



Tier 2 Baseline Emission Inventory October 2023



Kilkenny County Council
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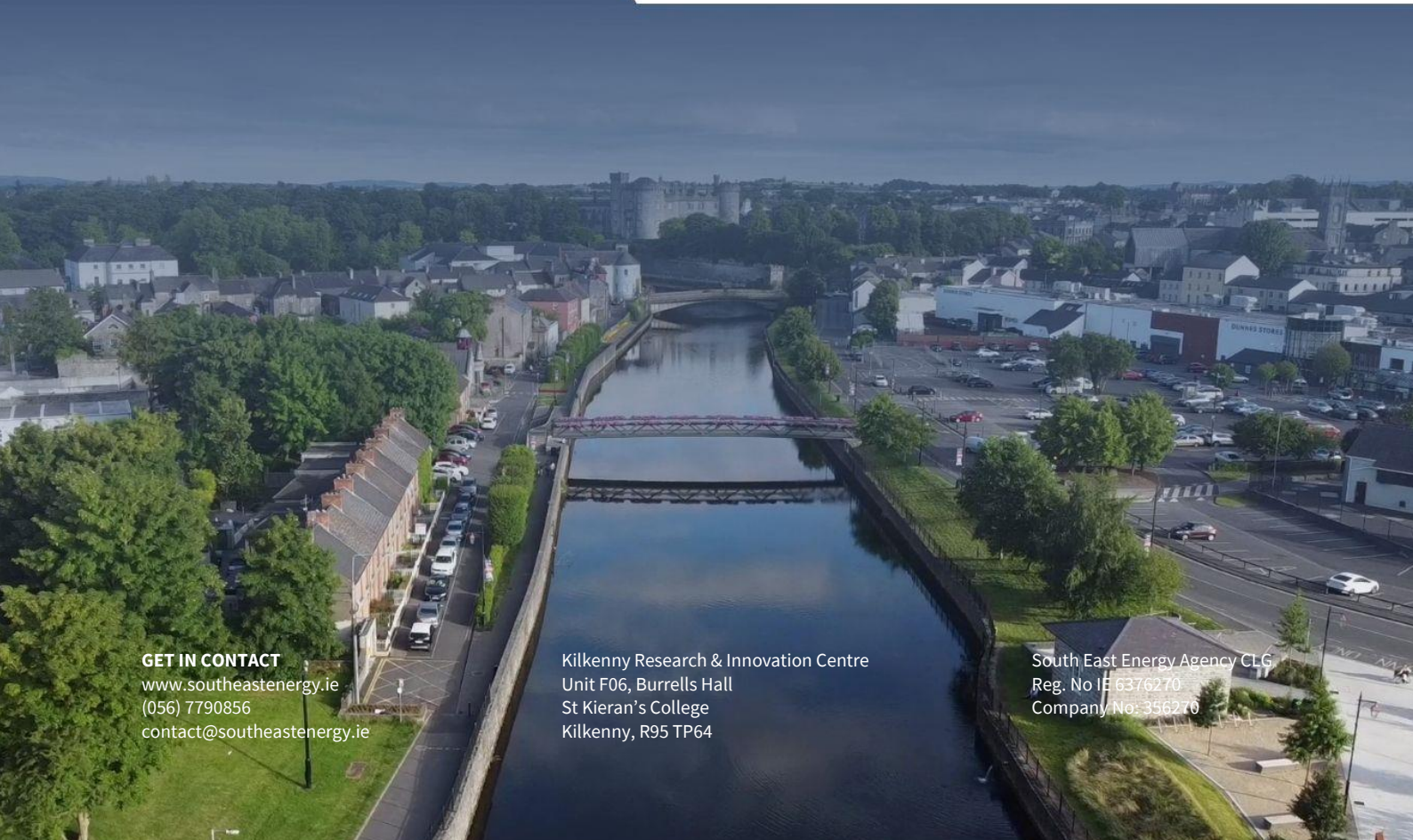


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GLOSSARY OF TERMS

- BER** - Building Energy Rating
- KCC** - Kilkenny County Council
- CIBSE** - Chartered Institution of Building Energy Services Engineers
- CNG** - Compressed Natural Gas
- CO₂** - Carbon Dioxide
- CSO** - Central Statistics Office
- eq** - equivalent
- F-gases** – Fluorinated gases
- GHG** – Greenhouse Gas Emissions
- kt** - Kilotons
- ktoe** - kiloton of oil equivalent
- kWh** - Kilowatt Hour
- LPG** - Liquid Petroleum Gas
- LULUCF** – Land Use, land use change, and forestry
- M&R** – monitoring and Reporting
- MWh** - Megawatt-hour
- NFR** - Nomenclature for Reporting
- PSVs** – Public Service Vehicles
- SEAI** - Sustainable Energy Authority of Ireland
- TFC** - Total Final Consumption
- WWTP** - Wastewater Treatment Plant

EXECUTIVE SUMMARY

This County Kilkenny Baseline Emissions Inventory, prepared by the South East Energy Agency, was commissioned by the Climate Action Office of Kilkenny County Council, and funded by the Department of Environment, Climate and Communications, with support from the Climate Action Regional Office.

The national carbon reduction targets set out in the Climate Action and Low Carbon Development (Amendment) Act 2021 are 51% reduction by 2030, compared to 2018 levels. The table below outlines the sectoral GHG emissions reduction target and emissions ceiling.

Sector	Reduction	2018 (ktCO ₂ eq)	2030 ceiling (ktCO ₂ eq)
Electricity	75%	10,325.06	2,581.27
Transport	50%	12,188.38	6,094.19
Buildings (Commercial and Public)	45%	1,540.54	847.30
Buildings (Residential)	40%	7,093.73	4,256.24
Industry	35%	6,982.72	4,000.00
Agriculture	25%	23,393.35	17,545.01
F-gases, Petroleum Refining and Waste	50%	2,143.76	1,071.88
LULUCF	Not confirmed	6,263.98	Not confirmed
Total	51%	69,931.54	34,266.45

Table 1. GHG Emissions Reduction target and Ceiling by Sector

Kilkenny County Council is required, under Section 16 of the Climate Action and Low Carbon Development (Amendment) Act 2021, to prepare a Local Authority Climate Action Plan (LACAP). The LACAP will outline the pathway for Kilkenny County Council to reduce its Greenhouse Gas Emissions (GHG) by the required 51% by 2030.

For the purpose of this report and the data analysis, all GHG are converted and reported as CO₂equivalent emissions, or CO₂eq. Some emissions are actual carbon dioxide (CO₂), some are methane (CH₄) and some are Nitrous Oxide (N₂O). All emissions are converted into CO₂eq.

The quantitative Baseline Emission Inventory was prepared in accordance with the methodology provided in “Technical Annex C: Climate Mitigation Assessment” of the Local Authority Climate Action Plan Guidelines” (DECC, 2023). These guidelines outlined the Tier 2 approach to be taken by the Local Authorities in the development of the Baseline Emissions Inventory at County Level. Tier 2 is the bottom-up approach for data analysis, which takes national datasets and local-scale datasets together to look at county wide GHG emissions across various sectors which include:

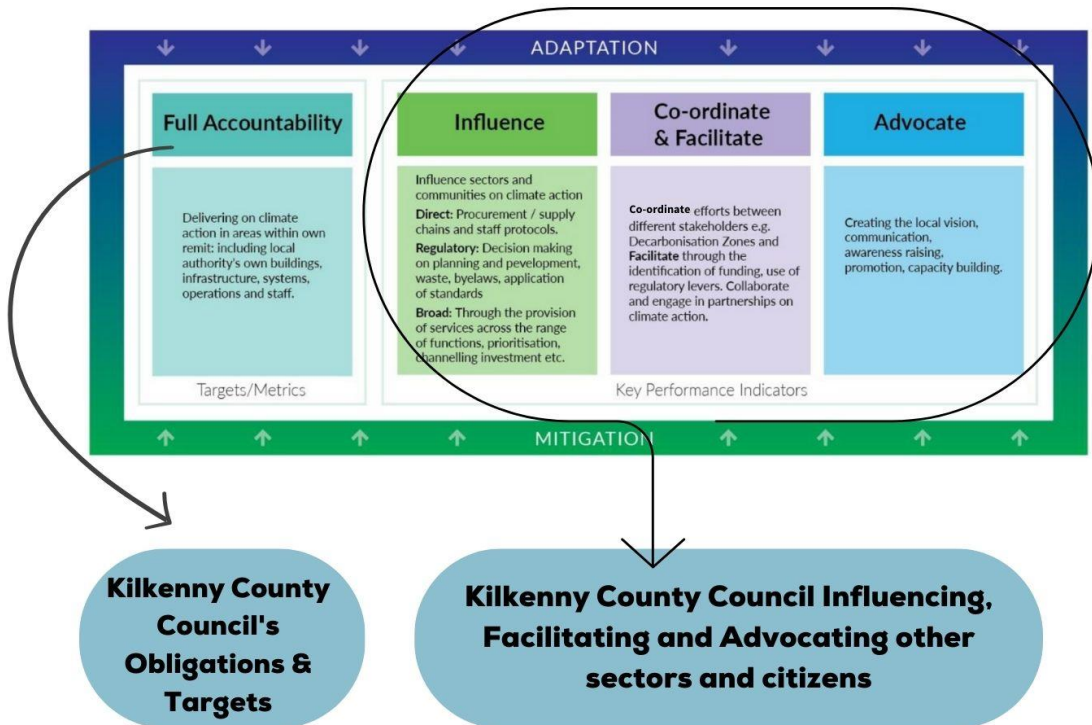
- Residential
- Manufacturing & Commercial
- Industrial Processes
- Agriculture

- Transport
- Land Use, Land Use Change and Forestry (LULUCF)
- Waste
- F-gases

The LACAP will address the specific targets for Kilkenny County Council and, therefore, included in this BEI is the extraction of Kilkenny County Councils direct GHG emissions from the above sectors. Kilkenny County Councils data is reported as a separate sector in this report. Kilkenny County Council has full accountability and obligations to reduce its own GHG emissions and can influence, co-ordinate, facilitate and advocate for all other sectors in the county to reduce their own GHG emissions by their sectoral emissions targets by 2030. The BEI therefore outlines the 2018 baseline data for County Kilkenny as a whole and Kilkenny County Council as a separate sector.



GHG Emissions in ktCO₂eq



51% Reduction in GHG emissions by 2030

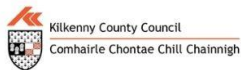


Figure 1. Local Authority Scope on Climate Action (source CCMA/CARO)

This Tier 2 Baseline Emissions Inventory (BEI) outlines the GHG figures for 2018, in order to establish the absolute GHG emissions target for 2030 for County Kilkenny.

The methodology used, including the data collection process, the sources of data, assumptions or projections made, and the calculation methodology, are as provided in the “Technical Annex C: Climate Mitigation Assessment” of the Local Authority Climate Action Plan Guidelines”.

In order to ascertain the GHG emissions per sector, the energy consumption has also been analysed and is reported alongside the GHG data in this report. Although not the focus of the report, which is GHG emissions, the energy data has been included for reference purposes, as it is the energy data that is converted to CO₂eq. GHG emissions in some sectors (where applicable).

Energy consumption in 2018 for County Kilkenny was 3,312.73 Gigawatt hours (GWh). It should be noted that energy from on-site renewables only contributed to 6.32% of the total fuel mix. Renewables associated with grid electricity were 33.20%¹, see **Error! Reference source not found.**

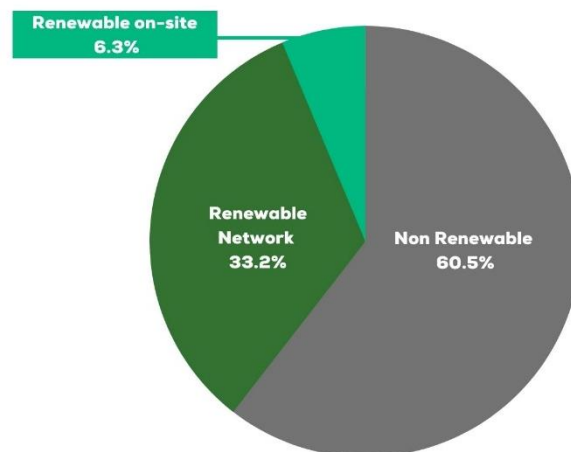


Figure 2. Sources of energy, County Kilkenny (2018)

The non-energy related GHG emissions include Methane (CH₄), Nitrous Oxide (N₂O), sulfur Hexafluoride (SF₆) and are mainly associated with agriculture, industrial processes, waste & F-gases sectors.

The breakdown of GHG emissions and energy consumption per sector for 2018 is as follows, see **Error! Reference source not found.:**

Kilkenny County Council

- Total final emissions produced by Kilkenny County Council in County Kilkenny in 2018 was 4.47 ktCO₂eq.
- Total final energy used in 2018 was 15.08 GWh

¹ <https://www.seai.ie/publications/Energy-in-Ireland-2019-.pdf>

- Total average GHG emissions produced by Kilkenny County Council in the period 2016-2018 was 5.06 ktCO₂eq.
- Average final energy used in 2016-2018 baseline was 15.45 GWh

Residential

- Total residential emissions were 289.32 kt of CO₂eq in 2018
- Total delivered energy for the residential sector for 2018 was 931.37 GWh

Manufacturing and Commercial

- Total emissions in 2018 were 298.53 kt of CO₂eq;
- Total final energy used in 2018 was 1,225.11 GWh

Industrial Processes

- Total emissions from industrial processes were 20.32 ktCO₂eq.

Agriculture

- Total emissions in 2018 were 966.15 ktCO₂eq.
- Total final energy used in 2018 was 133.26 GWh

Transport

- Total final emissions from transport were 274.31 ktCO₂eq.
- Total final Energy for Transport sector was 1,007.92 GWh

Land Use, Land Use Change and Forestry (LULUCF)

- Total emissions from LULUCF sector were 72.86 ktCO₂eq in 2018

Waste

- Total emissions from waste sector were 19.48 ktCO₂eq in 2018

F-Gases

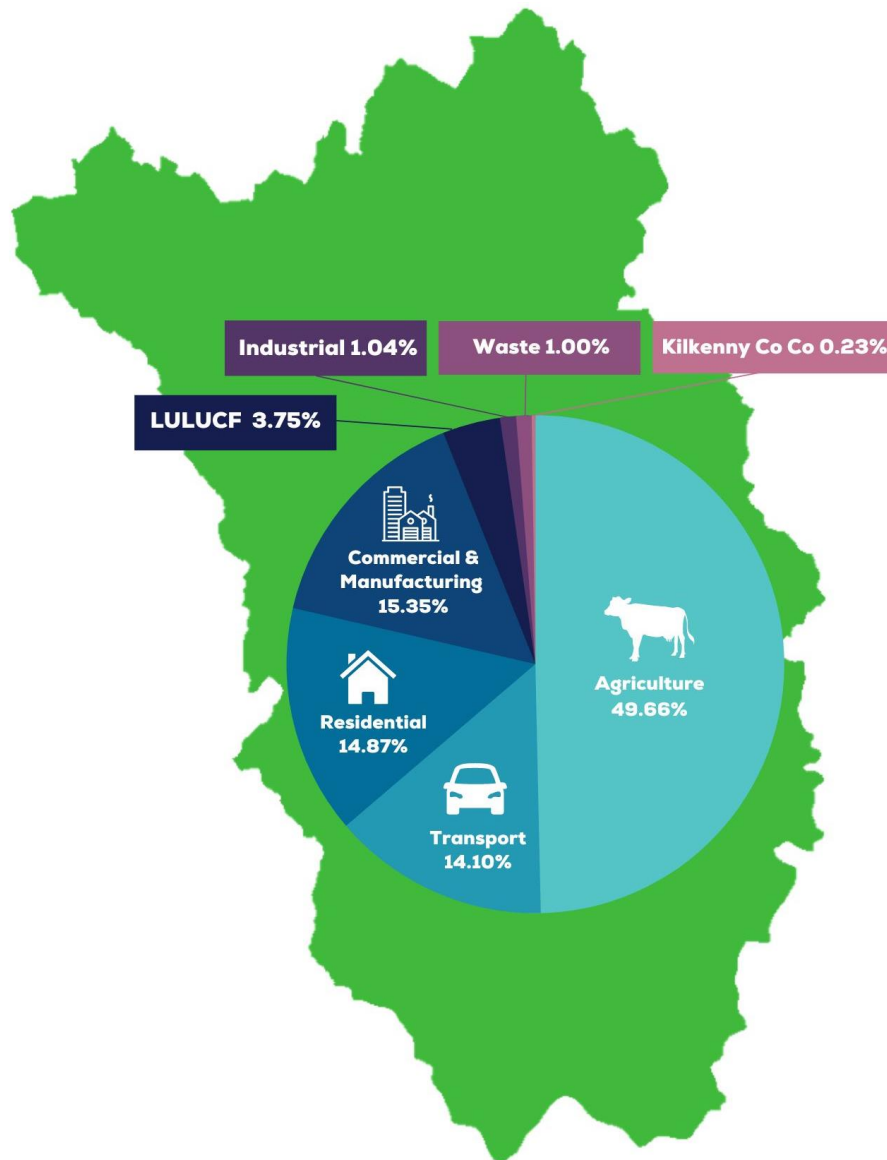
- In County Kilkenny there were no emission accounted for by F-gases

GHG emissions in 2018 for County Kilkenny was **1,945.45kt of CO₂eq.**

Agriculture is the highest GHG emitter, with 49.66% of the County GHG emissions.

Manufacturing & Commercial is second with 15.35% and Residential follows with 14.87% GHG emissions.

GHG emissions for Kilkenny County Council in 2018 were **4.47kt of CO₂eq.** or 0.23% of the County wide GHG emissions. The average GHG emissions for Kilkenny County Council in 2016-2018 was **5.06ktCO₂eq.**



County Kilkenny Total Emissions 2018

Figure 3. Share of Total Emissions in County Kilkenny 2018

1.0 INTRODUCTION

This County Kilkenny Baseline Emissions Inventory, prepared by the South East Energy Agency, was commissioned by the Climate Action Office of Kilkenny County Council, and funded by the Department of Environment, Climate and Communications, with support from the Climate Action Regional Office.

The 2030 Emission Reduction Target as set out in the Climate Action and Low Carbon Development (Amendment) Act 2021 is a 51% absolute reduction in overall greenhouse gas emissions by 2030 and setting us on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government (Government of Ireland, 2021) .

An absolute reduction means that regardless of activity in the county, the total GHG emissions across the County by 2030 must be 51% less than the total GHG emissions in the baseline year, which in this case is 2018. For example, if the GHG emissions in 2018 were 100 ktCO₂ equivalent, then the total allowable GHG emissions by 2030 is 49kt CO₂ equivalent. The absolute target must be met regardless of growth or changes within each sector.

Although the National targets are set against a 2018 baseline, Local Authorities are required, in accordance with Department Guidelines on the preparation of a Climate Action Plan, to use the data average of 2016-2018 as their baseline period. Therefore, throughout this report, when Kilkenny County Councils baseline data is outlined, it is for the 2016-2018 baseline period. All other sectors data included in this report use 2018 period for their baseline.

Kilkenny County Council (KCC) requested the South East Energy Agency (SEEA) to prepare this Tier 2 Baseline Emissions Inventory (BEI) for County Kilkenny to serve as an evidence-base for mitigation planning in County Kilkenny, and to inform the development of the 5-year County Kilkenny Climate Action Plan.

The following report outlines the results and the methodology used to calculate County Kilkenny's energy consumption and GHG emissions per sector for 2018. The methodology and Tier 2 approach for the County Wide GHG emissions inventory was outlined in the "Technical Annex C: Climate Mitigation Assessment" of the Local Authority Climate Action Plan Guidelines" published in March 2023 (pages 24-30) (DECC, 2023).

Tier 2 is the bottom-up approach for data analysis, which takes national datasets and local-scale datasets together to look at county wide GHG emissions across various sectors which include:

- Residential
- Manufacturing & Commercial
- Industrial Processes
- Agriculture
- Transport
- Land Use, Land Use Change and Forestry (LULUCF)
- Waste

- F-gases

This baseline report aims to raise awareness of climate change and the impact that different sectors in County Kilkenny have on Ireland's overall carbon emissions and energy use. It provides Kilkenny County Council with the necessary information to make decisions on climate change actions.

It is important to note that the BEI is a 'snapshot in time' of an area's GHG emissions sources, and it is not an inventory of emission reduction opportunities ((page 17 (DECC, 2023)).

The methodology used for the analysis was developed using MapElre² and EPA data, and other publicly available local sources including:

- Electricity metered consumption dataⁱ
- Central Statistics Office's household census, agricultural census and transport Omnibusⁱⁱ
- SEAI's latest Energy in Ireland reportⁱⁱⁱ, emission factors for fuels and grid electricity^{iv}
- M&R system^v and National Building Energy Rating Database^{vi}
- Valuation Office data on commercial buildings^{vii}
- CIBSE energy benchmarks (Guide F and TM46)
- Agricultural energy and emissions benchmarks from sources such as Teagasc, Dept. Agriculture, Food and Marine, and the Carbon Trust

MapElre is the state-of-the-art integrated model system to map emissions for Ireland's emission inventories of air pollutants and greenhouse gases. Based on a variety of spatial and statistical data, the MapElre model produced detailed spatial emissions at a resolution of 1 km × 1 km (Plejdstrup, 2018).

ⁱ [Metered Electricity Consumption 2020 - CSO - Central Statistics Office](#)

ⁱⁱ [Introduction and Overview of Results - CSO - Central Statistics Office](#)

ⁱⁱⁱ [Energy in Ireland 2019 Report \(seai.ie\)](#)

^{iv} <https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/>

^v <https://psmr.seai.ie/Reports/PublicAnnualReportForPublic?customerId=261&query=undefined>

^{vi} <https://ndber.seai.ie/BERResearchTool/ber/search.aspx>

^{vii} <https://opendata.valoff.ie/api/>

² <https://projects.au.dk/mapeire>

2.0 SCOPE OF REQUIREMENTS

The following elements for the Baseline Emissions Inventory (BEI) were required by Kilkenny County Council, as outlined in Annex C³ of the Local Authority Climate Action Plan Guidelines (DECC, 2023).

- A calculation of the Greenhouse Gas (GHG) emissions resulting from activity within the geographical boundary of the Kilkenny County Council area.
- Visual representation of the resulting GHG emissions baseline, broken down as far as possible into sub-sectors.
- A ranking of sectors and sub-sectors contributing the largest GHG emissions.
- A detailed report outlining the methodology, assumptions and all data sets used to formulate the BEI, and an executive summary customised for a non-technical audience.
- A calculation of the emissions reduction required, based on the baseline, to meet the national climate action plan 2030 targets.
- Any other outputs resulting from the BEI analysis that will add to the evidence-base for mitigation planning in the Local Authority administrative area.
- Present the findings to Kilkenny County Council Climate Action Team.

The GHG Protocol Corporate Standard categorises greenhouse gas emissions as Scope 1, Scope 2, and Scope 3 emissions. This report analyses Scope 1 emissions, which are direct emissions associated with direct consumption and activity of each sector. This does not include emissions associated with the purchase of energy (Scope 2) or indirect emissions from the value chain (Scope 3).

- **Scope 1 emissions** – This covers the GHG emissions from direct consumption and activity – for example running boilers and vehicles
- **Scope 2 emissions** – This covers the indirect GHG emissions associated with the purchase of electricity, heat or cooling
- **Scope 3 emissions** – This covers the indirect GHG emissions for a sectors value chain, for example goods and services purchased

The Scope 1 emissions included in this report includes all emissions locally produced from the following sectors:

- Residential
- Manufacturing & Commercial
- Industrial Processes
- Agriculture
- Transport
- Land Use, Land Use Change and Forestry (LULUCF)
- Waste
- F-gases

³ <https://assets.gov.ie/250051/e165c6b5-3eed-487d-b4ec-1db46dcec7e1.pdf>

3.0 METHODOLOGY

The methodology used in the inventory was that outlined in “Technical Annex C: Climate Mitigation Assessment” of the Local Authority Climate Action Plan Guidelines” published in September 2022 (pages 24-30) (DECC, 2023).

The Baseline Emissions Inventory (BEI) is a key instrument that will enable Kilkenny County Council to identify actions to include in the Climate Action Plan, and as a baseline against which to measure the impact of actions. The BEI represents an evidence-based approach to not only inform appropriate emission reduction actions, but also measure progress overtime.

Source of database used in the inventory is listed in Appendix 16.1.

3.1 KILKENNY COUNTY COUNCILS DIRECT GHG EMISSIONS

Kilkenny County Council maintains responsibility to deliver its own targets for emission reductions and establishing the baseline is a necessary starting point. Data for the Local Authorities direct energy-based emissions are reported annually to the SEAI under the mandatory Monitoring & Reporting system⁴. The M&R system is the tool that tracks the public sectors progress towards the 2030 targets, based on the annual submission of energy data. The methodology for reporting Kilkenny County Councils data to the SEAI via the Monitoring & Reporting system is set out by the SEAI. Kilkenny County Council have reported using this system since 2012, and all data has been verified and accepted by SEAI, and is published in the Annual Report on Public Sector Energy Efficiency Performance (see most recent 2021 report - Sustainable Authority of Ireland, 2021⁵)

The Local Authority’s own emissions are captured within the Manufacturing & Commercial and Transport sectors datasets provided by MapElre. For this report Kilkenny County Councils data is reported separately and have been extracted from the data reported for the Manufacturing & Commercial sector to avoid ‘double-counting’. The transport emissions attributed to Kilkenny County Council are also extracted from the general Transport data and reported under Kilkenny County Council direct emissions.

It is necessary that Kilkenny County Council addresses its own GHG emissions and clearly identifies the sources and level of emissions and energy use from across the range of activities performed. The required data extracted from the local authority’s M&R system provides an energy and carbon based BEI distinct to Kilkenny County Council. This BEI should be used to inform the development of targeted and specific actions to further reduce the local authority’s own emissions.

⁴ <https://psmr.seai.ie/Account/LogOn?ReturnUrl=%2f>

⁵ <https://www.seai.ie/publications/Public-Sector-Annual-Report-2021.pdf>

3.2 COUNTY WIDE GHG EMISSIONS

This report focuses on energy use and GHG emissions from different sectors which align with the sectors addressed by the National Emissions Inventory (Environmental Protection Agency, 2020).

The sectors are:

1. Residential
2. Manufacturing & Commercial
3. Industrial Processes
4. Agriculture
5. Transport
6. Waste
7. Land Use, Land Use Change & Forestry (LULUCF)
8. Fluorinated Gases (F-Gases)

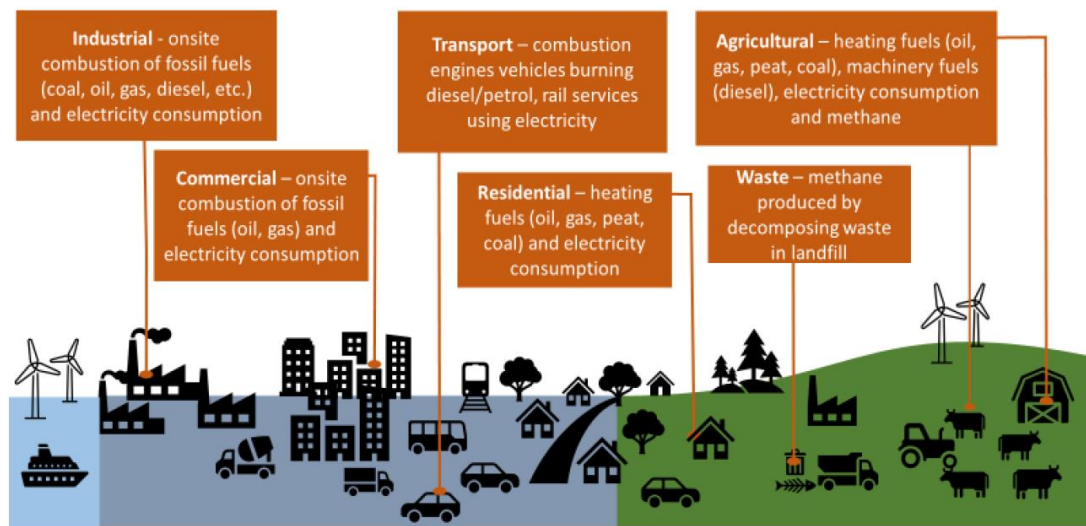


Figure 4. Representative Sectoral Sources of GHG Emissions (Source: Codema)

The analysis focused on the energy demand and fuels used to provide energy, and the associated CO₂eq emissions and GHG emissions related to activities within County Kilkenny. Non-energy related emissions were also reported where available and are mainly outlined in the Waste, Land Use, Land Use Change & Forestry (LULUCF) and Agriculture sections.

3.3 EMISSIONS SCOPE

The emissions accounted for in the MapEire data source includes both ‘emissions trading scheme’ (ETS) and ‘non-emissions trading scheme’ (non-ETS) sectors and emissions. This includes all emissions locally produced from sectors, those produced by large industries, buildings (residential and commercial), industrial processes, waste, transport, agriculture and land-use. Domestic

aviation is also accounted for however, it does not include emissions from intra-EU aviation as those are not considered part of Ireland’s total reportable greenhouse gas emissions. More detail can be found in the EPA 2022 Report (EPA, 2022).

- **Emissions Trading Scheme (ETS)** – This means that GHG from certain sectors are treated as a commodity or product that can be traded on the EU carbon market. This includes emissions from large industries, electricity generators, and the aviation industry.
- **Non Emissions Trading Scheme (Non-ETS)** – This means that GHG from sectors that cannot be traded on the EU carbon market. Non-ETS emissions include greenhouse gas emissions from homes, cars, small businesses and agriculture.

3.4 EMISSION FACTORS

Emission factors are used to convert energy use to CO₂eq emissions. Emissions factors for different fuel types are published by SEAI annually and the 2018 factors were used for this report as the baseline year is 2018⁶. The emission factors are values that relate the quantity of emissions into the atmosphere based on the type of fuel used. **Error! Reference source not found.** below illustrates the emission factors for different fuel types. It should be noted that Peat has the highest emission factor, as it has the highest emissions in kgCO₂eq for every 1 kWh of energy use.

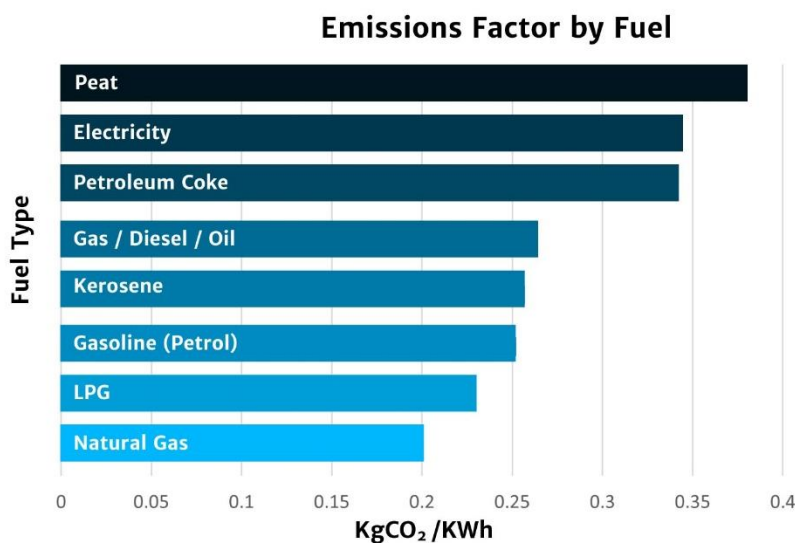


Figure 5. Emission Factors for Different Fuel Types, 2018 (SEAI)

3.5 CARBON-OFFSETTING

Calculations on ‘carbon offsetting’ are not included in this analysis as currently offsetting cannot be used to meet the public sector’s mandatory emissions and energy targets. Carbon offsetting is a

⁶ <https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/>

practice which involves an organisation removing or offsetting the same amount of carbon emissions from the atmosphere to compensate for the carbon emissions that it emits.

Large renewable energy projects like wind and solar farms that are connected to the national electricity grid contribute to the reduction of emissions at a national level and are reflected in reduced emissions intensity of electricity generation. Therefore, the associated reductions cannot be counted separately at a local level, as this would be ‘double-counting’ the emission reduction.

3.6 ASSUMPTIONS AND LIMITATIONS

It is important to note that there are assumptions used in all methodologies for local level emissions baseline. These are required as it is impossible to create a completely accurate picture of all emissions.

All data from the Central Statistics Office is from the Census 2016 data set and the 2020 Agricultural Census. The Census 2022 data was not fully available at time of analysis. This is as per the Technical Annex C: Climate Mitigation Assessment” of the Local Authority Climate Action Plan Guidelines” (DECC, 2023).

The data sources used for each sector, along with the respective assumptions and limitations are provided in the Appendix 16.1.

Kilkenny County Council

- The baseline year for Kilkenny County Council’s energy efficiency targets is 2009, and for GHG emissions the baseline is 2016-2018.
- Energy and GHG Emissions reported by Kilkenny County Council includes their non-domestic buildings and facilities, public lighting and fleet.
- Local Authority social housing energy related emissions is reported under residential sector.
- Staff business travel energy related emissions is reported under transport sector.

Residential

- Average energy use per dwelling from SEAI’s Energy in Ireland Annual Report (SEAI, 2019) is used. The average energy use per dwelling in 2018 was 18,208 kWh, equating to 5.1 tonnes of CO₂eq.
- Census provides information on the main source of heating fuel used per dwelling, which is used to calculate a percentage breakdown of energy consumption at County level – this comes from the Private Households in Permanent Housing Units 2011-2016⁷.

Manufacturing and Commercial

⁷ <https://data.cso.ie/table/E1005>

- There are no energy benchmarks available in Ireland for commercial properties, so a Chartered Institution of Building Services Engineers CIBSE UK Guide was used; this was based on numerous surveys in the UK for different commercial property types (CIBSE, 2008).
- All offices are taken to be ‘naturally ventilated open plan’, as described by CIBSE (CIBSE, 2008).
- The CIBSE benchmarks only split energy consumption averages for buildings into thermal and electricity. Therefore, to split the thermal consumption by fuel types, the national breakdown of thermal and electricity in the Manufacturing & Commercial sector had to be used.

Industrial Processes

- MapElre database was used for non-energy related emissions (AARHUS University, 2022)

Agriculture

- The agricultural sector in Ireland has very little publicly available energy related GHG data and as such, energy use was based on benchmark data. Livestock data was extracted from Central Statistics Office Census of Agricultural⁸
- MapElre database was used for non-energy related emissions (AARHUS University, 2022)
- Energy benchmarks developed by Teagasc (Teagasc, 2019) are the only Irish energy in agriculture benchmarks and benchmarks for poultry and sheep are not available. Therefore, the UK Carbon Trust and the UK’s Department of the Environment, Food and Rural Affairs (DEFRA) in Britain, were used as a representation of Irish agriculture

Transport

- Average vehicle efficiency and GHG emissions were extracted from the SEAI report on ‘Energy in Transport 2014’ (SEAI, 2014) to determine the energy use per vehicle type.
- The 2018 fuel mix from the SEAI’s ‘Energy in Ireland 2019’ (SEAI, 2019) was used to breakdown the energy use from transportation per fuel type.
- The national dataset shows that an average of 1% of transport fuel is related to Compressed Natural Gas (CNG). Without data specific to County Kilkenny, this national average has been used to estimate the fuel mix breakdown.
- MapElre database was used to estimate rail emissions and non-energy related emissions (AARHUS University, 2022)

Waste

⁸ <https://data.cso.ie/table/AVA28>

- Energy related emissions for waste services is covered under Manufacturing & Commercial emissions reported in Section 7 of this report (under industrial uses).
- MapElre database was used for non-energy related emissions (AARHUS University, 2022)

Land Use, Land Use Change & Forestry (LULUCF)

- MapElre database was used for non-energy related emissions (AARHUS University, 2022)

Fluorinated Gases (F-Gases)

- MapElre database was used for non-energy related emissions (AARHUS University, 2022)



SECTORAL GHG EMISSIONS 2018

This section of the report outlines the GHG emissions associated with the individual sections highlighted above, the methodology and results of each and summarises the emissions from each sector in 2018. They are presented in the following order:

- Kilkeny County Council
- Residential
- Manufacturing & Commercial
- Industrial Processes
- Agriculture
- Transport
- Waste
- Land Use, Land Use Change & Forestry (LULUCF)
- Fluorinated Gases (F-Gases)

4.0 KILKENNY COUNTY COUNCIL

Kilkenny County Council (KCC) is responsible for the energy use and emissions from its buildings and facilities, its public lighting, and its vehicle fleet.

Although the National targets are set against a 2018 baseline, Local Authorities are required, in accordance with Department Guidelines on the preparation of a Climate Action Plan, to use the data average of 2016-2018 as their baseline period. Therefore, this Chapter outlines both the 2018 baseline data for Kilkenny County Councils and the 2016-2018 baseline period. The 2018 data is used in the overall County Wide final figures and 2030 target, and the 2016-2018 data is used for Kilkenny County Councils own 2030 target.

4.1 METHODOLOGY

In Ireland, public sector bodies are required to report on their annual energy use to the Sustainable Energy Authority of Ireland (SEAI). This is done through the Monitoring and Reporting system⁹ (M&R), which is used to track the local authorities progress towards 2030, compared to the baseline year. The baseline year for Kilkenny County Council's energy efficiency targets is 2009, and for GHG emissions the baseline is 2016-2018.

For this report, the Kilkenny Co Co 2018 figures are used for the County Wide BEI final figures. However, for the Local Authority targets, the 2016-2018 baseline figures are reported.

The methodology for reporting Kilkenny County Councils data to the SEAI via the Monitoring & Reporting system is set out by the SEAI¹⁰. Kilkenny County Council has reported using this system since 2012, and all data has been verified and accepted by SEAI. The results are published in the Annual Report on Public Sector Energy Efficiency Performance (see most recent 2021 report - Sustainable Authority of Ireland, 2021¹¹)

From the M&R system, the 2018 energy & CO₂ emissions data for Kilkenny County Council was extracted and is broken down by fuel type:

- Electricity – imports from national grid
- Electricity - generated by on-site PV
- Natural Gas
- Liquid Petroleum Gas (LPG)
- Kerosene
- Woodchip
- Gasoil
- Petrol
- Road Diesel

⁹ <https://psmr.seai.ie/Account/LogOn?ReturnUrl=%2f>

¹⁰ <https://www.seai.ie/business-and-public-sector/public-sector/monitoring-and-reporting/supports/MR-2030-Methodology-Guidance.pdf>

¹¹ <https://www.seai.ie/publications/Public-Sector-Annual-Report-2021.pdf>

- Marked Diesel

The fuel types are categorised by energy use:

1. Electricity
2. Thermal
3. Transport

To outline where the energy and GHG emissions are coming from within Kilkenny County Council, the energy use was broken down into three categories for reporting GHG emissions in this BEI. This will allow for targeted projects within the LA Climate Action Plan to reduce GHG emissions most effectively:

- Local Authority Buildings/Facilities
- Public Lighting
- Local Authority Fleet

4.2 RESULTS

4.2.1 ENERGY RESULTS - 2018

From the results obtained from the M&R system, Kilkenny County Councils energy consumption in 2018 was **15.08 GWh**, see Figure 6.

- Building and Facilities was the highest energy consumer, accounting for 5.73 GWh of the total energy consumption (37.99%)
- Public Lighting accounted for 4.95 GWh (32.84%)
- Transport accounted for 4.40 GWh(29.17%)

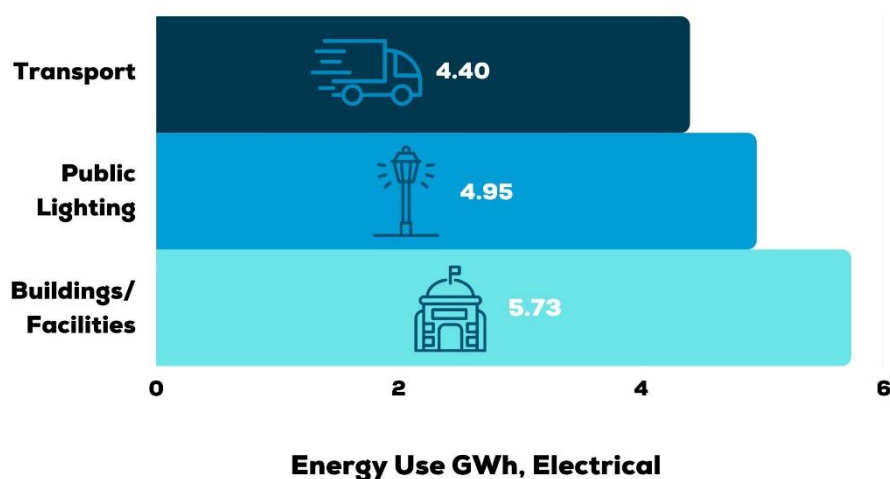


Figure 6. Energy Use in Kilkenny County Council grouped by Category - 2018

4.2.2 GHG EMISSIONS RESULTS - 2018

When energy use was converted into emissions, Kilkenny County Council's total emissions amounted to **4.47 ktCO₂eq**, see Figure 7.

- Public Lighting was the highest contributor, accounting for 1.83ktCO₂eq (40.98%) of these total emissions.
- Building and Facilities contributing 1.51ktCO₂eq (33.88%)
- Transport 1.12ktCO₂eq (25.14%) to the council's CO₂eq emissions, respectively.

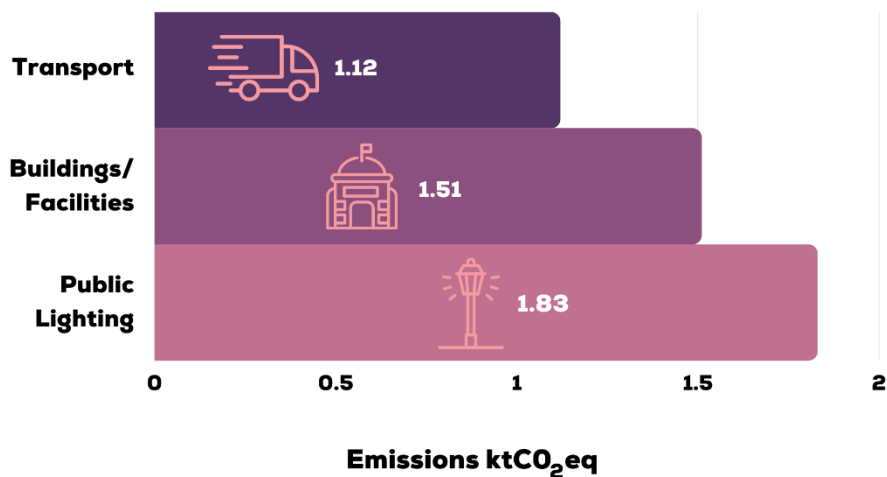


Figure 7. Emissions in ktCO₂eq by sector in Kilkenny County Council - 2018

4.2.3 ENERGY RESULTS – 2016-2018

From the results obtained from the M&R system, Kilkenny County Councils energy consumption in 2016-2018 was **15.45 GWh**, see Figure 8.

- Building and Facilities was the highest energy consumer, accounting for 5.57 GWh of the total energy consumption (36.08%)
- Public Lighting accounted for 5.36 GWh (34.67%)
- Transport accounted for 4.52 GWh(29.26%)

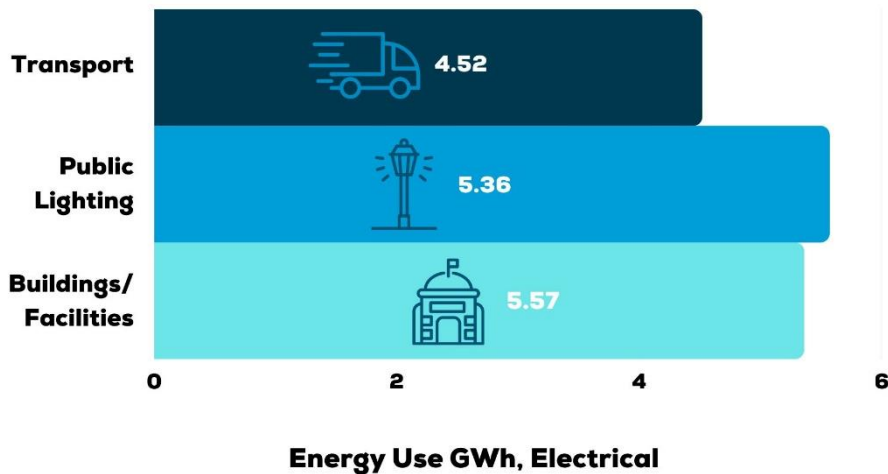


Figure 8. Energy Use in Kilkenny County Council grouped by Category – 2016-2018

4.2.4 GHG EMISSIONS RESULTS – 2016-2018

When energy use was converted into emissions, Kilkenny County Council's total emissions amounted to **5.06 ktCO₂eq**, see Figure 9.

- Public Lighting was the highest contributor, accounting for 2.32ktCO₂eq (45.94%) of these total emissions.
- Building and Facilities contributing 1.58ktCO₂eq (31.16%)
- Transport 1.16ktCO₂eq (22.90%) to the council's CO₂eq emissions, respectively.

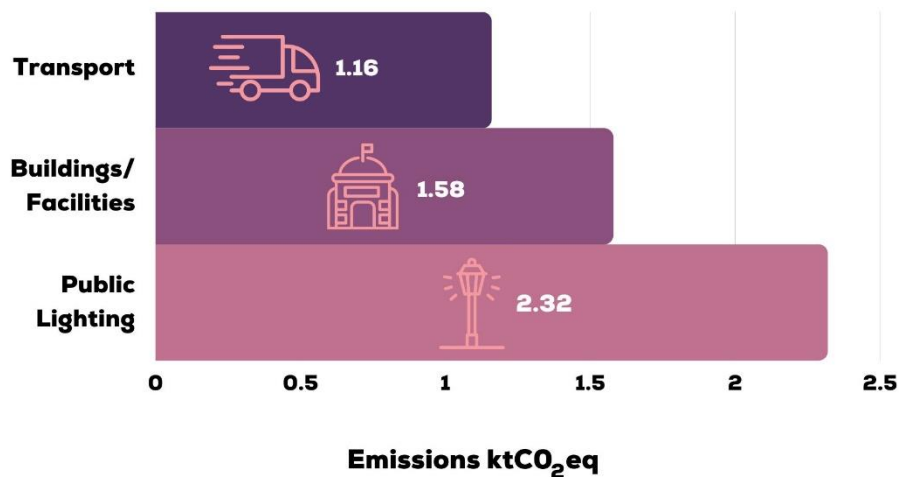


Figure 9. Emissions in ktCO₂eq by sector in Kilkenny County Council

4.3 KEY FINDINGS

The key findings from Kilkenny County Council emissions are summarised below.

- Total final energy used in 2018 was 15.08 GWh
- Buildings/Facilities was the largest consumer of energy in the sector, accounting for 37.99% of the total energy consumption, followed by Public lighting at 32.84% and Transport 29.17%
- Total final emissions produced by Kilkenny County Council in County Kilkenny in 2018 were 4.47 ktCO₂eq.
- Public Lighting was responsible for the highest GHG emissions from Kilkenny County Council, with 40.98%, followed by Buildings/Facilities at 33.88% and Transport 25.14%
- Total final emissions produced by Kilkenny County Council in County Kilkenny in 2016-2018 were 5.06 ktCO₂eq.

Kilkenny County Council	Electricity	Fossil Fuels					Renewable Energies			Total
		Thermal			Transport		Electricity	Thermal	Transport	
		Natural Gas	Heating Oils	LPG	Road Diesel	Petrol	Solar PV	WoodChip	Biofuel	
Building/ Facilities (GWh)	2.72	1.98	0.15	0.03			0.02	0.82		5.73
Public Lighting (GWh)	4.95									4.95
Transport (GWh)					4.24	0.02				0.14
Total Energy (GWh)	7.67	1.98	0.15	0.03	4.24	0.02	0.02	0.82	0.14	15.08
Buildings / Facilities (ktCO ₂ eq)	1.06	0.41	0.04	0.01						1.51
Public Lighting (ktCO ₂ eq)	1.83									1.83
Transport (ktCO ₂ eq)					1.12	0.01				1.12
Total Emissions (ktCO₂eq)	2.90	0.41	0.04	0.01	1.12	0.01	-	-	-	4.47

Table 2: Kilkenny County Council Inventory, Energy and CO₂eq Emissions - 2018

5.0 RESIDENTIAL

This section looks at the emissions arising from the residential sector. In Ireland, the residential sector is the second largest energy user after transportation (SEAI, 2019), thus monitoring energy use and emissions in this sector is crucial.

At a national level, a 40% reduction of the residential sector GHG emissions is required.

5.1 METHODOLOGY

Domestic dwellings are responsible for emissions from the use of energy for space heating, hot water and electricity. This methodology is based on five main data sources:

- Central Statistics Office's Census 2016¹² (CSO, 2016)
- EPA's national emissions inventories - MapEire (AARHUS University, 2022)
- SEAI BER research tool (SEAI, 2021)
- Central Statistics Office's Metered Electricity Consumption data
- Central Statistics Office's Natural Gas Consumption data

Firstly, the total number of houses in County Kilkenny is obtained from the Census data. This is split by category, which was simplified into 4 main house types:

- Semi-detached
- Detached
- Terraced
- Apartment

The Census 2016 data shows that there are 34,743 residential properties in Kilkenny, see Figure 10, of which:

- 59.16% - Detached house,
- 22.24% - Semi-Detached house,
- 13.31% - Terraced house and
- 4.48% - Apartments
- 0.81% - Not stated

¹² Census 2022 not available at time of analysis. Preliminary data published post analysis



Figure 10. Percentage % of Residential Dwelling Types in County Kilkenny, Census 2016

The total number of houses across the county includes all social houses. Kilkenny County Council in 2018 had a total of 2,395 social houses under its remit, which is equivalent to 7% of the total houses in the County. The LA social houses are not included in Section 4 above, which outlines the Local Authority’s own energy. That is because even though the homes are owned or under the remit of Kilkenny County Council, it is individual tenants that use the energy, and therefore it is reported under the Residential sector and not the Local Authorities section.

However, the Local Authorities still has accountability in relation to upgrading its own social housing stock and therefore GHG savings in the Residential sector can be completed directly by the Local Authority.

These simplified house types allow for comparison with the breakdown provided by the Building Energy Rating Certificates (BER) data, so that the same house type categories are used for the analysis. The BER data is downloaded from SEAI BER research tool¹³. The database does not provide exact addresses, however the BER data provided the number of houses with BER ratings. All houses constructed after 2018 were removed from the BER data set. The BER data provides a breakdown of BER rating (A1 – G) for each house type categorised above.

Additional data from published Building Energy Rating Certificates (BER) helped further inform the breakdown of emissions based on the average BER rating of the homes across County Kilkenny. The BERs were filtered per County for County Kilkenny, and information is available on theoretical energy demand and emissions from those dwellings. The data provides us with detailed information for each BER rating. The average BER rating per house type is then applied to the total domestic dwellings across the County.

Figure 11 below shows the number of published BERs in 2018 for each BER rating for County Kilkenny, which totaled 16,288 houses, or 47.27% of the total housing stock in County Kilkenny.

¹³ <https://ndber.seai.ie/BERResearchTool/ber/search.aspx>

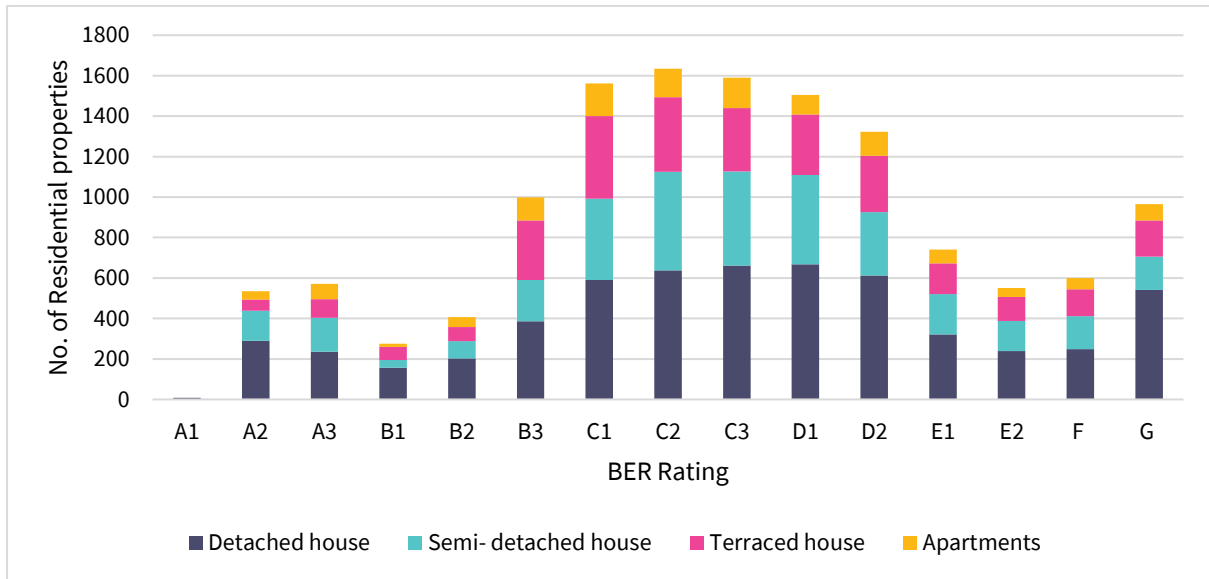


Figure 11. BER ratings of Residential Sector, County Kilkenny 2018

The BER ratings of the Kilkenny County Council owned social housing was provided by Kilkenny County Council, and showed that out of the 2,395 social houses 1,493 (62.34%) have BER's

The BER data was used to calculate the average energy demand for each house type at each BER rating (A1-G). This average demand was then applied to the total number of dwellings of each house type and each BER rating in each category. This gave a total energy and emissions for the residential sector in County Kilkenny.

The average consumption per house type and BER rating is shown in Table 3 and Figure 12 below.

BER	Detached (kWh)	Semi-Detached (kWh)	Terraced (kWh)	Apartments (kWh)
A1	5,868	-	-	-
A2	4,863	2,590	1,884	2,366
A3	8,850	2,874	3,538	2,859
B1	15,485	6,790	5,691	5,905
B2	24,343	10,071	10,085	7,787
B3	25,803	13,006	10,778	9,580
C1	26,810	15,234	11,734	9,772
C2	27,561	15,314	14,029	11,238
C3	27,844	17,555	15,660	10,798
D1	28,865	18,881	17,202	11,220
D2	30,101	19,820	19,375	10,962
E1	33,845	20,653	20,107	12,078
E2	36,587	23,644	24,202	12,011
F	39,996	26,123	30,442	14,010
G	51,207	34,558	46,571	21,205

Table 3: Average Consumption per House and BER Type

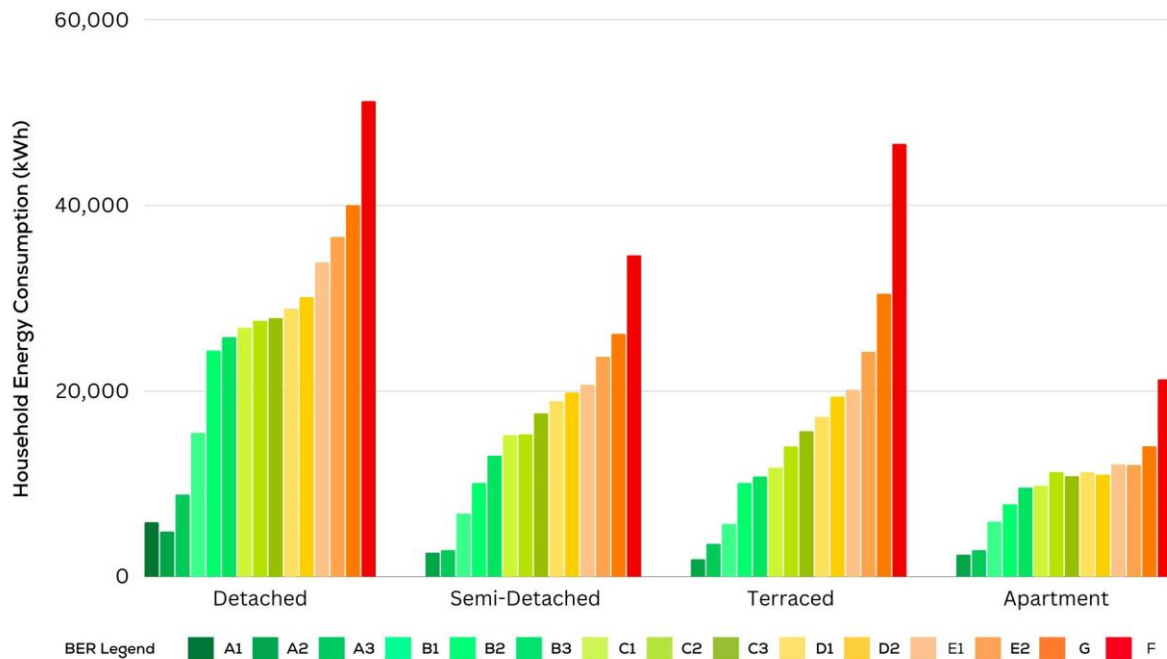


Figure 12. Average Consumption per House and BER Type

The electricity and natural gas data comes directly from the Central Statistics Office’s Metered Electricity Consumption data¹⁴ and Natural Gas Consumption data¹⁵.

The Central Statistics Office Energy Balance (2018) was used to get a national average breakdown between the thermal fuel types. The average % breakdown was used to calculate the breakdown of the thermal fuel for County Kilkenny residential sector.

To summarise:

- The total homes and house types in County Kilkenny was found from the Census 2016 data
- The total thermal energy consumption was found from the BER data and extrapolated against the total number of homes and house types in the County to get the total energy consumption in homes in County Kilkenny
- The electricity and natural gas data comes directly from the Central Statistics Office’s Metered Electricity Consumption data¹⁶ and Natural Gas Consumption data¹⁷
- The thermal breakdown, in terms of what fuel is used to heat a home, was calculated using the actual metered gas data and the national average fuel mix breakdown from the Residential Fuel Mix in 2018¹⁸ taken from the CSO data

¹⁴ <https://www.cso.ie/en/statistics/energy/meteredelectricityconsumption/>

¹⁵ <https://www.cso.ie/en/statistics/energy/networkedgasconsumption/>

¹⁶ <https://www.cso.ie/en/statistics/energy/meteredelectricityconsumption/>

¹⁷ <https://www.cso.ie/en/statistics/energy/networkedgasconsumption/>

¹⁸ <https://data.cso.ie/table/SEI01>

- The total electricity data from the Metered Electricity Consumption data, minus the thermal electricity found from the average fuel mix breakdown, gave the non-thermal electricity consumption

All energy data was then converted into equivalent GHG emissions using the CO₂eq. conversion factors for each fuel type.

MapElre data set provides additional emissions produced in the form of Methane (CH₄) and Nitrous Oxide (N₂O) by residential sectors, i.e. in addition to CO₂ emissions from the combustion of fossil fuels such as natural gas, heating oil, coal, etc. These emissions are converted into CO₂eq using the conversion factors provided by EPA (EPA, 2023)

5.2 RESULTS

The total number of houses in County Kilkenny from the 2016 Census data was 34,743. The BER ratings for County Kilkenny showed that 16,288 houses had a BER rating – this is equal to 47.27% of the total domestic dwellings.

The breakdown of heating fuel types for houses is shown in Table 4 and Figure 13. This shows that a total of 89.00% of homes use fossil fuels to heat their homes. 55.24% of homes in County Kilkenny use heating oils to heat their homes.

Type of Central Heating	No of Houses	% of homes
No central heating	449	1.29%
Oil	19,193	55.24%
Natural Gas	7,679	22.10%
Electricity	1,465	4.22%
Coal (incl. anthracite)	3,177	9.14%
Peat (incl. turf)	315	0.91%
Liquid Petroleum Gas (LPG)	242	0.70%
Wood (incl. wood pellets)	1,472	4.24%
Other fuels	316	0.91%
Not stated	435	1.25%

Table 4: Thermal Fuel Sources for Houses, County Kilkenny

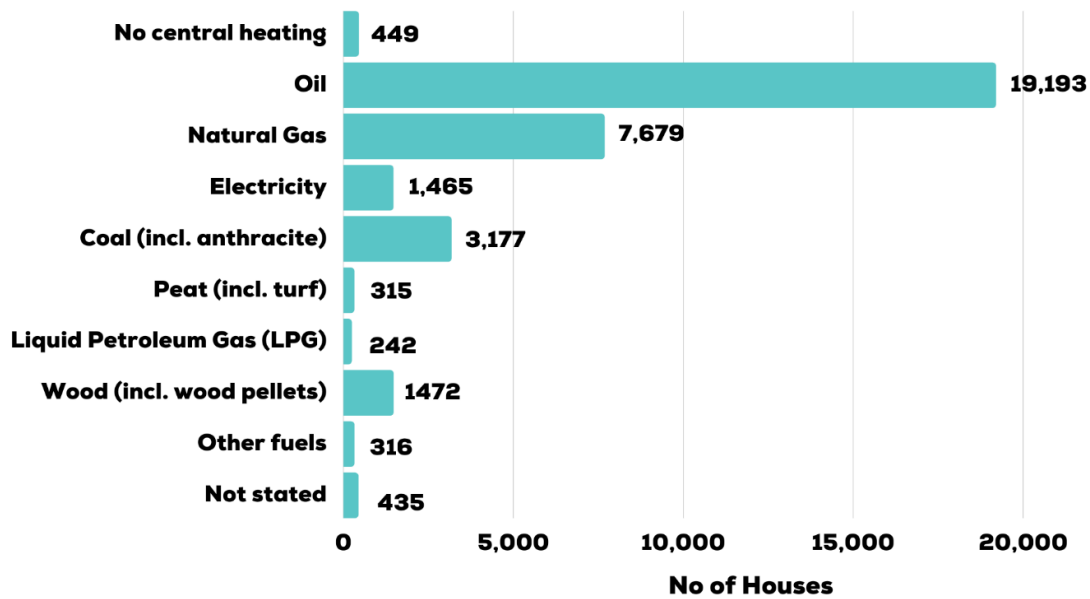


Figure 13. Thermal Fuel Sources for Houses in County Kilkenny

5.2.1 ENERGY RESULTS

Total energy use in the residential sector was **931.37 GWh**. The residential fuel split is shown in Table 5 and Figure 14, and mainly comes from:

- Electricity - making up 18.47% of the fuel mix
- Heating Oils accounts for 50.56%
- Natural Gas accounts for 7.62% of the fuel mix.
- Total renewable fuels only accounted for 3.42% of the final energy consumption. The majority of this came from biomass sources (mainly wood)

The percentage of the LA energy contribution is also outlined, and equates for 47.07GWh (5.05%) of the counties energy demand in the residential sector.

Total Consumption GWh	Total Residential GWh	LA Social Housing GWh	% breakdown of each Fuel Type
Electricity (non-thermal)	138.57	7.00	14.88%
Electricity (thermal)	33.43	1.69	3.59%
Coal	72.22	3.65	7.75%
Peat	91.46	4.62	9.82%
Heating Oils	470.93	23.80	50.56%
LPG	20.30	1.03	2.18%
Petroleum Coke	1.63	0.08	0.18%
Natural Gas	71.00	3.59	7.62%
Renewables	31.83	1.61	3.42%
Total Energy Consumption	931.37	47.07	

Table 5: Breakdown of Energy Consumption in Domestic Houses by Fuel Type

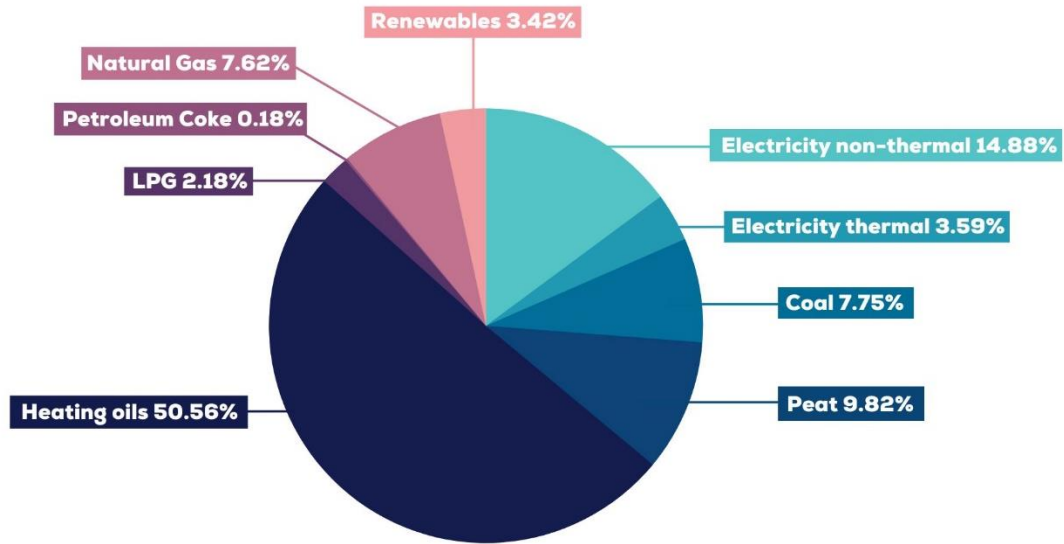


Figure 14. Share of Total Energy Demand in the Residential Sector by Fuel Mix

5.2.2 GHG EMISSION RESULTS

The GHG emissions from methane (CH₄), and nitrous Oxide (N₂O) obtained from the MapElre data equates to 3.21 ktCO₂eq. When energy use was converted into GHG emissions, the total GHG emissions in 2018 for the Residential Sector in County Kilkenny was **289.32ktCO₂eq.**

The percentage of the LA Social housing contribution is also outline, and equates for 14.62 ktCO₂eq (5.05%) of the counties GHG emissions in the residential sector.

Figure 15 below shows the total emissions for the residential sector in County Kilkenny by fuel type. The highest emissions in the residential sector come from electricity and heating oils, which contribute 29.94% and 41.84% respectively.

Total GHG Emissions	Total residential ktCO ₂ Eq	LA Social Housing GHG Emissions ktCO ₂ Eq	%
Electricity (non-thermal)	74.13	3.75	25.62%
Electricity (thermal)	12.50	0.63	4.32%
Coal	24.60	124	8.50%
Peat	34.24	1.73	11.84%
Kerosene	121.03	6.12	41.83%
LPG	4.65	0.24	1.61%
Petroleum Coke	0.43	0.02	0.15%
Natural Gas	14.53	0.73	5.02%
Renewables	0.00	0.00	0.00%
CH ₄ to CO ₂ eq	2.83	0.14	0.98%
N ₂ O to CO ₂ eq	0.37	0.02	0.13%
Total GHG Emissions	289.32	14.62	

Table 6: Breakdown of GHG emissions from energy use in domestic houses

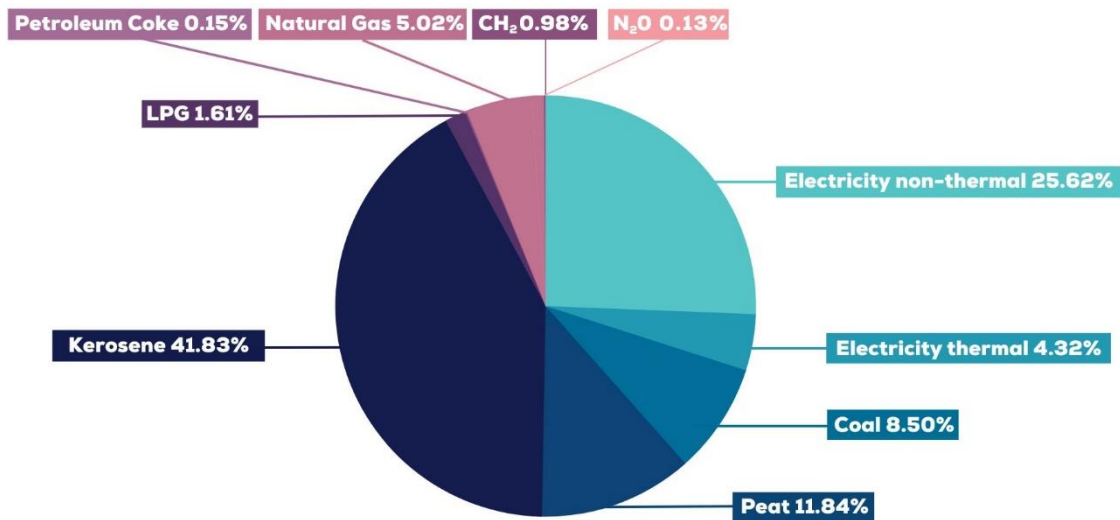


Figure 15. Share of Total Emissions (%) in the Residential Sector by Fuel Type

5.3 KEY FINDINGS

- Total energy consumed by the residential sector in 2018 was 931.37 GWh
- 50.56% of the residential fuel mix was made up heating oil followed by 18.47% electricity and 9.82% peat
- Total residential emissions were 289.32 ktCO₂eq in 2018
- 41.83% of residential emissions came from heating oil, 29.94% from electricity and 11.84% from peat.

Residential Sector					Total
	Electricity	Fossil Fuels	Renewable Energies	CH ₄ /N ₂ O	
Total Energy (GWh)	172.00	727.54	31.83	0.00	931.37
Total Emissions (ktCO₂eq)	86.63	199.49	0.00	3.21	289.32

Table 7: County Kilkenny Residential Inventory; Energy and CO₂eq Emissions

6.0 MANUFACTURING & COMMERCIAL

Manufacturing & Commercial data is reported as one sector as outlined in “Technical Annex C: Climate Mitigation Assessment” of the Local Authority Climate Action Plan Guidelines” (DECC, 2023).

The national data provided for the Baseline Emissions Inventory (BEI) has Kilkenny County Councils data included within this sector (EPA, 2022). Kilkenny County Council’s data is presented and analysed separately in this report (see Section 4 **Error! Reference source not found.**). Therefore, the data presented in this section is for the Manufacturing & Commercial sector, without the Local Authority data, which has been extracted from this data set. Other public sector energy and emissions data is included in this section.

The Manufacturing and Commercial sectors are responsible for emissions from the operation of manufacturing plants as well as space heating, water heating, cooking and laundry involved in commercial services. The main data sources for these sectors are MapElre¹⁹, CSO non-residential metered consumption data²⁰, CSO Energy Balance²¹ and Valuation Office²² data set.

At a national level, a 45% reduction of the Manufacturing and Commercial sectors GHG emissions and a 51% reduction of the Public Sector GHG emissions is required.

6.1 METHODOLOGY

The CSO data and the data provided from the Valuations Office form the foundation of data collection for this sector.

The Valuation Office (VO) provides data on a number of businesses in County Kilkenny and the associated floor area of each. The public sector buildings are not registered to the Valuation Office. The properties are categorised by the Valuation Office as follow:

- **Industrial Uses** includes (Warehouse, Workshops, Factory, Livestock Mart, Showrooms, workshop offices)
- **Office** includes (Business parks, industrial offices, studio)
- **Retail (Warehouse)** includes (Garden Yard, Motor showroom Yard)
- **Hospitality** includes (Pubs, Night Clubs, Guesthouse, Funeral homes, Caravan parks, Hostel, Hotels)
- **Health** includes (Nursing home, Clinic, Surgery centers, Surgery office)
- **Fuel/Depot** includes (Oil/Fuel Depot store, Service station, Motorway service station, Oil/Fuel Depot yard)
- **Miscellaneous** includes (Crèche, Car park, Advertising station)
- **Retail (Shops)** includes (retail shops, Supermarket, Restaurant, Post Office, Department store, Café, Bank, ATM, Pharmacy)

¹⁹ <https://projects.au.dk/mapeire/spatial-results/download>

²⁰ <https://www.cso.ie/en/statistics/energy/meteredelectricityconsumption/>

²¹ <https://data.cso.ie/table/SEI01>

²² <https://maps.valoff.ie/maps/VO.html>

- **Leisure** includes (Clubhouse, Community hall, Stable, Stadium, Swimming Pool, Gymnasium/Fitness Centre, Cinema, Equestrian Centre, Theatre)
- **Minerals** includes (Quarries)

Table 8 shows the total number of businesses and the associated floor area for each category. 52.83% of the commercial properties can be categorised as retail shops, 16.29% as industrial and 12.40% as office, see Figure 16.

	No. of Buildings	Total Floor Area (m ²)
Industrial Uses	905	1,596,098
Office	689	71,632
Retail (Warehouse)	172	94,129
Hospitality	217	331
Health	158	45,532
Fuel/Depot	110	2,621,721
Miscellaneous	125	117,414
Retail (Shops)	2,935	154,969
Leisure	124	76,474
Minerals	121	1,005,313
TOTAL	5,556	5,783,611

Table 8: Number of Properties & Floor Area of Manufacturing & Commercial Businesses

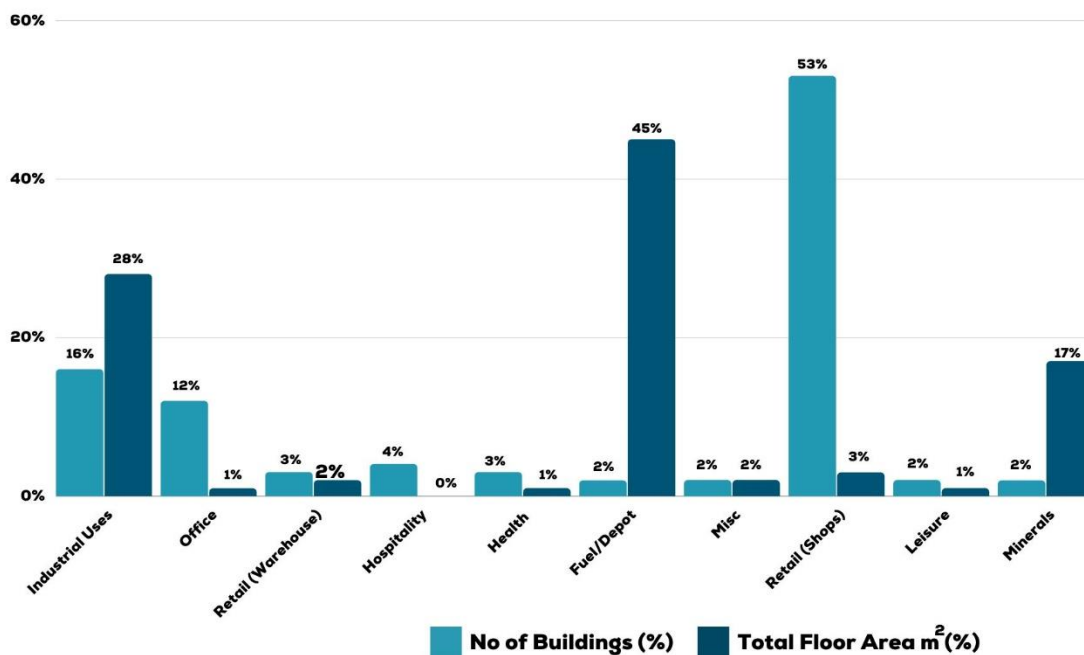


Figure 16. Number of Properties & Floor Area of Manufacturing & Commercial Businesses

The Chartered Institute for Building Service Engineers (CIBSE, 2008) produce benchmarks, given in kilowatt-hours per meter squared floor area (kWh/m²) for heat and electricity, in each building category.

	kWh/m ²	CO ₂ Eq
Industrial Uses	195	49.7
Office	215	75.1
Retail (Warehouse)	195	49.7
Hospitality	435	120.5
Health	270	76.5
Fuel/Depot	195	49.7
Miscellaneous	70.39	112.6
Retail (Shops)	165	90.8
Leisure	1375	349.5
Minerals	195	49.7

Table 9: CIBSE Benchmarks used for each Manufacturing & Commercial Category

The advantage of using CIBSE energy benchmarks is that they are based on a large sample set, and as Irish building regulations follow the UK regulations, the energy figures are applicable in the Irish context. The relevant benchmarks can be matched by property type and multiplied by the floor areas from the Valuation Office for all Manufacturing & Commercial businesses in the County.

The CSO Natural Gas Consumption data²³ and the Electricity Metered Data²⁴ for non-residential buildings was obtained from CSO data. The Local Authority data was also used and subtracted from the electricity and thermal data to obtain the split between thermal and electrical consumption for the Manufacturing & Commercial sector.

MapElre data set provides additional emissions produced in the form of Methane (CH₄) and Nitrous Oxide (N₂O) by Manufacturing & Commercial sector. These emissions are converted into CO₂eq using the conversion factors provided by EPA (EPA, 2023)

²³ <https://www.cso.ie/en/statistics/energy/networkedgasconsumption/>

²⁴ <https://www.cso.ie/en/statistics/energy/meteredelectricityconsumption/>

6.2 RESULTS

6.2.1 ENERGY RESULTS

Total energy use in the Manufacturing & Commercial sector in 2018 was **1,225.11 GWh**. The energy demand mainly comes from thermal consumption, which accounts for 999.78 GWh (81.61%) of the energy. 225.33 GWh (18.39%) is electricity, see Figure 17.

Fuel Type	Energy GWh
Electricity	225.33
Natural Gas	240.02
Heating Oils	410.53
LPG	86.30
Coal/Peat	86.30
Renewables	176.63
TOTAL	1,225.11

Table 10: Breakdown of Consumption by Fuel Type

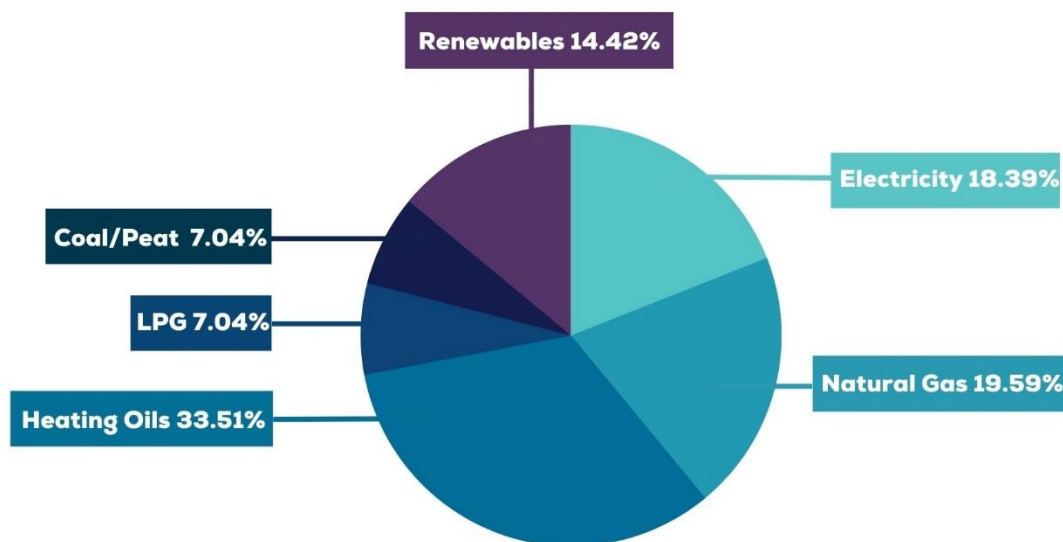


Figure 17. Breakdown of Consumption % by Fuel Type

6.2.2 GHG EMISSION RESULTS

When energy use was converted into GHG emissions, total emissions from the Manufacturing & Commercial sector in 2018 was calculated at 298.53 ktCO₂eq. As can be seen from Figure 18, the commercial properties that produced the most emissions were:

- Fuel/Depot: 120.34 ktCO₂eq (40.31%)
- Industrial uses (Manufacturing & Engineering buildings): 73.26 ktCO₂eq (24.54%)
- Minerals: 46.14 ktCO₂eq (15.46%)
- Leisure: 24.73 ktCO₂eq (8.28%)

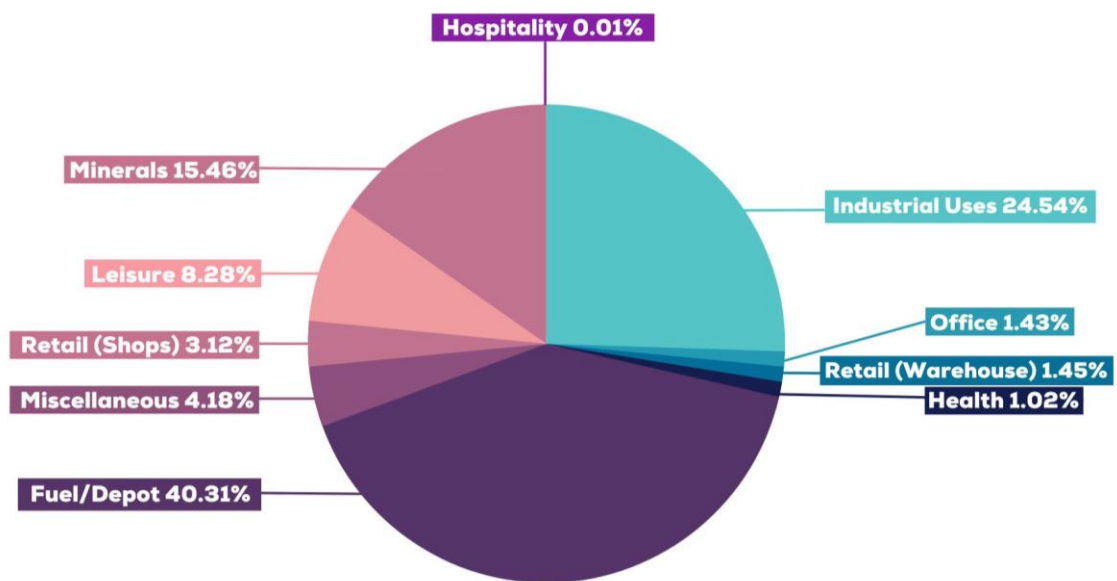


Figure 18. Manufacturing & Commercial Emissions by Property Category

Figure 19 below gives an indication of emissions in comparison to the percentage of buildings for different commercial properties in the region.

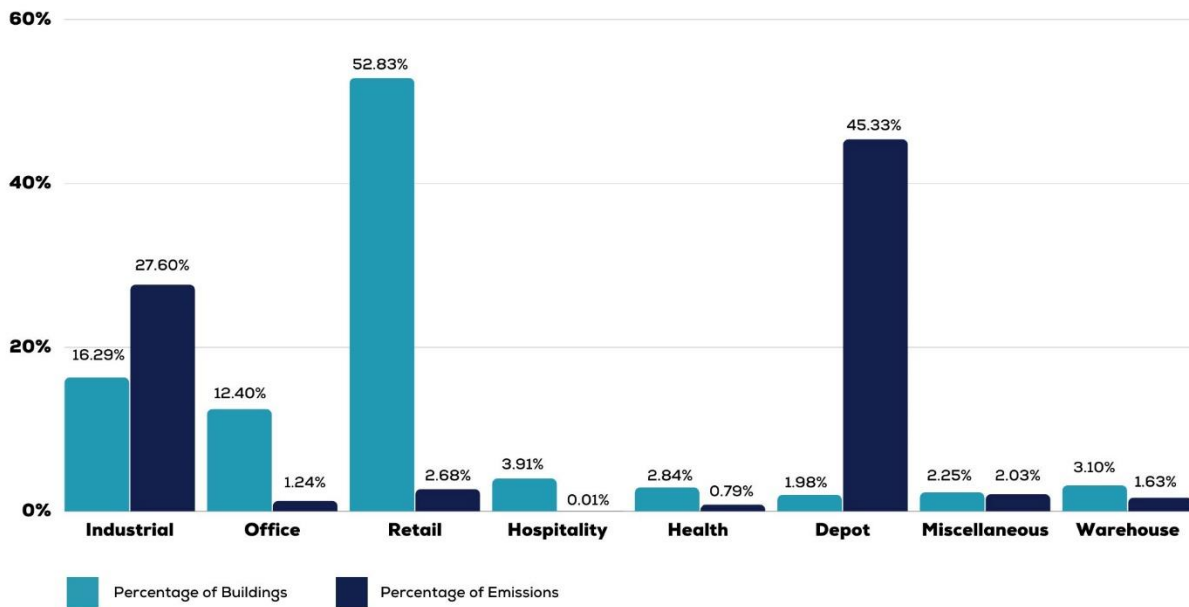


Figure 19. Share of Total Emissions and Number of Commercial Properties in County Kilkenny

Industrial uses, Minerals and Fuel/Depot are the main CO₂eq emitters, as altogether they make up 80.31% of the commercial sector’s total emissions. From this analysis, these three categories should be the main targets of energy and emission reduction initiatives within the commercial sector.

Figure 20 below shows the electricity and types of fossil fuel consumption of commercial & manufacturing buildings by category. These figures are representative of the CIBSE energy benchmark. Electricity and heating oil account for the highest share of use (28.32%) and (37.62%) respectively. CIBSE only breaks down fuel use into fossil fuels and electricity. Therefore, CSO energy balance 2018 was used to take a national average use by fuel type to calculate the emissions.

Total GHG Emissions	ktCO ₂ eq emissions
Electricity	84.54
Natural Gas	48.96
Heating Oils	112.32
LPG	19.79
Coal/Peat	32.31
Renewables	-
CH ₄	0.24
N ₂ O	0.37
TOTAL	298.53

Table 11: Manufacturing & Commercial Emissions by Fuel Type

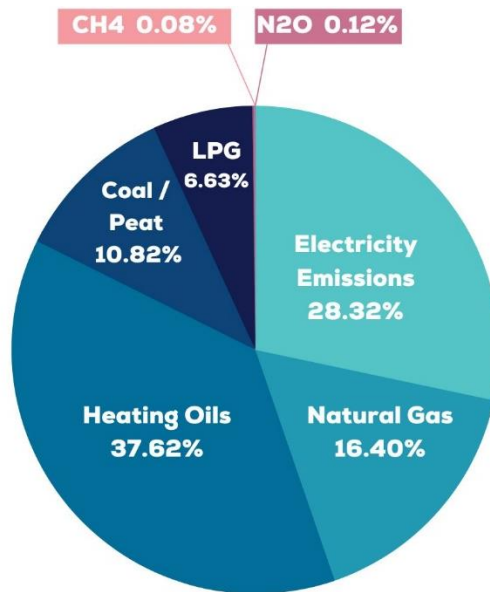


Figure 20. Manufacturing & Commercial Emissions by Fuel Type

6.3 KEY FINDINGS

- Total energy consumed by the Manufacturing & Commercial sector in 2018 was 1,225.11 GWh
- 18.39% of the energy was electricity, 19.59% was natural gas and 33.51% was Heating Oils. 14.42% was from Renewable energy systems
- Total Manufacturing & Commercial emissions were 298.53 ktCO₂eq in 2018
- 28.32% of the emissions came from electrical consumption, 16.40% from natural gas and 37.62% from heating oils
- 40.31% of emissions came from the fuel/Depot category, 24.54% from Industrial uses and 15.46% from Minerals

Manufacturing and Commercial Sector				Total
	Electricity	Thermal	CH ₄ & N ₂ O	
Total Energy (GWh)	225.33	999.78		1,225.11
Total Emissions (ktCO₂eq)	84.54	213.38	0.60	298.53

Table 12: County Kilkenny Manufacturing & Commercial Inventory; Energy and CO₂eq Emissions

7.0 INDUSTRIAL PROCESSES

The industrial processes sector includes greenhouse gas emissions occurring from industrial processes, from the use of greenhouse gases in the production of products, and from non-energy uses of fossil fuel carbon (EPA). For example, emissions caused by the processes that convert raw materials to a range of chemical, mineral or metal products like cement and fertilisers. These are a mix of energy related and non-energy related GHG emissions.

Industrial Processes differs from industrial uses outlined in Section 6 in that industrial uses includes the GHG emissions that come from energy consumption and the manufacturing and delivery of services.

At a national level, a 35% reduction of the Industrial Processes sector GHG emissions is required.

7.1 METHODOLOGY

As per the methodology provided on page 28 of Technical Annex C: Climate Mitigation Assessment” of the Local Authority Climate Action Plan Guidelines” (DECC, 2023). MapEIre provides emission data for industrial processes across County Kilkenny.

GHG emissions from industrial processes is split by MapEIre into main categories including:

- Lime Production
- Ceramic
- Lubricant use
- Paraffin wax use
- Food and Beverages Industry
- Domestic solvent use
- Other solvent use (painting, coating, adhesive, etc.)

The non-energy related GHG emissions include Methane (CH₄), Nitrous Oxide (N₂O), sulfur Hexafluoride (SF₆). These are all converted into CO₂eq using the conversion factors from EPA²⁵

GHG	CO ₂ eq/kg
CO ₂	1
CH ₄	25
N ₂ O	298
SF ₆	228000

Table 13: CO₂eq. Conversion Factors for Various GHG Emissions

²⁵ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

7.2 RESULTS

Using the methodology outlined in the Technical Annex C: Climate Mitigation Assessment (EPA, 2023), the CO₂eq emissions from the industrial processes are **20.32ktCO₂eq**.

Figure 21 below shows non-energy related emissions = 20.32 ktCO₂eq

- Lime Production: 0 ktCO₂eq
- Ceramic: 0.01 ktCO₂eq
- Lubricant use: 0.63 ktCO₂eq
- Paraffin wax use: 0.60 ktCO₂eq
- Food and Beverages Industry: 9.76 ktCO₂eq
- Domestic solvent use: 0.98ktCO₂eq
- Other solvent use: 8.35 ktCO₂eq

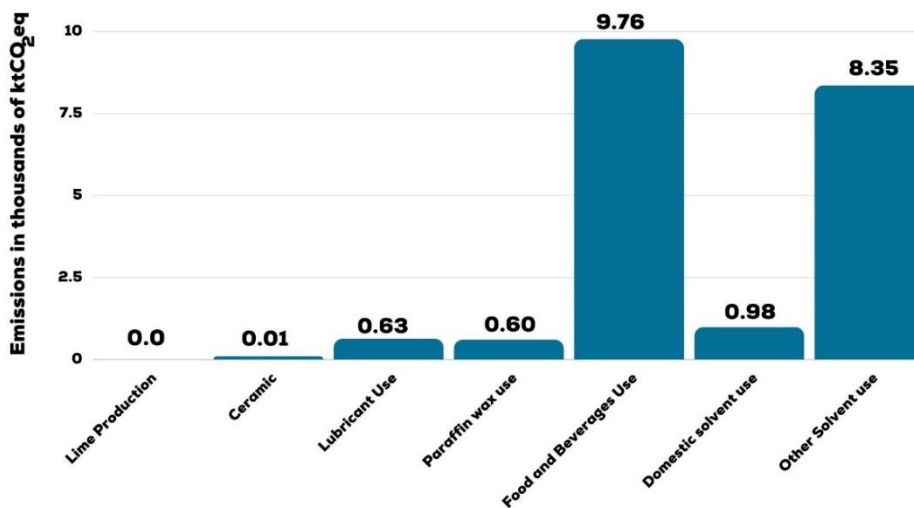


Figure 21. CO₂ Emissions from the Industrial Processes, ktCO₂eq

7.3 KEY FINDINGS

- Total emissions from industrial processes are 20.32 ktCO₂eq.
- 9.76 ktCO₂eq (48.03%) emissions were from the food and beverage industry
- 8.35 ktCO₂eq (41.08%) emissions were from other solvent use
- The remaining 2.21 ktCO₂eq emissions were from ceramics, lubricant use, paraffin wax use, and domestic solvents

Industrial Process Sector	Lime Production	Ceramics	Lubricant Use	Paraffin Wax Use	Food Industry	Solvent Use	Total
Total Emissions (ktCO₂eq)	0.00	0.01	0.63	0.60	9.76	9.32	20.32

Table 14: County Kilkenny Industrial Processes CO₂eq emissions

8.0 AGRICULTURE

This sector's emissions are from both energy and non-energy related actions.

The non-energy related emissions come from a range of sources, including, livestock units (dairy cows, sheep, horses, poultry, fisheries, non-dairy cows), enteric fermentation, manure management, agricultural soils, liming, and use of fertilisers and urea.

Energy related emissions are for electricity and fuels used within the agricultural sector.

Transport related emissions from the Agricultural sector are reported under the Transport Sector, as per the methodology outlined page 28 of the Technical Annex C: Baseline Mitigation Assessment.

At a national level, a 25% reduction of the agriculture sector GHG emissions is required.

8.1 METHODOLOGY

MapElre data provides a breakdown of emissions within this sector covering a wide range of categories, including:

- Agriculture/ Forestry/ Fisheries: Stationary
- Dairy Cattle
- Non-dairy Cattle
- Sheep
- Swine
- Goats
- Horses
- Mules and asses
- Manure management - Dairy Cattle
- Manure management - Non-Dairy Cattle
- Manure management - Sheep
- Manure management - Swine
- Manure management - Goats
- Manure management - Horses
- Manure management - Mules and asses
- Liming
- Inorganic N-fertilizers
- Animal manure applied to soils
- Sewage sludge applied to soils
- Urine and dung deposited by grazing animals
- Crop residues applied to soils
- Mineralization
- Atmospheric deposition
- Nitrogen leaching and run-off
- Urea application

The data from MapElre, categorized as ‘off-road vehicles’ has been removed from this data set and is reported under the Transport Data (Section 9 of this report). This is reported under the Tractors & Machinery heading.

MapElre data set provides emissions produced in the form of Methane (CH₄) and Nitrous Oxide (N₂O). These emissions are converted into CO₂eq using the conversion factors provided by EPA²⁶. This data is for both energy and non-energy related emissions.

For the energy related emissions, additional data from CSO Census of Agriculture is broken down to County level and gives information on the number of farms, the number of livestock units (dairy cow, sheep, pig, poultry etc.), and the crops grown (Central Statistics Office, 2020), (EPA, 2022), see Figure 22. In County Kilkenny there are a total of:

- 373,951 cows of which 100,988 dairy cows, and 272,963 other cattle in 2,802 farms.
- 98,026 sheep of which 46,806 are Ewes in 507 farms.
- 29,400 poultry of which 27,600 fowl and 1,800 other poultry in 191 farms.
- 53,500 pigs of which 4,300 are breeding pigs and 30,200 are other pigs over 20 kgs in 48 farms.



Figure 22. Breakdown of Livestock Units and a Number of Farms in County Kilkenny

Benchmarks from Teagasc were used to estimate energy and non-energy related emissions (Teagasc, 2017). These provide benchmarks in formats such as kWh electricity/dairy, cow/year, methane/dairy, cow/year, kWh. This methodology allows a detailed breakdown of agricultural emissions. Average energy consumption in the agriculture sector, by livestock, in Ireland are:

²⁶ <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results>

- 350 kWh of energy per cow
- 5.77 kWh of energy by sheep
- 10.7 kWh of energy by poultry
- 28 kWh of energy by pig produced

The energy related emissions calculated from the CSO data and Teagasc benchmarks is subtracted from the total emissions provided by MapEire to give energy and non-energy related GHG emissions for the agricultural sector.

8.2 RESULTS

8.2.1 ENERGY RESULTS

Using the Teagasc Benchmarks and the number of different livestock from the CSO data, as outlined above, the total Energy related emissions associated with the Agriculture sector in County Kilkenny in 2018 was **160.14GWh**.

82% of this is associated with cattle and 17% associated with sheep.

	Electrical GWh	Thermal GWh	Total	%
Cattle	130.88	-	130.88	98.22%
Sheep	0.57	-	0.57	0.42%
Poultry	0.04	0.28	0.31	0.24%
Pigs	1.47	0.03	1.50	1.12%
TOTAL	159.84	0.31	133.26	

Table 15: Energy Related Energy Consumption Associated with the Livestock in County Kilkenny

8.2.2 GHG EMISSION RESULTS

The GHG emissions are split between energy related and non-energy related emissions.

The energy related emissions associated with the 133.26GWh outlined above are calculated using the electricity and thermal conversion factors.

The total energy related emissions are 49.97ktCO₂eq, see Figure 25.

	ktCO ₂ eq	%
Cattle	49.11	98.28%
Sheep	0.21	0.42%
Poultry	0.09	0.18%
Pigs	0.56	1.12%
TOTAL	49.97	

Table 16: Energy Related GHG Emissions Associated with the Livestock in County Kilkenny

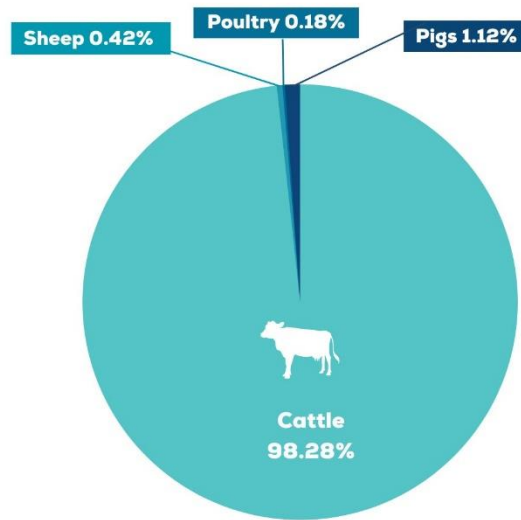


Figure 23. Breakdown of Energy Related GHG Emissions Associated with the Livestock in County Kilkenny

The non-energy related emissions calculated using the MapElre data and the energy related emissions above, gave a total of 906.09 ktCO₂eq, see Figure 24.

NFR_Code	NFR Name	ktCO₂eq
1A4ci	Agriculture/ Forestry/ Fisheries: Stationary	2.22
1A4ciii	Agriculture/ Forestry/ Fisheries: National fishing	0.01
3A1a	Dairy Cattle	238.16
3A1b	Non-dairy Cattle	312.16
3A2	Sheep	14.96
3A3	Swine	1.72
3A4d	Goats	0.02
3A4e	Horses	1.51
3A4f	Mules and asses	0.10
3B1a	Manure management - Dairy Cattle	27.32
3B1b	Manure management - Non-Dairy Cattle	49.24
3B2	Manure management - Sheep	1.78
3B3	Manure management - Swine	9.68
3B4d	Manure management - Goats	0.01
3B4e	Manure management - Horses	0.37
3B4f	Manure management - Mules and asses	0.02
3G	liming	11.76
3Da1	Inorganic N-fertilizers	119.57
3Da2a	Animal manure applied to soils	28.94
3Da2b	Sewage sludge applied to soils	0.69
3Da3	Urine and dung deposited by grazing animals	61.71
3Da4	Crop residues applied to soils	12.32
3Da5	Mineralization	1.06
3Da6	Cultivation of organic soils	3.74
3Db1	Atmospheric deposition	7.98
3Db2	Nitrogen leaching and run-off	3.95
3H	Urea application	5.17
	Total	916.18

Table 17: Non-Energy Related Emissions from the Agriculture sector in County Kilkenny by Category

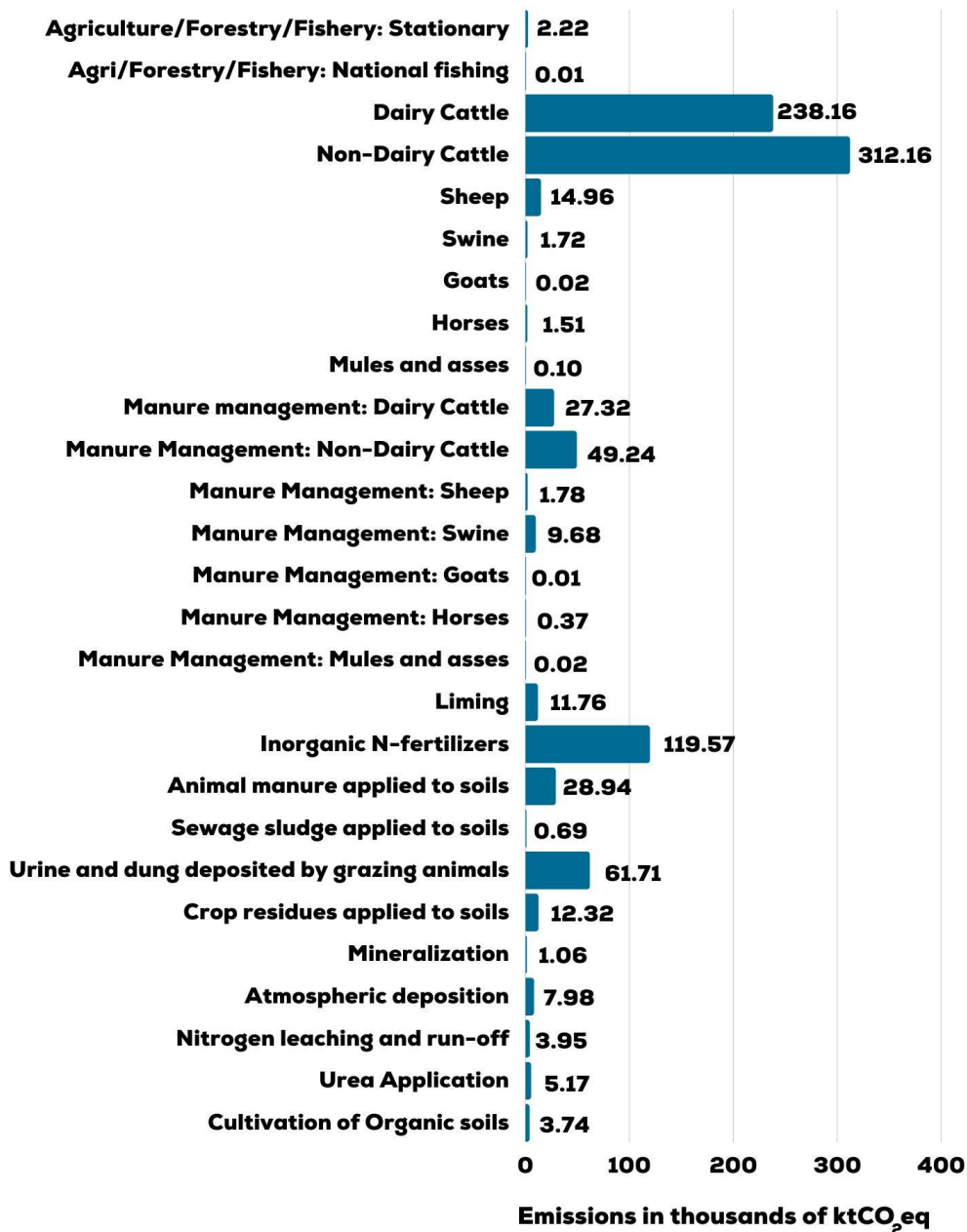


Figure 24. Non-Energy Related Emissions from the Agriculture sector in County Kilkenny by Category

Therefore, the total emission from agriculture is **966.15 ktCO₂eq** in 2018.

8.3 KEY FINDINGS

- Energy Consumption from agriculture sector accounts for 133.26 GWh
- Non-energy related GHG emissions totaled 916.18 ktCO₂eq
- Total emissions from agriculture sector accounts for 966.15 ktCO₂eq

Agriculture Sector				Total
	Electricity	Thermal	CH ₄ & N ₂ O	
Total Energy (GWh)	132.95	0.31		133.26
Total Emissions (ktCO₂eq)	49.88	0.08	916.18	966.15

Table 18: County Kilkenny Agriculture Sector CO₂eq emissions

9.0 TRANSPORT

Transport is a complicated sector to develop an accurate baseline for an area due to the number of different transport modes and movement across boundaries.

This section does not include Kilkenny County Councils direct transport emissions, which are presented separately in Section 4 of this report. This data was subtracted from the total transport emissions for this sector to avoid ‘double-counting’.

The Central Statistics Office (CSO) published ‘Census 2018, Commuting in Ireland’, which shows that commuting has increased nationally, and is in line with the changes and growth in the Irish economy (SEAI, 2019).

Comparing 2016²⁷ and 2011 census data, the number of people commuting to work increased by 11%. Nationally, commuting by car increased by 8%, public transport rose by 21%, walking by 3%, and cycling was up by 43% in 2018.

Significant improvements have been made to the sustainability of the transport system in recent years at national levels. The national vehicle road tax system was revised, and as of July 2008, the system moved away from assessing vehicles based on their engine size to one that is based on CO₂eq emissions per kilometer (CSO- transport, 2018).

At a national level, a 50% reduction of the transport sector GHG emissions is required.

9.1 METHODOLOGY

The primary source of the Transport sector’s GHG emissions come from the burning of diesel and petrol in combustion engines. MapEire data and CSO Transport Omnibus (CSO- transport, 2018) data both provide a breakdown of transport emissions at a County wide level, covering a range of vehicle type categories as outlined below. As seen in Figure 25, County Kilkenny had a total number of vehicles of 58,030 in 2018, of which:

- 44,549 are private cars
- 8,221 are goods vehicles
- 872 motorcycles
- 3,877 tractors and machinery
- 216 small PSVs (Public Service Vehicle)
- 295 large PSVs

²⁷ Census 2022 not available at time of analysis. Preliminary data published post analysis

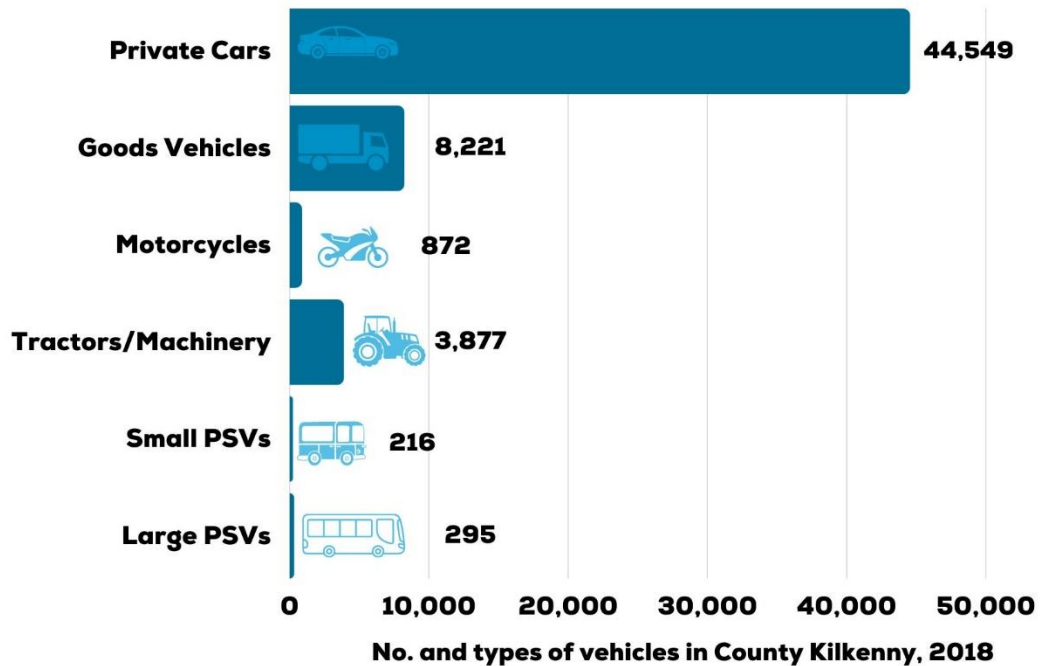


Figure 25. Number and Types of Vehicles in County Kilkenny in 2018

**A public service vehicle is a vehicle that carries passengers for a fee. Small PSV is defined as vehicle that carries up to 8 passengers, and large PSV is defined as more than 8 passengers²⁸.*

The SEAI’s ‘Energy in Ireland 2019’ (SEAI, 2019) includes the section on the share of emissions in Transport and gives a breakdown of average fuel use in Ireland in 2018 for Transport Vehicles. The 2018 fuel mix from this report was used to find an average national fuel type associated with energy use from transportation. The national dataset shows that an average of 1% of transport fuel is related to Compressed Natural Gas (CNG). Without data specific to County Kilkenny, this national average has been used to estimate the fuel mix breakdown. It is not known if there is any actual CNG vehicles in County Kilkenny.

This data was then combined with vehicular efficiency and GHG emissions data from the SEAI report on ‘Energy in Transport 2014’ (SEAI, 2014) as well as average age of private cars to estimate the overall average energy usage and fuel breakdown for each vehicle type and therefore the Transport Sector as a whole across County Kilkenny. Carbon emission factors for transport fuels was then used to convert energy to GHG emissions in 2018 for the Transport sector.

For public transport, providers of public transport differ in each county. Public Service Vehicles are reported as above, and MapElre provides for rail emissions as a subcategory.

The transport data associated with Kilkenny County Council as reported in Section 4 of this report was subtracted from the total Transport data to avoid ‘double-counting’.

²⁸ Road Safety Authority [https://www.rsa.ie/road-safety/road-users/special-purpose-vehicles/small-public-service-vehicles-\(spsv\)#:~:text=What%20is%20a%20small%20public,Yes](https://www.rsa.ie/road-safety/road-users/special-purpose-vehicles/small-public-service-vehicles-(spsv)#:~:text=What%20is%20a%20small%20public,Yes).

9.2 RESULTS

9.2.1 ENERGY RESULTS

The total energy consumption related to Transport in 2018 for County Kilkenny was **1,007.92 GWh**.

As seen in Figure 26, road diesel was the main fuel source for both public and private transport, accounting for 80.4% of fuel consumption. This was followed by petrol at 20.93%.

Fuel Type	GWh	%
Petrol	190.51	18.90%
Road Diesel	810.64	80.43%
CNG	5.56	0.55%
Electricity	1.21	0.12%
TOTAL	1,007.92	

Table 19: County Kilkenny Total Energy Consumption Related to Transport in 2018

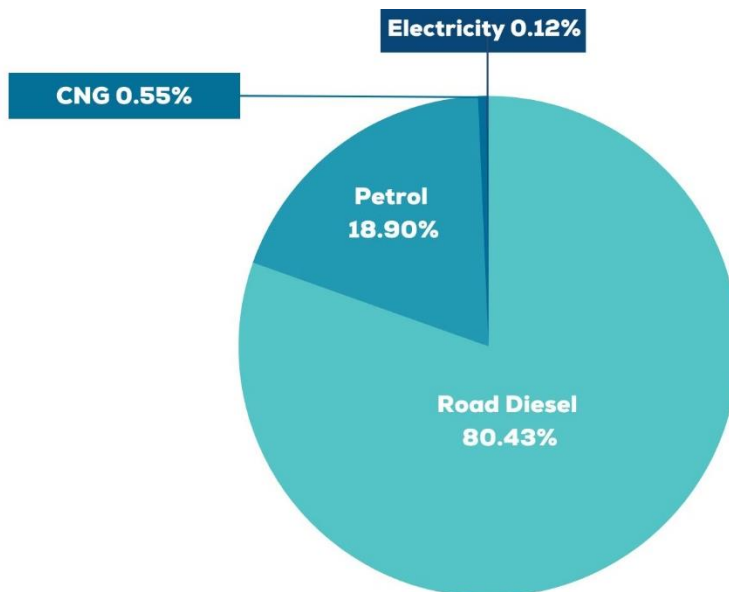


Figure 26. County Kilkenny Transport Energy Use %

9.2.2 GHG EMISSION RESULTS

The total energy related emissions from Transport in 2018 were the equivalent of 264.6 ktCO₂eq of which:

- 164.41 ktCO₂ from private vehicles
- 61.39 ktCO₂ from goods vehicles
- 0.48 ktCO₂ from motorcycles
- 21.44 ktCO₂ from tractors and machinery
- 3.13 ktCO₂ from small PSVs
- 7.64 ktCO₂ from large PSVs
- 5.97 ktCO₂ from railways
- 0.18 ktCO₂ from National Navigation (Shipping)

The LA Transport emissions were removed from the Total transport emissions to give a total of **263.51 ktCO₂eq.**

As seen in Figure 27, the split of emissions from the different fuel types is

Fuel Type	ktCO ₂ eq	%
Petrol	47.99	18.2%
Road Diesel	213.93	81.2%
CNG	1.14	0.4%
Electricity	0.45	0.2%
TOTAL	263.51	

Table 20: Split of Transportation Emissions from different fuel types

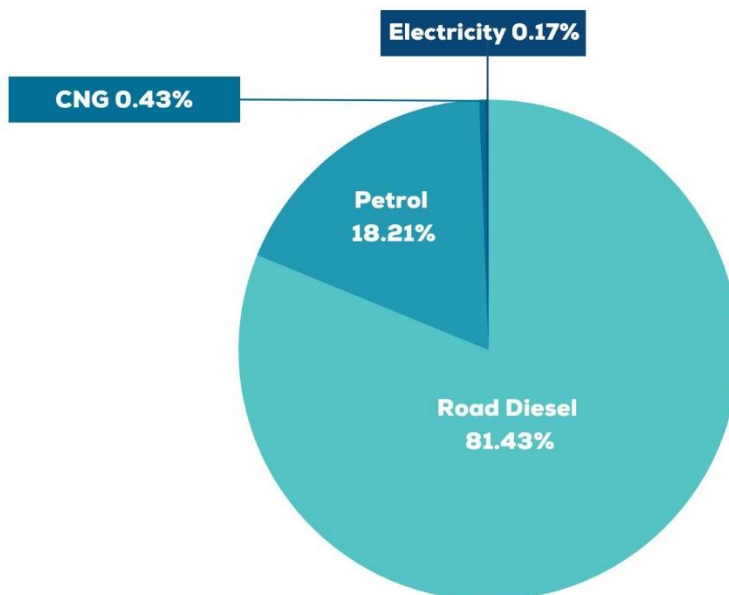


Figure 27. Split of Transportation Emissions from different fuel types %

The GHG emissions from methane (CH₄), and nitrous Oxide (N₂O) obtained from the MapEire data equates to 10.80 ktCO₂eq.

This gives a total GHG emissions for the Transport Sector of **274.31 ktCO₂eq.**

9.3 KEY FINDINGS

- Total energy use in transport was 1,007.92GWh
- Total final emissions from transport were 274.31 ktCO₂eq
- Transport emissions came primarily from diesel (79.17%) and Petrol (20.19%)

Transport Sector	Electricity	Fossil Fuels			Other Emissions		Total
		CNG	Road Diesel	Petrol	CH ₄	N ₂ O	
Total Emissions (ktCO₂eq)	0.45	1.14	213.93	47.99	0.89	9.91	274.31

Table 21: County Kilkenny Transport Inventory, ktCO₂eq Emissions

10.0 LAND USE, LAND USE CHANGE & FORESTRY (LULUCF)

Land Use, Land-use Change and Forestry covers the following categories: Forest land, Cropland, Grassland, Wetlands, Settlements, Other land and Harvested Wood products (EPA, 2022). The emissions associated with LULUCF is determined by the CO₂eq emissions from Grassland and Wetlands, due to drainage of organic soils. This is offset somewhat by Forest Land and harvested wood products, which acts as a carbon sink. (EPA, 2022).

At a national level, no GHG emissions reduction target have yet been confirmed.

10.1 METHODOLOGY

MapElre²⁹ provides data on the level of emissions and carbon sinks on a County wide level including forest land, cropland, wetlands, settlements as well as for harvested wood products (EPA, 2022). The data is taken directly from this data source.

The non-energy related GHG emissions include Carbon Dioxide (CO₂), Methane (CH₄) and Nitrous Oxide (N₂O).

10.2 RESULTS

10.2.1 ENERGY RESULTS

There are no energy related results in this Section. GHG emissions in this sector are all non-energy related.

10.2.2 GHG EMISSION RESULTS

CO₂ emissions from LULUCF sector is 60.66kt. CH₄ and N₂O emissions from LULUCF sector is 12.2kt CO₂eq. This is equivalent to total emissions from LULUCF sector of **72.86ktCO₂eq.**

See Figure 28, emissions from different sectors in LULUCF account for the following:

- Grassland accounts for 143.21 ktCO₂eq.
- Wetlands accounts for 5.40 ktCO₂eq.
- Settlements accounts for 2.84 ktCO₂eq.
- Cropland accounts for -1.40 ktCO₂eq.
- Harvested wood products accounts for -6.76 ktCO₂eq.
- Forest land accounts for -70.50 ktCO₂eq.

²⁹ <https://projects.au.dk/mapeire/spatial-results/download>

- Other land accounts for 0.08 ktCO₂eq

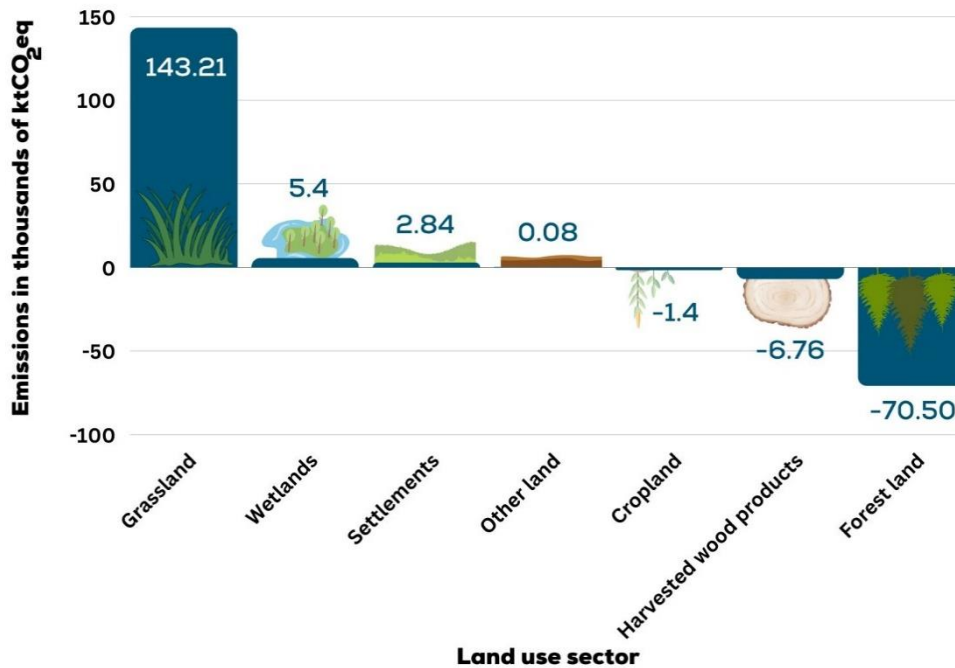


Figure 28. Emissions From Different Sectors in LULUCF

Negative emissions account for the amount of CO₂eq absorbed by the forests, crops and harvested woods.

10.3 KEY FINDINGS

- Total emissions from LULUCF sector accounts for 72.86 ktCO₂eq.

LULUCF Sector	Grasslands	Wetlands	Settlements	Croplands	Harvested Wood Products	Forest land	Other land	Total
Total Emissions (ktCO ₂ eq)	143.21	5.40	2.84	-1.40	-6.76	-70.50	0.08	72.86

Table 22: County Kilkenny LULUCF sector CO₂eq emission

11.0 WASTE

This sector is responsible from handling of waste, incineration of waste (without energy utilisation), composting, and wastewater handling (EPA, 2022). This sector accounts for non-energy related emissions. Energy related emissions for waste services is covered under Manufacturing & Commercial emissions reported in Section 7 of this report (under industrial uses).

At a national level, a 40% reduction of the residential sector GHG emissions is required.

11.1 METHODOLOGY

MapElre provides data on the emission levels within this sector (EPA, 2022). For County Kilkenny the data is split into GHG emissions related to the following waste categories:

- Composting
- Solid waste disposal on land
- Open burning of waste
- Domestic waste-water handling

Additional data collection such as number of landfills and wastewater treatment plants provides further breakdown of emissions within this sector.

The National Waste Collection Permit Office (NWCPO) grant waste collection licenses for providers in each County. In 2018, there was one provider in County Kilkenny who has a permit for waste collection.

The Pollutant Release and Transfer (PRTR)³⁰ shows that in 2018 there were 2 facilities reporting under waste and wastewater management.

11.2 RESULTS

11.2.1 ENERGY RESULTS

There are no energy related emissions for Waste covered in this section. Energy related emissions for waste services is covered under Manufacturing & Commercial emissions reported in Section 7 of this report (under industrial uses).

11.2.2 GHG EMISSION RESULTS

The total emissions from the waste sector accounts for **19.48 ktCO₂eq** of this:

- 0 ktCO₂eq from solid waste disposal on land
- 0.01 ktCO₂eq from domestic wastewater handling

³⁰ <https://gis.epa.ie/EPAMaps/PRTR>

- 14.17 ktCO₂eq from composting and the remaining
- 5.31 ktCO₂eq from open burning of waste

11.3 KEY FINDINGS

- Total emissions from waste sector accounts for 19.48 ktCO₂eq.

Waste Sector	Solid Waste Disposal	Domestic Wastewater Handling	Composting	Open Burning of Waste	Total
Total Emissions (ktCO₂eq)	0.00	0.01	14.17	5.31	19.48

Table 23: County Kilkenny Waste sector CO₂eq emission

12.0 F-GASES

These gases comprise of HFCs (Hydrofluorocarbons), PFCs (Perfluorocarbons), SF₆ (Sulphur Hexafluoride) and NF₃ (Nitrogen Trifluoride). They are much more potent than the naturally occurring greenhouse gas emissions. These were extracted from MapEire dataset for the local authority area and is presented as CO₂eq (EPA, 2022).

At a national level, a 50% reduction of the F-gases GHG emissions is required.

For County Kilkenny there are no emissions from these gases. The only recorded producers of these emissions in Ireland are in Limerick city and county, and Kildare County

13.0 RESULTS SUMMARY

This section examines total emission from the different carbon emitting sectors in County Kilkenny, as outlined in Chapters 4 – 12.

The total baseline GHG emission for 2018 for County Kilkenny is **1,945.44kt CO₂eq.**

At 49.66%, agriculture accounted for the greatest percentage of total emissions in the County. This was followed by Manufacturing & Commercial (15.35%), Residential (14.87%) and Transport (14.1%). Figure 29 below illustrates the total emissions by sector.

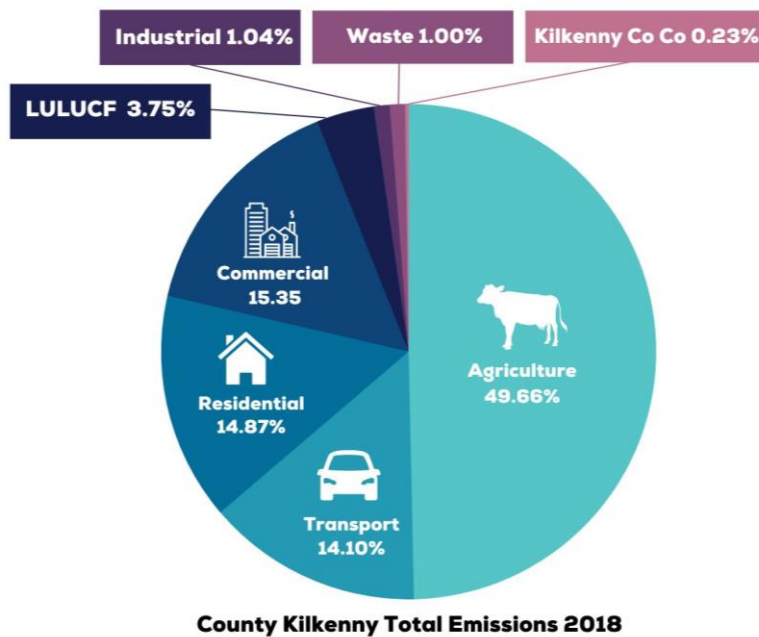


Figure 29. Share of Total Emission in County Kilkenny

County Kilkenny													Total
	Electricity	Fossil Fuels							CH ₄	N ₂ O	CO ₂	SF ₆	
		Natural Gas	Heating Oil	Diesel	Petrol	LPG	Coal	Peat					
Kilkenny County Council (ktCO ₂ eq)	2.90	0.41	0.04	1.12	0.01	0.01							4.47
Residential (ktCO ₂ eq)	86.63	14.53	121.03			4.65	25.03	34.24	2.83	0.37			289.32
Manufacturing and Commercial (ktCO ₂ eq)	84.54	48.96	112.32				19.79	32.01	0.30	0.24	0.37		298.53
Industrial Processes (ktCO ₂ eq)									-	1.04	12.29	6.99	20.32
Agriculture (ktCO ₂ eq)	49.88		0.08						660.13	256.04			966.15
Transport (ktCO ₂ eq)	0.45	1.14		213.93	47.99				0.89	9.91			274.31
LULUCF (ktCO ₂ eq)									6.55	5.65	60.66		72.86
Waste (ktCO ₂ eq)									16.83	1.13	1.51		19.48
Total Emissions (ktCO₂)	224.40	65.04	233.47	215.05	47.99	24.45	57.03	34.55	687.48	274.52	74.46	6.99	1,945.45

Table 24: BEI Summary Table for County Kilkenny

14.0 CONCLUSION

The total baseline GHG emission for 2018 for County Kilkenny is **1,945.45 ktCO₂eq.**

The 2030 target for GHG emissions by 2030 is 51% reduction from the baseline year of 2018.

Therefore, the allowable GHG emissions in 2030 is **953.27kt CO₂eq.**

The average GHG emissions for Kilkenny County Council in 2016-2018 was **5.06ktCO₂eq.**

Due to the public sector targets which outline reduction in Thermal, Transport & Electricity GHG Emissions, the allowable GHG emissions in 2030 by Kilkenny County Council is **1.56 ktCO₂eq.**

The resulting Climate Action Plan for County Kilkenny must define and outline a clear pathway to achieve this reduction. As part of the climate action plan the individual local authority will be responsible for reducing greenhouse gas emissions from across its own assets and infrastructure, whilst also taking on a broader role of influencing and facilitating others to meet their own targets. This is necessary to ensure the environmental, social and economic benefits that come with climate action can be fully realised.

Kilkenny County Council must demonstrate alignment with the key principles of the Local Authority Climate Action Planning Guidelines to ensure that the local authority climate action plan is: **Ambitious, Action-focused, Evidence-based, Participative and Transparent.**

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16.0 APPENDIX

16.1 DATABASE

Sector	Data source	Data source link	Data assumption
Kilkenny County Council	SEAI Monitoring & Reporting (M&R)	https://psmr.seai.ie/Account/LogOn?ReturnUrl=%2f	Data on the M&R system has been submitted as per the SEAI methodology guidelines and are categorised correctly by the Local Authority at submission. Energy and carbon conversion factors used in the system are set by the SEAI.
Residential	Census data 2016	https://data.cso.ie/	2016 Census data was used - there is no specific 2018 census data so 2016 data was closest to the baseline period of 2018. The house types provided by the Census were grouped into 4 main house types of semi-detached, detached, terraced and apartments. All bedsits were assumed to be apartments.
	BER data	https://ndber.seai.ie/BERResearchTool/ber/search.aspx	All BER's for properties published post 2018 were removed from the data sets analysed. The remaining BERs are used to ascertain the average energy consumption per house type and per BER rating. These averages are used to estimate the total energy consumption per house type for all houses across the county.
	SEAI Energy in Residential Sector 2018	https://www.seai.ie/publications/Energy-in-the-Residential-Sector-2018-Final.pdf	This data was used to give an average breakdown between electricity, space heating & hot water in the residential sector. It was assumed that 20% of energy is electrical energy and 80% is thermal energy
	SEAI Energy Balance 2018	https://www.seai.ie/publications/2018-National-Energy-Balance-Final.pdf	This gives the national average breakdown of fuel types used for thermal energy in homes for 2018. This was used to calculate the average consumption per fuel type across the residential sector
	CSO Metered electricity data	https://www.cso.ie/en/statistics/energy/meteredelectricityconsumption/	The total metered electrical data for residential sector for County Kilkenny was downloaded from CSO
	CSO metered natural gas data	https://www.cso.ie/en/statistics/energy/networkedgasconsumption/	The total metered natural gas data for residential sector for County Kilkenny was downloaded from CSO
	SEAI Conversion Factors	https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/	The fuel type was used to ascertain GHG emissions using the conversion factors per fuel type from the SEAI

	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	Methane and nitrous oxide emissions relating to the residential sector were obtained from the MapEire datasets and added to the total energy related GHG emissions calculated from the localised data sets.
	USA EPA GHG Conversion Factors	https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results	GHG conversion factors were used to convert methane and nitrous oxide into CO2 equivalents. 1 unit of methane emissions is equivalent to 25 units of CO2eq. 1 unit of nitrous oxide is equivalent to 298 units of CO2eq.
Manufacturing & Commercial	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	This data set includes Local Authority data. As such the total Kilkenny Co Co data as outlined in Section 4 of the report was removed from the final M&C data results so as not to double account
	CSO non-residential Metered Electricity data	https://www.cso.ie/en/statistics/energy/meteredelectricityconsumption/	assume that all data provided in this data set was associated with M&C sector, minus the LA specific data
	CSO non-residential Natural gas consumption data	https://www.cso.ie/en/statistics/energy/networkedgasconsumption/	assume that all data provided in this data set was associated with M&C sector, minus the LA specific data
	CSO Energy Balance	https://data.cso.ie/table/SEI01	National averages for fuel types provided from the Energy Balance was used to calculate the thermal breakdown of fuels, other than the natural gas and electricity which was provided by the CSO metered data sets
	Valuations Office	https://maps.valoff.ie/maps/VO.html	Assume that the number and categories provided by the Valuations Office for 2018 is correct in terms of number of businesses and floor areas
Industrial Processes	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	No localised data sets available for this sector so a full breakdown was taken from MapEire
Agriculture	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	The data from MapEire categorized as 'off-road vehicles' has been removed from this data set and is reported under the Transport Data (Section 9 of this report). This is reported under the Tractors & Machinery heading. This data was used for the non energy related GHG emissions
	CSO Census of Agriculture	https://www.cso.ie/en/releasesandpublications/ep/p-coa/censusofagriculture2020-preliminaryresults/kf/	Provides the number of livestock (sheep, Pigs, cows and poultry).

	Teagasc	https://www.teagasc.ie/media/website/rural-economy/rural-development/diversification/Energy-12_Poultry-Energy-Efficiency-in-Poultry-Units.pdf	Provides the average energy consumption per poultry.
	Teagasc	https://www.teagasc.ie/media/website/rural-economy/rural-development/diversification/Energy-14-Energy-Use-on-Pig-Farms.pdf	Provides the average energy consumption per pig
	Teagasc	https://www.teagasc.ie/rural-economy/rural-development/diversification/energy-auditing-in-agriculture/	Provides the average energy consumption per cow
Transport	CSO Transport Omnibus 2018	https://www.cso.ie/en/statistics/transport/transportomnibus/	Kilkenny County Council transport data was removed from the Transport sector data as it is reported separately Under Section 4 of this report. This data provides the number and breakdown of vehicle types in County Kilkenny. The data also provides the average breakdown of fuel types and km travelled by each vehicle type. This average was used against the number of vehicles specified for County Kilkenny. The national dataset shows that an average of 1% of transport fuel is related to Compressed Natural Gas (CNG). Without data specific to County Kilkenny, this national average has been used to estimate the fuel mix breakdown. It is not known if there are any actual CNG vehicles in County Kilkenny.
	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	Provides rail data and shipping data for County Kilkenny
	SEAI Energy in Transport 2014	https://www.seai.ie/publications/Energy-in-Transport-2014-report.pdf	gCO2/km travelled for the different vehicle types - factors used to calculate the overall GHG emissions from the road vehicle in County Kilkenny
LULUCF	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	Only MapEire data used for LULUCF figures
Waste	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	This sector accounts for non-energy related emissions. Energy related emissions for waste services is covered under Manufacturing & Commercial emissions reported in Section 7 of this report (under industrial uses)
	National Waste Collection Permit Office	https://www.nwcpo.ie/permitsearch.aspx	Provided the number of waste collection licences in the County. No other data was provided
	Pollutant Release and Transfer	https://gis.epa.ie/EPAMaps/PRTR	Provided the number of facilities reporting under waste & waste water management in the County. No other data was provided

F-Gases	Map Eire	https://projects.au.dk/mapeire/spatial-results/download	There are no F-gases related GHG emissions attributed to County Kilkenny
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Driving sustainability today and tomorrow.



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