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Approximated EU GHG inventory: proxy GHG estimates for 2014

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Contact persons

Ricardo Fernandez
European Environment Agency (EEA)
Ricardo.fernandez@eea.europa.eu

Lukas Emele
Oeko Institut — EEA's European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM)
l.emele@oeko.de

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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The complete report will be available at:
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Executive summary

Objective of the report

This report provides estimates of greenhouse gas (GHG) emissions in the European Union (EU) and its Member States for the year 2014, covering the full GHG inventory (all sectors, except land use, landuse change and forestry (LULUCF), and all gases). These estimates are also referred to as approximated ('proxy') estimates or inventories in this report as they cover the year for which no official GHG inventories have been prepared yet. The proxy inventories in this report are based on GHG emission estimates reported by Member States to the European Commission under existing EU legislation ([1]) and on calculations made by the European Environment Agency's (EEA) European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM) using activity and/or emissions data at country level. The official submission of 2014 inventories to the United Nations Framework Convention on Climate Change (UNFCCC) will take place in 2016. The proxy estimates greatly improve the timeliness of information on GHG emissions and are used for analysis of emission trends and progress towards EU climate targets.

Under the UNFCCC rules, the official GHG inventories for 2013, submitted in 2015, must follow the 2006 IPCC Guidelines. Unfortunately the delay in the new UNFCCC CRF Reporter software has also delayed the preparation and submission of inventories. Therefore the official GHG inventory data for the EU for the year 2013 were not available at the time of production of this report. All EU 2013 GHG emissions presented in this report have to be regarded as preliminary.

For the second commitment period of the Kyoto Protocol (2013–2020) that was established in Doha in 2012 (COP 18/CMP8), the Doha amendment includes new quantified emission limitation and reduction commitments (QELRCs) for Annex I Parties intending to take part in the second commitment period. The EU, its 28 Member States and Iceland agreed to a joint QELRC, corresponding to a – 20% reduction compared to the base year. They declared that they intended to fulfil this commitment jointly, under Article 4 of the Kyoto Protocol ([2]). For this reason, the aggregates in this report will refer to the EU-28 and Iceland to the extent possible. The Doha Amendment's entry into force is subject to acceptance by at least three quaters of the Parties to the Kyoto Protocol.

The executive summary and Chapter 2 are based on proxy estimates reported by Member States as well as EEA estimates when Member States did not report proxy estimates by 31 July. The estimates in this report are based on the IPCC 2006 Reporting Guidelines and GWPs from the IPCC Fourth Assessment Report (AR4).

Proxy GHG emission estimates for 2014 at EU level

The estimates for 2014 indicate that emissions continued to decrease in 2014. Compared to preliminary 2013 emissions, the fall in emissions between 2013 and 2014 is estimated to be – 185.4 million tonnes of CO_2-equivalents (Mt CO_2-eq.) or – 4.1% for the EU plus Iceland ([3]) (total GHG emissions without LULUCF and including indirect CO_2) ([4]). For EU plus Iceland, total GHG emissions in 2014 are estimated to be – 24.4% below 1990 emissions.

([1]) Regulation (EU) 525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions (EU MMR).

([2]) Submission by Denmark and the European Commission on behalf of the European Union and its Member States (19 April 2012). Available at: http://unfccc.int/files/meetings/ad_hoc_working_groups/kp/application/pdf/awgkp_eu_19042012.pdf. Submission by Iceland (10 May 2012), available at: http://unfccc.int/resource/docs/2012/awg17/eng/misc01a01.pdf.

([3]) EU plus Iceland refers to the EU-28 plus Iceland. In figures and tables this may be abbreviated to EU + IS. The attribution 'EU-28' is used in contexts where Iceland is not included.

([4]) According to the UNFCCC reporting guidelines, Annex I Parties may report indirect CO_2 from the atmospheric oxidation of CH_4, CO and NMVOCs. For Parties that decide to report indirect CO_2 the national totals shall be presented with and without indirect CO_2. The EU proxy estimates are based on national totals excluding LULUCF and including indirect CO_2 if reported by Member States.

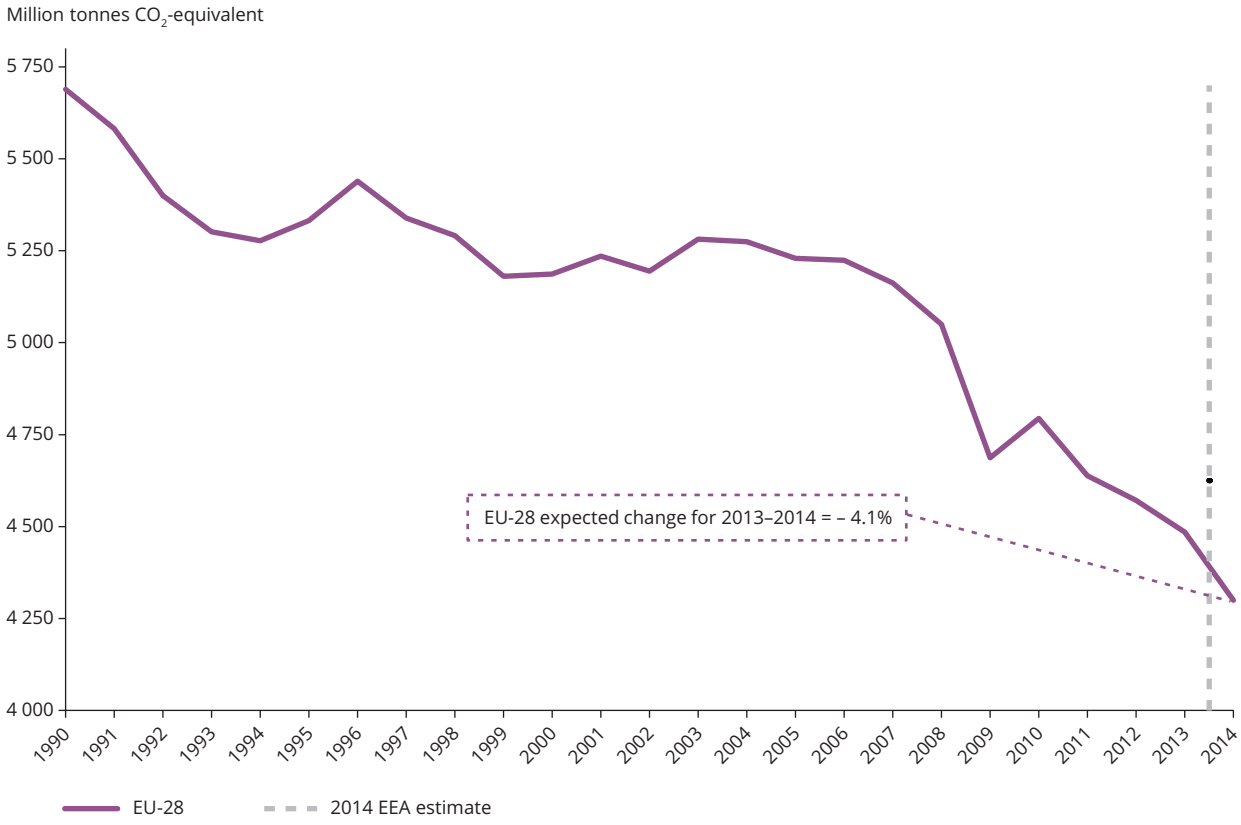
Figure ES.1 shows the emission trend for total GHG emissions without LULUCF but including indirect CO_2 in the EU-28 in the period 1990–2014 ([5]).

The – 4.1% emission decrease for EU plus Iceland occurred against an increase in gross domestic product (GDP) of + 1.4% on average in 2014 compared to 2013. As in 2013, notwithstanding economic developments in specific sectors and countries, there was no common pattern between GDP and GHG emissions for all EU Member States in 2014. The economic situation in the EU improved slightly during 2014 compared to 2013. The GHG emission reductions in 2014 compared to 2013 were even larger than in 2013 compared to 2012 (– 4.1% and – 1.8%, respectively). Most Member States achieved significant emission reductions in 2014 while also recording positive economic growth (see Figure ES.2).

Analysis of emission trends needs to include climatic factors which can affect behaviour and energy demand. 2014 was the warmest year on record in Europe. Winter in Europe in 2014 was generally much warmer than it was in 2013 ([6]). Higher winter temperatures in most Member States led to lower heating demand and lower emissions from the residential and commercial sectors. A regional distribution of GHG emission changes is presented in Figure ES.3.

On a sectoral basis, the largest absolute emission reduction in the EU occurred in the energy sector (i.e. all combustion activities and fugitive emissions). GHG emissions fell by – 181.9 Mt CO_2-eq. (– 5.2%) across the EU plus Iceland. This decrease in emissions in the energy sector reflects the decline of gross inland energy consumption in the EU plus Iceland in 2014. Within the energy sector, emissions decreased mostly

Figure ES.1 Trends in total GHG emissions, 1990–2014



Note: Total GHG emissions without LULUCF including indirect CO_2. The diagram does not include Iceland because at the time of production of this report Iceland had not developed full inventories for all years 1990–2013.

Source: EEA's ETC/ACM, based on the preliminary 2015 Member States' GHG inventory submitted to the EU for the years 1990–2013 and proxy estimates for 2014.

([5]) This is not equivalent to the difference to base year emissions because of accounting rules such as the selection of the base year (which varies from country to country) for fluorinated gases (F-gases) and the continuing recalculations of GHG inventories.

([6]) http://cib.knmi.nl/mediawiki/index.php/2014_warmest_year_on_record_in_Europe.

Figure ES.2 GHG emissions, GDP growth and heating degree days in the EU, changes 2013–2014

Source: EEA's ETC/ACM, based on GDP from Eurostat (gross domestic product at market prices, Chain linked volumes (2010), million euro). Heating Degree Days (HDDs), an indication of heat demand based on outdoor temperatures, produced by EEA. HDD 2014 data was not available for, MT, CY and IS.

in energy industries (– 85.7 Mt CO_2-eq.), other sectors (i.e. residential and commercial) (– 85.3 Mt CO_2-eq.) as well as for manufacturing industries and construction (– 13.6 Mt CO_2-eq.).

Primary energy consumption in the EU-28 dropped by 3.9% in 2014 and reached the lowest level since 1985. The contribution of fossil fuels to the energy mix declined while renewables further increased (BP, 2015).

Based on Eurostat monthly consumption data for solid, liquid and gaseous fuels (Eurostat, 2015), total fuel consumption in the EU fell by – 5%, with different trends for the different fossil fuel types. Consumption of natural gas dropped most significantly by – 10.7%. Consumption of solid fossil fuels fell by – 4.3% and consumption of liquid fuels was reduced by only – 1.2%. Natural gas consumption fell in all Member States between 2013 and 2014. Five Member States experienced declines in natural gas consumption of more than 15%: Denmark by – 16.4%, Estonia by – 21.5%, Greece by – 23.3%, Slovakia by – 34.4% and Sweden by – 17.0%.

Ten Member States showed increasing solid fossil fuel consumption (including peat), most notably in Belgium by 17.1%, followed by Bulgaria with 9.4% and Spain with 7.5% (Eurostat, 2015). On the other hand, solid fossil fuel consumption (including peat) decreased in 18 Member States, most notably in Denmark (– 18.9%), France (– 26.3%), Latvia (– 24.2%) ([7]), Lithuania (– 16.6%), Slovenia (– 21.8%) and the United Kingdom (– 20.1%). These changes in solid fossil fuel and natural gas consumption are not only related to Heating Degree Days (HDD) effects as described before but also strongly connected with the trends in electricity generation.

Hydroelectric generation increased by + 2% in the EU, but also electricity production from renewable sources other than hydro increased considerably. Gross wind generation grew by almost + 5% in the EU (Eurostat, 2015). Solar consumption continued with a strong growth by + 15% (BP, 2015). Thus, the use of renewables continues to play an important role in GHG mitigation efforts by the EU and its Member States. In 2014 nuclear electricity production across

([7]) Based on the provisional energy balance by the Central Statistical Bureau of Latvia, the reduction of solid fossil fuels excluding peat and peat briquettes was – 16.2% (– 16.9% if peat and peat briquettes are included).

the EU-28 was almost constant (– 0.1%) compared to 2013 according to the Eurostat monthly data.

GHG emissions from industrial processes increased in 2014 compared to 2013, up by + 0.9% in the EU plus Iceland. Emissions from mineral products grew by 2.9%. This is consistent with the increase in emissions from mineral products related activities under the EU ETS in the same period ([8]). Emissions from metal production fell by – 0.5% across the EU plus Iceland. Emissions from the chemical industry remained relatively stable in the EU plus Iceland (falling by only – 0.1% between 2013 and 2014).

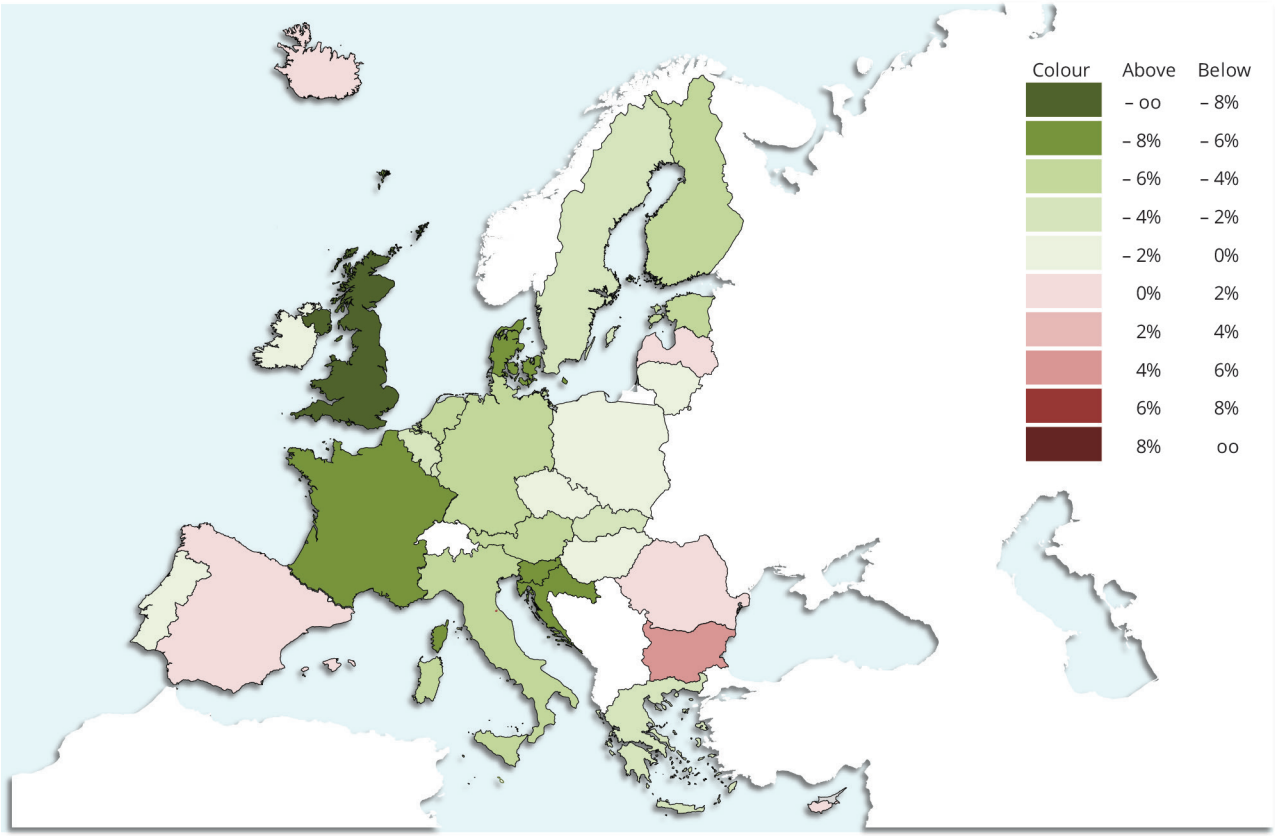
Agriculture emissions decreased slightly by – 0.4%, mainly from emission reductions from agricultural soils. The proxy inventory calculations for emissions from waste are based on extrapolation of past trends. The trend in emissions from waste continues the decrease seen in previous years with largest reduction being in emissions from solid waste disposal.

Change in GHG emissions in the period 1990–2014

Figure ES.4 presents the estimated change in GHG emissions for each Member State between 1990 and 2014 ([9]). Based on these 2014 estimates, total EU plus Iceland emissions (excluding LULUCF and including indirect CO_2) in 2014 were 24.4% below the 1990 level.

In addition to the recent economic recession, a wide range of policies (climate-related and non climaterelated) have contributed to the longterm decline in GHG emissions in the EU, particularly for CO_2. These include

Figure ES.3 Regional trends in total GHG emissions, change 2013–2014 (displayed as ranges)



Note: Change of total GHG emissions excluding LULUCF and including indirect CO_2.

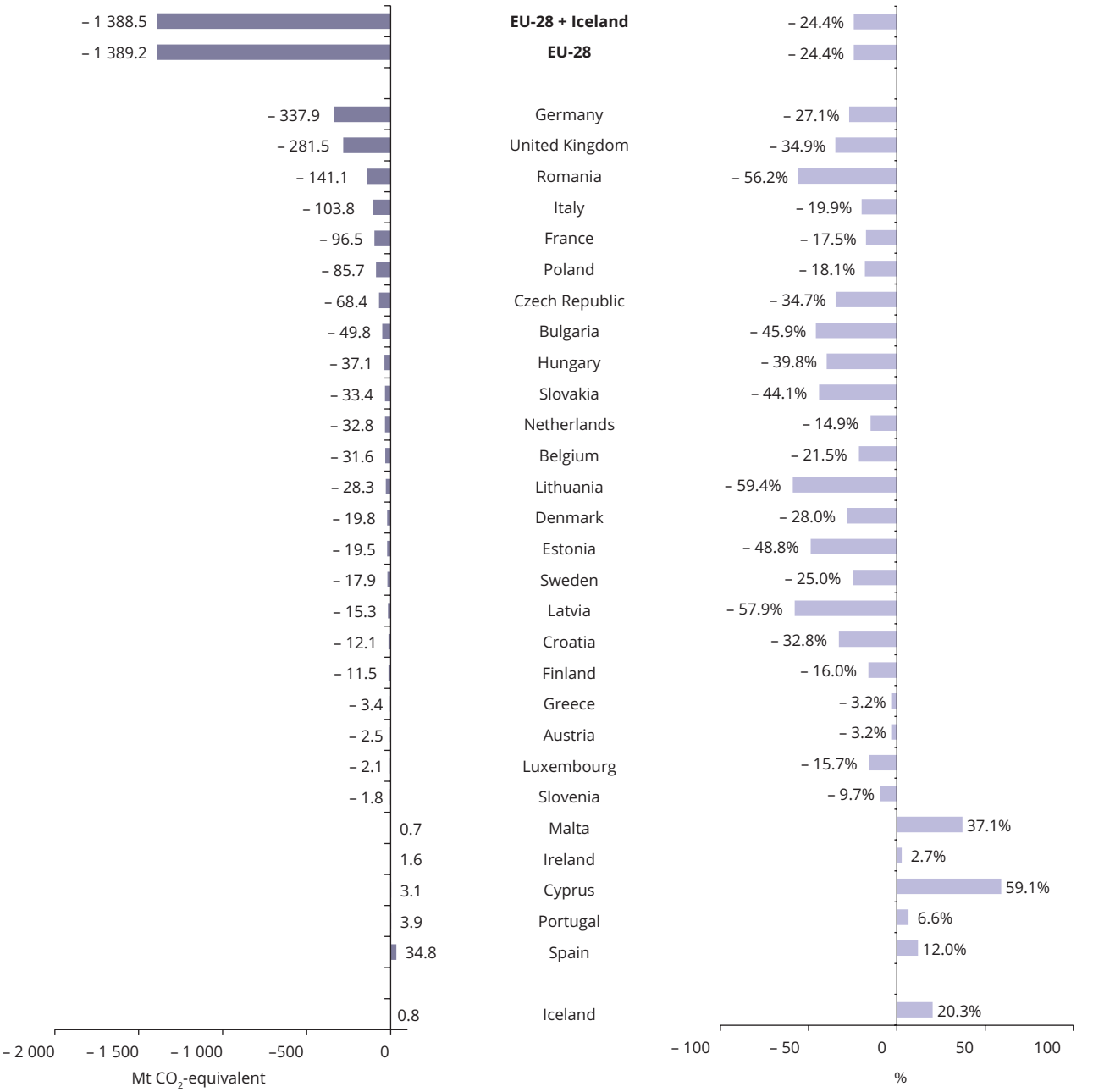
Source: EEA's ETC/ACM, based on the preliminary 2015 Member States' GHG inventory submitted to the EU for the years 1990–2013 and proxy estimates for 2014.

([8]) Production of cement clinker; production of lime, or calcination of dolomite/magnesite; manufacture of glass; manufacture of ceramics; manufacture of mineral wool; production or processing of gypsum or plasterboard.

([9]) The percentage change cannot be directly compared to the emission reduction obligations under the Kyoto Protocol since the fixed base-year emissions are not identical to the latest recalculation of 1990 emissions. Furthermore, Member State use of flexible mechanisms and LULUCF activities also contribute to compliance with the Kyoto targets.

improvements in energy efficiency, the shift to less carbon-intensive fossil fuels, and the strong increase in renewable energy use ([10]). The effects of the Montreal Protocol in reducing emissions of ozone-depleting substances have also indirectly contributed to very significant reductions in emissions of some potent GHGs such as chlorofluorocarbons. Specific polices to reduce F-gases have also slowed the growth in consumption of fluorinated gases with high global warming potential. Other EU policies such as the Nitrates Directive, the Common Agriculture Policy (CAP), and the Landfill Waste Directive have also been successful in indirectly reducing

Figure ES.4 Member States emissions, change 1990–2014



Note: Total GHG emissions without LULUCF including indirect CO_2, based on the preliminary 2015 MS GHG inventories submitted to the EU for the years 1990–2013 as well as proxy estimates for 2014.

Source: EEA's ETC/ACM, based on the preliminary 2015 Member States' GHG inventory submitted to the EU for the years 1990–2013 and proxy estimates for 2014.

([10]) See EEA, 'Why did GHG emissions decrease in the EU between 1990 and 2012?', www.eea.europa.eu/publications/why-are-greenhouse-gases-decreasing.

GHG emissions from non-CO_2 gases such as methane and nitrous oxides. Further implementation of the EU's Climate and Energy Package should lead to additional reductions in emissions.

Change in GHG emissions in the period 2013–2014 at Member State level

As explained above, total GHG emissions in the EU plus Iceland decreased by over 4% in 2014 alongside an improved economic situation, with GDP increasing by 1.4% compared to 2013. The main reason for the decrease in emissions was the lower heat demand by households due to a warmer winter (2014 was the warmest year on record in the EU). Natural gas consumption fell in all Member States and consumption of solid and liquid fuels also decline significantly for the EU as a whole. Renewables continued to increase in 2014, which partly contributed to the overall decline in GHG emissions.

As Figure ES.5 illustrates, GHG emissions decreased in 23 Member States (United Kingdom, Germany, France, Italy, Netherlands, Poland, Denmark, Belgium, Greece, Austria, Finland, Sweden, Croatia, Slovakia, Slovenia, Estonia, Portugal, Czech Republic, Hungary, Ireland, Lithuania, Luxembourg and Malta). The largest absolute decrease of emissions occurred in the United Kingdom (– 49.9 Mt CO_2-eq. compared to 2013), Germany (– 40.7 Mt CO_2-eq. or – 4.3% compared to 2013), followed by France ([11]) (– 36.7 Mt CO_2-eq.) and Italy (– 20.0 Mt CO_2-eq.). The largest relative fall in emissions compared to the previous year also took place in the United Kingdom (– 8.7%), followed by Denmark (– 7.8%), Slovenia (– 7.7%) and France (– 7.5%). The largest absolute growth in emissions occurred in Spain (+ 3.5 Mt CO_2-eq.) and the largest relative increase in Bulgaria (+ 5.0% or + 2.8 Mt CO_2-eq.). Chapter 2 of the main report includes explanations for some of the change in emissions by Member State.

Twenty-three Member States submitted preliminary 2014 GHG data to the European Commission and the EEA by 31 July 2014. Austria, Belgium, Croatia, The Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Poland, Slovakia, Slovenia, Spain, Sweden and the United Kingdom all submitted emissions in the form of largely complete CRF Summary 2 tables.

As Bulgaria, Cyprus, Iceland, Lithuania, Portugal and Romania did not submit preliminary GHG inventories, approximated GHG emissions calculated centrally by EEA and its ETC/ACM were used for these countries Member States.

Using the available proxy emission estimates by Member States and gap-filling the missing countries with estimates calculated centrally by EEA and its ETC/ACM, the GHG emissions of EU plus Iceland are expected to decrease by -4.1% between 2013 and 2014.

Figure ES.6 shows the expected change in total GHG emissions in 2014 broken down by the European Emissions Trading System (ETS) and the Effort Sharing Decision (ESD) sectors by Member State. Between 2013 and 2014 emission reductions in the EU-28 were greater for the installations covered by the ETS (a decline in emissions of – 5.2% ([12])) than they were in the ESD sector (where emissions decreased by – 3.3%).

Official 2014 GHG emissions for the EU will be available in the late May or early June 2016, when the EEA publishes the 1990–2014 EU GHG inventory and 2016 inventory report for submission to the UNFCCC.

Rationale for proxy GHG emission estimates

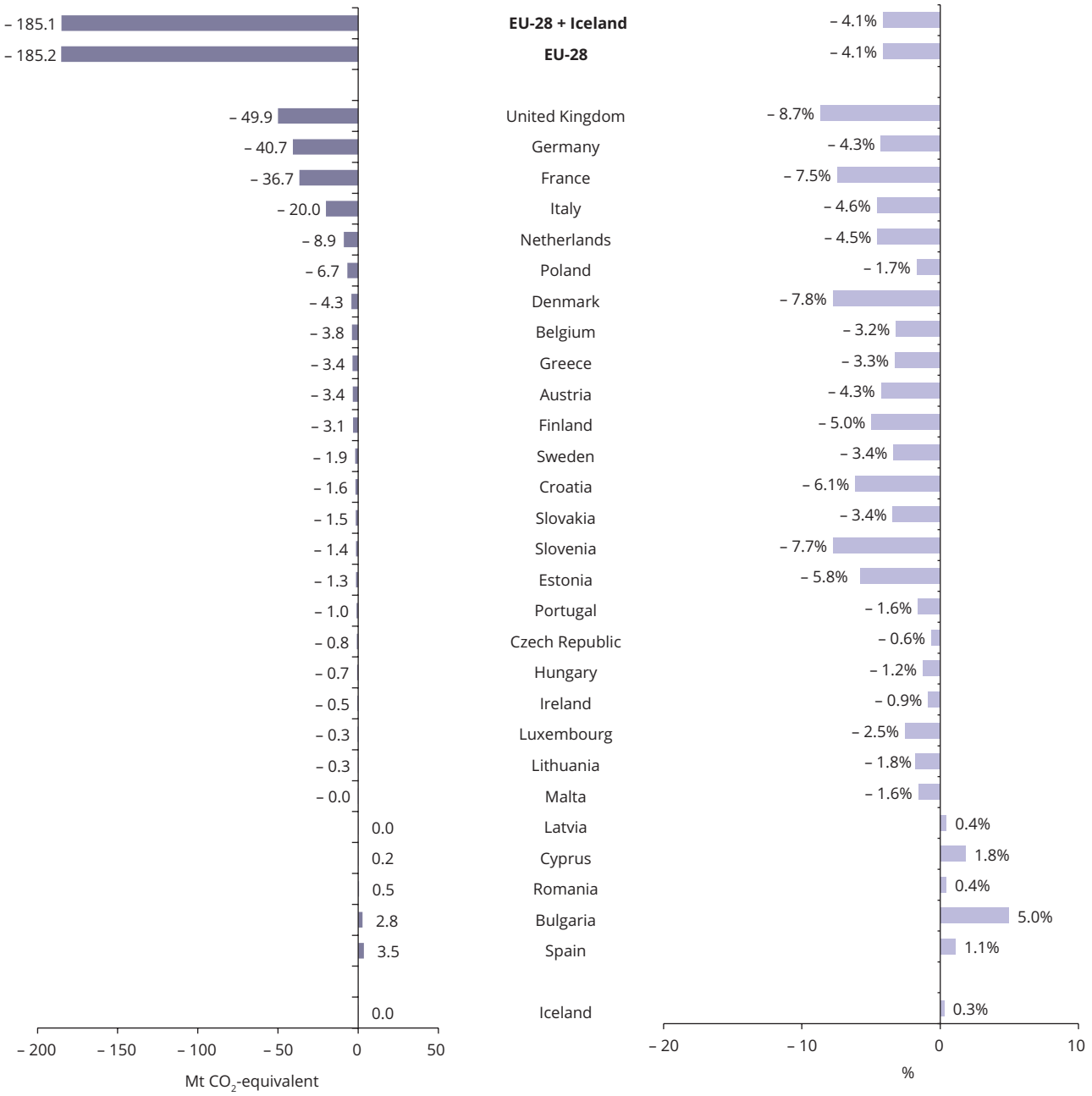
The EU, as a Party to the UNFCCC, reports annually on GHG emissions within the area covered by its Member States (i.e. emissions occurring within its territory). National GHG inventories for EU Member States are only available with a delay of one and a half years. Inventories submitted on 15 April of the year *t* therefore include data up to the year *t*–2. For example, the data submitted on 15 April 2014 included data covering all of 2012, but not 2013. Thus, the timeliness of the data does not always allow for timely analysis of emission trends and progress towards targets.

The latest official EU data available (1990–2012) covering all countries, sectors and gases was released in May 2014 with the annual submission of the EU GHG

([11]) The 2014 Proxy inventory submitted by France includes Mayotte. The inventory basis 1990–2013 is consistent with the Proxy. The official inventory submission from France does not include Mayotte for the period 1990–2013. The inclusion or exclusion of emissions from Mayotte result in a difference of less than 0.5 Mt CO_2-eq., equivalent to less than 0.1 percentage points.

([12]) The European Commission announced on 18 May 2015 a reduction of ETS emissions of – 4.5% for all participating countries (EU-28, Iceland, Liechtenstein and Norway). This – 4.5% change was calculated on the basis of those installations having reported emissions both in 2013 and 2014. In this report the -5.2% reduction refers to the EU28 plus Iceland and is calculated on the basis of all verified emissions.

Figure ES.5 Member States emissions, change 2013–2014



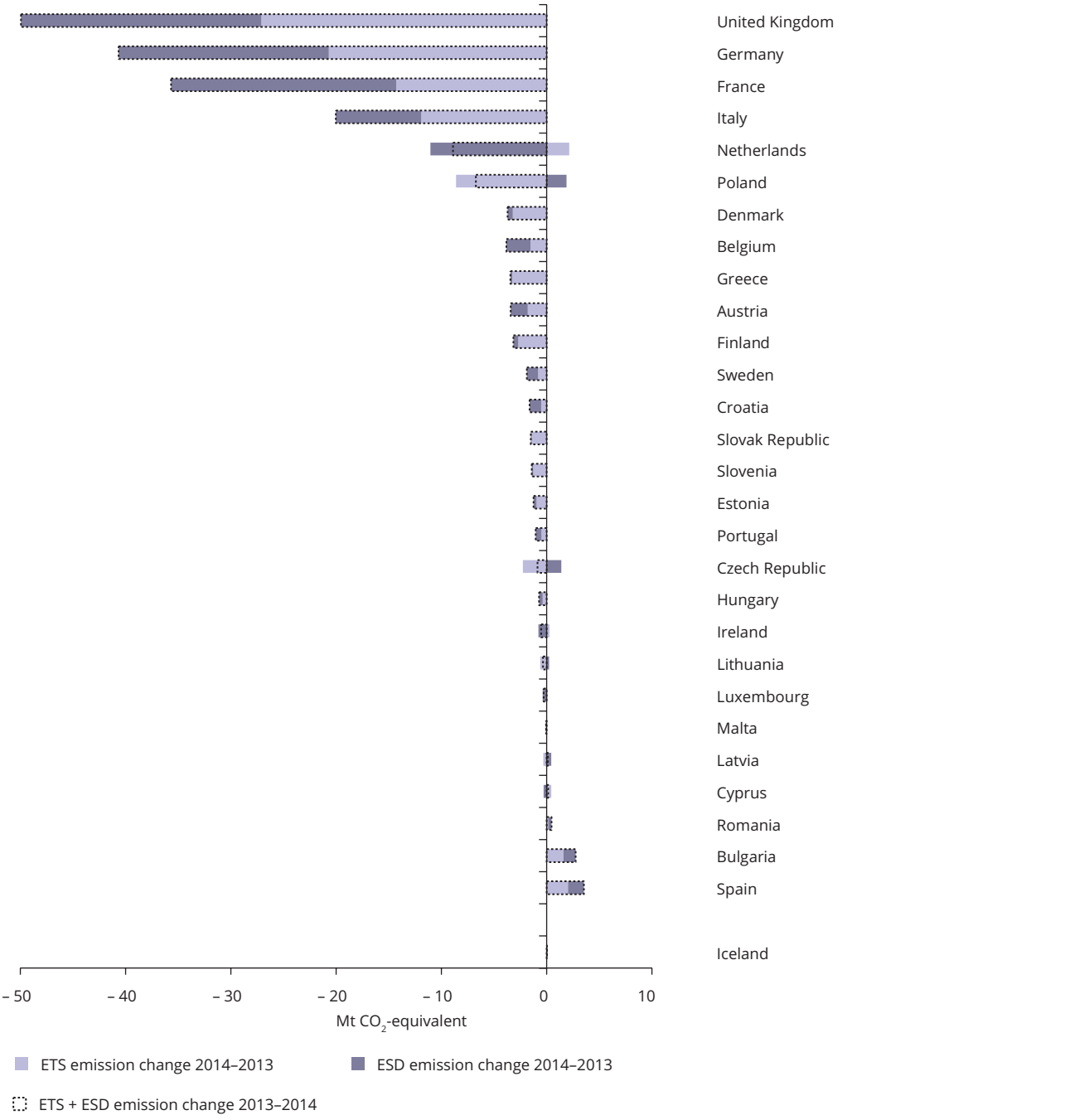
Note: Total GHG emissions without LULUCF including indirect CO_2, based on the preliminary 2015 MS GHG inventories submitted to the EU for the years 1990–2013 as well as proxy estimates for 2014.

Source: EEA's ETC/ACM, based on the preliminary 2015 Member States' GHG inventory submitted to the EU for the years 1990–2013 and proxy estimates for 2014.

inventory to the UNFCCC (EEA, 2014a). The inventory data include GHG emissions not controlled by the Montreal Protocol, both from sectors covered by the ETS and from non-trading sectors. However, whereas UNFCCC emissions run on a year *t*–2 basis, Kyoto registries and EU ETS information are available on a year *t*–1 basis. Verified EU ETS emissions are therefore already available for 2014 (EEA, 2015).

Due to the delays in the new UNFCCC CRF Reporter software, an official GHG inventory of the EU for the years 1990 to 2013 is not yet available. All historic emissions data presented in this report are therefore based on the sum of the preliminary GHG inventory submissions to the EU. These submissions have not undergone the regular quality assurance and quality control processes associated with the compilation of the official EU GHG inventory.

Figure ES.6 ETS and ESD emissions, change 2013–2014



Source: EEA's ETC/ACM, based on the preliminary 2015 Member States' GHG inventory submitted to the EU for the years 1990–2013 and proxy estimates for 2014 and ETS data (2013 and 2014 verified emissions).

There are clear advantages in generating proxy GHG estimates for all sectors. When Member States set national emission caps for installations under the ETS for the period 2013–2020, they allocated part of their Kyoto emission budget (Kyoto Assigned Amounts) to the EU ETS and fixed the overall contribution of the ETS sectors towards reaching Kyoto national targets. ETS information runs on a year *t*–1 timeline but success in reducing emissions from sectors not covered by the EU ETS (running on a year *t*–2 timeline) will determine whether governments need to use Kyoto flexible mechanisms to achieve their targets.

Starting in 2014, the legal basis for the proxy GHG emission estimates is Regulation (EU) 525/2013 on a mechanism for monitoring and reporting GHG emissions (EU MMR). Article 8 requires Member States to submit to the Commission, where possible,

approximated GHG inventories for the year *t*–1 by 31 July every year. These estimates are used to assess progress towards GHG emission targets.

Publishing a proxy GHG emissions report also fulfils the goals of the 'Beyond GDP' process (EU, 2014), which encourages authorities to produce data on the environment with the same frequency and timeliness as they produce data on the economy.

Methodology for proxy GHG emission estimates

This report presents the estimated GHG emissions for 2014 based on emissions estimates, submitted to EEA by 31 July 2015. The aggregated EU plus Iceland proxy 2014 GHG emission estimates are based on these submissions and gap filling where necessary.

Under the recently adopted Regulation (EU) 525/2013 on a mechanism for monitoring and reporting GHG emissions (EU MMR) and its implementing provisions, Member States are to submit, where possible, to the European Commission approximated GHG inventories by 31 July every year for the preceding year *t*–1 (in this case 2014). Where a Member State has not submitted a ‚proxy' inventory, the EEA uses its own estimates for gapfilling purposes in order to have a complete approximated GHG inventory at EU level.

Member States are responsible for the methodological choice regarding their own estimates. For gapfilling, the EEA uses the latest activity data available at country level to estimate the emissions. For emission sources for which no appropriate datasets exist, emissions are extrapolated from past trends, or emissions from the previous year are kept constant if historic data do not show a clear linear trend. The emission estimates assume no change in emission factors or methodologies as compared to the latest official inventory submissions to UNFCCC for the year *t*–2. On this basis, a detailed bottomup approach has been developed covering the full scope of emissions included in a GHG inventory submission.

The EEA has used the proxy estimates of 2014 GHG emissions produced by Member States to assess progress towards GHG emission targets in its annual *Trends and projections* report (to be published later in the autumn). In that report, the EEA's proxy estimates for 2014 were only used for countries that lack their own estimates to track progress towards national and EU targets.

Where Member States' estimates are missing, gaps are filled with estimates by EEA and its ETC/ACM. In recent years, a methodology to estimate GHG emissions using a 'bottomup' approach has been developed (see Annex II). It uses data sources (or estimates) that were published prior to the end of July of 2014 for individual countries, sectors and gases to derive EU GHG estimates for the preceding year (*t*–1). For transparency, this report shows the country-level GHG estimates from which the EU estimates have been derived. The estimates cover total GHG emissions as reported under the Kyoto Protocol and the UNFCCC excluding the LULUCF sector but including indirect CO_2 emissions.

Estimates by the EEA and ETC/ACM are made for all major source categories in all sectors. For the most important source categories, data sources with updated activity or emissions data for the year *t* 1 were identified and used to calculate emissions. For source categories for which no international datasets with updated activity data exist or which are too complex for such an approach, emissions were extrapolated from past trends (linear extrapolation), or emissions from the previous year were kept constant or the average of three preceding years was used if historic data did not show a clear trend. On this basis, a detailed bottom-up approach was developed covering the full scope of emissions included in a GHG inventory submission.

The EEA estimates (see Section 2.4 and Annex II) are based on publicly available datasets at the national, European and international levels. These datasets are disaggregated by major source categories in all sectors reported under the UNFCCC and the Kyoto Protocol.

The GHG estimates in this report have been compiled by the EEA's ETC/ACM. Chapter 2 shows the complete dataset of EU proxy GHG emission estimates, based on the submissions made by Member States and the EEA's gapfilling of the remaining Member States which did not submit, where applicable. Section 2.1 shows trends and general results while Section 2.2 shows detailed results per sector. An overview of developments in the ETS and ESD sectors is presented in Section 2.3. An introduction into the applied methodologies for gap-filling is given in Section 2.4. Further details on the methods and data sources developed by the EEA and its ETC/ACM are described in Annex II (Section 4.2). The detailed results for each Member State are shown in Annex I (Section 4.1) of this report in order to ensure complete transparency regarding the GHG estimates available.

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- Monthly Oil and Gas Consumption;
- Monthly data on crude oil production (indicator code 100100, product code 3100);
- Monthly total consumption data for natural gas (indicator code 100900, product code 4100);
- Production data for natural gas (indicator code 100100, product code 4100);
- annual data for the final energy consumption of motor spirit, automotive diesel oil and kerosene/jet fuels;
- Monthly data on production of nuclear energy (indicator code 100100, product code 5100);
- Monthly data for the internal market deliveries of motor spirit, automotive diesel oil and kerosene/jet fuels;
- Annual statistics on livestock population for cattle, sheep and swine [apro_mt_ls];
- Annual road freight transport by type;
- Annual data on GDP and main components (output, expenditure and income) [na-ma_10_gdp] (Gross domestic product at market prices, Chain linked volumes (2010), million euro);

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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