Monaghan County Council

Decarbonisation Zone

Comhairle Contae Mhuineacháin
Monaghan County Council

KPMG
Sustainable
Futures

Report
June 2023

KPMG Future Analytics

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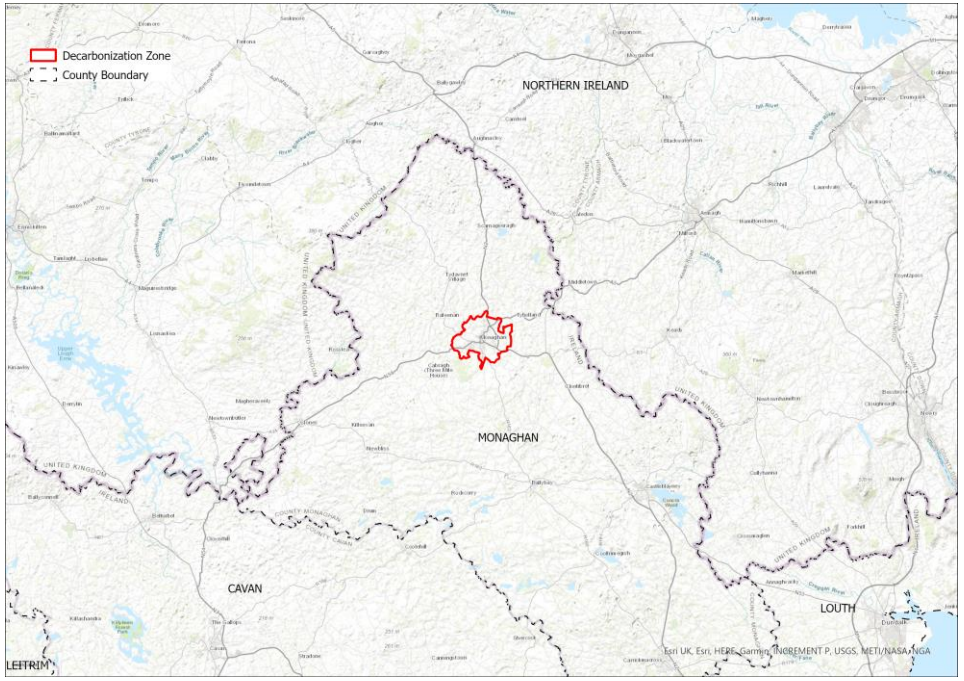
Executive Summary

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.

Monaghan Town has been designated as the DZ for Monaghan 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. The Monaghan Town DZ area contains (or overlaps) 56 townlands, from Aghnasedagh in the east to Cornecassa in the west and from Derrynagrew in the north and Drumbear in the south.



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.

Monaghan 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.

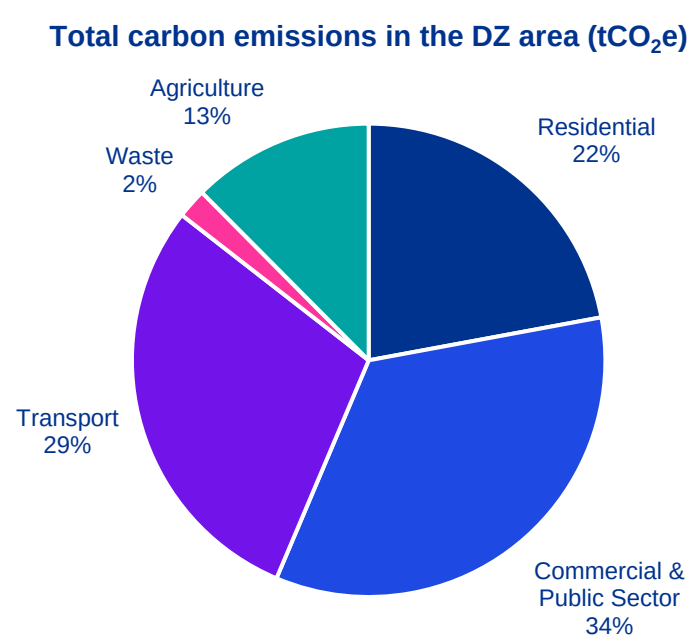
Emissions associated with the following sectors are considered in this BEI assessment due to their relevance in the DZ area: **Residential, Commercial & Public Sector, Transport, Waste and Agriculture.**

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 equate to approximately **86,354 tCO_2e**.

	Carbon emissions (tCO_2e)
Residential	19,075
Commercial & Public Sector	29,601
Transport	25,173
Waste	1,757
Agriculture	10,748
Total carbon emissions	**86,354**
Total carbon emissions per capita (tCO_2e/capita)	**10.32**



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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.

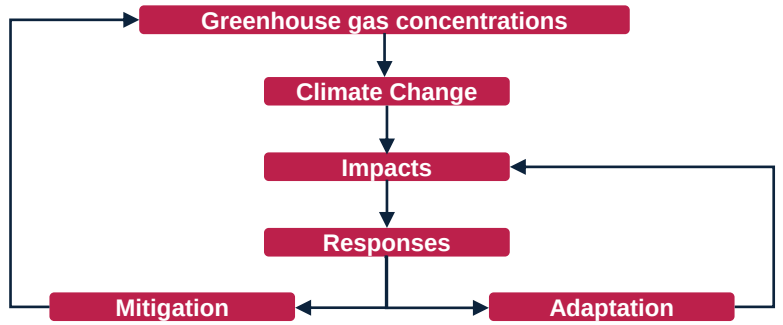
International organisations, national and local governments are increasingly compelled to take ambitious action through mitigation (decreasing emissions that cause climate change) and adaptation (enhancing resilience to climate change impacts and risks).

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

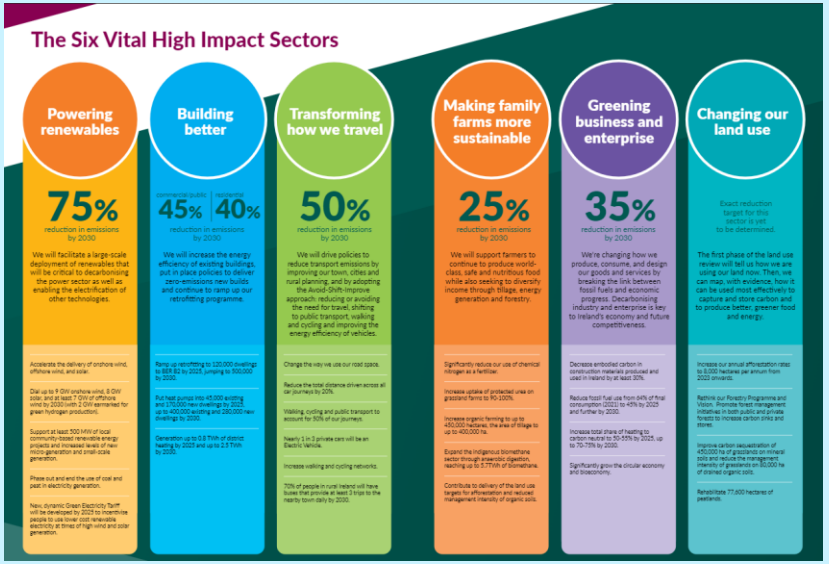
The EU adopted a legislative proposal for the European Climate Law in June 2021 to frame the climate neutrality objective by 2050 across the EU with an intermediate target of **reducing net greenhouse gas emissions by at least 55% by 2030**. The European Commission (EC) is clear in the commitment required 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:

- Monaghan County Development Plan 2019 – 2025
- Monaghan County Council Climate Change Adaptation Strategy 2019-2024

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.

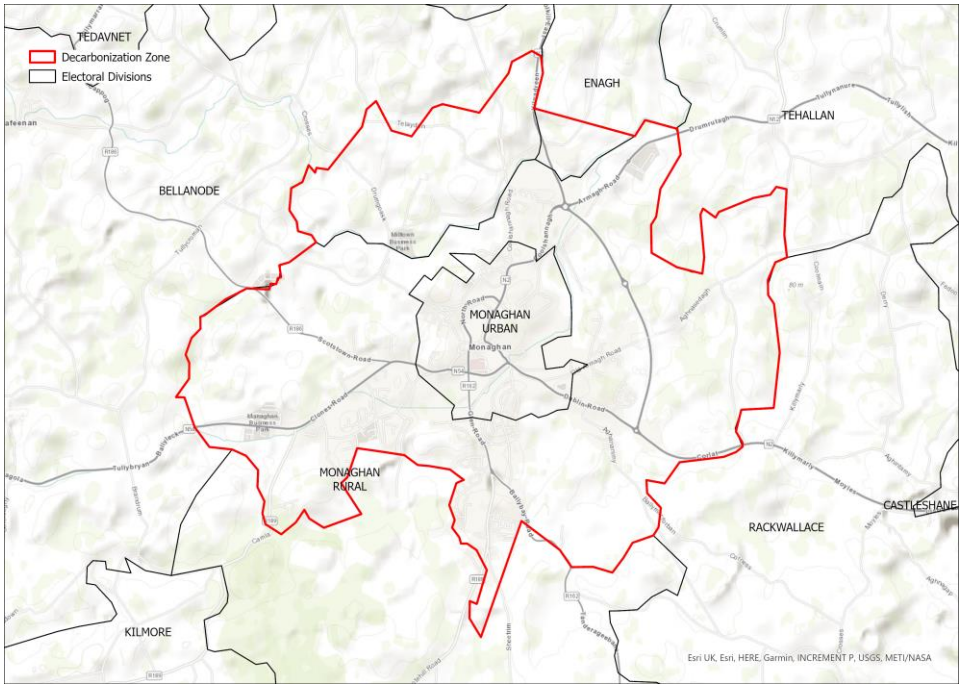
Once a DZ area is identified and the associated overarching vision and objectives are set, each local authority must kickstart the next stages of the DZ, as illustrated on the right.

2.4 Identification of the Decarbonisation Zones

Monaghan County Council has also set an overarching vison for the area:

"The DZ contains many buildings, properties and infrastructure which is under the ownership / control of the local authority and other government department and agencies providing substantial opportunities for decarbonizing initiatives. The DZ also provides opportunities to identify carbon saving initiatives across a wide spectrum of activity including industry, retail, leisure, residential, education and health. Additionally, the area provides a range of opportunities for Active Travel initiatives, greenways, urban cycleways and footpaths."*

Monaghan Town 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.



Zoning

The Monaghan Town DZ includes 32 small areas under 3 Electoral Divisions (EDs) (as shown within the red line boundary on the left)

Population

The total population of the Monaghan Town DZ area was estimated at 8,366 (2016 Central Statistic Office (CSO) data).

Land Area

The Monaghan Town DZ has a total land area of approximately 16.6 km^2

Scalability

The Monaghan Town DZ is considered to be an appropriate demonstration area and testbed for rural decarbonisation measures to be adopted in other rural areas as well as scaled up across Monaghan County and wider.

***Source: Monaghan County Council DZ RFP**

2.5 Establishment of the Baseline Emissions Inventory

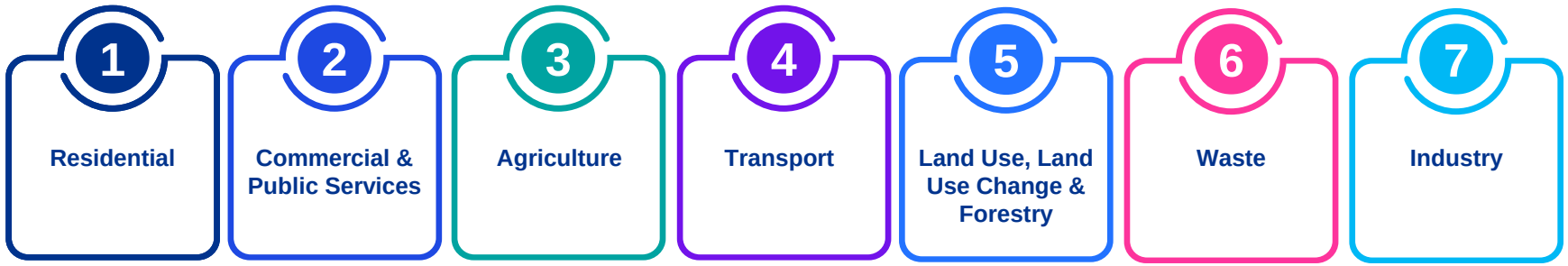
The baseline emissions inventory (BEI) is an overview of an area's or region's total carbon emissions at a point in time. The BEI is a key instrument that enables a local authority to measure the impact of planned actions related to emission reductions across its own operations as well as relevant sectors 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.

Monaghan County Council's BEI for the Monaghan Town 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 Monaghan County Council DZ 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 'Industrial Processes' and 'Land Use, Land Use Change & Forestry (LULUCF)' are excluded from the assessment given the negligible activities in the DZ area.



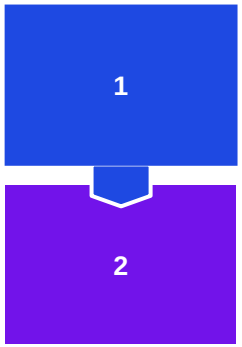
03

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:



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**.

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**.

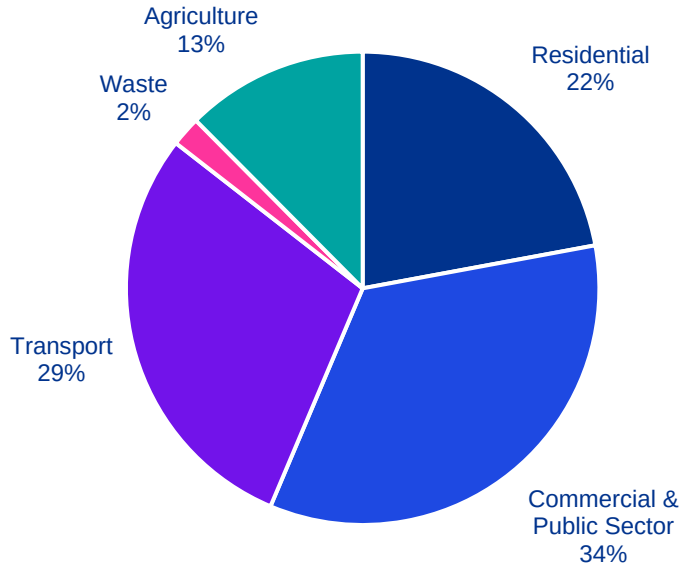
3.2 BEI Assessment

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 **86,354 tCO_2e (tonnes of carbon dioxide equivalent)*.** This translates to **10.32 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 higher than the EU average of 8.2 tCO_2e per capita.**

	Carbon emissions (tCO_2e)
Residential	19,075
Commercial & Public Sector	29,601
Transport	25,173
Waste	1,757
Agriculture	10,748
Total carbon emissions	86,354
Total carbon emissions per capita (tCO_2e/capita)	**10.32**



CO_2e is a unit of measurement that is used to standardise the climate effects of various greenhouse gases on the basis of their global-warming potential (GWP)

***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

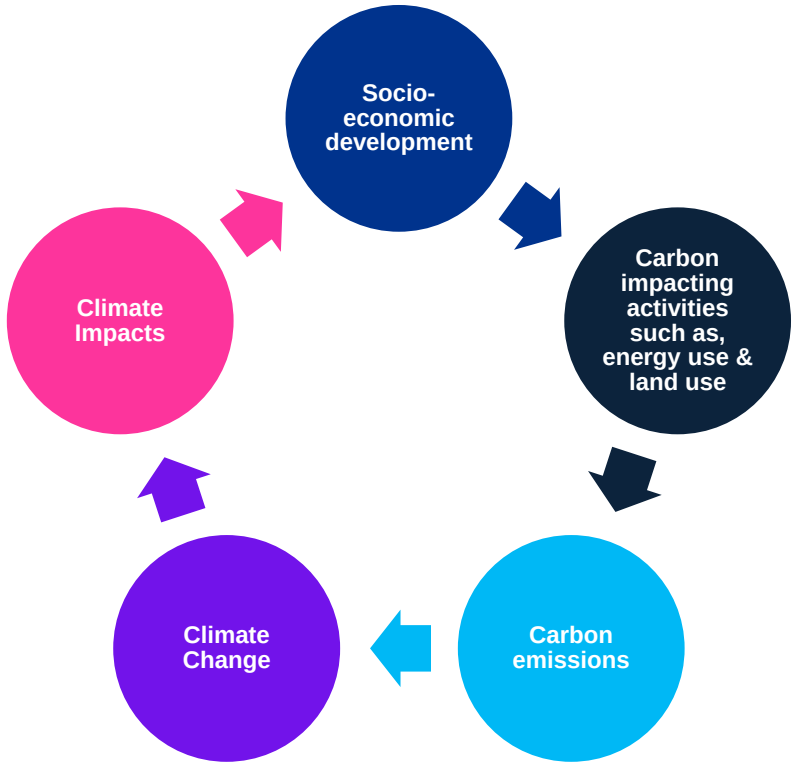
Socio-economic development and decarbonisation are intricately linked, with social and economic activities impacting on carbon emissions, for example, through energy use and land use. Carbon emissions contribute and influence the severity of climate change – climate change has a direct effect on socio-economic 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 Monaghan Town DZ area is 8,366. A 49% male : 51% female split in gender is seen in the demographics of the region.

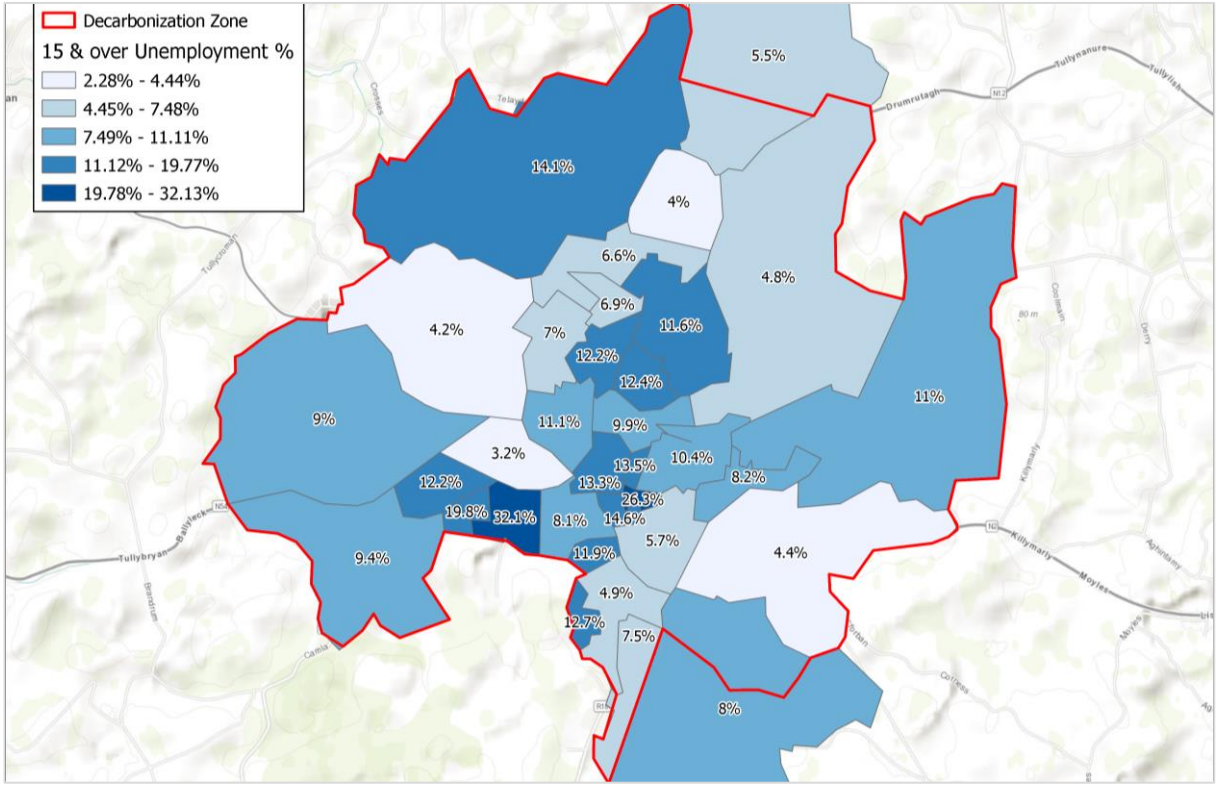
The largest age cohort was the 30-39 bracket, representing 17.7% of the population. The smallest cohort being 80+ which accounted for 3.6%.

The nationality breakdown of the study area found that 31.5% of the population is non-Irish. This was higher than the state average, Lithuanian was the largest non-Irish cohort (13.0%).

The average household income within the study area was € 38,731, this is 13% lower than the state average of €44,477.
Employment rates were marginally below the national average of 53.4% with the study area at a level of 52.7%.

The average unemployment rate within the area was 10.6%, higher than the state figure of 7.9%. 14.6% of population in the DZ area is retired.

2016 Pobal data highlighted a mixture of marginally above and marginally below average across the study area, with a pocket in the south of the study area noted as 'Very Disadvantaged.

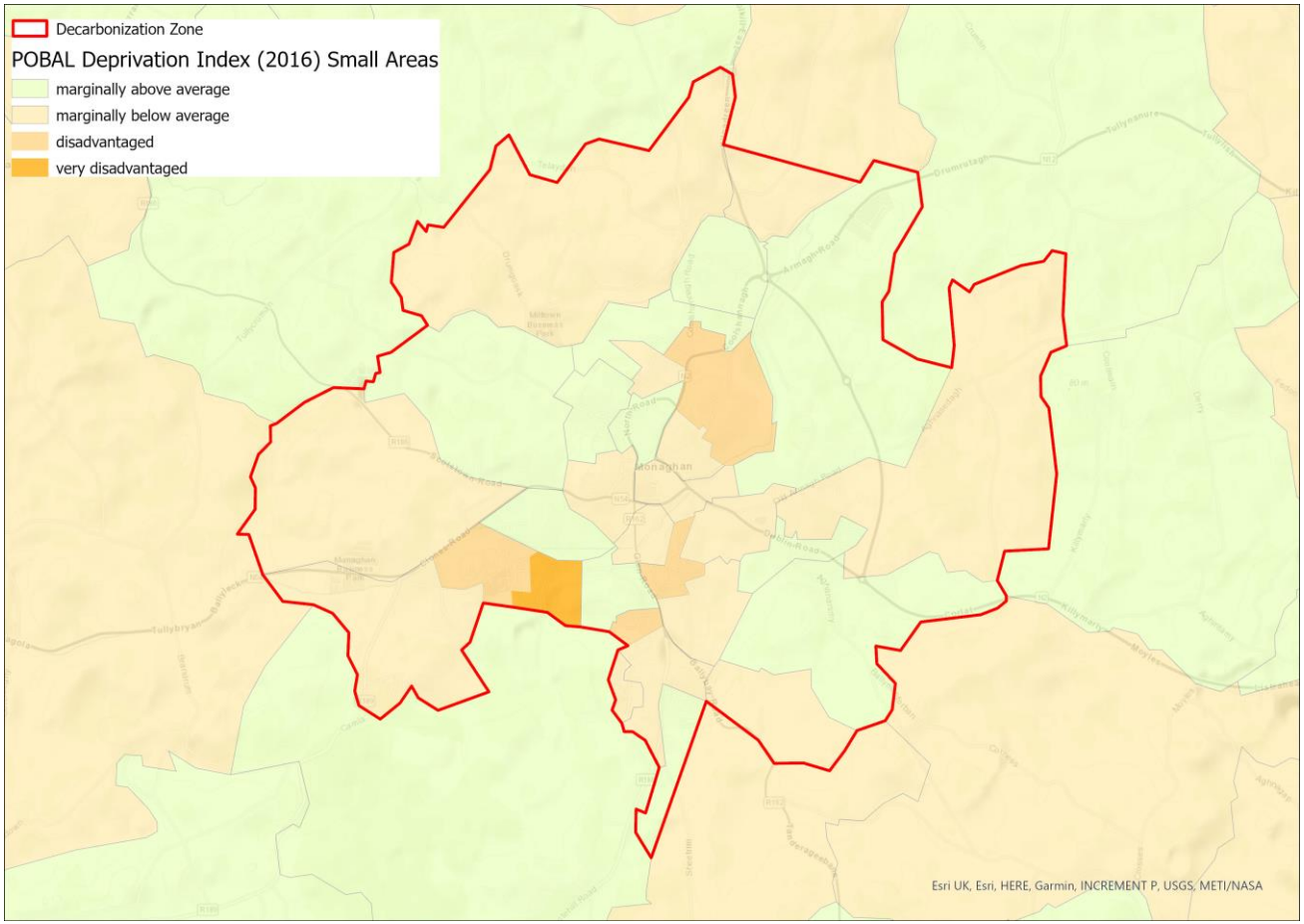


Please note, depending on the data sources available, some information beyond the DZ boundary is included in the maps contained within this report.

3.2.2.3 Socio-Economic context

Socio-Economic Snapshot 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 and understanding of these areas of unemployment and deprivation is vital when planning for climate change action. Some socio-economic groups will need assistance and encouragement to adopt climate change and decarbonisation measures to combat influencing factors such as affordability, social isolation, and housing types.
- For example, while higher socio-economic groups may be able to afford home energy saving and efficiency initiatives such as smart technology, solar panels, these initiatives are likely unaffordable for some socio-economic groups.



3.2.2.4 Socio-Economic context

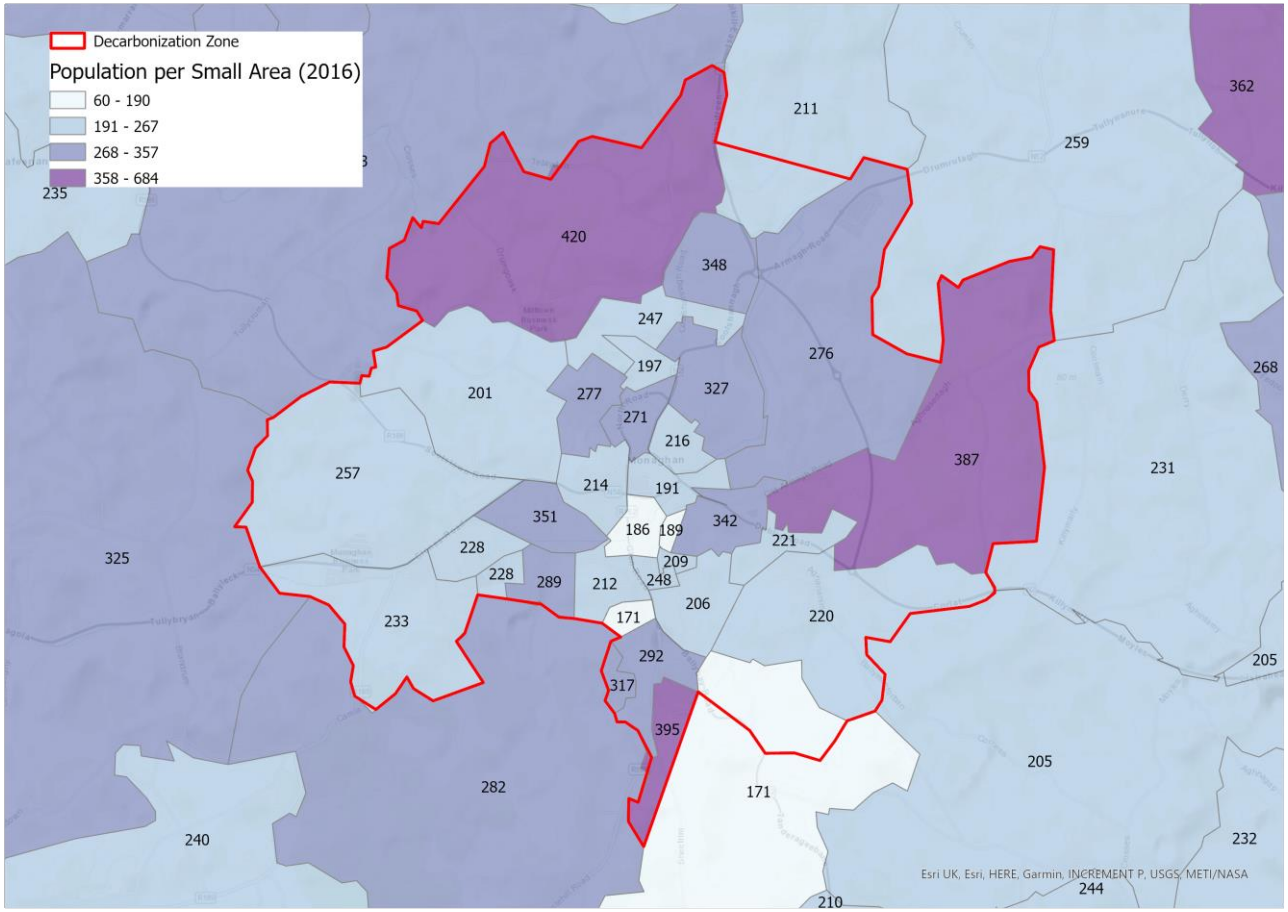
Population Density

- The highest population within the study area is found in the small areas - North West and East sections of the study area.

- Central Statistics Office (CSO) data indicated that the average household size was 2.61 in 2016. This was slightly lower than the state average of 2.75. There is a slightly higher propensity of single person households (26.3%) than the national average (23%).

- Overall the average population density of the study area was 504 people per km^2. Regionally, the population density is lower than its surrounding counties, with Carrick on Shannon's DZ's average of 680 people per km^2 and Cavan Town's D's average of 818 people per km^2.

- Population density is a key decision making consideration in decarbonisation and climate change action. For example, areas with higher population densities are more suited to certain renewable energy infrastructure projects such as district heating.



3.2.2.5 Socio-Economic context

Zoning and Development Profile

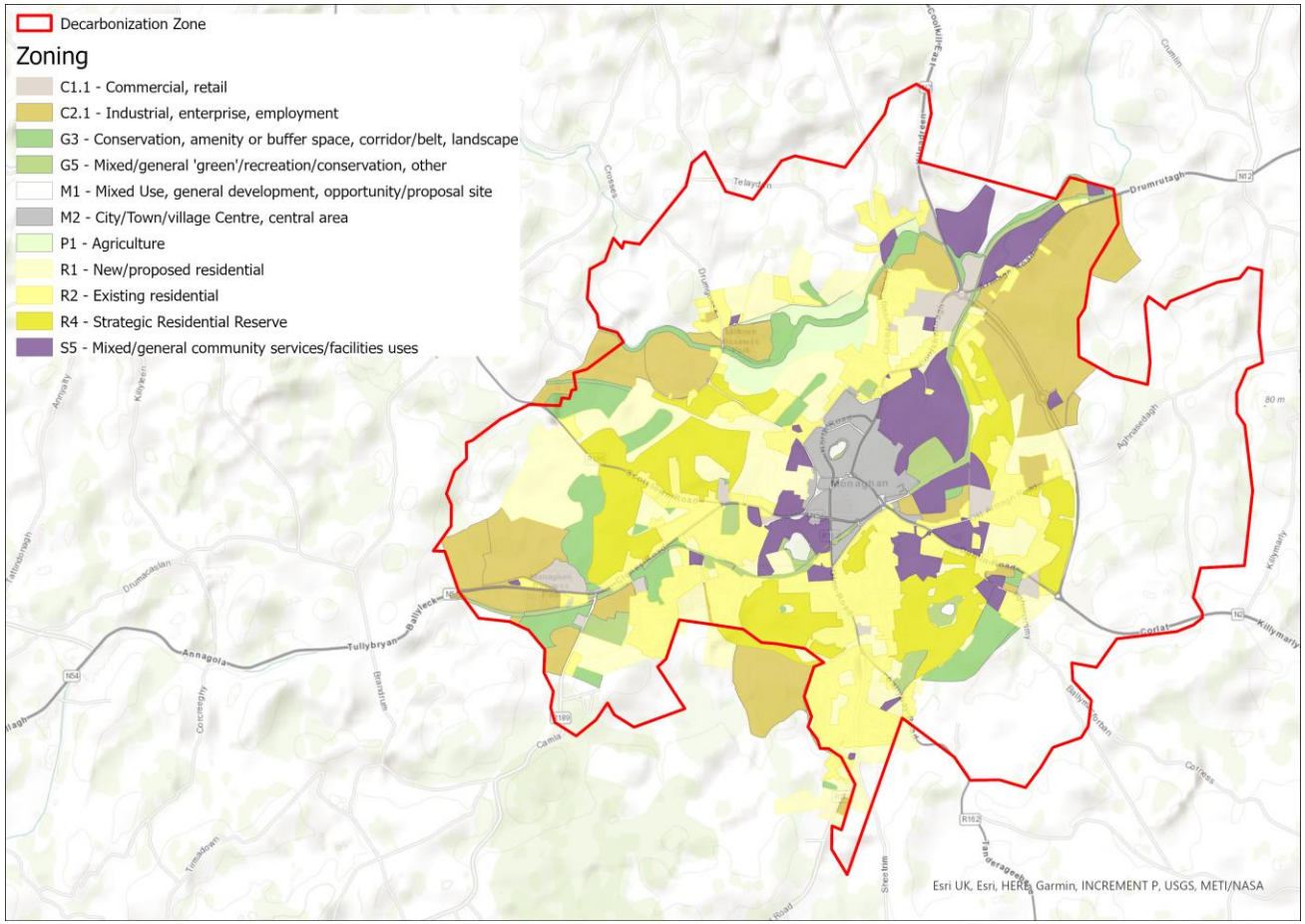
- The map to the right sets out the zoning and development profile for the DZ area, identifying the use and/or proposed use of land. Typically land may be designated for residential use; for industrial, commercial, agricultural or recreational use; as open space; or a mixture of those uses.

- According to the latest CSO figures, there are 3,240 occupied dwellings in Monaghan Town, with an additional 417 vacant dwellings.

- The average year of construction is 1980, with 31.5% of the housing stock being built in the 2000s. Approximately 31.5% of the housing stock being built prior to 1970. This will likely have a impact on energy efficiency requirements and retrofitting needs in the DZ area.

- The area also contains 454 social housing units which the local authority will have responsibility for retrofitting. The could be used as a pilot scheme to show the medium to long term benefits of energy efficiency.

Average Year of Housing Stock*	
2000+	31.5%
1971-2000	39.2%
1919-1970	23.6%
Pre 1919	5.8%



Please note, depending on the data sources used, some information within the DZ boundary is unavailable for some of the maps contained within this report.

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.

Monaghan County Council's 2023 Socio-Economic Statement outlines how it will support the County on its journey to reduce the use of fossil fuels, including within the residential sector. One of the high-level goals in the Statement aims to 'transition to a more sustainable County based around climate action, clean energy, and environmental responsibility' and achieving this goal will involve exploring the development of micro generation, community wind, and larger scale renewable energy projects which will support the residential sector in reducing its emissions.

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**.

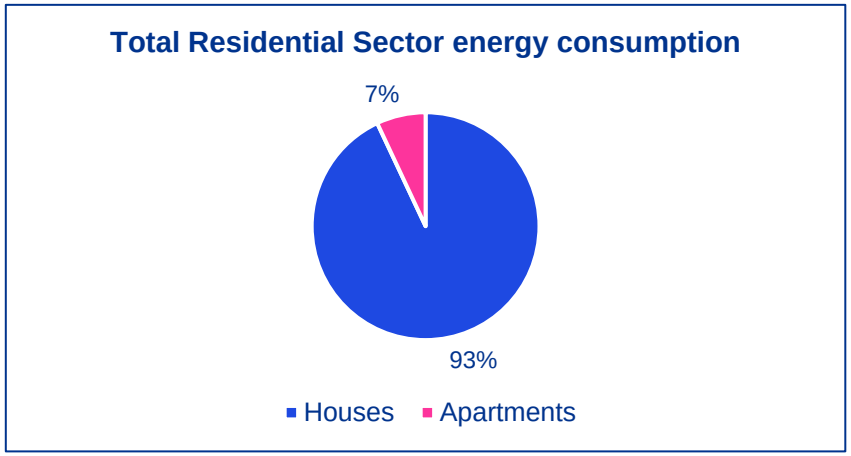
3.2.3.2 Residential Summary Results

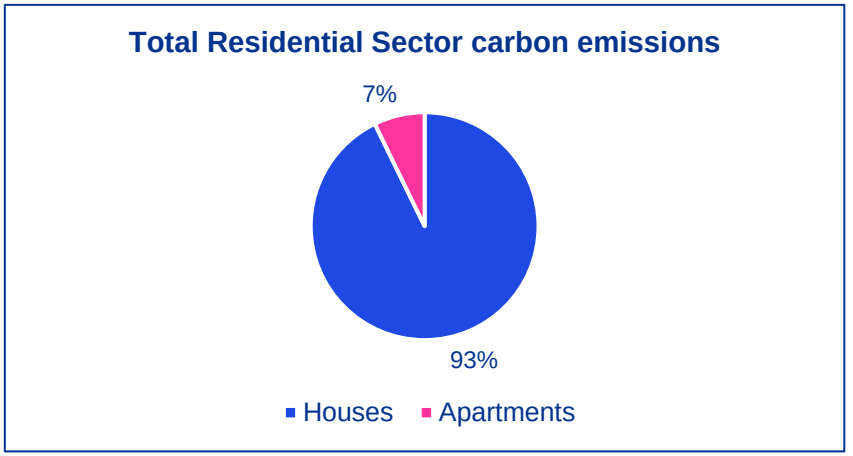
The results of the residential sector assessment are presented in the table and chart below. Note that, for the purposes of this assessment, 'occupied' residential homes have been focussed on. These account for the majority of residential homes in the DZ area.

Total energy consumption of the sector equates to **67,174 MWh**. The associated carbon emissions of the sector equate to approximately **19,075 tCO_2e**. The 'Houses' within the DZ account for ~93% of the sector's energy consumption and ~89% of the sector's total carbon emissions. Whereas, the 423 'Apartments' within the DZ account for the remaining ~7% of total residential energy consumption and ~11% of carbon emissions.

	Energy Consumption (MWh/ year)
Houses	62,482
Apartments	4,692
Total energy consumption	**67,174**

	Carbon emissions (tCO_2e)
Houses	17,699
Apartments	1,376
Total carbon emissions	**19,075**





3.2.3.3 Residential Sector Analysis

Residential Sector: Age of Housing Stock

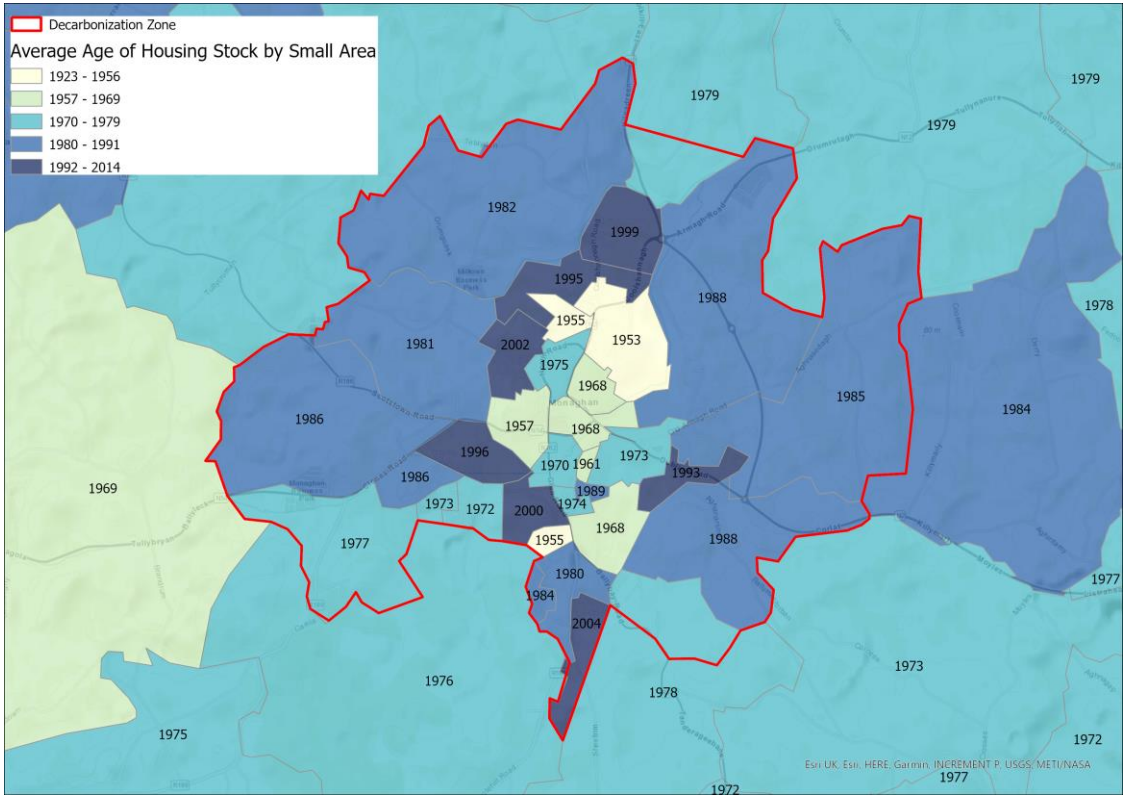
- The age of housing stock in an area has a strong correlation with energy efficiency, consumption and demand, including this DZ area. Energy use is a proxy for carbon emissions and therefore, in general, older housing stock may mean higher carbon emissions.

- Age of construction of residential housing stock ranges from pre-1919 to 2018. The average year of construction is 1980 with approximately 70% of the housing stock being built since 1970. Approximately 30% of the residential units have been built pre-1970s. This is summarised on the table below.

- The map on the right provides an overview of the average year of construction of residential housing stock within each SA. This is based on the average year of construction of the housing stock combined with the frequency of each residential housing stock to estimate average construction year by SA.

- Focussing on the more populated area of Monaghan town centre, there is a similar trend – the average housing stock for the small areas is dated at the older end of the stock (~1960s), whereas the younger housing stock is in the immediate perimeter of the town centre (particularly the north and south) before aging again into more rural areas.

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



Average Year of Housing Stock*	
2000+	31.5%
1971-2000	39.2%
1919-1970	23.6%
Pre 1919	5.8%

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., 1970-1979". 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.*

3.2.3.4 Residential Sector Analysis

Residential Sector: Energy Efficiency & BER rating

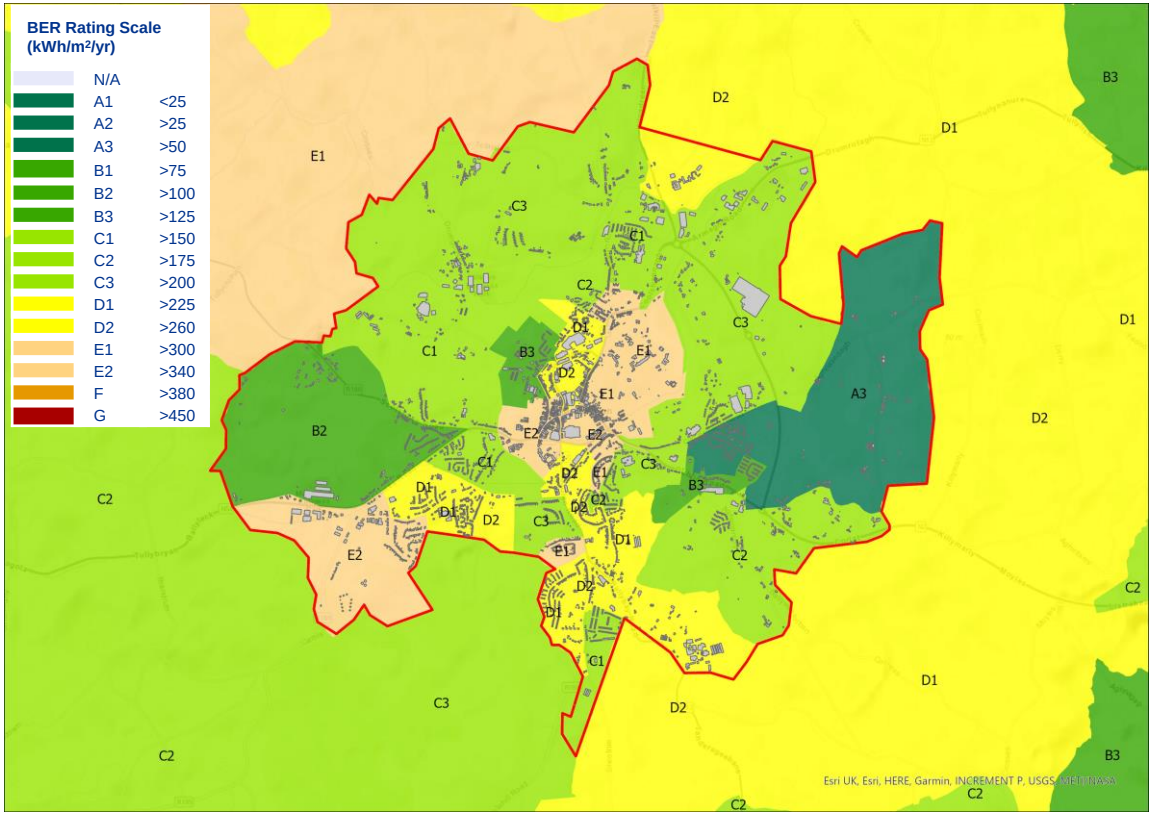
- A Building Energy Rating (BER) Certificate supports the understanding of the energy efficiency of a home. It is a helpful indicator for the likely energy consumption of a home and its associated carbon emissions. It uses a scale of A to G, with A-rated homes being the most energy-efficient and comfortable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

- BER ratings in the Monaghan Town DZ area range from A1 rated buildings to E2. The map on the right presents the range of BER ratings across the DZ area. Note that these BER ratings are average ratings.

- The table below sets out the average BER rating by residential type, displayed by ED.

- Note that residential BER ratings are only available for a limited number of residential dwellings.

- 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
Monaghan Rural	135	148	156	155
Monaghan Urban	203	197	197	177

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:

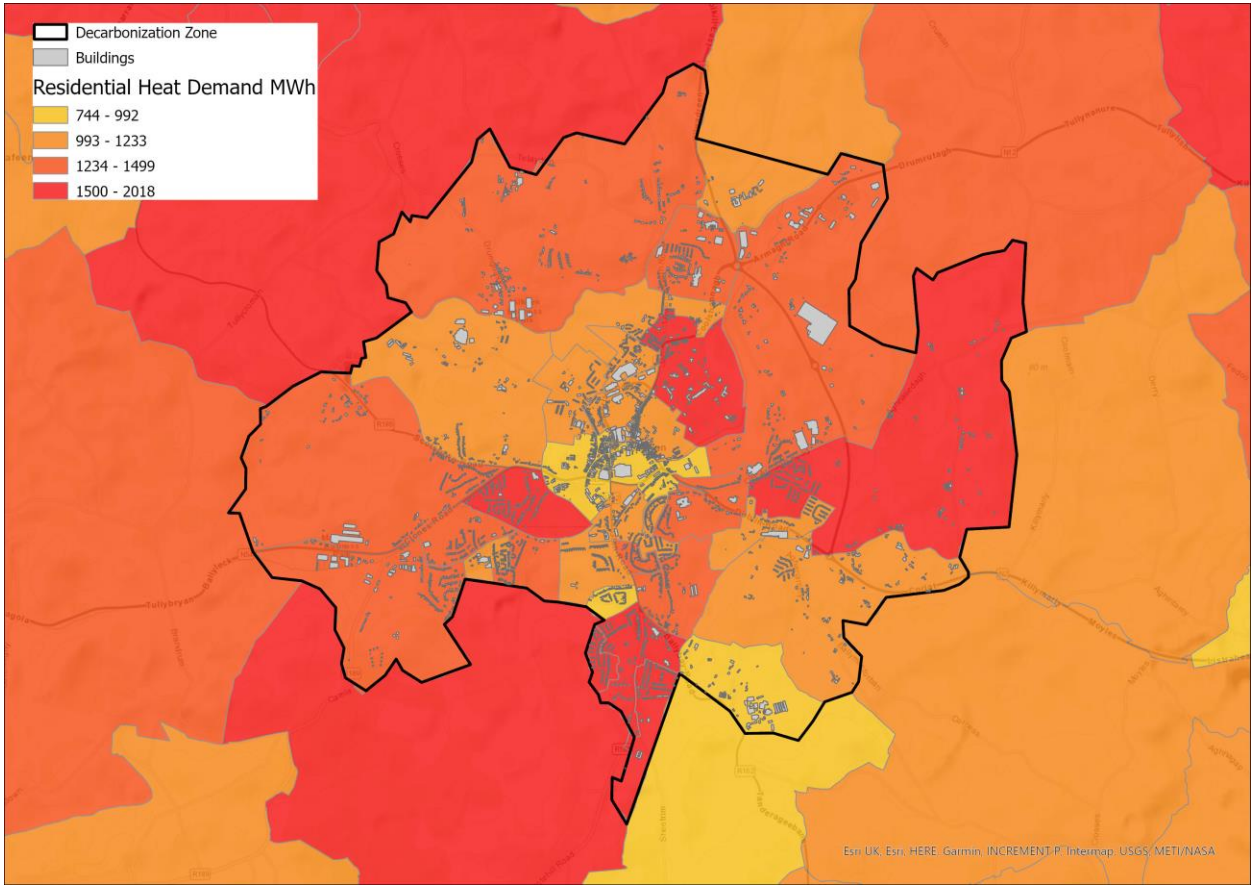
Building type (a residential dwelling, a commercial or public sector building or an industrial site)

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 Monaghan Town DZ follows a similar pattern across the EDs, with higher heat demand observed in and around the more densely populated areas of the town – those areas should be considered as a priority area with targeted actions to reduce this demand. The map on the right provides a visual representation of heat demand per m^2 of the DZ area.

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

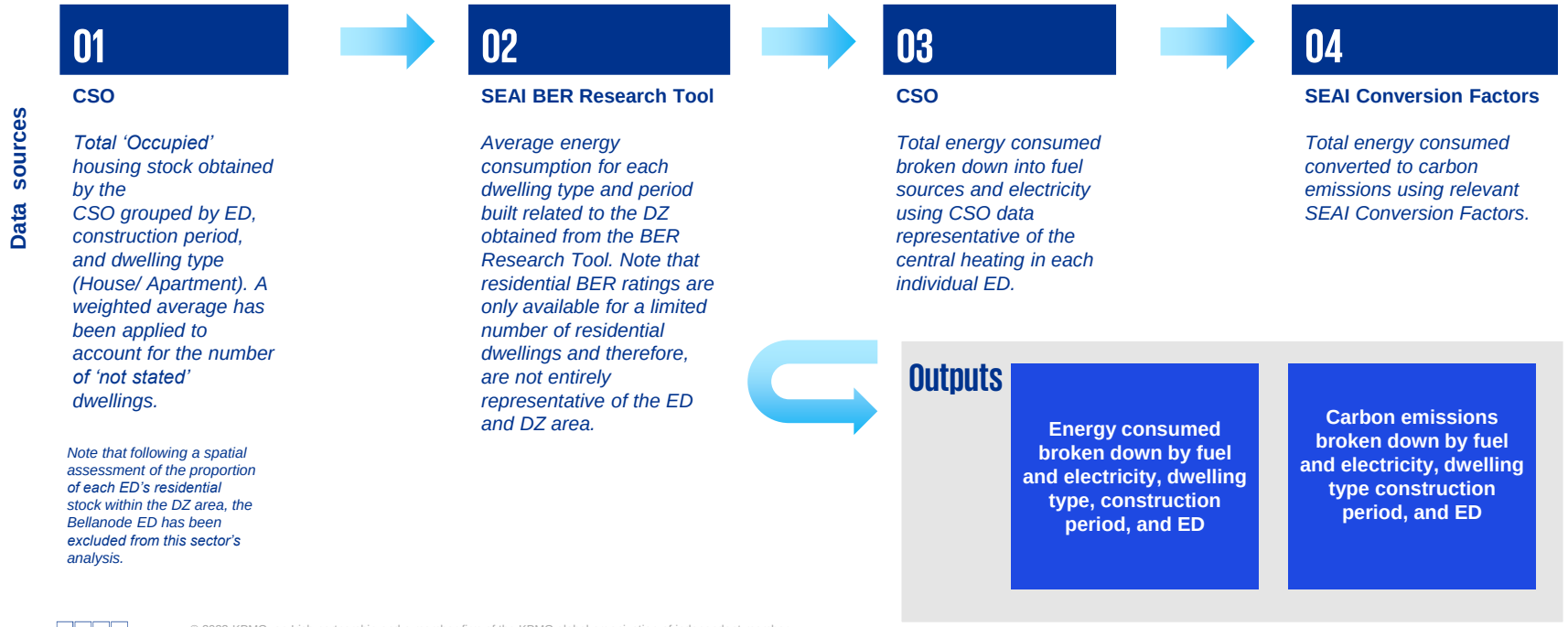


3.2.3.6 Residential Sector Analysis

Residential Sector: Energy & Carbon Emissions

To estimate residential sector energy consumption and associated carbon emissions within the Monaghan Town DZ, a number of non-spatial data points have been used. Occupied' homes, as defined by the 2016 CSO database, account for the majority of residential homes in the DZ area, at 84.5%. These 'Occupied' homes are included in the assessment. 'Other vacant dwellings' (13.2%), 'temporarily absent' (2.0%), and 'unoccupied holiday homes' (0.4%) account for the remaining ~15% of residential stock – these are excluded from the assessment. 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**



3.2.3.7 Residential Sector Analysis

Residential Sector: Occupied Dwellings: Energy & Carbon Emissions

Total residential sector energy consumption and associated carbon emissions of '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'. The individual energy split of each ED has been applied to the total energy consumption across all households within each of the EDs.

Further information on the ED's energy spits are included in the **Appendix**.

	Energy Source	Coal	Peat	Oil	LPG	Natural Gas	Renewables	Electricity	Wood	Total
Energy consumption (MWh)	Houses	5,707	118	47,537	680	1,913	213	5,732	582	62,482
	Apartments	326	10	2,557	117	463	19	1,172	28	4,692
	Total	6,033	127	50,095	797	2,376	232	6,904	610	67,174
Carbon emissions (tCO_2e)	Houses	1,944	42	13,006	156	392	-	2,151	9	17,699
	Apartments	111	3	700	27	95	-	440	0	1,376
	Total	2,055	45	13,706	183	486	-	2,590	9	19,075

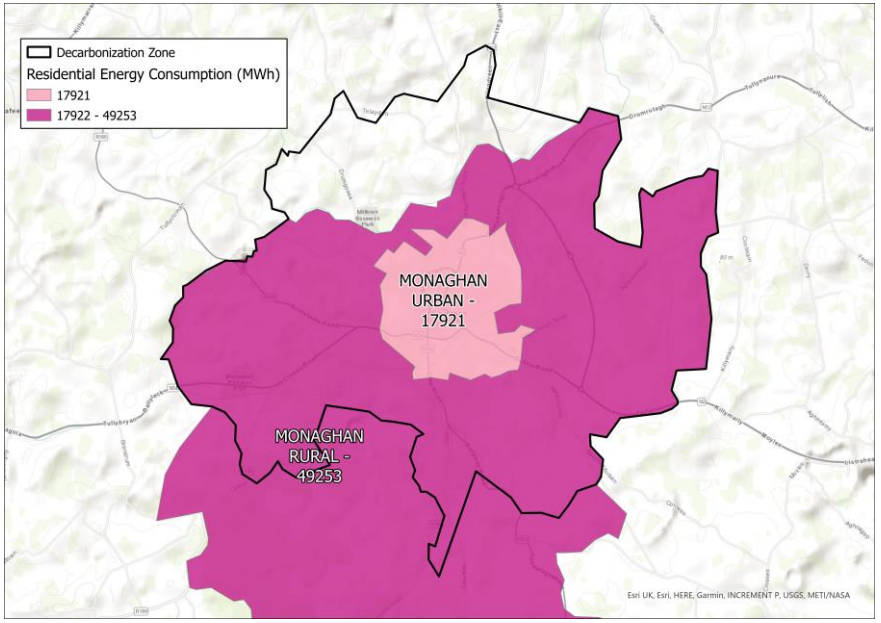
3.2.3.8 Residential Sector Analysis

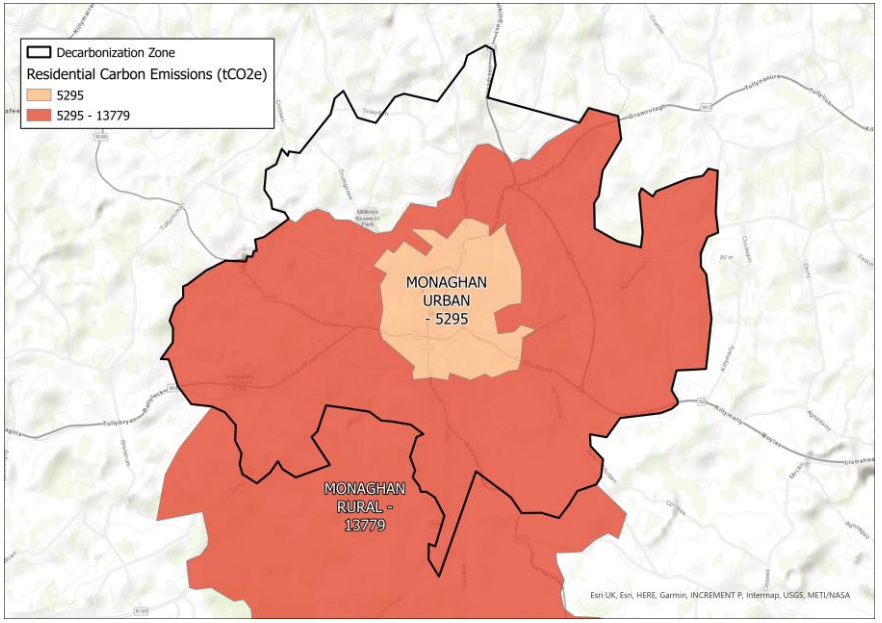
Residential Sector: Occupied Dwellings: Energy & Carbon Emissions

Total residential sector energy consumption and associated carbon emissions within the Monaghan Town DZ is presented by ED below. A visual representation of energy and emissions across the DZ area is presented below.

ED	Energy Consumption (MWh)
Monaghan Rural	49,253
Monaghan Urban	17,921
Total	**67,174**

ED	Carbon emissions (tCO_2e)
Monaghan Rural	13,779
Monaghan Urban	5,295
Total	**19,075**





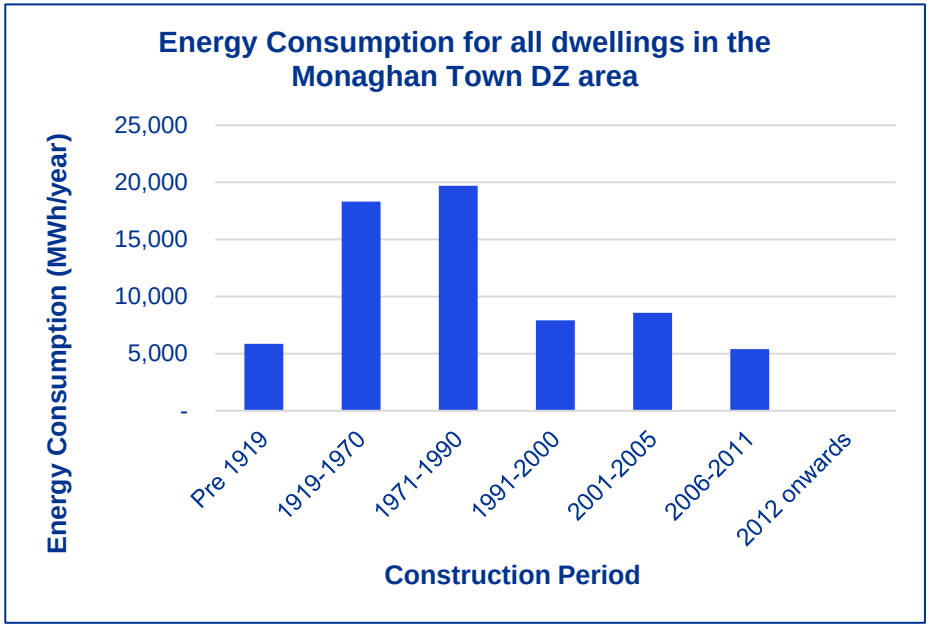
Please note, depending on the data sources used, some information within the DZ boundary is unavailable for some of the maps contained within this report.

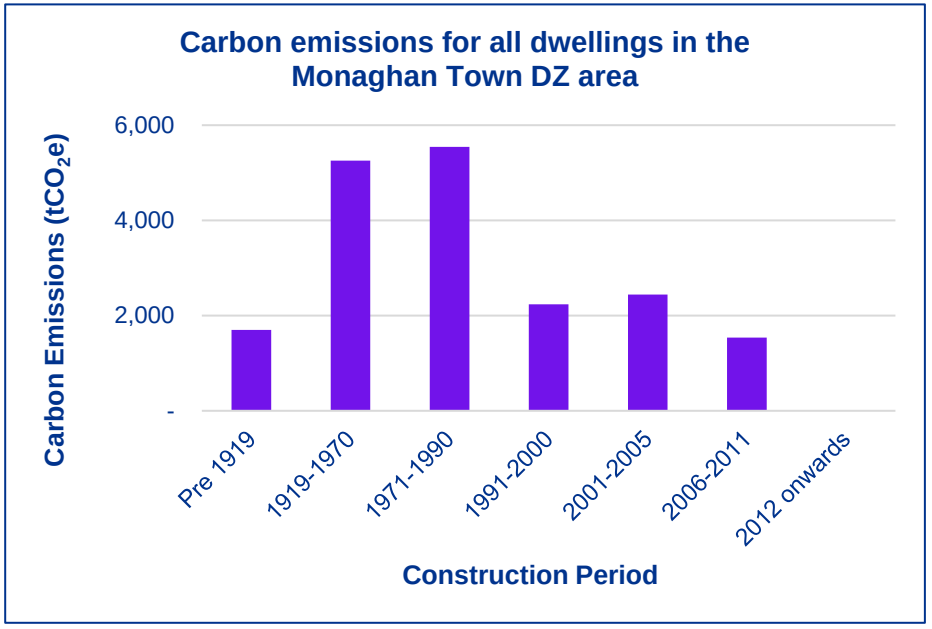
3.2.3.9 Residential Sector Analysis

Residential Sector: Occupied Dwellings: Energy & Carbon Emissions

Total residential sector energy consumption and associated carbon emissions within the Monaghan Town DZ is presented by construction period for all dwellings below. The majority of households (~51%) in the DZ were built during the construction periods of 1919-1970, and 1971-1990, and as shown below, these periods account for the highest proportion of both energy consumption and carbon emissions (~58% of total energy consumption and carbon emissions).

Although only approximately ~6% of all dwellings were constructed during the 'Pre 1919' construction period, these dwellings account for 9% of both total energy consumption and carbon emissions. The older building fabric of these dwelling leads to lower energy efficiency which likely results in their high energy consumption and carbon emissions.





3.2.3.10 Residential Sector Analysis

Residential Sector: Social Housing: Energy & Carbon Emissions

Social housing (within the residential sector) energy consumption and associated carbon emissions within the Monaghan Town DZ area has also been included in our analysis using a number of non-spatial data points to inform the assessment. Total number of social housing units has been provided by Monaghan County Council – 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 source	Coal	Peat	Oil	LPG	Natural Gas	Renewables	Electricity	Wood	Total
Energy consumption (MWh)	Social Housing units	651	61	6,117	293	1,234	108	1,123	114	9,701
Carbon emissions (tCO_2e)	Social Housing units	222	22	1,674	67	253	-	421	2	2,660

The table to the right 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 (190 out of 454 total) and therefore, are not entirely representative of social housing in the ED and DZ area.

The social housing units in the DZ area account for approximately 14.0% of the total residential stock. When compared to the entire DZ area, the social housing units account for approximately 13.9% of total residential energy consumption and 14.4% of total residential carbon emissions. These findings suggest that the number of social housing units is proportional to its energy consumption and carbon emissions produced.

Average BER rating by residential building type

Unit: kWh/m2/year	Residential building type	
ED	**Apartment**	**Terraced**
Apartment	135	203
Terraced	148	197
Semi-detached	156	197
Detached	155	177

BER Rating Scale (kWm/m²/yr)

N/A	
A1	<25
A2	>25
A3	>50
B1	>75
B2	>100
B3	>125
C1	>150
C2	>175
C3	>200
D1	>225
D2	>260
E1	>300
E2	>340
F	>360
G	>450

3.2.3.11 Residential Sector Analysis

Residential Sector: Social Housing: Energy & Carbon Emissions

Total energy consumption and associated carbon emissions of social housing units within the Monaghan Town DZ is presented by ED below.

ED	Energy Consumption (MWh)
Monaghan Rural	6,609
Monaghan Urban	3,092
Total	**9,701**

ED	Carbon emissions (tCO_2e)
Monaghan Rural	1,737
Monaghan Urban	923
Total	**2,660**

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.

- According to the 2023 draft socio-economic statement for Monaghan County, the commercial vacancy rate (as of Q4 of 2022) for Monaghan stood at 13.7%. Vacant buildings can be regarded as inefficient land usage in area, offering very little to the local economy in terms of employment and services, and potentially contributing to carbon emissions. As hybrid working becomes more common, the use of offices and commercial buildings may be reconsidered to ensure building use is as optimal as possible.

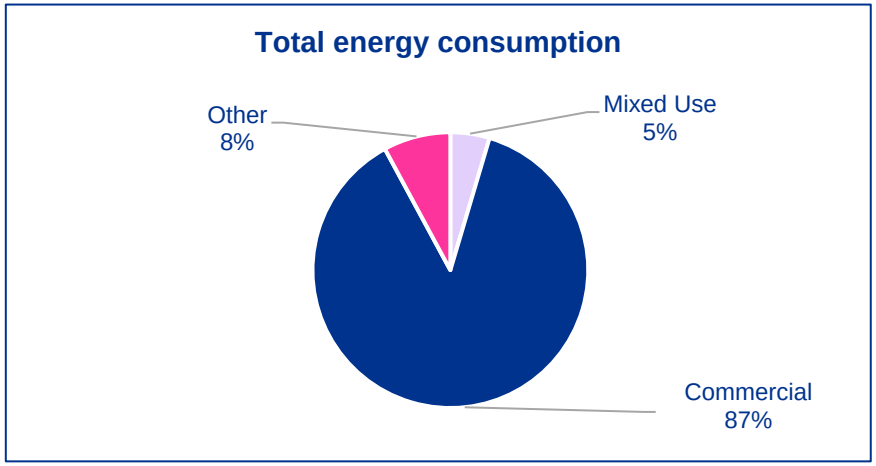
3.2.4.2 Commercial & Public Sector Summary Results

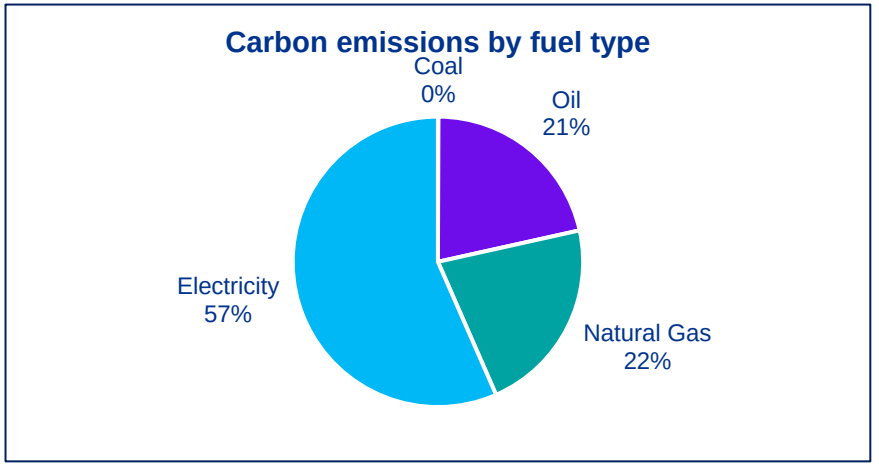
The results of the commercial and public sector assessment are presented in the table and chart below. Note that, for the purposes of this assessment, commercial and public sector buildings have been sub-categorised into 'mixed use', 'commercial' and 'other', as per the OSI dataset from which they are derived from. Further detail on the types of buildings contained within these categories are provided in the pages that follow. These account for the majority of commercial and public sector buildings in the DZ area.

Total energy consumption of the sector equates to **103,389 MWh**. The associated carbon emissions of the sector equate to approximately **29,601 tCO_2e**. The 288 commercial buildings within the DZ primarily rely upon electricity as their primary fuel source. Electricity is used to power 57% of commercial buildings in the DZ.

Building type	Total energy use (MWh)	Total carbon emissions (tCO_2e)
Mixed Use	4,745	1,358
Commercial	90,493	26,082
Other	8,150	2,161
Total	**103,389**	**29,601**

Energy source	Carbon emissions (tCO_2e)
Coal	17
Oil	6,354
Natural Gas	6,486
Electricity	16,744
Total	**29,601**





3.2.4.3 Commercial & Public Sector Analysis

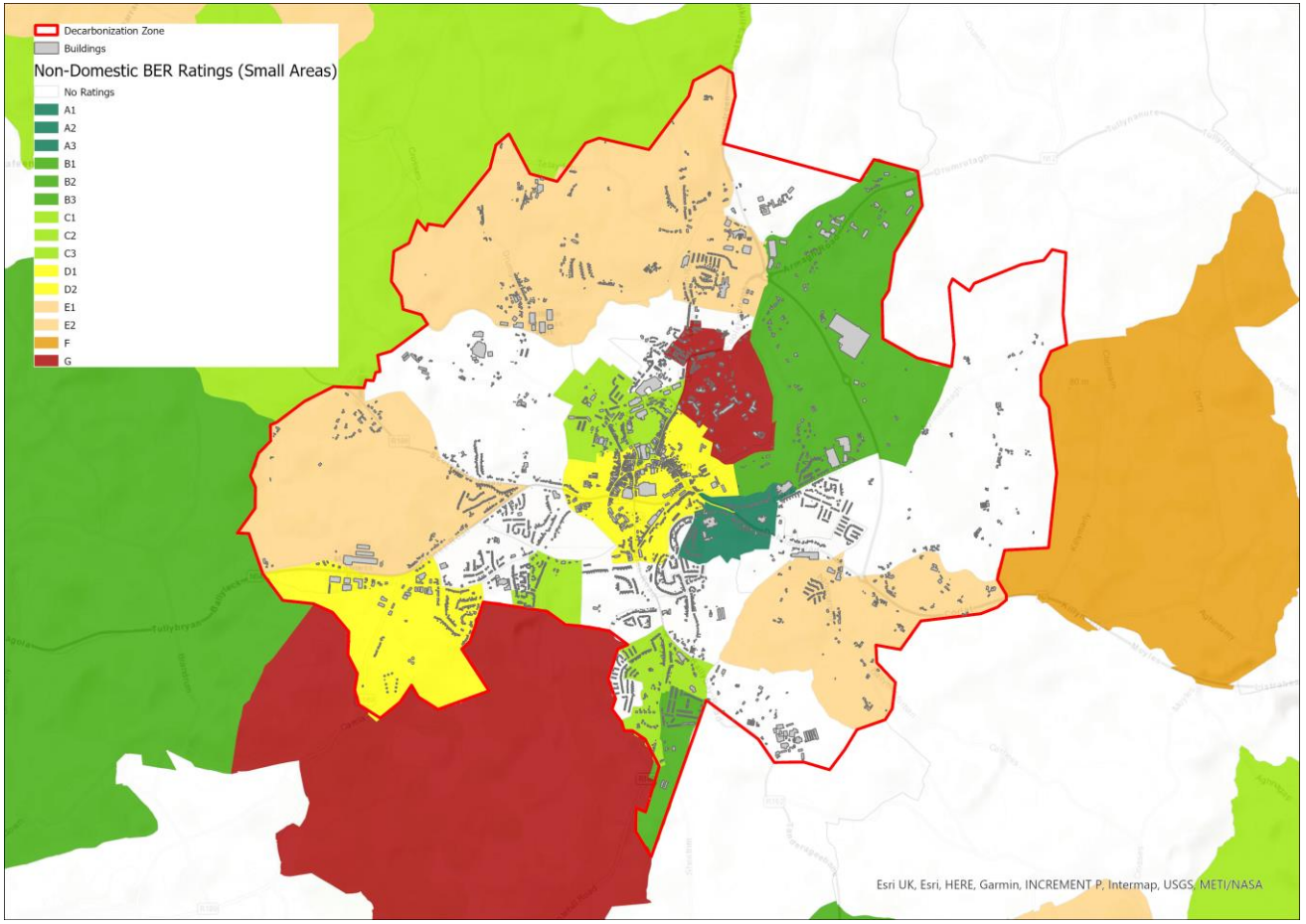
Commercial & Public Sector: Energy Efficiency & BER Rating

- 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 Monaghan DZ area range from A1 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.

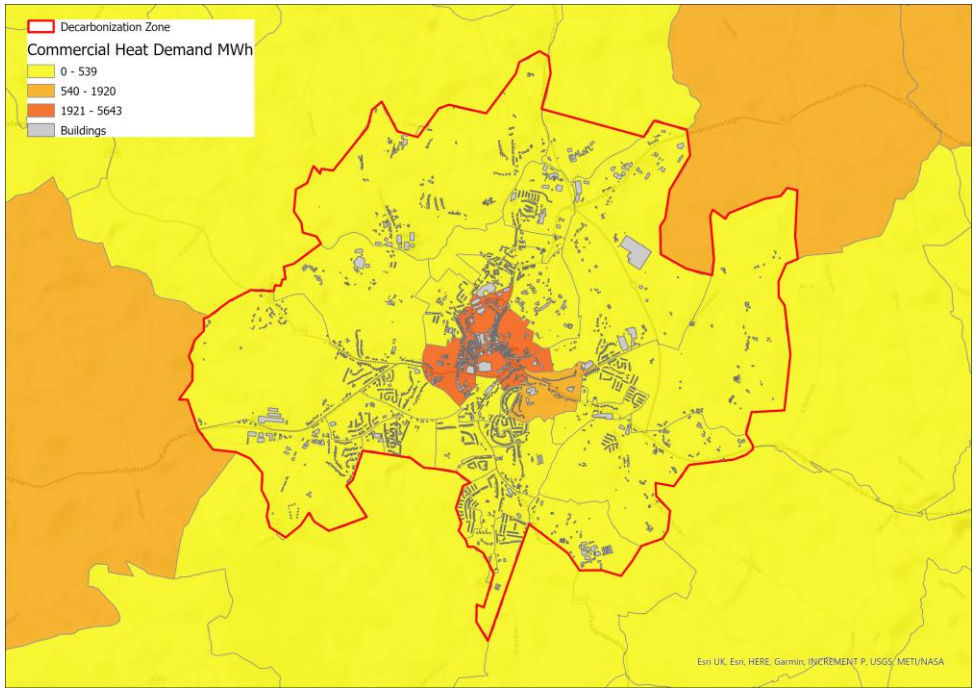
- Note that BER ratings are only available for a limited number of commercial & public sector buildings.

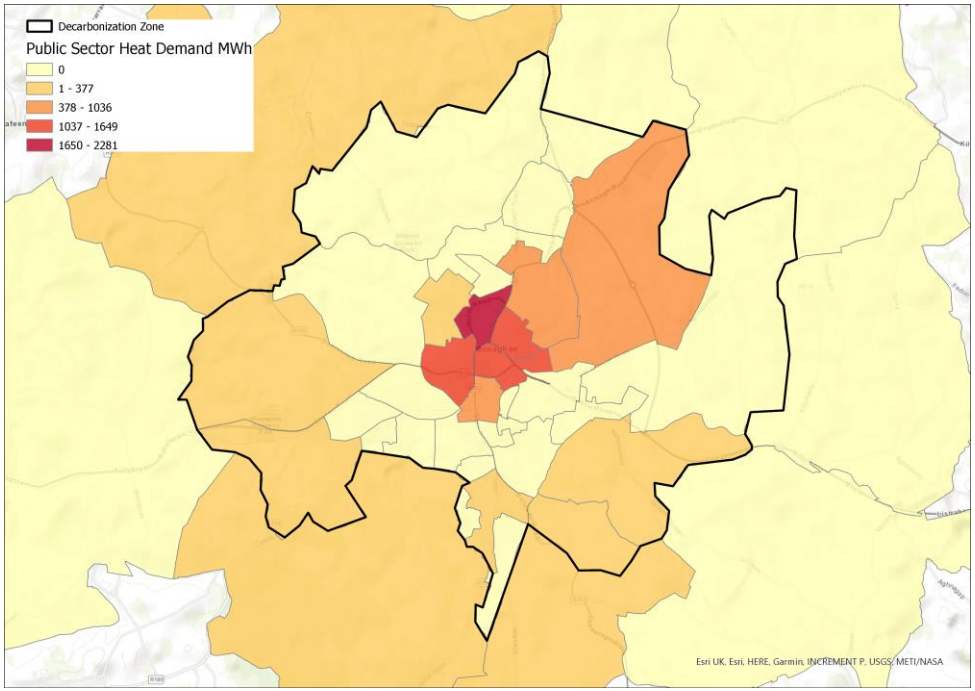
- Energy efficiency opportunities should be explored, including the use of heat pumps and other renewable energy sources to support the decarbonisation of the DZ area as well as to contribute to wider national energy and climate targets.



3.2.4.4 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 industrial site),
- The type of fuel used to generate the heat,
- Other metrics such as the area of the buildings, and current planned energy efficiency measures

- Heat demand in the Monaghan DZ follow a similar pattern across the EDs, with higher heat demand observed in and around the more populated and active region of Monaghan town centre – this area should be considered and prioritised with targeted actions to reduce this demand.
- The maps provided here provide a visualisation of heat demand across the DZ area.
- Heat demand is further explored in the Energy & Electricity Sector section.

3.2.4.5 Commercial & Public Sector Analysis

Commercial & Public Sector: Energy & Carbon Emissions

To estimate commercial and public 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. 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 has not been 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**

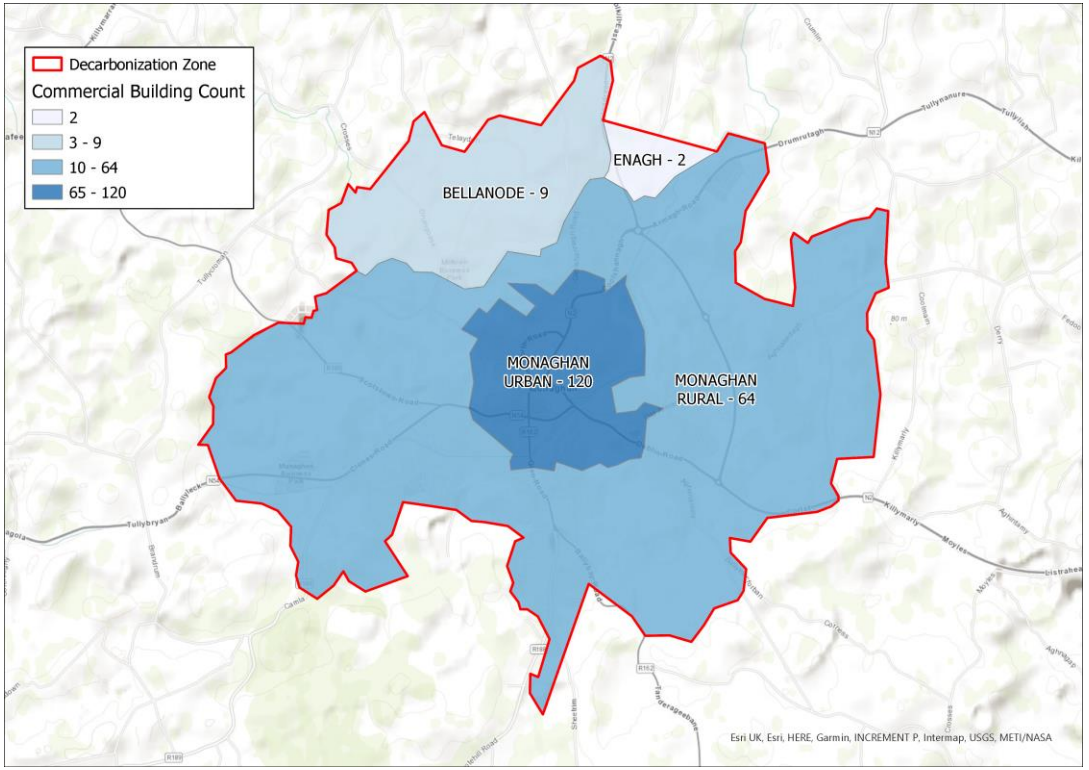
3.2.4.6 Commercial & Public Sector Analysis

Commercial & Public Sector: Buildings Number & Locations

Commercial and public sector building types are shown in the table and map below. Both the table and map provide a breakdown of building types by ED. The vast majority of commercial and public sector buildings in the Monaghan DZ are located within the Monaghan Urban ED, decreasing outwards with 64 in the Monaghan Rural ED, and less in Bellanode and Enagh on the border DZ area.

The table below breaks commercial and public sector building types into three categories: 'Mixed Use', 'Commercial' and 'Unknown'. The 'Mixed Use' category refers to building types with multiple uses, such as commercial and retail and commercial and residential. The 'Commercial' category refers to building types including churches, clubhouses, hotels and garda stations. The 'Unknown'* category refers to building types including glasshouses, day centres, and factories.

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



	Building Type			
ED	**Mixed Use**	**Commercial**	**Unknown**	**Total**
BELLANODE	0	9	0	9
ENAGH	1	1	0	2
MONAGHAN RURAL	1	63	0	64
MONAGHAN URBAN	17	101	2	120
Total	**19**	**174**	**2**	**195**

The 'Unknown' category is a result of a GeoDirectory allocation of points that were labelled as 'unknown'. The building types included in this category are detailed in the **Appendix.*

3.2.4.5 Commercial & Public Sector Analysis

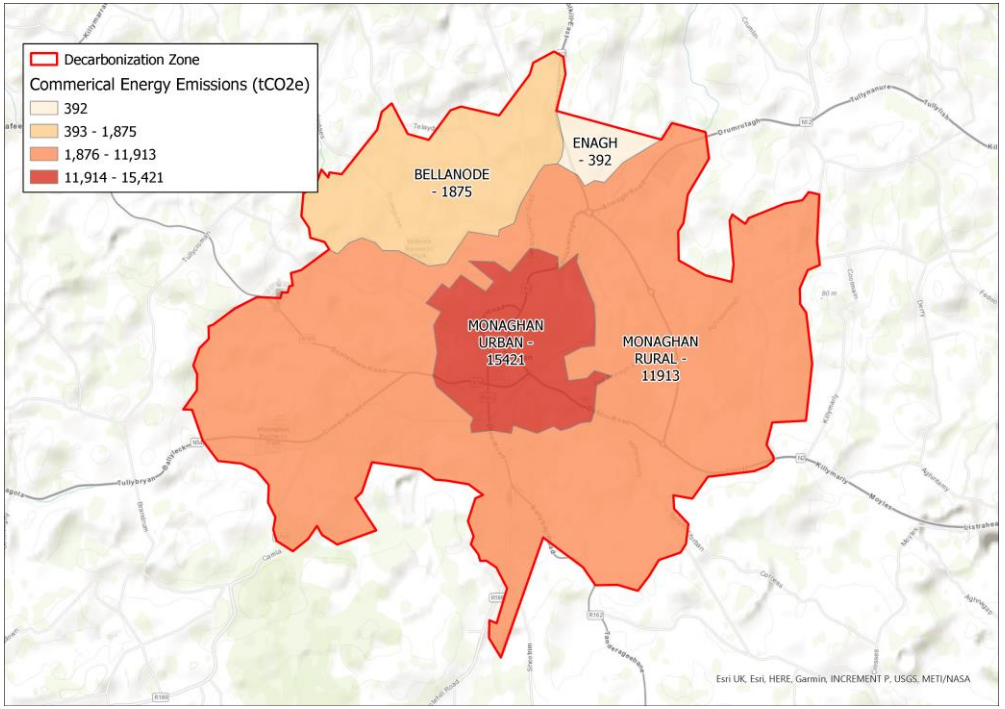
Commercial & Public Sector: Energy & Carbon Emissions

Total commercial and public sector energy consumption and associated carbon emissions within the Monaghan DZ is presented by building type and energy split below. As noted, energy split assumed for this analysis is representative of the national energy split for the commercial and public sector and may not reflect the actual energy split within the DZ area.

In addition, the map displays carbon emissions by ED, further supported by the information on the subsequent page.

Building type	Fuel use (MWh)	Electricity use (MWh)	Fuel related carbon emissions (tCO_2e)	Electricity related carbon emissions (tCO_2e)
Mixed Use	2,699	2,046	591	768
Commercial	50,327	40,166	11,012	15,070
Other	5,736	2,415	1,255	906
Total	**58,762**	**44,627**	**12,857**	**16,744**
Total	**103,389**		**29,601**	

Energy source	Energy consumption (MWh)	Carbon emissions (tCO_2e)
Coal	50	17
Oil	23,224	6,354
Natural Gas	31,685	6,486
Renewables	3,802	-
Electricity	44,627	16,744
Total	**103,389**	**29,601**



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.

- Monaghan's draft 2023 LECP highlighted that existing public transport in the county is a constraint, with low levels of accessibility in the county. '*Supporting the development of sustainable transport alternatives specifically developed for rural communities'* is one of the actions outlined in the LECP which will be a key enabler in the shift towards 'active travel' across the County.

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

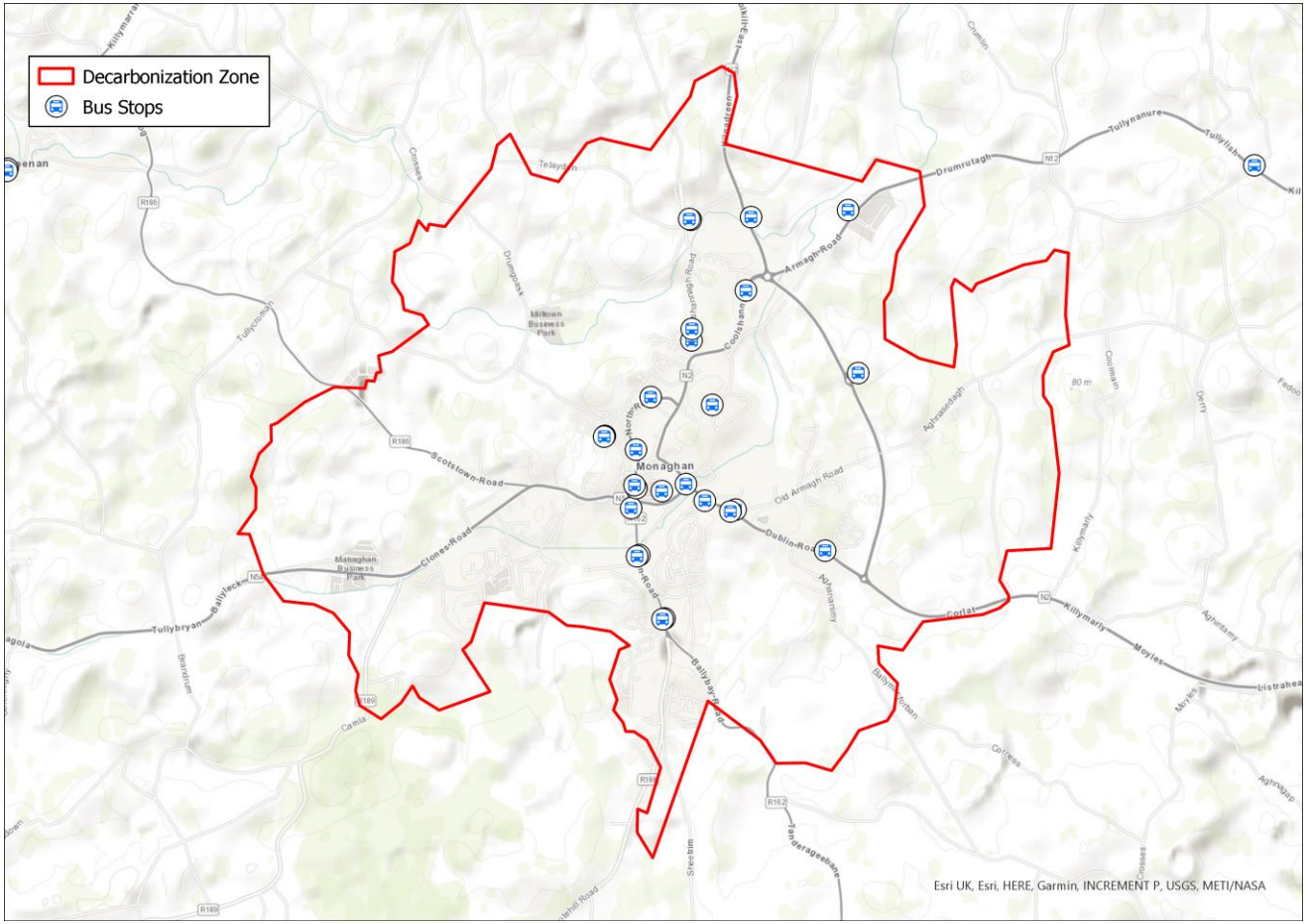
3.2.5.2 Transport Sector Analysis

Transport Sector: Public Transport

- Buses are the key public transport within the study area with several unique public and private operators such as Bus Eireann and Local link. In total the study area contains 26 Bus stops.

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

- The uptake of ‘Green’ transport methods such as Buses, Electric vehicles, and walking are vital in the reduction of Irelands overall emissions and an increase in the general health of a population through reduced air pollutants.



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 Monaghan. 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 Monaghan Town 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.

Transport mode	Total energy consumption by transport mode in the DZ area (MWh)				
	Oil	Natural Gas	Renewables	Electricity	Total
Road Freight	44,631	2	1,913	-	**46,546**
Road Light Goods Vehicle	10,919	-	468	-	**11,387**
Road Private Car	38,545	-	1,523	21	**40,089**
Public Passenger Services	1,864	-	79	-	**1,943**
Total	**95,959**	**2**	**3,984**	**21**	**99,965**

Transport mode	Total carbon emissions by transport mode in the DZ area (tCO_2e)				
	Oil	Natural Gas	Renewables	Electricity	Total
Road Freight	11,778	0.4	-	-	**11,779**
Road Light Goods Vehicle	2,881	-	-	-	**2,881**
Road Private Car	10,014	-	-	8	**10,022**
Public Passenger Services	491	-	-	-	**491**
Total	**25,165**	**0.4**	**-**	**8**	**25,173**

3.2.5.5 Transport Sector Analysis

Transport Sector: Commuting & Carbon Emissions

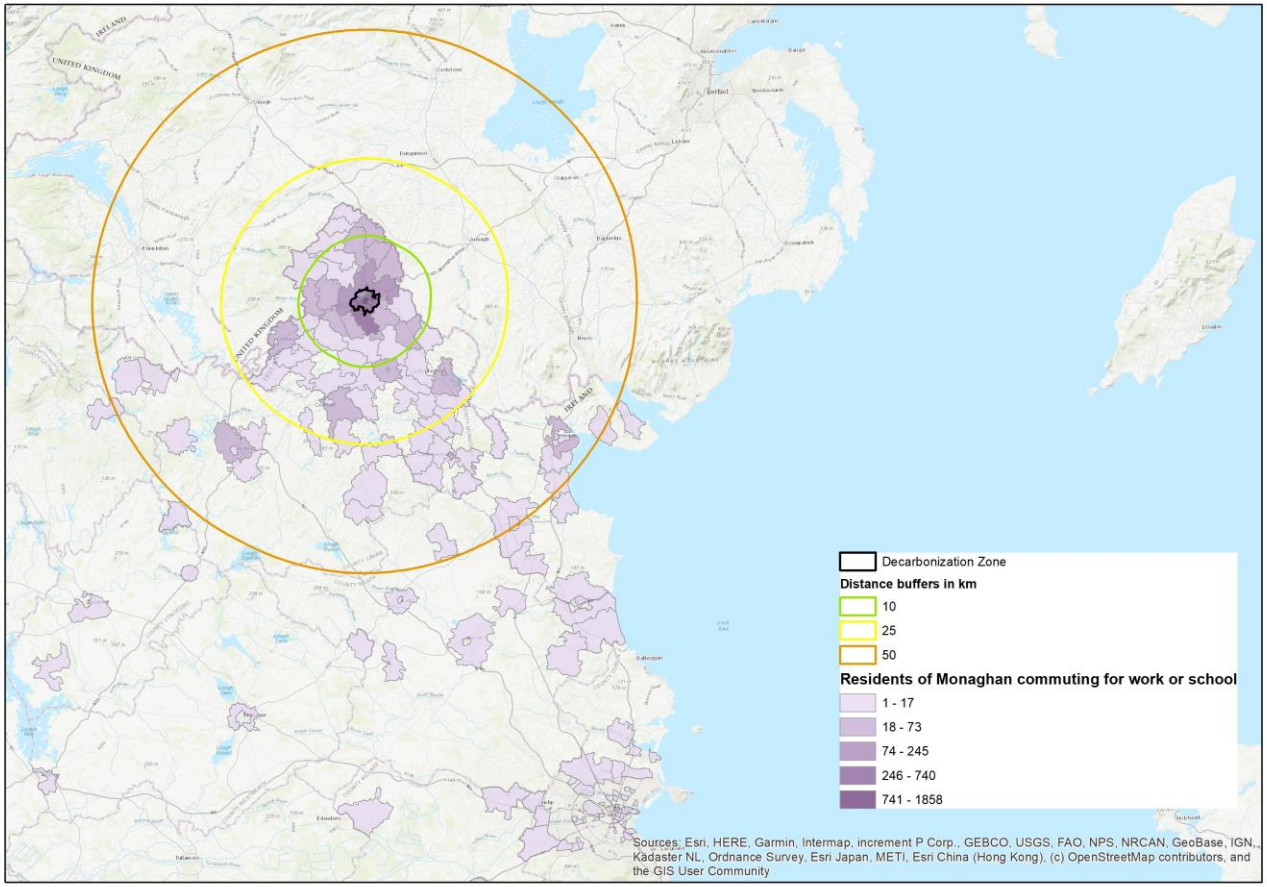
Using POWSCAR data, commuters to the DZ area and from the DZ area to attend work, college or school on a daily basis from within the DZ area and from surrounding areas has been explored. Carbon emissions associated with these commuting patterns are estimated using distances taken from POWSCAR and assumptions 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 28% 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 50% of households own a car, approximately 23% own two cars and approximately 22% 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



Please note, there is no equivalent of POWSCAR data for Northern Ireland

- 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 Monaghan Urban ED. To provide for a proportional assessment, commuters travelling to the top 90% of EDs are included in the carbon emissions estimate. An uplift is then applied to the resulting carbon emissions to represent 100% of commuters.
- It is estimated that these daily commuter trips leaving the DZ area, and assumed to then return, contribute approximately **3,383 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	**3,383**

3.2.5.7 Transport Sector Analysis

Transport Sector: Commuting & Carbon Emissions

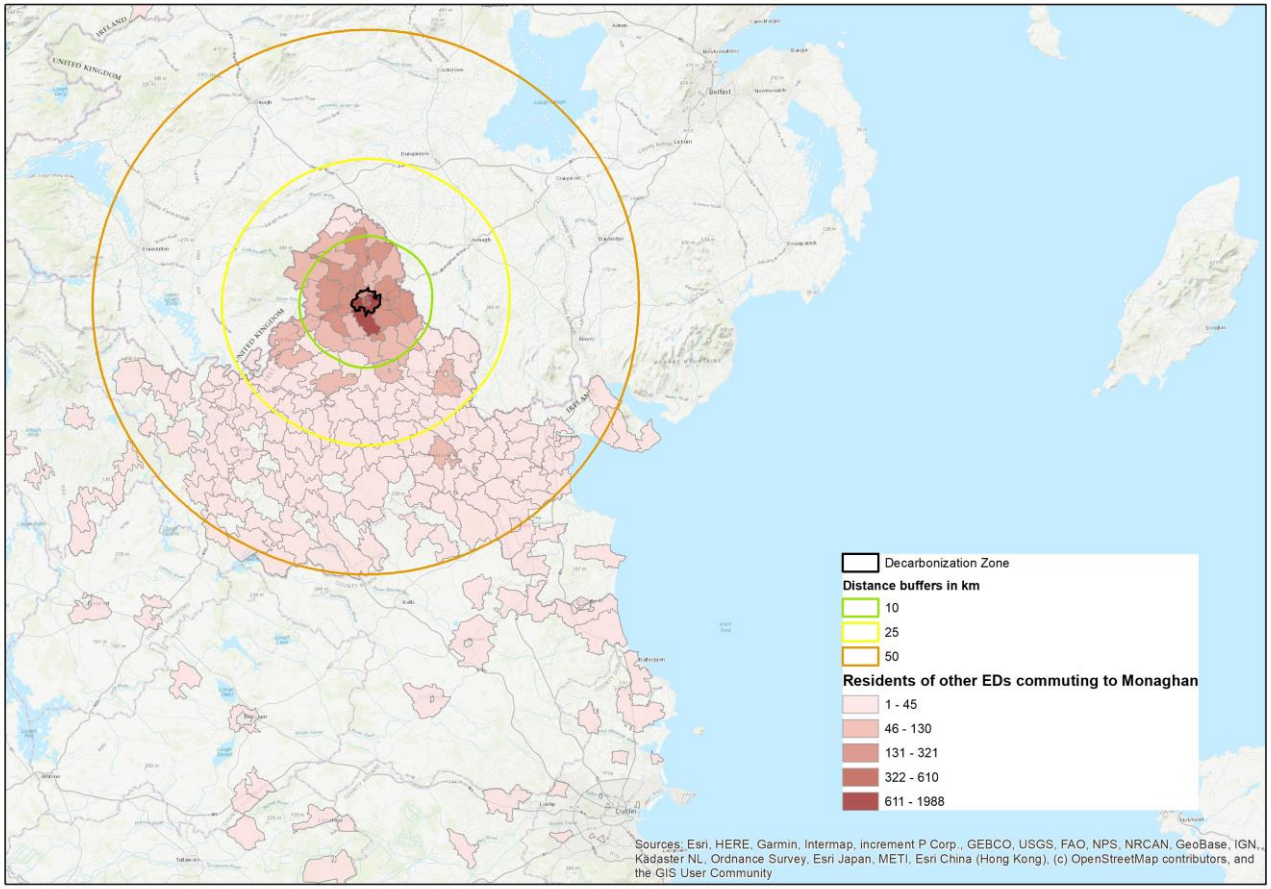
- The map on the right provides an illustration of commuters travelling into the DZ area from surrounding EDs on a daily basis.

- For the purposes of this assessment, the end point for all commuters is assumed to be Monaghan Urban ED. To provide for a proportional assessment, commuters travelling to the top 90% of EDs are included in the carbon emissions estimate. An uplift is then applied to the resulting carbon emissions to represent 100% of commuters.

- It is estimated that these daily commuter trips travelling into the DZ area, and assumed to then return, contribute approximately **6,547 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	**6,547**



3.2.6 Agriculture Sector

3.2.6.1 Agriculture Sector Overview

Overview of the agriculture sector

- As Ireland's largest contributor to national carbon emissions, agriculture is a key sector to decarbonise whilst maintaining food availability and affordability. Over the last decade emissions in the sector have increased by 19% - largely related to the expansion of the dairy sector.

- Agricultural carbon emissions come from a variety of activities and are responsible for a proportion of national carbon emissions each year:
    - Enteric fermentation, i.e. methane emissions from the digestive systems of ruminant livestock such as cattle and sheep, contributed approximately 61% of total agriculture related carbon emissions in 2018 at a national level;
    - Agricultural soils, including nitrogen fertiliser use, contributed approximately 22% of total agriculture related carbon emissions in 2018 at a national level;
    - Manure management contributed approximately 12% of total agriculture related carbon emissions in 2018 at a national level;
    - Fuel combustion and electricity use associated with agricultural machinery and buildings contributed approximately 2.6% of total agriculture related carbon emissions in 2018 at a national level;
    - Liming and urea application contributed approximately 2.4% of total agriculture related carbon emissions in 2018 at a national level.

- As part of Ireland's response to climate change, the agriculture sector is required to reduce its emissions by 25% by 2030 with key measures to achieve this target set out in the CAP 23. These measures include: a reduction in nitrogen fertiliser use to a maximum of 300,000 tonnes, earlier finishing of beef cattle and improved animal breeding focusing on low methane traits. The CAP 23 also sets out a target to support land use diversification options for livestock farmers, such as anaerobic digestion, forestry and tillage to incentivise voluntary livestock reductions - whilst not a direct cap, it signals the ambition to reduce herd numbers.
- Measures set out at a national level can be considered by the DZ area.

- Although agriculture sector emissions encompass the emissions sources outlined above, there are close synergies with other sectors, including LULUCF sector which is explored further in the next section. Decarbonisation measures must consider these synergies to ensure an effective plan is developed.

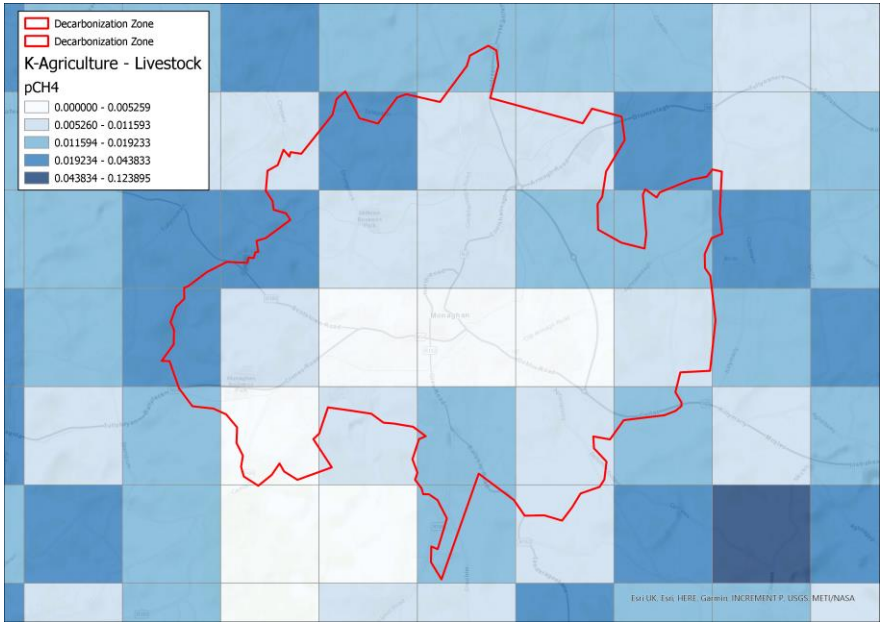
- According to Monaghan's 2022 Draft Socio-Economic Statement, 'specialist beef production" is the leading farming activity in Monaghan, with this type of agriculture accounting for more than two thirds of agricultural holdings in the county.

- The following sections present an overview of agriculture related activities, energy and emissions within the DZ area.

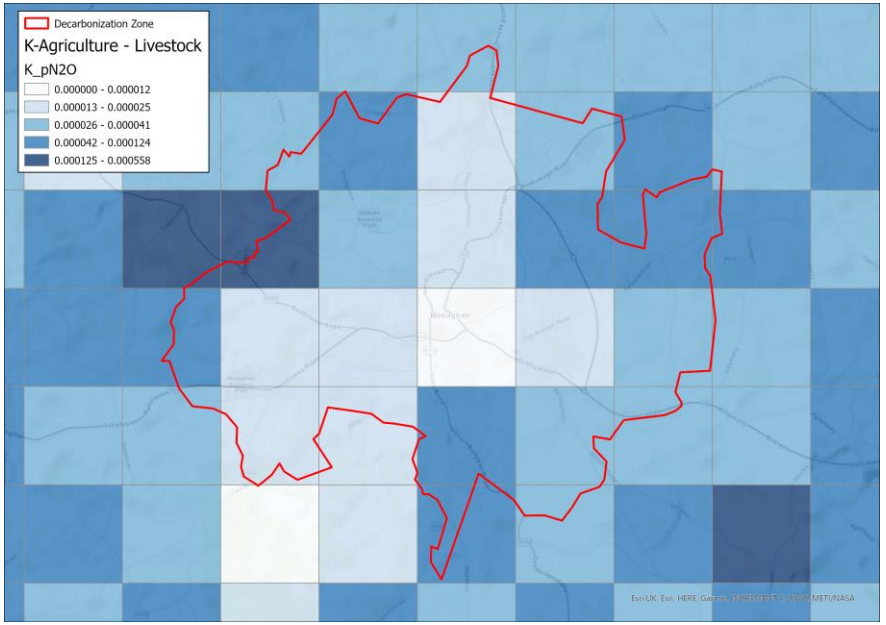
3.2.6.2 Agriculture Sector Analysis

Agriculture sector: Carbon Emissions

The maps below provide an overview of agriculture related activities, presented by 'livestock' related methane (CH_4) and nitrous oxide (N_2O) emissions



Methane emissions predominantly associated with livestock in the DZ area



Nitrous oxide emissions associated with livestock in the DZ area

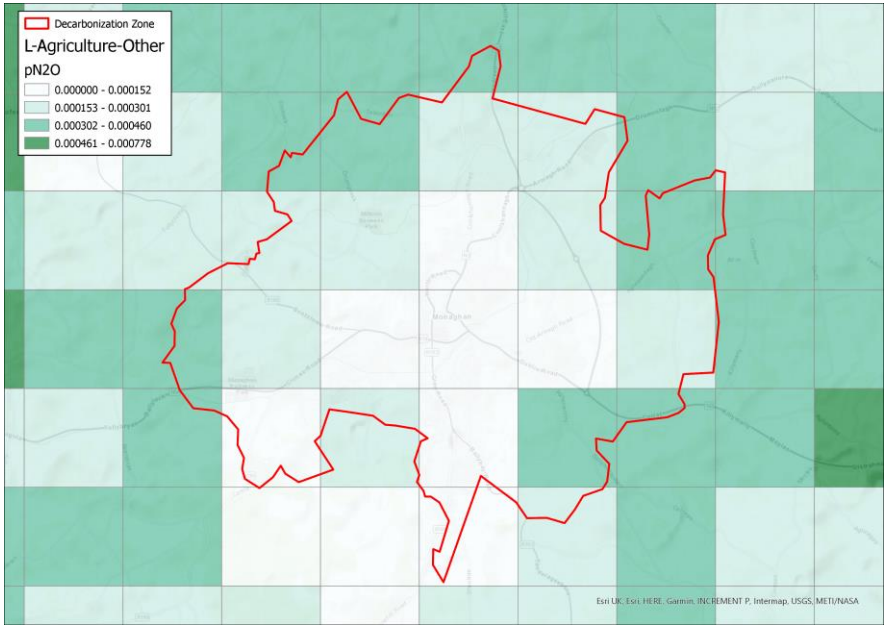
According to the EPA's MapEire database, in the baseline year of 2018, the agricultural sector accounts for 30% of DZ area's total carbon emissions. *Note that this is based on the MapEire database which adopts a 'top-down' assessment approach.*

The majority of the DZ area's agriculture carbon emissions are attributed predominantly to ruminant livestock related emissions (methane emissions resulting from enteric fermentation and manure management and nitrous oxide emissions associated with manure management).

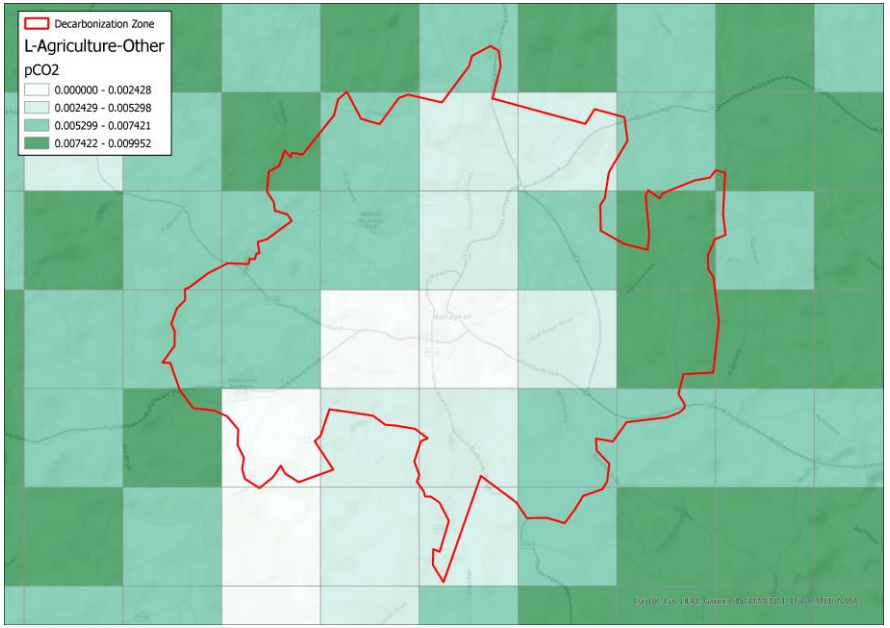
3.2.6.2 Agriculture Sector Analysis

Agriculture sector: Carbon Emissions

The maps below provide an overview of agriculture related activities, presented by other' related carbon dioxide (CO2) and nitrous Oxide (N2O).



Nitrous oxide emissions associated with agriculture activities, excluding livestock, in the DZ area



Carbon dioxide emissions associated with agriculture activities, excluding livestock, in the DZ area

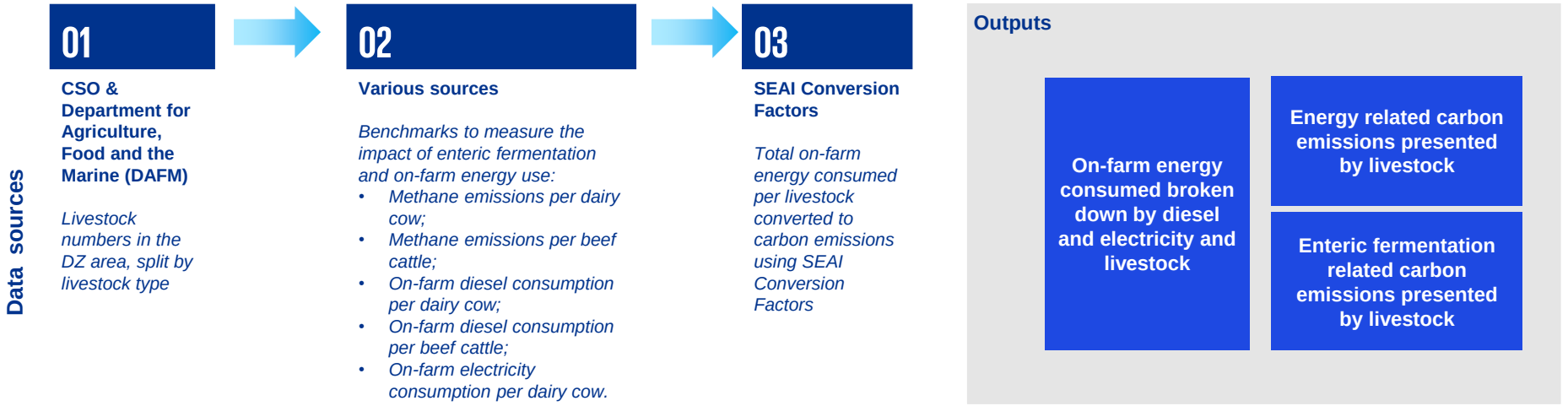
The remaining proportion of emissions are attributed to the category 'Other', largely associated with nitrous oxide associated with nitrogen fertiliser use and carbon dioxide emissions associated with on-farm fuel combustion and electricity use, liming and urea application.

As such, the agriculture sector is one of the main carbon hotspots in the DZ area and hence should be targeted in terms of carbon reduction measures.

3.2.6.2 Agriculture Sector Analysis

Agriculture Sector: Energy & Carbon Emissions

To estimate the agriculture sector's energy consumption and associated carbon emissions within the DZ area, a number of non-spatial data points have been used. As discussed previously, there are a number of emissions sources within the agriculture sector, including enteric fermentation, agricultural soils, including nitrogen fertiliser use, manure management and fuel combustion associated with agricultural machinery. These have been explored as far as possible using the approach outlined below.



Note that the quantification of the impact of agricultural soils, manure management, liming and urea application on carbon emissions is complex and requires an understanding of the various elements included as part of these activities. For example, to understand the impact of fertiliser use on carbon emissions, annual amount of synthetic fertiliser applied to soils and annual amount of animal manure applied to soils, amongst a number of other data points. For the purposes of this baseline assessment, an estimate of these emissions sources have been excluded.

3.2.6.3 Agriculture Sector Analysis

Agriculture sector: Livestock Numbers

- Beef and dairy farming are the most common activities within the DZ area.

- Beef cattle and dairy cows account for approximately 58% and 31%, respectively, of all livestock. Sheep account for approximately 11% of all livestock.

- Farming activities occur predominantly in 1 ED: Monaghan Rural

	Number of Livestock		
ED	**Beef cattle**	**Dairy cows**	**Sheep**
Monaghan Rural	2,430	1,303	451
Total		**4,183**	

3.2.6.4 Agriculture Sector Analysis

Agriculture sector: Beef Cattle, Dairy Cows & Sheep enteric fermentation

- As previously discussed, methane emissions produced by livestock enteric fermentation is one of the main contributors to agriculture's total carbon emissions.
- As the majority of livestock in the DZ area are beef cattle, dairy cows and sheep, to provide for a meaningful and proportionate assessment, these livestock have been focussed on.
- To estimate methane emissions associated with beef cattle, dairy cows and sheep within the DZ area, benchmarks (gCH_4/livestock/day) have been used and are presented below.
- Estimated carbon emissions related to enteric fermentation in beef cattle, dairy cows and sheep are presented by ED are shown on the tables to the right.

ED	tCH_4/year for all beef cattle	tCO_2e/year for all beef cattle***
Monaghan Rural	204	5,690

ED	tCH_4/year for all dairy cows	tCO_2e/year for all dairy cows***
Monaghan Rural	157	4,378

ED	tCH_4/year for all Sheep	tCO_2e/year for sheep***
Monaghan Rural	1	40

*** Note that methane emissions (CH_4) have been converted to carbon dioxide equivalent (CO_2e) using IPCC conversion factors as included in the **Appendix**.

Benchmarks

	gCH_4/livestock/day
Beef cattle*	230
Dairy cow**	330
Sheep***	8.62

Summary

	Beef cattle (tCO_2e)	Dairy cows (tCO_2e)	Sheep (tCO_2e)
Enteric fermentation related carbon emissions	5,690	4,378	40
Total	10,108		

Source: https://www.teagasc.ie/environment/climate-change--air-quality/methane/
Source: https://www.teagasc.ie/news--events/daily/sheep/measuring-methane-from-sheep-systems.php

*For the purpose of this assessment, beef cattle related methane emissions benchmark is assumed for a '500kg Beef animal on a high concentrate diet'

** For the purpose of this assessment, dairy cow related methane emissions benchmark is assumed for a '550kg Dairy cow grazing on pasture'

***For the purpose of this assessment, Sheep related methane emissions benchmark is assumed for a ewe lamp on a grass silage based diet

3.2.6.5 Agriculture Sector Analysis

Agriculture sector: Beef Cattle, Dairy Cows & Sheep energy related emissions

- As previously discussed, on-farm fuel combustion and electricity use contributes to national agriculture carbon emissions.
- As the majority of livestock in the DZ area are beef cattle, dairy cows and sheep, to provide for a meaningful and proportionate assessment, these livestock have been focussed on.
- To estimate carbon emissions associated with beef cattle, dairy cows and sheep within the DZ area, benchmarks (kWh/livestock/year) have been used and are presented below.
- Estimated carbon emissions related to energy consumption in beef cattle, dairy cows and sheep and presented by ED are shown on the tables to the right.

ED	Energy consumption (kWh) for all beef cattle	Carbon emissions (tCO_2e) for all beef cattle
Monaghan Rural	1,100,564	290

ED	Energy consumption (kWh) for all dairy cows	Carbon emissions (tCO_2e) for all dairy cows
Monaghan Rural	1,139,906	348

ED	Energy consumption (kWh) for all sheep	Carbon emissions (tCO_2e) for all sheep
Monaghan Rural	8,569	2

*** Note that methane emissions (CH_4) have been converted to carbon dioxide equivalent (CO_2e) using IPCC conversion factors as included in the **Appendix**.

Benchmarks

	kWh/livestock/year
Beef cattle	453
Dairy cow	875
Sheep	19

Summary

	Beef cattle (tCO_2e)	Dairy cows (tCO_2e)	Sheep (tCO_2e)
Energy related carbon emissions	290	348	2
Total	640		

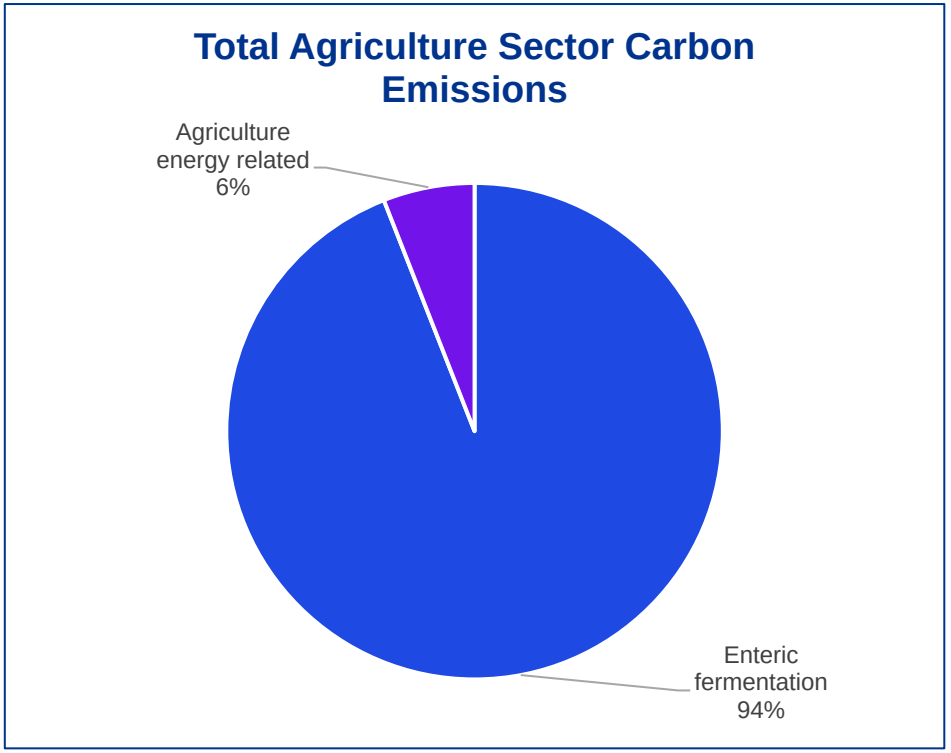
Source: Department for Environment, Food & Rural Affairs (DEFRA)

3.2.6.6 Agriculture Sector Summary Results

Agriculture Sector: Summary

The results of the agriculture sector assessment are presented in the table and chart below. A number of activities contribute to the agriculture sector's carbon emissions, including enteric fermentation and fuel combustion associated with agricultural machinery. Total carbon emissions of the sector equates to approximately **10,748 tCO_2e**. Note that a mix of benchmarks and robust assumptions have been used to understand the impact of the agriculture sector within the DZ area.

Agricultural sector emissions sources	Carbon emissions (tCO_2e)
Enteric fermentation	10,108
Agriculture energy related	640
Total	**10,748**



3.2.7 Waste Sector

3.2.7.1 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 to Monaghan Town DZ as areas to focus on, 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.

- According to the 2022 Draft Socio-Economic Statement, Monaghan County Council aims to deliver high standards of protection for water and air and promote sustainable waste management through education and regulation to mitigate the impacts of climate change

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

3.2.7.2 Waste Sector Analysis

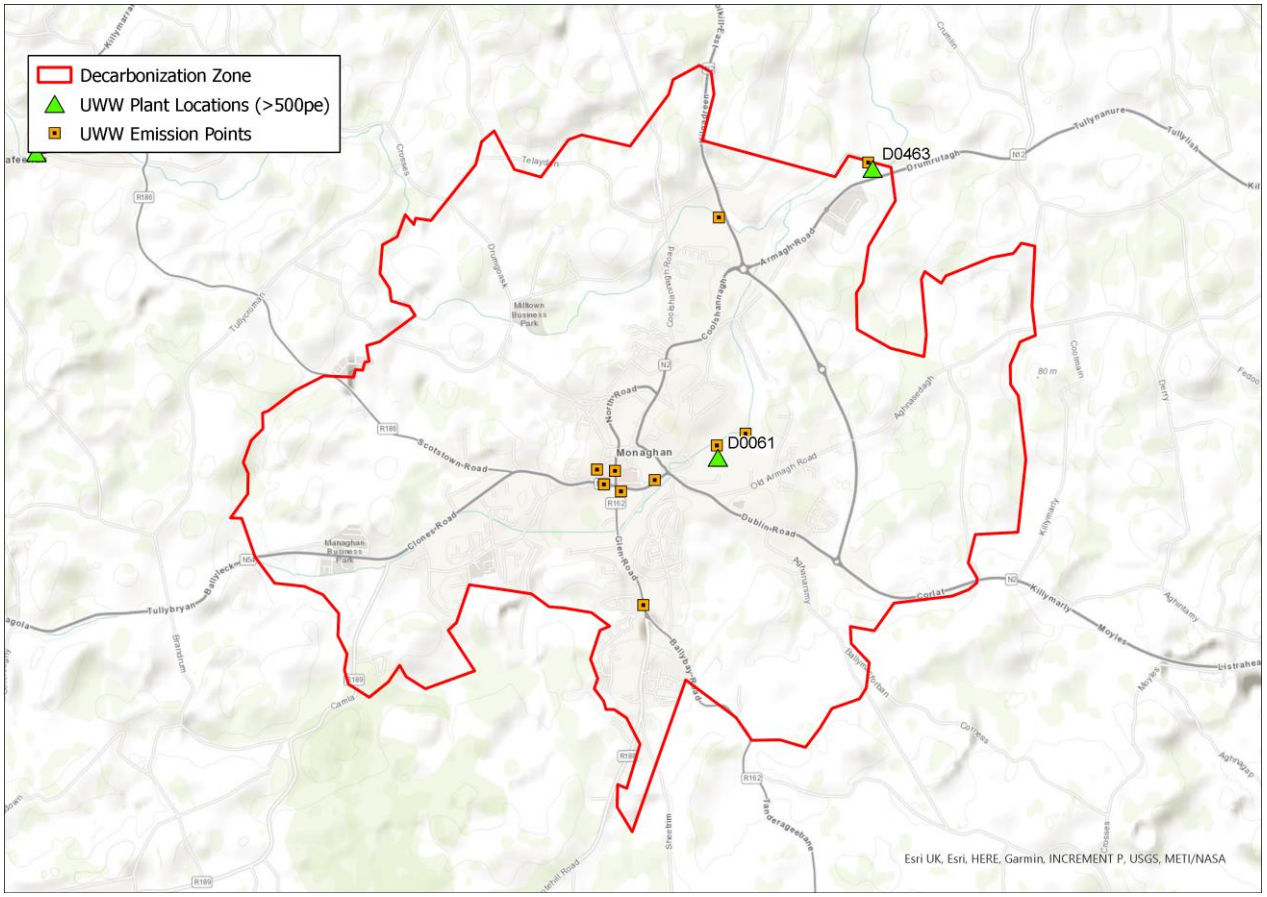
Waste Sector: Locations & Carbon Emissions

- There are two wastewater treatment plants located within the DZ, with several emissions points located in Monaghan Town and some more sparsely towards the DZ borders.

- The EPA's Pollutant Release & Transfer Register (PRTR) has been reviewed to understand carbon emissions associated with the wastewater facility. No emissions data has been included on this register.

- Using a benchmark for waste related carbon emissions of 0.21 tCO_2e/head of population*, it can be estimated that waste related carbon emissions within the boundary of DZ area is approximately **1,757 tCO_2e**.

* 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 (8,366).



3.2.8 Energy & Electricity Sector

3.2.8.1 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.

3.2.8.2 Energy & Electricity Sector Analysis

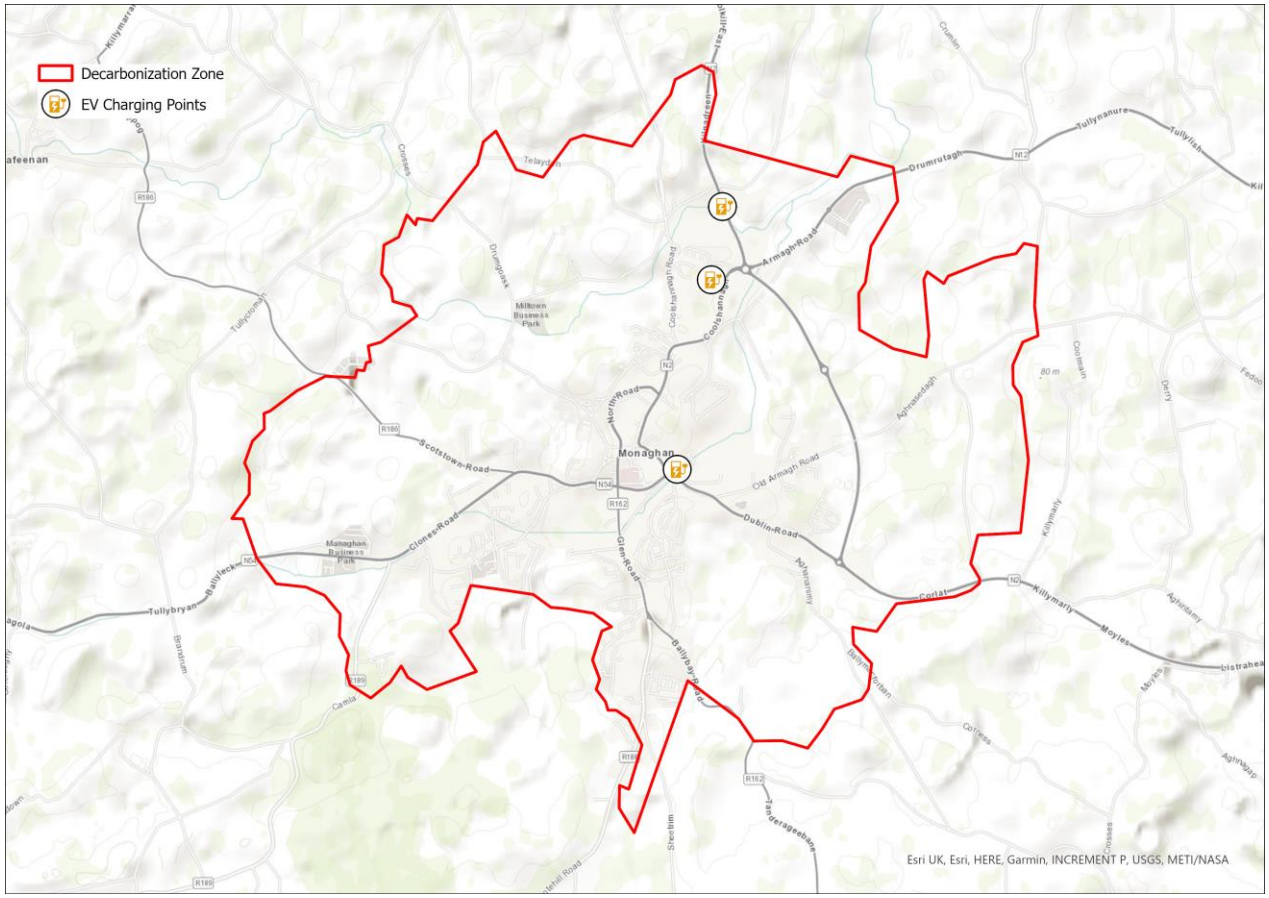
Energy & Electricity Sector: Electric Vehicle charging points

- 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 Electric Vehicle (EV) charging infrastructure is shown on the map to the right. There are 3 charging stations located within the DZ boundary.

- 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.



3.2.8.3 Energy & Electricity Sector Analysis

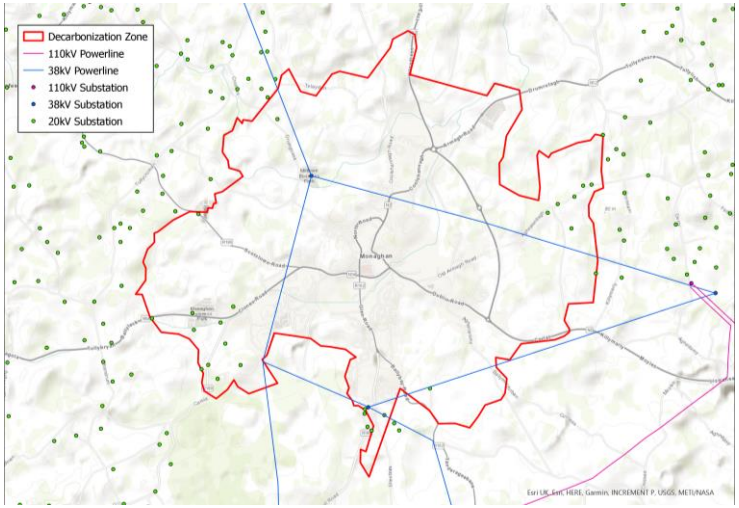
Energy & Electricity Sector: Power Line & Substation Locations

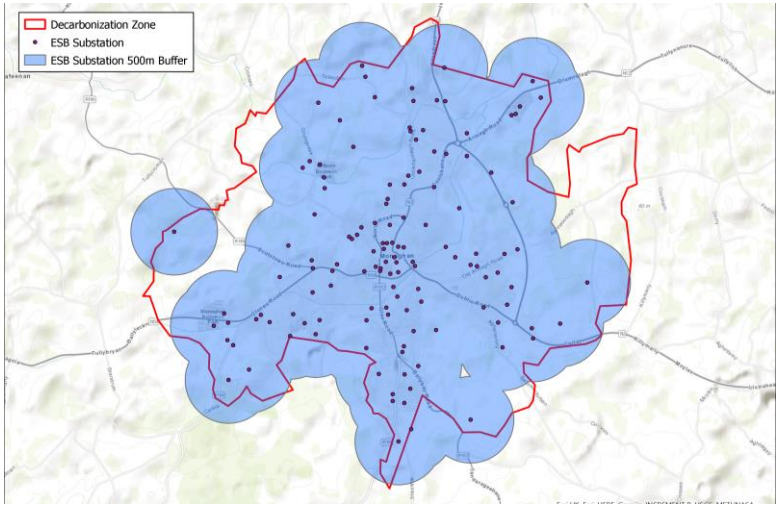
- The Monaghan Town DZ area has several 38kV power lines that run into a substation located in northwest of the town centre. There is a 110kV powerline and substation located outside the DZ boundary to the east.

- Locations of ESB substations with a 500m buffer zone are shown on the map to the bottom right.

- Monaghan town centre has the highest density of ESB substations in the DZ area, with a less-dense pockets of substations located towards the perimeter of the DZ. For areas with sparse substations, expansion of renewable energy capacity should either be prioritised close to the denser regions, or the substation network should be expanded.

- In order to expand the production of renewable energy in the region, including supporting EV charging points, there will be a requirement to have strong grid connections and sub stations.





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. A range of sectoral specific measures to reduce carbon emissions can be explored by Monaghan 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.

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 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 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 acts as a public transport centre with a number of bus stops.

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. Monaghan 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.

3.3.4 Conclusions and Recommendations

Agriculture:

As presented in this BEI assessment, agricultural activities in the DZ area account for a large proportion of total carbon emissions.

Although larger than national trends (Ireland's agriculture sector accounts for approximately one third of annual carbon emissions), it reflects the dependence of the DZ area on the agriculture sector.

CAP 23 and Teagasc have called out a range of key measures for farmers and the agricultural sector to implement in order to effectively reduce emissions, including reducing chemical fertiliser use, reducing calving age and improved animal feeding.

Monaghan County Council could explore opportunities to engage with farmers as well as government bodies and Teagasc.

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.
	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.
	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.
	Zoning	https://viewer.myplan.ie	Monaghan County Development Plan 2019 - 2025	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.
	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
	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

4.2 Data Sources, Assumptions & Limitations: Spatial Data

Sector	Data source	Data source link	Data assumption	Data limitation
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
	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
	Buildings Number and Locations	Monaghan 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	Total Heat Demand with Building Use	https://gis.seai.ie/server/services Monaghan County Council	Heat Demand and Geodirectory Building Use Locations	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
	Wind and Solar	Monaghan County Council	Wind and Solar Potential	No limitation in data set.
	Direct Radiation and Diffuse Radiation	https://gis.seai.ie/server/services	Direct and Diffuse Solar Radiation	No limitation in data set. Additional information on the data source can be found here: About Solar PV | SEAI
	Power Lines and Substations Locations	https://gis.seai.ie/server/services	Power Lines and Substations Locations	No limitation in data set.
	Agriculture Gas Production	https://gis.seai.ie/server/services	Agriculture Gas Production	No limitation in data set.
	Agriculture Biomass Crop Suitability	https://gis.seai.ie/server/services	Agriculture Biomass Crop suitability	No limitation in data set.
	Electric Vehicle Charging Points	Data.gov.ie	Electric Vehicle Charging Points	No limitation in data set.

4.3 Data Sources, Assumptions & Limitations: Spatial Data

Sector	Data source	Data source link	Data assumption	Data limitation
Waste	Waste Facilities and Wastewater Treatment Plants	https://gis.epa.ie/arcgis/services	Waste Facilities and Wastewater Treatment Plants	No limitation in dataset.
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
	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.
	Bus Stops	Data.gov.ie	Bus stops Locations	No limitation in data set.
Agriculture	Agriculture Carbon Emissions	https://projects.au.dk/mapeire/spatial-results/download	MapEire modelled agriculture carbon emissions	No limitation in data set. Additional information on the data source can be found here: https://projects.au.dk/mapeire/spatial-results

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
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 the DZ area 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	

4.5 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 was used, in conjunction with local knowledge and energy SME input to decide on the most relevant energy split for the commercial and public sector in Monaghan 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	

4.6 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 Monaghan.	Number of vehicles for Monaghan 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	

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

Sector	Data source name & description	Data source link	Data assumption	Data limitation	Overview of methodology used
Agriculture	CSO & Department for Agriculture, Food and the Marine (DAFM)	https://data.gov.ie/dataset/dafm-2020-average-beef-and-dairy-herds-per-electoral-division?package_type=dataset https://data.cso.ie/	Number of Livestock broken down by livestock type	2020 data is used to reflect 2018 baseline year. This is due to no 2018 specific data being made available. 2020 data is deemed a reasonable proxy for 2018	Total livestock numbers have been combined with: • Teagasc's methane emissions benchmarks to estimate enteric fermentation related emissions in the DZ area • Defra estimated energy consumption benchmarks
	Teagasc	https://www.teagasc.ie/environment/climate-change--air-quality/methane/	Methane emissions benchmarks representing beef cattle and dairy cow enteric fermentation (gCH_4/beef cattle/day & gCH_4/dairy cow/day)	n/a	
	Defra	n/a	Carbon dioxide emissions benchmarks representing beef cattle and dairy cow on-farm diesel consumption and electricity use (kWh/beef cattle/month, kWh/dairy cow/month, litres/beef cattle/month, litres/dairy cow/month)	n/a	
	Ireland's Provisional Greenhouse Gas Emissions, EPA	https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/GHG_Final-emissions-data_1990-2021_AR5_Web.xlsx	National carbon emissions breakdown for agricultural by emissions source	n/a	The EPA's 2018 annual carbon emissions data has been used to understand the % contribution of each agriculture emissions source to total national agriculture carbon emissions. This % contribution has been used to uplift emissions in the DZ area to estimate total carbon emissions in the DZ area.
	SEAI Conversion Factors	https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/	Carbon intensity factor for electricity grid	n/a	This energy consumption has then been converted into carbon emissions using robust SEAI and UK Government carbon factors.
	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 factor for diesel use	n/a	
	Global Warming Potentials (GWPs) over 100 Year time period	https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter_07_Supplementary_Material.pdf	GWP is a measure of how much energy the emissions of 1 tonne of a gas will absorb over a given period of time, relative to the emissions of 1 tonne of carbon dioxide. It allows for comparisons of global warming impacts of different greenhouse gases.	n/a	IPCC GWP100 conversion factors have been applied to methane emissions to convert to carbon dioxide equivalent.

4.8 Supporting Data: Residential Sector

Residential Sector: Occupied Dwellings: 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	**Monaghan Rural**	**Monaghan Urban**	**Total**
All years	**2,242**	**988**	**3,230**
Before 1919	63	124	**186**
1919 to 1970	405	356	**762**
1971-1990	782	99	**881**
1991-2000	309	76	**385**
2001-2005	330	155	**486**
2006-2011	330	155	**486**
2012 onwards	22	22	**44**

Weighted average of CSO data of dwelling types in DZ area.

	Number		
Dwelling type	**Monaghan Rural**	**Monaghan Urban**	**Total**
All households	2,245	988	**3,233**
House/Bungalow	2,185	625	**2,810**
Flat/Apartment	60	363	**423**

4.9 Supporting Data: Residential Sector

Residential Sector: Occupied Dwellings: Energy & Carbon Emissions

KPMG calculation of average energy consumption for housing units in the DZ grouped by dwelling type

	kWh/year
Dwelling type	**All years**
House/Bungalow	22,247
Flat/Apartment	11,107

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

	kWh/year							
Dwelling type	**All years**	**Before 1919**	**1919-1970**	**1971-1990**	**1991-2000**	**2001-2005**	**2006-2011**	**2012 onwards**
All households	21,249	36,650	25,004	22,447	21,035	18,782	12,120	-

4.9 Supporting Data: Residential Sector

Residential Sector: Occupied Dwellings: Energy & Carbon Emissions

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

	%	
Dwelling type	**Monaghan Rural**	**Monaghan Urban**
Coal	10%	6%
Peat	<1%	<1%
Oil	84%	50%
LPG	<1%	3%
Natural Gas	1%	11%
Renewables	<1%	<1%
Electricity	4%	28%
Wood	1%	1%
Total	**100%**	**100%**

4.10 Supporting Data: Residential Sector

Residential Sector: Energy & Carbon Emissions

Number of social housing units in the DZ area

	Number
Electoral District	**Social Housing units**
All EDs	454
Monaghan Rural	309
Monaghan Urban	145

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

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

	kWh/year
Dwelling type	**All years**
All households	21,249

4.11 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	**19**	**13,894**
Commercial/Residential	1	265
Commercial/Retail	6	3,943
Multiple Use	7	1,895
Unknown	3	2,029
School	2	5,761
Commercial	**174**	**272,282**
Commercial/Residential	1	353
Ambulance Station	1	491
Bus Station	1	257
Civil Defence	1	372
Commercial/Residential	2	150
Commercial/Retail	61	93,335
Courthouse	1	949
Day Centre	1	1,147
Delivery Service Unit	1	938
Electricity Station	1	13
Factory	14	73,523
Fitness Centre	1	1,741
Hall	5	1,908
Health Centre	2	1,553
Library	1	335
Local Government Building	4	2,382
Multiple Use	15	15,060
Museum	1	417
Nursing Home	3	2,511
Office	3	2,160
Post Office	1	356
Public House	1	519

Building type	Number	Area m²
Theatre	1	1,070
Unknown	19	9,454
Warehouse	3	4,879
Church	8	5,260
Clubhouse	3	1,721
College	1	2,631
Filling Station	1	573
Fire Station	2	883
Garda Station	1	764
Hospital	2	5,485
Hotel	2	11,657
School	8	17,090
Shopping Centre	1	10,347
Other	**95**	**29,418**
Commercial/Retail	4	2,020
Creamery	1	2,879
Day Centre	1	616
Electricity Station	2	134
Factory	4	6,562
Multiple Use	1	1,114
Nursing Home	5	2,273
Presbytery	1	189
Unknown	15	5,003
Chapel	2	244
Clubhouse	1	91
Glasshouse	48	498
Hospital	1	2,561
School	8	5,108
Tower General	1	127
Total	**288**	**315,594**

4.12 Supporting Data: Commercial & Public Sector

Commercial & Public Sector: Energy & Carbon Emissions

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
Restaurant/ public house	1250	730
Hotel	400	140
Warehouses	169	67
Workshops/ maintenance depot	311	39
Industrial process building	96	0
Hospitals and primary health care	267	113
Community/ day centre	139	47
Nursing residential homes and hostels	337	83
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
Town Hall	159	101
Car Park (enclosed)	0	15
Other	333	162
Department Stores	248	294
Banks and building societies	98	101
Cinema	620	160
Courts (combined County/Crown)	122	82
Library	106	69
Post offices	210	70
Ambulance station	460	70
Museum	109	72
Theatre	237	202

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%**

Carbon emissions factors

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

4.13 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)*	Monaghan County Council (number)
Road Freight	21	155
Road Light Goods Vehicle	1,537	11,275
Road Private Car	3,577	26,248
Public Passenger Services	39	288
Total	**5,174**	**37,966**

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

14% of Monaghan County Council residents reside in the DZ area. Numbers of licenced vehicles in the DZ area have been estimated by multiplying Monaghan County Council licenced vehicles (made available by the CSO Transport Omnibus) by 14% to reflect likely licenced vehicles numbers in the DZ area.

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**

4.14 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	**21%**
Bicycle	**2%**
Bus minibus or coach	**5%**
Train DART or LUAS	**1%**
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

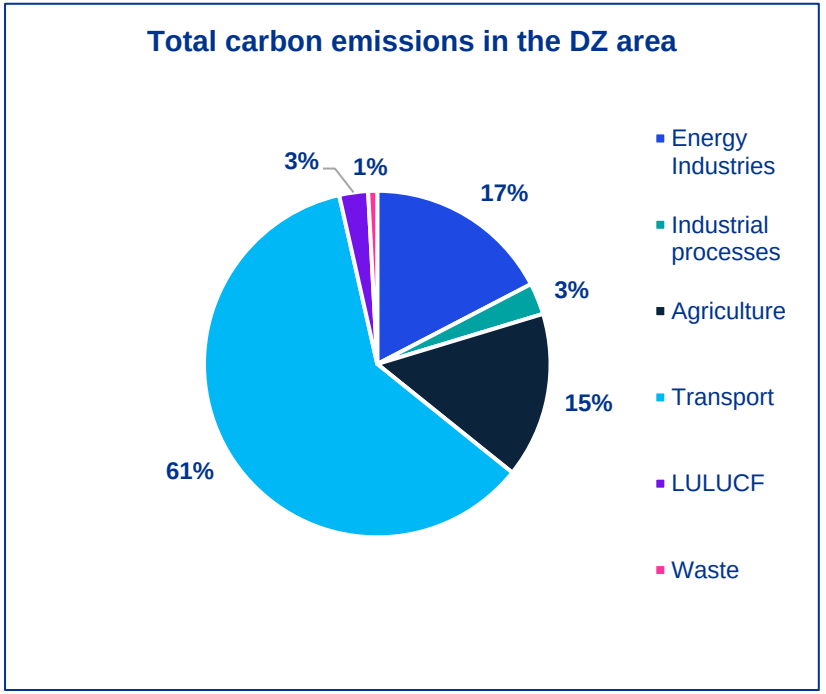
Fuel type	Petrol	Diesel	Electric	Hybrid	Other	Total
% of private cars using fuel type	29%	64%	1%	6%	0%	100%

4.15 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 Monaghan Town 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	268	15,145	35	**15,449**
Industrial processes	7	2,538	84	**2,630**
Agriculture	11,101	174	2,474	**13,749**
Transport	68	53,420	503	**53,991**
LULUCF	178	1,954	261	**2,392**
Waste	48	0	702	**751**
Total	**11,670**	**73,232**	**4,060**	**88,962**