal for the European Climate Law in June 2021 to frame the climate neutrality objective by 2050 across the EU with an intermediate target of **reducing net greenhouse gas emissions by at least 55% by 2030**. The European Commission (EC) is clear in the commitment required by all Member States, and the use of all policy levers and instruments, to fight against the urgent challenge of climate change and to activate leadership efforts to reach climate neutrality by 2050.

Climate Action and Low Carbon Development (Amendment) Act, 2021

Climate policy in Ireland reflects the ambition of the EU and that required to confront the challenges of climate change. The Climate Action and Low Carbon Development (Amendment) Act, 2021 frames Ireland's legally binding climate ambition to delivering a **reduction in greenhouse gas emissions of 51% by 2030**, to achieve climate neutrality by the end of 2050.

Through progressive economy-wide carbon budgets, sectoral ceilings, a suite of strategies devised to promote a **combination of adaptation and mitigation measures**, and robust oversight and reporting arrangements, climate policy is working to scale up efforts across all of society and deliver a step change on ambitious and transformative climate action to 2030 and beyond to 2050.

Climate Action Plan 2023



Regional & Local Policies:

- Regional & Spatial Economic Strategies
- Local Economic & Community Plans
- Westmeath County Development Plan 2021 - 2027

2.3 Identification of the Decarbonisation Zones

Local Authorities have a key role to play in addressing and driving forward climate change mitigation. In addition to meeting their 2030 and 2050 energy and emission targets, they are well placed to assess, exploit and support opportunities within their administrative areas, in cooperation with each other and with national bodies, and through the involvement and support of local communities.

Action 80 of the Government's Climate Action Plan 2019 states that they will support, monitor and assess Local Authority Climate Action.

Action 165 of the Government's Climate Action Plan 2019, requires Local Authorities to identify and develop plans for one Decarbonising Zone.

A **Decarbonisation Zone (DZ)** is a spatial area, identified by each local authority in Ireland, in which a range of climate change mitigation measures are identified, whilst enhancing and embracing adaptation and biodiversity measures to contribute to reaching wider national climate action targets.

DZs are a demonstration and testbed of what is possible for decarbonisation and climate action at a local and community level. Through a feedback loop of experimentation and evaluation, the DZ enables a flexible, incremental and community-driven approach to ensure that its objectives are delivered.

The criteria for selecting a DZ are:

- Urban areas and agglomerations with a population not less than 5000 persons, **or**
- Rural areas with an area of not less than 4 km^2
- Other location/areas that can demonstrate decarbonisation at a replicable scale.

Once a DZ area is identified and the associated overarching vision and objectives are set, each local authority must kickstart the next stages of the DZ, as illustrated on the right.

Identify

1. Identify & define the decarbonisation zone area
2. Identify a clear overarching vision and objectives

Baseline & Scoping

3. Establish the Baseline Emissions Inventory (BEI)
4. Explore policy context and alignment
5. Identify and map stakeholders

This report focusses on Step 3, i.e. the establishment of the BEI

Register of Opportunities

6. Compile a portfolio of actions, projects, technologies and interventions

Action

7. Set out actions to be delivered over the timeline of the plan

Implement

8. Develop a strategy for implementation

2.4 Identification of the Decarbonisation Zones

Westmeath County Council has set an overarching vison for the area:

"Mullingar will become an important testbed for the various strategies plans and ideas, that will contribute to the overall target for the country to become carbon neutral by 2050" *

Mullingar has been designated as the spatial area in which a range of climate mitigation, adaptation and biodiversity measures and actions are identified to address local low carbon energy, greenhouse gas emissions and climate needs to contribute to national climate action targets. Its socioeconomic and physical environmental characteristics have been reviewed and identified as an appropriate fit for the defined DZ criteria. In summary:

Zoning

Mullingar includes 75 small areas under 3 Electoral Divisions* (EDs) (as shown within the red line boundary left): Mullingar North Urban, Mullingar South Urban, and Mullingar Rural. ***Note:** *Small areas of the Castle and Belvidere EDs are also located within the DZ area.*

Population

The total population of the Mullingar area was estimated at 19,250 (2016 Central Statistic Office (CSO) data).

Land Area

Mullingar has a total land area of approximately 15.48 km^2

Scalability

Mullingar will become an important testbed for the various strategies plans and ideas, that will contribute to the overall target for the country to become carbon neutral by 2050.

***Source:** *https://www.westmeathcoco.ie/en/ourservices/yourcouncil/councilnews/decarbonisingzoneforthecountyofwestmeath.html*

2.5 Establishment of the Baseline Emissions Inventory

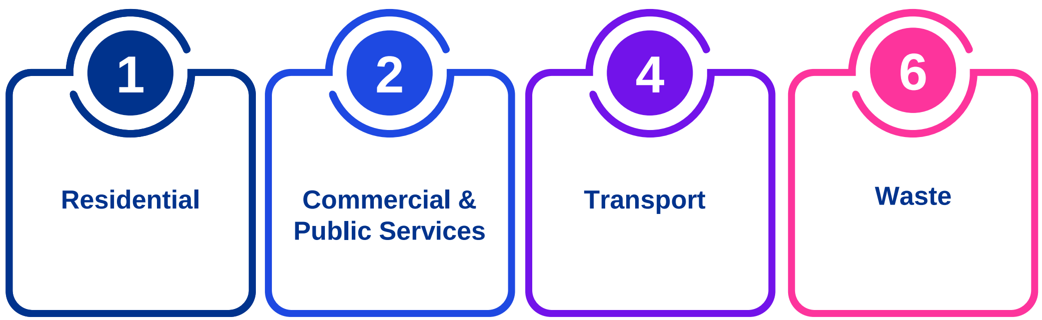
The baseline emissions inventory (BEI) is an overview of an area's or region's total carbon emissions at a point in time. The BEI is a key instrument that enables a local authority to measure the impact of planned actions related to emission reductions across its own operations as well as relevant sectors of society. The BEI represents an evidence-based approach to not only inform appropriate emission reduction actions but also measure progress over time.

The BEI is required to be undertaken for the purpose of informing climate change action planning. Local authorities are encouraged to update their emissions baseline where and/or when more up to date versions of relevant datasets become available (for example, when new census data is released) or upon any review or update of the national climate action plan. The BEI should be treated as a live inventory and regularly updated to assess progress against actions as well as to improve accuracy with the inclusion of new and better datasets as they evolve.

Westmeath County Council's BEI for the DZ area is informed by the guidance document Technical Annex C: Climate Mitigation Assessment and Technical Annex D Decarbonising Zones. These guidance documents support a robust approach to the assessment and reporting of baseline energy and carbon emissions for all local authorities. 3 approaches to the development of a BEI are outlined – Tier 1, Tier 2 and Tier 3 – each of which allow for local authorities at varying levels of experience and maturity to produce a BEI. This BEI assessment for Westmeath County Council DZ area follows a Tier 3 approach, i.e. a 'bottom-up, spatially led' approach to BEI development.

2018 is used as the baseline year for the BEI assessment. This year has been purposefully chosen to align with Ireland's national targets which are set against a 2018 baseline year. This BEI assessment provides a snapshot in time of the carbon emissions across all identified sectors of the economy within the boundaries of a specific local authority. The baseline assessment covers both direct and indirect emission sources within the administrative area, as well as the level of control and influence a local authority has over these emissions.

Emissions associated with the following sectors are considered in this BEI assessment, aligning with Ireland's National Emissions Inventory. Note that 'Agriculture', 'LULUCF' and 'Industry' are excluded from the assessment given the negligible industrial activities in the DZ area.



03

DZ BEI Tier 3 Assessment

3.1 Approach to Assessment

3.1.1 Approach to BEI Assessment

This section of the report sets out the analysis of energy and carbon emissions associated with the main activities, and emissions sources, presented by sector, within the DZ area. Two steps have been undertaken to inform a robust understanding of the energy and carbon emissions within the DZ area, as summarised below:

1

A 'top-down' overview of carbon emissions within the DZ area, informed by data gathered from the Environmental Protection Agency's (EPA) MapEire database, has been undertaken. This assessment allows for a 'helicopter' overview of the magnitude of emissions within the area and the sectoral hotspots. The purpose of this 'top-down' assessment is not to override the 'bottom-up' assessment outcomes, but rather to provide an additional layer of context to inform decision making. The results of this assessment is contained in the **Appendix**.

2

This 'top-down' overview is followed by the **Tier 3** 'Bottom-Up' assessment approach, informed predominantly by spatial data and the use of geographical information systems (GIS) software and processes. This allows for the mapping of data and information within the DZ area, supporting effective communication and engagement with key internal and external stakeholders. The assessment also includes non-spatial data to support the analysis and future action planning.

Although the Tier 3 approach can provide a more robust evidence base on which to inform the action planning, it relies heavily on the quantity, quality, and variety of the data available for analysis. As more datasets and methodologies are made available, BEIs will improve further and better equip local authorities in their decision making and action planning supporting decarbonisation and climate action.

! A full list of data sources, assumptions & limitations are included in the **Appendix**.

3.2 BEI Assessment

3.2.1 Summary

3.2.1.1 Summary Results

The results of the 'bottom-up' Tier 3 assessment are presented on the table and chart below. Total carbon emissions equate to approximately **138,421 tCO_2e**. This translates to **7.19 tCO_2e per capita** based on 2016 census population data. In 2018, Ireland's national carbon emissions equated to approximately 12.6 tCO_2e per capita. While the DZ's carbon emissions per capita is lower than the national equivalent, Ireland is significantly higher than the EU average of 8.2 tCO_2e per capita.*

	Carbon emissions (tCO_2e)
Residential	45,091
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Transport	36,855
Waste	4,043
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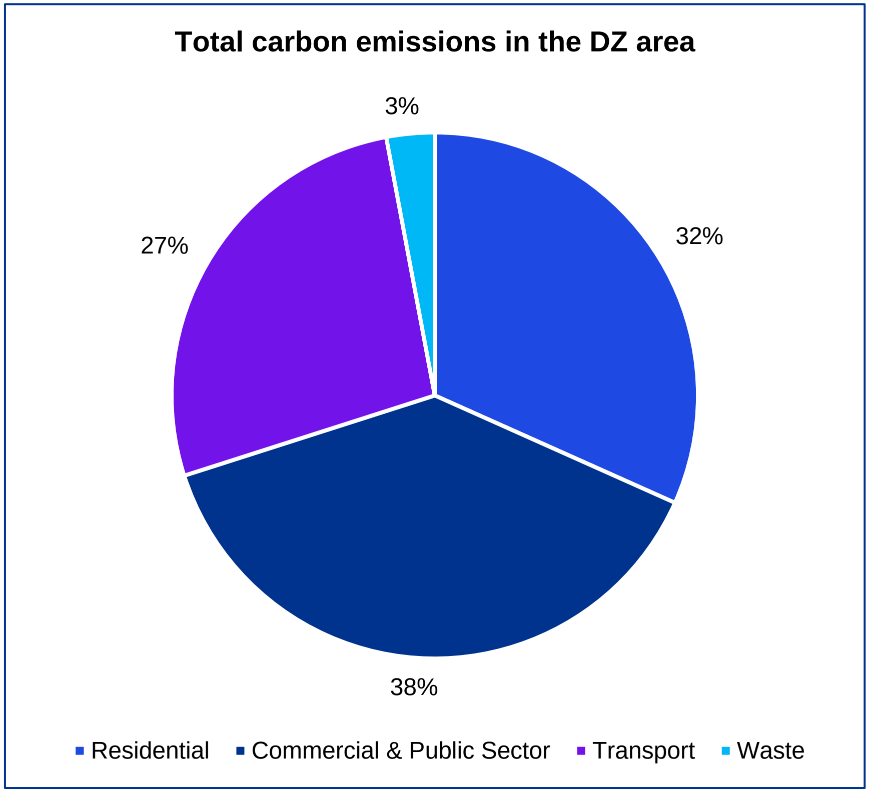
Total carbon emissions per capita (tCO_2e/capita)	**7.19**



* Source: https://www.cso.ie/en/releasesandpublications/ep/p-eii/environmentalindicatorsireland2020/greenhousegasesandclimatechange/#:~:text=In%202018%2C%20Ireland%20had%20the,EU28%20average%20of%208.2%20tonnes.

3.2.2 Socio-Economic

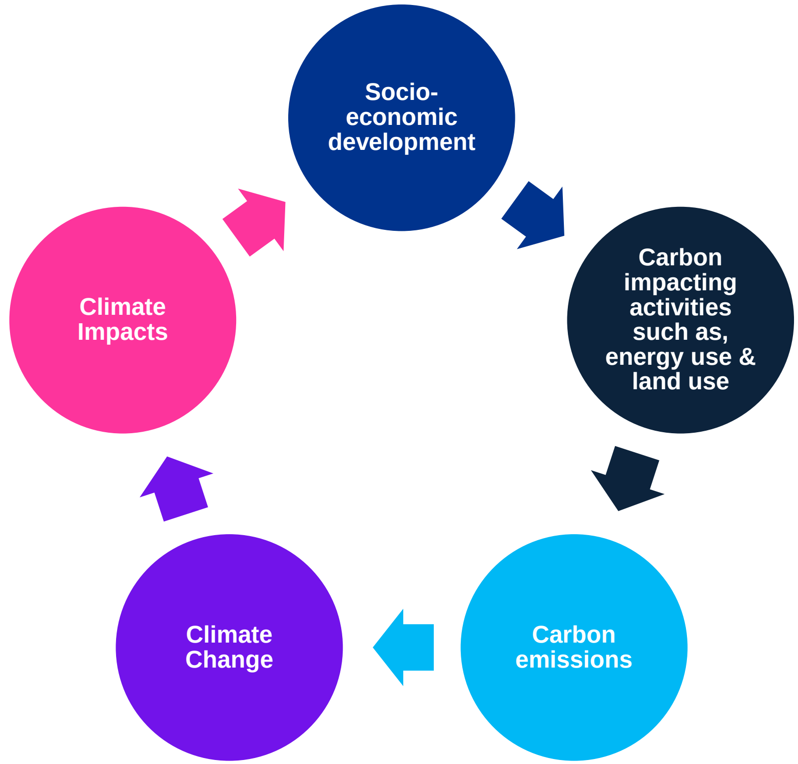
3.2.2.1 Socio-Economic overview

Overview of the Socio-Economic analysis

01 Socio-economic development and decarbonisation are intricately linked, with social and economic activities impacting on carbon emissions, for example, through energy use and land use. Carbon emissions contribute and influence the severity of climate change – climate change has a direct effect on socio-economic development, often contributing to and/or heightening various social issues.

02 Socio-economic factors including income, wealth, and industrialisation can contribute significantly to carbon emissions. Addressing these socio-economic factors as part of a holistic approach to decarbonisation and climate change action planning and decision making will result in effective solutions, supporting the shift to a more sustainable and just society.

03 The following pages focus on socio-economic factors including population and zoning associated with the DZ area. This overview is based on data from the 2016 CSO which is considered to be an appropriate proxy for activities in the baseline year of 2018.



3.2.2.2 Socio-Economic context

Socio-Economic snapshot of the DZ area

The population of the Mullingar DZ area is 19,250. The demographics of the region contain a 49% male 51% female split in gender.

The largest age cohort is the 30-39 bracket, representing 17.6% of the population. The smallest cohort is the 80+ grouping which accounts for 2.8%. The greatest variance to the state demographics is seen in the 0-9 age group with a +2.3% difference.

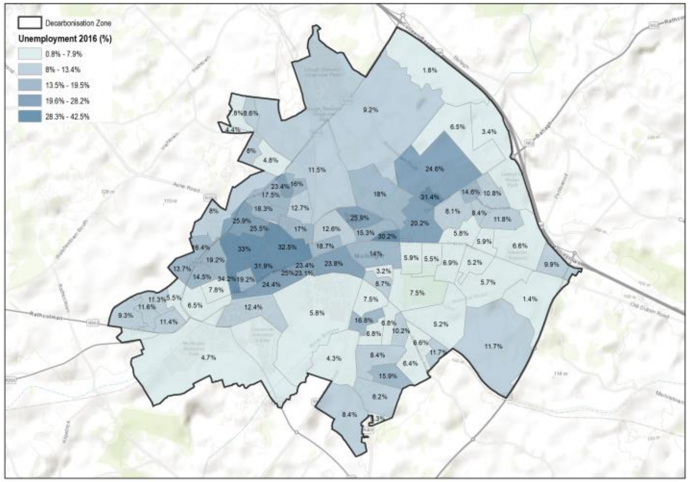
The nationality breakdown of the DZ area found that 18.5% of the population is non-Irish, 5.5% greater than the state average. Polish nationals are the largest non Irish cohort (4.5%).

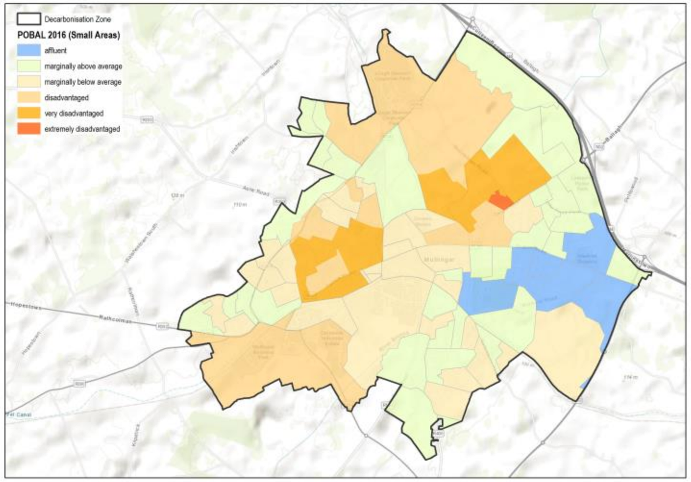
Average household income within the study area is €38,867, 13.6% lower than the state average of €44,477. The national average employment rate is 53.4%. The study area has a median employment rate of 49.9%

The labour force unemployment rate (LFUR) within the study area totalled 21%. This was greater than the state figure of 13%. 2016 Pobal data highlighted a mixture of deprivation, with a majority of the study are marked as 'Marginally below average'. Several small areas are 'Marginally above average', with a singular SA marked as 'Extremely Disadvantaged' and 'Affluent'. The highest levels of unemployment are seen in the west and north of the centre of the DZ area.

The Pobal data, or Deprivation Index, provides a measurement of the affluence/or deprivation of a given area relative to the national mean at a specific point in time. By comparing Deprivation Index scores for a particular area at two different points in time, Pobal can assess whether it has moved up or down in its position relative to the rest of the country.

Knowledge of these areas of disadvantage and deprivation are vital when planning climate change mitigations. Some socioeconomic groups will need assistance and encouragement to adopt climate mitigations, factors influencing this could include affordability, social isolation, and housing types. While higher socioeconomic groups can afford energy efficient white goods and smart technology, these easily available solutions are financially beyond some groups. Changes in public transportation methods and frequencies also disproportionally affect the socially disadvantaged.





3.2.2.3 Socio-Economic context

Population Density

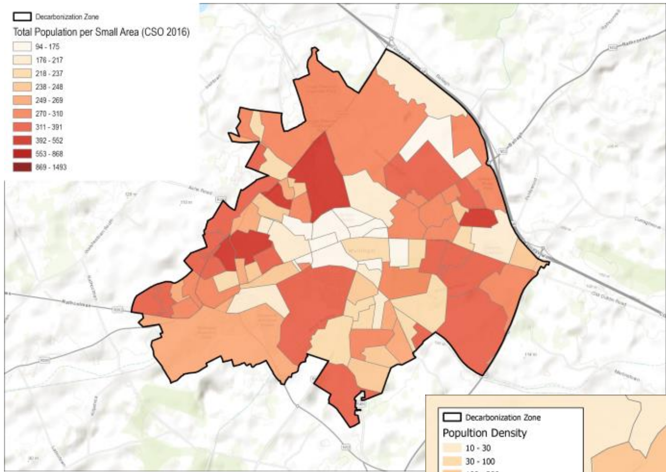
- Using 2016 population figures the study area as a whole has a population density of 1,309. This is greater than both the national and regional population densities of 70 people per km^2 and 15 people per km^2 respectively.

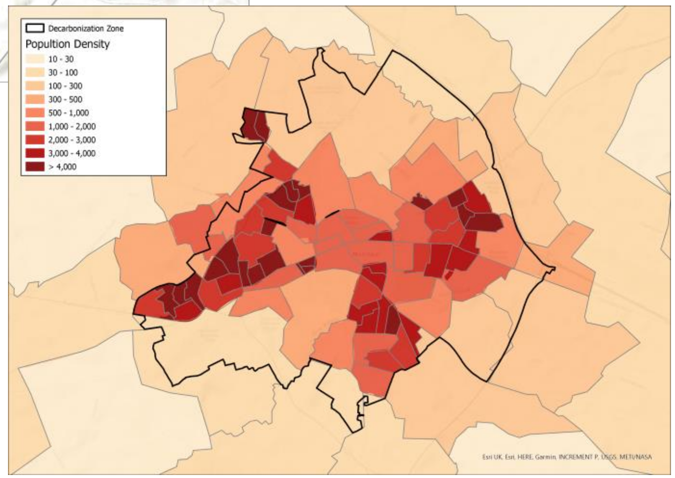
- The highest population within the study areas are found in the western and eastern regions. This is due to these areas being primarily zoned for housing.

- The lowest population density recorded in the DZ area is 98 people per km^2, found along the southern SAs. 24,468 people per km^2 was the highest population density and is found within the town centre due to the smaller sizes of the boundaries. 2016 CSO data indicated that the average household size is 2.65.* This the same as the state average of 2.65. There is a slightly higher proportion of single person households (26%) than the state average (23%).

* The methodology for household size is explained here by the CSO

- Areas with higher population densities are more suited to certain renewable energy infrastructure projects such as district heating.





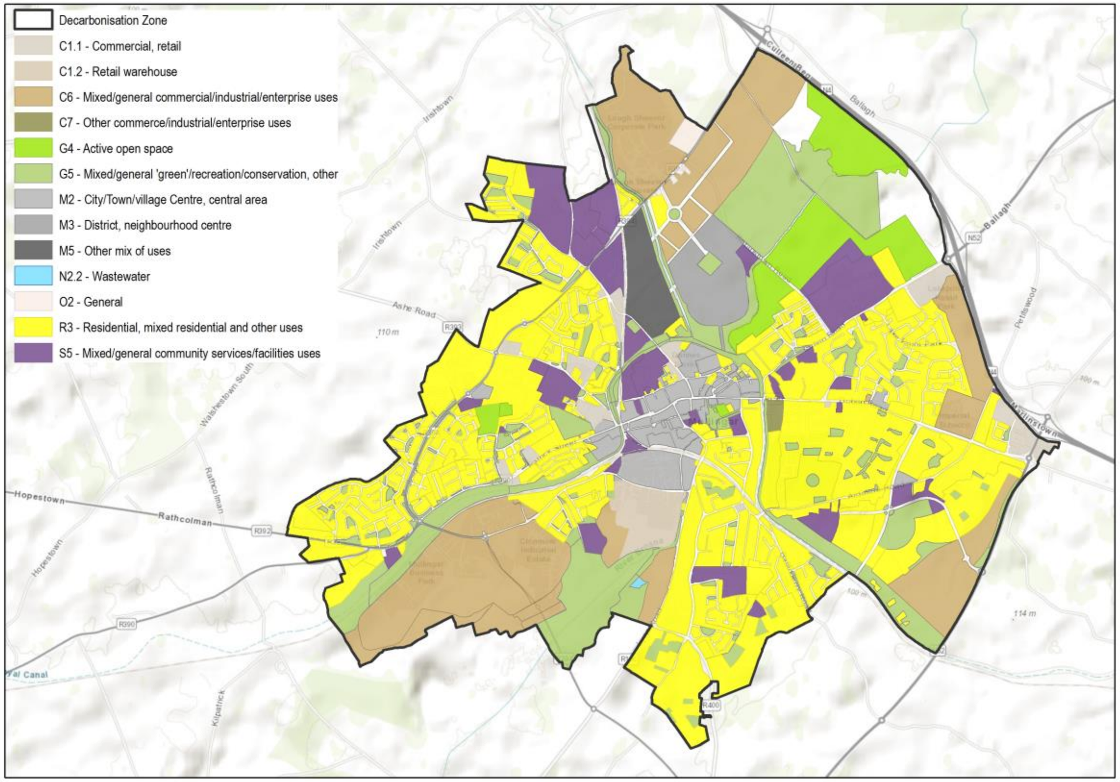
3.2.2.4 Socio-Economic context

Zoning and Development Profile

- The map to the right provides an overview of the development and zoning activities within the DZ area.

- According to the latest CSO figures, there are 7,142 houses in Mullingar. 9.4% of houses are vacant.

- The area also contains 775 social housing units which the local authority will have responsibility for retrofitting. They could be used as a pilot scheme to show the medium to long term benefits of energy efficiency.



3.2.3 Residential sector

3.2.3.1 Residential Sector Overview

Overview of the Residential Sector

Ireland's domestic properties face a significant decarbonisation challenge. Our housing stock is one of the least energy efficient within the EU while our heating systems have a particularly low level of renewables in the energy mix – the SEAI have indicated that fossil fuels are used as the heat source in 73% of dwellings. The ongoing cost of the energy crisis has highlighted Ireland's dependence on imported fossil fuels (these provide approximately 75% of our home heating), leaving Irish households highly vulnerable to global energy prices.

The residential sector accounted for approximately 10% of Ireland's carbon emissions in the baseline year of 2018 with similar levels seen in the latest reported figures. To achieve Ireland's climate goals, the sector is required to reduce its emissions by 40% by 2030 (compared to a 2018 baseline).

CAP 2023 sets out a number of actions and targets for the residential sector to meet its overarching goal, including:

- All new dwellings designed and constructed to Nearly Zero Energy Building (NZEB) standard by 2025 and Zero Emission Building (ZEB) standard by 2030;
- Equivalent of 120,000 dwellings retrofitted to BER B2 or cost optimal equivalent by 2025, and 500,000 dwellings by 2030;
- Up to 0.8 TWh of district heating installed capacity by 2025, and up to 2.5 TWh by 2030;
- 170,000 new dwellings using heat pumps by 2025, and 280,000 by 2030;
- 45,000 existing dwellings using heat pumps by 2025, and 400,000 by 2030;
- Up to 0.4 TWh of heating provided by renewable gas by 2025, and up to 0.7 TWh by 2030.

To achieve theses highly ambitious targets, the DZ area must significantly reduce its use of fossil fuels, including, coal, peat and oil, and increase dependence on renewables and electricity, to heat existing residential buildings while also optimising and enabling energy efficiency. Retrofit activity must be supported to underpin this reduction, with resulting benefits for homeowners in terms of efficiency, comfort, and health and wellbeing.

The following sections present an overview of the residential sector related activities, energy and emissions within the DZ area. Further detail on data sources, assumptions and limitations is included in the **Appendix**.

3.2.3.2 Residential Sector Analysis

Residential Sector: Age of Housing Stock

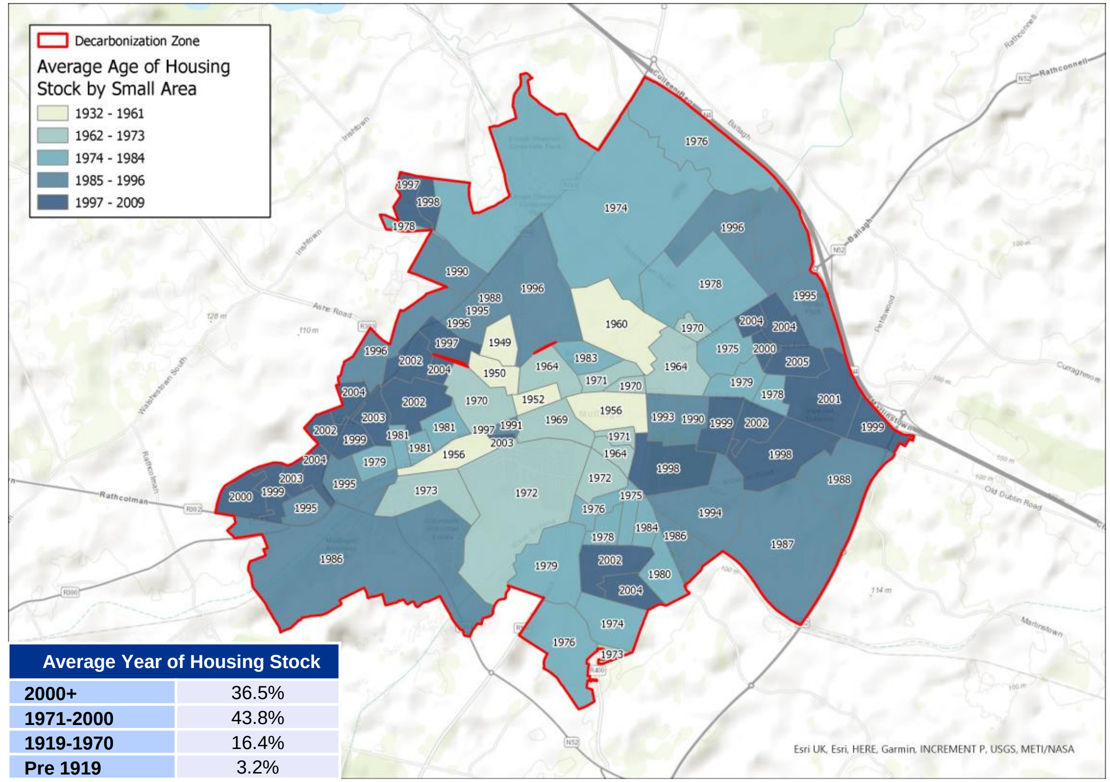
- The age of housing stock in an area has a strong correlation with energy efficiency, consumption and demand, including this DZ area. Energy use is a proxy for carbon emissions and therefore, in general, older housing stock may mean higher carbon emissions.

- Age of construction of residential housing stock ranges from pre-1919 out to the 2000s. The average year of construction is 1986, with approximately ~80% of the housing stock being built since 1970. Approximately ~20% of the residential units have been built pre-1970s. This is summarised on the table below.

- Focussing on the more populated area of Mullingar town centre, there is a similar trend – the average housing stock for the small areas is dated from 1949 to 1991, indicating an older cluster of housing.

- As the DZ area includes relatively older housing including in the most populated region of Mullingar town centre, it is likely that energy efficiency is low and energy demand and consumption is high, leading to high carbon emissions.

- As the DZ area includes a mix of both new and relatively older housing, it is likely that energy efficiency is low in some SAs, causing energy demand and consumption to be high, leading to high carbon emissions.



Average Year of Housing Stock	
2000+	36.5%
1971-2000	43.8%
1919-1970	16.4%
Pre 1919	3.2%

Note: *The figures in the map included above have been derived from CSO SA data. This data has been broken out into various bands e.g., "Pre 1919" and 1946-1960". The average of these bands and their frequency within each SA are used to find the average year of the residential housing stock in the SA.*

3.2.3.3 Residential Sector Analysis

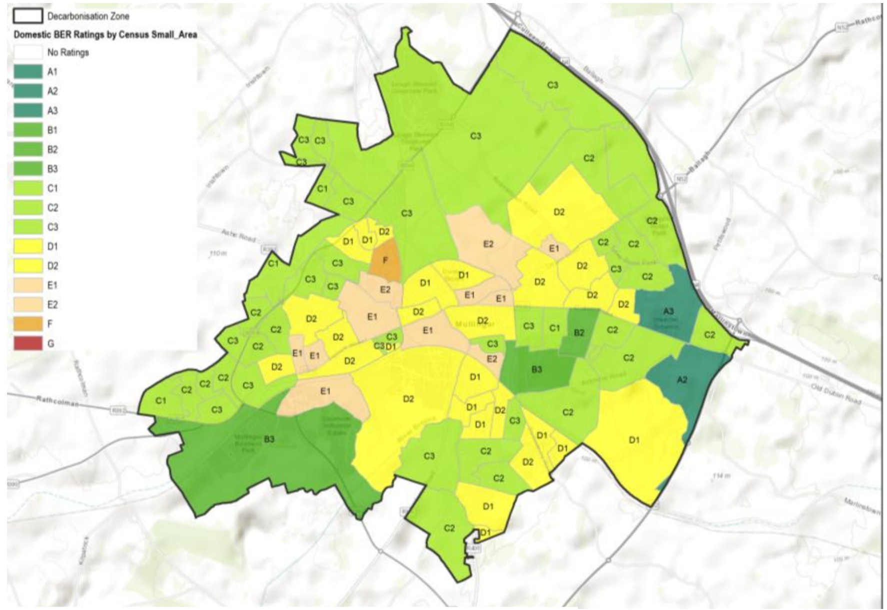
Residential Sector: Energy Efficiency & BER rating

- A Building Energy Rating (BER) Certificate supports the understanding of the energy efficiency of a home. It is a helpful indicator for the likely energy consumption of a home and its associated carbon emissions. It uses a scale of A to G, with A-rated homes being the most energy-efficient and comfortable and G-rated homes the least energy efficient.

- BER ratings in the Mullingar DZ area range from F rated buildings to A2. In the town centre, there is a trend of lower BER ratings (D, E, F), with more energy efficient residential buildings (i.e., C/B/A ratings) located in the outskirts of the town centre.

- These BER ratings largely align with the Age of Housing included on the previous slide, whereby the less efficient, older housing is located in Mullingar town centre.

- Energy efficiency opportunities should be explored, including the use of heat pumps and other renewable energy sources to support the decarbonisation of the DZ area as well as to contribute to wider national energy and climate targets.



Average BER rating by residential building type

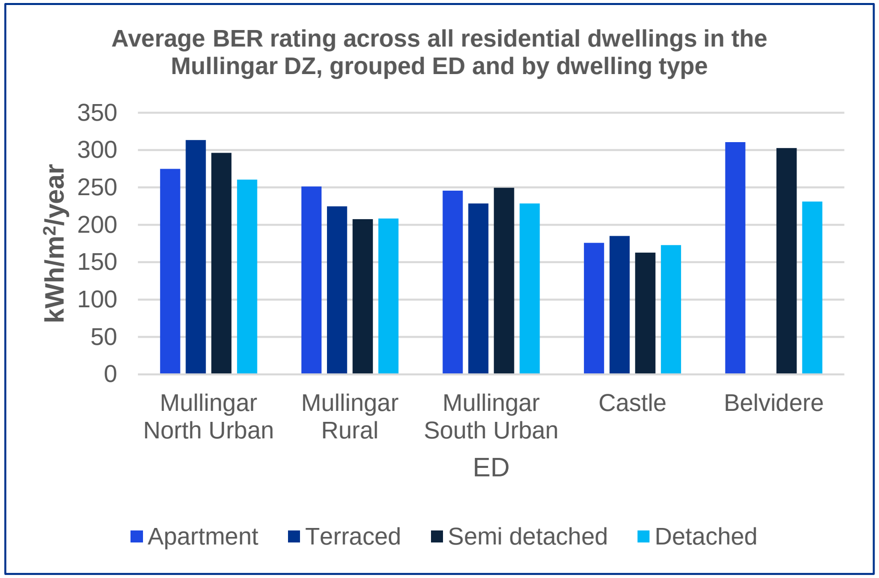
Unit: kWh/m2/year	Residential building type			
ED	**Apartment**	**Terraced**	**Semi detached**	**Detached**
Mullingar North Urban	275	313	296	261
Mullingar Rural	251	225	208	208
Mullingar South Urban	246	228	249	229
Castle	176	185	163	173
Belvidere	311	-	303	231

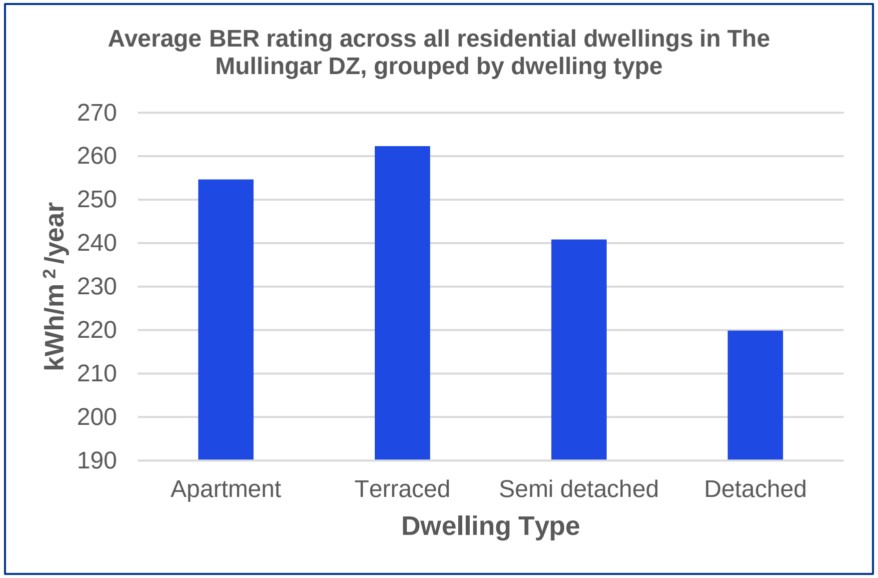
3.2.3.4 Residential Sector Analysis

Residential Sector: Energy Efficiency & BER rating

The charts below support the data analysis on the previous page. Average residential sector BER ratings by ED and residential dwelling type is shown on the left, with average BER ratings by residential dwelling type shown on the right.

Further information on data sources and methodology is included in the **Appendix.**





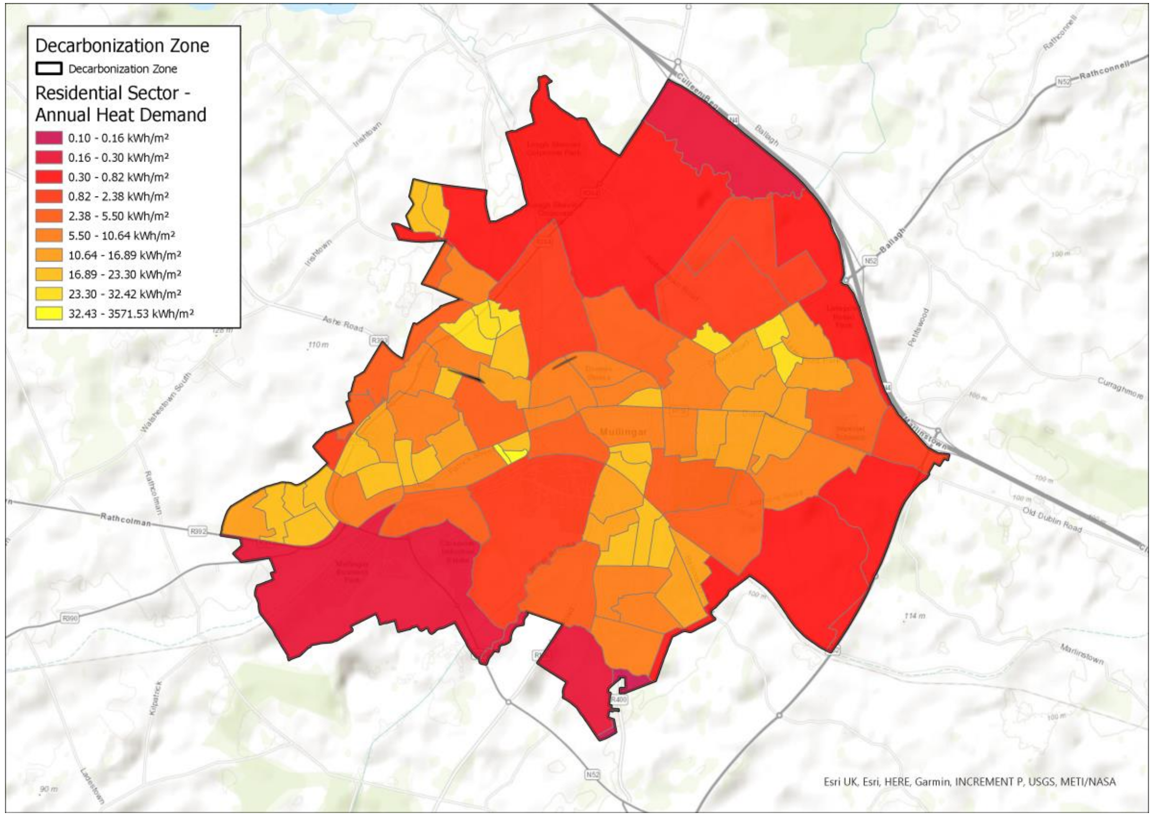
3.2.3.5 Residential Sector Analysis

Residential Sector: Energy Consumption & Heat Demand

- Heat demand maps allow users to explore Ireland's heating and cooling demands. Heat mapping describes the spatial disaggregation of national heat demand into smaller geographic areas. This disaggregation is based on the characteristics of the buildings within each area and include:
  - Building type (a residential dwelling, a commercial or public sector building or an industrial site),
  - The type of fuel used to generate the heat,
  - Other metrics such as the area of buildings, and current and planned energy efficiency measures

- Heat demand in the Mullingar DZ follows a similar pattern across the EDs, with higher heat demand observed in and around the more populated and active region of Mullingar town centre – this area should be considered and prioritised with targeted actions to reduce this demand.

- Heat demand is further explored in the Energy & Electricity Sector section.



3.2.3.6 Residential Sector Analysis

Residential Sector: Energy & Carbon Emissions

To estimate residential sector energy consumption and associated carbon emissions within the DZ area, a number of non-spatial data points have been used. An overview of the approach used is outlined below with results of the assessment on the following pages.

Further information on data sources, assumptions and limitations is included in the **Appendix**.

Data sources

01

CSO

Total housing stock obtained by the CSO grouped by construction period and dwelling type (House/ Apartment). A weighted average has been applied to account for the number of 'not stated' dwellings.

02

SEAI BER Research Tool

Average energy consumption for each dwelling type and period built related to the DZ obtained from the BER Research Tool. Note that residential BER ratings are only available for a limited number of residential dwellings and therefore, are not entirely representative of the ED and DZ area.

03

CSO

Total energy consumed broken down into fuel sources and electricity using CSO data representative of the central heating in each individual ED.

04

SEAI Conversion Factors

Total energy consumed converted to carbon emissions using relevant SEAI Conversion Factors

Outputs

- **Energy consumed broken down by fuel and electricity, dwelling type, construction period and ED**
- **Carbon emissions broken down by fuel and electricity, dwelling type construction period and ED**

3.2.3.7 Residential Sector Analysis

Residential Sector: Energy & Carbon Emissions

Total residential sector energy consumption and associated carbon emissions for ‘Occupied’ homes within the DZ area is presented by energy split and residential dwelling type below. Note that as a result of the data available, residential dwelling types have been grouped into ‘houses’ and ‘apartments’.

This energy split of each ED has been applied to total energy consumption across all households within each ED area. A full breakdown of each ED’s energy split is detailed **Appendix**.

	Energy consumption (MWh)		
Energy Source	**Houses**	**Apartments**	**Total**
Coal	8,686	798	9,484
Peat	8,892	810	9,701
Oil	81,886	5,742	87,629
LPG	742	77	819
Natural Gas	33,595	1,787	35,382
Renewables	1,035	82	1,117
Electricity	16,251	2,276	18,527
Wood	3,129	243	3,372
Total	**154,215**	**11,814**	**166,030**

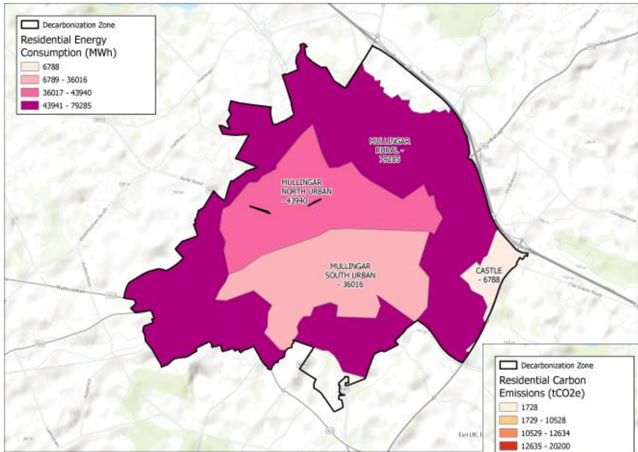
	Carbon emissions (tCO_2e)		
Energy Source	**Houses**	**Apartments**	**Total**
Coal	2,959	272	3,230
Peat	3,164	288	3,453
Oil	22,404	1,571	23,975
LPG	170	18	188
Natural Gas	6,877	366	7,243
Renewables	-	-	-
Electricity	6,097	854	6,951
Wood	47	4	51
Total	**41,719**	**3,372**	**45,091**

3.2.3.8 Residential Sector Analysis

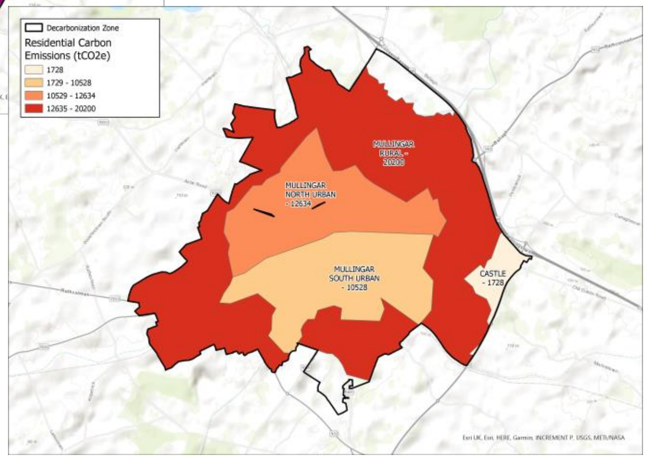
Residential Sector: Energy & Carbon Emissions

Total residential sector's energy consumption and associated carbon emissions within the DZ area is presented by ED below. A visual representation of these emissions is shown on the right.

ED	Energy Consumption (MWh)
Mullingar North Urban	43,940
Mullingar South Urban	36,016
Mullingar Rural	79,285
Castle	6,788
Total	**166,030**



ED	Carbon emissions (tCO_2e)
Mullingar North Urban	12,634
Mullingar South Urban	10,528
Mullingar Rural	20,200
Castle	1,728
Total	**45,091**

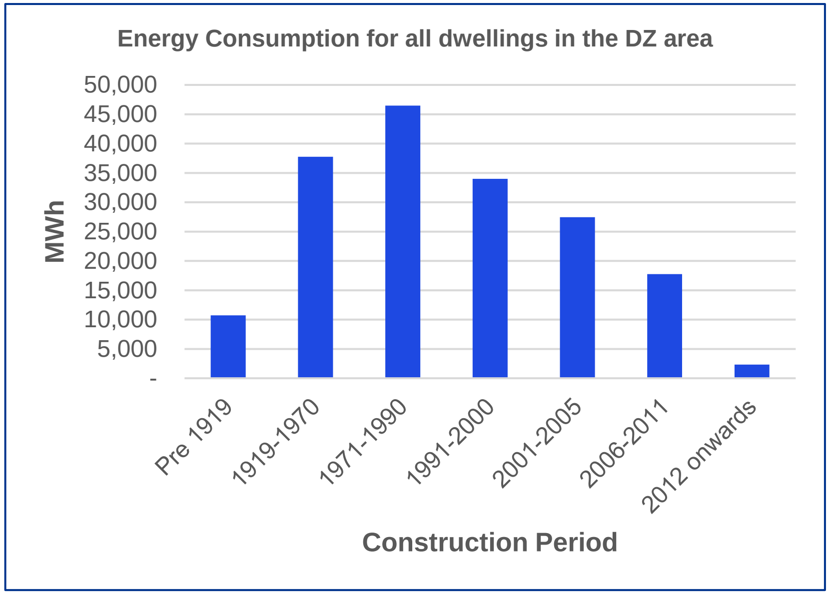


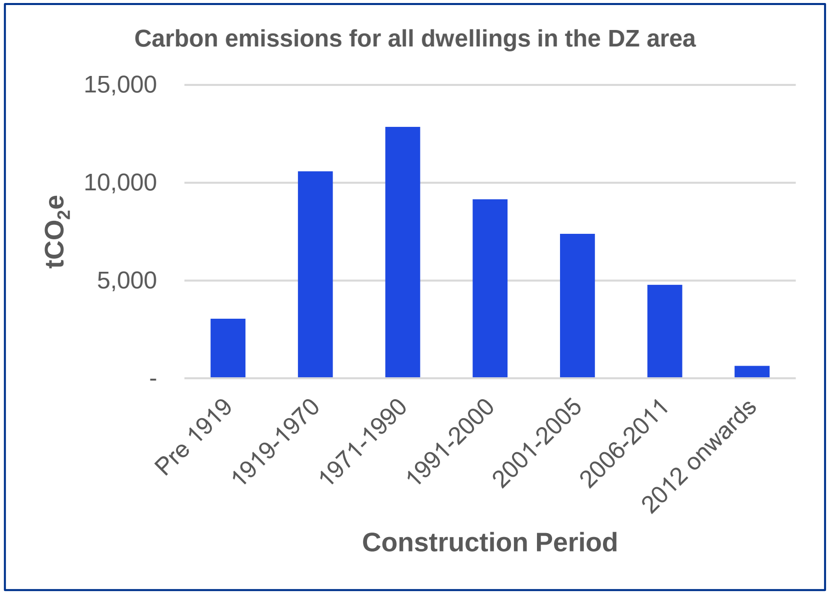
3.2.3.9 Residential Sector Analysis

Residential Sector: Energy & Carbon Emissions

Total residential sector energy consumption and associated carbon emissions for all dwelling types within the DZ area, broken down by construction period, are shown on the charts below. Dwellings built during the period ‘1971-1990’ consume the highest proportion of energy consumption and carbon emissions amongst the built periods, which can be expected as the largest proportion of dwellings were built during this period (~23.6%). The built period ‘Pre 1919’ accounts for approx. 6% of the sector’s energy consumption and carbon emissions. However, with just 3.4% of dwellings built during this period, its higher than expected energy consumption and carbon emissions may be attributed to the building fabric of these dwellings. An older building fabric may lead to lower energy efficiency, likely resulting in their high energy consumption and carbon emissions.

Further information on data sources and methodology is included in the **Appendix.**





3.2.3.10 Residential Sector Analysis

Residential Sector: Social Housing: Energy Efficiency & BER rating

Social housing (within the residential sector) energy consumption and associated carbon emissions within the Mullingar DZ area has also been included in our analysis using a number of non-spatial data points to inform the assessment. To understand energy consumption and carbon emissions associated with social housing units, Step 2-4 outlined in Section 3.2.3.5 has been applied. Further information on data sources and methodology is included in the **Appendix**.

	Energy consumption (MWh)
Energy source	**Social Housing units**
Coal	1,493
Peat	1,498
Oil	9,163
LPG	87
Natural Gas	3,300
Renewables	152
Electricity	2,517
Wood	377
Total	**18,587**

	Carbon emissions (tCO_2e)
Energy source	**Social Housing units**
Coal	509
Peat	533
Oil	2,507
LPG	20
Natural Gas	675
Renewables	-
Electricity	945
Wood	6
Total	**5,194**

The table below sets out the average BER rating for social housing units by dwelling type and ED. Note that BER ratings are only available for a limited number of social housing units and therefore, are not entirely representative of social housing in the ED and DZ area.

Average BER rating by residential building type

Unit: kWh/m2/year	Residential building type			
ED	**Apartment**	**Terraced**	**Semi-detached**	**Detached**
Castle	-	-	-	-
Mullingar North Urban	330	353	372	374
Mullingar Rural	218	183	236	200
Mullingar South Urban	265	281	249	174

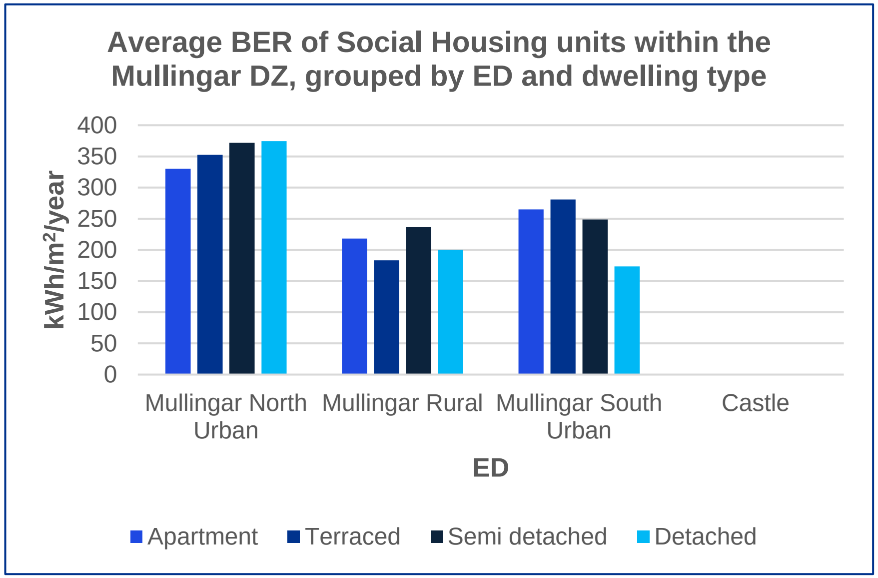
The social housing units in the DZ area account for approximately 9.8% of the total residential stock. When compared to the entire DZ area, the social housing units account for approximately 10.8% of total residential energy consumption and 11.1% of total residential carbon emissions. These figures show that the proportion the of total residential energy consumption and carbon emissions that social housing units are responsible for align to the number of social housing units.

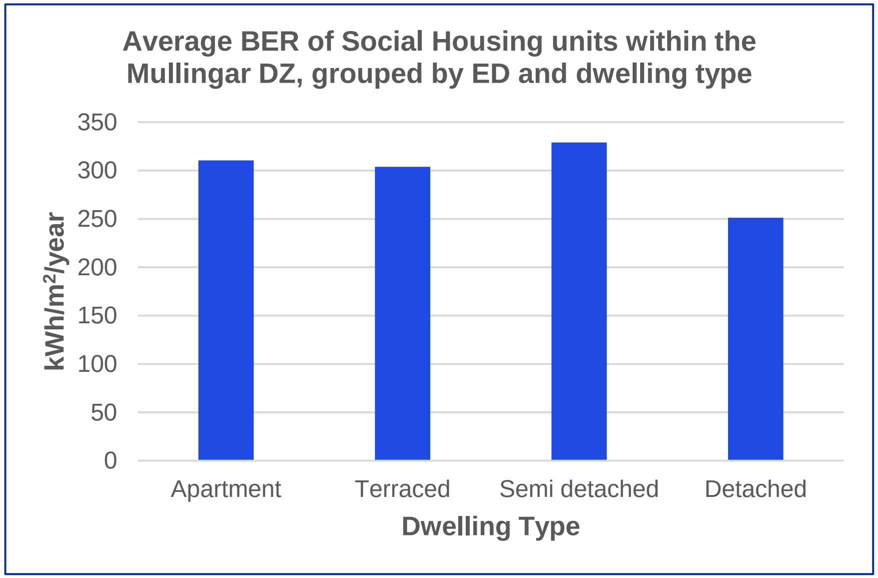
3.2.3.11 Residential Sector Analysis

Residential Sector: Social Housing: Energy Efficiency & BER rating

Average residential sector BER ratings for **social housing** by residential dwelling type and ED within the DZ area are shown on the charts below. Note that energy consumption data was not available for social housing in the DZ area. The average BER of the social housing units located within the DZ is 316 kWh/m ^{2} /year.

Further information on data sources and methodology is included in the **Appendix**.





3.2.4 Commercial & Public sector

3.2.4.1 Commercial & Public Sector Overview

Overview of the commercial & public sector

- The built environment comprises the residential, commercial and public sectors, of which the commercial and public sector account for approximately 2% of Ireland's carbon emissions in the baseline year of 2018. The emissions from commercial and public sectors are typically from fuel combustion for space and hot water heating in commercial and public/institutional buildings in Ireland. Emissions from commercial services and public services decreased by 3.0% and 3.8% respectively in 2021 compared to 2020 emissions due to a decrease in natural gas use.

- The sector is required to reduce its emissions by 45% by 2030, compared to the 2018 baseline. Actions and targets to support the achievement of this target are set out in the CAP 2023 and include:
    - decarbonising heating in commercial and public buildings;
    - determining optimum management of property portfolios for decarbonisation;
    - installing rooftop solar PV (e.g. in schools);
    - retrofitting buildings owned by public bodies;
    - promoting and supporting building automation and control optimisation and smart building technologies to increase energy efficiency and monitoring;
    - upgrading existing building energy management systems to high-efficiency and zero-carbon equivalents.

- To achieve this ambitious target, the use of all fossil fuels (coal, natural gas, oil, and peat) to heat our buildings must be reduced and the support for a major expansion in retrofit activity must be realised. The challenge facing the commercial and public sector is that its existing buildings will require the most effort to decarbonise. Technologies such as heat pumps in the residential sector are also suitable for commercial buildings and the scaling-up in deployment of solutions such as district heating and renewable gases will also benefit commercial and public buildings – these will be important levers for the DZ area to consider. This chapter explores the various factors impacting the decarbonisation of commercial and public sector buildings, whilst also considering the constraints associated with protected buildings.

3.2.4.2 Commercial & Public Sector Analysis

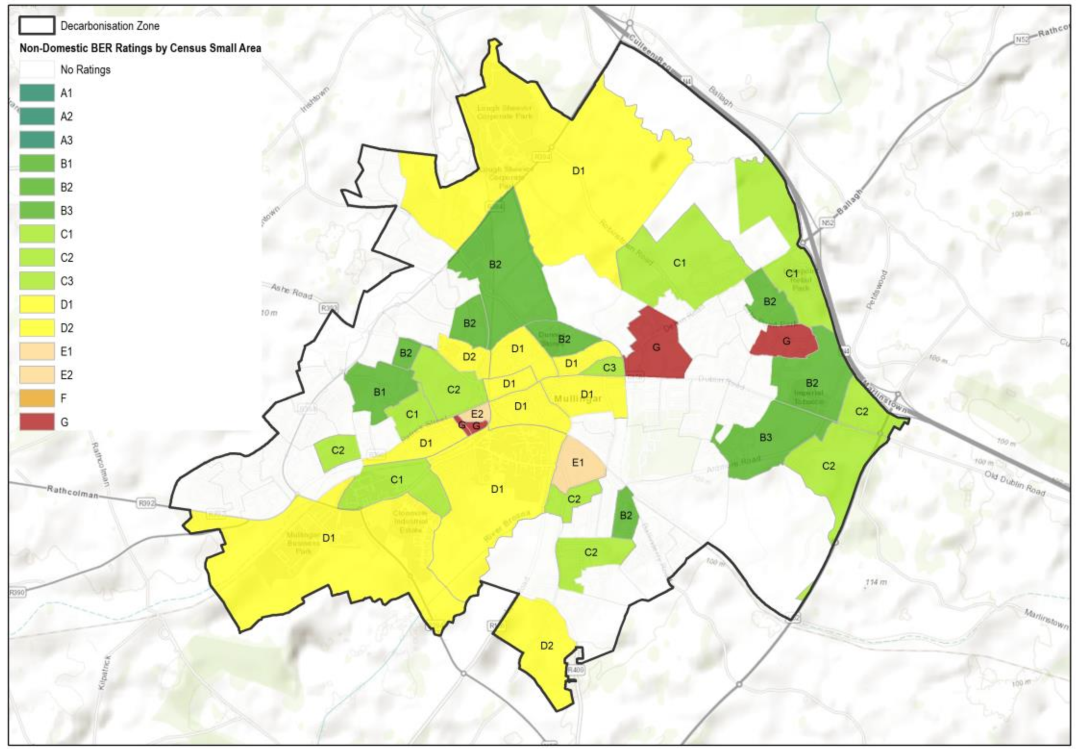
Commercial & Public Sector: Energy Efficiency & BER Rating

- A Building Energy Rating (BER) Certificate supports the understanding of the energy efficiency of buildings. It is a helpful indicator for the likely energy consumption and its associated carbon emissions in commercial and public settings. Similar to residential sector, it uses a scale of A to G, with A-rated homes being the most energy-efficient and comfortable and G-rated homes the least energy efficient.

- Average BER ratings in the Mullingar DZ area range from B1 rated buildings to G. The map on the right presents the range of BER ratings across the DZ area. Note that these BER ratings are average ratings.

- Note that BER ratings are only available for a limited number of commercial & public sector buildings.

- Energy efficiency opportunities should be explored, including the use of heat pumps and other renewable energy sources to support the decarbonisation of the DZ area as well as to contribute to wider national energy and climate targets.



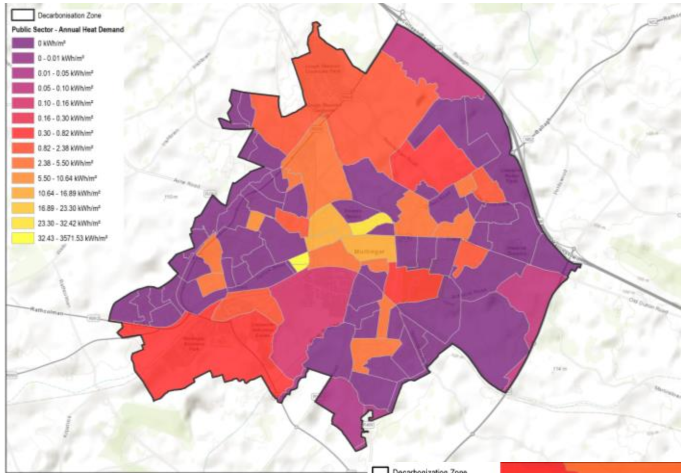
3.2.4.3 Commercial & Public Sector Analysis

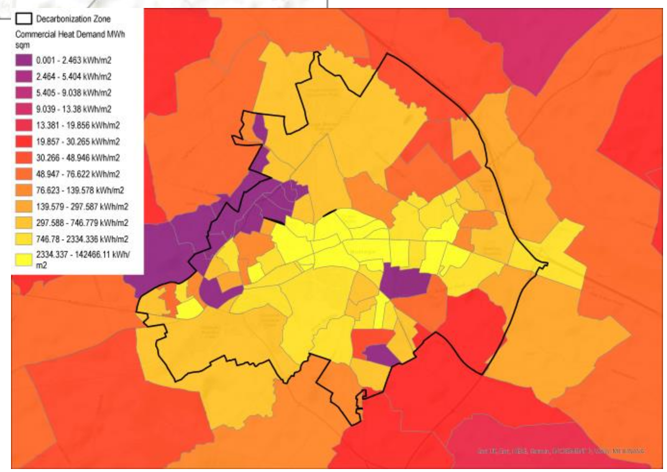
Commercial & Public Sector: Energy Consumption & Heat Demand

- Heat demand maps allow users to explore Ireland's heating and cooling demands. Heat mapping describes the spatial disaggregation of national heat demand into smaller geographic areas. This disaggregation is based on the characteristics of the buildings within each area and include:
  - Building type (a residential dwelling, a commercial or public sector building or an industrial site),
  - The type of fuel used to generate the heat,
  - Other metrics such as the area of buildings, and current and planned energy efficiency measures

- Heat demand in the Mullingar DZ follows a similar pattern across the SAs, with higher heat demand observed in and around the more populated and active region of Mullingar town centre – this area should be considered and prioritised with targeted actions to reduce this demand.

- Heat demand is further explored in the Energy & Electricity Sector section.





3.2.4.4 Commercial & Public Sector Analysis

Commercial & Public Sector: Energy & Carbon Emissions

To estimate commercial and public sector energy consumption and associated carbon emissions within the Mullingar DZ, a number of non-spatial data points have been used. An overview of the approach used is outlined below. Further information on data sources, assumptions and limitations is included in the **Appendix**.

Data sources

01

Ordnance Survey Ireland (OSI)

Total commercial and public sector buildings broken down by building use and total floor area (m^2)

02

CIBSE Energy Benchmarks

Fuel and electricity consumption benchmarks (kWh/m^2) to estimate energy use for each of the building types based on their floor area

03

SEAI National Breakdown of Fuel/Electricity

Total energy consumed broken down into fuel sources and electricity using the national energy breakdown for the commercial and public sector. Note that data directly representative of the DZ area were not available.

04

SEAI Conversion Factors

Total energy consumed converted to carbon emissions using SEAI Conversion Factors

Outputs

- **Energy consumed broken down by fuel and electricity, building type and ED**
- **Carbon emissions broken down by fuel and electricity , building type and ED**

3.2.4.5 Commercial & Public Sector Analysis

Commercial & Public Sector: Buildings Number & Locations

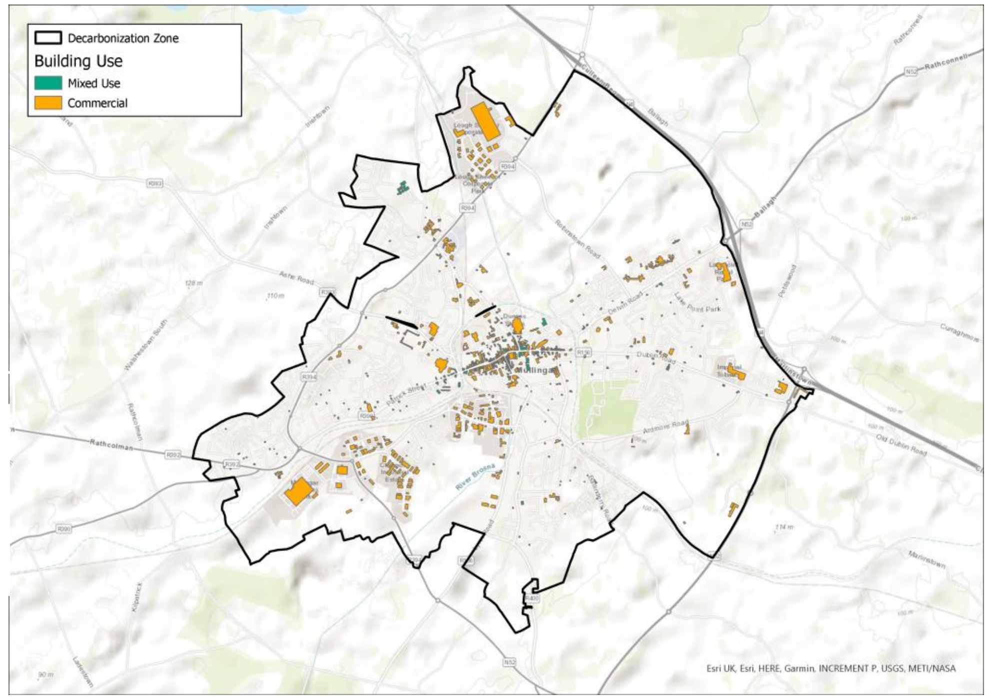
Number of commercial and public sector building types are shown on the table and map below. A breakdown of numbers of buildings, by building type and by ED are presented on the table below.

	Building Type (number)		
ED	**Mixed Use***	**Commercial****	**Total**
CASTLE	0	3	3
MULLINGAR NORTH URBAN	8	82	90
MULLINGAR RURAL	3	98	101
MULLINGAR SOUTH URBAN	5	110	115
Total	**16**	**293**	**309**

Note: There is no commercial information available for the Belvidere ED, as such it is not included in the commercial and public sector analysis of this report.

* Mixed Use category includes building types such as: state government buildings, shopping centres and hotels

** Commercial category includes building types such as: churches, clubhouses, colleges and garda stations



3.2.4.6 Commercial & Public Sector Analysis

Commercial & Public Sector: Energy & Carbon Emissions

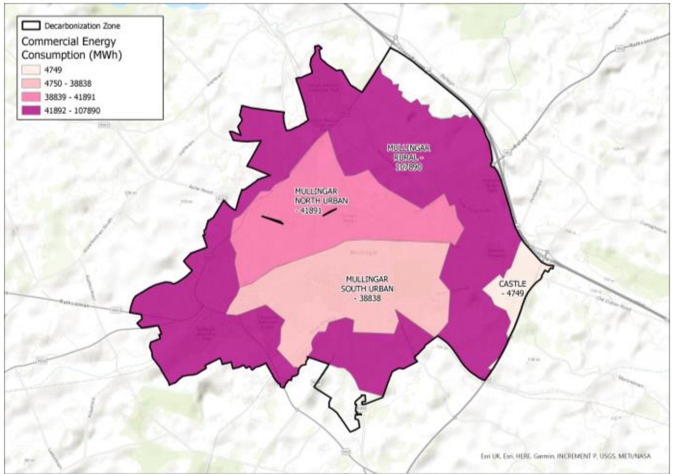
Total energy consumption and associated carbon emissions for commercial buildings within the Mullingar DZ area are shown on the tables below. The associated maps display energy consumption and carbon emissions by ED.

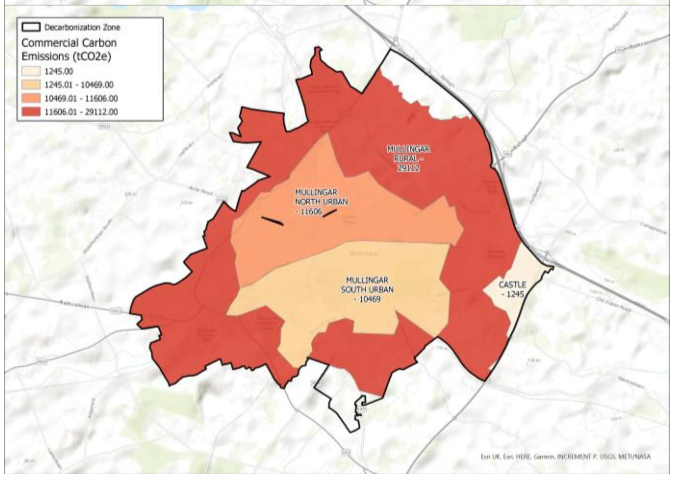
Energy consumption, broken down by fuel and electricity use, and presented by building type, and associated carbon emissions.

Building type	Fuel use (MWh)	Electricity use (MWh)	Fuel use related carbon emissions (tCO_2e)	Electricity use related carbon emissions (tCO_2e)
Mixed Use	4,113	1,902	900	714
Commercial	124,532	62,820	27,248	23,570
Total	128,645	64,722	28,148	24,284
Total	**193,367**		**52,432**	

Energy consumption and associated carbon emissions, by energy source

Energy source	Energy consumption by fuel & electricity (MWh)	Carbon emissions (tCO_2e)
Coal	110	37
Oil	50,844	13,911
Natural Gas	69,367	14,200
Renewables	8,324	-
Electricity	64,722	24,284
Total	**193,367**	**52,432**





3.2.4.7 Commercial & Public Sector Analysis

Commercial & Public Sector: Energy & Carbon Emissions

Total energy consumption and associated carbon emissions for commercial buildings, broken down by energy source, for each ED within the Mullingar DZ area are shown on the tables below.

Energy consumption, broken down by fuel and electricity use, presented by ED

ED	Energy consumption by energy source (MWh)					
	Coal	Oil	Natural Gas	Renewables	Electricity	Total
Castle	3	1,358	1,852	222	1,314	**4,749**
Mullingar North Urban	22	10,390	14,175	1,701	15,603	**41,891**
Mullingar Rural	62	28,727	39,193	4,703	35,204	**107,890**
Mullingar South Urban	22	10,369	14,147	1,698	12,601	**38,838**
Total	**110**	**50,844**	**69,367**	**8,324**	**64,722**	**193,367**

Carbon emissions, broken down by fuel and electricity use, presented by ED

ED	Carbon emissions by energy source (tCO_2e)					
	Coal	Oil	Natural Gas	Renewables	Electricity	Total
Castle	1	371	379	0	493	**1,245**
Mullingar North Urban	8	2,843	2,902	0	5,854	**11,606**
Mullingar Rural	21	7,860	8,023	0	13,208	**29,112**
Mullingar South Urban	8	2,837	2,896	0	4,728	**10,469**
Total	**37**	**13,911**	**14,200**	**0**	**24,284**	**52,432**

3.2.5 Transport Sector

3.2.5.1 Transport Sector Overview

Overview of the transport sector

- Despite the growing focus on achieving Ireland's climate ambitions, Ireland's road transport emissions are increasing. In 2018, the transport sector accounted for approximately 17% of Ireland's total carbon emissions. Although the impact of COVID-19 supported the decrease in transport related emissions, 2021 saw a 6.1% increase in emissions over 2020 levels, largely driven by the cessation of public health restrictions that had artificially reduced transport demand.

- Ireland's transport sector must reduce its emissions by 50% by 2030. The actions and targets outlined in CAP 23 are pivotal in encouraging a shift to 'active travel' and overcoming the challenges deeply embedded through our settlement patterns, policies, and mindsets which favour private car usage over more sustainable transport modes. These targets will require a transformational shift in how we travel, as well as investment and innovation efforts into electric vehicles (EVs), increased charging facilities, and alternative fuels. Achieving a shift to transport modes with zero- or low-carbon emissions, such as active travel (walking and cycling) and public transport, will require unprecedented levels of public buy-in and engagement.

- The following pages present an overview of the transport sector related activities and associated energy and carbon emissions within the DZ area.

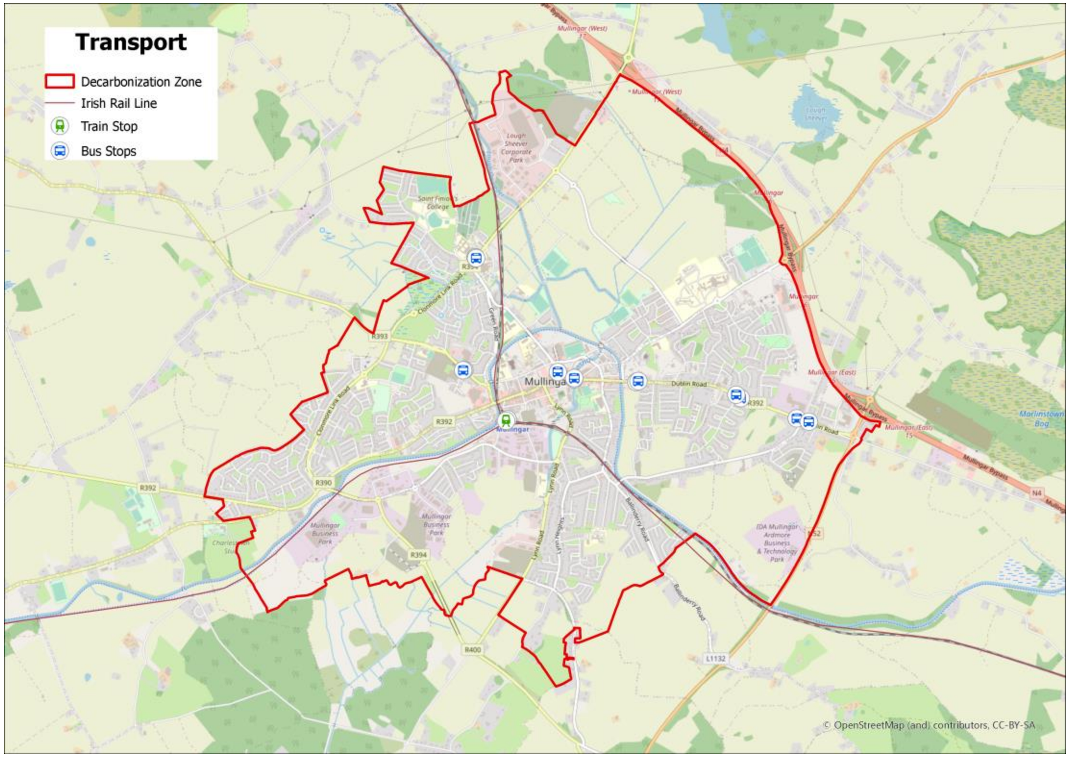
3.2.5.2 Transport Sector Analysis

Transport Sector: Public Transport

- The map shown here provides a visual of the locations of bus stops and the rail network within the DZ area.

- Commuting patterns in the DZ area show a ~65% reliance on private car with approximately one quarter of commuting journeys using public transport, cycling or walking. This is discussed further later in this section.

- Improving the attractiveness sustainable transport modes such as bus, rail, cycling and walking to shift away from car use is key to the successful decarbonisation of the DZ area.
- Combining this with an increased proportion of Electric Vehicles (EV) in the vehicle fleet as well as electrifying freight and public transport will decrease reliance on fossil fuels and, in turn, reduce carbon emissions.



3.2.5.3 Transport Sector Analysis

Transport Sector: Energy & Carbon Emissions

To estimate transport sector energy consumption and associated carbon emissions within the DZ area, a number of non-spatial data points have been used. An overview of the approach used is outlined below. Note that this approach reflects vehicles owned and licenced within the area and does not reflect all transport movements within the DZ area. Further information on data sources, assumptions and limitations is included in the **Appendix**.

Data sources

01

Transport Omnibus

Number of vehicles licenced by end of 2018 in Westmeath. These numbers have been proportioned down to the DZ area based on population.

02

SEAI National Energy Balance

Total energy consumed per transport mode broken down into fuel sources and electricity, supported by the SEAI National Energy Balance

03

SEAI Conversion Factors

Total energy consumed per transport mode converted to carbon emissions using SEAI Conversion Factors

Outputs

Energy consumed broken down by fuel and electricity source, and transport mode

Carbon emissions broken down by fuel and electricity source, and transport mode

3.2.5.4 Transport Sector Analysis

Transport Sector: Energy & Carbon Emissions

Total transport sector related energy consumption and associated carbon emissions within the DZ area, broken down by transport mode and energy type are shown below. As mentioned on the previous page, energy consumption and carbon emissions presented below reflect vehicles owned and licenced within the DZ area based on the entire Westmeath area, factored down by population in the DZ area. Although this approach does not provide total energy consumption and associated carbon emissions of all transport movements in the DZ area in the baseline year, it provides a useful overview of vehicle ownership in the DZ area and impact of their usage.

Private cars account for the highest carbon emissions. Petrol and diesel are the most common sources of fuel with just a small proportion relying on electricity.

Total carbon emissions result in approximately 36,855 tCO_2e.

Transport mode	Total energy consumption by transport mode in the DZ area (MWh)				
	Oil	Natural Gas	Renewables	Electricity	Total
Road Freight	30,130	1	1,292	-	**31,423**
Road Light Goods Vehicle	17,184	-	737	-	**17,920**
Road Private Car	89,815	-	3,550	48	**93,413**
Public Passenger Services	3,863	-	164	-	**4,026**
Total	**140,991**	**1**	**5,742**	**48**	**146,782**

Transport mode	Total carbon emissions by transport mode in the DZ area (tCO_2e)				
	Oil	Natural Gas	Renewables	Electricity	Total
Road Freight	7,951	0.3		-	**7,952**
Road Light Goods Vehicle	4,535	-		-	**4,535**
Road Private Car	23,334	-		18	**23,352**
Public Passenger Services	1,017	-		-	**1,017**
Total	**36,837**	**0.3**		**18**	**36,855**

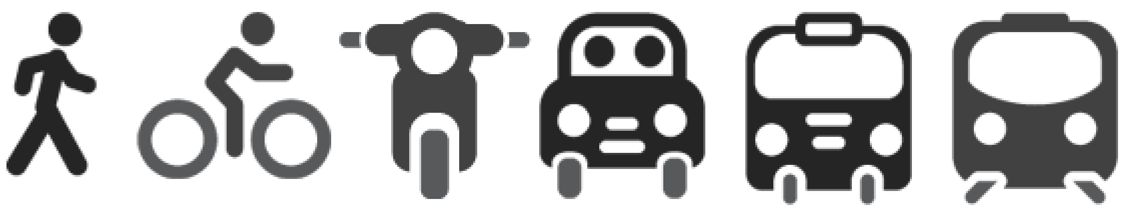
3.2.5.5 Transport Sector Analysis

Transport Sector: Commuting & Carbon Emissions

Using POWSCAR data, commuters leaving and entering the DZ area to attend work, college or school on a daily basis from within the DZ area and from surrounding areas has been explored. Carbon emissions associated with these commuting patterns are estimated using distances taken from POWSCAR and assumptions on transport modes used in the DZ area – this results of which are shown on the next pages.

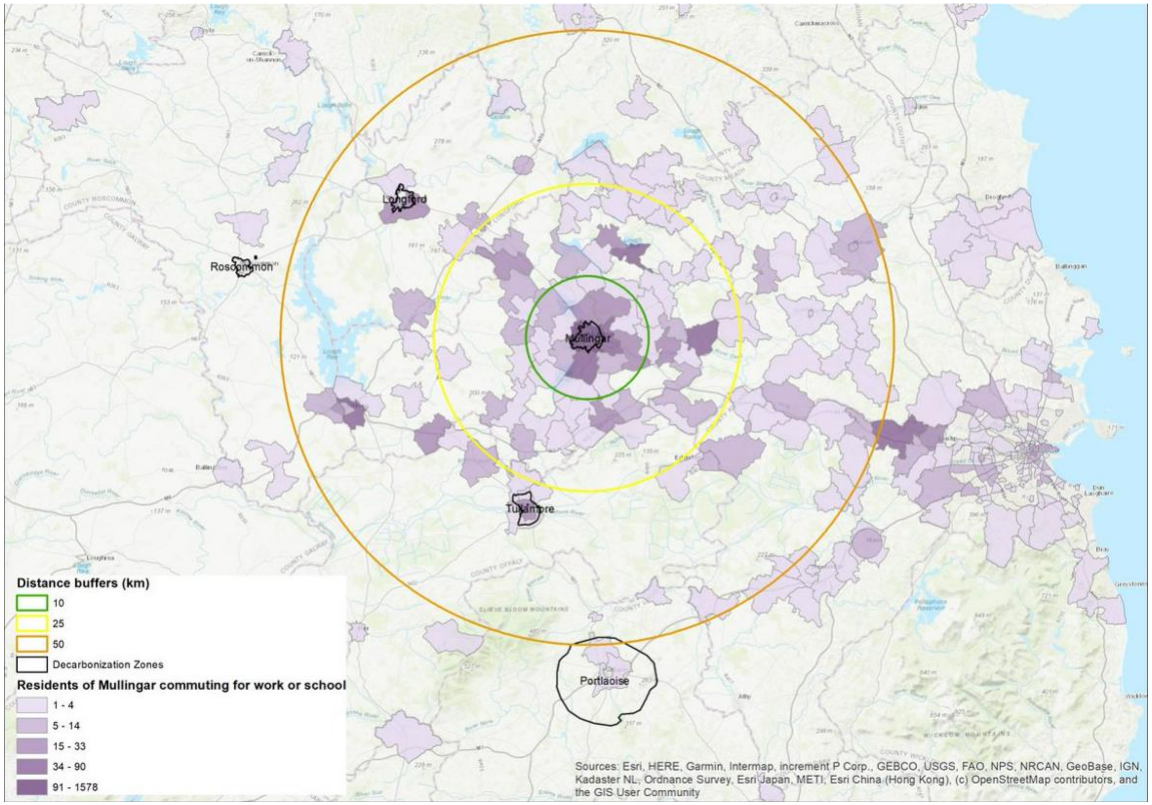
65% of these commutes are made in a car, while 25% are made using public transport, bicycle or on foot. The remaining commuters take a van or motorcycle with some ‘telecommuting’ (i.e. work from home). In addition, within the DZ area, approximately 48% of households own a car, approximately 27% own two cars and approximately 19% of households do not own a car.

Note that although these commuting patterns focus on commuters travelling in and out of the DZ area, the impact of which are not entirely associated with the DZ area boundary itself, it is important to understand opportunities for decarbonisation through both control and influencing mechanisms available to the Council.



3.2.5.6 Transport Sector Analysis

Transport Sector: Commuting & Carbon Emissions



- The map on the left provides an illustration of commuters leaving the DZ area and travelling to surrounding EDs on a daily basis.

- For the purposes of this assessment, the starting point for all commuters is assumed to be Mullingar North Urban ED. In addition, commuters travelling to the top 90% of EDs are included in this assessment, with an uplift applied to the resulting carbon emissions to represent 100%.

- It is estimated that these daily commuter trips leaving the DZ area, and assumed to then return, contribute approximately **4,818 tCO_2e** on an annual basis.

- Further information on data sources, assumptions and limitations included in the **Appendix**.

Emissions source	Total per year (return journey)
Total carbon emissions (tCO_2e) associated with commuter travel out of the DZ area to surrounding EDs	**4,818**

3.2.5.7 Transport Sector Analysis

Transport Sector: Commuting & Carbon Emissions

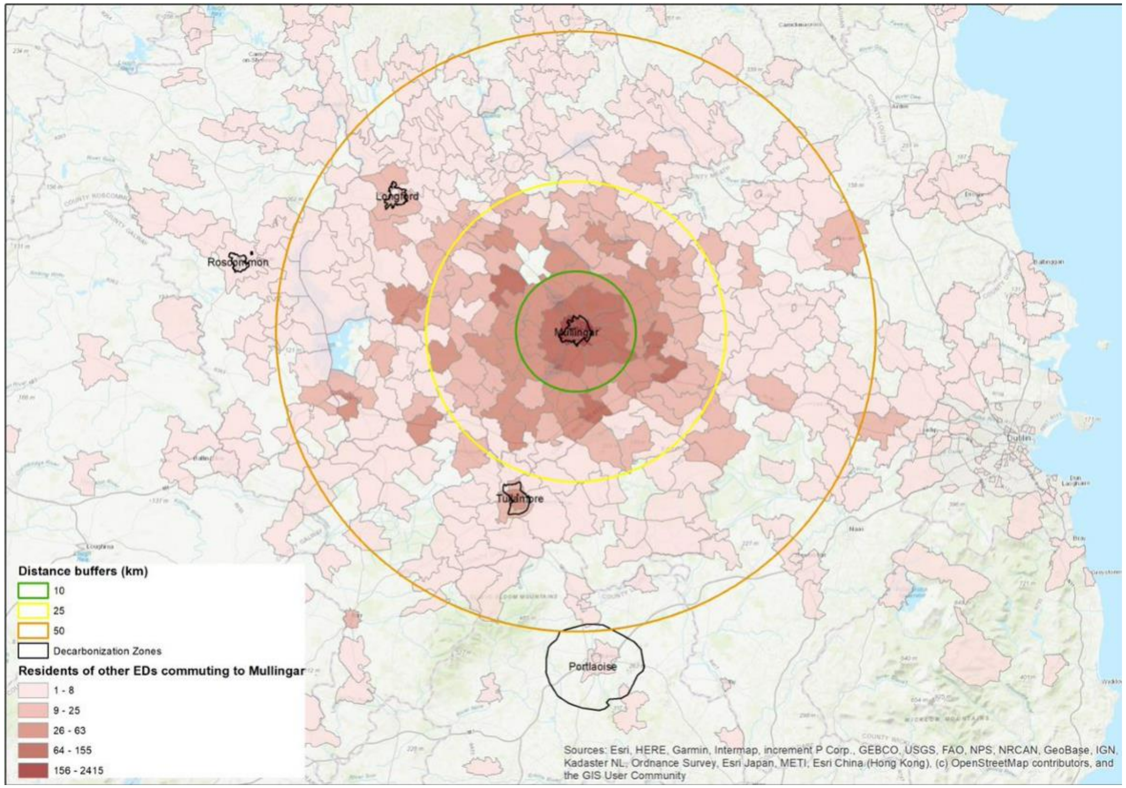
- The map on the right provides an illustration of commuters travelling into the DZ area from surrounding EDs on a daily basis.

- For the purposes of this assessment, the end point for all commuters is assumed to be Mullingar North Urban ED. In addition, commuters travelling from the top 90% of EDs are included in this assessment, with an uplift applied to the resulting carbon emissions to represent 100%.

- It is estimated that these daily commuter trips travelling into the DZ area, and assumed to then return, contribute approximately **8,145 tCO_2e** on an annual basis.

- Further information on data sources, assumptions and limitations included in the **Appendix**.

Emissions source	Total per year (return journey)
Total carbon emissions (tCO_2e) associated with commuter travel into the DZ area from surrounding EDs	8,145



3.2.6 Waste Sector

3.2.6.1 Waste Sector Overview

Overview of the waste sector

- Waste emissions are predominantly associated with methane emissions arising from disposal to landfill. The waste sector accounts for approximately 1% of Ireland's annual carbon emissions. Waste emissions per head of population are lower in Ireland compared to the EU average and carbon emissions have decreased since 2005. Minimising waste generation, and improving segregation, reuse and recycling will lead to a continued reduction in carbon emissions.

- A number of targets and goals have been set in Ireland to meet both its climate and circular economy objective – for example, Ireland has set a plastic recycling target of 55% by 2030, with a 90% collection target for beverage containers.

- Ireland has made significant progress in managing waste streams, particularly in improving recycling rates and diversion from landfill but substantial change is needed to pivot towards a more circular economy in Ireland. Businesses and households play a vital role in enabling this change by influencing and facilitating sustainable consumer behaviour.

- A number of initiatives outlined in CAP 2023 will be beneficial for the DZ area to consider, including:
    - Deposit and return schemes for plastic and aluminium beverage containers;
    - Promotion of trials for better public recycling opportunities on street and at Bring Centres;
    - Improvement of segregation and collection performance to increase recycling and reduce contamination.

- The following sections present an overview of the waste sector related activities and emissions within the DZ area.

KPMG

3.2.6.2 Waste Sector Analysis

Waste Sector: Locations & Carbon Emissions

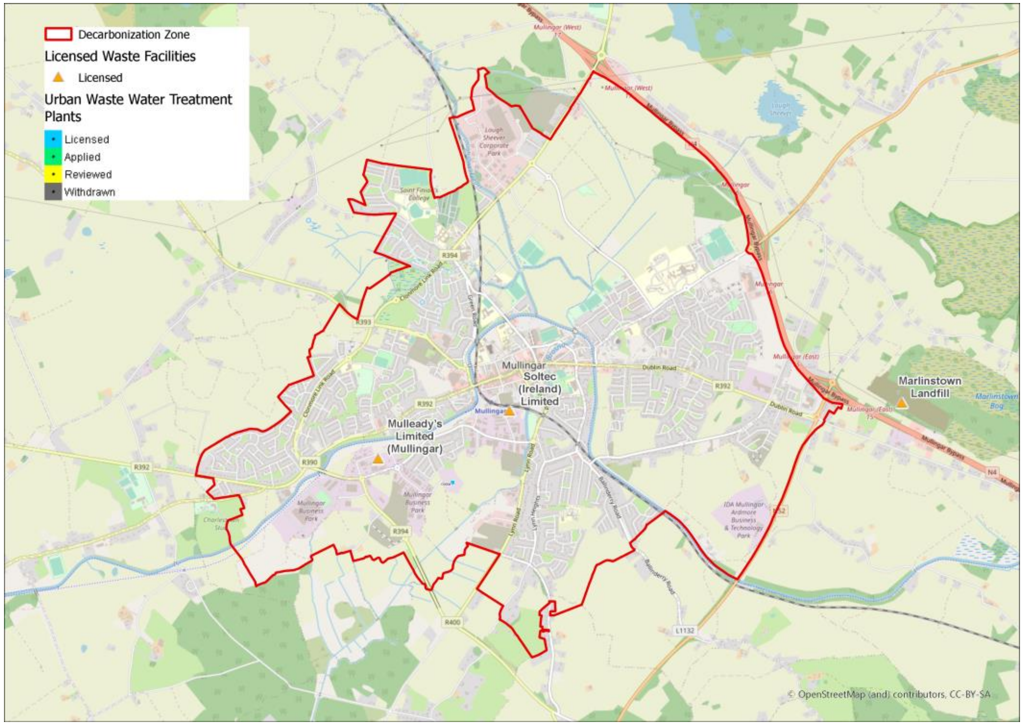
- There are two waste management facilities located in the Mullingar DZ area. One of these is located in the town centre (Soltec) and the other is located further out towards the south east perimeter of the DZ area (Mulleady's).

- There are no waste water treatment plants located within the Mullingar DZ.

- There is no carbon emissions data available on the EPA's PRTR portal for either waste management facility.

- Using a benchmark for waste related carbon emissions of 0.21 tCO2e/head of population*, it can be estimated that waste related carbon emissions within the boundary of DZ area is approximately **4,043** tCO2e.

* Benchmark is estimated using 2018 national waste sector emissions divided by national population (2016 CSO data). This benchmark is then multiplied by total population of the DZ area (19,250).



3.2.7 Energy & Electricity Sector

3.2.7.1 Energy & Electricity Sector Overview

Overview of energy & electricity sector

- Considerable progress has been made in decarbonising the electricity sector over the last decade, resulting in electricity emissions falling by 45% between 2005 and 2020. This has been possible through the deployment of renewables and their successful integration into the power grid, and the increased use of higher-efficiency gas turbines. The deployment of renewable energy has enabled emissions reductions during a period of increased demand, with electricity accounting for just 14.4% of Ireland's carbon emissions in 2021.

- Since 2021, there have been significant increases in prices in the international oil and gas markets, due to increased demand as the post-COVID 19 recovery continues and the disruption to traditional energy supplies following the Russian invasion of Ukraine. The resultant sharp increase in energy prices underlines the importance for Ireland to eliminate our dependency on fossil fuels and that an increase in renewable energy generation, along with supporting flexibility and demand management measures, is necessary for our future energy security.

- Targets and actions outlined in CAP 2023 focus on an acceleration towards renewable energy generation, with the aim of renewables accounting for at least 75% of energy demand by 2030. Key to the success of decarbonising the energy sector will be increased flexibility during Ireland's transition to a renewable electricity grid. The development of dynamic tariffs to incentivise consumers to move their demand to times of high renewable penetration will reduce the strain on the network at peak times.

- In particular, of relevant to the DZ area is the CAP 2023 measure which looks to support at least 500 MW of local community-based renewable energy projects and increased levels of new micro-generation and small-scale generation.

- The following section presents an overview of the potential opportunities for the DZ area in terms of energy efficiency and reduction as well as opportunities to support national energy decarbonisation targets.

3.2.7.2 Energy & Electricity Sector Analysis

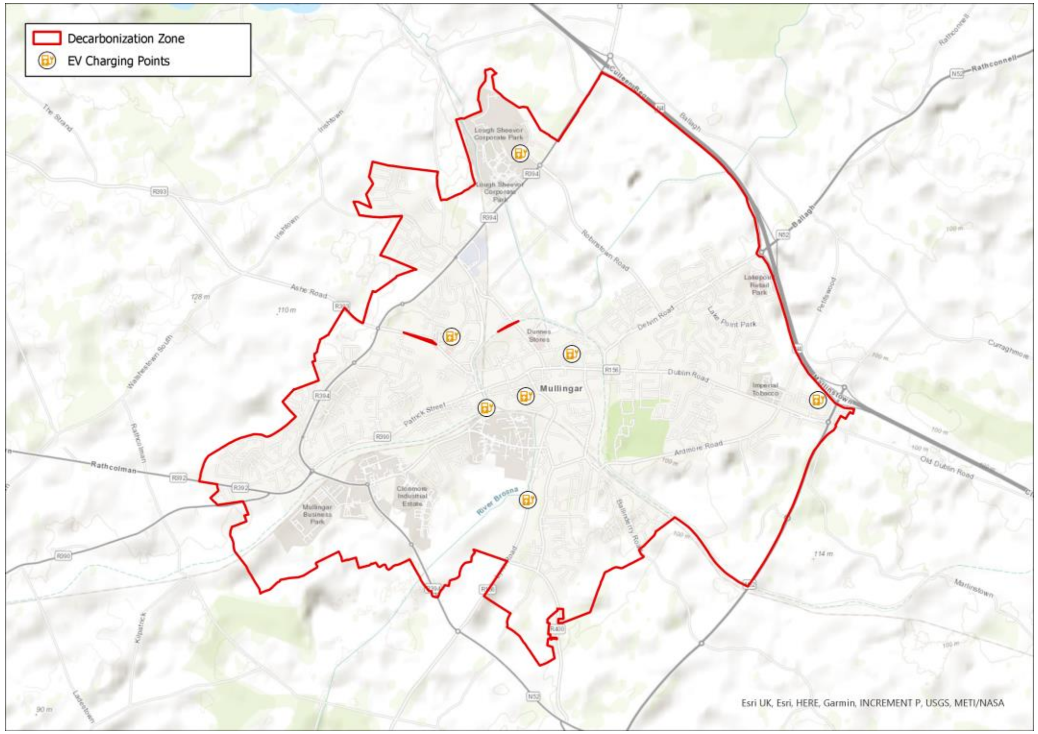
Energy & Electricity Sector: Electric Vehicle charging points

- As previously mentioned, to support the decarbonisation of the transport sector, an increased proportion of EVs in the vehicle fleet as well as the electrification of freight and public transport is required to shift away from fossil fuels.

- The current level of EV charging infrastructure is shown on the map to the right. The Mullingar DZ area centre has 7 EV charging points located relatively close to each other.

- In order to expand the production of green energy in this region, a strong grid connection and a number of substations are needed.

- The next page provides an overview of grid connections and substations in the area.



3.2.7.3 Energy & Electricity Sector Analysis

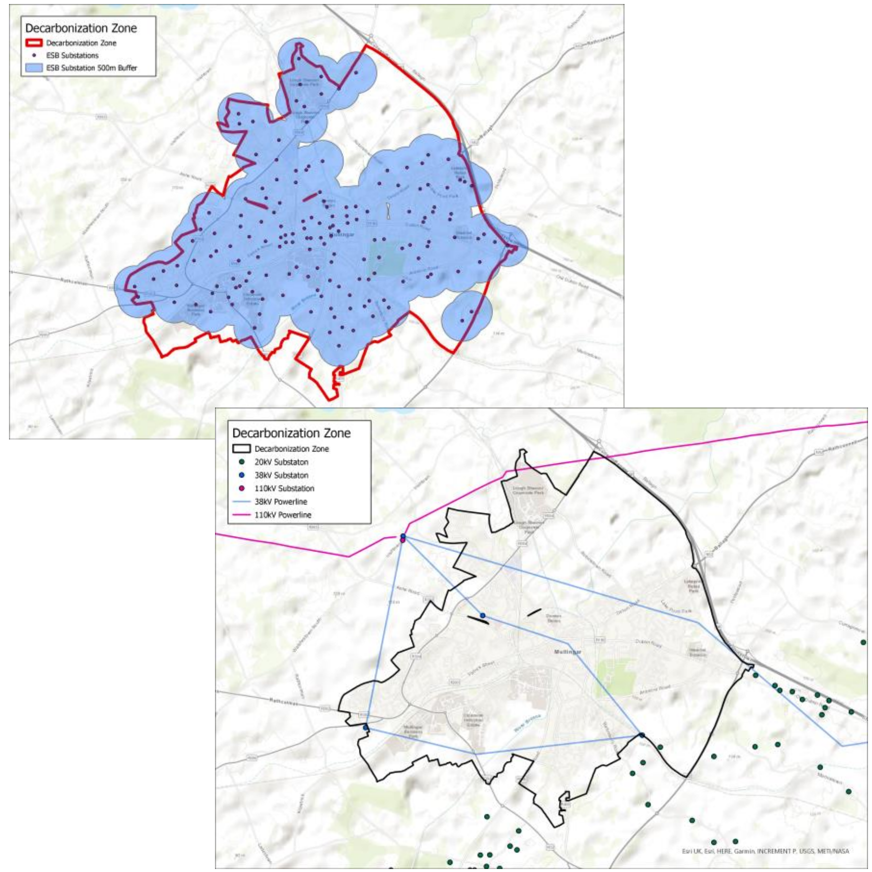
Energy & Electricity Sector: Power Line & Substation Locations

- The DZ area is serviced by a 38kV power line running through the DZ area. Another 110kV power line runs through the very north of the DZ area. Both power lines are shown on the map to the right.

- The DZ area contains a number of substations, with a high density of 20kV in the immediate vicinity of the DZ area.

- There is a high density of ESB substations in the DZ area. The locations and 500m buffer zone of these are displayed on the map, showing there is a strong grid connection should electricity upgrades be explored.

- In order to expand the production of renewable energy and enable electrification in the region, there will be a requirement to have strong grid connections and sub stations.



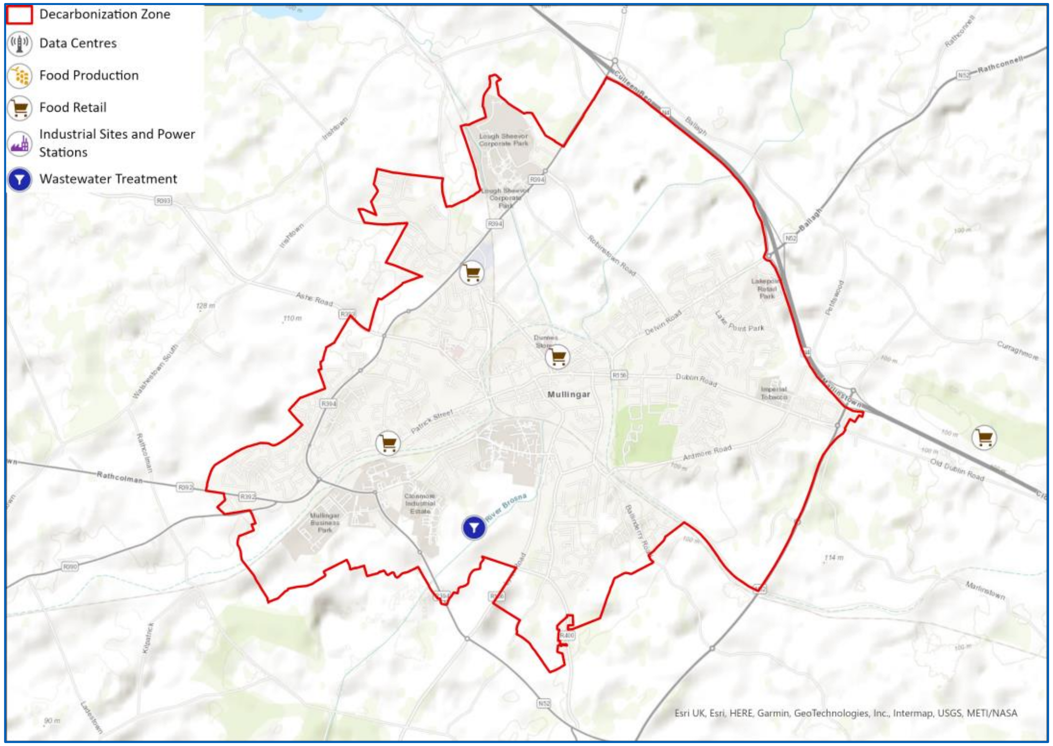
3.2.7.4 Energy & Electricity Sector Analysis

Energy & Electricity Sector: Potential Waste Heat Sources

- It is estimated that between 20 to 50% of industrial energy input is lost as waste heat in the form of hot exhaust gases, cooling water, and heat lost from hot equipment surfaces and heated products. As the industrial sector continues efforts to improve its energy efficiency, recovering waste heat losses generate cost savings, reduces environmental impact, and improves work flow and productivity.

- Numerous technologies are commercially available for waste heat recovery and many industrial facilities have upgraded or are improving their energy productivity by installing these technologies, however these technologies are not being pursued to the fullest extent possible due to several barriers such a material constraints, and greater maintenance costs.

- In the DZ there are 3 food/retail facilities located throughout the town centre and one just outside the DZ boundary which may be a potential source of waste heat for re-use. Furthermore, there is a wastewater treatment facility located in the south of the DZ which may also feed in waste heat to reduce overall energy use in the area.



3.3 Conclusions and Recommendations

3.3.1 Conclusions and Recommendations

Carbon emissions within an area, such as the DZ area, generally reflect trends such as the level of economic activity, energy use and potentially growth. The challenge for the DZ area (and other areas) is to allow for continued growth and improvement whilst reducing carbon emissions in a just and meaningful manner.

This report highlights the carbon hotspots within the DZ area: Residential Sector (including Social Housing), Commercial and Public Sector and Transport Sector. The waste sector, although a smaller impact in comparison to those just mentioned, should also be focussed on given its transboundary nature and the level of influence the local authority can have on its impact on carbon emissions.

A range of sectoral specific measures to reduce carbon emissions can be explored by Westmeath County Council during the next stages of the DZ development, including stakeholder engagement and register of opportunities for action planning. Examples of key measures specific to these sectors to consider are set out on the following pages.

In addition to sectoral specific measures, local authorities can also engage with relevant government departments to develop and resource programmes which will directly and indirectly provide the necessary tools to enable an effective transition to a low carbon economy. These include but are not limited to:

- Citizen engagement and awareness raising to promote behavioural change across the DZ area;
- Internal capacity building to equip employees with the knowledge and skills to promote decarbonisation;
- Support for external initiatives such as innovation and knowledge sharing hubs.

3.3.2 Conclusions and Recommendations

Residential (including Social Housing):

Achieving a low carbon housing stock is an important part of the DZ area successfully achieving national carbon reduction targets.

Targeting existing and proposed and/or new residential developments with suitable measures to optimise energy efficiencies and carbon emissions reductions is a key part of decarbonising the residential sector.

National, government resourced programmes to incentivise retrofit of private and social housing will be critical. The government has committed to providing increased funding to accelerate retrofitting, including free upgrades for low-income households.

Roll-out of energy management systems and smart meters to council owned buildings, such as social housing is an effective measure to manage and understand energy use and trends in demand.

Potential for renewable energy heat sources is also encouraged by the CAP, including the installation of heat pumps at existing residential units as well as new developments and use of renewable gas.

District heating is also a key part of achieving and optimising decarbonisation of the residential sector.

For proposed and new residential developments, National Building Standards revision will be required to reach net zero targets.

Commercial & Public Sector:

Similar to the residential sector, optimising the energy efficiency of existing commercial and public sector buildings is key to meeting national carbon targets.

The CAP provides an overview of key potential measures to drive decarbonisation across the commercial & public sector. For example:

- A retrofitting programme to upgrade existing buildings could optimise the energy efficiency of current building stock which range between C1 BER rated to G BER rated buildings.
- In addition, opportunities for the use of renewable energy are also encouraged including the use of heat pumps and renewable gas for commercial buildings.
- Public sector buildings can avail of SEAI supports promoting energy efficiency including the ‘Gap to Target’ tool as well as the Building Pathfinder Programme which supports building retrofits.
- Appropriate knowledge and skills are required to enable energy efficiency improvements in protected buildings – to understand, specify and install appropriate retrofitting within these protected buildings, specialists are required.
- Potential for renewable energy heat sources should be explored including the use of renewable gas as well as district heating opportunities to reduce energy consumption and carbon emissions at public and protected buildings.
- Leveraging the public procurement process can embed low carbon, sustainable criteria at the earliest stages of new public sector building developments.

3.3.3 Conclusions and Recommendations

Transport:

A shift to active travel and increased uptake of public transport is key to the achievement of Ireland's national carbon targets.

A key focus of the CAP and also mentioned in the National Planning Framework (NPF) is sustainable mobility. The provision of sustainable modes of travel such as public transport, walking and cycling will contribute towards reducing greenhouse gas emissions.

As highlighted in the report, the DZ area as a public transport hub with the majority of public transport routes including a number of bus stops, a railway station, the rail network and cycle routes passing through.

In addition, investment in electric vehicles (EVs), increased charging facilities are part of the solution. Provision of EV charging is driven by the Department of Transport (DOT) and Department of the Environment, Climate and Communications (DECC).

Waste & Circular Economy:

Local authorities can play a key role in minimising waste and embracing circular economy principles. Westmeath County Council can consider the implementation of targeted initiatives to reduce waste related emissions and embrace circular economy principles, including:

- Deposit and return schemes for plastic and aluminium beverage containers;
- Promotion of trials for better public recycling opportunities on street and at Bring Centres;
- Improvement of segregation and collection performance to increase recycling and reduce contamination.

In addition, capacity building will play a key role in closing Ireland's circularity gap at a local level. Current measures in place to support this include the Local Authority Prevention Network (LAPN), which involves co-operation between the EPA and local authorities to build local authority expertise and capacity in waste prevention and circular economy at the local level.

04

Appendices

4.1 Data Sources, Assumptions & Limitations: Spatial Data

Sector	Data source	Data source link	Data assumption	Data limitation
Socio-economic	Unemployment 2016	https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics	Number of unemployed by small area	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.
Socio-economic	POBAL Deprivation 2016	https://www.pobal.ie/research-analysis/open-data	Deprivation Index 2016 by ED	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.
Socio-economic	Population Density	https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics	Total Population per Small Area	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.
Socio-economic	Zoning	https://viewer.myplan.ie	Westmeath County Development Plan 2021 - 2027	No limitation in data set.
Residential	Housing Stock	https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics	Average Built Year of Housing Stock by Small Area	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.
Residential	BER Ratings	https://gis.seai.ie/server/services	Domestic BER Ratings	No limitation in data set. Additional information on the data source can be found here: Understand BER Ratings | Home Energy | SEAI
Residential	Annual Heat Demand	https://gis.seai.ie/server/services	Residential Sector – Annual Heat Demand	No limitation in data set. Additional information on the data source can be found here: Map Of Heat Demand In Ireland | SEAI GIS Maps | SEAI
Commercial & Public	BER Ratings	https://gis.seai.ie/server/services	Non-Domestic BER Ratings	No limitation in data set. Additional information on the data source can be found here: Understand BER Ratings | Home Energy | SEAI
Commercial & Public	Annual Heat Demand	https://gis.seai.ie/server/services	Commercial and Public Sector – Annual Heat Demand	No limitation in data set. Additional information on the data source can be found here: Map Of Heat Demand In Ireland | SEAI GIS Maps | SEAI

4.2 Data Sources, Assumptions & Limitations: Spatial Data

Sector	Data source	Data source link	Data assumption	Data limitation
Commercial & Public	Buildings Number and Locations	Westmeath County Council	Geodirectory Building Use Locations	2022 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2022 data is deemed a reasonable proxy for 2018.
Energy & Electricity	Power Lines and Substations Locations	https://gis.seai.ie/server/services	Power Lines and Substations Locations	No limitation in data set.
Energy & Electricity	Electric Vehicle Charging Points	Data.gov.ie	Electric Vehicle Charging Points	No limitation in data set.
Waste	Waste Facilities and Wastewater Treatment Plants	https://gis.epa.ie/arcgis/services	Waste Facilities and Wastewater Treatment Plants	No limitation in dataset.
Transport	Bus Stops	Data.gov.ie	Bus stops Locations	No limitation in data set.
Transport	Transport Carbon Emissions	https://projects.au.dk/mapeire/spatial-results/download	MapEire modelled transport carbon emissions	No limitation in data set. Additional information on the data source can be found here: https://projects.au.dk/mapeire/spatial-results
Transport	POWSCAR (Place of Work, School or College)	Census 2016 Place of Work, School or College - Census of Anonymised Records (POWSCAR) - CSO - Central Statistics Office	Commuting and Carbon Emissions	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.

4.3 Data Sources, Assumptions & Limitations: Non-Spatial Data

Sector	Data source name & description	Data source link	Data assumption	Data limitation	Overview of methodology used
Residential	CSO	https://data.cso.ie/	No. of housing units in the DZ area	Data used is representative of 2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018	CSO data on number of residential buildings has been combined with BER Research Tool data to estimate total energy consumption
	SEAI BER Research Tool	https://ndber.seai.ie/BERResearchTool/ber/search.aspx	The average energy consumption per dwelling type and built period	The research tool does not contain total delivered energy consumption of all houses in the DZ area but can be considered a good proxy.	
	CSO	https://data.cso.ie/	Fuel breakdown of the residential sector within the DZ	CSO data reflective of 2016 has been used to inform fuel type breakdown within the residential sector. This data is reflective of Mullingar residential sector activities.	
	SEAI Conversion Factors	https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/	Carbon intensity factors for each energy source	The SEAI conversion factors represent some of the most robust carbon benchmarks for fuel types in Ireland and would be considered a strong proxy for carbon calculations in the DZ	

4.4 Data Sources, Assumptions & Limitations: Non-Spatial Data

Sector	Data source name & description	Data source link	Data assumption	Data limitation	Overview of methodology used
Commercial & Public Sector	OSI (PRIME2 dataset)	https://osi.ie/wp-content/uploads/2018/04/PRIME2-Client-Documentation-Concepts-V-02.4.pdf	Number of buildings by type in the DZ area reflecting the 2018 baseline year	The OSI PRIME2 dataset is considered a strong proxy for spatial data pertaining to commercial building types across Ireland, however a potential limitation could be the generic classification of some buildings that were removed from our analysis (e.g., general buildings, which could be either residential or commercial)	The OSI data combined with CIBSE benchmarks has been used to calculate the estimated energy consumption for each of the building types in the DZ area. National commercial and public sector energy split (%) has been applied to energy consumption and converted to carbon emissions.
	CIBSE (energy benchmarks for building types)	https://www.cibse.org/knowledge-research/knowledge-resources/knowledge-toolbox/benchmarking-registration#:~:text=CIBSE's%20Energy%20Benchmarking%20Tool%20is,of%20energy%20use%20in%20buildings.	CIBSE benchmarks are assumed to be representative of same building types in the DZ	CIBSE benchmarks are a UK data source based on energy consumption data gathered in the UK. The benchmarks do not reflect actual energy consumption in the DZ area but are considered a good proxy.	
	SEAI (national energy breakdown for commercial and public sector)	https://www.seai.ie/publications/Previous-Energy-Balances.xlsx	National fuel energy split represents that of the DZ	The national energy split reflects energy consumption of the commercial and public sector at a national level. Although not an actual reflection of energy consumption at the DZ area level, it is a considered to be a good proxy.	
	SEAI Conversion Factors	https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/	Carbon intensity factors for each energy source	The SEAI conversion factors represent some of the most robust carbon benchmarks for fuel types in Ireland and would be considered a strong proxy for carbon calculations in the DZ	

4.5 Data Sources, Assumptions & Limitations: Non-Spatial Data

Sector	Data source name & description	Data source link	Data assumption	Data limitation	Overview of methodology used
Transport	Transport Omnibus	https://www.cso.ie/en/statistics/transport/transportomnibus/	Number of vehicles licenced by end of 2018 in Westmeath.	Number of vehicles for Westmeath County have only been made available. To estimate number of vehicles in the DZ area, total numbers have been proportioned down based on population.	To estimate transport emissions in the DZ area number of vehicles by vehicle type has been combined with transport energy split provided by SEAI to understand energy consumption by transport mode. This energy consumption has then been converted into carbon emissions using robust SEAI factors. Note that this assessment accounts for vehicles owned and licenced within the area and does not reflect all transport movements within the DZ area.
	SEAI National Energy Balance	https://www.seai.ie/publications/Previous-Energy-Balances.xlsx	Total energy consumed per transport mode presented by energy source	Representative of national data rather than the DZ area.	
	SEAI Conversion Factors	https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/	Carbon intensity factors for each transport energy source	n/a	
	POWSCAR (Place of Work, School or College)	Census 2016 Place of Work, School or College - Census of Anonymised Records (POWSCAR) - CSO - Central Statistics Office	Commuting patterns into and out of the DZ area to surrounding EDs for work, school and college. Trips are assumed to be daily, single trips.	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.	To estimate carbon emissions associated with commuting patterns in the DZ area, POWSCAR data has been relied upon to understand distances travelled from start to end point by residents travelling in and out of the DZ area. Distances have been applied to the travel mode split typical of the DZ area. Total distances by travel mode have then been converted into carbon emissions using robust UK Government factors.
	CSO	https://www.cso.ie/en/census/census2016reports/census2016smallareapopulationstatistics	Travel modes for work, school and college for residents of the DZ area	2016 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2016 data is deemed a reasonable proxy for 2018.	
	CSO	https://www.cso.ie/en/releasesandpublications/er/vlftm/vehicleslicensedforthefirsttimedecemberandyear2018/	Private car fuel split	n/a	
	UK Government Conversion Factors	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/715426/Conversion_Factors_2018_-_Full_set__for_advanced_users__v01-01.xls	Carbon intensity factors for each transport mode	n/a	

4.6 Supporting Data: Residential Sector

Residential Sector: Energy & Carbon Emissions

Weighted average of CSO data of dwelling types in DZ area. ***Note that number of house/bungalow & flat/apartment by construction period is not available from the CSO.***

	Number				
Dwelling type	**Mullingar North Urban**	**Mullingar South Urban**	**Mullingar Rural**	**Castle**	**Belvidere**
All households	2,178	1,870	3,614	325	250
House/Bungalow	1,736	1,347	3,507	278	242
Flat/Apartment	442	523	107	47	8

Calculation of average energy consumption for housing units in the DZ grouped by dwelling type and construction period

	Number				
Dwelling type	**Mullingar North Urban**	**Mullingar South Urban**	**Mullingar Rural**	**Castle**	**Belvidere**
All years	2,178	1,869	3,605	323	98
Before 1919	121	103	18	16	17
1919-1970	506	404	299	46	29
1971-1990	613	535	663	77	17
1991-2000	442	204	954	42	13
2001-2005	236	300	810	66	10
2006-2011	236	300	810	66	10
2012 onwards	23	24	52	9	1

4.7 Supporting Data: Residential Sector

Residential Sector: Energy & Carbon Emissions

Central heating energy source split of residential units across EDs within the DZ.

	Number				
Fuel type	**Mullingar North Urban**	**Mullingar South Urban**	**Mullingar Rural**	**Castle**	**Belvidere**
Coal	11%	4%	4%	2%	0.4%
Peat	10%	4%	5%	10%	15%
Oil	45%	49%	58%	56%	73%
LPG	0.4%	1%	0.3%	0.3%	1%
Natural Gas	14%	12%	29%	23%	2%
Renewables	1%	0.4%	1%	0.9%	2%
Electricity	16%	27%	2%	3%	2%
Wood	2%	2%	2%	5%	4%

4.8 Supporting Data: Residential Sector

Residential Sector: Energy & Carbon Emissions

KPMG calculation of average energy consumption for housing units in the DZ grouped by built period

	kWh/year							
Dwelling type	**All years**	**Before 1919**	**1919-1970**	**1971-1990**	**1991-2000**	**2001-2005**	**2006-2011**	**2012 onwards**
All households	21,777	38,920	29,416	24,365	20,498	19,263	12,542	21,782

KPMG calculation of average energy consumption for housing units in the DZ grouped by built period

	kWh/year
Dwelling type	**All years**
House/Bungalow	22,654
Flat/Apartment	10,564

SEAI carbon emission conversion factors

Energy source	gCO_2/kWh
Coal	340.6
Peat	355.9
Residual Oil	273.6
LPG	229.3
Natural Gas	204.7
Renewables	0
Electricity	375.2
Wood	15.1

4.9 Supporting Data: Residential Sector

Residential Sector: Social housing: Energy & Carbon Emissions

Weighted average of CSO data of social housing units in DZ area, by ED. Note that number of social housing units by dwelling type is not available from the CSO

	Number				
Dwelling type	**Mullingar North Urban**	**Mullingar South Urban**	**Mullingar Rural**	**Castle**	**Belvidere**
All households	483	99	219	10	3

Calculation of average energy use for all social housing units in the DZ

	kWh/year
Dwelling type	**All years**
All households	22,912

4.10 Supporting Data: Commercial & Public Sector

Commercial & Public Sector: Energy & Carbon Emissions

Breakdown of commercial building types in the DZ area

Building type	Number	Area m2
Mixed Use	**16**	**18206.92563**
Building General	14	9917.468228
Hotel	1	4,639
School	1	3,650
Commercial	**600**	**787496.8909**
Building General	2	730
Church	1	99
Clubhouse	1	690
Garda Station	1	4,806
Hotel	293	397,638
na	253	328,869
Railway Station	2	1,539
School	44	51,395
Shopping Centre	3	1,731
Total	**616**	**805,704**

Energy benchmarks used for commercial buildings types in the DZ area

Building type	Typical practice fossil fuels (kWh/m^2)	Typical practice electricity (kWh/m^2)
Retail	169	287
Office	151	85
Hotel	400	140
Community/ day centre	139	47
Schools and colleges	111	41
Sports facilities	598	152
Church	150	20
Sports ground changing facility	216	164
Police Station	164	143
Fire station	173	83
Other	333	162

Carbon emissions factors

Energy source	gCO_2/kWh
Oil	274
Coal	341
Natural Gas	205
Electricity	375
Renewables	0

National Commercial and Public Sector energy consumption breakdown

Fuel split in commercial sector	Commercial/Public Services	%	% fossil fuel only
Coal	0.52	0.03%	0.1%
Oil	241	14%	40%
Natural Gas	329	20%	54%
Renewables	39	2%	7%
Electricity	1,079	64%	-
TOTAL	**1,688**	**100%**	**100%**

4.11 Supporting Data: Transport Sector

Transport Sector: Energy & Carbon Emissions

Licenced vehicles in the DZ area in 2018

Licenced vehicles categories (Transport Omnibus)	DZ area (number)*	Westmeath County Council (number)
Road Freight	14	71
Road Light Goods Vehicle	2,418	12,040
Road Private Car	8,335	41,499
Public Passenger Services	81	405
Total	**10,849**	**54,015**

~20% of Westmeath County Council residents reside in the DZ area. Numbers of licenced vehicles in the DZ area have been estimated by multiplying Westmeath County Council licenced vehicles (made available by the CSO Transport Omnibus) by 20% to reflect likely licenced vehicles numbers in the DZ area.

Carbon emissions factors

Energy source	gCO_2/kWh
Gasoline	251.9
Gasoil / Diesel /DERV	263.9
LPG	229.3
Natural Gas	204.7
Electricity	375.2

National Transport Energy consumption broken down by transport mode and energy source. *Note that 'Oil' is a sum of 'Gasoline', 'LPG', 'Gasoil/Diesel/DERV' and 'Renewables' is a sum of 'Biodiesel' and 'Bioethanol'. These 'sub-categories' are included in italics below for completeness.*

	Energy consumption (MWh)									
Transport mode	**Oil**	***Gasoline***	***LPG***	***Gasoil / Diesel /DERV***	**Natural Gas**	**Renewables**	***Biodiesel***	***Bioethanol***	**Electricity**	**Total**
Road Freight	8,182,762	-	-	*8,182,762*	346	350,788	*350,788*	-	-	8,533,895
Road Light Goods Vehicle	3,828,407	-	-	*3,828,407*	-	164,120	*164,120*	-	-	3,992,528
Road Private Car	23,129,880	*7,845,370*	*21,540*	*15,262,970*	-	914,095	*654,310*	*259,785*	12,389	24,056,364
Public Passenger Services	1,537,385	*75,657*	-	*1,461,728*	-	65,168	*62,663*	*2,505*	-	1,602,553
Total	**36,678,434**	***7,921,027***	***21,540***	***28,735,867***	**346**	**1,494,171**	***1,231,881***	***262,290***	**12,389**	**38,185,340**

4.12 Supporting Data: Transport Sector

Transport Sector: Energy & Carbon Emissions

DZ area energy consumption broken by transport mode and energy source. *Note that 'Oil' is a sum of 'Gasoline', 'LPG', 'Gasoil/Diesel/DERV' and 'Renewables' is a sum of 'Biodiesel' and 'Bioethanol'. These 'sub-categories' are included in italics below for completeness.*

	Energy consumption (MWh)									
Transport mode	Oil	*Gasoline*	*LPG*	*Gasoil / Diesel /DERV*	Natural Gas	Renewables	*Biodiesel*	*Bioethanol*	Electricity	Total
Road Freight	30,130	-	-	30,130	1	1,292	1,292	-	-	**31,423**
Road Light Goods Vehicle	17,184	-	-	17,184	-	737	737	-	-	**17,920**
Road Private Car	89,815	30,464	84	59,267	-	3,550	2,541	1,009	48	**93,413**
Public Passenger Services	3,863	190	-	3,673	-	164	157	6	-	**4,026**
Total	**140,991**	30,654	84	110,253	**1**	**5,742**	4,726	1,015	**48**	**146,782**

DZ area carbon emissions broken by transport mode and energy source. *Note that 'Oil' is a sum of 'Gasoline', 'LPG', 'Gasoil/Diesel/DERV' and 'Renewables' is a sum of 'Biodiesel' and 'Bioethanol'. These 'sub-categories' are included in italics below for completeness.*

	Carbon emissions (tCO_2e)									
Transport mode	Oil	*Gasoline*	*LPG*	*Gasoil / Diesel /DERV*	Natural Gas	Renewables	*Biodiesel*	*Bioethanol*	Electricity	Total
Road Freight	7,951	-	-	7,951	0.3	-	-	-	-	7,952
Road Light Goods Vehicle	4,535	-	-	4,535	-	-	-	-	-	4,535
Road Private Car	23,334	7,674	19	15,641	-	-	-	-	18	23,352
Public Passenger Services	1,017	48	-	969	-	-	-	-	-	1,017
Total	**36,837**	**7,722**	**19**	**29,096**	**0.3**	**-**	**-**	**-**	**18**	**36,855**

4.13 Supporting Data: Transport Sector

Transport Sector: Commuting & Carbon Emissions

Transport mode to work or school in the DZ area in 2018

Transport Mode	Total %
On foot	19%
Bicycle	2%
Bus minibus or coach	4%
Train DART or LUAS	3%
Motorcycle or scooter	1%
Car driver	*65%*
Diesel	42%
Petrol	19%
Plug-in Hybrid Electric Vehicle	4%
Battery Electric Vehicle	1%
Hybrid	0%
Van	4%
Work mainly at or from home	2%
Total	100%

Carbon emissions factors

Transport Mode	Carbon factor (kg CO_2e/pass.km or kg CO_2e/km)
On foot	-
Bicycle	-
Bus minibus or coach	0.10
Train DART or LUAS	0.04
Motorcycle or scooter	0.12
Diesel	0.18
Petrol	0.18
Plug-in Hybrid Electric Vehicle	0.12
Battery Electric Vehicle	0.07
Hybrid	0.13
Van: Diesel	0.26

Private car fuel type, national data

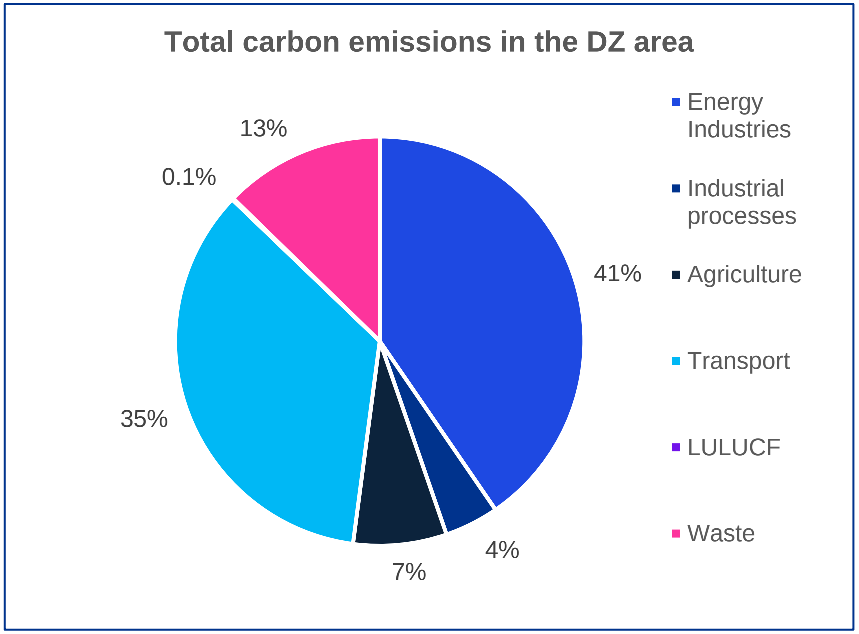
Fuel type	Petrol	Diesel	Electric	Hybrid	Other	Total
% of private cars using fuel type	29%	64%	1%	6%	0%	100%

4.14 Supporting Data: 'Top-down' Assessment Results

Top-Down Assessment of the DZ area

The EPA's MapEire database has been used to inform a 'top-down' assessment of carbon emissions within the DZ area – the results of this 'top-down' analysis are shown on the chart and table below.

Note that the MapEire database does not include analysis of residential and commercial and public sector. Note that the majority of emissions associated with Energy Industries are associated with electricity generation rather than consumption of energy.



Sector	Total tCH_4	Total tCO_2	Total tN_2O	Total tCO_2e
Energy Industries	761	32,776	79	33,615
Industrial processes	10	3,370	184	3,563
Agriculture	3,618	129	2,393	6,141
Transport	36	28,842	298	29,176
LULUCF	132	-457	425	100
Waste	9,696	0	867	10,563
Total	**14,252**	**64,661**	**4,245**	**83,158**

The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although we endeavor to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation.