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Early CO_2 emission estimates for 2015 based on Eurostat monthly energy data

Annual project report

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List of Abbreviations

CO_2	Carbon dioxide
CRF	Common Reporting Format
EU	European Union
GCV	Gross calorific value
Gg	Gigagram = 10^9 g = 1 kt (kiloton) = 1000 tons
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
kt	Kiloton (1 kt = 1000 t)
MS	Member State
NCV	Net calorific value
NIR	National inventory report
QA/QC	Quality assurance and quality control
TJ	Terajoule
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction and background

In order to improve the timeliness of the EU carbon dioxide emissions data, Eurostat initiated an action some years ago called “Early Estimates of CO_2 Emissions”. The aim is to provide estimates of CO_2 emissions from energy use (combustion of fossil fuels) only four to five months after the reference year (t+4), instead of the usual 16 months. These first estimates are based on a harmonised method and monthly energy statistics already available through the Energy Statistics Regulation. This information is particularly relevant because CO_2 emissions from fossil fuel combustion make up nearly 80% of the total emissions and, on average, around 80% of the annual change in EU greenhouse gas emissions.

The first objective of this project is to test whether the trend method developed to estimate early CO_2 emissions continues to produce valuable results based on the use of monthly energy data. For this purpose, early CO_2 estimates at t+4 months were calculated in April 2016 for the year 2015. In addition, the early CO_2 estimates calculated in 2014 were verified by comparison with subsequent official CO_2 emission data reported in the GHG inventory submissions to the UNFCCC under CRF table 1.A (b)[1].

The second objective of this project is to analyse the quality level of monthly Eurostat energy data on fuel consumption compared to annual Eurostat data and to energy data used by Member States for the GHG inventory. Based on the comparison it is assessed whether the quality of the monthly data improved in 2014 and in which areas substantial deviations continue to occur.

This report includes a description of the method used, a verification of the early CO_2 emission estimates for the year 2014 by comparing them to the final GHG inventory CO_2 emission data submitted to the UNFCCC and the calculation of the 2015 early CO_2 emission estimates.

[1] CRF (Common Reporting Format) table 1.A (b) SECTORAL BACKGROUND DATA FOR ENERGY: CO_2 from Fuel Combustion Activities - Reference Approach (IPCC Worksheet 1-1), Common Reporting Format - a set of standardised spread sheet data tables containing mainly numerical information and submitted electronically. These form one component of annual inventory submissions to the EU and the UNFCCC.

2. Method for early CO_2 estimates

2.1. Calculating early CO_2 emissions from fossil fuel combustion based on Eurostat monthly energy data

2.1.1. Method to calculate early CO_2 emission estimates

The method used to calculate early CO_2 estimates is based on the reported IPCC (2006) reference approach for the CO_2 emissions from fuel consumption of EU Member States and uses up-to-date Eurostat monthly energy data on fuel consumption.

The method estimates the consumption of cumulated liquid fuels, solid fuels, peat and gaseous fuels for the previous year and the year before and calculates the trend changes of consumption by dividing the year t-1 by the year t-2. The trend changes for liquid, solid, gaseous fuels and peat consumption are applied to the CO_2 emissions of the same aggregate fuel categories of the latest available reported year in Member States' GHG inventories as reported in the CRF reference approach table 1.A.(b) [2].

The first step of this method calculates the percentage changes in the consumption of fossil fuels over the last two years for solid, liquid, gaseous fuels and peat for each Member State based on Eurostat's monthly energy data in kilotons (kt) and in TJ NCVs for natural gas. According to the methodology for the IPCC reference approach, fossil fuel consumption is calculated differently for primary and for secondary fuels and also differs from the method of calculating gross inland consumption used by Eurostat:

Apparent consumption for primary fuels (IPCC): production + imports – exports – stock change.

Apparent consumption for secondary fuels (IPCC): imports – exports – stock changes – international marine and aviation bunkers.

This definition differs from the calculated gross inland consumption calculated by Eurostat under the flow code B_100900.

- Recovered products etc. are not taken into account under the IPCC definition.
- The use of kerosene type jet fuel without bio-components (product code 3247) for international flights is not to be taken into account and is therefore subtracted from the apparent consumption following the IPCC definition.

Biofuels should not be included in the calculation of the apparent consumption for liquid fuels, as the emission factor for biofuels is zero.

In the second step, the percentage changes of consumption are applied to the published CO_2 fuel combustion emissions for the most recent year available, as reported by Member States to the UNFCCC as part of their GHG inventories in CRF table 1.A (b), which is the reference approach calculation of CO_2 emissions.

The early CO_2 emission estimate calculations are conducted for each fossil fuel group and for each Member State. The sum of Member States' CO_2 emissions then represents the emissions for the energy sector for the EU-28.

[2] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8108.php

Equation 1

$$E_{CO2}^{Y} = \frac{C_{solid}^{Y}}{C_{solid}^{Y-1}} \cdot E_{solid,CO2}^{Y-1} + \frac{C_{peat}^{Y}}{C_{peat}^{Y-1}} \cdot E_{peat,CO2}^{Y-1} + \frac{C_{liquid}^{Y}}{C_{liquid}^{Y-1}} \cdot E_{liquid,CO2}^{Y-1} + \frac{C_{gaseous}^{Y}}{C_{gaseous}^{Y-1}} \cdot E_{gaseous,CO2}^{Y-1}$$

with

E_{CO2}^{Y} *CO2 emissions in reference approach table 1A(b)*

$C_{solid/peat/liquid/gaseous}^{Y}$ *consumption of solid/peat/liquid/gaseous fuels*

$C_{solid/peat/liquid/gaseous}^{Y-1}$ *consumption of solid/peat/liquid/gaseous fuels in the previous year*

$E_{...,CO2}^{Y-1}$ *CO2 emissions in the respective fuel category in the previous year*

The advantage of the method is the simplicity that ensures a fast and straightforward calculation for each Member State and better results than a bottom-up calculation of CO_2 emissions based on Eurostat monthly energy data and fuel-specific emission factors for each Member State. The trend change method also means that discrepancies between the Eurostat monthly energy data and (annual) energy data used in the GHG inventories are smoothened out when such discrepancies persist through the entire time series of fuel consumption data.

However, the application of the trend change method requires consistent reporting of monthly data for at least two consecutive years. Changes or improvements in the data may affect the trend change method in a negative way, leading to higher deviations between early CO_2 estimates and CO_2 emission data reported in the GHG inventories.

2.1.2. Allocation of fuels from monthly data

The method requires an accurate correspondence of fuel categories between Eurostat monthly data, Eurostat annual data and the fuel consumption data used in the GHG inventories reported in the CRF table 1.A.(b).

There are corresponding categories for almost all fuel types. However, the following fuels are not provided in Eurostat monthly data at the level of disaggregation required by the IPCC reference approach:

- Orimulsion is not reported separately in the Eurostat monthly energy data, but reported under ‘Other hydrocarbons’ in Eurostat monthly energy data.
- Shale oil is not reported separately in the Eurostat monthly energy data, but reported under ‘Other hydrocarbons’ in Eurostat monthly energy data.
- Bitumen and lubricants are not reported individually, but are included under ‘Other products’ in Eurostat monthly energy data.
- Hard coal is reported as an aggregate category in Eurostat monthly energy data covering anthracite, coking coal, other bituminous coal and sub-bituminous coal.
- Oil shale and oil sands are reported under “Lignite”.
- Peat is no longer reported under Solid Fuels but as a separate category.
- Eurostat monthly energy data do not include fossil waste whereas the new Eurostat database for annual data and the new reporting under the 2006 IPCC Guidelines CRF table (1.A(b) will include fossil waste as a separate category.

- Monthly and annual Eurostat energy data do not include the category “Other fossil fuels” whereas the new reporting under the IPCC 2006 Guidelines includes this category in the CRF table 1.A(b). But the monthly oil questionnaire includes the product 'other hydrocarbons' (mosoil, table 1) and 'other products' (mosoil, table 2). Shale oil is reported under 'other hydrocarbons. Bitumen under 'other products'.

2.1.3. Units of measurement / Conversion factors

Eurostat data provide liquid and solid fuel consumption in physical units (mass units -kt) while natural gas is reported in energy units (TJ GCV). The calculation of the trend changes used for calculating early CO_2 emissions are therefore based on trend changes in kt for liquid and solid fuels and peat. The trend changes for natural gas consumption are calculated from Terajoule (TJ) based on Net Calorific Values (NCV).

The energy data on fuel consumption in the GHG inventories for the reference approach (CRF Table 1.A(b)) are provided in physical or energy units (TJ) in the CRF table 1.A(b). For the year 2014 14 of the 28 Member States (Czech Republic, Germany, Denmark, Hungary, Italy, Lithuania, Latvia, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia and United Kingdom) report fuel consumption data for calculating CO_2 emissions from fuel combustion only in energy units (TJ). Sweden reports energy consumption data in the CRF table 1.A(b) partly in m^3.[3] For these Member States, fuel consumption data reported in the CRF table 1.A (b) in the GHG inventories were converted to physical mass units (kt) to allow for the comparison with Eurostat monthly and annual fuel consumption data. The Net Calorific Values (NCVs) used for this purpose were taken from Member States’ national inventory reports (NIR) as submitted under the UNFCCC, if available. If these were not available, NCVs as reported to Eurostat for annual fuel consumption were used. Nevertheless, the selection of NCVs is a source of uncertainty and can affect the comparison of the fuel consumption data; with regard to the latter, the use of different NCVs can have a large impact on the results, especially for coal consumption. This is only relevant for the comparison of fuel consumption data and the calculation of trend changes in energy units (TJ), which is used as a quality check of the CO_2 emission estimates. The calculation of the early CO_2 emission estimates is not affected by this conversion.

Data for natural gas are provided in Eurostat monthly energy data in TJ based on gross calorific values (GCVs), whereas natural gas consumption reported in the GHG inventories in the CRF table 1.A(b) are provided in TJ based on NCVs. For the comparison of Eurostat data with GHG inventory data, therefore, Eurostat data was multiplied with the factor 0.9 to convert to TJ NCV. Again, because the calculations are based on trend changes, the early CO_2 emission estimates are not affected by this conversion.

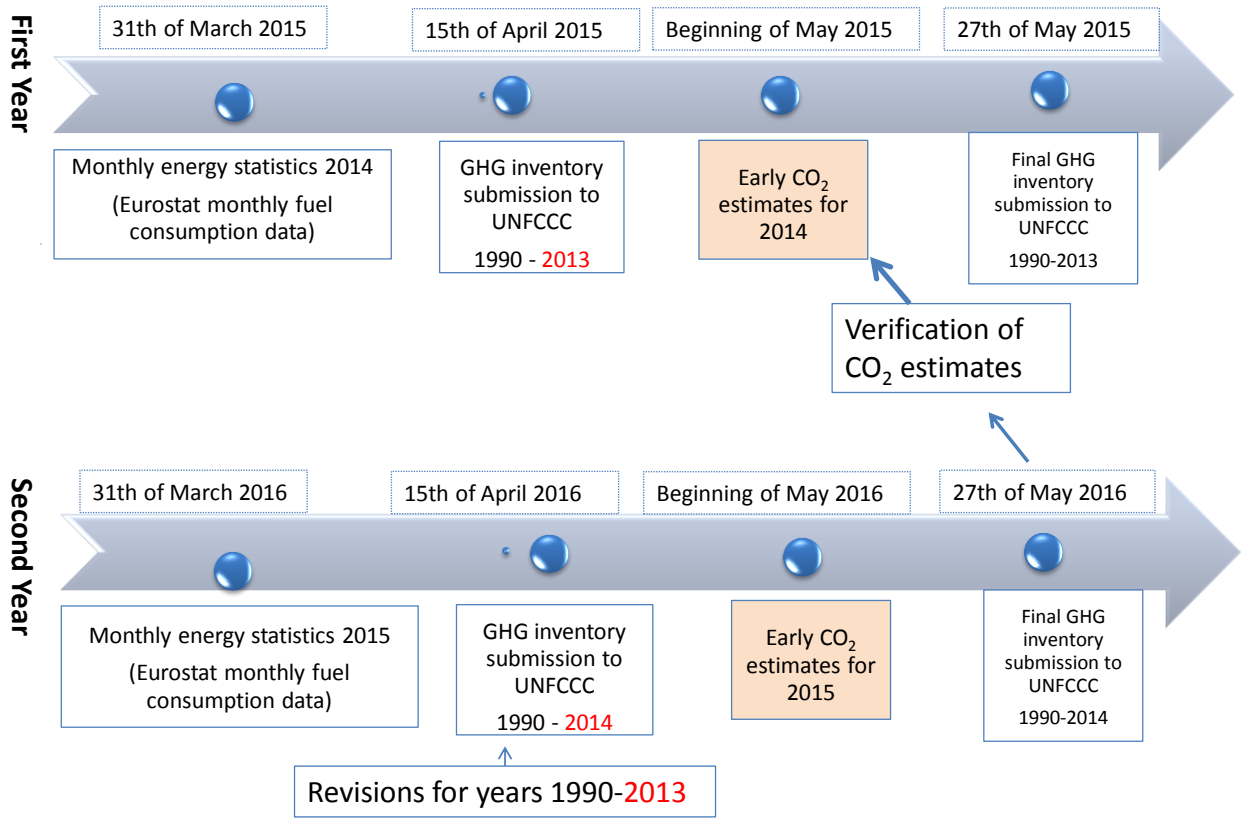
[3] *Sweden reports the reference approach table 1.A(b) in the GHG inventory in m3 instead of kt or TJ. This leads to confusion with regard to the NCVs used, as it is not clear that this is reported in GJ/m3. Checking the Annex of the 2016 NIR submission makes clear that the values used are in m3. However not for all fuels NCVs in tonnes/GJ are provided, thus this might lead to inconsistencies due to the calculation in physical units (kt).*

2.2. Data sources and data evaluation

2.2.1. Availability of data to calculate early CO_2 emissions and for verification of results

The estimation of early CO_2 emissions and the verification of results are based on a specific timeline depending on the availability of data sources used (see Figure 2-1).

Figure 2-1: Availability of data sources, example CO_2 estimate for reference year 2015 and verification of results of the CO_2 estimate for reference year 2014



Source: Authors' own compilation

For estimating CO_2 emissions four months after the reference year for the year 2015, three data sources are used:

1) Eurostat monthly energy data 2014 (as available on 31st March 2015).
2) Eurostat monthly energy data 2015 (as available on 31st March 2016).
3) GHG inventory data for CO_2 emissions for 2014 based on the reference approach (Table 1.A(b)) as available under UNFCCC on 15th April 2016[4].

To assess the quality of the early CO_2 estimates for the year 2014, the following data sources are compared:

1) Early CO_2 estimates for the year 2014

[4] http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8108.php

2) GHG inventory data for CO_2 emissions based on the reference approach (Table 1.A(b)) as reported to the UNFCCC for the year 2014 (as available on 27th May 2016)[5].

The closeness of results for the early CO_2 estimate for reference year 2014 with the respective inventory data can be influenced by different issues. Large differences can be due to:

1) Quality of Eurostat monthly energy data for 2013 (available on 31st March 2014).
2) Quality of Eurostat monthly energy data for 2014 (available on 31st March 2015).
3) Changes in reporting of Eurostat monthly energy data for 2014 in comparison to the reporting of 2013 data (e.g. inclusion of international bunkers in only one of the years, improved reporting) that influences the time series and hereby the trend.

Quality of monthly data

To assess the quality of the Eurostat monthly energy data for the year 2014 (as available on 31st March 2015), it is compared with:

1) Annual Eurostat data 2014 (as available by end of January 2016)
2) GHG inventory data on fuel consumption as reported to the UNFCCC for the year 2014 (as available on 27th May 2016)[6].

This is performed at the level of aggregated fuel consumption in physical units for liquid and solid fuels and in energy units for gaseous fuels. If differences exceed +/- 3 % in 2014, a detailed comparison is carried out.

As there are only very few data sources available that provide data as soon as 4 months after the reference year, the quality of the monthly data (for the year t-1) is analysed in terms of completeness, outliers and gaps.

2.2.2. Data revisions

Member States can submit revised data that affect the comparison of energy data on fossil fuel consumption and also the closeness of results of early CO_2 emission estimates. Data revisions can be submitted by Member States during the year and for any historic year for monthly and annual Eurostat energy data as well as for GHG inventory data.

Revision of Eurostat monthly energy data

Within the data preparation and processing for calculating early CO_2 emissions data, checks for the most recent year of Eurostat monthly energy data are carried out. These include checks on completeness, consistency, outliers and gaps. If there are issues identified, Eurostat contacts the Member State(s) and asks either for confirmation or for a revision of monthly data. In some cases, Member States send a revised set of monthly questionnaires that is uploaded to the Eurostat database; in other cases, information on revision of monthly data is only provided via email and included manually in the project file.

Throughout the year there might be new revisions of monthly data available that are uploaded to the Eurostat database. Thus, monthly data for 2013 that has been available in April 2014 might

[5] The inventory submission that becomes available on 27th May will be referred to as the final GHG inventory. In 2016 final inventory data was dlayed in some Member States due to problems with the reporing software. For assessing the quality of the 2014 early CO_2 estimates inventory submission as availbable by the end of September 2016 is used.

[6] Du to problems with the CRF data collector final inventory submissions 2016 (for the year 2014) became available in June or September 2016

have been revised and is not necessarily identical with monthly data for 2013 available in the database in April 2015.

To ensure consistency in calculating early CO_2 emissions for the year 2015, the checked monthly data 2014 as available in April 2015 and the checked monthly data 2014 as available in April 2015 were used to establish the trend change.

Revision of annual Eurostat data

Member States also revise their annual data and Eurostat incorporates these revised annual data in its database. As annual Eurostat data is only used for verification of the quality of monthly data, revisions of annual data do not have a large effect. A retracing of original annual data (as available in April for the year t-2) used for the comparison with monthly data is not possible, if Member States have revised their annual data.

Revision and recalculation of GHG inventory data

Member States have to report their inventory data to the UNFCCC by the 15th April for the year t-2 including the entire time series beginning in 1990. Until the 27th May Member States have time to make additional changes (error fixing etc.) and submit a final version to the UNFCCC. This final version submitted by the 27th May is reviewed by UNFCCC review experts.

Member States' inventory submissions are based on a quality control and quality assurance system. Additionally, the inventories are reviewed by external review experts from the EU and from the UNFCCC. Therefore, revisions of inventory data are not uncommon. In most cases Member States' inventory submissions include the most recent year (i.e. the data for reference year 2014 is available in Member States' submissions since April 2016) and revised data for the years 1990-2013. This ensures consistent reporting along the time series. When new data sources for activity data or new country-specific emission factors become available they can be applied consistently to all years in the time series.

2.3. Evaluation of Eurostat monthly energy data

2.3.1. Data tool, quality assurance and quality control

For consistency and comparability, the project this year builds on work from previous years and makes use of the same data 'tool' - a set of Excel spreadsheets that hold and calculate Eurostat monthly and annual energy and emissions data. The data used is drawn from the CRF table 1.A(b) on the IPCC reference approach for emissions from fuel combustion as reported in the 2016 GHG inventory submissions (for reference year 2014) to the UNFCCC and on Eurostat monthly energy data on fuel consumption from the Eurostat database as of April 2016 (for reference year 2015).

Eurostat monthly energy data are imported from the raw data files (as extracted from Eurostat's production database) and analysed with standard Excel features and functions such as pivot tables, conditional formatting, filters and formulas. Pivot tables are used to view and analyse the data in a convenient monthly table with rows for Member States and fuel activity.

The spreadsheet tool is also subject to quality control practices whereby each member of our team independently reviews the work of others and verifies data flows, calculations and results.

2.3.2. Completeness and Outliers in Eurostat monthly energy data for the year 2015

The first checks for the 2015 monthly data provided to Eurostat were completed by 10th of March 2016. In the first checking round, there were some general issues on completeness as some monthly oil and coal questionnaires were still missing. Germany and Greece did not report data for December to Eurostat and the Netherlands did not report November and December by that time.

The analysis of data gaps was based on a pivot table with formulas and conditional formatting configured to identify possible gaps. These results were then assessed for plausibility based on our own expert opinion. The first part of the analysis on the Eurostat monthly data set was to identify missing data (no values). The analysis was conducted on the Eurostat monthly data of the 28 Member States for six flows (primary production, total imports, stock change, total exports, international marine bunkers and deliveries to international aviation) and 33 fuels. While not all the fuel categories are directly relevant for the calculation of CO_2 early estimates, it was however assumed useful to apply the search for data gaps to the complete fuel list provided, independently of the use in the early CO_2 emissions calculations.

After identifying gaps Member States were asked if they could confirm the data where potential gaps and outliers have been identified. Member States responded very quickly and confirmed the data in most cases. Some Member States like France and Romania provided updated monthly Oil Questionnaires after the first checks were carried out. In addition, Sweden provided updated monthly Questionnaires after the first checks.

The resulting list of data gaps, included as Table 5-3 (see annex 5.1), was further examined with Eurostat, with the consensus that no data gaps and outliers were filled.

3. Main findings

3.1. Comparisons of early CO_2 estimates for 2014 with inventory data

The overview provided in Table 3-1 shows the closeness of the results of the early CO_2 emission estimates based on Eurostat monthly energy data with final GHG inventory data (CRF table 1.A.(b)) submitted to the UNFCCC for the year 2014. The comparison is based on trend changes calculated for CO_2 emissions from fossil fuel combustion. A comparison of calculated CO_2 emissions in kilotons (kt) is not conclusive due to data revisions and recalculations of UNFCCC inventory data (see chapter 2.2.2). The analysis of results is therefore based on the trend change analysis and not on absolute CO_2 emissions in kt.

Table 3-1: Closeness of early CO_2 emission estimates with final GHG inventory CO_2 emissions (CRF table 1A(b))

	2014
Number of MS with a difference to final inventory of ≤ ±2%	18 MS
Contribution of those MS' to total EU-28 emissions	66%
Number of MS with a difference to final inventory of ± >2 and ≤ 5%,	8 MS
Contribution of those MS' to total EU-28 emissions	33%
Number of MS with a difference to final inventory of > ± 5%	2 MS
Contribution of those MS' to total EU-28 emissions	1%
Closeness at EU28 level	**1.1%**

Source: Authors' own compilation based on Eurostat early CO_2 estimates and MS' GHG inventory submissions to UNFCCC

Table 3-1 and Table 3-2 indicate that the closeness of the early CO_2 estimates to the final GHG inventory data on CO_2 emissions from fossil fuel combustion for EU aggregates was quite good for the year 2014. The contribution of CO_2 emissions from Member States with less than 2 % difference in trend change was 66 % of total EU-28 emissions in 2014. Additionally, Member States with differences in trend change greater than 5 % represent only 1 % of the total EU-28 emissions in 2014. The closeness of 1.1 % at EU 28 level is also a result of balancing differences between Member States. Some Member States show positive differences, while some Member States show negative differences.

Table 3-2: Comparison of changes in CO_2 emissions from total fossil fuels

Member States	Trend changes of early CO_2 estimates	Trend changes in CO_2 emissions based on GHG inventory data (submission 2016)	Differences trend changes early estimates-GHG inventory	MS share in EU 28 total emission from fuel combustion
	2014/2013		2014/2013	2014
Belgium	-1.0%	-5.9%	4.8%	2.4%
Bulgaria	7.1%	7.2%	-0.1%	1.4%
Czech Republic	-2.1%	-1.3%	-0.8%	2.7%
Denmark	-10.7%	-11.4%	0.7%	1.1%
Germany*	-3.1%	-6.5%	3.4%	22.9%
Estonia	-2.0%	-2.5%	0.4%	0.6%
Ireland	-1.0%	-1.8%	0.8%	1.1%
Greece	-6.5%	-2.7%	-3.8%	2.3%
Spain	-2.1%	-1.9%	-0.1%	7.2%
France	-8.2%	-9.2%	1.0%	9.8%
Croatia	-6.3%	-5.4%	-0.9%	0.5%
Italy	-6.9%	-6.5%	-0.5%	10.2%
Cyprus	3.6%	3.2%	0.4%	0.2%
Latvia	-1.3%	-1.1%	-0.2%	0.2%
Lithuania	2.2%	-3.7%	5.9%	0.3%
Luxembourg	-6.2%	-5.3%	-0.8%	0.3%
Hungary*	-2.4%	-2.5%	0.1%	1.2%
Malta	2.5%	-1.5%	4.0%	0.1%
Netherlands	-6.9%	-5.4%	-1.5%	5.0%
Austria"	-3.5%	-6.8%	3.4%	1.6%
Poland*	-5.3%	-6.0%	0.7%	9.0%
Portugal	-5.7%	-2.5%	-3.2%	1.3%
Romania	-1.3%	-3.2%	1.8%	2.0%
Slovenia	-9.1%	-11.1%	1.9%	0.4%
Slovakia	-14.1%	-8.0%	-6.1%	0.8%
Finland	0.7%	-3.0%	3.7%	1.4%
Sweden	0.2%	-2.3%	2.5%	1.2%
United Kingdom"	-8.7%	-9.5%	0.8%	12.8%
EU 28	**-5.0%**	**-6.1%**	**1.1%**	

Note: Green: difference ≤ ± 2%, Yellow: difference ± >2 and ≤ 5%, Red: difference > ± 5% .

* Trend changes for solid fuels have been calculated based on consumption in TJ

" International bunkers for jet kerosene have been gap filled with annual Eurostat data for 2013

[1] The summing up of the total CO_2 emissions in the CRF table 1.A(b) for the Czech Republic is not correct, this has been corrected here

GHG inventory CO_2 emissions from CRF table 1A(b) without CO_2 emissions from waste and other fossils

Germany, Spain, France, Italy, Netherlands, Poland and the United Kingdom (shown in bold) each have a share of more than 5 % and together contributed 77% of EU CO_2 emissions from fossil fuel combustion.

Source: Eurostat early CO_2 estimates, MS GHG inventory submissions to UNFCCC 27th of May 2016

EU CO_2 emissions from fossil fuel combustion are dominated by seven Member States each of which have a share of more than 5 % of the total. The Netherlands, Spain, France, Italy, Poland and the United Kingdom show a very good match between the trend changes of the early CO_2

estimates and the trend changes from the GHG inventory with differences of 1.5 % or less. However, Germany with 23 % of EU total CO_2 emissions shows a difference of 3.4 %, which has implications on the result for total EU 28 CO_2 emissions. Differences above 5 % can only be found for Lithuania and Slovakia both of which have only a very low share in EU 28 total CO_2 emissions from fuel combustion.

The analysis of differences between Eurostat early CO_2 estimates and final GHG inventory data is carried out separately for liquid, solid and gaseous fuels. Table 3-3 shows the differences in trend changes for the aggregated fuel categories. All Member States except Denmark, Italy, Cyprus, Poland and the United Kingdom show differences for the trend changes of above 2 % in at least one of the fuel categories.

In all Member States except Estonia and Poland more than 20 % of CO_2 emissions are from liquid fuel consumption. While emissions from liquid, solid or gaseous fuels are all relevant, the relative contribution varies according to national circumstance. The share of CO_2 emissions from liquid, solid, gaseous fuels in Member State's total CO_2 emissions from fuel consumption indicates the importance of the fuel in the Member State. Differences in the trend change for liquid fuel consumption in Estonia are not as relevant as the differences in the trend changes for liquid fuel consumption in Sweden. Liquid fuel consumption in Estonia contributes only 5 % to total CO_2 emissions of fossil fuel consumption in Estonia, while for Sweden liquid fuels make up 71 % of total CO_2 emissions.

Table 3-3: Comparison of changes in CO_2 emissions from liquid, solid and gaseous fuels

Member States	Eurostat early CO2 estimates	Member States GHG inventory emission data (CRF Table 1.A(b))	Difference	Share of liquid fuels in total CO2 emission of MS	Eurostat early CO2 estimates	Member States GHG inventory emission data (CRF Table 1.A(b))	Difference	Share of solid fuels in total CO2 emission of MS	Eurostat early CO2 estimates	Member States GHG inventory emission data (CRF Table 1.A(b))	Difference	Share of gaseous fuels in total CO2 emission of MS
	Liquid fuels				Solid fuels				Gaseous fuels			
	Change 2014/2013		%		Change 2014/2013		%		Change 2014/2013		%	
Belgium	2.2%	-0.5%	2.7%	56%	17.1%	-6.6%	23.7%	7%	-12.4%	-12.8%	0.4%	37%
Bulgaria	4.9%	10.7%	-5.8%	26%	9.4%	7.7%	1.8%	64%	-0.9%	-3.0%	2.1%	11%
Czech Republic	6.2%	8.4%	-2.2%	27%	-2.3%	-2.4%	0.1%	56%	-10.7%	-11.1%	0.4%	17%
Denmark	-2.4%	-3.8%	1.4%	51%	-18.9%	-19.9%	1.0%	30%	-16.4%	-14.9%	-1.5%	20%
Germany*	-1.5%	-3.4%	1.9%	34%	-0.4%	-5.6%	5.3%	46%	-11.0%	-13.0%	2.1%	20%
Estonia	-13.2%	-19.8%	6.6%	5%	-0.3%	-1.6%	1.4%	89%	-21.5%	3.7%	-25.3%	6%
Ireland	-1.0%	-1.8%	0.8%	49%	1.6%	-0.6%	2.1%	25%	-3.4%	-3.1%	-0.3%	26%
Greece	-1.7%	3.9%	-5.6%	45%	-7.5%	-3.9%	-3.6%	48%	-23.3%	-25.9%	2.6%	7%
Spain	-1.8%	0.1%	-1.9%	56%	7.5%	3.2%	4.3%	19%	-9.3%	-9.6%	0.3%	25%
France	-1.3%	-1.0%	-0.3%	63%	-26.3%	-25.8%	-0.5%	12%	-13.1%	-17.7%	4.6%	24%
Croatia	-5.8%	-1.1%	-4.7%	59%	-4.1%	-4.1%	0.0%	17%	-8.7%	-15.5%	6.8%	23%
Italy	-4.1%	-2.5%	-1.6%	46%	-3.7%	-3.8%	0.1%	17%	-11.6%	-11.9%	0.3%	38%
Cyprus	3.6%	3.0%	0.5%	100%	-	-	-	0%	-	-	-	-
Latvia	8.3%	8.1%	0.2%	57%	-24.0%	-17.9%	-6.1%	4%	-9.8%	-10.1%	0.3%	40%
Lithuania	8.7%	4.1%	4.6%	66%	-17.4%	-15.6%	-1.8%	9%	-4.9%	-16.0%	11.2%	25%
Luxembourg	-6.6%	-5.8%	-0.7%	76%	2.6%	14.5%	-11.9%	2%	-5.3%	-5.1%	-0.1%	22%
Hungary*	4.5%	11.6%	-7.1%	37%	-0.1%	-3.2%	3.1%	23%	-8.8%	-12.7%	3.9%	40%
Malta	2.5%	-1.5%	4.1%	100%	-	-	-	-	-	-	-	-
Netherlands	-4.5%	-3.2%	-1.3%	34%	2.3%	11.0%	-8.7%	23%	-12.7%	-13.8%	1.1%	43%
Austria"	-1.7%	-3.8%	2.1%	62%	0.1%	-17.3%	17.4%	9%	-8.1%	-9.4%	1.3%	29%
Poland*	-1.9%	-2.3%	0.5%	19%	-6.6%	-7.3%	0.7%	71%	-2.1%	-3.8%	1.7%	10%
Portugal	-8.0%	-3.2%	-4.8%	57%	1.6%	1.0%	0.6%	25%	-7.6%	-4.9%	-2.6%	18%
Romania	1.6%	0.9%	0.8%	35%	0.3%	-6.0%	6.3%	32%	-6.1%	-4.5%	-1.6%	32%
Slovenia	1.2%	-2.1%	3.2%	53%	-21.8%	-22.3%	0.5%	35%	-9.4%	-9.6%	0.2%	12%
Slovakia	-4.0%	-1.9%	-2.1%	32%	-2.0%	-4.8%	2.8%	37%	-34.4%	-16.8%	-17.6%	31%
Finland	13.9%	5.4%	8.5%	49%	-9.3%	-9.6%	0.2%	39%	-12.2%	-10.9%	-1.2%	12%
Sweden	-0.8%	-6.1%	5.3%	75%	7.5%	20.5%	-13.0%	21%	-17.0%	-19.0%	2.0%	4%
United Kingdom"	-0.1%	-0.8%	0.7%	40%	-20.1%	-20.8%	0.7%	25%	-8.6%	-9.4%	0.9%	35%

Source: Eurostat early CO_2 estimates, MS GHG inventory submissions to UNFCCC

The application of the trend change method requires consistent reporting of monthly data for at least two consecutive years. Changes or improvements in the data may affect the trend change method in a negative way, leading to higher deviations between early CO_2 estimates and CO_2 emission data reported in the GHG inventories.

Differences in trend changes as observed in Table 3-3 might have different reasons:

- Improvement of data quality in the 2014 reporting of Eurostat monthly data in comparison to the reporting in 2013

- Deterioration of data quality in the 2014 reporting of Eurostat monthly data in comparison to the reporting in 2013
- Fluctuating data quality in 2013 and 2014

Another reason that became relevant with the application of the 2006 IPCC guidelines since the reporting year 2013 (Submission year 2015) is the increasing quantity of carbon stored and excluded in some countries. According to the IPCC Guidelines quantities of coke delivered to the iron and steel and non-ferrous metals industries as well as fuels used for non-energy uses and feedstocks should be excluded from total carbon in the IPCC reference approach. In Member States where the share of carbon stored is not changing over the years there is no influence on the trend change. However, in some Member States the share of carbon stored shows inter-annual changes, which leads to differences in the trend changes that are not related to the quality of the reported monthly Eurostat data. It seems that some countries are using this new margin excessively while others don't change the carbon stored figures. (e.g. Austria, Belgium)

Table 3-4 shows that for Estonia and Lithuania the reporting of liquid and gaseous fuel consumption data under monthly Eurostat and GHG inventory shows the same trend changes calculated based on fuel consumption in kt or TJ. The trend changes calculated on CO_2 emissions in the GHG inventory in kt CO_2 eq. differs from the trend changes calculated for consumption due to the subtraction of the amount of carbon stored.

Table 3-4: Countries with carbon stored that influence the trend changes 2014/2013

Member State	Fuel Type	Share of carbon stored 2013	Share of carbon stored 2014	Trend change Eurostat monthly based on fuel consumption in kt 2014/2013	Trend change GHG inventory based on fuel consumption in TJ 2014/2013	Trend change GHG inventory based on CO_2 emissions in kt 2014/2013
Estonia	Liquid fuels	20 %	26 %	-13 %	-12 %	-20 %
Estonia	Gaseous fuels	25 %	NA	-22 %	-22 %	-4 %
Lithuania	Gaseous fuels	38 %	45 %	-5 %	-5 %	-16 %
Austria	Solid fuels	62 %	67 %	0 %	-8 %	-17 %
Belgium	Solid fuels	57 %	59 %	17 %	-2 %	-7 %
Croatia	Gaseous fuels	22 %	25%	-9 %	-11 %	-16 %

Source: Own calculation based on the GHG inventory 2016 submission, CRF table 1.A(b)

For Austria, Belgium and Croatia there are differences in the reporting of fuel consumption, but also differences that appear due to the subtraction of carbon stored. The differences that appear due to changing shares of carbon stored in total carbon result in uncertainties that cannot be predicted. Monthly Eurostat data does not contain information on the amount of carbon used for feedstock or in iron and steel industries.

3.2. Analysis of differences

The analysis in the following sub-sections addresses liquid, solid and gaseous fuels and follows the same structure for each fuel type. Firstly, the differences for the trend changes for the CO_2 emissions for the year 2014 are shown. The trend changes that are based on monthly Eurostat data are calculated for total fuel consumption in kt in comparison to the GHG inventory submission data where trend changes are calculated based on CO_2 emissions from fuel consumption.

Secondly, because the results of the trend change method depends on the data quality of two consecutive years, we provide a comparison of the data quality for the reporting of total liquid, solid or fossil fuel consumption for the years 2013 and 2014. Finally, if this comparison shows differences above +/-3 % for the year 2014 a detailed analysis of the fuel(s) that contributes to the differences on the level of aggregated fuel consumption is carried out.

3.2.1. Analysis of differences for liquid fuels

Table 3-5 provides an overview of the trend changes for CO_2 emissions from liquid fuel consumption. The comparison between trend changes calculated with Eurostat monthly data and GHG inventory data shows that more than half of the Member States have differences in trend changes above 2 %. Large differences above 5 % can be found for Bulgaria, Estonia, Greece, Hungary, Finland and Sweden. However Bulgaria, Estonia and Hungary show good results on the level of total CO_2 emission (see Table 3-2) and Bulgaria and Estonia have a rather low share of CO_2 emissions from liquid fuel consumption in total CO_2 emissions.

Table 3-5: Comparison of trend changes in CO_2 emissions from liquid fuel consumption

Member States	Eurostat early CO2 estimates	Member States GHG inventory emission data (CRF Table 1.A(b))	Difference Eurostat estimates - GHG inventory	Share of liquid fuels in total CO_2 emission of MS
	Change 2014/2013		%	
Belgium	2.2%	-0.5%	2.7%	56%
Bulgaria	4.9%	10.7%	-5.8%	26%
Czech Republic	6.2%	8.4%	-2.2%	27%
Denmark	-2.4%	-3.8%	1.4%	51%
Germany	-1.5%	-3.4%	1.9%	34%
Estonia	-13.2%	-19.8%	6.6%	5%
Ireland	-1.0%	-1.8%	0.8%	49%
Greece	-1.7%	3.9%	-5.6%	45%
Spain	-1.8%	0.1%	-1.9%	56%
France	-1.3%	-1.0%	-0.3%	63%
Croatia	-5.8%	-1.1%	-4.7%	59%
Italy	-4.1%	-2.5%	-1.6%	46%
Cyprus	3.6%	3.0%	0.5%	100%
Latvia	8.3%	8.1%	0.2%	57%
Lithuania	8.7%	4.1%	4.6%	66%
Luxembourg	-6.6%	-5.8%	-0.7%	76%
Hungary	4.5%	11.6%	-7.1%	37%
Malta	2.5%	-1.5%	4.1%	100%
Netherlands	-4.5%	-3.2%	-1.3%	34%
Austria"	-1.7% *-7.4%*	-3.8%	2.1%	62%
Poland	-1.9%	-2.3%	0.5%	19%
Portugal	-8.0%	-3.2%	-4.8%	57%
Romania	1.6%	0.9%	0.8%	35%
Slovenia	1.2%	-2.1%	3.2%	53%
Slovakia	-4.0%	-1.9%	-2.1%	32%
Finland	13.9%	5.4%	8.5%	49%
Sweden	-0.8%	-6.1%	5.3%	75%
United Kingdom"	-0.1% -15.9%	-0.8%	0.7%	40%

Note: " For Austria and the United Kingdom international bunkers for the year 2013 has been gap filled. The figures above show the trend changes without international bunkers in 2013 and with gap filled international bunkers. Trend changes for monthly Eurostat data are based on fuel consumption in kt, trend changes from GHG inventory are based on CO_2 emissions in kt

- Trend changes for GHG inventory based on 2016 submission, thus effects on recalculations and data revisions are not relevant

Source: Own Calculation based on extraction from Eurostat database, MS inventory submission to UNFCCC, CRF table 1.A(b)

For Austria and the United Kingdom the trend change has been corrected by gap filling international bunkers for jet kerosene. As this fuel use was only reported for 2014 monthly Eurostat data, but not for 2013 monthly Eurostat data, differences are much lower after gap filling.

As pointed out above the trend changes are influenced by the reporting quality of two consecutive years and any changes in the quality of reporting affects the trend changes. Additionally there are some Member States that show good matches for the level of trend changes calculated with Eurostat monthly data and GHG inventory data, but only due to systematic differences in the reporting of monthly Eurostat data throughout the years. This becomes obvious in Table 3-6 that shows the differences in the reporting of liquid fuel consumption between Eurostat monthly data, Eurostat annual data and GHG inventory data for the year 2013 and 2014.

The comparison in Table 3-6 indicates that the quality of the reporting of liquid fuel consumption for monthly energy data is not consistent over the years for most Member States, while Denmark, Estonia and Portugal show systematic differences in the reporting of liquid fuel consumption for both years. The fluctuation in the reporting quality results in inconsistencies and causes differences in trend changes 2014/2013 (as shown in Table 3-5). The basis for the differences is aggregated liquid fuel consumption data calculated in kt. The differences are displayed as deviations from annual Eurostat data (which is 100 %), which is supposed to be the best reporting standard. GHG inventory data should be close to annual Eurostat data.

For most countries the consistency in reporting of total liquid fuel consumption between monthly and annual Eurostat data improved in 2014 in comparison to 2013. Only Bulgaria, the Netherlands and Finland show relevant increasing differences. Croatia and Hungary show a fluctuation in the reporting of monthly data as the differences between monthly and annual Eurostat data change from positive in 2013 to negative in 2014. The highest absolute differences in the reporting of liquid fuel consumption in 2014 are found for Belgium, France, the Netherlands, Portugal and the United Kingdom.

Table 3-6 also shows that for liquid fuel consumption the difference between annual Eurostat and GHG inventory data fluctuates throughout the years. Some differences e.g. for Belgium, Ireland, Italy, Latvia, Lithuania seem to be systematic, while for the Netherlands, Slovakia, Finland and Sweden there is a fluctuation in the reporting between annual Eurostat and GHG inventory data.

Table 3-6: Differences in liquid fuel consumption between monthly and annual Eurostat data and GHG inventory data

Member States	Eurostat monthly vs. Annual Eurostat		Difference monhtly-annual Eurostat in kt		Eurostat monthly vs. GHG inventory		Eurostat annual vs. GHG inventory	
	2013	2014	2013	2014	2013	2014	2013	2014
Belgium	2%	3%	487	675	0%	0%	2%	3%
Bulgaria	1%	-5%	28	- 178	1%	-4%	0%	0%
Czech Republic*	0%	0%	4	13	1%	0%	0%	0%
Denmark*	6%	7%	353	387	6%	8%	0%	-1%
Germany*	-1%	0%	- 866	- 450	-1%	-1%	1%	0%
Estonia	-25%	-23%	- 105	- 82	-25%	-23%	0%	0%
Ireland	-3%	1%	- 154	34	1%	4%	-3%	-3%
Greece	5%	0%	511	- 24	5%	0%	0%	0%
Spain	0%	0%	- 70	158	2%	2%	-2%	-2%
France	2%	2%	1,413	1,312	-1%	-3%	3%	5%
Croatia	2%	-2%	69	- 52	0%	-5%	2%	3%
Italy*	0%	0%	40	- 211	-4%	-4%	5%	4%
Cyprus	-1%	-1%	- 10	- 13	-1%	-1%	0%	1%
Latvia*	-12%	-7%	- 149	- 94	-7%	-1%	-5%	-6%
Lithuania*	0%	1%	4	31	-8%	-6%	8%	8%
Luxembourg	0%	-1%	- 7	- 23	0%	-1%	0%	0%
Hungary*	5%	-3%	260	- 178	2%	-2%	2%	-1%
Malta*	-3%	-5%	- 21	- 39	-8%	-4%	5%	-1%
Netherlands*	-1%	-10%	- 252	- 3,007	-3%	1%	2%	-11%
Austria	5%	-1%	584	- 69	3%	-2%	2%	2%
Poland*	1%	0%	243	76	1%	3%	0%	-2%
Portugal*	15%	10%	1,355	923	13%	9%	1%	1%
Romania*	1%	2%	108	192	-1%	-1%	2%	4%
Slovenia	-7%	-4%	- 169	- 87	-7%	-4%	0%	0%
Slovakia*	-2%	2%	- 63	68	-3%	-4%	1%	6%
Finland	0%	-5%	9	- 402	-6%	1%	6%	-6%
Sweden[1]	1%	1%	154	146	-5%	-2%	7%	4%
United Kingdom*	19%	-2%	10,554	- 869	18%	-2%	1%	1%
EU 28	**3%**	**0%**	**14,310**	**- 1,763**	**1%**	**0%**	**2%**	**1%**
<+/- 2%	14 MS	15 MS			10 MS	11 MS	18 MS	15 MS
+/-2-5%	7 MS	7 MS			7 MS	13 MS	5 MS	8 MS
> +/- 5%	7 MS	6 MS			11 MS	4 MS	5 MS	5 MS

Note: The data for GHG inventory submission for the year 2013 is based on the 2015 submission, the data for 2014 based on the 2016 submission, as this table focuses on the comparison in the specific year. Data used in this table might not reflect the trend changes for the GHG inventory as shown in Table 3-5 due to data revisions and recalculations between 2015 and 2016 GHG inventory submissions.

Data does not include the reporting of biofuels. Only for Sweden in 2013 and 2013 total gas/diesel oil and total motor gasoline data is used as the reporting without biofuels is incomplete. Also for Cyprus for the year 2013 total gas/diesel oil data has been used due to inconsistencies in reporting.

Differences are based on liquid fuel consumption in kt for all data sources

Source: Own compilation based on extraction from Eurostat database in the specific year, GHG inventory submission CRF table 1.A(b)

The improvement in the reporting of international bunkers from jet kerosene in the United Kingdom results in far lower absolute and relative differences for the EU 28 level in 2014.

For Member States that show differences above 3 % in the reporting of liquid fuel consumption in the different data sources for the year 2014 data is further analysed in the following tables. Table

3-7 shows detailed differences on the level of the single fuel categories for liquid fuel consumption. Table 3-8 provides a description of the differences and if available further explanations.

Table 3-7: Detailed differences for liquid fuel consumption between monthly and annual Eurostat data and GHG inventory data for 2014

Member State	Fuel Consumption	Monthly Eurostat	Annual Eurostat	GHG inventory data	Diffference between monthly-annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data		Flow
		Apparent fuel consumption in kt			kt	%	kt	%	kt	%	
Belgium	**Total liquids**	**22,469**	**21,794**	**22,395**	***675***	3%	***74***	0%	***601***	3%	
	Natural gas liquids	242	564	564	*-322*		*-322*		*0*		*Imports*
	Gasoline	-3,294	-3,483	-3,483	*189*		*189*		*0*		*Exports*
	Residual fuel oil	-5,655	-5,923	-5,923	*268*		*268*		*0*		*Imports/stock changes*
	Naphtha	3,077	2,825	2,825	*252*		*252*		*0*		*Imports*
	Other Oil, Bitumen,Lubricants	-825	-962	-361	*137*		*-464*		*601*		*Exports*
Bulgaria	**Total liquids**	**3,680**	**3,858**	**3,847**	***-178***	-5%	***-167***	-4%	***-11***	0%	
	Gas/diesel oil	-27	68	68	*-95*		*-95*		*0*		*Imports*
Denmark	**Total liquids**	**6,152**	**5,765**	**5,686**	***387***	7%	***466***	8%	***-79***	-1%	
	Jet Kerosene/Other Kerosene	527	-84	-61	*611*		*588*		*23*		*Int. Bunkers*
	Gas/diesel oil	353	517	386	*-164*		*-33*		*-131*		*Imports*
Estonia	**Total liquids**	**269**	**351**	**351**	***-82***	-23%	***-82***	-23%	***0***	0%	
	Shale Oil	-512	-603	-603	*91*		*91*		*0*		*Exports*
	Residual fuel oil	-132	-23	-23	*-109*		*-109*		*0*		*Exports*
	Other oil (Bitumen)	0	94	94	*-94*		*-94*		*0*		*Imports*
Ireland	**Total liquids**	**5,733**	**5,699**	**5,536**	***34***	1%	***197***	4%	***-163***	-3%	
	Gas/diesel oil	2,166	2,111	1,997	*55*		*169*		*-114*		*Imports/Stock changes*
Croatia	**Total liquids**	**2,903**	**2,955**	**3,044**	***-52***	-2%	***-141***	-5%	***89***	3%	
	Other oil	140	132	647	*8*		*-507*		*515*		*Imports*
Italy	**Total liquids**	**51,314**	**51,525**	**53,552**	***-211***	0%	***-2,238***	-4%	***2,027***	4%	
	Refinery feedstocks	5,051	5,044	7,438	*7*		*-2,387*		*2,394*		*Imports/Stock changes*
Latvia	**Total liquids**	**1,197**	**1,291**	**1,213**	***-94***	-7%	***-16***	-1%	***-78***	-6%	
	Gas/diesel oil	801	888	810	*-87*		*-9*		*-78*		*Imports/Stock changes*
Lithuania	**Total liquids**	**2,384**	**2,353**	**2,542**	***31***	1%	***-158***	-6%	***189***	8%	
	Residual fuel oil	-1,357	-1,361	-1,244	*4*		*-113*		*117*		*Exports*
Hungary	**Total liquids**	**6,044**	**6,222**	**6,137**	***-178***	-3%	***-93***	-2%	***-85***	-1%	
	Gasoline	4	108	102	*-104*		*-98*		*-6*		*Imports*
	Gas/diesel oil	-264	-163	-163	*-101*		*-101*		*0*		*Imports*
Malta	**Total liquids**	**730**	**769**	**762**	***-39***	-5%	***-32***	-4%	***-7***	-1%	
	Residual fuel oil	449	475	469	*-26*		*-20*		*-6*		*Int. Bunkers*
Netherlands	**Total liquids**	**26,657**	**29,664**	**26,397**	***-3,007***	-10%	***260***	1%	***-3,267***	-11%	
	Gas/diesel oil	-13,711	-10,640	-13,938	*-3,071*		*227*		*-3,298*		*Exports*
Portugal	**Total liquids**	**9,725**	**8,802**	**8,890**	***923***	10%	***835***	9%	***88***	1%	
	Jet Kerosene/Other Kerosene	-164	-810	-811	*646*		*647*		*-1*		*Int. Bunkers*
	Residual fuel oil	-1,858	-2,028	-2,020	*170*		*162*		*8*		*Int. Bunkers*
Slovenia	**Total liquids**	**2,188**	**2,275**	**2,273**	***-87***	-4%	***-85***	-4%	***-2***	0%	
	Petroleum Coke	0	79	79	*-79*		*-79*		*0*		*Imports*
Slovakia	**Total liquids**	**2,919**	**2,851**	**3,027**	***68***	2%	***-108***	-4%	***176***	6%	
	Gas/diesel oil	-1,080	-1,235	-1,087	*155*		*7*		*148*		*Exports*
	Residual fuel oil	-351	-229	-229	*-122*		*-122*		*0*		*Exports*
Finland	**Total liquids**	**8,196**	**8,598**	**8,117**	***-402***	-5%	***79***	1%	***-481***	-6%	
	Crude Oil	10,888	11,349	11,351	*-461*		*-463*		*2*		*Imports*
	Gasoline	-2,484	-2,557	-2,608	*73*		*124*		*-51*		*Exports*
	Gas/diesel oil	-1,491	-1,463	-1,993	*-28*		*502*		*-530*		*Exports*
Sweden	**Total liquids**	**11,471**	**11,325**	**11,746**	***146***	1%	***-275***	-2%	***421***	4%	
	Jet Kerosene/Other Kerosene	-121	-4	157	*-117*		*-278*		*161*		*Stock changes*
	Gas/diesel oil	-2,387	-2,710	-2,756	*323*		*369*		*-46*		*Exports*
	Residual fuel oil	-3,384	-2,897	-3,014	*-487*		*-370*		*-117*		*Exports*
	Liquidfied Petroleum gases	540	538	886	*2*		*-346*		*348*		*Stock changes*
	Refinery feedstocks	-40	-544	-678	*504*		*638*		*-134*		*Exports/Imports*
	Other oil	-836	-859	-473	*23*		*-363*		*386*		*Imports*

Note: Apparent consumption is calculated as production (only for primary fuels)+imports-exports-stock changes-international bunkers, negative numbers in total apparent consumption indicate that exports, stock changes or international bunkers are higher than imports.

Source: Eurostat database in the specific year, GHG inventory submission 2015 for the year 2013 and 2016 for the year 2014

As there are much more fuel categories under liquid fuel, than under solid fuels the fluctuation is higher and also a random levelling out of differences in the reporting of liquid fuels might lead to a reduction of differences in the reporting of total liquid fuel consumption. Especially for Belgium and Sweden Table 3-7 shows that the good matches between monthly and annual Eurostat data or GHG inventory data are rather randomly. On the basis of the single fuel consumption there are large differences.

Systematic differences can be found for the reporting of international bunkers. This might not strongly affect the trend changes but results in large differences in the reporting of apparent consumption for the affected fuels under monthly Eurostat data, in comparison to annual Eurostat data and GHG inventory data. Consumption of international bunker fuels is one area for which several Member States report much lower quantities in Eurostat monthly compared to annual energy data. The under-reporting of international bunker fuels in a Member State's monthly data has the effect that the combined monthly total fuel consumption in the reference approach calculation is higher than in the annual total. This is because international bunker fuels are subtracted from each Member State's total fuel consumption for internal consumption. This becomes obvious if Member States report higher monthly oil consumption than reported under annual Eurostat data – Denmark and Portugal (see Table 3-6).

Other differences are related to the reporting of gas/diesel oil and other oil. Differences in the reporting of gas/diesel oil are found for all compared data sources (monthly and annual Eurostat data and GHG inventory data). For some Member States these differences in the reporting might be related to the reporting of biofuels, as the main differences appear for the flows where large amounts of biofuels are reported (see Table 5-6). However, in most cases there is no clear indication that this is due to allocation problems for biofuels. Only Finland points out, that differences appear due to uncertainties in the allocation of the biofuel shares.

For the reporting of other oil the differences mainly occur between (monthly and annual) Eurostat data in comparison to GHG inventory data. This is especially the case for Belgium, Croatia and Sweden.

Explanations for the most relevant differences are provided in the following Table 3-8.

Table 3-8: Explanation of differences for liquid fuel consumption as shown in Table 3-7

Member state	Description	Further explanations
Belgium	Differences between annual and monthly Eurostat data occur for NGL, Gasoline, Residual fuel oil and Naphtha. For these fuels there are no differences between annual Eurostat and GHG inventory data. In the GHG inventory data (CRF Table 1.A(b)) Belgium reports a high amount under other oil. This results in large differences between annual Eurostat data and GHG inventory data and reduces the differences between GHG inventory data and monthly Eurostat data on total consumption of liquid fuels.	• *In May 2015 the MS has been asked if data on NGL imports is correctly reported, as there have been 4 month missing. Belgium confirmed that the data is correct. According to Table 5-3 the reporting of 2015 monthly import data for NGL shows also gaps for a few months.* • *There is no information available in the NIR what is reported under other oil.*
Denmark	There are systematic differences in the reporting of international bunkers from Jet Kerosene. In 2013 and 2014 the reporting of imports from Gas/Diesel oil deteriorated. There are large differences in the reporting of gas/diesel oil imports.	• *Differences for gas/diesel oil are shown in* Table 5-6*. It is not clear if differences in the reporting of gas/diesel oil imports are related to allocation problems with the amount of biofuels imported.* • *According to Eurostat experts there are ongoing improvements for the reporting of biofuels.*
Estonia	There are systematic differences in the reporting of shale oil and residual fuel oil exports between annual and monthly Eurostat data. Other oil (Bitumen) is not reported under monthly Eurostat data.	• *The cumulated monthly data of residual fuel oil exports include parts of the shale oil exports. Thus total differences are rather small.*
Italy	Systematic differences in the reporting of stock changes from refinery feedstocks for monthly and annual Eurostat data in comparison to GHG inventory data.	• *Italy is aware of these differences and refers to the differences in their NIR 2016, p. 417, but only in relation to earlier years. However there are no further explanations provided on this issue.*
Hungary	Differences in the reporting of imports for gasoline and gas/diesel oil.	• *No further explanations available.*
Netherlands	Large differences in the reporting of gas/diesel oil exports under annual Eurostat data in comparison to monthly	• *Differences for gas/diesel oil are shown in Table 5-6.*

	Eurostat data and GHG inventory data. These differences appear for the first time in 2014.	*It is not clear if differences in the reporting of gas/diesel oil exports are related to allocation problems with the amount of biofuels exports.* • *The reporting of higher exports in comparison to annual Eurostat data leads to an underestimation of CO_2 emissions. Also under GHG inventory data high exports are reported.*
Portugal	There are systematic differences in the reporting of international bunkers from Jet Kerosene. In 2014 the reporting of international bunkers from Residual fuel oil deteriorated.	• *The reporting of international bunker fuels is not mandatory for monthly energy statistics. However most Member States report sufficient data for international bunkers under monthly Eurostat data.*
Slovenia	Petroleum Coke is systematically not reported under monthly Eurostat data.	• *No further explanations available.*
Slovakia	There are differences in the reporting of gas/diesel oil and residual fuel oil exports. Lower exports are reported under gas/diesel oil and higher exports are reported under residual fuel oil.	• *This might be related to an allocation problem between residual fuel oil and gas/diesel oil.*
Finland	Differences in reporting of crude oil between Eurostat monthly data in comparison to Eurostat annual data and GHG inventory data. The reporting of gas/diesel oil shows good matches for annual and monthly Eurostat data, but not for GHG inventory data. This randomly decreases the differences between monthly Eurostat data and GHG inventory data on the level of total liquid fuel consumption.	• *Differences for gas/diesel oil are shown in Table 5-6. According to the FI NIR 2016, p. 503, the differences for gas/diesel oil are explained as follows: "…allocation of bio shares not clear"* • *According to Eurostat experts there are ongoing improvements for the reporting of biofuels.*
Sweden	There are large differences in the reporting of Gas/Diesel Oil exports and imports. The differences between monthly/annual Eurostat data and GHG inventory data for jet kerosene und LPG seem to be based on using the opposite sign for stock changes. Other oil: Sweden does not report consumption of other oil under monthly and annual Eurostat data. In the GHG inventory data other oil imports is reported. However there is no information in the NIR what kind of fuels are reported under other oil.	• *There have been differences in the reporting of Total gas/diesel oil (blended with biofuels) and Gas/diesel oil (without bio components). The differences in reporting do not seem to be related to the reporting of biofuels,*

		but seem to be related to completeness (see Table 5-5). • *According to Eurostat experts there are ongoing improvements for the reporting of biofuels.*

Source: Own compilation

The comparison shows that the differences in the reporting of liquid fuel consumption can be based on outliers in the reporting for a single fuel category and one flow. However, it also shows systematic differences in the reporting, e.g. Estonia where other oil is constantly not reported under Eurostat monthly data or Denmark and Portugal where international bunkers from jet kerosene are systematically underreported in Eurostat monthly data. Besides this, it also shows that there are Member States (Belgium and Sweden) that have general problems in the reporting of liquid fuels, as there are differences for many liquid fuel categories.

3.2.2. Analysis of differences for solid fuels

Table 3-9 provides an overview on the trend changes used to calculate CO_2 emissions from solid fuel consumption. The comparison between trend changes calculated with Eurostat monthly data and GHG inventory data shows that half of the Member States have differences in trend changes above 2 %. Large differences above 5 % can be found for Belgium, Germany, Latvia, Luxembourg, the Netherlands, Austria, Romania and Sweden. However, Latvia, Luxembourg, the Netherlands and Romania show good results on the level of total CO_2 emission (see Table 3-2). Latvia and Luxembourg have a rather low share of CO_2 emissions from solid fuel consumption in total CO_2 emissions, while for the Netherlands and Romania larger differences in the reporting of solid fuels are randomly levelled out by differences in liquid or gaseous fuel consumption.

Table 3-9: Comparison of trend changes in CO_2 emissions from solid fuel consumption

Member States	Eurostat early CO_2 estimates	Member States GHG inventory emission data (CRF Table 1.A(b))	Difference Eurostat estimates - GHG inventory	Share of solid fuels in total CO_2 emission of MS
	Change 2014/2013		%	
Belgium	17.1%	-6.6%	23.7%	7%
Bulgaria	9.4%	7.7%	1.8%	64%
Czech Republic	-2.3%	-2.4%	0.1%	56%
Denmark	-18.9%	-19.9%	1.0%	30%
Germany*	*-0.4%* *-1.7%*	-5.6%	5.3%	46%
Estonia	-0.3%	-1.6%	1.4%	89%
Ireland	1.6%	-0.6%	2.1%	25%
Greece	-7.5%	-3.9%	-3.6%	48%
Spain	7.5%	3.2%	4.3%	19%
France	-26.3%	-25.8%	-0.5%	12%
Croatia	-4.1%	-4.1%	0.0%	17%
Italy	-3.7%	-3.8%	0.1%	17%
Cyprus	-	-	-	-
Latvia	-24.0%	-17.9%	-6.1%	4%
Lithuania	-17.4%	-15.6%	-1.8%	9%
Luxembourg	2.6%	14.5%	-11.9%	2%
Hungary*	*-0.1%* *-4%*	-3.2%	3.1%	23%
Malta	-	-	-	-
Netherlands	2.3%	11.0%	-8.7%	23%
Austria	0.1%	-17.3%	17.4%	9%
Poland*	*-6.6%* *-5.5%*	-7.3%	0.7%	71%
Portugal	1.6%	1.0%	0.6%	25%
Romania	0.3%	-6.0%	6.3%	32%
Slovenia	-21.8%	-22.3%	0.5%	35%
Slovakia	-2.0%	-4.8%	2.8%	37%
Finland	-9.3%	-9.6%	0.2%	39%
Sweden	7.5%	20.5%	-13.0%	21%
United Kingdom	-20.1%	-20.8%	0.7%	25%

Note: Trend changes for monthly Eurostat data are based on fuel consumption in kt, trend changes from GHG inventory are based on CO_2 emissions in kt

- * Trend changes for Germany, Hungary and Poland have been calculated in TJ instead of kt, " x is the corrected trend change used for calculation, *x* is the trend change without correction
- Trend changes for GHG inventory based on 2016 submission, thus effects on recalculations and data revisions are not relevant

Source: Own calculation based on extraction from Eurostat database, MS inventory submission to UNFCCC, CRF table 1.A(b)

For Germany, Hungary and Poland the trend change for solid fuels has been corrected for the calculation of the 2014 early estimates. Instead of using the trend changes calculated from the consumption of solid fuels in kilotons, the trend change has been calculated based on consumption in TJ. This was done due to changes in the consumption between solid fuel categories with different NCVs. However, results show that for Germany and Hungary the correction of the trend change did not result in improved trend changes between monthly Eurostat and GHG inventory data.

In comparison to liquid fuel consumption, where the differences for the reporting of liquid fuel consumption decreased, the reporting quality for solid fuels under monthly Eurostat data

deteriorated for Denmark, Ireland, Greece, (Spain), Latvia, Lithuania, Luxembourg and the Netherlands in comparison to 2013. Improvements are found for Belgium, Austria, Slovakia and Sweden. This fluctuation in the data quality affects the trend changes calculated with monthly Eurostat data (see Table 3-9).

The highest absolute differences in the reporting of solid fuel consumption between monthly and annual Eurostat data are found for Germany, Greece, the Netherlands and Romania in 2014.

Table 3-10 shows that there is no constant good reporting quality for solid fuel consumption under annual Eurostat and GHG inventory. France and the Netherlands show systematic differences for the reporting of solid fuel consumption, while for some other Member States the differences in 2014 increase.

Table 3-10: Differences in solid fuel consumption between monthly and annual Eurostat data and GHG inventory data

Member States	Eurostat monthly vs. Annual Eurostat		Difference monhtly-annual Eurostat in kt			Eurostat monthly vs. GHG inventory			Eurostat annual vs. GHG inventory	
	2013	2014	2013	2014		2013	2014		2013	2014
Belgium	-20%	-4%	- 976	- 170		-19%	-4%		-1%	0%
Bulgaria	-1%	0%	- 176	- 88		-1%	0%		0%	0%
Czech Republic	2%	0%	856	224		0%	0%		2%	0%
Denmark	2%	10%	121	406		0%	4%		2%	6%
Germany	-4%	-3%	- 9,680	- 6,638		-4%	-2%		0%	-1%
Estonia	-1%	-2%	- 121	- 350		-1%	-2%		0%	0%
Ireland	2%	10%	131	563		0%	10%		3%	0%
Greece	-3%	-6%	- 1,495	- 2,952		-3%	-6%		0%	0%
Spain	-1%	2%	- 213	484		-1%	2%		0%	0%
France	7%	7%	1,228	978		-6%	-7%		13%	15%
Croatia	1%	0%	7	- 4		1%	0%		0%	0%
Italy	1%	0%	151	- 82		2%	-2%		-1%	2%
Cyprus	NA	0%	- 1	-		NA	-4%		NA	4%
Latvia	1%	-5%	1	- 5		1%	2%		0%	-7%
Lithuania	0%	17%	-	61		20%	-3%		-17%	21%
Luxembourg	-5%	-13%	- 4	- 12		-6%	-14%		1%	1%
Hungary	1%	0%	60	45		1%	1%		0%	0%
Malta	NO	NO	-	-		NO	NO		NO	NO
Netherlands	-1%	-10%	- 166	- 1,476		-6%	-14%		5%	4%
Austria	-9%	3%	- 420	122		-8%	3%		-1%	0%
Poland	0%	0%	- 308	- 454		0%	-1%		0%	1%
Portugal	0%	0%	1	- 7		1%	3%		-1%	-3%
Romania	-3%	-4%	- 915	- 1,139		-3%	-4%		0%	0%
Slovenia	-10%	-13%	- 442	- 454		-10%	-13%		0%	0%
Slovakia	-4%	0%	- 245	- 2		-4%	3%		0%	-3%
Finland	-1%	-1%	- 170	- 94		-3%	-3%		2%	2%
Sweden	-11%	1%	- 417	26		-11%	3%		0%	-2%
United Kingdom	0%	0%	249	59		0%	-2%		1%	2%
EU 28	**-1.7%**	**-1.5%**	**- 12,945**	**- 10,959**		**-2.1%**	**-2.0%**		**0%**	**0%**
<+/- 2%	14 MS	13 MS				12 MS	7 MS		21 MS	19 MS
+/-2-5%	7 MS	6 MS				6 MS	14 MS		3 MS	4 MS
> +/- 5%	5 MS	8 MS				8 MS	6 MS		2 MS	4 MS

Note: The reporting of coal tar is not included under the monthly coal Questionnaire. In the annual Eurostat data and in the GHG inventory data coal tar is reported. The data presented above does not include coal tar, as this is not included under the reporting for monthly Eurostat data.

Differences are based on solid fuel consumption in kt for all data sources

For Ireland own aggregates for hard coal and peat consumption are included under monthly Eurostat data

Source: Own compilation based on extraction from Eurostat database in the specific year, GHG inventory submission CRF table 1.A(b)

For Member States that show differences above 3 % in the reporting of solid fuel consumption in the different data sources for the year 2014 data is further analysed in the following tables. Table 3-11 shows detailed differences on the level of the single fuel categories for solid fuel consumption. Table 3-12 provides a description of the differences and if available further explanations.

Table 3-11: Detailed differences for solid fuel consumption between monthly and annual Eurostat data and GHG inventory data for 2014

Member State	Fuel Consumption	Monthly Eurostat	Annual Eurostat	GHG inventory data	Diffference between monthly-annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Difference GHG inventory data - annual Eurostat data		Flow
		Apparent fuel consumption in kt			kt	%	kt	%	kt	%	
Belgium	**Total solids**	**4,678**	**4,848**	**4,849**	***-170***	-4%	***-171***	-4%	***1***	0%	
	Hard coal	4,396	4,479	4,479	*-83*		*-83*		*0*		*Imports*
	BKB and Patent fuels	345	428	429	*-83*		*-84*		*1*		*Exports*
Denmark	**Total solids**	**4,447**	**4,041**	**4,293**	***406***	10%	***154***	4%	***252***	6%	
	Hard coal	4,424	4,028	4,274	*396*		*150*		*246*		*Imports*
Germany	**Total solids**	**233,670**	**240,308**	**238,777**	***-6,638***	-3%	***-5,107***	-2%	***-1,531***	-1%	
	Hard coal	54,305	61,730	60,782	*-7,425*		*-6,477*		*-948*		*Imports*
	Coke oven/gas coke	3,466	2,958	1,320	*508*		*2,146*		*-1,638*		*Exports*
Ireland	**Total solids**	**6,270**	**5,707**	**5,688**	***563***	10%	***582***	10%	***-19***	0%	
	Peat	4,239	3,648	3,642	*591*		*597*		*-6*		
Greece	**Total solids**	**49,200**	**52,152**	**52,152**	***-2,952***	-6%	***-2,952***	-6%	***0***	0%	
	Lignite	49,023	51,878	51,878	*-2,855*		*-2,855*		*0*		*Production*
Spain	**Total solids**	**21,961**	**21,477**	**21,477**	***484***	2%	***484***	2%	***0***	0%	
	Hard coal	20,160	21,385	21,385	*-1,225*		*-1,225*		*0*		*Production, (Imports, Stocks)*
	Lignite	1,694	0		*1,694*						*Production*
France	**Total solids**	**14,774**	**13,796**	**15,879**	***978***	7%	***-1,105***	-7%	***2,083***	15%	
	Hard coal	14,078	12,911	14,991	*1,167*		*-913*		*2,080*		*Imports*
	Coke oven/gas coke	420	622	623	*-202*		*-203*		*1*		*Imports*
Lithuania	**Total solids**	**428**	**367**	**443**	***61***	17%	***-15***	-3%	***76***	21%	
	BKB and Patent fuels	61	0	NO							-
Netherlands	**Total solids**	**13,183**	**14,659**	**15,242**	***-1,476***	-10%	***-2,059***	-14%	***583***	4%	
	Hard coal	13,204	14,610	15,195	*-1,406*		*-1,991*		*585*		*Exports, Imports*
Romania	**Total solids**	**25,840**	**26,979**	**26,929**	***-1,139***	-4%	***-1,089***	-4%	***-50***	0%	
	Lignite	24,406	25,435	25,440	*-1,029*		*-1,034*		*5*		*Stock changes*
Slovenia	**Total solids**	**3,163**	**3,617**	**3,617**	***-454***	-13%	***-454***	-13%	***0***	0%	
	Hard coal	0	394	394	*-394*		*-394*		*0*		*Imports*
	Lignite	3,157	3,186	3,186	*-29*		*-29*		*0*		
Slovakia	**Total solids**	**6,522**	**6,524**	**6,305**	***-2***	0%	***217***	3%	***-219***	-3%	
	Hard coal	3,766	3,848	3,629	*-82*		*137*		*-219*		*Stock changes*
	Lignite	2,518	2,451	2,451	*67*		*67*		*0*		*Stock changes*
Sweden	**Total solids**	**3,398**	**3,372**	**3,308**	***26***	1%	***90***	3%	***-64***	-2%	
	Hard coal	2,759	2,672	2,606	*87*		*153*		*-66*		*Stock changes*
	Coke oven/gas coke	168	140	-16	*28*		*184*		*-156*		
	Peat	471	560	717	*-89*		*-246*		*157*		*Production*

Note: Apparent consumption is calculated as production (only for primary fuels) + imports – exports - stock changes.
For Ireland own aggregates for hard coal and peat consumption are included under monthly Eurostat data
Source: Eurostat database in the specific year, GHG inventory submission 2015 for the year 2013 and 2016 for the year 2014

The number of solid fuels included under total solid fuel consumption is smaller than under liquid fuels. High amounts of consumption are mainly reported under hard coal and in some Member States under lignite. According to Table 3-11 in most Member States differences in the reporting of solid fuel consumption are due to differences in the reporting of hard coal. Especially the amounts of imports and exports are not exactly specified under monthly Eurostat data.

Table 3-12: Explanation of differences for solid fuel consumption as shown in Table 3-11

Member State	Description	Further explanations
Belgium	For the year 2014 Belgium reports a share of 57 % of carbon stored for solid fuels, which is excluded from total carbon. This reduces the share of CO_2 emissions from solid fuels in total CO_2 emissions to 7 %. The share of solid fuels in total consumption in TJ is 9 % in 2014. There have been systematic differences in the reporting of hard coal in the last years. However, this improved in 2014. The differences in the trend changes between monthly Eurostat data and GHG inventory data can be explained by the improvement of the reporting of hard coal and also by the inter annual changes in the amount of carbon stored.	• *No further explanations available.*
Denmark	For Denmark the data quality for solid fuel consumption deteriorated in 2014, due to differences in the reporting of hard coal for imports and stock changes.	• *No further explanations available.*
Germany	There are systematic differences in the reporting of hard coal and coke oven coke between monthly Eurostat data and annual Eurostat data and GHG inventory data. In 2014 the differences are below 3 %, however Germanys CO_2 emissions from solid fuel consumption have a share of 10 % in EU 28 total CO_2 emissions and are highly important for the results of the early estimates. According to Eurostat monthly data hard coal consumption in Germany increased by 3 % between 2013 and 2014, while lignite consumption decreased by 3 %. For the calculation of the 2014 early CO_2 estimates the trend change based on the consumption in TJ has been applied. The calculated trend change 2014/2013 in kt was 98.3 % and in TJ 99.6 %. The trend change calculated on the basis of the CO_2 emissions in the GHG inventory was 94.4 %. This results in differences of 5.3 % in the trend changes calculated for the early CO_2 estimates and the final GHG inventory.	• *No further information on the differences in hard coal imports available.* • *Germany provides resubmission for stock changes for hard coal on a regular basis. For 2012 and 2013 the value for stock changes provided for in the submission year 2015 and 2016 was close to the annual Eurostat data.* • *The German Ministry for Economic affairs and Energy has been informed about the differences in the reporting of monthly and annual Eurostat data.*
Ireland	Due to confidentiality reasons peat and hard coal consumption are not completely reported under Eurostat monthly data. However, hard coal and peat deliveries to main activity	• *No further explanations available*.

	producer power plants are reported under monthly Eurostat data. For the calculation of early CO_2 estimates for Ireland an approximation on the share of peat and hard coal deliveries to power plants was used. For hard coal it was assumed that 78 % of total hard coal consumption is delivered to power plants, while for peat it was assumed that deliveries to power plants represent 72 % of total peat consumption. For hard coal the results are matching rather good in 2014, while for peat consumption the results show a mismatch for 2013 and 2014. The differences at the level of trend changes are only 2.1 %.	
Greece	In Greece lignite production is systematically underreported. In 2014 the differences between monthly Eurostat and annual Eurostat and GHG inventory data for solid fuel consumption increased from 2.7 % in 2013 to 5.7 %. This influences the trend change for solid fuel consumption in Greece.	• *In earlier projects Greece pointed out the monthly coal reporting covers only 75% of the overall supply quantity.*
Spain	Under monthly Eurostat data Spain reports production and stock changes from lignite. Under annual Eurostat and GHG inventory data the amount of lignite produced equals the amount of sub-bituminous coal production. In 2014 large differences occur as the amount of stock changes reported under lignite is different from the stock changes reported under sub-bituminous coal.	• *No further explanations available.*
France	France shows systematic over reporting of hard coal and systematic under reporting of coke oven/gas coke in the monthly Eurostat data in comparison to annual Eurostat data. In comparison to GHG inventory data hard coal is systematically under reported. In comparison to GHG inventory data no production of hard coal is reported, but also the imported quantities are lower. Under annual Eurostat data no production is reported for other bituminous coal, which contributes to the differences between annual Eurostat data and GHG inventory. For coking coal the reported imports under annual Eurostat data are lower than the imports reported under GHG inventory data.	• *It has not been possible to reconcile the differences between the GHG inventory, the Eurostat (monthly and annual) and the annual questionnaire.*
Lithuania	BKB and Patent fuels are not reported under annual Eurostat data, which explains the differences.	• *No further explanations available.*
Netherlands	Systematic differences in imports and exports of hard coal, deterioration of data quality in 2014. Trend change for 2015 early CO_2	• *In their early national statistic available at http://statline.cbs.nl/StatWeb/dome/?LA=EN the Netherlands provide other data*

	estimates have been calculated based on based on market inland deliveries observed instead of hard coal consumption.		*for hard coal consumption. This issue was also raised by the energy expert of the Netherlands explaining that hard coal data reported under Eurostat monthly data is not reliable. Closeness of results would increase if market inland deliveries observed are used instead of hard coal consumption. The data referenced in the NIR from the NL energy balance and the NEA are consistent with Eurostat annual data and the NCVs used in our analysis.*
Romania	Systematic differences in the reporting of stock changes from lignite between monthly and annual Eurostat data.	•	*No further explanations available.*
Slovenia	Hard coal is systematically not reported under monthly Eurostat data. In the last years (2013, 2014) lignite is reported correctly, but as still no hard coal is reported, there is an underreporting of solid fuel consumption under monthly Eurostat data.	•	*In an earlier project Slovenia pointed out that: in the monthly tables there are the following categories: Hard Coal, Lignite, Peat, Coke, Patent Fuels, BKB and import of Hard Coal. Slovenia is reporting on a monthly basis inland deliveries of domestic lignite and brown coal under category "Lignite". Since we are importing and using sub-bituminous coal (ca. 400.000 t/year) we add the quantities also to "Lignite" category. Although it should be entered into the sub-bituminous coal category – but there is none in the monthly questionnaire. In annual reporting we enter the sub-bituminous coal import into the separate category (not into the lignite/brown coal anymore) and that is why there is a difference in data.*
Slovakia	Small differences in the reporting of hard coal, lignite e.g.	•	*No further explanations available.*
Sweden	Improvement of reporting between monthly and annual Eurostat data in 2014. Large differences are found for the reporting of peat production for all data sources.	•	*No further explanations available*.

Source: Own compilation

3.2.3. Analysis of differences for gaseous fuels

Table 3-13 shows the results and the differences for the trend changes calculated based on monthly Eurostat data and GHG inventory data for the year 2014/2013. Differences above 2 % are found for 10 Member States. The high differences for Estonia and Lithuania can be explained by the amount of carbon stored for ammonia production. According to Table 3-4 Estonia shows a high share of carbon stored from natural gas in 2013 and no carbon stored in 2014. This is because the ammonia production factory closed for the year 2014 (EE NIR 2016, p. 67). Differences for Croatia are partly related to carbon stored, but also based on reporting issues, while the large differences for Slovakia are only due to reporting problems.

Table 3-13: Comparison of trend changes in CO_2 emission from gaseous fuel consumption

Member States	Eurostat early CO2 estimates	Member States GHG inventory emission data (CRF Table 1.A(b))	Difference Eurostat estimates - GHG inventory	Share of gaseous fuels in total CO2 emission of MS
	Change 2014/2013		%	
Belgium	-12.4%	-12.8%	0.4%	37%
Bulgaria	-0.9%	-3.0%	2.1%	11%
Czech Republic	-10.7%	-11.1%	0.4%	17%
Denmark	-16.4%	-14.9%	-1.5%	20%
Germany	-11.0%	-13.0%	2.1%	20%
Estonia	-21.5%	3.7%	-25.3%	6%
Ireland	-3.4%	-3.1%	-0.3%	26%
Greece	-23.3%	-25.9%	2.6%	7%
Spain	-9.3%	-9.6%	0.3%	25%
France	-13.1%	-17.7%	4.6%	24%
Croatia	-8.7%	-15.5%	6.8%	23%
Italy	-11.6%	-11.9%	0.3%	38%
Cyprus	-	-	-	-
Latvia	-9.8%	-10.1%	0.3%	40%
Lithuania	-4.9%	-16.0%	11.2%	25%
Luxembourg	-5.3%	-5.1%	-0.1%	22%
Hungary	-8.8%	-12.7%	3.9%	40%
Malta	-	-	-	-
Netherlands	-12.7%	-13.8%	1.1%	43%
Austria	-8.1%	-9.4%	1.3%	29%
Poland	-2.1%	-3.8%	1.7%	10%
Portugal	-7.6%	-4.9%	-2.6%	18%
Romania	-6.1%	-4.5%	-1.6%	32%
Slovenia	-9.4%	-9.6%	0.2%	12%
Slovakia	-34.4%	-16.8%	-17.6%	31%
Finland	-12.2%	-10.9%	-1.2%	12%
Sweden	-17.0%	-19.0%	2.0%	4%
United Kingdom	-8.6%	-9.4%	0.9%	35%

- Trend changes for monthly Eurostat data are based on fuel consumption in TJ NCV, trend changes from GHG inventory are based on CO_2 emissions in kt
- Trend changes for GHG inventory based on 2016 submission, thus effects on recalculations and data revisions are not relevant

Source: Own calculation based on extraction from Eurostat database, MS inventory submission to UNFCCC, CRF table 1.A(b)

According to Table 3-14 the differences in the reporting of natural gas under different data sources are rather small in most Member States. The comparison on the level of consumption of natural gas shows, that there are only seven Member States that show differences in the reporting of natural gas of above 2 % in 2014. For the year 2014 improvements could be found for France, Croatia and Romania, while data quality deteriorated for Slovakia. The highest absolute differences between Eurostat monthly and annual natural gas consumption are found for Germany, followed by Slovakia in 2014.

Estonia, France and Portugal are the only Member states that show differences for the reporting of natural gas between annual Eurostat data and GHG inventory data in 2014.

Table 3-14: Differences in gaseous fuel consumption between monthly and annual Eurostat data and GHG inventory data

Member States	Eurostat monthly vs. Annual Eurostat		Difference monhtly-annual Eurostat in TJ NCV		Eurostat monthly vs. GHG inventory		Eurostat annual vs. GHG inventory	
	2013	2014	2013	2014	2013	2014	2013	2014
Belgium	-1%	-1%	- 8,126	- 6,768	-1%	-1%	0%	0%
Bulgaria	-3%	-3%	- 3,464	- 3,318	-3%	-3%	0%	0%
Czech Republic	0%	0%	- 1,274	- 247	-1%	0%	0%	0%
Denmark	0%	-1%	520	- 1,358	0%	-1%	0%	0%
Germany	1%	2%	23,944	56,216	-3%	2%	4%	0%
Estonia	0%	0%	-	-	1%	2%	-1%	-2%
Ireland	4%	4%	6,287	6,676	4%	4%	0%	0%
Greece	0%	0%	- 104	- 230	0%	0%	0%	0%
Spain	0%	0%	- 16	90	0%	0%	0%	0%
France	-4%	0%	- 62,614	52	-4%	1%	0%	-1%
Croatia	-9%	-6%	- 8,330	- 4,933	-9%	-6%	0%	0%
Italy	0%	0%	- 410	5	0%	0%	0%	0%
Cyprus	NO	NO	-	-	NO	NO	NO	NO
Latvia	0%	0%	- 238	- 13	-1%	0%	0%	0%
Lithuania	0%	0%	- 69	- 280	0%	0%	0%	0%
Luxembourg	0%	0%	1	-	0%	0%	0%	0%
Hungary	-1%	0%	- 2,237	- 150	-1%	0%	0%	0%
Malta	NO	NO	-	-	NO	NO	NO	NO
Netherlands	1%	1%	10,355	10,371	0%	1%	1%	0%
Austria	-1%	-1%	- 2,795	- 2,710	-1%	-1%	0%	0%
Poland	0%	0%	- 302	1,121	0%	0%	0%	0%
Portugal	3%	3%	4,955	4,478	3%	2%	0%	1%
Romania	5%	3%	20,794	12,625	5%	3%	0%	0%
Slovenia	0%	0%	- 13	31	0%	0%	0%	0%
Slovakia	1%	-16%	1,651	- 24,687	1%	-16%	0%	0%
Finland	-1%	-1%	- 1,085	- 1,137	-1%	-1%	0%	0%
Sweden	0%	0%	72	-	0%	0%	0%	0%
United Kingdom	0%	0%	- 2,555	8,712	0%	0%	0%	0%
EU 28	**0%**	**0%**	**- 25,051**	**54,545**	**-1%**	**0%**	**1%**	**0%**
<+/- 2%	20 MS	19 MS			19 MS	18 MS	25 MS	25 MS
+/-2-5%	4 MS	5 MS			5 MS	6 MS	1 MS	1 MS
> +/- 5%	2 MS	2 MS			2 MS	2 MS	0 MS	0 MS

Note: Differences are based on natural gas consumption in TJ NCV for all data sources

Source: Own compilation based on extraction from Eurostat database in the specific year, GHG inventory submission CRF table 1.A(b)

Data provided for Bulgaria, Ireland, Croatia and Portugal suggest that there is a systematic difference in the reporting of natural gas.

Table 3-15 provides a description and some explanations in the differences found for the reporting of natural gas under different data sources.

Table 3-15: Explanation of differences for gaseous fuel consumption as shown in Table 3-14

Member State	Description	Further Explanation
Bulgaria	Systematic underreporting of natural gas imports under Eurostat monthly data.	*No further explanations available.*
Germany	Fluctuating differences in the reporting of natural gas for most flows between monthly and annual Eurostat data and also for some years (e.g. 2013) between annual Eurostat data and GHG inventory data.	*No further explanations available.*
Ireland	Systematic differences in the reporting of natural gas production. Systematic over reporting of monthly natural gas production.	*Differences in the production data has been pointed out to the MS. MS answer: Data problems in reporting of natural gas production. No better production data available*
Croatia	Natural gas is systematically underreported for all flows under Eurostat monthly data.	*No further explanations available.*
Portugal	Total consumption of natural gas is overestimated under Eurostat monthly data. Monthly export data does not seem to be complete. No export reported for 5 months of the year.	*Issue has been raised in 2014. MS confirmed the data for natural gas export.*
Romania	Differences in 2014 due to production and stock change data. There is a systematic over reporting of natural gas production under monthly Eurostat data.	*No further explanations available.*
Slovakia	Large differences in imports of natural gas reported under monthly Eurostat data in comparison to imports reported under annual Eurostat data and GHG inventory data. The reporting quality of monthly Eurostat data for natural gas showed large fluctuations in the last year. Only in 2013 and 2010 the data quality was good, in all other years there have been differences between monthly Eurostat data and annual Eurostat data of above +/-10 to 20 %.	*The Slovak Republic is an important transit country regarding the transport of oil and natural gas from the former Soviet Union countries to Europe (NIR p.50). This might lead to uncertainties with regard to imports and export of natural gas under monthly Eurostat data.*

Source: Own compilation

3.3. Priorities

Table 3-16 indicates, on the basis of the results of the early CO_2 estimates and the GHG inventory for the year 2014, for which Member States differences in the reporting between monthly and annual Eurostat data reveal. For some Member States that show systematic inconsistencies in the reporting of monthly Eurostat data the results in Table 3-16 do not reflect the reporting quality.

Table 3-16: Results and differences for the trend changes of CO_2 emissions for the year 2014 and priorities

Member States	Trend changes of early CO_2 estimates	Trend changes in CO_2 emissions based on GHG inventory data (submission 2016)	Differences trend changes early estimates-GHG inventory	Comment
	2014/2013		2014/2013	
Belgium	-1.0%	-5.9%	4.8%	Improvements in reporting quality for solid fuels and natural gas in 2014
Bulgaria	7.1%	7.2%	-0.1%	-
Czech Republic	-2.1%	-1.3%	-0.8%	-
Denmark	-10.7%	-11.4%	0.7%	Priority - solid fuels
Germany*	-3.1%	-6.5%	3.4%	Priority - solid fuels
Estonia	-2.0%	-2.5%	0.4%	-
Ireland	-1.0%	-1.8%	0.8%	Priority - natural gas
Greece	-6.5%	-2.7%	-3.8%	Priority - solid fuels
Spain	-2.1%	-1.9%	-0.1%	-
France	-8.2%	-9.2%	1.0%	Priority - solid fuels
Croatia	-6.3%	-5.4%	-0.9%	Priority - natural gas
Italy	-6.9%	-6.5%	-0.5%	-
Cyprus	3.6%	3.2%	0.4%	-
Latvia	-1.3%	-1.1%	-0.2%	-
Lithuania	2.2%	-3.7%	5.9%	Differences due to amounts of carbon stored
Luxembourg	-6.2%	-5.3%	-0.8%	-
Hungary*	-2.4%	-2.5%	0.1%	-
Malta	2.5%	-1.5%	4.0%	Differences due to int. bunkers from fuel oil, will be improved next year
Netherlands	-6.9%	-5.4%	-1.5%	Priority - solid fuels
Austria"	-3.5%	-6.8%	3.4%	Differences due to improved reporting for liquid and solid fuel consumption
Poland*	-5.3%	-6.0%	0.7%	-
Portugal	-5.7%	-2.5%	-3.2%	Priority - liquid and natural gas
Romania	-1.3%	-3.2%	1.8%	-
Slovenia	-9.1%	-11.1%	1.9%	Priority - solid fuels
Slovakia	-14.1%	-8.0%	-6.1%	Priority - natural gas
Finland	0.7%	-3.0%	3.7%	Priority - liquid fuels
Sweden	0.2%	-2.3%	2.5%	Improved reporting in 2014
United Kingdom"	-8.7%	-9.5%	0.8%	-

Note: Green: difference ≤ ± 2%, Yellow: difference ± >2 and ≤ 5%, Red: difference > ± 5% .

* Trend changes for solid fuels have been calculated based on consumption in TJ

“ International bunkers for jet kerosene have been gap filled with annual Eurostat data for 2013

Source: Eurostat early CO_2 estimates, MS GHG inventory submissions to UNFCCC

For Member States with revealing differences there might be a follow up needed. Therefore the following chapter summarizes the information for the most important differences for the Member States and its relevance in terms of EU 28 CO_2 emissions.

3.3.1. Denmark

For Denmark the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of 0.7 %.

- The trend change calculated with Eurostat monthly data is -10.7 % and GHG inventory data calculated a trend change of -11.4 %.
- Denmark contributes with a share of 1 % to EU 28 total CO_2 emissions and is a rather small country.
- In Denmark, liquid fuels have a share of 51 %, solid fuels 30% and gaseous fuels 19 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of 1.4 %, the trend changes for solid fuels show differences of 1.0 % and the trend changes for gaseous fuels show differences of -1.5 %.
- The good matches of the trend changes do not reflect the systematic differences in the reporting of liquid fuels under monthly Eurostat data in comparison to other data sources.
- Liquid fuel consumption is over reported under monthly Eurostat data due to underreporting of international bunkers
- Comparison with early national statistics show only minor differences for trend changes compared to monthly and annual Eurostat data and GHG inventory data.

Table 3-17: Reporting of liquid fuel consumption in Denmark from different data sources for the year 2012, 2013, 2014

Denmark		2012	2013	2014	Trend change 2013/2012	Trend change 2014/2013
Fuel	Data sources	kt			%	
Liquids	Monthly Eurostat	6,490	6,303	6,152	97%	98%
	Early national statistics*	-	-	-	98%	99%
	Annual Eurostat	6,182	5,950	5,765	96%	97%
	GHG Inventory	6,032	5,930	5,686	98%	96%

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

- The good matches of the trend changes also do not reflect the systematic differences in the reporting of hard coal under monthly Eurostat data in comparison to other data sources.
- In 2014 the quality of the reporting under monthly Eurostat data deteriorated, which affects also the trend changes.

- Trend changes for early national statistics show a good match with trend changes based on monthly Eurostat data.

Table 3-18: Reporting of hard coal consumption in Denmark from different data sources for the year 2012, 2013, 2014

Denmark		2012	2013	2014	Trend change 2013/2012	Trend change 2014/2013
Fuel	Data sources	kt			%	
Hard Coal	Monthly Eurostat	4,311	5,467	4,424	127%	81%
	Early national statistics	4,238	5,400	4,435	127%	82%
	Annual Eurostat	4,249	5,344	4,028	126%	75%
	GHG Inventory	4,249	5,458	4,274	128%	78%

Note: National statistics may include updated data

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

3.3.2. Germany

For Germany the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of 3.4 %.

- The trend change calculated with Eurostat monthly data is -3.1 % and GHG inventory data calculated a trend change of -6.5 %.
- Germany contributes with a share of 23 % to EU 28 total CO_2 emissions and is therefore a highly relevant country.
- In Germany, liquid fuels have a share of 34 %, solid fuels 46% and gaseous fuels 20 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of 1.9 %, the trend changes for solid fuels show differences of 5.9 % and the trend changes for gaseous fuels show differences of 2.1 %.
- In comparison to the differences calculated by fuel consumption in kt, the differences between monthly Eurostat data and GHG inventory data increased due to conversion of monthly Eurostat data in TJ for calculating the trend changes.
- The high differences for the trend changes from solid fuels can be mainly explained by the differences from the reporting of hard coal.
- Comparison with early national statistics shows, that there are also systematic differences.

Table 3-19: Reporting of hard coal consumption in Germany from different data sources for the year 2012, 2013, 2014

Germany		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources	kt			%	
Hard Coal	Monthly Eurostat	52,455	52,950	54,305	101%	103%
	Early national statistics	-	65,255	60,109	-	92%
	Annual Eurostat	60,400	62,744	61,730	104%	98%
	GHG Inventory	61,115	61,629	60,782	101%	99%

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

3.3.3. Ireland

For Ireland the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of 0.8 %.

- The trend change calculated with Eurostat monthly data is -1.0 % and GHG inventory data calculated a trend change of -1.8 %.
- Ireland contributes with a share of 1 % to EU 28 total CO_2 emissions and is a rather small country.
- In Ireland, liquid fuels have a share of 49 %, solid fuels 25% and gaseous fuels 26 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of 0.8 %, the trend changes for solid fuels show differences of 2.1 % and the trend changes for gaseous fuels show differences of -0.3 %.
- Natural gas production seems to be systematically over reported under monthly Eurostat data. Relative differences between monthly and annual Eurostat data in 2014 are still 4 %.
- The systematic over reporting of natural gas production has no influence on the trend changes.
- Comparison with early national statistics show also differences in trend changes.

Table 3-20: Reporting of natural gas consumption in Ireland from different data sources for the year 2012, 2013, 2014

Ireland		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources	TJ NCV			%	
Natural gas	Monthly Eurostat	173,475	168,227	162,531	97%	97%
	Early national statistics	-	-	-	100%	93%
	Annual Eurostat	168,076	161,940	155,855	96%	96%
	GHG Inventory	168,449	162,109	155,787	96%	96%

Note: Early national statistics are provided for primary energy supply (incl. non energy) in ktoe
Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

3.3.4. Greece

For Greece the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of -3.8 %.

- The trend change calculated with Eurostat monthly data is -6.5 % and GHG inventory data calculated a trend change of -2.7 %.
- Greece contributes 2 % of EU 28 total CO_2 emissions.
- In Greece, liquid fuels have a share of 45 %, solid fuels 48% and gaseous fuels 7 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of -5.6 %, the trend changes for solid fuels show differences of -3.6 % and the trend changes for gaseous fuels show differences of 2.6 %.
- For liquid fuels improvements in the reporting in 2014 result in differences in the trend changes.
- For solid fuels the reporting quality in 2014 deteriorated which also results in differences in the trend changes.
- Differences in total consumption of lignite affect the trend changes. The differences are partly systematic as the reporting under monthly Eurostat data is always lower.

Table 3-21: Reporting of lignite consumption in Greece from different data sources for the year 2012, 2013, 2014

Greece		2012	2013	2014	Trend change 2013/2012	Trend change 2014/2013
Fuel	Data sources	kt			%	
Lignite	Monthly Eurostat	60,858	53,086	49,023	87%	92%
	Annual Eurostat	61,910	54,386	51,878	88%	95%
	GHG Inventory	61,910	54,386	51,878	88%	95%

Note: No relevant early national statistics could be found

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b)

3.3.5. France

For France the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of 1 %. However, there have been systematic differences in the reporting of solid fuels.

- The trend change calculated with Eurostat monthly data is -8.2 % and GHG inventory data calculated a trend change of -9.2 %. This results in a difference of 1 %.
- France contributes with a share of 10 % to EU 28 total CO_2 emissions and is therefore a highly relevant country.
- In France, liquid fuels have a share of 63 %, solid fuels 12 % and gaseous fuels 24 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of -0.3 %, the trend changes for solid fuels show differences of -0.5 % and the trend changes for gaseous fuels show differences of 4.6 % due to reporting in 2013.
- Large differences in the reported consumption of hard coal between different data sources do not affect the trend changes, as this is a systematic issue.

Table 3-22: Reporting of hard coal consumption in France from different data sources for the year 2012, 2013, 2014

France		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources		kt		%	
Hard Coal	Monthly Eurostat	18,265	19,563	14,078	107%	72%
	Annual Eurostat	16,533	18,016	12,911	109%	72%
	GHG Inventory	18,663	20,566	14,991	110%	73%

Note: Early national statistics are only available for total solid fossils

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b)

3.3.6. Croatia

For Croatia the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of -0.9 %.

- The trend change calculated with Eurostat monthly data is -6.3 % and GHG inventory data calculated a trend change of -5.4 %.
- Croatia contributes with a share of 0.5 % to EU 28 total CO_2 emissions and is a rather small country.
- In Croatia, liquid fuels have a share of 59 %, solid fuels 17% and gaseous fuels 23 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of -4.7 %, the trend changes for solid fuels show differences of -0.0 % and the trend changes for gaseous fuels show differences of 6.8 %.
- For liquid fuels fluctuations in the reporting in 2013 and 2014 result in differences in the trend changes.
- For natural gas the reporting quality in 2014 improved slowly, which also results in differences in the trend changes. Natural gas consumption seems to be systematically underreported under monthly Eurostat data. Relative differences between monthly and annual Eurostat data in 2014 are still above 5 %.
- Further differences in trend changes that are reflected in the data provided in Table 3-21 are due to the amount of carbon stored in natural gas consumption.
- Comparison with early national statistics show also differences for the reporting of natural gas.

Table 3-23: Reporting of natural gas consumption in Croatia from different data sources for the year 2012, 2013, 2014

Croatia		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources	TJ NCV			%	
Natural gas	Monthly Eurostat	91,488	87,207	79,616	95%	91%
	Early national statistics	92,599	85,646	79,373	92%	93%
	Annual Eurostat	101,038	95,537	84,549	95%	88%
	GHG Inventory	101,781	95,537	84,620	94%	89%

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

3.3.7. The Netherlands

For The Netherlands the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of -1.5 %.

- The trend change calculated with Eurostat monthly data is -6.9 % and GHG inventory data calculated a trend change of -5.4 %.
- The Netherland contributes with a share of 5 % to EU 28 total CO_2 emissions and is therefore also relevant for results on the EU 28 level.
- In the Netherlands, liquid fuels have a share of 34 %, solid fuels 23% and gaseous fuels 43 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of -1.3 %, the trend changes for solid fuels show differences of -8.7 % and the trend changes for gaseous fuels show differences of 1.1 %.
- The high differences for the trend changes from solid fuels can mainly be explained by differences in the reporting of hard coal.
- There are high uncertainties related to imports and exports of hard coal.
- National statistics show a good match with annual Eurostat data, but may include updates.
- Trend changes on the basis of the flow 'internal market deliveries' show a good match with annual Eurostat and GHG inventory data

Table 3-24: Reporting of hard coal consumption in the Netherlands from different data sources for the year 2012, 2013, 2014

Netherlands		2012	2013	2014	Trend change 2013/2012	Trend change 2014/2013
Fuel	Data sources	kt			%	
Hard Coal	Monthly Eurostat	15,926	12,891	13,204	81%	102%
	Early national statistics	13,320	13,560	15,200	102%	112%
	Annual Eurostat	12,790	12,979	14,610	101%	113%
	GHG Inventory	13,678	13,592	15,195	99%	112%
	Monthly Euostat (internal market deliveries (observed)	12,722	12,891	14,493	101%	112%

Note: National statistics may include updates

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b)

3.3.8. Portugal

For Portugal the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of -3.2 %.

- The trend change calculated with Eurostat monthly data is -5.7 % and GHG inventory data calculated a trend change of -2.5 %.
- Portugal contributes with a share of 1 % to EU 28 total CO_2 emissions and is a rather small country.
- In Portugal, liquid fuels have a share of 57%, solid fuels 25% and gaseous fuels 18 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of -4.8 %, the trend changes for solid fuels show differences of -0.6 % and the trend changes for gaseous fuels show differences of -2.6 %.
- For liquid fuel consumption the reporting quality in 2014 improved slowly, which also results in differences in the trend changes. Liquid fuel consumption is systematically over reported under monthly Eurostat data (but the size of overreporting varies from year to year) due to differences in the reporting of international bunkers. This results in relative differences between monthly and annual Eurostat data in 2014 of 10 %.
- Trend changes for early national statistics show a good match with trend changes based on monthly Eurostat data.

Table 3-25: Reporting of liquid fuel consumption in Portugal from different data sources for the year 2012, 2013, 2014

Portugal		2012	2013	2014	Trend change 2013/2012	Trend change 2014/2013
Fuel	Data sources	kt			%	
Liquids	Monthly Eurostat	9,457	10,569	9,725	112%	92%
	Early national statistics*	-	-	-	101%	92%
	Annual Eurostat	8,904	9,214	8,802	103%	96%
	GHG Inventory	9,158	9,341	8,890	102%	95%

Note: *Early national statistics are reported for total liquid fuel consumption in toe, therefore only the trend changes are included here
Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

3.3.9. Slovakia

For Slovakia the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of -6.1 %.

- The trend change calculated with Eurostat monthly data is -14.1 % and GHG inventory data calculated a trend change of -8.0 %.
- Slovakia contributes with a share of 1 % to EU 28 total CO_2 emissions and is a rather small country.
- In Slovakia, liquid fuels have a share of 32 %, solid fuels 37 % and gaseous fuels 31 % in total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of -2.1 %, the trend changes for solid fuels show differences of 2.8 % and the trend changes for gaseous fuels show differences of -17.6 %.
- The reporting quality of natural gas shows large fluctuations between the years. Thus the effect on the trend change is rather high (Gross inland consumption: 2013 monthly data overestimate annual data by 5,2%, while 2014 monthly data underestimate annual data by more than 15%) .

Table 3-26: Reporting of natural gas consumption in Slovakia from different data sources for the year 2012, 2013, 2014

Slovakia		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources	TJ NCV			%	
Natural gas	Monthly Eurostat	**225,478**	203,223	**133,253**	90%	66%
	Annual Eurostat	**182,768**	**201,571**	**157,940**	110%	78%
	GHG Inventory	182,788	201,628	**157,818**	110%	78%

Note: No early national statistics available

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b)

3.3.10. Slovenia

For Slovenia the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of 1.9 %.

- The trend change calculated with Eurostat monthly data is -9.1 % and GHG inventory data calculated a trend change of -11.1 %.
- Slovenia contributes with a share of 0.4 % to EU 28 total CO_2 emissions.
- In Slovenia, liquid fuels have a share of 53 %, solid fuels 35% and gaseous fuels 12 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of 3.2 %, the trend changes for solid fuels show differences of 0.5 % and the trend changes for gaseous fuels show differences of 0.2 %.
- The good match for the trend change for solid fuels does not indicate the differences on the level of solid fuel consumption that are systematically above -10 % between monthly and annual Eurostat data.
- The differences are due to the non-reporting of hard coal under monthly Eurostat data.
- Trend changes for early national statistics show a good match with trend changes based on monthly Eurostat data.

Table 3-27: Reporting of solid fuel consumption in Slovenia from different data sources for the year 2012, 2013, 2014

Slovenia		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources	kt			%	
Total solid	Monthly Eurostat	4,882	4,045	3,163	83%	78%
	Early national statistics*	-	-	-	-	78%
	Annual Eurostat	4,985	4,487	3,617	90%	81%
	GHG Inventory	4,985	4,487	3,617	90%	81%

Note: Early national statistics are available for total soli fuel consumption in TJ

Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b), early national statistics

3.3.11. Finland

For Finland the trend changes for CO_2 emissions from fossil fuel combustion for the year 2014/2013 between Eurostat early CO_2 estimates and GHG inventory calculation show a difference of 3.7 %.

- The trend change calculated with Eurostat monthly data is 0.7 %. With GHG inventory data a trend change of -3.0 % is calculated.
- Finland contributes with a share of 1 % to EU 28 total CO_2 emissions.
- In Finland, liquid fuels have a share of 49 %, solid fuels 39 % and gaseous fuels 12 % in the total CO_2 emissions from fossil fuel combustion.
- The trend changes for liquid fuels show a difference of 8.5 %, the trend changes for solid fuels show differences of 0.2 % and the trend changes for gaseous fuels show differences of -1.2 %.
- For liquid fuels the reporting quality deteriorated in 2014, due to differences in the reporting of crude oil and gas/diesel oil, which results in differences in the trend changes.

Table 3-28: Reporting of liquid fuel consumption in Finland from different data sources for the year 2012, 2013, 2014

Finland		**2012**	**2013**	**2014**	**Trend change 2013/2012**	**Trend change 2014/2013**
Fuel	Data sources	kt			%	
Liquids	Monthly Eurostat	8,046	7,196	8,196	89%	114%
	Annual Eurostat	7,887	7,187	8,598	91%	120%
	GHG Inventory	7,705	7,647	8,117	99%	106%

Note: Early national statistics could only be found from 2014 onwards and are reported for total liquid fuel consumption in TJ
Source: Extraction from Eurostat database, GHG inventory data, CRF table 1.A(b)

3.5. Early CO_2 emission estimates for the year 2015

3.5.1. Data improvements to correct trend changes of Eurostat monthly data

For calculating early CO_2 emission estimates for the year 2015 Eurostat monthly energy data for the year 2014 (as available in April 2015) and Eurostat monthly energy data for the year 2015 (as available in April 2016) have been used. Due to improvements in the reporting quality and the absence of obvious large outliers in monthly 2014 and 2015 Eurostat data, no gap filling has to be applied.

For improving the trend change analysis used to calculate 2015 CO_2 emissions the following adaptations were made:

- The trend changes were calculated on the basis of physical units (kt) and energy units (TJ). For most countries the results are very similar (see Table 5-4). However, for Bulgaria, Estonia, Malta and Hungary, the two approaches resulted in small differences for the trend changes for liquid fuels (Estonia, Malta) and solid fuels (Bulgaria, Hungary). For these countries, trend changes for liquid fuels or solid fuels calculated with energy units (TJ) have been used for the 2015 calculation of early CO_2 estimates.

- For the Netherlands, the trend changes calculated for solid fuels showed large differences in recent years. Statistical experts from the Netherlands pointed out that trend changes calculated based on gross inland consumption (calculated as production + imports – exports - stock changes) are unreliable and that the trend changes for market inland deliveries would provide better results (see also Table 3-24). Thus for the Netherlands trend changes from market inland deliveries where used for the 2015 calculation of early CO_2 estimates.

- For **Ireland** some **peat consumption** data in the Eurostat monthly database for the year 2014 and 2015 are not shown for confidentiality reasons. However, peat deliveries to main activity producer power plants are reported on a monthly basis. This monthly activity is used to estimate the peat consumption, assuming that peat delivered to power plants represents about 73 % of the total peat consumption. This ratio is derived from annual data of past years (2012-2014) for which a complete set of annual data for peat consumption is available.

- For Ireland **hard coal consumption** data in the Eurostat monthly database are much lower than annual Eurostat data also for confidentiality reasons. This resulted in improbably low CO_2 estimates for Ireland. Similar to the approximation of peat consumption, the reported deliveries to main activity producer power plants are used to estimate monthly hard coal consumption data. It is assumed that this consumption represents about 80 % of the total hard coal consumption. This ratio is also derived from previous data (2012-2014) for which hard coal consumption is available in annual data.

3.5.2. Calculation of early CO_2 estimates for the year 2015

This chapter presents the calculation of early CO_2 emission estimates for the year 2015.

The following steps are taken to calculate early CO_2 emissions for 2015:

1. Calculation of trend changes of the fuel consumption for the aggregated fuel categories (liquid, solid, peat and natural gas) from Eurostat monthly energy data 2014 and 2015;

2. Calculation of CO_2 emissions for the four fuel categories by multiplying the trend changes with the CO_2 emissions of the GHG inventory data of the Reference Approach (CRF table 1.A(b) for the year 2014 (as available in April 2016).

Table 3-29 and Table 3-30 show the calculation of the early CO_2 emissions according to the different steps.

Table 3-29: Calculation of trend changes for liquid, solid and gaseous fuel consumption, 2015/2014

Member States	Monthly Eurostat data for liquid fuel consumption		Trend change liquids	Monthly Eurostat data for solid fuels without peat consumption		Trend change solids w.o.peat	Monthly Eurostat data for peat consumption		Trend change peat	Monthly Eurostat data for natural gas fuel consumption		Trend change natural gas
	2014	2015	2015/2014	2014	2015	2015/2014	2014	2015	2015/2014	2014	2015	2015/2014
	kt		%	kt		%	kt		%	TJ NCV		%
Belgium	22,469	22,943	102%	4,678	4,618	99%	NO	NO	-	520,738	571,535	110%
Bulgaria	3,680	3,914	106%	33,281	37,020	111%	NO	NO	-	95,599	105,557	110%
Czech Republic	8,490	8,305	98%	45,718	45,516	100%	NO	NO	-	258,585	271,380	105%
Denmark	6,152	6,120	99%	4,447	2,952	66%	NO	NO	-	116,431	118,427	102%
Germany	97,508	98,438	101%	233,670	228,927	98%	NO	NO	-	2,738,165	2,823,782	103%
Estonia	269	125	46%	20,336	17,355	85%	220	26	12%	18,236	16,348	90%
Ireland	5,733	6,014	105%	2,031	2,377	117%	4,239	4,190	99%	162,531	157,111	97%
Greece	10,993	11,493	105%	49,200	41,372	84%	NO	NO	-	103,783	111,881	108%
Spain	45,406	46,844	103%	21,961	21,520	98%	NO	NO	-	990,950	1,028,018	104%
France	71,208	71,180	100%	14,774	14,367	97%	NO	NO	-	1,364,721	1,477,662	108%
Croatia	2,903	2,982	103%	1,099	1,008	92%	NO	NO	-	79,616	89,085	112%
Italy	51,314	52,175	102%	20,975	20,083	96%	NO	NO	-	2,122,967	2,315,403	109%
Cyprus	1,864	1,882	101%	4	6	150%	NO	NO	-	NO	NO	NO
Latvia	1,197	1,232	103%	97	69	71%	3	1	33%	45,274	46,009	102%
Lithuania	2,384	2,455	103%	387	310	80%	41	18	44%	86,157	86,536	100%
Luxembourg	2,209	2,151	97%	78	79	101%	NO	NO	-	35,302	32,193	91%
Hungary	6,044	6,583	109%	10,359	10,329	100%	NO	NO	-	292,156	312,136	107%
Malta	730	527	72%	NO			NO	NO	-	NO	NO	NO
Netherlands	26,657	24,297	91%	14,472	17,980	124%	NO	NO	-	1,217,665	1,203,719	99%
Austria	11,149	11,252	101%	4,455	4,895	110%	108	103	95%	267,122	284,576	107%
Poland	21,375	22,927	107%	129,964	129,973	100%	NO	NO	-	562,338	572,716	102%
Portugal	9,725	9,918	102%	4,519	5,499	122%	NO	NO	-	149,900	166,504	111%
Romania	8,227	8,617	105%	25,840	27,359	106%	NO	NO	-	404,690	389,761	96%
Slovenia	2,188	2,161	99%	3,163	3,209	101%	NO	NO	-	26,241	27,788	106%
Slovakia	2,919	3,278	112%	6,522	6,350	97%	NO	NO	-	133,253	161,427	121%
Finland	8,196	7,838	96%	4,955	4,421	89%	5,800	5,291	91%	104,086	92,214	89%
Sweden	11,325	9,558	84%	2,927	2,860	98%	471	399	85%	33,245	30,279	91%
United Kingdom	55,470	57,373	103%	48,781	39,005	80%	NO	NO	-	2,511,757	2,567,078	102%
EU 28	**497,784**	**502,582**	**101%**	**708,693**	**689,459**	**97%**	**10,882**	**10,028**	**92%**	**14,441,507**	**15,059,121**	**104%**

Note: NO is used if there is no consumption; Data on solid fuel consumption for Ireland has been corrected as reported data is confidential.

Source: Extraction from Eurostat database in the specific year

For calculating the early CO_2 emission estimates for the year 2015 some of the trend changes shown in Table 3-29 need to be adapted as explained in Chapter 3.5.1. Table 3-30 shows the final calculation of the early CO_2 estimates for the year 2015.

Table 3-30: Calculation of early CO_2 emissions for the year 2015

Member States	GHG Inventory data CO2 emissions from liquid fuels (UNFCCC 2016)	Trend change liquids without biofuels	CO2 emissions liquid fuels calculated with monthly Eurostat data	GHG Inventory data CO2 emissions from solid fuels without peat (UNFCCC 2016)	Trend change solids without peat	CO2 emissions solid fuels calculated with monthly Eurostat data	GHG Inventory data CO2 emissions from peat (UNFCCC 2016)	Trend change peat	CO2 emissions from peat calculated with monthly Eurostat data	GHG Inventory data CO2 emissions from natural gas (UNFCCC 2016)	Trend change natural gas	CO2 emissions natural gas calculated with monthly Eurostat data	**CO2 emissions without waste and other fossils calculated with monthly Eurostat data**		**Trend changes**
	2014	2015/2014	2015	2014	2015/2014	2015	2014	2015/2014	2015	2014	2015/2014	2015	2014	**2015**	**2015/2014**
	Liquid Fossil Totals			Solid Fossil Totals			Solid Fossil Totals			Gaseous Fossil Totals			Total		
	kt CO2	%	kt CO2	kt CO2	%	kt CO2	kt CO2	%	kt CO2	kt CO2	%	kt CO2	**kt CO2**		**%**
Belgium	41,199	102%	42,068	5,269	99%	5,201	NO	-	NO	27,277	110%	29,937	73,745	**77,207**	**4.7%**
Bulgaria[1]	11,231	106%	11,945	27,837	103%	28,651	NO	-	NO	4,611	110%	5,091	43,678	**45,688**	**4.6%**
Czech Republic	18,811	98%	18,401	57,123	100%	56,871	NO,NA	-	NO,NA	14,138	105%	14,838	90,072	**90,109**	**0.0%**
Denmark[3]	17,084	99%	16,995	10,003	66%	6,640	NO	-	NO	6,708	102%	6,823	33,795	**30,459**	**-9.9%**
Germany	242,380	101%	244,692	326,707	98%	320,076	NO,NA	-	NO,NA	144,244	103%	148,755	713,331	**713,522**	**0.0%**
Estonia[2]	878	85%	748	15,458	85%	13,098	255	12%	30	984	90%	882	17,575	**14,758**	**-16.0%**
Ireland[3;4]	16,751	105%	17,572	4,992	117%	5,843	3,646	99%	3,604	8,884	97%	8,588	34,273	**35,606**	**3.9%**
Greece	32,357	105%	33,829	34,208	84%	28,766	NO	-	NO	5,194	108%	5,600	71,760	**68,194**	**-5.0%**
Spain	126,213	103%	130,210	43,396	98%	42,525	NA,NO	-	NA,NO	55,430	104%	57,504	225,039	**230,238**	**2.3%**
France	192,216	100%	192,140	37,427	97%	36,396	NE,NO	-	NE,NO	74,082	108%	80,213	303,725	**308,750**	**1.7%**
Croatia	8,988	103%	9,232	2,574	92%	2,361	NO	-	NO	3,713	112%	4,154	15,275	**15,748**	**3.1%**
Italy	145,231	102%	147,668	52,479	96%	50,247	NO	-	NO	119,711	109%	130,562	317,421	**328,477**	**3.5%**
Cyprus	5,797	101%	5,852	9	150%	14	NO	-	NO	NO	NO	0	5,806	**5,866**	**1.0%**
Latvia	3,515	103%	3,618	234	71%	166	4	33%	1	2,493	102%	2,534	6,246	**6,320**	**1.2%**
Lithuania	6,840	103%	7,044	787	80%	630	133	44%	59	2,582	100%	2,594	10,343	**10,327**	**-0.2%**
Luxembourg	6,887	97%	6,707	183	101%	186	NA,NO	-	NA,NO	2,004	91%	1,827	9,074	**8,719**	**-3.9%**
Hungary[1]	14,266	109%	15,538	8,782	103%	9,050	NA,NO	-	NA,NO	15,094	107%	16,126	38,141	**40,713**	**6.7%**
Malta[2]	2,369	73%	1,731	NE,NA,NO	0%	0	NO	-	NO	1	NO	1	2,369	**1,731**	**-26.9%**
Netherlands[6]	53,074	91%	48,375	35,841	124%	44,529	NO	-	NO	66,394	99%	65,633	155,309	**158,537**	**2.1%**
Austria[3]	30,338	101%	30,618	4,158	110%	4,568	0	95%	0	14,406	107%	15,347	48,902	**50,534**	**3.3%**
Poland	57,020	107%	61,160	197,944	100%	197,958	NO	-	NO	26,643	102%	27,135	281,607	**286,252**	**1.6%**
Portugal	23,397	102%	23,861	10,399	122%	12,654	NO	-	NO	7,340	111%	8,153	41,136	**44,668**	**8.6%**
Romania[3]	21,879	105%	22,916	19,896	106%	21,066	31	100%	31	20,054	96%	19,315	61,860	**63,327**	**2.4%**
Slovenia	6,666	99%	6,584	4,355	101%	4,418	NA,NO	-	NA,NO	1,439	106%	1,524	12,460	**12,526**	**0.5%**
Slovakia	7,860	112%	8,827	9,248	97%	9,005	NO	-	NO	7,662	121%	9,281	24,771	**27,113**	**9.5%**
Finland	21,752	96%	20,802	11,080	89%	9,886	6,270	91%	5,720	5,244	89%	4,646	44,347	**41,054**	**-7.4%**
United Kingdom	158,197	103%	163,624	99,569	80%	79,615	7	100%	7	140,852	102%	143,954	398,625	**387,200**	**-2.9%**
EU 28	**1,273,195**	102%	**1,292,757**	**1,019,959**	97%	**990,418**	**10,346**	91%	**9,451**	**777,185**	104%	**811,017**	**3,080,685**	**3,103,645**	**0.7%**

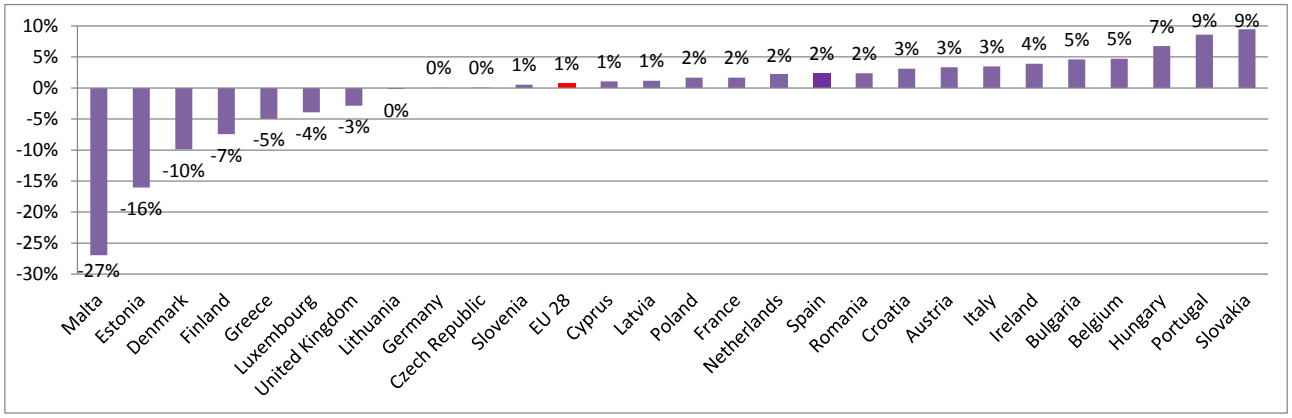
Note: [1] Trend changes of solid fuels were calculated in TJ; [2] Trend changes for liquid fuels were calculated in TJ, [3]Inventory submission as available under EIONET has been used, [4]solid fuel consumption data has been adapted, [5] Market inland deliveries observed are used instead of calculated hard coal consumption; Data for Sweden has been still under revision and is not included, EU aggregate excluding Sweden

Source: Eurostat database and Member States' inventory submissions UNFCCC 2014 submitted in May 2016

For Sweden the results of the early CO_2 estimates calculated with Eurostat monthly energy data lead to decreasing CO_2 emissions in 2015 by -7.4 %. Shortly before Eurostat published its early CO_2 emission estimates, Statistics Sweden published own estimates on the development of GHG emissions in Sweden for the year 2015[7]. According to national estimates total GHG emissions from Sweden decreased only by -0.7 % in comparison to 2014. Focusing on trend changes of sectors with CO_2 emissions from fuel combustion like household, transport and the electricity, gas, heat sector the strong decline calculated with Eurostat monthly energy data for Sweden did not show up. As the large differences in results could not be clarified, it has been decided not to include Swedish data in the early CO_2 emission estimates from Eurostat.

Table 3-30 shows the results for early CO_2 estimates for the year 2015 based on the method described in section 2.1. These early estimates suggest that the CO_2 emissions from fuel combustion decreased for eight Member States and increased for the other nineteen Member States in 2015 in comparison to the year 2014 (see Figure 3-1). The calculations do not include CO_2 emissions from the new categories waste fuels and other fossil fuels, as there are no Eurostat monthly energy data available that could indicate the trend changes.

Figure 3-1: Relative changes in total fossil fuel consumption for all Member States for 2015/2014



Source: Eurostat early estimates

The early estimates indicate that CO_2 emissions from the energy sector increased by 0.7 % for the EU-28 between 2014 and 2015. After the rather strong decline of CO_2 emissions from fuel combustion in 2014, due to a mild winter, this small increase in total EU 28 CO_2 emissions was to be expected.

To check if calculated trend changes are reliable, trend developments in net electricity generation as available in the Eurostat database and ENTSOE data (European Network of Transmission System Operators for Electricity) on net electricity generation from nuclear, lignite, hard coal, gas, oil and also renewables (wind, solar, biomass, hydro) has been used. A short explanation for decreases or increases in emissions in 2015 for certain Member States is provided below:

- Increases in CO_2 emissions in France, Italy, Portugal and Spain are due to decreasing electricity generation from hydropower due to drought. Natural gas consumption increased due to colder winters.

[7] http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Environment/Environmental-accounts-and-sustainable-development/System-of-Environmental-and-Economic-Accounts/Aktuell-Pong/38171/Behallare-for-Press/402698/

  - The decrease of CO_2 emissions from fossil fuel consumption in Malta is due to the new interconnector from Italy which is in operation since April 2015. Thus Malta is no longer an isolated island, but can import electricity from Italy, which leads to a decline of conventional power generation in Malta.[8]

- For Estonia electricity imports increased in 2015, while electricity generation decreased. Due to the use of oil shale and shale oil with very low NCVs this leads to a rather strong decrease in CO_2 emissions from fuel consumption.
- Denmark decreased its electricity generation from conventional power plants and increased electricity imports. Electricity generation from wind increased by 10% in 2015.
- The decrease of CO_2 emissions from fuel consumption in Finland is due to mild winter temperatures and increased electricity generation from hydropower.
- In Slovakia and Hungary cold winter temperatures in comparison to 2014 lead to increased electricity generation from oil and natural gas.

[8] http://www.enemalta.com.mt/index.aspx?cat=2&art=247&jse=0

3.6. Summary and conclusion

The application of the trend method to estimate early CO_2 emissions for all EU Member States represents a robust procedure that adjusts systematic errors of under- or over reporting in Eurostat monthly data. The advantage of the method is the simplicity that ensures a fast and straightforward calculation for each Member State. By applying the trend change method, inconsistencies in the reporting of Eurostat monthly energy data compared to Eurostat annual or GHG inventory data can be levelled out, if these inconsistencies persist through the entire time series of Eurostat monthly energy data. *In comparison to the reporting of Eurostat annual and energy data from GHG inventories, some Member States underestimate monthly data. Earlier projects initiated by Eurostat*[9] *showed that in some Member States the average coverage of the monthly data submission concerning the overall supplied quantities is not 100%.* Also international bunker fuels are incompletely reported in monthly Eurostat data by some Member States and can therefore not be subtracted from consumption.

The use of a trend change method requires a consistent reporting over two consecutive years. Any changes in reporting including improvements, can affect the trend changes in a negative way leading to higher deviations between early CO_2 estimates and final GHG inventory data on CO_2 emissions from fuel combustion.

The report shows the differences between the calculation of early CO_2 emission estimates and final GHG inventory CO_2 emission for the year 2014. The analysis of the differences starts at the most aggregated level of trend changes for total CO_2 emissions, as well as trend changes for CO_2 emissions from liquid, solid and gaseous fuels, followed by the level of aggregated liquid (kt), solid (kt) and gaseous fuel (TJ NCV) consumption and ends up with explanations on the level of single fuel categories for differences above +/-3 % in total liquid, solid or gaseous fuel consumption.

The comparison of differences at the level of trend changes for total CO_2 emissions shows, that there are only two Member States (Lithuania and Slovakia) that show differences above 5 %. For Lithuania the differences can partly be explained by changing shares in the amount of carbon stored. For carbon stored no data sources are available at the level of monthly energy statistics. Thus, this uncertainty will further remain in the methodology. For Slovakia, differences can be explained by large deviations in the reporting of natural gas in the year 2014. Differences in trend changes for total CO_2 emissions above 3 % are found for Belgium, Germany, Greece, Malta, Austria, Portugal and Finland. For Belgium and Austria the differences can be explained by improvements of data quality in 2014 that are not further followed up within this report. For Germany, Greece, (Malta), Portugal and Finland differences in the reporting of 2014 monthly Eurostat data persisted or increased in comparison to the 2013 reporting and influence the trend changes for the calculation of the early CO_2 estimates. For the Netherlands the increasing differences in reporting on the level of fuel consumption in 2014 for liquid and solid fuels does not end up in differences in trend changes on the level of total CO_2 emissions. Nevertheless, a follow up is needed. Besides differences in the reporting that affects the trend changes, there are systematic differences in the reporting of monthly Eurostat data that also need a follow up, even if there are no effects on the trend changes. Member States that show systematic issues in the reporting of monthly Eurostat data resulting in differences of above +/-3 % include Denmark and Portugal for the reporting of liquid fuels, Germany, Greece, France and Slovenia for solid fuels and Croatia and Ireland for natural gas.

Calculation of 2015 early CO_2 estimates shows that data quality further improved. With the reporting of international bunkers from jet kerosene starting in 2014 in Austria and the United Kingdom no gap filling needs to be applied. In addition, the analysis of gaps and outliers for the

[9] Tender 2010/S 66-098319

2015 monthly Eurostat data shows that reporting improved. Most Member States that are asked to confirm data or send corrected values confirmed their data. Only in a few cases updated questionnaires have been sent. Some Member States confirmed the data, but pointed out that they are aware of the differences between monthly and annual reporting and that no better data is available (Ireland natural gas production). Other Member States confirmed the monthly Eurostat data including data gaps for some month in 2015, but analysis of the 2014 data (where the same gaps have been detected) showed, that there are large differences between monthly and annual reporting that can be explained by the gaps in the monthly data (e.g. Belgium, Natural gas liquids imports).

The only correction that are applied to the calculation of the 2015 early CO_2 emission estimates are related to calculation of trend changes in TJ instead of kt. This applies for Bulgaria (solid fuels) Estonia (liquid fuels), Malta (liquid fuels) and Hungary (solid fuels).

For the calculation of the early CO_2 estimates in the year 2014 trend changes for solid fuels for Germany, Hungary and Poland have been calculated based on solid fuel consumption in TJ instead of kt. An analysis of the closeness of results for the year 2014 reveals, that the trend changes do not show a better match if calculated in TJ for Germany and Hungary, while for Poland the closeness improved (see Table 3-9). This seems to be related to the data quality of reporting. For Poland the data for solid fuel consumption shows a very good match between monthly and annual Eurostat data. For Hungary the data quality further improved in 2014 and Germany provides constantly insufficient data quality for solid fuels. Thus, results for the trend changes seem to be randomly affected by calculation in TJ, if data quality is not perfect. The results for the year 2015, where this approach was applied for some Member States will show, if this correction should be applied or not for following years.

Further improvements for the applied method should be further examined in the next year. For Ireland the correction of peat applied for the monthly data shows rather large differences in comparison to annual Eurostat data. Thus, further checks should be carried out, if the methodology could be improved next year.

4. References

ENTSOE Database on Net electricity generation:
https://www.entsoe.eu/data/statistics/Pages/default.aspx

Eurostat data:

- Data from Eurostat database for monthly and annual fuel consumption for the years 2013 – 2015 normally extracted between mid and end April in the year after the reference year
- Monthly data on net electricity generation

Inventory data: Data as reported by Member States to the UNFCCC in CRF table 1.A.(b).Submissions 2016 for the year 2014:
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php

IPCC 2006, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). IGES, Japan.

Early national statistics

Croatia:

http://www.dzs.hr/default_e.htm

Denmark:
https://ens.dk/en/our-services/statistics-data-key-figures-and-energy-maps/annual-and-monthly-statistics

Germany:
http://www.ag-energiebilanzen.de/6-0-Primaerenergieverbrauch.html

France:

http://developpement-durable.bsocom.fr/Statistiques/TableViewer/tableView.aspx?ReportId=13128

Netherlands:

http://statline.cbs.nl/Statweb/publication/?DM=SLEN&PA=37281eng&D1=0-16,20-21&D2=0,2,8-10&D3=44-48,138,143,148&LA=EN&HDR=G2,G1&STB=T&VW=T

Portugal:
http://www.dgeg.pt/

Slovenia:
pxweb.stat.si/pxweb/Database/Environment/18_energy/01_18179_balance_indicators/01_18179_balance_indicators.asp

5. Annex

5.1. Data tables

Table 5-1: Differences between monthly, annual Eurostat and GHG inventory data for fuel consumption

Fuel		Liquid fuels									Solid fuels									Natural gas								
Member States	Year	Cumulated Monthly Eurostat data	Annual Eurostat data	GHG inventory data	Difference Monthly Eurostat - Annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data		Cumulated Monthly Eurostat data	Annual Eurostat data	GHG inventory data	Difference Monthly Eurostat - Annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data		Cumulated Monthly Eurostat data	Annual Eurostat data	GHG inventory data	Difference Monthly Eurostat - Annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data	
		kt			kt	%	kt	%	kt	%	kt			kt	%	kt	%	kt	%	TJ NCV			TJ NCV	%	TJ NCV	%	kt	%
Belgium	2013	21,984	21,497	21,965	487	2%	19	0%	468	2%	3,994	4,970	4,917	-976	-20%	-923	-19%	-53	-1%	594,578	602,704	602,704	-8,126	-1%	-8,126	-1%	0	0%
	2014	22,469	21,794	22,395	675	3%	74	0%	601	3%	4,678	4,848	4,849	-170	-4%	-171	-4%	1	0%	520,738	527,506	524,869	-6,768	-1%	-4,130	-1%	-2,638	0%
Bulgaria	2013	3,509	3,481	3,473	28	1%	36	1%	-8	0%	30,409	30,585	30,585	-176	-1%	-176	-1%	0	0%	96,513	99,977	99,977	-3,464	-3%	-3,464	-3%	0	0%
	2014	3,680	3,858	3,847	-178	-5%	-167	-4%	-11	0%	33,281	33,369	33,370	-88	0%	-89	0%	1	0%	95,599	98,917	98,917	-3,318	-3%	-3,318	-3%	0	0%
Czech Republic	2013	7,996	7,992	7,955	4	0%	41	1%	-37	0%	46,801	45,945	46,747	856	2%	54	0%	802	2%	289,558	290,832	291,435	-1,274	0%	-1,877	-1%	602	0%
	2014	8,490	8,477	8,455	13	0%	35	0%	-22	0%	45,718	45,494	45,697	224	0%	21	0%	203	0%	258,585	258,833	259,389	-247	0%	-804	0%	556	0%
Denmark	2013	6,303	5,950	5,930	353	6%	373	6%	-20	0%	5,485	5,364	5,479	121	2%	6	0%	115	2%	139,353	138,833	138,833	520	0%	520	0%	0	0%
	2014	6,152	5,765	5,686	387	7%	466	8%	-79	-1%	4,447	4,041	4,293	406	10%	154	4%	252	6%	116,431	117,789	117,790	-1,358	-1%	-1,358	-1%	0	0%
Germany	2013	98,991	99,857	100,479	-866	-1%	-1,488	-1%	622	1%	237,599	247,279	246,447	-9,680	-4%	-8,848	-4%	-832	0%	3,075,491	3,051,546	3,178,642	23,944	1%	-103,151	-3%	127,096	4%
	2014	97,508	97,958	98,196	-450	0%	-688	-1%	238	0%	233,670	240,308	238,777	-6,638	-3%	-5,107	-2%	-1,531	-1%	2,738,165	2,681,949	2,688,044	56,216	2%	50,120	2%	6,095	0%
Estonia	2013	310	415	413	-105	-25%	-103	-25%	-2	0%	20,649	20,770	20,770	-121	-1%	-121	-1%	0	0%	23,233	23,233	23,083	0	0%	149	1%	-149	-1%
	2014	269	351	351	-82	-23%	-82	-23%	0	0%	20,556	20,906	20,906	-350	-2%	-350	-2%	0	0%	18,236	18,236	17,808	0	0%	428	2%	-428	-2%
Ireland	2013	5,792	5,946	5,762	-154	-3%	30	1%	-184	-3%	6,021	5,890	6,043	131	2%	-22	0%	153	3%	168,227	161,940	162,109	6,287	4%	6,118	4%	170	0%
	2014	5,733	5,699	5,536	34	1%	197	4%	-163	-3%	6,270	5,707	5,688	563	10%	582	10%	-19	0%	162,531	155,855	155,787	6,676	4%	6,744	4%	-68	0%
Greece	2013	11,180	10,669	10,687	511	5%	493	5%	18	0%	53,193	54,688	54,688	-1,495	-3%	-1,495	-3%	0	0%	135,392	135,497	135,497	-104	0%	-104	0%	0	0%
	2014	10,993	11,017	11,014	-24	0%	-21	0%	-3	0%	49,200	52,152	52,152	-2,952	-6%	-2,952	-6%	0	0%	103,783	104,013	104,013	-230	0%	-230	0%	0	0%
Spain	2013	46,235	46,305	45,467	-70	0%	768	2%	-838	-2%	20,420	20,633	20,633	-213	-1%	-213	-1%	0	0%	1,092,011	1,092,028	1,093,235	-16	0%	-1,223	0%	1,207	0%
	2014	45,406	45,248	44,507	158	0%	899	2%	-741	-2%	21,961	21,477	21,477	484	2%	484	2%	0	0%	990,950	990,860	991,961	90	0%	-1,011	0%	1,101	0%
France	2013	72,138	70,725	73,018	1,413	2%	-880	-1%	2,293	3%	20,052	18,824	21,317	1,228	7%	-1,265	-6%	2,493	13%	1,570,531	1,633,145	1,629,936	-62,614	-4%	-59,405	-4%	-3,209	0%
	2014	71,208	69,896	73,144	1,312	2%	-1,936	-3%	3,248	5%	14,774	13,796	15,879	978	7%	-1,105	-7%	2,083	15%	1,364,721	1,364,669	1,355,461	52	0%	9,260	1%	-9,208	-1%
Croatia	2013	3,083	3,014	3,073	69	2%	10	0%	59	2%	1,146	1,139	1,138	7	1%	8	1%	-1	0%	87,207	95,537	95,537	-8,330	-9%	-8,329	-9%	0	0%
	2014	2,903	2,955	3,044	-52	-2%	-141	-5%	89	3%	1,099	1,103	1,103	-4	0%	-4	0%	0	0%	79,616	84,549	84,620	-4,933	-6%	-5,005	-6%	72	0%
Italy	2013	53,495	53,455	55,913	40	0%	-2,418	-4%	2,458	5%	21,783	21,632	21,330	151	1%	453	2%	-302	-1%	2,402,257	2,402,667	2,402,951	-410	0%	-694	0%	284	0%
	2014	51,314	51,525	53,552	-211	0%	-2,238	-4%	2,027	4%	20,975	21,057	21,458	-82	0%	-483	-2%	401	2%	2,122,967	2,122,962	2,121,784	5	0%	1,183	0%	-1,178	0%
Cyprus	2013	1,816	1,826	1,830	-10	-1%	-14	-1%	4	0%	NA	1	13	-	-	-	-	12	-	NO	NO	NO	-	-	-	-	-	-
	2014	1,864	1,877	1,887	-13	-1%	-23	-1%	10	1%	4	4	4	0	0%	0	-4%	0	4%	NO	NO	NO	-	-	-	-	-	-
Latvia	2013	1,105	1,254	1,192	-149	-12%	-87	-7%	-62	-5%	132	131	131	1	1%	1	1%	0	0%	50,200	50,438	50,544	-238	0%	-344	-1%	106	0%
	2014	1,197	1,291	1,213	-94	-7%	-16	-1%	-78	-6%	100	105	98	-5	-5%	2	2%	-7	-7%	45,274	45,286	45,386	-13	0%	-112	0%	100	0%
Lithuania	2013	2,193	2,189	2,372	4	0%	-179	-8%	183	8%	513	513	427	0	0%	86	20%	-86	-17%	90,554	90,624	90,608	-69	0%	-54	0%	-16	0%
	2014	2,384	2,353	2,542	31	1%	-158	-6%	189	8%	428	367	443	61	17%	-15	-3%	76	21%	86,157	86,437	86,450	-280	0%	-293	0%	13	0%

Fuel		Liquid fuels									Solid fuels									Natural gas								
Member States	Year	Cumulated Monthly Eurostat data	Annual Eurostat data	GHG inventory data	Difference Monthly Eurostat - Annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data		Cumulated Monthly Eurostat data	Annual Eurostat data	GHG inventory data	Difference Monthly Eurostat - Annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data		Cumulated Monthly Eurostat data	Annual Eurostat data	GHG inventory data	Difference Monthly Eurostat - Annual Eurostat data		Difference Monthly Eurostat - GHG inventory data		Differences GHG inventory - annual Eurostat data	
		kt			kt	%	kt	%	kt	%	kt			kt	%	kt	%	kt	%	TJ NCV			TJ NCV	%	TJ NCV	%	kt	%
Luxem-bourg	2013	2,365	2,372	2,363	-7	0%	2	0%	-9	0%	76	80	81	-4	-5%	-5	-6%	1	1%	37,259	37,258	37,258	1	0%	1	0%	0	0%
	2014	2,209	2,232	2,225	-23	-1%	-16	-1%	-7	0%	78	90	91	-12	-13%	-13	-14%	1	1%	35,302	35,302	35,302	0	0%	0	0%	0	0%
Hungary	2013	5,784	5,524	5,662	260	5%	122	2%	138	2%	10,796	10,736	10,720	60	1%	76	1%	-16	0%	320,365	322,601	322,601	-2,237	-1%	-2,237	-1%	0	0%
	2014	6,044	6,222	6,137	-178	-3%	-93	-2%	-85	-1%	10,359	10,314	10,299	45	0%	60	1%	-15	0%	292,156	292,307	292,307	-150	0%	-150	0%	0	0%
Malta	2013	712	733	773	-21	-3%	-61	-8%	40	5%	NO	NO	NO	-	-	-	-	-	-	NO	NO	NO	-	-	-	-	-	-
	2014	730	769	762	-39	-5%	-32	-4%	-7	-1%	NO	NO	NO	-	-	-	-	-	-	NO	NO	NO	-	-	-	-	-	-
Nether-lands	2013	27,926	28,178	28,739	-252	-1%	-813	-3%	561	2%	12,890	13,056	13,668	-166	-1%	-778	-6%	612	5%	1,394,339	1,383,983	1,396,200	10,355	1%	-1,862	0%	12,217	1%
	2014	26,657	29,664	26,397	-3,007	-10%	260	1%	-3,267	-11%	13,183	14,659	15,242	-1,476	-10%	-2,059	-14%	583	4%	1,217,665	1,207,294	1,207,180	10,371	1%	10,485	1%	-114	0%
Austria	2013	12,032	11,448	11,680	584	5%	352	3%	232	2%	4,449	4,869	4,835	-420	-9%	-386	-8%	-34	-1%	290,772	293,567	293,566	-2,795	-1%	-2,794	-1%	-1	0%
	2014	11,149	11,218	11,421	-69	-1%	-272	-2%	203	2%	4,563	4,441	4,441	122	3%	122	3%	0	0%	267,122	269,832	269,832	-2,710	-1%	-2,710	-1%	1	0%
Poland	2013	21,781	21,538	21,593	243	1%	188	1%	55	0%	137,563	137,871	137,827	-308	0%	-264	0%	-44	0%	574,372	574,674	574,674	-302	0%	-302	0%	0	0%
	2014	21,375	21,299	20,817	76	0%	558	3%	-482	-2%	129,964	130,418	131,324	-454	0%	-1,360	-1%	906	1%	562,338	561,217	561,217	1,121	0%	1,121	0%	0	0%
Portugal	2013	10,569	9,214	9,341	1,355	15%	1,228	13%	127	1%	4,450	4,449	4,410	1	0%	40	1%	-39	-1%	162,206	157,251	157,799	4,955	3%	4,407	3%	549	0%
	2014	9,725	8,802	8,890	923	10%	835	9%	88	1%	4,519	4,526	4,377	-7	0%	142	3%	-149	-3%	149,900	145,422	146,369	4,478	3%	3,531	2%	947	1%
Romania	2013	8,095	7,987	8,139	108	1%	-44	-1%	152	2%	25,754	26,669	26,663	-915	-3%	-909	-3%	-6	0%	430,846	410,052	410,052	20,794	5%	20,794	5%	0	0%
	2014	8,227	8,035	8,325	192	2%	-98	-1%	290	4%	25,840	26,979	26,929	-1,139	-4%	-1,089	-4%	-50	0%	404,690	392,065	392,065	12,625	3%	12,625	3%	0	0%
Slovenia	2013	2,163	2,332	2,330	-169	-7%	-167	-7%	-2	0%	4,045	4,487	4,487	-442	-10%	-442	-10%	0	0%	28,954	28,967	28,967	-13	0%	-13	0%	0	0%
	2014	2,188	2,275	2,273	-87	-4%	-85	-4%	-2	0%	3,163	3,617	3,617	-454	-13%	-454	-13%	0	0%	26,241	26,210	26,210	31	0%	31	0%	0	0%
Slovakia	2013	3,042	3,105	3,134	-63	-2%	-92	-3%	29	1%	6,657	6,902	6,902	-245	-4%	-245	-4%	0	0%	203,223	201,571	201,628	1,651	1%	1,595	1%	57	0%
	2014	2,919	2,851	3,027	68	2%	-108	-4%	176	6%	6,522	6,524	6,305	-2	0%	217	3%	-219	-3%	133,253	157,940	157,818	-24,687	-16%	-24,565	-16%	-122	0%
Finland	2013	7,196	7,187	7,647	9	0%	-451	-6%	460	6%	11,337	11,507	11,719	-170	-1%	-382	-3%	212	2%	118,526	119,611	119,622	-1,085	-1%	-1,096	-1%	11	0%
	2014	8,196	8,598	8,117	-402	-5%	79	1%	-481	-6%	10,755	10,849	11,059	-94	-1%	-304	-3%	210	2%	104,086	105,223	105,243	-1,137	-1%	-1,157	-1%	20	0%
Sweden	2013	11,558	11,404	12,178	154	1%	-620	-5%	774	7%	3,252	3,669	3,669	-417	-11%	-417	-11%	0	0%	40,068	39,996	39,996	72	0%	72	0%	0	0%
	2014	11,471	11,325	11,746	146	1%	-275	-2%	421	4%	3,398	3,372	3,308	26	1%	90	3%	-64	-2%	33,245	33,245	33,396	0	0%	-150	0%	150	0%
United Kingdom	2013	65,925	55,371	56,009	10,554	19%	9,916	18%	638	1%	61,027	60,778	61,270	249	0%	-244	0%	492	1%	2,747,482	2,750,037	2,756,655	-2,555	0%	-9,173	0%	6,618	0%
	2014	55,470	56,339	56,882	-869	-2%	-1,412	-2%	543	1%	48,781	48,722	49,559	59	0%	-778	-2%	837	2%	2,511,757	2,503,045	2,500,355	8,712	0%	11,402	0%	-2,690	0%
EU 28	2013	515,278	500,968	509,118	14,310	3%	6,160	1%	8,150	2%	750,492	763,437	766,917	-12,945	-2%	-16,425	-2%	3,480	0%	16,163,517	16,188,567	16,334,109	-25,051	0%	-170,593	-1%	145,542	1%
	2014	497,930	499,693	502,388	-1,763	0%	-4,458	-1%	2,695	1%	718,286	729,245	732,747	-10,959	-2%	-14,461	-2%	3,502	0%	14,441,507	14,386,962	14,379,572	54,545	0%	61,935	0%	-7,390	0%

Note: Green: difference ≤ ± 2%, Yellow: difference ± >2 and ≤ 5%, Red: difference > ± 5%

Differences for comparison of monthly and annual Eurostat data and annual Eurostat data and GHG nventory data: annual Eurostat data = 100 %, a positive value indicates that monthly data is higher than annual data; a negative value indicates that monthly data is lower than annual data.For comparison of monthly Eurostat data and GHG inventory data: GHG inventory data = 100%, a positive value indicates that monthly Eurostat data is higher than GHG inventory data; a negative value indicates that monthly Eurostat data is lower than GHG inventory data.

Source: Own compilation based on extraction from Eurostat database in the specific year, GHG inventory submission CRF table 1.A(b)

Table 5-2: Net Calorific Values used for the purposes of converting GHG inventory data in physical units and for calculating trend changes in TJ

			AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	HR	HU	IE
			2014													
FUEL TYPYS			TJ/kt													
Liquid fossil	Primary fuels	Crude Oil	42.5	42.2	42.5		42.4	42.6	43.0		41.9	42.7	42.0	42.4	38.1	42.8
		Orimulsion			50.0				27.7	27.5		42.5	27.5	49.4	40.0	
		Natural gas liquids	42.5	45.2								45.2	44.0	46.1	43.0	
	Secondary fuels	Gasoline	41.0	44.0	43.2	44.3	44.4	43.5	43.8	44.0	44.8	43.0	44.0	44.6	44.3	44.6
		Jet Kerosene +Other Kerosene	43.3	43.0	43.0	44.1	43.3	42.8	43.5	43.0	43.4	43.3	44.0	44.0	41.8	44.1
		Gas / Diesel Oil	42.2	42.6	42.1	43.0	42.6	43.0	42.7	42.3	43.1	42.8	42.0	42.7	42.0	43.3
		Residual Fuel Oil	40.3	40.0	40.0	40.4	39.5	40.3	40.7	40.2	40.5	40.8	40.0	40.2	40.4	41.2
		Liquefied Petroleum Gas	46.1	46.0	46.0	47.3	45.9	46.0	46.0	45.5	44.8	46.2	46.0	46.9	47.0	47.2
		Ethane											46.4			
		Naphtha	45.0	44.0	44.0		43.6	44.0	44.5		45.0	44.3	45.0	44.6	42.0	44.0
		Bitumen	41.8	39.0	37.7	40.2	40.2	39.0	39.8	40.2	40.2	40.2	40.2	33.5	37.7	37.7
		Lubricants	41.8	42.0	42.3	40.2	40.2	41.8	41.9	40.2	40.2	40.2	40.2	33.5	39.8	42.3
		Petroleum coke	30.8	32.0	31.4	32.5	38.5	31.5	31.4		32.5	33.5	32.0	31.0	33.0	32.6
		Refinery feedstocks	41.5	42.2	41.9		40.3	42.5	42.7		44.8	42.5	44.8	42.7	41.8	44.6
Other liquid fossil		Other oil + bitumen + lubricants	41.8	41.8	40.4	40.2	39.9	39.5	47.8		40.2	42.0	40.2	38.2	39.1	43.6
Solid fossil	Primary fuels	Anthracite + Coking Coal + Other Bituminous Coal + Sub-bituminous Coal	28.5	26.3	26.6	23.2	22.2	27.3	24.7	27.2	22.5	25.5	26.0	25.0	23.4	25.5
		Lignite	20.4		6.8		12.1	9.1		9.0	12.3		17.0	12.1	6.9	19.8
		Oil Shale								9.0			9.4			
	Secondary fuels	BKB[3] and Patent Fuel	19.3	20.0	12.2		21.1	19.6	24.7				32.0		20.0	20.0
		Coke Oven/Gas Coke	29.0	29.3	28.5		28.6	28.7	29.3	28.5	27.7	28.1	28.0	29.3	28.5	
Peat			**8.8**					**2.0**		**10.7**		**10.1**				**8.8**

			IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK	UK	EL
			2014													
FUEL TYPYS			TJ/kt													
Liquid fossil	Primary fuels	Crude Oil	42.7	42.8				42.7	42.3	42.6	41.3	41.6		42.0	42.8	42.3
		Orimulsion						27.5	42.5	28.0	48.0			28.5	42.5	
		Natural gas liquids		44.2				44.0			49.5			37.0	45.3	41.6
	Secondary fuels	Gasoline	44.3	44.8	43.0	44.0	44.3	44.0	44.0	44.0	44.0	44.0	43.9	43.9	44.3	42.8
		Jet Kerosene +Other Kerosene	43.0	43.2	43.1	43.2	43.8	43.5	43.0	43.0	48.6	43.0	43.5	43.3	44.0	44.1
		Gas / Diesel Oil	42.6	43.1	42.5	42.5	43.0	42.7	43.3	42.6	42.4	42.9	42.6	42.0	42.9	42.8
		Residual Fuel Oil	40.4	43.1	40.0	40.6	40.0	41.0	40.4	40.2	40.4	40.4	41.4	40.4	40.4	40.6
		Liquefied Petroleum Gas	46.0	46.4	46.0	45.5	46.0	45.2	46.0	46.0	48.1	46.1	46.1	46.0	46.0	47.3
		Ethane						45.2				49.5		48.4	46.4	
		Naphtha	44.0					44.0	44.0	44.0	44.0	44.0		44.0	45.3	44.5
		Bitumen	39.0	39.0	40.2	41.9		41.9	39.0	39.0	35.2	39.0	40.2	40.2	40.5	40.2
		Lubricants	42.0	42.0	40.2	41.9	42.0	41.4	42.0	42.0	35.2	42.0	40.2	41.2	42.9	40.2
		Petroleum coke	32.0		32.5			35.2	32.0	32.0	34.3	34.8	33.1	35.0	34.0	32.3
		Refinery feedstocks	41.9	42.2				43.0	42.5	44.0	43.0	44.2		42.0	42.0	43.0
Other liquid fossil		Other oil + bitumen + lubricants	40.0	40.0	42.5	41.9		40.2	38.5	43.7	39.8	40.2	40.2	42.1	43.6	40.2
Solid fossil	Primary fuels	Anthracite + Coking Coal + Other Bituminous Coal + Sub-bituminous Coal	25.3	25.1	24.4	26.2		25.0	22.3	25.6	25.8	27.4	25.2	26.0	25.0	25.9
		Lignite	10.3		22.2			20.0	8.1	16.4	7.9		11.0	10.9		5.3
		Oil Shale				9.2		8.9						9.6		
	Secondary fuels	BKB[3] and Patent Fuel		15.0	22.2			20.7	20.0					28.0	20.7	
		Coke Oven/Gas Coke	28.5	29.3	28.5	26.8		28.5	28.5	29.4	28.5	28.1	30.1	28.7	28.5	
Peat				**11.7**		**10.1**					**9.0**	**10.8**			**9.8**	

Note: There might be small differences for NCVs used for calculating early CO_2 estimates in TJ and for converting GHG inventory data in physical units. This is due to inconsistencies that could only be identified after comparison of GHG inventory data with annual Eurostat data

Source: Database Eurostat annual data, GHG inventory data, IPCC 2006 GL

5.2. Data gaps and Outliers in 2015 monthly Eurostat data

Table 5-3: List of gaps for individual months examined in the monthly fuel data for the year 2014

MS	Fuel	Flow	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	No	Dec	Total	Comment
BE	Natural Gas Liquids	Total imports	20			30	53		10						**113**	data confirmed
BG	Refinery Feedstocks	Total imports	106		66	98	74	33	65	65	33		35		**575**	data confirmed
BG	Natural gas in TJ	Stock change	-2972	-2777	-2400	-109		645	3716	1738	2574	2205	-265	-2037	**318**	data confirmed
CY	Petroleum Coke	Total imports	15		14	7	21	45				22			**124**	data confirmed
CZ	Natural gas in TJ	Primary production	766	769	761	926	840	778	779	792	801	799	776	742	**9529**	outlier confirmed
DK	Refinery Feedstocks	Total imports	66	46											**112**	data confirmed
DK	Kerosene Type Jet Fuel	Total imports	99	33	90	69		188	49	110	36	131	22	86	**913**	data confirmed
DK	Petroleum Coke	Total imports	31	3	36				36				33	37	**176**	update provided
DK	Other Petroleum Products	Total imports		1	2	19	10	16	10	24	29	25	16	3	**155**	update provided
EE	Motor Gasoline	Total exports	2	3	4	27	18	45	15	10	21	5		4	**154**	data confirmed
EE	Residual Fuel Oil	Total exports	48	22	43				16	18	2	2	11	2	**164**	data confirmed
ES	Motor Gasoline	Total imports	5	4	3	26	4		14	17	5	13		13	**104**	data confirmed
ES	Naphta	Total exports	28	31	43	31	32	32		32	32	32	16	35	**344**	data confirmed
FI	Peat	Primary production	0	0	0	0	0	0	1	1544	666	0	0	0	**2211**	update provided
FI	Other Kerosene	Total imports	4				39				70				**113**	no update
FI	Kerosene Type Jet Fuel	Total imports	6	14	26	32	54	35			20		50	75	**312**	no update
FI	Petroleum Coke	Total imports	6	6	6	5		56	5	6		5	16		**111**	no update

FI	Residual Fuel Oil	Total exports	76	61	78	45	16		64	77	80	112	64	109	**782**	no update
FI	Residual Fuel Oil	Stock change	13	94	16	1	-86	124	-48	-16	-37	63	82		**206**	no update
FR	Natural Gas Liquids	Total imports	34			29	31		28	28	106	58	31	28	**373**	update provided
FR	Refinery Feedstocks	Total imports						33	48	72	45	35			**233**	data confirmed
FR	Refinery Feedstocks	Total exports		145	109		107				69	195	294		**919**	data confirmed
FR	Crude Oil	Stock change		74	197	-367	521	-54	-125	-314	-73	-419	-207	881	**114**	data confirmed
FR	Hard Coal	Exports	0	6	12	0	7	0	60	0	0	28	2	11	**126**	data confirmed
HR	Crude Oil	Total imports		238	144	266	238	176	393	75	374	175	248		**2327**	data confirmed
HU	Gas/ Diesel Oil	Stock change	52	12		2	60	-23	1	8	-8	21	10	62	**197**	data confirmed
IE	Residual Fuel Oil	Total imports		6		39	7	7	9	6	3	6	31	7	**121**	data confirmed
IE	Motor Gasoline	Total exports	11	18	11	12	95	129	76		12	6	11	11	**392**	data confirmed
IT	Crude Oil	Primary production	440	333	463	450	453	452	469	467	443	479	459	443	**5351**	data confirmed
IT	Other Kerosene	Total imports	40		58	33	73	65	64	33	33			15	**414**	data confirmed
IT	Residual Fuel Oil	Total imports	27		25	17	12	23	12	24	23	30	104	12	**309**	data confirmed
IT	Petroleum Coke	Total imports	130		155	138	94	59	68	194	34	79	188	40	**1179**	data confirmed
IT	Crude Oil	Total exports	58			90	90	29	29	88	59	62	119	86	**710**	data confirmed
IT	Refinery Feedstocks	Total exports	22	23	54	15	102	95	121	8			52	54	**546**	data confirmed
IT	Other Kerosene	Total exports	6		40	30	29	58	44	54	5	25	25		**316**	data confirmed
IT	Petroleum Coke	Stock change	118	-62	14	-30	51	2	-116	120	-28		61	35	**165**	data confirmed
LT	Natural Gas Liquids	Total imports				122			76						**198**	data confirmed
LT	Gas/ Diesel Oil	Total imports	73	114	138	119	140	136	133	124	146	146	13	142	**1544**	data

													3			confirmed
RO	Residual Fuel Oil	Total exports		5	15	12	6	11	32	11	11	11	14	18	**146**	update provided
SE	LPG	Total imports	89	12	44	182	111	91	230	162	11		11	46	**989**	no update
SE	Naphta	Total imports	20	21	39	28	30	16	13	27			19	26	**239**	no update
SE	Residual Fuel Oil	Total imports	4		31		21		17	6	24	69	68	39	**279**	no update
SE	Kerosene Type Jet Fuel	Total exports	23	6	15	14	16	28		5					**107**	update provided
SI	Kerosene Type Jet Fuel	Total imports	31	19	30		26	31	33	50	27	20	28	20	**315**	data confirmed

Source: Extraction from Eurostat database

5.3. Differences for calculation of 2015 early CO_2 estimates for trend changes calculated in TJ and in kt

Table 5-4: Differences for calculation of 2015 early CO_2 estimates for trend changes calculated in TJ and kt for liquid and solid fuels

Member Sates	Trend change solids kt	Trend change solids TJ	Difference		Trend change liquids kt	Trend change liquids TJ	Difference
	2015/2014				2015/2014		
Belgium	98.7%	98.5%	0.2%		102.1%	102.3%	-0.2%
Bulgaria	111.2%	102.9%	8.1%		106.4%	106.8%	-0.4%
Czech Republic	99.6%	100.1%	-0.6%		97.8%	97.6%	0.2%
Denmark	66.4%	66.4%	0.0%		99.5%	99.5%	0.0%
Germany	98.0%	96.0%	2.1%		101.0%	101.0%	-0.1%
Estonia	85.3%	84.7%	0.7%		46.5%	85.1%	-45.4%
Ireland	117.0%	116.8%	0.2%		104.9%	105.0%	-0.1%
Greece	84.1%	85.2%	-1.3%		104.5%	104.3%	0.2%
Spain	98.0%	99.4%	-1.4%		103.2%	102.7%	0.4%
France	97.2%	97.2%	0.0%		100.0%	100.0%	-0.1%
Croatia	91.7%	91.6%	0.1%		102.7%	103.0%	-0.2%
Italy	95.7%	95.5%	0.3%		101.7%	102.0%	-0.3%
Cyprus	150.0%	150.0%	0.0%		101.0%	101.4%	-0.4%
Latvia	71.1%	71.1%	0.0%		102.9%	102.8%	0.1%
Lithuania	80.1%	80.4%	-0.3%		103.0%	102.6%	0.4%
Luxembourg	101.3%	100.6%	0.7%		97.4%	97.4%	0.0%
Hungary	99.7%	103.1%	-3.2%		108.9%	109.8%	-0.8%
Malta	NA	NA	NA		72.2%	73.1%	-1.2%
Netherlands	106.2%	106.3%	-0.1%		91.1%	90.9%	0.3%
Austria	109.9%	110.1%	-0.2%		100.9%	100.9%	0.0%
Poland	100.0%	100.5%	-0.5%		107.3%	107.2%	0.1%
Portugal	121.7%	121.7%	0.0%		102.0%	101.5%	0.5%
Romania	105.9%	107.0%	-1.0%		104.7%	104.6%	0.2%
Slovenia	101.5%	101.4%	0.0%		98.8%	98.8%	0.0%
Slovakia	97.4%	95.7%	1.7%		112.3%	112.2%	0.1%
Finland	89.2%	89.4%	-0.2%		95.6%	95.8%	-0.2%
Sweden	97.7%	97.7%	0.0%		82.7%	83.5%	-0.9%
United Kingdom	80.0%	80.1%	-0.2%		103.4%	103.3%	0.1%

Note: For Germany trend changes for solid fuels have been calculated in kt even if there are differences for the calcualtion in TJ. But the results from last year show that trend changes did not improve.

Source: Own calcualtion based on monthly Eurostat data 2014 and 2015 and GG inventory data 2016 submission for th year 2014

5.4. Other issues

Table 5-5: Sweden – Reporting of Gas/diesel oil exports under annual and monthly Eurostat data for the year 2014

Montly Eurostat Gas/diesel oil (without bio components) - Exports - kt

	2014M 01	2014M 02	2014M 03	2014M 04	2014M 05	2014M 06	2014M 07	2014M 08	2014M 09	2014M 10	2014M 11	2014M 12	**Total 2014**
Extracted on 11.05.2015					243	389	297	341	335	453	482	480	**3,020**
Extracted on 15.10.2016	386	0	0	0	345	451	389	435	365	453	482	480	**3,786**

Monthly Eurostat Total gas/diesel oil (blended with bio components) - Exports - kt

	2014M01	2014M 02	2014M 03	2014M 04	2014M 05	2014M 06	2014M 07	2014M 08	2014M 09	2014M 10	2014M 11	2014M 12	**Total 2014**
Extracted on 11.05.2015	350	371	291	319	243	389	297	341	335	453	482	480	**4,351**
Extracted on 15.10.2016	386	385	308	348	345	451	389	435	365	453	482	480	**4,827**

Annual Eurostat - Export - kt

	Total 2014
Gas/diesel oil (without bio components) - Exports	**4,829**
Biodiesel	**1**

Source: Eurostat database in the specific year

Table 5-6: Reporting of gas/diesel oil under monthly and annual Eurostat data and GHG inventory data for selected Member States for 2014

Denmark		Annual Eurostat Extraction database June 2016	Annual Eurostat Extraction database April 2016	Monthly Eurostat Extraction database April 2015	GHG inventory
Gas/Diesel Oil (without biocomponents)	**Apparent consumption**	**517**	**517**	**353**	**386**
	Total Exports	1,673	1,673	1,669	1,671
	Total Imports	2,762	2,762	2,577	2,635
	Stock changes	273	273	275	282
	International Marine bunkers	299	299	280	296
Biodiesel	**Apparent consumption**	**273**	**0**	**19**	
	Total Exports	40	0	0	
	Total Imports	309	0	9	
	Stock changes	-4	0	-10	
	International Marine bunkers	0	0	0	

Netherlands		Annual Eurostat Extraction database June 2016	Annual Eurostat Extraction database April 2016	Monthly Eurostat Extraction database April 2015	GHG inventory
Gas/Diesel Oil (without biocomponents)	**Apparent consumption**	**-10,640**	**-10,640**	**-13,711**	**-13,938**
	Total Exports	24,846	24,846	27,685	27,918
	Total Imports	15,403	15,403	15,183	15,162
	Stock changes	-145	-145	-143	-160
	International Marine bunkers	1342	1,342	1,352	1,342
Biodiesel	**apparent consumption**	**-1478**	**-43**	**0**	
	Total Exports	1512	43	0	
	Total Imports	0	0	0	
	Stock changes	-34	0	0	
	International Marine bunkers	0	0	0	

Finland		Annual Eurostat Extraction database June 2016	Annual Eurostat Extraction database April 2016	Monthly Eurostat Extraction database April 2015	GHG inventory
Gas/Diesel Oil (without biocomponents)	**Apparent consumption**	**-1,463**	**-1,463**	**-1,491**	**-1,993**
	Total Exports	3,638	3,638	3,698	3,640
	Total Imports	2,159	2,159	2,158	1,657
	Stock changes	-49	-49	-49	-23
	International Marine bunkers	33	33	0	33
Biodiesel	**Apparent consumption**	**6**	**0**	**0**	
	Total Exports	289	0	0	
	Total Imports	295	0	0	
	Stock changes	0	0	0	
	International Marine bunkers	0	0	0	

Sweden		Annual Eurostat Extraction database June 2016	Annual Eurostat Extraction database April 2016	Monthly Eurostat Extraction database April 2015	GHG inventory
Gas/Diesel Oil (without biocomponents)	**Apparent consumption**	**-2,710**	**-2,710**	**-1,783**	**-2,756**
	Total Exports	4,829	4,829	3,020	4,882
	Total Imports	2,400	2,400	1,538	2,422
	Stock changes	-32	-32	65	-12
	International Marine bunkers	313	313	236	308
Biodiesel	**Apparent consumption**	**590**	**0**	**0**	
	Total Exports	1	0	0	
	Total Imports	591	0	0	
	Stock changes	0	0	0	
	International Marine bunkers	0	0	0	

Note: Apparent cnsumption is calculated as imports – exports – stock changes – international bunkers and does not include primar products receipt

Source: Exctraction from Eurostat database and GHG inventory submission 2016