Guide to the Jersey Greenhouse Gas Inventory

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List of acronyms

AIS – Automatic Identification System
CAA – Civil Aviation Authority
CDs – Crown Dependencies
CH_4 - Methane
CO_2 - Carbon dioxide
DEFRA – Department for Environment, Food and Rural Affairs
DUKES – Digest of UK energy statistics
ERF – Energy recovery facility
EMEP/EEA – European Monitoring and Evaluation Programme/European Environment Agency
FAO – Food and Agriculture Organisation of the United Nations
FAOSTAT – Food and Agriculture Organisation Corporate Statistical Database
F-gases – Fluorinated gases
GDP – Gross domestic product
GHG – Greenhouse gas
GVA – Gross value added
GWP – Global Warming Potential
HFCs - Hydrofluorocarbons
IPCC – Intergovernmental Panel on Climate Change
LTO – Landing/take off
LULUCF – Land use, land use change and forestry
MSW – Municipal solid waste
MW - Megawatt
N_2O - Nitrous oxide
NF_3 – Nitrogen trifluoride
OTs – Overseas Territories
PFCs – Perfluorocarbons
SF_6 - Sulphur hexafluoride
SOC – Soil organic carbon
tCO_2eq – Tonnes of carbon dioxide equivalent
UK – United Kingdom
UNFCCC – United Nations Framework Convention of Climate Change

Introduction

In 2019, the States Assembly declared a climate emergency and in doing so has recognised that climate change could have profound effects in Jersey. In response to the climate emergency declaration, the Minister for the Environment presented plans on how Jersey could aim to be carbon neutral by 2030 and presented the Carbon Neutral Strategy 2019. In May 2022 the States Assembly adopted the Carbon Neutral Roadmap, a document which outlines the policies needed to progress towards net zero. The roadmap focuses on action to be taken from 2022 to 2026.

The Paris Agreement is a legally binding international treaty on climate change with the aim to limit global warming to below 2°C, and to preferably 1.5°C, compared to pre-industrial levels. It was adopted by 196 Parties on 12th December 2015 and the UK's ratification was extended on the 3rd May 2022 to include Jersey.

A key component of planning for net zero carbon is to understand the key sources of emissions in Jersey, the trends in these key sources and their potential for future emissions reductions. This information is provided by the Jersey greenhouse gas emissions inventory. The inventory provides estimates for historical emissions of greenhouse gases from 1990 until the most recent submission year minus 2 (so the 2022 inventory covers the period 1990 to 2020).

This document provides a Q&A guide to the greenhouse gas inventory including an overview of the inventory methodology; how it is compiled, coverage and information on specific sources. Further detailed information on the inventory data and planned actions to reduce emissions can be found here.

1 Introduction to greenhouse gas inventories

1.1 What is a greenhouse gas inventory?

A greenhouse gas (GHG) inventory is a dataset which presents estimates of emissions of various greenhouse gases from a wide range of activities in a country or other geographical area. Greenhouse gas inventories are reported to the United Nations Framework Convention on Climate Change (UNFCCC) by countries and are used for policymaking, monitoring progress in carbon reductions and for modelling in the scientific community. The Jersey inventory forms part of the UK inventory, along with the other Overseas Territories and Crown Dependencies such as Guernsey and the Isle of Man. Decisions on what is and isn't included in the inventory and how the data are reported are not made by the UK or Jersey, but by the UNFCCC.

1.2 What sectors are included and excluded?

In line with international reporting guidelines, produced by the Intergovernmental Panel on Climate Change, greenhouse gas emissions are reported by National Communications sectors:

- Agriculture
- Business
- Energy supply
- Land use change
- Residential
- Transport
- Industrial processes
- Waste management

Figure 1 provides an overview of what is included and excluded from the Jersey greenhouse gas inventory. Emissions from international aviation and shipping are reported as memo items. This means that the activity is occurring outside of the country jurisdiction and, whilst an estimate of emissions is calculated, it is not included in the total emissions value (more information on aviation and shipping is provided in Chapter 2).

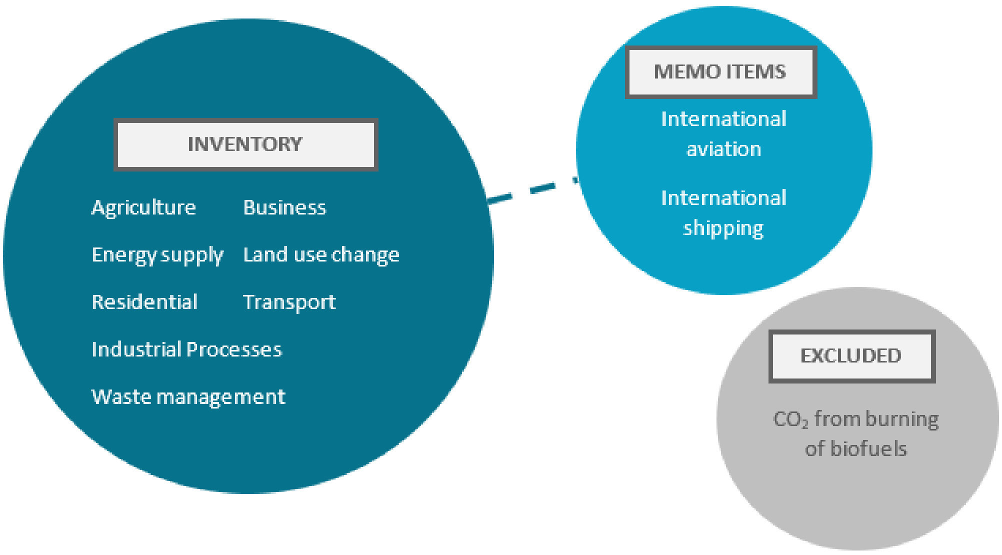


Figure 1 - Overview of sectors included and excluded from the greenhouse gas inventory

1.3 What is included within each inventory sector?

Figure 2 provides an overview of the key activities that are included in each inventory sector. Further information and data on sector and sub-sector trends and methodologies can be found in Chapters 3 and 4. A description of each sub-sector can be found in Annex 1.

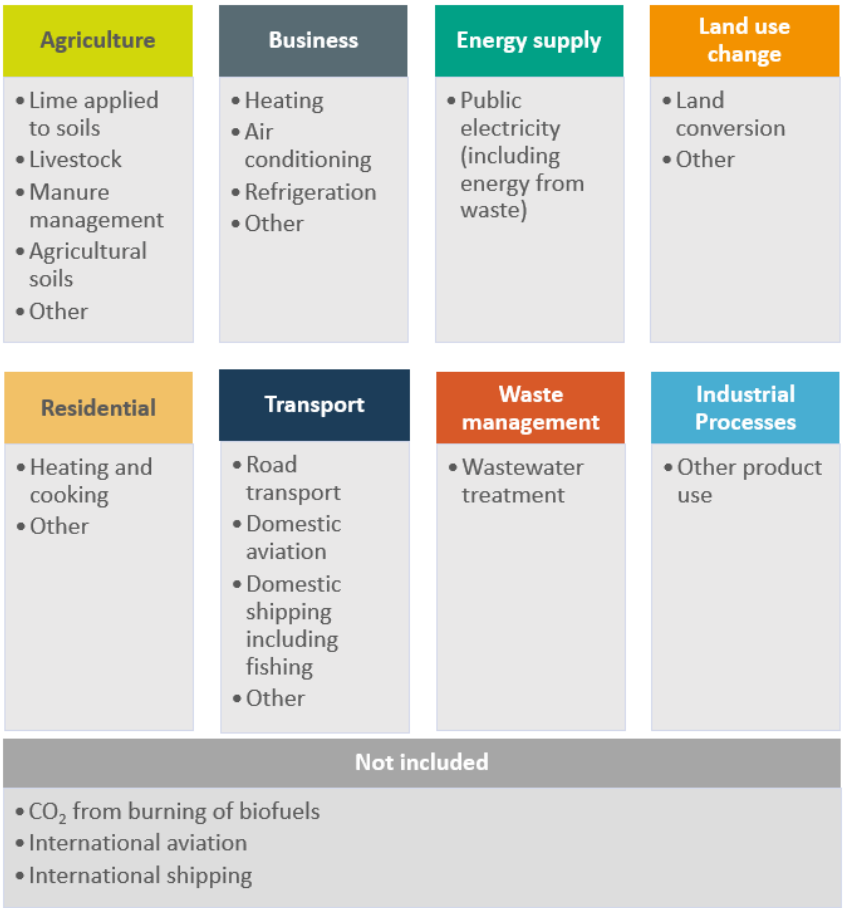


Figure 2 - Overview of activities covered in each sector.

Agriculture – This includes emissions from livestock, crop production and fertiliser application. In 2020 this sector contributed 6% to total GHG emissions in Jersey.

Business – This includes emissions from fuel use in the commercial and industrial sector as well as some specific industrial processes relating to the use of aerosols in air conditioning and refrigeration. In 2020, this sector contributed 16% to total GHG emissions in Jersey.

Energy supply – This sector includes emissions from fuel combustion for the generation of energy, predominantly the production of public electricity. For Jersey, this includes emissions from the Energy Recovery Facility where energy is generated from burning solid, non-biogenic waste and on-island energy generation. In 2020, this sector contributed 13% to total GHG emissions in Jersey.

Land use change – This sector consists of emissions or removals from the conversion of land from one use to another, for example the conversion of cropland to settlements. In

2020, this sector contributed -0.1% to total GHG emissions in Jersey. The negative value means that overall this sector was a sink for emissions rather than a source.

Residential – This sector includes emissions from combustion of fuels in homes, for heating and cooking, as well as some smaller sources such as metered dose inhalers and other aerosols used in a domestic setting. In 2020 this sector contributed 26% to total GHG emissions in Jersey.

Transport – This sector includes emissions from road transport, domestic aviation and domestic shipping. The largest source in this sector is passenger cars. This sector is the largest emissions source in Jersey in 2020, contributing 36% to total GHG emissions.

Waste management – This sector includes emissions from the treatment of domestic wastewater. In 2020, this sector contributed 3% to total GHG emissions in Jersey.

Industrial processes – This sector includes emissions from the use of N_2O as a propellant in squirty cream. In 2020, this sector contributed 0.03% to total GHG emissions.

Not included - CO_2 emissions from the burning of biofuels are not included in the Jersey inventory, in accordance with IPCC Guidelines, and are therefore not included in national total emission estimates. Biogenic emissions are excluded in GHG inventories as bio carbon is renewable and naturally circulates in the environment. For further information on live and fossil carbon and the potential for soil carbon sequestration on the island, please see the 'Carbon sequestration and the role of soil and crops' report and section 2.6.

Emissions from international aviation and shipping in Jersey are not included in the GHG inventory total but are included as a 'Memo Item' for the UK inventory. These memo items provide Jersey with an opportunity to report emissions from international transport, but not including these emissions in the national totals.

More information on the emission trends for each sector can be found in Chapters 3 and 4.

1.4 Which greenhouse gases are reported in the inventory?

The Jersey inventory covers the six main greenhouse gases (GHG) required for reporting under the Kyoto Protocol. These six GHGs directly contribute to climate change:

- Methane (CH_4)
- Carbon dioxide (CO_2)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF_6)

HFCs, PFCs and SF_6 are commonly referred to as 'F-gases'. The Paris Agreement requires the reporting on a seventh gas, nitrogen trifluoride (NF_3). This has not been included within the inventory as it is assumed there is no activity on the island that would result in these emissions.

Global Warming Potentials

Greenhouse gases absorb energy and slow the rate at which the energy can escape into space, causing global temperatures to increase. Different greenhouse gases absorb energy at different rates and therefore have different 'global warming potentials' (GWP). GWPs allow you to compare the impacts of each gas on global warming.

Carbon dioxide always has a global warming potential of 1 because it is used as the reference gas. The global warming potential of other gases is therefore a measure of how much energy will be absorbed by 1 tonne of the gas, relative to the amount of energy absorbed by 1 tonne of CO_2 over a given period of time (usually 100 years). **Table 1** shows the GWPs for key greenhouse gases.

Example: The global warming potential of methane is 25. Therefore, 1 metric tonne of methane (CH_4) emitted is equivalent to 25 metric tonnes of carbon dioxide (CO_2).

In the GHG inventory, each of the six GHGs is presented in carbon dioxide equivalent (CO_2eq) units, as this helps to increase consistency in reporting and allows the emissions to be added together to calculate a total. These are calculated by multiplying the emissions of a gas by the corresponding global warming potential. This metric of measurements allows for emissions from various GHGs to be compared.

***Table 1** - Global Warming Potentials (GWPs) for 100-year time horizon from IPCC Fourth Assessment Report (AR4) **

Greenhouse gas (GHG)	Global Warming Potential (tonnes of CO_2 equivalent per tonne of gas)
Carbon dioxide (CO_2)	1
Methane (CH_4)	25
Nitrous oxide (N_20)	298
Hydrofluorocarbons (HFCs)	Between 124 and 14,800
Perfluorinated compounds (PFCs)	Between 7,390 and 12,200
Sulphur hexafluoride (SF_6)	22,800

* AR4 values are used in line with international reporting requirements

1.5 How frequently are emissions reported?

The most recent inventory includes estimates of emissions from all sources and sectors for the years 1990 to 2020. The inventory always reports data for the timeframe of 1990 to the year that is 2 years before the year of reporting i.e. 2020 in 2022. This delay is the result of the time required for official statistics to be available and the amount of time to compile the necessary data and check and finalise the emissions reported. The data are provided annually in accordance with international regulations.

Every year the whole time series is updated and revised (from 1990) to capture any improvements in methodologies and ensure internal consistency. This is important as emissions from one source in 2010 may differ between the 2018 and 2019 inventory for example, as methodologies may have changed. The latest inventory year is therefore the most up to date and is the inventory which should be used.

Example: In the agriculture sector of the Jersey inventory, the emissions in 2019 for 3J Livestock were 22,818 tCO_2eq in the 1990-2019 inventory but in the 1990-2020 inventory this category is estimated at 19,801 tCO_2eq. This reflected an improvement made to the data for the most recent inventory and therefore this inventory more accurately reflects activities in Jersey.

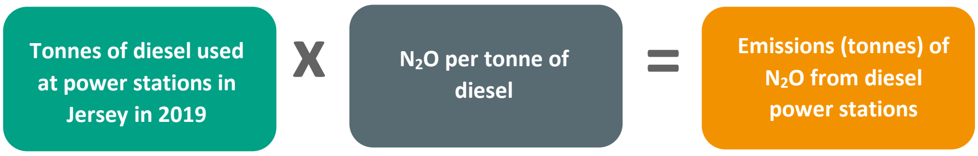
1.6 How are greenhouse gases emissions estimated?

The basic equation for estimating most emissions is:

Activity - This is a measure of the activity which is taking place, such as number of cows or tonnes of fuel combusted. This data typically comes from national statistical datasets.

Emission Factor - This is the emissions per unit of activity, which usually comes from the scientific literature. It is typically derived from measurement.

Example: Emissions of N_2O from diesel fuelled power stations in 2020 in Jersey



Emission factors often come from scientific literature and reference documentation, most notably the IPCC National Greenhouse Gas Inventory Guidelines[1]. The activity data is derived from the national datasets. By multiplying both values together, an amount of emissions for N_2O from diesel fuelled power stations for the relevant year is calculated. It is important to note that this is basic equation for calculating emissions, and that in reality it is rarely this simple. In this example, the type of fuel used, maintenance of the power station, age and more will impact the emissions estimate.

1.7 What is the difference between 'by source' and 'end user' emission inventories?

There are two methods for reporting GHG emissions, by-source and end user. The difference in the two lies in where the emissions related to fuel production are reported.

By Source – In a by-source inventory, emissions are allocated to the source sector in which they occur and emit emissions directly. The emissions related to fuel production are allocated to where the fuel is produced and processed.

Example: The energy supply emissions in the Jersey inventory remain continually small as emissions from electricity production and fuel processing are reported by source. As Jersey predominantly imports its electricity from France, the resultant greenhouse gas emissions from the energy supply sector are therefore counted in France's national

[1] https://www.ipcc-nggip.iges.or.jp/public/2006gl/

inventory. However, the on-island generation of energy i.e. from Energy from Waste facilities is counted within Jersey's inventory.

End User – This method reallocates some emissions to the final user of fuels. This means that emissions from the production and processing of fuels, including the production of electricity, are reallocated to users of these fuels to reflect total emissions for each type of fuel consumed.

The officially reported greenhouse gas inventory for Jersey is a 'by source' inventory, rather than an 'end user' one, in line with international reporting. This means emissions reported are attributed to the sector that emits them directly, from the production and processing of fuels (including the production of electricity). An 'end user' inventory by comparison allocates these emissions to the consumers of these fuels, to reflect the total emissions relating to that fuel use.

Example: If Jersey's inventory were reported on an end-user basis, this would include emissions associated with the production of imported electricity used in the island. This would increase emissions related to energy consumption.

1.8 Are there other methods for carbon accounting?

The UK government has historically published GHG emissions using 3 different accounting methods:

- **Emissions from the GHG inventory** – a by-source inventory of emissions occurring in the country for reporting under the United Framework Convention on Climate Change (UNFCCC) and for tracking progress against national and international emission reduction targets.
- **Emissions measured by the UK Environmental Accounts** – estimates emissions resulting from the various sectors of the UK economy. The figures represent emissions resulting from activities of UK residents and industries whether in the UK or abroad. This excludes emissions produced within the UK by oversees residents and businesses.
- **Embedded emissions** – measures emissions on a "consumption" basis and takes into account emissions that are embedded in goods and services imported and exported by the UK.

Jersey only produces emissions using the first method of accounting, the GHG inventory. Scope definitions and embodied carbon are therefore not considered as they are not included within the framework of UNFCCC inventories.

When looking at other forms of carbon accounting beyond the inventory, emissions are sometimes divided into three categories, or scopes, in order to distinguish between direct and indirect emission sources (**Table 2**). For more information on indirect GHG emissions, see the 'Considering the Channel Islands' indirect GHG emissions' report.

Table 2 - Description of different emission scopes according to the GHG Protocol for Cities[2]

Category	Description	Example sources
Scope 1: Direct emissions	Emissions from all activities that occur within the reporting jurisdiction, including operations that are owned or controlled by the jurisdiction	• All modes of transport, including cars, lorries and trains • Combustion in houses and commercial buildings e.g. for cooking and heating • On-island electricity generation
Scope 2: Indirect emissions	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting jurisdiction	• Emissions associated with electricity that is imported
Scope 3: Indirect emissions	GHG emissions that occur outside of the island boundaries as a result of activities that take place on-island	• Transboundary transport • Waste treatment and disposal outside the island boundary • Transmission and distribution losses from grid-supplied energy
Other Scope 3	Additional Scope 3 emissions that occur due to on-island activities. These are harder to measure and calculate and are not so well defined	• Embodied emissions in fuels, water, food and construction materials

This approach can help to improve completeness of reporting for certain requirements (such as organisation level carbon reporting) but is not consistent with the methods used for national inventories and so is not relevant to the Jersey GHG inventory.

More information on carbon accounting including scopes can be found in the 'GHG Protocol for Cities'[3] (this relates to city level emissions).

Embodied emissions are not included as such in the Jersey inventory, because the structure of the inventory is not defined in this way. However, some production emissions are included at source such as for food products in the agriculture sector. Embodied carbon can be defined as the full carbon footprint of a certain product or material. Different emissions are produced throughout the supply chain of the material including emissions from fuel combustion at the factory where a product is created, or emissions from transport as the goods are imported.

[2] https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.pdf

[3] https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities

2 Frequently asked questions

2.1 How are emissions from La Collette and Energy Recovery Facility reported?

In 2000, the 900MW Normandie 2 supply cable was installed, supplying Jersey with electricity from France, reducing the need for the diesel engine power plant and therefore causing a reduction in emissions. The La Collette site is where energy is produced on the island. At this site there are 2 facilities: an Energy Recovery Facility (ERF) and a back-up power station. Around 5% of Jersey's energy supply was produced on-island in 2020, from the ERF and solar panels. The back-up power station at La Collette relies on the burning of two fuel types: heavy fuel oil and diesel.

The amount of energy generated at La Collette (and hence the amount of fuel used and emissions produced on-island) depend on the supply of energy from France. In 2012, failure of the 900MW Normandie 2 supply cable meant electricity had to be generated on-island, leading to an increase in emissions in the energy supply sector.

Greenhouse gas emissions generated through Energy Recovery Facilities are accounted for in the energy supply sector because energy is captured from the incinerated solid waste and used to produce electricity. The solid waste is therefore considered as a fuel for energy supply. Municipal solid waste is split into biogenic (of biological origin, such as paper, cardboard and wood) and non-biogenic (manmade materials). The UK percentage split of biogenic and fossil carbon is applied to Jersey. Only non-biogenic waste is considered to contribute to GHG emissions and therefore only this data is included in the emissions calculation. This is because any impact of natural biomass reduction, e.g. through forestry or wood production, on carbon stock change are assumed to be accounted for in the land use change sector.

2.2 How are emissions from aviation sources reported?

Aviation emissions are split into domestic and international. Domestic aviation emissions are accounted for in the Jersey inventory whilst international aviation emissions are not.

Domestic aviation covers emissions from civil domestic passenger and freight traffic that depart and arrive the same country. The Jersey inventory is included within the UK inventory for reporting under the UNFCCC along with other Crown Dependencies (CDs) and Overseas Territories (OTs). Therefore the UK, Jersey and other OTs and CDs are all considered as the same country and classified as domestic when accounting for aviation emissions. The activity data used to calculate emissions comes from the UK Civil Aviation Authority who hold data on aircraft movements by airport, aircraft type and destination. Emissions from aircrafts are distinguished between two separate operations: Landing/Take Off (LTO) and Cruise. Emissions for the whole journey are attributed to the country that the flight departed from.

International aviation includes emissions from flights that depart in one country and arrive in another. For Jersey this means any flight that departs from Jersey and arrives anywhere outside of the UK and other OTs and CDs, or vice versa. The emissions for the entire journey are divided between the source country and the destination country. These emissions are included as 'memo items' for the UK inventory.

Figure 3 and **Table 3** summarise the differences between domestic and international aviation.

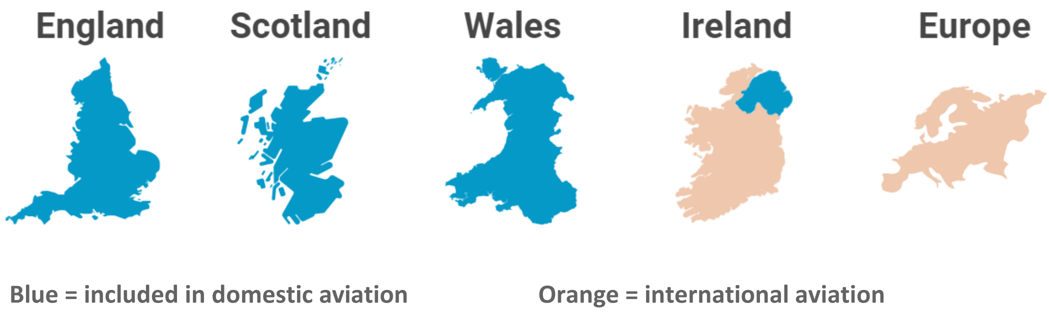


Figure 3 -Domestic and international boundaries for the Jersey inventory

Table 3 - Overview of domestic and international aviation for the Jersey inventory

Domestic aviation	International aviation
Civil domestic passenger and freight traffic that arrive and depart in the same country	Flights that depart from one country and arrive in another (outside of UK)
This includes flights between Jersey and the UK and other Crown Dependencies e.g. Guernsey	Emissions for the entire journey are divided between the two countries
Reported in the inventory under domestic aviation	Not included in national total emissions. Included as a memo item to the UK inventory

Jersey has witnessed an increase in overall emissions from aviation sources from 1990 – 2019. Emissions from domestic aviation remained a significant proportion of Jersey's total transport emissions at 31% in the 2019 inventory. The travel restrictions imposed to reduce the spread of COVID-19 during 2020 impacted the aviation sector. As such, emissions from domestic aviation decreased, comprising 16% of transport emissions in the 2020 inventory and became the third greatest source of emissions after cars and heavy-duty trucks and buses, respectively.

2.3 How are emissions from marine sources reported?

Emissions from international water-borne navigation and domestic water-borne navigation are differentiated. As with aviation, domestic navigation emissions are accounted for in the Jersey inventory whilst international navigation emissions are not.

The same definition of domestic and international as used for aviation (see section 2.2.) is used for navigation. Therefore, any journey leaving the UK, Jersey or another OT or CD and arriving in Jersey is classed as domestic navigation. Emissions for these journeys are attributed to the place of arrival.

International journeys are treated the same as in aviation, emissions are split equally between the two countries and reported as a memo item in the UK inventory.

Emissions from fishing in Jersey are counted as a separate marine source, and this includes emissions from fuels combusted for inland, coastal and deep-sea fishing. Any fishing vessel which has refuelled in Jersey (including international fishing), is considered in the inventory.

Emissions from shipping remain a small proportion of Jersey's total transport emissions, accounting for 5% in 2020. Emissions from fishing vessels in Jersey were estimated at 1% of total transport emissions in Jersey's 2020 inventory.

Chapter 3 provides more information on the Jersey inventory, considering trends, sources and methodologies in more detail.

2.4 Is blue carbon accounted for?

Blue carbon is the atmospheric carbon dioxide (CO_2) that is captured and stored in coastal and marine ecosystems such as mangroves, marshes and seagrass meadows. These coastal ecosystems can store more carbon per unit area than terrestrial forests and as such these ecosystems can therefore offer an option for the mitigation of climate change whilst also providing benefits for adaptation including coastal protection and food security. However, whilst these ecosystems sequester carbon, if they become degraded or damaged by human activity, the sequestered carbon could be released, contributing to CO_2 emissions.

Currently, accounting for blue carbon is not a key element of a national greenhouse gas inventory, although mangroves, salt marshes and seagrasses can be included in national accounting (included under wetlands) where relevant. The '2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands' provides methodologies and emission factors for calculating emissions from coastal wetlands. Several countries, including Japan, Australia and Canada have started to implement this in their national inventory report[4].

Conserving and restoring terrestrial forests is currently recognised as an important aspect of climate change mitigation with countries taking action to manage and conserve natural systems. For example, the UNFCCC's mechanism for reducing emissions from deforestation and forest degradation in developing countries (REDD+) encourages sustainable management of forest ecosystems. These approaches could be extended to coastal ecosystems, promoting sustainable management of the ecosystems and avoiding damage and degradation[5]. This is not yet something that is included in standard accounting practices for national emissions inventories. As outlined in Jersey's Carbon Neutral Roadmap 2022, additional research into Jersey's marine environment is underway. Once complete, this will provide more information relating to marine ecosystems and blue carbon.

2.5 How could Jersey achieve net zero emissions?

How Jersey aims to achieve net zero emissions has been set out in the [Carbon Neutral Roadmap.]

Although Jersey aims to be net zero carbon emissions in 2050, in reality, there will likely still be some "unavoidable" carbon emissions.

Individuals and organisations can reduce these emissions by purchasing offsets. Carbon offsetting is the process of compensating for CO_2-equivalent emissions that have been emitted into the atmosphere through human activity. This enables individuals and organisations to compensate for any emissions they cannot avoid or reduce, by paying

[4] Blue Carbon Partnership https://bluecarbonpartnership.org/blue-carbon/policy/
[5] IUCN https://www.iucn.org/resources/issues-briefs/blue-carbon

for a carbon credit i.e. to pay for an equivalent amount of emissions to be reduced or removed elsewhere. These emissions savings are generated through the implementation of a wide variety of projects across a wide range of locations and might range from planting trees, to installing solar panels, to cancelling industrial carbon credit allowances. The Climate Change Committee warns that offsetting is not a sole solution and that to reach net zero, "most sectors will need to reduce emissions close to zero without offsetting; the target cannot be met by simply adding mass removal of CO_2 onto existing plans."[6]

At a national scale, Jersey can also put in place measures that remove emissions from the atmosphere which could result in a net zero emissions inventory. These measures could include tree planting and implementing technology solutions such as carbon capture and storage on the Energy Recovery Facility. The use of carbon capture and storage on the Energy Recovery Facility would lead to a reduction in emissions from the energy supply sector of the inventory. In the long term, tree planting would impact emissions in the LULUCF sector, assuming that local land cover maps are used in future inventory updates. However, the extent to which tree planting can help to achieve negative emissions in Jersey is limited by land availability. Carbon credits bought by individuals and organisations as part of offsetting schemes would not impact the Jersey national GHG inventory unless the offsetting project was occurring within Jersey. For offsetting projects occurring within Jersey, the impacts would be reflected in changes in the activity data used in the inventory.

2.6 How are emissions from soil carbon sequestration accounted for?

Carbon sequestration is the act of capturing carbon dioxide (CO_2) from the atmosphere, storing it, and preventing it from being re-released. In the context of GHG inventories, the uptake and storage of CO_2 is covered under the land-use, land-use change and forestry (LULUCF) sector. CO_2 fluxes between the atmosphere and ecosystems are primarily controlled by uptake through plant photosynthesis and releases via respiration, decomposition and combustion of organic matter (**Figure 4**).

[6] Committee on Climate Change (2019), Net Zero – The UK's contribution to stopping global warming, 2 May 2019

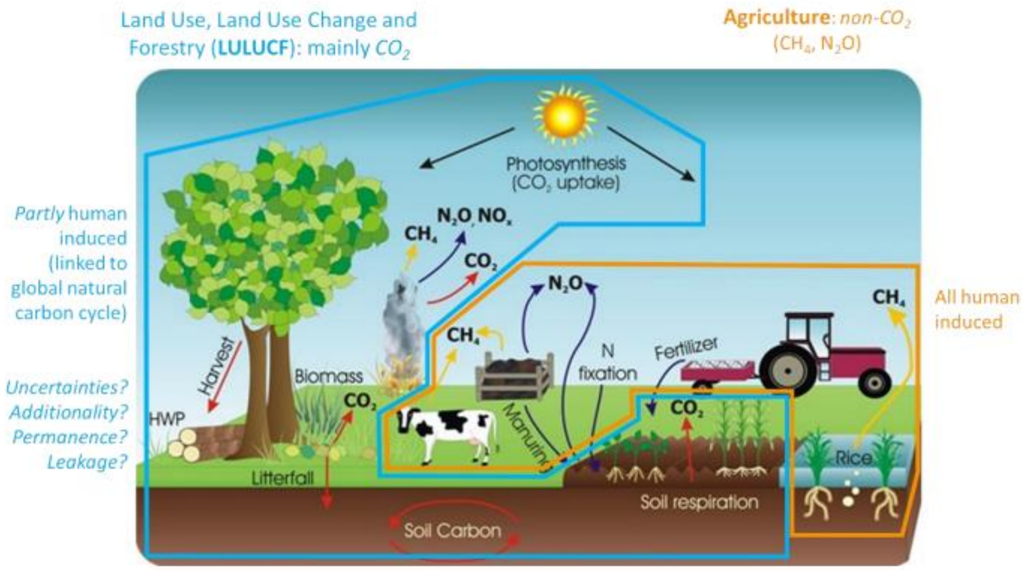


Figure 4 Sources and sinks of GHG emissions in agriculture, forests, and other land use systems. Source: IPCC 2006, Volume 4, Chapter 1[7]

Soil organic matter includes organic carbon in mineral soils to a specified depth. This includes live and dead fine roots and dead organic matter less than around 2mm which cannot be distinguished from the soil. The dominant processes governing the balance of soil organic carbon stocks are carbon inputs from plant residues (transfer of carbon from the living biomass pool) and carbon losses as emissions from decomposition. For further detail please see the ‘Carbon sequestration and the role of soil and crops‘ report.

In the case of Jersey, the Tier 1 approach outlined in the IPCC Guidelines and default values for soil organic carbon and management factors were used. Grassland converted to Cropland is considered as natural grassland changed to annual cropland. It is assumed that the soil organic carbon (SOC) is higher in grassland compared to cropland so as such, each year there is a loss of SOC until equilibrium is reached. It was assumed that the transition to equilibrium took place over 20 years, which is the default year listed within the IPCC Guidelines.

[7] https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_01_Ch1_Introduction.pdf

3 Jersey's greenhouse gas inventory – overview

3.1 Total GHG emissions from different sources

Figure 5 provides an overview of Jersey's inventory categorised by sector.

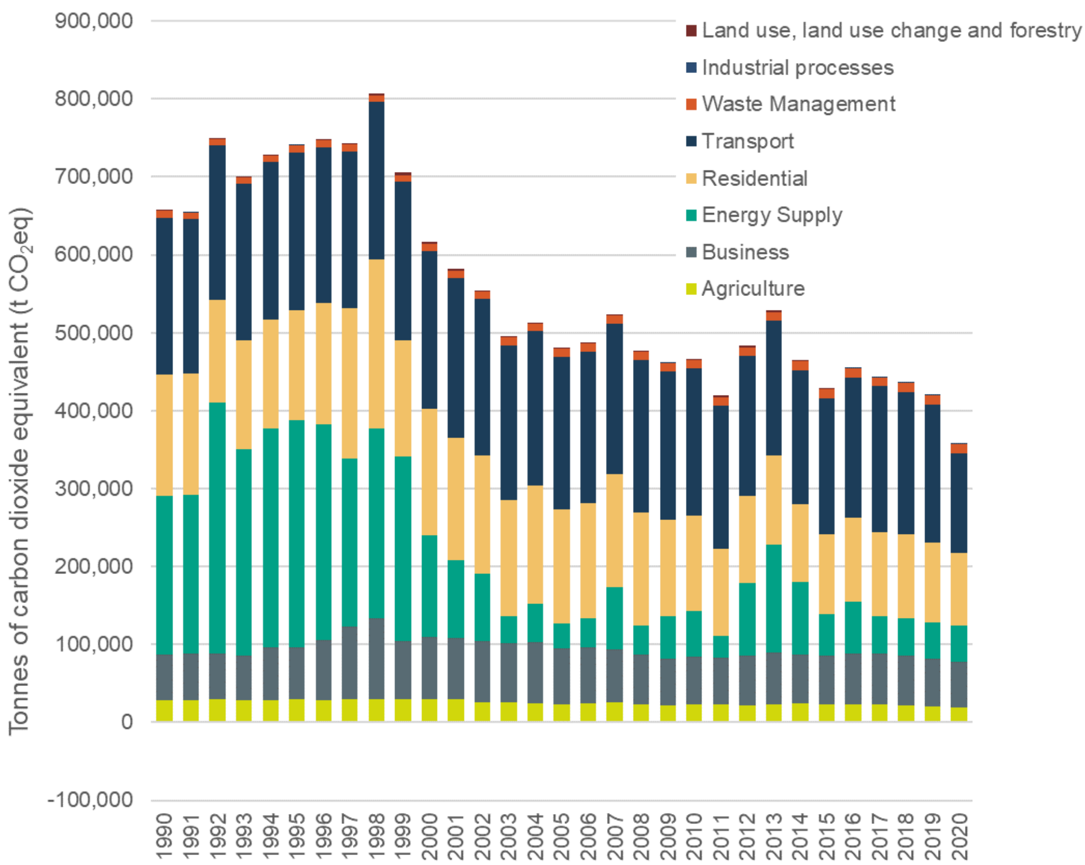


Figure 5 Jersey's Inventory categorised by sector

In 2020, Jersey emitted 356,808 tCO_2eq. Between 1990 and 2020, emissions in Jersey have decreased by 46%. As **Figure 5** shows, this reduction is largely driven by a decrease in emissions from energy supply. This reduction has been noticeable since the installation of the 90MW Normandie 2 supply cable in 2000. This cable supplies electricity to Jersey from France. Emissions associated with electricity supplied via the cable are accounted for in France's inventory. Total emissions noticeably decreased from 418,837 tCO2e in 2019 to 356,808 tCO2e in 2020, resulting from the impact of the COVID-19 pandemic. The transport sector experienced the greatest change in emissions between these two years (28% decrease) but was still the largest source of emissions in the 2020 inventory. Transport emission have remained one of the largest sources across the timeseries despite decreasing by 37% between 1990 and 2020.

Table 4 outlines the percentage contribution from each sector to the total GHG emissions by year. The balance of contributions from each sector to total emissions has changed over the timeseries. The decrease in contribution from energy supply has impacted the relative contributions of other sectors. In 1990, the largest contributions to total emissions came from energy supply and transport (both 31%) whilst in 2020 the largest contribution came from transport alone (36%).

Table 4 Percentage contribution of each sector to Jersey's total GHG emissions

	Agriculture	Business	Energy Supply	Residential	Transport	Waste Management	Industrial processes	Land use, land use change and forestry	Total
1990	4%	9%	31%	24%	31%	1%	0.01%	0.004%	100%
1995	4%	9%	39%	19%	27%	1%	0.01%	-0.05%	100%
2000	5%	13%	21%	26%	33%	2%	0.01%	0.5%	100%
2007	5%	13%	15%	28%	37%	2%	0.01%	0.2%	100%
2008	5%	14%	8%	31%	41%	2%	0.01%	0.2%	100%
2009	5%	13%	12%	27%	41%	2%	0.01%	-0.08%	100%
2010	5%	13%	13%	26%	41%	2%	0.01%	0.01%	100%
2011	6%	14%	7%	27%	44%	3%	0.02%	0.5%	100%
2012	5%	13%	19%	23%	37%	2%	0.02%	0.4%	100%
2013	4%	12%	26%	22%	33%	2%	0.02%	0.4%	100%
2014	5%	13%	20%	21%	37%	2%	0.02%	0.4%	100%
2015	5%	15%	12%	24%	41%	3%	0.03%	0.3%	100%
2016	5%	14%	15%	24%	40%	2%	0.02%	-0.1%	100%
2017	5%	15%	11%	24%	42%	3%	0.02%	-0.2%	100%
2018	5%	15%	11%	25%	42%	3%	0.02%	-0.3%	100%
2019	5%	15%	11%	24%	42%	3%	0.02%	-0.2%	100%
2020	6%	16%	13%	26%	36%	3%	0.03%	-0.1%	100%
1990-2020 % change in contribution to total emissions	**1%**	**8%**	**-18%**	**3%**	**5%**	**2%**	**0.02%**	**-0.1%**	

3.2 Total GHG emissions from different gases

Figure 7 provides an overview of Jersey's inventory categorised by gas.

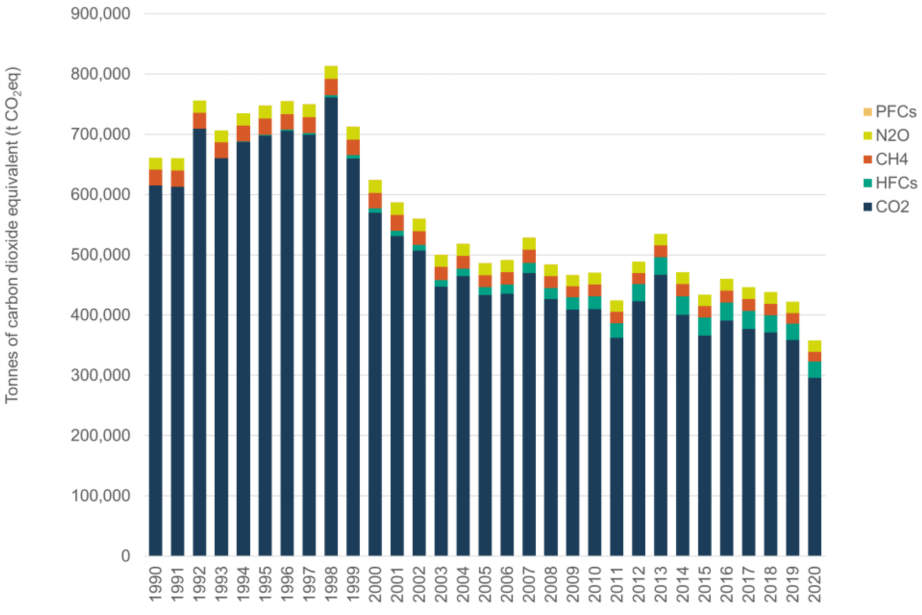


Figure 7 - Jersey's greenhouse gas inventory by gas

CH_4 – 67% of methane emissions in Jersey's 2020 inventory came from the agricultural sector, through activity such as livestock and use of fertilisers. Waste management is also a methane source, with emissions from domestic wastewater treatment.

Jersey has seen an overall reduction in methane emissions between 1990 and 2020, largely driven by the reduction in the number of cattle between 2000 and 2005. There was a peak in the number of cattle in 2006 and 2007 resulting in a peak of methane emissions.

CO_2 – 43% of carbon dioxide emissions in Jersey's 2020 inventory came from the transport sector, with passenger cars being the biggest source. The residential, business and energy supply sectors additionally continue to be significant sources of carbon dioxide. Carbon dioxide emissions in Jersey have seen a decrease since 1990 due to a reduction in the number of flights to the island, increased energy and fuel efficiency of buildings and vehicles, and decreased activity in the glasshouse sector of the agriculture industry.

Emissions reduced significantly between 1998 and 2005 when the first subsea cable was installed, causing a reduction in electricity generation. The spike in emissions in 2013 was when the cable failed, meaning Jersey saw an increase in electricity generation on the island. Carbon dioxide emissions continued to reduce from 2014, once the subsea cable had been restored.

N_2O – The biggest source of nitrous oxide in Jersey's 2020 inventory was the agriculture sector, accounting for 43% of N_2O emissions. The waste management sector was also a significant source, with 38% of total N_2O emissions emitted due wastewater treatment.

Nitrous oxide emissions have remained relatively stable across the time series. There was a decrease in emissions between 2000 and 2003 due to a reduction in the number of cattle.

Fluorinated gases (F-gases) – The two F-gases are produced by the business and residential sectors. HFCs are mainly used as refrigerants and in foams, aerosols and fire extinguishers. PFCs are used in the electronics sector. These gases were introduced to replace ozone depleting substances, meaning F-gas emissions have increased since 1990. SF_6 and NF_3 are not currently being emitted in a quantity that is deemed significant enough to be included in the inventory.

4 Jersey's greenhouse gas inventory - by sector

4.1 Agriculture

4.1.1 Sector and sub-sector trends

Emissions from the agriculture sector accounted for 6% of total greenhouse gas (GHG) emissions in the 2020 inventory. The largest agriculture emissions source in 2020 is enteric fermentation from dairy cattle (**Figure 8**). Enteric fermentation is part of the digestive process in ruminant animals which produces methane emissions. Emissions therefore come from the raising of animals for meat and milk.

Emissions from the agriculture sector for Jersey are separated into 4 different subsectors: 3F field burning, 3G liming, 3H urea application and 3J livestock. The subsector 3J livestock, includes enteric fermentation and manure management, and is by far the largest emission source in the agriculture sector.

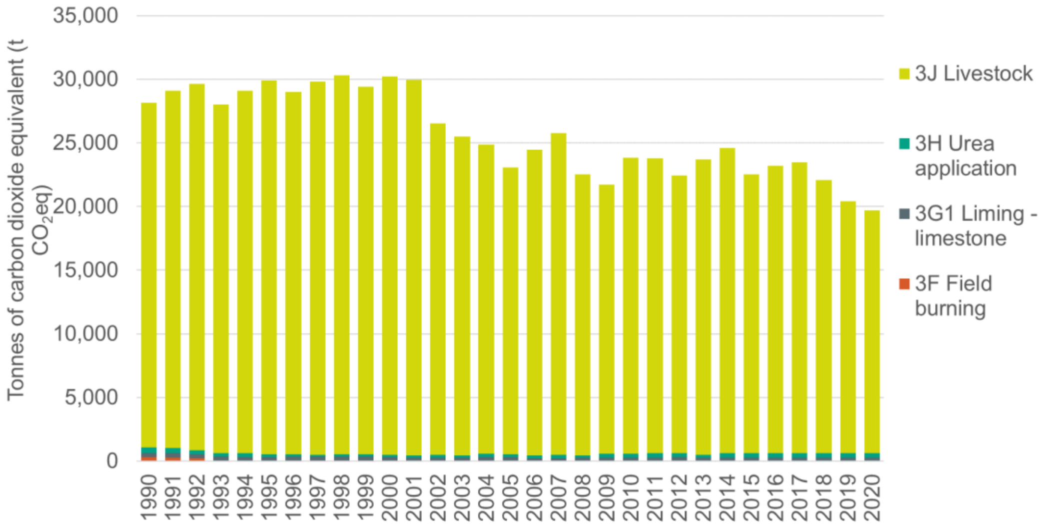


Figure 8 Agriculture sector emissions by sub-sector 1990-2020

Emissions from the agriculture sector reduced by 30% from 1990-2020. Sources from all sub-sectors reduced over the timeseries. Field Burning (3F) ceased in 1993 in England and Wales and is considered negligible in Northern Ireland and Scotland. It is assumed that Jersey followed the same time trend as England, and hence emissions from field burning cease in 1993 (**Table 5**).

Across the timeseries, agricultural emissions have steadily decreased, largely due to declining numbers of dairy cattle. There was, however, a peak in the number of cows in 2006 and 2007 resulting in a peak in emissions.

Table 5 Agriculture sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2019	2020	% change 1990-2020	% change 2019-2020
3F Field burning	315			-100.0%	-
3G1 Liming - limestone	322	263	263	-18.3%	0.0%
3H Urea application	422	355	358	-15.1%	0.9%
3J Livestock	27,108	19,801	19,053	-29.7%	-3.8%
Grand Total	**28,166**	**20,419**	**19,674**	**-30.1%**	**-3.6%**

4.1.2 Gases

Emissions in the agriculture sector are dominated by emissions of methane (CH_4), which accounts for 56% of agriculture sector emissions in 2020. Of the remaining 2020 emissions, 41% came from nitrous oxide (N_2O) emissions and 3% from carbon dioxide (CO_2) (**Figure 9**). Emissions from methane primarily come from enteric fermentation and manure management from livestock. Mineralisation/immobilisation of agricultural soils, and application of fertilisers lead to emissions of N_2O. CO_2 emissions are caused by the application of urea to agricultural soils and liming.

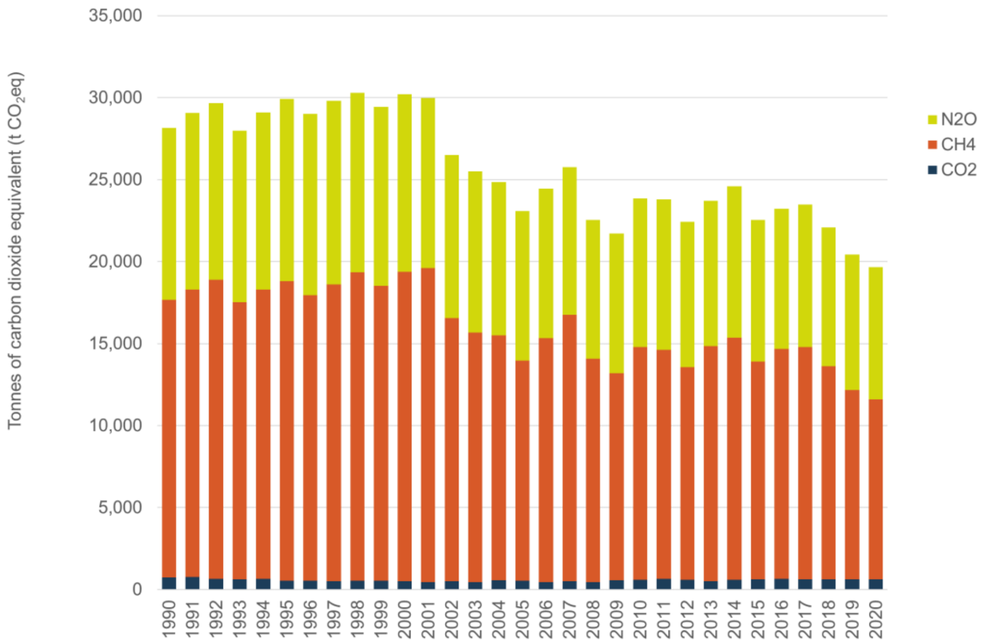


Figure 9 Agriculture sector emissions by greenhouse gas 1990-2020

4.1.3 Methodologies

Activity data

Activity data for the agriculture sector is provided by the Jersey Government, in the 'Agricultural Statistics' document. Jersey Government provided data up to 2020 while the most recent addition published online was in 2018 by the Department of Growth, Housing and Environment. The statistics provided include number of livestock, grassland and cereal areas, and crop and vegetable exports. Animal numbers are included in the inventory in the following categories: dairy cattle, non-dairy cattle, sheep, pigs, poultry, goats and horses.

Emission factors

“Implied emission factors” for the UK are generated by dividing total emissions from a source by total activity data such as livestock data and land area. In order to calculate the emission factor for enteric fermentation from pigs for example, the total UK emissions of methane from pig enteric fermentation is divided by total livestock numbers of pigs in the UK. This gives an emission factor that represents a weighted average of several different sources. These implied emission factors are applied to Jersey. Therefore, in this example, the implied emission factor for methane from pig enteric fermentation (based on UK data) is applied to Jersey pig livestock numbers. Similarly, in order to calculate the implied emission factor for synthetic fertilisers applied to grasslands, the UK total emissions of N_2O from synthetic fertilisers would be divided by total grassland areas in the UK. This implied emission factor would then be multiplied by Jersey specific activity data (grassland areas which are provided by the Centre for Ecology and Hydrology), in order to give the emissions from that source.

UK implied emission factors (which consider agricultural practices and climatic conditions on a UK level) are applied to the livestock data and, for agricultural soils, to cropland and grassland land areas. However, Jersey specific nuances are not captured (for example, body weight of Jersey specific cattle breeds and specific feed types). A reflection of these specific Jersey distinctions in the data would require improvements in the methodology and increased complexity in the inventory.

Assumptions

Implied emission factors represent weighted averages based on values from the UK which it is assumed can be applied to Jersey because the activities in Jersey are similar to those in the UK. The use of implied emission factors is a common approach used in calculating emission estimates where local data cannot be sourced.

Recent improvements to the inventory

Between the 1990-2019 and the 1990-2020 inventories there were some minor recalculations due to updated livestock numbers (mostly affecting 2018 and 2019 numbers) and updated data on land areas, affecting emissions from agricultural soils.

4.2 Business

4.2.1 Sector and sub-sector trends

Emissions from the business sector accounted for 16% of total greenhouse gas (GHG) emissions in the 2020 inventory. The largest business emissions source in 2020 is Other Manufacturing Industries and Construction (**Figure 10**). This subsector represents emissions from kerosene use in commercial settings.

Emissions from the business sector for Jersey are separated into 14 different subsectors, including air conditioning, refrigeration, stationary combustion in commercial and institutional settings and other manufacturing industries.

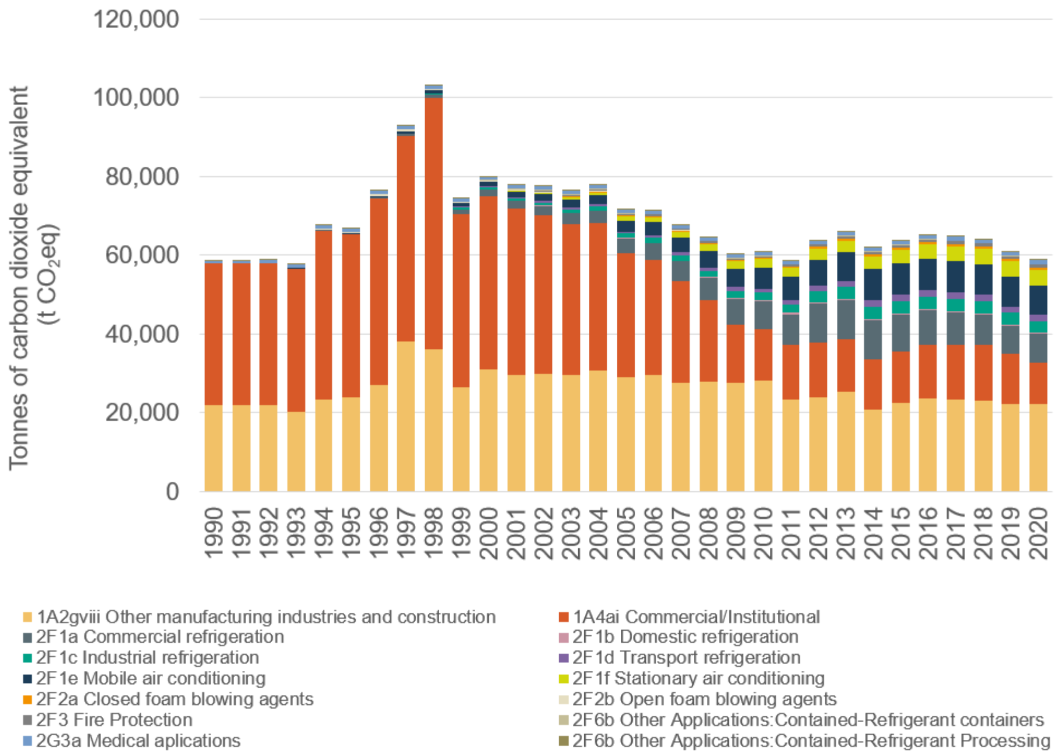


Figure 10 Business sector emissions by sub-sector 1990-2020

Emissions from the business sector increased by 0.1% from 1990-2020 but saw a reduction of 4% between 2019 and 2020 (**Table 6**). There is limited data from all of the subsectors at the start of the timeseries with no emissions reported from refrigeration, stationary air conditioning, blowing agents and fire protection.

Gas oil imports peaked in the late 1990s and this is related to an increase in the area of protected crops that were grown under glass. These crops, especially tomatoes, required heating which is reflected in the increased gas oil imports. Since the late 1990s this activity has substantially reduced and in 2006 and 2007 there was a government supported exit strategy for the high value protected crop sector.

Table 6 - Business sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2019	2020	% change 1990-2020	% change 2019-2020
1A2gviii Other manufacturing industries and construction	21,933	22,189	22,189	1.2%	0.0%
1A4ai Commercial/Institutional	35,912	12,861	10,679	-70.3%	-17.0%
2F1a Commercial refrigeration		7,178	7,178	-	0.0%
2F1b Domestic refrigeration		241	241	-	0.0%
2F1c Industrial refrigeration		3,007	3,007	-	0.0%
2F1d Transport refrigeration		1,545	1,545	-	0.0%
2F1e Mobile air conditioning	18	7,460	7,460	41,962.8%	0.0%
2F1f Stationary air conditioning		4,107	4,107	-	0.0%
2F2a Closed foam blowing agents		511	511	-	0.0%
2F2b Open foam blowing agents				-	0.0%
2F3 Fire Protection		699	699	-	0.0%
2F6b Other Applications: Contained-Refrigerant containers		98	98	-	0.0%
2F6b Other Applications: Contained-Refrigerant processing	0.62	21	21	3374.9%	0.0%
2G3a Medical applications	761	979	979	28.5%	0.0%
Grand Total	**58,625**	**60,895**	**58,713**	**0.1%**	**-3.6%**

4.2.2 Gases

Emissions in the business sector are dominated by emissions of carbon dioxide (CO_2), which account for 56% of business sector emissions in 2020. 42% of the remaining 2020 emissions come from HFCs, a fluorinated gas (**Figure 11**). Between 1990 and 2020, CO_2 emissions fell by 43% from 57,567 tonnes of carbon dioxide equivalent (tCO_2eq) to 32,729 tCO_2eq but peaked in 1998 at 99,588 tCO_2eq.

HFC emissions are associated with refrigeration and air conditioning. Whilst these emissions have grown since 1990, emissions have declined in more recent years from 27,343 tCO_2eq in 2014 to 24,866 tCO_2eq in 2020 (**Figure 11**).

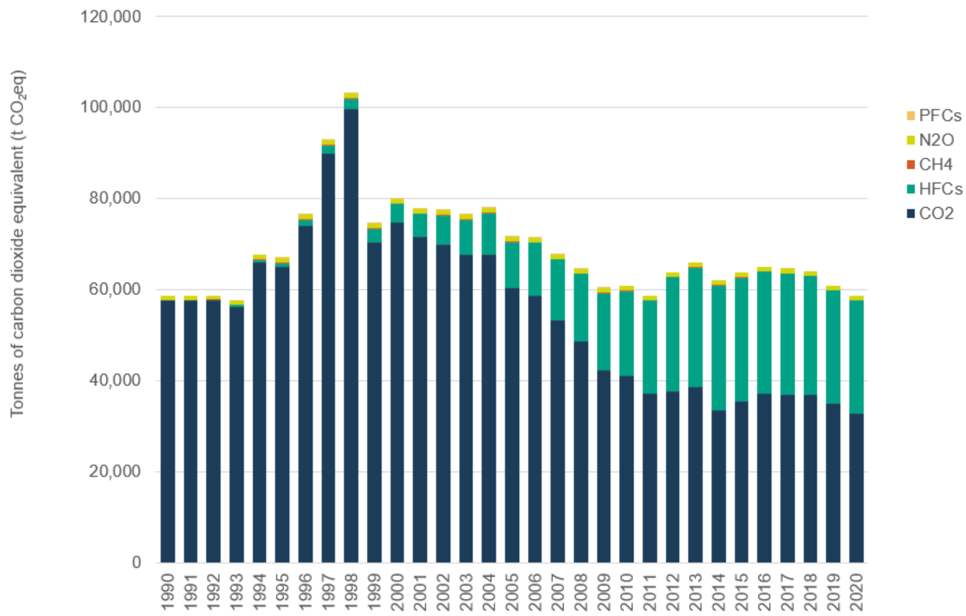


Figure 11 Business sector emissions by greenhouse gas 1990-2020

4.2.3 Methodologies

Activity data

Data to calculate emissions in the business sector comes from the 'Jersey Energy Trends' report which is published annually. Emissions arising from solvents are based on UK emissions and scaled by Jersey specific indicators such as population, GDP and number of houses. Population estimates are sourced from Government of Jersey publications, most recently 'Jersey Resident Population 2020 Estimate' report. GDP estimates are taken from 'Measuring Jersey's Economy GVA and GDP'. House numbers are extrapolated from the 2011 census figure, by dividing the Jersey total population by the 'number of persons per household' statistic.

Emission factors

Emission factors for carbon are UK specific, applied to the Jersey inventory. For other gases, default emission factors found in the 2019 EMEP/EEA Guidebook[8] are used. The Guidebook is an international document that supports the reporting of national emissions inventories by setting out methodologies, describing the data that is needed and providing default emission factors.

Assumptions

To split fuel use data (kerosene, heavy fuel oil, gas oil, LPG and coal) between residential and commercial, a 70/30 split is used, therefore assuming that 30% of the fuel used is being used in commercial settings. This assumption has been made based on advice from a representative fuel supplier. Emissions arising from solvent use (e.g. substances used to make products such as paint) are based on UK emissions and are scaled by proxy data such as GDP, population and number of households thereby assuming that activities are

[8] https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

similar to those in the UK. Similarly, for carbon dioxide emissions, UK emissions factors are used therefore assuming that activities in Jersey are similar to those in the UK.

Recent improvements to the inventory

Between the 1990-2019 inventory and the most recent 1990-2020 inventory, there has been the inclusion of an additional source: f-gas emissions from the processing of contained refrigerants. These are included under 2F6b Other Applications: Contained-Refrigerant Processing.

4.3 Energy supply

4.3.1 Sector and sub-sector trends

Emissions from the energy supply sector accounted for 13% of total greenhouse gas (GHG) emissions in the 2020 inventory. All emissions in this sector are attributed to the generation of public electricity (**Figure 12**).

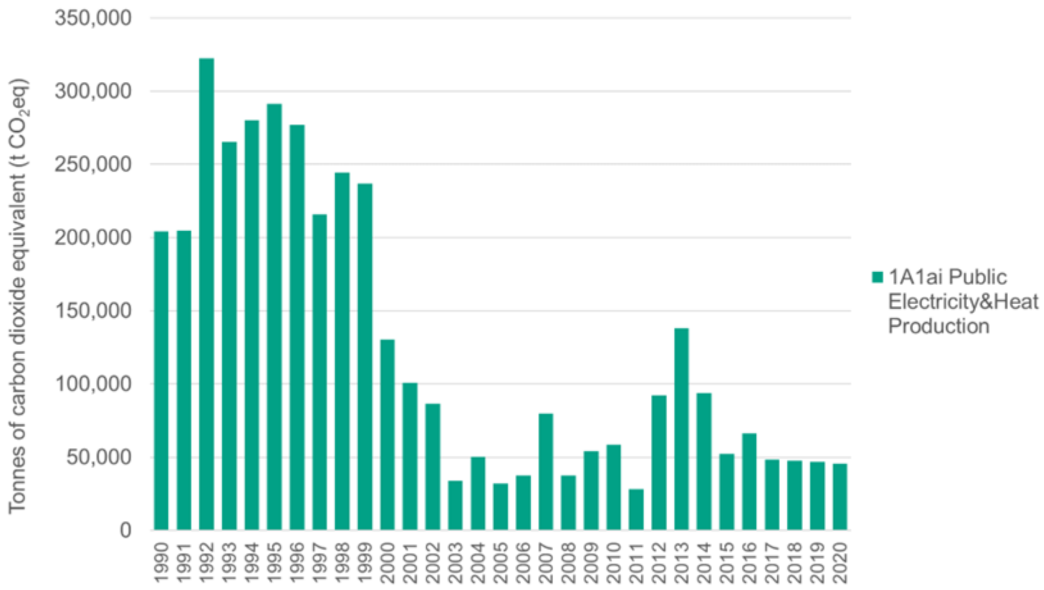


Figure 12 Energy supply sector emissions by sub-sector 1990-2020

Emissions from the energy supply sector reduced by 78% from 1990-2020 and saw a reduction of 3% between 2019 and 2020 (**Table 7**). Emissions from the energy supply sector reduced significantly when the 900MW Normandie 2 supply cable was installed in 2000 reducing the need for the diesel engine power plant. In 2012, the failure of this cable meant electricity had to be generated on-island using gas turbines and diesel engines leading to a spike in emissions until the cable was restored in 2014.

Table 7 Energy supply sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2019	2020	% change 1990-2020	% change 2019-2020
1A1ai Public electricity and heat production	204,221	46,759	45,482	-77.7%	-2.7%
Grand Total	**204,221**	**46,759**	**45,482**	**-77.7%**	**-2.7%**

4.3.2 Gases

Emissions in the energy supply sector are dominated by emissions of carbon dioxide (CO_2), which accounts for 97% of emissions in 2020. Between 1990 and 2020, CO_2 emissions fell by 78% from 203,079 tCO_2eq to 44,118 tCO_2eq but peaked in 1992 at 321,066 tCO_2eq (**Figure 13**).

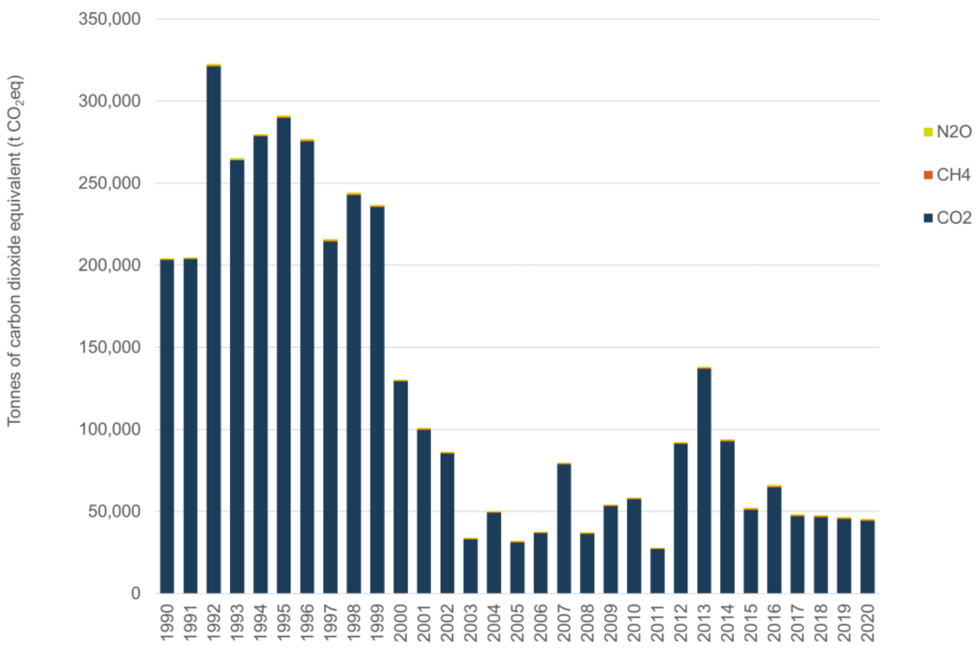


Figure 13 Energy supply sector emissions by greenhouse gas 1990-2020

4.3.3 Methodologies

Activity data

The Jersey government publishes the 'Jersey Energy Trends' annually which provides the statistics for the energy supply and transport sector. The amount of heavy fuel used on the island is influenced by the consistency of energy supply from France. For example, when the subsea cable failed in 2012, electricity had to be generated using the on-island backup generators, increasing emissions from energy supply. These emissions are accounted for in the Jersey inventory. For electricity that is imported from France, emissions are accounted for in the French inventory and not in the Jersey inventory. Municipal solid waste that is burned at the Energy Recovery Facility also contributes to emissions in the energy supply sector (see section 2.1 for more detail). Municipal Solid Waste data is taken from 'Jersey in Figures'.

Emission factors

Emissions factors for CO_2 from power stations are taken from the UK inventory and are UK specific factors. Non-CO_2 emission factors and the emissions factor for incineration of municipal solid waste are IPCC defaults. IPCC defaults are emissions factors that are found in the IPCC guidelines – international literature providing methods and information on emissions inventories.

Assumptions

The energy balance statistics received from the Jersey government provide all the data required for estimating emissions from energy supply, so there are no significant assumptions that have been made.

Recent improvements to the inventory

Between the 1990-2019 inventory and the 1990-2020 inventory there has been a revision to the carbon emission factor for municipal solid waste. This revision has been made at the UK level. Small revisions have also been made to the DUKES conversion factors used to convert fuel quantities into energy units (TJ).

4.4 Industrial processes

4.4.1 Sector and sub-sector trends

Emissions from the industrial processes sector accounted for 0.03% of total greenhouse gas (GHG) emissions in the 2020 inventory. All emissions in this sector are attributed to N_2O from product use: Other. This sub-sector is now included to improve the completeness of Jersey's inventory and relates to emissions from N_2O use as a propellant in squirty cream. (**Figure 14**).

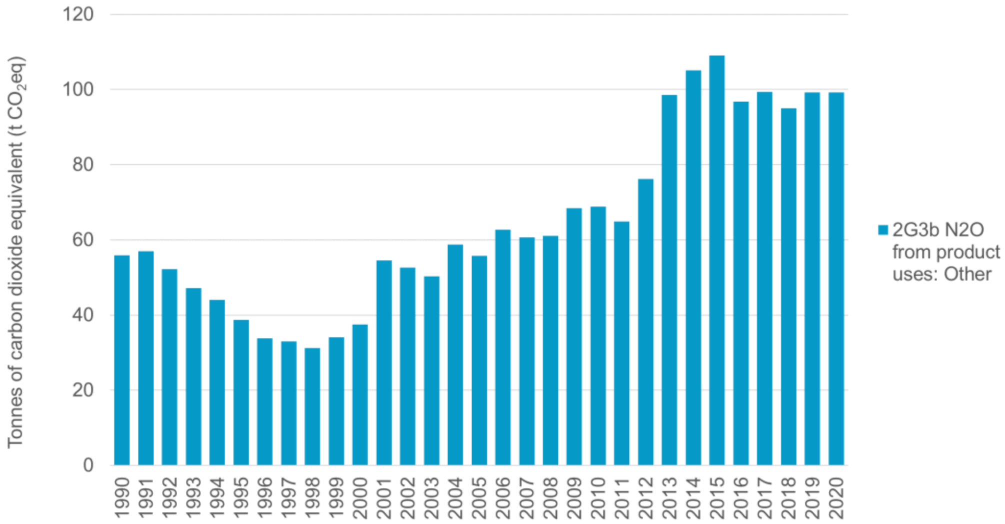


Figure 14 Industrial processes sector emissions by sub-sector 1990-2020

Despite decreasing between 1991 and 1998, emissions from the industrial processes sector have increased by 78% from 1990-2020 (**Table 8**).

Table 8 Industrial processes sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2019	2020	% change 1990-2020	% change 2019-2020
2G3b N_2O from product uses: Other	56	99	99	77.9%	0.0%
Grand Total	**56**	**99**	**99**	**77.9%**	**0.0%**

4.4.2 Gases

Emissions in the industrial processes sector, specifically the subsector 2G3b N_2O from product use: Other, are entirely emissions of N_2O, which have increased from 56 tCO_2eq to 99 tCO_2eq between 1990 and 2020, peaking in 2015 at 109 tCO_2eq (**Figure 15**).

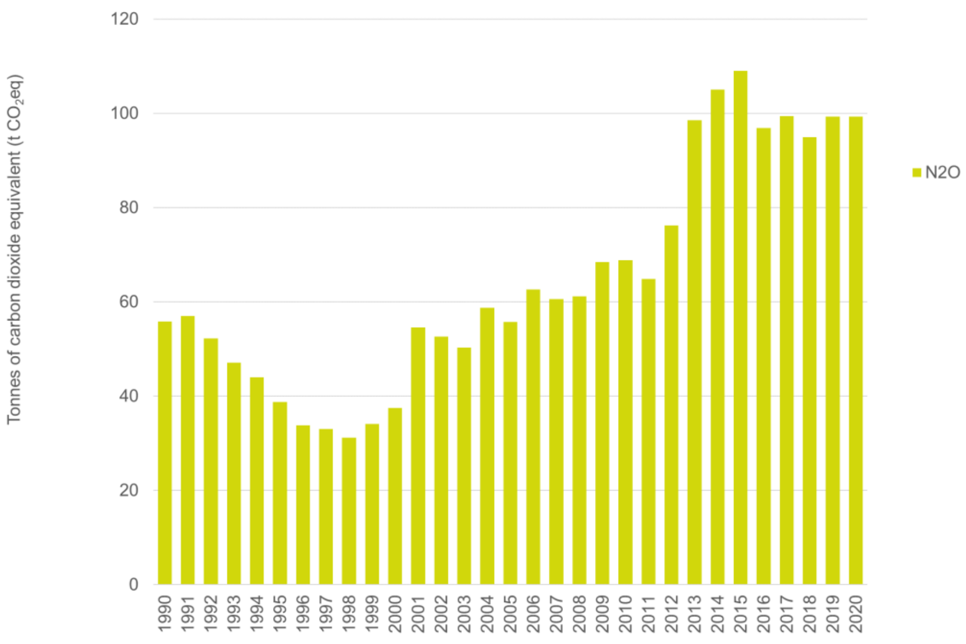


Figure 15 Industrial processes sector emissions by greenhouse gas 1990-2020

4.4.3 Methodologies

Activity data

Estimates of emissions from 2G3b N_2O from product use: Other in Jersey are scaled from the UK estimate using GDP as a proxy. For the UK estimate, cream consumption data is available from the Department for Environment, Food and Rural Affairs (DEFRA).

Emission factors

The methodology for this sub-sector uses emission factors presented in the Danish GHG inventory. This assumes that UK consumption of whipped cream sprays and the design of these products are the same in the UK as they are in Denmark.

Assumptions

The UK method for calculating emissions in this sub-sector assumes that 1% of cream consumption is in the form of whipped cream sprays and that N_2O consumption in those sprays is equal to 5% of the mass of the cream. It also assumes that all emissions are N_2O. As Jersey emissions are scaled from the UK, these assumptions are also applicable to the Jersey estimate.

Recent improvements to the inventory

Between the 1990-2019 inventory and the 1990-2020 inventory there have been small recalculation due to recalculations of the Jersey and UK GDP datasets for 2019.

4.5 Land use change

The land use, land use change and forestry (LULUCF) sector includes emissions from the conversion of land to other land types and forestry and harvested wood products.

4.5.1 Sector and sub-sector trends

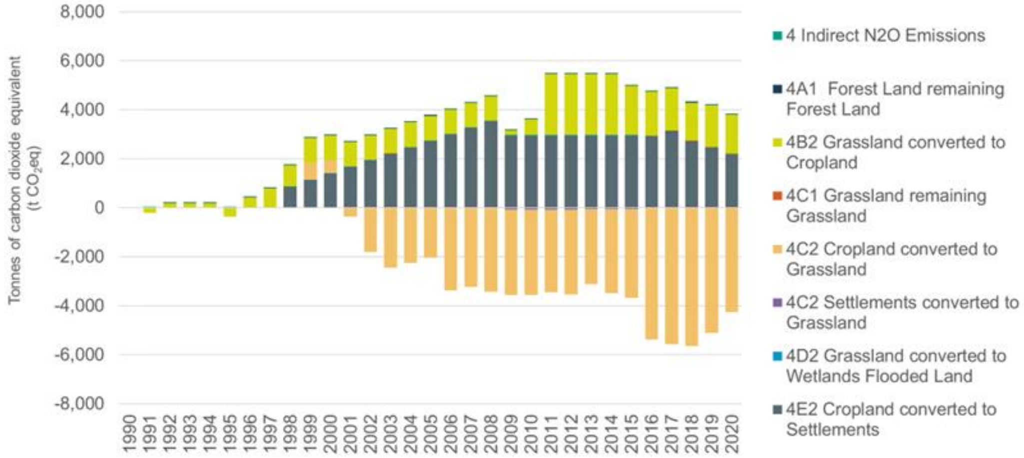


Figure 16 Land Use Change sector emissions by sub-sector 1991-2020

Jersey has a net sink (a negative emission) in the land use change sector, mostly attributed to cropland converted to grassland (**Figure 16**). This means that more carbon dioxide (CO_2) is removed from the atmosphere than the amount of greenhouse gases that are released. When this arises, the emissions source is instead referred to as a sink, and emissions can be expressed as a negative value. Cropland converted to grassland is the only emission sink in 2020, with 4,263 tonnes of carbon being stored in the land and not emitted into the atmosphere. Converting grassland to cropland results in 1,608 tonnes of carbon being released and converting cropland to settlements released 2,199 tonnes of carbon in 2020. (**Table 9**). As there is limited data available for land cover types and a simple methodology is applied to calculate emissions, some sources do not have any associated emissions.

Due to the complex nature of carbon flows within terrestrial ecosystems, there is a lag-time between land use changing and the effect that this has on emissions. As an example, in one year there may be a change in land use from grassland to forest land. The default period for carbon emissions and removals to reach equilibrium is 20 years, according to the IPCC Guidelines. Until this equilibrium is reached, the rate of emissions and removals will vary. For example, in the immediate years after grassland has converted into forest land where there is a high rate of tree growth. Conversely, in later years emissions from biomass decomposition may exceed removals. The emissions in the inventory therefore reflect the legacy effect of a change in land use over the course of multiple years.

Table 9 Land Use, Land Use Change and Forestry (LULUCF) sector emissions by sub-sector with absolute changes

Tonnes of carbon dioxide equivalent (tCO_2eq)					
	1991	**2019**	**2020**	**Absolute change 1991-2020**	**Absolute change 2019-2020**
4E2 Cropland converted to Settlements		2,466	2,199	2,199	-267
4B2 Grassland converted to Cropland	-212	1,726	1,608	1,821	-118
4A1 Forest Land remaining Forest Land	21	21	21	0	0
4C1 Grassland remaining Grassland	2	4	4	1	0
4 Indirect N2O Emissions	0.033	1	0.74	1	0
4D2 Grassland converted to Wetlands Flooded Land				0	0
4C2 Settlements converted to Grassland				0	0
4C2 Cropland converted to Grassland		-5,100	-4,263	-4,263	837
Grand Total	**-189**	**-883**	**-431**	**-242**	**452**

4.5.2 Gases

In the LULUCF sector in 2020, emissions of CO_2 are negative (-764 tonnes of CO_2) meaning that more carbon dioxide is removed from the atmosphere than is released. In contrast, the LULUCF sector is a source of N_2O in 2020, emitting 331 tonnes of carbon dioxide equivalent (**Figure 17**). N_2O emissions from the LULUCF sector are emitted from forest land remaining forest land, grassland converted to cropland, grassland remaining grassland and cropland converted to settlements, and through indirect emissions. There is an increase in emissions from 'Indirect N_2O'. This nitrous oxide gas is released when nitrogen is removed from agricultural soils and animal waste, via processes like leaching, harvest and runoff.

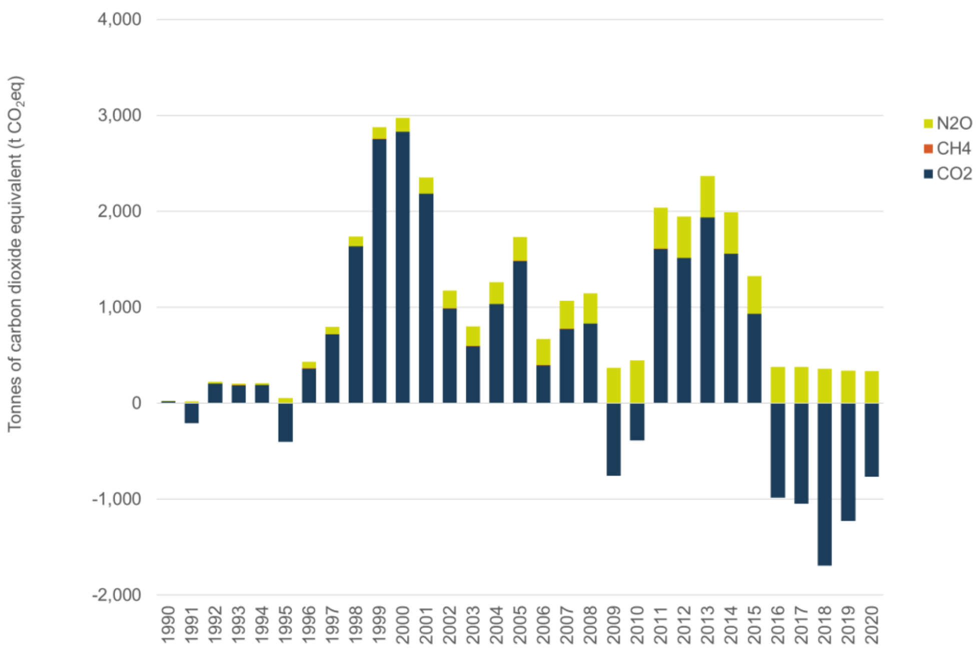


Figure 17 Land Use Change sector emissions by greenhouse gas 1991-2020

4.5.3 Methodologies

Activity data

Land cover surveys and agricultural land statistics have been used to compile annual land use change matrices for Jersey. These are then converted into a format consistent with international guidance (from the UNFCCC). Activity data for this sector, specifically land use areas, are supplied from various publications from the Government of Jersey. Forestry land area statistics for the years 1990-2010 are provided by the 'FAO (2010) Global Forest Resources Assessment: Jersey'. Statistics on Forestland, Cropland, Grassland and Settlement land areas for 2006, 2008-2011 are provided in the documents 'Jersey in Figures 2008-2011'. As no new surveys have been conducted, data for the most recent years has been extrapolated from the last available data.

Emission factors

Emission factors for estimating LULUCF emissions from Jersey are default factors found in the IPCC Guidebook. Emission factors for calculating harvested wood products and forest land fluxes come from a Carbon-Flow model.

Assumptions

The activity data for Jersey does not cover the entire time series, with most data covering until 2011. Activity data for the latter years are therefore extrapolated from the latest available year, which assumes a certain trend in the activity data has occurred. Other specific assumptions include the use of a carbon flow model to calculate forest land fluxes; only perennial crops included in the 'Crop remaining crop' subsector; rate of UK forest and grassland wildfires used as a proxy for Jersey; and default values for Soil Organic Carbon (SOC) in different land areas.

Recent improvements to the inventory

There have been changes made to the methodology and emission factors used to calculate emissions for Forest Land categories.

4.6 Residential

The residential sector includes emissions from residential stationary combustion, metered dose inhalers and other aerosols.

4.6.1 Sector and sub-sector trends

Emissions from the residential sector accounted for 26% of total GHG emissions in the 2020 inventory. The majority of emissions are from residential stationary combustion, the burning of fuels in homes, mainly for heating and cooking (**Figure 18**).

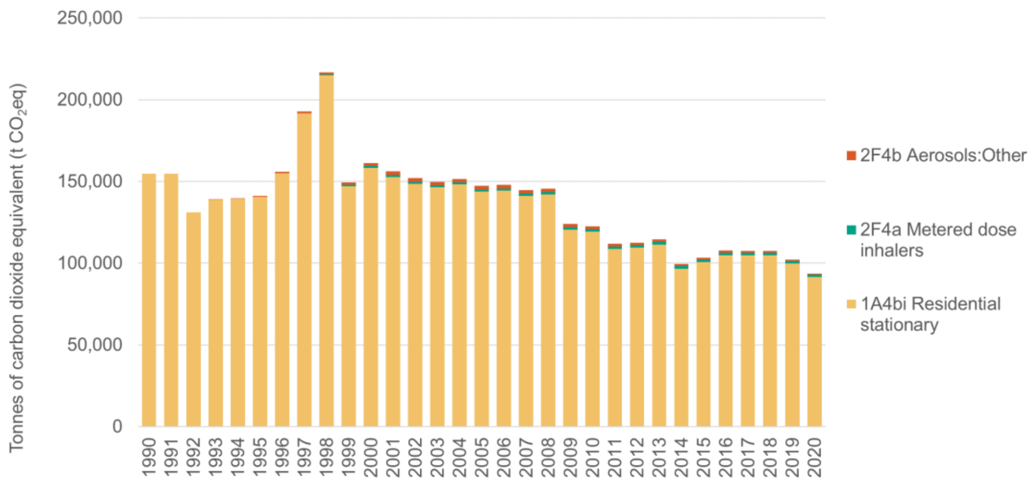


Figure 18 Residential sector emissions by sub-sector 1990-2020

Between 1990 and 2020, residential sector emissions have decreased by 39% from 154,767 to 93,741 tonnes of carbon dioxide equivalent (tCO_2eq). As mentioned above, this is driven by emissions from combustion of fuels in homes. There is an increase in emissions from 1996 to 1998 which is being driven by a peak in kerosene and gas oil use. Emissions were increasing between 2014 and 2016 but remained relatively constant from 2016 to 2018. A decrease in emissions of 8% is seen between 2019 and 2020 (**Table 10**).

Table 10 Residential sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)					
	1990	2019	2020	% change 1990-2020	% change 2019-2020
1A4bi Residential stationary	154,767	99,751	91,397	-40.9%	-8.4%
2F4a Metered dose inhalers		1,607	1,607	-	0.0%
2F4b Aerosols: Other		737	737	-	0.0%
Grand Total	**154,767**	**102,095**	**93,741**	**-39.4%**	**-8.2%**

4.6.2 Gases

Emissions in the residential sector are dominated by emissions of carbon dioxide (CO_2) which accounted for 97% of residential emissions in 2020. Between 1990 and 2020, residential sector CO_2 emissions fell by 40% from 151,326 to 90,912 tCO_2eq (**Figure 19**). This trend is being driven by a reduction in the use of all fuel types for residential stationary combustion as a result of the uptake of electrical space heating and an associated switch from gas and oil to electricity.

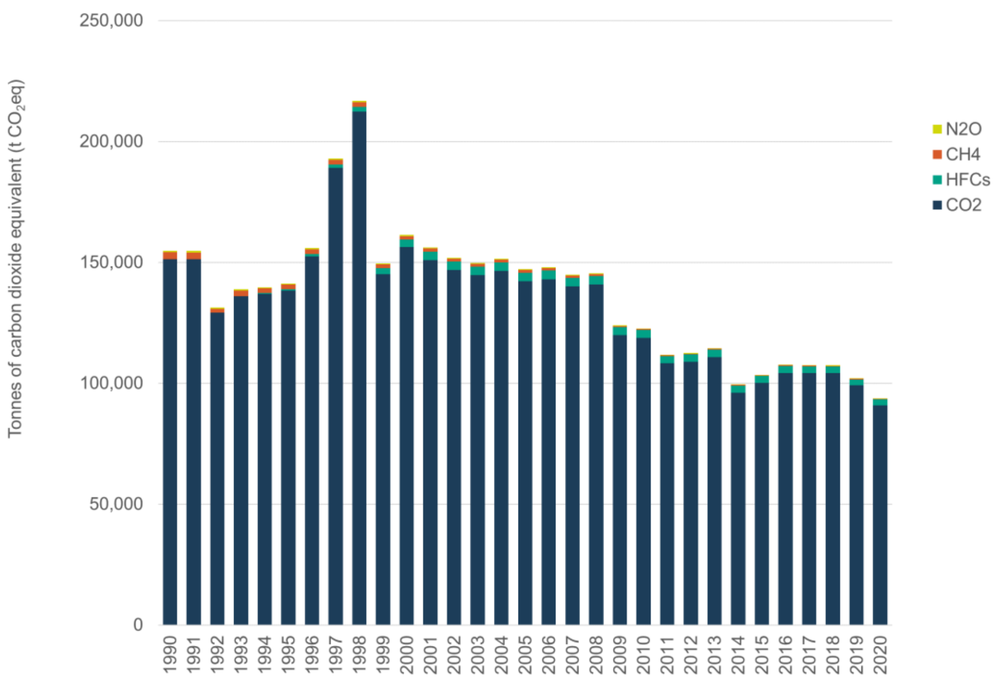


Figure 19 Residential sector emissions by greenhouse gas 1990-2020

4.6.3 Methodologies

Activity data

Data on fuel use is obtained from the 'Jersey Energy Trends' report which is published annually.

Emission factors

Emission factors for carbon are UK specific, applied to the Jersey inventory. For other gases, default emission factors found in the 2019 EMEP/EEA Guidebook[9] are used. The Guidebook is an international document that supports the reporting of national emissions inventories by setting out methodologies, describing the data that is needed and providing default emission factors.

Assumptions

To estimate the split of fuel use (kerosene, heavy fuel oil, gas oil, LPG and coal) between residential and commercial, a 70/30 split is used, therefore assuming that 70% of the fuel used is being used in residential settings. This assumption has been made based on advice from a representative fuel supplier. Emissions arising from solvent use are based on UK emissions and are scaled by proxy data such as GDP, population and number of households thereby assuming that activities are similar to those in the UK. Similarly, for carbon dioxide emissions, UK emissions factors are used therefore assuming that activities in Jersey are similar to those in the UK.

[9] https://www.eea.europa.eu/publications/emep-eea-guidebook-2019

Recent improvements to the inventory

Between the 1990-2019 inventory and the most recent 1990-2020 inventory there are very minor recalculations due to small adjustments in the carbon emission factor for domestic combustion of burning oil made at the UK level.

4.7 Transport

The transport sector includes emissions from road transport, domestic aviation and domestic navigation (i.e. shipping). Domestic aviation and navigation refer to activities that occur within Jersey and between Jersey and the UK. This includes, for example, take-off, landing and internal, recreational flights and shipping activity that occurs within Jersey waters. For international aviation and shipping (journeys to and from other countries), the emissions are equally divided between the two countries. However, these statistics are recorded as memo items to the inventory and are not included in the national total.

4.7.1 Sector and sub-sector trends

Transport sector emissions accounts for 36% of total GHG emissions in the 2020 inventory. The largest emissions source in 2020 in this sector is passenger cars (**Figure 20**). Between 1990 and 2020, emissions in the transport sector have decreased by 37% from 201,888 to 127,895 tCO_2eq.

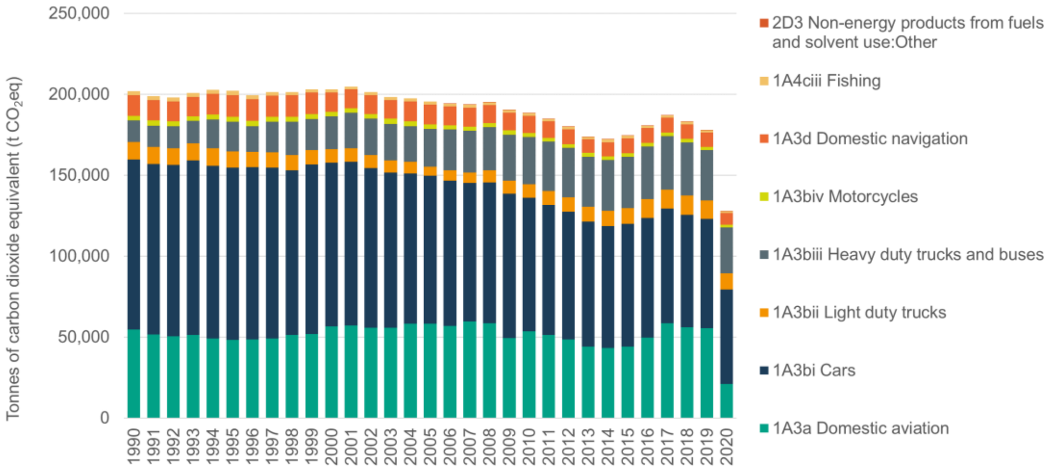


Figure 20 Transport sector emissions by sub-sector 1990-2020

The overall trend is dominated by emissions from passenger cars and domestic aviation. Passenger car emissions have decreased by 45% between 1990 and 2020 and by 14% between 2019 and 2020 (**Table 11**). Between 1990 and 2020, all sources of transport emissions decrease except for heavy-duty trucks and buses. The transport sector was heavily impacted by the COVID-19 pandemic in 2020, resulting in a significant decrease in emissions from 55,444 tCO2eq in 2019 to 20,994 tCO2eq in 2020. A decrease in emissions was seen across all transport modes but is most notable with domestic aviation (62%) due to a reduction in the number of flights across this period.

Table 11 Transport sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2019	2020	% change 1990-2020	% change 2019-2020
1A3a Domestic aviation	54,504	55,444	20,994	-61.5%	-62.1%
1A3bi Cars	105,290	67,674	58,266	-44.7%	-13.9%
1A3bii Light duty trucks	10,722	11,224	10,104	-5.8%	-10.0%
1A3biii Heavy duty trucks and buses	13,214	31,127	28,355	114.6%	-8.9%
1A3biv Motorcycles	2,952	2,108	1,796	-39.1%	-14.8%
1A3d Domestic navigation	12,830	8,743	6,979	-45.6%	-20.2%
1A4ciii Fishing	2,376	1,419	1,329	-44.0%	-6.3%
2D3 Non-energy products from fuels and solvent use: Other		78	71	-	-8.9%
Grand Total	**201,888**	**177,819**	**127,895**	**-36.7%**	**-28.1%**

4.7.2 Gases

Transport sector emissions are predominantly carbon dioxide (CO_2). CO_2 emissions account for 99% of total emissions in 2020 with nitrous oxide (N_2O) making up 0.8% and methane (CH_4) the remaining 0.2%. CO_2 emissions have decreased by 36% between 1990 and 2020 and by 28% between 2019 and 2020 (**Figure 21**).

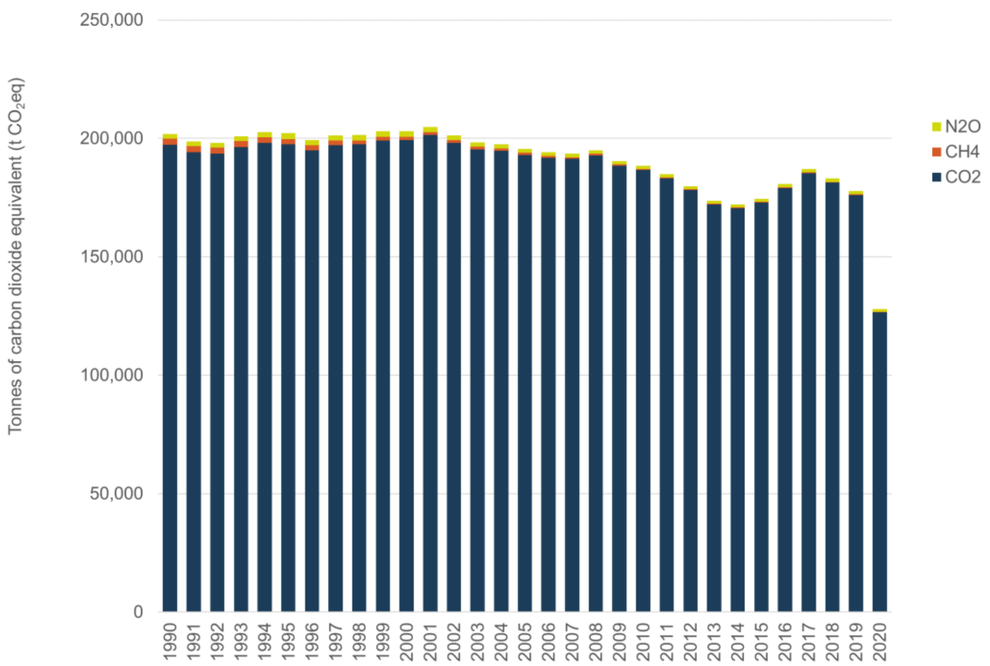


Figure 21 Transport sector emissions by greenhouse gas 1990-2020

4.7.3 Methodologies

Activity data

Road transport: Fuel consumption split by fuel type is taken from the 'Jersey Energy Trends' report. Vehicle data is provided annually by the Government's Department of Infrastructure, Housing and the Environment (Driver and Vehicle Standards), for the GHG inventory reporting. For the 1990-2018, 1990-2019 and 1990 – 2020 inventories, this data was updated to take account of an updated assumption regarding vehicle numbers in 2019 made in the 'Quantitative analysis of carbon neutrality by 2030' report[10].

Aviation: Detailed aviation activity data is provided by the UK Civil Aviation Authority (CAA), including aircraft movements broken down by airport, aircraft type and destination. Deliveries of aviation spirit and aviation turbine fuel are provided in the Digest of UK Energy Statistics (DUKES).

Shipping: For 2014 the UK inventory used data from high-resolution Automatic Identification System (AIS) to provide detailed data on vessels and vessel movements. For other years, shipping mode-specific proxy data (including port statistics provided by the Department for Transport) are used to generate a time series.

Emission factors

Road transport: UK vehicle emission factors by vehicle type (and by euro standard) are applied to Jersey and the properties of the fuel are assumed to be the same as the UK and are therefore taken from DUKES. The factors used assume that petrol and diesel for road transport are 100% mineral.

Aviation: A UK specific emission factor for carbon is applied to Jersey. For non-CO_2 emissions, default emission factors from the 2016 EMEP/EEA Guidebook are used.

Shipping: For carbon and N_2O, shipping specific factors from the International Maritime Organisation (2015) are used. For methane, the emission factor is taken from a 2004 study by IVL (Swedish Environmental Research Institute).

Assumptions

Road transport: Fleet mix, in terms of the age distribution of vehicles, is assumed to be the same as that of the UK. Updated 2019 vehicle numbers provided in the 'Quantitative analysis of carbon neutrality by 2030' report were used and extrapolated for 2020. The 2020 data assumes that vehicles registered before 2000 are no longer operational. This is because official data on vehicle numbers does not take account of deregistered vehicles and therefore does not reflect the actual number of operational vehicles.

Aviation: The aviation estimates are generated by a model compiled for the purposes of the UK inventory, which is considered to be detailed and of good quality. International flights that first stop at a domestic airport are accounted as having a domestic leg and an international leg.

Shipping: The main assumption in the shipping sector concerns the allocation of vessel movements to domestic or international, where a cargo or passenger vessel starts or finishes in a UK port when it goes out of AIS signal range. The shipping estimates are

[10] https://www.gov.je/SiteCollectionDocuments/Environment%20and%20greener%20living/R-Oxera%20Quantitative%20analysis%20of%20carbon%20neutrality%20by%202030%2020200401%20HL.pdf

generated by a model compiled for the purposes of the UK inventory, which is considered to be detailed and of good quality.

Recent improvements to the inventory

Road transport: There are minor recalculations throughout the timeseries due to updated DUKES conversion factors, used to convert the activity data to energy units (TJ). There was also a revision to the amount of petrol and diesel consumed for road transport in 2018 and 2019 in the updated Energy Trends report.

Shipping: Emissions from fishing vessels have been recalculated due to updated NAEI emission factors which are now published on a kt/TJ basis. This has impacted emissions across the whole timeseries.

4.8 Waste management

The waste management sector includes emissions from domestic wastewater treatment. Emissions generated by the Energy Recovery Facility (incineration of municipal solid waste) are accounted for under the energy supply sector.

4.8.1 Sector and sub-sector trends

Emissions from the waste management sector accounted for 3% of total GHG emissions in the 2020 inventory. Emissions from the waste management sector have increased by 35% across the time series, although remained constant between 2019 and 2020 (**Figure 22**).

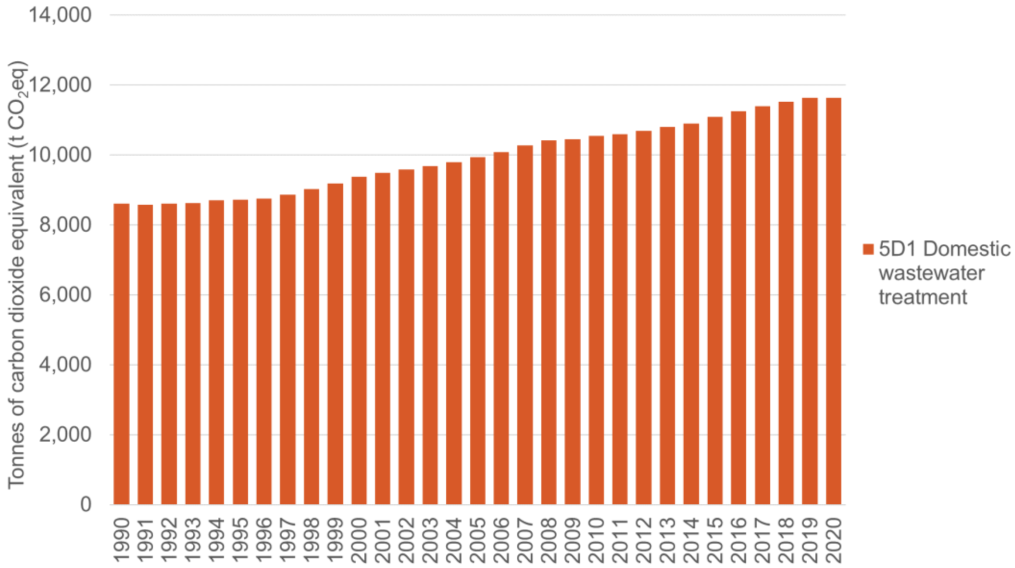


Figure 22 Waste management sector emissions by sub-sector 1990-2020

Across the entire time series, there has been a steady increase in total emissions from 8,612 in 1990 to 11,635 tCO_2eq in 2020. The only source of emissions from the waste management sector for Jersey is from the domestic wastewater treatment sector (**Table 12**). Emissions have therefore increased as population has increased.

Table 12 Waste management sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2019	2020	% change 1990-2020	% change 2019-2020
5D1 Domestic wastewater treatment	8,612	11,635	11,635	35.1%	0.0%
Grand Total	**8,612**	**11,635**	**11,635**	**35.1%**	**0.0%**

4.8.2 Gases

Emissions from the waste management sector are split between methane (CH_4) and nitrous oxide (N_2O). CH_4 accounts for 38% of waste management sector emissions in 2020, whilst N_2O accounts for 62%. Between 1990 and 2020, CH_4 and N_2O emissions have steadily increased by 29% and 39% respectively. Between 2019 and 2020, emissions did not change (**Figure 23**).

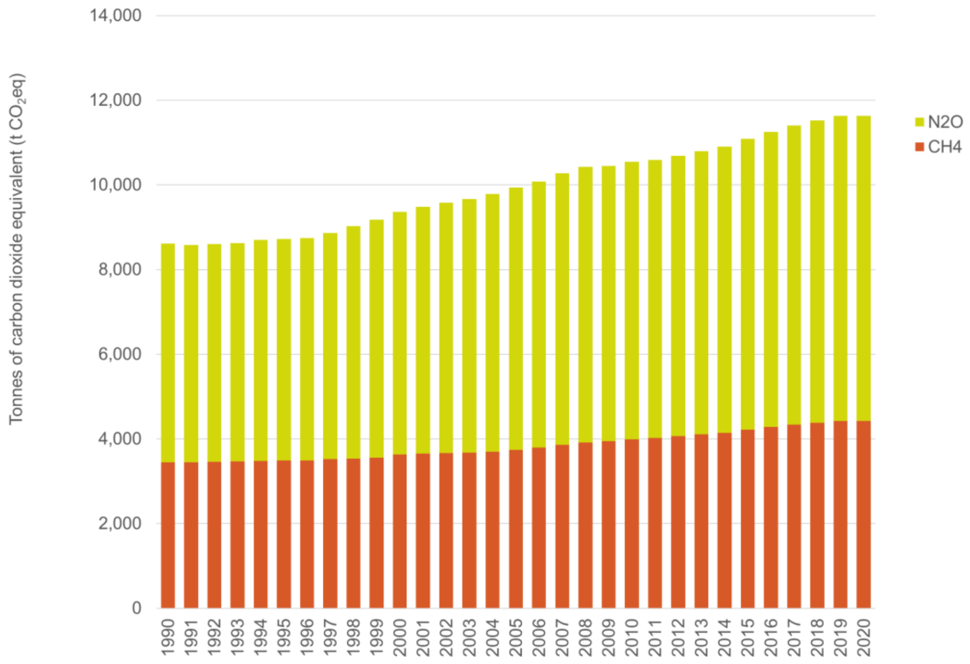


Figure 23 Waste management sector emissions by greenhouse gas 1990-2020

4.8.3 Methodologies

Activity data

Population estimated are sourced from Government of Jersey publications, most recently 'Jersey Resident Population 2019 Estimate' report. Per capita protein consumption (kg/person/year) was provided by FAOSTAT in 2011 and is used to calculate the total amount of nitrogen in effluent. This has not been updated since 2011 and is assumed to be static from the 2011 number.

Emissions from domestic wastewater treatment are estimated using UK data, scaled by population.

Emission factors

Current emission factors for the waste management sector are default values taken from the relevant literature such as the IPCC Guidebook.

Assumptions

It is assumed that domestic wastewater management practices are comparable to those of the UK.

Recent improvements to the inventory

There were no recalculations in this sector.

5 Annex 1 Inventory Detail

5.1 GHG inventory sub-sectors

Sector	Sub-sector	Description	Data sources
Agriculture	3F Field burning	Emissions from open burning of agriculture residues. This activity ceased in 1993 in England and Wales and is considered negligible in Northern Ireland and Scotland	Land area surveys from Centre for Ecology and Hydrology (CEH) and activity data from Rothamsted
	3G1 Liming	Emissions from the use of lime in agricultural soils	Activity data and estimated emissions from liming from CEH
	3H Urea application	Emissions from the application of urea to agricultural soils	Land area surveys from CEH and Implied emission factors from Rothamsted
	3J Livestock	Emissions from enteric fermentation and manure management for livestock and managed soil from fertiliser application and indirect emissions from agricultural soils	Agricultural Statistics
Business	1A2gviii Other manufacturing industries and construction	Emissions from the use of kerosene in commercial settings	Energy Trends report
	1A4ai Commercial/Institutional	Miscellaneous fuel combustion in industrial and commercial buildings, for example fuel combustion for heating	
	2F1a Commercial refrigeration	F-gas emissions released during the manufacture, operation and disposal of commercial refrigeration units	GDP data from Measuring Jersey's Economy report
	2F1b Domestic refrigeration	F-gas emissions released during the manufacture, operation and disposal of domestic refrigeration units	Population data from Jersey Resident Population report
	2F1c Industrial refrigeration	F-gas emissions released during the manufacture, operation and disposal of industrial refrigeration units. These are considered to be the largest refrigeration units with the greatest cooling capacity	GDP data from Measuring Jersey's Economy report
	2F1d Transport refrigeration	Emissions from refrigeration during transport, for example refrigerated trucks and refrigerated containers on ships	
	2F1e Mobile air conditioning	Emissions from air conditioning – mobile sources, for example f-gas emissions released during manufacture, use and disposal of vehicle air conditioning systems	Number of vehicles data from the Jersey Government

Sector	Sub-sector	Description	Data sources
	2F1f Stationary air conditioning	Emissions from manufacture, use and disposal of stationary air conditioning units	Population data from Jersey Resident Population report
	2F2a Closed foam blowing agents 2F2b Open foam blowing agents	HFCs are being used as replacements for CFCs and HCFCs in foams, particularly in closed-cell insulation applications. The processes and applications for which these various HFCs are being used include insulation boards and panels, pipe sections, sprayed systems and one-component gap filling foams	GDP data from Measuring Jersey's Economy report
	2F3 Fire Protection	Emissions from firefighting. There are two general types of fire protection (fire suppression) equipment that use greenhouse gases as partial replacements for halons: portable (streaming) equipment, and fixed (flooding) equipment	
	2F6b Other Applications: Contained-Refrigerant containers	Emissions from leakage of refrigerants from containers during transport and repackaging	
	2F6b Other Applications: Contained-Refrigerant processing	Emissions from leakage from contained refrigerants during processing, for example during reclamation. Note this has the same subsector code as above	
	2G3a Medical applications	Emissions from the use of N_2O as an anaesthetic	Population data from Jersey Resident Population report
Energy supply	1A1ai Public electricity and heat production	Emissions from all fuel use for electricity generation. In Jersey and Guernsey this include use of fuel oil, gas oil and municipal solid waste	Energy Trends report
Land use change	4 Indirect N_2O emissions	Indirect emissions from nitrogen leaching and run-off associated with land use and land use change	Land surveys and activity data held by CEH
	4B2_2 Grassland converted to cropland	Emissions and removals from grassland that is converted to cropland (carbon stock change and N mineralisation/immobilisation)	
	4C2_2 Cropland converted to grassland	Emissions and removals from cropland that is converted to grassland (carbon stock change)	
	4E2_2 Cropland converted to settlements	Emissions and removals from cropland that is converted to settlements (carbon stock change and N mineralisation/immobilisation)	
	4D2 Land converted to Wetlands	Emissions and removals from grassland converted to flooded land (carbon stock change)	

Sector	Sub-sector	Description	Data sources
	4A1 Forest Land remaining Forest Land	Emissions and removals from forest land that remains forest land, specifically from biomass burning through wildfires	
	4C1 Grassland remaining Grassland	Emissions and removals from grassland that remains grassland, specifically from biomass burning through wildfires	
	4C2_4 Settlements converted to Grassland	Emissions and removals from settlements converted to grassland (carbon stock change)	
Residential	1A4bi Residential stationary	Emissions from all fuel combustion in households	Energy Trends report
	2F4a Metered dose inhalers	Most aerosol packages now contain hydrocarbon (HC) as propellants but, in a small fraction of the total, HFCs and PFCs may be used as propellants or solvents. The 5 main sources are metered dose inhalers (MDIs), personal care products (e.g. hair care, deodorant, shaving cream), household products (e.g. air-fresheners, oven and fabric cleaners), industrial products (e.g. special cleaning sprays such as those for operating electrical contact, lubricants, pipe-freezers) and other general products (e.g. silly string, tire inflators, claxons)	Population data from Jersey Resident Population report
	2F4b Aerosols: Other		
Transport	1A3a Domestic aviation	Emissions from flights that depart and arrive in the same country. For Jersey this includes flights between the UK and Crown Dependencies (take-off and landing and cruise)	Activity data from the UK Civil Aviation Authority and fuel data from Digest of UK Energy Statistics
	1A3bi Cars	Emissions from passenger cars	Fuel data from Jersey's energy balance, number of vehicles data from the Jersey Government and 'Quantitative analysis of carbon neutrality by 2030' report
	1A3bii Light duty trucks	Emissions from light duty trucks – vehicles designed to transport light weight cargo or equipped with special features such as four-wheel drive for off-road operation	
	1A3biii Heavy duty trucks and buses	Emissions from buses and coaches, HGVs rigid and HGVs articulated	
	1A3biv Motorcycles	Emissions from vehicles designed to travel with no more than three wheels in contact with the ground, including mopeds (<50cc 2st), motorcycle (>50cc 2st) and motorcycle (>50cc 4st)	
	1A3d Domestic navigation	Emissions from fuels used by vessel of all flags that depart and arrive in the same country. For Jersey this includes journeys between to and from the UK	
	1A4ciii Fishing	Emissions from fuels combusted for inland, coastal and deep-sea fishing	AIS data and UK Sea Fisheries Annual Statistics

Sector	Sub-sector	Description	Data sources
	2D3 Non-energy products from fuels and solvent use: other	This includes urea consumption by road transport. Some catalytic converters, particularly in diesel vehicles, use urea as a reducing agent	GDP data from Measuring Jersey's Economy report, population data from Jersey Resident Population report, number of vehicles data from the Jersey Government and number of households data from census
Waste management	5D1 Domestic wastewater treatment	Emissions from the treatment of liquid waste and sludge from housing and commercial sources. This includes sewage sludge decomposition	Population data from Jersey Resident Population report
Industrial processes	2G3b N_2O from product use: Other	Emissions from the use of N_2O as a propellant in squirty cream	GDP data from Measuring Jersey's Economy report

6 Useful links

Tackling the climate emergency

Carbon Neutral Strategy

Carbon Neutral Roadmap

Report of Jersey's Citizen's Assembly on Climate Change

Sustainable Transport Policy

Young people and the climate emergency

GHG emissions from Waste – A guide for Jersey

Development of an emission factor for imported electricity

Considering the Channel Islands' indirect GHG emissions

Carbon Neutrality by 2030

Quantitative analysis of carbon neutrality by 2030

GHG Inventory Infographic

Carbon sequestration and the role of soil and crops

Climate emergency additional information

7 About the authors

Kathryn Hampshire: Kathryn specialises in emissions inventories and data visualisation. She has led work to compile and QA/QC greenhouse gas inventories for the UK Overseas Territories and Crown Dependencies and the Devolved Administrations as part of the UK emissions inventory programme. She has recently been working with Jersey, Guernsey and the Isle of Man creating technical reports, reports for the general public and visualisations of emissions data to increased understanding of emissions data and facilitate stakeholder engagement.

Katie King: Katie is a Company Director at Aether and has been involved in the compilation of emissions estimates for 15 years, focused in particular at the local level through spatial mapping of emissions. Katie is Knowledge Leader for Local Authority carbon emission data as part of the UK NAEI programme, overseeing the production of the LA level CO_2 dataset for DECC each year. Katie has much experience in data evaluation for emissions estimates, advising on and reviewing the work of the National Atmospheric Emissions Inventory emissions mapping team covering many sectors.

Courtney Szanto: Courtney is an assistant consultant with experience in GHG and air pollutant inventory compilation. She has contributed to the compilation and QA/QC greenhouse gas inventories for the UK Overseas Territories and Crown Dependencies and the Devolved Administrations. She has recently worked with local authorities such as Tamworth Borough Council, Luton Council and Renfrewshire Council to support their progress towards net zero. Courtney has compiled carbon footprints for both Council estates and Council areas, facilitated stakeholder engagement, and developed trajectory models to show the effect of climate action on greenhouse emissions across multiple sectors.

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