Experimental Statistics on carbon dioxide emissions at Local Authority and Regional Level: 2004

Defra Statistics Summary

27 November 2006

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

Published by the Department for Environment, Food and Rural Affairs. Produced in the UK, November 2006 in electronic format.

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Defra Statistics Summary

For a second year, Defra has commissioned AEA Energy and Environment (formerly Netcen) to produce a set of experimental statistics of carbon dioxide emissions for local authority areas. This paper explains the background to the estimates, summarises some of the results and conclusions, and discusses some of the issues which need to be considered when using the data.

Fuller details of the results and methodology are available in the AEA Energy and Environment research report and accompanying spreadsheet (see http://www.defra.gov.uk/environment/statistics/globatmos/galocalghg.htm).

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Introduction

The UK compiles an annual inventory of its greenhouse gas emissions in order to monitor progress against domestic and international targets such as the Kyoto Protocol. Disaggregated versions of the UK inventory are also produced for England, Scotland, Wales and Northern Ireland, and maps estimating the geographical distribution of the sources of emissions are also produced.

Carbon dioxide (CO_2) is the main greenhouse gas, accounting for about 85 per cent of the UK total, and the vast majority of CO_2 emissions come from the burning of fossil fuels. In recent years, increasing emphasis has been placed on the role of regional and local government in contributing to energy efficiency improvements, and hence reductions in CO_2 emissions, therefore interest in local estimates of such emissions has increased.

This project combines data from the National Atmospheric Emissions Inventory (NAEI) with local energy consumption data from the Department of Trade and Industry (DTI) to produce a nationally consistent set of CO_2 emission estimates down to local authority level.

As last year, this report shows emissions from electricity generation (about 30 per cent of total UK emissions) re-allocated according to where electricity is consumed

rather than where power stations are located. A second set of figures is provided, for the first time, which go further and also re-allocate other emissions from the energy production sector (for example refineries) to the end users of the fuel. This second approach corresponds to the 'end user' classification of emissions sometimes used in UK level reports on emissions. The general principle is that emissions are distributed according to the point of energy consumption (or point of emission if not energy related). Except for the energy industry, emissions from the production of goods are assigned to where the production takes place – thus as with the national inventories, emissions from the production of goods which are exported will be included, and emissions from the production of goods which are imported are excluded.

Improvements in the estimates since last year

Improvements in the 2004 estimates compared with those for 2003 include:

- Production of estimates on a more complete 'end user' basis, re-allocating most energy sector emissions to energy users. These estimates are provided in addition to a set only re-allocating power station emissions to electricity customers, the basis used last year.

- Improved quality of DTI electricity use data sets, with less consumption unallocated to LAs (1½ per cent instead of 8 per cent) and higher quality allocation of meter point locations to LAs

- Improved estimates of the distribution of solid and liquid fuel combustion in the domestic sector. While still heavily modelled, these estimates benefit from better data on the distribution of gas and electricity use, and information from the Building Research Establishment on home energy consumption.

- Better and more complete estimates of emissions and removals of carbon dioxide resulting from land use, land use change and forestry, provided by the Centre for Ecology and Hydrology.

Comparability

Because there have been improvements in both the raw data and in the modelling methods used, the 2004 estimates are not comparable with those for 2003. Any differences are more likely to represent changes in the underlying data or methods than real changes over time, so the data sets should not be used for comparisons over time. It is hoped that as these data sets are further developed, more consistent comparisons over time will become possible.

Use of the estimates

The purpose of these estimates is to assist those using local emissions accounting as a tool in developing emissions reduction strategies and for raising awareness of greenhouse gas emissions as an issue. The estimates and methodological report

should be useful to those who are already working on local inventories, and encourage others to do more by providing a useful starting point for further work.

Despite the important improvements made since last year, these estimates are not perfect. They stretch the information available to the limit in order to provide estimates for each authority. Some of the limitations of the 2004 estimates include:

- some inaccuracies in the location information available in the raw gas consumption data, and in its allocation to local authority boundaries, which is thought to be significant for some authorities. The quality of this data source will be improved in future DTI updates.
- confidentiality constraints on data for some large electricity and gas customers which either prevents their allocation to local authority boundaries, or introduces some additional uncertainty into the allocation, which may have a significant impact on results for a few authorities
- road transport emission estimates rely on national traffic statistics, and distribution of traffic on minor roads has had to be imputed at local level from regional level data
- the local distribution of emissions from sources other than gas, electricity generation or road transport (these residual sources are about 20 per cent of total emissions) largely has to be estimated from proxy information such as population or employment data
- some of the key sources used for mapping emissions do not cover the whole of the UK, and therefore alternative methods have had to be used for authorities in Northern Ireland, and in the case of domestic solid fuel use, Scotland as well.

Further detail on data quality and the methods used is available in the main report.

It is also very important to bear in mind that circumstances vary enormously between authorities, and also that local authorities have relatively little influence over some types of emissions.

For all these reasons, these statistics should be interpreted with caution. They do not provide simple ready made ‘performance indicators’ for local areas. However, used with care they can provide useful contextual information, help in setting priorities, and highlight useful lines for further investigation. In some cases more accurate data may be obtainable from locally available information, on which Defra would welcome feedback.

Because these statistics and some of the sources they use are still under development, and because of the issues outlined above, they are defined as ‘experimental statistics’ under the terms of the National Statistics Code of Practice.

It should be noted that the results at Government Office Region level are much more robust. Most of the difficulties in allocating data to local authorities have little impact at regional level. Problems of interpretation, such as economic activity or road transport taking place across boundaries, still exist but are less acute at the regional level than at the local level.

Description of the results

Estimates have been produced for each local authority in the UK of CO_2 emissions from the following broad source categories:

- industry, commercial & public sector (including electricity-related emissions)
- domestic (including electricity-related emissions)
- road transport
- land use, land use change and forestry

The level of detail is constrained by the detail available in DTI statistics on local electricity and gas use. To estimate a further breakdown would have involved further general assumptions about energy use for different sectors, since local data is not available. However, further detail, mostly in terms of fuel types, is shown in the main report in order to provide additional insight into how the estimates are constructed.

Because land use, land use change and forestry can act as a sink, removing carbon from the atmosphere, as well as a source of carbon emissions, net emissions for this sector may sometimes be negative. Because this sector is rather different in nature from others (for which emissions are largely attributable to fuel consumption), it may be convenient to use figures which exclude the land use, land use change and forestry sector, and such sub-totals are provided in the report.

Table 1 shows the contribution of these sectors to the total of emissions allocated to LAs in this report, before any re-allocation of energy sector emissions (source basis), when only power station emissions are re-allocated to electricity customers (electricity user basis), and after a more complete re-allocation of energy production sector emissions to energy customers (end user basis). The main report presents its estimates for local authority emissions on both the electricity user basis and the end user basis.

Table 1: Contribution of sectors to total emissions

	Sector (percentage contribution)			
Emission allocation method	Industrial, commercial & public	Domestic	Road transport	Total[1]
Source basis	60	16	24	100
Electricity user basis	47	29	24	100
End user basis	44	29	28	100

1. Includes net emissions from land use, land use change and forestry

Table 2 shows a summary of the end user results for Government Office Regions. Estimates are also shown per resident in order to make some allowance for the different size of regions. However, it should be noted that while emissions per resident may be a useful measure for domestic emissions, emissions from industry and road transport are driven by many factors other than resident population. Therefore industrial and commercial and road transport emissions per resident

should be interpreted with caution at regional level, and would be even less appropriate at local authority level.

Table 2: End user carbon dioxide emissions 2004: Government Office Region summary

	Total emissions (million tonnes carbon dioxide)				Per capita emissions (tonnes carbon dioxide per resident)			
Government Office Region	Industrial, commercial & public	Domestic	Road transport	Total[1]	Industrial, commercial & public	Domestic	Road transport	Total[1]
North East	21	6	5	33	8.4	2.6	2.2	13.1
North West	26	18	17	61	3.9	2.6	2.5	9.1
Yorkshire and the Humber	28	13	13	54	5.6	2.7	2.6	10.9
East Midlands	19	11	13	43	4.5	2.6	3.0	10.3
West Midlands	20	13	14	48	3.8	2.6	2.7	9.1
East of England	17	14	16	47	3.1	2.6	2.9	8.8
Greater London	22	17	12	51	3.0	2.4	1.7	7.1
South East	25	21	23	69	3.1	2.7	2.9	8.7
South West	17	13	13	44	3.4	2.7	2.7	8.9
England[2]	194	128	126	450	3.9	2.6	2.6	9.2
Wales[2]	17	8	7	31	5.7	2.7	2.5	10.8
Scotland[2]	23	14	12	45	4.6	2.8	2.4	8.9
Northern Ireland[2]	5	5	5	15	3.0	3.0	3.0	8.9
UK sum above[2]	239	155	150	542	4.1	2.6	2.6	9.2

1. Total column includes net emissions from land use, land use change and forestry

2. Sum of local authority emission estimates for countries differ from the official inventories for the UK and the Devolved Administrations (see Reconciliation section below)

Results for individual local authorities may be found in the spreadsheet supplied with the main report.

There can be a great deal of variation between local authorities. In particular a significant amount of industrial emissions are concentrated in a few areas, so for most local authorities the contribution of industrial, commercial & public sector emissions is lower than the overall averages in Table 1 suggest. Typical ranges for the share of end user emissions in a local authority are as follows:

Industrial, commercial & public	31-45%
Domestic	26-36%
Road transport	22-37%

(For each sector, half of authorities have figures which fall within the ranges shown)

Emissions per resident vary least between areas for the domestic sector, and are dominated by gas and electricity consumption, for which real local data are available. Therefore these are perhaps the most interesting results, although there are still some problems with data quality at local authority level which are noted in the main report. Domestic emissions here represent emissions from energy consumption in and around the home, including emissions attributable to the use of electricity, but not activities by private individuals elsewhere, such as personal travel.

Domestic emissions are important. In one third of local authorities, domestic end user emissions are greater than industrial and commercial end user emissions, and in three fifths of authorities the domestic end user emissions amount to at least 80 per cent of total industrial and commercial end user emissions.

In about half of local authorities, average domestic end user emissions are between 2.5 tonnes and 2.9 tonnes CO_2 per person per year. This can be influenced by the fuel types used, the type and condition of the housing (including its insulation), the average temperature (and urban areas can be much warmer and therefore easier to heat than rural areas), average household size, type of household and the income and preferences of the occupiers.

Overall, about 48 per cent of domestic end user emissions in this report arise from gas use, 41 per cent from electricity, and 10 per cent from consumption of other fuels. This pattern varies locally with the availability of different fuel types.

Road transport emissions include both freight and passenger transport, both private and for business purposes. The estimates are made on the basis of the distribution of traffic, therefore some of the emissions within an authority represent through traffic, or part of trips into or out of the area whether by residents or non-residents. In some authorities this can be particularly significant, and the issue has to be borne in mind when looking at either totals or per capita estimates. This year the main report shows how the estimates break down between major and minor roads, to help with consideration of this point. On the end user basis, road transport emissions include a share of emissions from oil refineries.

Reconciliation with the UK inventory

These local estimates are designed to be as consistent as possible with the national inventories of the UK and the devolved administrations. However, some differences are unavoidable.

A number of emission sources included in the UK inventory are not included in the local estimates, as there is no obvious basis for doing so. Excluded sources are aviation, fishing and shipping and the offshore oil and gas industry. Some of these categories are also excluded from the devolved administration inventories.

Also unallocated in the local data set are a small proportion of emissions attributable to large electricity customers whose location is not disclosed for confidentiality reasons, and a small proportion of electricity and gas customers where supply point postcodes could not be matched to a local authority.

A third difference occurs for road transport emissions. In the UK inventory, road transport emissions are constrained to agree with UK road fuel sales, in accordance with international guidance on inventory compilation. The sum of the estimates in this report built up from road traffic data is about 8 per cent higher than the UK estimate based on fuel sales. This may in part be due to imperfections in the local estimation method (or the national fuel sales data), but it will also include a contribution from cross-border traffic from the continent and the Republic of Ireland. The local

estimates are not adjusted to match the UK fuel sales-based total because the link to traffic figures is considered to be more relevant to local policy making.

A small proportion of the gas consumption allocated to the domestic sector in these estimates would be attributed to business in the UK inventory. This is because it is impossible to distinguish between domestic customers and smaller businesses in the meter point gas consumption data used in these local estimates.

Table 3 shows a summary of the reconciliation between the UK inventory and the local inventory. More detail can be found in the main report.

Table 3: Reconciliation of local emission estimates with UK inventory

	million tonnes CO_2
End user emissions allocated to local areas (from Table 2)	**541.8**
difference between end user and electricity user allocations	-9.9
Electricity user emissions allocated to local areas (main report)	**531.3**
Unallocated large electricity users (high voltage lines)	3.2
Other unallocated (mostly industry & commercial electricity)	3.9
UK electricity user basis in scope of local emissions project	**538.3**
Excluded from local allocation:	
domestic aviation	4.4
domestic shipping	4.5
offshore oil & gas industry	20.8
Methodological differences:	
higher road traffic in local method	-9.5
lower industry & commercial in local method	0.5
UK Greenhouse Gas Inventory total	**559.0**

The future

It is hoped that, resources permitting, further sets of statistics will be produced annually. These will take advantage of improvements to the underlying DTI local electricity and gas data and other lessons learned in the course of this project. The 2004 estimation project included an exercise to develop a strategy for future development of the estimates, and the main report includes a summary of some of the possible developments identified so far, which will be considered as resources allow.

Feedback

In order to inform future work Defra would welcome feedback from users on the published results. An optional feedback form is available for you to use for this on our Local CO2 Statistics Home Page: http://www.defra.gov.uk/environment/statistics/globatmos/galocalghg.htm.

Comments may be sent to:

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Internet links

The results of this project are available on the Defra e-Digest of Environmental Statistics pages here:
http://www.defra.gov.uk/environment/statistics/globatmos/galocalghg.htm

Details of DTI's programme of work on estimates of local and regional energy statistics are available here:
http://www.dti.gov.uk/energy/statistics/regional/index.html

The home pages of the UK National Atmospheric Emissions Inventory are here:
http://www.naei.org.uk