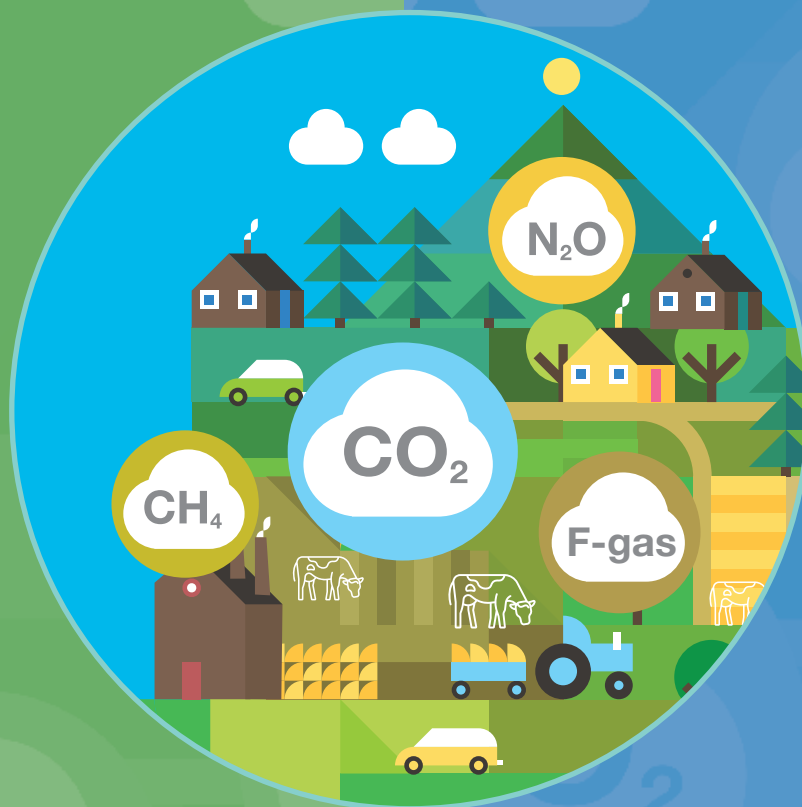


Ireland's Provisional Greenhouse Gas Emissions

1990-2023

July 2024



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Key Findings

Reduction in overall GHG emissions driven by decreases in all key sectors except Transport	Ireland's emissions in 2023 are below the 1990 baseline for the first time in three decades. 2023 total national greenhouse gas emissions (excluding LULUCF) are estimated to have decreased by 6.8% on 2022 levels to 55.01 million tonnes carbon dioxide equivalent (Mt CO ₂ eq). Emissions per capita decreased from 11.4 to 10.4 in 2023.
Largest annual reduction in emissions from electricity generation	Overall emissions from the Energy Industries sector decreased by 21.6% in 2023, down 2.2 Mt CO ₂ eq on last year. This was due to a 12-fold increase in the amount of imported electricity (9.5% of electricity supply in 2023), in combination with an increase in the share of renewable energy to 40.7% in 2023. The emissions intensity of power generation decreased from 332g CO ₂ /kWh in 2022 to a historic low of 255g CO ₂ /kWh in 2023.
Declines in fertiliser use reduce Agriculture emissions	Agriculture emissions decreased by 4.6% or 1.0 Mt CO ₂ eq in 2023. This was primarily due to an 18% reduction in fertiliser nitrogen use, leading to -0.43 Mt CO ₂ eq less emissions from agricultural soils. A 26.6% decrease in liming and a 2.1% reduction in methane from livestock in combination represent -0.46 Mt CO ₂ eq.
Marginal increase in Transport emissions	Greenhouse gas emissions from the Transport sector increased by 0.3% or 0.03 Mt CO ₂ eq in 2023, having already increased by 6% in both 2021 and 2022. Emissions in 2023 are 4.3% below 2019 pre-COVID levels. In 2023 the increased use of biofuels and electric vehicles slowed growth in emissions in this sector due to increases in the national fleet and a growing workforce.
Residential emissions hit 34-year low for second consecutive year	Greenhouse gas emissions from the Residential sector declined substantially for a second year running (-7.1% or 0.4 Mt CO ₂ eq), with 2023 being a low point in emissions since 1990. A milder weather contributed to reduced fossil fuel use, as coal, natural gas and peat use declined by 22.1%, 13.9 and 13.0% respectively. Over 25,000 heat-pumps were installed in Irish homes in 2023 bringing the total to 120,000 with renewable ambient heat increasing by almost 25%.
Decrease in emissions from cement sector	Manufacturing Combustion and Industrial Processes decreased by 5.1% to 6.3 Mt CO ₂ eq in 2023 due to declines in fossil fuel usage. Total emissions (combustion and process) from the cement sector decreased by 6.2% to 2.7 Mt CO ₂ eq in line with a reduction in clinker production.
EU Effort Sharing limits exceeded	Using the ETS flexibility Ireland can meet compliance with the ESR for 2021-2023. The provisional estimates of greenhouse gas emissions indicate that Ireland exceeded its 2023 annual emission limit, without the use of flexibilities, set under the EU's Effort Sharing Regulation (ESR) by 2.27 Mt CO ₂ eq.
National Compliance and First Carbon Budget 2021-2025	Provisional estimates of National greenhouse gas emissions (including LULUCF) in 2023 are 7.8% below 2018, well off the National Climate ambition of a 51% reduction by 2030. The data indicate that from 2021-2023 Ireland has used 64% (188.4 Mt CO ₂ eq) of the 295 Mt CO ₂ eq Carbon Budget for the five-year period 2021-2025. This leaves 36% of the budget available for the next two years, requiring a substantial 8% annual emissions reduction for 2024 and 2025 to stay within budget.
Sectoral Emissions Ceilings 2021-2025	Annual emissions reductions of 10%, 14%, 12%, and 3% are required for 2024-25 in the Electricity, Industry, Transport and Buildings (Commercial and Public) sectors are needed to achieve respective Sectoral Emission Ceilings (SEC). Data indicate Residential and Agricultural sectors can meet their SEC. For Agriculture this was largely driven by refinements to the Agricultural inventory. However, the National Climate objective of a 51% reduction by 2030 will not be achieved unless all sectors meet their indicative reductions. This highlights the need for sectoral ceilings to be updated to reflect emissions inventory updates.

1. Introduction

The EPA is responsible for compiling the inventories of greenhouse gas emissions for Ireland and for reporting the data to the relevant European and international institutions. As such, Ireland's legal reporting obligations require that we submit preliminary and final data for the period 1990-2023 in January 2025, March 2025 to the European Commission and by April 2025 to the United Nations Framework Convention on Climate Change (UNFCCC).

The EPA is publishing the provisional inventory data in July 2024 to facilitate the early monitoring and reporting processes associated with the National Climate Objective and associated Carbon budgets, annual review of the Climate Action Plan and greater level of sectoral reporting and more in-depth assessment and reporting of Policies and Measures.

The provisional estimates of Ireland's greenhouse gas figures for the years 1990-2023 are based on interim energy balances provided by the SEAI in June 2024 and the latest available data from other data providers such as the Central Statistics Office and the Department of Agriculture, Food and the Marine (DAFM). These are compiled using methodologies in accordance with UNFCCC reporting guidelines. Verified emissions data from installations within the EU's Emissions Trading Scheme (ETS) are included.

Ireland's emissions targets

Ireland's EU and National legislative commitments have different emissions reduction requirements and timeframes for achievement. Ireland's revised 2030 target under the EU's Effort Sharing Regulation (ESR)

is to deliver a 42% reduction of emissions compared to 2005 levels by 2030. There are also annual binding emission allocations over the 2021-2030 period to meet that target. Ireland's compliance status at 2030 can only be determined when the 2030 inventory is compiled. Under the ESR two flexibilities may be utilised (use of EU Emissions Trading Scheme allowances and credit from action undertaken in the Land use, Land use Change and Forestry (LULUCF) sector) to allow for a fair and cost-efficient achievement of the targets.

The revised Annex III of the LULUCF Regulation (2023)¹ sets out Member State targets for 2030. Ireland's target is an emission reduction of 626 kt of CO₂eq by 2030 on an average baseline of 2016 to 2018. There is a high degree of uncertainty relating to the estimation of emission/removals from the LULUCF sector, however, significant research is currently underway to address this uncertainty.

Ireland's national emission reduction objectives as set in the Climate Action and Low Carbon Development (Amendment) Act 2021, are to achieve a 51% emissions reduction (including LULUCF) by 2030 compared to 2018 and achieve a climate neutral economy by no later than the end of 2050. The Act provides for the establishment of carbon budgets to support achievement of Ireland's climate ambition. The 51% target, relative to 2018, is the primary constraint on carbon budgets over the course of the first two budget periods ending on 31 December 2030, see Table 1. The Climate Action Plan 2024 (CAP 24) sets out a major programme of policies and measures that aim to achieve significant progress towards those objectives.

Ireland's emissions inventory has been compiled using Global Warming Potentials (GWPs) as specified in the 5th IPCC assessment report (AR5)². Ireland's National emissions reduction objective, carbon budgets and European target under the ESR are estimated on an AR5 basis.

¹ Regulation (EU) 839/2023 Annex III

² IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (<https://www.ipcc.ch/report/ar5/wg1/>)

Table 1. European Union and National GHG Targets comparison

	Base Year	Reduction required by 2030	Scope	Other key points to note
European Union Target: Effort Sharing Regulation	2005	42% The 42% reduction defines the trajectory, but it is the annual limits that are binding	Sectors covered by the Effort Sharing Regulation (excludes ETS)	Annual binding emission limits (AEAs) define the permitted budget and some flexibilities are available.
European Union Target: LULUCF Regulation	Average 2016-2018	-626 kt CO ₂ eq	LULUCF sector	Annex III Regulation (EU) 2023/839
National Targets	2018	51%	Economy-wide target (includes ETS)	Unlike the EU target, the national target includes LULUCF. Binding Carbon budgets set the required reduction trajectory.

This report provides a summary of the 2023 provisional emission estimates accompanied by an assessment of changes relative to the 2022 estimates. The recent and long-term trends in greenhouse gas emissions across key sectors, and their significance in relation to Ireland's target under the EU's Effort Sharing Regulation and Climate Action Plan 2024 are also presented.

2. Ireland's Provisional Greenhouse Gas Emissions in 2023

Provisional total national greenhouse gas emissions in 2023 (excluding LULUCF) are estimated to be 55.01 million tonnes carbon dioxide equivalent (Mt CO₂eq) which is 6.8% lower (or 4.00 Mt CO₂eq) than emissions in 2022 (59.00 Mt CO₂eq) and follows a 2.0% decrease in emissions reported for 2022. Emissions in 2023 are 1.2% lower than the historical 1990 baseline for the first time in 33 years.

Provisional national total emissions including Land Use Land Use Change and Forestry (LULUCF) decreased by 3.8% to 60.62 Mt CO₂eq. ETS³ emissions decreased (17.0%) and ESR emissions decreased (3.4%). LULUCF emissions are discussed in more detail in section 4.7.

Emissions per capita decreased from 11.4 tonnes CO₂eq/person in 2022 to 10.4 tonnes CO₂eq/person in 2023. Ireland's average tonnes of GHG/capita over the last ten years were 12.1 tonnes. With recent CSO 2023 data showing a population of 5.28 million people and with population projected to increase to 5.5 million in 2030, 5.9 million in 2040 and 6.2 million by 2050, per capita emissions need to reduce significantly in order to meet reduction targets. At current per capita emission levels, each additional 500,000 people would contribute an additional 5 million tonnes of CO₂eq annually.

The inter-annual change in total greenhouse gas emissions is presented in Figure 1 and sectoral share of emissions (excluding LULUCF) in Figure 2 and Table 4. The annual reduction in 2023 at 4.0 Mt CO₂eq is the largest annual reduction since the economic recession in 2009-2011. Detailed sectoral data are shown in Table A.1 in the Appendix.

Agriculture is the largest contributor to the overall emissions at 37.8% of the total (excluding LULUCF). *Transport* and *Energy Industries* are the second and third largest contributors at 21.4% and 14.3% respectively. *Residential* and *Manufacturing Combustion* emissions account for 9.7% and 6.8% respectively. These five sectors accounted for 90.7% of national total emissions in 2023. The remainder is made up by the *Industrial Processes* sector at 3.9%, *F-Gases* at 1.2%, *Commercial Services* at 1.3%, *Public Services* at 1.2% and *Waste* at 1.5%. Figure 2 shows the contributions from each of the sectors in 1990 and 2023.

³ ETS emissions in this report refers to CO₂ emissions from stationary installations and from domestic aviation. It does not include emissions from intra-EU aviation as those are not considered part of Ireland's total reportable greenhouse gas emissions.

Figure 1. Inter Annual Changes in GHG Emissions 1990-2023

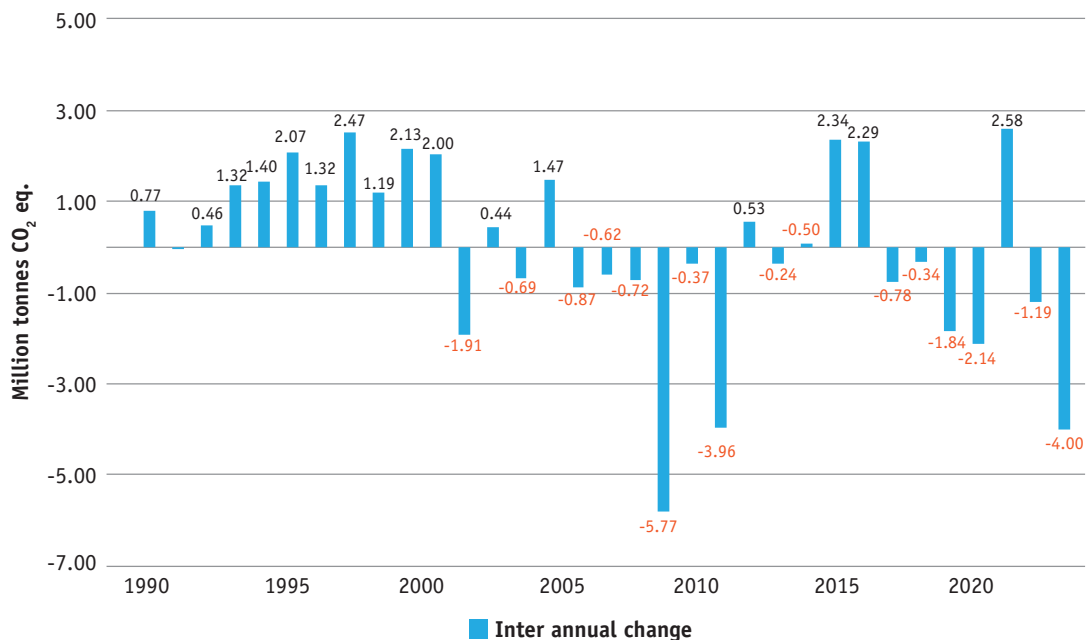
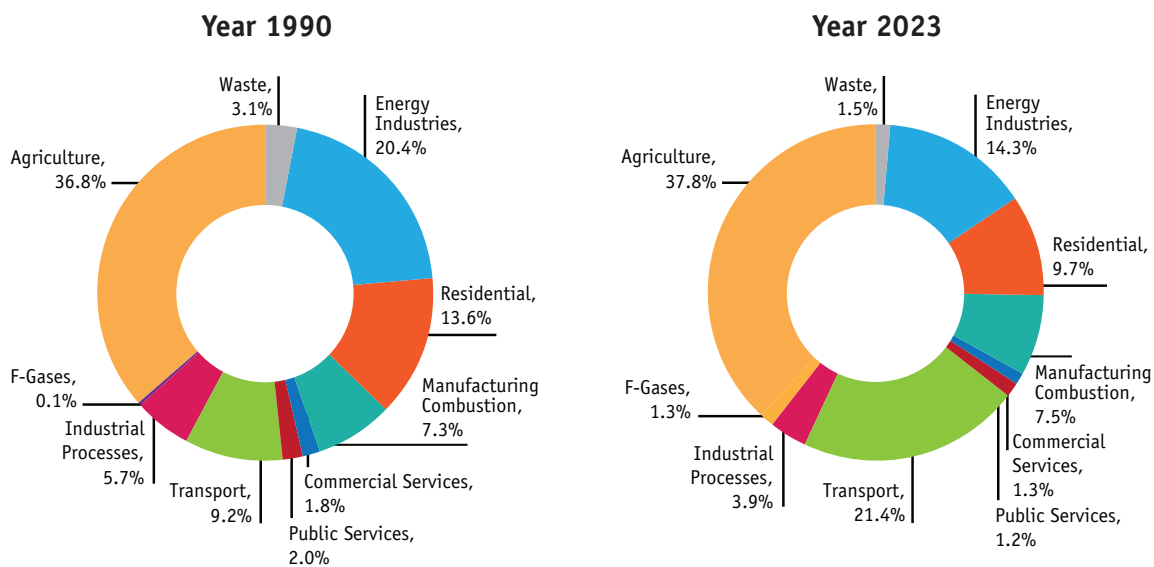


Figure 2. Profile of GHG Emissions (excluding LULUCF) in 1990 and 2023 by Sector



Methodology changes in the 1990-2023 Provisional Inventory

Changes are made each year to update and improve underlying data and methods used to estimate emissions. For this report, two important changes have occurred. Estimates of CH₄ and N₂O emissions associated with non-dairy cattle and sheep categories have been revised for this report. Further minor revisions may occur before final submission of the 1990-2023 data to the EU in March 2025 and will be reported along with detailed methodologies in the Ireland's National Inventory Report 2025.

With respect to non-dairy cattle, additional disaggregation of production systems within the herd (than those previously modelled) have been taken on board in conjunction with detailed output from the Irish Cattle Breeding Federation (ICBF) databases. This approach allows for more detailed estimates of a larger number of production system cohorts from birth to slaughter and allows for revised live weight and average daily weight gain to be incorporated at a more refined level. The approach also tracks the changes in slaughter age that have occurred over the last decade or so. Other developments include future proofing of the approach so that changes in feed characteristics and use of feed additives can be more readily incorporated in emission estimates.

With respect to sheep, a Tier 2 approach to estimating emissions from the national flock developed by Teagasc has been implemented. In comparison to the previous approach, which was based on default IPCC Guideline assumptions, country specific parameters associated with sheep production in Ireland are used including parameters such as feed characteristics, fecundity, lambing patterns, mortality, liveweights and liveweight gains.

These revisions together have reduced the Agriculture sector emissions by, on average, 1.4 Mt CO₂eq per annum for the years 2018 to 2023 or in total by approximately 8.5 Mt CO₂ eq over the six-year period. This can be seen by the usage of the Sectoral Emissions Ceiling and the reductions required to meet SEC compliance in Figures 4 and 5 below.

3. Compliance with National and EU commitments

Ireland has several greenhouse gas emission reduction commitments, both set out in National legislation and by virtue of its EU membership and commitment to UN goals under the Framework Convention on Climate Change (UNFCCC). These various commitments have different scopes and interim targets associated with them, but all ultimately require Ireland playing its part in achieving the global goal of limiting global temperature rise.

3.1 National Climate Objective

The Climate Action and Low Carbon Development (Amendment) Act 2021⁴ sets a national climate objective of achieving a climate resilient and climate neutral economy by 2050. A key milestone in achieving this aim is the 2030 reduction target of 51% of total emissions (including LULUCF) over the period 2018 to 2030.

Climate Action Plan 2024, published in December 2023 and approved by Government in May 2024, outlines many of the policies and measures to be implemented to achieve the objective, with further measures to be developed in future plans. Progress towards Ireland's climate objective is shown in Table 2.

Carbon Budgets

The Climate Action and Low Carbon Development (Amendment) Act 2021 provides for the establishment of carbon budgets in support of achieving Ireland's climate ambition. The 51% target is the primary constraint on carbon budgets over the course of the first two budget periods ending on 31 December 2030, relative to 2018. The provisional carbon budget proposed for 2031 to 2035 continues the trajectory towards climate neutrality by 2050.

Three Carbon budgets for the period up to 2035 have been approved⁵ by the Oireachtas and came into force on 6th April 2022. Figure 3 illustrates a linear emissions reduction trajectory towards achieving the 51% reduction target, along with the extent to which the first carbon budget (for the period 2021-2025) has been 'used up' based on emissions in 2021, 2022 and 2023.

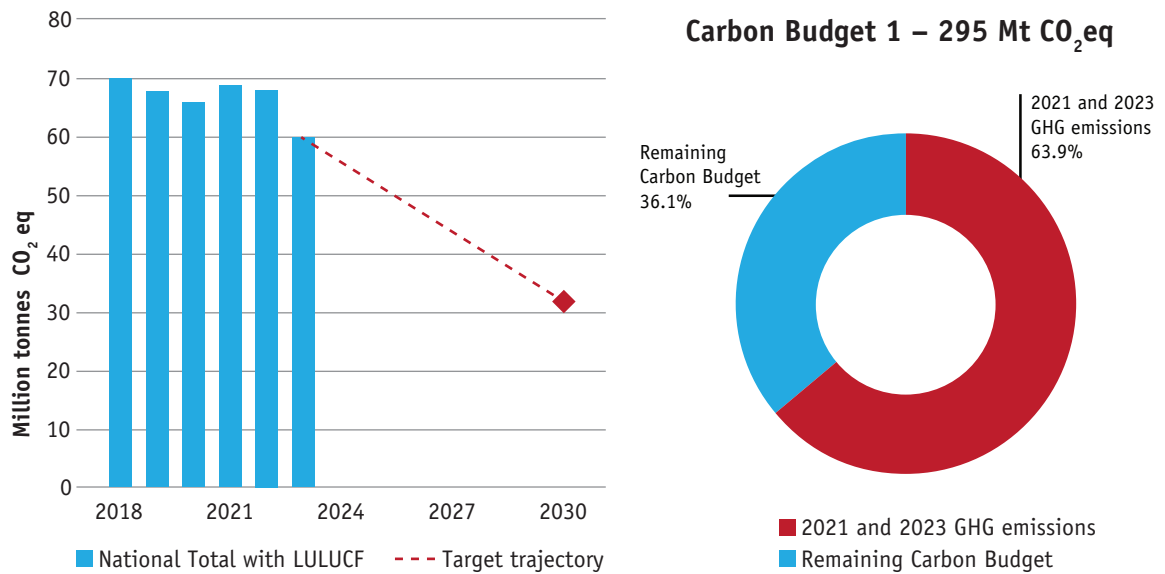
- Budget 1 from 2021-2025 has been set at 295 Mt CO₂eq.
- Budget 2 from 2026-2030 has been set at 200 Mt CO₂eq.
- Budget 3 from 2031-2035 has been set at 151 Mt CO₂eq.

Latest emission estimates for the years 2021 and 2022, in addition to provisional national total emissions including LULUCF for 2023 in this report, represent 188.43 Mt CO₂eq or 63.9% of the first five-year Carbon Budget of 295 Mt CO₂eq. This leaves 36.1% of the budget available for the remaining 2 years. To stay within budget for the first carbon budget period will now require a substantial 8.3% annual emissions reduction from 2024-2025 or ca. 5 Mt CO₂eq emissions reductions annually. Figure 3 below highlights the amount of the first Carbon budget that has now been used with three years already passed. Section 6D – paragraph 5 of the Climate Action and Low Carbon Development (Amendment) Act 2021 states that non-achievement of the first Carbon Budget would see the excess emissions carried forward into the second budget period and the second Carbon budget would be reduced by that amount. If this occurs this would make achievement of the second budget substantially more difficult.

4 Climate Action and Low Carbon Development (Amendment) Act 2021 (<https://www.irishstatutebook.ie/eli/2021/act/32/section/15/enacted/en/html>)

5 <https://www.gov.ie/en/publication/9af1b-carbon-budgets/>

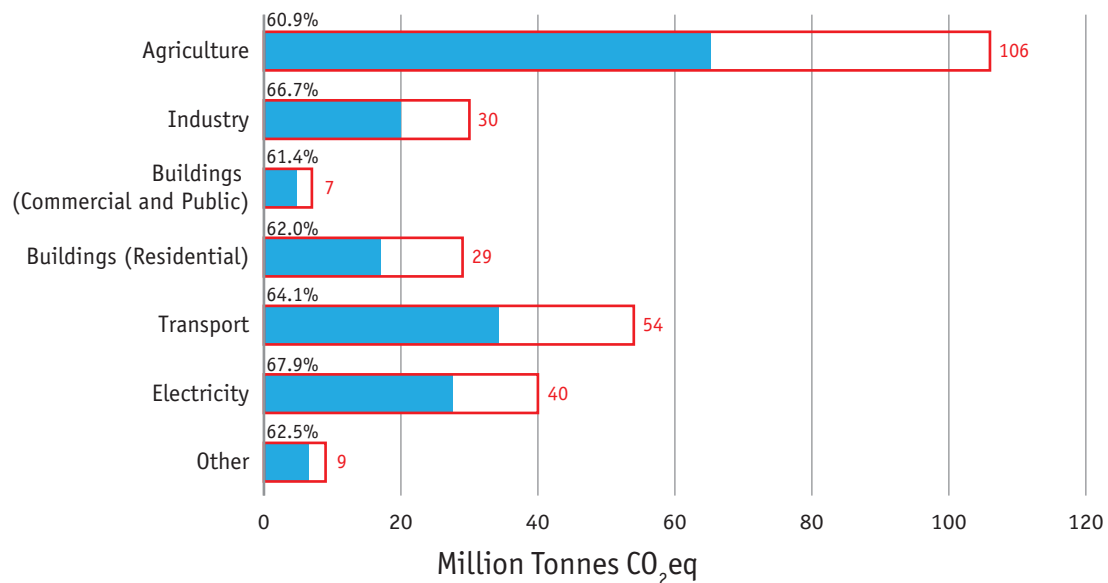
Figure 3. Climate Act Target and Carbon Budgets



Sectoral Emissions Ceilings

Sectoral Emissions Ceilings (SECs) for the two Carbon budget periods (2021-25 and 2026-30) have been approved by government to divide up the responsibility of carbon budget achievement across the key greenhouse gas emitting sectors⁶. The sectors (Electricity, Transport, Built Environment (Residential and Commercial and Public), Industry, Agriculture and Other) do not correspond directly to the sectors defined in the Inventory as they take consideration of the division of Departmental responsibility. However, it has been possible to map the Inventory data onto the SEC sectors to assess usage of the budgets to date what is required to achieve ceiling compliance. Figure 4 below presents the Sectoral ceilings along with the amount used to date by sector.

Figure 4. First Sectoral Ceilings 2021-2025 and usage



6 <https://www.gov.ie/en/publication/76864-sectoral-emissions-ceilings/>

The amount of the sectoral budget already used up ranges from 61% in the case of *Agriculture Sector* to 68% in the case of *Electricity* sector. In part the reason for the extent of the usage of the *Electricity* budget is related to use of coal in electricity generation in the years 2021 and 2022. The sectoral ceilings for each sector were set with the expectation of achievement of specific emission reductions in 2030 relative to 2018 with indicative percentage reduction by 2025. Sectoral emissions indicative percentage reductions and 2023 reductions relative to 2018 are set out in Table 2, these range from a 75% reduction for the *Electricity* sector to 25% reduction for the *Agriculture* sector.

Table 2. Sectoral Emissions reduction targets and progress

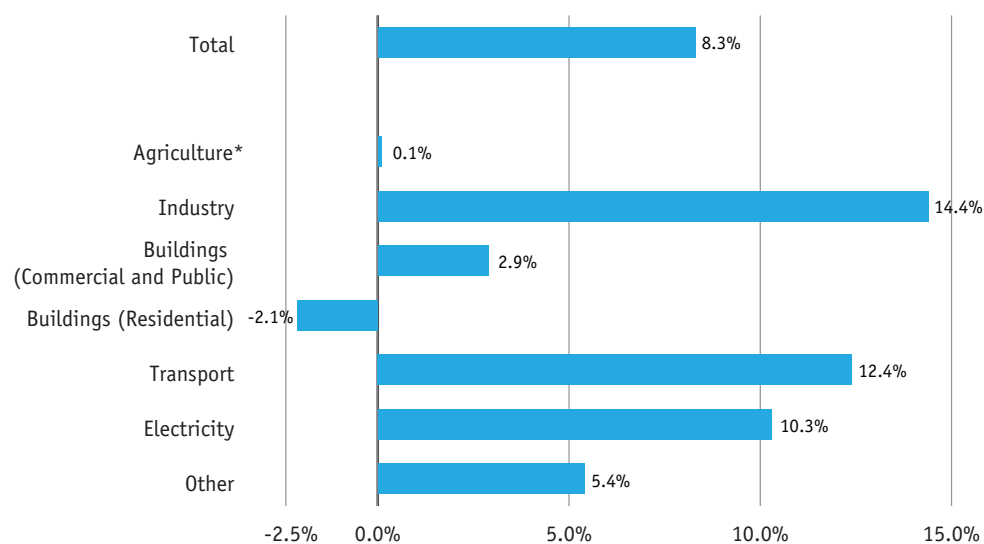
Sector	2018 (Mt CO ₂ eq)	2023 (Mt CO ₂ eq)	% change 2018-2023	Indicative % reduction by 2025	Indicative % reduction by 2030
Electricity	10.24	7.56	-26.2%	~40%	~75%
Transport	12.31	11.79	-4.2%	~20%	~50%
Buildings (Residential)	7.00	5.35	-23.6%	~20%	~40%
Buildings (Commercial and Public)	1.55	1.41	-8.9%	~20%	~45%
Industry	6.95	6.29	-9.6%	~20%	~35%
Agriculture	21.39	20.78	-2.9%	~10%	~25%
Other	2.14	1.83	-14.6%	~25%	~50%
LULUCF	4.19	5.61	34.1%	NA	NA
National Total (incl LULUCF)	65.77	60.62	-7.8%		51%

The amount of each budget already used makes a significant difference to the level of emissions reduction required over the next two years to stay within budget. The two largest sectors; *Agriculture* and *Transport*, have reduced emissions by the lowest amounts, -2.9% and -4.2% since 2018 and have the furthest to go to achieve their indicative percentage reduction targets.

Across all sectors, average emission reductions of 8.3% per annum is required. For example, in the *Electricity* sector, with 68% of the budget already used, annual emissions reductions of 10.3% are now required for 2024 and 2025 to stay within the first 2021-25 budget. For *Commercial and Public Sector* buildings the corresponding required emissions reduction is 2.9% per annum as that sector is currently much closer to being on the planned trajectory.

The *Residential* sector is on track to meet its 2025 SEC and is ahead of its 2025 indicative reduction target of -20% and could increase emissions in the next 2 years by 2% per annum and still meet its SEC. *Agriculture* is also on track to meet its 2025 SEC following the significant methodological changes outlined in Section 2 of this report. This has reduced overall emissions from the sector across the timeseries including the 2018 baseline. However, the overall National Climate objective of a 51% reduction by 2030 will not be achieved unless all sectors meet the indicative reduction targets for 2025 and 2030 as set out in Table 2 above.

Figure 5 below highlights the emission reductions required for each sector with a defined emissions ceiling to stay within the 2021 to 2025 budget.

Figure 5: Annual emission reductions required from 2024-2025 to achieve SEC compliance

* Change in distance to SEC is largely a result of refinements to the Agricultural inventory. From Table 2, there has been a 0.6 Mt CO₂eq (2.9%) reduction in emissions from 2018 to 2023. By comparison, Agricultural inventory refinement has led to an 8.5 Mt CO₂eq reduction in the inventory across this time period (see box Section 2). The indicative percentage reduction for Agriculture is ~10% by 2025 and ~25% by 2030 to support the achievement of the national target of a 51% reduction by 2030 on 2018 levels.

3.2 European targets

The greenhouse gas emission inventory for 2023 is the third of ten years over which compliance with targets set in the European Union's Effort Sharing Regulation (EU 2018/842) will be assessed. This Regulation sets 2030 targets for emission reductions outside of the Emissions Trading Scheme (known as ESR emissions) and annual binding national limits for the period 2021-2030. Ireland's target is to reduce ESR emissions by 42% by 2030 compared with 2005 levels, with a number of flexibilities available to assist in achieving this.

Compliance assessment

Annual Emissions Allocation

Ireland's ESR emissions annual limit for 2023 is 40.52 Mt CO₂eq. Ireland's provisional 2023 greenhouse gas ESR emissions are 42.79 Mt CO₂eq, this is 2.27 Mt CO₂eq more than the annual limit for 2023, see Table 3 and Figure 6. This value is the national total emissions less emissions generated by stationary combustion, i.e., power plants, cement plants, and domestic aviation operations that are within the EU's emissions trading scheme. Cumulatively from 2021-2023 and after using the ETS flexibility, Ireland is in compliance with the ESR by a net distance to target of 0.15 Mt CO₂eq, although in 2023 there is an exceedance of 0.36 Mt CO₂eq above its Annual Emissions Allocation with the ETS flexibility. Agriculture and Transport accounted for 76.0% of total ESR emissions in 2023.

The revised LULUCF Regulation (2023) incorporates new rules around LULUCF flexibilities for the period 2021-2025 and 2026-2030. There is a high degree of uncertainty relating to the availability of the LULUCF flexibility and, if available, the quantity of flexibility in each budgetary period.

Emissions Trading Scheme

Since 2005, emissions in the ETS sector have decreased by 45.7% or 10.25 Mt CO₂eq whereas emissions under the ESR decreased by 10.1% or 4.82 Mt CO₂eq, considerably short of Ireland's 42% reduction commitment by 2030. Within the ETS sector, electricity generation and the cement sectors are responsible for most of the decrease. Since 2005, emissions under the ESR decreased in the *Transport, Residential, Manufacturing combustion, Public Services, Commercial Services, F-Gases* and *Waste* sectors, with the *Agriculture* and *Energy Industries* sectors increasing.

Table 3. Compliance with EU ESR Targets 2021-2025 (all numbers in the table are rounded to the nearest kt CO₂eq)

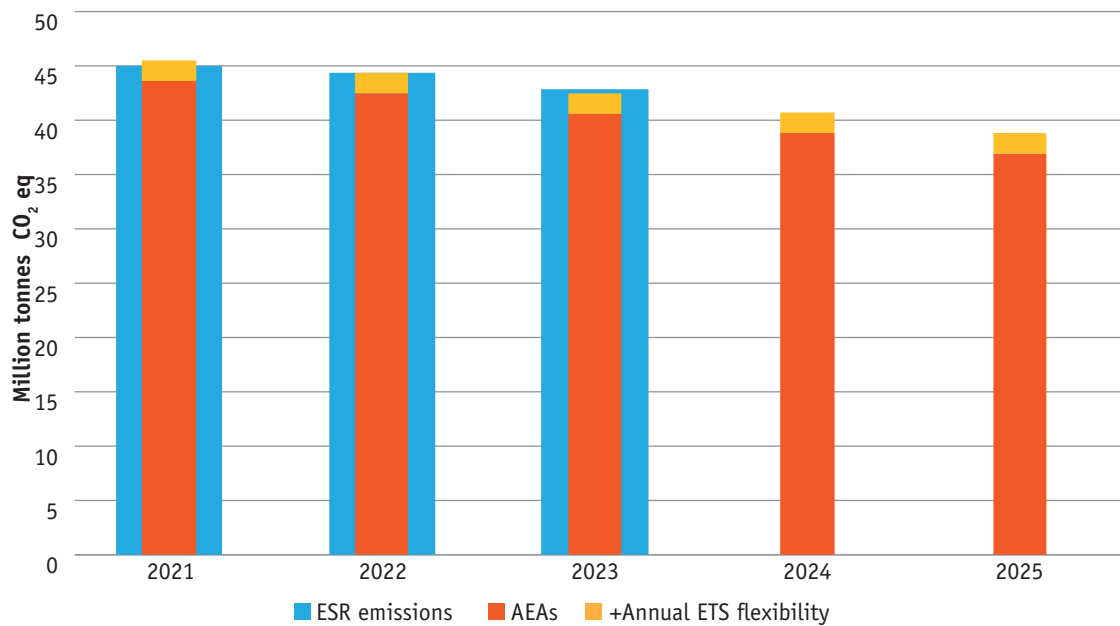
	2021	2022	2023	2024	2025
Total greenhouse gas emissions without LULUCF	60,191	59,003	55,007		
– Total verified emissions from stationary installations under Directive 2003/87/EC	15,320	14,686	12,189		
– CO ₂ emissions from domestic aviation	20	21	31		
Total ESR emissions	44,852	44,295	42,787		
EU ESR Targets†	43,479	42,357	40,520	38,683	36,845
Gross distance to target	-1,372	-1,938	-2,267		
+ annualised ETS flexibility †	1,908	1,908	1,908	1,908	1,908
Net distance to target	536	-30	-359		

† Set out in Annex II and Annex III of Commission Implementing Decision (EU) 2020/2126⁷ with additional potential flexibilities arising from LULUCF⁸

7 <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32020D2126&from=EN#d1e32-62-1>

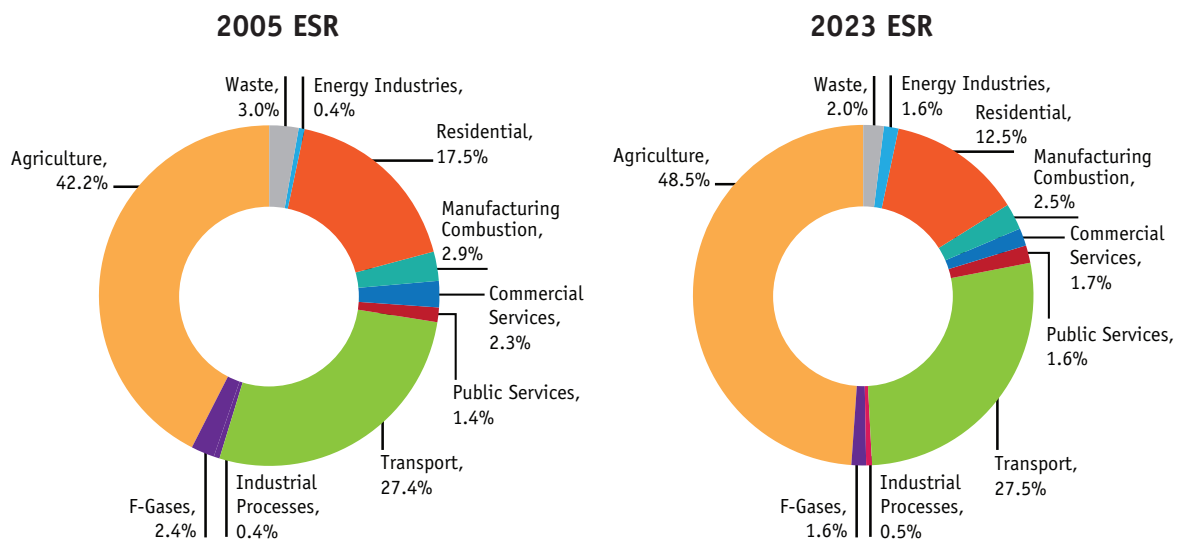
8 <https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-greenhouse-gas-emissions-projections-2023-2050.php>

Figure 6. Compliance with ESR Targets 2021-2025



The data presented in Figure 7 shows the sectoral shares of emissions covered by the Effort Sharing Regulation in 2005 and 2023.

Figure 7. Profile of Effort Sharing Regulation relevant GHG Emissions in 2005 and 2023 by Sector



4. Greenhouse Gas Emissions by Sector

For the purposes of this report emissions are classified into ten key sectors and fluorinated gases (F-gases). Although F-gases can be emitted from any sector it is helpful to group them collectively as the emissions from any one sub-sector are seldom significant, and measures to reduce them are often cross-sectoral in nature. The sectoral breakdown used in this report, and changes in emissions for those sectors between 2022 and 2023, are presented in Table 4 below and described in more detail in the Appendix.

This sectoral breakdown is produced for national reporting purposes and is generally in alignment with the classification used for UNFCCC reporting. Key energy subcategories; *Energy Industries* (largely electricity generation), *Residential*, *Manufacturing Combustion*, *Transport*, *Commercial Services* and *Public Services* are also shown separately rather than as part of an overarching Energy category as reported to the UNFCCC.

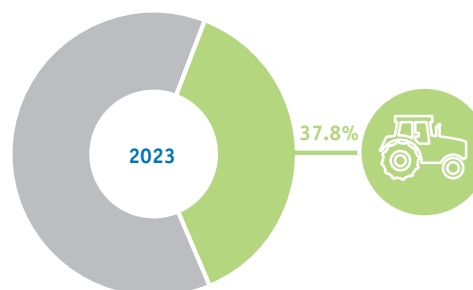
In this section, the time series since 1990 is graphically presented, as 1990 is the historical base year used for UNFCCC reporting.

Table 4. Ireland's Provisional Greenhouse Gas Emissions for 2022 and 2023 by Sector

Million tonnes CO ₂ eq	2022	2023	% Change
Agriculture	21.795	20.782	-4.6%
Transport	11.760	11.791	0.3%
Energy Industries (including electricity generation)	10.003	7.845	-21.6%
Residential	5.753	5.346	-7.1%
Manufacturing Combustion	4.334	4.133	-4.6%
Industrial Processes	2.288	2.155	-5.8%
F-Gases	0.741	0.699	-5.7%
Commercial Services	0.751	0.732	-2.5%
Public Services	0.696	0.677	-2.7%
Waste	0.881	0.846	-4.0%
LULUCF	3.983	5.614	40.9%
Total excluding LULUCF	59.003	55.007	-6.8%
Total including LULUCF	62.986	60.620	-3.8%

4.1 Agriculture

Total emissions from the *Agriculture* sector in 2023 were 20.8 Mt CO₂eq, a decrease of 4.6% on 2022. The most significant driver for the reduction in emissions in 2023 was a decrease in use of synthetic nitrogen fertiliser of 18.0%. Livestock numbers decreased in general, non-dairy cattle by 1.1%, sheep by 1.2% and pigs by 4.3%. Dairy cow numbers increased by 0.6%, however milk output per cow and overall production was reduced.



Methane emissions originate from Enteric Fermentation, Manure Management and fuel combustion. In 2023, CH₄ emissions contribute 72.1% to the *Agriculture* sector and have decreased by 2.1% since 2022.

Nitrous Oxide emissions originate from Manure Management, Agricultural Soils and fuel combustion. In 2023, N₂O emissions contribute 21.3% to the *Agriculture* sector and have decreased 9.2% since 2022, reflecting the reduction in fertiliser use.

Carbon dioxide emissions originate from Liming, Urea Application and fuel combustion. In 2023, CO₂ emissions contribute 6.6% to the *Agriculture* sector and have decreased by 14.6% since 2022. In 2023, liming on soils decreased by 26.6%, using 1.0 million tonnes of lime, following a 2022 usage of 1.42 million tonnes. Weather conditions throughout the latter half of 2023 proved difficult for field work and likely contributed to reduced lime application. However, it should be noted that as a mitigation measure, elevated levels of lime application improve soil fertility, leading to sustained reductions in fertiliser nitrogen usage and a net reduction in greenhouse gas emissions.

Agriculture emissions by source category and by gas are presented in Figures 8 and 9. Increasing methane emissions are evident in the gas share trend, 15.0 Mt CO₂eq (72.1% share) in 2023 compared to 14.3 Mt CO₂eq (69.7% share) in 1990, increasing in level by 4.8%.

This is the 13th consecutive year of increases in dairy cow numbers. Milk output per cow decreased in 2023 (-4.5%). This reflects national plans to expand milk production under Food Wise 2025 and the removal of the milk quota in 2015. In 2023, total cattle numbers decreased by 0.8%, sheep numbers by 1.2% and pig numbers by 4.3%. the poultry population increased by 3.1%.

Total fossil fuel consumption in agriculture/forestry/fishing activities in 2023 decreased by 7.5%.

Figure 8. Trend in Agriculture 1990-2023

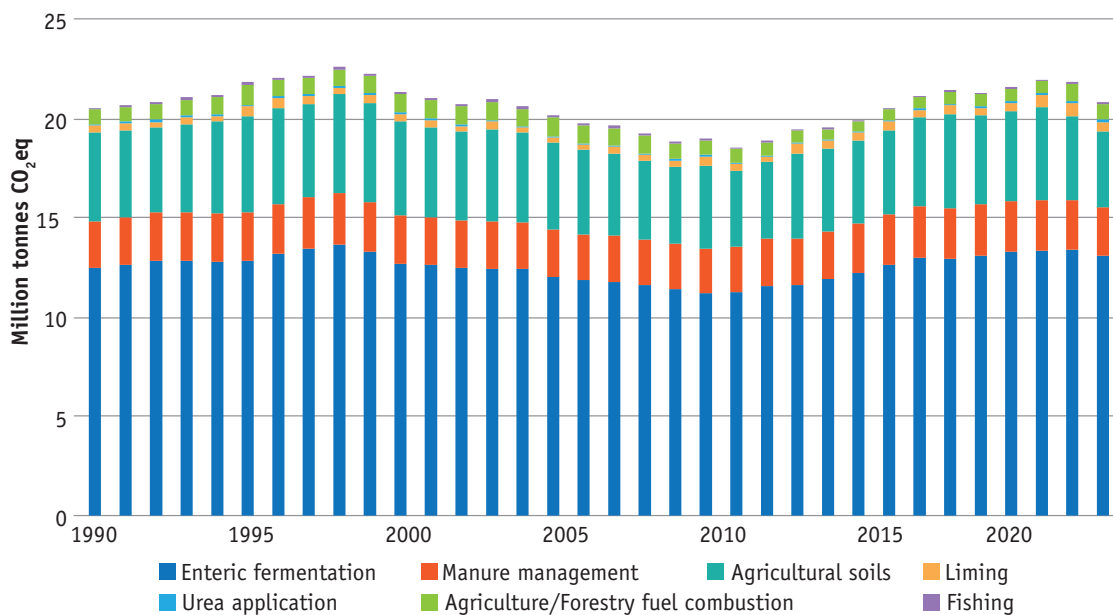
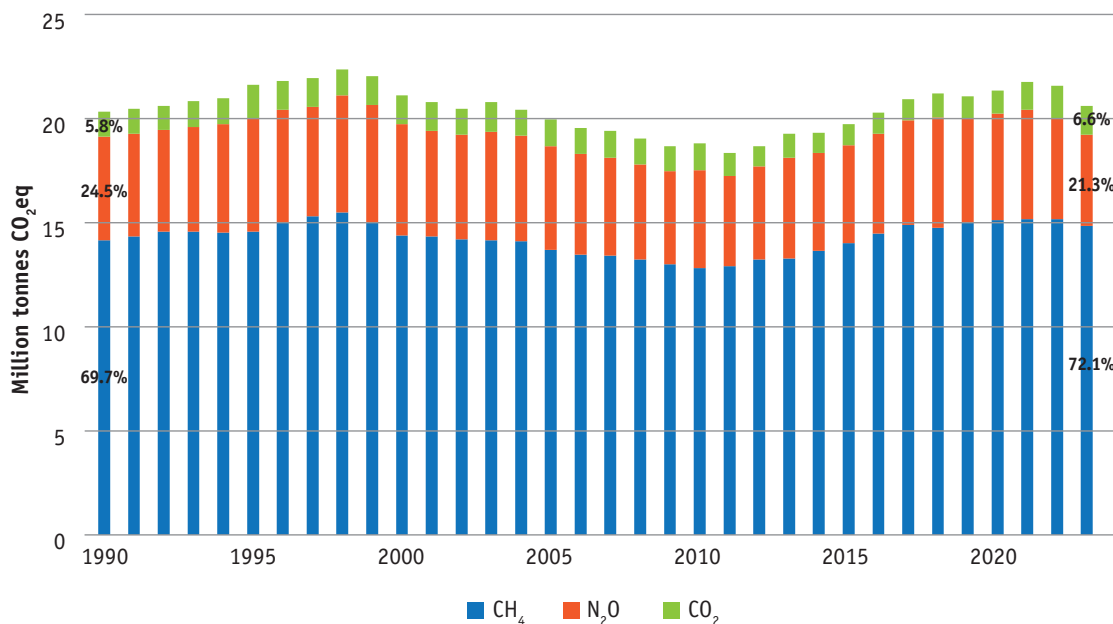
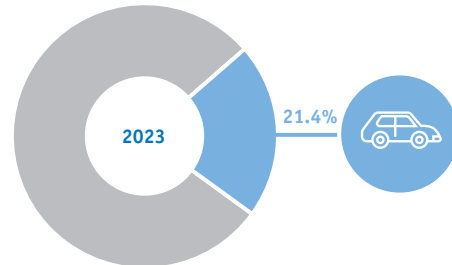


Figure 9. Trend in Agriculture, by Gas 1990-2023



4.2 Transport

In 2023, *Transport* emissions increased slightly by 0.3% on 2022 and, at 11.8 Mt CO₂eq, represent 21.4% of national total emissions. This small rise in emissions is in the context of a 6% increase in both 2021 and 2022 as *Transport* emissions rebounded following the ending of COVID travel restrictions. Despite this rebound, *Transport* emissions in 2023 are still 4.3% below pre-COVID levels.

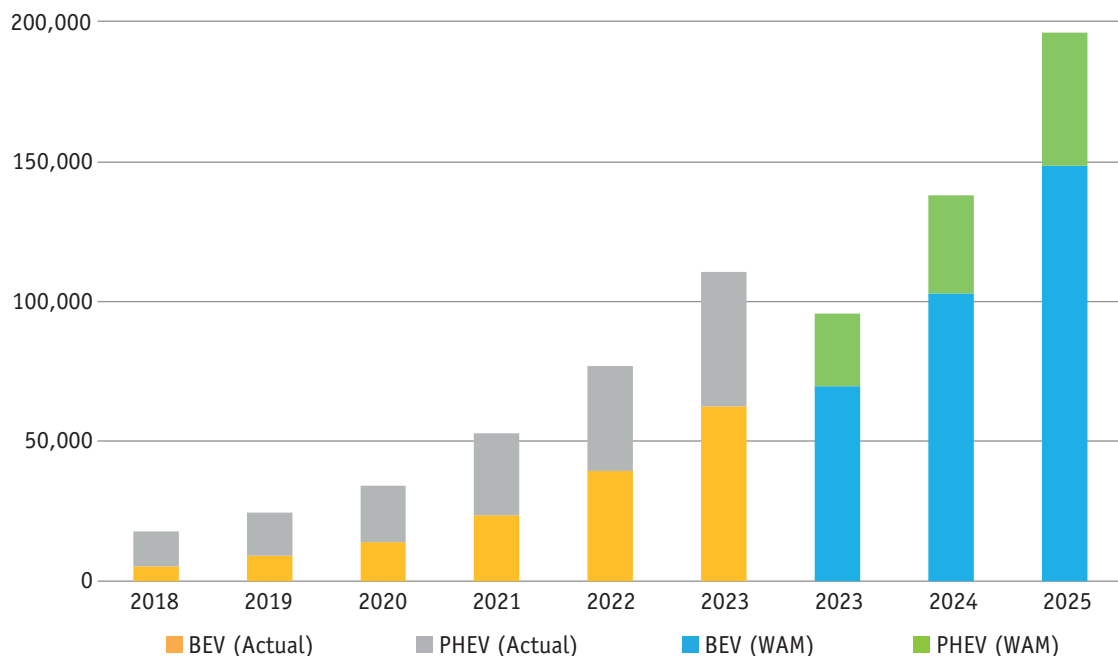


Emissions from road transport were relatively stable for the period 2015-2019, at an average 11.6 Mt CO₂eq but reduced to 9.8 Mt CO₂eq in 2020. However, with the easing and ending of travel restrictions in 2021/22, road transport emissions rebounded to 10.4 Mt CO₂eq and 11.1 Mt CO₂eq respectively. Despite an increase in electricity and biofuel use within the sector, emissions still rose slightly in 2023 by 0.3%. This was in part due to a 3% increase in the vehicle fleet.

Total energy consumption in road transport increased by 2.3% in 2023; petrol +6.6%, diesel -1.2%, bioethanol +41.0% and biodiesel +29.5%.

At the end of 2023, there were just over 62,000 battery electric (BEVs) and almost 48,000 plug-in hybrid electric (PHEVs) vehicles in Ireland, approximately 56% of the Climate Action Plan target for 2025 of 195,400 or <12% of the 2030 policy target of 944,600 vehicles. As a result, the continued uptake of electric vehicles has meant the annual target in 2023 was exceeded, see Figure 10.

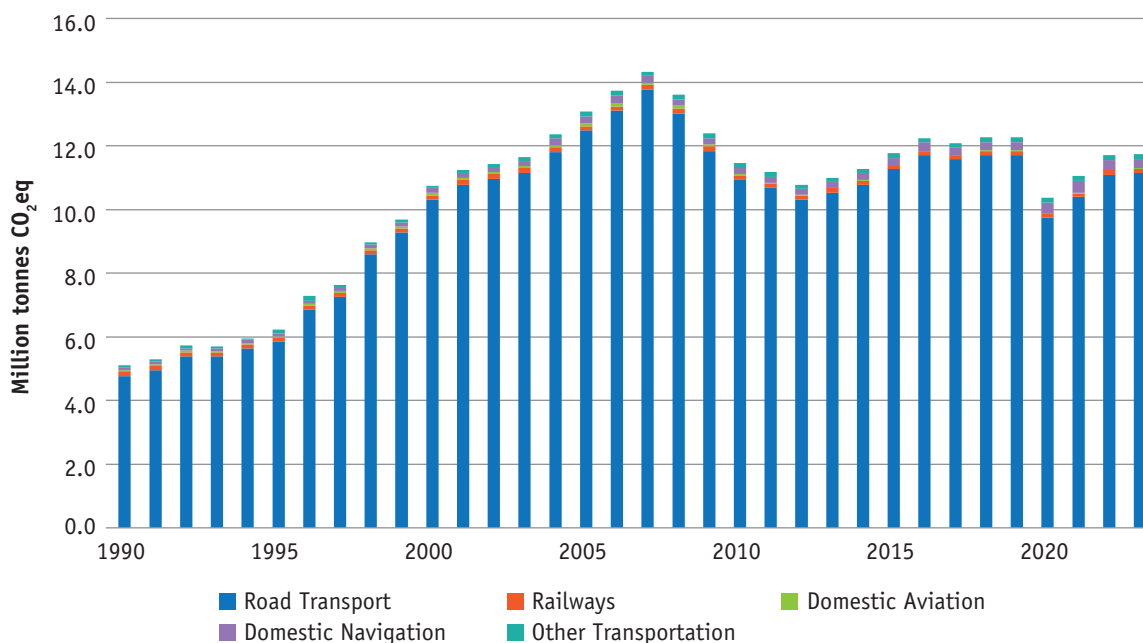
Figure 10. Total Electric Vehicles and Climate Action Plan target (CAP 24) 2025



The impact of electric vehicles in reducing Transport emissions is still very small due to the low number in the vehicle fleet but they are projected to contribute substantially to emissions reductions towards the latter half of the 2020s. Evidence of this shift appears in the 2023 vehicle numbers whereby newly registered fully electric cars and plug-in electric cars accounted for approximately 23% of all new registrations in 2023.

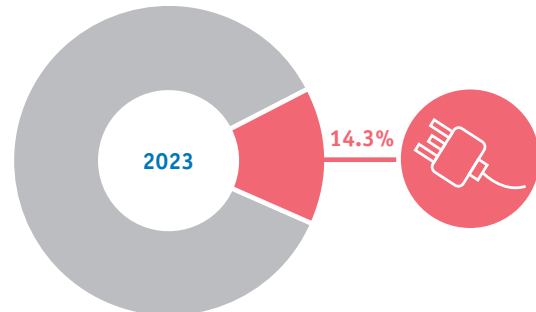
Passenger cars were responsible for 49% of road transport emissions in 2022, with heavy goods vehicles responsible for 21%, light goods vehicles for 22% and buses 8%. Modal share data for 2023 is not available for these provisional estimates.

Figure 11. Trend in Transport 1990-2023



4.3 Energy Industries

Sectoral emissions in the *Energy Industries* sector show a decrease of 21.6% in 2023, the largest annual change in emissions ever recorded for the sector and are now at an all-time low across the 1990 to 2023 timeseries at 7.8 Mt CO₂eq. This reduction in emissions is partly due to a 12-fold increase in the amount of imported electricity, accounting for 9.5% of electricity supply in 2023. Imported electricity amounted to 3,275 GWh, which would have resulted in additional emissions of over 1 Mt of CO₂eq if generated in Ireland.



There was an increase in the renewable share in electricity generation rising from 38.6% to 40.7% from 2022 to 2023, with wind accounting for 33.7% of electricity supply (up from 33.1%).

As a result, there was an annual reduction of 18.7% in total fuel used for electricity generation with reductions of 44.2% in coal, 78.2% in oil, and 7.2% in natural gas use in 2023. The increase in renewables combined with the increase in imported electricity from interconnectors caused emissions intensity of power generation to decrease by 23.3%, from 332g CO₂/kWh in 2022 to a historic low of 255g CO₂/kWh in 2023.

Renewables accounted for 40.7% and natural gas 44.3% of electricity generated in 2023, with coal, oil, and peat together accounting for 4.6% of electricity generated (see Figures 12 and 13). Solar now accounts for 1.9% of electricity generated in Ireland, increasing by 334% in the latest year.

Emissions from electricity generation had decreased year-on-year from 2016 to 2020, but 2021 and 2022 had seen increases in emissions of 1.4-1.6 million tonnes when compared to 2020 due to the return to using more carbon intensive fuel along with less renewables. In 2023, this trend reversed with a 2.2 million tonne reduction despite electricity demand increasing by 3%. The emission categories relevant under the *Energy Industries* sector are: Public electricity and heat production, Petroleum refining, Manufacture of solid fuels and other energy industries, and Fugitive emissions (Figure 14).

Figure 12. Emissions Intensity of Electricity Generation 1990-2023

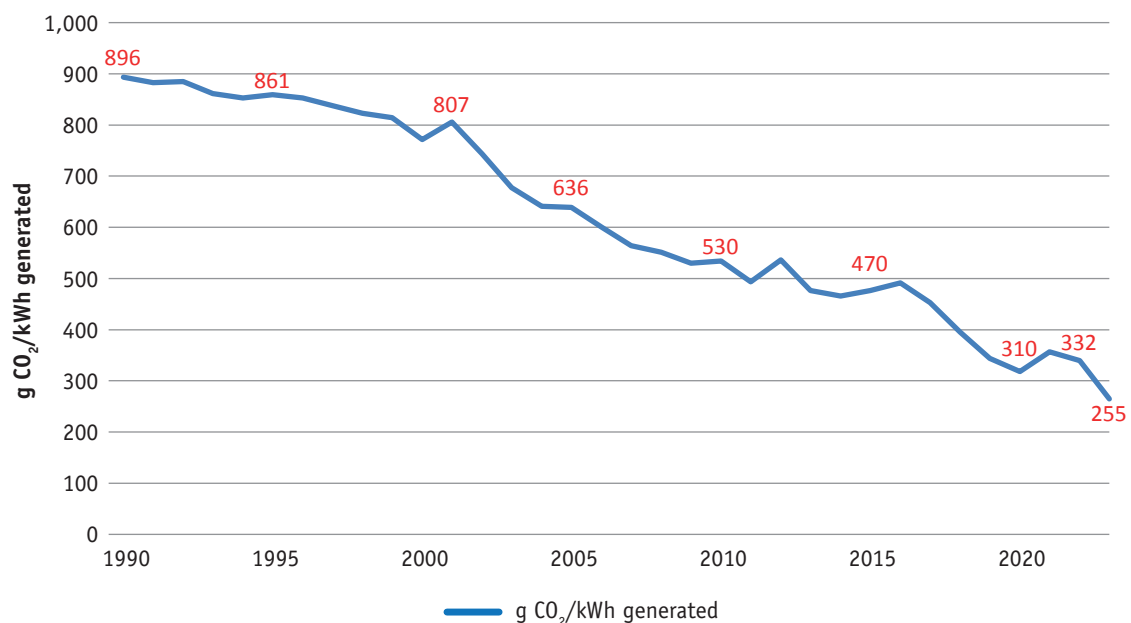


Figure 13. Electricity Generated by Fuel 1990-2023

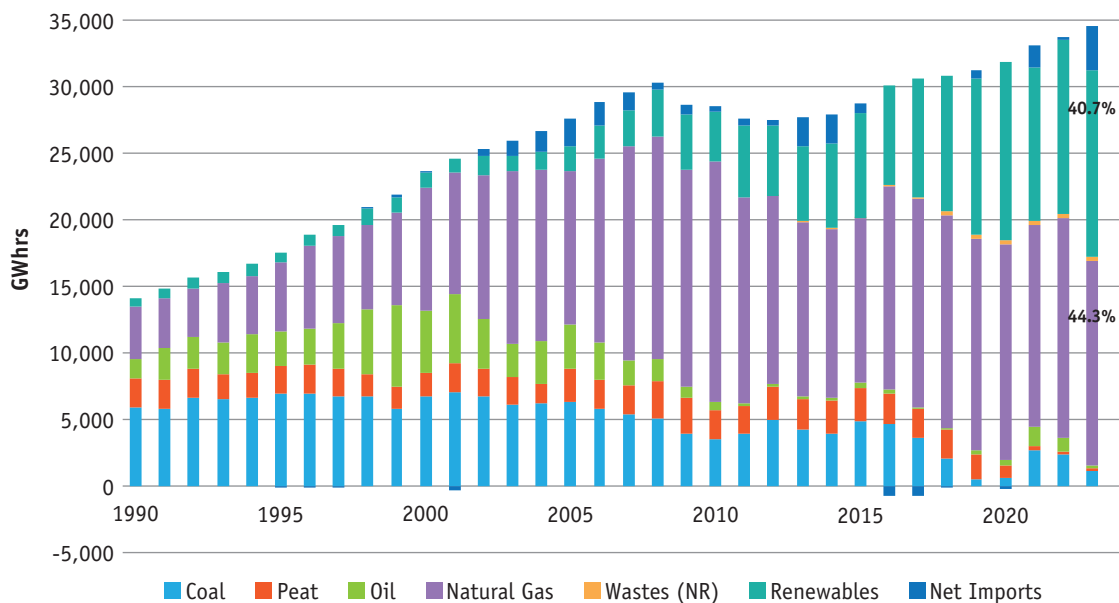
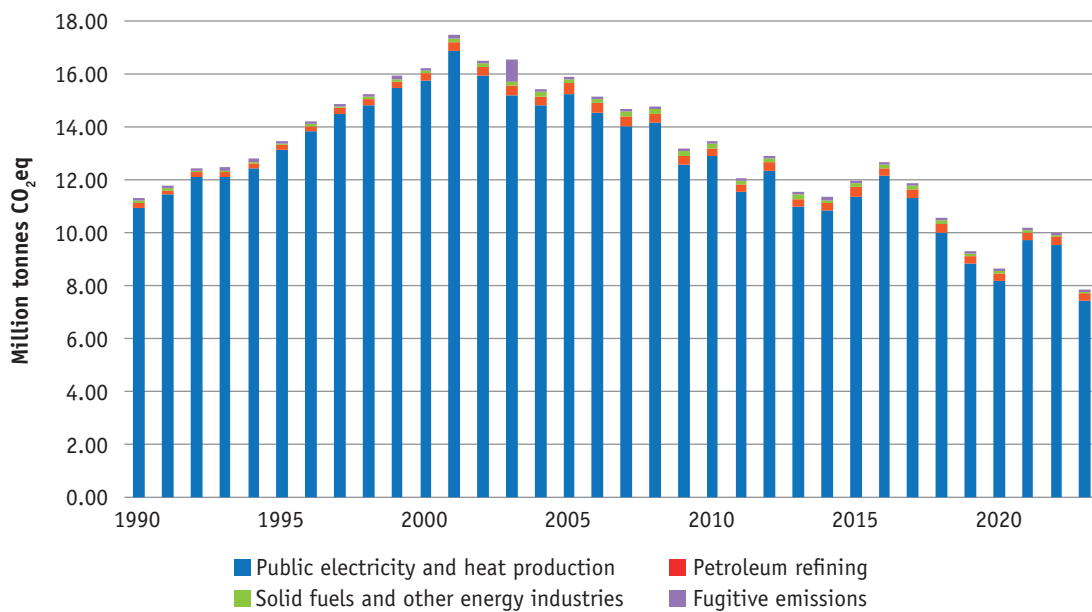
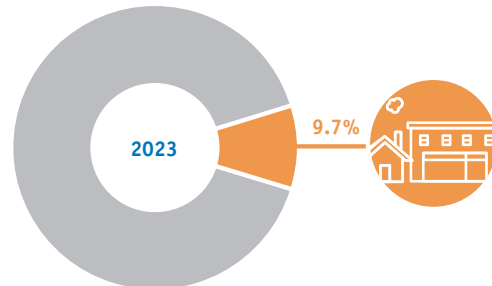


Figure 14. Trend in Energy Industries 1990-2023



4.4 Residential

Emissions in the *Residential* sector are 5.35 Mt CO₂eq or 9.7% of national total emissions in 2023 and decreased by 7.1% or 0.41 Mt CO₂eq since 2022. 2023 marks the third continuous year of reductions since the start of the COVID-19 pandemic in 2020 which saw emissions of 7.3 Mt of CO₂eq, the highest for the sector since 2011. Within the different fuels used in household space and water heating, decreases were seen in 2023 for all fossil fuels; coal, peat, kerosene, and natural gas by 22%, 13%, 0.3%, and 14% respectively.

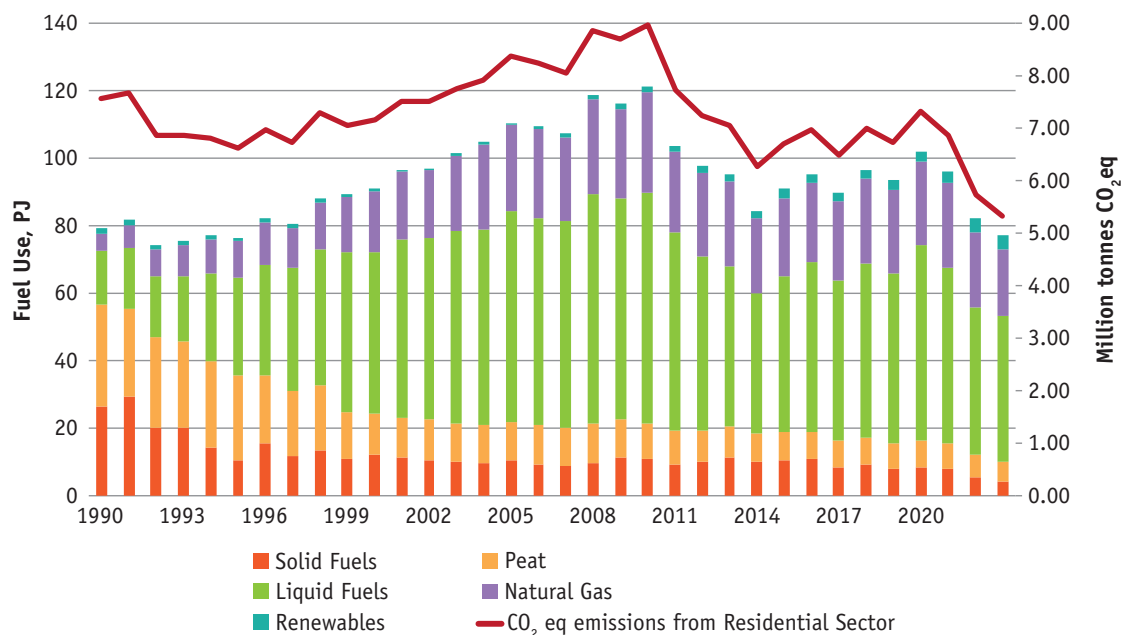


High fuel prices and a mild winter were significant contributors to the reduction in fossil fuel use, in addition to the introduction of nationwide solid fuel regulations.

Fuel switching, from coal and peat to oil and natural gas use, as well as improvements in buildings regulations helped reduce emissions per household from 7.5 t CO₂eq per year in 1990 to a low of 3.6 t CO₂eq per year in 2014. From 2015 to 2021, CO₂eq emissions per household averaged 3.8 t per annum. The last two years showed consecutive lows of 3.1 and 2.8 t CO₂eq household emissions per year, respectively, driven by further fuel switching away from fossil fuels, increased uptake in heat pumps, and expansion of energy efficiency programs (see Figures 15 and 16).

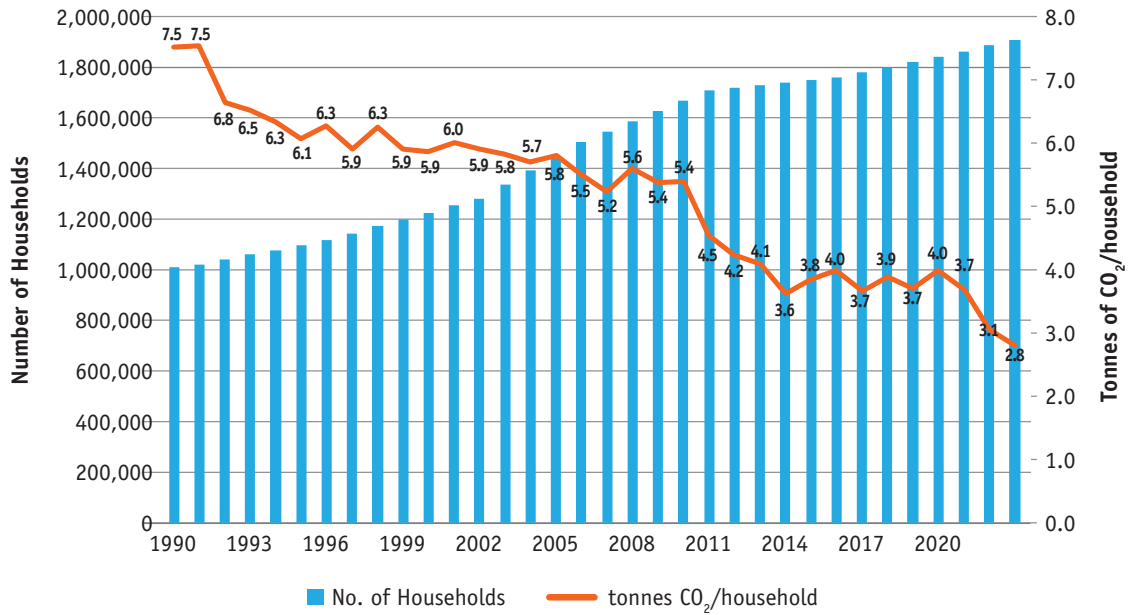
Additionally, there were 6.2% less heating degree days⁹ in 2023 than in 2022. While weather is a key variable from year to year, the continuation of the recent downward trend in per household CO₂ emissions evident in Figure 16 is needed through increased retrofit activity and heat pump use in order to achieve future emissions reduction commitments.

Figure 15. Trend in Residential 1990-2023



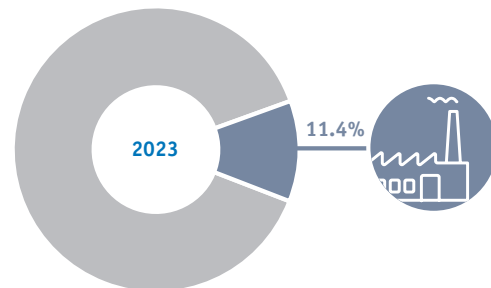
⁹ Degree days are a measure of the heating or cooling requirement on a given day with reference to a level where neither is required (typically 15.5°C). The number of degree days in a year is a strong indicator of the annual Residential energy demand.

Figure 16. CO₂ emissions per Household 1990-2023



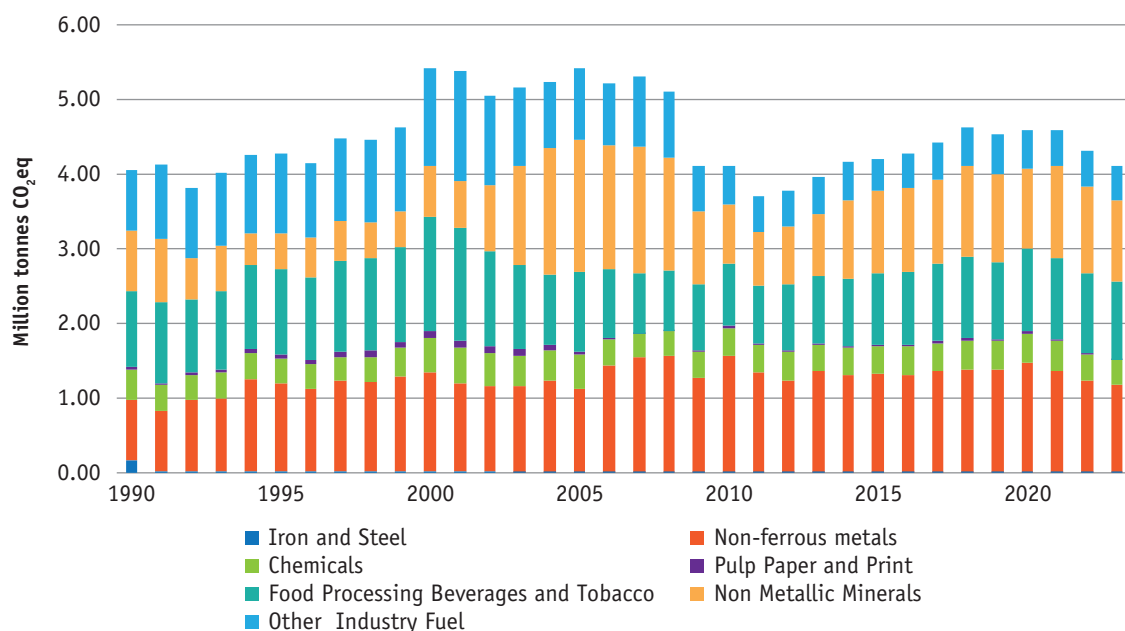
4.5 Manufacturing and Industry

Emissions relating to *Manufacturing Combustion* and *Industrial Processes* combined accounted for 11.4% of Ireland's total emissions in 2023, or 6.29 Mt CO₂eq. Emissions from the *Manufacturing Combustion* sector decreased by 4.6% or 0.2 Mt CO₂eq in 2023. There were decreases in combustion emissions from major sub sectors including non-ferrous metals, chemicals, food processing, beverages and tobacco sector and non-metallic minerals, i.e. 5.6%, 3.9%, 3.6% and 5.9% respectively. See Figure 17.



In 2023, significant fuel reductions occurred in this sector with coal, petroleum coke and natural gas use all decreasing by 26.1%, 8.1% and 5.6% respectively.

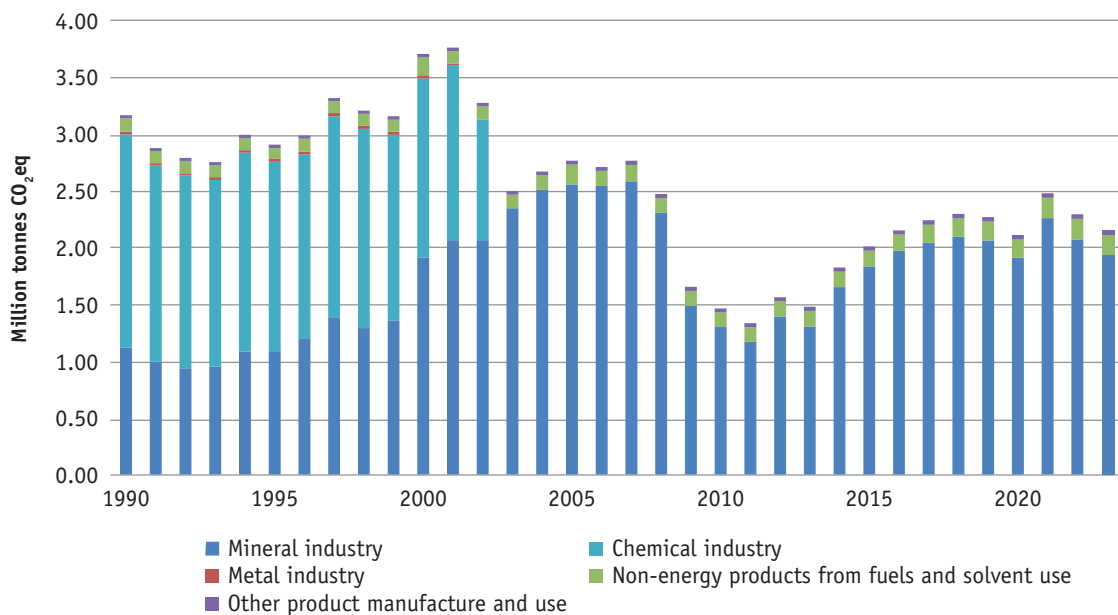
Figure 17. Trend in Manufacturing Combustion 1990-2023



Emissions from the *Industrial Processes* sector decreased by 5.8% (0.13 Mt CO₂eq) in 2023 from 2.29 Mt of CO₂eq to 2.15 Mt CO₂eq, following a 7.4% decrease in 2022. Total process emissions from the mineral products subsector (including cement) decreased by 6.5% in line with a reduction in production.

In 2023, total emissions (combustion and process) from the cement sector decreased by 6.2% and amounted to 2.70 Mt CO₂eq, or 4.9% of national total emissions. Cement sector emissions are now 77.7% higher than the 2011 low during the economic recession, see Figure 18.

Figure 18. Trend in Industrial Processes 1990-2023

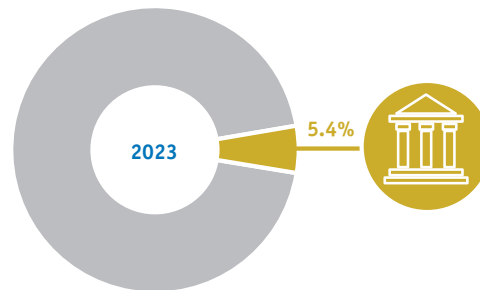


Emissions from *F-Gases*, *Commercial Services*, *Public Services* and *Waste* account for 5.4% of total national emissions in 2023.

4.6 Other Sectors

Commercial and Public Services

Emissions from *Commercial Service* and *Public Services* decreased by 2.5% and 2.7% in 2023. Natural gas decreased by 5.7% while oil increased by 2.5% within these sectors.



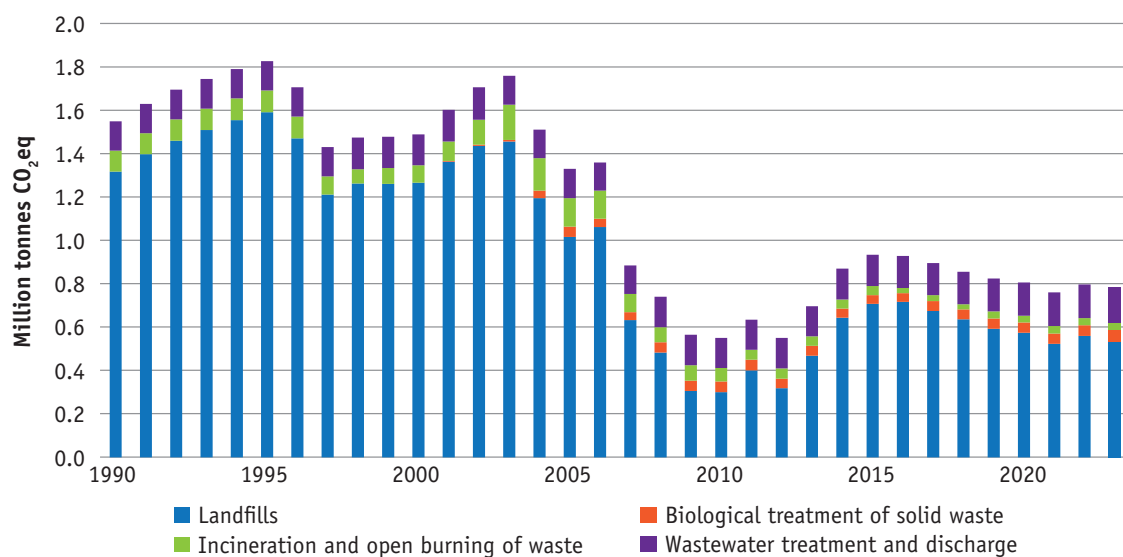
Waste

Emissions from the *Waste* sector, which account for 1.5% of total national emissions, decreased by 4.0% in 2023 because of a decrease in emissions of methane from landfills by 6.3%. Actual generation of methane at landfills fell 5.0% in 2023, with methane flared and utilised for electricity generation falling by 4.0% with a net overall decrease in emissions. Waste sector emissions decreased by 0.04 Mt CO₂eq. See Figure 19.

Long-term decreases are a result of decreased quantities of municipal solid wastes (MSW) disposed of at landfills which now are combusted in Waste to Energy (WtE) plants. In addition, a decrease in the proportion of organic materials (food and garden waste) in MSW as well as a diversion of paper products from landfills. A large proportion of organic food and garden waste is now treated in composting and anaerobic digestion facilities, which have significantly lower emissions than landfills.

The emissions associated from combustion at WtE plants are estimated under electricity generation in *Energy Industries*. Improved management of landfill facilities, including increased recovery of landfill gas utilised for electricity generation and flaring is also a big driver in decreased emissions from the waste sector.

Figure 19. Trend in Waste 1990-2023

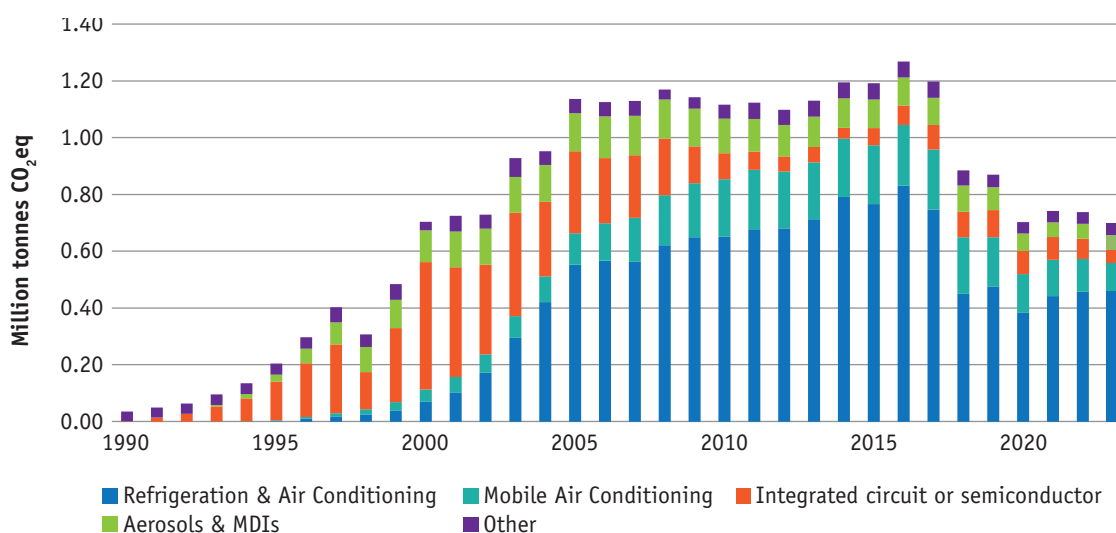


Fluorinated Gas Emissions

Provisional F-Gas emissions in 2023 are 5.7% lower than in 2022, following a decrease of 0.5% in the previous year. The decrease is based on a reduction in PFCs and NF₃ use in the semiconductor industry. Emissions of F-gases (HFCs, PFCs, SF₆ and NF₃) were 0.70 Mt CO₂eq in 2023 compared to 0.04 Mt CO₂eq in 1990, a 20-fold increase over the time series, see Figure 20. However, F-gas emissions have risen from a very low base and only accounted for 1.3 per cent of the national total in 2023. F-gases include a wide range of substances that are used in a diverse range of products and manufacturing processes.

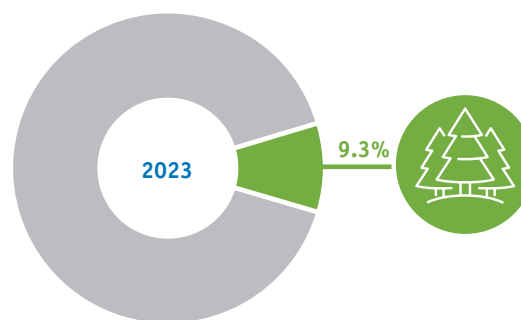
The main reason behind the more recent decreases in F-gas emissions has been the phasing out of refrigerant and air conditioning (AC) gases with high global warming potentials (GWPs), due to the implementation of the F-Gas Regulation (EU) No. 517/2014. These refrigerant gases are being replaced with products containing a blend of HFCs and hydrofluoroolefins (HFOs) with low GWPs in this subcategory, Refrigeration and Air Conditioning.

Figure 20. Composition and Trend in F-Gas Emissions 1990-2023



4.7 LULUCF

The *LULUCF* sector is made up of six land use categories (Forest Land, Cropland, Grassland, Wetlands, Settlements, and Other Land) and Harvested Wood Products. This sector accounts for 9.3% of national total emissions (including LULUCF). See Figure 21.



These categories are sub-divided into land remaining in the same category (e.g., Forest land remaining forest land) and land converted from one category into another (e.g., grassland converted to forest land).

The provisional LULUCF emissions data are based on 1990-2022 final inventory data and 2023 projected data published in May 2024. The sector is a net source of CO₂eq emissions in all years 1990-2023. The net CO₂ emissions to, or removals from, the atmosphere are estimated with respect to overall carbon gain or loss for relevant carbon pools for the defined land categories. These pools¹⁰ are above-ground biomass, below-ground biomass, litter, dead wood, soils and harvested wood products. Emissions from biomass burning (wildfires), drainage of organic soils and emissions from mineralisation in soils are also estimated.

The main sources of emissions are the drainage of grasslands on organic soils and the exploitation of wetlands for peat extraction. Forest land and Harvested wood products are a carbon sink (CO₂ removal) for all years 1990-2023. See Figure 22. The carbon sink associated with Forest land is on a declining trend.

A complex dynamic exists between land use categories and the relative contributions between the carbon pools in biomass and soils lead to fluctuations in emissions and removals over the period 1990-2023. In any one year the Croplands land use can act as either a small sink (removal) or a small source of emissions. This results from the dynamic of using temporary grassland as part of cropping rotations. The Settlements and Other Land uses are comparatively less important and do not affect the absolute level of emissions or the trend over time to a significant extent.

Emissions from the *LULUCF* sector in 2023 were 12.0% above those in 1990 and increased by 40.9% between 2022 and 2023. There has been a considerable long-term decline in the area of land afforested annually, an increase on the level of harvest and increased emission from forestry on organic soils resulting in a reduction in the contribution of the forest land sector to the removal of CO₂ from the atmosphere.

Afforestation rates have declined from c.17,000 ha annually in the 1990s to c.1,650 ha by 2023 resulting in a decreasing carbon sink in land converted to forest land. Afforestation rates are well below those suggested in the CAP 24. For forest land remaining forest land, it is transitioning from a sink to an emission source due an increase in the level of harvest from 1.7 million m³ in 1990 to 4.0 million m³ annually in recent years. Further increases in the level of harvest are projected as the forest estate matures.

¹⁰ A carbon pool is a reservoir of carbon that has the capacity to both take in and release carbon.

Figure 21. Profile of GHG Emissions (including LULUCF) in 1990 and 2023 by Sector

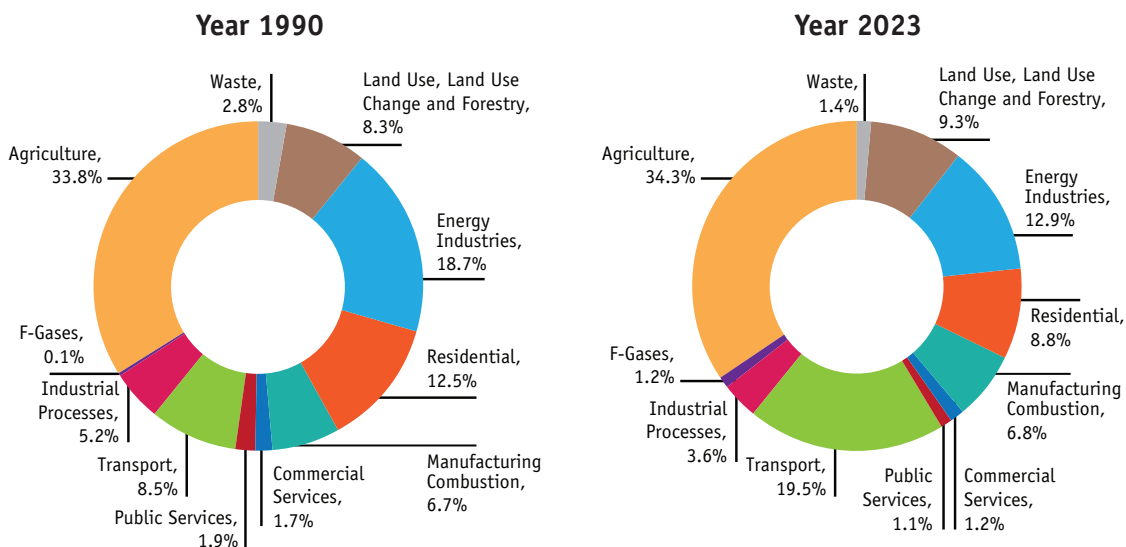
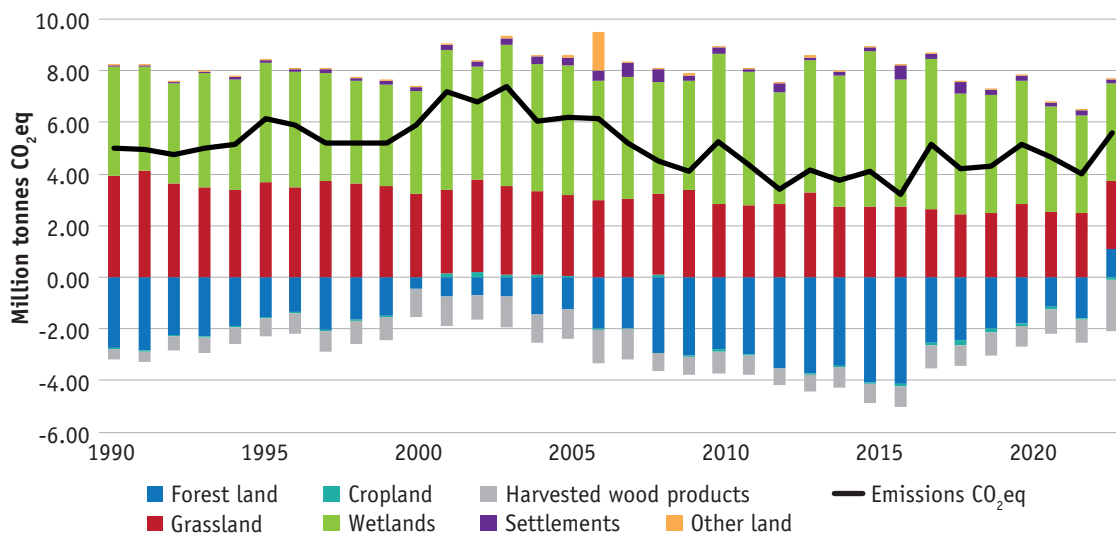


Figure 22. Trend in LULUCF 1990-2023



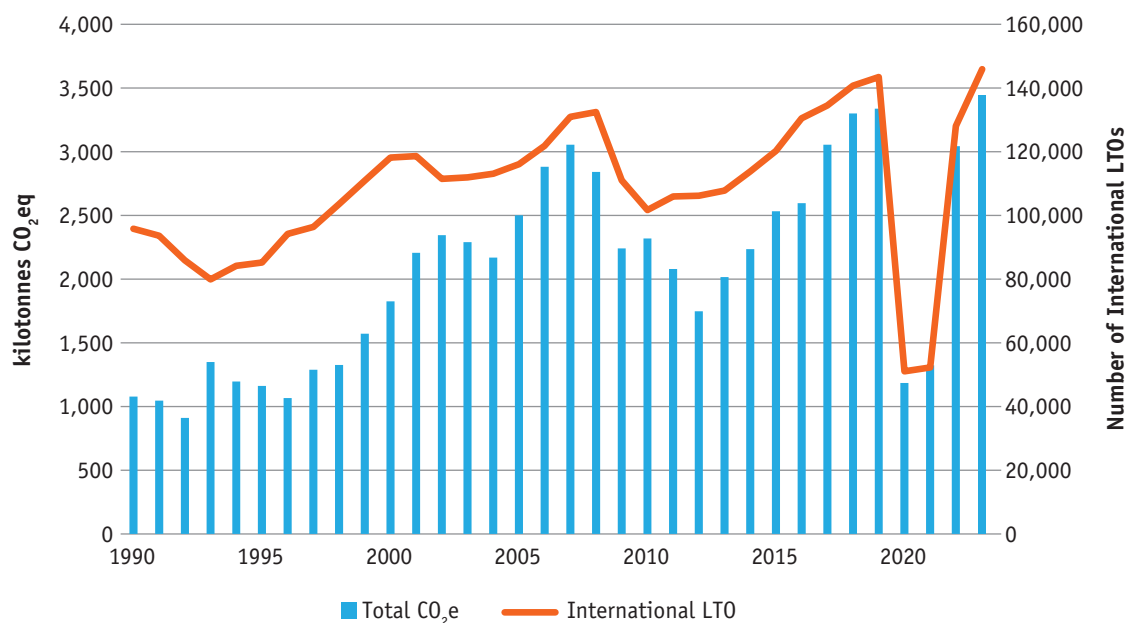
5. International Aviation and Maritime Emissions

Emissions from international aviation and maritime navigation are reported as “memo items” in the national emission inventory. This means they are not counted as part of Ireland's national total emissions but are reported by Ireland to the UNFCCC and EU for information purposes. A substantial proportion of Ireland's international aviation emissions is included in the EU ETS, such as all intra EU flights and flights within the European Economic Area (EEA) including; Iceland, Norway and Liechtenstein. In 2023, total international aviation contributed 3.43 Mt CO₂ from almost 145,000 return flights from Irish airports, see Figure 23, a substantial increase of 0.38 Mt CO₂ since 2022. Emissions in 2023 have passed pre COVID pandemic levels and are now the highest in the time series.

In recent years, CO₂ emissions from international aviation have increased very rapidly and it is therefore important that they are closely monitored for comparison with other emission sources and for the benefit of the international organisations that will have to develop control strategies for them in the future.

International marine navigation is another important source of emissions that is also excluded from Ireland's national total emissions and any EU or UN reduction commitments. In 2023, emissions from this source amounted to 0.40 Mt CO₂eq, which is a reduction of 1.4% on 2022.

Figure 23. Trend in International Aviation 1990-2023



6. Long-term Changes in Sectoral Emissions 1990-2023

As 1990 is the historical base year used by most countries in relation to UNFCCC reporting, it is instructive to look at how emissions have evolved over the longer timeframe from 1990 to the present. The share of CO₂ in total greenhouse gas emissions has increased to 61.0% of total greenhouse gas emissions in 2023 compared to 59.2% in 1990. The share of CH₄ and N₂O emissions, primarily from the agriculture sector, have fallen from 40.8% of total greenhouse gas emissions in 1990 to 37.7% in 2023 as emissions (primarily CO₂) from other sectors grew at a faster rate. Emissions from F-gases account for 1.3% of the total in 2023. The trend in national total emissions (excluding LULUCF) from 1990 to 2023 is -1.2%, the first-time in 33 years that emissions in the latest year are below the historical 1990 baseline. See Figures 24 and 25 and Table A.1 in the Appendix.

Between 1990 and 2023, **Transport** shows the greatest overall increase of GHG emissions at 129.2%, from 5,143.3 kt CO₂eq in 1990 to 11,790.8 kt CO₂eq in 2023, with road transport increasing by 133.6%. Fuel combustion emissions from Transport accounted for 9.2 per cent and 21.4 per cent of total national greenhouse gas emissions in 1990 and 2023, respectively. The increase in emissions up to 2007 can be attributed to general economic prosperity and increasing population, with a high reliance on private car travel as well as rapidly increasing road freight transport. Over the time series passenger car numbers increased by 191% and commercial vehicles increased by 177%. Both the increase in transport emissions up to 2007 and the subsequent fall during the financial crisis highlight that transport emissions have not yet been effectively decoupled from economic activity through sustainable planning or electrification.

Energy Industries show a decrease in emissions of 30.8% over the period 1990 to 2023. Over the time series, emissions from electricity generation have decreased by 32.1% whereas total electricity consumption has increased by 164%. Emissions from electricity generation increased from 1990 to 2001 by 54.3% and have decreased by 56.0% between 2001 and 2023. This decrease reflects the improvement in efficiency of modern gas fired power plants replacing older peat and oil-fired plants and the increased share of renewables, primarily wind power, along with increased interconnectivity. This year was the lowest year in the 34-year time series for peat fired electricity generation, 39% less than in 2022. These reductions reflect the gradual ending of peat fired electricity generation for market and climate policy reasons. Emissions from electricity generation had decreased year-on-year from 2016 to 2020 but increased in 2021 by 19.0% compared to 2020 due to an increase in coal and oil use, driven by a number of factors including the war in Ukraine. Coal in electricity generation decreased in by 44.0% in 2023.

The latest estimates show that total emissions in the **Agriculture** sector have increased by 1.3% from 1990 to 2023 mainly driven by a 4.9% increase in methane emissions from enteric fermentation and a 4.5% increase in emissions from manure management. After initially showing a rising trend in emissions in the 1990s, the Agriculture sectoral emissions began to decrease steadily between 1998 until 2011.

However, since 2011, emissions have trended upwards again with an overall peak in emissions reported in 2021. Fossil fuel combustion emissions from agriculture/forestry/fishing activities have decreased by 6.1% since 1990. In the last 10 years, dairy cow numbers have increased by 40.6% with a corresponding milk production increase of 56.0%. This reflects national plans to expand milk production under Food Wise 2025 and the removal of the milk quota in 2015. In the same 10-year period sheep numbers increased by 11.5%, pigs by 1.6% and poultry by 29.4%.

Emissions in 2023 from the **Residential** sector were 29.4% below the 1990 level and 7.1% below the 2022 level. At 17.8% below the previous lowest level in 2014, 2023 also represents a new low point for **Residential** sector emissions across the entire Inventory time series since 1990. Increased housing stock and a growing population had driven a gradual upward trend in the emissions after 1997 following emission reductions in the early 1990s due to fuel switching.

Following a decline from 2010 to 2014, emissions remained relatively stable from 2015 to 2021 despite an increasing population. The number of households has increased by 88.6% and population by 50.7% between 1990 and 2023 with winter heating demand remaining an important annual variable driving emissions from this sector.

Figure 24. GHG Emissions by Gas 1990-2023

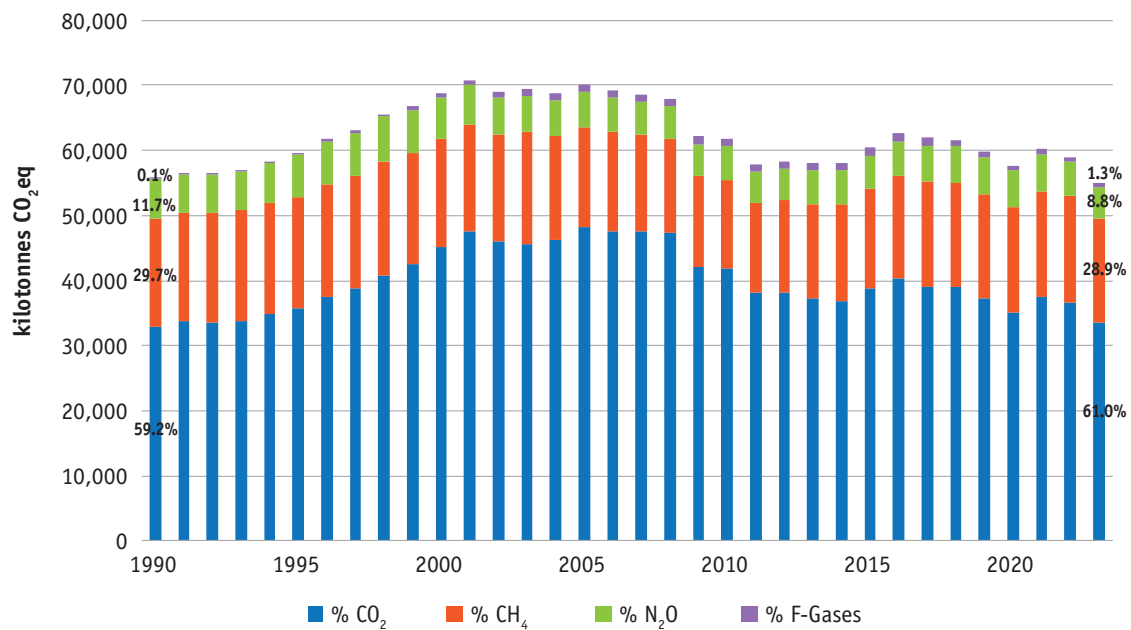
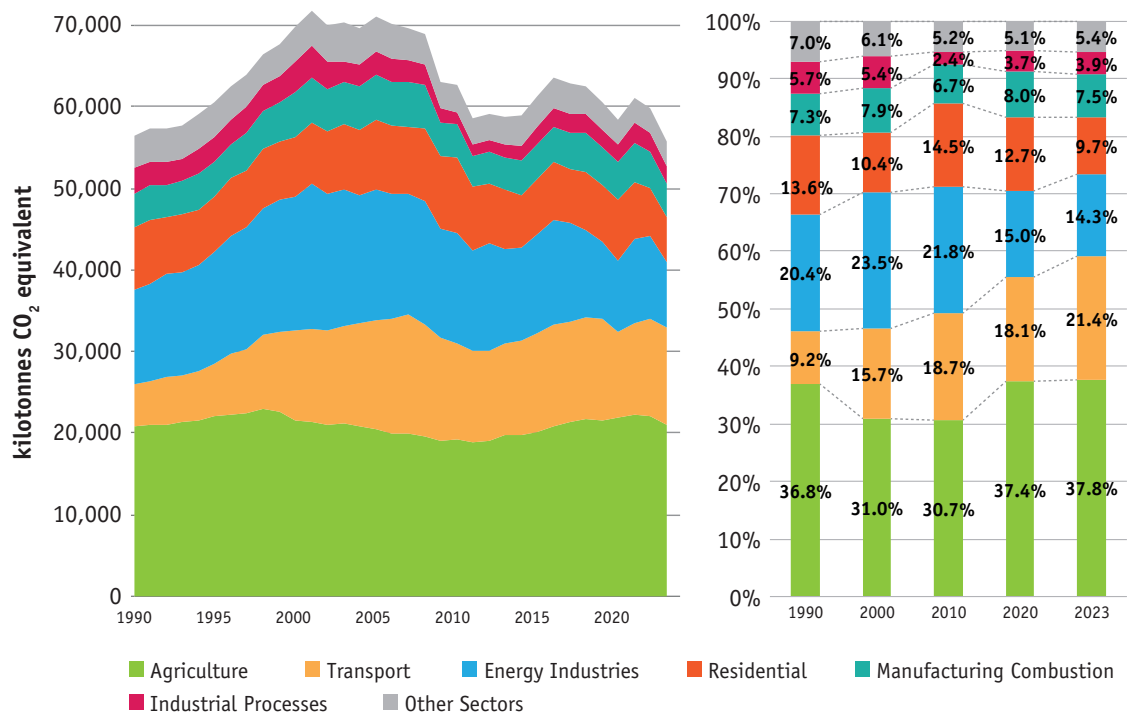


Figure 25. Trend in Emissions for Largest Sectors 1990-2023



Appendix – Additional Tables

Table A.1 Ireland's Provisional GHG Emissions by Sector 1990-2023 (kilotonnes CO₂ equivalent)

1990-2023 Submission 2024 Provisional	1990	1995	2000	2005	2010	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	% Share 2023	% Share 2023 incl LULUCF	Annual change
Energy Industries	11335	13482	16202	15901	13461	11343	11953	12675	11873	10559	9309	8665	10187	10003	7845	14.3%	12.9%	-21.6%
Public electricity and heat production	10947	13126	15747	15235	12880	10831	11380	12136	11327	10012	8826	8170	9721	9538	7433	13.5%	12.3%	-22.1%
Petroleum refining	169	181	275	412	310	279	359	314	311	322	275	301	294	308	287	0.5%	0.5%	-6.9%
Solid fuels and other energy industries	101	69	87	172	173	134	114	125	129	118	107	92	81	67	34	0.1%	0.1%	-49.7%
Fugitive emissions	119	106	93	83	97	98	99	100	106	107	102	102	91	90	91	0.2%	0.2%	1.9%
Residential	7571	6642	7166	8382	8977	6272	6713	6998	6509	7000	6730	7344	6868	5753	5346	9.7%	8.8%	-7.1%
Manufacturing Combustion	4075	4299	5444	5447	4141	4198	4233	4312	4453	4662	4554	4620	4622	4334	4133	7.5%	6.8%	-4.6%
Commercial Services	1010	1078	1026	1079	983	855	964	861	797	868	838	673	761	751	732	1.3%	1.2%	-2.5%
Public Services	1123	914	856	683	549	587	608	634	635	678	697	670	683	696	677	1.2%	1.1%	-2.7%
Transport	5143	6264	10777	13122	11526	11336	11814	12296	12133	12308	12322	10401	11089	11760	11791	21.4%	19.5%	0.3%
Domestic aviation	48	46	70	80	49	15	16	17	18	17	18	14	20	22	31	0.1%	0.1%	44.3%
Road transportation	4789	5878	10357	12543	10981	10832	11319	11754	11626	11762	11750	9794	10438	11150	11187	20.3%	18.5%	0.3%
Railways	147	123	136	135	135	119	121	124	128	129	135	108	116	130	136	0.2%	0.2%	4.8%
Domestic navigation	86	92	153	211	200	225	222	266	235	260	277	339	362	306	287	0.5%	0.5%	-6.2%
Other transportation	73	125	62	153	161	146	137	135	127	140	142	148	152	153	150	0.3%	0.2%	-2.0%
Industrial Processes	3163	2902	3701	2759	1462	1818	2005	2147	2236	2292	2264	2107	2472	2288	2155	3.9%	3.6%	-5.8%
Mineral industry	1117	1084	1909	2553	1299	1650	1830	1968	2040	2095	2058	1907	2257	2068	1934	3.5%	3.2%	-6.5%
Chemical industry	1875	1668	1577	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			
Metal industry	26	25	29	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO			
Non-energy products from fuels and solvent use	117	97	156	173	127	131	137	141	158	159	167	160	175	179	180	0.3%	0.3%	0.3%
Other product manufacture and use	28	29	30	33	36	37	37	38	38	39	39	40	40	41	41	0.1%	0.1%	0.6%
F-Gases	36	206	706	1141	1121	1199	1196	1273	1202	888	873	706	745	741	699	1.3%	1.2%	-5.7%
Agriculture	20516	21822	21301	20161	18969	19514	19904	20492	21103	21393	21260	21545	21940	21795	20782	37.8%	34.3%	-4.6%
Enteric fermentation	12480	12827	12685	12016	11205	11901	12226	12628	12977	12916	13091	13261	13341	13380	13091	23.8%	21.6%	-2.2%
Manure management	2342	2419	2403	2357	2246	2415	2477	2529	2612	2556	2583	2585	2546	2504	2448	4.5%	4.0%	-2.3%
Agricultural soils	4431	4840	4741	4371	4170	4150	4161	4227	4472	4697	4467	4509	4675	4230	3804	6.9%	6.3%	-10.1%
Liming	355	495	366	267	428	391	401	434	333	461	344	399	597	624	458	0.8%	0.8%	-26.6%
Urea application	97	86	92	61	98	55	64	79	84	89	92	109	102	127	122	0.2%	0.2%	-3.6%
Agriculture/Forestry fuel combustion	723	998	900	944	746	529	510	535	555	590	610	622	619	877	799	1.5%	1.3%	-8.8%
Fishing	88	158	113	145	76	74	65	60	71	84	73	59	58	54	61	0.1%	0.1%	13.7%
Waste	1709	2020	1643	1454	589	949	1020	1016	979	934	899	879	825	881	846	1.5%	1.4%	-4.0%
Landfills	1476	1784	1420	1140	337	722	793	803	756	714	665	644	590	634	594	1.1%	1.0%	-6.3%
Biological treatment of solid waste	0	0	0	48	50	42	42	41	47	46	49	48	43	52	53	0.1%	0.1%	1.9%
Incineration and open burning of waste	98	101	80	133	62	42	42	25	27	24	33	31	35	36	37	0.1%	0.1%	0.6%
Wastewater treatment and discharge	135	135	143	134	140	143	144	147	149	150	152	156	158	159	163	0.3%	0.3%	2.2%
Land use, land-use change and forestry	5011	6151	5868	6212	5248	3738	4082	3198	5165	4186	4282	5152	4628	3983	5614		9.3%	40.9%
Forest land	-2723	-1554	-428	-1238	-2790	-3450	-4081	-4151	-2556	-2463	-2009	-1769	-1135	-1575	1081		1.8%	-168.6%
Cropland	-48	-45	1	43	-113	-51	-71	-93	-92	-155	-142	-125	-101	-83	-117		-0.2%	39.7%
Grassland	3928	3683	3221	3121	2818	2725	2734	2730	2646	2452	2482	2829	2512	2485	2624		4.3%	5.6%
Wetlands	4203	4638	3972	5040	5839	5096	6041	4923	5820	4634	4567	4785	4081	3758	3786		6.2%	0.8%
Settlements	63	86	172	306	251	119	129	536	162	491	200	194	188	221	181		0.3%	-18.1%
Other land	1	24	54	70	63	62	60	57	55	53	50	48	46	44	44		0.1%	0.0%
Harvested wood products	-413	-680	-1123	-1130	-819	-763	-729	-804	-869	-826	-866	-809	-963	-866	-1985		-3.3%	129.3%
Other																		
National Total	55680	59630	68821	70129	61779	58072	60411	62704	61920	61582	59746	57610	60191	59003	55007	100.0%	100.0%	-6.8%
National Total with LULUCF	60691	65781	74689	76341	67027	61810	64493	65902	67085	65769	64028	62762	64819	62986	60620	100.0%	100.0%	-3.8%

Background Notes

Units: 1 Mt = 1,000 kilotonnes

CO₂ Equivalent: greenhouse gases other than CO₂ (i.e. methane, nitrous oxide and F-gases) may be converted to CO₂ equivalent using their global warming potentials (GWPs).

F-gases: These gases comprise HFCs (Hydrofluorocarbons), PFCs (Perfluorocarbons), SF₆ (Sulphur Hexafluoride) and NF₃ (Nitrogen Trifluoride). They are much more potent than the naturally occurring greenhouse gas emissions (carbon dioxide, methane and nitrous oxide).

Ireland's GHG Sectors: include the following eleven sectors for analysis:

1. Energy Industries (electricity generation, waste to energy incineration, oil refining, briquetting manufacture and fugitive emissions)
2. Residential (combustion for domestic space and hot water heating)
3. Manufacturing Combustion (combustion of fuels for heating, steam generation and powering machinery)
4. Commercial Services (combustion for Commercial Services space and hot water heating)
5. Public Services (combustion for Public services space and hot water heating)
6. Transport (combustion of fuel used in road, rail, navigation, domestic aviation and pipeline gas transport)
7. Industrial Processes (process emissions from mineral, chemical, metal industries, non-energy products and solvents)
8. F-Gases (gases used in refrigeration, air conditioning and semiconductor manufacture)
9. Agriculture (emissions from fertiliser application, ruminant digestion, manure management, agricultural soils and fuel used in agriculture/forestry/fishing)
10. Waste (emissions from solid waste disposal on land, solid waste treatment (composting and anaerobic digestion), wastewater treatment, waste incineration and open burning of waste).
11. Land Use Land-use Change and Forestry (LULUCF) covers the following categories; Forest land, Cropland, Grassland, Wetlands, Settlements, Other land and Harvested Wood products.

GWPs

Industrial designation or common name	Chemical formula	GWP for 100-year time horizon IPCC 4th assessment report (AR4)	GWP for 100-year time horizon IPCC 5th assessment report (AR5)
Carbon dioxide	CO ₂	1	1
Methane	CH ₄	25	28
Nitrous oxide	N ₂ O	298	265
Hydrofluorocarbons	HFCs	12 to 14,800	4 to 12,400
Perfluorinated compounds	PFCs	7,390 to 12,200	6,630 to 11,100
Sulphur hexafluoride	SF ₆	22,800	23,500
Nitrogen trifluoride	NF ₃	17,200	16,100

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