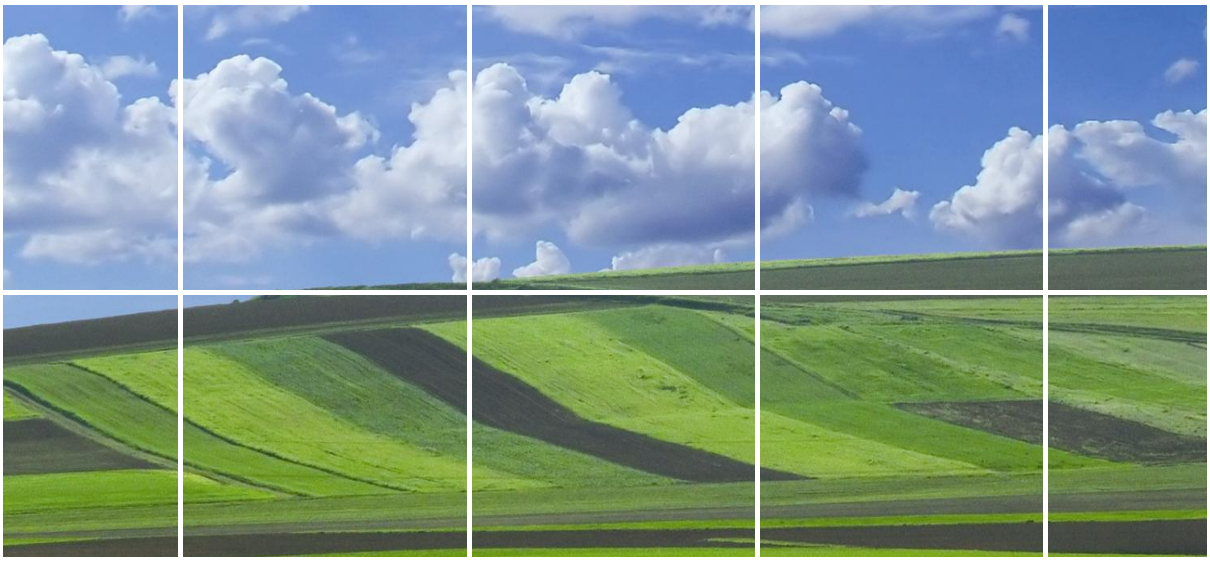
AEA

2009 EUETS Data Analysis for the UK GHGI

Task 2 of the 2010 UK / DA GHG Inventory Improvement Programme



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Executive Summary

This report summarises the analysis of the 2009 European Union Emissions Trading System (EUETS) energy and emissions data that is used within the compilation of the UK GHG inventory. The EUETS data are used to inform activity data estimates for heavy industry sectors, carbon dioxide emission factors of UK fuels within those sectors, and for comparison of fuel allocations to specific economic sectors against data presented in the *Digest of UK Energy Statistics* (DUKES), published by the Department of Energy and Climate Change (DECC).

This analysis has been conducted as part of the 2010 UK / DA GHG Improvement Programme, and will also provide input data that are used to inform the inventory estimates for the Devolved Administrations (DA) and Local Authority (LA) carbon dioxide estimates.

The analysis of the 2009 EUETS data seeks to:

- improve emission estimates across the highly energy intensive sources through the use of verified data and up to date fuel compositional analysis for source sectors such as power stations and refineries;
- ensure that GHG inventory data are accurate and consistent with EUETS as far as is practicable, and identify activity data inconsistencies between EUETS and DUKES, seeking to resolve these through consultation with DECC where possible;
- derive estimates of traded (within EUETS) and non-traded (outside of EUETS) GHG emissions in the UK, to support policy development using the National Communication and IPCC sector formats.

The full details of the research have been provided to the DECC DUKES team of energy statisticians, to highlight the sources where EUETS data appears to be inconsistent with current national energy statistics; the analysis is being quality-checked and considered for use within the compilation of DUKES 2011.

The key findings from this research include:

- In the 2009 EUETS dataset, a very high coverage of Tier 3 emissions data is evident for all fuel use in the power sector, as well as for coal autogeneration, coal use in the lime sector, and refinery fuel oil and OPG use. All of the fuel quality data for these sources and fuels are therefore used within the UK GHGI, as the EUETS fuel quality data is the most representative dataset available to inform UK carbon dioxide emission factors in the inventory;
- EUETS emissions data for petcoke use in refineries has been compared against DUKES activity data. Consultation with DECC energy statisticians has identified that the figures given in DUKES are subject to considerable uncertainty and, as a result, the EUETS data have been used instead within the UK GHGI;
- EUETS-derived emission factors from 2009 for colliery methane and OPG (at refineries) have been applied to all sources using those fuels;
- Allocations of OPG use within refinery and other industry sectors derived from EUETS are not consistent with data within DUKES. The allocation of data from EUETS to DUKES fuel categories is somewhat uncertain for OPG due to the wide range of fuel nomenclature reported with EUETS. The analysis and subsequent consultation with DECC DUKES has helped to identify site-specific issues of mis-reporting that are being resolved;

Several of the main data discrepancies at UK level pertaining to differences in reported fuel use by sector compared to DUKES will be taken forward in meetings with the DECC DUKES team, during 2011, aiming to clarify the key DUKES revisions that may be possible based on this analysis. The main fuels where such discussions are ongoing are: OPG, coke and petroleum coke.

The estimation of the traded and non-traded share of UK emissions for 2009 indicates that of the total carbon dioxide emissions in the UK, 52% are non-traded. Further work may be needed to revise and improve the reporting of the traded / non-traded split, depending on the format that is decided upon as most useful for reporting across DECC.

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1 Background

The European Union Emissions Trading System (EUETS) data provides annual estimates of fuel use and fuel quality data from the most energy intensive sites in the UK, and provides a source of data that can be used to cross-check data held in the UK Greenhouse Gas Inventory (GHGI), and to inform the carbon contents of current UK fuels. The EUETS has operated since 2005, and there are now 5 years' worth of data on fuel use and emissions across major UK industrial plant, for 2005-2009.

The data reported under the EUETS includes quantities of fuels consumed, carbon contents, calorific values and emissions of carbon dioxide, all presented by installation and by emission source. Data for individual installations are treated as commercially confidential by the UK regulatory authorities and so only aggregated emissions data are reported in inventory outputs.

1.1 Consistency between EUETS and GHG Inventory

As part of the UK's annual reporting requirements to the EUMM and UNFCCC, the UK must include a comparison of the EUETS data against the national inventory dataset within the National Inventory Report, which will be published on 15th April 2011. Furthermore, the analysis of the inventory against the EUETS dataset is coming under increasing scrutiny due to the development of domestic GHG reduction targets that are based on non-traded[1] emissions data only, and the growing need to understand the UK non-traded sector emissions for future reporting under the Effort Sharing Decision.

In the 1990-2009 inventory cycle, the inventory agency team has updated and extended the EUETS analysis conducted for inventory compilation, using the 2009 EUETS dataset. The main findings are reported within the National Inventory Report (NIR), and this short report also summarises progress. The full analysis of the Devolved Administration (DA) -specific traded and non-traded data has not yet been completed, as that analysis is done in conjunction with the ongoing DA GHG inventory compilation, although some of the UK-wide data processing covered here will feed into the DA analysis, and the underlying issues of data consistency between EUETS and UK energy statistics (e.g. sector allocations of fuel use that may differ between EUETS and DUKES) are also of interest to the DAs, as these reporting inconsistencies affect the sub-national analysis of sector emission energy and emission estimates.

1.2 EUETS Data in UK and DA GHG Inventory Compilation

The main aim of the EUETS analysis reported here is to analyse EUETS 2009 data to assess its usefulness as a quality check for sector-specific fuel use (i.e. comparing EUETS fuel totals against reported national sector energy statistics within DUKES) and to inform sector-specific, fuel-specific carbon emission factors. The outputs from this analysis comprise:

- improved emission estimates across the highly energy intensive sources (at UK and DA level) through the use of verified data and up to date fuel compositional analysis for several source sectors such as power stations and refineries;
- ensuring that inventory data are accurate and consistent with EUETS as far as is practicable, and identify activity data inconsistencies between EUETS and DUKES, seeking to resolve these through consultation with DECC where possible. (This aspect of the work is likely to become ever-more important as the demands of reporting accurately under the Effort Sharing Decision evolve);
- derivation of an estimated traded/ non-traded split for the UK, to support policy development using the National Communication and IPCC sector formats;

As noted above, the analysis focussing at DA-level is to be progressed in the coming months, alongside the compilation of the DA GHG inventories, and will be reported in the DA GHG Inventory report to be published in summer 2011, although the findings at UK will also impact on the DA analysis.

[1] All GHG emissions that are regulated within the EUETS are defined as "traded" emissions, whilst all other GHG emissions are defined as "non-traded". The EU Effort Sharing Decision will lead to the UK adopting a new target for GHG reductions by 2020 for all of the non-traded emissions (i.e. everything outside of EUETS), and progress towards this target will be monitored through the UK GHG inventory.

2 Data Processing

DECC provided the detailed EUETS regulator data from the Environment Agency, Scottish Environment Protection Agency and Northern Ireland Environment Agency during late summer 2010, and the AEA team of industrial emissions analysts have progressed the analysis, combining the datasets to generate a UK-wide EUETS dataset. This work builds on analysis conducted in previous years, as the EUETS has been in place since 2005, so there are now 5 annual datasets of energy and emissions data.

The initial steps in the analysis require the identification of new sites in the 2009 dataset and allocation of those sites to align with economic sectors as reported within the DUKES Commodity Balance tables. There were very few new sites within the 2009 dataset.

Building on the previous years' analysis, the next step is to allocate the reported fuel names for every UK installation to one of the GHGI fuel names, which are also aligned with the fuel types reported within DUKES. This enables a direct comparison of EUETS fuel totals against sector fuel allocations within DUKES and therefore sued within the GHGI.

This is a resource-intensive process, and there are expert judgements that need to be made to assess the data from operators and determine which fuel type is the most appropriate. The allocation of fuels to GHGI categories is, occasionally, quite uncertain. The uncertainties largely centre on the allocation of fuels to GHGI fuel categories such as LPG, OPG, gas oil and fuel oil, and are due to the use of abbreviations or other ambiguous names for fuels within the EUETS reporting system.

The AEA team uses the reported EUETS fuel names as well as the reported fuel quality data such as calorific values and carbon emission factors in order to make best estimates for all fuel use entries in the EUETS spreadsheets. Assumptions from previous years are taken into consideration. This quality checking and allocation process is an open-ended task for such a large dataset, and hence the AEA team focuses on the highest emitters and the known "problem" sites and fuel types. Where uncertainties arise in allocations, the most important allocation decisions are copied across to the DECC DUKES team, for their information and input, as ultimately the EUETS analysis by the AEA team is taken into account to some degree within the compilation of DUKES for the following year.

As a data verification step, the installation emissions (broken down by fuel) from the EUETS regulator spreadsheets are then compared against the total installation emissions for 2009 on the Community Installation Transaction Log (CITL) which is a central website that holds the verified EUETS emissions totals for all EU installations in the scheme. Each year we have noted that for some sites the regulator data does not match the CITL dataset, and therefore some "residual" emissions allocations are generated, from the difference between CITL and regulator information. These instances are then fed back to the regulator contacts, for their consideration and to request any insights into the likely fuels that the residual emissions should be allocated against.

The range of assumptions in these allocation decisions (of sites to sectors, EUETS fuels to GHGI fuel types, and residuals to GHGI fuel types) does introduce uncertainty to the "finalised" EUETS dataset that AEA then takes forward into the core inventory compilation process.

The AEA team then totals the fuel data by sector, and conducts comparisons against reported emissions data within DUKES, to identify where data inconsistencies are evident. The most significant data discrepancies are then discussed with the appropriate DUKES chapter editors, to determine where the EUETS data indicates that DUKES data may be revised in future editions.

Finally, once the UK GHG inventory is compiled and reported, the UK emission totals by sector are compared against the EUETS sector totals, in order to generate an estimated UK traded / non-traded split for carbon dioxide emissions. The format of this traded / non-traded analysis is under development through consultation with the DECC CESA team, as the usefulness of the analysis for consideration in policy reporting outputs and Carbon Budgets analysis continues to evolve. In this report we present the data using an "expanded" National Communication format with some additional IPCC format, but this is expected to evolve further, and the data presentation within the DA GHGI report may differ from that presented here.

3 Summary of Findings

3.1 Use of EUETS data in the GHGI

From the 2008 EUETS dataset onwards, all historic plant opt-outs (under the UK Emissions Trading Scheme and Climate Change Agreements) have ceased, and a more complete picture of fuel use and emissions across heavy industry in the UK is available. However, emissions from smaller combustion units in the industrial, commercial and public sectors are not reported, as they are outside the scope of EUETS, and this limits how much of the EUETS data can be used to cross-check and directly inform the GHGI. However, from the 2008 dataset onwards, 100% of sector emissions should be covered for several major industrial sectors:

- Power stations;
- Oil refineries;
- Coke ovens & Integrated steelworks;
- Cement and lime kilns.

In the case of coke ovens and integrated steelworks, the EUETS reporting format does not provide a breakdown of emissions for the sectors reported within the GHGI: estimates of emissions from coke ovens, blast furnaces and sinter plants are not provided explicitly. In addition, the scope of reporting of EUETS does not cover 100% of iron & steel sites or activities, as some secondary steel processes are excluded from the scope of EUETS reporting. These factors make the analysis and comparison of the EUETS and the GHGI estimates much more uncertain for these sectors. The EUETS data has, however, been useful as a quality check for the use of fuels within the iron and steel sector. This section summarises what data are available in the 2005 to 2009 EUETS datasets for power stations and refineries, and identifies which EUETS fuel quality data (i.e. carbon dioxide emission factors) have been used within the GHGI.

3.1.1 Coverage of Installations within EUETS

The level of coverage of the EUETS data can be seen in table 3.1.1 below. The number of sites in each sector which are included in the ETS dataset for 2005 and 2009 are given, together with AEA's estimate of the total number of installations in that sector throughout the UK in those years.

Table 3.1.1 Numbers of installations included in the EUETS data

Sector	Number of installations			
	2005		2009	
	EUETS	UK total	EUETS	UK total
Power stations (fossil fuel, > 75MWe)	60	60	62	62
Power stations (fossil fuel, < 75MWe)	23	27	24	29
Power stations (nuclear)	12	12	10	10
Coke ovens	4	4	4	4
Sinter plant	3	3	3	3
Blast furnaces	3	3	3	3
Cement kilns	8	15	13	13
Lime kilns	4	17	13	15
Refineries	12	12	12	12
Combustion – iron & steel industry	11	200[a]	12	200[a]
Combustion – other industry	171	5000[a]	379	5000[a]
Combustion – commercial sector	28	1000[a]	33	1000[a]
Combustion – public sector	169	1000[a]	120	1000[a]

[a] These estimates are 'order of magnitude' figures, to show that the number of installations in the UK is likely to be considerably higher than the number of installations reporting in the EUETS.

Data are included in EUETS for all coke ovens, refineries, sinter plant and blast furnaces. Power stations are divided into three categories in the table in order to show that, although eight stations are not included in the EUETS data, these are all small (in most cases, very small diesel-fired plant supplying electricity to Scottish islands). In comparison, coverage is quite poor in 2005 for cement and lime kilns (due to CCA participants opting out) and for combustion processes (due to CCA/UKETS opt-outs and the fact that numerous combustion plant are too small to be required to join the EUETS). All cement kilns are included in 2009 and all but two lime kilns, which are excluded.

3.1.2 Power Station EUETS Data

Table 3.1.2 below summarises data given in the EUETS datasets for the major fuels burnt by major power stations and coal burnt by autogenerators. The percentage of emissions that are based on use of Tier 3 emission factors is given (tier 3 factors are based on fuel analysis, and are therefore more reliable than emission factors based on default values). The table then gives the average emission factor for all EUETS emissions that were based on use of the Tier 3 factors.

Table 3.1.2 EUETS data for Fuels used at Power Stations and Autogenerators (Emission Factors in ktonne / Mtonne for Coal & Fuel Oil and ktonne / Mtherm for Gases)

Year	Fuel	% Tier 3	Average Carbon Emission Factor (Tier 3 sites only)
2005	Coal	99	615.6
2006		100	615.6
2007		100	615.4
2008		100	614.0
2009		100	610.5
2005	Fuel oil / Waste oil[a]	59	860.2
2006		66	873.3
2007		70	871.2
2008		92	869.5
2009		97	872.7
2005	Natural gas	52	1.443
2006		76	1.465
2007		95	1.464
2008		97	1.467
2009		100	1.464
2005	Sour gas	100	-[b]
2006		100	-[b]
2007		100	-[b]
2008		-	n.a.
2009		100	-[b]
2005	Coal - autogenerators	100	594.3
2006		100	596.3
2007		100	594.5
2008		100	581.3
2009		100	600.6

[a] It is not possible to distinguish between fuel oil and waste oil in the EUETS data, so all emissions have been reported under fuel oil.

[b] Emission factors can be calculated for 2005-2007 and for 2009, but are based on data for a limited number of sites and are therefore confidential.

The EUETS data shown are regarded as good quality data, since a high proportion of emissions are based on Tier 3 emission factors (i.e. verified emissions based on fuel analysis to ISO17025). The EUETS based emission factors presented above have therefore been used directly as the emission factors in the GHGI, with the exception of the 2005 figure for gas, where Tier 3 factors were only used for about half of the sector's emissions. Small quantities of sour gas were burnt at one power station in 2005-2007 and 2009 and EUETS Tier 3 emission factors are available and therefore used. Due to the confidentiality of the data, the emission factors are not shown.

3.1.3 Refinery EUETS Data

Tables 3.1.3a and 3.1.3b below summarises data given in the EUETS datasets for the major fuels burnt by refineries in the UK.

The main fuels in refineries are fuel oil and OPG and emissions also occur due to the burning off of 'petroleum coke' deposits on catalysts used in processes such as catalytic cracking. In the latter case, emissions in the EUETS are not generally based on activity data and emission factors but are instead based on direct measurement of carbon emitted. This is due to the technical difficulty in measuring the quantity of petroleum coke burnt and the carbon content.

Table 3.1.3b also shows the carbon emission that would be obtained if the previous inventory method were being used. This involves the use of petroleum coke consumption data from UK energy statistics (DECC, 2010) and an emission factor of 930 kt C / Mt petroleum coke taken from Baggott *et al*, 2004.

Table 3.1.3a EUETS Data for Fuel Oil & OPG burnt at Refineries (Emission Factors in ktonne / Mtonne for Fuel Oil and ktonne / Mtherm for OPG)

Year	Fuel	% Tier 3	Average Carbon Emission Factor (Tier 3 sites only)
2005	Fuel Oil	25	861.0
2006		65	873.9
2007		79	877.4
2008		91	871.6
2009		91	876.2
2005	OPG	60	1.495
2006		58	1.469
2007		58	1.511
2008		82	1.483
2009		81	1.489

Table 3.1.3b EUETS Derived Data for Carbon Emissions from Petroleum Coke burnt at Refineries (in Mtonnes)

Year	Fuel	% Tier 3	Emission from EUETS	Emission, based on DUKES[b]
2005	Petroleum Coke	-[a]	1.273	1.123
2006		-[a]	1.338	1.263
2007		-[a]	1.350	1.300
2008		-[a]	1.282	1.271
2009		-[a]	1.263	1.311

[a] It was unclear from the data received how much of the emission was based on a Tier 3 approach.

[b] Using an emission factor of 930 kt/Mt of petroleum coke burnt (figure suggested by the refinery industry).

Emission factors for **fuel oil** generated from EUETS data have been adopted in the GHGI, with the exception of data for 2005, where Tier 3 methods were used for only 25% of fuel.

Carbon factors can be derived for **OPG** based on moderate levels of Tier 3 reporting for 2005-2007, but levels of more than 80% for 2008 onwards. There is some uncertainty regarding the allocation of EUETS fuels to the OPG fuel category, and the derived emission factors for 2006 and 2007 are significantly different to the values for 2005 and 2008-2009. For these reasons, only the data for 2008 – 2009 are used. For earlier years, the mean of the 2008 and 2009 figures is used.

Emission data for **petroleum coke** are higher in 2005-2008 than would be obtained using DUKES activity data, and an appropriate emission factor, and lower in 2009. This is especially noticeable for 2005, where the petroleum coke consumption given in DUKES would have to be more than 100% carbon in order to generate the carbon emissions given in the EUETS. Consultation with DECC energy statisticians has identified that the figures given in DUKES are subject to considerable uncertainty and, as a result, the EUETS data have been used instead within the UK GHGI.

3.1.4 Other Industrial Combustion EUETS Data

Table 3.1.4 below summarises data given in the EUETS datasets for coal, fuel oil and natural gas used by industrial combustion installations.

At first sight, the data for coal looks like it should be reliable enough to be used in the GHGI with 91% or more of emissions based on Tier 3 factors in each year. However, it must be recalled that numerous smaller industrial consumers will not be represented in EUETS and that the EUETS data are not fully representative of UK fuels as a whole. This is also true for EUETS data for fuel oil and natural gas but here, in addition, very little of the EUETS data are based on Tier 3 factors. Therefore, none of these data have been used directly in the compilation of the GHGI estimates.

Data for coal burnt in lime kilns are available for 2007 onwards, although in 2007 only 50% of the data was based on Tier 3 reporting, and hence these data have been disregarded. However, in 2008 the level of Tier 3 analysis of coal in the lime sector within EUETS increases to 81%, with 100% Tier 3 reporting in 2009, and therefore these operator data have been used directly to inform GHGI estimates in those years.

Table 3.1.4 EUETS data for Coal, Fuel Oil and Natural Gas used by Industrial Combustion Plant (Emission Factors in ktonne / Mtonne for Coal & Fuel Oil and ktonne / Mtherm for Natural Gas)

Year	Fuel	% Tier 3	Average Carbon Emission Factor (Tier 3 sites only)	GHGI Carbon Emission Factor
2005	Coal	98	607.1	631.1
2006		98	603.0	631.1
2007		99	613.5	645.4
2008		94	596.8	640.6
2009		91	595.7	652.5
2005	Fuel oil	17	864.7	879.0
2006		27	865.3	879.0
2007		20	865.7	879.0
2008		18	870.7	879.0
2009		30	867.8	879.0
2005	Natural gas	13	1.593	1.478
2006		32	1.449	1.478
2007		43	1.469	1.477
2008		35	1.504	1.474
2009		44	1.496	1.474

Emission factors can also be derived from EUETS where a high percentage of Tier 3 analysis is evident, for a number of other minor fuels. Due to the very low number of sites that report data for each fuel type, these EUETS-derived emission factors are confidential and are not tabulated here. The source/activity combinations for which EUETS emission factor data are used within the inventory are:

- Lime kilns / coal
- Other industrial combustion / petroleum coke
- Other industrial combustion / waste solvents
- Other industrial combustion / colliery methane

The EUETS-derived emission factors for colliery methane for each year (2005-9), and emission factors for OPG burnt at refineries (just for 2008-9 where there is a high percentage of Tier 3 reporting), are also applied to all other sources using these fuels.

3.1.5 Cement Sector Process Emissions Data in EUETS

The EUETS dataset also provides a detailed breakdown of cement sector process emissions from the decarbonisation of raw materials during the clinker manufacturing process. These data are useful to compare against other statistics that are provided from the British Cement Association (BCA) regarding clinker production and the non-combustion emissions associated with UK cement production. However, it must be noted that due to the CCA opt-outs the EUETS dataset only has complete coverage of the UK cement sector for 2008 and 2009, so there is a very limited dataset to work with, and firm conclusions cannot be drawn at this stage from the EUETS information. Note also that the BCA data on clinker production is commercially confidential.

From the detailed EUETS site-specific calculations for the UK cement sector, it is evident that sites use a range of estimation methods to derive the EUETS emissions from process sources, using a range of activity data and emission factors to reflect the different process designs and sub-sources of process CO_2 emissions. The activity data used within the EUETS by cement kiln operators include:

- Mass of cement clinker produced
- Mass of raw meal used to manufacture clinker
- Mass of cement kiln dust manufactured

The industry-wide estimates provided by the BCA and used within the GHGI show very close comparison with the EUETS estimates, with the sum of the EUETS data around 1% lower than those reported to the GHGI, as outlined below:

Table A3.1.5 Comparison of Cement Sector Carbon Dioxide Emissions within the UK GHGI and the EUETS for 2008-9

	2008	2009
GHGI CO_2 emissions (kt)	5203	3721
Sum of EUETS CO_2 emissions (kt)	5163	3677
EUETS / GHGI	99.2 %	98.8 %

3.2 Ongoing Data Clarifications: EUETS data and DUKES

In addition to the direct use of EUETS data within the UK GHGI compilation, as outlined above, the analysis of the EUETS data in 2009 has identified a number of data reporting inconsistencies that could not be resolved within the GHGI compilation, but may be considered by DECC DUKES within future energy statistics work.

Most of these are related to sector-specific allocations of fuels, where EUETS indicates differences to that reported in DUKES, and an example that we have acted upon in the 2009 GHGI is the data on petroleum coke use in refineries, mentioned in section 3.1.3 above. It is notable that the main focus of such data inconsistencies tends to relate to “secondary” or “process” fuels that are generated on a site and then either used there or exported to other sites for use (sometimes co-located sites that may have previously all been under one wider ownership) rather than refined fuels that are usually sold as energy commodities such as gas oil or natural gas.

A meeting with the DECC DUKES team is scheduled for April 2011, and several of the following issues may be taken forward following that meeting:

Refinery and Other Industry OPG use

There is some level of uncertainty in the allocation of fuels in EUETS to specific “DUKES” fuels, although the OPG use in refineries seems to be reported quite consistently as “Refinery Gas”, “Refinery Off-Gas”, or “OPG/RFG”. The DECC DUKES team have reviewed the year to year consistency of OPG use in refineries through the DORS system; there may be further revisions needed, but for now we have used the EUETS data in preference to the published DUKES data for this source and fuel.

In the “other industry” sites where OPG use has been allocated by the AEA team from EUETS data, the fuel is defined as ethane for the one petrochemical production plant, whilst the other all use either “OPG”, “High Pressure Refinery Gas”, “Low Pressure Refinery gas”, or “RFG/OPG/ROG” within the EUETS forms. It’s the direct references to refinery gases, and the locations of the installations that raises doubts about how the fuel consumption is tracked and then reported within DUKES, although it appears most likely that the fuel use is recorded within the autogenerators sector in DUKES.

DECC have since taken forward discussions with refinery operators, to request clarifications on fuel use and exports to co-located installations, to try to improve the understanding of OPG use within the refinery and other industrial sectors, and perhaps update DUKES accordingly.

The DECC DUKES team have clarified that one site has recently been identified that had been incorrectly reporting CHP unit data within refinery sector submissions to DECC, within the DORS system used for DUKES compilation (Personal Communication, Alison Colquhoun, 2011). Data have now been revised, show close consistency with 2009 EUETS data, and the data will be updated within DUKES 2011, resolving an error that may have propagated through other data and years.

Another refinery site has been approached for clarifications by DECC, and has confirmed the sale of OPG to co-located units (i.e. outside the scope of the refinery); this practice is evident in several refinery locations, and DECC are engaging with refineries to review the consistency of reporting to DORS under such circumstances. The site also has inconsistent data between EUETS and DORS for petroleum coke, but this has been clarified as due to a difference in scope of reporting.

Oil & Gas Terminal OPG and LPG Use

As above there are definitional problems to resolve for some of the reported fuel use in EUETS, but it appears that there are small amounts of these fuels being used in the upstream oil & gas sector that are not evident within DUKES. It is likely that these fuels are being abstracted from the upstream side, rather than purchased from other sources. This suggests that the inventory approach to using the EEMS dataset for upstream oil and gas production will ensure that there is no gap or double-count in the inventory. Furthermore, the EEMS data have now been provided to the DECC DUKES team, in order that they can review this fuel use in more detail (as well as reviewing the reported diesel use by offshore operators that EEMS includes).

Coke Use in Industry

The EUETS data on coke use by different industries supplements other data sources on coke use that the AEA team obtains directly from specific iron and steel, chemical and petrochemical production plant operators. The sum of these coke use data exceeds that provided within DUKES for final industrial consumption of coke, and this matter has been raised with the DECC DUKES team, but more research is needed due to the disparate nature of the source data (of which EUETS is a part) and the need to review more detailed coke use transfers and sales records, especially for the iron and steel sector. The EUETS data has helped to identify that there may be an under-report in coke use within DUKES, and the AEA team will continue to work with DECC to resolve this issue, assessing where non-fuel use of coke may need to be re-allocated to emission sources.

3.3 Draft UK Traded / Non-traded Split in 2009

The analysis of the UK traded / non-traded split is ongoing, as the reporting format is yet to be agreed and further checks on data consistency need to be clarified. An initial analysis of the traded / non-traded split is presented below, and we would welcome further engagement with the DECC CESA team to take this analysis forward and develop an output that meets the needs of domestic reporting, e.g. for Carbon Budgets analysis.

The initial analysis presented below indicates that the UK non-traded share of carbon dioxide emissions in 2009 was 52% of the UK GHGI total, at 66,679 kt as Carbon. Note, however, that these data are not finalised due to a number of data inconsistencies that need further analysis.

Sectors where the EUETS data are higher than the GHGI may indicate that the GHGI may be under-estimating the total sector emissions, or that emissions are mis-allocated within one of the datasets. Where this is evident, the non-traded sector estimate is set to zero. The main examples are:

- **Refineries.** This is due to higher emissions reported in EUETS from fuel oil and OPG use, compared to the GHGI which is based on DUKES activity data;
- **Gas Production.** The EUETS data indicates that gas use in this sector is higher than that reported in DUKES, and therefore the EUETS emissions are higher than those in the GHGI;
- **Iron and Steel.** Several data inconsistencies are evident that require further analysis. Notably the GHGI shows a decline in BFG use in flaring in 2009 which is not reflected in EUETS;
- **Lime Production.** The lime sector GHGI emissions are lower than those reported in EUETS, and this is partly due to data confidentiality issues and the allocation in the GHGI of some lime sector emissions to the “other industrial combustion” part of 1A2f. We also know that 2 out of 15 lime kilns are NOT within the EUETS, however, so more work is needed to derive the non-traded estimates for lime kilns, although these will be a small part of total sector emissions. Finally, and perhaps most importantly, data in the EUETS for lime-producing sites will also cover very significant carbon emissions from other plant such as CHP which would

be included in the GHGI under 1A2f. Emissions from lime decarbonisation are also much lower in the GHGI and this is most likely due to the reliability of the activity data used in the GHGI. Data are not available for the latest year in the GHGI, so are carried over from the previous year. In addition, the available activity data do not provide a breakdown of lime production at sites that use the evolved carbon dioxide, and those that do not. This is crucial, since the split has to be estimated based on data from 2003 which is probably unlikely to give realistic results.

Table 3.3 Initial Estimate of the UK Carbon Dioxide Traded / non-Traded Split for 2009 Data (kt as Carbon)

National Communication	IPCC (Amended)	Sources	GHGI 2009	EUETS 2009	Non-traded 2009	Comments
Energy Supply	1A1a	Power Stations	40,887	40,826	60	
	1A1b	Refineries	4,040	4,445	0	Higher refinery emissions in EUETS. (Fuel oil and OPG)
	1A1c	Collieries and SSF	75	7	68	
	1A1c_Coke	Coke production	308	13	295	
	1A1c_Gas	Gas Production	176	286	0	Higher gas production emissions in EUETS (Natural Gas)
	1A1c_Oil & Gas	Oil & Gas extraction	4,848	4,878	0	Oil & gas sector EUETS higher than GHGI, but very close.
	1B1b	Iron & steel flaring	215	300	0	GHGI low in 2009. Big drop in BFG allocation in GHGI evident since 2008 - needs checking.
	1B2b	Gas network leakage	2		2	
	2A3	Flue Gas Desulphurisaton	97	95	2	
Agriculture	1A4c	Agriculture combustion	1,099	42	1,057	
	2B5	Use of agrochemicals	11		11	
Business	1A2a	Iron and steel combustion	3,579	3,488	91	
	1A2f	Other industrial combustion	13,821	5,480	8,341	
	1A2f_Cement	Cement fuel use	536	537	0	Very close agreement. 100% traded
	1A4a	Commercial combustion	2,528	45	2,483	
Industrial Process	3	Solvents	0		0	
	1A2a	Sinter Production	510	544	0	Close agreement but need to check allocation issues across I&S.
	1A2f_Lime	Lime fuel use	157	325	0	Under-report in inventory for lime plant (BGS stats).
	2A1	Cement decarbonising	1,015	1,003	12	
	2A2	Lime decarbonising	171	265	0	Higher emissions in EUETS for lime plant (BGS stats).
	2A3	Glass processes	140	103	37	
	2A7	Fletton brick manufacture	20	25	0	
	2B1	Ammonia production	219		219	
	2C1	Ladle arc furnaces and EAFs	7	26	0	Higher emissions in EUETS for EAFs. Need to check.
	2C3	Primary aluminium production	107		107	
Public	1A4a	Public admin combustion	2,230	362	1,867	
Transport	1A3a	Aviation	532		532	
	1A3b	Road transport	30,572		30,572	
	1A3c	Rail transport	523		523	
	1A3d	Shipping	414		414	
	1A3e	Aircraft support vehicles	120		120	
	1A4a	Railways - stationary combustion	11	1	10	
	1A4c	Fishing vessels	3		3	
	1A5b	Naval shipping and military aviatic	662		662	
Residential	1A4b	Domestic combustion	20,000		20,000	
	2B5	Non-aerosol products	424		424	
Land Use Change	(all LULUCF)	(all sources and sinks)	-1,307		-1,307	
Waste Management	6C	Waste incineration	76		76	
TOTAL			**128,824**	**63,096**	**66,679**	Non-traded Carbon dioxide emissions are 52% of the total in the UK GHGI for 2009.

4 Summary and Recommendations

The analysis for the 2009 GHGI dataset at UK level is complete. Key findings include:

- In the 2009 EUETS dataset, a very high coverage of Tier 3 emissions data is evident for all fuel use in the power sector, as well as for coal autogeneration, coal use in the lime sector, and refinery fuel oil and OPG use. All of the fuel quality data for these sources and fuels are therefore used within the UK GHGI, as the EUETS fuel quality data is the most representative dataset available to inform UK carbon dioxide emission factors;
- EUETS emissions data for petcoke use in refineries has been compared against DUKES activity data. Consultation with DECC energy statisticians has identified that the figures given in DUKES are subject to considerable uncertainty and, as a result, the EUETS data have been used instead within the UK GHGI;
- EUETS-derived emission factors from 2009 for colliery methane and OPG (at refineries) have been applied to all sources using those fuels;
- Allocations of OPG use within refinery and other industry sectors derived from EUETS are not consistent with data within DUKES. The allocation of data from EUETS to DUKES fuel categories is somewhat uncertain for OPG due to the wide range of fuel nomenclature reported with EUETS. The analysis and subsequent consultation with DECC DUKES has, however, helped to identify site-specific issues of mis-reporting that are being resolved through discussions with operators, such as clarifying where OPG is used directly within the refinery or to fire CHP plant with power and heat used by co-located industrial operators;

A number of data discrepancies have been identified, through the aggregation of installation-level energy data from EUETS for 2009 and comparison against reported sector fuel use within DUKES; where the EUETS data indicates that the DUKES sector fuel allocations are too low, these issues are being taken forward through further consultation with the DECC DUKES team during 2011 in order to ensure that any appropriate revisions of DUKES based on the 2009 EUETS data can be completed in time for the publication of DUKES 2011.

The main fuels where such discussions are ongoing are: OPG, coke and petroleum coke. The full detail of EUETS analysis within spreadsheet calculations has been provided to the DECC DUKES team, and we understand that this is being quality-checked and considered for use within the compilation of DUKES 2011.

It is recommended that the reporting allocations within the EUETS, DUKES and GHGI be kept under review, in order to address the data inconsistencies evident in the table 3.3 above that cannot be explained simply by known activity data inconsistencies.

The estimation of the traded and non-traded share of UK emissions for 2009 indicates that of the total carbon dioxide emissions in the UK, 52% are non-traded. Further work may be needed to revise and improve the reporting of the traded / non-traded split, depending on the format that is decided upon as most useful for reporting across DECC.

In the coming months, alongside the compilation of the DA GHG Inventories, further analysis at the DA level will be conducted to derive DA-specific information, review the highest emitting sites in each DA and assess any data discrepancies that are evident, feeding back any further outlier data that may be identified to the appropriate regulators. The derivation of the DA-level traded and non-traded split will be finalised once the DA GHG inventories to 2009 are completed, and this will be reported within the 1990-2009 DA GHG inventory report to be published in summer 2011.