

Note 04d: Measuring fuel to your generators

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Introduction

Data Centres use standby generators to provide emergency power in the event of mains grid failure. Generators tend to be test fired on average once a month (for around an hour). Consequently fuel use is low: on-site generated electricity averages 0.14% of total energy use in data centres. However, generator fuel consumption has to be reported by CCA participants and some sites also have to report under EU ETS if the generating capacity is large enough (see our separate guidance).

Measuring very small volumes of fuel has proved problematic and time consuming. (Consider filling the bath, letting out a tiny amount of water and then working out how much is left). Meters are not the obvious solution.

We held a workshop on 29th January 2016 with the ETS and CCA regulators, with the CCA technical helpdesk, data centre operators and energy consultants to define an approach that would be robust and compliant but not too burdensome. At this workshop it was agreed that, in view of the small volumes concerned, fuel use by standby generators for data centres does not have to be measured: For CCA it can be estimated or calculated provided that the approach is consistent and traceable. For ETS it can also be estimated or calculated depending on the emissions threshold.

The following approach for accounting for fuel use by generators has been approved by the Regulator for both CCA and ETS. Once fuel use has been established, however, the reporting procedures diverge because CCA reporting is in KWh and ETS reporting is in tonnes CO₂. These are explained below for good measure.

A document set from the workshop is available. It includes the agenda, previous approaches, CCA regulator recommendations, meeting notes and points of agreement. A ready reckoner spreadsheet is also available to assist you in your calculations.

Basic principles

- 1. CCA participants and ETS participants emitting below 1000 tonnes CO₂ per annum are not obliged to measure fuel consumption. They can use estimates and calculations based on generator run times, load and capacity.**
- 2. ETS participants emitting between 1000 tonnes and 25,000 tonnes CO₂ per annum need to add further evidence from fuel invoices.**
- 3. Information needs to be logged and auditable. Operators need to explain why they have applied a particular methodology.**
- 4. The factor used by ETS participants for converting fuel litres to tonnes can be found in DUKES (See table below) but standard factors may be accepted with adequate justification.**
- 5. For ETS participants, data must be independently verified.**

Measuring fuel consumed by standby generators: detailed guidance

STEP 1: (ETS only) check your emission threshold

NB: CCA participants who are NOT in ETS should skip this step.

Firstly you need to confirm that your emissions threshold is below 1000 tonnes CO₂. Most data centre emissions are below 100 tonnes and you would need to have suffered a significant mains outage or do a lot of STOR to be anywhere near this threshold. As a rule of thumb you would have to:

- Run five 4MW generators at 50% load constantly for ten days or
- Consume more than 350,000 litres of gasoil in a year (1000 litres produces about 2.7TCO₂)

You can double check with the [Ready reckoner](#).

If, as is very likely, your emissions are below 1000 tonnes then the following approach will allow you to be compliant with both ETS and CCA. If you are in ETS and your emissions are above 1000 tonnes but below 25,000 tonnes CO₂ then fuel invoices would be required as the primary method for deriving fuel use. The calculation could be used as a sense check.

STEP 2: Calculate or estimate your emissions

Emissions are a factor of the type and quantity of fuel, the calorific value of the fuel, a conversion factor and an oxidation factor. A series of calculations turns the fuel into CO₂ emissions. For CCAs you only need to report in KWh so you don't need to do the full set of calculations. For ETS you need to go the whole hog and report in tonnes CO₂.

For most operators the trickiest thing is working out how many litres of fuel have been consumed. To get the quantity of fuel you need to know the run time of the generator, the load and the capacity. Alternatively you can use a fuel meter but you will need to ensure that it is calibrated and correctly positioned. Our [Ready Reckoner](#), kindly prepared by Prof. Ian Bitterlin, estimates your fuel consumption based on run time, load and capacity.

The subsequent calculations are more straightforward and the steps you need to take to report emissions in line with EUETS are set out in [Table 1](#) below, and in the [Annexe](#), which guides you through the ETSWAP pages. The [Ready Reckoner](#) does these calculations too but is calculated using factors valid in 2016 which might not remain the same in future years.

STEP 3: Ensure you have

- a) A clear justification for the route you have taken, for example if you have calculated rather than measured your consumption of generator fuel because emissions from burning generator fuel are minimal (well under the 1000t threshold) and calculating from generator characteristics will provide a more consistent approach to measuring consumption than readings from tank fuel gauges.
- b) An audit trail (ie you have retained documentation providing a record of:
 - Generator specifications (manuals and /or photographs of the plates)
 - Load
 - Run time
 - dates,
 - times and
 - duration

STEP 4: Validate if necessary and submit

For CCA you just need to submit the data on your reporting template.

For ETS participants you need to have your data externally verified.

Table 1

Factor	Value	What is it	Example
Litres of fuel	Use the Ready reckoner	This is a function of run time, generator capacity and load	1000 litres
Calorific Value (CV)	10.9 (CV for gasoil)	This is the factor that converts the fuel into kWh.	10900 kWh This is the figure you report for CCA
Tonnes of Fuel	Varies each year, currently 1172 (litres per tonne) NB for low emissions the EA would consider accepting a standard factor if an acceptable one were proposed.	This factor converts litres of fuel into tonnes of fuel. It is published in the Digest of UK Energy Statistics (DUKES) https://www.gov.uk/government/statistics/digest-of-united-kingdom-energy-statistics-dukes-2015-printed-version (pg. 233 in this version)	1000 litres / 1172 = 0.85 tonnes
In reality you can stop at this point for ETS as well as ETSWAP* will do the rest of the calculations. However, these are included below for good measure.			
Net Calorific Value (NCV) NB: This factor is pre-populated in ETSWAP, just select the correct fuel from the drop down lists.	Varies each year, currently 43 GJ/tonne	This is taken from the national inventory data available here: https://www.gov.uk/guidance/participating-in-the-eu-ets under the heading: <i>Using UK greenhouse gas inventory data in EU ETS monitoring and reporting: the country-specific factor list</i>	0.85 Tonnes * 43 = 36.55 GJ
Emissions Factor (EF)	Varies each year, currently 74.1 TJ / tonne NB This factor is pre-populated in ETSWAP, just select the correct fuel from the drop down lists.	This is taken from the national inventory data available here: https://www.gov.uk/guidance/participating-in-the-eu-ets under the heading: <i>Using UK greenhouse gas inventory data in EU ETS monitoring and reporting: the country-specific factor list</i>	36.55 GJ * 74.1 / 1000 (GJ/TJ) = 2.7 Tonnes CO ₂
Oxidation factor (EU ETS) or Primary energy factor (CCA)	1	EU ETS uses an oxidation factor that measures the % of carbon oxidised during combustion. CCAs use calculations based on primary energy. Both gas oil and fuel oil have oxidation and primary energy factors of 1	2.7*1 = 2.7 Tonnes CO ₂
Full Calculation		Tonnes CO ₂ * NCV * EF * OxF	2.7 TCO₂ This is what you report for ETS

*See [Annexe](#) for ETSWAP process.

Contacts and Links

For CCA queries:

techUK CCA helpdesk:

Email: techUK@slrconsulting.com

Tel: +44 (0)844 800 1880

Don't forget that there is a [directory of CCA related guidance materials](#) freely available on the techUK website (scroll down below the main description to the links)

For ETS queries

We have a number of basic guidance materials on EUETS, but these are not intended to be a substitute for the formal guidance provided by government and the EA's ETS helpdesk should be your first port of call for technical enquiries.

[techUK Data Centres Council Communication on ETS](#)

[techUK guidance note on CCA, ETS and CRC](#)

[techUK briefing on ETS – inclusion criteria](#)

[techUK ETS Group](#)

[Compliance Roadmap: understanding regulatory obligations for data centre combustion plant](#)

Environment Agency ETS helpdesk: ethelp@environment-agency.gov.uk

Either visit the ETS website: <https://euets.environment-agency.gov.uk> (predicated around registering a new facility)

Or visit gov.uk website: <https://www.gov.uk/guidance/participating-in-the-eu-ets> (generic information about the scheme)

For general or policy related queries regarding data centres

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Annexe: How to report emissions in ETSWAP

* Activity Data

0.85

1) Insert tonnes of fuel here.

Emissions Calculation Data

For the Source Stream and Source Stream Type chosen above please complete the relevant fields below, the tCO₂ emitted for the source stream will be calculated automatically based upon the data entered. **The fields below become editable depending upon the Source Stream Type selected above (e.g. Commercial standard fuels, Other gaseous & liquid fuels etc).**

The Calculated tCO₂ eq. emissions and Calculated tCO₂ eq. emissions from biomass figures will only be displayed when a Source Stream Type has been selected and **consistent** units have been selected for the mandatory fields.

For example, if Activity Data and (prelim) Emission Factor are the only mandatory fields, then units of Tonnes for Activity Data and tCO₂/Tonne for (prelim) Emission Factor would be **consistent** and the calculated emissions fields would be shown. Whereas, if Tonnes for Activity Data and tCO₂Nm³ for (prelim) Emission Factor were selected, the units would be **inconsistent** and the calculated emissions fields would not be shown.

Note: If you wish to use the UK Greenhouse Gas National Inventory figures in your calculations, you should set the 'Tier Used' values for Net Calorific Value (NCV) to Tier 2a and Emission Factor (EF) to Tier 2 or Tier 2a. The Tier Used and Units for Activity Data and the Tier Used for Oxidation Factor must also be specified. Selecting these values will display a button below that will allow you to use UK Greenhouse Gas National Inventory figures for NCV and EF instead of entering this data manually.

3) Select the units here

Parameter	Tier Applied	Tier Used	Value	Units
Activity Data	No tier	* No Tier	0.85	* Tonnes
(prelim) Emission Factor	2a	* Tier 2a	*	* tCO ₂ /TJ
Net calorific value	2a	* Tier 2a	*	* GJ/Tonne
Oxidation factor	1	* Tier 1	* 1	N/A

* Tiers Valid From

1 January Year 2015 23

* Tiers Valid Until

31 December Year 2015 23

* Use UK Greenhouse Gas National Inventory figures?

☒ Yes ☐ No ?

4) Select "yes"

Please note that to use this functionality, you must have specified the Activity Data

Find data from UK National Inventory Figures

5) Click this

Note: You will need to insert the "Tier Used" and the "Units" before this box appears.

Calculated tCO₂ eq. emissions

0 ?

Calculated tCO₂ eq. emissions from biomass

0 ?

* Do you disagree with the calculated emissions figure and want to provide your own figure?

☐ Yes ☒ No

UK Greenhouse Gas Inventory Data

* Select the data set to use

☒ National Emission Factors/Calorific Values for other fuel types
☐ Regional Emission Factors/Calorific Values for Natural Gas

6) Select national factors

National Emission Factors/Calorific Values for other fuel types

Data for Emission Factor and Net Calorific Value is grouped by IPCC Sector and UK GHG fuel. First select an IPCC Sector from the drop down list then click the 'Get fuels for selected IPCC Sector' button. This will get the relevant fuels and populate a second drop down list. Similarly select a fuel then click the 'Get EF and NCV for selected fuel' button. This will allow Activity Data to then be entered and the Emissions will calculate automatically.

You can obtain Emission Factors and Net Calorific Values from the latest UK National Inventory using the drop down lists and buttons below. The data are grouped by IPCC Sector and then by fuel type.

First select the IPCC Sector which best matches your main activity from the drop down list and then click the 'Get fuels for selected IPCC Sector' button. (This will search for the fuel types specific to that sector and populate these in a second drop down list.)

Next select the fuel type which best matches the fuel you are using and then click the 'Get EF and NCV for selected fuel' button.

Emissions will be calculated automatically using the emission factors, net calorific values and oxidation factors for the selected fuel type and IPCC sector. (Please note that the factors for the same fuel type may vary between different IPCC sectors.)

It may be necessary in some cases to select a different IPCC sector in order to locate the fuel type which best matches the fuel you use. You can view a complete list of the IPCC sectors and fuel types from the DECC website at the following link: <https://www.gov.uk/participating-in-the-eu-ets>

* IPCC Sector

1(A)1(a) Public Electricity & Heat Production

Get fuels for selected IPCC Sector

7) Select Public electricity and heat production

* UK GHG fuel

Gas Oil

Get EF and NCV for selected fuel

8) Select Gas Oil

	Value	Units
Activity Data	0.85	Tonnes
Emission Factor	74.148687951546194	tCO ₂ /TJ
NCV	43.021664821427	GJ/Tonne
Oxidation Factor	1	N/A
Emissions	2.7115	tCO ₂

9) Emissions are shown here

OK Cancel