Guernsey Annual Greenhouse Gas Bulletin

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POLICY COUNCIL
THE STATES OF GUERNSEY

1.1 Introduction

The Greenhouse Gas Bulletin provides annual updates of Guernsey's greenhouse gas emissions inventory. The data is provided by AEA Technology, a UK-based company which calculates greenhouse gas emissions for the UK and British Isles on behalf of the Department of Energy and Climate Change.

Guernsey has signed up to the Kyoto Protocol, which set a target reduction in greenhouse gas emissions of 12.5% by 2008 to 2012 (average) compared to 1990. The analysis provided in this bulletin uses 1990 as a base year for comparison.

1.2 Headlines

- The cumulative percentage change in Guernsey's greenhouse gas emissions between 1990 and the 2008 to 2012 average (which was 411.2kt of CO_2 equivalent) was a decrease of 19.5% (or 99.4kt of CO_2 equivalent). This exceeds the Kyoto Protocol target of a decrease of 12.5%.
- Greenhouse gas emissions increased by 24.3% in 2012, when they totalled 454.5kt of carbon dioxide (CO_2) equivalent, compared to 365.8kt in 2011.
- Power generation contributed the largest proportion (34.8%) of the greenhouse gases emitted in 2012. (In 2011 the largest proportion came from transport.) This was due to a fault in the cable link to France which resulted in the need to generate electricity on Island (see ***page 5*** for more details).
- The majority (85.4%) of the emissions were in the form of carbon dioxide.

Figure 1.2.1: Total emissions

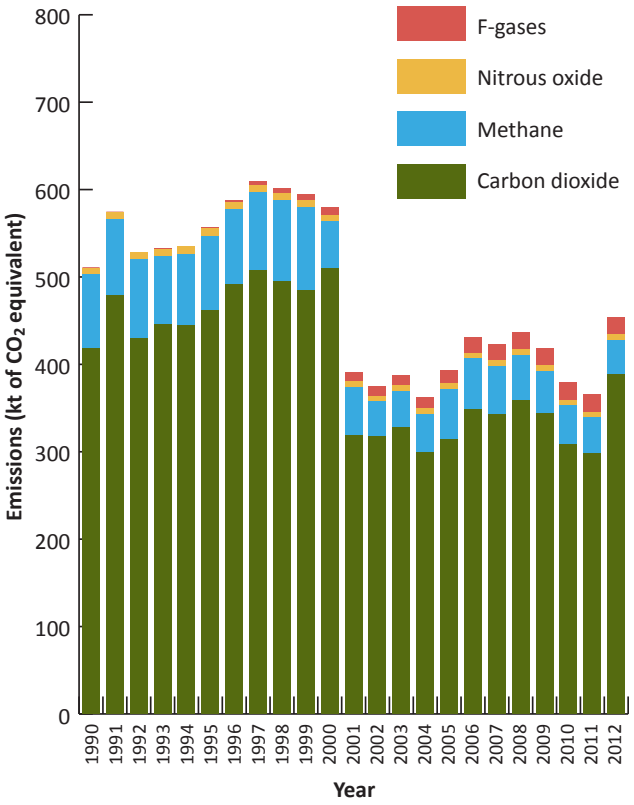


Table 1.2.1: Key data

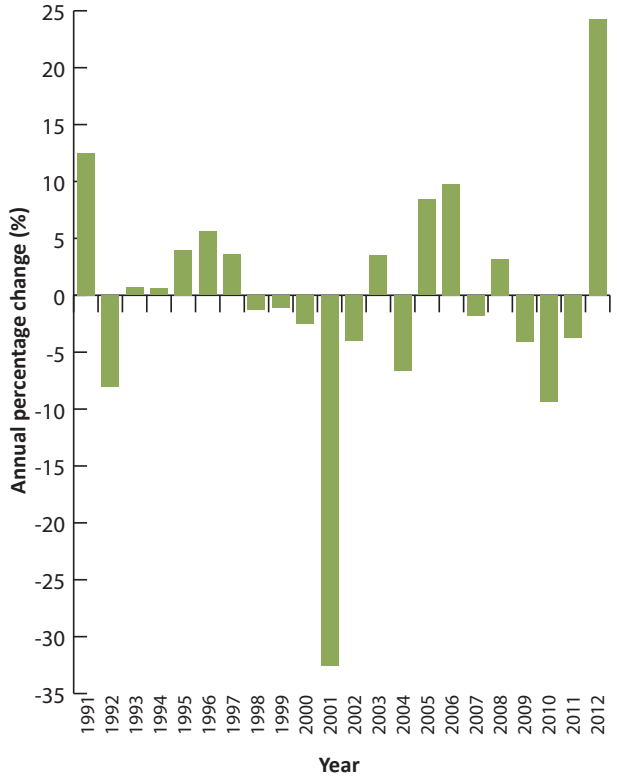
	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	510.6		
1991	574.2	12.5	12.5
1992	528.4	-8.0	3.5
1993	532.4	0.7	4.3
1994	535.8	0.6	4.9
1995	557.2	4.0	9.1
1996	588.2	5.6	15.2
1997	609.2	3.6	19.3
1998	601.5	-1.3	17.8
1999	594.7	-1.1	16.5
2000	579.7	-2.5	13.5
2001	390.5	-32.6	-23.5
2002	374.9	-4.0	-26.6
2003	387.9	3.5	-24.0
2004	362.3	-6.6	-29.0
2005	392.6	8.4	-23.1
2006	431.1	9.8	-15.6
2007	423.5	-1.8	-17.1
2008	436.8	3.2	-14.4
2009	419.1	-4.1	-17.9
2010	379.8	-9.4	-25.6
2011	365.8	-3.7	-28.4
2012	454.5	24.3	-11.0

2.1 Emissions Inventory - Type

Table 2.1.1: Emissions by type

	Carbon Dioxide (kt)	Methane (kt of CO_2 equivalent)	Nitrous Oxide (kt of CO_2 equivalent)	F-Gases (kt of CO_2 equivalent)
1990	418.7	83.9	8.0	0.0
1991	478.4	87.6	8.2	0.0
1992	429.1	91.1	8.1	0.1
1993	445.4	78.4	8.3	0.4
1994	444.7	81.9	8.3	1.0
1995	461.5	85.3	8.5	1.9
1996	491.4	86.1	7.6	3.0
1997	507.6	89.5	7.7	4.3
1998	495.3	92.7	7.6	5.9
1999	484.4	96.0	7.5	6.8
2000	509.6	53.9	7.7	8.5
2001	318.1	55.8	6.8	9.8
2002	317.1	40.4	6.6	10.8
2003	327.4	42.0	6.5	12.0
2004	299.7	43.2	6.4	13.0
2005	313.9	58.0	6.6	14.1
2006	347.9	58.7	6.7	17.7
2007	342.6	55.8	6.7	18.3
2008	358.6	51.9	6.7	19.6
2009	344.1	48.1	6.6	20.2
2010	308.8	44.2	6.6	20.3
2011	297.7	41.3	6.5	20.4
2012	388.1	39.6	6.7	20.1

Figure 2.1.1: Annual percentage change in total emissions



Greenhouse gas emissions need to be calculated in a consistent manner across all jurisdictions to ensure comparability and avoid double counting or omissions.

The content and structure of the inventory is based on the categories defined by the United Nations Economic Commission for Europe (UNECE). See ***www.unece.org*** for more information.

The methodology used to calculate the data is refined each year and the whole data set is revised to ensure comparability between one year and the next. As such, the figures published here should not be compared with those previously published.

Emissions of the greenhouse gases; carbon dioxide, methane, nitrous oxide and fluorinated gases (hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride) are all estimated for the inventory. They are all presented in the form of carbon dioxide (CO_2) equivalents for ease of comparison.

The Guernsey emissions inventory is compiled by AEA Technology, the company which calculates emissions for the whole of the UK and British Isles on behalf of the Department of Energy and Climate Change (DECC). More information on the work of the DECC can be found via their website: ***www.decc.gov.uk***.

In 2012, Guernsey's emissions totalled 454.5kt of CO_2 equivalent, which equates to 7.2 tonnes per capita. The total was 24.3% higher than in 2011 (see ***Table 1.2.1***) but 11.0% lower than 1990.

The 2008 to 2012 average total, which was 411.2kt of CO_2 equivalent, was 19.5% (or 99.4kt of CO_2 equivalent) lower than the 1990 total.

Table 2.1.1 shows that the majority of Guernsey's emissions are in the form of carbon dioxide (CO_2). The main source of these emissions is combustion of fossil fuels for power generation, transport and heating i.e. energy.

The variability in recent years as shown in ***Figure 2.1.1*** is largely due to changes in the amount of power being generated on island.

Figure 3.2.1 and Figure 3.2.2 show the proportions of emissions contributed by different sources. This data is also provided in ***Table 3.2.1*** overleaf.

Power generation contributed the largest proportion of emissions in both 1990 and 2012 (at 28.2% and 34.8% respectively). Its contribution to greenhouse gas emissions was 6.6 percentage points higher in 2012 than in 1990.

Transport contributed the second largest proportion in both 1990 and 2012 (at 24.6% and 22.1% respectively).

The proportions contributed by commercial and domestic combustion and by industrial combustion decreased by 1.2 and 0.8 percentage points respectively.

The contribution from agriculture, land use, land use change and forestry was 0.3 percentage points higher in 2012 than in 1990.

F-Gases, which contributed less than 0.1% in 1990, contributed 4.4% in 2012.

The changes in terms of emissions by mass, rather than proportions, are given on ***pages 5*** to ***11***.

Figure 3.2.1: Percentage contribution of emissions by source in 1990

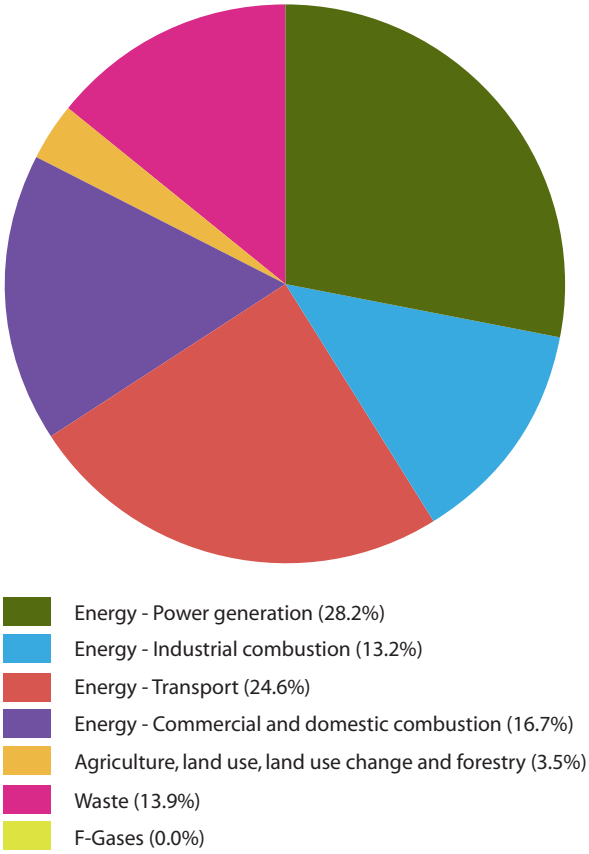


Figure 3.2.2: Percentage contribution of emissions by source in 2012

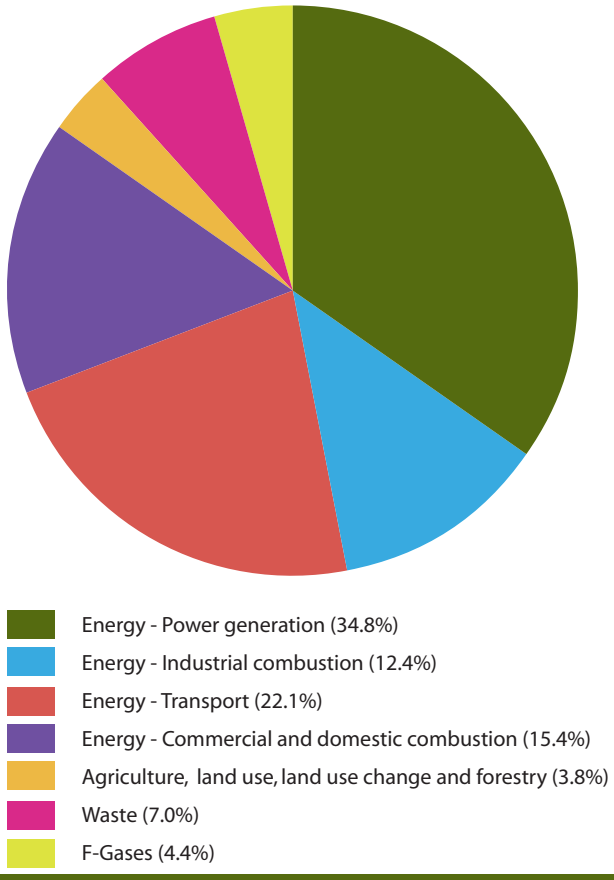


Table 3.2.1: Percentage contribution of emissions by source

	Energy - Power generation (%)	Energy - Industrial combustion (%)	Energy - Transport (%)	Energy - Commercial and domestic combustion (%)	Agriculture, land use, land use change and forestry (%)	Waste (%)	F gases (%)
1990	28.2	13.2	24.6	16.7	3.5	13.9	0.0
1991	30.0	14.1	22.3	17.6	3.1	13.0	0.0
1992	27.9	13.1	24.0	16.7	3.4	14.8	0.0
1993	28.9	13.6	24.6	17.2	3.4	12.3	0.1
1994	28.9	13.6	24.1	17.1	3.3	12.9	0.2
1995	28.9	13.6	23.7	17.3	3.2	13.0	0.3
1996	28.3	14.1	23.7	18.1	2.5	12.9	0.5
1997	27.6	14.2	24.5	17.6	2.4	13.0	0.7
1998	29.2	13.3	23.4	16.9	2.4	13.7	1.0
1999	30.3	12.2	23.8	15.7	2.4	14.5	1.1
2000	29.1	14.7	26.4	18.2	2.6	7.6	1.5
2001	10.4	15.3	35.3	20.8	3.6	12.1	2.5
2002	9.5	17.5	34.9	22.7	3.7	8.7	2.9
2003	10.8	17.3	33.6	22.6	3.7	8.8	3.1
2004	9.7	15.6	35.3	21.9	4.1	9.8	3.6
2005	13.1	14.2	32.6	19.8	4.0	12.7	3.6
2006	24.2	11.5	28.2	16.5	3.8	11.7	4.1
2007	17.6	14.5	29.8	18.5	3.9	11.3	4.3
2008	26.7	13.0	24.5	17.3	3.9	10.0	4.5
2009	24.4	13.6	25.5	17.9	4.1	9.6	4.8
2010	15.0	16.5	27.6	21.4	4.7	9.6	5.3
2011	18.5	14.7	28.2	19.1	4.8	9.2	5.6
2012	34.8	12.4	22.1	15.4	3.8	7.0	4.4

Combustion of fuels for energy (including electricity generation, heating, industrial processes and transport) has contributed the largest proportion of emissions since 1990. The majority of the emissions are in the form of carbon dioxide, but methane and nitrous oxide are also released in the combustion processes. In 2012, emissions from fuels for energy constituted 84.7% of the total emissions.

The emissions inventory is “source based”, which means it reflects only emissions released from Guernsey. As such, emissions resulting from the generation of electricity in Europe, which is imported for consumption in Guernsey, are not included. Electricity has been imported via a cable link to France since 2001, resulting in a significant decrease in the amount of power generated on-Island.

Landfilled waste is the next largest contributor to Guernsey’s total emissions, although the proportion it has contributed has decreased since 1990. The emissions are mostly in the form of methane gas, which is released by decomposing material.

Agriculture, land use, land use change and forestry combined contribute a small proportion of total emissions. The majority of the emissions are methane released by the digestive processes of cattle.

Nitrous dioxide is also released as a result of the combustion of fuels for energy and as a result of waste disposal and agricultural processes, but at comparatively low levels.

The fluorinated gases (“F-gases”) are not estimated by source in the same way as the other three gases mentioned above. They are associated with chemicals used in refrigeration, air-conditioning and heat pump systems and can be released as greenhouse gases if the systems leak or are disposed of improperly.

More detail and analysis of Guernsey emissions by source is provided over the next pages.

4.1 Emissions by Source - Energy

Combustion of fuels for power generation contributed 34.8% of Guernsey's total greenhouse gas emissions in 2012 (see ***Table 3.2.1***). The majority of the emissions are in the form of carbon dioxide, but methane and nitrous oxide are also released in the combustion processes.

Electricity has been imported via a cable link to France since 2001, reflected by a 75.9% decrease in power generation emissions between 2000 and 2001 (see ***Table 4.1.1***).

Excepting this large change, levels of greenhouse gas emitted from Guernsey as a result of fuel combusted for power generation have generally been trending upwards since 1990 (see ***Figure 4.1.1***). The red line on the chart shows the historic three year average.

Prior to 2000, when all of Guernsey's electricity was generated on island, power generation was the single largest component contributor to Guernsey's total emissions. Some electricity is still generated on Island and it is this amount which impacts most noticeably on the total level of emissions.

The amount of electricity generated on Island varies from year to year. In 2012, a fault in the cable link to France resulted in the need to generate electricity on Island, resulting in an increase in power generation emissions between 2011 and 2012 of 133.5%.

In total, the emissions from power generation increased by 9.9% (or 14.2kt of CO_2 equivalent) between 1990 and 2012.

Figure 4.1.1: Energy emissions - Power generation

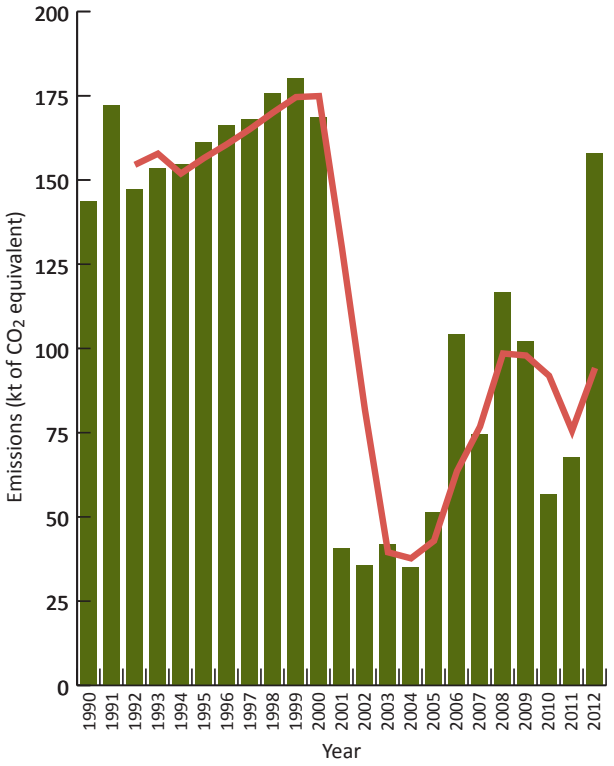


Table 4.1.1: Energy emissions - Power generation

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	143.8		
1991	172.3	19.8	19.8
1992	147.4	-14.5	2.5
1993	153.6	4.2	6.8
1994	154.7	0.7	7.5
1995	161.1	4.1	12.0
1996	166.2	3.2	15.5
1997	168.0	1.1	16.8
1998	175.8	4.6	22.2
1999	180.1	2.5	25.3
2000	168.7	-6.4	17.3
2001	40.7	-75.9	-71.7
2002	35.8	-12.0	-75.1
2003	42.0	17.3	-70.8
2004	35.2	-16.2	-75.5
2005	51.5	46.4	-64.2
2006	104.1	102.2	-27.6
2007	74.7	-28.3	-48.1
2008	116.8	56.4	-18.8
2009	102.2	-12.5	-29.0
2010	56.8	-44.4	-60.5
2011	67.7	19.1	-52.9
2012	158.0	133.5	9.9

Figure 4.1.2: Energy emissions - Industrial combustion

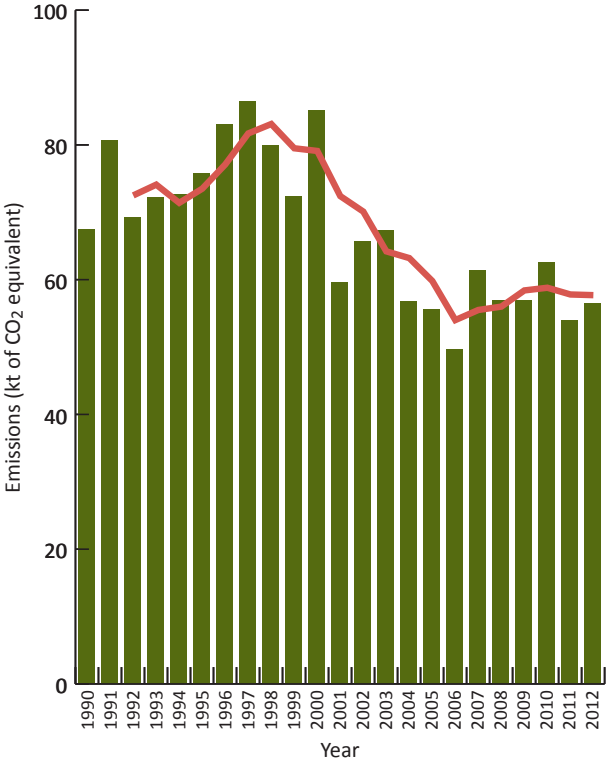


Table 4.1.2: Energy emissions - Industrial combustion

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	67.4		
1991	80.7	19.7	19.7
1992	69.3	-14.2	2.7
1993	72.2	4.2	7.1
1994	72.7	0.7	7.8
1995	75.7	4.1	12.2
1996	83.0	9.7	23.1
1997	86.4	4.0	28.0
1998	79.9	-7.5	18.4
1999	72.4	-9.4	7.3
2000	85.1	17.6	26.2
2001	59.6	-30.0	-11.6
2002	65.7	10.2	-2.6
2003	67.3	2.4	-0.3
2004	56.7	-15.7	-15.9
2005	55.6	-2.0	-17.6
2006	49.7	-10.6	-26.3
2007	61.3	23.4	-9.1
2008	56.9	-7.2	-15.6
2009	56.9	0.0	-15.6
2010	62.6	9.9	-7.2
2011	53.9	-13.9	-20.1
2012	56.5	4.9	-16.2

Energy emissions also include industrial combustion emissions (relating to building processes, use of generators etc), which decreased by 16.2% (or 10.9kt of CO_2 equivalent) between 1990 and 2012 (see ***Figure 4.1.2*** and ***Table 4.1.2***). The red line on the chart shows the historic three year average.

The majority of the emissions are in the form of carbon dioxide, but methane and nitrous oxide are also released in the combustion processes.

This source was the fourth largest contributor to emissions in 2012, at 56.5kt of CO_2 equivalent (12.4% of the total).

Levels of greenhouse gas emitted from Guernsey as a result of industrial fuel combustion had generally trended downwards since a peak in 1997 (see ***Figure 4.1.2***). However, levels began to increase again after 2006.

In 2012, emissions from industrial combustion were 4.9% (2.6kt of CO_2 equivalent) higher than in 2011.

Emissions from transport decreased between 1990 and 2012 by 19.9% (24.9kt of CO_2 equivalent) to 100.5kt of CO_2 equivalent (see ***Figure 4.1.3*** and ***Table 4.1.3***). The red line on the chart shows the historic three year average.

Despite this decrease, emissions from this source constituted the second largest proportion of the total in 2012, when it contributed 26.1% of energy emissions and 22.1% of total emissions.

Similar to previous years, approximately 80% of transport emissions resulted from on Island road transport in 2012.

Levels of greenhouse gases emitted as a result of transport have generally been trending downwards since a peak in 2000 (see ***Figure 4.1.3***).

The majority of greenhouse gas emissions resulting from transport are carbon dioxide. Other non-greenhouse gas air pollutants, such as nitrogen dioxide, sulpher dioxide are also present in vehicle exhaust emissions.

Figure 4.1.3: Energy emissions - Transport

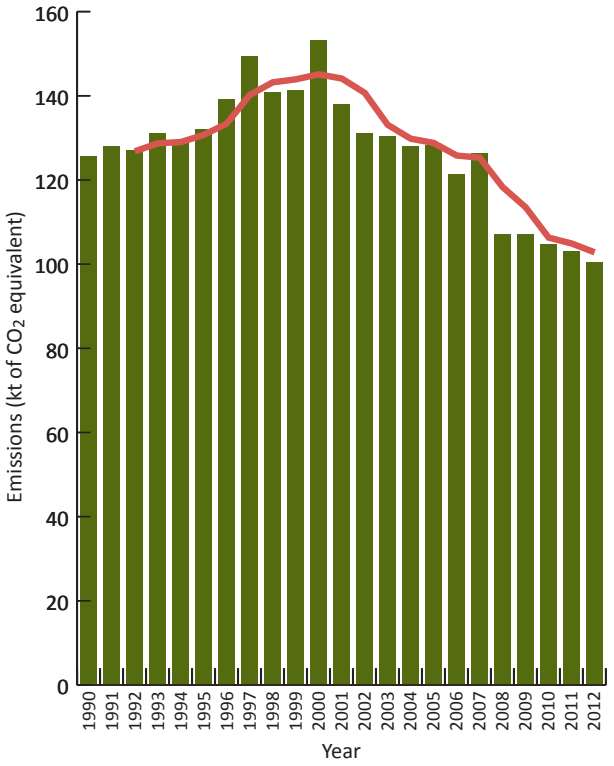


Table 4.1.3: Energy emissions - Transport

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	125.5		
1991	127.9	1.9	1.9
1992	127.0	-0.6	1.3
1993	131.1	3.2	4.5
1994	129.0	-1.6	2.8
1995	131.9	2.3	5.2
1996	139.1	5.5	10.9
1997	149.4	7.4	19.1
1998	140.9	-5.7	12.3
1999	141.3	0.3	12.7
2000	153.1	8.3	22.0
2001	137.9	-9.9	9.9
2002	131.0	-5.0	4.4
2003	130.4	-0.5	4.0
2004	127.9	-1.9	2.0
2005	128.1	0.1	2.1
2006	121.4	-5.2	-3.2
2007	126.3	4.0	0.7
2008	107.0	-15.3	-14.7
2009	107.1	0.0	-14.7
2010	104.7	-2.2	-16.5
2011	103.0	-1.6	-17.9
2012	100.5	-2.4	-19.9

Figure 4.1.4: Energy emissions - Commercial and domestic combustion

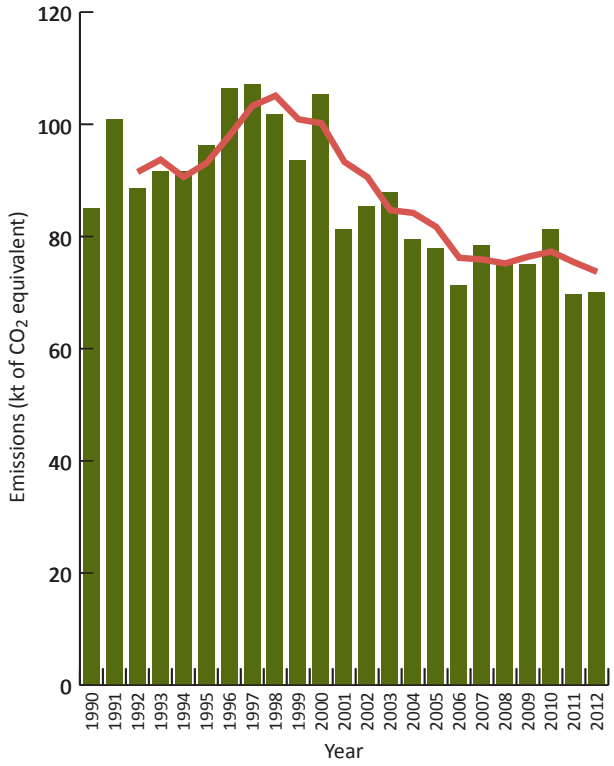


Table 4.1.4: Energy emissions - Commercial and domestic combustion

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	85.0		
1991	100.8	18.6	18.6
1992	88.5	-12.3	4.0
1993	91.7	3.6	7.8
1994	91.6	-0.1	7.7
1995	96.2	5.0	13.1
1996	106.4	10.6	25.1
1997	107.2	0.8	26.1
1998	101.8	-5.0	19.7
1999	93.6	-8.1	10.0
2000	105.3	12.5	23.8
2001	81.2	-22.9	-4.6
2002	85.3	5.0	0.2
2003	87.8	3.0	3.2
2004	79.4	-9.5	-6.6
2005	77.8	-2.0	-8.5
2006	71.3	-8.4	-16.2
2007	78.5	10.1	-7.6
2008	75.6	-3.7	-11.1
2009	75.1	-0.7	-11.7
2010	81.3	8.2	-4.4
2011	69.7	-14.2	-18.0
2012	70.0	0.4	-17.7

Commercial and domestic combustion of fuels for heating and hot water in homes and offices etc also contribute a substantial amount of the Island's emissions (15.4% of the 2012 total).

The emissions from commercial and domestic combustion were 70.0kt of CO_2 equivalent in 2012, which was 17.7% lower than in 1990 but 0.4% higher than in 2011 (see ***Table 4.1.4***).

The emissions from this source have ranged from under 70kt to over 100kt of CO_2 equivalent over the twenty-three years covered by the inventory. The trend (see ***Figure 4.1.4***) is similar to that for industrial combustion (as in ***Figure 4.1.2, Page 6***), generally decreasing over the ten year period ending in 2006.

The red line on the chart shows the historic three year average.

4.2 Emissions by Source - Agriculture, land use, land use change and forestry

Other emissions include those from agriculture, land use, land use change and forestry (shown in ***Figure 4.2.1***), which contributed 3.8% of the total emissions in 2012. The red line on the chart shows the historic three year average.

The majority of these emissions are methane released by the digestive processes of cattle. The decrease between 1995 and 1996 resulted from a change in the way cattle data were sourced.

There was a decrease in the number of cattle on the Island in 2001, when the milk quota was reduced, resulting in a reduction in emissions from cattle. Livestock-related emissions have since remained at a steady level. However, there has been a generally increasing trend in total emissions from this source since 2002, due to increasing emissions resulting from land use change.

The total level of emissions from these sources decreased by 2.2% between 1990 and 2012.

Figure 4.2.1: Agriculture, land use, land use change and forestry emissions

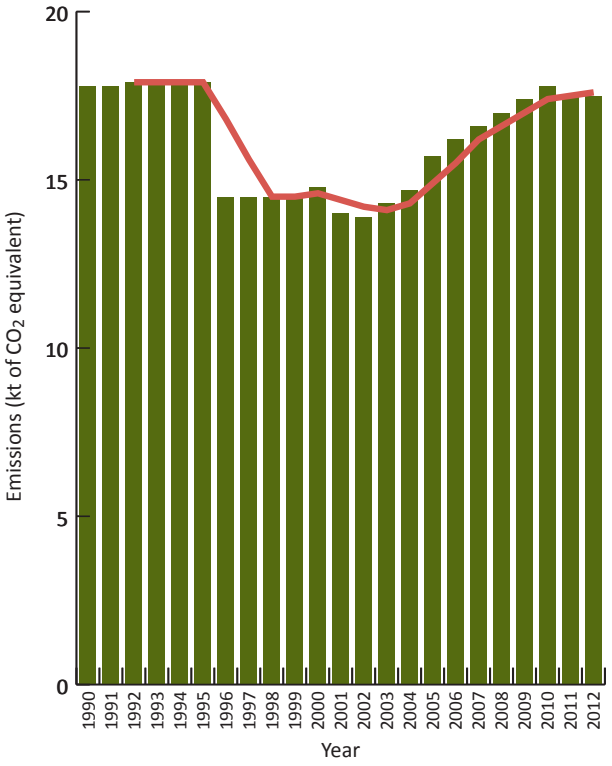


Table 4.2.1: Agriculture, land use, land use change and forestry emissions

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	17.8		
1991	17.8	-0.0	-0.0
1992	17.9	0.6	0.6
1993	17.9	0.0	0.6
1994	17.9	-0.2	0.4
1995	17.9	0.0	0.4
1996	14.5	-19.0	-18.7
1997	14.5	0.1	-18.6
1998	14.5	-0.4	-18.9
1999	14.5	-0.1	-19.0
2000	14.8	2.6	-16.9
2001	14.0	-5.4	-21.4
2002	13.9	-1.2	-22.3
2003	14.3	3.4	-19.7
2004	14.7	2.4	-17.7
2005	15.7	6.9	-12.0
2006	16.2	3.1	-9.3
2007	16.6	2.5	-7.0
2008	17.0	2.4	-4.8
2009	17.4	2.3	-2.6
2010	17.8	2.2	-0.4
2011	17.5	-1.5	-1.9
2012	17.5	-0.2	-2.2

Figure 4.3.1: Waste emissions

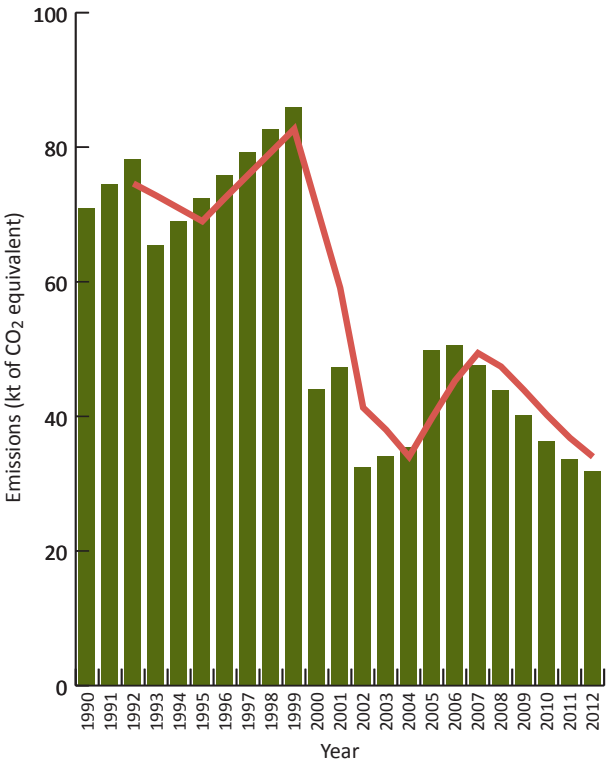


Table 4.3.1: Waste emissions

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	71.0		
1991	74.6	5.1	5.1
1992	78.2	4.8	10.2
1993	65.5	-16.3	-7.7
1994	69.0	5.4	-2.7
1995	72.5	5.0	2.2
1996	75.9	4.7	7.0
1997	79.3	4.5	11.8
1998	82.7	4.2	16.5
1999	86.0	4.0	21.2
2000	44.1	-48.7	-37.9
2001	47.3	7.3	-33.3
2002	32.5	-31.3	-54.2
2003	34.1	4.9	-51.9
2004	35.4	3.9	-50.1
2005	49.9	40.7	-29.7
2006	50.6	1.5	-28.7
2007	47.7	-5.6	-32.7
2008	43.9	-8.1	-38.2
2009	40.2	-8.3	-43.3
2010	36.4	-9.5	-48.7
2011	33.6	-7.7	-52.6
2012	31.9	-5.3	-55.1

Waste is the next largest contributor to Guernsey's total emissions after energy. It contributed 7.0% (31.9kt of CO_2 equivalent) of the total emissions in 2012.

The emissions are mostly in the form of methane gas, which is released as landfilled matter decomposes. In a weight for weight comparison, methane has a twenty one times higher global warming potential than carbon dioxide i.e. one kilotonne of methane is equivalent to 21 kilotonnes of carbon dioxide.

As a result, relatively small changes in the amount of methane emitted equate to considerably larger changes to emissions in terms of CO_2 equivalents.

There have been decreases in the emissions from this source since 2006 (see ***Figure 4.3.1*** and ***Table 4.3.1***). This mirrors the trend in waste going to landfill during these years.

The cumulative decrease between 1990 and 2012 was 55.1% (or 39.1kt of CO_2 equivalent). The red line on the chart shows the historic three year average.

Fluorinated gases ("F-gases") are not estimated by source in the same way as the other three gases mentioned above, but are included in the total greenhouse gas emissions.

F-gases can be released by refrigeration, air-conditioning and heat pump systems if they leak or are disposed of improperly. They contribute a relatively small, but increasing amount of total emissions (see ***Figure 5.1.1***). The red line on the chart shows the historic three year average.

In 2012, they contributed 4.4% of the total, compared to less than 0.1% in 1990, an increase of 20.1kt of CO_2 equivalent.

F-gases have very high global warming potentials compared to carbon dioxide. As such, amounts in the region of one gram in weight could have the same effect as one tonne of carbon dioxide being released into the atmosphere. The result of this is a highly volatile trend in terms of percentage changes.

Figure 5.1.1: F-gases emissions

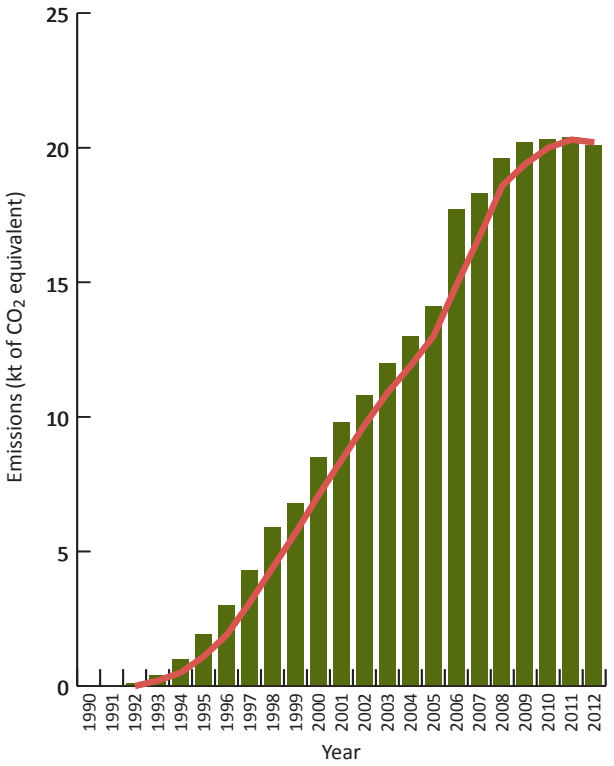


Table 5.1.1: F-gases emissions

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	0.0		
1991	0.0	21.6	21.6
1992	0.1	45.7	77.1
1993	0.4	493.2	950.4
1994	1.0	166.6	2,699.9
1995	1.9	99.4	5,482.7
1996	3.0	57.3	8,683.8
1997	4.3	45.0	12,632.7
1998	5.9	36.3	17,249.4
1999	6.8	14.8	19,822.9
2000	8.5	26.0	24,997.0
2001	9.8	15.0	28,761.1
2002	10.8	10.1	31,678.2
2003	12.0	11.3	35,264.6
2004	13.0	7.9	38,068.8
2005	14.1	8.4	41,277.9
2006	17.7	26.1	52,071.9
2007	18.3	3.3	53,792.7
2008	19.6	7.3	57,708.0
2009	20.2	3.0	59,448.2
2010	20.3	0.2	59,548.8
2011	20.4	0.5	59,823.7
2012	20.1	-1.2	59,106.8

7.1 Further Information

This bulletin has been compiled by the States of Guernsey Policy and Research Unit. The emissions inventory is calculated by AEA Technology, using data collated from a variety of sources.

Please contact the Policy and Research Unit for further information.

Policy and Research Unit
Sir Charles Frossard House
La Charroterie
St Peter Port
Guernsey
GY1 1FH

Tel: (01481) 717292
Fax: (01481) 713787

e-mail: ***policy.research@gov.gg***
web: ***www.gov.gg/pru***