



# Energy and carbon conversions



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of climate change

## Calculate for energy savings

This leaflet provides a number of useful conversion factors to help you calculate energy consumption in common units, and to work out the carbon dioxide emissions associated with energy use. This can be useful for monitoring energy use internally, and also for public reporting of energy consumption and carbon emissions.

## Heat content of fuels

The default gross calorific values given below can be used when fuel-specific values are not available from your energy supplier.

	By weight		By volume
	kWh/tonne	litres/tonne	kWh/litre
<b>Solid fuels</b>			
Coal (weighted average)	7,417	—	—
Coke	8,445	—	—
<b>Liquid fuels</b>			
Crude oil (weighted average)	12,682	1,192	10.6
Petroleum products (weighted average)	12,751	—	—
Ethane	14,071	2,730	5.2
Liquefied petroleum gas	13,721	1,850	7.4
Aviation turbine fuel	12,845	1,251	10.3
Motor spirit	13,087	1,362	9.6
Gas/diesel oil	12,668	1,187	10.7
Fuel oil	12,087	1,031	11.7
Power station oil	12,087	1,142	10.6
<b>Gaseous fuels</b>			
Natural gas	—	—	11.00
Coke oven gas	—	—	5.00
Blast furnace gas	—	—	0.83
Landfill gas	—	—	5.8-7.0*
Sewage gas	—	—	5.8-7.0*
<b>Solid renewables</b>			
Domestic wood (2)	2,778	—	—
Industrial wood (3)	3,306	—	—
Straw	4,167	—	—
Poultry litter	2,445	—	—
General industrial waste	4,445	—	—
Hospital waste	3,889	—	—
Municipal solid waste	2,639	—	—
Refuse-derived waste	5,139	—	—
Tyres	8,890	—	—

Source: Annex A of the Digest of UK Energy Statistics 2005

\*Depends on methane content of the gas

## Conversion factors for energy units

To	therms	kWh	Btu	MJ	toe	kcal
From						
therms	1	29.31	100,000	105.5	$2.52 \times 10^{-3}$	$25 \times 10^3$
kWh	0.03412	1	3412	3.6	$85.98 \times 10^{-6}$	859.7
Btu	$1 \times 10^{-5}$	$0.2931 \times 10^{-3}$	1	$1.055 \times 10^{-3}$	$25.2 \times 10^{-9}$	0.252
MJ	$9.478 \times 10^{-3}$	0.2778	947.8	1	$2.388 \times 10^{-5}$	238.8
toe	396.8	11,630	$39.68 \times 10^6$	41,870	1	$1 \times 10^7$
kcal	$4 \times 10^{-5}$	$1.163 \times 10^{-3}$	3.968	$4.187 \times 10^{-3}$	$1 \times 10^{-7}$	1

toe = tonne of oil equivalent

Example: To convert 10kWh to MJ:  $10\text{kWh} = 10 \times 3.6 = 36\text{MJ}$

## Common prefixes

The following prefixes are used for multiples of joules, watts and watthours:

kilo (k) =  $10^3$ ; mega (M) =  $10^6$ ; giga (G) =  $10^9$ ; tera (T) =  $10^{12}$ ; peta (P) =  $10^{15}$

## Carbon emission factors

The factors given below are taken from Annex A of UKETS(01)05 (Guidelines for the measurement and reporting of emissions in the UK Emissions Trading Scheme). These figures are consistent with the National Air Emission Inventory and with the carbon factors given in the generic PP3.02 (Underlying Climate Change Agreement for the [ ] sector).

Fuel	Carbon emission factors		
	kg C/kWh	kg CO <sub>2</sub> /kWh	
Grid electricity	Delivered <sup>1</sup>	0.117	0.43
	Primary <sup>2</sup>	0.0453	0.1661
Natural gas	0.0518	0.19	
Coal	0.0817	0.3	
Coke	$0.101^3$	$0.37^3$	
Petroleum coke	0.0927	0.34	
Gas/diesel oil	0.068	0.25	
Heavy fuel oil	0.0709	0.26	
Petrol	0.0655	0.24	
LPG	$0.0573^4$	$0.21^4$	
Jet kerosene	0.0655	0.24	
Ethane	0.0545	0.2	
Naphtha	0.0709	0.26	
Refinery gas	0.0545	0.2	

<sup>1</sup> The carbon emission factor for delivered electricity should be used when taking consumption as read from the meter.

<sup>2</sup> The carbon emission factor for primary electricity should be used in calculations for Climate Change Agreements, where all energy use is reported in terms of primary energy.

<sup>3</sup> Climate Change Agreement participants should use 0.117 kg C/kWh (0.43 kg CO<sub>2</sub>/kWh) for Coke.

<sup>4</sup> Climate Change Agreement participants should use 0.0627 kg C/kWh (0.23 kg CO<sub>2</sub>/kWh) for LPG.



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**The Carbon Trust helps businesses and public sector organisations cut their energy costs to combat climate change through the provision of free, professional advice and assistance.**

### **Want to find out more?**

You can get useful energy saving guides at [www.thecarbontrust.co.uk/energy](http://www.thecarbontrust.co.uk/energy) or by contacting The Carbon Trust at 0800 085 2005.

The following websites might also provide more information:

**Department for Environment, Food and Rural Affairs**

For information and guidelines on environmental reporting and climate change  
[www.defra.gov.uk/environment](http://www.defra.gov.uk/environment)

**Department of Trade and Industry**

For information on energy prices, energy trends and the Digest of UK Energy Statistics  
[www.dti.gov.uk/energy](http://www.dti.gov.uk/energy)

**Scottish Energy Efficiency Office**

[www.energy-efficiency.org](http://www.energy-efficiency.org)

**Invest Northern Ireland**

[www.investni.com](http://www.investni.com)

**Environment Agency**

[www.environment-agency.gov.uk](http://www.environment-agency.gov.uk)

**Scottish Environment Protection Agency**

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

We've got many more tips on saving energy and money. So call the Carbon Trust today.

**The Carbon Trust 0800 085 2005**  
[www.thecarbontrust.co.uk/energy](http://www.thecarbontrust.co.uk/energy)

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