

2008

for

Greenhouse Gas Inventory

Cornwall &
the Isles of Scilly



INTERREG IVC

INNOVATION & ENVIRONMENT
REGIONS OF EUROPE SHARING SOLUTIONS



**REGIONS FOR
SUSTAINABLE
CHANGE**

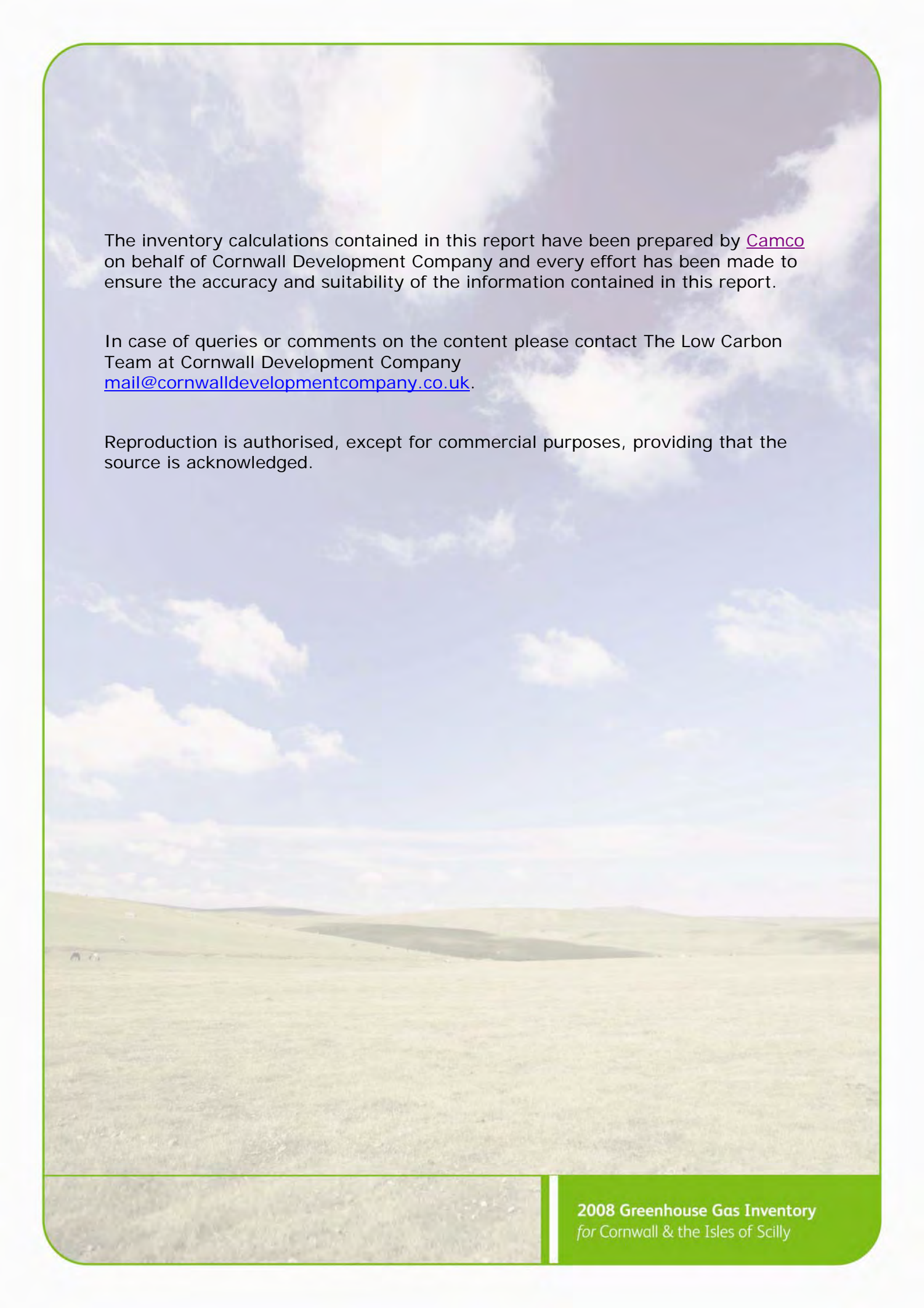


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The inventory calculations contained in this report have been prepared by [Camco](#) on behalf of Cornwall Development Company and every effort has been made to ensure the accuracy and suitability of the information contained in this report.

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Executive summary

This report presents the findings of a pilot project that has been carried out to quantify and compare regional Greenhouse Gas (GHG) emissions in Cornwall and the Isles of Scilly (IoS) for the years 2007 and 2008. This work has been carried out within the framework of the INTERREG IVC funded 'Regions for Sustainable Change' (RSC) project. The inventory is the first of its kind in the UK, has followed the International Local Government GHG Emissions Analysis Protocol ¹ and is based on the most comprehensively available published data.

In addition to covering emissions from premises energy sources, transport, agriculture and waste, it also extends to activity areas such as marine and aviation emissions. The production of this inventory provides an important opportunity for the region to actively measure and manage GHG emissions and it is anticipated that the inventory will be repeated in future years in order to review progress against national/European targets.

The estimated emissions for the calendar year 2008 were 4,734 thousand tonnes of Carbon Dioxide Equivalent (CO₂e). Updated calculations for 2007 estimate that emissions were in the order of 4,902 thousand tonnes of CO₂e. A comparison of year on year change shows an overall reduction in emissions of 3.4%.

The estimated avoided emissions from the re-use and recycling of waste and the generation of renewable electricity and heat have been calculated and included as a supplementary analysis to this inventory.

¹ http://www.iclei.org/fileadmin/user_upload/documents/Global/Progams/CCP/Standards/IEAP_October2010_color.pdf

1 Introduction

Since October 2008 Cornwall has been participating in the Regions for Sustainable Change (RSC) project, which is funded by the European INTERREG IVC programme and seeks to identify opportunities for, and the costs and effects of, moving to a low-carbon economy.

Within the RSC project, Cornwall has carried out a pilot study to quantify the Greenhouse Gas (GHG) emissions in 2008 for Cornwall and the Isles of Scilly (IoS). This 2008 study was based on an earlier inventory which was completed in 2009 for the year 2007. The 2007 inventory was completed using published data, and focussed on GHG emissions emitted from premises energy sources, transport, agriculture and waste in Cornwall only.

The 2008 study has been expanded to quantify GHG emissions for both Cornwall and the IoS and to include sources of scope three emissions such as aviation and marine transport. The 2007 inventory has also been updated to include IoS, and the additional scope three activity areas. In line with inventory management best practice, emissions factors applied have been updated to 2010 where available. It should be noted that in the original 2007 inventory, the Global Warming Potential (GWP) factors used were taken from the Intergovernmental Panel on Climate Change (IPCC) 2006 guidelines. To complete the 2008 Inventory and 2007 update the Inventory author, Camco², has reverted to using 1996 data in accordance with United Nations Framework Convention on Climate Change (UNFCCC) guidelines. Revised results for the updated 2007 inventory can be found in Appendix I of this report.

² The inventory calculations contained in this report have been prepared by [Camco](#) on behalf of Cornwall Development Company

2 Assessment methodology

2.1 Standards and protocols

The assessment methodology employed by Camco for the 2008 Cornwall GHG Inventory, and 2007 update, follows the reporting principles and guidelines of the ICLEI Local Governments for Sustainability Protocol.

The ICLEI protocol in turn utilises the guidelines and principles laid out in internationally recognised GHG reporting standards including ISO14064, World Resources Institute (WRI)/ World Business Council for Sustainable Development (WBCSD) GHG Protocol Corporate Accounting and Reporting Standard, and IPCC Second Assessment Report 1996.

In line with the ICLEI Protocol the following procedure has been used:

1. Establishment of the assessment boundaries (including the selection of greenhouse gases, project boundaries and assessment boundaries).
2. Collection of data and available data sources.
3. Evaluation of data quality and data sources.
4. Calculation of emissions using appropriate conversion factors.
5. Analysis of results.

The assessment procedure and a summary of results are presented in the main text of this report. A glossary of climate change terms is found in Section 7. A detailed description of emissions calculations and associated assumptions are presented in Appendix II.

2.2 Greenhouse Gases - Overview

This GHG Inventory includes the six greenhouse gases covered by the Kyoto Protocol. The six Kyoto gases are Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Sulphur Hexafluoride (SF₆), Perfluorocarbons (PFCs), and Hydrofluorocarbons (HFCs).

When calculating GHG emissions, the individual gases can be converted to Carbon Dioxide Equivalent (CO₂e) in order to calculate a single number that represents the total amount of greenhouse gas being released. CO₂e is the standard unit that allows amounts of greenhouse gases of different strengths to be added together, based on each gas's impact on climate change.

An individual gas's GWP is calculated based on a specific time frame, most commonly 100 years, taking into consideration both the impact and the length of time the gas remains in the atmosphere based on a 100 year time frame. GWP's used here are from the IPCC's Second Assessment Report 1996.

Figure 2.1: Global Warming Potentials (GWP) from the IPCC Second Assessment Report

Kyoto gas	GWP
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous oxide (N ₂ O)	310
Sulphur hexafluoride (SF ₆)	22,200
Perfluorocarbons (PFCs)	4,800 – 9,200
Hydrofluorocarbons (HFCs)	12 – 12,000

2.3 Assessment Boundary

2.3.1 Geographic boundary

For the purposes of this assessment, the geographic boundary was set as Cornwall and the Isles of Scilly (IoS).

Figure 2.2:

2008 - Geographic Boundary of GHG Inventory



2.3.2 Emission sources

The activity emission sources quantified in the inventory are displayed in Figure 2.3 below and include:

- Domestic, and Commercial/Industrial Premises - electricity, natural gas, petroleum, coal and manufactured solid fuel;
- Transport – diesel and petrol cars, buses, motorcycles, marine and aircraft, petrol and diesel HGVs;
- Agriculture – livestock, petroleum (farm vehicles) and crop fertilisers;
- Waste – landfill, incinerated clinical, and wastewater.

In accordance with the ICLEI Protocol and in agreement with the Cornwall GHG Inventory Steering Group, the sequestration of carbon from agriculture and land use has been excluded from the inventory calculations.

Figure 2.3:

2008 - Activity emission sources quantified in the inventory.



2.3.3 Emission factors

Factors for emissions associated with electricity were calculated using data from Department for Food and Rural Affairs (Defra: 2010), Department for Business, Enterprise and Regulatory Reform (BERR: 2009) and IPCC (1996). Defra factors are applicable across the UK. Camco has applied the grid rolling average figure for electricity provided from the national / local grid.

Factors associated with premises natural gas, petroleum, coal and manufactured solid fuel consumption were calculated using Defra (2010), BERR (2009) and IPCC (1996).

Factors associated with vehicles were calculated using IPCC (1996), Defra (2010) and BERR (2009).

Factors associated with agricultural livestock were calculated using Dr D. Chadwick's report 'Agricultural nitrous oxide and methane emissions from Cornwall and potential mitigation' (2008) and IPCC (1996). Factors associated with agricultural crops were calculated using Carbon Trust (2009), Ecoinvent (2009) and Defra (2007).

In order to calculate the CH₄ emissions from waste disposal, conversion factors were taken from typical UK waste data in Brown et al. (1999) and Smith et al. (2001). Factors for waste water and discharge were calculated using Defra (2010).

3 Data

The data used to calculate the Greenhouse Gas Inventory of Cornwall was gathered from a number of sources which are discussed in further detail below.

Wherever possible, the data provided relates to the calendar year 2008. Where calendar year data was not available data from other time periods has been used in order to make the analysis as complete as possible. Where preferred data was unavailable but it was possible to make assumptions based on other data sets, these assumptions have been highlighted throughout the results. Details on data limitations, extrapolations and assumptions is explained below and shown in the calculations in Appendix II. Many people have contributed their time and energy into providing data for the 2008 inventory. A list of references is provided in Section 6 and a summary of data sources and assumptions is provided below in points 3.1 – 3.7.

3.1 Premises Fuel

Premises energy use (stationary sources) for Domestic, Industrial and Commercial consumption was sourced from the Department for Business Innovation & Skills (BIS). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which breaks the data down to six key areas in Cornwall and the IoS. The dataset provided is for the calendar year 2008 and provided the primary data for: premises electricity, natural gas, petroleum, coal, and manufactured solid fuel.

3.2 Transport Fuel

Transport fuel use (mobile sources) for Domestic, Industrial and Commercial consumption was sourced from BIS. The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which breaks the data down to six key areas in Cornwall and the IoS. The dataset provided is for the calendar year 2008 and provided the primary data for: transport diesel cars, petrol cars, buses, motorcycles, diesel HGV, diesel LGV, petrol LGV, and rail petroleum. Emissions from Heritage Railways were not included as data was not available.

3.3 Aviation

Data provided is from records of air traffic in and out of Newquay Cornwall Airport in 2008. Aviation data for take-off and landings from other sites, British International

Helicopters at Penzance and airports at Land's End and St Mary's on the IoS, was unavailable and has therefore not been included. Data has been provided by Cornwall Airport Ltd. (CAL) on the number of movements at Newquay Cornwall Airport during 2007 and 2008, detailing distances flown and a breakdown of aircraft type.

For ease of computation, the aircrafts using Newquay Cornwall Airport were broken down in to six categories: Heavy jet, Medium jet, Light jet, Turbo prop, Piston and Helicopter. Military movements have been excluded.

Camco calculated emissions using representative aircraft inputs in the [Eurocontrol](#) 'Small Emitter's Tool', provided for airline operators to calculate emissions for compliance with the EU Emissions Trading System (EU ETS) aviation scheme. These emissions include Landing and Take-off (LTO) cycle emissions and cruise emissions. Distances (cruise emissions) were halved for allocation to Cornwall, as Cornwall would not take account for the whole journey.

An average distance was derived from distance flown and movement figures, and then entered in the Eurocontrol tool using representative aircraft types for the aircraft categories. Having calculated emissions for an average flight, totals were then calculated for each aircraft category.

Flight distances were derived from airport codes, and where destinations did not have a code, [Google Earth](#) was used to calculate distances assuming a direct flight. Details were available on whether aircraft had landed, overshot, were rolling or circuit flying. For those that were circuit flying an additional 10 miles have been attributed to each circuit.

3.4 Agriculture

The emissions quantified under agriculture include agricultural diesel use, enteric and manure methane emissions from livestock, and fertiliser application from arable crops. It is acknowledged by the Cornwall GHG Inventory Steering Group that carbon sequestration is not included in this inventory in accordance with the ICLEI Protocol. There is however significant interest to take carbon sequestration forward as a future area of research. Land use or energy credits from agricultural land used for creating renewable energy is also not accounted for due to the restrictions of the inventory project, and as it is outside the methodological requirements.

Emissions from fertiliser application have not followed the IPCC methodology. The emissions calculated are for CO₂e production from fertiliser applications using crop and fertiliser data from Defra for 2008, and emissions factors from published sources (Carbon Trust and Ecoinvent v2.2).

3.4.1 Agriculture Diesel

Data for diesel consumption was sourced from BIS. The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which breaks the data down to six key areas in Cornwall and the IoS.

3.4.2 Agriculture Electricity

Camco was unable to obtain clarification from the Department of Energy and Climate change (DECC) on whether the figures for Commercial and Industrial electricity included dairy consumption in the totals. To avoid the risk of double counting it has been assumed that Industrial and Commercial electricity does include dairies. However, further detail on the contribution of this sector to the emissions can be seen in the analysis section, Section 4.3, of this report.

3.4.3 Livestock

Data for livestock numbers was provided from Defra's 2008 Census.

3.4.4 Arable Crops

Data for arable crop production was sourced from Defra's 2008 Census.

3.4.5 Soil Types

The soil types for Cornwall have been further refined for the 2008 inventory. Differing soil types have been identified (www.landis.org.uk) and there are 3 predominate soil types in Cornwall and Isles of Scilly:

- Free draining slightly acid loamy soils - the predominate soil type across Cornwall and the IoS, the land cover commonly found on this type of soil is arable and grassland;
- Free draining acid and loamy soils over rock - found across Cornwall, land cover is mainly grassland and rough grazing;
- Very acid loamy upland soils with wet peaty surface - found on higher ground in north and south of Cornwall, the land cover is dominated by moorland, rough grazing, forestry and grassland.

3.4.6 Fertiliser Application

Fertiliser application rates were taken from The Fertiliser Manual - RB209, 8th edition (Defra, 2010), assuming a Soil Nitrogen Supply (SNS) index of 2. The original 2007 inventory assumed a default SNS index of 3. At the Cornwall GHG Inventory Agricultural Reference Group meeting on the 11th July 2011 attendees recommended a SNS index of

1 or 2 would be more appropriate. Following further research on soil types in the region, a SNS index of 2 was indicated as the most appropriate index for the calculations.

3.4.7 Fertiliser Quantities and Sales

At the Cornwall GHG Inventory Agricultural Reference Group meeting on the 11th July 2011 sales of fertiliser was suggested as potential source for quantities of fertiliser applied in 2008. However, although sales figures may provide trends over time, it was agreed that fertiliser use is often lower than fertiliser sales due to forward purchasing. RB209 provides fertiliser costs per tonne of product so it would be feasible in the long run to calculate emissions based on expenditure if sales figures were readily available. Recommended application rates from RB209 have been used in the 2008 inventory.

Due to emission factor limitations Camco was required to make assumptions about the weight of nitrogen required for various crops. Camco assumed 'other cereals' to be equal to that of wheat as a worst case scenario; the weight of nitrogen required for 'other crops for stock feed' was assumed to be equal to that of root crops; the weight of nitrogen required for 'other arable crops' and 'bare fallow' was assumed to be equal to that of maize.

3.4.8 Nitrates

Nitrogen can be lost to the atmosphere as ammonia gas. Significant losses commonly occur from livestock housing, livestock grazing and where organic manures are applied to fields and are not immediately incorporated by cultivation. The 'Nitrate Regulations', which implement the European Community's Nitrates Directive, designate areas known as Nitrate Vulnerable Zones (NVZs) where nitrate pollution is a problem, and set rules for certain farming practices which must be followed within these zones. There are three significant NVZs in Cornwall. The NVZs rules set limits for certain crops on the amount of nitrogen from livestock manure and manufactured nitrogen fertilisers that can be used.

Defra data used in the study takes into account restrictions created by NVZs, however theoretically the NVZs may offer an alternative and more detailed approach to future nitrate calculations.

3.4.9 Sulphur Deficiency

Sulphur is a structural component of some amino acids and vitamins, and is essential in the manufacturing of chloroplasts. Camco had previously assumed that no cereal crops suffered from sulphur deficiency, however the Cornwall GHG Inventory Agricultural

Reference Group highlighted that sulphur deficiency was on the rise across Cornwall and the South West. Due to lack of data Camco was unable to include sulphur deficiency affects within the calculations. For future studies it would be beneficial to be able to quantify this.

3.5 Marine Transport

Data availability for marine transport has improved since the last study. However, despite contacting many harbours and ports, the data collected was still patchy and varied in type, such as numbers and types of boats, fuel sold or hours at sea.

Camco was able to obtain data from the Marine Management Organisation (MMO) which publishes lists of registered vessels. Unfortunately Camco was unsuccessful in the project timeframe in gaining more detail on the available data from MMO.

Considering the data available, Camco assumes that all registered vessels in Cornwall are registered to Newlyn, as the available data sets seem to present one harbour per region for registered craft in the UK. It is recommended that further attempts are made to clarify that this is case, and that craft details from other harbours do not need to be collected if they are all registered through Newlyn. Elsewhere actual data was sourced for ports and harbours; however the timing of requests in the year was not ideal, and it is recommended that ports and harbours are contacted again later in the year.

Fuel used by boats is predominately red diesel and has therefore been assumed to be solely red diesel for the purpose of this assessment. GHG emissions for red diesel are assumed to be the same as gas oil.

The MMO report lists fishing vessels under and over 10m per port authority, which in this instance is Newlyn. This data was used to create a benchmark figure for kWh consumption per boat based on these two categories. Where data was otherwise unavailable, leisure boats have been assumed to be equivalent to small fishing vessels.

3.6 Refrigerant Gas Loss

The Environment Agency was able to provide a sample data set for HCFC's releases within the Cornwall inventory boundary; however, this data is not broken down by individual gases making any GHG quantification very generic. In addition, more detailed data was not made available during the time frame of the inventory data collection period.

3.7 Waste and Waste Water

Updated landfill and clinical waste to incineration data is provided by Cornwall Council and reported for the financial year 2008/09. Camco were unable to obtain updated NHS data for 2008, however to avoid the risk of double counting with Cornwall Council clinical waste figures, NHS waste has been excluded from the 2008 figures.

Waste water figures for 2008 were unavailable, and data remains the same as the previous year as this is deemed to be representative.

4 Results

4.1 Cornwall & Isles of Scilly GHG inventory 2008 GHG Emissions

The inventory estimates that for the calendar year 2008, emissions associated with Cornwall and the IoS were **4,734 thousand tonnes of CO₂e**.

- The top three highest contributing activities to the total Co₂e emissions are:
 - i. Commercial/industrial electricity
 - ii. Agriculture - livestock
 - iii. Domestic petroleum
- The highest contributing sector to the total Co₂e emissions is the domestic sector which represents 32% of total emissions.
- The highest contributing fuel to the emissions of premises is electricity which represents 55% of premises emissions.
- The highest contributing mode of transport to the emissions of transport is petrol cars which represent 39% of transport emissions.

A series of figures now follows which illustrate how the total CO₂e emissions for Cornwall and the IoS in 2008 break down by sector in graphical and tabular form.

- Figure's 4.1 and 4.2 show a summary of breakdown emissions, and percentage contribution to total emissions by activity.
- Figure 4.3 shows the contribution to total emissions by sector.
- Figure 4.4 shows the contribution to premises emissions of different fuel types.
- Figure 4.5 shows the contribution to transport emissions of different fuel types and modes of transport.
- Figure 4.6 shows total emissions broken down by ICLEI Macro and Community Sectors.

Figure 4.1:

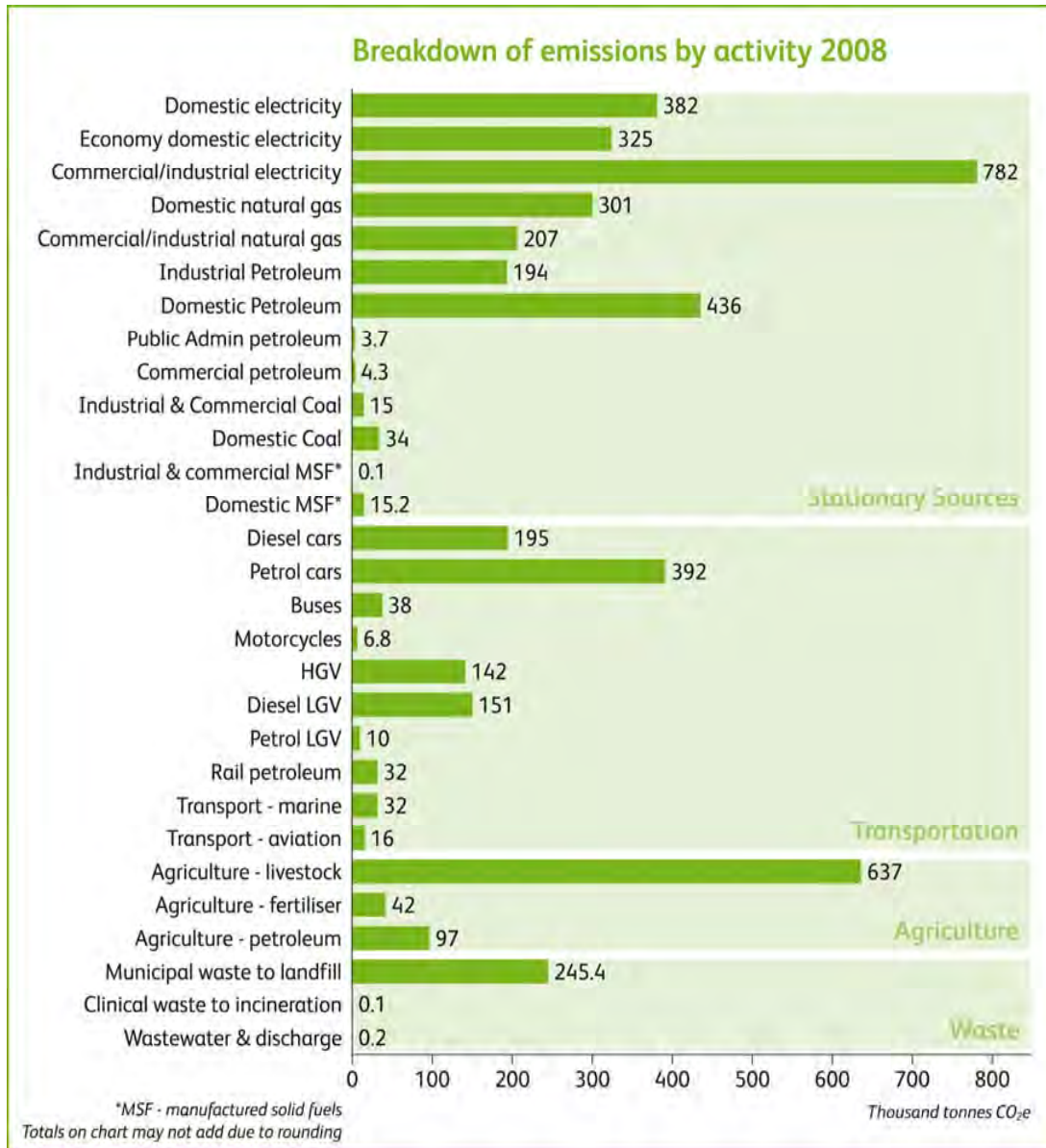


Figure 4.2:

Summary by General Activity 2008

Source of emissions	Total equiv. CO ₂ e (t/yr)	Proportion of total
Premises		
Domestic electricity	381,810	8.1%
Economy domestic electricity	324,643	6.9%
Commercial /industrial electricity	781,545	17%
Domestic natural gas	300,803	6.4%
Commercial /industrial natural gas	207,002	4.4%
Industrial petroleum	194,327	4.1%
Domestic petroleum	436,021	9.2%
Public administration petroleum	3,662	0.08%
Commercial petroleum	4,256	0.09%
Industrial & commercial coal	14,735	0.3%
Domestic coal	33,534	0.7%
Industrial & commercial MSF*	62	0.001%
Domestic MSF*	15,207	0.3%
Transportation		
Diesel cars	195,115	4.1%
Petrol cars	391,770	8.3%
Buses	37,550	0.8%
Motorcycles	6,776	0.1%
HGV	142,158	3%
Diesel LGV	151,492	3.2%
Petrol LGV	9,648	0.2%
Rail petroleum	31,766	0.7%
Aviation	15,990	0.3%
Marine	32,420	0.7%
Agriculture		
Livestock	636,649	13%
Fertiliser	41,765	0.9%
Diesel	97,171	2.1%
Electricity***	0	0%
Refrigerants		
Refrigerant Gas Losses**	0	0%
Waste		
Municipal waste to landfill	245,401	5.2%
Municipal waste to incineration	-	-
Clinical waste (NHS) to incineration	93	0.002%
Wastewater and discharge	173	0.004%
Total	4,733,544	100%

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases, ***Agricultural electricity figures have been included within commercial and industrial electricity.

Figure 4.3:

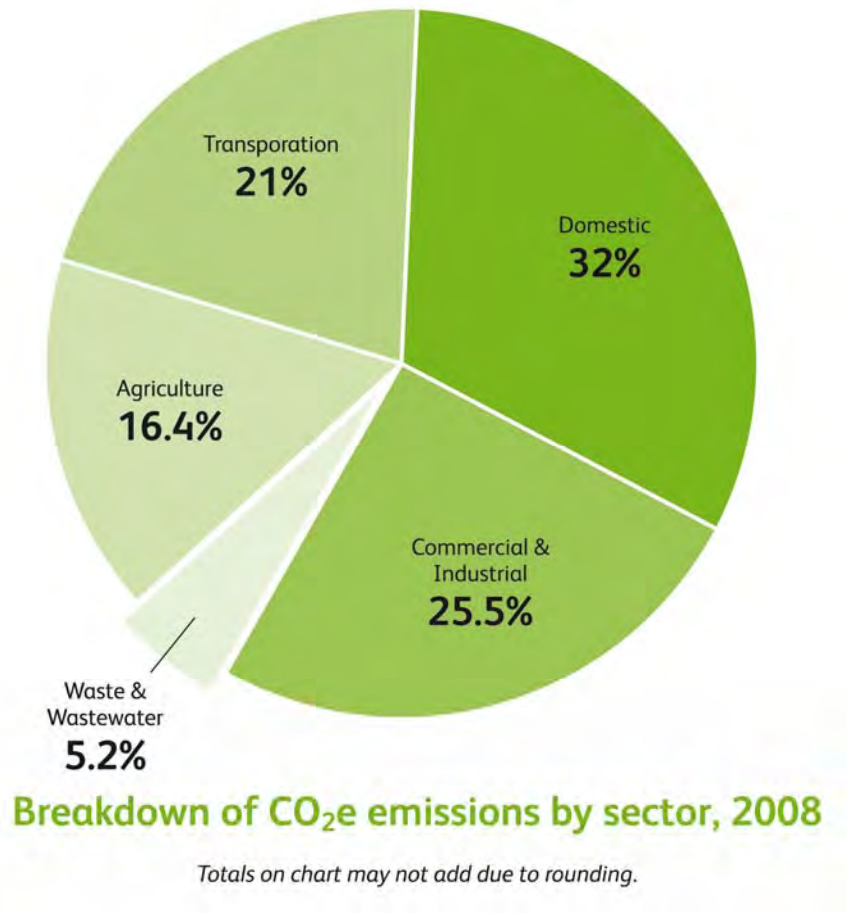


Figure 4.4:

Breakdown of premises emissions by Fuel type, 2008

Totals on chart may not add due to rounding.

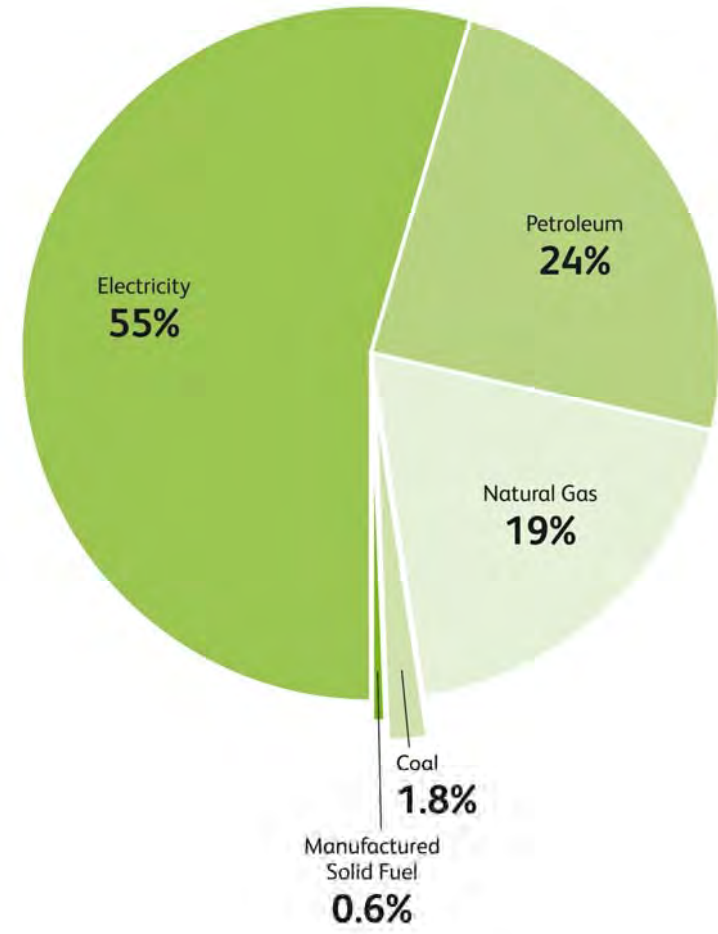
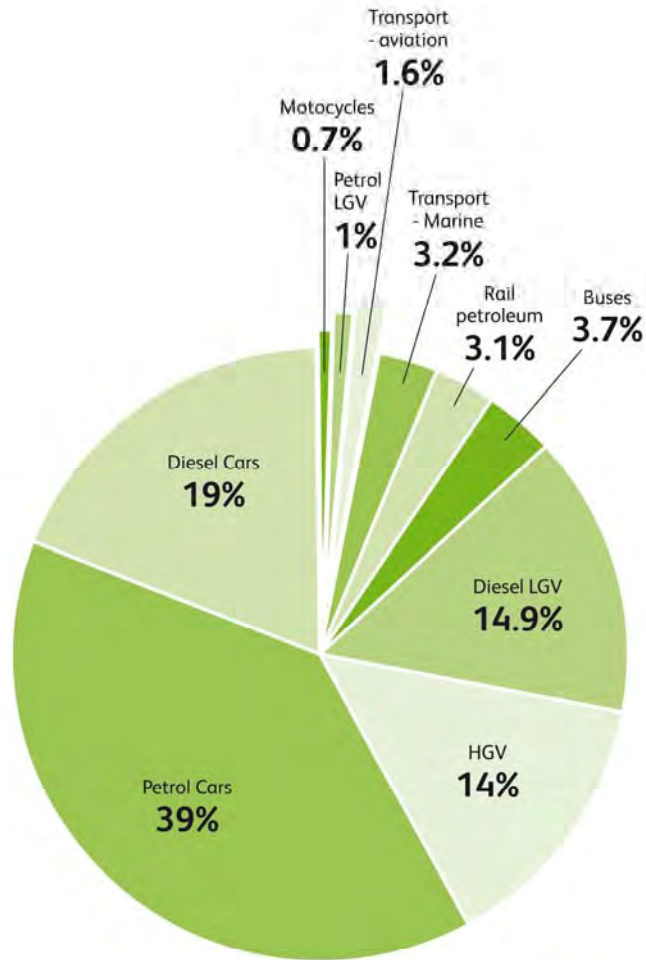


Figure 4.5:



Breakdown of emissions from transportation, 2008

Totals on chart may not add due to rounding.

Figure 4.6:

2008 Summary (By ICLEI Protocol)

Macro Sector (IPCC)	Community Sector (ICLEI)	Source of emissions	Total equiv. CO ₂ e (t/yr)	
Stationary Combustion	Energy Combustion	Domestic electricity	381,810	
		Economy domestic electricity	324,643	
		Commercial /industrial electricity	781,545	
		Domestic natural gas	300,803	
		Commercial /industrial natural gas	207,002	
		Industrial petroleum	194,327	
		Domestic petroleum	436,021	
		Public administration petroleum	3,662	
		Commercial petroleum	4,256	
		Industrial & commercial coal	14,735	
		Domestic coal	33,534	
		Industrial & commercial MSF*	62	
		Domestic MSF*	15,207	
Mobile Combustion	Transportation	Diesel cars	195,115	
		Petrol cars	391,770	
		Buses	37,550	
		Motorcycles	6,776	
		HGV	142,158	
		Diesel LGV	151,492	
		Petrol LGV	9,648	
		Rail petroleum	31,766	
		Marine	32,420	
Aviation	15,990			
Fugitive emissions	Other	Refrigerant Gas Losses**	0	
Industrial Processes and Product use	Other	-	-	
Agriculture, Forestry & other Land Use	Agricultural	Livestock	636,649	
		Fertiliser	41,765	
		Petroleum	97,171	
Waste	Waste	Solid waste disposal	Municipal waste to landfill	245,401
		Biological treatment of Solid Waste	Municipal waste to incineration	-
		Incineration and Open Burning of Solid Waste	Clinical waste (NHS) to incineration	93
		Wastewater treatment and Discharge	Wastewater and discharge	173

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases

4.2 Year on Year Change

To enable a comparison of the GHG emissions between the 2008 Inventory and the updated 2007 inventory, a table is presented in Figure 4.7 to show the differences in activity area emissions over the two inventory years.

Figure 4.7:

Comparison of Inventory Year-on-Year Totals

Source of emissions	Total equiv. CO ₂ e (t/yr) 2007	Total equiv. CO ₂ e (t/yr) 2008	Total equiv. CO ₂ e (t/yr) Year on year change	Change in emission source as a percentage of baseline emission source year	Significance change as a percentage of total baseline year emissions
Premises					
Domestic electricity	392,560	381,810	-10,749	-2.7%	-0.22%
Economy domestic electricity	348,057	324,643	-23,414	-6.7%	-0.48%
Commercial /Industrial electricity	835,508	781,545	-53,963	-6.5%	-1.10%
Domestic natural gas	315,918	300,803	-15,115	-4.8%	-0.31%
Commercial /Industrial natural gas	244,201	207,002	-37,199	-15.2%	-0.76%
Industrial petroleum	225,129	194,327	-30,802	-13.7%	-0.63%
Domestic petroleum	413,245	436,021	22,776	5.5%	0.46%
Public administration petroleum	2,653	3,662	1,009	38.0%	0.02%
Commercial petroleum	2,044	4,256	2,212	108.2%	0.05%
Industrial & commercial coal	11,996	14,735	2,739	22.8%	0.06%
Domestic coal	29,747	33,534	3,787	12.7%	0.08%
Industrial & commercial MSF*	112	62	-50	-44.5%	0.00%
Domestic MSF*	16,768	15,207	-1,561	-9.3%	-0.03%
Transportation					
Diesel cars	187,371	195,115	7,744	4.1%	0.16%
Petrol cars	401,836	391,770	-10,067	-2.5%	-0.21%
Buses	43,039	37,550	-5,489	-12.8%	-0.11%
Motorcycles	7,243	6,776	-467	-6.5%	-0.01%
HGV	148,131	142,158	-5,973	-4.0%	-0.12%
Diesel LGV	150,458	151,492	1,034	0.7%	0.02%
Petrol LGV	10,528	9,648	-880	-8.4%	-0.02%
Rail petroleum	31,389	31,766	377	1.2%	0.01%
Aviation	9,780	15,990	6,211	63.5%	0.13%
Marine	41,231	32,420	-8,811	-21.4%	-0.18%
Agriculture					
Livestock	633,643	636,649	3,005	0.5%	0.06%
Fertiliser	36,925	41,765	4,840	13.1%	0.10%
Diesel	97,318	97,171	-147	-0.2%	-0.003%
Electricity***	-	-	-	-	0%
Refrigerants					
Refrigerant Gas Losses**	-	-	-	-	0%
Waste					
Municipal waste to landfill	264,821	245,401	-19,420	-7.3%	-0.40%
Municipal waste to incineration	91	-	-	-	-
Clinical waste (NHS) to incineration	325	93	-232	-71.3%	-0.0047%
Wastewater and discharge	170	173	3.6	2.1%	0.0001%
Total	4,902,239	4,733,544	-168,695	-3.4%	-3.4%

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases, ***Agricultural electricity figures have been included within commercial and industrial electricity.

Analysis of the data found that the 2008 emissions for Cornwall and the IoS were 4,734 thousand tonnes of CO₂e whilst emissions in 2007 were 4,902 thousand tonnes of CO₂e. This represents a reduction of 168,000 tonnes or 3.4% between the two years.

The main areas of reduction in 2008 from 2007 are in:

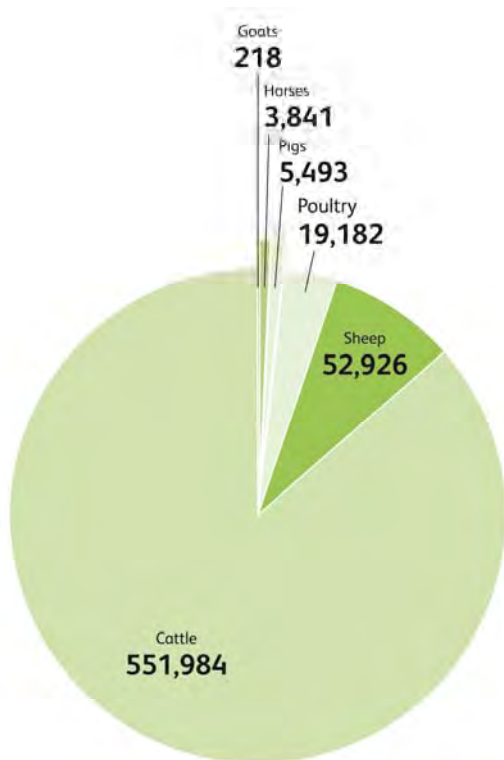
- fuel usage in premises – a reduction of 172,853 CO₂e (t/yr),
- transport emissions– a reduction of 31,687 CO₂e (t/yr),
- agricultural diesel emissions - a reduction of 147 CO₂e (t/yr),
- municipal waste to landfill - a reduction of 19,420 CO₂e (t/yr),
- clinical waste to incineration - a reduction of 232 CO₂e (t/yr).

4.3 Agriculture Emissions breakdown

At the Agricultural Reference Group meeting on 11th July 2011 it was agreed that a more detailed breakdown of agricultural emissions would be provided.

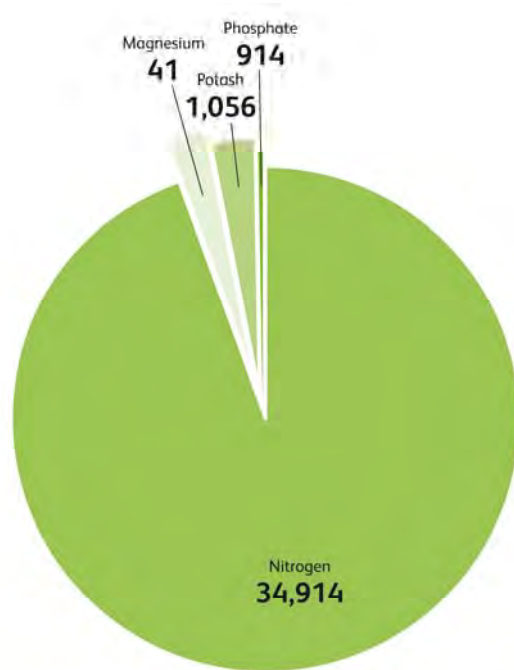
Emissions from livestock and fertiliser application for arable crops are presented here in Figures 4.8 and 4.9 respectively. Overall, emissions from livestock account for 82% of CO₂e emissions from agriculture. Emissions from Cattle represent 87% of the total emissions for livestock. Emissions from Nitrogen account for 84% of the total emissions for fertiliser.

Figure 4.8:



GHG emissions associated with Livestock 2008

Figure 4.9:



GHG emissions associated with fertilisers 2008

4.4 Supplementary Analysis³

Throughout the study, consultation with stakeholders has provided a rich and diverse amount of data. Not all data calculated was included in the results due to the following reasons:

- Lack of confirmable data / robust sources,
- The reporting does not fit with the methodologies outlined in the ICLEI Protocol,
- Data was obtained outside of the study's timeframe.

However, where possible these additional data sources have been included below as the further detail may be of illustrative value.

4.4.1 Agricultural Data

The role of agriculture and land use with regards to GHG emissions is complex as it has the potential to both emit and sequester carbon by the very nature of managing land. The ICLEI protocol methodology followed in this inventory does not allow a finer analysis of these issues but for a more accurate analysis the Ecosystem Goods and Services Approach, best defined as the benefits obtained from ecosystems, could be taken. This approach would include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling. The area of organic farming (as this would use no inorganic fertiliser) and the contribution made by energy reduction measures and renewable energy on farms would also need to be considered.

4.4.1.1 Dairy Electricity

Camco was unable to obtain clarification from DECC on whether the figures for Commercial and Industrial electricity were included in the totals. For the purposes of the study we have assumed that dairy herd electricity is included in the data set, however Figure 4.10 aims to demonstrate the dairy herd's potential contribution to the total electricity emissions. Figures have been based on an average of 300kWh per head (Farming & Wildlife Advisory Group, 2010), as advised during the Cornwall GHG Inventory Agricultural Reference Group meeting on the 11th July 2011.

To demonstrate the dairy herd's potential contribution to the total electricity emissions, Camco were required to make some assumptions about the number of animals being milked. However it is recognised that dairy cows will not be milked until their first

³not included in totals

lactation. More detailed research would be necessary to provide more accurate data on electricity use in the dairy sector in Cornwall in future inventories.

Figure 4.10

Agricultural Electricity

Source of emissions	Electricity usage (kWh/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. (tCO ₂ e/yr)
Dairy female 2yr+	22,125,695	11,983	5.3	75	12,063
Dairy female 2yr+ (no offspring)	4,894,654	2,651	1.2	16	2,669
Dairy female 1-2yr	5,507,259	2,983	1.3	19	3,003
Dairy female <1yr	5,597,664	3,032	1.3	19	3,052
Total	38,125,272	20,649	9.2	128	20,786

4.4.2 Recycling and Re-Use of Waste in Cornwall

The calculation of CO₂e avoided through recycling and re-use of waste in Cornwall has not previously been calculated. For the purposes of this paper, and following advice from the Waste and Resources Action Programme ([WRAP](#)), Defra 2011 carbon saving factors have been used as they provide the most comprehensive set of conversion factors for waste to date.

Figure 4.11 shows the total estimated amount of CO₂e avoided by re-use and recycling of waste in Cornwall in 2008. Detailed data can be found in Appendix IV of this report.

Figure 4.11:

2008			
Municipal Waste to Landfill (tonnes)	Recycled / Re-Used (tonnes)	CO ₂ e avoided (tonnes CO ₂ e)	% Avoided
245,401	118,042	104,561	43%

In 2008 municipal waste to landfill accounted for 245,401 tonnes CO₂e representing 5.2% of total GHG emissions in Cornwall and the IoS. During the same period the amount of waste diverted from landfill in Cornwall through re-use and recycling equates to avoiding 104,561 tonnes CO₂e.

The CO₂e avoided through re-use and recycling represented 43% of the total GHG emissions from waste to landfill in 2008.

4.4.3 Generation of Renewable Electricity and Heat in Cornwall and the Isles of Scilly

Detail on the installed renewable energy generation in Cornwall and the IoS has been taken from the 2008 Regen SW Survey of Renewable Energy and Heat Projects in South West England. The total installed capacity in Cornwall and the IoS in 2008 was 57.28 MW of renewable electricity and 11.63 MW of renewable heat. A detailed breakdown can be found in Appendix V of this report.

4.4.3.1 Renewable Electricity

For the purposes of this paper, the calculation of CO₂e avoided from renewable electricity generation in Cornwall and the IoS has been calculated using load and conversion factors taken from the DECC Digest of United Kingdom energy statistics (DUKES), and Defra 2010.

Figure 4.12 shows the total figure of CO₂e avoided by renewable electricity generation in Cornwall and the IoS. Detailed data can be found in Appendix V of this report.

Figure 4.12:

2008				
Premises electricity - total tonnes equiv. CO ₂ e	Total GWh delivered of renewable electricity	Total kgCO ₂ e	CO ₂ e avoided (tonnes CO ₂ e)	% Avoided
1,487,998	171	92,995,169	92,995	6%

In 2008 premises electricity use accounted for 1,487,998 tonnes CO₂e representing 32% of total GHG emissions in Cornwall and the IoS. During the same period the amount of renewable electricity delivered in Cornwall and the IoS equates to avoiding 92,995 tonnes CO₂e.

The CO₂e avoided through the generation of renewable electricity represented 6% of the total GHG emissions from premises electricity use in 2008.

4.4.3.2 Renewable Heat

For the purposes of this paper, the calculation of GWh delivered by renewable heat generation in Cornwall and the IoS has been calculated using load factors taken from the UK Supply Curve for Renewable Heat, DECC, 2009, and the AEA Microgeneration Index - Quarterly Summary Report, 2011.

The total⁴ GWh delivered by renewable heat generation in Cornwall and the IoS in 2008 was approximately 23 GWh. Detailed data can be found in Appendix V of this report. As robust conversion factors could not be sourced in the timeframe of this pilot project, the total figure of CO₂e avoided by renewable heat generation could not be calculated. It is hoped that future versions of this report will contain this calculation.

⁴A load factor was not available for MW of Sewage Gas CHP, renewable heat, so has not been included in GWh totals

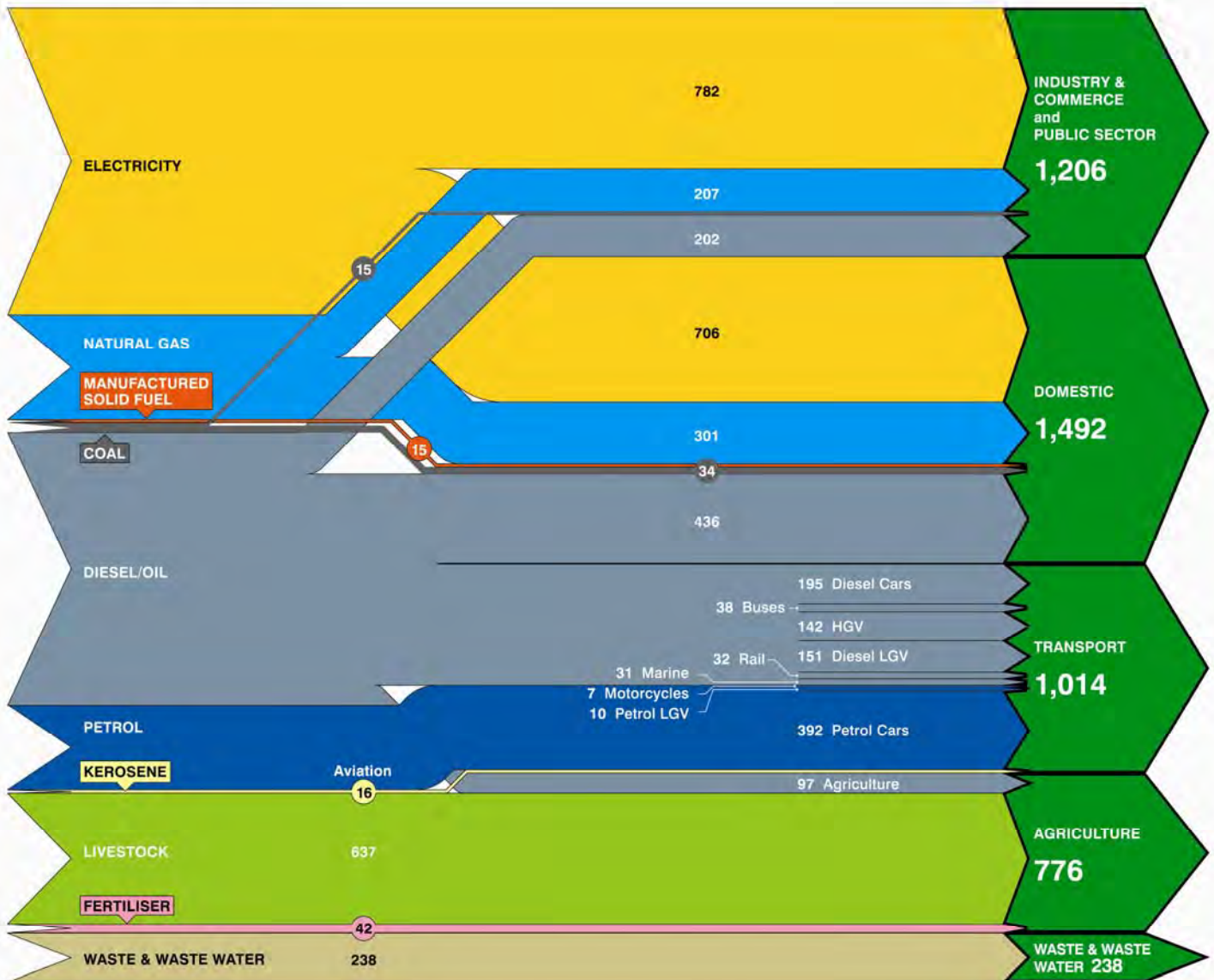
5 Sankey Diagram

Camco produced an energy flow map, in the form of a Sankey diagram for the 2008 inventory results. The Sankey diagram found in figure 5.1 demonstrates the flow of GHG emissions.

Figure 5.1:

Cornwall 2008 GHG Emissions – Sankey Diagram

Tonnes of CO₂e / year



6 References

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7 Glossary

Carbon Dioxide Equivalent (CO₂e)

The universal unit of measurement used to indicate the global warming potential (GWP) of each of the 6 Kyoto greenhouse gases. It is used to evaluate the impacts of releasing (or avoiding the release of) different greenhouse gases.

Climate change

A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability over comparable time periods (Source: United Nations Framework Convention on Climate Change).

The European Union Emissions Trading Scheme (EU ETS)

The EU ETS is a cornerstone of the European Union's policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively. Being the first and biggest international scheme for the trading of greenhouse gas emission allowances, the EU ETS covers some 11,000 power stations and industrial plants in 30 countries.

Global warming

The continuous gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns (see also Climate Change).

Global Warming Potential (GWP)

The GWP is an index that compares the relative potential (to CO₂e) of the 6 greenhouse gases to contribute to global warming i.e. the additional heat/energy which is retained in the Earth's ecosystem through the release of this gas into the atmosphere. The additional heat/energy impact of all other greenhouse gases are compared with the impacts of carbon dioxide (CO₂) and referred to in terms of a CO₂ equivalent (CO₂e) e.g. Carbon dioxide has been designated a GWP of 1, Methane has a GWP of 25.

Greenhouse gases (GHG)

The current IPCC inventory includes six major greenhouse gases. These are Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆).

ICLEI—Local Governments for Sustainability

[ICLEI](#) is an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development. ICLEI was founded in 1990 as the International Council for Local Environmental Initiatives.

The Intergovernmental Panel on Climate Change (IPCC)

A special intergovernmental body established by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) to provide assessments of the results of climate change research to policy makers. The Greenhouse Gas Inventory Guidelines are being developed under the auspices of the IPCC and will be recommended for use by parties to the Framework Convention on Climate Change.

Kyoto Protocol

The Kyoto Protocol originated at the 3rd Conference of the Parties (COP) to the United Nations Convention on Climate Change held in Kyoto, Japan in December 1997. It specifies the level of emission reductions, deadlines and methodologies that signatory countries (i.e. countries who have signed the Kyoto Protocol) are to achieve.

United Nations Framework on Climate Change ([UNFCCC](#))

In 1992 countries joined an international treaty, the UNFCCC, to cooperatively consider what they could do to limit average global temperature increases and the resulting climate change, and to cope resulting impacts. In 1995 countries launched negotiations to strengthen the global response to climate change, and, two years later, adopted the Kyoto Protocol. The Kyoto Protocol legally binds developed countries to emission reduction targets. The Protocol's first commitment period started in 2008 and ends in 2012.



This inventory was undertaken through the Regions for Sustainable Change project.

For more detail on the project and related outputs, please see the project website www.rscproject.org.

2008 Greenhouse Gas Inventory
for Cornwall & the Isles of Scilly

2008 Greenhouse Gas Inventory for Cornwall and the Isles of Scilly

Appendices:

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Appendix I: Updated 2007 results

Cornwall Greenhouse Gas Inventory - Calendar Year 2007

Camco estimates that for the calendar year 2007, emissions associated with Cornwall were in the order of **4,902 thousand** tonnes of CO₂e.

A series of figures now follows which illustrate how the total CO₂e emissions for Cornwall and the IoS in 2007 break down by sector in graphical and tabular form.

- Figure's 8.1 and 8.2 show a summary of breakdown emissions, and percentage contribution to total emissions by activity.
- Figure 8.3 shows the contribution to total emissions by sector.
- Figure 8.4 shows the contribution to premises emissions of different fuel types.
- Figure 8.5 shows the contribution to transport emissions of different fuel types and modes of transport.
- Figure 8.6 shows total emissions broken down by ICLEI Macro and Community Sectors.

Figure 8.1:



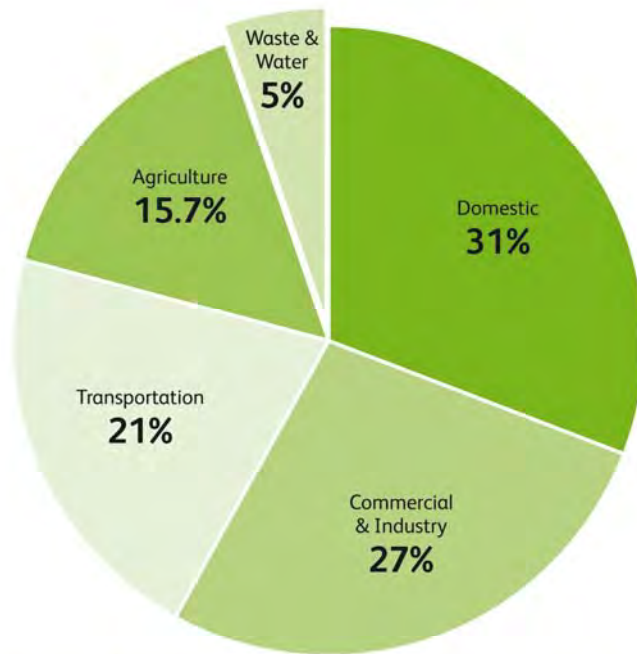
Figure 8.2:

Summary by General Activity 2007 (updated)

Source of emissions	Source Table	Total equiv. CO ₂ e (t/yr)	Proportion of total
Premises			
Domestic electricity	A	392,560	8%
Economy domestic electricity	A	348,057	7.1%
Commercial /industrial electricity	A	835,508	17%
Domestic natural gas	B	315,918	6.4%
Commercial /industrial natural gas	B	244,201	5%
Industrial petroleum	C	225,129	4.6%
Domestic petroleum	C	413,245	8.4%
Public administration petroleum	C	2,653	0.05%
Commercial petroleum	C	2,044	0.04%
Industrial & commercial coal	D	11,996	0.2%
Domestic coal	D	29,747	0.6%
Industrial & commercial MSF*	E	112	-
Domestic MSF*	E	16,768	0.3%
Transportation			
Diesel cars	F	187,371	3.8%
Petrol cars	G	401,836	8.2%
Buses	H	43,039	0.9%
Motorcycles	I	7,243	0.1%
HGV	J	148,131	3%
Diesel LGV	K	150,458	3.1%
Petrol LGV	L	10,528	0.2%
Rail petroleum	M	31,389	0.6%
Aviation	N	9,780	0.2%
Marine	R	41,231	0.84%
Agriculture			
Livestock	N	633,643	13%
Fertiliser	O	36,925	0.8%
Diesel	P	97,318	2%
Electricity***	N/A	-	-
Refrigerants			
Refrigerant Gas Losses**	S	0	0%
Waste			
Municipal waste to landfill	T	264,821	5.4%
Municipal waste to incineration	-	91	0.002%
Clinical waste (NHS) to incineration	-	325	0.01%
Wastewater and discharge	-	170	0.003%
Total	-	4,902,239	100%

*MSF - manufactured solid fuels. **Refrigerants - refer to section 3.6 for information on refrigerant gases.
***Agricultural electricity figures have been included within commercial and industrial electricity.

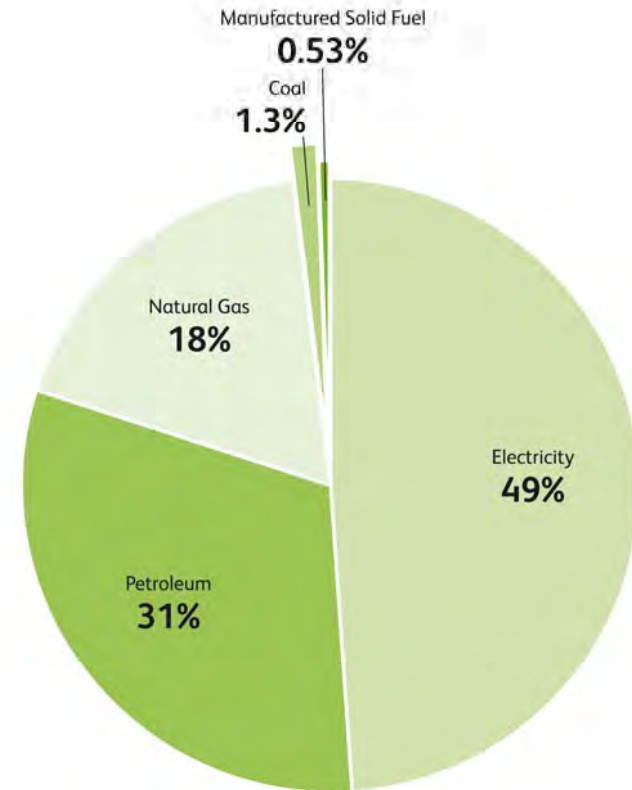
Figure 8.3:



Breakdown of CO₂e emissions by sector 2007 (Updated)

Totals on chart may not add due to rounding.

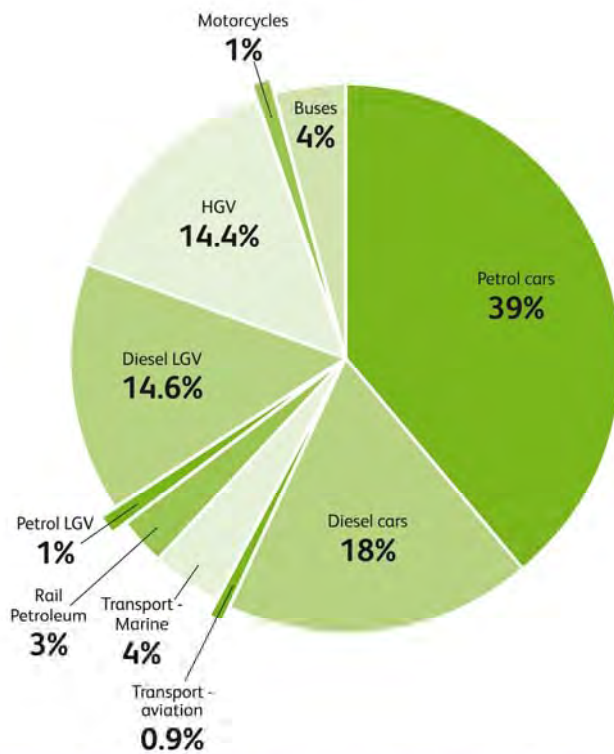
Figure 8.4:



Breakdown of premises emissions by fuel type, 2007 (Updated)

Totals on chart may not add due to rounding.

Figure 8.5:



Breakdown of emissions from transportation, 2007 (Updated)

Totals on chart may not add due to rounding.

Figure 8.6 shows a breakdown of the identified emissions as they fall within the ICLEI Protocol.

It is not possible to break down the data further to fit into ICLEI categories of Residential, Commercial and Industrial, due to the way in which BIS has categorised their data. Therefore in Figure 8.6 'Commercial' consists of Economy Domestic and Public Administration figures. Industrial covers all commercial/industrial mixes in addition to emissions from industry.

Figure 8.6:

2007 (updated) Summary (By ICLEI Protocol)

Macro Sector (IPCC)	Community Sector (ICLEI)	Source of emissions	Total equiv. CO ₂ e (t/yr)
Stationary Combustion	Energy Combustion	Domestic electricity	392,560
		Economy domestic electricity	348,057
		Commercial /industrial electricity	835,508
		Domestic natural gas	315,918
		Commercial /industrial natural gas	244,201
		Industrial petroleum	225,129
		Domestic petroleum	413,245
		Public administration petroleum	2,653
		Commercial petroleum	2,044
		Industrial & commercial coal	11,996
		Domestic coal	29,747
		Industrial & commercial MSF*	112
		Domestic MSF*	16,768
		Mobile Combustion	Transportation
Petrol cars	401,836		
Buses	43,039		
Motorcycles	7,243		
HGV	148,131		
Diesel LGV	150,458		
Petrol LGV	10,528		
Rail petroleum	31,389		
Marine	41,231		
Aviation	9,780		
Fugitive emissions	Other	Refrigerant Gas Losses**	0
Industrial Processes and Product use	Other	-	-
Agriculture, Forestry & other Land Use	Agricultural	Livestock	633,643
		Fertiliser	36,925
		Petroleum	97,318
Waste	Waste	Solid waste disposal	
		Municipal waste to landfill	264,821
		Biological treatment of Solid Waste	
		Municipal waste to incineration	91
		Clinical waste (NHS) to incineration	325
		Wastewater treatment and Discharge	170

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases

Figure 8.7 shows the widened project Geographical boundary to include the Isles of Scilly.

Figure 8.7:

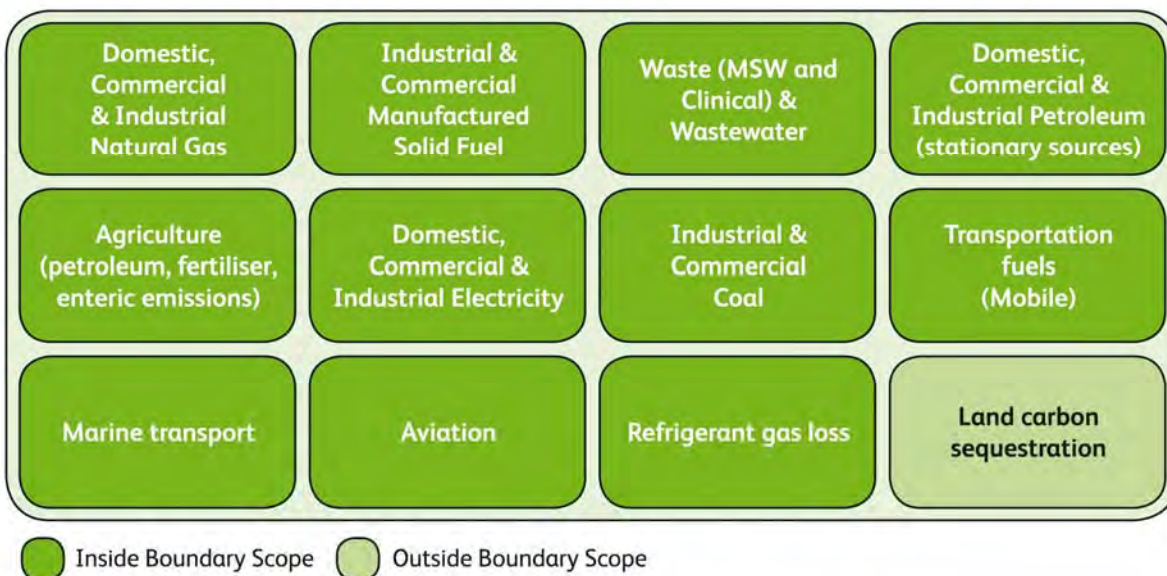
2007 (updated) - Geographic Boundary of GHG Inventory



Figure 8.8 shows the updated emission sources included in the inventory.

Figure 8.8:

2007 (updated) - Activity emission sources quantified in the inventory.



Appendix II: Calculations Cornwall & Isles of Scilly 2008 Inventory

Cornwall 2008 GHG Inventory

A. PREMISES - ELECTRICITY

Source of emissions	Electricity usage (MWh/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Domestic:					
Caradon	115,356	62,477	0.03	0.4	62,477
Carrick	121,978	66,063	0.03	0.4	66,064
Isles of Scilly	4,018	2,176	0.001	0.01	2,176
Kerrier	128,730	69,720	0.03	0.4	69,721
North Cornwall	116,030	62,842	0.03	0.4	62,842
Penwith	86,076	46,619	0.02	0.3	46,619
Restormel	132,774	71,910	0.03	0.4	71,911
Subtotal	704,963	381,808	0.2	2.4	381,810
Economy Domestic:					
Caradon	84,157	45,579	0.02	0.3	45,580
Carrick	103,283	55,938	0.02	0.3	55,939
Isles of Scilly	4,365	2,364	0.001	0.01	2,364
Kerrier	102,372	55,445	0.02	0.3	55,445
North Cornwall	117,115	63,430	0.03	0.4	63,430
Penwith	71,051	38,481	0.02	0.2	38,481
Restormel	117,067	63,404	0.03	0.4	63,404
Subtotal	599,411	324,641	0.1	2.0	324,643
Non-domestic:					
Caradon	163,345	88,468	0.04	0.6	88,468
Carrick	209,799	113,627	0.05	0.7	113,628
Isles of Scilly	8,076	4,374	0.002	0.03	4,374
Kerrier	214,851	116,364	0.05	0.7	116,364
North Cornwall	282,395	152,945	0.07	1.0	152,946
Penwith	121,507	65,808	0.03	0.4	65,809
Restormel	443,046	239,954	0.11	1.5	239,955
Subtotal	1,443,020	781,539	0.3	4.9	781,545
Total	2,747,393	1,487,988	0.7	9.3	1,487,998

Data collection period:

Calendar Year 2008

Assumptions

Data for electricity was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the

calendar year 2008.

CO ₂ emissions for electricity - U.K.:	0.5416	kgCO ₂ /kWh (Defra 2010)
CH ₄ emissions for electricity - U.K.:	0.0002	kgCO ₂ e/kWh (Defra 2010)
N ₂ O emissions for electricity - U.K.:	0.0034	kgCO ₂ e/kWh (Defra 2010)

B. PREMISES - NATURAL GAS

Source of emissions	Natural Gas usage (MWh/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Domestic:					
Caradon	280,762	51,899	0.1	0.03	51,899
Carrick	295,110	54,551	0.1	0.03	54,551
Isles of Scilly	-	-	-	-	-
Kerrier	246,035	45,479	0.1	0.03	45,480
North Cornwall	233,547	43,171	0.1	0.03	43,171
Penwith	227,988	42,144	0.1	0.03	42,144
Restormel	343,839	63,559	0.1	0.04	63,559
Subtotal	1,627,280	300,803	0.4	0.2	300,803
Non-domestic:					
Caradon	131,694	24,344	0.04	0.01	24,344
Carrick	107,196	19,815	0.03	0.01	19,815
Isles of Scilly	-	-	-	-	-
Kerrier	112,792	20,850	0.03	0.01	20,850
North Cornwall	116,940	21,616	0.03	0.01	21,616
Penwith	54,161	10,012	0.01	0.01	10,012
Restormel	597,051	110,365	0.2	0.1	110,365
Subtotal	1,119,835	207,002	0.3	0.1	207,002
Total	2,747,115	507,804	0.7	0.3	507,805

Data collection period:

Calendar Year 2008

Assumptions

Data for natural gas was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas. Gas Data for the Isles of Scilly is not provided as part of the BIS dataset.

CO ₂ emissions for natural gas:	0.1849	kgCO ₂ /kWh (Defra 2010)
CH ₄ emissions for natural gas:	0.0003	kgCO ₂ e/kWh (Defra 2010)
N ₂ O emissions for natural gas:	0.0001	kgCO ₂ e/kWh (Defra 2010)

C. PREMISES - PETROLEUM

Source of emissions	Diesel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Industrial:					
Caradon	6,826	21,399	43	145	21,587

Carrick	6,453	20,229	41	137	20,408
Isles of Scilly	699	2,192	4.4	15	2,212
Kerrier	7,533	23,615	47	160	23,823
North Cornwall	19,089	59,845	120	407	60,372
Penwith	2,663	8,348	17	57	8,421
Restormel	18,183	57,002	115	387	57,504
Subtotal	61,445	192,631	387	1,309	194,327
Domestic:					
Caradon	20,683	64,841	130	441	65,412
Carrick	23,831	74,712	150	508	75,369
Isles of Scilly	2,204	6,911	14	47	6,971
Kerrier	28,527	89,433	180	608	90,220
North Cornwall	28,082	88,038	177	598	88,813
Penwith	13,294	41,676	84	283	42,043
Restormel	21,246	66,607	134	453	67,193
Subtotal	137,868	432,216	869	2,937	436,021
Public Administration:					
Caradon	97	303	2.1	2.1	308
Carrick	254	798	5.4	5.4	809
Isles of Scilly	3.6	11	0.08	0.08	11
Kerrier	435	1,363	9.3	9.3	1,382
North Cornwall	124	390	2.6	2.6	395
Penwith	85	268	1.8	1.8	271
Restormel	153	480	3.3	3.3	486
Subtotal	1,152	3,612	25	25	3,662
Commercial:					
Caradon	185	580	3.9	3.9	588
Carrick	276	865	5.9	5.9	876
Isles of Scilly	5.5	17	0.1	0.1	17
Kerrier	225	706	4.8	4.8	715
North Cornwall	238	747	5.1	5.1	758
Penwith	154	483	3.3	3.3	489
Restormel	256	801	5.4	5.4	812
Subtotal	1,339	4,199	29	29	4,256
Total	201,805	632,658	1,309	4,298	638,265

Data collection period:

Calendar Year 2008

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for petroleum:	3,135	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for petroleum:	6.3	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for petroleum:	21.3	kgCO ₂ e/tonne (Defra 2010)

D. PREMISES – COAL

Source of emissions	Coal usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Industrial & Commercial:					
Caradon	1,168	2,681	2.1	46	2,729
Carrick	409	938	0.7	16	955
Isles of Scilly	9.4	22	0.02	0.4	22
Kerrier	315	723	0.6	12	736
North Cornwall	780	1,790	1.4	31	1,823
Penwith	177	407	0.3	7.0	414
Restormel	3,448	7,913	6.2	136	8,056
Subtotal	6,306	14,475	11	248	14,735
Domestic:					
Caradon	1,753	4,393	578	80	5,051
Carrick	2,026	5,077	668	92	5,837
Isles of Scilly	225	563	74	10	647
Kerrier	2,471	6,194	815	112	7,121
North Cornwall	2,158	5,408	711	98	6,218
Penwith	1,269	3,182	419	58	3,658
Restormel	1,736	4,352	572	79	5,003
Subtotal	11,638	29,168	3,837	530	33,534
Total	17,944	43,643	3,848	778	48,269

Data collection period:

Calendar Year 2008

Assumptions

Data for coal consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for coal(industrial):	2,295	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for industrial coal:	1.8	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for industrial coal:	39.4	kgCO ₂ e/tonne (Defra 2010)
CO ₂ emissions for coal (domestic):	2,506	kgCO ₂ e/tonne (Defra 2010)
CH ₄ emissions for domestic coal:	330	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for domestic coal:	45.5	kgCO ₂ e/tonne (Defra 2010)

E. PREMISES - MANUFACTURED SOLID FUEL

Source of emissions	Coal usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Industrial & Commercial:					
Caradon	0	0	0	0	0
Carrick	0	0	0	0	0
Isles of Scilly	0	0	0	0	0
Kerrier	1.9	5.6	0.1	0.1	5.8
North Cornwall	0	0	0.0	0.0	0
Penwith	18	55	0.5	1.3	56
Restormel	0	0	0	0.0	0

Subtotal	20	60	0.586	1.4	62
Domestic:					
Caradon	742	2,216	22	52	2,290
Carrick	858	2,561	25	61	2,647
Isles of Scilly	95	284	2.8	6.7	294
Kerrier	1,046	3,125	30	74	3,229
North Cornwall	914	2,728	27	64	2,820
Penwith	537	1,605	16	38	1,659
Restormel	735	2,196	21	52	2,269
Subtotal	4,927	14,716	143	348	15,207
Total	4,948	14,776	144	349	15,269

Data collection period: Calendar Year 2008

Assumptions

Data for manufactured solid fuel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas and IoS. The dataset provided is for the calendar year 2008. Camco has assumed all manufactured solid fuel to be coke.

CO ₂ emissions for coking coal:	2,987	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for coking coal (energy industries):	29.1	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for coking coal (energy industries):	70.6	kgCO ₂ e/tonne (Defra 2010)

F. TRANSPORT - DIESEL CARS

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	9,889	31,293	18	346	31,657
Carrick	10,547	33,374	19	369	33,763
Isles of Scilly	23	73	0.04	0.8	74
Kerrier	9,479	29,993	17	332	30,342
North Cornwall	15,065	47,669	27	527	48,224
Penwith	5,022	15,892	9.0	176	16,077
Restormel	10,927	34,577	20	382	34,979
Total	60,952	192,872	110	2,133	195,115

Data collection period: Calendar Year 2008

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/tonne (Defra 2010)

G. TRANSPORT - PETROL CARS

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	19,252	60,355	121	410	60,887

Carrick	22,820	71,542	144	486	72,172
Isles of Scilly	43	135	0.3	0.9	136
Kerrier	20,940	65,646	132	446	66,224
North Cornwall	28,394	89,015	179	605	89,799
Penwith	10,713	33,587	67	228	33,882
Restormel	21,713	68,070	137	462	68,669
Total	123,876	388,351	780	2,639	391,770

Data collection period: Calendar Year 2008

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO ₂ e/tonne (Defra 2010)

H. TRANSPORT - BUSES

Source of emissions	Fuel usage/tonnes	Fuel consumption (litres)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	1,540	1,845,428	4,874	0.6	4.1	4,879
Carrick	2,293	2,747,352	7,257	0.9	6.1	7,264
Isles of Scilly	15	18,267	48	0.01	0.04	48
Kerrier	2,661	3,187,340	8,419	1.1	7.1	8,427
North Cornwall	2,128	2,549,107	6,733	0.9	5.7	6,740
Penwith	1,295	1,551,965	4,099	0.5	3.5	4,103
Restormel	1,923	2,303,227	6,084	0.8	5.1	6,089
Total	11,855	14,202,686	37,514	4.9	32	37,550

Data collection period: Calendar Year 2008

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for diesel:	2.6413	kgCO ₂ /litre (Defra 2010)
CO ₂ emissions for an average bus:	0.1339	kgCO ₂ e/pass.km (Defra 2010)
CH ₄ emissions for an average bus:	0.00016	kgCO ₂ e/pass.km (Defra 2010)
N ₂ O emissions for an average bus:	0.00104	kgCO ₂ e/pass.km (Defra 2010)
Average number of passengers per bus:	9	passengers (Defra 2009)
Fuel efficiency of buses:	20	pass.km/litre (derived from above)
Diesel - Conversion tonnes to litres:	1,198	litres/tonne (Defra 2010)

I. TRANSPORT – MOTORCYCLES

Source of emissions	Fuel usage/tonnes	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	349	1,095	2.2	7.44	1,105

Carrick	324	1,015	2.0	6.90	1,024
Isles of Scilly	8.9	28	0.1	0.2	28
Kerrier	457	1,433	2.9	9.73	1,445
North Cornwall	434	1,359	2.7	9.24	1,371
Penwith	213	667	1.3	4.53	673
Restormel	357	1,119	2.2	7.61	1,129
Total	2,143	6,717	13.5	45.6	6,776

Data collection period:

Calendar Year 2008

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008. Camco assumes all motorcycles are petrol fuelled.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO ₂ e/tonne (Defra 2010)
Petrol - Conversion tonnes to litres:	1,361	litres/tonne (Defra 2010)

J. TRANSPORT – HGV

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	7,574	23,967	14	265	24,246
Carrick	7,092	22,442	13	248	22,703
Isles of Scilly	18	57	0.03	0.6	58
Kerrier	4,877	15,431	9	171	15,610
North Cornwall	14,416	45,617	26	505	46,148
Penwith	2,403	7,604	4.3	84	7,692
Restormel	8,029	25,405	14	281	25,701
Total	44,409	140,524	80	1,554	142,158

Data collection period:

Calendar Year 2008

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/tonne (Defra 2010)

K. TRANSPORT - DIESEL LGV

Source of emissions	Fuel usage/tonnes	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	7,888	24,959	14	276	25,249
Carrick	7,738	24,486	14	271	24,771
Isles of Scilly	41	129	0.1	1.4	130
Kerrier	7,288	23,063	13	255	23,331
North Cornwall	11,851	37,502	21	415	37,938

Penwith	3,731	11,805	6.7	131	11,942
Restormel	8,788	27,807	16	308	28,131
Total	47,325	149,751	85	1,656	151,492

Data collection period: Calendar Year 2008

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/tonne (Defra 2010)

L. TRANSPORT - PETROL LGV

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	507	1,589	3.2	11	1,603
Carrick	517	1,622	3.3	11	1,636
Isles of Scilly	2.7	8	0.02	0.1	8.4
Kerrier	480	1,506	3.0	10	1,519
North Cornwall	740	2,319	4.7	16	2,339
Penwith	249	782	1.6	5	789
Restormel	554	1,738	3.5	12	1,753
Total	3,051	9,564	19.2	65	9,648

Data collection period: Calendar Year 2008

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008. Camco assumes all petrol HGVs are Class III light commercial vehicles.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO ₂ e/tonne (Defra 2010)

M. TRANSPORT - RAIL PETROLEUM

Source of emissions	Petrol usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	3,227	10,116	20.3	69	10,205
Carrick	1,647	5,164	10.4	35	5,210
Isles of Scilly	-	-	-	-	-
Kerrier	708	2,221	4.5	15	2,240
North Cornwall	545	1,708	3.4	12	1,723
Penwith	1,308	4,101	8.2	28	4,137
Restormel	2,609	8,180	16.4	56	8,252
Total	10,044	31,489	63	214	31,766

Data collection period:

Calendar Year 2008

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas.. The dataset provided is for the calendar year 2008. Emissions from IoS and Heritage Railways was not included as data was not available.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO ₂ e/tonne (Defra 2010)

N. TRANSPORT – AVIATION

Source of emissions	Total distance movements	Total distance travelled	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Heavy jet	2,334	322,872	10,823	17.1	222	11,062
Medium jet	34	12,290	95.1	0.7	8	104
Light jet	356	37,268	423	2.0	26	451
Turbo prop	10,747	613,567	3,568	32.5	422	4,023
Piston	521	14,260	299	0.8	10	310
Helicopter	217	3,661	38	0.2	3	41
Total	14,209	1,003,918	15,246	53	691	15,990

Data collection period:

Calendar Year 2008

Assumptions

Aviation calculations relate to Newquay Cornwall Airport. Emissions from Land's End and IoS aircraft movements have not been included.

Average flight distance - heavy jets:	138	nm
Number of movements - medium jets:	181	nm
Number of movements - light jets:	105	nm
Number of movements - turbo prop:	57	nm
Number of movements - piston:	102	nm
Number of movements - helicopters:	66	nm
CO ₂ emissions for a heavy jet:	4,637	kgCO ₂ /average flight
CO ₂ emissions for a medium jet:	2,797	kgCO ₂ /average flight
CO ₂ emissions for a light jet:	1,188	kgCO ₂ /average flight
CO ₂ emissions for a turbo prop:	332	kgCO ₂ /average flight
CO ₂ emissions for a piston aircraft:	574	kgCO ₂ /average flight
CO ₂ emissions for a helicopter:	176	kgCO ₂ /average flight
CH ₄ emissions for flights:	0.05	kgCH ₄ /nm
N ₂ O emissions for flights:	0.69	kgN ₂ O/nm

O. AGRICULTURE - LIVESTOCK

Livestock type	Number/ livestock	Enteric EF (tCH ₄ /yr)	Manure EF (tCH ₄ /yr)	Total equiv. CO ₂ (t/yr)
Cattle				
Dairy female 2yr+	73,752	7,501	1,844	196,233
Beef female 2yr+	45,355	2,177	272	51,432

Dairy female 2yr+ (no offspring)	16,316	1,659	408	43,411
Beef female 2yr+ (no offspring)	14,412	692	86	16,344
Male 2yr+	17,333	832	104	19,655
Dairy female 1-2yr	18,358	1,867	459	48,844
Beef female 1-2yr	26,883	1,290	161	30,486
Male 1-2yr	35,204	1,690	211	39,922
Dairy female <1yr	18,659	1,898	466	49,646
Beef female <1yr	30,978	1,016	92	23,264
Male <1yr	43,201	1,417	128	32,442
Subtotal	340,451	22,039	4,232	551,678
Pigs				
Sows in pig	4,014	6.0	12	379
Gilts in pig	591	0.9	1.8	56
Other sows	1,098	1.6	3.3	104
Boars for service	308	0.5	0.9	29
Gilts	617	0.9	1.9	58
Barren sows for fattening	119	0.2	0.4	11
Pigs over 110kg	397	0.6	1.2	38
Pigs 80kg to 100kg	8,329	12	25	787
Pigs 50kg to 80kg	13,290	20	40	1,256
Pigs 20kg to 50kg	12,947	19	39	1,223
Pigs under 20kg	11,985	18	36	1,133
Subtotal	53,695	81	161	5,074
Sheep				
Ewes	220,998	1,768	42	38,009
Other breeding sheep	23,045	184	4.4	3,964
Rams	6,338	51	1.2	1,090
Other sheep over 1yr	10,033	80	1.9	1,726
Lambs under 1yr	242,960	389	0	8,163
Subtotal	503,374	2,472	49	52,952
Goats	1,992	10	-	209
Subtotal	1,992	10	-	209
Horses	10,164	183	-	3,842
Subtotal	10,164	183	-	3,842
Poultry				
Growing pullets	240,321	0	187	3,936
Birds in the laying flock	778,478	0	607	12,751
Layer breeders	1,685	0	1.3	28
Broiler breeders	529	0	0.4	8.7
Cocks and cockerels	1,369	0	1.1	22
Table chicken	326,733	0	255	5,352

Ducks	9,112	0	7.1	149
Geese	3,047	0	2.4	50
Turkeys	3,287	0	2.6	54
All other birds	33,093	0	26	542
Subtotal	1,397,654	0	1,090	22,894
Total	2,307,331	24,784	5,533	636,649

Data collection period:

Calendar Year 2008

Assumptions

Data for livestock numbers was sourced from Defra's Farming survey.

Livestock category - Enteric emissions:

Dairy cow	101.7	kgCH ₄ /head/yr (IPCC 1996)
All other cattle >1 year old	48.0	kgCH ₄ /head/yr (IPCC 1996)
All cattle < 1 year old	32.8	kgCH ₄ /head/yr (IPCC 1996)
Horses	18	kgCH ₄ /head/yr (IPCC 1996)
Pigs	1.5	kgCH ₄ /head/yr (IPCC 1996)
Sheep	8.0	kgCH ₄ /head/yr (IPCC 1996)
Lambs	1.6	kgCH ₄ /head/yr (IPCC 1996)
Goats	5	kgCH ₄ /head/yr (IPCC 1996)
Poultry	0.0	kgCH ₄ /head/yr (IPCC 1996)

Livestock category - Manure emissions:

Dairy cow	25.0	kgCH ₄ /head/yr (IPCC 1996)
All other cattle >1 year old	6.0	kgCH ₄ /head/yr (IPCC 1996)
All cattle < 1 year old	2.96	kgCH ₄ /head/yr (IPCC 1996)
Pigs	3.0	kgCH ₄ /head/yr (IPCC 1996)
Sheep	0.19	kgCH ₄ /head/yr (IPCC 1996)
Lambs	0.0	kgCH ₄ /head/yr (IPCC 1996)
Poultry	0.78	kgCH ₄ /head/yr (IPCC 1996)
Global warming potential (in CO ₂ equivalents) of CH ₄ :	21	(IPCC 1996)

Q. AGRICULTURE - ARABLE CROPS

Crop type	Planted area (ha)	Fertiliser required (t/yr)	Total equiv. CO ₂ (t/yr)
Nitrogen			
Wheat	12,317	1,848	12,379
Winter Barley	8,328	916	6,138
Spring Barley	13,235	1,324	8,868
Oats	2,918	263	1,759
Other cereals	2,366	213	1,426
Potatoes	3,815	610	4,090
Sugar beet	68	6.8	45
Field beans	541	0	0
Peas for harvesting dry	156	0	0
Oilseed rape	1,291	207	1,384

Linseed	441	35.3	236
Root crops, brassicas, fodder beet	1,199	72	482
Other crops for stockfeed	798	48	321
Maize	6,000	300	2,010
Other arable crops	1,220	61	409
Bare fallow	2,511	0	0
Subtotal	57,204	5,903	39,548
Phosphate			
Wheat	12,317	739	238
Winter Barley	8,328	541	175
Spring Barley	13,235	596	192
Oats	2,918	131	42
Other cereals	2,366	0	0
Potatoes	3,815	649	209
Sugar beet	68	3	1
Field beans	541	22	7
Peas for harvesting dry	156	6	2
Oilseed rape	1,291	65	21
Linseed	441	0	0
Root crops, brassicas, fodder beet	1,199	54	17
Other crops for stockfeed	798	36	12
Maize	6,000	330	106
Other arable crops	1,220	0	0
Bare fallow	2,511	0	0
Subtotal	57,204	3,172	1,023
Potash			
Wheat	12,317	431	166
Winter Barley	8,328	0	0
Spring Barley	13,235	0	0
Oats	2,918	0	0
Other cereals	2,366	0	0
Potatoes	3,815	1,144	440
Sugar beet	68	7	3
Field beans	541	22	8
Peas for harvesting dry	156	6	2
Oilseed rape	1,291	0	0
Linseed	441	18	7
Root crops, brassicas, fodder beet	1,199	186	71
Other crops for stockfeed	798	124	48
Maize	6,000	1,050	404
Other arable crops	1,220	0	0

Bare fallow	2,511	0	0
Subtotal	57,204	2,988	1,149
Magnesium			
Wheat	12,317	0	0
Winter Barley	8,328	0	0
Spring Barley	13,235	0	0
Oats	2,918	0	0
Other cereals	2,366	0	0
Potatoes	3,815	153	45
Sugar beet	68	0	0
Field beans	541	0	0
Peas for harvesting dry	156	0	0
Oilseed rape	1,291	0	0
Linseed	441	0	0
Root crops, brassicas, fodder beet	1,199	0	0
Other crops for stockfeed	798	0	0
Maize	6,000	0	0
Other arable crops	1,220	0	0
Bare fallow	2,511	0	0
Subtotal	57,204	153	45
Sulphur			
Wheat	12,317	0	0
Winter Barley	8,328	0	0
Spring Barley	13,235	0	0
Oats	2,918	0	0
Other cereals	2,366	0	0
Potatoes	3,815	0	0
Sugar beet	68	0	0
Field beans	541	0	0
Peas for harvesting dry	156	0	0
Oilseed rape	1,291	0	0
Linseed	441	0	0
Root crops, brassicas, fodder beet	1,199	0	0
Other crops for stockfeed	798	0	0
Maize	6,000	0	0
Other arable crops	1,220	0	0
Bare fallow	2,511	0	0
Subtotal	57,204	0	0
Total	-	12,214	41,765

Data collection period: Calendar Year 2008

Assumptions - Arable crops

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills).

Data for arable crop production was provided from Defra's Farming survey.

Fertiliser application rates were taken from RB209, 8th edition, assuming a Soil Nitrogen Supply (SNS) index of 2

Soil types for three region are defined as: Free draining slightly acid loamy soils, free draining acid and loamy soils over rock and very acid loamy upland soils with wet peaty surface

Agricultural fuels: all emissions associated with fuel usage for arable crops has already been accounted for in previous tables, Camco has only assessed the emissions arising from the use of fertiliser.

Fertiliser weights: Due to data limitations Camco made assumptions about the weight of nitrogen required for various crops. Camco assumed 'other cereals' to be equal to that of wheat as a worst case scenario; the weight of nitrogen required for 'other crops for stockfeed' was assumed to be equal to that of root crops; the weight of nitrogen required for 'other arable crops' and 'bare fallow' was assumed to be equal to that of maize.

Nitrogen

Application rates from Defra RB209: Eighth edition (2010)

Wheat - weight of fertiliser required:	150	kg per ha (assume spring sown, all other mineral soils, SNS 2)
Winter barley - weight of fertiliser required:	110	kg per ha (assumed feed barley, deep fertile silty soils, SNS 2)
Spring barley - weight of fertiliser required:	100	kg per ha (assumed Malting Barley, other mineral soils, SNS2)
Oats - weight of fertiliser required:	90	kg per ha (all other mineral soils, SNS 2)
Other cereals - weight of fertiliser required:	90	kg per ha (assumed as above, all other mineral soils, SNS 2)
Potatoes - weight of fertiliser required:	160	kg per ha (all other mineral soils, SNS 2)
Sugar beet - weight of fertiliser required:	100	kg per ha (all other mineral soils, SNS 2)
Field beans - weight of fertiliser required:	0	kg per ha (P, K and SNS Index 2)
Peas for harvesting dry - weight of fertiliser required:	0	kg per ha (P, K and SNS Index 2)
Oilseed rape - weight of fertiliser required:	160	kg per ha (all mineral soils, SNS 2)
Linseed - weight of fertiliser required:	80	kg per ha (all other mineral soils, SNS 2)
Root crops, brassicas, fodder beet - weight of fertiliser required:	60	kg per ha (K index of 2; assumed same as forage swedes and turnips)
Other crops for stockfeed - weight of fertiliser required:	60	kg per ha (K index of 2; assumed same as forage swedes and turnips)
Maize - weight of fertiliser required:	50	kg per ha (assuming N index of 2)
Other arable crops - weight of fertiliser required:	50	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Phosphate		
Wheat - weight of fertiliser required:	60	kg per ha (assuming P index of 2)
Winter barley - weight of fertiliser required:	65	kg per ha (assuming P index of 2)
Spring barley - weight of fertiliser required:	45	kg per ha (assuming P index of 2)
Oats - weight of fertiliser required:	45	kg per ha (assuming P index of 2)
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	170	kg per ha (assuming P index of 2)
Sugar beet - weight of fertiliser required:	50	kg per ha (assuming P index of 2)
Field beans - weight of fertiliser required:	40	kg per ha (assuming P index of 2)
Peas for harvesting dry - weight of fertiliser required:	40	kg per ha (assuming P index of 2)
Oilseed rape - weight of fertiliser required:	50	kg per ha (assuming P index of 2)
Linseed - weight of fertiliser required:	0	kg per ha
Root crops, brassicas, fodder beet - weight of fertiliser required:	45	kg per ha (N index of 2; assumed same as forage swedes and turnips)
Other crops for stockfeed - weight of fertiliser required:	45	kg per ha (N index of 2; assumed same as forage swedes and turnips)

Maize - weight of fertiliser required:	55	kg per ha (assuming P index of 2)
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Potash		
Wheat - weight of fertiliser required:	35	kg per ha (assuming K index of 2)
Winter barley - weight of fertiliser required:	0	kg per ha
Spring barley - weight of fertiliser required:	0	kg per ha
Oats - weight of fertiliser required:	0	kg per ha
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	300	kg per ha (assuming K index of 2)
Sugar beet - weight of fertiliser required:	100	kg per ha (assuming K index of 2)
Field beans - weight of fertiliser required:	40	kg per ha (assuming K index of 2)
Peas for harvesting dry - weight of fertiliser required:	40	kg per ha (assuming K index of 2)
Oilseed rape - weight of fertiliser required:	0	kg per ha
Linseed - weight of fertiliser required:	40	kg per ha (P index of 2; assumed same as forage swedes and turnips)
Root crops, brassicas, fodder beet - weight of fertiliser required:	155	kg per ha (P index of 2; assumed same as forage swedes and turnips)
Other crops for stockfeed - weight of fertiliser required:	155	kg per ha (assuming K index of 2)
Maize - weight of fertiliser required:	175	kg per ha (assuming K index of 2)
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Magnesium		
Wheat - weight of fertiliser required:	0	kg per ha
Winter barley - weight of fertiliser required:	0	kg per ha
Spring barley - weight of fertiliser required:	0	kg per ha
Oats - weight of fertiliser required:	0	kg per ha
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	40	kg per ha (assuming Mg index of 2)
Sugar beet - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Field beans - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Peas for harvesting dry - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Oilseed rape - weight of fertiliser required:	0	kg per ha
Linseed - weight of fertiliser required:	0	kg per ha
Root crops, brassicas, fodder beet - weight of fertiliser required:	0	kg per ha
Other crops for stockfeed - weight of fertiliser required:	0	kg per ha
Maize - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
CO ₂ e emissions from nitrogen fertiliser:	6.70	KgCO ₂ e/kg (Carbon Trust 2009)
CO ₂ emissions from Phosphate fertiliser :	0.32	kg CO ₂ /kg (Carbon Trust 2007)
CO ₂ emissions from Potash fertiliser:	0.38	kg CO ₂ /kg (Carbon Trust 2007)
CO ₂ e emissions from magnesium (magnesium sulphate)	0.30	kg CO ₂ e/kg (SCLCI 2009, ref no 297)

fertiliser:

CO₂e emissions from sulphur (sulphur dioxide) fertiliser: 0.41

kg CO₂e/kg (SCLCI 2009, ref no 349)

R. AGRICULTURE - DIESEL

Source of emissions	Diesel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	5,911	18,705	11	207	18,922
Carrick	3,286	10,398	5.9	115	10,519
Isles of Scilly	16	52	0.03	0.6	52
Kerrier	3,368	10,658	6.1	118	10,782
North Cornwall	12,164	38,490	22	426	38,938
Penwith	1,951	6,173	3.5	68	6,244
Restormel	3,659	11,579	6.6	128	11,714
Total	30,356	96,054	55	1,062	97,171

Data collection period:

Calendar Year 2008

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2008.

CO ₂ emissions for diesel:	3,164	kgCO ₂ e/tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/tonne (Defra 2010)

S. AGRICULTURAL ELECTRICITY

Source of emissions	Electricity usage (kWh/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Dairy female 2yr+	22,125,695	11,983	5.3	75	12,063
Dairy female 2yr+ (no offspring)	4,894,654	2,651	1.2	16	2,669
Dairy female 1-2yr	5,507,259	2,983	1.3	19	3,003
Dairy female <1yr	5,597,664	3,032	1.3	19	3,052
Total	38,125,272	20,649	9.2	128	20,786

Data collection period:

Calendar Year 2008

Assumptions

Camco has assumed that dairy electricity is equivalent to an average of 300kWh/ head.

Dairy female 2yr+	73,752	cattle
Dairy female 2yr+ (no offspring)	16,316	cattle
Dairy female 1-2yr	18,358	cattle
Dairy female <1yr	18,659	cattle
Average electricity consumption per head of cattle:	300	kWh/head
CO ₂ emissions for electricity - U.K.:	0.5416	kgCO ₂ /kWh (Defra 2010)
CH ₄ emissions for electricity - U.K.:	0.0002	kgCO ₂ e/kWh (Defra 2010)
N ₂ O emissions for electricity - U.K.:	0.0034	kgCO ₂ e/kWh (Defra 2010)

T. MARINE TRANSPORT - DIESEL

Source of emissions	Gas oil consumption (kWh/yr)	Diesel usage (l/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Penzance	-	56,181	155	0.2	14	170
St Ives	4,420,721	-	1,115	1.1	101	1,217
Newlyn	68,369,600	-	17,239	17.1	1,568	18,824
Truro	-	34,235	95	0.10	8.6	103
Falmouth	-	27,388	76	0.08	6.9	83
St Mawes	-	42,794	118	0.12	11	129
Fowey Harbour	22,913,814	-	5,777	5.7	526	6,309
Hayle	15,191,366	-	3,830	3.8	348	4,183
Newquay	5,090,527	-	1,284	1.3	117	1,402
Total	115,986,029	160,597	29,689	29	2,701	32,420

Data collection period:

Calendar Year 2008

Assumptions

Fuel used by boats is predominately red diesel (gas oil) and has therefore been assumed to be solely red diesel for the purpose of this assessment. Where possible actual data was sourced for ports and harbours. Marine Management produced a report highlighting all fishing vessels under and over 10m per port authority, in this instance, Newlyn. This data was used to create a benchmark figure for Penzance - data was provided and is for calendar year 2010

Port/harbour	Fishing vessels (in summer)	Number of vessels	Notes
Fowey Harbour:	Commercial	70	
	Fishing boats	40	
Hayle:	Residential fleet	200	Residential fleet
	Commercial	20	Commercial Fishing Vessels
Falmouth:	Dredger	1	50ft sand dredger
	Park & Ride Float	1	Falmouth Park and Ride/Float – £16,000 of fuel between May and the end of October in 2010
Newquay:	Commercial fishing fleet	33	
	Pleasure boats	43	
St Ives:	Commercial fishing fleet	60	
	Pleasure boats	6	
Truro	King Harry Ferry	1	
St Mawes	Leisure boats		St Moors Ferry £25,000 of diesel.

Boats under 10m

Total number of vessels:	547	boats
Total engine power of all vessels:	22,899	kW
Average engine power of a vessel under 10m:	42	kW per boat

Boats over 10m

Total number of vessels:	82	boats
Total engine power of all vessels:	23,351	kW
Average engine power of a vessel over 10m:	285	kW per boat

Average price of Gas oil 2008:	0.584	pence per litre (DECC; Quarterly fuel prices)
Total work hours:	1,600	hours per year
Newlyn 2008		
Total engine power of all vessels:	42,731	kW
CO2 emissions for gas oil:	0.2521	kgCO2e/kWh (Defra 2010)
CH4 emissions for gas oil:	0.0003	kgCO2e/kWh (Defra 2010)
N2O emissions for gas oil:	0.0229	kgCO2e/kWh (Defra 2010)
CO2 emissions for gas oil:	2.7667	kgCO2e/litre (Defra 2010)
CH4 emissions for gas oil:	0.0028	kgCO2e/litre (Defra 2010)
N2O emissions for gas oil:	0.2517	kgCO2e/litre (Defra 2010)

U. PREMISES - REFRIGERANT GAS LOSSES

Source of emissions	Refrigerant type	Refrigerant (kg/yr)	Total equiv. CO ₂ e(t/yr)
Tulip Bodmin			
Tulip Bugle			
Samworth Bros Callington			
Dairy Crest Davidstow			
Jaspers Treburley			
Jaspers South Petherin			
Vion (St Merryn meat) Bodmin			
Indian Queens peak power facility			

Total

Data collection period: Calendar Year 2008

Assumptions

CDC has requested data on refrigerant gas losses from IPPC permitted facilities in Cornwall from the EA, but has not been able to obtain figures in time to complete the results from refrigerant gas losses. High level figures were obtained for one site from the NAEI for total HFC's emitted.

Hydro-fluorocarbons

		Hydro-chlorofluorocarbons	
Tulip Bodmin	256	126	kg/year (NAEI, Defra)
Tulip Bugle	135	300	kg/year (NAEI, Defra)
Samworth Bros Callington	-	-	
Dairy Crest Davidstow	-	-	
Jaspers Treburley	-	-	
Jaspers South Petherin	-	-	
Vion (St Merryn meat) Bodmin	-	-	
Indian Queens peak power facility	-	-	

V. WASTE

Source of emissions	Total volume of waste water (litres/yr)	Total weight of waste generated (t/yr)	CH ₄ generated (tCH ₄ /yr)	CH ₄ emitted (t/yr)	Total equiv. CO ₂ e(t/yr)
Municipal waste to landfill	-	194,958	14,037	11,686	245,401
Municipal waste to incineration	-	-	-	-	-
Clinical waste to incineration	-	413	-	-	93
Commercial & Industrial Waste water and discharge	249,939,086	-	-	-	173
Total	195,371	14,037	11,686	11,686	245,668

Data collection period: Financial Year 2008/09

Assumptions

Updated waste data provided by Cornwall Council is for the financial year 2008/09 as this was the data available and was deemed representative. Camco were unable to obtain updated NHS or water waste figures. For the purposes of this assessment the water data from the previous assessment was deemed representative and therefore data remains the same as the 2007 Inventory. High grade clinical waste was deemed to be the only waste incinerated within the

Cornwall region and therefore Council data for incinerated waste has been included, whilst previous NHS data has been removed due to risk of double counting.

Total sewage discharge in the South West:	578,205,000	litres/year (South West Water, 2007)
Population of Devon:	704,499	people
Population of Cornwall	534,300	people (2008)
Population of the Isles of Scilly:	2,100	people (2008)
536,400	people	Population of Cornwall & the Isles of Scilly:
Litres per tonne (assuming density of water):	1,000	litres/tonne
Methane generated from land filled commercial waste:	0.072	tCH ₄ /t waste (see below)
Methane emitted from land filled commercial waste in Europe:	0.060	tCH ₄ /t waste (see below)
Emissions from incinerated waste:	226	kgCO ₂ /t waste (IPCC 2006)
Emissions from waste water treatment:	693	kgCO ₂ e/million litres (Defra 2009)
To calculate carbon emissions from commercial waste the following parameters were used:		
Degradable organic C content (DOC) of typical MSW (doc):	18%	(Smith et al 2001)
Proportion of dissimilable DOC (di):	60%	(Brown et al 1999)
Proportion of dissimilable DOC decaying to methane (dm):	50%	(IPCC 2006)
Methane oxidation factor (ox):	10%	(Brown et al 1999)
Avg. landfill gas collection efficiency for European landfills (gc):	63%	(Smith et al 2001)
Global warming potential of CH ₄ :	21	(IPCC 1996)

Notes:

CH₄ generated (mg) = mass x doc x dm x di x 16/12

CH₄ emitted = mg x (1-gc) x (1-ox)

16/12 is the conversion factor carbon to CH₄

44/12 is the conversion factor carbon to CO₂

Summary by General Activity 2008

Source of emissions	Total equiv. CO ₂ e (t/yr)	Proportion of total
Premises		
Domestic electricity	381,810	8.1%
Economy domestic electricity	324,643	6.9%
Commercial /industrial electricity	781,545	17%
Domestic natural gas	300,803	6.4%
Commercial /industrial natural gas	207,002	4.4%
Industrial petroleum	194,327	4.1%
Domestic petroleum	436,021	9.2%
Public administration petroleum	3,662	0.08%
Commercial petroleum	4,256	0.09%
Industrial & commercial coal	14,735	0.3%
Domestic coal	33,534	0.7%
Industrial & commercial MSF*	62	0.001%
Domestic MSF*	15,207	0.3%
Transportation		
Diesel cars	195,115	4.1%
Petrol cars	391,770	8.3%
Buses	37,550	0.8%
Motorcycles	6,776	0.1%
HGV	142,158	3%
Diesel LGV	151,492	3.2%
Petrol LGV	9,648	0.2%
Rail petroleum	31,766	0.7%
Aviation	15,990	0.3%
Marine	32,420	0.7%
Agriculture		
Livestock	636,649	13%
Fertiliser	41,765	0.9%
Diesel	97,171	2.1%
Electricity***	0	0%
Refrigerants		
Refrigerant Gas Losses**	0	0%
Waste		
Municipal waste to landfill	245,401	5.2%
Municipal waste to incineration	-	-
Clinical waste (NHS) to incineration	93	0.002%
Wastewater and discharge	173	0.004%
Total	4,733,544	100%

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases, ***Agricultural electricity figures have been included within commercial and industrial electricity.

SUMMARY BY WBCSD SCOPE			
Source of emissions	WBCSD Scope	Total equiv. CO ₂ e(t/yr)	Proportion of total
Premises - domestic natural gas	Scope 1	300,803	6.4%
Premises - commercial/industrial natural gas		207,002	4.4%
Premises - industrial petroleum		194,327	4.1%
Premises - domestic petroleum		436,021	9.2%

Premises - public administration petroleum		3,662	0.08%
Premises - commercial petroleum		4,256	0.1%
Premises - industrial & commercial coal		14,735	0.3%
Premises - domestic coal		33,534	0.7%
Premises - industrial & commercial MSF*		62	-
Premises - domestic MSF*		15,207	0.3%
Agriculture - diesel		97,171	2.1%
Refrigerant Gas Losses**		0	0%
Subtotal		1,306,779	28%
Premises - domestic electricity	Scope 2	381,810	8.1%
Premises - economy domestic electricity		324,643	6.9%
Premises - commercial/industrial electricity		781,545	17%
Agriculture - electricity		0	0%
Subtotal		1,487,998	31%
Transport - diesel cars	Scope 3	195,115	4.1%
Transport - petrol cars		391,770	8.3%
Transport - buses		37,550	0.8%
Transport - motorcycles		6,776	0.1%
Transport - HGV		142,158	3.0%
Transport - diesel HGV		151,492	3.2%
Transport - petrol HGV		9,648	0.2%
Transport - rail petroleum		31,766	0.67%
Transport - aviation		15,990	0.3%
Transport - marine		32,420	0.7%
Agriculture - livestock		636,649	13%

Agriculture - fertiliser		41,765	0.9%
Municipal waste to landfill		245,401	5.2%
Municipal waste to incineration		-	-
Clinical waste (NHS) to incineration		93	0.002%
Waste water and discharge		173	0.004%
Subtotal		1,938,767	41%
Total	-	4,733,544	100%

2008 Summary (By ICLEI Protocol)

Macro Sector (IPCC)	Community Sector (ICLEI)	Source of emissions	Total equiv. CO ₂ e (t/yr)	
Stationary Combustion	Energy Consumption	Domestic electricity	381,810	
		Economy domestic electricity	324,643	
		Commercial /industrial electricity	781,545	
		Domestic natural gas	300,803	
		Commercial /industrial natural gas	207,002	
		Industrial petroleum	194,327	
		Domestic petroleum	436,021	
		Public administration petroleum	3,662	
		Commercial petroleum	4,256	
		Industrial & commercial coal	14,735	
		Domestic coal	33,534	
		Industrial & commercial MSF*	62	
		Domestic MSF*	15,207	
		Mobile Combustion	Transportation	Diesel cars
Petrol cars	391,770			
Buses	37,550			
Motorcycles	6,776			
HGV	142,158			
Diesel LGV	151,492			
Petrol LGV	9,648			
Rail petroleum	31,766			
Marine	32,420			
Aviation	15,990			
Fugitive emissions	Other	Refrigerant Gas Losses**	0	
Industrial Processes and Product use	Other	-	-	
Agriculture, Forestry & other Land Use	Agricultural	Livestock	636,649	
		Fertiliser	41,765	
		Petroleum	97,171	
Waste	Waste	Solid waste disposal	Municipal waste to landfill	245,401
		Biological treatment of Solid Waste	Municipal waste to incineration	-
		Incineration and Open Burning of Solid Waste	Clinical waste (NHS) to incineration	93
		Wastewater treatment and Discharge	Wastewater and discharge	173

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases

Comparison of Inventory Year-on-Year Totals

Source of emissions	Total equiv. CO ₂ e (t/yr)	Total equiv. CO ₂ e (t/yr)	Total equiv. CO ₂ e (t/yr) Year on year change	Change in emission source as a percentage of baseline emission source year	Significance change as a percentage of total baseline year emissions
	2007	2008			
Premises					
Domestic electricity	392,560	381,810	-10,749	-2.7%	-0.22%
Economy domestic electricity	348,057	324,643	-23,414	-6.7%	-0.48%
Commercial /Industrial electricity	835,508	781,545	-53,963	-6.5%	-1.10%
Domestic natural gas	315,918	300,803	-15,115	-4.8%	-0.31%
Commercial /Industrial natural gas	244,201	207,002	-37,199	-15.2%	-0.76%
Industrial petroleum	225,129	194,327	-30,802	-13.7%	-0.63%
Domestic petroleum	413,245	436,021	22,776	5.5%	0.46%
Public administration petroleum	2,653	3,662	1,009	38.0%	0.02%
Commercial petroleum	2,044	4,256	2,212	108.2%	0.05%
Industrial & commercial coal	11,996	14,735	2,739	22.8%	0.06%
Domestic coal	29,747	33,534	3,787	12.7%	0.08%
Industrial & commercial MSF*	112	62	-50	-44.5%	0.00%
Domestic MSF*	16,768	15,207	-1,561	-9.3%	-0.03%
Transportation					
Diesel cars	187,371	195,115	7,744	4.1%	0.16%
Petrol cars	401,836	391,770	-10,067	-2.5%	-0.21%
Buses	43,039	37,550	-5,489	-12.8%	-0.11%
Motorcycles	7,243	6,776	-467	-6.5%	-0.01%
HGV	148,131	142,158	-5,973	-4.0%	-0.12%
Diesel LGV	150,458	151,492	1,034	0.7%	0.02%
Petrol LGV	10,528	9,648	-880	-8.4%	-0.02%
Rail petroleum	31,389	31,766	377	1.2%	0.01%
Aviation	9,780	15,990	6,211	63.5%	0.13%
Marine	41,231	32,420	-8,811	-21.4%	-0.18%
Agriculture					
Livestock	633,643	636,649	3,005	0.5%	0.06%
Fertiliser	36,925	41,765	4,840	13.1%	0.10%
Diesel	97,318	97,171	-147	-0.2%	-0.003%
Electricity***	-	-	-	-	0%
Refrigerants					
Refrigerant Gas Losses**	-	-	-	-	0%
Waste					
Municipal waste to landfill	264,821	245,401	-19,420	-7.3%	-0.40%
Municipal waste to incineration	91	-	-	-	-
Clinical waste (NHS) to incineration	325	93	-232	-71.3%	-0.0047%
Wastewater and discharge	170	173	3.6	2.1%	0.0001%
Total	4,902,239	4,733,544	-168,695	-3.4%	-3.4%

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases.

***Agricultural electricity figures have been included within commercial and industrial electricity.

Appendix III: Calculations Cornwall & Isles of Scilly 2007 Updated Inventory

A. PREMISES - ELECTRICITY

Source of emissions	Electricity usage (MWh/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Domestic:					
Caradon	118,452	64,154	28	399	64,581
Carrick	123,892	67,100	30	418	67,547
Isles of Scilly	4,201	2,275	1.0	14	2,290
Kerrier	131,751	71,356	32	444	71,832
North Cornwall	117,349	63,556	28	395	63,980
Penwith	89,080	48,246	21	300	48,567
Restormel	135,291	73,273	32	456	73,762
Subtotal	720,015	389,960	173	2,426	392,560
Economy Domestic:					
Caradon	90,122	48,810	22	304	49,135
Carrick	109,908	59,526	26	370	59,923
Isles of Scilly	4,374	2,369	1.0	15	2,385
Kerrier	109,580	59,349	26	369	59,744
North Cornwall	124,215	67,275	30	419	67,723
Penwith	76,101	41,216	18	256	41,491
Restormel	124,092	67,208	30	418	67,656
Subtotal	638,392	345,753	153	2,151	348,057
Commercial/Industrial:					
Caradon	166,004	89,908	40	559	90,507
Carrick	208,559	112,956	50	703	113,709
Isles of Scilly	8,293	4,492	2.0	28	4,522
Kerrier	214,508	116,177	51	723	116,952
North Cornwall	311,172	168,531	75	1,049	169,654
Penwith	126,391	68,453	30	426	68,909
Restormel	497,524	269,459	119	1,677	271,255
Subtotal	1,532,452	829,976	368	5,164	835,508
Total	2,890,858	1,565,689	694	9,742	1,576,125

Data collection period:

Calendar Year 2007

Assumptions

Data for electricity was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007.

CO ₂ emissions for electricity:	0.542	kgCO ₂ /kWh (Defra 2010)
CH ₄ emissions for electricity:	0.000	kgCO ₂ e/kWh (Defra 2010)
N ₂ O emissions for electricity:	0.003	kgCO ₂ e/kWh (Defra 2010)

B. PREMISES - NATURAL GAS

Source of emissions	Natural Gas usage (MWh/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Domestic:					
Caradon	292,040	53,984	79	32	54,095
Carrick	309,190	57,154	83	34	57,271
Isles of Scilly	8,575	1,585	2.3	0.9	1,588
Kerrier	260,579	48,168	70	29	48,267
North Cornwall	244,349	45,168	66	27	45,261
Penwith	236,267	43,674	64	26	43,764
Restormel	354,547	65,538	96	39	65,673
Subtotal	1,705,546	315,270	460	188	315,918
Commercial/Industrial:					
Caradon	151,592	28,022	41	17	28,079
Carrick	111,527	20,616	30	12	20,658

Isles of Scilly	8,293	1,533	2.2	0.9	1,536
Kerrier	128,207	23,699	35	14	23,748
North Cornwall	119,823	22,149	32	13	22,195
Penwith	54,438	10,063	15	6.0	10,084
Restormel	744,487	137,618	201	82	137,901
Subtotal	1,318,367	243,700	356	145	244,201
Total	3,023,913	558,970	816	333	560,119

Data collection period:

Calendar Year 2007

Assumptions

Data for natural gas was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007.

CO ₂ emissions for natural gas:	0.1849	kgCO ₂ /kWh (Defra 2010)
CH ₄ emissions for natural gas:	0.0003	kgCO ₂ e/kWh (Defra 2010)
N ₂ O emissions for natural gas:	0.0001	kgCO ₂ e/kWh (Defra 2010)

C. PREMISES - PETROLEUM

Source of emissions	Diesel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Industrial:					
Caradon	7,948	25,150	14	278	25,442
Carrick	6,923	21,906	12	242	22,161
Isles of Scilly	693	2,193	1.2	24	2,219
Kerrier	8,286	26,218	15	290	26,523
North Cornwall	22,788	72,108	41	798	72,947
Penwith	2,792	8,834	5.0	98	8,937
Restormel	20,899	66,131	38	731	66,900
Subtotal	70,329	222,541	127	2,462	225,129
Domestic:					
Caradon	19,367	61,284	35	678	61,996
Carrick	22,315	70,611	40	781	71,432
Isles of Scilly	2,063	6,529	3.7	72	6,605
Kerrier	26,711	84,521	48	935	85,504
North Cornwall	26,293	83,198	47	920	84,166
Penwith	12,449	39,394	22	436	39,852
Restormel	19,896	62,958	36	696	63,690
Subtotal	129,095	408,495	232	4518	413,245
Public Administration:					
Caradon	67	213	0.1	2.4	216
Carrick	193	611	0.3	6.8	618
Isles of Scilly	2.5	7.8	0.004	0.09	7.9
Kerrier	313	991	0.6	11	1,002
North Cornwall	87	274	0.2	3.0	277
Penwith	60	188	0.1	2.1	190
Restormel	107	337	0.2	3.7	341
Subtotal	829	2,622	1.5	29	2,653
Commercial:					
Caradon	88	279	0.2	3.1	282
Carrick	131	416	0.2	4.6	421
Isles of Scilly	2.6	8.2	0.005	0.1	8.3
Kerrier	107	340	0.2	3.8	343
North Cornwall	114	360	0.2	4.0	364
Penwith	73	232	0.1	2.6	235
Restormel	122	386	0.2	4.3	390
Subtotal	638	2,020	1.1	22	2,044
Total	200,891	635,678	362	7,031	643,071

Data collection period:

Calendar Year 2007

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
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CH ₄ emissions for diesel:	1.8	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/metric tonne (Defra 2010)

D. PREMISES – COAL

Source of emissions	Coal usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Industrial & Commercial:					
Caradon	931	2,137	1.7	37	2,176
Carrick	385	885	0.7	15	900
Isles of Scilly	8.6	20	0.02	0.3	20
Kerrier	295	678	0.5	12	690
North Cornwall	644	1,479	1.2	25	1,506
Penwith	168	386	0.3	6.6	393
Restormel	2,701	6,199	4.9	106	6,311
Subtotal	5,134	11,784	9.2	202.3	11,996
Domestic:					
Caradon	1,555	3,897	513	71	4,480
Carrick	1,797	4,503	592	82	5,177
Isles of Scilly	199	500	66	9.1	574
Kerrier	2,192	5,494	723	100	6,317
North Cornwall	1,914	4,797	631	87	5,515
Penwith	1,126	2,822	371	51	3,245
Restormel	1,540	3,860	508	70	4,438
Subtotal	10,323	25,874	3,404	470	29,747
Total	15,458	37,658	3,413	672	41,743

Data collection period:

Calendar Year 2007

Assumptions

Data for coal consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for coal (industrial):	2,295	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for coal (industrial):	2	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for coal (industrial):	39	kgCO ₂ e/metric tonne (Defra 2010)
CO ₂ emissions for coal (domestic):	2,506	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for coal (domestic):	330	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for coal (domestic):	45.5	kgCO ₂ e/metric tonne (Defra 2010)

E. PREMISES - MANUFACTURED SOLID FUEL

Source of emissions	Coal usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Industrial & Commercial:					
Caradon	0	0	0	0	0
Carrick	0	0	0	0	0
Isles of Scilly	0	0	0	0	0
Kerrier	3.4	10	0.1	0.2	10
North Cornwall	0	0	0	0	0
Penwith	33	98	1.0	2.3	102
Restormel	0	0	0	0	0
Subtotal	36	108	1.1	2.6	112
Domestic:					
Caradon	818	2,444	24	58	2,525
Carrick	946	2,824	28	67	2,918
Isles of Scilly	105	313	3.1	7.4	324
Kerrier	1,154	3,446	34	81	3,561
North Cornwall	1,007	3,008	29	71	3,109
Penwith	593	1,770	17	42	1,829
Restormel	811	2,421	24	57	2,502
Subtotal	5,433	16,226	158	384	16,768
Total	5,469	16,334	159	386	16,880

Data collection period:

Calendar Year 2007

Assumptions

Data for manufactured solid fuel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas and IoS. The dataset provided is for the calendar year 2007. Camco has assumed all manufactured solid fuel to be coke. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for coking coal:	2,987	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for coking coal:	29.1	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for coking coal:	70.6	kgCO ₂ e/metric tonne (Defra 2010)

F. TRANSPORT - DIESEL CARS

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	9,509	30,089	17	333	30,439
Carrick	10,204	32,289	18	357	32,664
Isles of Scilly	23	73	0.04	0.8	74
Kerrier	9,369	29,645	17	328	29,990
North Cornwall	14,016	44,351	25	491	44,867
Penwith	5,046	15,969	9.1	177	16,154
Restormel	10,366	32,802	19	363	33,184
Total	58,533	185,217	105	2,049	187,371

Data collection period:

Calendar Year 2007

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/metric tonne (Defra 2010)

G. TRANSPORT - PETROL CARS

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Caradon	19,700	61,759	124	420	62,302
Carrick	23,539	73,796	148	501	74,446
Isles of Scilly	46	143	0.3	1.0	144
Kerrier	21,992	68,946	139	468	69,553
North Cornwall	28,182	88,351	178	600	89,129
Penwith	11,613	36,407	73	247	36,727
Restormel	21,987	68,928	139	468	69,535
Total	127,059	398,330	800	2,706	401,836

Data collection period:

Calendar Year 2007

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO ₂ e/metric tonne (Defra 2010)

H. TRANSPORT – BUSES

Source of emissions	Fuel usage/tonnes	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ (t/yr)
Caradon	1,716	5,429	3.1	60	5,492
Carrick	2,561	8,105	4.6	90	8,199
Isles of Scilly	17	55	0.0	0.6	56
Kerrier	2,994	9,475	5.4	105	9,585
North Cornwall	2,472	7,821	4.4	87	7,912
Penwith	1,479	4,680	2.7	52	4,734
Restormel	2,206	6,980	4.0	77	7,061
Total	13,445	42,544	24	470.6	43,039

Data collection period:

Calendar Year 2007

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/metric tonne (Defra 2010)

I. TRANSPORT - MOTORCYCLES

Source of emissions	Fuel usage/tonnes	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ (t/yr)
Caradon	368	1,152	2.3	7.8	1,163
Carrick	359	1,124	2.3	7.6	1,134
Isles of Scilly	9.0	28	0.1	0.2	28
Kerrier	487	1,528	3.1	10	1,541
North Cornwall	442	1,385	2.8	9.4	1,397
Penwith	236	740	1.5	5.0	746
Restormel	390	1,223	2.5	8.3	1,234
Total	2,290	7,180	14	49	7,243

Data collection period:

Calendar Year 2007

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. Camco assumes all motorcycles are petrol fuelled. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO ₂ e/metric tonne (Defra 2010)

J. TRANSPORT – HGV

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ (t/yr)
Caradon	7,742	24,498	14	271	24,783
Carrick	7,234	22,890	13	253	23,156
Isles of Scilly	19	60	0.03	0.7	60
Kerrier	5,002	15,828	9.0	175	16,012
North Cornwall	15,544	49,187	28	544	49,759
Penwith	2,487	7,869	4.5	87	7,960
Restormel	8,247	26,096	15	289	26,399
Total	46,275	146,428	83.3	1619.6	148,131

Data collection period:

Calendar Year 2007

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. Camco has assumed all HGVs in this section are diesel fuelled.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/metric tonne (Defra 2010)

K. TRANSPORT - DIESEL LGV

Source of emissions	Fuel usage/tonnes	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ (t/yr)
Caradon	7,797	24,671	14	273	24,958
Carrick	7,614	24,093	14	266	24,373
Isles of Scilly	39	125	0.07	1.4	126
Kerrier	7,196	22,770	13	252	23,035
North Cornwall	11,876	37,580	21	416	38,017
Penwith	3,771	11,933	6.8	132	12,071
Restormel	8,709	27,556	16	305	27,877

Total	47,002	148,728	85	1,645	150,458
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Data collection period: *Calendar Year 2007*

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO _{2e} /metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO _{2e} /metric tonne (Defra 2010)

L. TRANSPORT - PETROL LGV

Source of emissions	Fuel usage (t/yr)	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO _{2e} /yr)	N ₂ O emitted (tCO _{2e} /yr)	Total equiv. CO ₂ (t/yr)
Caradon	550	1,724	3.5	12	1,739
Carrick	559	1,752	3.5	12	1,767
Isles of Scilly	2.8	8.8	0.02	0.06	8.9
Kerrier	521	1,634	3.3	11	1,648
North Cornwall	815	2,555	5.1	17	2,578
Penwith	277	867	1.7	5.9	875
Restormel	604	1,895	3.8	13	1,911
Total	3,329	10,436	21	70.9	10,528

Data collection period: *Calendar Year 2007*

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. Camco assumes all petrol HGVs are Class III light commercial vehicles. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for petrol:	3,135	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for petrol:	6.3	kgCO _{2e} /metric tonne (Defra 2010)
N ₂ O emissions for petrol:	21.3	kgCO _{2e} /metric tonne (Defra 2010)

M. TRANSPORT - RAIL PETROLEUM

Source of emissions	Diesel usage (t/yr)	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ (t/yr)
Caradon	3,167	10,020	5.7	111	10,136
Carrick	1,589	5,029	2.9	56	5,088
Isles of Scilly	0	0	0	0	0
Kerrier	684	2,163	1.2	24	2,188
North Cornwall	536	1,698	1.0	19	1,717
Penwith	1,262	3,995	2.3	44	4,041
Restormel	2,567	8,124	4.6	90	8,219
Total	9,806	31,029	18	343	31,389

Data collection period:

Calendar Year 2007

Assumptions

Data for petroleum consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007. Emissions from Heritage Railways would be included in this section if data were available. Camco recommends covering heritage railways as transport within 'leisure' activities. All fuel data has been updated, in addition to inclusion of Isles of Scilly, as data had changed.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/metric tonne (Defra 2010)

N. TRANSPORT – AVIATION

Source of emissions	Total distance movements	Total distance travelled (nm)	CO ₂ emitted (t/yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ e(t/yr)
Heavy jet	1,376	142,108	5,587	7.1	98	5,692
Medium jet	36	8,042	112	0.4	5.5	118
Light jet	405	59,497	541	3.0	41	585
Turbo prop	7,423	455,058	2,650	23	314	2,987
Piston	493	57,649	325	2.9	40	368
Helicopter	113	8,981	24	0.4	6.2	30
Total	9,846	731,335	9,239	37	505	9,780

Data collection period:

Calendar Year 2007

Assumptions

Aviation calculations relate to Newquay Cornwall Airport. Emissions from Land's End and IoS aircraft movements have not been included.

Average flight distance - heavy jets:	103	nm
Number of movements - medium jets:	223	nm
Number of movements - light jets:	147	nm
Number of movements - turbo prop:	61	nm
Number of movements - piston:	117	nm
Number of movements - helicopters:	79	nm
CO ₂ emissions for a heavy jet:	4,060	kgCO ₂ /average flight

CO ₂ emissions for a medium jet:	3,106	kgCO ₂ /average flight
CO ₂ emissions for a light jet:	1,336	kgCO ₂ /average flight
CO ₂ emissions for a turbo prop:	357	kgCO ₂ /average flight
CO ₂ emissions for a piston aircraft:	660	kgCO ₂ /average flight
CO ₂ emissions for a helicopter:	211	kgCO ₂ /average flight
CH ₄ emissions for flights:	0.1	kgCH ₄ /nm
N ₂ O emissions for flights:	0.69	kgN ₂ O/nm
Global warming potential (in CO ₂ equivalents) of CH ₄ :	21	(IPCC 2006)
Global warming potential (in CO ₂ equivalents) of N ₂ O:	310	(IPCC 2006)

N. AGRICULTURE - LIVESTOCK

Livestock type	Number/livestock	Enteric EF (tCH ₄ /yr)	Manure EF (tCH ₄ /yr)	Total equiv. CO ₂ (t/yr)
Cattle				
Dairy female 2yr+	74,211	7,547	1,855	197,454
Beef female 2yr+	46,064	2,211	276	52,236
Dairy female 2yr+ (no offspring)	16,605	1,689	415	44,180
Beef female 2yr+ (no offspring)	13,927	668	84	15,793
Male 2yr+	16,299	782	98	18,483
Dairy female 1-2yr	17,049	1,734	426	45,364
Beef female 1-2yr	27,425	1,316	165	31,100
Male 1-2yr	36,710	1,762	220	41,629
Dairy female <1yr	18,882	1,920	472	50,240
Beef female <1yr	31,677	1,039	94	23,788
Male <1yr	42,234	1,385	125	31,716
Subtotal	341,084	22,055	4,230	551,984
Pigs				
Sows in pig	4,213	6.3	13	398
Gilts in pig	696	1.0	2.1	66
Other sows	1,260	1.9	3.8	119
Boars for service	286	0.4	0.9	27
Gilts	625	0.9	1.9	59
Barren sows for fattening	99	0.1	0.3	9.4
Pigs over 110kg	384	0.6	1.2	36
Pigs 80kg to 100kg	9,587	14	29	906
Pigs 50kg to 80kg	15,223	23	46	1,439
Pigs 20kg to 50kg	12,583	19	38	1,189
Pigs under 20kg	13,177	20	40	1,245
Subtotal	58,132	87	174	5,493
Sheep				

Ewes	219,645	1,757	42	37,777
Other breeding sheep	22,456	180	4.3	3,862
Rams	6,346	51	1.2	1,091
Other sheep over 1yr	12,192	98	2.3	2,097
Lambs under 1yr	241,018	386	0	8,098
Subtotal	501,658	2,471	50	52,926
Goats	2,078	10	-	218
Subtotal	2,078	10	-	218
Horses	10,161	183	-	3,841
Subtotal	10,161	183	-	3,841
Poultry				
Growing pullets	184,067	0	144	3,015
Birds in the laying flock	696,350	0	543	11,406
Layer breeders	1,459	0	1.1	24
Broiler breeders	117	0	0.1	1.9
Cocks and cockerels	1,101	0	0.9	18
Table chicken	246,395	0	192	4,036
Ducks	8,834	0	6.9	145
Geese	2,853	0	2.2	47
Turkeys	1,926	0	1.5	32
All other birds	27,952	0	22	458
Subtotal	1,171,054	0	913	19,182
Total	2,084,166	24,806	5,367	633,643

Data collection period:

Calendar Year 2007

Assumptions - livestock

All references for emissions factors (unless stated otherwise) have been taken from Dr D Chadwick: Agricultural nitrous oxide and methane emissions from Cornwall and potential migration (Draft 2008).

Livestock category - Enteric emissions:

Dairy cow	101.7	kgCH ₄ /head/yr
All other cattle >1 year old	48.0	kgCH ₄ /head/yr
All cattle < 1 year old	32.8	kgCH ₄ /head/yr
Horses	18	kgCH ₄ /head/yr (IPCC 2006)
Pigs	1.5	kgCH ₄ /head/yr
Sheep	8.0	kgCH ₄ /head/yr
Lambs	1.6	kgCH ₄ /head/yr
Goats	5	kgCH ₄ /head/yr (IPCC 2006)
Poultry	0.0	kgCH ₄ /head/yr

Livestock category - Manure emissions:

Dairy cow	25.0	kgCH ₄ /head/yr
All other cattle >1 year old	6.0	kgCH ₄ /head/yr
All cattle < 1 year old	2.96	kgCH ₄ /head/yr
Pigs	3.0	kgCH ₄ /head/yr

Sheep	0.19	kgCH ₄ /head/yr
Lambs	0.0	kgCH ₄ /head/yr
Poultry	0.78	kgCH ₄ /head/yr
Global warming potential (in CO ₂ equivalents) of CH ₄ :	21	(IPCC 1996)

O. AGRICULTURE - ARABLE CROPS

Crop type	Planted area (ha)	Fertiliser required (t/yr)	Total equiv. CO ₂ (t/yr)
Nitrogen			
Wheat	10,488	1,573	10,540
Winter Barley	7,904	869	5,825
Spring Barley	10,703	1,070	7,171
Oats	2,718	245	1,639
Other cereals	2,210	199	1,333
Potatoes	3,472	556	3,722
Sugar beet	77	7.7	51
Field beans	677	0	0
Peas for harvesting dry	170	0	0
Oilseed rape	1,245	199	1,334
Linseed	300	24	161
Root crops, brassicas, fodder beet	1,071	64	430
Other crops for stockfeed	858	51	345
Maize	5,629	281	1,886
Other arable crops	1,418	71	475
Bare fallow	2,575	0	0
Subtotal	51,516	5,211	34,914
Phosphate			
Wheat	10,488	629	203
Winter Barley	7,904	514	166
Spring Barley	10,703	482	155
Oats	2,718	122	39
Other cereals	2,210	0	0
Potatoes	3,472	590	190
Sugar beet	77	3.8	1.2
Field beans	677	27	8.7
Peas for harvesting dry	170	6.8	2.2
Oilseed rape	1,245	62	20
Linseed	300	0	0
Root crops, brassicas, fodder beet	1,071	48	16
Other crops for stockfeed	858	39	12
Maize	5,629	310	100
Other arable crops	1,418	0	0

Bare fallow	2,575	0	0
Subtotal	51,516	2,834	914
Potash			
Wheat	10,488	367	141
Winter Barley	7,904	0	0
Spring Barley	10,703	0	0
Oats	2,718	0	0
Other cereals	2,210	0	0
Potatoes	3,472	1,042	401
Sugar beet	77	7.7	2.9
Field beans	677	27	10
Peas for harvesting dry	170	6.8	2.6
Oilseed rape	1,245	0	0
Linseed	300	12	4.6
Root crops, brassicas, fodder beet	1,071	166	64
Other crops for stockfeed	858	133	51
Maize	5,629	985	379
Other arable crops	1,418	0	0
Bare fallow	2,575	0	0
Subtotal	51,516	2,746	1,056
Crop type	Planted area (ha)	Fertiliser required (t/yr)	Total equiv. CO₂ (t/yr)
Magnesium			
Wheat	10,488	0	0
Winter Barley	7,904	0	0
Spring Barley	10,703	0	0
Oats	2,718	0	0
Other cereals	2,210	0	0
Potatoes	3,472	139	41
Sugar beet	77	0	0
Field beans	677	0	0
Peas for harvesting dry	170	0	0
Oilseed rape	1,245	0	0
Linseed	300	0	0
Root crops, brassicas, fodder beet	1,071	0	0
Other crops for stockfeed	858	0	0
Maize	5,629	0	0
Other arable crops	1,418	0	0
Bare fallow	2,575	0	0
Subtotal	51,516	139	41
Sulphur			
Wheat	10,488	0	0
Winter Barley	7,904	0	0
Spring Barley	10,703	0	0

Oats	2,718	0	0
Other cereals	2,210	0	0
Potatoes	3,472	0	0
Sugar beet	77	0	0
Field beans	677	0	0
Peas for harvesting dry	170	0	0
Oilseed rape	1,245	0	0
Linseed	300	0	0
Root crops, brassicas, fodder beet	1,071	0	0
Other crops for stockfeed	858	0	0
Maize	5,629	0	0
Other arable crops	1,418	0	0
Bare fallow	2,575	0	0
Subtotal	51,516	0	0
Total	-	10,930	36,925

Data collection period:

Calendar Year 2007

Assumptions - Arable crops

As all emissions associated with fuel usage for arable crops has already been accounted for in previous tables, ECCM has only assessed the emissions arising from the use of fertiliser.

ECCM assumes all soils are categorised as 'deep fertile silty soils'.

ECCM assumes all soils have a SNS index of 3.

ECCM assumes no cereal crops have sulphur deficiency.

ECCM assumes that the weight of nitrogen required for 'other cereals' is equal to that of wheat as a worst case scenario.

ECCM assumes that the weight of nitrogen required for 'other crops for stockfeed' is equal to that of root crops.

ECCM assumes that the weight of nitrogen required for 'other arable crops' is equal to that of maize.

ECCM assumes that the weight of nitrogen required for 'bare fallow' is equal to that of maize.

All figures from the following tables taken from: Fertiliser recommendations for agricultural and horticultural crops (RB209): Seventh edition (2000)

Nitrogen

Wheat - weight of fertiliser required:	150	kg per ha (all other mineral soils, SNS 2)
Winter barley - weight of fertiliser required:	110	kg per ha (assumed feed barley, deep fertile silty soils, SNS 2)
Spring barley - weight of fertiliser required:	100	kg per ha (assumed Malting Barley, other mineral soils, SNS2)
Oats - weight of fertiliser required:	90	kg per ha (all other mineral soils, SNS 2)
Other cereals - weight of fertiliser required:	90	kg per ha (assumed as above, all other mineral soils, SNS 2)
Potatoes - weight of fertiliser required:	160	kg per ha (all other mineral soils, SNS 2)
Sugar beet - weight of fertiliser required:	100	kg per ha (all other mineral soils, SNS 2)
Field beans - weight of fertiliser required:	0	kg per ha (P, K and SNS Index 2)
Peas for harvesting dry - weight of fertiliser required:	0	kg per ha (P, K and SNS Index 2)
Oilseed rape - weight of fertiliser required:	160	kg per ha (all mineral soils, SNS 2)

Linseed - weight of fertiliser required:	80	kg per ha (all other mineral soils, SNS 2)
Root crops, brassicas, fodder beet - weight of fertiliser required:	60	kg per ha (N index of 2; assumed same as forage swedes and turnips)
Other crops for stockfeed - weight of fertiliser required:	60	kg per ha (N index of 2; assumed same as forage swedes and turnips)
Maize - weight of fertiliser required:	50	kg per ha (assuming N index of 2)
Other arable crops - weight of fertiliser required:	50	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Phosphate		
Wheat - weight of fertiliser required:	60	kg per ha (assuming P index of 2)
Winter barley - weight of fertiliser required:	65	kg per ha (assuming P index of 2)
Spring barley - weight of fertiliser required:	45	kg per ha (assuming P index of 2)
Oats - weight of fertiliser required:	45	kg per ha (assuming P index of 2)
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	170	kg per ha (assuming P index of 2)
Sugar beet - weight of fertiliser required:	50	kg per ha (assuming P index of 2)
Field beans - weight of fertiliser required:	40	kg per ha (assuming P index of 2)
Peas for harvesting dry - weight of fertiliser required:	40	kg per ha (assuming P index of 2)
Oilseed rape - weight of fertiliser required:	50	kg per ha (assuming P index of 2)
Linseed - weight of fertiliser required:	0	kg per ha
Root crops, brassicas, fodder beet - weight of fertiliser required:	45	kg per ha (P index of 2; assumed same as forage swedes and turnips)
Other crops for stockfeed - weight of fertiliser required:	45	kg per ha (P index of 2; assumed same as forage swedes and turnips)
Maize - weight of fertiliser required:	55	kg per ha (assuming P index of 2)
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Potash		
Wheat - weight of fertiliser required:	35	kg per ha (assuming K index of 2)
Winter barley - weight of fertiliser required:	0	kg per ha
Spring barley - weight of fertiliser required:	0	kg per ha
Oats - weight of fertiliser required:	0	kg per ha
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	300	kg per ha (assuming K index of 2)
Sugar beet - weight of fertiliser required:	100	kg per ha (assuming K index of 2)
Field beans - weight of fertiliser required:	40	kg per ha (assuming K index of 2)
Peas for harvesting dry - weight of fertiliser required:	40	kg per ha (assuming K index of 2)

Oilseed rape - weight of fertiliser required:	0	kg per ha
Linseed - weight of fertiliser required:	40	kg per ha (K index of 2; assumed same as forage swedes and turnips)
Root crops, brassicas, fodder beet - weight of fertiliser required:	155	kg per ha (K index of 2; assumed same as forage swedes and turnips)
Other crops for stockfeed - weight of fertiliser required:	155	kg per ha (assuming K index of 2)
Maize - weight of fertiliser required:	175	kg per ha (assuming K index of 2)
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Magnesium		
Wheat - weight of fertiliser required:	0	kg per ha
Winter barley - weight of fertiliser required:	0	kg per ha
Spring barley - weight of fertiliser required:	0	kg per ha
Oats - weight of fertiliser required:	0	kg per ha
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	40	kg per ha (assuming Mg index of 2)
Sugar beet - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Field beans - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Peas for harvesting dry - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Oilseed rape - weight of fertiliser required:	0	kg per ha
Linseed - weight of fertiliser required:	0	kg per ha
Root crops, brassicas, fodder beet - weight of fertiliser required:	0	kg per ha
Other crops for stockfeed - weight of fertiliser required:	0	kg per ha
Maize - weight of fertiliser required:	0	kg per ha (assuming Mg index of 2)
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
Sulphur		
Wheat - weight of fertiliser required:	0	kg per ha
Winter barley - weight of fertiliser required:	0	kg per ha
Spring barley - weight of fertiliser required:	0	kg per ha
Oats - weight of fertiliser required:	0	kg per ha
Other cereals - weight of fertiliser required:	0	kg per ha
Potatoes - weight of fertiliser required:	0	kg per ha
Sugar beet - weight of fertiliser required:	0	kg per ha
Field beans - weight of fertiliser required:	0	kg per ha
Peas for harvesting dry - weight of fertiliser	0	kg per ha

required:		
Oilseed rape - weight of fertiliser required:	0	kg per ha
Linseed - weight of fertiliser required:	0	kg per ha
Root crops, brassicas, fodder beet - weight of fertiliser required:	0	kg per ha
Other crops for stockfeed - weight of fertiliser required:	0	kg per ha
Maize - weight of fertiliser required:	0	kg per ha
Other arable crops - weight of fertiliser required:	0	kg per ha
Bare fallow - weight of fertiliser required:	0	kg per ha
CO ₂ e emissions from nitrogen fertiliser:	6.70	KgCO ₂ e/kg (Carbon Trust 2009)
CO ₂ emissions from Phosphate fertiliser :	0.32	kg CO ₂ /kg (Carbon Trust 2007)
CO ₂ emissions from Potash fertiliser:	0.38	kg CO ₂ /kg (Carbon Trust 2007)
CO ₂ e emissions from magnesium (magnesium sulphate) fertiliser:	0.29	kg CO ₂ e/kg (SCLCI 2009, ref no 297)
CO ₂ e emissions from sulphur (sulphur dioxide) fertiliser:	0.41	kg CO ₂ e/kg (SCLCI 2009, ref no 349)

P. AGRICULTURE - DIESEL

Source of emissions	Diesel usage (t/yr)	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO ₂ e/yr)	N ₂ O emitted (tCO ₂ e/yr)	Total equiv. CO ₂ (t/yr)
Caradon	5,923	18,742	11	207	18,960
Carrick	3,283	10,389	5.9	115	10,510
Isles of Scilly	6.6	21	0.01	0.2	21
Kerrier	3,358	10,626	6.0	118	10,749
North Cornwall	12,221	38,671	22	428	39,120
Penwith	1,942	6,145	3.5	68	6,217
Restormel	3,668	11,606	6.6	128	11,741
Total	30,402	96,199	55	1,064.1	97,318

Data collection period:

Calendar Year 2007

Assumptions

Data for diesel consumption was sourced from BIS (Department for Business Innovation & Skills). The data provided is sorted by Middle Layer Super Output Area and Intermediate Geography Zone (MLSOA/IGZ), which with regards to Cornwall breaks the data down to six key areas, and IoS. The dataset provided is for the calendar year 2007.

CO ₂ emissions for diesel:	3,164	kgCO ₂ /metric tonne (Defra 2010)
CH ₄ emissions for diesel:	1.8	kgCO ₂ e/metric tonne (Defra 2010)
N ₂ O emissions for diesel:	35.0	kgCO ₂ e/metric tonne (Defra 2010)

R. MARINE TRANSPORT - DIESEL

Source of emissions	Gas oil consumption (kWh/yr)	Diesel usage (l/yr)	CO ₂ emitted (tCO ₂ /yr)	CH ₄ emitted (tCO _{2e} /yr)	N ₂ O emitted (tCO _{2e} /yr)	Total equiv. CO _{2e} (t/yr)
Penzance	-	56,181	155	0.2	14	170
St Ives	4,411,979	-	1,112	1.1	101	1,215
Newlyn	96,724,800	-	24,388	24	2,219	26,631
Truro	-	34,235	95	0.1	8.6	103
Falmouth	-	27,388	76	0.1	6.9	83
St Mawes	-	42,794	118	0.1	11	129
Fowey Harbour	26,518,923	-	6,686	6.6	608	7,301
Hayle	15,252,586	-	3,846	3.8	350	4,199
Newquay	5,080,461	-	1,281	1.3	117	1,399
Total	147,988,749	160,597	37,758	37	3,435	41,231

Data collection period:

Calendar Year 2007

Assumptions

Fuel used by boats is predominately red diesel (gas oil) and has therefore been assumed to be solely red diesel for the purpose of this assessment. Where possible actual data was sourced for ports and harbours. Marine Management produced a report highlighting all fishing vessels under and over 10m per port authority, in this instance, Newlyn. This data was used to create a benchmark figure for kW consumption per boat based on these two categories. Where data was otherwise unavailable, leisure boats have been assumed to be equivalent to small fishing vessels. The dataset provided is for the calendar year 2007.

Penzance - data was provided and is for calendar year 2010

Port/harbour	Fishing vessels (in summer)	Number of vessels	Notes
Fowey Harbour:	Commercial	70	
	Fishing boats	40	
Hayle:	Residential fleet	200	Residential fleet
	Commercial	20	Commercial Fishing Vessels
	Dredger	1	50ft sand dredger
Falmouth:	Park & Ride Float	1	Falmouth Park and Ride/Float – £16,000 of fuel between May and the end of October in 2010
Newquay:	Commercial fishing fleet	33	
	Pleasure boats	43	
St Ives:	Commercial fishing fleet	60	
	Pleasure boats	6	
Truro	King Harry Ferry	1	
St Mawes	Leisure boats		St Moors Ferry £25,000 of diesel.

Newlyn 2007

Total engine power of all vessels:	60,453	kW
Boats under 10m		
Total number of vessels:	543	boats
Total engine power of all vessels:	23,940	kW
Average engine power of a vessel under 10m:	42	kW per boat
Boats over 10m	107	boats

Total number of vessels:	36,513	kW
Total engine power of all vessels:	341	kW per boat
Average engine power of a vessel over 10m:		
Average price of Gas oil 2008:	0.584	pence per litre (DECC; Quarterly fuel prices)
Total work hours:	1,600	hours per year
Newlyn 2008		
Total engine power of all vessels:	42,731	kW
CO ₂ emissions for gas oil:	0.2521	kgCO ₂ e/kWh (Defra 2010)
CH ₄ emissions for gas oil:	0.0003	kgCO ₂ e/kWh (Defra 2010)
N ₂ O emissions for gas oil:	0.0229	kgCO ₂ e/kWh (Defra 2010)
CO ₂ emissions for gas oil:	2.7667	kgCO ₂ e/litre (Defra 2010)
CH ₄ emissions for gas oil:	0.0028	kgCO ₂ e/litre (Defra 2010)
N ₂ O emissions for gas oil:	0.2517	kgCO ₂ e/litre (Defra 2010)

S. PREMISES - REFRIGERANT GAS LOSSES

Source of emissions	Refrigerant type	Refrigerant (kg/yr)	Total equiv. CO ₂ e(t/yr)
Tulip Bodmin	-	-	-
Tulip Bugle	-	-	-
Samworth Bros Callington	-	-	-
Dairy Crest Davidstow	-	-	-
Jaspers Treburley	-	-	-
Jaspers South Petherin	-	-	-
Vion (St Merryn meat) Bodmin	-	-	-
Indian Queens peak power facility	-	-	-
Total	-	0	

Data collection period: Calendar Year 2007

Assumptions

CDC has requested data on refrigerant gas losses from IPPC permitted facilities in Cornwall from the EA, but has not been able to obtain figures in time to complete the results from refrigerant gas losses. High level figures were obtained for one site from the NAEI for total HFC's emitted (figures are based on Calendar year 2009).

Hydro-fluorocarbons		Hydro-chlorofluorocarbons	
Tulip Bodmin	-	-	
Tulip Bugle	135	300	kg/year (NAEI, Defra)
Samworth Bros Callington	-	-	
Dairy Crest Davidstow	-	-	
Jaspers Treburley	-	-	
Jaspers South Petherin	-	-	

Vion (St Merryn meat) Bodmin	-	-
Indian Queens peak power facility	-	-

T. WASTE

Source of emissions	Total volume of waste water (litres/yr)	Total weight of waste generated (t/yr)	CH ₄ generated (t/yr)	CH ₄ emitted (t/yr)	Total equiv. CO ₂ (t/yr)
Municipal waste to landfill	-	210,386	15,148	12,611	264,821
Municipal waste to incineration	-	404	-	-	91
Clinical waste (NHS) to incineration	-	1,438	-	-	325
Commercial & Industrial	-	-	-	-	-
Waste water and discharge	244,807,408	-	-	-	170
Total	212,228	15,148	12,611	12,611	265,407

Data collection period:

Calendar Year 2007

Assumptions

Total sewage discharge in the South West:	578,205,000	litres/year (South West Water, 2007)
Population of Devon:	704,499	people
Population of Cornwall (excluding the Isles of Scilly):	517,300	people
Litres per tonne (assuming density of water):	1,000	litres/tonne
Methane generated from land filled commercial waste:	0.072	tCH ₄ /t waste (see below)
Methane emitted from land filled commercial waste in Europe:	0.060	tCH ₄ /t waste (see below)
Emissions from incinerated waste:	226	kgCO ₂ /t waste (IPCC 2006)
Emissions from waste water treatment:	693	kgCO ₂ e/million litres (Defra 2009)
To calculate carbon emissions from commercial waste the following parameters were used:		
Degradable organic C content (DOC) of typical MSW (doc):	18%	(Smith et al 2001)
Proportion of dissimilable DOC (di):	60%	(Brown et al 1999)
Proportion of dissimilable DOC decaying to methane (dm):	50%	(IPCC 2006)
Methane oxidation factor (ox):	10%	(Brown et al 1999)
Avg. landfill gas collection efficiency for European landfills (gc):	63%	(Smith et al 2001)
Global warming potential of CH ₄ :	21	(IPCC 1996)

Notes

CH_4 generated (mg) = mass x doc x dm x di x 16/12

CH_4 emitted = mg x (1-gc) x (1-ox)

16/12 is the conversion factor carbon to CH_4

44/12 is the conversion factor carbon to CO_2

Summary by General Activity 2007 (updated)

Source of emissions	Source Table	Total equiv. CO ₂ e (t/yr)	Proportion of total
Premises			
Domestic electricity	A	392,560	8%
Economy domestic electricity	A	348,057	7.1%
Commercial /Industrial electricity	A	835,508	17%
Domestic natural gas	B	315,918	6.4%
Commercial /Industrial natural gas	B	244,201	5%
Industrial petroleum	C	225,129	4.6%
Domestic petroleum	C	413,245	8.4%
Public administration petroleum	C	2,653	0.05%
Commercial petroleum	C	2,044	0.04%
Industrial & commercial coal	D	11,996	0.2%
Domestic coal	D	29,747	0.6%
Industrial & commercial MSF*	E	112	-
Domestic MSF*	E	16,768	0.3%
Transportation			
Diesel cars	F	187,371	3.8%
Petrol cars	G	401,836	8.2%
Buses	H	43,039	0.9%
Motorcycles	I	7,243	0.1%
HGV	J	148,131	3%
Diesel LGV	K	150,458	3.1%
Petrol LGV	L	10,528	0.2%
Rail petroleum	M	31,389	0.6%
Aviation	N	9,780	0.2%
Marine	R	41,231	0.84%
Agriculture			
Livestock	N	633,643	13%
Fertiliser	O	36,925	0.8%
Diesel	P	97,318	2%
Electricity***	N/A	-	-
Refrigerants			
Refrigerant Gas Losses**	S	0	0%
Waste			
Municipal waste to landfill	T	264,821	5.4%
Municipal waste to incineration	-	91	0.002%
Clinical waste (NHS) to incineration	-	325	0.01%
Wastewater and discharge	-	170	0.003%
Total	-	4,902,239	100%

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases,

***Agricultural electricity figures have been included within commercial and industrial electricity.

SUMMARY BY WBCSD SCOPE			
Source of emissions	WBCSD Scope	Total equiv. CO ₂ e(t/yr)	Proportion of total
Premises - domestic natural gas	Scope 1	315,918	6.4%
Premises - commercial/industrial natural gas		244,201	5.0%
Premises - industrial petroleum		225,129	4.6%
Premises - domestic petroleum		413,245	8.4%
Premises - public administration petroleum		2,653	0.1%
Premises - commercial petroleum		2,044	0.0%
Premises - industrial & commercial coal		11,996	0.2%
Premises - domestic coal		29,747	0.6%
Premises - industrial & commercial MSF *		112	0.0%
Premises - domestic MSF *		16,768	0.3%
Agriculture - diesel		97,318	2.0%
Refrigerant Gas Losses**		0	0.0%
Subtotal		1,359,131	28%
Premises - domestic electricity	Scope 2	392,560	8.0%
Premises - economy domestic electricity		348,057	7.1%
Premises - commercial/industrial electricity		835,508	17%
Agriculture - electricity			
Subtotal		1,576,125	32%
Transport - diesel cars	Scope 3	187,371	3.8%
Transport - petrol cars		401,836	8%

Transport - buses		43,039	0.9%
Transport - motorcycles		7,243	0.1%
Transport - HGV		148,131	3.0%
Transport - diesel HGV		150,458	3.1%
Transport - petrol HGV		10,528	0.2%
Transport - rail petroleum		31,389	0.6%
Transport - aviation		9,780	0.2%
Transport - marine		633,643	13%
Agriculture - livestock		36,925	0.8%
Agriculture - fertiliser		41,231	0.8%
Municipal waste to landfill		264,821	5.4%
Municipal waste to incineration		91	0.002%
Clinical waste (NHS) to incineration		325	0.01%
Waste water and discharge		170	0.003%
Subtotal		1,966,983	40%
Total	-	4,902,239	100%

2007 (updated) Summary (By ICLEI Protocol)

Macro Sector (IPCC)	Community Sector (ICLEI)	Source of emissions	Total equiv. CO ₂ e (t/yr)	
Stationary Combustion	Energy Consumption	Domestic electricity	392,560	
		Economy domestic electricity	348,057	
		Commercial /Industrial electricity	835,508	
		Domestic natural gas	315,918	
		Commercial /Industrial natural gas	244,201	
		Industrial petroleum	225,129	
		Domestic petroleum	413,245	
		Public administration petroleum	2,653	
		Commercial petroleum	2,044	
		Industrial & commercial coal	11,996	
		Domestic coal	29,747	
		Industrial & commercial MSF*	112	
		Domestic MSF*	16,768	
Mobile Combustion	Transportation	Diesel cars	187,371	
		Petrol cars	401,836	
		Buses	43,039	
		Motorcycles	7,243	
		HGV	148,131	
		Diesel LGV	150,458	
		Petrol LGV	10,528	
		Rail petroleum	31,389	
		Marine	41,231	
		Aviation	9,780	
Fugitive emissions	Other	Refrigerant Gas Losses**	0	
Industrial Processes and Product use	Other	-	-	
Agriculture, Forestry & other Land Use	Agricultural	Livestock	633,643	
		Fertiliser	36,925	
		Petroleum	97,318	
Waste	Waste	Solid waste disposal	Municipal waste to landfill	264,821
		Biological treatment of Solid Waste	Municipal waste to incineration	91
		Incineration and Open Burning of Solid Waste	Clinical waste (NHS) to incineration	325
		Wastewater treatment and Discharge	Wastewater and discharge	170

*MSF - manufactured solid fuels, **Refrigerants - refer to section 3.6 for information on refrigerant gases

Appendix IV: Recycling and Re-Use of Waste in Cornwall 2007-2008

This table aims to show the value of recycling in helping Cornwall to achieve GHG reduction targets. Waste materials collected through kerbside collections bring banks, third parties and household waste recycling centres are all shown in tonnes for the years 2007 and 2008. In addition, estimates of the carbon saved (CO₂e) are calculated as a result of these materials being recycled or reused as opposed to being sent to landfill.

Kerbside Collections	2007		2008		Process
	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO ₂ e)	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO ₂ e)	
Mixed Paper & Card	22,331.83	17,843.13	24,249.62	19,375.45	Closed loop
Cans	1,069.728	4,182.63	1,133.77	4,433.04	Closed loop
Plastics ***	1,338.078	422.83	1,519.37	480.12	Open loop
Glass	8,891.569	3,485.50	9,906.69	3,883.42	Closed loop
Textiles	457.4292	6,435.57	445.69	6,270.41	Re-use
Garden waste	7,209.91	1,838.53	7275.06	1,855.14	Composting
Street sweepings	6,006.64		8,112.96		
Bring Banks	2007		2008		Process
	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO ₂ e)	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO ₂ e)	
Paper	3,769.31	2,777.98	3,901.57	2,875.46	Closed loop
Cans	599.29	2,343.22	677.84	2,650.35	Closed loop

Plastics ***	278.99	88.16	310.53	98.13	Open loop
Glass	8,435.98	3,306.90	6,987.06	2,738.93	Closed loop
Textiles	685.68	9,646.83	729.92	10,269.24	Re-use
Books	44.48	32.78	31.79	23.43	Closed loop
Third Parties	2007		2008		Process
	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO₂e)	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO₂e)	
Paper	2,494.14	1,838.18	2,696.75	1,987.50	Closed loop
Mixed Paper & card	226.07	180.63	95.96	76.67	Closed loop
Cans	41.2	161.09	70.52	275.73	Closed loop
Plastics ***	100.97	31.91	101.02	31.92	Open loop
Textiles	823.95	11,592.15	1,018.62	14,330.96	Re-use
Furniture *	0	0.00	37.88	102.28	Re-use
Wood	383.69	504.55	801.57	1,054.06	Closed loop
Fridges	85.44	57.50	31.34	21.09	Open loop
WEEE	3.68	5.06	47.58	65.37	Open loop
Household Waste Recycling Centres	2007		2008		Process
	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO₂e)	Amount Recycled (Tonnes)	Carbon Saved (Tonnes CO₂e)	

Paper	1,427.77	1,052.27	2,139.55	1,576.85	Closed loop
Metal	5,859.66	13,248.69	5,942.91	13,436.92	Closed loop
Glass	484.66	189.99	709.06	277.95	Closed loop
Wood	4,603.26	6,053.29	3,884.29	5,107.84	Closed loop
Textiles	35.34	497.20	52.3	735.81	Re-use
Engine Oil **	55.04	104.58	28.11	53.41	
Fridges	1,380.72	929.22	1,282.53	863.14	Open loop
Electrical	1,294.21	1,778.24	1,976.5	2,715.71	Open loop
Tyres **	265.56	N/A	287.48	N/A	
Gas Bottles **	19.88	N/A	71.93	N/A	
Car Batteries **	244.17	N/A	189.96	N/A	
Fluorescent Tubes **	5.33	N/A	10.77	N/A	
Garden waste	15,773.64	4,022.28	16,909.92	4,312.03	Composting
Construction waste	10,709.19		14,080.45		
Bric a Brac *	222.46	1,957.65	293.49	2,582.71	Re-use
TOTALS 2007			TOTALS 2008		
Recycled (Tonnes)	Carbon saved compared with landfill (tonnes CO₂e)		Recycled (Tonnes)	Carbon saved compared with landfill (tonnes CO₂e)	
107,658.94	96,608.55		118,042.36	104,561.10	

* The waste conversion factors used for these calculations were provided by Somerset Waste Partnership through the Recycling End-Use Register and based on 2010 Defra conversion factors.

** No figures available for carbon saving

*** For the years 2007 and 2008, plastic bottles were primarily processed 'open loop', however new technology has improved the quality of the end product thus, in following years it may be possible to move ever closer to closed loop recycling for some plastics.

Please note: For the purposes of this analysis open loop is defined as 'the process of recycling material into other products' and closed loop is the process of recycling material back into the same product.

Appendix V: Generation of Renewable Electricity and Heat in Cornwall and the Isles of Scilly

Cornwall & IoS Installed Renewable Electricity and Renewable Heat 2007-2008														
Renewable Electricity														
	MW of Wind		MW of Hydro		MW of Landfill Gas		MW of Sewage Gas		MW of Advanced Treatment of Waste		MW of CHP		MW of Solar PV	
Year	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Cornwall & IoS	39.22	43.335	1.58	1.731	11.48	11.476	0.4	0.395	0	0.143	0	0	0.12	0.205
Load Factor	27.50%	27%	38.20%	37.40%	60.80%	60%	34.90%	40.80%	41.20%	39.90%			9.70%	9.70%
GWh delivered	94.48	102.50	5.29	5.67	61.14	60.32	1.22	1.41	0.00	0.50	0.00	0.00	0.10	0.17
kgCO ₂ e	51492134.10	55880787.58	2881516.15	3091922.67	33323152.13	32885295.09	666478.32	769692.42	0.00	272501.49	0.00	0.00	55571.69	94969.81
tonnes CO ₂ e	51492.13	55880.79	2881.52	3091.92	33323.15	32885.30	666.48	769.69	0.00	272.50	0.00	0.00	55.57	94.97
Renewable Heat														
	MW of Biomass Thermal		MW of Heat Pumps		MW of Sewage Gas CHP		MW of Solar Thermal		MW of CHP		Total GWh			
Year	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Cornwall & IoS	4.49	4.653	2.01	3.827	0.79	0.79	0.21	2.361	0	0				
Load Factor	28.40%	28.40%	31.45%	31.50%			5%	5%						
GWh delivered	11.17	11.58	5.54	10.56	0.00	0.00	0.09	1.03	0.00	0.00	16.80	23.17		
Electricity	2007	2008												
Total GWh delivered	162.24	170.57												
Total kgCO ₂ e	88418852.39	92995169.06												
Total tonnes CO ₂ e displaced	88418.85	92995.17												

Sources:

[Survey of renewable electricity and heat projects in South West England 2007, Regen SW](#)

[Survey of renewable electricity and heat projects in South West England 2008, Regen SW](#)

[Digest of United Kingdom energy statistics \(DUKES\) 2010, Chapter 7 Renewable sources of energy](#)

[The UK Supply Curve for Renewable Heat \(Study for the Department of Energy and Climate Change\), 2009, NERA Economic Consulting & AEA, Ref: URN 09D/689 \(DECC\)](#)

[The AEA Microgeneration Index - Quarterly Summary Report - Issue 4, September 2011](#)

Notes:

GWh delivered is calculated using: (installed capacity x load factor) x 8760/1000

MW of Sewage Gas
Load factor for Sewage Sludge digestion taken from Digest of United Kingdom energy statistics (DUKES) 2010

MW of Advanced Treatment of Waste
Load factor for Municipal solid waste combustion taken from Digest of United Kingdom energy statistics (DUKES) 2010

MW of Solar PV
9.7% load factor used taken from The AEA Microgeneration Index - Quarterly Summary Report - Issue 4, September 2011

MW of Sewage Gas CHP - renewable heat
Load factor has not been identified, so has not been included in GWh totals



This inventory was undertaken through the Regions for Sustainable Change project.

For more detail on the project and related outputs, please see the project website www.rscproject.org.