



Department  
of Energy &  
Climate Change

# Local authority CO<sub>2</sub> emissions estimates 2012

Methodology summary

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This document is also available from our website at:  
<https://www.gov.uk/government/publications/local-authority-carbon-dioxide-emissions-methodology-notes>

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# 1. Background on national CO<sub>2</sub> emissions estimates

## 1.1 Coverage and Accountability

The UK's National Greenhouse Gas (GHG) inventory includes estimates of greenhouse gas emissions, such as carbon dioxide (CO<sub>2</sub>), for the UK. DECC use these estimates to meet international reporting obligations such as reporting progress against the UK's Kyoto Protocol targets.

To estimate national CO<sub>2</sub> emissions, it is necessary to define the required coverage and accountability:

- **Coverage:** The sources included and excluded in the estimates are based on guidelines set out by the Intergovernmental Panel on Climate Change (IPCC). For example, the estimates need to include emissions caused by all domestic, commercial, industrial and agricultural fuel and electricity use, as well as emissions associated with transport and land use change. However, international shipping and aviation are excluded.
- **Accountability:** There are two main definitions of who is responsible for the emissions – the producer (or source) and the end-user. By source emissions estimates assign emissions to where they are geographically emitted. In end user emissions estimates the emissions are apportioned out to the end-users. For example, all the carbon dioxide produced by a power station is allocated to the power station when reporting on a source basis. However, when applying the end-user method, these emissions are reallocated to the users of the electricity generated, such as domestic homes or large industrial users.

For reporting emissions against national targets, the by source definition is used. However, for regional emissions reporting the end-user approach can be more useful.

Further information on definitions can be found on the NAEI web site<sup>1</sup>.

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<sup>1</sup> <http://naei.defra.gov.uk/>

To produce national CO<sub>2</sub> emissions estimates, data are collected that allow either direct reporting (based on site operator emissions returns), calculation (from reported fuel use), or modelling of by source emissions. The end-user allocation is an additional step in the UK's National GHG inventory compilation and requires further modelling. Further details can be found in Annex 11 of the UK's National GHG inventory Report<sup>2</sup>.

Once measured/estimated, emissions can be broken down in different formats depending on user needs – by sector (e.g. all industrial emissions), by fuel type (e.g. all emissions associated with the burning of coal), and overall.

To produce estimates of CO<sub>2</sub> emissions by smaller geographic areas such as Local Authorities (LAs), the national emissions based on the end-user definition are used as a starting point. Some modelling already involved in producing component estimates at the national level lends itself to dis-aggregation by smaller geographic area; however in some cases additional data are required.

## 1.2 National Statistics Accreditation

The local authority carbon dioxide emissions statistics have been assessed by the UK Statistics Authority against the Code of Practice for Official Statistics<sup>3</sup>. The Statistics Authority published its report on 12 June 2014<sup>4</sup>.

The Statistics Authority has determined that these statistics can be designated as National Statistics subject to DECC implementing a small number of requirements across the range of DECC statistics assessed, relating to further documentation on the needs of users, improving methodology on assumptions, assessing risks to use of admin data, improving clarity and linkages between the range of stats produced and review data release formats. These actions will be taken forward by end September 2014.

These data represent a consistent time series, with previous estimates being revised to reflect the methodological changes used in calculating the 2012 estimates. This is important as it allows trends to be monitored over time. Any future improvements to methodology will also be backcast where appropriate so that a comparable time-series is maintained with a 2005 base year. Data for earlier years are not available because DECC sub-national data for gas and electricity are not available on a consistent basis for these years.

A range of Quality Assurance and Quality Control<sup>5</sup> procedures are used in the compilation of this dataset. The procedures follow a methodology consistent with that for the national inventory compilation. This report summarises the data sources used and the key assumptions

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<sup>2</sup> [http://naei.defra.gov.uk/reports/reports?report\\_id=789](http://naei.defra.gov.uk/reports/reports?report_id=789)

<sup>3</sup> <http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html>

<sup>4</sup> <http://www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/index.html>

<sup>5</sup> [www.gov.uk/government/publications/uk-greenhouse-gas-emissions-statistics-qaqc-plan](http://www.gov.uk/government/publications/uk-greenhouse-gas-emissions-statistics-qaqc-plan)

used when compiling estimates. Further technical details are provided in the Technical Report that also accompanies the statistical release.

## 2. Background on Local Authority CO<sub>2</sub> emissions estimates

### 2.1 Sector breakdown

As with the national end-user estimates, the emissions associated with all domestic, commercial, industrial and agricultural fuel and electricity use, as well as emissions associated with transport and land use change are measured or modelled but now at a lower level of geography. Emissions are estimated for the following sectors/sub-sectors:

#### **Industrial and commercial**

- electricity use
- gas use
- large industrial installations
- other fuels
- agricultural combustion

#### **Domestic**

- electricity use
- gas use
- other fuels

#### **Transport**

- A-roads
- motorways
- minor roads
- diesel railways
- other

#### **Land use, land use change, and forestry**

## 2.2 Summary of improvements and recalculations for 2012

The carbon dioxide emissions Local Authority dataset is reviewed every year, and the whole historical data series is revised to incorporate methodological improvements and new data. The main improvements that have been made to the dataset this year are:

### **Large Industrial Installations:**

Some additional Other Petroleum Gases (OPG) combustion emissions have been included in the point source estimates for 2005-2007 following the inclusion of new sites and the reclassification of some fuels.

### **Industrial and Commercial Other Fuels:**

There have been some revisions in national emissions estimates for industrial stationary oil combustion, following revisions and reallocations in the Digest of UK Energy Statistics (DUKES).

### **Domestic (other fuels)**

Distribution grids for domestic solid and liquid fuel consumption have been updated using Census 2011 data. Additionally, allocation to domestic oil consumption to Northern Ireland Local Authorities has been decreased.

### **Road Transport**

There have been some revisions to national diesel fuel consumption, primarily affecting emissions in 2007. This affects emissions from all road types.

### **Transport Other**

A new grid has been used to map emissions from coal use in rail transport, based on information from the latest version of the 'UK Heritage Railways' website. These emissions were previously mapped using the diesel railways grid.

### **Land Use, Land Use Change and Forestry**

In the 2012 national inventory there was a major change in the methodology used for modelling Forest Land. The changes to modelling methodology include a better UK representation of forest areas in existence before 1920, and the distribution of tree species, growth rates and forest management practices. The improved representation of Forest Land in the LULUCF Sector has increased the estimates of the size of the removals from Forest Land and therefore the LULUCF Sector as a whole.

### 3. Methodology for Local Authority CO<sub>2</sub> emissions estimates

This section of the report summarises how emissions have been estimated within each of the separate sub-sectors, particularly with reference to the underlying data on which the estimates have been based. A separate Technical Report<sup>6</sup> provides further details of these sectoral methodologies.

Some sectors of the UK national inventory are not included in the local CO<sub>2</sub> estimates because these could not be spatially disaggregated to LA level. These are domestic aviation and shipping, military transport, exports, and international aviation and shipping. Emissions from UK Crown Dependencies and Overseas Territories are also excluded. International aviation and shipping are excluded from the UK national inventory and therefore are also excluded from the local CO<sub>2</sub> estimates.

**Table 1** lists the sub-components of the dataset, along with the data source type, and a reference to a detailed methodology section in the Technical Report explaining how that element is estimated. **Figure 1** follows the table and illustrates the data sources, transformations and flows used to compile the final dataset.

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<sup>6</sup> <https://www.gov.uk/government/publications/local-authority-carbon-dioxide-emissions-methodology-notes>

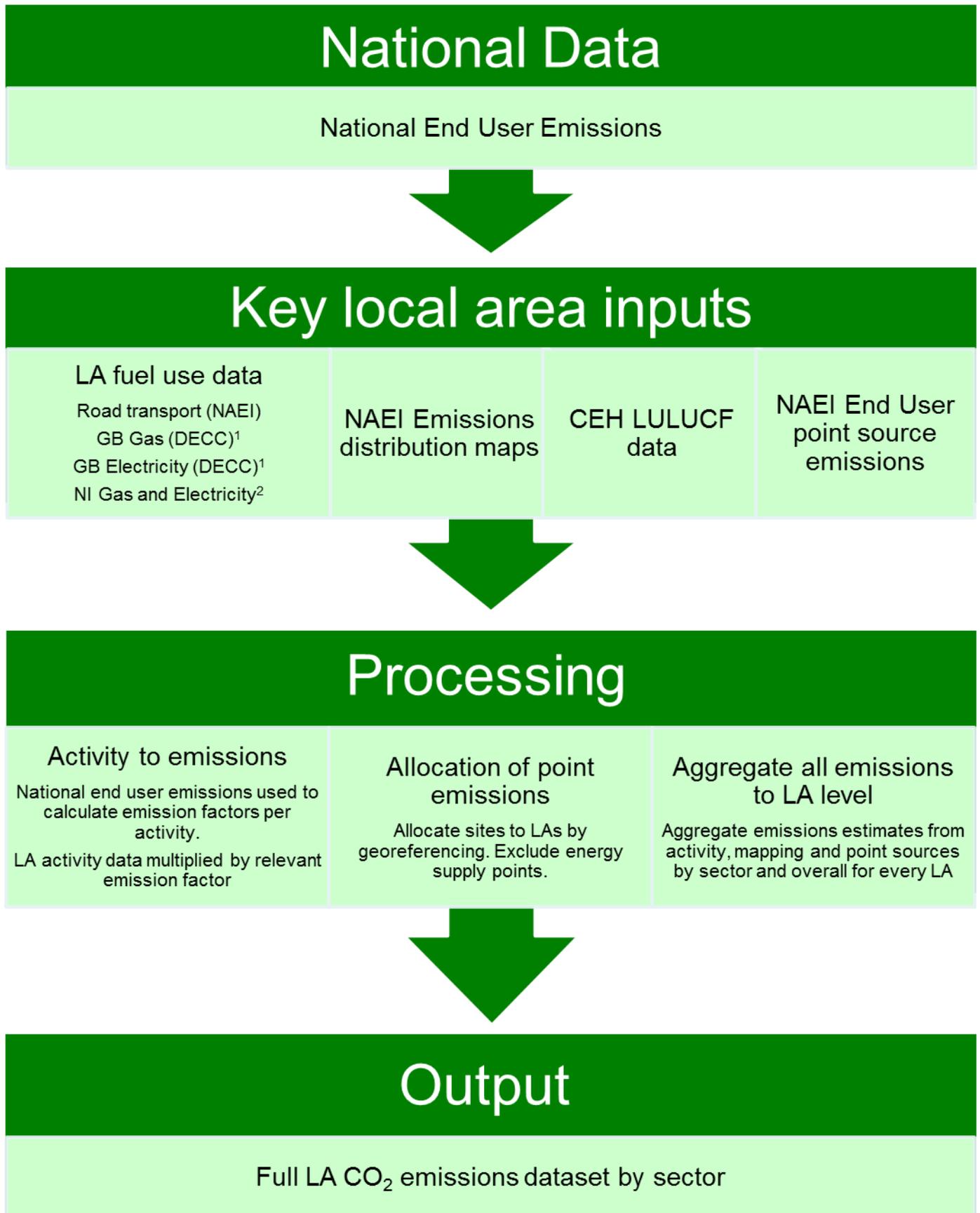
**Table 1: Methodology summary for local CO2 reporting sectors and fuels**

Sector Code	New Sector Heading	Data source / method summary	Report section
A	Industrial, Commercial and Agriculture Electricity	DECC GB regional energy statistics and DECC NI non domestic electricity statistics.	2
B	Industrial, Commercial and Agriculture Gas	DECC regional energy statistics. Further data for Northern Ireland from energy providers.	3
C	Large Industrial Installations	Point source emissions for large industrial installations.	4
D	Industrial and Commercial Other Fuels <sup>(1)(2) (4)</sup>	Remaining emissions (all fuels – excluding electricity and gas and large industrial installations emissions from old sectors D to I) distributed using high resolution (1km) emissions distribution of fuel use based in employment distributions and fuel intensity by sector.	5
E	Agricultural Combustion <sup>(3)</sup>	High resolution (1km) emissions distribution maps developed under the NAEI programme.	6
F	Domestic Electricity	DECC regional energy statistics and DECC NI domestic electricity statistics.	7
G	Domestic Gas	DECC regional energy statistics; Further data for Northern Ireland from energy providers.	8
H	Domestic 'Other Fuels'	High resolution emissions distribution maps developed under the NAEI programme.	9
I	Road Transport (A roads)	Based on the NAEI data used to compile the DECC road transport fuel estimates. Emissions from fuel combustion in the road transport sector based on detailed DfT traffic census data and NAEI emissions factors.	10
J	Road Transport (Motorways)		
K	Road Transport (Minor roads)		
L	Diesel Railways	High resolution emissions distribution maps developed under the NAEI programme.	11
M	Transport Other	High resolution emissions distribution maps developed under the NAEI programme.	12
N	LULUCF Net Emissions	LULUCF regional data supplied by CEH.	13
	Unallocated emissions	Emissions not allocated for confidentiality reasons or because of problems with geo-referencing	Emissions not allocated for confidentiality reasons or because of problems with geo-referencing
	Sectors not included in these estimates that are included in national totals	Aviation <sup>(4)</sup> , Exports, Shipping (including coastal shipping and fishing) <sup>(4)</sup>	Excluded

Notes

- (1) Includes the management of airports (support vehicles, stationary heating and power)
- (2) Includes industry autogeneration of electricity
- (3) Includes agricultural off-road machinery
- (4) International aviation and shipping are outside the scope of the UK inventory and are therefore not included in the National Totals
- (5) Colours represent the high level sectors: industrial/commercial, domestic, transport and LULUCF

Figure 1: Summary of data sources, transformations and flows used to compile the LA CO<sub>2</sub> emissions



## 3.1 Industrial and commercial

Since the input data – the LA energy and fuel use data produced by DECC – groups industrial and commercial activities together for the LA, CO<sub>2</sub> emissions for this sector follow the same grouping. Industrial and commercial emissions are therefore grouped together, meaning that the LA CO<sub>2</sub> data shows fewer sectoral breakdowns than the national end-user emissions data.

### 3.1.1 Industry and commercial electricity use

Electricity consumption data for 2005-2012 published by DECC<sup>7</sup> is geographically accurate to the level of an address. Industrial and commercial meter data are reported separately from domestic data, and for domestic meters logging over a threshold of 100,000kWh has nominally been re-classified as industrial. Further, the addresses of those meters logging usage between 50,000 and 100,000kWh are checked, and if the address is indicative of industrial or commercial activity these records are also re-classified.

To convert the LA electricity use into estimates of CO<sub>2</sub> emissions, an emissions factor defining CO<sub>2</sub> per GWh is applied. This varies from year to year and is based on the proportion of electricity produced using different fuel types for that year at the national level. There is just one national emissions factor for each year which is applied for all LAs.

For Northern Ireland, emissions are allocated based on the estimates of non-domestic electricity consumption in 2009-2011 at District Council level, published by DECC<sup>8</sup>. These estimates are based on aggregated meter point data derived from NIE's Distribution Use of System (DUoS) Billing system. As these data are only available currently for 2008-11, earlier emissions are distributed in proportion to electricity consumption in 2008 or 2009, and for 2012 in proportion to 2011.

### 3.1.2 Industry and commercial gas use

Gas use per LA per calendar year is produced by DECC<sup>9</sup> using meter point data that is geographically accurate to the level of an address. The only way to distinguish industrial and commercial users from domestic users for this data is to use an arbitrary cut off. DECC have classified all users above 73,200kWh (the gas industry standard cut off) as industrial and commercial, meaning some small and medium businesses with usage below this threshold are incorrectly included in the domestic sector and conversely a small number of larger domestic consumers are incorrectly included in the non-domestic sector.

There are two factors users should note about the relationship between emissions and energy consumption for this sector.

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<sup>7</sup> [www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics-2005-to-2011](http://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics-2005-to-2011)

<sup>8</sup> [www.gov.uk/government/statistical-data-sets/sub-national-non-domestic-electricity-consumption-in-northern-ireland-2010](http://www.gov.uk/government/statistical-data-sets/sub-national-non-domestic-electricity-consumption-in-northern-ireland-2010)

<sup>9</sup> [www.gov.uk/government/statistical-data-sets/gas-sales-and-numbers-of-customers-by-region-and-local-authority](http://www.gov.uk/government/statistical-data-sets/gas-sales-and-numbers-of-customers-by-region-and-local-authority)

Firstly, the Annual Quantities (AQ) data used in the sub-national analysis – which is an estimate of annualised consumption between two meter readings at least 6 months apart – covers the gas year from 1<sup>st</sup> October to 30<sup>th</sup> September, rather than a calendar year basis, i.e. January to December.

Secondly, DECC local consumption gas data are weather corrected using a 17 year average weather correction<sup>10</sup>. However the national total, as reported in DUKES, is not weather corrected. The total LA CO<sub>2</sub> emissions from gas consumption are consistent with those from the national inventory, which is not weather corrected. This therefore results in a partial weather correction whereby the impact of changes in the weather are still evident in the time series for an individual Local Authority but the magnitude of change is reduced. This is covered in more detail in section 3.1 of the Technical Report.

Data for some power stations and large industrial users at specific locations has been suppressed in order to comply with non-disclosure agreements. Data from public domain sources and the EU Emissions Trading System have been used for these sites. The total gas used by these large installations can be assigned to the correct LA, as their location is known. The total gas use for all the excluded installations in the DECC data is known and is close to but not the same as the total when using the alternative data from the national inventory, comprising approximately a 5% difference as a percentage of total gas consumption. See sections 3.1 and 4 of the Technical Report for more information.

The remainder of the national emissions estimate (i.e. after the above emissions are subtracted) are then added to the emissions associated with domestic gas use. This new total is used to calculate an emissions factor per unit of gas at the National level that can then be multiplied by actual gas use at the local level as captured by the local meter point data.

Data for Northern Ireland gas consumption has been provided directly by the energy suppliers Airtricity and Firmus energy. The data received from Airtricity differed in format from the data provided for previous years, and because of this, data for certain Local Authorities have been disaggregated for wider regions based on data for earlier years since explicit data were not provided.

### **3.1.3 Large industrial installations**

Emissions from large industrial installations are mapped using the NAEI database of point sources. A “point source” is in general a large energy consumer at a known location. Site specific data have been compiled from a number of various sources like the Environment Agency Pollution Inventory, the EU Emissions Trading System, and other information obtained from industry contacts.

The emissions in the NAEI point source database are calculated as “at source” emissions. Therefore, where appropriate, an “end-user” adjustment was made to take into account the additional emissions generated by the use of electricity in that particular site.

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<sup>10</sup> [www.gov.uk/government/publications/regional-energy-data-guidance-note](http://www.gov.uk/government/publications/regional-energy-data-guidance-note)

Details of how emissions from large industrial installations have been derived can be found in Section 4 of the Technical Report.

### **3.1.4 Industrial and commercial ‘Other fuels’ (oil and other solid fuels)**

While electricity and gas emissions for the industrial and commercial sector are estimated using DECC regional statistics and emissions from large industrial installations are provided directly, there are other emissions that cannot be directly measured and need to be estimated with the use of additional modelling. This includes emissions from the other fuels for the public, commercial and agricultural sectors.

The industrial sectors in the NAEI are mapped using a combination of “point source” estimates of emissions and area source employment based distributions. The national level data to distribute locally come from the DECC UK Energy Consumption statistics. For some sectors the NAEI’s UK total emissions estimate is entirely accounted for by point source emissions; in this instance all emissions will belong to the sector labelled “Large industrial installations”. In other cases there are sectors that have no identified point sources, in which case all emissions have to be modelled as an area source. Many sectors, however, are comprised of a combination of point source and area source emissions. In this situation, point source emissions are mapped explicitly in the LA where they belong and the remaining emissions (national total minus point source emissions total) are treated as an area source and are distributed across the UK using modelling based on detailed employment data and fuel used.

To do this, the emissions for each sector, by fuel type, are matched up with the equivalent total number of employees who work in that sector using data from the Inter-Departmental Business Register (IDBR). The matching is possible using Standard Industrial Classification (SIC) codes<sup>11</sup> that define the activity type in both datasets. This matching allows calculation of the average fuel use, or “fuel intensity”, per employee for each different type of activity (or SIC code). The IDBR data also includes geographic location so that each employee (and their estimated fuel use) can be assigned to a 1km<sup>2</sup> grid square, and by extension to the relevant LA using LA boundary information. This estimated LA fuel use can then be multiplied by emissions factors depending on the fuel in question (oil, solid). Finally, the resulting emissions are combined with point source emissions to calculate final oil and solid fuel related emissions per LA.

This modelling approach also incorporates various other factors. Firstly, since the point source emissions are often from sites that employ large numbers of people, these sites are removed from the employment data before it is used to distribute the remaining emissions, so as to prevent double counting. Secondly, data on gas availability is used to build up a picture of the gas network, and in particular to determine the locations that do not have access to gas and that are therefore most likely to be using oil and solid fuel. Finally, data on the location of Smoke Control Areas (SCAs) is used to constrain burning of coal to outside these areas.

It should be noted that a limitation of this modelling approach is that it assumes the same fuel intensity per sector is present uniformly across the whole country, which may not be the case in practice.

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<sup>11</sup> [www.gov.uk/government/organisations/department-of-energy-climate-change/series/energy-consumption-in-the-uk](http://www.gov.uk/government/organisations/department-of-energy-climate-change/series/energy-consumption-in-the-uk)

Other national end-user industrial and commercial emissions from sectors such as waste, dry cleaning, petrol stations and chemical manufacture are also distributed similarly using employment data.

### **3.1.5 Agricultural combustion**

Emissions from agricultural oil and solid fuel use are estimated at the local level using IDBR employment data.

Other agricultural emissions estimated at the national level are those associated with off-road machinery use and breakdowns of pesticides. Emissions from off-road machinery use are distributed using arable, pasture and forestry land use data combined with information on the number of hours of use of tractors and other machinery on the different types of land. Emissions from pesticides applied to crops are distributed using maps of arable land cover.

## **3.2 Domestic**

### **3.2.1 Domestic electricity use**

The emissions estimates are based on LA domestic electricity use data produced by DECC<sup>12</sup>. The emissions associated with electricity consumption are estimated using an average UK emissions factor for the relevant year, as already described for industrial and commercial electricity.

For Northern Ireland, emissions are allocated based on the estimates of domestic electricity consumption in 2008-2011 at District Council level, published by DECC<sup>13</sup>. These estimates are based on aggregated meter point data derived from NIE's Distribution Use of System (DUoS) Billing system.

### **3.2.2 Domestic gas use**

The emissions estimates are based on LA domestic gas use data produced by DECC<sup>14</sup>. The methodology is the same as for the industrial and commercial gas emissions (as described above) in that there is a 73,200kWh cut off for domestic users with the rest being re-classified as industrial, and the same emissions factors are used.

### **3.2.3 Domestic 'other fuels' (oil and solid fuels)**

The domestic "other fuel" use distributions in the UK have received substantial updates in the 2012 inventory. This has been achieved by combining very detailed spatially resolved data on central heating and house type data from the 2011 census with newly available data with newly

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<sup>12</sup> [www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics-2005-to-2011](http://www.gov.uk/government/statistical-data-sets/regional-and-local-authority-electricity-consumption-statistics-2005-to-2011)

<sup>13</sup> [www.gov.uk/government/statistical-data-sets/experimental-sub-national-domestic-electricity-consumption-statistics-for-northern-ireland-2009](http://www.gov.uk/government/statistical-data-sets/experimental-sub-national-domestic-electricity-consumption-statistics-for-northern-ireland-2009)

<sup>14</sup> [www.gov.uk/government/statistical-data-sets/gas-sales-and-numbers-of-customers-by-region-and-local-authority](http://www.gov.uk/government/statistical-data-sets/gas-sales-and-numbers-of-customers-by-region-and-local-authority)

available data from to DECC's National Household Model (NHM) which provides average household energy consumption estimates across the 13 regions of England, Wales and Scotland. The census data were combined with full-address matched dwelling locations from Ordnance Survey data to give a more accurate distribution of households at 1x1 km resolution.

The following data series were used in the domestic model:

- 2011 census returns from the Office for National Statistics<sup>15</sup>, the National Records of Scotland<sup>16</sup> and the Northern Ireland Statistics and Research Agency<sup>17</sup>: census data gives details of the composition of the house, number of floors, number of rooms etc; it is used to calculate percentages of houses types within each local area. It also contains information on central heating fuel types
- Ordnance Survey AddressBase products: used to generate a full-postcode spatial distribution database.
- DECC National Household model: used to give estimates of regional energy consumption per household by house type by fuel type

For more detail on the data series and how they were utilised in the model, see section 9 of the Technical Report.

Additional assumptions are used to constrain and improve the model:

- Data on Smoke Control Areas (SCAs) are used such that the burning of coal is assumed to occur exclusively outside these areas.
- It is assumed smokeless solid fuel only is used within SCAs.

## 3.3 Transport

### 3.3.1 Road transport

It is difficult to measure emissions from road transport. Within the NAEI, hot exhaust emissions and the related fuel consumption are calculated using fuel consumption and emission factors for each vehicle type. These in turn are calculated on the basis of the composition of the vehicle fleet (age profile and fuel mix). The resulting fuel consumption and emission factors are applied to detailed mapped traffic movements. The fleet mix varies by location and therefore different factors are applied to different road types in different geographical areas.

*Vehicle kilometres:*

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<sup>15</sup> <http://www.ons.gov.uk/ons/guide-method/census/2011/census-data/2011-census-data-catalogue/commissioned-tables/index.html>

<sup>16</sup> <http://www.scotlandscensus.gov.uk/ods-web/data-warehouse.html>

<sup>17</sup> <http://www.ninis2.nisra.gov.uk/public/Theme.aspx>

The Department for Transport (DfT) collects average annual daily flow statistics by vehicle type at thousands of census points in major roads (Motorways and A-roads) throughout Great Britain; equivalent data for Northern Ireland are collected by the Roads Service in Northern Ireland. These counts are applied to road links with matching road names in close proximity of the census point. Where possible, minor road count points have been allocated to minor roads in a similar way as for major roads, but also using local parameters for these census points. Where the above methodology is not possible, regional average flows by vehicle type are applied.

#### *Emissions factors:*

Emissions from road transport depend on many variables including the age, size and efficiency of the vehicle, the speed and manner in which it is driven, and the type of fuel used (petrol or diesel). As such, different emissions factors are estimated for the following categories of vehicle:

- Passenger cars
- Mopeds/motorcycles
- Light goods vehicles (LGVs)
- Rigid heavy goods vehicles (HGVs)
- Articulated HGVs
- Buses / coaches

There are further divisions by fuel type and regulatory emission standard. The categories for the latter are pre-Euro 1, Euro 1, 2 or 3 – categories actually related to pollutants, not CO<sub>2</sub> emissions but a good proxy for the proportion of cars in the total fleet that are of different ages. Finally, how emissions vary by average speed per vehicle category is also estimated. This is at present an unavoidable over-generalisation, and possible limitation, of the modelling as the fuel use / emissions for the same average speed can vary depending on the range of speeds and amount of acceleration / deceleration involved in the journey.

Finally, the vehicle kilometres for each road link (regional averages for minor roads) are multiplied by the appropriate emissions factors according to the vehicle types recorded there, and average speed per vehicle type on that road link. The incorporation of DfT's Automatic Number Plate Recognition (ANPR) data has led to revisions in the emission factors for road transport. Emissions factors have been adjusted to reflect the different vehicle fleets (e.g. the age of the vehicles, Euro standard mix and the petrol-diesel split) in each of the Devolved Administrations (DAs). Previously the four DAs used the same emission factors. Once emissions have been modelled to the road network, it is split out into 1km<sup>2</sup> grids that can be overlaid with LA boundaries to distribute the emissions accordingly.

It is worth mentioning that the methodology assumes that diesel cars travel more miles in a year than petrol cars, on average around 1.6 times higher.

### 3.3.2 Railways

CO<sub>2</sub> emissions from rail are associated with electricity and diesel use depending on the type of train.

Electricity use by rail travel cannot currently be separated out from the industrial and commercial electricity use covered earlier, and as such is included in that total.

Emissions associated with diesel rail use are modelled using data on the number of vehicle kilometres broken down by location and type (freight, intercity and regional), which are then multiplied by an appropriate emissions factor. The spatial element of the vehicle kilometres data is then used to assign the emissions to the appropriate LAs.

Emissions from coal use in railways are included in the “Transport – Other” section.

### 3.3.3 Transport – Other

Other transport emissions include emissions for the combustion of lubricants and from vehicles which run on LGP from road transport; emissions from inland waterways; emissions from airport support vehicles; and emissions from coal combustion in railways.

A new grid has been used to map emissions from coal use in rail transport, based on by extracting station, line and operating information from the latest version of the 'UK Heritage Railways' website. See section 12.3 of the Technical Report for more details. These emissions were previously mapped using the diesel railways grid.

## 3.4 Land use, land use change, and forestry (LULUCF)

Land Use, Land Use Change and Forestry activities remove as well as produce atmospheric CO<sub>2</sub>. Generally emissions are produced from soils and liming of soils and are removed through forest growth. Currently in the UK, LULUCF activities result in a net removal of emissions from the atmosphere.

In the 2012 national inventory there was a major change in the methodology used for modelling Forest Land. The changes to modelling methodology include a better UK representation of forest areas in existence before 1920, and the distribution of tree species, growth rates and forest management practices. The improved representation of Forest Land in the LULUCF Sector has increased the estimates of the size of the removals from Forest Land and therefore the LULUCF Sector as a whole.

Emissions are estimated using dynamic models of change in stored carbon driven by land use change data. For forestry, the model deals primarily with plant carbon and is driven by the area of land newly afforested each year. Changes in soil carbon are driven by estimated time series of land use transitions between semi-natural, cultivated (farm), woodland and urban.

More information on the LULUCF methodology can be found in the report entitled *Mapping carbon emissions & removals for the Land Use, Land Use Change & Forestry (LULUCF) sector*<sup>18</sup>, which is published alongside these statistics on the DECC area of the GOV.UK website.

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<sup>18</sup> <https://www.gov.uk/government/publications/local-authority-carbon-dioxide-emissions-methodology-notes>

## 4. Reasons for changes to previous years' emissions estimates

In order to produce a consistent time series, the 2005 to 2011 estimates have been recalculated to reflect the methodological changes and revisions to data used in calculating the 2012 estimates. This is important as it allows changes to be monitored over time. Furthermore, there is a commitment to back-cast any future improvements to methodology where appropriate so that a comparable series starting in 2005 is always maintained. Details of the changes to estimates for earlier years in the series can be found in **Table 2** below.

**Table 2: Reasons for changes to previous years' emissions**

Sector	Nature of change in emissions	Reason(s) for changes	Notable examples of changes
<b>A. Industry and Commercial Electricity</b>	No significant changes	N/A	N/A
<b>B. Industry and Commercial Gas</b>	No significant changes	N/A	N/A

<b>C. Large Industrial Installations</b>	Very large increases in 2005, 06 and 07 (maximum 1,229 kt CO <sub>2</sub> ).	Additional OPG combustion emissions included in points database; some new sites and some previously included as other fuels	East Riding of Yorkshire, Flintshire, Redcar and Cleveland, Stockton-On-Tees, Trafford
<b>D. Industrial and Commercial Other Fuels</b>	Average 12% increase in sector total.	Up to 40% increase in national emissions from industrial stationary fuel oil combustion, reflecting revision and reallocation of DUKES data.	Cheshire East, Amber Valley, Broxtowe, Cornwall, Wiltshire, Fermanagh
<b>E. Agricultural Combustion</b>	No significant changes	N/A	N/A
<b>F. Domestic Electricity</b>	No significant changes	N/A	N/A
<b>G. Domestic Gas</b>	No significant changes	N/A	N/A
<b>H. Domestic 'Other Fuels'</b>	1. Average 32% reduction in Northern Ireland LAs for the sector; 2. Positive and negative changes up to 149 kt CO <sub>2</sub>	1. Northern Ireland LA allocation of domestic oil consumption reduced by around 30-50% ; 2. Revised mapping grids for domestic SSF	1. Belfast, Craigavon; 2. Halton, Mansfield
<b>I. Road Transport (A roads)</b>	1. Around 60 kt CO <sub>2</sub> increase; 2. 2% increase in 2007	1. Revised mapping grid split between A road and Motorway 2. Revision to national diesel fuel consumption	1. Wakefield

<b>J. Road Transport (Motorways)</b>	1. Around 60 kt CO <sub>2</sub> increase; 2. 2% increase in 2007	1. Revised mapping grid split between A road and Motorway 2. Revision to national diesel fuel consumption	1. Wakefield
<b>K. Road Transport (Minor roads)</b>	2% increase in 2007	Revision to national diesel fuel consumption	
<b>L. Diesel Railways</b>	No significant changes	N/A	N/A
<b>M. Transport Other</b>	Up to 7 kt CO <sub>2</sub> increase in selected LAs, small decrease in the majority of LAs	New grid for mapping emissions from coal use in rail transport (previously used diesel railways grid)	Richmondshire, Ryedale, Shepway, West Devon, West Somerset, Gwynedd
<b>N. LULUCF Net Emissions</b>	Up to 2,836 kt CO <sub>2</sub> difference (increases and decreases observed).	Significant change to model methodology for forest land	Northumberland, Aberdeenshire, Argyll and Bute, Dumfries and Galloway

## 5. CO<sub>2</sub> emissions within the scope of influence of local authorities

CO<sub>2</sub> emissions within the scope of influence of Local Authorities (LAs) form a subset of the full National Statistics dataset. The full dataset includes all the emissions that occur within the boundaries of each local authority; however, the reduced dataset excludes certain emissions, which it has been considered local authorities are unable to directly influence. The emissions that are removed from the National Statistics dataset to compile the CO<sub>2</sub> emissions within the scope of influence of LAs are:

- Motorways – all emissions from the “Road transport (motorways)” sector have been removed.
- EU Emissions trading system sites – these emissions have been removed from the “Large industrial installations” sector with the exception of energy suppliers (e.g. power stations), whose emissions are indirectly included via the end-user estimates for electricity use. Note that not all the emissions from the “Large industrial installations” sector are produced by EU ETS installations, hence the fact that there are emissions remaining in this sector.
- Diesel railways – all emissions from the “Diesel Railways” sector have been excluded.
- Land Use, Land Use Change, and Forestry – all emissions belonging to the “LULUCF Net emissions” sector have been excluded from the main dataset.

In effect, these are emissions that LAs can be least expected to responsible for. Arguments can be made for other exclusions, but a line has to be drawn somewhere that results in a dataset that is fair in terms of local authority actions actually affecting changes in the dataset, and where real change at the local level will be captured. LAs were consulted during development of this subset of the data.

## 6. Planned improvements to the dataset

There are currently no planned improvements to the LA CO<sub>2</sub> emissions dataset. However the local authority estimates are consistent with the national emissions estimates and any future updates to the local authority dataset will therefore need to reflect any changes made at the national level, including those made in response to revisions to underlying data.

## 7. Further information and feedback

### Comments

We would welcome comments on these statistics. These should be sent to:

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### Useful links

Details of DECC's estimates of local and regional energy statistics are available here:

[www.gov.uk/government/organisations/department-of-energy-climate-change/series/sub-national-energy-consumption](http://www.gov.uk/government/organisations/department-of-energy-climate-change/series/sub-national-energy-consumption)

The UK National Atmospheric Emissions Inventory website is here:

[www.naei.org.uk](http://www.naei.org.uk)

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