

Transforming UK buildings:

achieving a 60% cut in CO₂ emissions from non-residential buildings by 2050



Project aims

This poster describes the development of the UK non-domestic carbon model (UKNDCM) to explore the energy and carbon intensity of the UK stock of non-domestic buildings from 2004 to 2050 under a range of scenarios.

The model takes as its input a model of the UK non-domestic building stock as expressed in 55 different building types classed by activity and the energy intensity of the building classes as expressed by 8 types of energy end use. The poster discusses the data sources, the modelling framework and indicates how a 60% reduction can be achieved by 2050.

The aim of this work is to develop a model of the non-domestic sector, comparable to that for the domestic sector developed elsewhere [Boardman 2005, Hinnells 2007] and able to draw out similar key conclusions.

The UK non-domestic carbon model

Four areas of data are being examined to improve the data in the model's structure:

- 1) Current consumption - Data availability for current stock is poor.** Work is being undertaken to improve understanding of floor area and of the built form.
- 2) Projections of consumption under 'basecamp' conditions.** Since there are no existing projections for floor area needs, 'storylines' are being developed for each sector of drivers. For the retail, hospital, and prison sectors these include: demographics, socio-economic trends, socio-technological trends, and (economic) decision-making frameworks.
- 3) Estimates of saving potential.**
- 4) Analysis of the major points of intervention to reduce carbon emissions from buildings i.e. build, demolition, change of use.** Understanding the rate of stock turnover will help to estimate the rate at which change could be achieved, allowing for the differences, and their implications on policy, in each sector.

Preliminary results

Using the assumption that the stock model represents energy use that could be considered 'typical' in the CIBSE benchmark guide, the reductions by converting to 'best practice' are 22%, 29% and 32% for the non-domestic building categories which fall into the DUKES Public Administration, Miscellaneous and Commercial sectors respectively.

This is far short of the 50% by 2030 or 60% by 2050 we are trying to achieve.

Analysis using the NDCM shows greater potential. The business as usual scenario (scenario A) takes the DTI prediction of a 2.25% year on year growth in energy. The preliminary large scale reduction scenario (scenario B) assumes a change in space and water heating system technology (away from gas boilers and electrical resistance heaters and towards combined heat and power and heat pumps) and an increase in lighting, appliance and space cooling efficiency. This is calculated against the background of static demand for useful energy (energy service) whilst taking account of the change in gains due to appliance efficiency changes.

Most of the reduction (64% comes from the change to the heating system, with less (31%) from lighting and the rest from other appliances and space cooling. The change to the heating system is not particularly ambitious and matched in carbon intensity that predicted for the domestic sector by 2050. This analysis used a grid intensity of 0.145kgC/kWh which is also on the higher range of what can be expected as the grid decarbonises.

Further reductions can be expected from climate change (through offset to an extent due to demand for space cooling), grid decarbonisation and more ambitious eating system changes.

model data

The model uses floor area of each building type multiplied by indicative energy use per m²

Data is used from two sources:

- 1) 2004 Non-Domestic Stock Model (NDSM)
- 2) Digest of UK Energy Statistics (DUKES)

	DUKES (elec+gas)	DUKES (all energy)	NDSM	NDSM +15% (scaled to UK)	Difference (elec + gas)	Difference (all energy)
Public Administration	66.7	84.4	56.4	64.9	-3%	-23%
Commercial	115.3	120.2	97.7	112.4	-3%	-6%
Miscellaneous	20.8	26.2	11.4	13.1	-37%	-50%
Industry	262.4	396.4	291.9	300.8	15%	-24%
Total	465.2	627.2	457.4	491.2	6%	-22%

Table 1: Energy supplied to Non-domestic buildings 2004 – comparison of DUKES 2004 with NDSM



This work is thus simply a starting point for a model which explores historical trends 1994 – 2004 and projects energy use each year to 2050 under a variety of scenarios.

data quality

These 4 combine to give a model shown in figure 1.

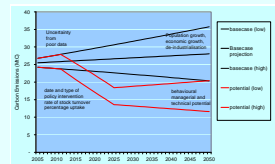


Figure 1: The structure of the non-domestic model



This analysis shows that large reductions in CO₂ emissions from the non-domestic sector in the UK are possible. Further work is needed to explore the possible trajectories such reductions might take.



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