



Department
of Energy &
Climate Change

A Comparison of Emissions Factors for Electricity Generation



A COMPARISON OF EMISSIONS FACTORS FOR ELECTRICITY GENERATION

Introduction

Emissions factors are used in order to calculate the greenhouse gas emissions associated with various activities. The general formula used to calculate emissions is as follows:

$$\text{Emissions} = \text{Activity Data} \times \text{Emissions Factor}$$

DECC produce and publish a range of emissions factors, some in partnership with Defra, for many greenhouse gas emitting activities. For electricity generation, there are a range of different emissions factors used by different policy areas. The aim of this note is to explain the differences between these electricity emissions factors and the reasons for these differences.

The table below provides a simple comparison of the current range of emissions factors used to calculate the emissions associated with generating electricity. In this case, the factors represent grammes of carbon dioxide equivalent associated with the production of one kWh of electricity. A more detailed version summarising the differences in the different factors is provided as in an annex.

GhG Emissions from electricity generated used in various departmental policies

Policy	Emissions (g/kWh CO ₂ e)
EU-ETS	Installation dependent
DECC/Defra Company reporting factors	483
CCA	520
CRC	541
DUKES	443
Fuel Mix Disclosure	430

Details of the different approaches

Methodology and rationale for the various conversion factors are laid out below:

The UK Greenhouse Gas Inventory

Under the UK's international reporting obligations, we are required to produce a greenhouse gas inventory covering all of the UK's anthropogenic emissions sources. Emissions factors are used in the Inventory to calculate overall emissions on a sectoral basis for the UK. The implied emissions factors are published in the Common Reporting Format submitted to the UNFCCC.

Emissions factors for power stations burning fossil fuels are based on their individual returns under the EU Emissions Trading System (EU-ETS), which are considered the best quality data available. The EU-ETS returns are used to calculate installation specific implied emissions factors. These factors are then used to refine the factors in the Greenhouse Gas Inventory.

Further detail on the UK's Greenhouse Gas Inventory can be found here: <http://naei.defra.gov.uk/>

All of the policy areas listed in the rest of this note use factors which are in different ways derived from the greenhouse gas inventory.

EU Emissions Trading Scheme (EU-ETS)

Under the EU Emissions Trading System (EU ETS), power stations and energy-intensive industrial installations, such as, refineries and large manufacturing plants, are required to report their emissions.

Within the EU ETS, installations report depending on the “tiers” listed on their approved monitoring and reporting plan. Installations who report using national factors (tier 2 and 2b reporters) use factors obtained from the UK GHG Inventory. However, some installations, in particular high emitting organisations, are required to derive site specific emissions factors. These site specific factors are used to inform future updates to the GHG Inventory emissions factors, and in turn, subsequent updates to EU-ETS national factors in what is a cyclical annual process.

Further, detailed guidance on the EU-ETS can be found at the following location: <https://www.gov.uk/participating-in-the-eu-ets>

DECC/Defra Conversion Factors for Company Reporting

DECC and Defra jointly publish a series of GhG conversion factors which allow companies to use data such as utility bills, fuel consumption and travel mileage to calculate their organisation's GhG emissions. Defra introduced legislation in June 2013 making it mandatory for some UK listed companies to report on their emissions (<http://www.legislation.gov.uk/ukdsi/2013/9780111540169/contents>). The conversion factors for company reporting are provided as one of the tools available to produce these company reports.

The conversion factors for company reporting are produced from a subset of the emissions factors used in the UK GhGI, as well as other data sources. Electricity factors are aggregated and averaged in order to improve usability for reporting organisations. For electricity emissions factors, a single, in year figure is presented; this is a new development which has replaced the previously presented five year grid rolling average. The conversion factors are presented as emissions on a per kWh generated basis, with a separate factor for transmission and distribution losses. Summing these two factors produces the electricity factor for emissions per kWh consumed.

The factors cover the UK, excluding overseas territories and Crown dependencies and are updated on an annual, calendar years basis.

Further details on the DECC/Defra conversion factors for company reporting can be found here: <https://www.gov.uk/measuring-and-reporting-environmental-impacts-guidance-for-businesses>

Climate Change Agreements (CCAs)

Climate Change Agreements are used to set the terms by which energy intensive organisations can apply for a reduction in the Climate Change Levy (CCL). This reduction in the CCL is available provided companies meet challenging targets for energy efficiency and reduced emissions.

In the first phase of the CCAs, emissions factors remained fixed from the inception of the scheme in 2001. This allowed companies to make informed investment decisions based on the knowledge that emissions savings will be measured in a consistent way. This avoided the risk of changes to the emissions factor impacting on the ease, or difficulty, with which companies met their targets.

For the second phase of the CCA, beginning in 2013, it has been decided that the factors used will be the DECC/Defra conversion factors and will remain fixed for each of the biennial target setting and reporting cycles. For the first reporting cycle this will be the same as the DECC/Defra electricity factor published in 2012. It is also possible for a reporting organisation to request annually updated emissions factors from the Scheme Administrator; the Environment Agency.

Further details on the Climate Change Agreements can be found here: <https://www.gov.uk/government/policies/reducing-demand-for-energy-from-industry-businesses-and-the-public-sector--2/supporting-pages/climate-change-agreements-ccas>

The CRC Energy Efficiency Scheme

The CRC Energy Efficiency Scheme (CRC) requires participants from across the private and public sectors to report their energy use and purchase carbon allowances for their annual energy consumption. The scheme is designed to encourage energy efficiency and emissions reductions in organisations not currently covered by Climate Change Agreements or the EU-ETS. The emissions covered by the scheme comprise approximately 10% of the UK's total greenhouse gas emissions.

For reporting emissions in the first phase of the CRC (April 2010 – March 2013), organisations were required to use the 2008 DECC/Defra company reporting factor for electricity. This was set out in the most recent Source List Tool spread sheet produced by the Environment Agency. The rationale behind this was to provide certainty to participants in the scheme, in the same way as CCA's.

Following consultation on the second phase of the CRC, the decision has now been made to align the CRC factors with the latest DECC/Defra factors for company reporting. The factors will be updated in the summer of each compliance year following the publication of the DECC/Defra factors in each May, beginning with those published in 2014.

Scope will be in line with the DECC/Defra conversion factors.

Further details on the previous and new CRC schemes can be found here: <https://www.gov.uk/crc-energy-efficiency-scheme>

Digest of UK Energy Statistics (DUKES)

The Digest of UK Energy Statistics (DUKES) is a long running series (>60 years), providing a comprehensive set of energy statistics for the UK. Although the vast majority of the publication is concerned with statistics on the production and use of energy, including electricity, DUKES also provides some broad level emissions factors for electricity generation. These factors are shown in Table 5A.

The emissions factors are produced on a calendar year basis and are for single years, as opposed to multiyear rolling averages. This difference in methodology is the principle source of variation in values between DUKES and the DECC/Defra conversion factors. The emissions factor for the year n-2 are calculated using the most recent DECC/Defra factors on a gross calorific value basis and then adjusted for the single calendar year and geographical coverage of DUKES, which is UK only. In order to calculate the most recent provisional figures, for year n-1, the preceding year's emissions factors are scaled by the most recent set of generators' fuel use data (from March Energy Trends Table 5.1).

The fuel use data presented in DUKES are used to inform emissions estimates in the UK Greenhouse Gas Inventory.

The latest edition of DUKES is published here:

<https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/digest-of-uk-energy-statistics-dukes>

The latest Energy Trends statistics are available here:

<https://www.gov.uk/government/publications/electricity-section-5-energy-trends>

Fuel Mix Disclosure (FMD)

Under the Electricity (Fuel Mix Disclosure) Regulations 2005, electricity suppliers are obliged to provide information to their customers on the mix of fuels used to produce their electricity as well as the associated environmental impact. Reports are sent to Ofgem in October of each year, covering the previous April to March period.

Emissions figures are produced on a financial year basis covering Great Britain only (i.e. not including NI, which generates a higher proportion of its electricity from carbon intensive fuels). Emission from Crown Dependencies are included. The Fuel Mix Disclosure data tables use the latest UK Greenhouse Gas Inventory emissions factors. Emissions are then scaled by the most recent Energy Trends publication (Table 5.1 in Energy Trends) to produce the emissions for the reported year. The FMD values only contain carbon dioxide (CO₂) emissions; methane (CH₄) and nitrous oxide (N₂O) are not considered. Figures are also rounded to the nearest 10 in order to reflect uncertainty in the data; this is not the case in the other policy areas. FMD data also include auto-generators which other factors such as the DECC/Defra factors currently do not. The emission factors are single year figures (not rolling averages) and are updated each year to better reflect the actual emissions from the latest UK energy mix.

The latest information on the FMD can be found at the following location:

<https://www.gov.uk/government/organisations/department-of-energy-climate-change/series/fuel-mix-disclosure-data-tables>

In July 2013 Ofgem initiated a review of the FMD. Further details of this review, including its outcomes will become available in due course.

GhG Emissions from electricity generation used in various UK Government policy areas (g/kWh CO2e)

	EUETS Phase III	Conversion Factors for Company Reporting (Decc/Defra)				CCA	CRC		DUKES 2012 (Table 5A)			Fuel Mix Disclosure (2012)	
	2013 - 2020	Direct Emissions (generated)	All Emissions (generated)	Direct Emissions (consumed)	All Emissions (consumed)	Response to consultation	CURRENT Source list tool	PROPOSED from 2014/15					
Last updated	2013	2013				2013	2008		2012			2012	
Year of Factor		2011	2011	2011	2011	2013-2023	2008		2009	2010	2011*	2011/12	
Coal	National factors are the same as the UK GhG Inventory.Tier 3 factors are bespoke to each installation.	-	-	-	-	-	-	Will be in line with Decc/Defra factors published in 2014	910	908	912	910	
Natural Gas		-	-	-	-	-	-		403	394	392	390	
Nuclear		-	-	-	-	-	-		-	-	-	-	0
Renewables		0	0	0	0	-	-		-	-	-	-	0
Other		-	-	-	-	-	-		-	-	-	-	540
Overall Average		-	-	-	-	-	-		-	-	-	-	430
All Fossil Fuels		-	-	-	-	-	-		-	592	586	609	-
All Fuels (inc. Nuclear & renewables)		445	515	483	559	547	541	449	456	443	-		
Methodology† and coverage	Details on Tier 2 and 2a factors can be found here: https://www.gov.uk/participating-in-the-eu-ets	Calendar year UK All GhGs but available disaggregated				Calendar year UK All GhGs	Calendar year UK All GhGs	Calendar year UK All GhGs	Calendar year UK All GhGs			Fiscal year GB and CDs CO2 only	
Time frame		YES (From 2013)				NO	NO	Yes	YES			YES	
Geographical coverage		Annually				Fixed biannual	Fixed	Annually	Annually			Annually	
Gases		Single year (from 2013)				5 Year average	Single year	Single year	Single year			Single year	
Autogeneration included		Default will not include T&D losses but can be manually added						Will inc. T&D losses	Does not inc. T&D			Does not inc. T&D	

*Provisional figures

† Refers to EF methodology, not reporting methodology

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URN: 13D/196