Guernsey Annual Greenhouse Gas Bulletin

2010 - Issue date 29th February 2012

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. This analysis provided in this bulletin uses the 1990 base year for comparison.

1.2 Headlines

- Guernsey's greenhouse gas emissions decreased by 11.6% in 2010, when they totalled 379.1kt of carbon dioxide (CO_2) equivalent, compared to 428.9kt in 2009.
- The cumulative percentage change between 1990 and the 2008 to 2010 average (which was 399.3kt of CO_2 equivalent) was a decrease of 19.5% (or 96.9kt of CO_2 equivalent). This exceeds the Kyoto Protocol target of a decrease of 12.5%.
- Transport contributed the largest proportion (27%) of the greenhouse gases emitted in 2010.
- The majority (82.9%) of the emissions were in the form of carbon dioxide.

Figure 1.2.1: Total emissions

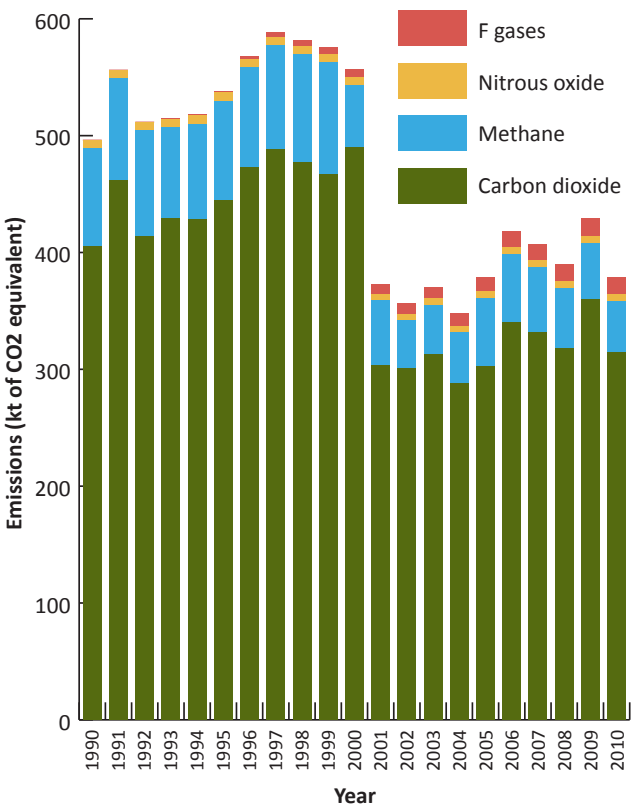


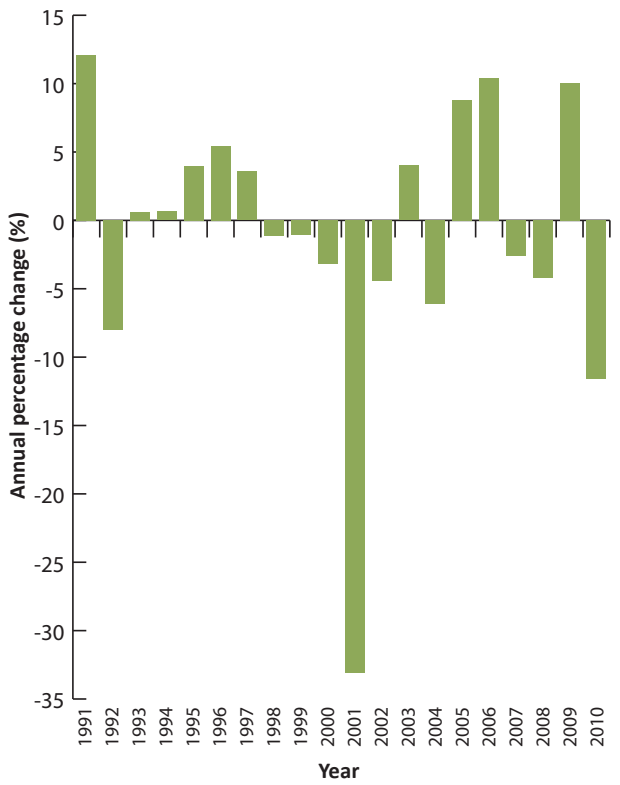
Table 1.2.1: Key data

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	496.2	n/a	n/a
1991	556.1	12.1	12.1
1992	511.6	-8.0	3.1
1993	514.7	0.6	3.7
1994	518.1	0.6	4.4
1995	538.6	4.0	8.5
1996	567.9	5.4	14.4
1997	588.2	3.6	18.5
1998	581.6	-1.1	17.2
1999	575.6	-1.0	16.0
2000	557.2	-3.2	12.3
2001	373.0	-33.1	-24.8
2002	356.3	-4.5	-28.2
2003	370.6	4.0	-25.3
2004	347.9	-6.1	-29.9
2005	378.6	8.8	-23.7
2006	417.9	10.4	-15.8
2007	407.0	-2.6	-18.0
2008	389.8	-4.2	-21.4
2009	428.9	10.0	-13.6
2010	379.1	-11.6	-23.6

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	405.6	83.8	6.8	0.0
1991	461.7	87.5	6.9	0.0
1992	413.7	91.0	6.9	0.0
1993	429.1	78.2	7.0	0.4
1994	428.4	81.7	7.0	0.9
1995	444.5	85.1	7.2	1.7
1996	472.7	85.9	6.6	2.7
1997	488.3	89.4	6.7	3.8
1998	477.1	92.6	6.5	5.3
1999	467.3	95.8	6.5	6.0
2000	489.6	53.7	6.7	7.2
2001	303.2	55.7	5.9	8.2
2002	301.1	40.3	5.7	9.3
2003	313.0	41.9	5.7	10.0
2004	288.3	43.1	5.6	11.0
2005	302.9	57.9	5.7	12.0
2006	340.0	58.7	5.8	13.5
2007	331.8	55.7	5.8	13.6
2008	317.9	51.7	5.7	14.5
2009	359.9	48.1	5.8	15.2
2010	314.3	44.2	5.7	15.0

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, 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 2010, Guernsey's emissions totalled 379.1kt of CO_2 equivalent, which equates to 6.1 tonnes per capita. The total was 11.6% lower than in 2009 (see ***Table 1.2.1***) and 23.6% lower than 1990.

The 2008 to 2010 average total was 19.5% (or 96.9kt of CO_2 equivalent) lower than the 1990 total, which was 496.2kt of CO_2 equivalent.

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, heating and transport i.e. energy.

3.2 Emissions Inventory - source

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 (29.0%) of emissions in 1990, but the fourth largest in 2010 (15.0%).

Waste emissions was the only other group contribution that decreased during the period, from 14.3% to 9.6%.

Transport, which had contributed the second largest proportion in 1990, contributed the largest proportion (27.0%) in 2010.

The proportions contributed by commercial and domestic combustion and by industrial combustion both increased during the period.

The contributions from agriculture, land use, land use change and forestry increase by 1.3 percentage points.

F Gases, which contributed less than 0.1% in 1990, contributed 3.9% in 2010.

The changes in terms of emissions by mass, rather than proportions are given on ***pages 6 to 8***.

Figure 3.2.1: Percentage contribution of emissions by source in 1990

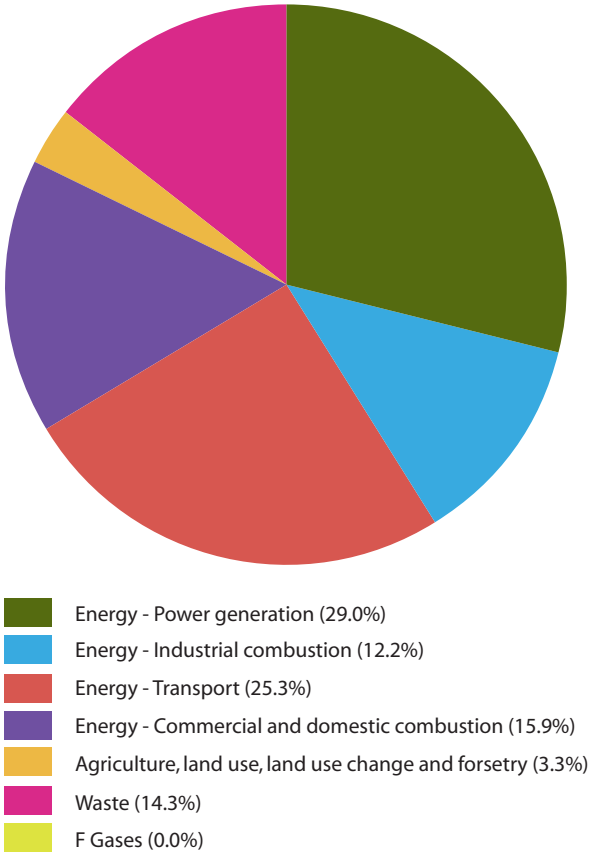


Figure 3.2.2: Percentage contribution of emissions by source in 2010

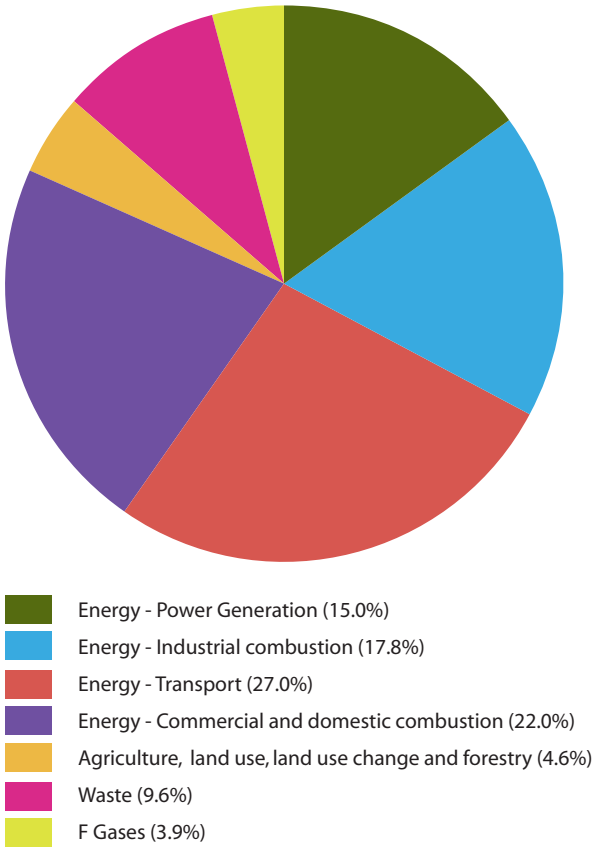


Table 3.2.1: Percentage contribution of emissions by source

	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	29.0	12.2	25.3	15.9	3.3	14.3	0.0
1991	31.0	13.0	22.8	16.8	3.0	13.4	0.0
1992	28.8	12.2	24.4	16.0	3.3	15.3	0.0
1993	29.9	12.6	25.0	16.5	3.2	12.7	0.1
1994	29.9	12.6	24.5	16.4	3.2	13.3	0.2
1995	29.9	12.6	24.1	16.6	3.1	13.5	0.3
1996	29.3	13.1	24.0	17.4	2.4	13.4	0.5
1997	28.6	13.2	25.0	16.9	2.3	13.5	0.7
1998	30.2	12.3	23.8	16.2	2.3	14.2	0.9
1999	31.3	11.3	24.0	15.1	2.3	14.9	1.0
2000	30.3	13.7	26.8	17.5	2.5	7.9	1.3
2001	10.9	14.3	36.1	20.3	3.5	12.7	2.2
2002	10.0	16.5	35.8	22.2	3.7	9.1	2.6
2003	11.3	16.3	34.8	22.0	3.7	9.2	2.7
2004	10.1	14.6	36.6	21.3	4.0	10.2	3.2
2005	13.6	13.2	33.7	19.2	4.0	13.2	3.2
2006	24.9	10.7	28.9	16.4	3.8	12.1	3.2
2007	18.5	13.5	30.9	18.0	4.0	11.7	3.4
2008	30.0	9.2	27.0	14.6	4.3	11.3	3.7
2009	23.8	15.3	24.5	19.5	4.0	9.4	3.5
2010	15.0	17.8	27.0	22.0	4.6	9.6	3.9

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 2010, these emissions constituted 81.8% 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 or “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 15% of Guernsey's total greenhouse gas emissions in 2010 (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 decrease, 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.

In total, the emissions from power generation decreased by 60.5% (or 41.7kt of CO_2 equivalent) between 1990 and 2010.

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 2010, emissions from power generation were 44.4% (145.4kt of CO_2 equivalent) lower than in 2009.

Figure 4.1.1: Energy emissions - Power generation

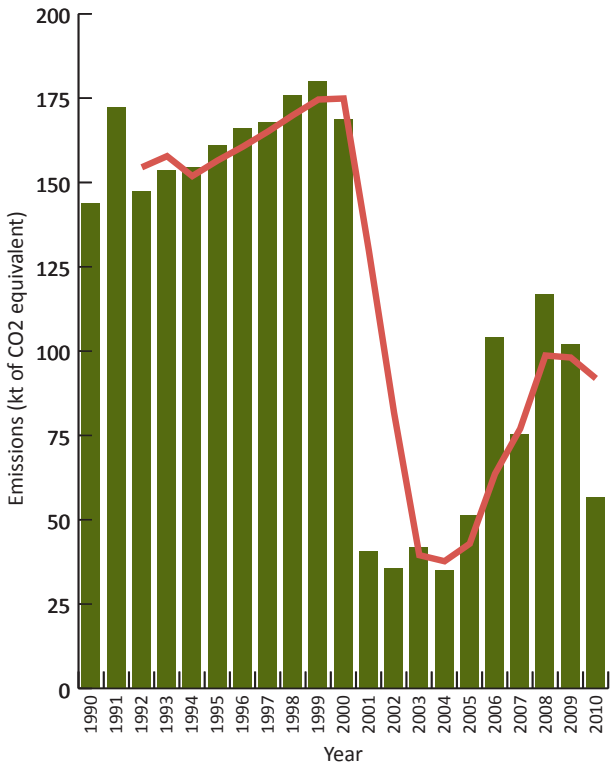


Table 4.1.1: Energy emissions - Power generation

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	143.8	n/a	n/a
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	75.3	-27.7	-47.7
2008	116.8	55.1	-18.8
2009	102.2	-12.5	-29.0
2010	56.8	-44.4	-60.5

Figure 4.1.2: Energy emissions - Industrial combustion

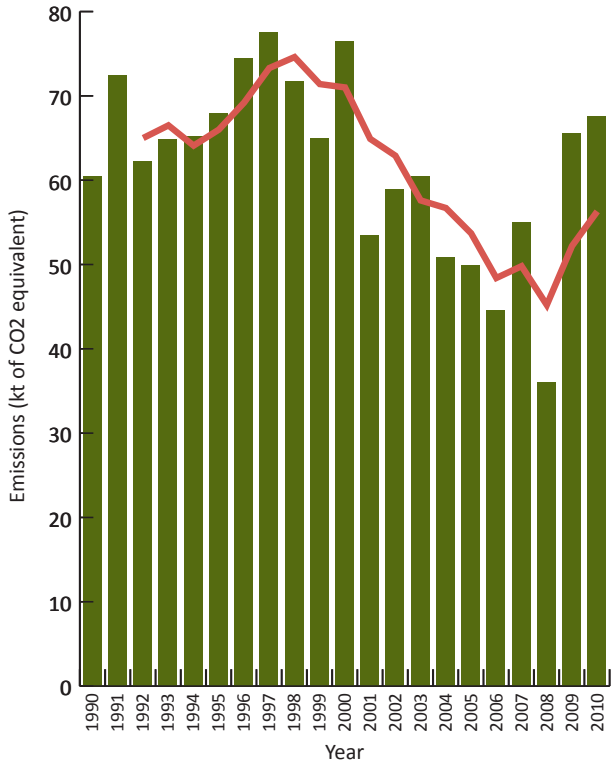


Table 4.1.2: Energy emissions - Industrial combustion

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	60.5	n/a	n/a
1991	72.4	19.7	19.7
1992	62.2	-14.2	2.7
1993	64.8	4.2	7.1
1994	65.2	0.7	7.8
1995	67.9	4.1	12.2
1996	74.5	9.7	23.1
1997	77.5	4.0	28.0
1998	71.7	-7.5	18.4
1999	65.0	-9.4	7.3
2000	76.4	17.6	26.2
2001	53.5	-30.0	-11.6
2002	58.9	10.2	-2.6
2003	60.4	2.4	-0.3
2004	50.9	-15.7	-15.9
2005	49.9	-1.9	-17.6
2006	44.6	-10.6	-26.3
2007	55.0	23.4	-9.1
2008	36.0	-34.6	-40.5
2009	65.5	81.9	8.2
2010	67.6	3.2	11.6

Energy emissions also include industrial combustion emissions (relating to building processes, use of generators etc), which increased by 11.6% (or 7.0kt of CO_2 equivalent) between 1990 and 2010 (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 third largest contributor to emissions in 2010, at 67.6kt of CO_2 equivalent (17.8% 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 1998 (see ***Figure 4.1.2***). However, levels returned to near 1998 levels following an increase in 2009.

In 2010, emissions from industrial combustion were 3.2% (2.1kt of CO_2 equivalent) higher than in 2009.

Emissions from transport decreased between 1990 and 2010, by 18.6% (23.3kt of CO_2 equivalent) to 102.2kt 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 largest proportion of the total in 2009, when it contributed 33.0% of energy emissions and 27.0% of total emissions.

Similar to previous years, approximately 80% of transport emissions resulted from on Island road transport in 2010.

Levels of greenhouse gas 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. However, 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

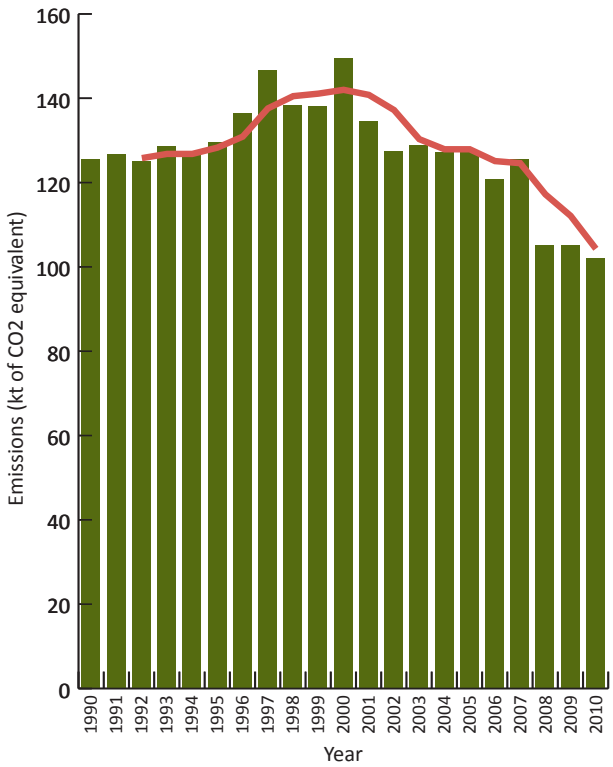


Table 4.1.3: Energy emissions - Transport

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	125.5	n/a	n/a
1991	126.8	1.0	1.0
1992	125.0	-1.4	-0.4
1993	128.7	3.0	2.6
1994	126.8	-1.5	1.0
1995	129.6	2.2	3.2
1996	136.5	5.3	8.7
1997	146.8	7.6	17.0
1998	138.3	-5.8	10.2
1999	138.2	0.0	10.2
2000	149.6	8.2	19.2
2001	134.5	-10.1	7.2
2002	127.6	-5.1	1.6
2003	129.0	1.1	2.8
2004	127.2	-1.4	1.3
2005	127.5	0.2	1.6
2006	120.8	-5.3	-3.8
2007	125.7	4.1	0.2
2008	105.3	-16.3	-16.1
2009	105.3	0.0	-16.1
2010	102.2	-2.9	-18.6

Figure 4.1.4: Energy emissions - Commercial and domestic combustion

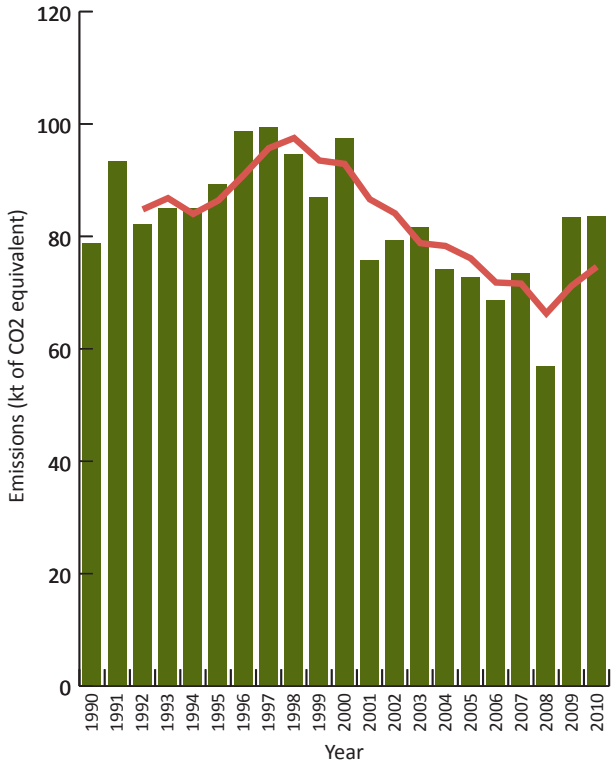


Table 4.1.4: Energy emissions - Commercial and domestic combustion

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	78.8	n/a	n/a
1991	93.4	18.5	18.5
1992	82.1	-12.1	4.2
1993	85.0	3.5	7.8
1994	84.9	-0.2	7.7
1995	89.2	5.1	13.2
1996	98.7	10.7	25.2
1997	99.3	0.6	25.9
1998	94.5	-4.9	19.8
1999	86.9	-8.0	10.2
2000	97.4	12.1	23.6
2001	75.7	-22.3	-4.0
2002	79.2	4.7	0.4
2003	81.6	3.0	3.5
2004	74.2	-9.1	-5.9
2005	72.7	-2.0	-7.8
2006	68.6	-5.6	-12.9
2007	73.4	6.9	-6.9
2008	56.8	-22.6	-28.0
2009	83.4	46.9	5.8
2010	83.6	0.2	6.0

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 (22.0% of the 2010 total).

The emissions from commercial and domestic combustion were 83.6kt of CO_2 equivalent in 2010, which was 6.0% higher than in 1990 and 0.2% higher than in 2009 (see ***Table 4.1.4***).

The emissions from this source have ranged from under 60kt to over 90kt of CO_2 equivalent over the twenty one years covered by the inventory. The trend is similar to that for industrial combustion (see ***Figure 4.1.4***), with a generally decreasing trend over the ten year period ending in 2008. However, as with industrial combustion, increases since 2008 have resulted in a level higher than that in 1990. 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 4.6% of the total emissions in 2010. 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 was 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. 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 increased by 6.3% between 1990 and 2010.

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

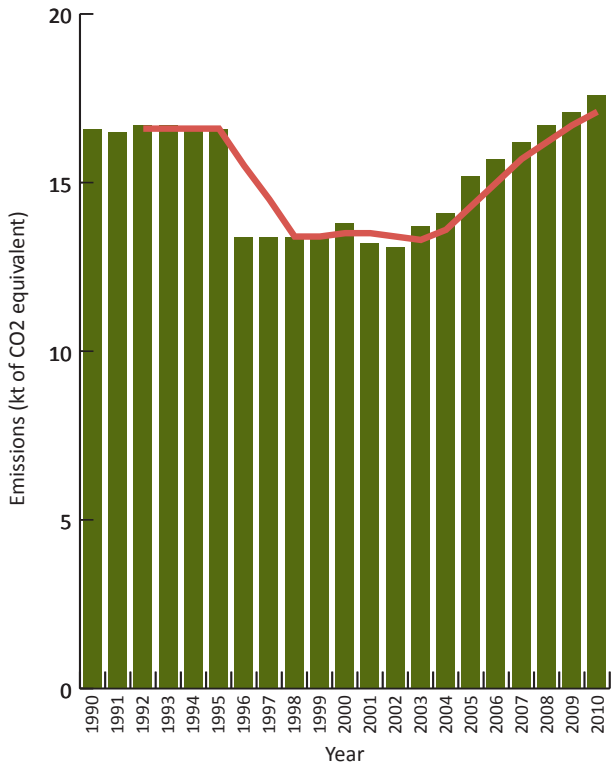
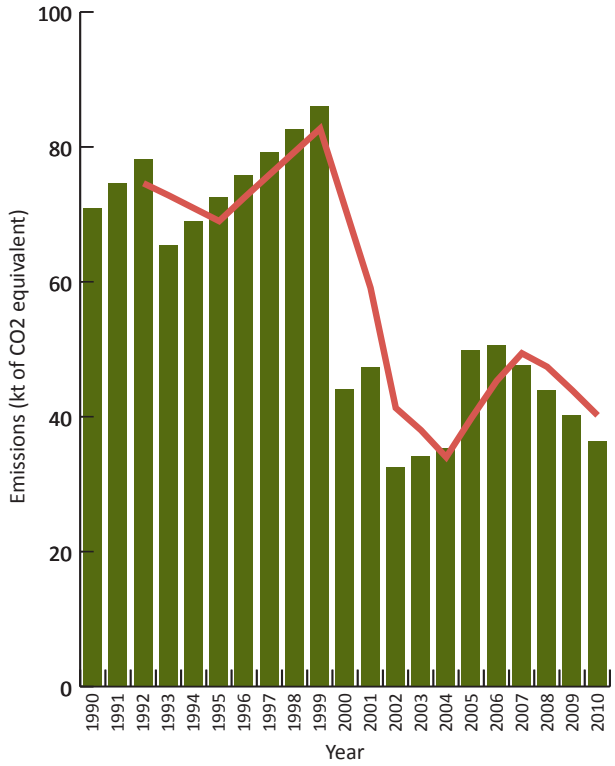


Table 4.2.1: Agriculture, land use, land use change and forestry emissions

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	16.6	n/a	n/a
1991	16.5	-0.1	-0.1
1992	16.7	0.7	0.7
1993	16.7	0.0	0.7
1994	16.6	-0.3	0.4
1995	16.6	0.0	0.4
1996	13.4	-19.2	-18.9
1997	13.4	0.1	-18.8
1998	13.4	-0.4	-19.2
1999	13.4	-0.1	-19.3
2000	13.8	3.5	-16.4
2001	13.2	-4.7	-20.4
2002	13.1	-0.5	-20.8
2003	13.7	4.2	-17.5
2004	14.1	3.1	-14.9
2005	15.2	7.6	-8.5
2006	15.7	3.9	-4.8
2007	16.2	2.9	-2.0
2008	16.7	2.9	0.7
2009	17.1	2.8	3.5
2010	17.6	2.7	6.3

Figure 4.3.1: Waste emissions



Waste is the next largest contributor to Guernsey's total emissions after energy. It contributed 9.6% (36.4kt of CO_2 equivalent) of the total emissions in 2010.

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***). The cumulative decrease between 1990 and 2010 was 48.7% (or 34.5kt of CO_2 equivalent). The red line on the chart shows the historic three year average.

Table 4.3.1: Waste emissions

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	71.0	n/a	n/a
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

5.1 Emissions - F Gases

Fluorinated or "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 2010, they contributed 3.9% of the total, compared to less than 0.1% in 1990, an increase of 14.9kt 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

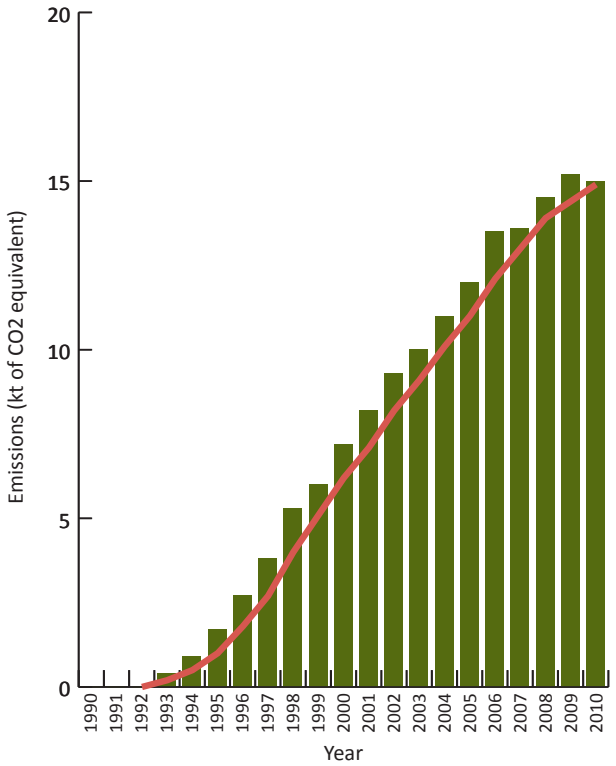


Table 5.1.1: F gases emissions

	Total emissions (kt of CO_2 equivalent)	Annual % change	Cumulative % change
1990	0.0	n/a	n/a
1991	0.0	-0.2	-0.2
1992	0.0	3.0	2.8
1993	0.4	1019.2	1050.2
1994	0.9	123.7	2473.4
1995	1.7	89.3	4772.0
1996	2.7	53.8	7394.3
1997	3.8	44.3	10717.9
1998	5.3	38.8	14911.9
1999	6.0	12.0	16711.5
2000	7.2	21.1	20261.9
2001	8.2	12.8	22858.7
2002	9.3	13.6	25982.2
2003	10.0	7.7	27979.8
2004	11.0	10.0	30780.4
2005	12.0	9.2	33629.1
2006	13.5	12.1	37726.8
2007	13.6	1.4	38256.0
2008	14.5	6.0	40574.4
2009	15.2	4.9	42586.8
2010	15.0	-1.5	41954.1

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.

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