Different emission estimates produced by EU bodies/institutions

The objective of this paper is to give a snapshot of the key GHG emission estimates which are regularly published by EU bodies. There is a light update of the paper every year in May as a joint effort of the four institutions involved: DG Climate Action of the European Commission (DG CLIMA), the Joint Research Centre (DG JRC), Eurostat (Eurostat), and the European Environment Agency (EEA) – who coordinates the final product.

EU GHG inventory submission to UNFCCC (EEA and DG Climate Action)

The European Union (EU), as a party to the United Nations Framework Convention on Climate Change (UNFCCC), reports annually on greenhouse gas (GHG) inventories for the years 1990 to X-2 (i.e. two years before the current year[1]) and within the area covered by its Member States. The legal basis for the compilation of the EU GHG inventory is Regulation (EU) 525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions (EU MMR). The annual GHG inventory is the official data source on greenhouse gas emissions of the European Union and its final submission to the UNFCCC takes place at the end of May.

Total GHG emissions reported in the EU GHG inventory submission to UNFCCC include all anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol within the EU geographical area. These emissions are also relevant for EU's compliance under the Kyoto Protocol[2]. The EU GHG inventory is based on the aggregation of Member States' inventories as reported to the EU and to the UNFCCC according to the above mentioned EU MMR. Both EU and Member States' GHG inventories are reported in line with UNFCCC Reporting Guidelines and the 2006 IPCC Guidelines; they are also subject to annual reviews by experts from Annex and non-Annex I Parties according to internationally agreed Review Guidelines.

The main institutions involved in the compilation of the EU GHG inventory are the Member States, the European Commission's Directorates-General Climate Action (DG CLIMA), Eurostat, the Joint Research Centre and the European Environment Agency (EEA) and its European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM).

Official EU greenhouse gas inventory - **http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory**

[1] If the current year is 2017, the inventory covers up to the year 2015.

[2] The European Union and Iceland have a collective target under Kyoto Protocol's second commitment period.

GHG Data Viewer (EEA) - http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer

Approximated/Proxy GHG inventory (EEA, DG Climate Action)

The approximated GHG inventory is an early estimate for the GHG emissions for the year preceding the current year[3], available around September each year. The legal basis for the Proxy GHG emission estimates is the EU MMR. Article 8 establishes that Member States shall, where possible, submit to the Commission (and copy to the EEA) approximated greenhouse gas inventories for the year X-1 by 31 July every year. The EEA assists the Commission in the compilation of the Union approximated greenhouse gas inventory. When Member States do not provide their own proxy emission estimates, the EEA produces gap-filled estimates in order to have a complete approximated GHG inventory for the European Union. The Commission has to make this information available to the public each year by 30 September.

In relation to the scope, the Proxy GHG estimates cover total GHG emissions, for all gases, sectors and Member States, and is consistent with the Kyoto Protocol scope (i.e. excluding the land use, land-use change and forestry (LULUCF) sector).

Member States are responsible for the methodological choice regarding their own estimates. For gap-filling, the EEA uses the latest activity data available at country level to estimate the emissions. For emission sources for which no appropriate datasets exist, emissions are extrapolated from past trends, or emissions from the previous year are kept constant if historic data do not show a clear trend. The emission estimates assume no change in emission factors or methodologies as compared to the latest official inventory submissions to UNFCCC for the year X-2. On this basis, a detailed bottom-up approach was implemented to cover the full scope of emissions included in a GHG inventory submission. The EEA proxy estimates are used both for gap-filling purposes, when MS do not provide their own proxy estimates, and as verification of the estimates provided by MS.

Approximated EU GHG inventory - http://www.eea.europa.eu//publications/approximated-eu-ghg-inventory

European Union Emissions Trading System (DG Climate Action, EEA)

The EU emissions trading system (EU ETS) is the cornerstone of the European Union's policy to combat climate change and its key tool for reducing industrial greenhouse gas emissions cost-effectively, based on a "cap-and-trade" approach. In January 2005 the EU ETS commenced operation as the first and largest multi-country, multi-sector Greenhouse Gas Emission Trading System world-wide. The scheme is based on Directive 2003/87/EC (EU ETS Directive), and covers approximately 11,000 power stations and industrial plants across all Member States of the European Union, Iceland, Norway and Liechtenstein. As from 2012 it also includes emissions from flights within the European Economic Area (EEA).

In terms of scope, the EU ETS covers emissions of carbon dioxide (CO_2) from power plants, a wide range of energy-intensive industry sectors, and airlines. Starting from Phase 3, nitrous oxide (N_2O) emissions from

[3] If the current year is 2017, the approximated inventory refers to the year 2016.

the production of nitric, adipic and glyoxylic acids and emissions of perfluorocarbons (PFCs) from aluminum production are also included.

Installations and aircraft operators covered by the EU ETS are required to have an approved monitoring plan, according to which they carry out the monitoring of their emissions during the calendar year. The data in the annual emissions report for a given year must be verified by an accredited verifier and submitted to the Competent Authority of the respective Member State by 31 March of the following year. Moreover, in order to meet their compliance obligations, operators must surrender a number of allowances equivalent to their verified emissions by 30 April of that year. This annual procedure of monitoring, reporting and verification (MRV) is known as the 'compliance cycle' of the EU ETS. The monitoring and reporting of annual emissions by installations and aircraft operators is conducted in accordance with two Commission Regulations: the Monitoring and Reporting Regulation (MRR)[4] and the Accreditation and Verification Regulation (AVR)[5].

The main database on the ETS at EU level is the Union Registry, which serves to guarantee accurate accounting for all allowances issued under the EU ETS. It is operated by the European Commission, covers all 31 countries participating in the EU ETS, and holds accounts for stationary installations (transferred from the national registries used before 2012) and for aircraft operators (included in the EU ETS since January 2012).

The Union Registry records:

- National implementation measures (a list of installations covered by the EU ETS Directive in the territory of each Member State and any free allocation to each of those installations in the period 2013-2020);
- Accounts of companies or physical persons holding those allowances (not public);
- Transfers of allowances ("transactions") performed by the account holders (public after 3 years);
- Annual verified ETS-covered emissions from installations;
- Annual reconciliation of allowances and verified emissions, where each company must have surrendered enough allowances to cover all its verified emissions.

The European Union Transaction Log (EUTL), run by the European Commission, automatically checks, records, and authorizes all transactions that take place between accounts in the Union Registry. The EEA publishes the information from the EUTL in aggregated form by country, by sector and by year on the verified emissions, allowances and surrendered units of the installations covered by the EU ETS. Data on the annual verified emissions from installations are available early April each year for the previous year[6].

ETS Data Viewer (EEA) - **http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer-1**

EUTL - **http://ec.europa.eu/environment/ets/**

[4] Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council

[5] Commission Regulation (EU) No 600/2012 of 21 June 2012 on the verification of greenhouse gas emission reports and tonne-kilometre reports and the accreditation of verifiers pursuant to Directive 2003/87/EC of the European Parliament and of the Council

[6] If the current year is 2017, the ETS data covers up to 2016.

CO_2 early estimates from fossil fuel combustion (Eurostat)

Eurostat, the statistical office of the European Union, produces early CO2 emission estimates from fossil fuel combustion using cumulated monthly energy statistics reported by Member States under the EU Energy Statistics Regulation (Regulation (EU) 1099/2008). CO_2 early estimates are released only four to five months after the end of the reference year[7].

Eurostat is using one method and one data source for all MS. In a first step the growth rate in the consumption of solid, gaseous and liquid fossil fuels between the last two years is calculated for each Member State. In a second step these percentage changes are applied to CO_2 emissions from fossil fuel combustion reported by Member States in their latest GHG inventory using the IPCC Reference Approach (CRF table 1.A (b)). The sum of early CO_2 emission estimates for each Member State equals the total CO_2 early estimate from fossil fuel combustion for the EU as a whole.

An overview of Eurostat's methodology to produce CO_2 early estimates can be found at http://ec.europa.eu/eurostat/documents/38154/43500/MethodCO2.pdf

Eurostat early estimates on CO_2 from fossil fuel combustion - http://ec.europa.eu/eurostat/web/products-press-releases/

Air emissions accounts, air emission intensities and air emission footprints (Eurostat)

Air emissions accounts (AEA) record flows of gaseous and particulate materials (six greenhouse gases including CO2 and seven air pollutants) emitted by the economy into the atmosphere. Eurostat collects the data annually as stipulated by Regulation (EU) 691/2011 (Annex I).

AEA are conceptually embedded in the international statistical standards of the System of Environmental-Economic Accounting (SEEA CF 2012). AEA offer a detailed breakdown by 64 emitting industries plus households as defined and classified in national accounts. AEA follow the national accounts' residence principle, which implies that emissions by resident economic units are included even if these occur outside the territory (for example, resident airlines and shipping companies operating in the rest of the world). These two features make AEA in particular suitable for their main purpose of integrated environmental-economic analyses and modelling, for example AEA intensities, 'carbon footprints' and climate-change modelling scenarios. AEA reconcile the emission totals in the accounts with national inventory totals by reporting on so-called 'bridging items'.

Along with the AEA and AEA intensities, Eurostat also publishes estimates of emissions of greenhouse gases and air pollutants induced by final use of products. These are also referred to as footprints and are estimated using environmental-economic modelling. They aim is to capture all emissions occurring along the full production chain of a product that ends up in the EU-28 as final consumption or investment, irrespective of the industry or country where the emission occurred. As such they offer a complementary consumption perspective view compared to GHG inventories and AEA, which record emissions from a production perspective. The estimation method used requires various modelling assumptions, which results in higher margins of error. For example, it is assumed that the imported products are produced with production technologies similar to those employed within the EU. The emissions embodied in imports hence represent

[7] For example, the early estimate from Eurostat for the year 2016 is available by May 2017.

the amount of emissions avoided by the EU through importing the products from elsewhere instead of producing them in the EU.

Dedicated section on air emissions accounts - **http://ec.europa.eu/eurostat/web/environment/emissions-of-greenhouse-gases-and-air-pollutants/air-emissions-accounts**

Air emissions accounts datasets, including air emission intensities and air emission footprints - **http://ec.europa.eu/eurostat/web/environment/emissions-of-greenhouse-gases-and-air-pollutants/air-emission-accounts/database**

EDGAR database (DG JRC)

The European Commission's Joint Research Centre (JRC)[8] in collaboration with the Netherlands Environmental Assessment Agency (PBL) produces preliminary emission estimates on an annual basis covering the whole world. The emission estimates are used in the joint JRC and PBL's publications on Trends in Global CO_2 emissions. The estimates are based on the latest energy consumption data published by the International Energy Agency and, for fast-track time series, further extended with data from British Petroleum as well as data from the National Bureau of Statistics of China. In addition to the energy data, also non-combustion emissions are included with production data for cement, lime, ammonia, steel, agricultural liming from the U.S. Geological Survey and others. The historic time series by country can be found under the Emission Database for Global Atmospheric Research (EDGAR), available at edgar.jrc.ec.europa.eu[9]

In addition, for the consolidated past inventory (1970-2012) the EDGAR database contains greenhouse gas, air pollutants, particulate matter and Hg emissions per country on a 0.1 x 0.1 degree grid for all anthropogenic sources. Although the database distinguishes between about 5000 sources activities, emissions are provided using the source categories defined by IPCC (1996). For the emissions factors, the new 2006 IPCC Guidelines are used for the calculation of the emissions, and region-specific data only where scientific literature indicates necessity.

Detailed methodological descriptions and overviews per emission source category are provided through the annual CO2 report available at **http://edgar.jrc.ec.europa.eu/news_docs/jrc-2016-trends-in-global-co2-emissions-2016-report-103425.pdf**

EDGAR database - **http://edgar.jrc.ec.europa.eu/**

[8] In addtion to being the organisation responsibile for the agriculture and LULUCF sectors within the EU's GHG inventory system under UNFCCC, the JRC is also responsible for the QA/QC of the LULUCF data reported under the EU Regulation 525/2013.

[9] Olivier J.G.J. and Janssens-Maenhout, G., CO2 Emissions from Fuel Combustion -2014 Edition, IEA CO2 report 2015, Part III, Greenhouse-Gas Emissions, ISBN 978-92-64-24595-2.

Olivier, J.G.J., Janssens-Maenhout, G., Muntean, M. and Peters, J.A.H.W. (2015). Trends in global CO2 emissions: 2015 Report, JRC 98184,2015.

Overview of EU data sources for GHG estimates

What	Who	When	Timeliness	Geographical scope	Sectoral Scope	EU reporting obligation
EU GHG inventory to UNFCCC	EEA	15 April (draft submission) & End May (final submission)	X-2	EU and its 28 Member States (UNFCCC Convention) & EU-28 + Iceland (Kyoto Protocol)	All gases and sectors (100% of emissions)	EU MMR (525/2013)
Proxy GHG inventory	EEA	30 September	X-1	EU and its 28 Member States, plus other EEA member countries States if reported	All gases and sectors (100% of emissions)	EU MMR (525/2013)
EU ETS	DG CLIMA	Early April and May	X-1	EU-28, Iceland, Norway and Liechtenstein	~ 11,000 heavy energy-using installations, plus aircraft operators (~45% of total emissions)	EU ETS Directive (2003/87/EC)
CO_2 early estimates	Eurostat	April / May	X-1	EU and its 28 Member States	CO_2 from fossil fuel combustion (~80% of total emissions)	Eurostat's work programme
Air emissions accounts and air emission intensities	Eurostat	December/ January	X-2	EU and its 28 Member States, EFTA and EU candidate countries	All gases and economic sectors (100% of emissions)	Regulation (EU) 691/2011 (Annex I)
Emissions induced by final use (footprints)	Eurostat	March / April	X-3	EU	All gases and economic sectors (100% of emissions)	Eurostat's work programme
EDGAR global database	JRC	August / September	X-1	Global coverage	All gases and sectors (100% of emissions)	JRC's work programe

European Environment Agency http://www.eea.europa.eu/

DG Climate Action, European Commission http://ec.europa.eu/clima/

Eurostat, European Commission http://ec.europa.eu/eurostat

DG Joint Research Centre, European Commission http://ec.europa.eu/dgs/jrc/