DEPARTMENT OF ENERGY & CLIMATE CHANGE

Emissions from Heat

Statistical Summary

13 January 2012

Emissions from Heat: Statistical Summary

Introduction

The purpose of this summary report is to provide an overview of what proportion of the UK's greenhouse gas emissions are directly attributable to heat related activities, and how these activities can be broken down by their source sector and the type of activity.

All figures (excluding estimates from renewable sources) in the report are based on data for the calendar year 2009.

Sector and activity definitions

For the purposes of this analysis, activities that are considered to be from "heat" are as follows:

- space heating;
- water heating;
- cooking/catering; and
- cooling and ventilation.

In the industrial sector, there are also some additional uses of heat which have been approximated; these are:

- high temperature processes;
- low temperature process;
- drying/separation;
- compressed air; and
- refrigeration.

In terms of the sectoral coverage and breakdowns, estimates of emissions from heat have been included for the following sectors:

- domestic;
- public sector;
- commercial;
- miscellaneous services; and
- industry.

Overall summary: Total emissions from heat

In 2009, around 32 per cent (182 $MtCO_2e$) of all greenhouse gas (GHG) emissions in the UK resulted from heat related activities. In terms of carbon dioxide (CO_2) emissions, this represents around 38 per cent (or 180 $MtCO_2$) of all CO_2 emissions. The table below summarises the overall results.

Table 1: Proportion of total UK emissions related to heat

	CO_2 only	All GHGs
Emissions from heat ($MtCO_2e$)	180	182
Total UK emissions ($MtCO_2e$)	474	562
Proportion from heat (%)	38	32

This report focuses on all greenhouse gas emissions, as opposed to just carbon dioxide alone.

Breakdown of emissions by sector and fuel

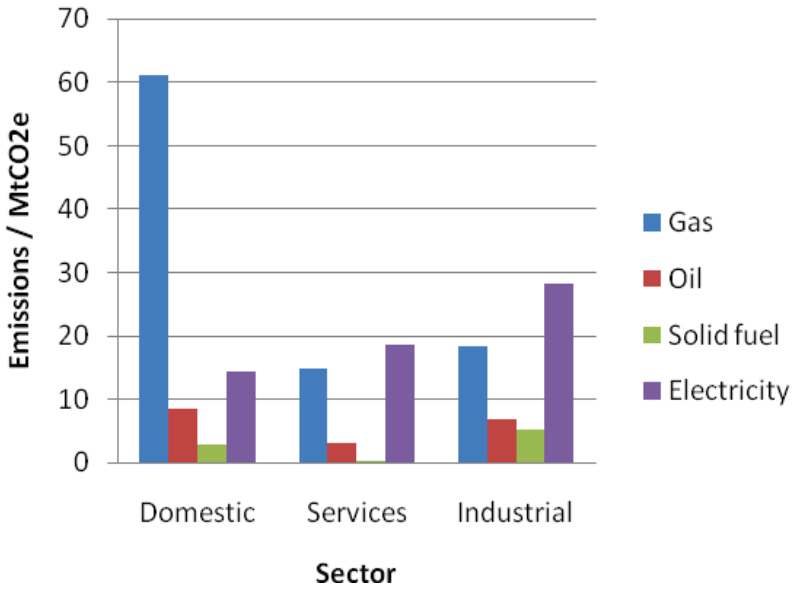
Overall, this analysis shows that almost 52 per cent (94 $MtCO_2e$) of heat emissions result from gas use, with almost 34 per cent (61 $MtCO_2e$) being from electricity use. The remainder of emissions are related to the use of oil (10 per cent or 19 $MtCO_2e$) and solid fuel (5 per cent, or 8 $MtCO_2e$).

These results are shown in the table and chart below. Note that "Services" refers to the public, commercial and miscellaneous services sectors combined.

Table 2: Emissions by sector and fuel

GHG emissions / $MtCO_2e$	Gas	Oil	Solid fuel	Electricity	**Total**	*Percentage of total / %*
Domestic	61	9	3	14	87	*48*
Services	15	3	0	19	37	*20*
Industrial	18	7	5	28	59	*32*
Total	**94**	**19**	**8**	**61**	**182**	*100*

Figure 1: Emissions by sector and fuel



Breakdown of emissions by end-use sector and activity

Domestic sector

In the domestic sector, the majority of heat related activities were from gas and electricity use (61.0 $MtCO_2e$ and 14.4 $MtCO_2e$ respectively), from a total of 86.9 $MtCO_2e$.

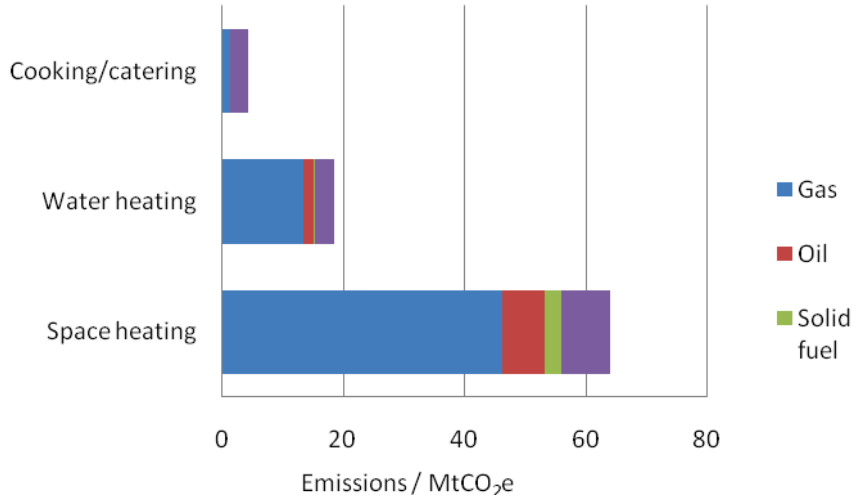
This was almost entirely in relation to space heating (64.0 $MtCO_2e$) and water heating (18.6 $MtCO_2e$).

These results are shown in the table and chart below.

Table 3: Domestic sector, by end-use and fuel

End-use / $MtCO_2e$	Gas	Oil	Solid fuel	Electricity	Total
Space heating	46.2	7.0	2.7	8.1	**64.0**
Water heating	13.5	1.5	0.2	3.3	**18.6**
Cooking/catering	1.4	0.0	0.0	2.9	**4.3**
Total	**61.0**	**8.6**	**2.9**	**14.4**	**86.9**

Figure 2: Domestic sector, by end-use and fuel



Services sector

Estimates of emissions from heat from the services sector have been disaggregated further into three separate sectors. Emissions from the public, commercial and miscellaneous sectors are estimated below.

Public sector

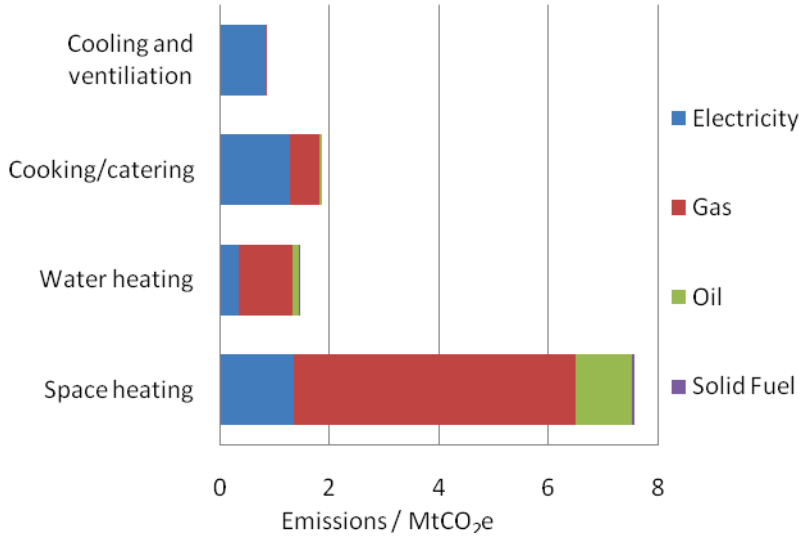
More than half of all heat emissions in the public sector were from gas use (6.7 $MtCO_2e$), of which the main use being space heating (5.1 $MtCO_2e$). Electricity use was also significant (3.8 $MtCO_2e$), across a range of heat-generating activities.

These results are shown in the table and chart below:

Table 4: Public sector, by end-use and fuel

End use / $MtCO_2e$	Gas	Oil	Solid Fuel	Electricity	Total
Space heating	5.1	1.0	0.05	1.4	**7.6**
Water heating	1.0	0.1	0.01	0.3	**1.5**
Cooking/catering	0.6	0.0	-	1.3	**1.9**
Cooling and ventilation	0.0	-	-	0.8	**0.9**
Total	**6.7**	**1.2**	**0.06**	**3.8**	**11.8**

Figure 3: Public sector, by end-use and fuel



Commercial sector

In the commercial sector, the large majority of heat emissions (14.7 $MtCO_2e$) resulted from electricity use, across a range of heat-generating activities.

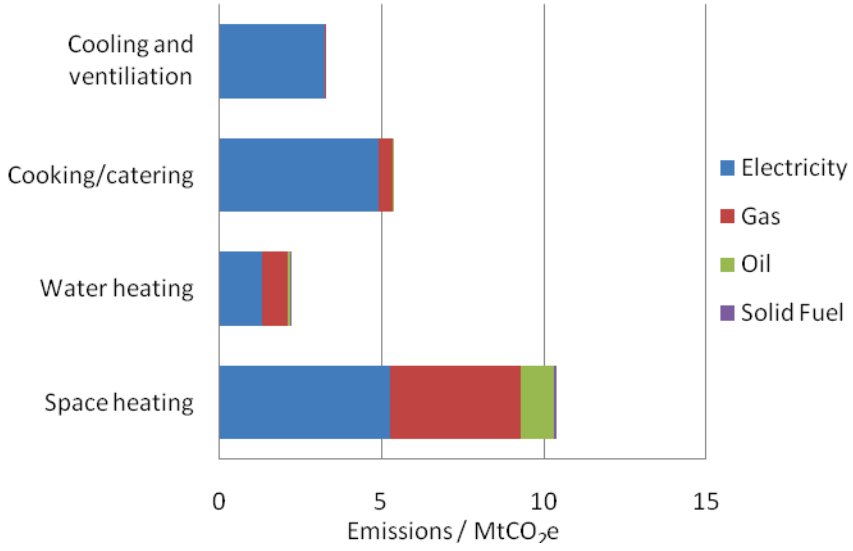
Almost half of emissions in this sector were related to space heating (primarily electricity and gas use).

These results are shown in the table and chart below:

Table 5: Commercial sector, by end-use and fuel

End Use / $MtCO_2e$	Gas	Oil	Solid Fuel	Electricity	Total
Space heating	4.1	1.0	0.09	5.2	**10.4**
Water heating	0.8	0.1	0.02	1.3	**2.2**
Cooking/catering	0.4	0.0	-	4.9	**5.4**
Cooling and ventilation	0.0	-	-	3.2	**3.3**
Total	**5.3**	**1.2**	**0.12**	**14.7**	**21.3**

Figure 4: Commercial sector, by end-use and fuel



Miscellaneous services sector

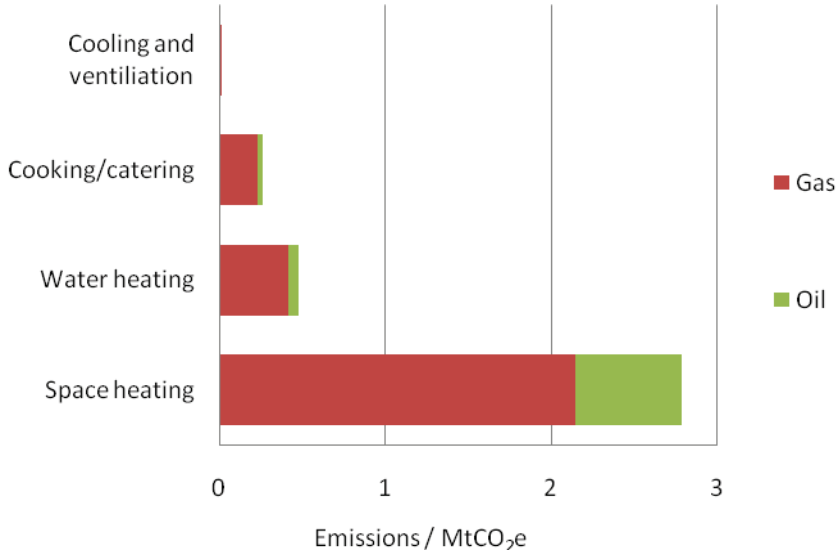
The miscellaneous services sector only accounted for 3.5 $MtCO_2e$ (out of 182 $MtCO_2e$ for all heat emissions). Around 80 per cent of these (2.8 $MtCO_2e$) were related to space heating, primarily due to gas use.

These results are shown in the table and chart below.

Table 6: Miscellaneous sector, by end-use and fuel

End Use / $MtCO_2e$	Gas	Oil	Total
Space heating	2.1	0.6	**2.8**
Water heating	0.4	0.1	**0.5**
Cooking/catering	0.2	0.0	**0.3**
Cooling and ventilation	0.0	-	**-**
Total	**2.8**	**0.7**	**3.5**

Figure 5: Miscellaneous sector, by end-use and fuel



Industrial sector

Around 32 per cent of total heat emissions were from the industrial sector (59.0 $MtCO_2e$).

Almost half of these emissions were from electricity use (28.4 $MtCO_2e$), with the largest emitting activities being low temperature process (8.2 $MtCO_2e$) and high temperature process (6.1 $MtCO_2e$).

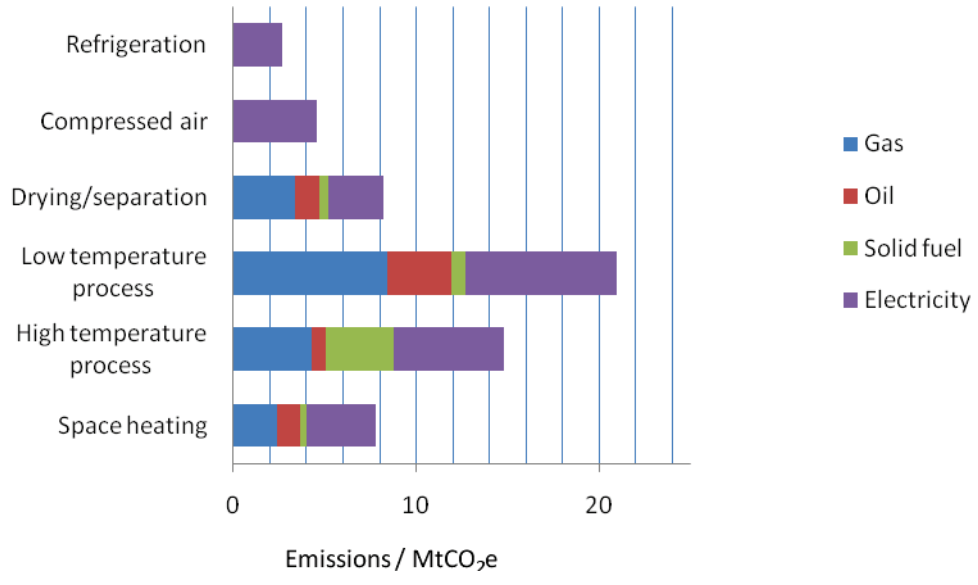
Gas use made up around a third of heat emissions from this sector (18.5 $MtCO_2e$), with almost half of this being related to low temperature process (8.4 $MtCO_2e$).

These results are shown in the table and chart below:

Table 7: Industrial sector, by end-use and fuel

End use / $MtCO_2e$	Gas	Oil	Solid fuel	Electricity	Total
Space heating	2.4	1.3	0.3	3.8	**7.8**
High temperature process	4.3	0.8	3.7	6.1	**14.8**
Low temperature process	8.4	3.5	0.8	8.2	**21.0**
Drying/separation	3.4	1.3	0.5	3.0	**8.2**
Compressed air	-	-	-	4.5	**4.5**
Refrigeration	-	-	-	2.7	**2.7**
Total	**18.5**	**6.9**	**5.3**	**28.4**	**59.0**

Figure 6: Industrial sector, by end-use and fuel



Additional data: Renewables

Emissions from renewables are estimated using a different data source to the sectors reported above, relating to activities in the calendar year 2010.

In 2010, renewable sources made up a small proportion of activities used for heat purposes (1.5 $MtCO_2e$).

The breakdown of these emissions by source and gas is shown in the table below.

Table 8: By sector, proportion of fuel used

Fuel / $ktCO_2e$	Carbon dioxide	Methane	Nitrous oxide	Total
MSW[1]	31.0	6.8	1.3	**39.1**
Non-biodegradable wastes[2]	159.4	34.7	6.8	**200.9**
Landfill gas	-	0.1	0.0	**0.1**
Sewage gas	-	0.3	0.1	**0.4**
Wood combustion - domestic	-	103.3	20.3	**123.7**
Wood combustion - industrial	-	6.7	13.3	**20.0**
Animal biomass[3]	-	1.3	18.8	**20.1**
Plant biomass[4]	-	68.3	1008.5	**1076.8**
Total	**190.4**	**221.5**	**1069.3**	**1481.2**

Estimates from renewable sources are not included in the totals for the previous sections.

1. MSW - Biodegradable part only.
2. Non-biodegradable part of municipal solid waste plus waste tyres, hospital waste, and general industrial waste.
3. Includes heat from farm poultry litter, waste digestion, meat and bone combustion and sewage sludge combustion
4. Includes heat from straw, energy crops, paper and packaging

Annex: Raw data and assumptions

Raw Data:

Two models were used to estimate the energy consumption by activity and fuel type for the sections related to the domestic, services and industry sectors.

i) Domestic sector: The Building Research Establishment Domestic Energy Model (BREDEM).

   The model takes into account building construction, heating systems and controls, occupancy and locations.

ii) Services and Industrial sectors: Non-Domestic Energy Model (NDEM):

The fuel breakdown for these sectors is taken from the Digest of UK Energy Statistics (DUKES) publication.

Consumption data from renewables is taken from table 7.6 of DUKES.

Assumptions:

- Estimates do not take into account of heat sold, blast furnace gas or coke oven gas
- No emissions from transport are estimated
- Emissions from renewables are estimated separately, using data from DUKES
- Unlike with the GHG inventory, no adjustments to consumption data by sector are made, e.g. where data is used as a float, or where there is other known reliable data
- In the industrial sector, the following sub-sectors / sources are excluded: construction; coke manufacture; refined petroleum products; nuclear fuel; the mining of metal ores; gas manufacture and distribution; and other unclassified sectors
- To estimate total emissions by sector more accurately, the reconciliation of Energy Trends data with DUKES was carried out to give detailed consumption data by fuel type. It is assumed that the allocation of fuel use to end-use is consistent in both datasets.

Links:

- Energy Trends homepage:
  http://www.decc.gov.uk/en/content/cms/statistics/publications/trends/trends.aspx

- Special edition of Energy Trends *(September 2011)*:
  From page 43 of the publication, there is a section on estimates of heat use in the UK, by sector and by fuel.

  http://www.decc.gov.uk/assets/decc/11/stats/publications/energy-trends/2871-trends-sep11.pdf

- The Digest of UK Energy Statistics (DUKES) publication:
  http://www.decc.gov.uk/en/content/cms/statistics/publications/dukes/dukes.aspx

Department of Energy & Climate Change
3 Whitehall Place
London SW1A 2AW
www.decc.gov.uk

URN 11D/945