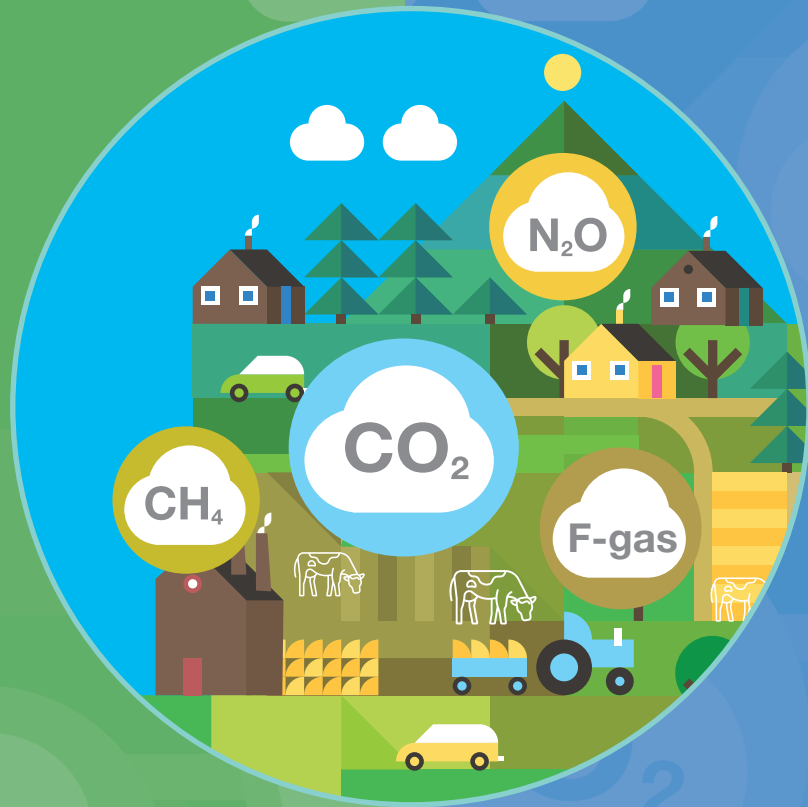


Ireland's Final Greenhouse Gas Emissions

1990-2021

April 2023



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Environmental Protection Agency

The EPA is responsible for protecting and improving the environment as a valuable asset for the people of Ireland. We are committed to protecting people and the environment from the harmful effects of radiation and pollution.

The work of the EPA can be divided into three main areas:

- **Regulation:** Implementing regulation and environmental compliance systems to deliver good environmental outcomes and target those who don't comply.
- **Knowledge:** Providing high quality, targeted and timely environmental data, information and assessment to inform decision making.
- **Advocacy:** Working with others to advocate for a clean, productive and well protected environment and for sustainable environmental practices.

Our responsibilities include:

LICENSING

- Large-scale industrial, waste and petrol storage activities;
- Urban waste water discharges;
- The contained use and controlled release of Genetically Modified Organisms;
- Sources of ionising radiation;
- Greenhouse gas emissions from industry and aviation through the EU Emissions Trading Scheme.

NATIONAL ENVIRONMENTAL ENFORCEMENT

- Audit and inspection of EPA licensed facilities;
- Drive the implementation of best practice in regulated activities and facilities;
- Oversee local authority responsibilities for environmental protection;
- Regulate the quality of public drinking water and enforce urban waste water discharge authorisations;
- Assess and report on public and private drinking water quality;
- Coordinate a network of public service organisations to support action against environmental crime;
- Prosecute those who flout environmental law and damage the environment.

WASTE MANAGEMENT AND CHEMICALS IN THE ENVIRONMENT

- Implement and enforce waste regulations including national enforcement issues;
- Prepare and publish national waste statistics and the National Hazardous Waste Management Plan;
- Develop and implement the National Waste Prevention Programme;
- Implement and report on legislation on the control of chemicals in the environment.

WATER MANAGEMENT

- Engage with national and regional governance and operational structures to implement the Water Framework Directive;
- Monitor, assess and report on the quality of rivers, lakes, transitional and coastal waters, bathing waters and groundwaters, and measurement of water levels and river flows.

CLIMATE SCIENCE & CLIMATE CHANGE

- Publish Ireland's greenhouse gas emission inventories and projections;
- Provide the Secretariat to the Climate Change Advisory Council and support to the National Dialogue on Climate Action;

- Support National, EU and UN Climate Science and Policy development activities.

ENVIRONMENTAL MONITORING & ASSESSMENT

- Design and implement national environmental monitoring systems: technology, data management, analysis and forecasting;
- Produce the State of Ireland's Environment and Indicator Reports;
- Monitor air quality and implement the EU Clean Air for Europe Directive, the Convention on Long Range Transboundary Air Pollution, and the National Emissions Ceiling Directive;
- Oversee the implementation of the Environmental Noise Directive;
- Assess the impact of proposed plans and programmes on the Irish environment.

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

- Coordinate and fund national environmental research activity to identify pressures, inform policy and provide solutions;
- Collaborate with national and EU environmental research activity.

RADIOLOGICAL PROTECTION

- Monitoring radiation levels and assess public exposure to ionising radiation and electromagnetic fields;
- Assist in developing national plans for emergencies arising from nuclear accidents;
- Monitor developments abroad relating to nuclear installations and radiological safety;
- Provide, or oversee the provision of, specialist radiation protection services.

GUIDANCE, AWARENESS RAISING, AND ACCESSIBLE INFORMATION

- Provide independent evidence-based reporting, advice and guidance to Government, industry and the public on environmental and radiological protection topics;
- Promote the link between health and wellbeing, the economy and a clean environment;
- Promote environmental awareness including supporting behaviours for resource efficiency and climate transition;
- Promote radon testing in homes and workplaces and encourage remediation where necessary.

PARTNERSHIP AND NETWORKING

- Work with international and national agencies, regional and local authorities, non-governmental organisations, representative bodies and government departments to deliver environmental and radiological protection, research coordination and science-based decision making.

MANAGEMENT AND STRUCTURE OF THE EPA

The EPA is managed by a full time Board, consisting of a Director General and five Directors. The work is carried out across five Offices:

- Office of Environmental Sustainability
- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by advisory committees who meet regularly to discuss issues of concern and provide advice to the Board.

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Key Findings

Increase in overall GHG emissions driven by coal fired electricity	<p>2021 total national greenhouse gas emissions are estimated to have increased by 5.2% on 2020 levels to 62.11 million tonnes carbon dioxide equivalent (Mt CO₂eq). This increase in total emissions was driven by increased use of coal and oil for electricity generation and increases in both the Agriculture and Transport sectors. It highlights that further, transformative measures will be needed to meet National Climate ambitions.</p>
EU Effort Sharing limits exceeded	<p>The final estimates of greenhouse gas emissions indicate that Ireland exceeded its 2021 annual limit, without the use of flexibilities, set under the EU's Effort Sharing Regulation (ESR) by 3.29 Mt CO₂eq. This is the first year of compliance under the ESR.</p>
Higher 2021 emissions both within and outside the Emissions Trading Scheme	<p>Emissions from Ireland's Emissions Trading Sector (ETS) increased by 15.2% or 2.02 Mt CO₂eq in 2021 while ESR emissions increased by 2.2% or 1.02 Mt CO₂eq.</p>
Carbon Budget 2021-2025	<p>Final National total emissions (including LULUCF) for 2021 at 69.45 Mt CO₂eq have used 23.5% of the 295 Mt CO₂eq Carbon Budget for the five-year period 2021-2025. This leaves 76.5% of the budget available for the succeeding four years, requiring an 8.4 per cent average annual emissions reduction from 2022-2025 to stay within budget.</p>
More coal and less wind means more emissions from electricity generation	<p>Emissions in the Energy Industries sector increased by 17.6% or 1.53 Mt CO₂eq in 2021. This is attributable to a tripling of coal and oil use in electricity generation as gas fired plant were offline. Electricity generated from wind and hydro decreased by 16% and 20% respectively in 2021. Emissions intensity of power generation increased from 309g CO₂/kWh in 2020 to 346g CO₂/kWh in 2021.</p>
More livestock and fertiliser use increase Agriculture emissions	<p>Agriculture emissions increased by 3.6% or 0.82 Mt CO₂eq in 2021, driven by increased fertiliser nitrogen use (5.2%), limestone application (49.5%) increased numbers of livestock including dairy cows (2.8%), other cattle (0.3%), sheep (0.3%) and pigs (4.5%). Total milk production increased by 5.5% in 2021, with milk output per cow also increasing (2.5%).</p>
Transport emissions increase post COVID	<p>Greenhouse gas emissions from the Transport sector increased by 6.7% or 0.69 Mt CO₂eq in 2021. This increase was largely driven by ending COVID travel restrictions on passenger car and public transport usage. By the end of 2021 there were 47,000 electric vehicles in Ireland, ahead of the Climate Action Plan trajectory. International aviation, not included in national total emissions, also increased by 11.7% in 2021 or by 0.14 Mt CO₂eq.</p>
Residential emissions decrease	<p>Greenhouse gas emissions from the Residential sector decreased by 6.0% or 0.44 Mt CO₂eq, driven by a combination of: reduced time in the home due to ending COVID restrictions, a milder winter, increased fuel prices and a possible stockpiling of heating oil from 2020. Coal, peat and kerosene sales declined by 4.9%, 5.0% and 11.8% whilst natural gas showed an increase of 0.9%.</p>

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 data for the period 1990-2021 in January, March and April 2023 to the European Commission and the United Nations Framework Convention on Climate Change (UNFCCC).

The EPA published the provisional inventory data in July 2022, three months earlier than usual, in response to climate governance and legislative advancements in 2021, grounded in the Climate Action and Low Carbon Development (Amendment) Act 2021. The earlier publication facilitated the 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 final estimates of Ireland's greenhouse gas figures for the years 1990-2021 are based on final energy balances provided by the SEAI in October 2022 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 2030 target under the EU's Effort Sharing Regulation (ESR) is to deliver a 30% 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.

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 2021 sets out a major programme of policies and measures that aim to achieve significant progress towards those objectives.

This year Ireland's emissions inventory has been compiled using Global Warming Potentials (GWPs) as specified in the 5th IPCC assessment report (AR5)¹ for the first time. Ireland's National emissions reduction objective, carbon budgets and European target under the ESR are all now estimated on an AR5 basis and this change simplifies the assessment of progress towards these targets.

1 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 Targets	2005	30% <i>The 30% reduction defines the trajectory but it is the annual limits that are binding</i>	Sectors covered by the Effort Sharing Regulation (excludes ETS)	Annual binding emission limits (AEAs) define the permitted budget and some flexibilities are available.
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 2021 final emission estimates accompanied by an assessment of changes relative to the 2020 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 National Climate Action Plan 2021 are also presented.

Methodology changes in the 1990-2021 Inventory

Changes are made each year to update and improve the underlying data and methods being used to estimate emissions. For this inventory submission, two important changes occurred, use of the 2019 Refinement to the 2006 IPCC Guidelines and changes to Global Warming Potentials for greenhouse gases.

In 2019 the IPCC published a refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. The aim of the refinement is to provide an updated scientific basis for supporting the preparation and continuous improvement of national GHG inventories. This is achieved by firstly providing supplementary methodologies where gaps or new technologies or processes have emerged or were not well covered in the 2006 IPCC Guidelines. Secondly updated default values for emission factors and other parameters are provided taking on board the latest scientific information and finally additional or alternative guidance is provided as clarification and/or elaboration of guidance in the 2006 IPCC Guidelines. These refinements have been applied across the full time-series 1990-2021 in these final estimates for the Agriculture sector. The impact of these changes amounts to increasing Agriculture sectoral emissions by an average 0.06 Mt CO₂eq per annum.

In previous Inventory reports GWPs from the 4th IPCC assessment report (AR4) were used. Ireland's National emissions reduction objective, carbon budgets and European target under the ESR are all now estimated on an AR5 basis and this change simplifies the assessment of progress towards these targets. GWPs allow methane, nitrous oxide and other greenhouse gases to be expressed in CO₂ equivalent terms based (for Inventory reporting) on a 100-year time horizon. A comparison of AR4 and AR5 GWPs is presented in the Background notes section.

2. Ireland's final Greenhouse Gas Emissions in 2021

For 2021, final total national greenhouse gas emissions (excluding LULUCF) are estimated to be 62.11 million tonnes carbon dioxide equivalent (Mt CO₂eq) which is 5.2% higher (or 3.05 Mt CO₂eq) than emissions in 2020 (59.06 Mt CO₂eq) and follows a 3.4% decrease in emissions reported for 2020. Emissions are over 1.5% higher than pre-pandemic 2019 figures.

In 2021, national total emissions excluding Land Use Land Use Change and Forestry (LULUCF) increased (5.2%), ETS² emissions increased (15.2%) and ESR emissions increased (2.2%). When LULUCF is included, total national emissions increased by 5.1%. LULUCF emissions are discussed in more detail in section 4.7.

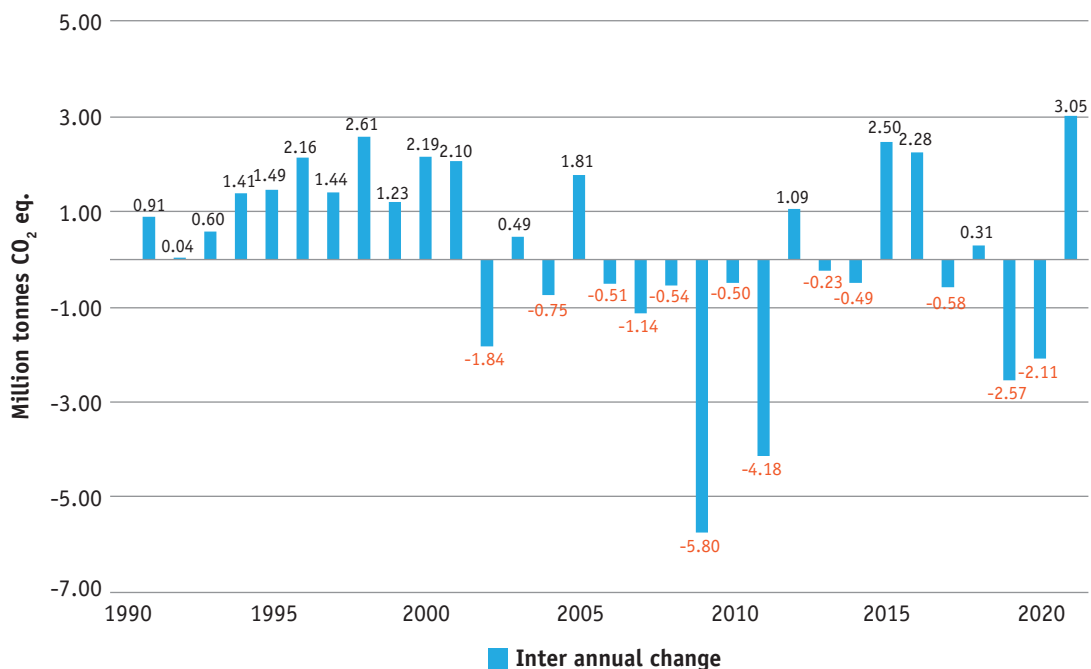
Emissions per capita increased from an historic low of 11.8 tonnes CO₂eq/person in 2020 to 12.3 tonnes CO₂eq/person in 2021. Ireland's average tonnes of GHG/capita over the last ten years were 12.8 tonnes. With recent CSO preliminary 2022 census data showing a population of 5.12 million people and with 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 6 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 Figures 2 and 23. Detailed sectoral data are shown in Table 4.

Agriculture is the largest contributor to the overall emissions at 38.0% of the total (excluding LULUCF). *Transport* and *Energy Industries* are the second and third largest contributors at 17.7% and 16.5% respectively. *Residential* and *Manufacturing Combustion* emissions account for 11.1% and 7.4% respectively. These five sectors accounted for 90.9% of national total emissions in 2021. The remainder is made up by the *Industrial Processes* sector at 4.0%, *F-Gases* at 1.2%, *Commercial Services* at 1.3%, *Public Services* at 1.1% and *Waste* at 1.5%. Figure 2 shows the contributions from each of the sectors in 1990 and 2021.

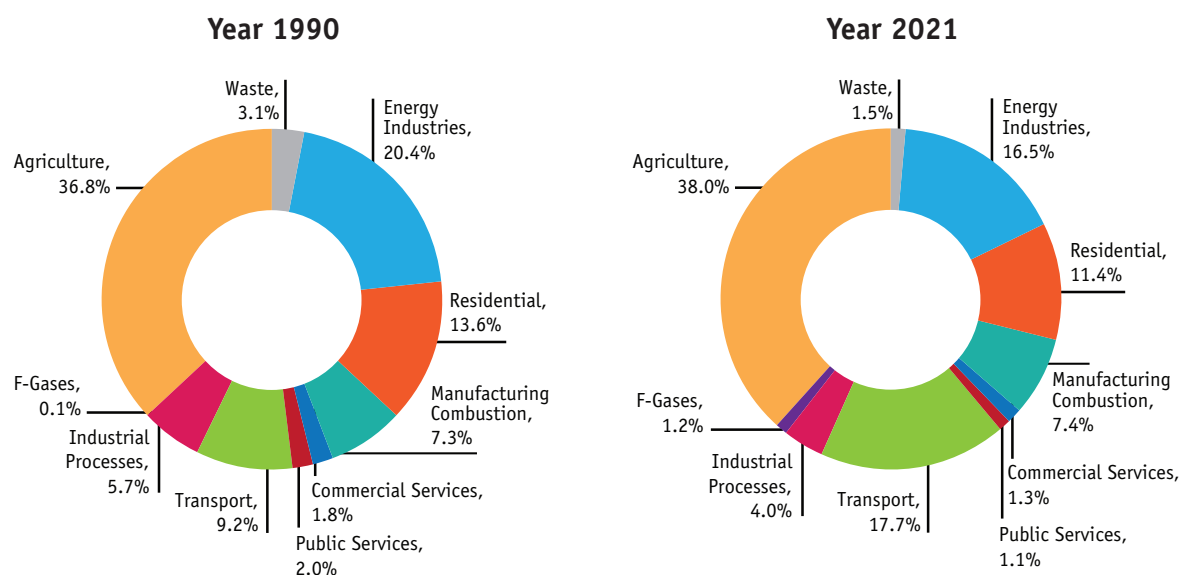
2 ETS emissions in this report refers to CO₂ emissions from stationary installations and from domestic aviation. It does not include emissions from intra-EU aviation as those are not considered part of Ireland's total reportable greenhouse gas emissions.

Figure 1. Inter Annual Changes in GHG Emissions 1990-2021



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 2. Profile of GHG Emissions (excluding LULUCF) in 1990 and 2021 by Sector



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 scope 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 2021³ sets a national climate objective of achieving a climate resilient and climate neutral economy by the end of the year 2050. A key milestone to achieving this aim, an interim target has been set out to achieve a reduction of 51% in total emissions (including LULUCF) over the period 2018 to 2030. Climate Action Plan 2023, published in December 2022 outlines many of the policies and measures to be implemented to achieve the objective, with further measures to be developed in future plans.

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.

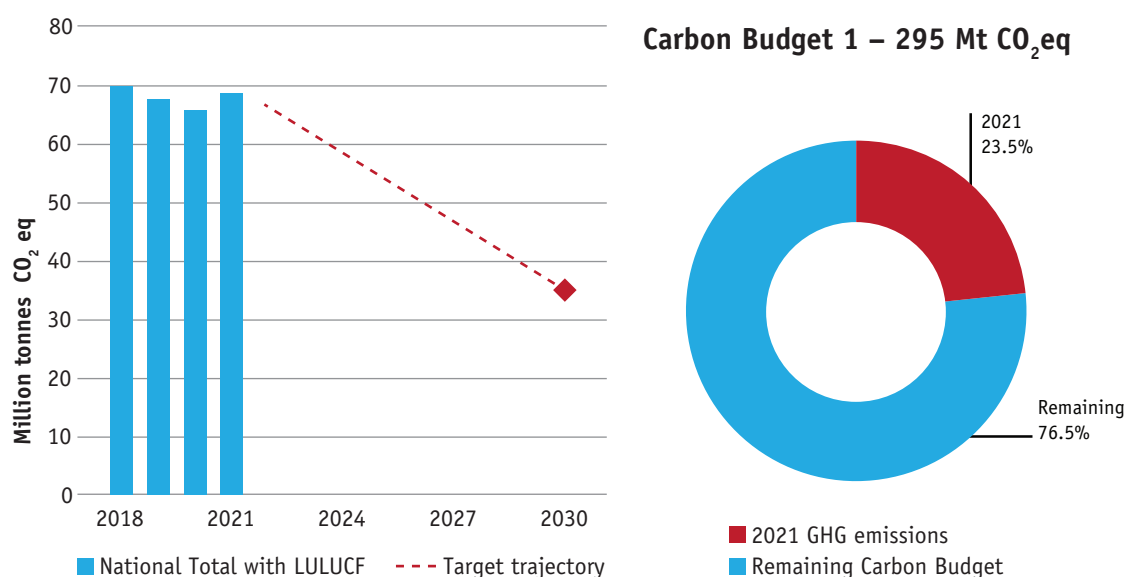
Three Carbon budgets for the period up to 2035 have been approved⁴ by the Oireachtas and came into force on 6th April 2022, with sectoral budgets also set to be determined shortly. Figure 3 illustrates a linear emissions reduction trajectory towards achieving the 51% reduction target, along with the extent to which the first carbon budget (for the period 2021-2025 has been 'used up' based on emissions in 2021.

Budget pathways for each period and sectoral budgets have yet to be finalised, and LULUCF emissions/removals are included in the carbon budgeting process.

- 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.

3 Climate Action and Low Carbon Development (Amendment) Act 2021 ([irishstatutebook.ie](https://www.irishstatutebook.ie))

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

Figure 3. Climate Act Target and Carbon Budgets

To put Ireland on a linear trajectory towards achieving the Climate Act target of a 51% reduction in emissions by 2030 on the 2018 level would require an annual average emission reduction of 7.5% over the remaining nine years until 2030. While the carbon budgets do not currently prescribe the compliance trajectory, they do implicitly incorporate an acceleration of emissions reductions in the second budget period compared to the first, reflecting the time lag inherent in the implementation of some measures. Final national total emissions including LULUCF for 2021 of 69.45 Mt CO₂eq account for 23.5% of the first five-year Carbon Budget of 295 Mt CO₂eq. To stay within budget for the first carbon budget period would require an 8.4 per cent average annual emissions reduction from 2022-2025, or over 5 Mt CO₂eq emissions reductions annually.

3.2 European targets

The greenhouse gas emission inventory for 2021 is the first 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 emissions 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 30% 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 2021 is 43.48 Mt CO₂eq. Ireland's final 2021 greenhouse gas ESR emissions are 46.77 Mt CO₂eq, this is 3.29 Mt CO₂eq more than the annual limit for 2021, see Table 2 and Figure 4. This value is the national total emissions less emissions generated by stationary combustion and aviation operators that are within the EU's emissions trading scheme. This indicates that Ireland is not in compliance with its 2021 Effort Sharing Regulation annual limit, exceeding the allocation by 1.38 Mt CO₂eq after using the ETS flexibility. Agriculture and Transport accounted for 74.0% of total ESR emissions in 2021.

Emissions Trading Scheme

Since 2005, emissions in the ETS sector have decreased by 31.7% or 7.12 Mt CO₂eq whereas emissions under the ESR only decreased by 4.6% or 2.24 Mt CO₂eq, considerably short of Ireland's 30% reduction commitment. 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, Public Services, Commercial Services, F-Gases and Waste* sectors, with the *Agriculture and Energy Industries* sectors increasing.

Table 2. Compliance with EU ESR Targets 2021-2030 (all numbers in the table are rounded to the nearest kt CO₂eq)

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total greenhouse gas emissions without LULUCF	62,110									
- Total verified emissions from stationary installations under Directive 2003/87/EC	15,320									
- CO ₂ emissions from domestic aviation	19									
Total ESR emissions	46,771									
EU ESR Targets†	43,479	42,357	41,235	40,113	38,991	37,869	36,747	35,625	34,503	33,381
Gross distance to target	-3,291									
+ annualised ETS flexibility†	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908
+ annualised projected LULUCF flexibility*	0	0	0	0	0	0	0	0	0	0
Net distance to target	-1,383									

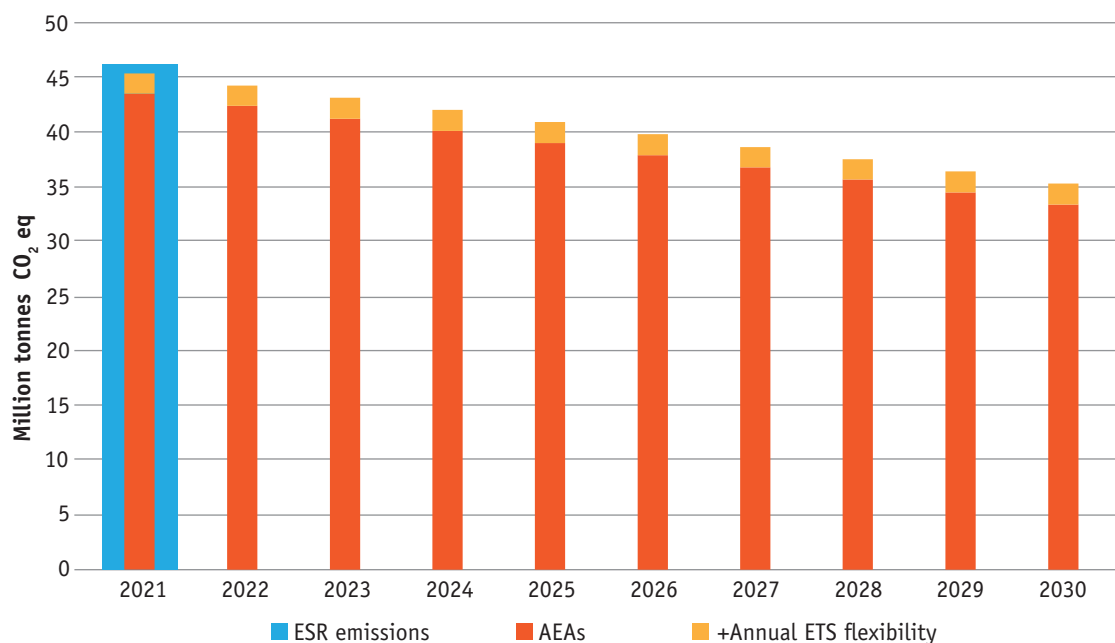
* No flexibility projected to be available under the EPA's "With Existing Measures" scenario⁵

† Set out in Annex II and Annex III of Commission Implementing Decision (EU) 2020/2126⁶

5 <https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-greenhouse-gas-emissions-projections-2021-2040.php>

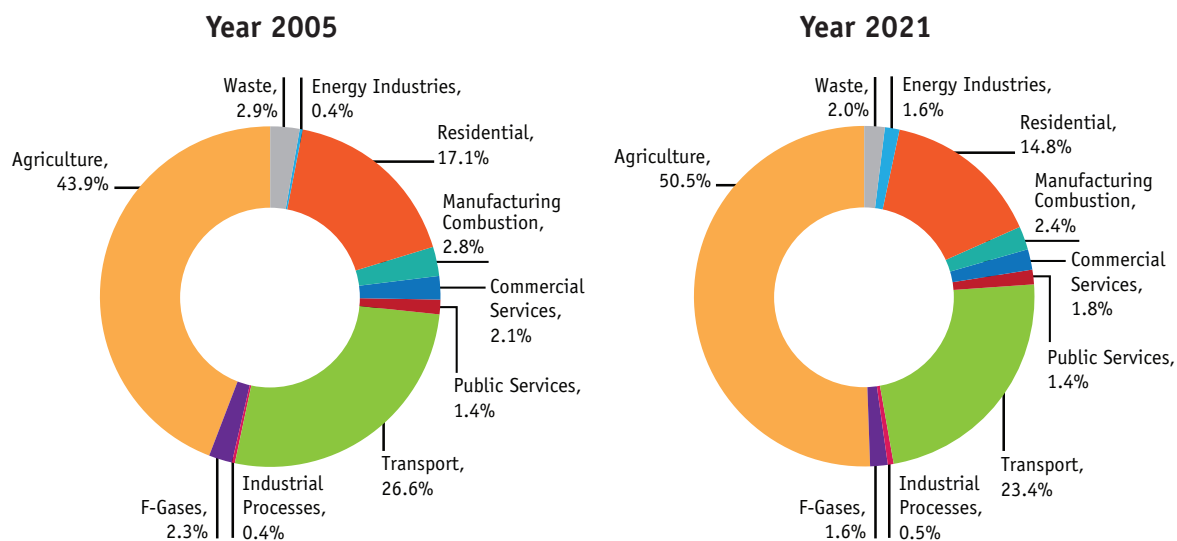
6 <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32020D2126&from=EN#d1e32-62-1>

Figure 4. Compliance with ESR Targets 2021-2030



The data presented in Figure 5 shows the sectoral shares of emissions covered by the Effort Sharing Regulation in 2005 and 2021.

Figure 5. Profile of Effort Sharing Regulation relevant GHG Emissions in 2005 and 2021 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 2020 and 2021, are presented in Table 3 below and described in more detail in the Appendix.

This sectoral breakdown is produced for National reporting purposes (including comparisons with the 2023 Climate Action Plan) and although generally in alignment with the classification used for UNFCCC reporting, some adjustments have been made for ease of comparison with national policies. 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 3. Ireland's Final Greenhouse Gas Emissions for 2020 and 2021 by Sector

Million tonnes CO ₂ eq	2020	2021	% Change
Agriculture	22.810	23.626	3.6%
Transport	10.301	10.989	6.7%
Energy Industries	8.737	10.272	17.6%
Residential	7.361	6.917	-6.0%
Manufacturing Combustion	4.512	4.624	2.5%
Industrial Processes	2.108	2.477	17.5%
F-Gases	0.720	0.766	6.5%
Commercial Services	0.853	0.836	-2.0%
Public Services	0.682	0.659	-3.4%
Waste	0.973	0.943	-3.0%
LULUCF	7.042	7.338	4.2%
Total	59.056	62.110	5.2%
Total including LULUCF	66.099	69.448	5.1%

4.1 Agriculture

Total emissions from the agriculture sector in 2021 were 23.6 Mt CO₂eq an increase of 3.6% on 2020. The most significant drivers for the increased emissions in 2021 were increased use of synthetic nitrogen fertiliser use of 5.2% and higher dairy cow numbers of 2.8% with an increase in milk production of 5.5%.

Methane emissions originate from Enteric Fermentation, Manure Management and fuel combustion. In 2021, CH₄ emissions contribute 70.1% to the Agriculture sector and have increased by 2.5% since 2020.

Nitrous Oxide emissions originate from Manure Management, Agricultural Soils and fuel combustion. In 2021, N₂O emissions contribute 24.4% to the Agriculture sector and have increased 4.1% since 2020.

Carbon dioxide emissions originate from Liming, Urea Application and fuel combustion. In 2021, CO₂ emissions contribute 5.6% to the Agriculture sector and have increased by 16.5% since 2020. Agriculture emissions by source category and by gas are presented in Figures 6 and 7. Increasing methane emissions are evident in the gas share trend, 16.6 Mt CO₂eq (70.1% share) in 2021 compared to 13.9 Mt CO₂eq (67.9% share) in 1990, increasing in level by 19.1%. The current situation indicates methane emissions from agriculture are steadily increasing due to increased production when a methane emissions reduction of almost 30% is required to achieve at least a 25% reduction in Agriculture emissions compared to 2018, the lower end of the range committed to in the 2023 Climate Action Plan.

This is the 11th consecutive year of increases in dairy cow numbers. Milk output per cow also increased (2.5%), therefore increased production was driven by an increase in livestock numbers in conjunction with an increase in milk yield per cow. In 2021, total cattle numbers increased by 0.8% and sheep numbers increased by 0.3%, pig numbers increased by 4.5% and the poultry population decreased by 0.5%.

Total fossil fuel consumption in agriculture/forestry/fishing activities remained at similar levels to 2020. In 2021, liming on soils increased by 49.5%, a welcome measure in improving soil fertility, which should lead to a reduction in fertiliser nitrogen use in future years.

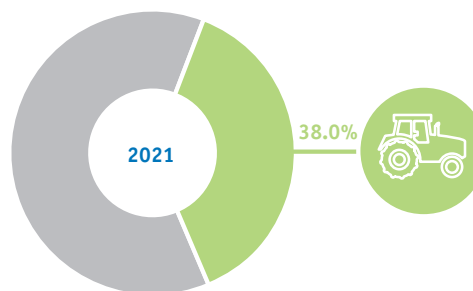


Figure 6. Trend in Agriculture 1990-2021

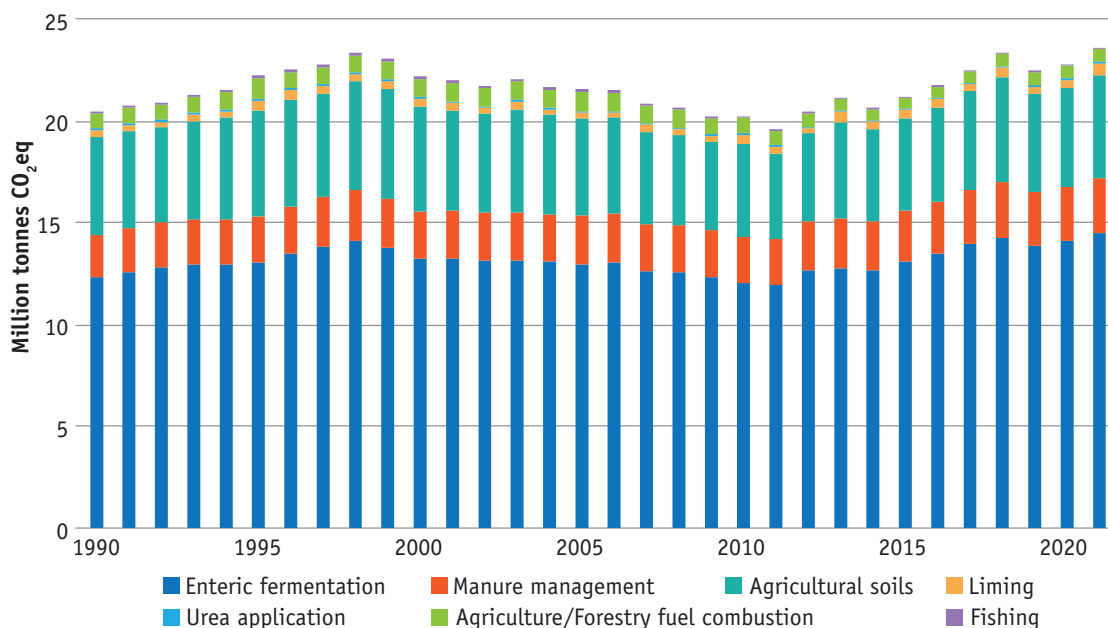
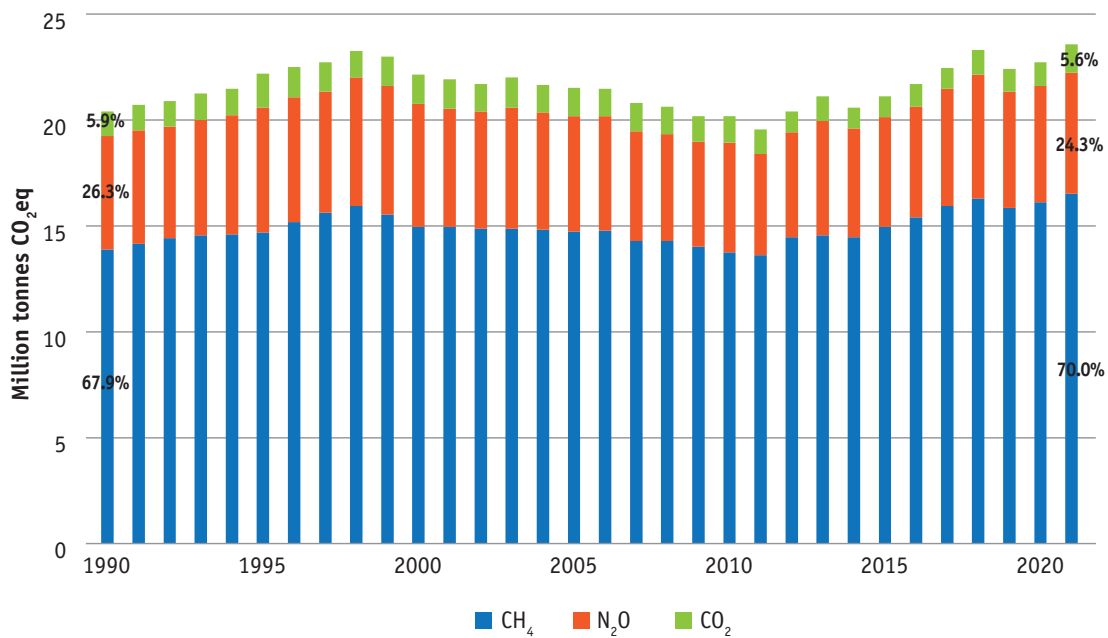
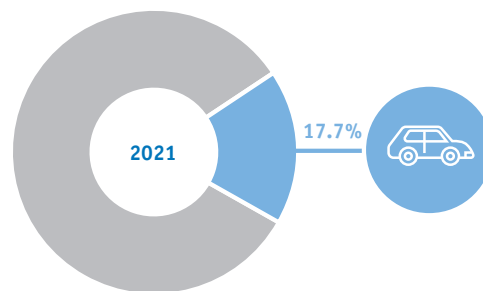


Figure 7. Trend in Agriculture, by Gas 1990-2021



4.2 Transport

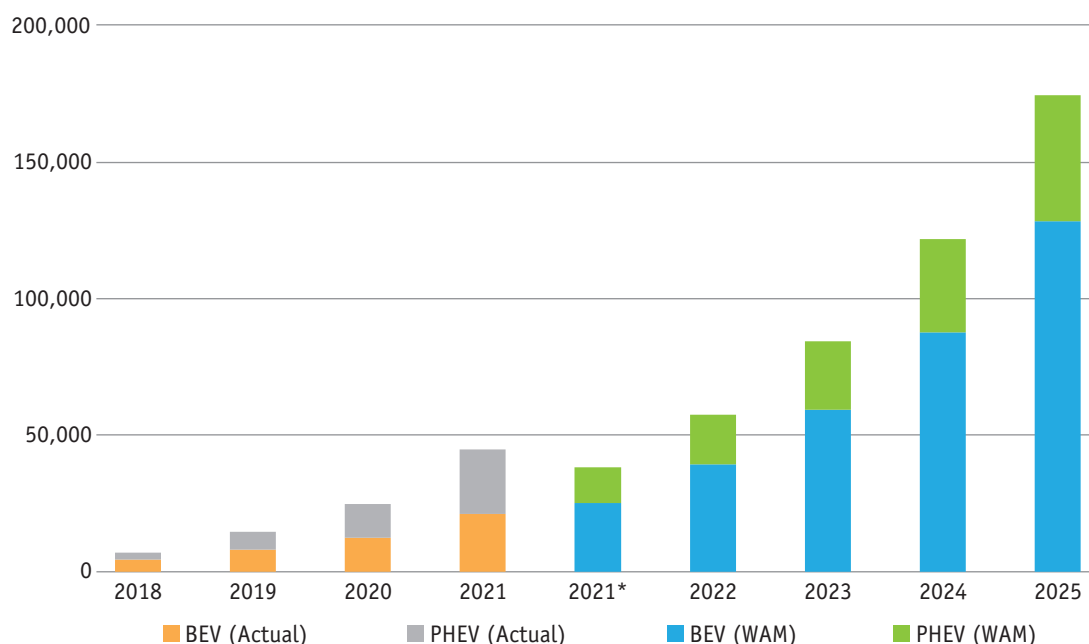
Transport emissions and the expected rebound effect from the partial lifting of covid-restrictions started to take effect with a 6.7% increase in 2021. Emissions from road transport were relatively stable for the period 2015-2019, at an average 11.6 Mt CO₂eq but reduced to 9.7 Mt CO₂eq in 2020. The expected increase in road transport activity in 2021 has seen emissions rise to 10.3 Mt CO₂eq, still below pre-pandemic levels. Total energy consumption in road transport increased by 6.3% in 2021; petrol, +5.9%, diesel +6.7%, bioethanol +4.6% and biodiesel +1.9%.



Transport emissions in 2021 were 23.6% below peak levels in 2007 primarily due to the effect of some continued COVID restrictions, economic downturn and also due to improving vehicle fuel efficiency, the increased use of biofuels and a significant decrease in fuel tourism in recent years.

At the end of 2021, there were just over 47,000 battery electric (BEVs) and plug-in hybrid electric (PHEVs) vehicles in Ireland, approximately 24% (compared to 14% in 2020) of the Climate Action Plan target for 2025 of 195,300 (With Additional Measures scenario) or <5% of the 2030 policy target of 945,000 vehicles (WAM). As a result, the continued uptake of electric vehicles has meant the annual trajectory target in 2021 was exceeded, see Figure 8.

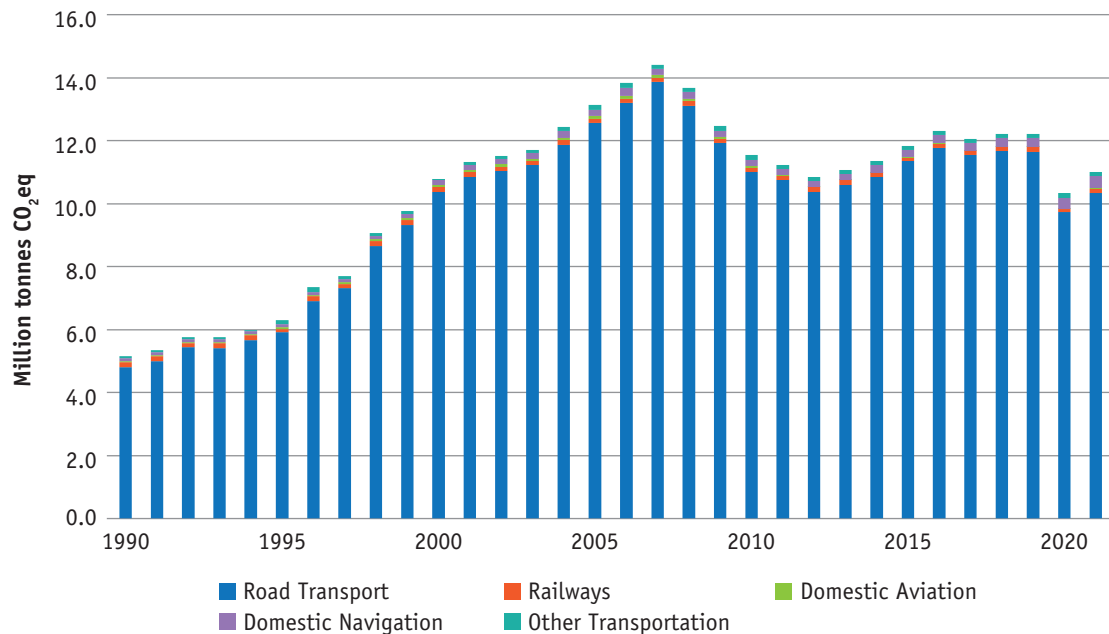
Figure 8. Total Electric Vehicles and Climate Action Plan target (WAM) 2025



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 2021 vehicle numbers whereby newly registered fully electric cars and hybrid vehicles more than doubled compared to 2020.

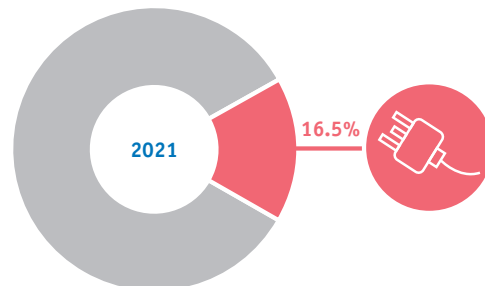
Passenger cars were responsible for 53% of road transport emissions in 2021, with Heavy Goods Vehicles responsible for 22%, Light Goods Vehicles for 19% and Buses 6%.

Figure 9. Trend in Transport 1990-2021



4.3 Energy Industries

Sectoral emissions in the *Energy Industries* sector show an increase of 17.6% in 2021 which is attributable to a more than tripling of both coal and fuel oil use in electricity generation. The use of peat has continued to decline, a 68% reduction in 2021, and is currently at an all time low within the electricity generation sector. There was also a reduction in natural gas use by 8.9% as plants were offline in 2021.



In 2021, overall electricity share generated from renewables reduced from 42% in 2020 to 35%, due to low rainfall for hydro and low wind. Electricity generated from hydro reduced by 20% and from wind by 16% in 2021. The reduction in hydro and wind generation, combined with an increase in coal and oil use, resulted in the emissions intensity of power generation in 2021 increasing by 11.9%, 346g CO₂/kWh compared with 309g CO₂/kWh in 2020.

In 2021 renewables accounted for 34.8%, (down from a high of 42.3% in 2020) and natural gas 46.0% of electricity generated in 2021. In 2021, Ireland also imported almost 1,600 GWh of electricity which would have resulted in additional emissions of over 500 kt of CO₂, if generated in Ireland. See Figures 10 and 11.

Emissions from electricity generation had decreased year-on-year from 2016 to 2020, but 2021 has seen an increase of 18.8% compared to 2020. The return to using more carbon intensive fuel along with less renewables and natural gas plant availability has played a big part in reversing the trend. 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 12.

Figure 10. Emissions Intensity of Electricity Generation 1990-2021

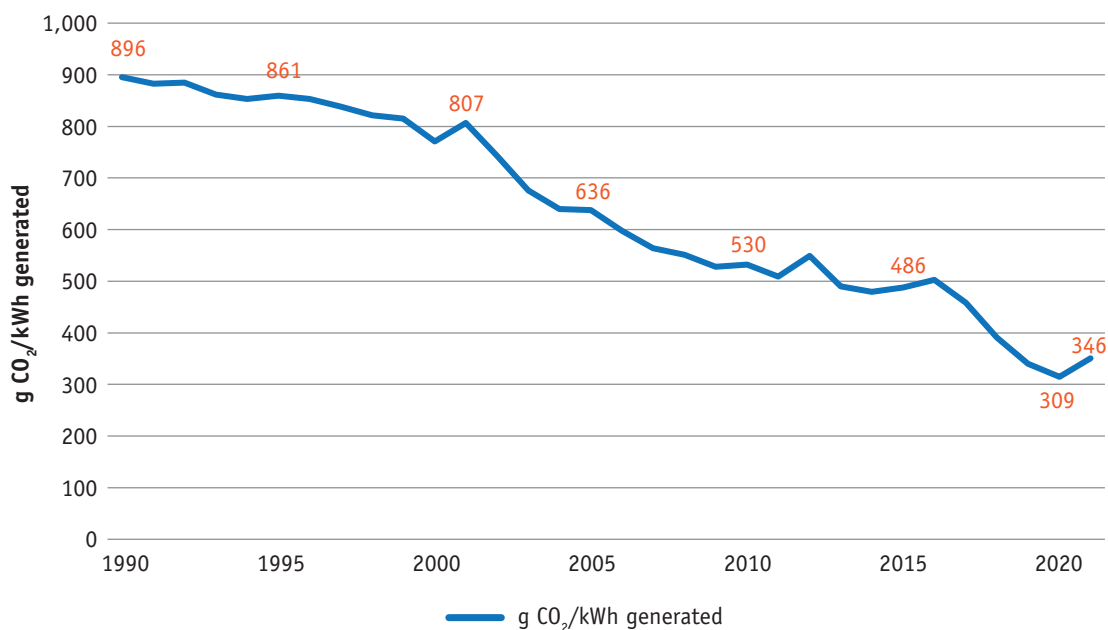


Figure 11. Electricity Generated by Fuel 1990-2021

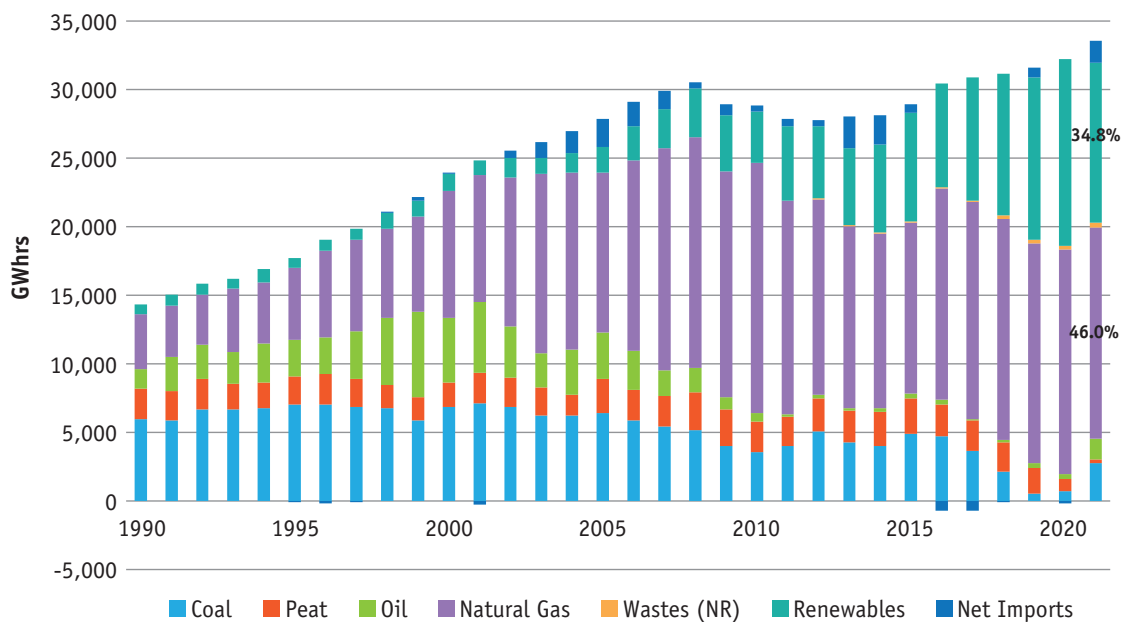
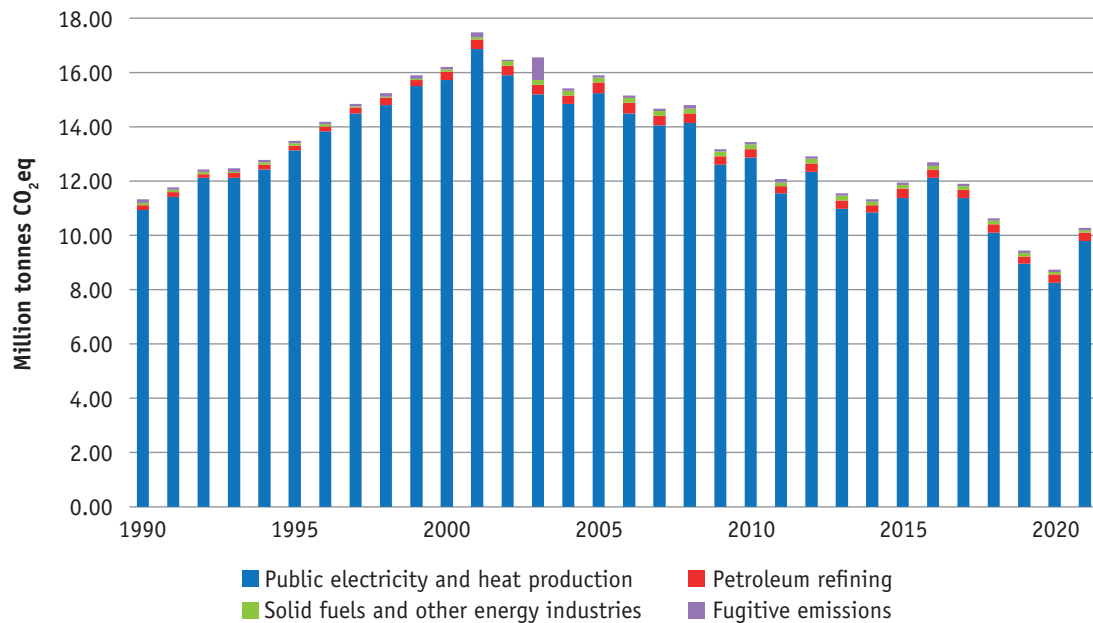
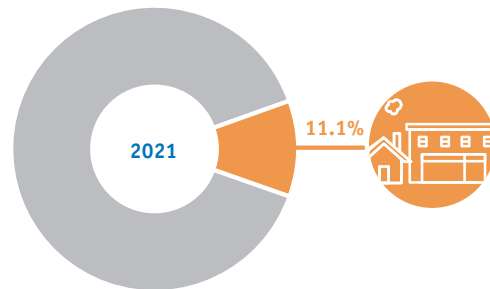


Figure 12. Trend in Energy Industries 1990-2021

4.4 Residential

Emissions in the *Residential* sector are 6.92 Mt CO₂eq in 2021 and decreased by 6.0% or 0.44 Mt CO₂eq since 2020. Within the different fuels used in household space and water heating, decreases were seen in; coal, peat and kerosene by 4.9%, 5.0% and 11.8% respectively. Natural gas however increased by 0.9% in 2021.



There were 2.5% less heating degree days⁷ in 2021

than in 2020. Fuel switching, from coal and peat to oil and natural gas use, as well as improvements in buildings regulations helped reduced emissions per household from 7.5 t/CO₂ per year in 1990 to a low of 3.6 t/CO₂ per year in 2014. Since 2014, fuel use per household has increased by 14.9% with CO₂ emissions per household increasing to 3.8 t CO₂ in 2021. See Figures 13 and 14. While weather is a key variable from year to year, the flattening of the historic downward trend in per household CO₂ emissions is evident in Figure 14, indicates a need for increased energy efficiency retrofit activity in order to achieve future emissions reduction commitments.

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.

⁷ 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 13. Trend in Residential 1990-2021

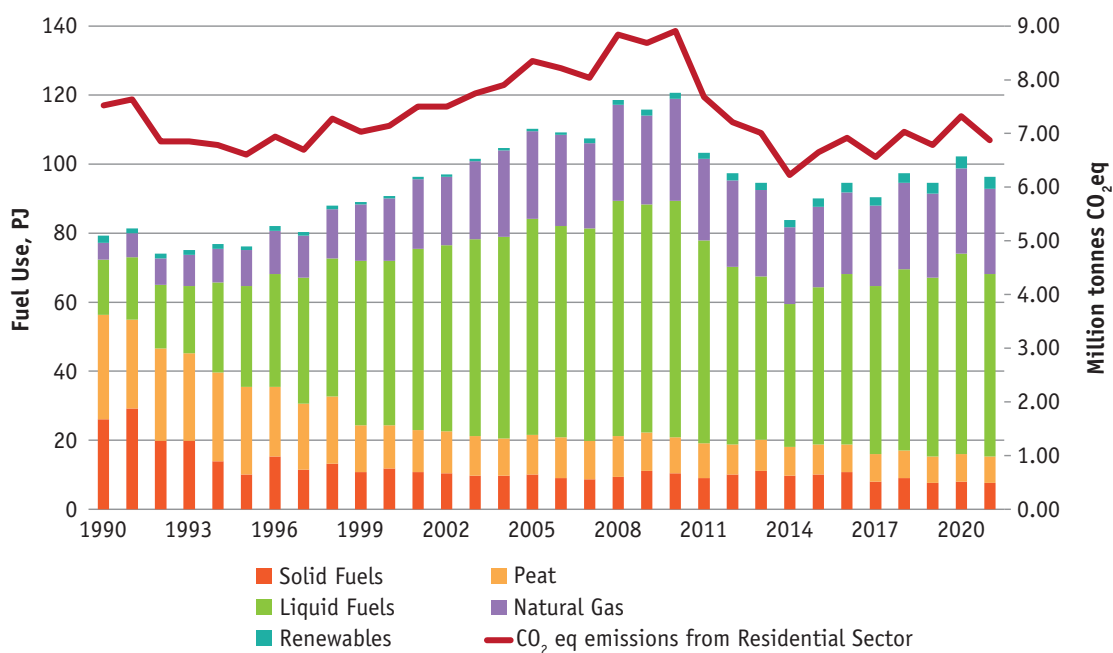
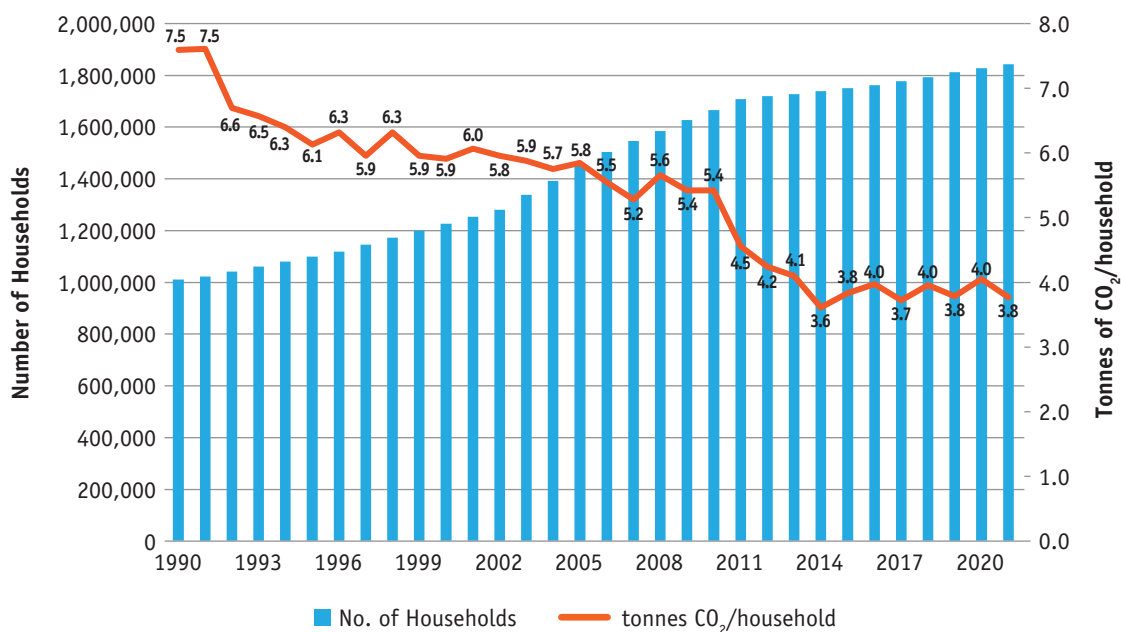


Figure 14. CO₂ emissions per Household 1990-2021



4.5 Manufacturing and Industry

Emissions relating to *Manufacturing Combustion* and *Industrial Processes* combined accounted for 11.4% of Ireland's total emissions in 2021, or 7.10 Mt CO₂eq. Emissions from the Manufacturing Combustion sector increased by 2.5% or 0.11 Mt CO₂eq in 2021. There were decreases in combustion emissions from major sub sectors including chemical and the food processing, beverages and tobacco sector, i.e. 2.3% and 2.8% respectively. However, combustion emissions from non-metallic minerals (including cement) increased significantly by 15.1% and 0.16 Mt CO₂eq. See Figure 15.

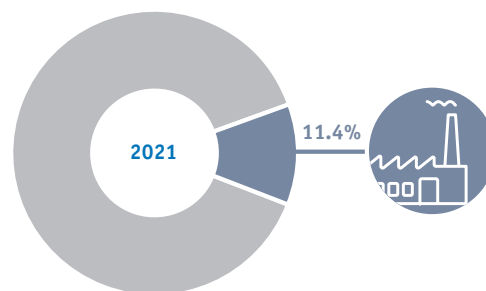
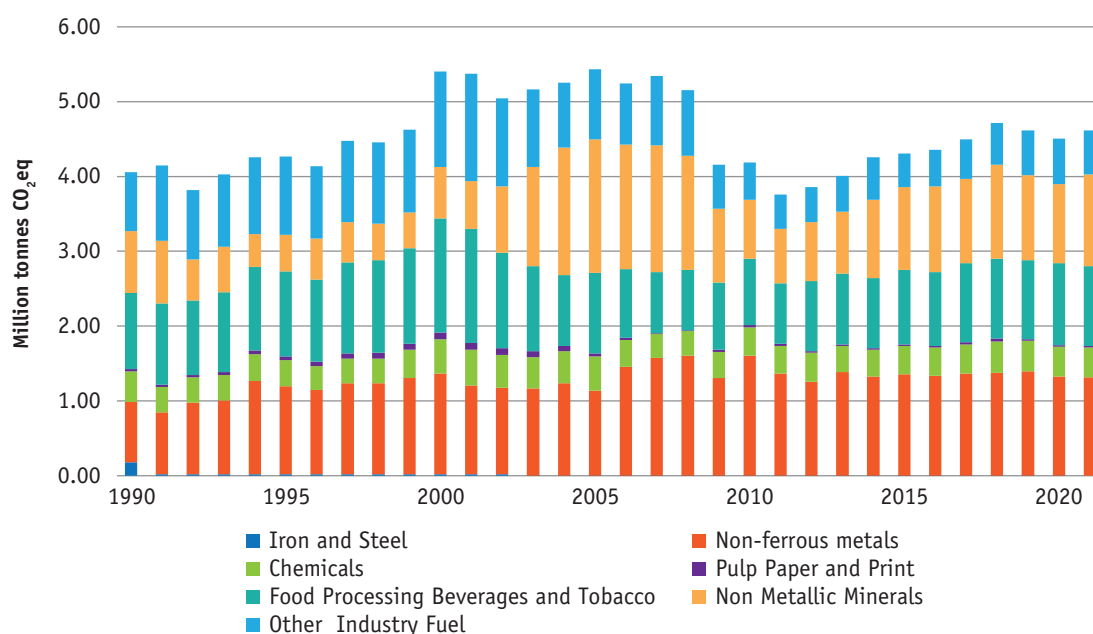


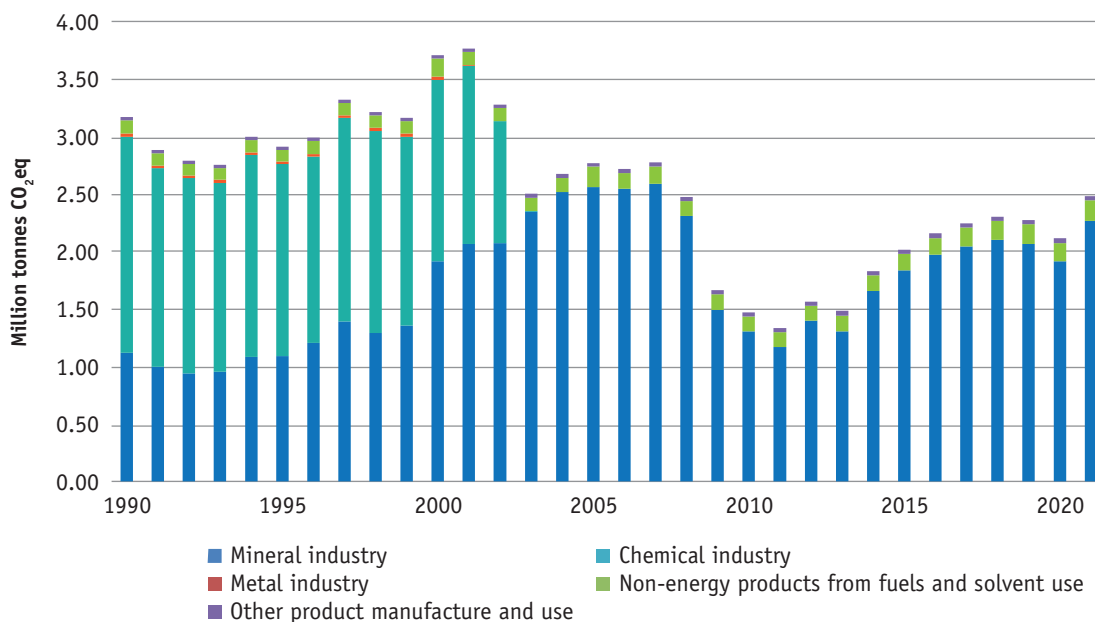
Figure 15. Trend in Manufacturing Combustion 1990-2021



Emissions from the *Industrial Processes* sector increased by 17.5% (0.37 Mt CO₂eq) in 2021 from 2.11 Mt of CO₂eq to 2.48 Mt CO₂eq, following a 7.0% decrease in 2020. The yearly increase is due to an upturn in cement production levels after a COVID affected year in 2020. Total process emissions from the mineral products subsector (including cement) increased by 18.3%.

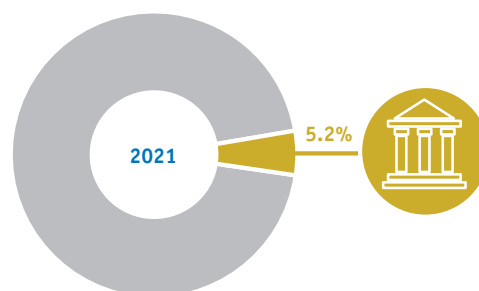
In 2021, total emissions (combustion and process) from the cement sector increased by 16.8% and amount to 3.13 Mt CO₂eq, or 5.0% of national total emissions. Cement sector emissions are now 106.2% higher than the 2011 low during the economic recession, see Figure 16.

Figure 16. Trend in Industrial Processes 1990-2021



4.6 Other Sectors

Emissions from *F-Gases*, *Commercial Services*, *Public Services* and *Waste* account for 5.2% of total national emissions in 2021.



Commercial and Public Services

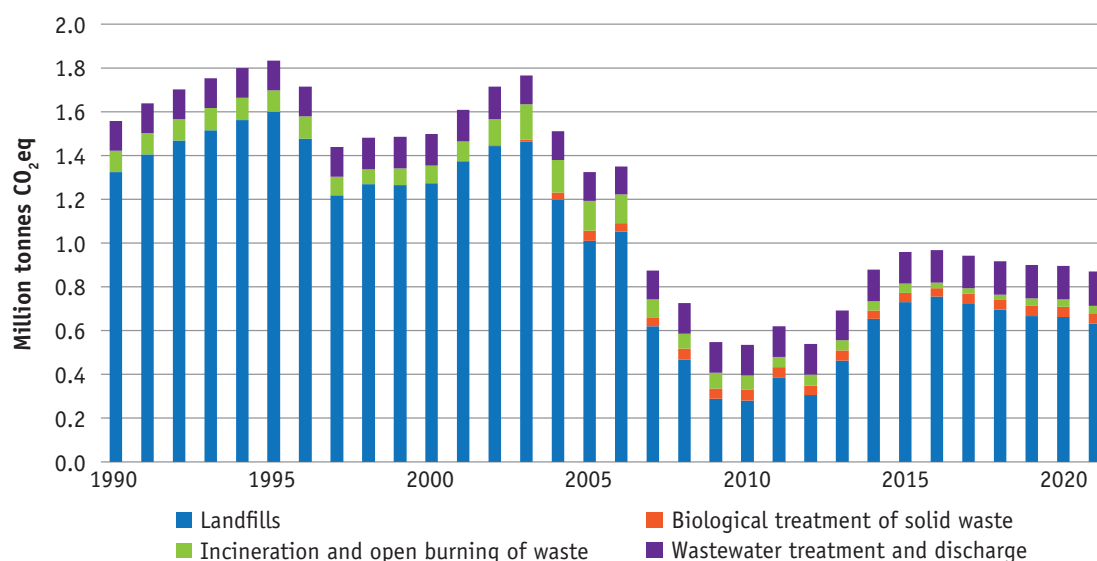
Emissions from *Commercial Services* and *Public Services* decreased by 2.0% and 3.4% respectively. Natural gas use in both sectors decreased by 3.9% with oil also reducing by 3.3% within Public Services.

Waste

Emissions from the *Waste* sector decreased by 3.0% in 2021, largely as a result of a decrease in emissions of methane from landfills by 4.8%. Overall emissions decreased by 0.03 Mt CO₂eq. See Figure 17.

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 and 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. The increasing trend of methane emissions from landfills from 2010 to 2016 is due to a decrease in landfill gas flaring as overall landfill gas generation volumes decrease.

Figure 17. Trend in Waste 1990-2021

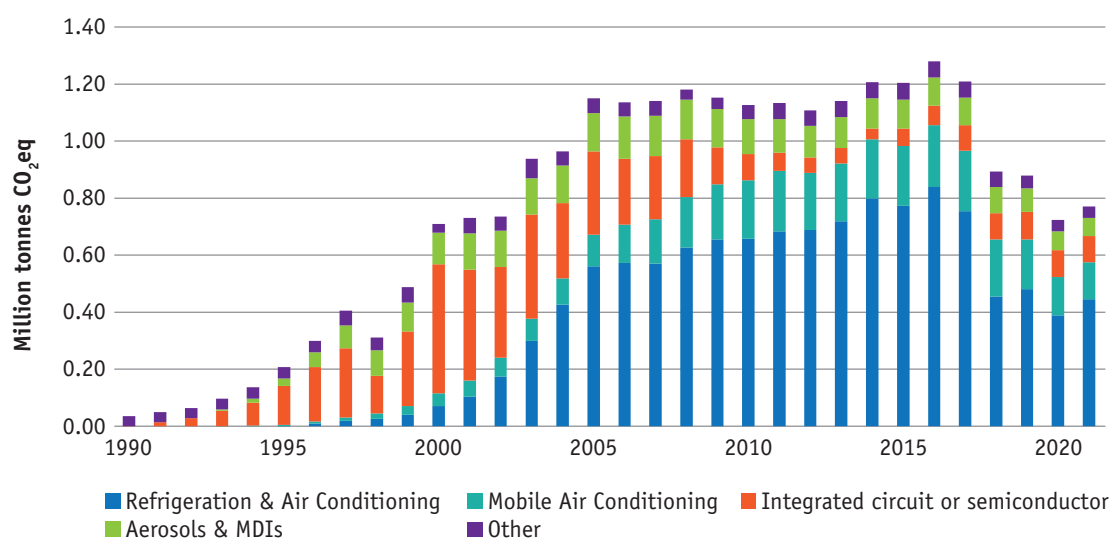


Fluorinated Gas Emissions

F-Gas emissions were up 6.5% from 2020 to 2021, following a decrease of 17.7% in the previous year. This is driven by an increase in refrigeration and air conditioning emissions. Emissions of F-gases (HFCs, PFCs, SF₆ and NF₃) were 0.77 Mt CO₂eq in 2021 compared to 0.04 Mt CO₂eq in 1990, a 22-fold increase over the time series, see Figure 18. However, F-gas emissions have risen from a very low base and only accounted for 1.2 per cent of the national total in 2021. F-gases include a wide range of substances that are used in a diverse range of products and manufacturing processes.

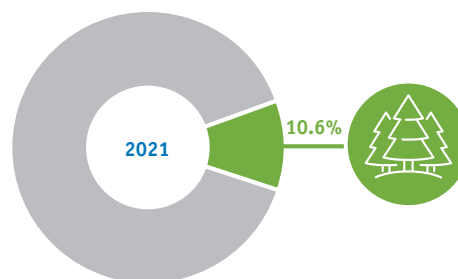
The main reason behind the more recent decreases in F-gas emissions has been the phasing out of refrigerant and air conditioning (AC) gases with high global warming potentials (GWPs), due to the implementation of the F-Gas Regulation (EU) No. 517/2014. These refrigerant gases are being replaced with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

Figure 18. Composition and Trend in F-Gas Emissions 1990-2021



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 10.6% of national total emissions (including LULUCF). See Figure 19. 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 sector is a net source of CO₂ eq emissions in all years 1990-2021. 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 pools⁸ 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 source of emissions is 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 1990-2021. See Figure 20. 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 1990-2021. 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 2021 were 22.1% above those in 1990 and increased by 4.2% between 2020 and 2021. There has been a significant long-term decline in the area of land afforested annually and 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. 15,000 ha in the 1990s to c. 2,000 ha by 2021 resulting in a decreasing carbon sink in land converted to forest land. 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 1.67 million m³ in 1990 to 4.33 million m³ in 2021.

⁸ A carbon pool is a reservoir of carbon that has the capacity to both take in and release carbon.

Figure 19. Profile of GHG Emissions (including LULUCF) in 1990 and 2021 by Sector

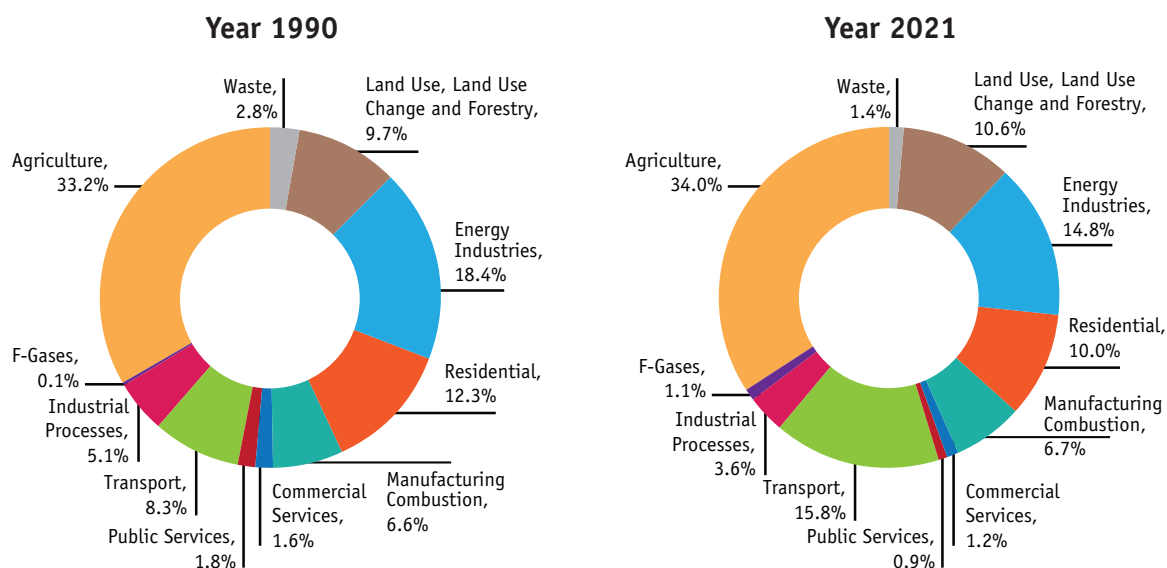
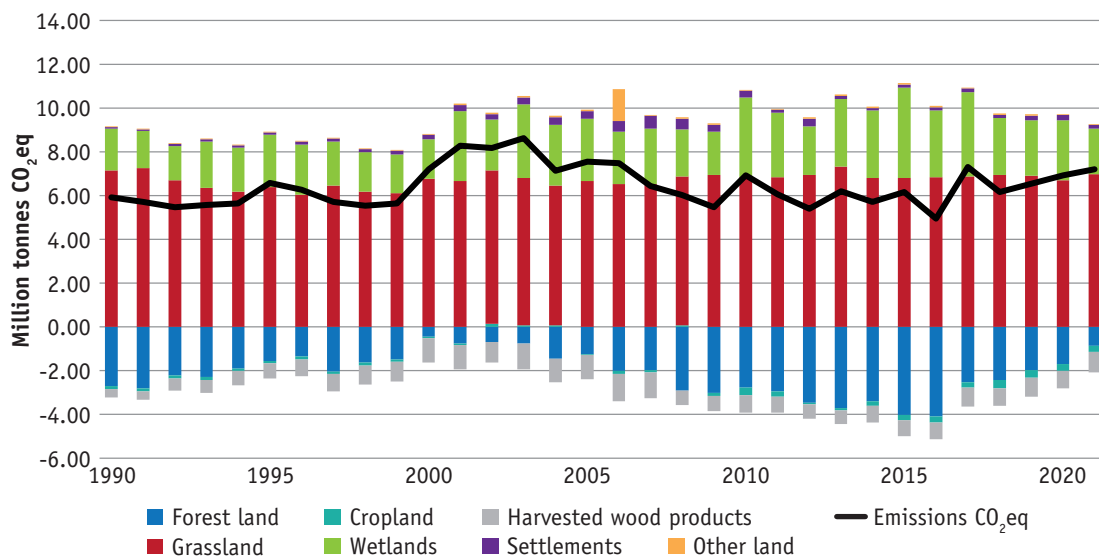


Figure 20. Trend in LULUCF 1990-2021



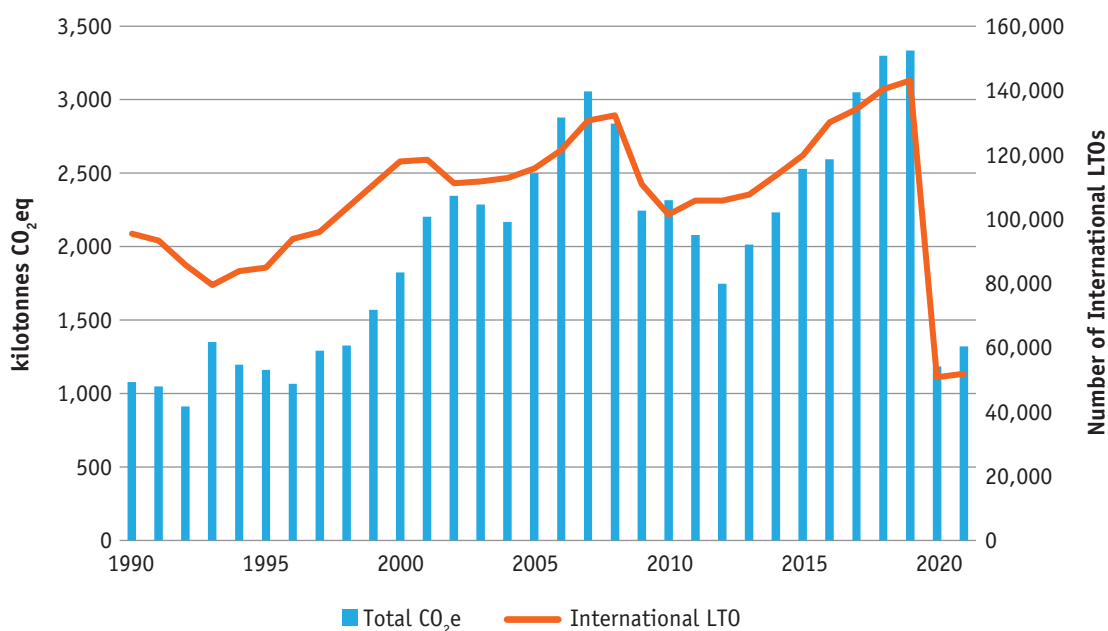
5. International Aviation and Maritime Emissions

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 2021, total international aviation contributed 1.33 Mt CO₂eq from 52,000 return flights from Irish airports, see Figure 21. This is a significant reduction on recent trends, with international aviation emissions averaging over 3.0 Mt CO₂eq per year prior to the COVID pandemic.

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 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 2021, emissions from this source amounted to 0.53 Mt CO₂eq, up 10.7% on 2020.

Figure 21. Trend in International Aviation 1990-2021



6. Long-term Changes in Sectoral Emissions 1990-2021

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 60.5% of total greenhouse gas emissions in 2021 compared to 59.2% in 1990. The share of CH₄ and N₂O emissions, primarily from the agriculture sector, have fallen from 40.7% of total greenhouse gas emissions in 1990 to 38.3% in 2021 as emissions (primarily CO₂) from other sectors grew at a faster rate. Emissions from F-gases account for 1.2% of the total in 2021. The trend in national total emissions (excluding LULUCF) from 1990 to 2021 is +11.6%, shown in Figures 22 and 23 and Table 4 in the Appendix.

Between 1990 and 2021, **Transport** shows the greatest overall increase of GHG emissions at 113.7%, from 5,143.3 kt CO₂eq in 1990 to 10,989.4 kt CO₂eq in 2021, with road transport increasing by 115.7%. Fuel combustion emissions from Transport accounted for 9.2 per cent and 17.7 per cent of total national greenhouse gas emissions in 1990 and 2021, 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 181% and commercial vehicles increased by 167%. 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 9.4% over the period 1990 to 2021. Over the time series, emissions from electricity generation have decreased by 10.5% whereas total electricity consumption has increased by 151.0%. Emissions from electricity generation increased from 1990 to 2001 by 54.3% and have decreased by 42.0% between 2001 and 2021. 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 32-year time series for peat fired electricity generation, 68% less than in 2020. 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 2021 has seen an increase of 18.8% compared to 2020. In 2021, there was a tripling of coal and oil used for electricity generation due to the unavailability of enough gas-fired generation and lower renewables. This threatens to undo some of the good work done over recent years and negatively impact achievement of National targets, particularly for the first carbon budget period.

The latest estimates show that total emissions in the **Agriculture** sector have increased by 15.4% from 1990 to 2021 mainly driven by a 17.6% increase in methane emissions from enteric fermentation and a 29.0% 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 the latest inventory year, 2021. Meanwhile, total fossil fuel combustion emissions from agriculture/forestry/fishing activities have decreased by 17.0% since 1990. In the last 10 years, dairy cow numbers have increased by 44.5% with a corresponding milk production increase of 62.8%. 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 20.2%, pigs by 9.9% and poultry by 27.7%.

Increased housing stock and a growing population drove the gradual upward trend in the emissions from the **Residential** sector after 1997 following emission reductions in the early 1990s due to fuel switching, from coal and peat to oil and natural gas, to reach a peak in 2010. The 2021 emissions in this sector are 6.0% lower than 2020 levels and are 8.6% lower than their 1990 level, whereas the housing stock increased by 82.6% and population by 42.9% between 1990 and 2021. Winter heating demand is the most important annual variable in emissions from this sector.

Figure 22. GHG Emissions by Gas 1990-2021

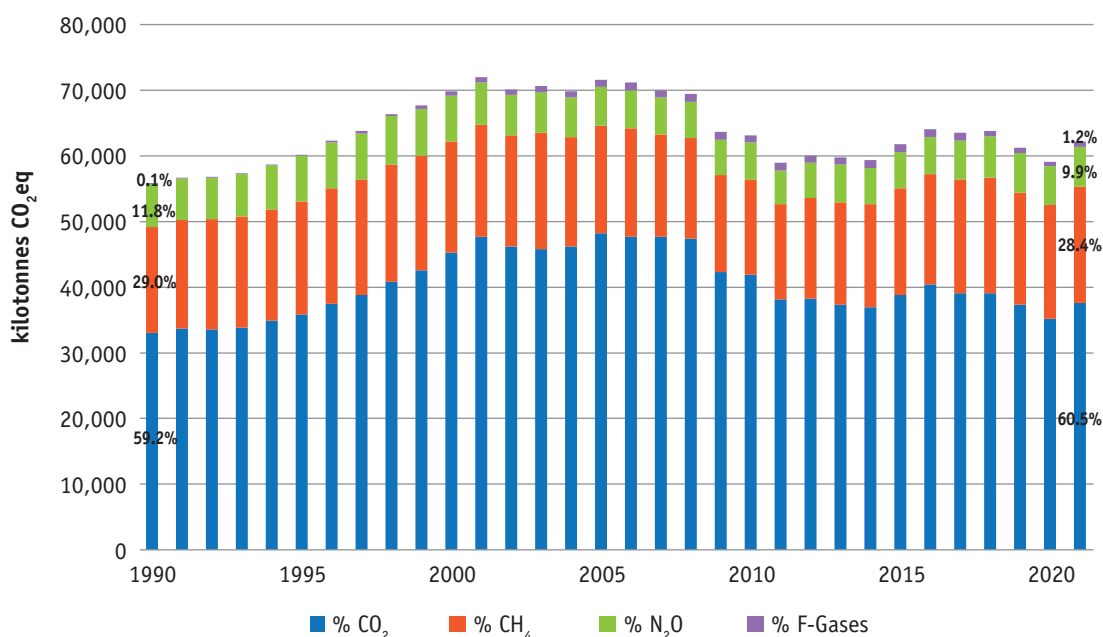
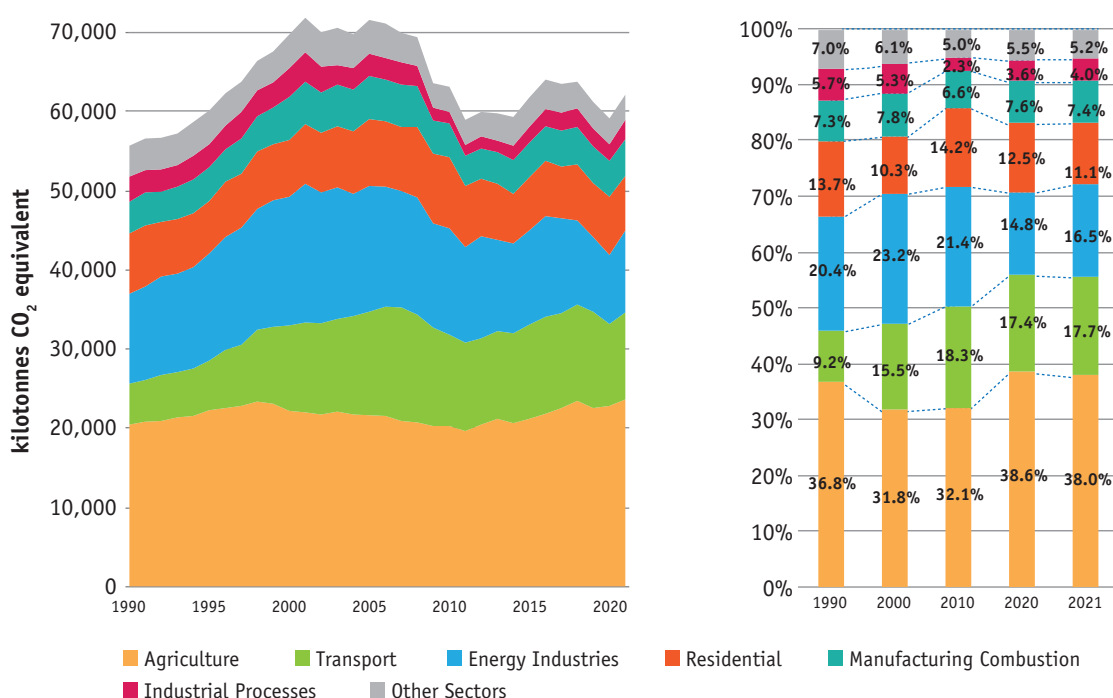


Figure 23. Trend in Emissions for Largest Sectors 1990-2021



7. Conclusion

The impact of restrictions to tackle the COVID-19 pandemic continued into 2021, albeit to a lesser extent than in 2020 and a projected⁹ rise in emissions as some sectors recovered has been borne out in the 2021 emissions data. The overall increase in greenhouse gas emissions in 2021 was 5.2% compared to 2020, underlining the challenge presented by Ireland's Climate Act 2021 and Carbon Budget targets.

The 2021 data for the Transport sector suggests that we are on a trajectory back to pre-pandemic levels of activity, Transport emissions increased by 6.7% in 2021 compared to 2020, an additional 0.69 Mt CO₂eq.

Emissions from *Electricity generation* in 2021 were 9.4% higher than the pre-pandemic 2019 year, driven by a return to higher levels of coal use. Additionally, 2021 was a less windy year than 2020 and there was a consequent reduction in renewable electricity generation. The emissions intensity of electricity generation had been falling year-on-year over the last four years to an all-time low in 2020, but these factors led to a 11.9% increase in 2021. The effect of current geopolitical impacts on fuel pricing could result in a continued increase in the amount of coal being used, particularly over the first carbon budget period, which could seriously impact budget achievement.

Emissions from the *Agriculture* Sector grew by 3.6% in 2021, driven by a further increase in the number of dairy cows in the herd, along with increased nitrogen fertiliser usage. Although some measures to mitigate agricultural nitrous oxide emissions (such as use of stabilised urea fertilisers and Low Emission Slurry Spreading) are starting to be implemented, measures to tackle methane emissions also need to be implemented, as methane accounts for 70% of Agricultural greenhouse gas emissions.

Some decreases in emissions were observed in 2021, *Residential* emissions decreased by 6.0%, driven by a combination of milder winter weather, easing of COVID restrictions and an increase in fuel prices. However, *Residential* emissions are still 1.4% above pre-pandemic 2019 levels. There were also emission reductions in some of the smaller sectors, *Commercial services*, *Public services* and *Waste* (2.0%, 3.4% and 3.0% respectively).

That 23.5% of the budget for the first (2021-2025) Carbon Budget period has already been used up in 2021 places additional pressure on emissions reductions in the subsequent years and implementation of effective measures will need to be swiftly stepped up to avoid the budget being exceeded. Globally the situation is the same with the IPCC Working Group III report highlighting that "It's now or never" if the target of limiting global temperature rise to 1.5 degrees is to be achieved, with no further implementation delays possible.

Moving away from fossil fuels for heating and transport needs improves the air quality in our towns and cities, something that has been observed during the COVID-19 lockdown periods, where traffic volumes were reduced. For individuals, environmentally 'greener' choices such as active travel, building lower energy buildings and reducing food waste are often also 'better' choices, benefitting our health and pockets and safeguarding us from the uncertainty of future energy costs.

9 <https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/irelands-greenhouse-gas-emissions-projections-2021-2040.php>

The Climate Action and Low Carbon Development (Amendment) Act 2021.
<https://data.oireachtas.ie/ie/oireachtas/act/2021/32/eng/enacted/a3221.pdf>

Appendix – Additional Tables

Table 4. Ireland's Final GHG Emissions by Sector 1990-2021 (kilotonnes CO₂ equivalent)

1990-2021 Submission 2023 Final	1990	1995	2000	2005	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	% Share 2021	% Share 2021 inc. LULUCF	Annual change
Energy Industries	11,335	13,482	16,202	15,901	13,461	12,898	11,534	11,343	11,953	12,675	11,908	10,647	9,437	8,737	10,272	16.5%	14.8%	17.6%
Public electricity and heat production	10,947	13,126	15,747	15,235	12,880	12,352	10,994	10,831	11,380	12,136	11,362	10,100	8,954	8,242	9,795	15.8%	14.1%	18.8%
Petroleum refining	169	181	275	412	310	314	295	279	359	314	311	322	275	301	294	0.5%	0.4%	-2.2%
Solid fuels and other energy industries	101	69	87	172	173	145	161	134	114	125	129	118	107	92	81	0.1%	0.1%	-12.0%
Fugitive emissions	119	106	93	83	97	87	85	98	99	100	106	107	102	102	102	0.2%	0.1%	-0.7%
Residential	7,571	6,650	7,181	8,403	8,972	7,247	7,060	6,257	6,689	6,971	6,592	7,084	6,822	7,361	6,917	11.1%	10.0%	-6.0%
Manufacturing Combustion	4,065	4,278	5,414	5,441	4,199	3,864	4,016	4,261	4,310	4,367	4,504	4,719	4,625	4,512	4,624	7.4%	6.7%	2.5%
Commercial Services	1,016	1,085	1,031	1,052	912	901	923	803	903	836	772	839	837	853	836	1.3%	1.2%	-2.0%
Public Services	1,126	920	865	694	568	511	598	591	616	630	643	683	652	682	659	1.1%	0.9%	-3.4%
Transport	5,143	6,269	10,772	13,116	11,522	10,826	11,050	11,332	11,811	12,293	12,014	12,188	12,197	10,301	10,989	17.7%	15.8%	6.7%
Domestic aviation	48	46	70	80	49	15	15	15	16	17	17	17	18	14	19	0.0%	0.0%	41.7%
Road transportation	4,789	5,883	10,352	12,537	10,977	10,358	10,580	10,828	11,315	11,750	11,506	11,643	11,625	9,693	10,328	16.6%	14.9%	6.5%
Railways	147	123	136	135	135	130	130	119	121	124	128	129	135	108	116	0.2%	0.2%	8.1%
Domestic navigation	86	92	153	211	200	183	179	225	222	266	235	260	277	339	374	0.6%	0.5%	10.4%
Other transportation	73	125	62	153	161	139	145	146	137	135	127	140	142	148	152	0.2%	0.2%	2.9%
Industrial Processes	3,162	2,902	3,700	2,762	1,463	1,561	1,477	1,821	2,008	2,151	2,239	2,296	2,267	2,108	2,477	4.0%	3.6%	17.5%
Mineral industry	1,117	1,084	1,909	2,553	1,299	1,392	1,302	1,650	1,830	1,968	2,040	2,095	2,058	1,907	2,257	3.6%	3.2%	18.3%
Chemical industry	1,875	1,668	1,577	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	116	96	156	177	128	132	139	134	141	144	161	162	170	161	180	0.3%	0.3%	11.4%
Other product manufacture and use	28	29	30	33	36	37	37	37	37	38	38	39	39	40	40	0.1%	0.1%	0.7%
F-Gases	36	206	706	1,143	1,121	1,102	1,135	1,200	1,197	1,274	1,204	889	874	720	766	1.2%	1.1%	6.5%

1990-2021 Submission 2023 Final	1990	1995	2000	2005	2010	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	% Share 2021	% Share 2021 inc. LULUCF	Annual change
Agriculture	20,479	22,269	22,196	21,576	20,250	20,457	21,172	20,659	21,195	21,756	22,523	23,393	22,479	22,810	23,626	38.0%	34.0%	3.6%
Enteric fermentation	12,319	13,055	13,251	12,974	12,059	12,643	12,762	12,676	13,103	13,468	13,950	14,278	13,887	14,105	14,488	23.3%	20.9%	2.7%
Manure management	2,095	2,245	2,320	2,376	2,270	2,444	2,450	2,397	2,498	2,573	2,660	2,738	2,645	2,666	2,703	4.4%	3.9%	1.4%
Agricultural soils	4,803	5,232	5,154	4,810	4,573	4,343	4,730	4,537	4,555	4,608	4,871	5,153	4,821	4,853	5,063	8.2%	7.3%	4.3%
Liming	355	495	366	267	428	229	516	391	401	434	333	461	344	399	597	1.0%	0.9%	49.5%
Urea application	97	86	92	61	98	46	47	55	64	79	84	89	92	109	102	0.2%	0.1%	-6.7%
Agriculture/Forestry fuel combustion	723	998	900	944	746	681	590	529	510	535	555	590	616	617	614	1.0%	0.9%	-0.5%
Fishing	88	158	113	145	76	70	78	74	65	60	71	84	73	59	59	0.1%	0.1%	-0.8%
Waste	1,709	2,020	1,643	1,442	564	572	746	953	1,042	1,052	1,027	995	976	973	943	1.5%	1.4%	-3.0%
Landfills	1,476	1,784	1,420	1,128	312	339	516	726	814	840	804	776	742	739	703	1.1%	1.0%	-4.8%
Biological treatment of solid waste	0	0	0	48	50	45	46	42	42	41	47	46	49	48	49	0.1%	0.1%	2.7%
Incineration and open burning of waste	98	101	80	133	62	48	45	42	42	25	27	24	33	31	35	0.1%	0.0%	11.3%
Wastewater treatment and discharge	135	135	143	134	140	139	139	143	144	147	149	150	151	155	156	0.3%	0.2%	0.8%
Land use, land-use change and forestry	6,009	6,702	7,326	7,691	7,056	5,487	6,290	5,827	6,259	5,036	7,439	6,264	6,657	7,042	7,338		10.6%	4.2%
Forest land	-2,723	-1,554	-428	-1,238	-2,790	-3,510	-3,757	-3,450	-4,081	-4,150	-2,550	-2,457	-2,004	-1,724	-865		-1.2%	-49.8%
Cropland	-135	-134	-96	-45	-350	-58	-90	-198	-252	-260	-262	-363	-340	-312	-270		-0.4%	-13.4%
Grassland	7,284	6,491	6,883	6,780	6,967	7,077	7,447	6,921	6,935	6,967	6,981	7,043	7,037	6,808	7,109		10.2%	4.4%
Wetlands	1,910	2,438	1,827	2,870	3,669	2,252	3,148	3,124	4,181	3,076	3,904	2,642	2,573	2,786	2,083		3.0%	-25.2%
Settlements	86	118	210	385	316	331	142	131	145	150	179	171	206	246	197		0.3%	-19.7%
Other land	1	23	53	68	63	62	62	62	60	58	55	53	51	49	48		0.1%	-1.3%
Harvested wood products	-413	-680	-1,123	-1,130	-819	-669	-662	-763	-729	-804	-869	-826	-866	-809	-963		-1.4%	19.0%
Other																		
National Total	55,643	60,081	69,712	71,531	63,032	59,940	59,712	59,221	61,724	64,005	63,425	63,734	61,165	59,056	62,110	100.0%	100.0%	5.2%
National Total with LULUCF	61,652	66,783	77,038	79,222	70,088	65,426	66,001	65,048	67,983	69,042	70,863	69,998	67,822	66,099	69,448	100.0%	100.0%	5.1%

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).

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

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.

An Gníomhaireacht Um Chaomhnú Comhshaoil

Tá an GCC freagrach as an gcomhshaoil a chosaint agus a fheabhsú, mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaoil a chosaint ar thionchar díobhálach na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

- Rialáil: Rialáil agus córais chomhlíonta comhshaoil éifeachtacha a chur i bhfeidhm, chun dea-thorthaí comhshaoil a bhaint amach agus díriú orthu siúd nach mbíonn ag cloí leo.
- Eolas: Sonraí, eolas agus measúnú ardchaighdeán, spriocdhírthe agus tráthúil a chur ar fáil i leith an chomhshaoil chun bonn eolais a chur faoin gcinnteoireacht.
- Abhcóideacht: Ag obair le daoine eile ar son timpeallachta glaine, táirgiúla agus dea-chosanta agus ar son cleachtas inbhuanaithe i dtaobh an chomhshaoil.

I measc ár gcuid freagrachtaí tá:

CEADÚNÚ

- Gníomhaíochtaí tionscail, dramhaíola agus stórála peitрил ar scála mór;
- Sceitheadh fuíolluisce uirbigh;
- Úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe;
- Foinsí radaíochta ianúcháin;
- Astaíochtaí gás ceaptha teasa ó thionscal agus ón eitlíocht trí Scéim an AE um Thrádáil Astaíochtaí.

FORFHEIDHMIÚ NÁISIÚNTA I LEITH CÚRSAÍ COMHSHAOIL

- Iniúchadh agus cigireacht ar shaoráidí a bhfuil ceadúnas acu ón GCC;
- Cur i bhfeidhm an dea-chleachtais a stiúradh i ngníomhaíochtaí agus i saoráidí rialáilte;
- Maoirseacht a dhéanamh ar fhreagrachtaí an údarais áitiúil as cosaint an chomhshaoil;
- Caighdeán an uisce óil phoiblí a rialáil agus údaruithe um sceitheadh fuíolluisce uirbigh a fhorfheidhmiú;
- Caighdeán an uisce óil phoiblí agus phríobháidigh a mheasúnú agus tuairisciú air;
- Comhordú a dhéanamh ar líonra d'eagraíochtaí seirbhíse poiblí chun tacú le gníomhú i gcoinne coireachta comhshaoil;
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaoil.

BAINISTÍOCHT DRAMHAÍOLA AGUS CEIMICEÁIN SA CHOMHSHAOIL

- Rialacháin dramhaíola a chur i bhfeidhm agus a fhorfheidhmiú lena n-áirítear saincheisteanna forfheidhmithe náisiúnta;
- Staitisticí dramhaíola náisiúnta a ullmhú agus a fhoilsiú chomh maith leis an bPlean Náisiúnta um Bainistíocht Dramhaíola Guaisí;
- An Clár Náisiúnta um Chosc Dramhaíola a fhorbairt agus a chur i bhfeidhm;
- Reachtaíocht ar rialú ceimiceán sa timpeallacht a chur i bhfeidhm agus tuairisciú ar an reachtaíocht sin.

BAINISTÍOCHT UISCE

- Plé le struchtúir náisiúnta agus réigiúnacha rialachais agus oibriúcháin chun an Chreat-treoir Uisce a chur i bhfeidhm;
- Monatóireacht, measúnú agus tuairisciú a dhéanamh ar chaighdeán aibhneacha, lochanna, uisce idirchreasa agus cósta, uisce snámha agus screamhuisce chomh maith le tomhas ar leibhéal uisce agus sreabhadh abhann.

EOLAÍOCHT AERÁIDE & ATHRÚ AERÁIDE

- Fardail agus réamh-mheastacháin a fhoilsiú um astaíochtaí gás ceaptha teasa na hÉireann;
- Rúnaíocht a chur ar fáil don Chomhairle Chomhairleach ar Athrú Aeráide agus tacaíocht a thabhairt don Idirphlé Náisiúnta ar Ghníomhú ar son na hAeráide;
- Tacú le gníomhaíochtaí forbartha Náisiúnta, AE agus NA um Eolaíocht agus Beartas Aeráide.

MONATÓIREACHT & MEASÚNÚ AR AN GCOMHSHAOIL

- Córais náisiúnta um monatóireacht an chomhshaoil a cheapadh agus a chur i bhfeidhm: teicneolaíocht, bainistíocht sonraí, anailís agus réamhaisnéisiú;
- Tuairiscí ar Staid Timpeallacht na hÉireann agus ar Tháscairí a chur ar fáil;
- Monatóireacht a dhéanamh ar chaighdeán an aeir agus Treoir an AE i leith Aeir Ghlain don Eoraip a chur i bhfeidhm chomh maith leis an gCoinbhinsiún ar Aerthruaillíú Fadraoin Trasteorann, agus an Treoir i leith na Teorann Náisiúnta Astaíochtaí;
- Maoirseacht a dhéanamh ar chur i bhfeidhm na Treorach i leith Torainn Timpeallachta;
- Measúnú a dhéanamh ar thionchar pleananna agus clár beartaithe ar chomhshaoil na hÉireann.

TAIGHDE AGUS FORBAIRT COMHSHAOIL

- Comhordú a dhéanamh ar ghníomhaíochtaí taighde comhshaoil agus iad a mhaoiniú chun brú a aithint, bonn eolais a chur faoin mbeartas agus réitigh a chur ar fáil;
- Comhoibriú le gníomhaíocht náisiúnta agus AE um thaighde comhshaoil.

COSAINT RAIDEOLAÍOCH

- Monatóireacht a dhéanamh ar leibhéal radaíochta agus nochtadh an phobail do radaíocht ianúcháin agus do réimsí leictreamaighnéadacha a mheas;
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha;
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta;
- Sainseirbhísí um chosaint ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

TREOIR, ARDÚ FEASACHTA AGUS FAISNÉIS INROCHTANA

- Tuairisciú, comhairle agus treoir neamhspleách, fianaise-bhunaithe a chur ar fáil don Rialtas, don tionscal agus don phobal ar ábhair maidir le cosaint comhshaoil agus raideolaíoch;
- An nasc idir sláinte agus folláine, an geilleagar agus timpeallacht ghlan a chur chun cinn;
- Feasacht comhshaoil a chur chun cinn lena n-áirítear tacú le hionpraíocht um éifeachtúlacht acmhainní agus aistriú aeráide;
- Tástáil radóin a chur chun cinn i dtithe agus in ionaid oibre agus feabhsúchán a mholadh áit is gá.

COMHPHÁIRTÍOCHT AGUS LÍONRÚ

- Oibriú le gníomhaireachtaí idirnáisiúnta agus náisiúnta, údarais réigiúnacha agus áitiúla, eagraíochtaí neamhrialtais, comhlachtaí ionadaíochta agus ranna rialtais chun cosaint comhshaoil agus raideolaíoch a chur ar fáil, chomh maith le taighde, comhordú agus cinnteoireacht bunaithe ar an eolaíocht.

BAINISTÍOCHT AGUS STRUCTÚR NA GNÍOMHAIREACHTA UM CHAOMHNÚ COMHSHAOIL

Tá an GCC á bainistiú ag Bord Iánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóir. Déantar an obair ar fud cúig cinn d'Oifigí:

- An Oifig um Inbhuanaitheacht i leith Cúrsaí Comhshaoil
- An Oifig Forfheidhmithe i leith Cúrsaí Comhshaoil
- An Oifig um Fhianaise agus Measúnú
- An Oifig um Chosaint ar Radaíocht agus Monatóireacht Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tugann coistí comhairleacha cabhair don Ghníomhaireacht agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

