Factsheets

UK Transport and Climate Change data

Department for Transport

DfT have produced a set of factsheets to provide a useful guide to the sources of UK climate change data available on transport.

There are 5 factsheets in the set, these are:

1. **Overview of UK Transport and Climate Change**
2. **Road Transport**
3. **Railways**
4. **Shipping**
5. **Aviation**

NOTE: All data contained in these factsheets is published elsewhere

Factsheet 1
Overview of UK Transport and Climate Change

Department for Transport

Last updated: 26/03/2009

Introduction

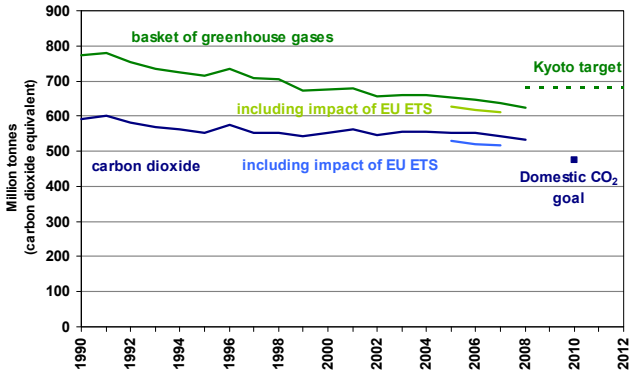
The UK has a number of goals, both international and domestic, for reducing emissions:

- As a result of the 2004 Spending Review, DfT assumed joint responsibility for a Public Service Agreement (PSA) target on greenhouse gas emissions. This target is jointly owned with the Department for Energy & Climate Change (DECC). The target requires a reduction in emissions of a 'basket' of greenhouse gases (GHGs)[1] of **12.5% below 1990 levels by 2008-2012** in line with the Kyoto Protocol.
- The UK has a domestic goal of reducing emissions of carbon dioxide (CO_2) **to 20% below 1990 levels by 2010.**
- The UK Climate Change Act (November 2008) set legally binding targets for the UK to reduce GHG emissions **by at least 80% by 2050**, and CO_2 emissions **by at least 26 per cent by 2020**, both set against the 1990 baseline. It also requires the Government to set **five year carbon budgets**.
- In January 2009, the Government set a new target for CO_2 emissions from **UK aviation**, which requires them to be **no higher than 2005 levels in 2050**. This target incorporates emissions from both domestic and international aviation.

UK greenhouse gas and CO_2 emissions

- In 2007, emissions from the 'basket' of six **GHGs** were **18.4% below the base year** at 636.6 million tonnes of CO_2 equivalent. Incorporating net effects of EU ETS[2], emissions were **21.7% below the base year**.
- *Provisional* 2008 data show **GHG emissions** to be 623.8 million tonnes of CO_2 equivalent.
- Between 1990 (base year) and 2007, **CO_2 emissions fell by 8.5%** to 542.6 million tonnes of CO_2. Incorporating net effects of EU ETS, CO_2 emissions were **12.8% lower** in 2007 than in 1990.
- *Provisional* 2008 data show **CO_2 emissions** to be 531.8 million tonnes of CO_2.

Figure 1:
UK emissions of greenhouse gases, 1990-2008(p)



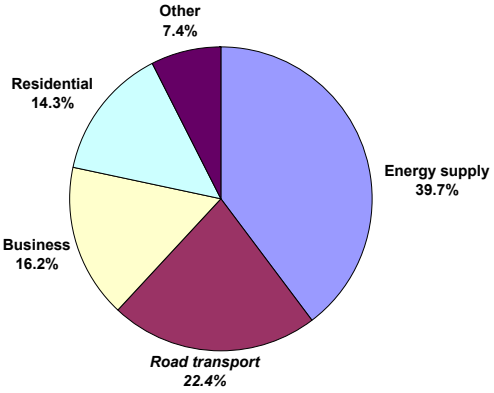
(p) - 2008 data is provisional
Source: AEA Energy and Environment / DECC

- Between 2006 and 2007, there was a decrease of 8.5 million tonnes (-1.5%) of CO_2.
- Longer term, between 1970 and 2007, total UK CO_2 emissions **fell by 21%**. Much of this decline was caused by a reduction in emissions attributable to the business sector (e.g. industrial combustion), which declined by more than half since 1970, whilst those attributable to transport (excluding memo items[3]) doubled.

CO_2 emissions from transport (NAEI)

- For the transport sector, almost all GHG emissions are from CO_2.

Figure 2:
UK domestic CO_2 emissions by source category, 2007



Total UK CO_2 emissions = 542.6 mtCO_2

'Other' includes: Non-road transport; Public; Agriculture; Industrial process; Waste; Land use change.

Source: National Atmospheric Emissions Inventory

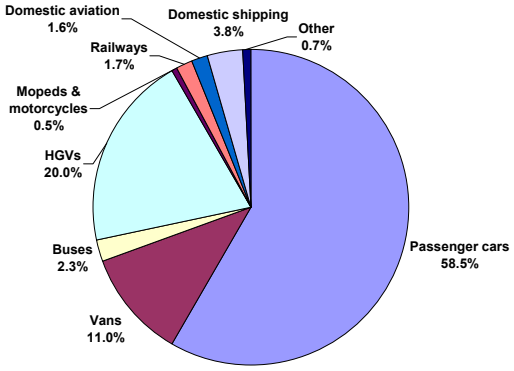
[1] The 'basket' of six GHGs consists of carbon dioxide, nitrous oxide, methane, sulphur hexafluoride, perfluorocarbons and hydrofluorocarbons.

[2] EU ETS – European Union Emissions Trading Scheme

[3] The UK reports international emissions to the United Nations Framework Convention on Climate Change (UNFCCC) as memo items based on bunker fuel sales. Emissions from bunker fuels do not form part of the UK's national inventory, i.e. those emissions for which the UK is responsible.

- In 2007, **domestic transport** (road, rail, aviation and shipping) was the source of **24% (131 million tonnes) of all CO_2 emissions in the UK**, up from 20% (117 million tonnes) in 1990.
- Between 1990 and 2007, domestic transport CO_2 emissions, by source, **increased by 12%**. The majority of CO_2 emissions from transport are from road transport (**see Table 1**).
- CO_2 emissions from **road transport** **increased by 11% between 1990 and 2007**. In 2007, road transport represented 22% of the UK's total domestic emissions from all sources.
- By 2007, CO_2 emissions from **railways** (*diesel trains only*) had **risen by 32% since 1990**; representing 0.4% of the UK's total emissions by source.
- By 2007, CO_2 emissions from **domestic shipping** (vessel journeys between UK ports) had **risen by 20% since 1990**, and represented 0.9% of the UK's total emissions.
- By 2007, CO_2 emissions from **domestic aviation** had **risen by 72% since 1990**, but represented only 0.4 % of the UK's emissions.
- By 2007, CO_2 emissions from **international aviation** had **more than doubled (+123%) since 1990**, while emissions from **international shipping** **increased only slightly (+3.5%).**
- International aviation and shipping are excluded from the UK's total emissions estimate, as there is no internationally agreed way of reporting them. However, if they were included, emissions from both domestic and international aviation would make up **6.3% of the UK total CO_2 emissions**, and emissions from domestic and international shipping would be **2.0% of the total**.

Figure 3:
CO_2 emissions from UK domestic transport, by source, 2007

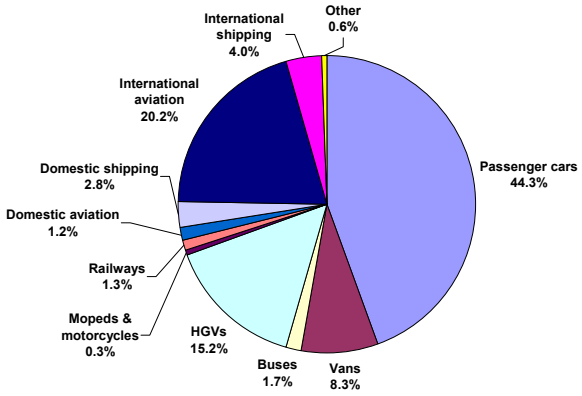


Total CO_2 emissions from domestic transport = 131.4 $mtCO_2$

'Other' includes: LPG emissions; Road vehicle engines; Aircraft support vehicles.

Source: National Atmospheric Emissions Inventory

Figure 4:
CO_2 emissions from UK domestic and international transport, by source, 2007



Total CO_2 emissions from transport = 173.2 $mtCO_2$

'Other' includes: LPG emissions; Road vehicle engines; Aircraft support vehicles.

Source: National Atmospheric Emissions Inventory

EU-15 domestic transport CO_2 emissions

Figure 5:
EU-15 domestic transport CO_2 emissions, 2006

	Million tonnes of CO_2			
	All domestic transport	All Sources[1]	% of All Sources	% of EU-15 transport total
Germany	160.6	880.3	18.2%	18.7%
France	139.1	408.7	34.0%	16.2%
UK	131.0	557.9	23.5%	15.3%
Italy	128.5	488.0	26.3%	15.0%
Spain	105.6	359.6	29.4%	12.3%
Netherlands	35.6	172.2	20.7%	4.2%
Belgium	25.2	119.1	21.2%	2.9%
Greece	23.4	109.7	21.3%	2.7%
Austria	22.8	77.3	29.5%	2.7%
Sweden	20.0	51.5	38.8%	2.3%
Portugal	19.3	64.0	30.1%	2.2%
Finland	13.7	68.1	20.1%	1.6%
Irish Republic	13.5	47.3	28.5%	1.6%
Denmark	13.4	58.2	23.0%	1.6%
Luxembourg	7.0	12.1	57.8%	0.8%
EU-15 total	**858.7**	**3474.0**	**24.7%**	**100.0%**

1. Land Use Change category has been excluded from the 'All Sources' total as treatment of this category can differ between countries.

Source: National Inventory Submissions to UNFCCC in 2008 (2006 data)

Global CO_2 emissions

Figure 6:
Global CO_2 emissions in 2005

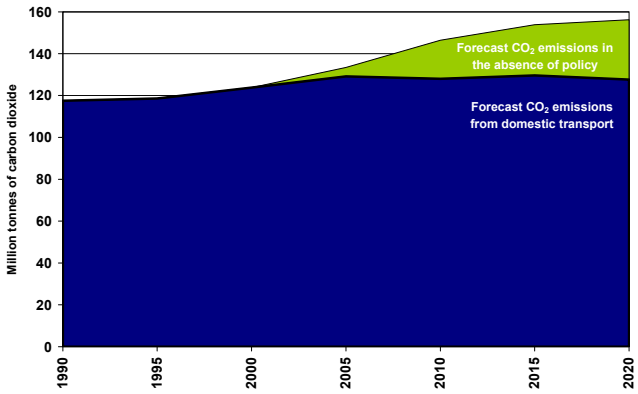
	Million tonnes of CO_2	% of global total
Country level emissions:		
Global	27,136	-
Europe (EU 27)	3,976	14.7%
UK	530	2.0%
Transport emissions:		
World transport	6,337	23.4%

Source: IEA World Energy Outlook 2006

Historic and forecast transport CO_2 emissions

- Figure 7 shows how historic and forecast CO_2 emissions from domestic transport. It also shows where we would expect transport emissions to be if measures had not already been taken to reduce CO_2 emissions. These measures are expected to contribute to a substantial reduction in CO_2 emissions (around 29 $MtCO_2$ in 2020) compared to where they would otherwise be. Nevertheless, forecast transport emissions in 2020 are only a little below current levels.

Figure 7:
Historic and forecast CO_2 emissions from UK domestic transport, 1990-2020



Source: *Carbon Pathways Analysis*, DfT, 2008
(Historic data apart from rail emissions from the NAEI (2006), rail data from DfT analysis (passenger trains only); Forecasts from DfT analysis.)

Further information

Chapter 3 of *Transport Statistics Great Britain:*
http://www.dft.gov.uk/pgr/statistics/datatablespublications/energyenvironment/

DECC Emissions data (NAEI):
http://www.defra.gov.uk/environment/statistics/globatmos/alltables.htm

NAEI website:
http://www.naei.org.uk/

National Inventory Submissions to UNFCCC:
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/4303.php

***Guidelines to DEFRA's greenhouse gas conversion factors for company reporting (June 2008)*:**
http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm

Carbon Pathways Analysis (July 2008):
http://www.dft.gov.uk/pgr/sustainable/analysis.pdf

Background to data sources

- There are **two main sources** of UK emissions data; the National Atmospheric Emissions Inventory (NAEI) produced by AEA Energy & Environment and published by DECC (formerly DEFRA), and the Environmental Accounts produced by the Office for National Statistics (ONS).

1. National Atmospheric Emissions Inventory (NAEI):

- The **NAEI** produces emissions statistics for greenhouse gases and other air pollutants on three different bases; by source, fuel type and end user.
  - ***Source*:** emissions are split by the sector producing them.
  - ***Fuel type*:** emissions are broken down from the consumption of each type of energy.
  - ***End/final user*:** emissions are split by the sector responsible for them, but also include the redistribution of emissions from power stations and other fuel processing industries to the sector that actually uses them.

- The NAEI data is on the basis used by the International Panel on Climate Change (IPCC); the same basis as the Kyoto Protocol. International aviation and shipping are excluded from the national total, but are reported as memo items.

- The **geographic coverage** of reported GHG and CO_2 emissions estimates by DECC are slightly different. The UK GHG total is based on emissions in the UK, and those Crown Dependencies (Jersey, Guernsey, and the Isle of Man), and Overseas Territories (Bermuda, Cayman Islands, Falkland Islands, Gibraltar and Montserrat) that are party to the UK ratification of the Kyoto Protocol. Reporting of CO_2 emissions for the UK only incorporates Crown Dependencies, but excludes Overseas Territories.

- Data can be presented by **National Communication (NC) sector** or by more detailed **IPCC sector**. The transport sector based on NC includes the additional categories of Military Aircraft & Shipping and Railways (stationary combustion); therefore total emissions are slightly higher on that basis.

- Emissions from the transport categories in the NAEI are calculated using a combination of the volume of fuel purchased in the UK, activity data and emissions factors.

- See **Table 1** for latest transport CO_2 emissions data from the NAEI.

- Due to the ongoing development of the DECC website, under interim arrangements currently in place more information and the latest NAEI statistics can be found on DEFRA's website at:

  http://www.defra.gov.uk/environment/statistics/globatmos/gagccukem.htm

2. Environmental Accounts:

- The ONS **Environmental Accounts** reports greenhouse gas emissions produced by UK residents and UK-registered companies on a **UK industry** basis. It includes emissions produced during activity by UK flagged ships, aircraft and other vehicles *wherever this takes place* and *wherever fuel is bought*, and excludes emissions from activity by foreign ships, aircraft or other vehicles. Therefore, water and air transport includes international activity.

- See **Table 2** for latest transport CO_2 emissions data from the Environmental Accounts.

- More information and the latest Environmental Accounts statistics can be found on the National Statistics website at:

  http://www.statistics.gov.uk/STATBASE/Product.asp?vlnk=3698

National Atmospheric Emissions Inventory (NAEI) data

Table 1:

Estimated CO_2 emissions by IPCC source category, 1970-2007

United Kingdom	Million tonnes of CO_2						
	1970	1990	1997	2006	2007	% of 2007 total	% of 2007 total (inc. memo items)
Road transport	**60.3**	**109.5**	**116.7**	**120.4**	**121.6**	***22.4%***	***20.8%***
Passenger cars	40.2	71.7	76.5	77.0	76.8	*14.2%*	*13.1%*
Light duty vehicles	4.5	10.3	12.6	14.0	14.5	*2.7%*	*2.5%*
Buses	2.1	3.3	3.3	2.8	3.0	*0.6%*	*0.5%*
HGVs	12.7	23.3	23.6	25.4	26.3	*4.8%*	*4.5%*
Mopeds & motorcycles	0.4	0.6	0.5	0.5	0.6	*0.1%*	*0.1%*
LPG emissions (all vehicles)	0.0	0.0	0.0	0.4	0.4	*0.1%*	*0.1%*
Other (road vehicle engines)	0.4	0.3	0.2	0.2	0.2	*0.0%*	*0.03%*
Other transport	**5.6**	**7.3**	**7.4**	**10.4**	**9.7**	***1.8%***	***1.7%***
Domestic aviation	0.7	1.2	1.5	2.3	2.1	*0.4%*	*0.4%*
Railways – diesel trains	1.8	1.7	1.7	2.2	2.2	*0.4%*	*0.4%*
Domestic shipping	3.0	4.1	3.8	5.5	4.9	*0.9%*	*0.8%*
Other (aircraft support vehicles)	0.1	0.3	0.3	0.5	0.5	*0.1%*	*0.1%*
Total Domestic transport	**65.9**	**116.8**	**124.1**	**130.8**	**131.4**	***24.2%***	***22.5%***
Total UK emissions	**684.3**	**592.9**	**551.6**	**551.1**	**542.6**	***100.0%***	***92.8%***
Memo items							
International aviation	6.6	15.7	22.7	35.6	35.0	..	*6.0%*
International shipping	16.2	6.7	8.2	6.8	6.9	..	*1.2%*
Total UK emissions (inc. memo items)	**707.1**	**615.3**	**582.6**	**593.5**	**584.4**	..	***100.0%***

Note: The IPCC source categories for transport exclude emissions from Military Aircraft & Shipping and Railways (stationary combustion). These are included in other sectors and in the UK total.
However, based on National Communications sectors the transport sector would include both of these categories. The impact of including these gives transport an additional 3.52 $mtCO_2$ in 2007.

Source: National Atmospheric Emissions Inventory

Environmental Accounts data

Table 2:

Estimated CO_2 emissions by economic sector, 1990-2006

United Kingdom	Million tonnes of CO_2				% of 2006 total
	1990	1997	2005	2006	
Railways	1.8	1.8	2.2	2.2	*0.4%*
Buses and coaches	4.9	5.5	5.3	5.5	*0.9%*
Freight transport by road	16.0	18.9	18.7	18.8	*3.0%*
Water transport	16.9	19.6	27.1	19.2	*3.1%*
Air transport	20.2	27.8	42.4	43.2	*6.9%*
Other transport sectors[1]	2.1	2.6	2.4	2.4	*0.4%*
Total transport industries	**61.9**	**76.2**	**98.0**	**91.4**	***14.6%***
Household use of private vehicles	58.7	60.7	62.4	61.8	*9.9%*
Total UK emissions	**627.9**	**600.3**	**634.4**	**626.3**	***100.0%***

1. Other transport sectors include: Tubes & trams; Taxis; Transport via pipeline.

Source: Environmental Accounts

Factsheet 2
ROAD TRANSPORT: Carbon dioxide emissions

Department for Transport

Last updated: 26/03/2009

Introduction

- This factsheet details the latest statistics and information on road transport and carbon dioxide (CO_2) emissions.
- Overall UK CO_2 emissions are decreasing; however emissions from domestic transport have increased. In particular, emissions from road transport have doubled since 1970.

Road transport summary (NAEI)

- In 2007, **road transport** was the source of **22% (121.6 million tonnes) of total UK CO_2 emissions** by source. This is the highest proportion recorded, up from 18.5% in 1990 and 9% in 1970.
- In 2007, **road transport produced 93% of all CO_2 emissions from domestic transport**, down from 94% in 1990 but up from 91% in 1970.
- Between 2006 and 2007, road transport CO_2 emissions **increased by 1.0% to reach its highest level** at 121.6 million tonnes.
- Since 1970, **CO_2 emissions from road transport have doubled** from 60.3 million tonnes. This compares to a 21% fall for total UK emissions and an increase of 99% for all domestic transport. The majority of road transport emissions are from passenger cars (77 million tonnes in 2007), HGVs (26 million tonnes) and light duty vehicles (vans) (14.5 million tonnes).
- Since 1990, CO_2 emissions from road transport have **risen 11%** from 109.5 million tonnes. In comparison to an 8.5% fall for total UK emissions and an increase of 12% for all domestic transport.

Summary by mode (NAEI)

Passenger cars:

- Since 1970, CO_2 emissions from **passenger cars** have **increased by 91%**. There was a 7% increase between 1990 and 2007, emissions decreased by 0.3% between 2006 and 2007. Emissions reached a peak of 79 million tonnes in 2002.
- In 1990 **petrol cars** were responsible for **96%** of passenger car emissions. This decreased to **68%** in 2007 due to the increasing ownership of diesel cars.

HGV's:

- **HGV's** currently contribute **4.8% of total UK CO_2 emissions in comparison to 1.9% in 1970**. Since 1970, HGV CO_2 has more than doubled. Between 1990 and 2007 emissions increased by 13%, reaching a peak of 26.3 million tonnes in 2007. HGV's are the second highest contributor to road transport CO_2 emissions.

Light duty vehicles (vans):

- Emissions from **vans** have **more than trebled since 1970** from 4.5 million tonnes to 14.5 million tonnes in 2007, the largest percentage increase by any road transport mode. Between 1990 and 2007 emissions increased by 40%. Vans contributed **2.7% of total UK CO_2 emissions in 2007** in comparison to 0.7% in 1970 and 1.7% in 1990.

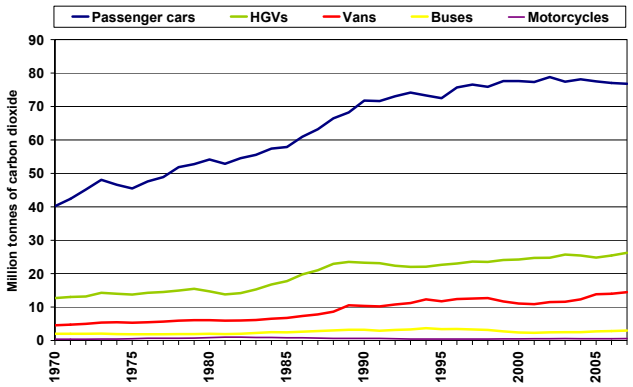
Buses & coaches:

- Since 1970, CO_2 emissions from **buses & coaches** have increased by 45%, including an 8% fall between 1990 and 2007. Emissions from buses & coaches reached a peak of 3.7 million tonnes of CO_2 in 1994. In 2007, they made up **0.6% of the UK total emissions**.

Mopeds & motorcycles:

- **Mopeds & motorcycles** produced **0.6 million tonnes of CO_2 in 2007**, down from a peak of 1.0 million tonnes in 1982.

Figure 1:
Estimated CO_2 emissions from road transport, 1970-2007



Source: National Atmospheric Emissions Inventory

- It should be noted that CO_2 emissions estimates for cars and HGVs are more accurate than those for vans and buses due to the availability of detailed data on vehicle km and fuel use.

Emission factors

- To estimate total CO_2 emissions associated with an average journey, DEFRA emission factors can be used:

Average petrol car[1]: 207.0g CO_2 per vehicle km (129.4g CO_2 per passenger km)

Average diesel car[1]: 197.9g CO_2 per vehicle km (124.7g CO_2 per passenger km)

Average bus/coach: 68.6g CO_2 per passenger km

1. The factors for cars are estimated values for the average petrol and diesel car in the UK car fleet. This has been divided by an average car occupancy rate of 1.6 passengers to derive average emissions per passenger kilometre.

Source: *Guidelines to DEFRA's greenhouse gas conversion factors for company reporting*, 2008

- Further road transport emission factors are available in Annex 6 of DEFRA's report.

- Emission factors for **road freight** (kg CO_2 per tonne-km) can be found in Annex 7 of DEFRA's report.

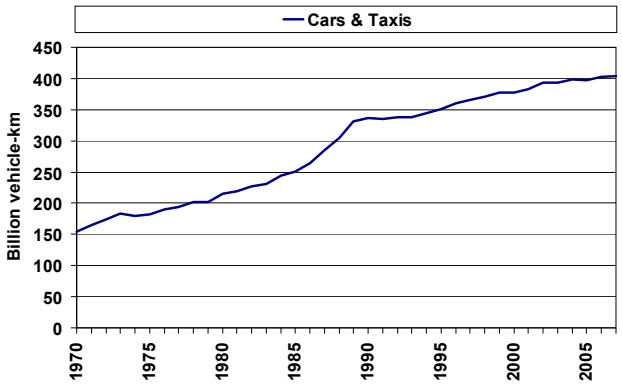
Use weighted emissions factors:

- The DEFRA emission factors do not take account of how much individual cars are driven within the UK fleet. The factors therefore differ from the results obtained by dividing total CO_2 emissions from all cars (total car fuel sales) by total car kilometres driven; that is, the emission factor for the average car kilometre driven in the UK. This is because lower CO_2 emitting cars, such as newer cars and diesel cars, are on average driven more than higher CO_2 emitting cars, such as older cars and sports cars. Thus, a use or traffic weighted average car emission factor will be significantly lower than these DEFRA factors and hence the DEFRA factors do not correlate to national emissions.

- For comparison purposes with other modes, a use weighted factor may be more appropriate. A vehicle use weighted figure that reflects the average (petrol and diesel) car kilometre driven for the UK fleet is currently around **170g CO_2 per vehicle kilometre**, or about **106g CO_2 per passenger kilometre**. It is these use weighted factors that are used in the DfT's National Transport Model (NTM). Furthermore, car fuel economy is expected to continue improving over time and so these factors will likewise continue to fall.

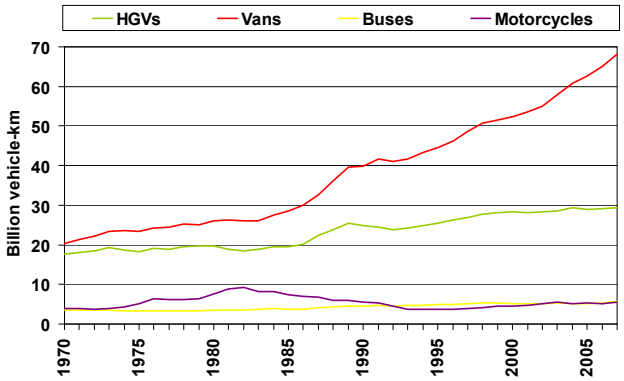
Overview of road travel demand

Figure 2:
Road traffic: Cars - vehicle kilometres, 1970-2007



Source: Transport Statistics Great Britain

Figure 3:
Road traffic: Other types of vehicles - vehicle kilometres, 1970-2007



Source: Transport Statistics Great Britain

- The greatest growth in traffic was in the period of strong economic growth in the late 1980s. There was little growth during the recession of the early 1990s, before a period of stronger growth in the mid- to late 1990s.

- Since 1997, excluding motorcycles, the type of vehicle that has shown the greatest proportional increase in traffic is the van. Annual van traffic increased by 40% from 1997 to 2007 (3.5% a year on average).

EU-15 road transport CO_2 emissions

Figure 4:
EU-15 road transport CO_2 emissions, 2006

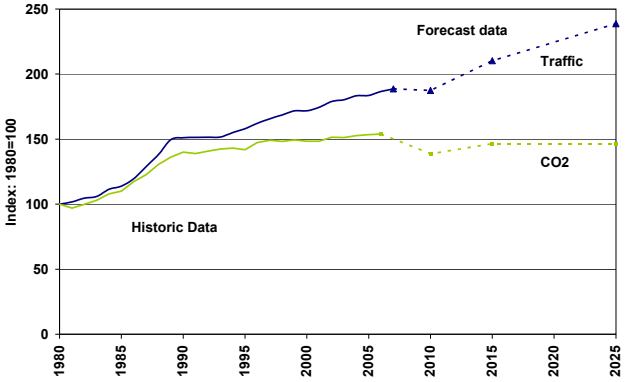
	Million tonnes of CO_2	
	Road transport	% of EU-15 total
Germany	148.9	18.7%
France	130.1	16.4%
UK	120.5	15.1%
Italy	118.3	14.9%
Spain	95.1	12.0%
Netherlands	34.9	4.4%
Belgium	24.4	3.1%
Austria	21.9	2.8%
Greece	19.8	2.5%
Portugal	18.5	2.3%
Sweden	18.5	2.3%
Irish Republic	13.1	1.6%
Denmark	12.6	1.6%
Finland	11.9	1.5%
Luxembourg	7.0	0.9%
EU-15 total	**795.7**	**100.0%**

Source: National Inventory Submissions to UNFCCC in 2008 (2006 data)

DfT forecasts of road traffic and CO_2 emissions

- Road transport forecasts are made using the Department's **National Transport Model (NTM)**, a strategic multi-modal model of land-based transport in Great Britain (although results are usually published at the England level only).
- The NTM comprises six modes (**car driver, car passenger, rail, bus, walk and cycle**) and is capable of modelling the impacts of congestion and rail over-crowding on travellers' choice of mode.
- Using the NTM, central forecasts of **traffic, congestion and emissions** are produced for England, based on a 'baseline scenario' that represents a continuation of existing policies up to 2025. Forecasts for two intervening years – 2010 and 2015 – have also been produced.

Figure 5:
Historic and forecast traffic and CO_2 emissions, England, 1980-2025



Source: DfT National Transport Model

- **Traffic** on English roads, as measured by total vehicle kilometres, is forecast to continue growing, though at a gradually slow rate. For the period as a whole (2003-2025) traffic growth of 32% is forecast. This works out at an average annual rate of about 1.3%.
- The central **CO_2** forecast suggests that emissions will fall a little then stabilise slightly below current levels. The main causes for the reduction towards 2010 are the introduction of biofuels in line with the Renewable Transport Fuel Obligation (RTFO), the continued improvement in vehicle economy and the economic slow down.
- Further details & latest forecasts are available at: http://www.dft.gov.uk/pgr/economics/ntm/

Further information

DECC Emissions data (NAEI):
http://www.defra.gov.uk/environment/statistics/globatmos/alltables.htm

***Guidelines to DEFRA's greenhouse gas conversion factors for company reporting (June 2008)*:**
http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm

***Carbon Pathways Analysis (July 2008)*:**
http://www.dft.gov.uk/pgr/sustainable/analysis.pdf

DfT road traffic statistics:
http://www.dft.gov.uk/pgr/statistics/datatablespublications/roadstraffic/traffic/

DfT National Transport Model:
http://www.dft.gov.uk/pgr/economics/ntm/

Factsheet 3
RAILWAYS: Carbon dioxide emissions

Department for Transport

Last updated: 26/03/2009

Introduction

- This factsheet details the latest statistics and information on railways and carbon dioxide (CO_2) emissions.
- The *railways* sector in the National Atmospheric Emissions Inventory (NAEI) refers to emissions from **diesel trains only**.

Overview of railway CO_2 emissions

- In 2007, **railways (diesel trains only)** were the **source of 0.4% (2.2 million tonnes) of total UK carbon dioxide emissions**, up from 0.3% in 1990 and in 1970.
- In 2007, railways **produced 1.7% of all CO_2 emissions from domestic transport**, up from 1.4 % in 1990 but down from 2.8% in 1970.
- After successive year-on-year increases from 2000, including a 4.9% increase between 2000 and 2001, railways emissions **reached a peak of 2.2 million tonnes in 2007**. In 1994, emissions reached a low of 1.5 million tonnes.
- Since 1970, carbon dioxide emissions from railways **increased by 20%** from 1.8 million tonnes. This compares to a reduction of 21% for total UK emissions and an increase of 99% for all domestic transport over the same period.
- Since 1990, carbon dioxide emissions from railways have **risen 32%** from 1.7 million tonnes. This large percentage increase was mainly due to the rise seen after a downturn in emissions between 1988 and 1994. Since 1990, there has been an overall reduction of 8.5% for total UK emissions and an increase of 12% for all domestic transport.

NAEI railway CO_2 emissions - Methodology

- The *railways* sector in the NAEI refers to emissions from **diesel trains only**. The total is the sum of three train categories: freight, intercity and regional. Emission estimates are based on train kilometres travelled and gas oil consumption, using fuel-based emission factors.

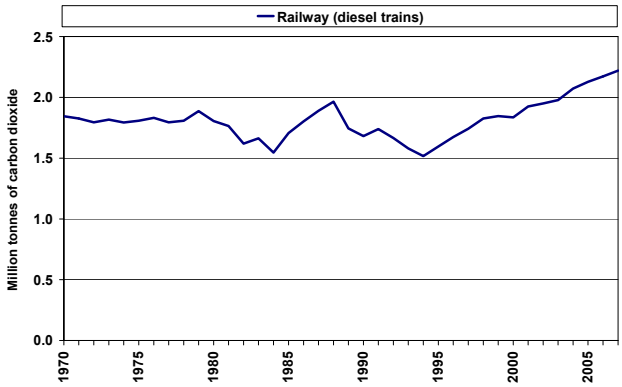
The fuel consumption is distributed according to:

- Train km data for the three categories;
- Assumed mix of locomotives for each category; and
- Fuel consumption factors for different types of locomotive.

- Most of the electricity used by the railways for **electric traction** is supplied from the public distribution system, so the emissions arising from its generation are reported under the *Energy Supply* sector in the NAEI.
- For further information on the methodology see section "A3.3.5.2 Railways" of the Annex to the report to the UNFCCC "*UK Greenhouse Gas Inventory, 1990 to 2006: Annual Report for submission under the Framework Convention on Climate Change"* at:
  http://www.naei.org.uk/reports.php

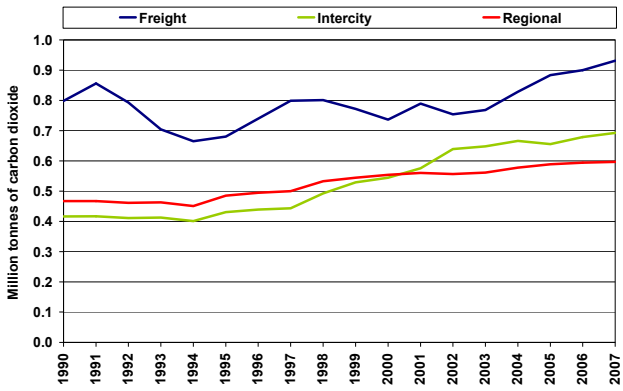
Historic UK railway CO_2 emissions

Figure 1:
Railway (diesel trains) CO_2 emissions, by source, UK, 1970-2007



Source: National Atmospheric Emissions Inventory

Figure 2:
Type of railway (diesel trains) CO_2 emissions, by source, UK, 1990-2007



Source: National Atmospheric Emissions Inventory

- Since 1990, CO_2 emissions from **diesel passenger trains** in the UK (**intercity and regional**) have **increased by 44%.** Total passenger kilometres (diesel and electric trains) increased by 34% over the same period (ORR National Rail Trends).

- Currently about 40% of the rail network is electrified. This accounts for about 60% of passenger kilometres. Freight traffic is almost entirely (95%) diesel. Of total CO_2 from rail, estimates show that approximately 43% is from electric trains and 57% is from diesel.

- There are some gaps in obtaining robust data about rail's historic CO_2 performance, not least because only the emissions from diesel trains are reported in the NAEI. However, using historic traction electricity consumption data for England and Scotland from Network Rail, estimates of historic CO_2 emissions from passenger movements produced by the Association of Train Operating Companies (ATOC) and the DfT are shown in **Figure 3**. This suggests that absolute passenger rail emissions reduced between 1990 and 2005 despite a significant increase in passenger traffic.

Figure 3:
Historic passenger railway CO_2 emissions (diesel & electric trains), GB, 1990 and 2005

	1990	2005
Total CO_2 emissions (million tonnes)	2.81	2.68
CO_2 emissions per passenger (g/pkm)	85	60

Source: *Carbon Pathways Analysis*, DfT, 2008
(DfT analysis; ATOC)

Emission factor (per passenger km)

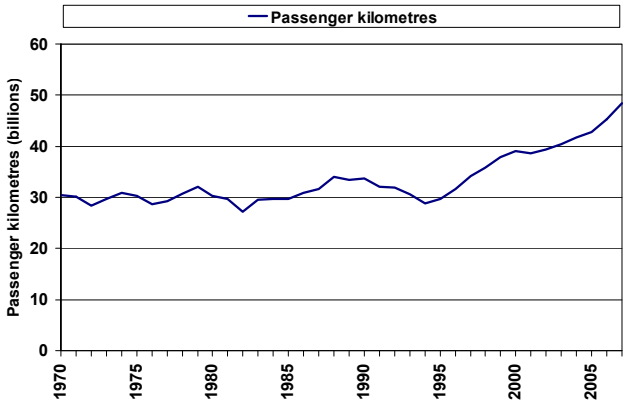
- To estimate total CO_2 emissions associated with an average train journey (diesel and electric train average):

National rail: 60.2g CO_2 per pkm

Source: *Guidelines to DEFRA's greenhouse gas conversion factors for company reporting*, 2008

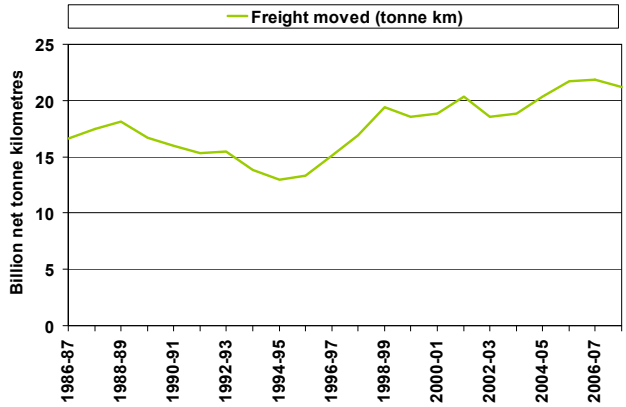
Overview of railway demand

Figure 4:
Rail passenger kilometres travelled (diesel & electric trains), GB, 1970-2007



Source: Office for Rail Regulation

Figure 5:
Freight moved by rail, GB, 1986/87-2007/08



Source: Office for Rail Regulation

- Rail passenger kilometres have grown by 49% between 1970 and 2007, with significant growth since 1994.

- Rail freight tonne kilometres increased by 28% between 1986-87 and 2007-08

EU-15 railway CO_2 emissions

Figure 6:
EU-15 railway CO_2 emissions, 2006

	Million tonnes of CO_2	
	Railways (diesel trains)	% of EU-15 total
UK	2.17	37.2%
Germany	1.27	21.8%
France	0.61	10.5%
Italy	0.35	6.0%
Spain	0.30	5.2%
Denmark	0.23	3.9%
Austria	0.14	2.5%
Finland	0.13	2.2%
Greece	0.13	2.2%
Irish Republic	0.12	2.1%
Belgium	0.12	2.0%
Netherlands	0.10	1.7%
Portugal	0.07	1.3%
Sweden	0.06	1.1%
Luxembourg	0.02	0.4%
EU-15 total	**5.84**	**100.0%**

Source: National Inventory Submissions to UNFCCC in 2008 (2006 data)

DfT forecasts of railway CO_2 emissions

- The demand forecasting methodology used by DfT is an elasticity based model which takes trip information from ticket sales for a given base year. This base demand is combined with growth assumptions for a number of demand drivers and elasticities of response to changes in these drivers by market segment to generate future year rail demand. These key elasticities are estimated from econometric time series analysis of the relevant rail passenger flows and demand drivers.

- The forecasts of rail patronage are derived from the **Network Modelling Framework (NMF)**. The model includes industry-agreed assumptions and parameters for rail demand forecasting. The forecast of rail emissions (including freight) has been based on a further model constructed to use the NMF timetable information, combined with data and assumptions of energy consumption for each class of rolling stock that is expected to be in operation in the forecast year.

Figure 7:
CO_2 emissions under 'Business as Planned' maximum and minimum impact of measures, GB, 2008-2022

		Million tonnes of CO_2				
		Passenger			Freight	Total
Impact of measures		Total	electric trains	diesel trains		
2008	MAX	2.696	1.425	1.271	0.644	3.340
	MIN	2.704	1.432	1.273	0.644	3.349
2014	MAX	2.730	1.450	1.280	0.569	3.298
	MIN	2.895	1.540	1.355	0.600	3.495
2020	MAX	2.988	1.584	1.404	0.607	3.594
	MIN	3.136	1.665	1.472	0.640	3.776
2022	MAX	3.018	1.596	1.422	0.618	3.636
	MIN	3.168	1.678	1.491	0.651	3.819

Source: *Carbon Pathways Analysis*, DfT, 2008
(DfT and rail industry analysis)

- The business as planned trajectory includes the CO_2 impact of a number of CO_2 saving measures. Consequently, emissions are forecast to be lower than they would be if no action were to be undertaken. In 2020, forecast rail CO_2 emissions are lower than the base case by 10 to 14%. The projections for 2020 anticipate a near 50% reduction from 1990 levels in terms of CO_2 emissions per passenger kilometre.

Further information

DECC Emissions data (NAEI):
http://www.defra.gov.uk/environment/statistics/globatmos/alltables.htm

***Guidelines to DEFRA's greenhouse gas conversion factors for company reporting (June 2008)*:**
http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm

***Carbon Pathways Analysis (July 2008)*:**
http://www.dft.gov.uk/pgr/sustainable/analysis.pdf

ATOC – "*Energy and Emissions Statement 30th October 2007*" and "*Baseline Energy Statement 13th March 2007*":
http://www.atoc-comms.org/atoc-publications-and-factsheets.php

Office of Rail Regulation:
http://www.rail-reg.gov.uk/

Factsheet 4
UK SHIPPING: Carbon dioxide emissions

Department for Transport

Last updated: 26/03/2008

Introduction

- This factsheet details the latest information on shipping and carbon dioxide (CO_2) emissions.
- UK CO_2 emissions from the shipping sector include emissions from both **domestic** and **international** shipping[4].
- The UK reports international emissions to the United Nations Framework Convention on Climate Change (UNFCCC) as memo items based on bunker fuel sales. Emissions from bunker fuels do not form part of the UK's national inventory, i.e. those emissions for which the UK is responsible.

Overview of UK shipping CO_2 emissions

Figure 1:
UK domestic and international shipping CO_2 emissions, 1997 and 2007

	Million tonnes of CO_2		Share of total UK CO_2 emissions (inc. memo items - international)	
	1997	**2007**	**1997**	**2007**
Domestic	3.8	4.9	0.7%	0.8%
International	8.2	6.9	1.4%	1.2%
Total shipping	12.0	11.8	2.1%	2.0%

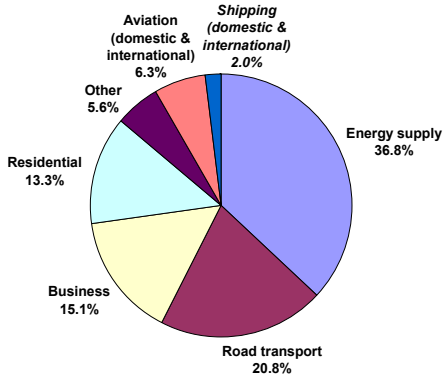
Source: National Atmospheric Emissions Inventory

- In 2007, **total UK shipping (domestic and international)** was the source of **2.0% (11.8 million tonnes)** of all UK CO_2 emissions (i.e. UK domestic total + memo items), down from 2.7% in 1970 and 2.1% in 1997.
- Over the period 1997 to 2007, total UK shipping CO_2 emissions **fell slightly by 1.7%**, from 12.0 to 11.8 million tonnes.
- In 2007 **UK domestic shipping** was the source of **0.8% (4.9 million tonnes) of total UK CO_2 emissions**, up from 0.7% in 1997 and 0.4% in 1970.
- In 2007 **UK international shipping** was the source of **1.2% (6.9 million tonnes) of all UK CO_2 emissions**, down from 1.4% in 1997 and 2.3 % in 1970.

[4] The International Maritime Organisation (IMO) defines international shipping as "shipping between ports of different countries as opposed to *domestic shipping*". Domestic shipping is defined as "shipping between ports of the same country as opposed to *international shipping*".

- In the context of other sectors, **Figure 2** shows shipping emissions are small proportion of total UK emissions. Aviation emissions are three times those from shipping. However, both are much less than road transport emissions.

Figure 2:
Shipping's share of total UK CO_2 emissions (including international), 2007



Total UK CO_2 emissions (inc. memo items) = 584.4 $mtCO_2$

'Other' includes: Public; Agriculture; Industrial process; Waste; Land use change.

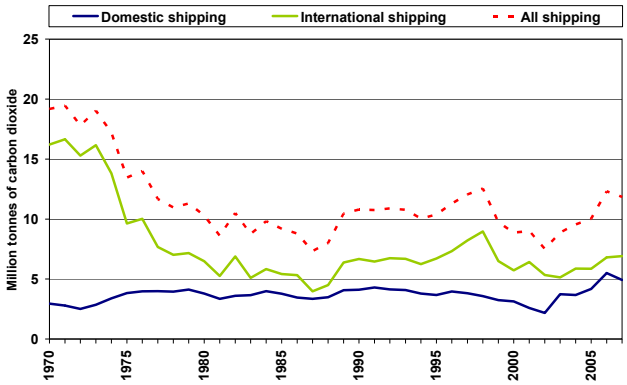
Source: National Atmospheric Emissions Inventory

- In 2007, UK domestic and international shipping produced **7% of all UK CO_2 transport emissions**, down from 8% in 1990 and 22% in 1970.

Historic UK shipping CO_2 emissions

- Since 1970, total UK domestic and international shipping emissions have **reduced by 38%** from 19.2 million tonnes, but have increased by 10% since 1990 from 10.8 million tonnes.

Figure 3:
UK domestic and international shipping CO_2 emissions, 1970- 2007



Source: National Atmospheric Emissions Inventory

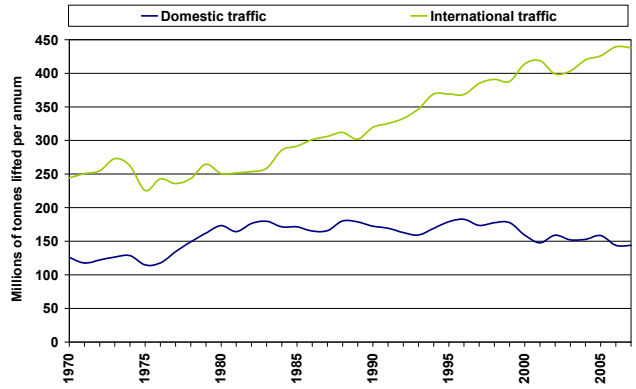
- Since 1970, CO_2 emissions from **UK domestic shipping** have **risen 67%** from 3.0 million tonnes. In comparison to a reduction of 21% for total domestic UK emissions and an increase of 99% for domestic transport. Much of the growth has occurred in the last few years.

- CO_2 emissions from **UK international shipping** show a **57% fall between 1970 and 2007**. This overall fall includes a 67% fall, from 16.2 million tonnes to 5.3 million tonnes, between 1973 and 1981. The ensuing period to 2007 shows emissions fluctuating around a long-run average of 6.2 million tonnes per annum.

Overview of UK demand for domestic and international shipping services

- This section presents trends in demand for **UK domestic and international shipping services**, as measured by tonnes lifted at UK ports, for the period 1970 to 2007 (**see Figure 4**).

Figure 4
UK ports domestic and international traffic, 1970-2007



Source: DfT Maritime Statistics

- **UK ports domestic traffic**, measured in tonnes lifted, grew by 14% between 1970 and 2007.

- **UK ports international traffic**, measured in tonnes lifted, grew by 79% between 1970 and 2007.

- Between 1970 and 2007, **total demand for UK port services** (UK international and UK domestic ports traffic) has grown by 57%, while CO_2 emissions from **UK domestic and UK international shipping**, based on bunker fuel sales, have shown an overall decline of 38%.

- Past improvements in shipping efficiency mean port traffic and CO_2 emissions will grow at different rates. However, the overall inverse relationship also highlights the challenge of allocating emissions to the UK using a fuel sales-based method.

EU-15 shipping CO_2 emissions

Figure 6:
EU-15 shipping emissions, 2006

	Million tonnes of CO_2			
	Domestic shipping	International shipping	Total	% of EU-15 total
Netherlands	0.63	56.16	56.78	30.1%
Spain	2.76	26.24	29.01	15.4%
Belgium	0.50	27.28	27.78	14.7%
Italy	6.10	6.54	12.65	6.7%
UK	5.50	6.81	12.31	6.5%
France	2.96	9.31	12.27	6.5%
Greece	2.28	9.80	12.08	6.4%
Germany	0.86	8.58	9.44	5.0%
Sweden	0.48	7.14	7.62	4.0%
Denmark	0.45	3.43	3.89	2.1%
Finland	0.57	1.82	2.38	1.3%
Portugal	0.20	1.67	1.87	1.0%
Irish Republic	0.00	0.40	0.41	0.2%
Austria	0.05	..	0.05	0.0%
Luxembourg	0.01	..	0.01	0.0%
EU-15 total	**23.36**	**165.19**	**188.55**	**100.0%**

Source: National Inventory Submissions to UNFCCC in 2008 (2006 data)

International shipping CO_2 emissions allocation methodology issues

- There is no internationally agreed method of allocating international shipping (and international aviation) CO_2 emissions to individual nation states.

- At present a nation's estimated marine bunker fuel sales to international maritime users are the basis of CO_2 emissions reported to the UNFCCC. International shipping (and aviation) emissions are reported as "memo items". Memo items do not form part of national inventories for which the nation is responsible.

- This section presents results using some of the alternative allocation methods.

- The government's policy priority is to achieve a global sectoral agreement that would contain shipping emissions. This may then avoid problems of allocating international shipping emissions to national inventories.

1. NAEI bunker fuel sales method

- NAEI emissions estimates are calculated using **UK refiners' declared sales of fuel** to maritime users, and are based upon only those refiners' best estimates of the final use – domestic or international shipping – to which marine bunker fuel is put. Therefore, accurate disaggregation of UK marine bunker fuel sales between domestic and international shipping services is difficult. For example, because a vessel can operate domestically and then internationally on the same tank of fuel, or because marine bunkers are sold through third parties.

- Vessels, when possible, buy fuel where prices are lowest. Emissions measured on fuel sales are therefore sensitive to the relative price of fuel available in the UK relative to other bunker markets. Currently, the cost of heavy fuel oil available in the UK market is approximately 20% higher than that available in Rotterdam.

- NAEI estimates total CO_2 emissions from UK domestic and international shipping were 11.8 million tonnes in 2007.

2. Ownership method

- The **ONS Environmental Accounts** reports emissions produced by UK residents and UK-registered companies on a **UK industry** basis. It includes emissions produced during activity by UK-owned shipping wherever this takes place, wherever fuel is bought, and whatever nations' cargoes may be carried.

- ONS estimate total CO_2 emissions from UK-owned shipping for 2006 to be 19.2 million tonnes (56% higher than the 2006 NAEI bunker fuel sales estimate at 12.3 mtCO_2).

3. Vessel activity method

- Individual vessel movement data can be used to build up an estimate of shipping's fuel use and emissions.

- A **vessel activity-based methodology** employed in Entec (2005) estimated emissions based on movements within waters up to 200 miles around the European Union allocated to country by departure/destination. This method estimated total UK shipping CO_2 emissions were up to 146% higher than the same study's UK estimate based on bunker fuel sales.

Global shipping emissions

Figure 5:
Global shipping CO_2 emissions (2007)

		Million tonnes of CO_2		
Sector	**Estimation method**	**Low bound**	**Consensus**	**High bound**
Domestic shipping	IEA statistical fuel sales data	111	**111**	111
International shipping	hybrid estimate	685	**843**[2]	1039
Fishing	activity based	58	**65**[3]	74
Total (global)[1]	activity based	854	**1019**[4]	1039

[1] All non-military ships greater than 100 GT
[2] IEA fuel sales measure: International = 582 million tonnes
[3] IEA fuel sales measure: Fishing = 20 million tonnes
[4] IEA fuel sales measure: Total = 713 million tonnes

Source: IMO (2008)

- The International Maritime Organisation (IMO) (2008) (**Figure 5**) used an activity-based method to construct an estimate of current CO_2 emissions from global shipping. This method led to a consensus estimate of 1019 million tonnes of CO_2 emitted in 2007 (3.7% of total global CO_2 emissions). The research quotes a low/high estimation range around the central estimate of -19% and +23% to reflect uncertainty in the activity-based method.

- IMO (2008) concluded declared marine fuel sales data do not provide a complete picture of energy consumption by ships engaged in domestic and international trade.

- The IMO (2008) activity-based method leads to an estimate that is 45% greater than can be estimated from International Energy Agency (IEA) statistics on declared fuel sales to international shipping (582 million tonnes of CO_2).

- International marine fuel statistics, collected since the 1973 inception of the IEA, were not originally intended to measure the total energy used by ships engaged in global commerce.

- CO_2 emissions from global shipping are on a strongly rising trend as long-term world trade growth significantly outstrips global GDP growth. IMO (2008) projects CO_2 emissions from global international shipping will grow to between 1.9 and 2.7 billion tonnes in 2050.

Further information

DECC Emissions data (NAEI):
http://www.defra.gov.uk/environment/statistics/globatmos/alltables.htm

***Guidelines to DEFRA greenhouse gas conversion factors for company reporting (June 2008)*:**
http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm

***Carbon Pathways Analysis (July 2008)*:**
http://www.dft.gov.uk/pgr/sustainable/analysis.pdf

IMO study:
'Updated study on greenhouse gas emissions from ships – Preliminary Phase 1 report' (2008)

2005 European Commission study
http://ec.europa.eu/environment/air/pdf/task2_so2.pdf

DfT Maritime Statistics:
http://www.dft.gov.uk/pgr/statistics/datatablespublications/maritime/

Factsheet 5
UK AVIATION: Carbon dioxide emissions

Department for Transport

Last updated: 26/03/2009

Introduction

- This factsheet details the latest statistics and information on aviation carbon dioxide (CO_2) emissions.
- **Domestic** aviation refers to flights between UK airports. **International** aviation refers to flights departing UK airports for an overseas destination. All CO_2 emissions reported here are from departing flights in line with the data reported for the UK National Atmospheric Emissions Inventory.
- The UK reports international emissions to the United Nations Framework Convention on Climate Change (UNFCCC) as memo items based on bunker fuel sales. Emissions from bunker fuels do not form part of the UK's national inventory, i.e. those emissions for which the UK is responsible.

Overview of UK aviation CO_2 emissions

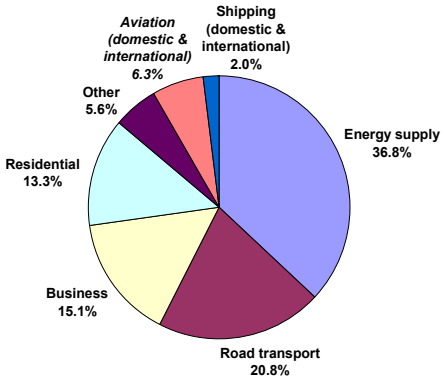
Figure 1:
UK domestic and international aviation CO_2 emissions, 1997 and 2007

	Million tonnes of CO_2		Share of total UK CO_2 emissions (inc. memo items - international)	
	1997	**2007**	**1997**	**2007**
Domestic	1.5	2.1	0.3%	0.4%
International	22.7	35.0	3.9%	6.0%
Total aviation	24.2	37.1	4.2%	6.3%

Source: National Atmospheric Emissions Inventory

- In 2007, **domestic and international aviation** accounted for **6.3% of total UK CO_2 emissions** (i.e. UK domestic total + memo items). This has increased from 3.8% in 1996 and 2.8% in 1990.
- Annual average growth in CO_2 emissions over the last ten years is 4.5% (ranging from -2.2% to +11.1%).
- Domestic aviation emissions account for only a very small proportion – less than half a percentage point – of the UK total CO_2 emissions
- In the context of other sectors, **Figure 2** shows aviation's emissions are much less than the energy industry, road transport, manufacturing and residential emissions.

Figure 2:
Aviation's share of total UK CO_2 emissions (including international), 2007



Total UK CO_2 emissions (inc. memo items) = 584.4 $mtCO_2$

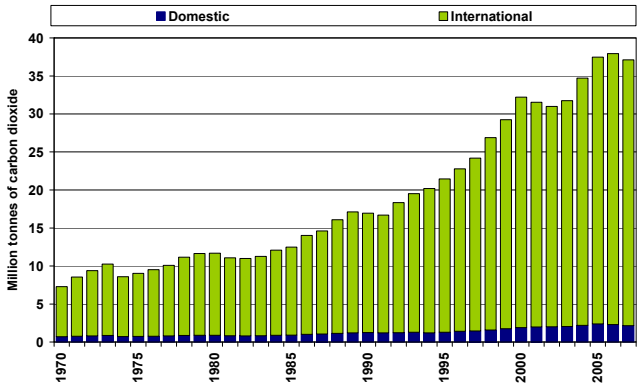
'Other' includes: Public; Agriculture; Industrial process; Waste; Land use change.

Source: National Atmospheric Emissions Inventory

- Aviation's share of UK emissions has grown since 1970 with some periods of slow growth reflecting factors such as slower economic growth or external demand disturbances.
- This strong growth is from a very low base; aviation accounted for only 1% of total UK emissions in 1970, rising to just over 6% in 2007.

Historic UK aviation CO_2 emissions

Figure 3:
Domestic and international aviation CO_2 emissions, 1970-2007



Source: National Atmospheric Emissions Inventory

- The share of total UK aviation CO_2 emissions accounted for by domestic flights is very small at just under 6%. This is lower than the 7 to 7.6% seen during the 1980s.
- There was a noticeable reduction in domestic aviation emissions from 2005 to 2006, then again from 2006 to 2007.

NAEI aviation CO_2 emissions - methodology

- The NAEI estimates aviation CO_2 emissions based on bunker fuel use published by BERR in DUKES[5]. To produce the split between domestic and international the number of aircraft movements broken down by aircraft type at each UK airport are obtained from CAA and used. This methodology complies with the IPCC Tier 3 specification.
- Estimates are made for emissions from the Landing and Take Off (LTO) phase and the Cruise phase for both domestic and international aviation. For the LTO phase, fuel consumed and emissions per LTO cycle are based on detailed airport studies and engine-specific emission factors (from ICAO database). For the cruise phase, fuel use and emissions are estimated using distances (based on great circles) travelled from each airport for a set of representative aircraft.
- For further information on the methodology see section "A3.3.5.1 Aviation" of the Annex to the report to the UNFCCC "*UK Greenhouse Gas Inventory, 1990 to 2006: Annual Report for submission under the Framework Convention on Climate Change*" at: http://www.naei.org.uk/reports.php

CO_2 emissions from UK airports

Figure 4:
CO_2 emissions from UK airports, 2005

	Million tonnes of CO_2	Share of UK departure CO_2
Heathrow	17.1	46%
Gatwick	4.4	12%
Stansted	1.3	4%
Luton	0.6	2%
London City	0.1	0%
London Total	**23.5**	**63%**
Other UK airports	**7.8**	**21%**
Freight	0.7	2%
Residual	5.5	15%
Total	**37.5**	**100%**

Source: *UK Air Passenger Demand and CO_2 Forecasts*, 2009

- It should be noted that the emissions at the airport level represent emissions from passenger flights only and do not include additional emissions from congestion during taxiing,or the individual airport contribution to the freight total. The national total has been increased by around +5 mtCO_2 to ensure consistency with NAEI 2005 outturn estimates.
- **Figure 4** shows that in 2005 London airports accounted for a little under two thirds of total UK aviation CO_2 emissions. Heathrow currently accounts for nearly half of the UK's aviation CO_2 emissions. This reflects its large share of traffic and its larger proportion of long haul flights, which combine to give it a large share of seat kilometres.

Emission factors (per passenger km)

- To estimate total CO_2 emissions associated with an average flight per passenger kilometre, DEFRA emission factors can be used:

Domestic	175.3g CO_2 per pkm
Short haul	98.3g CO_2 per pkm
Long haul	110.6g CO_2 per pkm

Source: *Guidelines to DEFRA's greenhouse gas conversion factors for company reporting*, 2008

When multiplying by distance, a **9% uplift factor** should be added to take into account non-direct routes (i.e. not along the straight line great circle distances between destinations) and delays/circling.

- Actual CO_2 emissions per passenger will vary significantly according to the type of aircraft in use, the load, cabin class, flight route, etc.
- Emission factors for **air freight** (kg CO2 per tonne-km) can be found in Annex 7 of DEFRA's report.

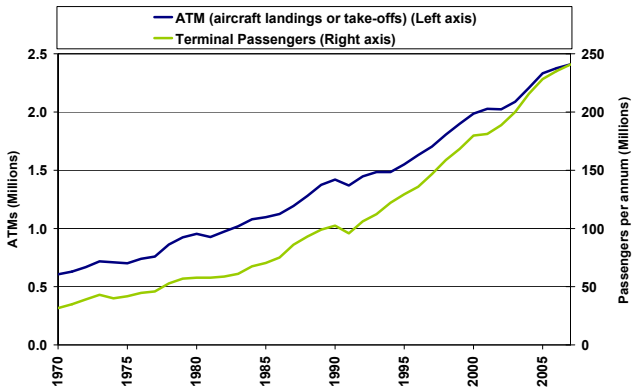
Non-CO_2 effects

- Understanding of the impacts of CO_2 emissions is relatively good. For other climate change emissions there are greater uncertainties, although the impacts of NOx emissions are better understood than other non-CO_2 emissions. Further research is ongoing - for example through the EU QUANTIFY project - to understand better the effects of these other emissions at altitude.
- The full 'radiative forcing' impacts of aviation emissions were estimated by the Inter-Governmental Panel on Climate Change (IPCC) in 1999 to be 2-4 times greater than that from carbon dioxide alone (excluding cirrus cloud enhancement). More recently the total radiative impacts were estimated, by the EC TRADEOFF project, to be approximately twice those of CO_2, once again excluding cirrus. DfT uses a factor of 1.9 in line with the evidence.

[5] Fuel consumption data was published by Department for Business and Regulatory Reform (BERR) in their annual publication *'Digest of UK Energy Statistics*' (DUKES). In future, the Department for Energy and Climate Change (DECC) will publish this data.

Overview of UK air travel demand

Figure 5:
Activity at UK airports: ATMs and Terminal passengers, 1970-2007

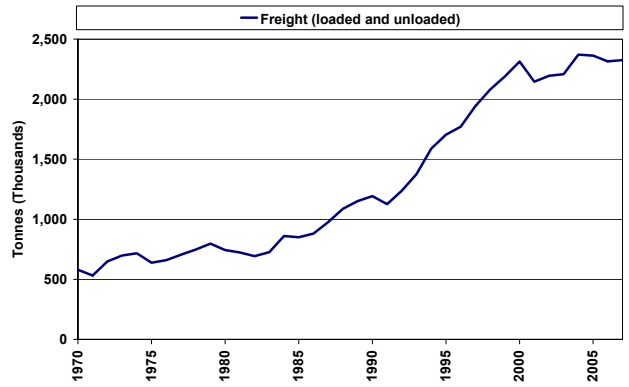


Source: Transport Statistics Great Britain / CAA Airport Statistics

- Air traffic movements (ATMs) and passengers have grown significantly since 1970.
- Average annual growth in **ATMs** over 1997-2007 was 3.6% (ranging from -0.2% to +6.1%).
- Average annual growth in **airport passengers** over 1997-2007 was 5.4% (ranging from 0.7% to +8.3%); greater than the annual average growth in emissions or ATMs. The faster growth in passengers than in ATMs meant that the number of passengers per ATM increased.
- Over the same period (1997-2007) average annual UK economic growth (GDP) was 2.9%.
- **Load factors of UK airlines** have increased slightly from 78.1% in 1997 to 79.5% in 2007 on international flights; and on domestic flights, 64.2% in 1997 and 65.1% in 2007. Overall, average load factors have increased from 77.6% to 79.0% over the period.

Overview of UK air freight

Figure 6:
Activity at UK airports: freight, 1970-2007



Source: Transport Statistics Great Britain / CAA Airport Statistics

- Average annual growth in **air freight tonnes** from UK airports over 1997-2007 was 2.6% (ranging from -7.3% to +9.7%).

EU-15 aviation CO_2 emissions

Figure 7:
EU-15 aviation emissions, 2006

	Million tonnes of CO_2			
	Domestic aviation	International aviation	Total	% of EU-15 total
UK	2.34	35.60	37.94	25.3%
Germany	5.29	21.16	26.45	17.6%
France	4.83	16.76	21.58	14.4%
Spain	7.20	10.01	17.22	11.5%
Italy	2.77	9.22	12.00	8.0%
Netherlands	0.04	10.97	11.02	7.3%
Greece	1.11	2.86	3.98	2.7%
Belgium	0.01	3.70	3.71	2.5%
Irish Republic	0.11	2.84	2.96	2.0%
Denmark	0.14	2.58	2.72	1.8%
Portugal	0.44	2.26	2.70	1.8%
Sweden	0.62	2.01	2.63	1.8%
Austria	0.23	1.81	2.04	1.4%
Finland	0.32	1.43	1.76	1.2%
Luxembourg	0.001	1.24	1.24	0.8%
EU-15 total	25.46	124.48	149.93	100.0%

Source: National Inventory Submissions to UNFCCC in 2008 (2006 data)

- The UK, Germany, France and the Netherlands have high levels of CO_2 emissions from international aviation due to them having large hub airports with high volumes of international flights.

DfT forecasts of aviation passengers and CO_2 emissions

- In January 2009, DfT published its forecasts of UK air passenger demand and CO_2 emissions. This covered the period 2005 to 2030 in detail with projections out to 2050. These figures are uncertain and make a range of assumptions on future trends.

Air Passenger Demand Forecasts:

Figure 7:
DfT forecasts of air passengers through UK airport terminals, 2005-2030

	Million passengers per annum (mppa)		
	Low	Central	High
2005	228	228	228
2010	250	260	260
2015	280	310	315
2020	320	355	370
2025	365	405	430
2030	410	455	480

Note: Figures in forecast years rounded to 5mppa

Source: *UK Air Passenger Demand and CO_2 Forecasts*, 2009

- Forecasts of passenger demand are produced assuming that airport capacity is in line with that supported by the Air Transport White Paper.
- Passengers are assumed to face their external costs of carbon emissions, valued in line with DEFRA guidance on the shadow price of carbon.
- Oil price assumptions are from BERR; GDP assumptions (economic growth) are from HM Treasury.
- Forecasts are regularly updated to reflect the most recent evidence based assumptions.

Aviation CO_2 forecasts:

- It has been agreed that from 2012 aviation will join the **EU Emissions Trading Scheme** (EU ETS). This means that in 2012 CO_2 emissions from all flights departing and arriving at airports in the EU will be **capped at 97% of average 2004-06 levels**, with the cap tightening to **95% of average 2004-06 levels from 2013 onwards**. Any aviation emissions above this cap will need to be accounted for by airlines securing reductions from other sectors within the EU ETS.
- The Government announced a **new target to bring UK aviation CO_2 emissions in 2050 below 2005 levels** and has asked the Committee on Climate Change to advise on the best basis for its development.
- DfT published its updated forecasts of UK aviation CO_2 emissions. However, this document did not assume a specific Government target in relation to aviation emissions. It assumed fuel efficiency improvements in the form of both improvements to air traffic management and improvements in line with the EU manufacturers' target for fuel efficiency improvement for new aircraft by 2020, and that these aircraft form a larger share of the fleet over time. The forecasts do not assume any major new technological developments, nor the adoption of sustainable alternative fuels. The industry has suggested these have the potential to offer significant reductions.
- Meeting the target will involve a combination of technology developments, improved air traffic management, airlines operating efficiently and economic measures, such as emissions trading. The precise combination will need to be considered.
- DfT forecasts of air passenger demand and CO_2 emissions can be found at:

http://www.dft.gov.uk/pgr/aviation/atf/co2forecasts09/

Further information

DECC Emissions data (NAEI):
http://www.defra.gov.uk/environment/statistics/globatmos/alltables.htm

***Guidelines to DEFRA's greenhouse gas conversion factors for company reporting (June 2008)*:**
http://www.defra.gov.uk/environment/business/envrp/conversion-factors.htm

***Carbon Pathways Analysis (July 2009)*:**
http://www.dft.gov.uk/pgr/sustainable/analysis.pdf

***UK Air Passenger Demand and CO_2 Forecasts (*January 2009):**
http://www.dft.gov.uk/pgr/aviation/atf/co2forecasts09/

Civil Aviation Authority - Statistics:
http://www.caa.co.uk/default.aspx?catid=80

Civil Aviation Authority - Environmental:
http://www.caa.co.uk/default.aspx?catid=697&pagetype=90