Guide to the Jersey Greenhouse Gas Inventory

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Contents

List of acronyms

AIS – Automatic Identification System
CAA – Civil Aviation Authority
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
N_2O - Nitrous oxide
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 will present plans on how Jersey could aim to be carbon neutral by 2030.

A key component of this planning 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 2020 inventory covers the period 1990 to 2018).

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, planned actions to reduce emissions and potential future reduction targets 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.

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).

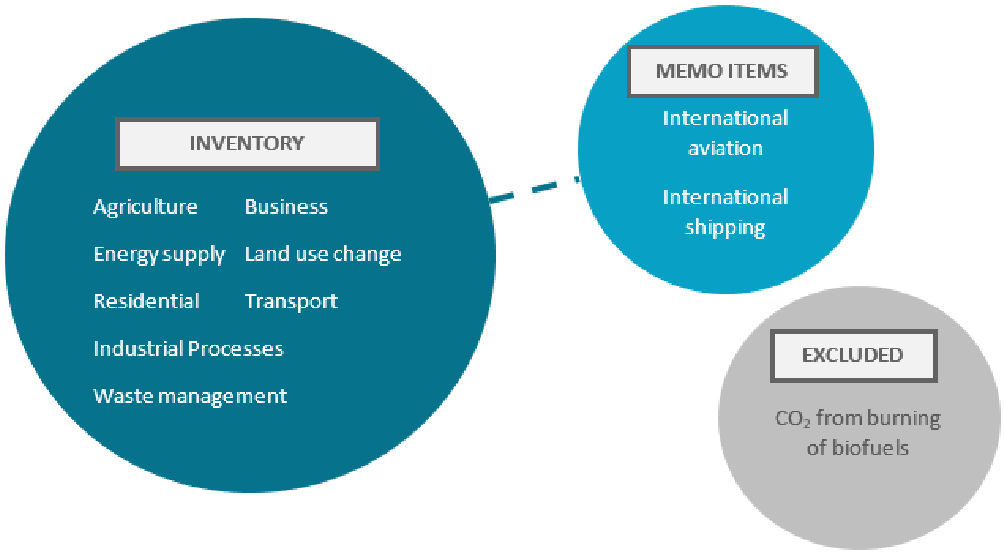

Figure 1 - Overview of sectors included and excluded from the greenhouse gas inventory

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.

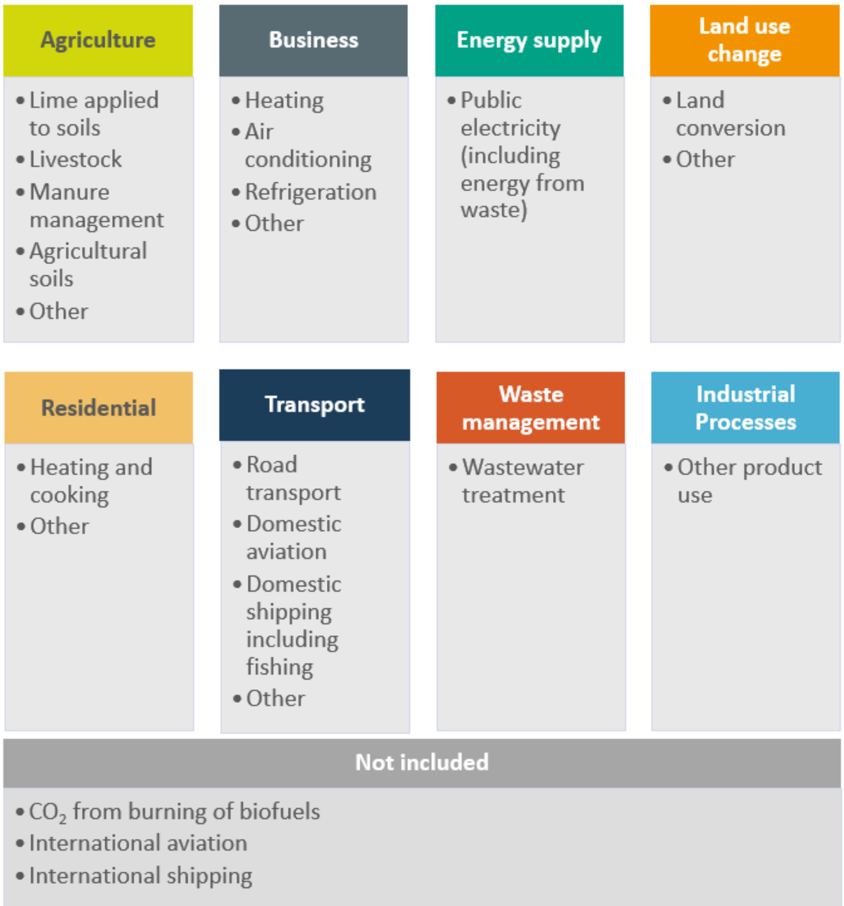

Figure 2 - Overview of activities covered in each sector.

Agriculture – This includes emissions from livestock, crop production and fertiliser application. In 2018 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 2018, this sector contributed 15% 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 2018, this sector contributed 12% to total GHG emissions in Jersey.

Land use change – This sector consists of emissions or removals from the conversion of 7land from one use to another, for example the conversion of cropland to settlements. In

2018, this sector contributed -0.2% 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 2018 this sector contributed 21% 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 2018, contributing 44% to total GHG emissions.

Waste management – This sector includes emissions from the treatment of domestic wastewater. In 2018, this sector contributed 3% to total GHG emissions in Jersey.

Industrial processes – This sector includes emissions from the use of N2O as a propellant in squirty cream. In 2018, this sector contributed 0.02% 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 island, please see the 'Carbon sequestration and the role of soil and crops' report.

Emissions from international aviation and shipping in Jersey are not included in the GHG inventory total but are included added 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'.

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 2018. The inventory always reports data for the timeframe of 1990 to the year that is 2 years before the year of reporting i.e. 2018 in 2020. 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 2017 and 2018 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 business sector of the Jersey inventory, the emissions in 2017 for 1A4ai Commercial/institutional were 19,769 tCO_2eq in the 1990-2017 inventory but in the 1990-2018 inventory this sector is estimated at 13,803 tCO_2eq. This reflects an improvement made to the inventory methodology for the most recent inventory which reallocates some emissions from the business sector to the residential sector to reflect activities in Jersey more accurately.

1.6 How are greenhouse gases emissions estimated?

The basic equation for estimating most emissions is:

Activity X **Emission Factor** = **Emission**

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 2018 in Jersey

Tonnes of diesel used in Jersey in 2018 X **N_2O per tonne of diesel** = **Emissions (tonnes) of N_2O from diesel power stations**

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 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

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

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 produce 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. Only 2% of Jersey's energy supply was produced on-island in 2017, from the ERF facility. 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?

International aviation includes emissions from flights that depart in one country and arrive in another. The emissions for the entire journey are divided between the source country and the destination country. These emissions are included as 'memo items' meaning they are not in the main body of the inventory. Domestic aviation covers emissions from civil domestic passenger and freight traffic that depart and arrive in Jersey. It includes journeys between the UK and Jersey. Emissions from aircrafts are distinguished between two separate operations: Landing/Take Off (LTO) and Cruise. The amount of GHG emissions will differ between landing/take off and cruise, with 90% of aviation emissions occurring at higher altitudes.

Jersey has witnessed an increase in overall emissions from aviation sources over the entire time series and emissions from domestic aviation remain a significant proportion of Jersey's total transport emissions at 31% in the 2018 inventory.

2.3 How are emissions from marine sources reported?

Emissions from international water-borne navigation and domestic water-borne navigation are differentiated. The fuel used by marine vessels that both depart and arrive in Jersey, such as ferries, are reported within the inventory. International shipping considers marine vessels which have departed from Jersey and arrived in another country, or vice versa. These are included within the inventory as 'Memo Items', meaning they are not included within the inventory totals.

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 at only 4.9% in 2018. Emissions from fishing vessels in Jersey were estimated at 0.83% of total transport emissions in Jersey's 2018 inventory.

The 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 Strategy 2019, additional research into Jersey's marine environment is being planned. This will provide more information relating marine ecosystems and blue carbon.

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

3 Jersey's greenhouse gas inventory – overview

3.1 Total GHG emissions from different sources

Figure 3 provides an overview of Jersey's inventory categorised by sector.

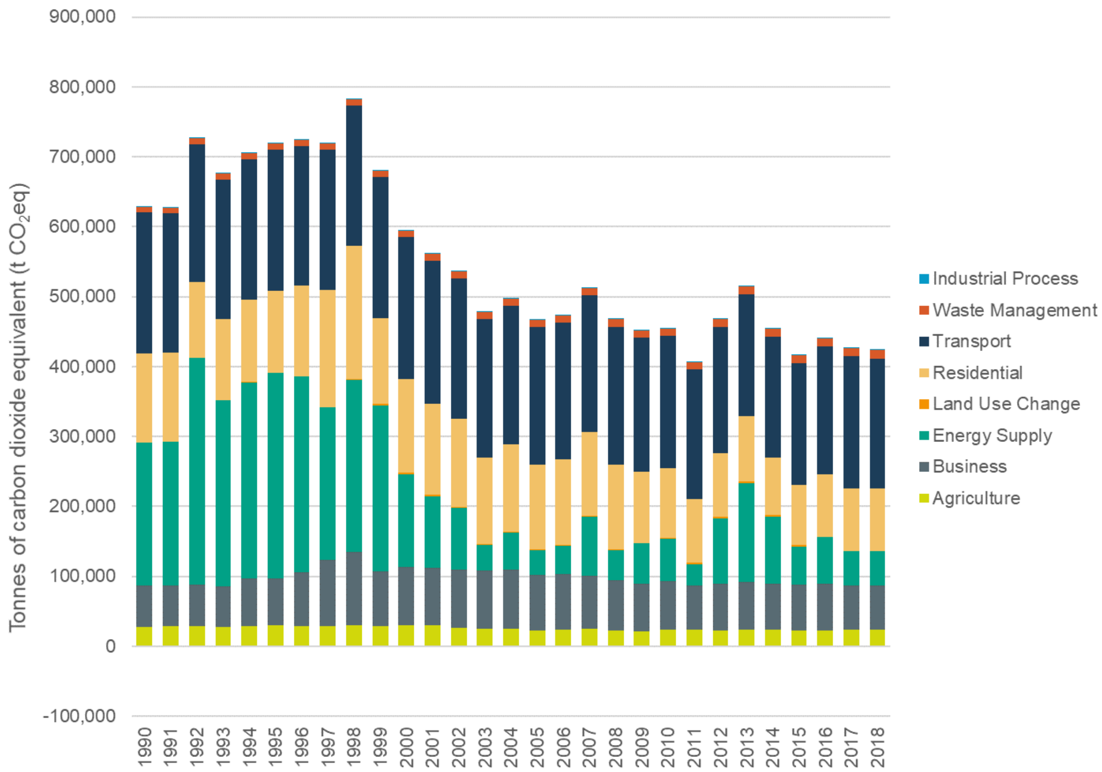

Figure 3 - Jersey's Inventory categorised by sector

Between 1990 and 2018, emissions in Jersey have decreased by 33%. As **Figure 3** 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. Emissions from transport are the largest source in the 2018 inventory and have remained largely constant across the timeseries, decreasing by 8% between 1990 and 2018.

Table 2 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 32%) whilst in 2018 the largest contribution came from transport alone (44%).

Table 3 Percentage contribution of each sector to Jersey's total GHG emissions

	Waste Management	Agriculture	Business	Transport	Residential	Energy Supply	Land Use, Land Use Change and Forestry	Industrial Processes
1990	1%	4%	9%	32%	20%	32%	0.0%	0.01%
1995	1%	4%	9%	28%	16%	41%	0.0%	0.01%
2000	2%	5%	14%	34%	22%	22%	0.5%	0.01%
2007	2%	5%	15%	38%	24%	16%	0.3%	0.01%
2008	2%	5%	16%	42%	26%	9%	0.3%	0.01%
2009	2%	5%	15%	42%	23%	13%	0.0%	0.02%
2010	2%	5%	15%	42%	22%	13%	0.1%	0.02%
2011	3%	6%	16%	46%	22%	8%	0.6%	0.02%
2012	2%	5%	14%	39%	19%	20%	0.5%	0.02%
2013	2%	5%	13%	34%	18%	27%	0.5%	0.02%
2014	2%	5%	14%	38%	18%	21%	0.5%	0.02%
2015	3%	5%	16%	42%	21%	13%	0.4%	0.03%
2016	3%	5%	15%	41%	20%	15%	0.0%	0.02%
2017	3%	5%	15%	44%	21%	12%	0.0%	0.02%
2018	3%	6%	15%	44%	21%	12%	-0.2%	0.02%
% change 1990-2018	**1%**	**1%**	**6%**	**12%**	**1%**	**-21%**	**-0.2%**	**0.001%**

3.2 Total GHG emissions from different gases

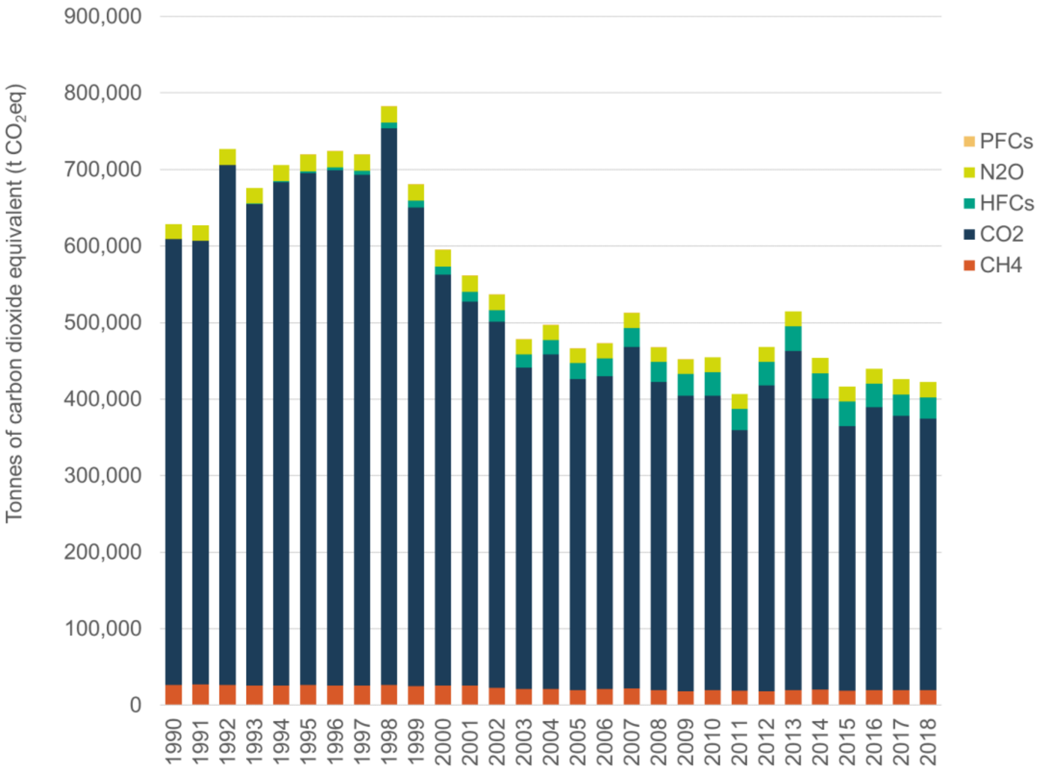

Figure 4 - Jersey's greenhouse gas inventory by gas

Figure 4 provides an overview of Jersey's inventory categorised by gas.

CH_4 – 72% of methane emissions in Jersey's 2018 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 2018, 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 – 52% of carbon dioxide emissions in Jersey's 2018 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 2018 inventory was from agriculture, accounting for 42% of N_2O emissions. The waste management sector was also a significant source, with 35% 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 is 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 2018 inventory. The largest agriculture emissions source in 2018 is enteric fermentation from dairy cattle (**Figure 5**). 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.

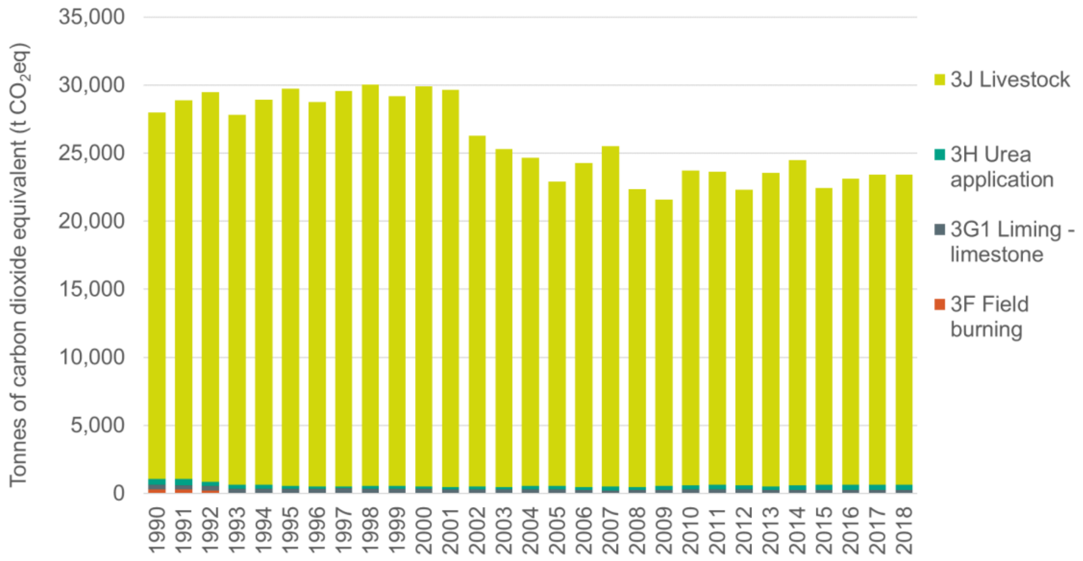

Figure 5 - Agriculture sector emissions by sub-sector 1990-2018

Emissions from the agriculture sector reduced by 16% from 1990-2018. 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 3**).

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 4 Agriculture sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
3F Field burning	315			-100%	-
3G1 Liming - limestone	322	263	263	-18%	0.0%
3H Urea application	422	355	355	-16%	0.0%
3J Livestock	26,937	22,779	22,779	-15%	0.0%
Grand Total	**27,996**	**23,398**	**23,398**	**-16.4%**	**0.0%**

4.1.2 Gases

Emissions in the agriculture sector are dominated by emissions of methane (CH_4), which accounts for 60.6% of agriculture sector emissions in 2018. Of the remaining 2018 emissions, 36.8% came from nitrous oxide (N_2O) emissions and 2.6% from carbon dioxide (CO_2) (**Figure 6**). 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.

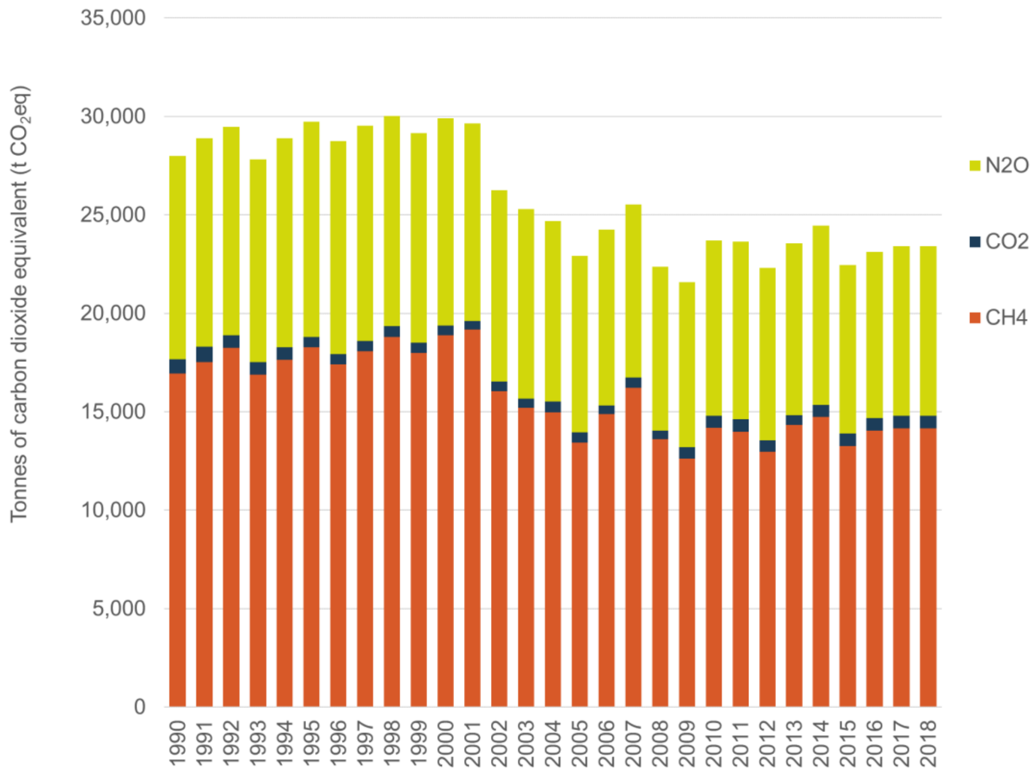

Figure 6 Agriculture sector emissions by greenhouse gas 1990-2018

4.1.3 Methodologies

Activity data

Activity data for the agriculture sector is provided by the Jersey Government, in the 'Agricultural Statistics' document. The most recent addition was published 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 1990-2017 and the 1990-2018 inventories there were some significant updates made to the agriculture sector. A correction was made in the calculation for estimating emissions from fertiliser application and field burning. This impacts 1990 to 2017 values for fertiliser application and 1990 to 1993 values for field burning. There were also recalculations in the UK livestock numbers. UK livestock numbers are used to calculate the implied emission factors for this sector and therefore this also contributes to recalculations in the Jersey agriculture emissions.

4.2 Business

4.2.1 Sector and sub-sector trends

Emissions from the business sector accounted for 15% of total greenhouse gas (GHG) emissions in the 2018 inventory. The largest business emissions source in 2018 is Other Manufacturing Industries and Construction (**Figure 7**). This subsector represents emissions from kerosene use in commercial settings.

Emissions from the business sector for Jersey are separated into 13 different subsectors, including air conditioning, refrigeration, stationary combustion in commercial and institutional settings and other manufacturing industries.

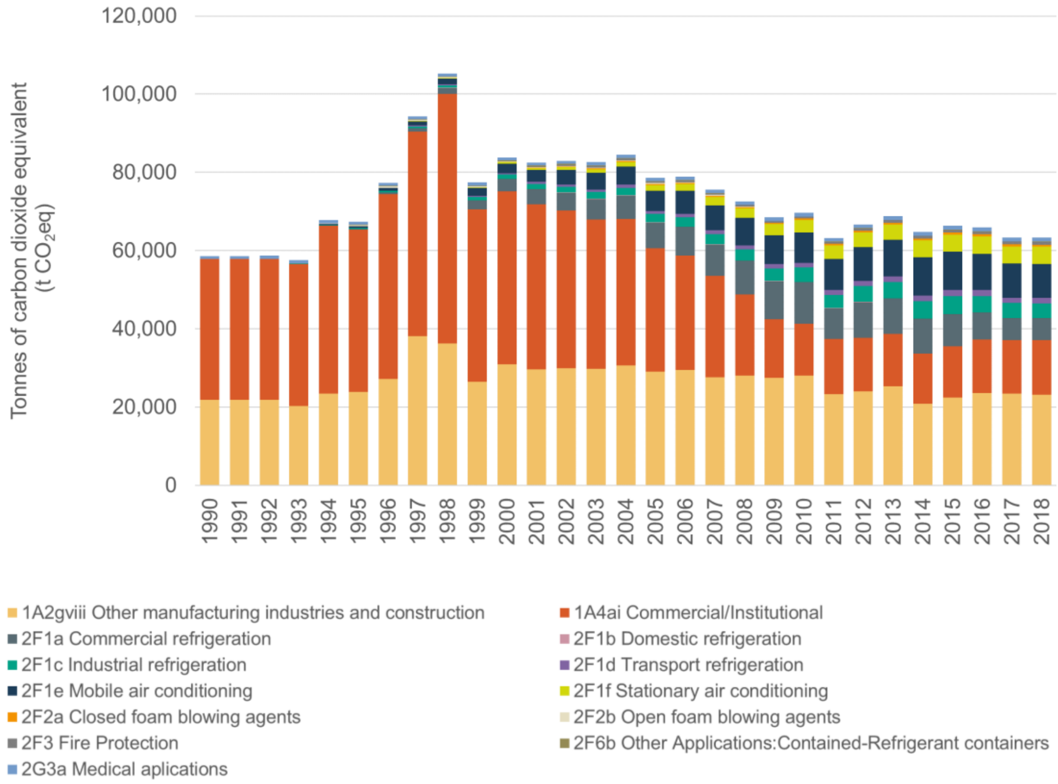

Figure 7 Business sector emissions by sub-sector 1990-2018

Emissions from the business sector reduced by 8% from 1990-2018 and saw a reduction of 0.05% between 2017 and 2018. Between 1990 and 2018 there were no significant increases in emissions from any subsector. There is limited data from all of the subsectors at the start of the timeseries however, with no emissions reported from refrigeration, air conditioning, blowing agents and fire protection. There was a decrease in emissions of 61% from commercial and institutional sources, across the whole time series (**Table 4**).

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 5 - Business sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
1A2gviii Other manufacturing industries and construction	21,938	23,402	23,232	5.9%	-0.7%
1A4ai Commercial/Institutional	35,892	13,803	13,942	-61.2%	1.0%
2F1a Commercial refrigeration		5,536	5,536	-	0.0%
2F1b Domestic refrigeration		10.4	10.4	-	0.0%
2F1c Industrial refrigeration		3,830	3,830	-	0.0%
2F1d Transport refrigeration		1,377	1,377	-	0.0%
2F1e Mobile air conditioning		8,702	8,702	-	0.0%
2F1f Stationary air conditioning		4,394	4,394	-	0.0%
2F2a Closed foam blowing agents		521	521	-	0.0%
2F2b Open foam blowing agents				-	-
2F3 Fire Protection		690	690	-	0.0%
2F6b Other Applications: Contained-Refrigerant containers		111	111	-	0.0%
2G3a Medical applications	761	959	959	25.9%	0.0%
Grand Total	**58,591**	**63,335**	**63,305**	**8.04%**	**-0.05%**

4.2.2 Gases

Emissions in the business sector are dominated by emissions of carbon dioxide (CO_2), which account for 58% of business sector emissions in 2018. 40% of the remaining 2018 emissions come mostly from fluorinated gases, especially HFCs (**Figure 8**). Between 1990 and 2018, CO_2 emissions fell by 36% from 57,552 tonnes of carbon dioxide equivalent (tCO_2eq) to 37,013 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 remained relatively constant since 2012 (between 25,172 and 29,161 tCO_2eq) (**Figure 8**).

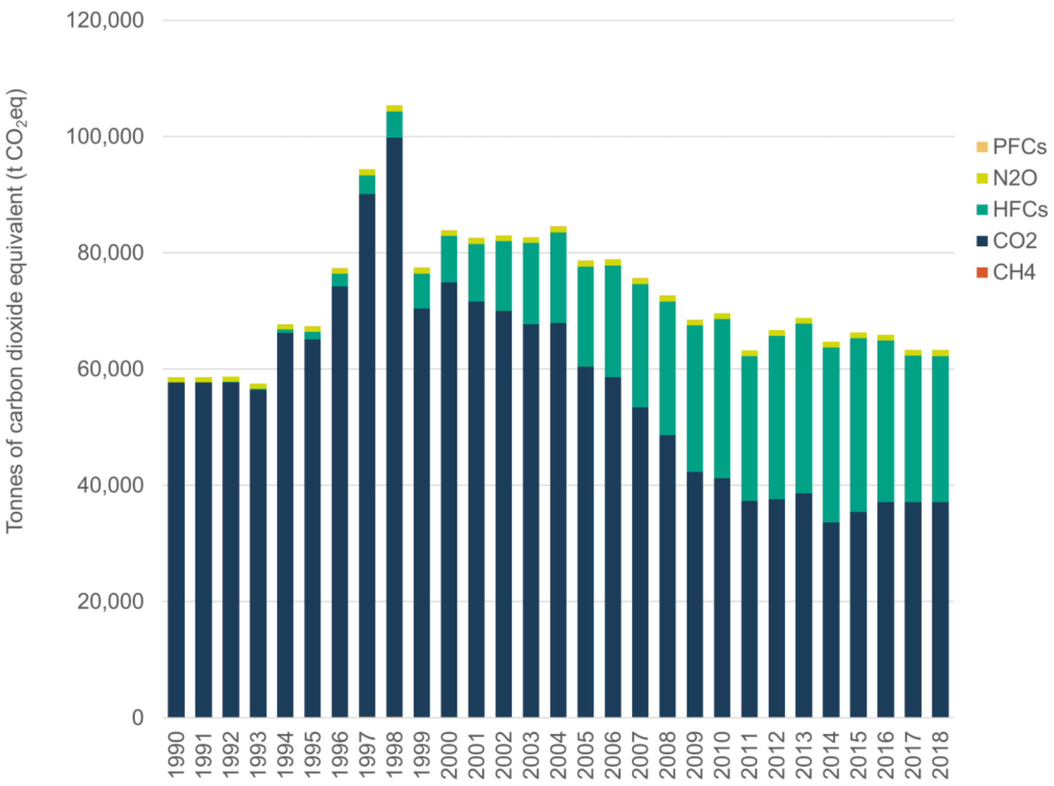

Figure 8 Business sector emissions by greenhouse gas 1990-2018

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 2018 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[6] 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

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

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 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 1990-2017 inventory and the most recent 1990-2018 inventory there have been significant recalculations due to improvements to the data and methodology in this sector. In the previous inventory, a 50/50 split in fuel use between residential and commercial. However, in the most recent inventory this was adjusted to 70/30 on the advice of a representative fuel supplier. This has caused a reallocation of emissions from the business sector to the residential sector. There were also improvements made to the final energy consumption for 2017 following an update to the energy balance provided by Jersey.

4.3 Energy supply

4.3.1 Sector and sub-sector trends

Emissions from the energy supply sector accounted for 12% of total greenhouse gas (GHG) emissions in the 2018 inventory. All emissions in this sector are attributed to the generation of public electricity (**Figure 9**).

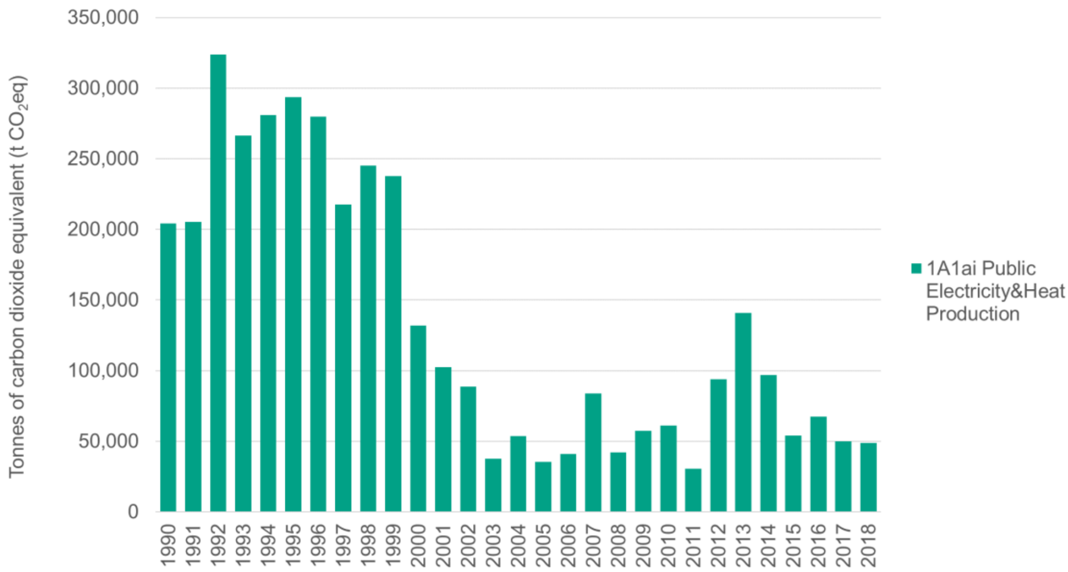

Figure 9 Energy supply sector emissions by sub-sector 1990-2018

Emissions from the energy supply sector reduced by 76% from 1990-2018 and saw a reduction of 2% between 2017 and 2018 (**Table 5**). 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 6 Energy supply sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
1A1ai Public electricity and heat production	204,271	49,821	49,020	-76%	-2%
Grand Total	**204,271**	**39,748**	**22,656**	**-76%**	**-2%**

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 2018. Between 1990 and 2018, CO_2 emissions fell by 77% from 203,128 tCO_2eq to 47,603 tCO_2eq but peaked in 1992 at 322,215 tCO_2eq (**Figure 10**).

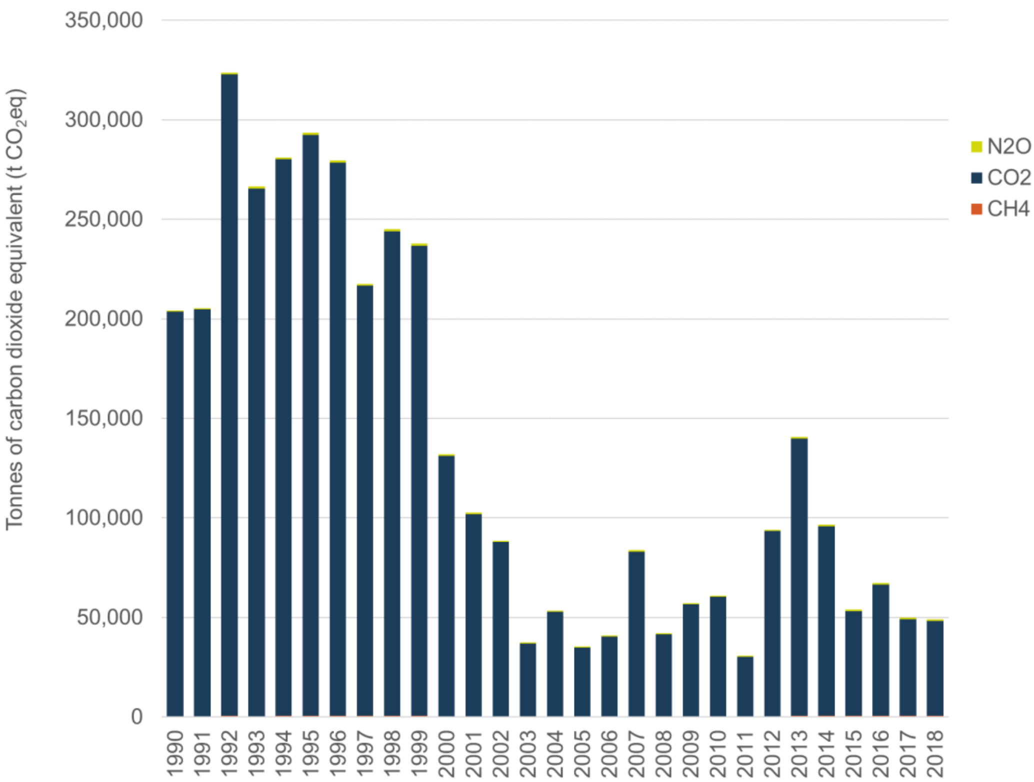

Figure 10 Energy supply sector emissions by greenhouse gas 1990-2018

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 1990-2017 inventory and the 1990-2018 inventory there have been improvements made to the municipal solid waste activity data, resulting in recalculations. Previously extrapolated data for quantities of municipal solid waste going to the Energy Recovery Facility have been replaced with more accurate numbers, provided in the 'Jersey in Figures' report.

4.4 Industrial processes

4.4.1 Sector and sub-sector trends

Emissions from the industrial processes sector accounted for 0.02% of total greenhouse gas (GHG) emissions in the 2018 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 9**).

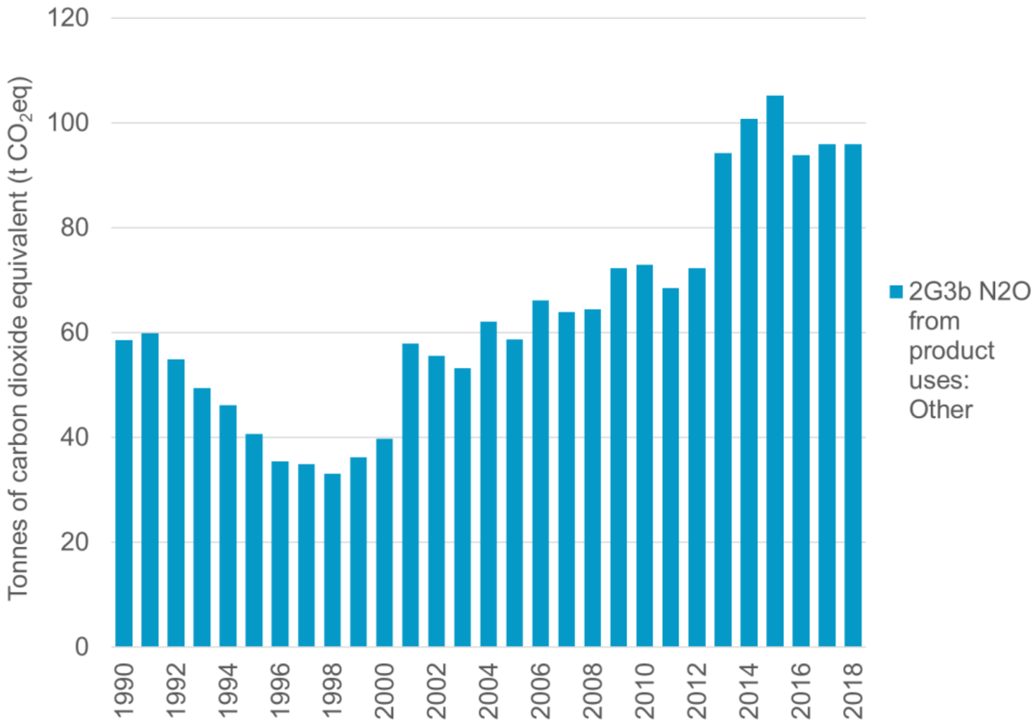

Figure 11 Industrial processes sector emissions by sub-sector 1990-2018

Despite decreasing between 1991 and 1998, emissions from the industrial processes sector have increased by 64% from 1990-2018 (**Table 5**).

Table 7 Industrial processes sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
2G3b N_2O from product uses: Other	58.6	96.0	96.0	64%	0%
Grand Total	**58.6**	**96.0**	**96.0**	**64%**	**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 59 tCO_2eq to 96 tCO_2eq between 1990 and 2018, peaking in 2015 at 105 tCO_2eq (**Figure 10**).

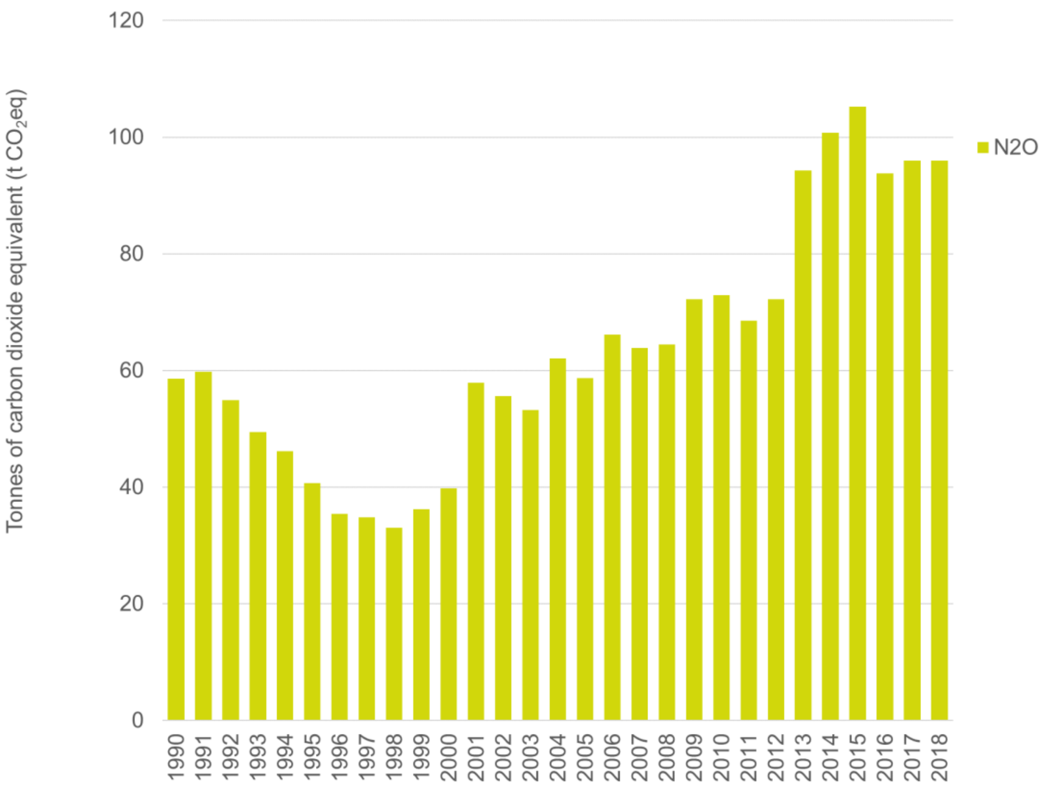

Figure 12 Industrial processes sector emissions by greenhouse gas 1990-2018

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

Emissions in this sector are included for the first time in the 1990-2018 inventory for Jersey and therefore there are no recalculations.

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

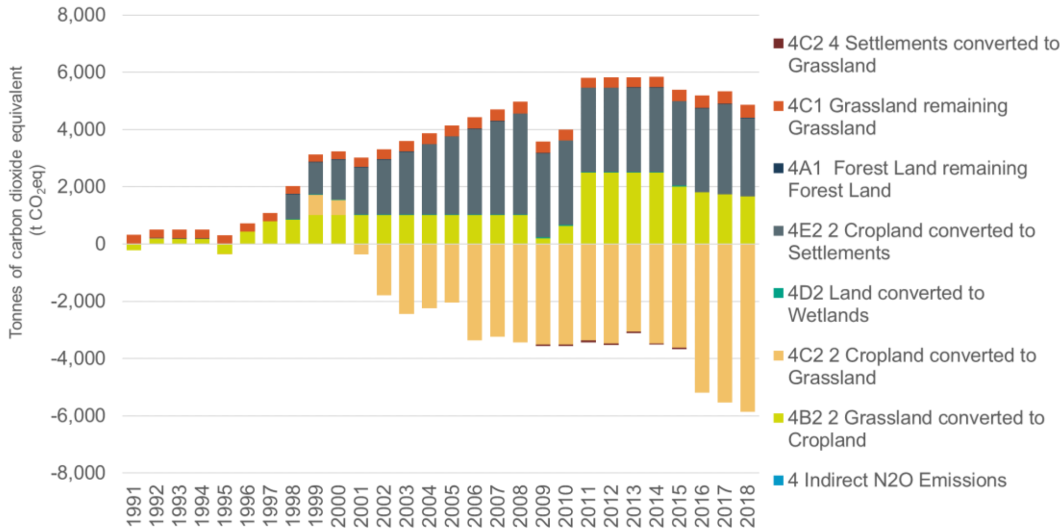

Figure 11 Land Use Change sector emissions by sub-sector 1991-2018

Jersey has a net sink (a negative emission) in the land use change sector, mostly attributed to cropland converted to grassland (**Figure 11**). 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 2018, with 5,863 tonnes of carbon being stored in the land and not emitted into the atmosphere. Converting grassland to cropland results in 1,669 tonnes of carbon being released and converting cropland to settlements released 2,733 tonnes of carbon in 2018. (**Table 6**). 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.

Table 8 Land Use, Land Use Change and Forestry (LULUCF) sector emissions by sub-sector with absolute changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1991	2017	2018	Absolute change 1991-2018	Absolute change 2017-2018
4 Indirect N2O Emissions	0.033	0.84	0.78	0.74	-0.059
4B2 2 Grassland converted to Cropland	-212	1,739	1,669	1882	-70
4C2 2 Cropland converted to Grassland		-5,541	-5,863	-5863	-322
4D2 Land converted to Wetlands				-	-
4E2 2 Cropland converted to Settlements		3,140	2,733	2733	-407
4A1 Forest Land remaining Forest Land	12.17	12.17	12.17	0.0	0.0
4C1 Grassland remaining Grassland	307	448	454	147	6
4C2 4 Settlements converted to Grassland				-	-
Grand Total	**107**	**- 201**	**- 994**	**-1100**	**-793**

4.5.2 Gases

In the LULUCF sector in 2018, emissions of CO_2 are negative (-1,795 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, emitting 800 tonnes of carbon dioxide (**Figure 12**). 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.

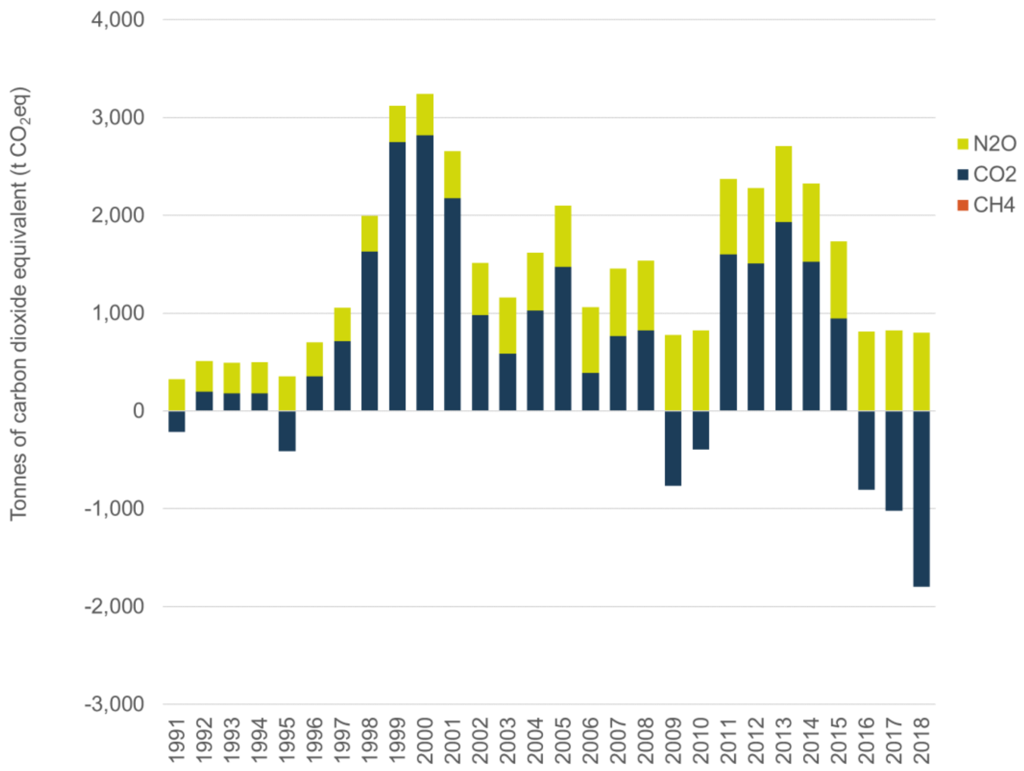

Figure 13 Land Use Change sector emissions by greenhouse gas 1991-2018

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 States 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

Between the 1990-2017 inventory and the most recent 1990-2018 inventory there have been a few recalculations in this sector. Improvements were made to the methodology for calculating emissions occurring through conversion of land from grassland to settlements and vice versa, moving to a coded model and correcting some previous discrepancies. Additionally, emissions from forest and grassland wildfires have been included for the first time in the 1990-2018 inventory in response to a UNFCCC review comment (previously assessed to be insignificant and therefore not reported).

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 21% of total GHG emissions in the 2018 inventory. The majority of emissions are from residential stationary combustion, the burning of fuels in homes, mainly for heating and cooking (**Figure 13**).

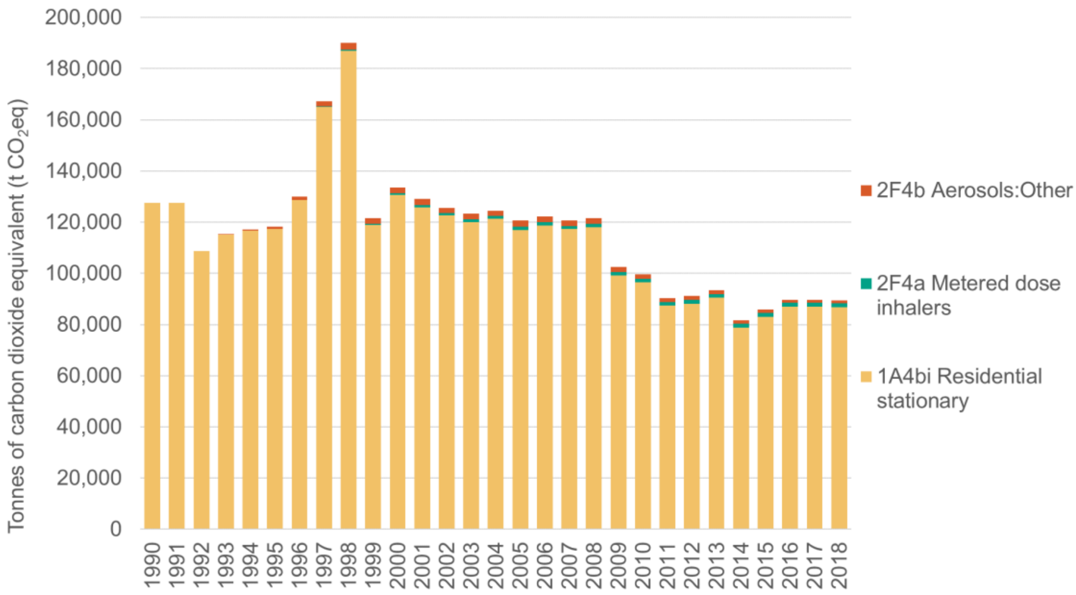

Figure 14 Residential sector emissions by sub-sector 1990-2018

Between 1990 and 2018, residential sector emissions have decreased by 30% from 127,498 to 89,506 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 have since remained relatively constant, decreasing by 0.1% between 2017 and 2018 (**Table 7**).

Table 9 Residential sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
1A4bi Residential stationary	127,498	86,944	86,872	-32%	-0.08%
2F4a Metered dose inhalers		1,540	1,540	-	0.0%
2F4b Aerosols: Other		1,094	1,094	-	0.0%
Grand Total	**127,498**	**89,579**	**89,506**	**-30%**	**-0.08%**

4.6.2 Gases

Emissions in the residential sector are dominated by emissions of carbon dioxide (CO_2) which accounted for 96% of residential emissions in 2018. Between 1990 and 2018, residential sector CO_2 emissions fell by 30% from 124,123 to 86,364 tCO_2eq (**Figure 14**).

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.

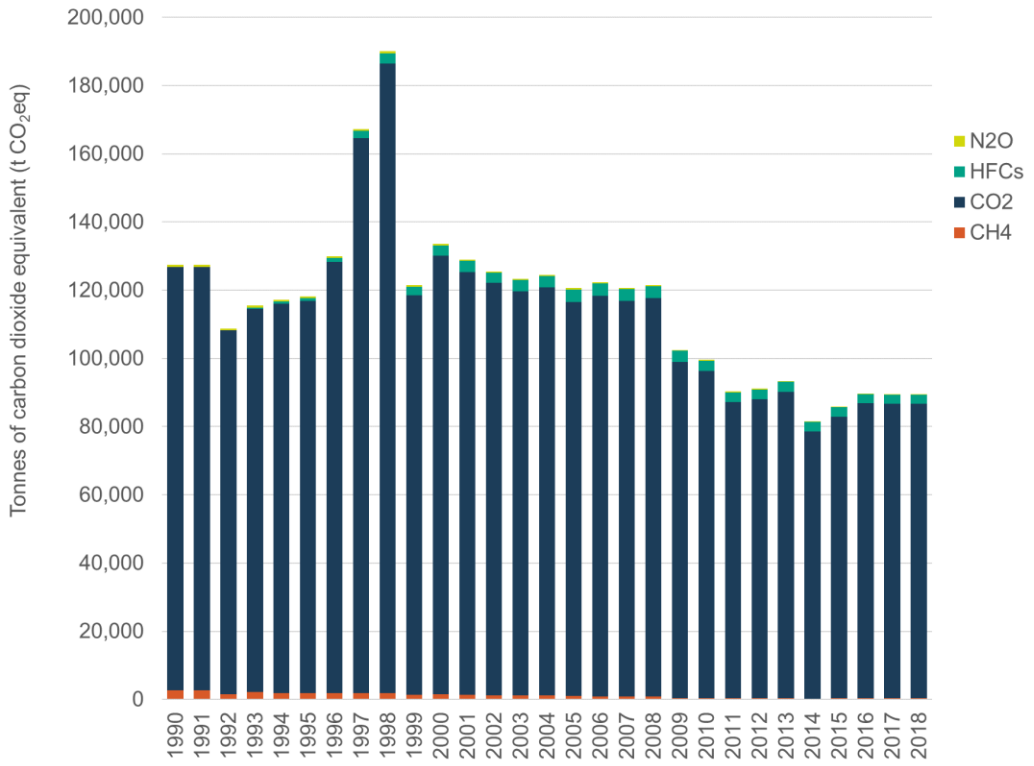

Figure 15 Residential sector emissions by greenhouse gas 1990-2018

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[7] 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

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

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.

Recent improvements to the inventory

Between the 1990-2017 inventory and the most recent 1990-2018 inventory there have been significant recalculations due to improvements to the data and methodology in this sector. In the previous inventory, a 50/50 split in fuel use between residential and commercial. However, in the most recent inventory this was adjusted to 70/30 on the advice of a representative fuel supplier. This has caused a reallocation of emissions from the business sector to the residential sector. There were also improvements made to the final energy consumption for 2017 following an update to the energy balance provided by Jersey.

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 44% of total GHG emissions in the 2018 inventory. The largest emissions source in 2018 in this sector is passenger cars (**Figure 15**).

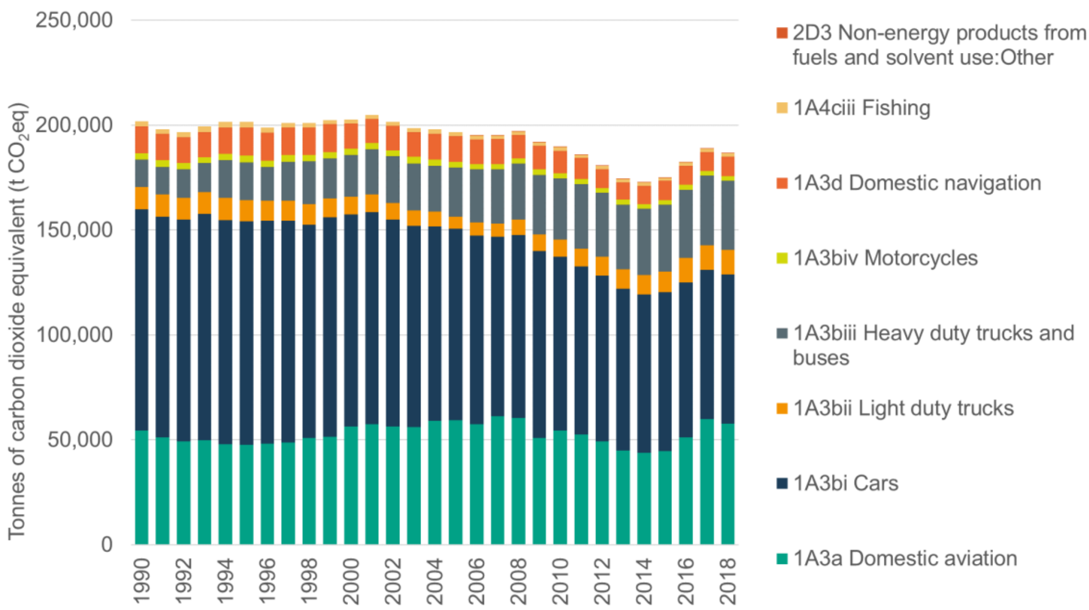

Figure 16 Transport sector emissions by sub-sector 1990-2018

Between 1990 and 2018, emissions in the transport sector have decreased by 8% from 201,749 to 186,590 tCO_2eq. Transport emissions steadily decreased between 2001 and 2014, mainly due to passenger cars becoming gradually more fuel efficient and therefore using less fuel. However, emissions increased from 2015 to 2017, reversing the trend.

The overall trend is dominated by emissions from passenger cars and domestic aviation. Passenger car emissions have decreased by 33% between 1990 and 2018 and increased by 0.2% between 2017 and 2018 (**Table 8**). Between 1990 and 2018, all sources of transport emissions decrease except for domestic aviation, light duty trucks and heavy duty trucks. This trend could be being influenced by an increase in tourism, especially visitors from the UK whose flights are accounted for under domestic aviation.

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

Tonnes of carbon dioxide equivalent (tCO₂eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
1A3a Domestic aviation	54,453	60,024	57,815	6%	-4%
1A3bi Cars	105,320	70,890	71,053	-33%	0.2%
1A3bii Light duty trucks	10,724	11,890	11,820	10%	-1%
1A3biii Heavy duty trucks and buses	13,092	33,060	32,860	151%	-1%
1A3biv Motorcycles	2,955	2,211	2,218	-25%	0.3%
1A3d Domestic navigation	12,830	9,002	9,185	-28%	2%
1A4ciii Fishing	2,376	1,584	1,552	-35%	-2%
2D3 Non-energy products from fuels and solvent use: Other		85.5	85	-	0%
Grand Total	**201,749**	**188,746**	**186,590**	**-8%**	**-1%**

4.7.2 Gases

Transport sector emissions are predominantly carbon dioxide (CO_2). CO_2 emissions account for 99% of total emissions in 2018 with nitrous oxide (N_2O) making up 0.8% and methane (CH_4) the remaining 0.2%. CO_2 emissions have decreased by 6% between 1990 and 2018 and by 1% between 2017 and 2018 (**Figure 16**).

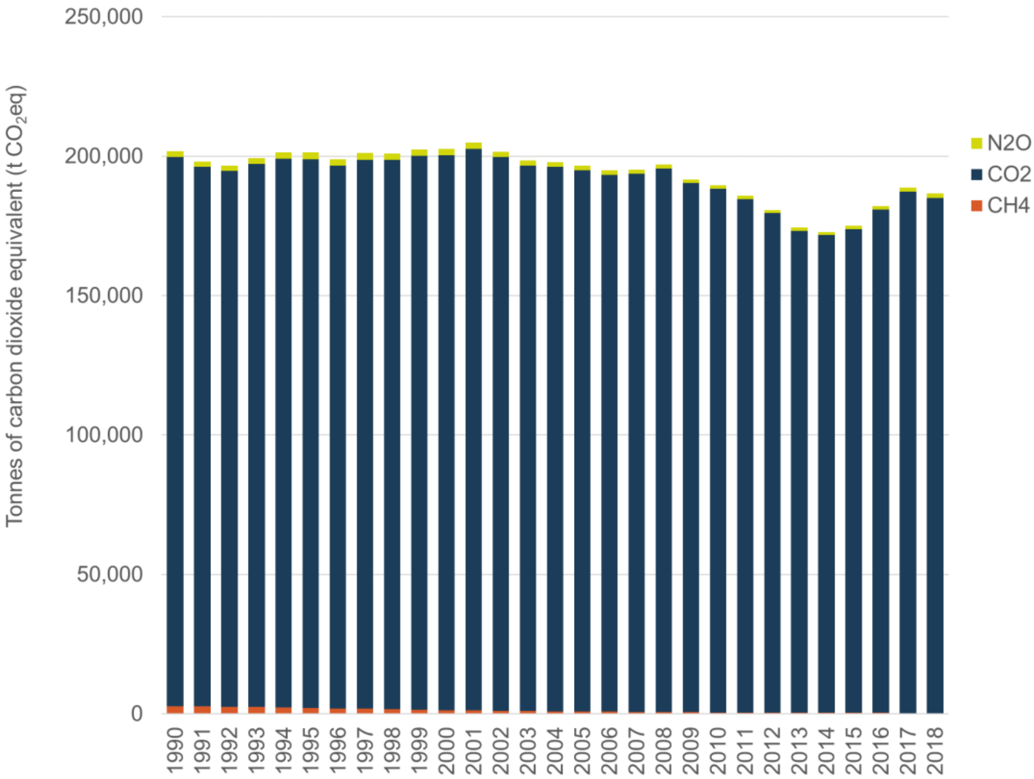

Figure 17 Transport sector emissions by greenhouse gas 1990-2018

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 Growth, Housing and the Environment (Driver and Vehicle Standards), for the GHG inventory reporting. For the 1990-2018 inventory, 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[8].

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.

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 to scale the 1990-2018 timeseries for vehicle numbers. The 2019 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.

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

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 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 have been recalculations between the 1990-2017 inventory and the 1990-2018 inventory due to updates to the vehicle numbers, as outlined above. These changes have been made to reflect the vehicle fleet size and mix in Jersey more accurately. The 2017 figure for petrol and diesel consumption was also updated to replace previously extrapolated data with actual data following an update of ‘Jersey Energy Trends’.

Aviation: In the latest inventory submission there have been very minor recalculations due to revisions to the UK wide aviation model used in the UK national inventory to take account of adjustments to aircraft types.

Shipping: Emissions from fishing vessels have been recalculated due to updated UK Sea Fisheries Annual Statistics data. There are also minor recalculations due to updated port statistics from the Department for Transport which are used as proxy data for calculating average emission factors.

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 2018 inventory. Emissions from the waste management sector have increased by 34% across the time series and were still increasing between 2017 and 2018 (**Figure 17**).

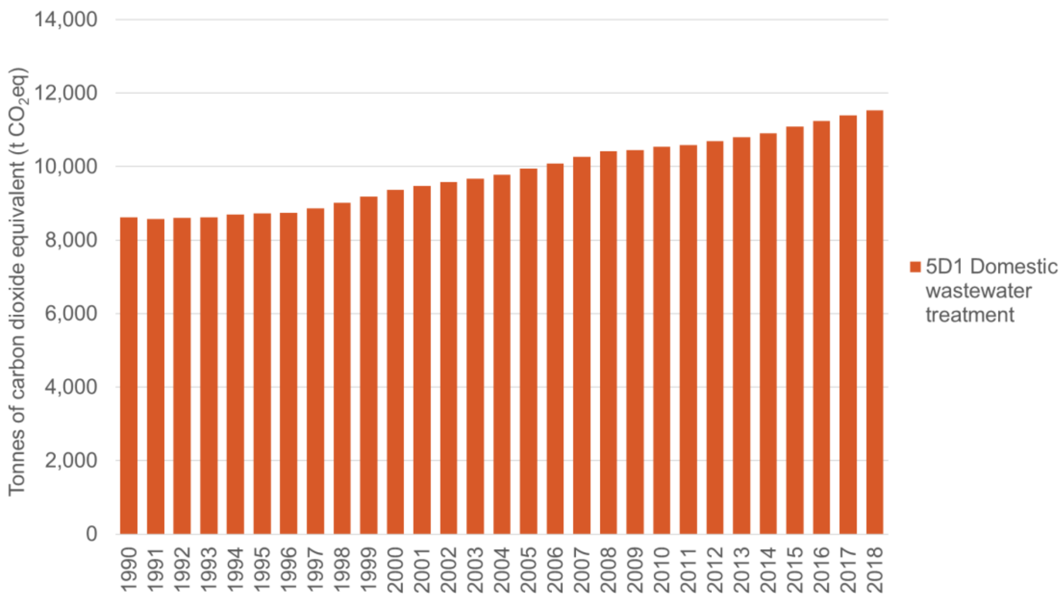

Figure 18 Waste management sector emissions by sub-sector 1990-2018

Across the entire time series, there has been a steady increase in total emissions from 8,612 to 11,527 tCO_2eq in 2018. The only source of emissions from the waste management sector for Jersey is from the domestic wastewater treatment sector (**Table 9**). Emissions have therefore increased as population has increased.

Table 11 Waste management sector emissions by sub-sector with percentage changes

Tonnes of carbon dioxide equivalent (tCO_2eq)	1990	2017	2018	% change 1990-2018	% change 2017-2018
5D1 Domestic wastewater treatment	8,612	11,398	11,527	34%	1%
Grand Total	**8,612**	**11,398**	**11,527**	**34%**	**1%**

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 2018, whilst N_2O accounts for 62%. Between 1990 and 2018, CH_4 and N_2O emissions have steadily increased by 27% and 38% respectively. Between 2017 and 2018, both increased by 1.1% (**Figure 18**).

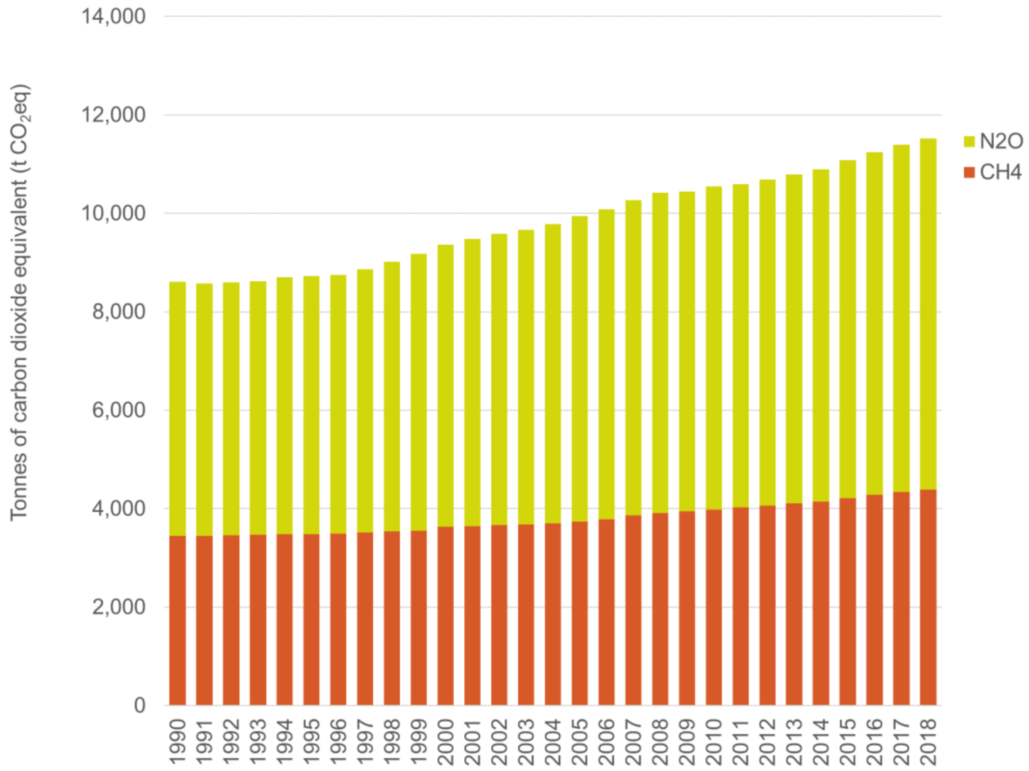

Figure 19 Waste management sector emissions by greenhouse gas 1990-2018

4.8.3 Methodologies

Activity data

Population estimated are sourced from States of Jersey publications, most recently 'Jersey Resident Population 2018 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 very minor recalculations due to updated population data for 2017.

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	
	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 N2O 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)	
	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	

Sector	Sub-sector	Description	Data sources
	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 2F4b Aerosols: Other	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
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, the UK and Gibraltar and the UK and Bermuda (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
	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,

Sector	Sub-sector	Description	Data sources
			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 N2O as a propellant in squirty cream	GDP data from Measuring Jersey's Economy report

6 Useful links

Tackling the climate emergency

Carbon Neutral Strategy

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

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 Oversees 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.

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