Department for Transport

Transport Energy and Environment Statistics: Notes and Definitions

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These notes and definitions give background information for the Transport Energy and Environment tables. It also describes the main sources of the data and some of the considerations when using the statistics.

Fuel Consumption (ENV01)

Petroleum consumption by transport mode and fuel type: ENV0101 (TSGB0301)

The Department for Business, Energy and Industrial Strategy (BEIS) produces petroleum consumption figures which are published in table 3.2 of the Digest of United Kingdom Energy Statistics (DUKES).

Road transport – Estimates of total consumption of road fuels are produced by BEIS – based on inland deliveries of petrol (motor spirit), road diesel (DERV) and liquefied petroleum gas (propane and butane). However it is not possible to trace what this fuel is used for. The BEIS figures include the road fuel consumed by off-road machinery and equipment.

The National Atmospheric Emissions Inventory (NAEI) produces estimated breakdowns by vehicle type of petrol and DERV consumption as a part of its work in producing the UK greenhouse gas emissions estimates.

To produce the breakdowns of road fuel consumption by vehicle type the NAEI produces "bottom up" estimates of petrol and DERV consumption by vehicle type derived using a number of different data sources including:

- road traffic volume estimates by vehicle type and road type

- information on the what kinds of vehicles are on the road (engine sizes, fuel types, how old vehicles are etc) and

- estimated grams of fuel used per km for different types of vehicles under different conditions.

The "bottom up" estimates are then adjusted to add up to the "top down" totals for petrol and DERV produced by BEIS (after removal of estimated fuel consumed by off-road machinery and equipment).

Fuel Consumption (ENV01)

The road fuel consumption by vehicle type estimates are revised periodically due to methodological improvements and due to revisions in the data sources used. These revisions are usually small.

More information on the methodology used by the NAEI to construct the breakdown of road transport fuel consumption by vehicle type can be found in the latest version of the Annex to the UK Greenhouse Gas Emissions Inventory report (see pages 157 - 191 of the 2019 report).

Rail – Ricardo Energy and Environment produce estimates on fuel oil, gas/diesel oil and burning oil deliveries to railways which contributes to the compilation of the NAEI.

Shipping – a combination of automatic identification systems (AIS) data and fuel and gas/diesel oil delivered, for inland, coastal and international shipping for use in ports and harbours. This includes gas/diesel oil used by fishing vessels and for UK oil and gas exploration and production. The methodology for estimating fuel consumption, emissions and other aspects was revised in 2017 to utilise AIS data.

Aviation –Total inland deliveries of aviation turbine fuel and aviation spirit. This covers deliveries of aviation fuels in the United Kingdom to UK and foreign airlines, UK and foreign governments (including armed services) and for private flying.

More information on petroleum consumption (including the average mass to volume conversion factors in Annex A of the main annual reports) can be found in DUKES.

The 2019 conversion factors from mass to volume for petrol and road diesel (which hold approximately for previous years) were:
   Premium Petrol: One tonne = 1,370 litres
   Road diesel: One tonne = 1,193 litres

Energy consumption by transport mode and energy source: ENV0102 (TSGB0302)

This is the energy content of fuels delivered to consumers, excluding non-energy use of fuels. The data measures the energy content of the fuels, both primary and secondary, supplied to final users. Thus it is net of fuel industry's own use and conversion, transmission and distribution losses.

These figures are calculated using net calorific values, which mean that they exclude the amount of energy necessary to evaporate the water present in the fuel or formed during the combustion process.

Fuel Consumption (ENV01)

The figures are given in million tonnes of oil equivalent. This unit should be regarded as a measure of energy content rather than a physical quantity. There is no intention to represent an actual physical tonne of oil.

Data for individual fuels are converted from original units to tonnes of oil equivalent using net calorific values and conversion factors appropriate to each category of fuel and then aggregated.

The estimated average net calorific values for road petroleum fuels for 2018 were:

- 44.7 GJ per tonne of motor spirit (petrol)
- 42.9 GJ per tonne of DERV (diesel)
- 45.9 GJ per tonne of liquefied petroleum gas (LPG).

The full set of estimates average net calorific values are published in tables A3 of (DUKES), along with further information on UK energy consumption.

Part b) of the Table was revised in 2013 to be in line with the DUKES Table 6.7, Renewable sources data used to indicate progress under the 2009 EU Renewable Energy Directive. It reflects domestic transport excluding air transport.

Average new car and van fuel consumption: ENV0103 (TSGB0303)

These figures are based on all newly registered petrol and diesel passenger cars and light goods vehicles (vans) for each year in question. They are calculated from average carbon dioxide (CO_2) emissions figures (grams of CO_2 per km) for registrations of new petrol and diesel cars and vans, weighted by the numbers of new vehicles for each model. These average CO_2 figures are converted into fuel consumption figures (litres per 100km) using information on the typical carbon content of petrol and diesel published in Defra and BEIS emission reporting guidelines. This approach accounts for the relative sales of different models of car. From 2001 onwards new car CO_2 figures have been recorded on the Driver and Vehicle Licensing Agency's (DVLA) registration database and earlier figures are based on the Society of Motor Manufacturers & Traders (SMMT) car registration database. The conversion to miles per gallon is indicative only as the conversion is carried out on the overall litres per 100km average rather than individually for every model. The latter would give a slightly different result, but cannot be carried out for all years in the series.

The CO_2 figures for individual vehicle models used in both databases are obtained under carefully controlled laboratory conditions in order to ensure repeatability and a fair comparison between models. The standard test used consists of drive cycles simulating urban and extra-urban driving,

effectively with a single occupant, on a level road and without heaters or lights on. The actual fuel consumption achieved on the road will reflect many extraneous factors such as cold starts, different driving conditions, weather conditions and different loads carried, gradients, etc.

Average heavy goods vehicle fuel consumption: ENV0104 (TSGB0304)

This table has been discontinued indefinitely following a review of the collection and the quality of the data used.

The miles per gallon figures in ENV0104 are for Great Britain-registered heavy goods vehicles (HGVs) carrying freight within the United Kingdom (or travelling empty as part of their normal business). The figures exclude non-freight carrying HGVs such as recovery vehicles or fire engines. The figures are produced from data collected by the Department for Transport's (DfT) Continuing Survey of Road Goods Transport (CSRGT), based on returns on the amount of fuel purchased by road hauliers or taken from their own supplies for a surveyed vehicle, and the mileage covered by that vehicle, during a given survey week.

During a given survey week, for some hauliers the amount of fuel purchased for a vehicle may be less than the amount actually used during the survey week (for example, if they had filled up the tank just prior to the survey week and then topped up during the week with a smaller amount), while for others the amount of fuel purchased may be much more than the fuel actually used during the week. It is believed that over the whole survey these two scenarios balance out giving unbiased estimates of the average miles per gallon.

Petrol and diesel prices and duties: ENV0105 (TSGB0305)

The price estimates are based on information provided by oil marketing companies and super/hypermarket chains and are representative of prices paid (inclusive of taxes) on or about the 15th of the month. Changes in fuel duty historically occurred during the month in which a Budget was held, although in some years the rates have increased twice during the year. VAT is rebated to business users.

Greenhouse Gas Emissions (ENV02 and ENV04)

Greenhouse gas emissions by transport mode: ENV0201 (TSGB0306), ENV0202 (TSGB0307)

Table ENV0201 shows greenhouse gas (GHG) emissions from transport based on the internationally agreed basket of seven greenhouse gases: carbon dioxide (CO_2), methane (NH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitogren trifluroide (NF_3). Table ENV0202 shows transport emissions of carbon dioxide alone.

Greenhouse gases

Some gases have a higher global warming potential then others, so the greenhouse gas emissions are expressed in terms of the million tonnes of carbon dioxide equivalent ($MtCO_2e$). On this basis carbon dioxide makes up over 99% of greenhouse gases from transport.

At a UK level, carbon dioxide is reported in terms of 'net emissions', which means total emissions minus total removals of CO_2 from the atmosphere by carbon sinks. Carbon sinks are incorporated within the Land Use, Land Use Change and Forestry (LULUCF) sector, which covers afforestation, reforestation, deforestation and forest management.

The figures on greenhouse gas emissions from transport in sections (a) and (b) of ENV0201 and ENV0202 are in principle based on fuel purchased in the UK, in line with international guidelines. This is to avoid double counting of emissions between individual nation states.

"By source" emissions - section (a) of ENV0201 and ENV0202

These figures are produced by the National Atmospheric Emissions Inventory (NAEI) on behalf of the Department for Business, Energy and Industrial Strategy (BEIS). The 'by source' emissions figures allocate emissions to the sector producing them. The 'by source' figures in these tables, are those published by BEIS and they include crown dependencies (Jersey, Guernsey, and the Isle of Man) and exclude overseas territories.

Road transport is by far the main source of transport greenhouse gas (GHG) emissions. Carbon dioxide makes up 99% of GHG emissions from road transport. Carbon dioxide emissions from road transport by mode are calculated directly from the estimated amounts of fuel consumed using information on the carbon content of the fuels. An outline of how road transport fuel consumption by mode is estimated can be found in the "Road transport" section on pages 1-2.

The road transport emissions of the other greenhouse gases are derived along the same lines as road transport emissions of air pollutants (see the background note for table ENV0301 on page 8).

Rail carbon dioxide emissions are calculated directly from estimated rail gas oil consumption. In the past rail oil consumption was modelled using other data sources but the latest rail emissions

estimates make use of real data on rail fuel consumption for Great Britain. More information on this can be found in the "Rail" section on page 2.

Shipping emissions are based on automatic identification system (AIS) data, as a result of the shipping methodology review, and the BEIS marine fuel deliveries figures. Naval fuel consumption from UK supplies is subtracted from these figures. Naval emissions are allocated to 'Military aircraft and shipping', which is included in the "Other" category of tables ENV0201 and ENV0202.

In the past the domestic/international split for the consumption of marine fuels has been based on refiner's best estimates and utilising 'bottom up' estimates of marine fuel consumption. In 2017 the (1990-2016) version of the emissions inventory made use of 2014 terrestrial automatic identification system (AIS) data, supplied by the Maritime and Coastguard Agency (MCA), in order to estimate heavy fuel oil and marine diesel oil fuel consumption and emissions, including GHGs. Utilising the AIS data has allowed the emission estimates to take into account where available several aspects, such as engine power of individual vessels, engine speed and load, leading to better coverage of both existing and new vessel types.

Domestic and international shipping are defined by the start/destination of the voyage (i.e. a journey between UK ports are classed as domestic for reporting purposes in the NAEI).

Aviation carbon dioxide emissions estimates are based on the BEIS figures on the deliveries of aviation spirit and aviation turbine fuel in the UK. The fuel used for military aviation is subtracted from these figures. Emissions for military aircraft are allocated to 'Military aircraft and shipping', which is included in the 'Other' category in tables ENV0201 and ENV0202.

The aviation fuels (after subtraction of fuel used for military aviation) are split between domestic aviation and international aviation on the basis of data on domestic and international flights, taking into account the types of aircraft used for each flight. Only international flights departing the UK are included for compatibility with consumption of fuels from UK supplies.

More details of how greenhouse gas emissions are estimated are given in the UK Greenhouse Gas Inventory report (157 - 191 of the 2019 report) for the details of the methodology for transport emissions.

"End user" emissions - section (b) of ENV0201 and ENV0202

These figures are based on the 'by source' emissions data, but re-allocate emissions from power stations and fuel processing facilities within the UK to the final users of the fuel on an approximate basis, according to their use of the fuel. For example, emissions from fuel consumed by vehicles, and emissions from power stations generating the electricity used by the electrified rail network are both allocated to transport by end user. However, only emissions from vehicles would be classified

as transport emissions using by source; electricity used by the rail network would be classified as energy supply emissions.

The environmental accounts – section (c) of ENV0201 and ENV0202

The Office for National Statistics (ONS) Environmental Accounts report GHG produced by UK residents and UK-registered companies, broken down by the industry emitting the gases. These emissions figures are on the same basis as the National Accounts and so can be used to look at emissions per unit of economic output.

Environmental Accounts GHG figures are based on the 'by source' NAEI data (including emissions from international aviation and international shipping), but apply cross-boundary adjustments to remove purchases by overseas residents of UK fuel, and add purchases by UK residents of foreign fuel.

Emissions are allocated to economic sector regardless of the activity that produced them. For example HGV emissions are allocated to a range of industries including the road haulage industry (referred to as road freight and removal services) and parts of the retail & wholesale, manufacturing and construction sectors.

In the 2012 ONS Environmental Accounts greenhouse gas emissions from biofuels were included in the end-user emissions for the first time. The justification is that although total emissions from biofuels are zero, with the carbon dioxide emitted having been captured by the biofuels, the economic sectors that these take place in are different.

The 2011 version of the environmental accounts switched to using the Standard Industrial Classification of Economic Activities 2007 (SIC 2007).

Emissions from transport - ENV0401

This table has been discontinued as it only summarised information available in ENV0201 and provided no unique information.

Pollutants, Emissions and Noise (ENV03)

Air quality pollutant emissions by transport mode: ENV0301 (TSGB0308)

Table ENV0301 shows the estimated emissions of key pollutants from transport, that affects air quality, human health and ecosystems in the UK. These figures are produced by the NAEI on behalf of Defra and are based on United Nations Economic Commission for Europe (UNECE) definitions.

Emissions from aviation (cruise, both domestic and international) and international shipping are not included in the national total that is reported to the UNECE but are reported separately as memo items. Emissions from aircraft cruising at altitude or from international shipping in sea territories distant from the UK make a relatively small contribution to ground-level air quality in the UK compared with emissions occurring during take-off and landing and from domestic shipping around UK coastal waters, but they do contribute to global air pollution.

Road transport is by far the main source of air quality pollutant emissions from transport. Estimates of sulphur dioxide emissions and lead emissions from transport by mode are calculated directly from the estimated amounts of fuel consumed, using information on the sulphur/lead content of road fuels. An outline of how road transport fuel consumption by mode is estimated can be found in the "Road transport" section on pages 1-2.

The emissions of other air pollutants from road transport (and the basket greenhouse gases other than carbon dioxide) are not directly related to road fuel consumption in the same way, as they are also affected by vehicle technologies such as particle traps and catalytic converters. Instead they are derived from a range of different information/data sources including:

- road traffic volume estimates by vehicle type and road type;

- information on what kinds of vehicles are on the road (engine sizes, fuel types, etc.);

- estimated grams of pollutant emitted per km for different types of vehicles under different conditions (the fuel consumption-speed relationships given in COPERT 5 and the EMEP/ European Environment Agency (EEA) Emissions Inventory Guidebook (2016), see page 9);

- catalyst failure rates;

- information on the retrofitting of older vehicles with modern pollution abatement devices;
- models for cold start emissions (excess emissions when a vehicle is started with its engine below normal operating temperature);

- models for emissions from the evaporation of petrol from the tank, fuel delivery system in vehicles, and while the vehicle is in motion.

Shipping in this table includes emissions from fishing vessels but not military vessels. See the shipping section in the greenhouse gas section (page 6) for more information on the revised method for estimating shipping emissions.

Pollutants, Emissions and Noise (ENV03)

Rail in this table includes emissions from rail stationary combustion e.g. the small-scale combustion of coal, burning oil, and fuel oil, presumably for heating of buildings, as well as natural gas combustion. This gas usage may include fuel used for electricity generation for own use by the railway sector.

Aviation in this table does not include emissions from military aircraft or associated emissions.

More details of the methodology used by the NAEI can be found in the UK Informative Inventory Report (see pages 141 - 189 for transport in the 2019 version).

For further information, both the NAEI website and Defra publish data and information about air pollutant emissions.

Average emissions from road vehicles in urban conditions: ENV0302 (TSGB0309)

The factors provided here have been derived from the 2017 NAEI based on factors provided from the tool developed for the European Environment Agency, "Computer Programme to Calculate Emissions from Road Transport", or referred to as COPERT 5. The COPERT factors are based on measurements on in-service vehicles tested under laboratory conditions on a rolling road over different drive cycles that aim to represent realistic driving operation, different from the regulatory test cycle. Further details on the source of these factors and the method used in the NAEI are available in the UK's National Inventory Report.

Particulate emissions (PM_{10} are fine particles less than 10 micrometres or 0.01 millimetres diameter and $PM_{2.5}$ are less than 2.5 micrometres or 0.0025 millimetres in diameter) are much lower for vehicles with petrol engines than they are for vehicles with diesel engines. Legislative standards exist only for diesel vehicles. For these pollutants, the index is against emissions from a pre-1993 diesel car (=100). This particulates index applies to both PM_{10} and $PM_{2.5}$.

Aircraft noise: ENV0303 (TSGB0310)

Air transport movements are landings or take-offs of aircraft engaged in transport of passengers or cargo on commercial terms. All scheduled service movements (whether loaded or empty) are included, as well as charter movements transporting passengers or cargo. Air taxi movements are excluded, and are therefore consistent with DfT aviation statistics.

The equivalent continuous sound level (Leq) is an index of aircraft noise exposure. It is a measure of the equivalent continuous sound level averaged over a 16 hour day from 0700 to 2300 hours BST and is calculated during the peak summer months that is mid-June to mid-September.

Pollutants, Emissions and Noise (ENV03)

The 57dBA Leq represents the approximate onset of significant community disturbance, 63dBA Leq - moderate disturbance and 69dBA Leq - high disturbance. Leq is correlated with community response to aircraft noise, but it is recognised that the reactions of different individuals to aircraft noise can vary considerably. Changes in wind direction from year to year influence the area affected by aircraft noise.

The methodology underlying the calculation of the aircraft noise Leq contours is published in: The CAA Leq Aircraft Noise Contour Model: ANCON Version 1 (DORA Report DR 9120), The UK Civil Aircraft Noise Contour Model ANCON: Improvements in Version 2 (R&D Report 9842) and The CAA Aircraft Noise Contour Model: ANCON Version 2.3 (ERCD Report 0606).

Heathrow, Gatwick and Stansted each publish annual contour reports.

An updated version of the Integrated Noise Model (INM) was used to estimate noise contours for Luton airport in 2008 and this was updated further for 2009, 2010 and 2011. As a result, any year on year comparison since 2007 should be treated with caution, although the difference in outcome resulting from each update is small. Further information can be found in Luton's Annual Monitoring Reports.

Renewable Fuel (ENV05)

Volume of fuels by fuel type: ENV0501 (TSGB0311)
Renewable fuels by country of origin of feedstock: ENV0502 (TSGB0312)
Greenhouse gas emissions savings from the use of renewable fuels: ENV0503 (TSGB0313)

The Renewable Transport Fuel Obligation

The Renewable Transport Fuel Obligation (RTFO) is one of the Government's main policies for reducing GHG emissions from road transport in the UK by encouraging the supply of renewable fuels.

DfT regularly reports statistics on renewable fuel supplied under the RTFO. Figures for the TSGB tables are drawn from the most recent report with final figures, the final report for April 15th - December 31st 2018.

For further information on renewable fuel, the RTFO, and other issues relating to these statistics, see the Notes and Definitions that accompany the statistical series.

Electric vehicle charging (ENV0601)

Publicly available electric vehicle charging devices by local authority: Table ENV0601 (TSGB0314)

Data on the number, locations, and types of electric vehicle charging devices in the UK is sourced from a third-party company, Zap-Map. Population figures by Local Authority are sourced from the Office for National Statistics Population Estimates for 2018. The Local Authority administrative geographies are the latest available geographies released on the ONS Geography Portal in June 2019.

For more information on how these statistics are collected and calculated, see the web release of these statistics.