Intergovernmental Panel on Climate Change

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With contributions from Neil Passant, Glen Thistlethwaite, Joanna MacCarthy and Sarah Choudrie and the UK GHG inventory team.

Presentation supported by UK DECC

Who am I …

- John Watterson
- AEA Knowledge Leader, emission inventories
- From 2002 to 2006 led the UK's GHG inventory team producing the UK's Greenhouse Gas inventory
- One of the lead authors for chapter on Stationary Combustion for the IPCC 2006 Guidelines

- I am providing perspectives as an UK GHG inventory compiler on
  - How Emissions Trading System (ETS) data has been used in the UK GHG inventory
  - Issues and problems than have arisen
  - How has validation and QA/QC been dealt with?
  - Is more detailed guidance needed about using ETS data?

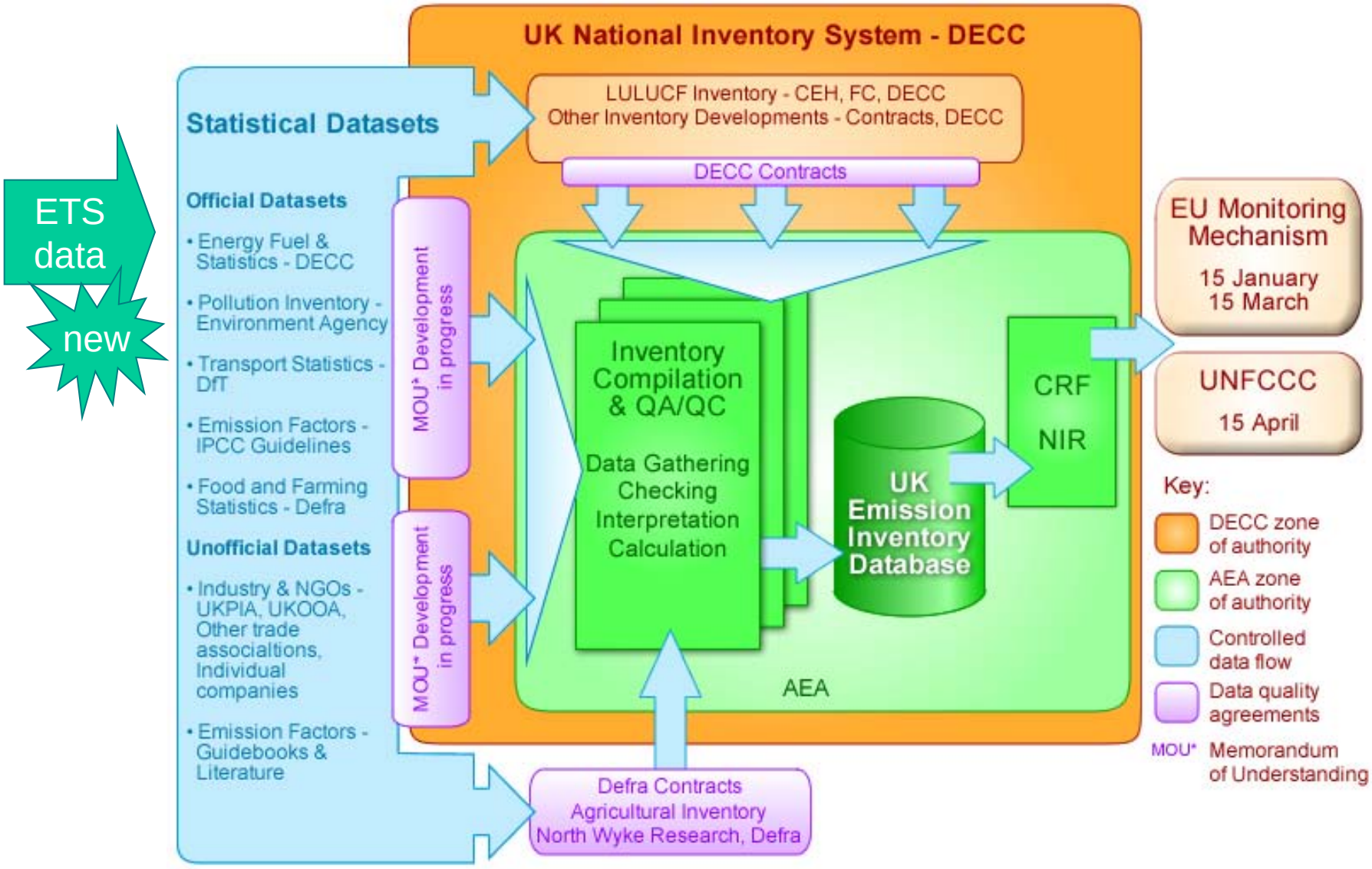
Content of this presentation…

- The EU Emissions Trading System (ETS)
  - What is it?
  - What data is available that might help GHG inventories?
- How has ETS data been used by the GHG inventory team
  - Sourcing data
  - Analysing data; validation and quality assurance and quality control
  - Using data in the UK GHG inventory
  - Using data in the GHG inventories of the Member States of the EU
- What lessons have been learnt?
  - What might be best practice when using ETS data in GHG inventories?
  - Strategies to deal with the different reporting nomenclatures of IPCC and ETS
  - How much time might be needed to analyse the data?

Why use Emissions Trading Systems (ETS) data in GHG inventories?

- To help in the development of more accurate and transparent national GHG inventories
  - Provide detailed data about
    - the fuel use
    - fuel parameters quality: NCV, carbon contents
    - perhaps operations at the installations
- For GHG inventories to help improve ETS data
  - By providing default emission factors
  - By providing feedback on the quality of the reported data

UK GHG National Inventory System and the ETS



Operation of the ETS

- January 2005 the European Union Greenhouse Gas Emission Trading System (EUETS) commenced operation
- The largest multi-country, multi-sector Greenhouse Gas Emission Trading System world-wide.
- The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003
- The European emissions trading system (ETS) covers around 10,500 installations across the 27 Member States of the European Union
- Cap and trade system
- The scheme currently has two operating phases:
  - Phase 1 from 1 January 2005 to 31 December 2007
  - Phase 2 from 1 January 2008 to 31 December 2012
  - Phase 3??

Operation of the ETS

Tier based system analogous to IPCC guidelines for activity data and emission factors

Higher Tiers, lower uncertainty

MRG documentation

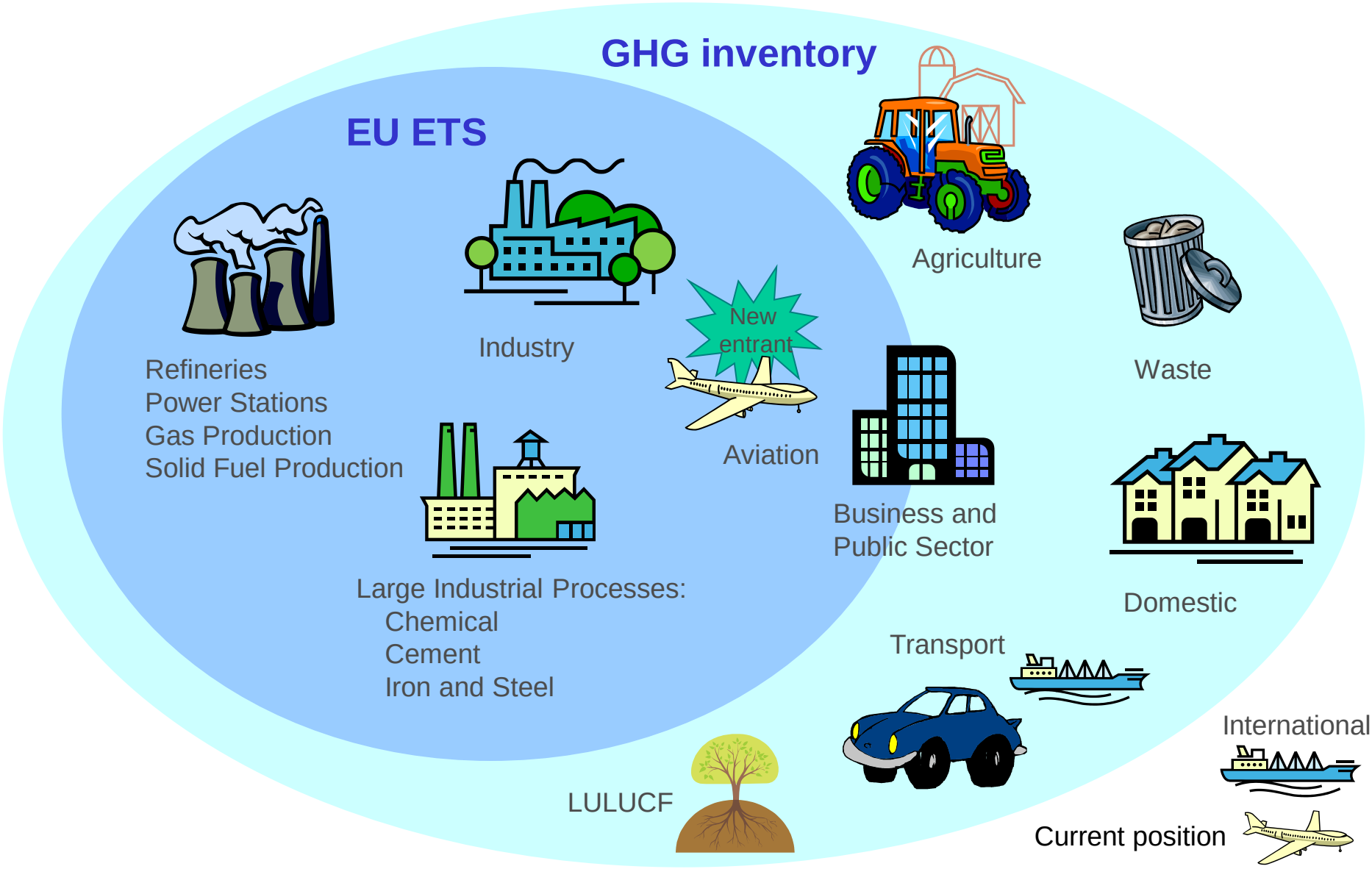
What data are available in the detailed returns?

- Activity data (fuel use)
- Emission factors
- Conversion factors
- Oxidation factors

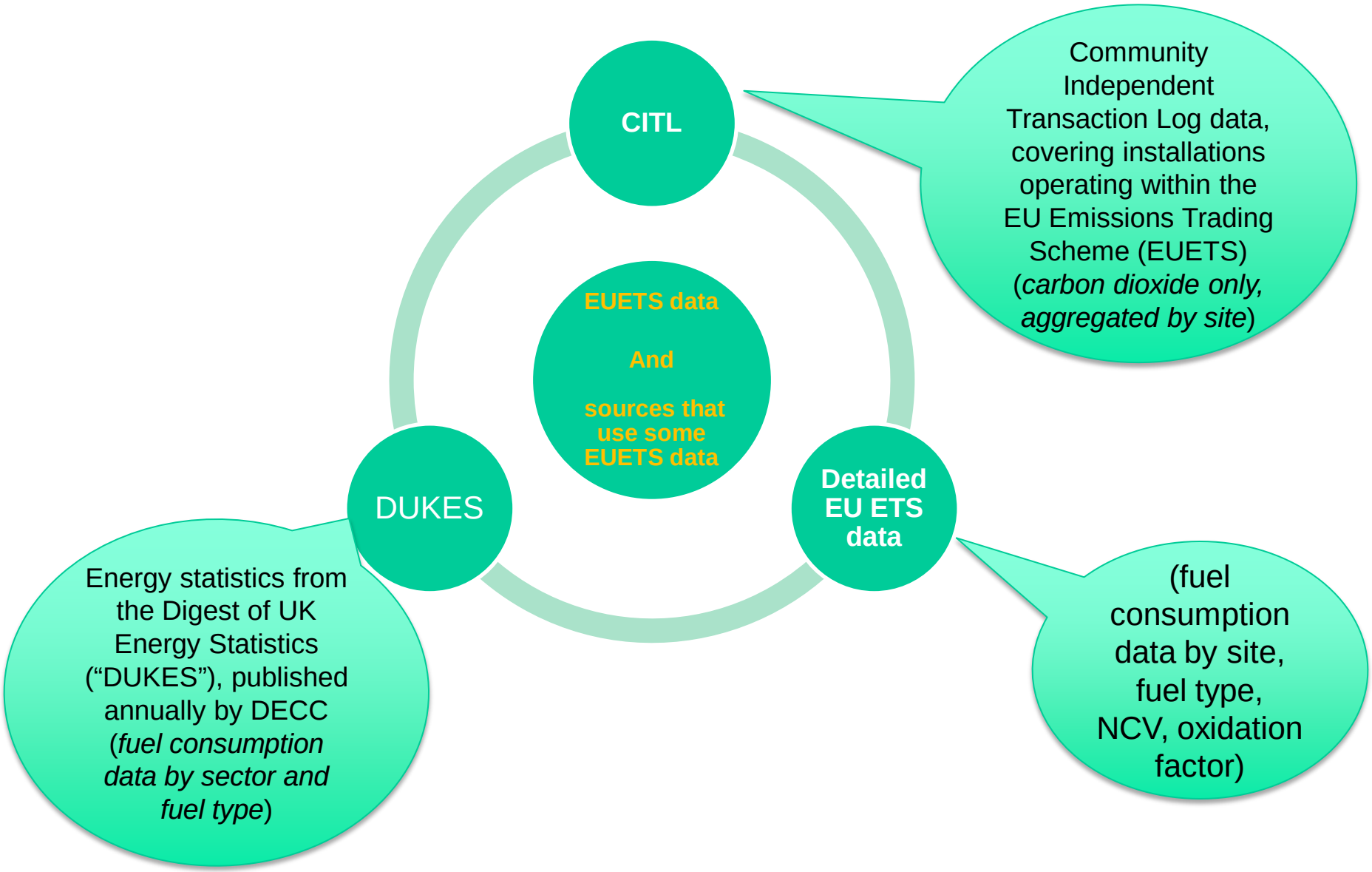
Operation of ETS in the UK

- There are EUETS permits for 740 Installations in England & Wales
- And a UK wide registry for 1,050 installations.
- All ETS installations account for about 50% of UK CO_2
- But is it unlikely this level of direct substitution of EUETS installation data will ever be possible in the inventory
- Considerable work remains to understand the differences between the data returned under the ETS, energy balance in UK energy statistics and emissions reported from other environmental regulators.

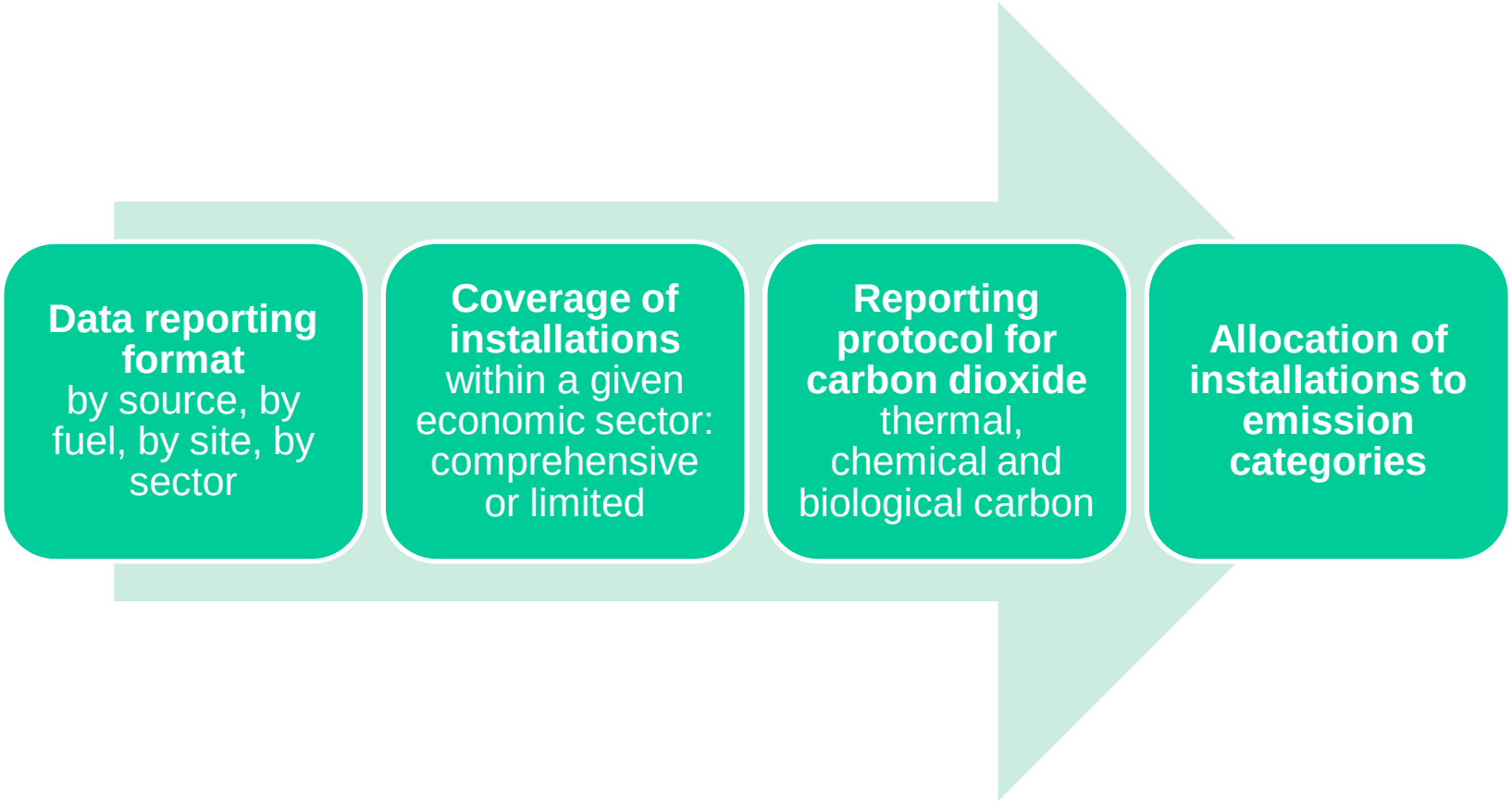
EU ETS data that could be used in the UK GHG inventory



Sources relying on ETS data



General barriers to using ETS data

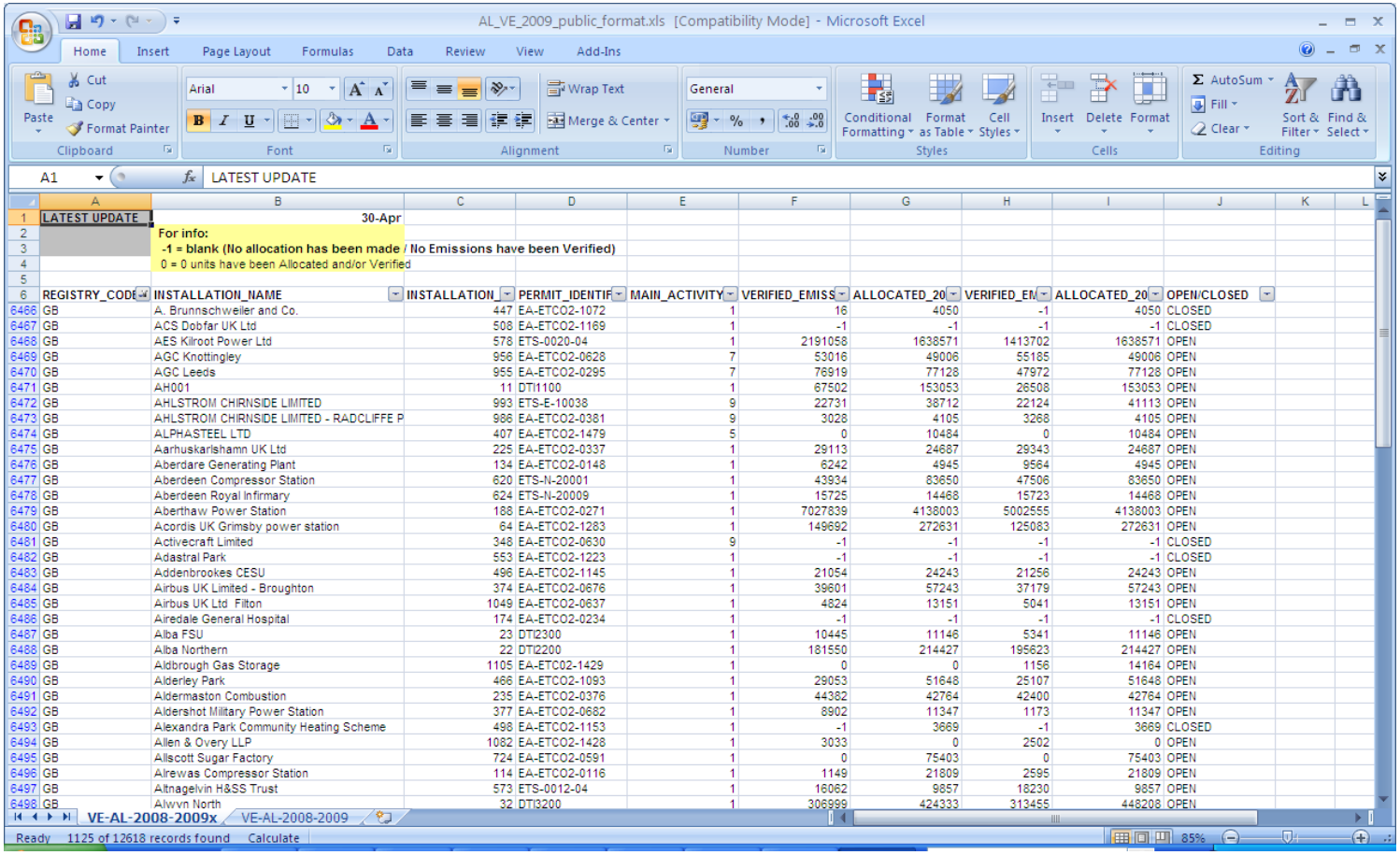


Data reporting format Example

	National Energy Statistics (chemicals: gas)	National Energy Statistics (chemicals: oil)	National Energy Statistics (chemicals: biomass)	National Activity Data (flaring)
EUETS (1): Large chemical site	gas combustion	oil combustion	biomass combustion	flaring
EUETS (2): Large chemical site	gas combustion	oil combustion	biomass combustion	flaring
NON-EUETS: Small chemical site	gas combustion	oil combustion	biomass combustion	flaring

- There is a fundamental difference in the requirements of emissions reporting within a GHG inventory reported to the UNFCCC, and the data sets gathered for UK regulatory purposes, for example the EUETS.
- The format for the GHG inventory is internationally agreed to ensure comparability of data across counties.
- The reporting is at source-specific level using source categories defined by the IPCC and adopted by the UNFCCC; in contrast, the EUETS reporting contains installation specific data.

Data reporting format
CITL extract



- CITL data; this contains verified emissions from each installation
- The CITL data alone will not provide enough data for the GHG inventory compilers

Data reporting format
MRG form return

PGB

B1 Combustion emissions data (M&RG Section 11.3)

Please complete the following pages for each Schedule 1 combustion process within your installation. Emissions occurring from different sources within a single installation belonging to the same type of activity may be reported in an aggregate manner for the type of activity provided that the emission factors and the oxidation factors are identical.

B1.1 Calculation of carbon dioxide emissions from fossil fuel combustion (for M&RG Annex II activities)

Relevant Row ID in Table A 2.1:	1
Type of Schedule 1 activity:	E1 Combustion
Description of activity:	Various boilers and furnaces (heaters) providing heat/energy to the oil refining process. Flares.

Please complete the following boxes using one box for each fuel associated with the activity stated above.

*** NCV - Net Calorific value**

Type of fuel:	RFG		
Sources included	Various		
Parameter	**Units**	**Data**	**Tier applied**
Activity data (mass/vol.)	m3	1	Tier 4a
(NCV)*	TJ/m3	1	Tier 3
Emission factor	tCO2/TJ	1	Tier 3
Oxidation factor	no units	0.995	Tier 1
Emissions	**tCO_2**	1	

Type of fuel:	Flare1		
Sources included	#1 Flare		
Parameter	**Units**	**Data**	**Tier applied**
Activity data (mass/vol.)	m3	1	Tier 2
(NCV)*			
Emission factor	tCO2/m3	1	Tier 1
Oxidation factor	no units	0.995	Tier 1
Emissions	**tCO_2**	1	

Type of fuel:	NG		
Sources included	GT706, GT711-4		
Parameter	**Units**	**Data**	**Tier applied**
Activity data (mass/vol.)	m3	1	Tier 4a
(NCV)*	TJ/m3	1	Tier 2
Emission factor	tCO2/TJ	1	Tier 2a
Oxidation factor	no units	0.995	Tier 1
Emissions	**tCO_2**	0.995	

Type of fuel:	Flare3		
Sources			
Parameter	**Units**	**Data**	**Tier applied**
Activity data (mass/vol.)	m3	1	Tier 2
(NCV)*			
Emission factor	tCO2/m3	1	Tier 1
Oxidation factor	no units	0.995	Tier 1
Emissions	**tCO_2**	0.995	

Type of fuel:	SG

Type of fuel:	VG1

- Example of the detailed returns that a refinery, participating in the UK ETS, makes to the UK Environment Agency.
- Detailed returns provide much richer source of data for inventory compilers, and include information about the complexity (Tier) of the method used to estimate the emissions, the fuel consumptions, their carbon contents, calorific values and oxidation factors.
- Information about carbon contents is particularly valuable as in many cases operators have detailed fuel quality analytical programmes in place and hence the carbon contents are known very accurately.
- Data anonomised in this example.

Data reporting format
Detailed ETS data from database

AppID	ReportingYear	ActivityID	FuelID	FuelType	SourcesIncluded	ActivityUnit	ActivityData	ActivityTier	NCVUnit	NCVData	NCVTier
	2007	1	1	RFG (OPG): F1 (major)	S1-S10 inclusive, S47	tonnes	148332.023	Tier 4a	TJ/tonne	0.051186	Tier 3
	2007	1	2	RFG (OPG): F3 (major)	S36 & S37	tonnes	74010.46714	Tier 4a	TJ/tonne	0.051501	Tier 3
	2007	1	3	RFG (OPG): F5 (major)	S40	tonnes	32765.1604	Tier 4a	TJ/tonne	0.043339	Tier 3
	2007	1	4	Fuel Oil: F7 (major)	S22,S23,S28	tonnes	64607.9733	Tier 3a	TJ/tonne	0.040322	Tier 3
	2007	1	5	Flare F10 (minor)	S41	tonnes	26269.23526	Tier 1	TJ/tonne	0.04875	Tier 2
	2007	1	6	RFG (OPG): F1 (De Minimis)	S38 & S58-68 inclusive	tonnes	7205.561792	No Tier	TJ/tonne	0.051172	Tier 3
	2007	1	7	RFG (OPG): F3 (De Minimis)	S81 & S82	tonnes	2736.665494	No Tier	TJ/tonne	0.0515	Tier 3
	2007	1	8	GO: F12 (De Minimis)	S43, S44 & S55	tonnes	459.0479326	No Tier	TJ/tonne	0.0434	Tier 2
	2007	1	9	RFG (OPG): F2 (major)	S11-S21 inclusive	tonnes	142673.909	Tier 4a	TJ/tonne	0.048064	Tier 3
	2007	1	10	RFG (OPG): F4 (major)	S22-S24 & S26-S30 inclusive, S48	tonnes	226348.8885	Tier 4a	TJ/tonne	0.04334	Tier 3
	2007	1	11	Fuel Oil: F6 (major)	S1,S36	tonnes	179287.7307	Tier 4a	TJ/tonne	0.040363	Tier 3
	2007	1	12	Natural Gas F9 (major)	S39,S40	tonnes	181292.7382	Tier 4a	TJ/tonne	0.046536	Tier 3
	2007	1	13	Flare F11 (minor)	S42	tonnes	47106.05252	Tier 1	TJ/tonne	0.035249	Tier 2
	2007	1	14	RFG (OPG): F2 (De Minimis)	S69-80 inclusive	tonnes	2472.533571	No Tier	TJ/tonne	0.048106	Tier 3
	2007	1	15	RFG (OPG): F4 (De Minimis)	S50,S83,S84	tonnes	1569.279963	No Tier	TJ/tonne	0.043228	Tier 3
	2007	1	16	F13 (De Minimis)	S49 (VDU-2 Offgas)	tonnes	8925.438353	No Tier	TJ/tonne	0.048165	No Tier

r	EFUnit	EFData	EFTier	OxFactorData	OxFactorTier	CombustionEmissions	WasteCat	IEA
	tCO2/t	1.303954	Tier 3	0.995	Tier 1	218818.9626		
	tCO2/t	1.294011	Tier 3	0.995	Tier 1	108347.4423		
	tCO2/t	1.238423	Tier 3	0.995	Tier 1	45905.9458		
	tCO2/t	1.522725	Tier 3	0.995	Tier 1	111300.0218		
	tCO2/TJ	1.274472	Tier 2	0.995	Tier 1	37876.11951		
	tCO2/t	1.304572	Tier 3	0.995	Tier 1	10634.65986		
	tCO2/t	1.294437	Tier 3	0.995	Tier 1	4007.655431		
	tCO2/t	1.51844	Tier 2a	0.995	Tier 1	788.5755405		
	tCO2/t	1.257598	Tier 3	0.995	Tier 1	202989.7431		
	tCO2/t	1.227377	Tier 3	0.995	Tier 1	314299.8167		
	tCO2/t	1.537078	Tier 3	0.995	Tier 1	311769.8771		
	tCO2/t	1.256929	Tier 3	0.995	Tier 1	257797.6337		
	tCO2/t	1.086765	Tier 2	0.995	Tier 1	57916.16495		
	tCO2/t	1.259136	Tier 3	0.995	Tier 1	3522.105443		
	tCO2/t	1.225692	Tier 3	0.995	Tier 1	2176.052979		
	tCO2/t	1.033327	No Tier	0.995	No Tier	10434.09423		

- Example of the detailed ETS data that the UK GHG inventory team is now able to access which is supplied from a database that the UK Environment Agency maintains in its role as the ETS regulator.
- e.g. **FuelType**. Some of the fuel nomenclature is clear, and identifying some of the fuels is easy, for example RFG (OPG). The identities of other fuels need be guessed, for example GO and F13.
- Data anonomised on this example.

Power stations coal – good agreement between ETS and GHG inventory

Emissions from coal/oil-fired power stations (ktonnes CO_2)

IPPC regulatory inventories	CITL (EUETS)	GHG inventory
119,625	118,664	117,836

Emissions for gas-fired power stations (ktonnes CO_2)

IPPC regulatory inventories	CITL	GHG inventory
59,250	59,154	58,564

- The scope of reporting of power station activities is broadly consistent across all reporting mechanisms, and the GHG inventory estimates are derived from emission factors from EUETS data, and hence good agreement across all reporting mechanisms is achieved. There are some small differences in emissions reported from the data sets, which are, due to:
  - IPPC regulatory inventories include emissions of bio-carbon, at sites where co-firing of biofuels occurs. As a result, the IPPC data are slightly higher than the emissions reported under EUETS.
  - The GHG inventory figure is based on (i) emission factors from EUETS data, and (ii) fuel consumption data from the Digest of UK Energy Statistics (DUKES). Analysis has shown that the activity data in DUKES is not fully consistent with the fuel use data reported within EUETS, which underpins the emission estimates reported in the CITL, and hence there is a small inconsistency in emissions data. The IPPC data may also include emissions from the burning of natural gas as a start-up fuel.

Power stations gas – good agreement between ETS and GHG inventory

Emissions for gas-fired power stations (ktonnes CO_2)

IPPC regulatory inventories	CITL	GHG inventory
59,250	59,154	58,564

- As with coal/oil-fired power stations, there are relatively small differences between the data. The CITL figure is slightly lower than the figure given in the regulators' inventories, although a number of very small power stations do not report in these inventories, so one might expect the CITL figure to be the higher of the two. The reason why this is not so is not clear but it is most likely due to small differences in scope at some installations, or due to inconsistent reporting.

Iron and Steel Overview

Emissions for integrated steelworks (ktonnes CO_2)

IPPC regulatory inventories	CITL	Corus	GHG inventory
21,776	20,486	21,677	21,355

- The agreement between the total emissions from the CITL and the GHG inventory is reasonable.

Iron and Steel Detail

Emissions for integrated steelworks, broken down by source type (ktonnes CO_2)

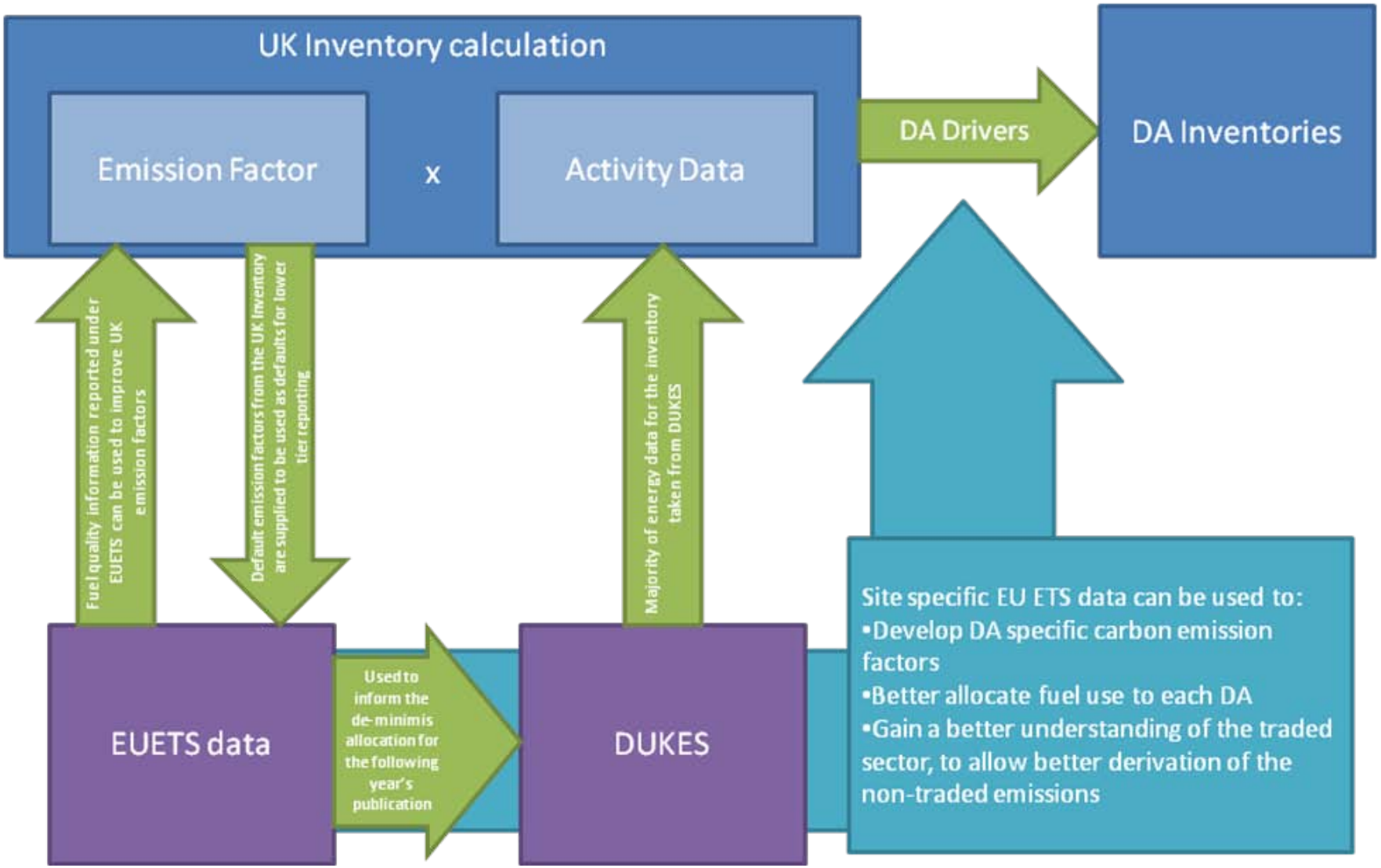
Source	Corus	GHG inventory
Coke ovens	1,206	1,320
Sintering	2,988	2,977
Blast furnaces	4,495	4,631
Basic oxygen furnaces	1,547	136
Flaring/losses	1,613	2,127
Combustion	9,827	10,168

- There are considerable differences between the emissions totals from different sub-sources; however there are some factors that help to explain at least some of these differences. Generally, these are to do with the scope of the estimates.
- An important question to answer is is it possible to use the detailed ETS data to identify the emissions from combustion alone in this sector? For the UK it is not possible to isolate combustion emissions from the whole iron and steel sector; **it is possible to identify combustion emissions from coke ovens and sintering processes, but not from blast furnaces.**

Reporting protocol for carbon emissions – process and biocarbon

- Both the GHG inventory and the EUETS contain detailed information on the sources of carbon emissions
- Allows a distinction to be made between carbon emissions from combustion of fossil fuels and carbon emissions from ‘processes’.
- EUETS data includes information on the use of biofuels, but no emissions data are included in the CITL data set.
- However, comparison of the EUETS and the Environment Agency’s Pollution Inventory (PI) data for the same installation can help to identify where carbon emissions reported in the PI might include biocarbon.

Using ETS data in national energy statistics and regional GHG inventories



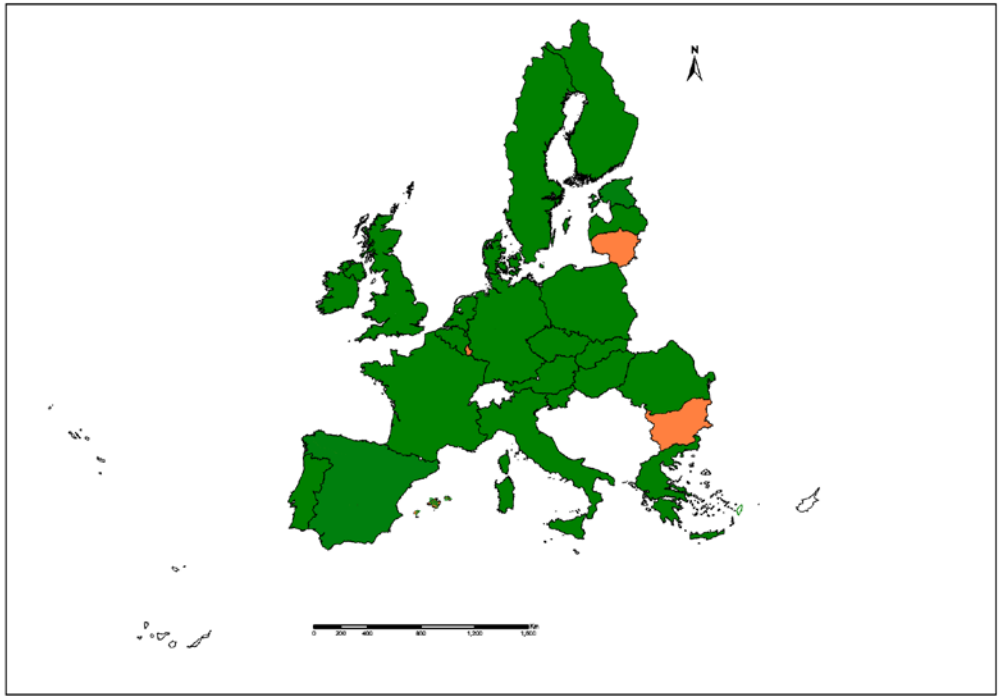
Specific examples of problems and issues (i)

- Access to data
  - CITL is of very limited use to inventory compilers
  - Need detailed ETS returns
- Formats and aggregation of sources
  - EUETS emissions data is reported at an installation-level, which may aggregate many different process and combustion sources
  - This limits the detail of reporting aligned to IPCC format.
- Coverage of sources
  - The scope of EUETS does not cover all sites within a given industrial sector
- UK implementation of the ETS
  - “medium” and “broad” definitions; different adoption in different MSs
  - Makes comparisons emissions problematic
  - Greater harmonization planned in Phase III of the ETS

Specific examples of problems and issues (ii)

- Nomenclature
  - Fuel naming nomenclature in the EUETS is not rigidly defined, and there is no mandatory requirement for agreement with the IPCC nomenclature.
- Commercial confidentiality
  - Where one or two plant in a given economic sector are reported in isolation, this is problematic.
- Variable data quality
  - EUETS data (fuel use, emission factors and calorific values, and methodological approach) are estimated using a Tiered approach
  - Need to use higher Tier data only
- Coverage of GHGs
  - CO_2 only
- Extent of time series
  - Good quality data is available from 2005 onwards

Use of ETS data for inventory purposes in the EU



- Bulgaria and Luxembourg – no information in NIR on whether they are using ETS data

- Nearly all Member States use the ETS for quality control and verification purposes. Often the emissions reported in the ETS are compared with emissions reported in the GHG inventory of a MS
- Both mature and more recent GHG inventories were able to make use of EUETS data
- Many MSs use EUETS emissions in their GHG inventory, and some use activity data and emission factors

Use of ETS data in the European GHG inventory

- EUETS data can benefit the EU GHG inventories in a variety of ways, including:
  - Reported verified emissions can be directly used in the GHG inventory to report CO_2 emissions for a specific source category.
  - Emission factors and other parameters such as oxidation factors can be compared with emission factors used in an inventory and they can be harmonised if appropriate.
  - Activity data reported under the EUETS can be used directly for the GHG inventory, in particular for source categories where energy statistics face difficulties in disaggregating fuel consumption to specific subcategories.
  - Data from EUETS can improve completeness of the estimation of IPCC source categories.

Use of ETS data in the European GHG inventory (i)

- EUETS data are widely used in the GHG inventories of EU Member States:
  - Some countries have completed specific studies to examine the feasibility of using ETS data in GHG inventories prior to ETS data being used.
  - Collection of plant specific data by the same entities compiling the GHG inventory, the ETS and national energy statistics could promote internal consistency and efficiency.
  - Germany reports an additional source category that includes the combustion emissions from source categories covered by the ETS (glass, cement and ceramics). This additional voluntary reporting considerably enhances the comparability of ETS emissions with inventory emissions at sectoral level.
  - France reports a very close agreement between the ETS emissions and estimates of GHG emissions. It is likely that close agreement is because the plant specific data is collected by the same entities compiling the GHG inventory, the ETS and national energy statistics.

Use of ETS data in the European GHG inventory (ii)

- EUETS data are widely used in the GHG inventories of EU Member States:
  - There are some problems discriminating between combustion and process emissions from ETS returns.
  - Detailed ETS data has been helpful to provide information about the specific uses of fuels, for example, reallocating the of non-energy use fuels from the energy to the industrial processes sector.

Specific suggestions for good practice

- Carefully review ETS data
  - It is good practice to carefully review the ETS data and to understand its limitations and then consider what ETS data could be used in the inventory
  - It is **not good practice** to just replace GHG inventory data with ETS data without any review of the ETS data. Commercial confidentiality can be problematic.
  - Only consider highest Tier data for inclusion in the GHG inventory
- Use the National Inventory Steering Committee (NISC)
  - Helps facilitate close cooperation and a good working relationship between the regulators of the ETS in the UK (the Environment Agency), the GHG inventory compilers and other environmental regulators

Points for discussion (i)

- Securing access to ETS data
  - What are suitable approaches to securing reliable access to ETS data, whilst maintaining commercial confidentiality?
- Developments to improve usefulness of EUETS data within GHG inventory
  - Harmonising activities
  - Harmonising fuel names
  - Clarity of reporting
- More research to investigate EUETS data quality management
  - for example, through cross-sectoral, cross-Member State fuel data analysis to identify outliers, system inconsistencies within a country, between sectors or between countries
  - It is not appropriate to use all ETS data in a GHG inventory since some of these data may be of lower quality that the data already in the GHG inventory

Points for discussion (ii)

- Would new IPCC guidance on “good practice” use of ETS data be appropriate?
  - Guidance on how to integrate new ETS data into existing GHG inventories to minimise impacts on time-series consistency
  - Best practice guidance on data quality checking, identification of outliers, resolution of activity data discrepancies
  - Best practice guidance on when to use EUETS data to either (i) change the national energy statistics total, or (ii) change the sector allocation of the existing total national energy statistics.
  - Preparing the guidance for future changes driven by a lower carbon economy. The current status may not persist, e.g. the development of more regionally disaggregated electricity generation will mean there will be challenges to track fuel use and fuel quality as countries may move to more to a smaller-scale lower-carbon generation infrastructure.

How much time is needed to prepare to use ETS data in a GHG inventory?

- The UK started to consider using ETS data in about 2006
- Decision to use selected emission factors in 2008
- So perhaps allow 2 GHG inventory cycles before including ETS data
- Then periodic review of the availability of the data and the way it is included in the GHG inventory

Important messages (i)

- This analysis has demonstrated that emissions data given in the UK GHG inventory are often broadly consistent with emissions data given in regulators' inventories, in the CITL (reporting verified emissions from the EUETS), and in other data sets. use the components of existing systems, including reporting and quality control systems
- In some cases where there are differences, we are able to identify reasons why these differences exist.
- The UK is making use of some detailed EUETS data in its inventory, such as carbon emission factors for fuels used in key sources (coal and gas used in power stations) and for fuels whose composition is variable (some fuels used in refineries).

Important messages (ii)

- Further investigation would be needed to completely understand issues such as the difference in scope between processes for the purpose of inclusion in the regulators' inventories compared with the scope of those same processes when covered by the EU ETS.
- In the European Community, good use is being made of data from the EUETS in the GHG inventories of many countries.
- We suggest that the ETS is a valuable source of data, but countries need to carefully investigate the relationship between emissions reported in the ETS and in other related data sets before ETS data can be used directly in GHG inventories. An annual repetition of the detailed numerical analysis is not considered essential once the key features are understood, but would probably be useful on a periodic basis, perhaps every 3 years.

Acknowledgements

- The UK GHG inventory is funded by the UK Department of Energy and Climate Change (DECC) and the Devolved Administrations
- AEA GHG inventory team

Possible data flows from an ETS to GHG inventory and reporting