

INFORMATION NOTE

Carbon Factsheet

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Who Should Read this: All DE Staff, CEstOs and Contracting Partners	
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Document Aim: To provide a non-technical reference guide on all aspects of Carbon and what its management means for the MOD.

CARBON MEASUREMENT

Emissions are measured in both forms, Carbon and CO₂. Standard units relate to mass, either in kilograms (kg) or multiples there of, i.e. kgC, tonnesC (tC) or kilotonnesC (ktC) etc. The difference in mass between C and CO₂ is a simple conversion factor calculation based on molecular level mass, i.e. C has an atomic weight of 12g/mol and CO₂ has an atomic weight of 44g/mol. To convert C to CO₂ simply multiply the mass of Carbon by 3.667 (44/12).

Carbon emissions are calculated using standard conversion factors for each fuel type at point of combustion for delivered primary fuels (gas, oil etc) and point of use for secondary fuels (electricity). Carbon emissions are reported by MOD as follows:

DEFRA Annual Report	kgC (all fuels inc. electricity)
SOGE Targets	kgC (all fuels inc. electricity)
EU ETS	tCO ₂ (tonnes CO ₂) (all primary fuels)
RP Centre Target	kgC (all fuels inc. electricity)
Energy Performance Commitment	tCO ₂ (all fuels inc. electricity) except ETS emissions

CARBON FROM FUEL

Different fuels release different amounts of CO₂ into the atmosphere when burnt. In ranked order the largest emitter per kWh is grid electricity then coal, oil, lpg and finally natural gas, as follows:

Energy Source	1 kWh =	
Grid Electricity	0.430 kgCO ₂	Most CO ₂
Coal	0.300 kgCO ₂	
Heavy Fuel Oil	0.260 kgCO ₂	
Gas/Diesel Oil	0.250 kgCO ₂	
Petrol	0.240 kgCO ₂	
LPG	0.214 kgCO ₂	
Natural Gas	0.19 kgCO ₂	
Renewables	0.00 kgCO ₂	Least CO ₂

Source: DEFRA¹

SAVING CARBON

Carbon emissions can be reduced by using less energy, switching to burning fossil fuels that emit less carbon per kWh and switching to renewable sources of energy such as wind generated electricity, biomass for heating etc. A different emissions figure per fuel means that fuel switching can reduce emissions without reducing consumption. If it were possible to convert all MOD's oil and LPG burning plant to natural gas, the resulting reduction in emissions would be 69,000tC.

TARGETS

MOD Targets for the reduction of emissions are as follows:

- SOGE
- Reverse upward trend in carbon emissions by Apr 07
 - Reduce carbon emissions by 12.5% by 2010/11 relative to 99/00
 - Reduce carbon emissions by 20% by 2020 relative to 99/00
 - Central Government Offices (Approx 35 MOD) to be carbon neutral by 2012
 - Departments to increase efficiency per m² by 15% by 2010 relative to 99/00
 - Departments to increase efficiency per m² by 30% by 2020 relative to 99/00
 - Departments to source at least 10% of electricity from renewables by 2010
 - Departments to source at least 15% of electricity from Combined Heat and Power by 2010

RP(Centre) A target was introduced in 2006 by Resource and Plans Centre to add a financial element to efficiency targets. The target represents a 15% reduction in emissions on the top 220 consuming sites by 2010/11 relative to 2004/05 linked to reduction of £31M in the 2010/11 Departmental utility budget (60,000tC).

CARBON FOOTPRINTING

Carbon footprinting is a representation of the effect human activities have on the climate in terms of the total amount of greenhouse gases produced. In theory the footprint relates to the through-life of an output and would include emissions from raw material processes, manufacturing, transportation, use, and ultimately waste processing. Due to the complexities of data capture through supply chains and waste streams carbon footprinting has been seen as the amount of energy used for a specific aspect of an organisations activity.

CARBON NEUTRALITY

A carbon neutral organisation is one where net CO₂ emissions from its activities are zero. In principle, a product or service can also be made carbon neutral. Since it is very difficult to reduce emissions to zero, the realistic options for achieving carbon neutrality are a combination of reducing emissions and investing in carbon offset projects. These are projects that enable the emitted greenhouse gases to be absorbed elsewhere such as a managed tree plantation in Bolivia. However there is no acceptable level of where to stop reducing emissions and start offsetting.

¹ <http://www.defra.gov.uk/environment/business/envrp/gas/envrpgas-annexes.pdf>

CARBON MARKETS

There are two markets for emissions. There is the CO₂ market set up to trade allowances for the EU Emission Trading Scheme and then there is the market in carbon offsetting.

The Emissions trading market operates through the simple principle that one operator has a surplus amount of allowances and another operator has a need to buy allowances - these are traded on the open market. Carbon Offsetting allows for an investment in a project that will offset emissions. Currently this market is unregulated, although there is an accepted standard called the CDM Gold Standard² which interestingly does not accredit tree planting projects.

MOD CARBON EMISSIONS

MOD carbon emissions by fuel type and percentage emissions from TLBs in FY 05/06

Fuel	kgC	tCO ₂	%
Electricity	249,205,302	913,753	47.5%
Gas	189,793,002	695,908	36.2%
Oil	75,784,136	277,875	14.4%
LPG	7,597,068	27,856	1.4%
Heat	1,593,332	3,056	0.3%
Coal	833,524	5,842	0.2%
	524,806,363	1,924,290	

TLB	%
Army	32%
RAF	23%
DLO	14%
Army Overseas	11%
PJHQ	9%
Navy	6%
CTLB	5%
DPA	1%

Performance to 05/06 over a 99/00 baseline – changes in Emissions.

TLB	Percent change since 1999/00					
	00/01	01/02	02/03	03/04	04/05	05/06
Army	-	6%	10%	10%	14%	-1%
Army Overseas	-	-3%	-4%	3%	5%	6%
DLO	-	-	-4%	3%	21%	23%
DPA	-10%	-9%	-5%	-2%	-4%	-3%
Navy	-8%	-7%	-8%	-9%	-18%	-18%
Royal Air Force	-4%	-11%	-11%	-11%	-12%	-17%
MOD Overall	-1%	-6%	-5%	-3%	-1%	-6%

Source: SD Commission³

CARBON CYCLE

Carbon is essential to life with its chemistry on earth and the relationship with CO₂. Essentially there are four reservoirs of carbon on earth, the atmosphere, the terrestrial biosphere, the oceans, and sediments.

Climate change is brought about by an imbalance in the carbon cycle due to the increased release and rate of release of carbon from the terrestrial biosphere to the atmosphere, believed to be as a result of human activity. Carbon naturally moves between reservoirs but there has been a significant increase in those released from the burning of fossil fuels and the reduced uptake of carbon dioxide by plants and forest due to deforestation, therefore increasing levels in the atmosphere which in turn increases temperatures through the Greenhouse Effect. The Greenhouse effect is where some of the sun's solar energy is absorbed by the earth with some emitted back into space but the increase in CO₂ levels in the atmosphere reduces the amount of energy emitted to space and therefore increases the temperature.

² <http://www.cdmgoldstandard.org/>

³ Data provided to DEFRA and reported by SDC 2006 (<http://www.sd-commission.org.uk/sdig2006/>)