EEA Report | No 23/2016

Approximated EU greenhouse gas inventory

Proxy GHG emission estimates for 2015

ISSN 1977-8449

European Environment Agency

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Cover design: EEA
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Layout: EEA/Pia Schmidt

Luxembourg: Publications Office of the European Union, 2016

ISBN 978-92-9213-813-4
ISSN 1977-8449
doi:10.2800/105561

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The complete report will be available at:
http://www.eea.europa.eu/publications/approximated-eu-ghg-inventory-2015

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 2015, covering the full GHG inventory (all sectors, except land use, land-use 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 emission data at country level. The official submission of 2015 inventories to the United Nations Framework Convention on Climate Change (UNFCCC) will take place in 2017. 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.

The second commitment period of the Kyoto Protocol (2013–2020) was established in Doha in 2012 (COP 18/CMP8). The so-called 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 (EU-28) 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 quarters of the Parties to the Kyoto Protocol.

The executive summary and Chapter 2 of this report 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 2016 ([3]). The GHG inventory data for 1990–2014 used in this report are taken from the countries' inventory submissions to the EEA by 25 May 2016. The estimates in this report are based on the International Panel on Climate Change (IPCC) 2006 Reporting Guidelines and global warming potentials (GWPs) from the IPCC Fourth Assessment Report (AR4). Unless otherwise stated, total GHG emissions are considered to include indirect CO_2 and exclude LULUCF and international transport.

Proxy GHG emission estimates for 2015 at EU level

The estimates for 2015 indicate that emissions increased for the first time since 2010. Compared with 2014 emissions, the increase in emissions between 2014 and 2015 is estimated to be 28.8 million tonnes of CO_2-equivalents (Mt CO_2-eq.) or 0.7 % for the EU plus Iceland ([4]) (total GHG emissions without LULUCF and including indirect CO_2) ([5]). For EU plus Iceland, total GHG emissions in 2015 are estimated to be 23.9 % below 1990 emissions (22.4 % if international aviation is included).

([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]) In some cases, the EEA allocates emissions reported by Member States in gases and sectors using the methodologies used in Section 4.1.3. This is to ensure that the provision of the EU proxy inventory and the explanation of the EU trends is performed at the appropriate level of detail, while safeguarding full consistency with the estimates provided by the Member States.

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

([5]) According to the UNFCCC reporting guidelines, Annex I Parties may report indirect CO_2 from the atmospheric oxidation of methane (CH_4), carbon monoxide (CO) and non-methane volatile organic compounds (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.

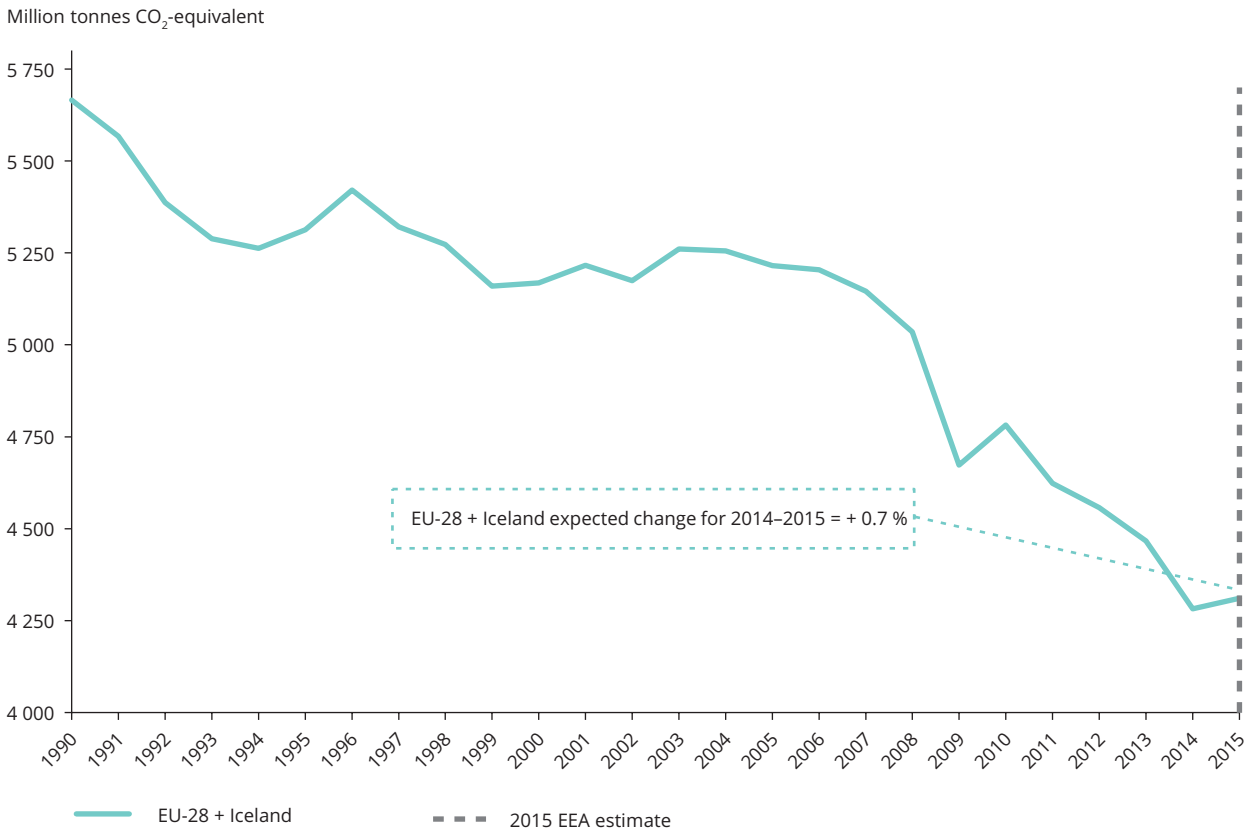
Figure ES.1 shows the emission trend for total GHG emissions in the EU and Iceland in the period 1990–2015 ([6]).

Compared with 2014, the 0.7 % emission increase for the EU plus Iceland in 2015 is considerably lower than the 2.0 % average growth in gross domestic product (GDP) over the same period. As in 2014, notwithstanding economic developments in specific sectors and countries, there was no common pattern between GDP and GHG emissions for all EU Member States in 2015. The economic situation in the EU improved during 2015 compared to 2014. Eleven Member States achieved emission reductions in 2015 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. The years 2014 and 2015 were the warmest years on record in Europe (KNMI, 2016). However, winter in Europe in 2015 was generally colder than it was in 2014. Lower winter temperatures especially in west and central Europe led to higher heating demand and higher emissions from the residential and commercial sectors, which partly explain the emission changes in Figure ES.2. A regional distribution of GHG-emission changes is presented in Figure ES.3.

On a sectoral basis, the largest absolute emission increase between 2014 and 2015 in the EU occurred in the energy sector (i.e. all combustion activities and fugitive emissions). GHG emissions grew by 39.5 Mt CO_2-eq. (1.2 %) across the EU plus Iceland. This increase in emissions in the energy sector reflects the increase of gross inland energy consumption in the EU plus Iceland in 2015. Within the energy sector, emissions mostly grew in residential and commercial (+ 30.6 Mt CO_2-eq.) and transport (+ 20.3 Mt CO_2-eq.) while it fell in energy industries (− 5.5 Mt CO_2-eq.) and manufacturing industries and construction (− 2.8 Mt CO_2-eq.).

Figure ES.1 Trends in total GHG emissions, 1990–2015

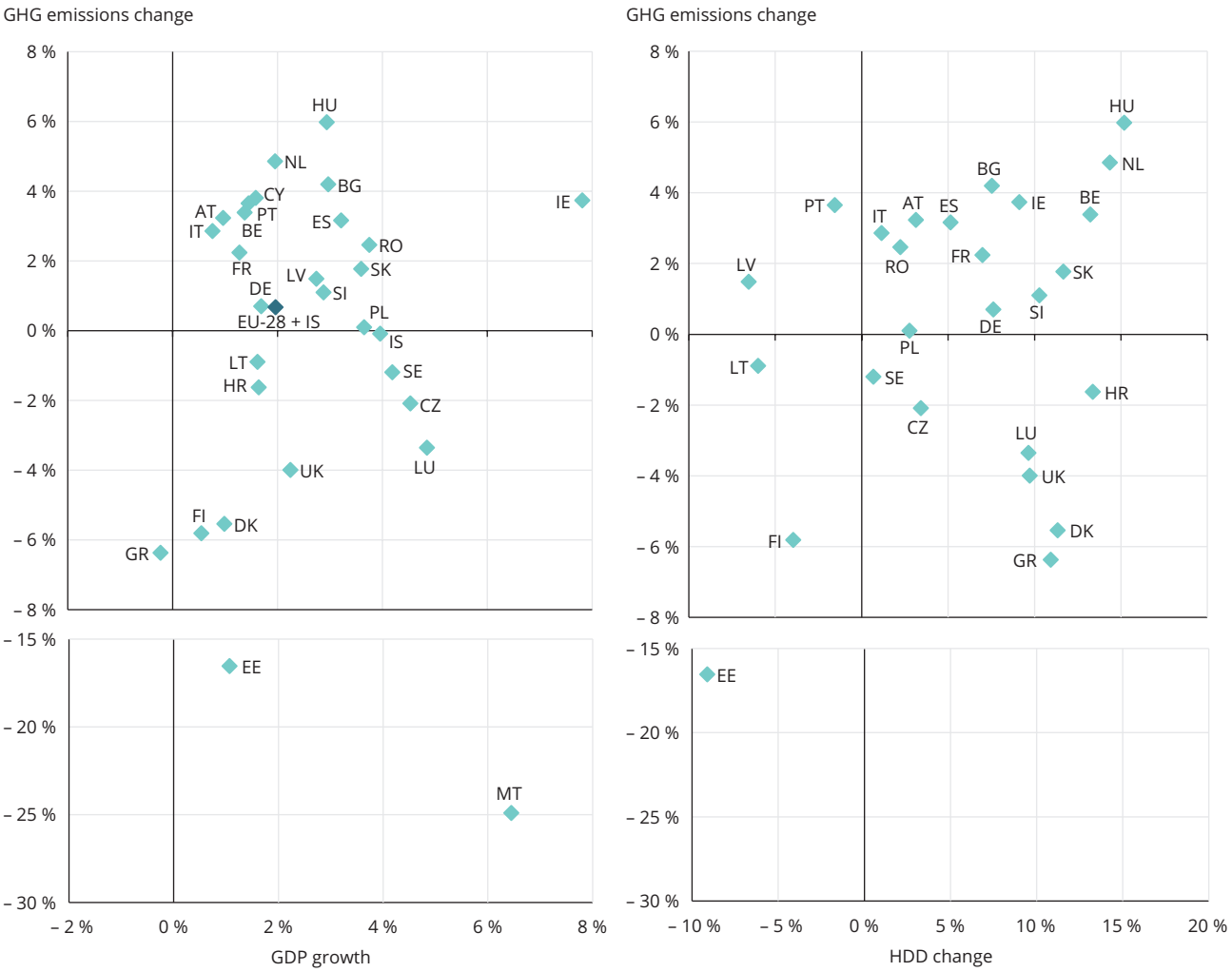


Note: Total GHG emissions without LULUCF including indirect CO_2.

Source: The EEA's ETC/ACM, based on the 2016 Member States' GHG inventories submitted to the UNFCCC for 1990–2014 and proxy estimates for 2015.

([6]) This is not equivalent to the difference from 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.

Figure ES.2 GHG emissions, GDP growth and heating degree days (HDD) in the EU, changes 2014–2015



Note: As GHG emission changes in Estonia and Malta are much greater than in all other Member States, these two are shown using different scales. Heating Degree Days (HDDs) are an indication of heat demand based on outdoor temperatures. HDD change was not available for Cyprus, Malta and Iceland.

Source: The EEA's ETC/ACM, based on GDP from Eurostat (Gross domestic product at market prices, Chain linked volumes (2010), million Euro). HDDs are produced by the EEA.

After decreasing between 2010 and 2014, primary energy consumption in the EU-28 increased by 1.6 % in 2015. Both fossil and renewable fuels increased their contribution to the energy mix while nuclear decreased its share slightly (BP 2016).

Based on Eurostat monthly consumption data for solid, liquid and gaseous fuels (Eurostat, 2016), total fuel consumption in the EU-28 increased by 4 %, with different trends for the different fossil fuel types. Consumption of natural gas increased by 4.3 % and consumption of liquid fuels grew by 1.2 %. Solid fossil fuel consumption (excluding peat) fell by 3.9 % and peat consumption dropped by 9.1 %.

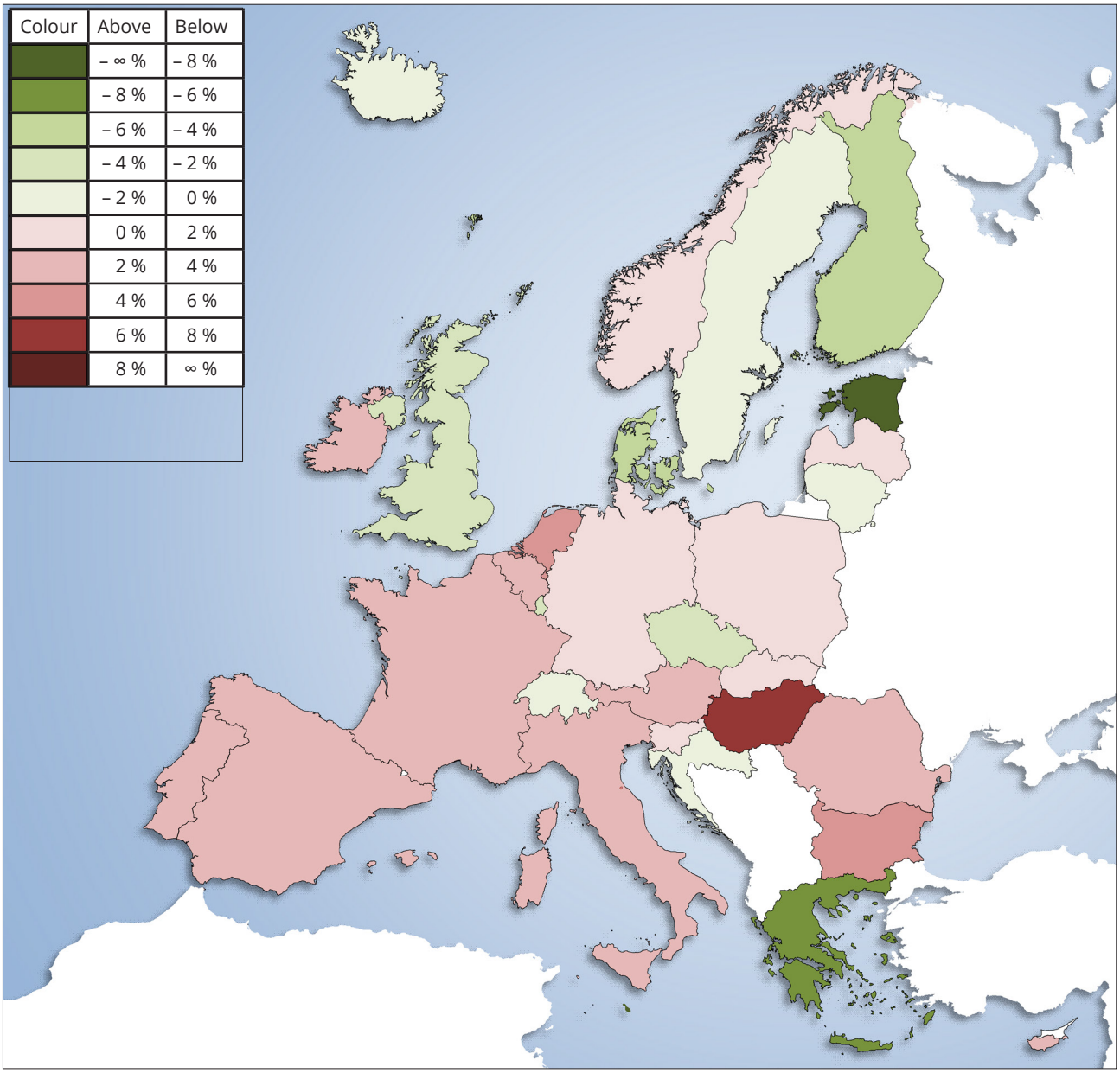
Natural gas consumption rose in 19 EU Member States between 2014 and 2015 and four Member States experienced increases in natural gas consumption of more than 10 %: Bulgaria (10.4 %), Croatia (11.9 %), Portugal (11.1 %) and Slovakia (21.1 %). In seven Member States, natural gas consumption fell with the largest decreases being observed in Estonia (10.4 %) and Finland (11.4 %).

Also liquid fossil-fuel consumption grew in 19 EU Member States, with the largest increase in Slovakia (12.3 %) followed by Hungary (8.9 %) and Poland (7.3 %). A decrease in liquid fuel consumption was observed in nine EU Member States; in three consumption decreased by more than 10 %: Estonia (14.9 %), Malta (26.9 %) and Sweden (15.6 %).

Sixteen Member States showed decreasing solid fossil fuel consumption (excluding peat), most notably

Denmark (33.6 %), followed by Latvia (29.9 %), the United Kingdom (20.0 %) and Lithuania (19.9 %). On the other hand, solid fossil fuel consumption (excluding peat) increased in eleven Member States, most notably in Cyprus (50.0 %) ([7]), Ireland (17.0 %), the Netherlands (24.2 %) and Portugal (21.7 %). These changes in fossil fuel consumption are not only related to heating degree day (HDD) effects, as described before, but are also strongly connected to the trends in electricity generation. Peat consumption decreased in all seven Member States that report peat consumption to Eurostat. Most pronounced were the decreases in Estonia (88 %), Latvia (67 %) and Lithuania (56 %).

Figure ES.3 Regional trends in total GHG emissions, change 2014–2015 (displayed as ranges)



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

Source: The EEA's ETC/ACM, based on the 2016 Member States' GHG inventories submitted to the UNFCCC for 1990–2014 and proxy estimates for 2015.

([7]) As the solid fuel consumption in Cyprus is very small, this very high relative increase corresponds to a small absolute increase of only 2 kilotonnes.

Hydroelectric generation decreased by 9 % in the EU-28 with strong regional differences. Most parts of central and southern Europe experienced disadvantageous conditions for hydro-electricity production because of lower rainfall (KNMI, 2016). In Portugal, renewable gross hydro generation fell by 45 % compared to the previous year, followed by Slovenia (36 %), Croatia (28 %), Spain (26 %), Italy and Hungary (23 %) each and the Netherlands (22 %). Hydro production decreased further in ten Member States. Northern Europe faced the opposite conditions with higher gross hydro generation, in particular in Finland (25 %), Ireland and Denmark (20 %) and Sweden (16 %). Good hydro conditions also occurred in the very south-eastern part of Europe with increasing hydro production in Greece (24 %) and Bulgaria (17 %).

In the EU plus Iceland, GHG emissions from industrial processes decreased by 1.1 % in 2015 compared with 2014. The largest emission decrease was observed for product uses of F-gases as substitutes for ozone-depleting substances (ODS), which decreased by 3.5 %. Emissions from mineral products decreased by 0.4 % and emissions from metal production fell by 1.4 % across the EU plus Iceland. Emissions from the chemical industry remained relatively stable in the EU plus Iceland, falling by only 0.1 % between 2014 and 2015.

Agriculture emissions increased by just 0.2 %, mainly due to emission increases from enteric fermentation. The trend in emissions from waste (− 3.4 %) continues the decrease seen in previous years with the largest reduction in emissions coming from solid waste disposal.

Change in GHG emissions over 1990–2015

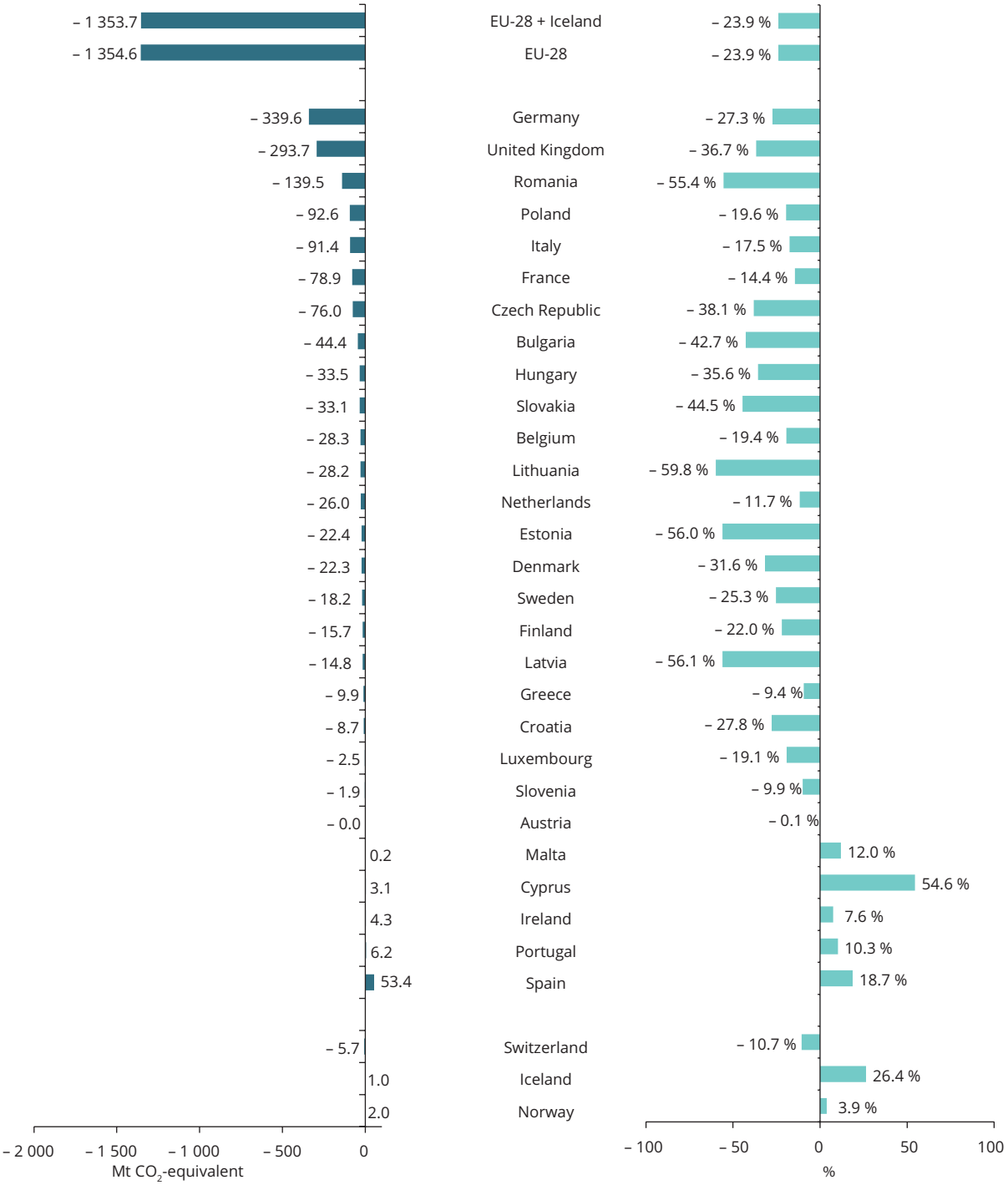
Figure ES.4 presents the estimated change in GHG emissions for each Member State between 1990 and 2015 ([8]). Based on these 2015 estimates, total EU plus Iceland emissions (excluding LULUCF and including indirect CO_2) in 2015 were 23.9 % below 1990 levels.

The reduction in greenhouse gas emissions over this period was due to a variety of factors, including the growing share in the use of renewables, the use of less carbon intensive fuels and improvements in energy efficiency, as well as to structural changes in the economy and the economic recession. Demand for energy to heat households has also been lower, as Europe on average has experienced milder winters since 1990, which has also helped reduce emissions ([9]). 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 growth in the consumption of fluorinated gases with high global-warming potential. Other EU policies such as the Nitrates Directive, the Common Agricultural Policy (CAP) and the Landfill Waste Directive have also been successful in indirectly reducing GHG emissions from non-CO_2 gases such as methane and nitrous oxide. Further implementation of the EU's Climate and Energy Package should lead to additional reductions in emissions.

([8]) 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.

([9]) See EEA, *Analysis of key categories and drivers in greenhouse gas emissions in the EU between 1990 and 2014*, http://www.eea.europa.eu/publications/analysis-of-key-trends-ghg.

Figure ES.4 Member States' emissions, change 1990–2015



Note: Total GHG emissions without LULUCF including indirect CO_2.

Source: The EEA's ETC/ACM, based on the 2016 Member States' GHG inventories submitted to the UNFCCC for 1990–2014 and proxy estimates for 2015.

Change in GHG emissions at Member State level over 2014–2015

As explained above, total GHG emissions in the EU plus Iceland increased by 0.7 % in 2015 alongside an improved economic situation, with GDP increasing by 2.0% compared with 2014. The main reasons for the increase in emissions were the higher heat demand by households due to a colder winter and the higher energy demand in transport. Liquid fuel and natural gas consumption grew in most Member States while consumption of solid fuels declined for the EU as a whole. Renewables continued to increase in 2015, which slowed down the overall growth of GHG emissions.

As Figure ES.5 illustrates, GHG emissions increased in 17 EU Member States (Austria, Belgium, Bulgaria, Cyprus, France, Germany, Hungary, Italy, Ireland, Latvia, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia and Spain). The largest absolute increase in emissions occurred in Italy (12.0 Mt CO_2-eq. compared to 2014), followed by Spain (10.4 Mt CO_2-eq.) and France (10.3 Mt CO_2-eq.). The largest relative growth in emissions compared to the previous year took place in Hungary (6.0 %), followed by the Netherlands (4.9 %) and Bulgaria + 4.2 %). Compared to 2014 the largest absolute fall of emissions occurred in the United Kingdom (21.1 Mt CO_2-eq.), followed by Greece (6.5 Mt O_2-eq.) , while the largest relative decrease occurred in Malta (24.9 %) and Estonia (16.5 %). Chapter 2 of the main report includes explanations for some of the changes in emissions by Member State. In the non-EU EEA member countries, GHG emissions increased in Norway (0.8 Mt CO_2-eq. (1.5 %)), decreased in Switzerland (0.7 Mt CO_2-eq. (1.5 %)) and were almost constant in Iceland (– 0.004 Mt CO_2-eq. (– 0.1%)).

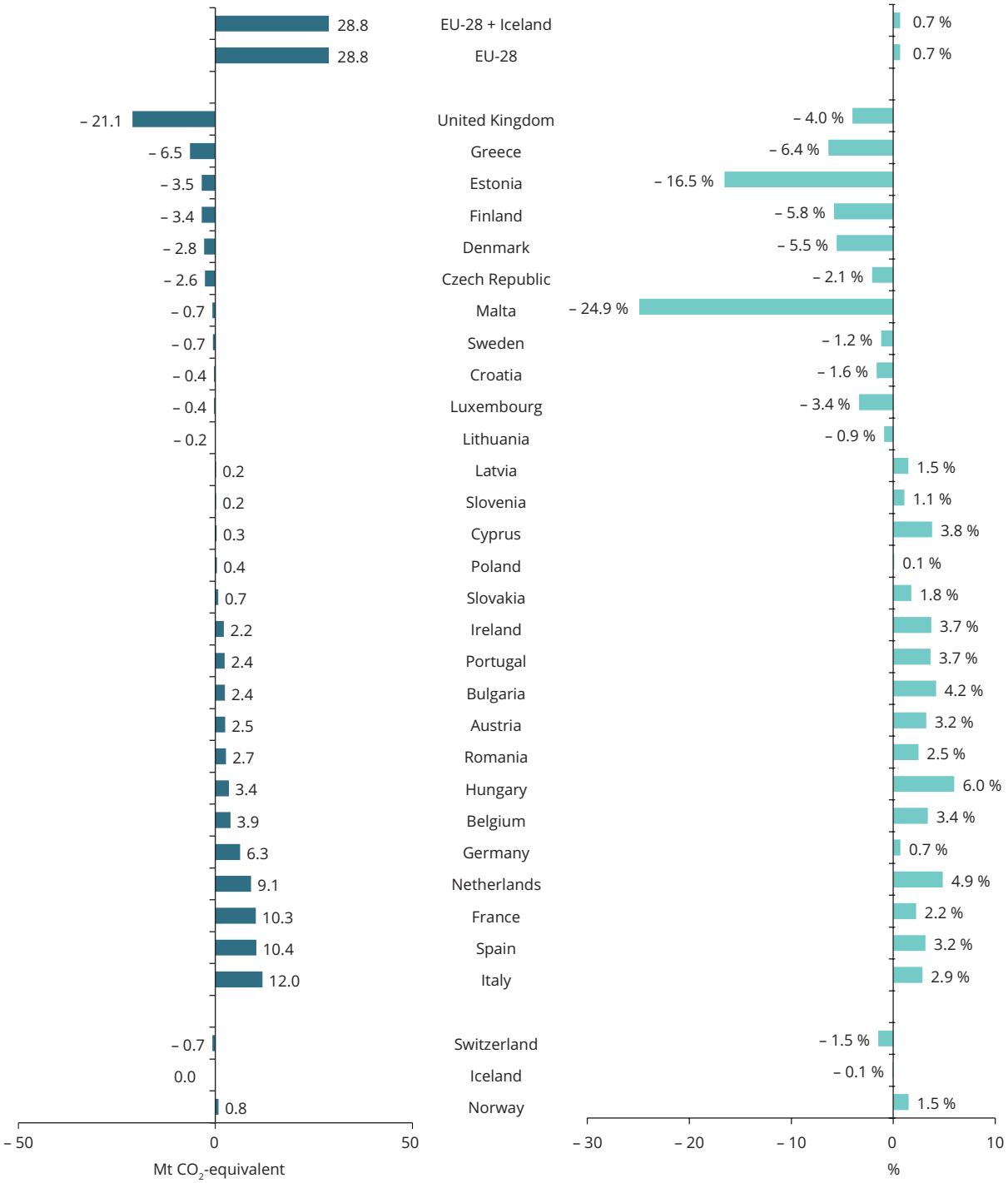
A total of 22 EU Member States submitted preliminary 2015 GHG data to the European Commission and the EEA by 31 July 2016 ([10]) ([11]). Austria, Belgium, Croatia, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden and the United Kingdom all submitted emissions in the form of largely complete common reporting format Summary2 tables.

Luxembourg submitted preliminary GHG data on 5 August 2016 and Malta on 16 August 2016. As these submissions were made after the official submission deadline, they were not included in the totals for European Union plus Iceland and approximated GHG emissions calculated centrally by EEA and its ETC/ACM were used for these countries ([12]).

Other countries for which the EEA and its ETC/ACM calculated centrally approximated GHG emissions are Bulgaria, Cyprus, Lithuania and Romania because they did not submit preliminary GHG inventories by 31 July 2016 (see Section 4.1.2).

([10]) Where LULUCF data were provided, these data were not used, as for the approximated GHG inventories for EU-28 and EU plus Iceland, emissions from LULUCF are not calculated.
([11]) Hungary submitted preliminary GHG data on 1 August, which was only one day after the official deadline and the EEA and its ETC/ACM were therefore still able to include these data in the EU-28 and EU plus Iceland totals.
([12]) For reasons of transparency, the proxy inventories reported by Luxembourg and Malta are presented in Annex I of this report.

Figure ES.5 Member States' emissions, change 2014–2015



Note: Total GHG emissions without LULUCF including indirect CO_2.

Source: The EEA's ETC/ACM, based on the 2016 Member States' GHG inventories submitted to the UNFCCC for 1990–2014 and proxy estimates for 2015.

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 2016 included data covering all of 2014, but not 2015. Thus, the timeliness of the data does not always allow for timely analysis of emission trends and progress towards targets.

The latest official EU GHG inventory data available (1990–2014), covering all countries, sectors and gases, were released in June 2016 with the annual submission of the EU GHG inventory to the UNFCCC (EEA, 2016a). The inventory data include GHG emissions not regulated 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 2015 (EEA, 2016b).

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 (European Commission, 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 2015 based on emissions estimates submitted to the EEA by 31 July 2016. The aggregated EU plus Iceland proxy 2015 GHG emission estimates are based on these submissions. Where a Member State has not submitted a 'proxy' inventory, the EEA uses its own estimates for gap-filling purposes in order to have a complete approximated GHG inventory at EU level. In addition, the EEA may allocate the Member States' reported emissions in gases and sectors using the methodologies used in Section 4.1.3, to ensure that the provision of the EU proxy inventory and the explanation of the EU trends is performed at the appropriate level of detail. In such cases, the detailed proxy estimates are fully consistent with the estimates provided by the Member States.

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

For the most important source categories, publicly available data sets at the national, European and international levels with updated activity or emissions data for the year *t*–1 that were published prior to the end of July 2016 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.

The EEA has used the proxy estimates of 2015 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 2015 were only used for countries that lack their own estimates to track progress towards national and EU targets.

The report is structured as follows: Chapter 2 shows the complete dataset of EU proxy GHG emission estimates, based on the submissions made by Member States and the EEA's gap-filling of the remaining Member States that 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. Chapter 3 presents the performance of last year's EU proxy. An introduction to the applied methodologies for gap-filling is given in Chapter 4. Further details on the methods and data sources developed by the EEA and its ETC/ACM are described in Annex II (Section 6.2). The detailed results for each Member State are shown in Annex I (Section 6.1) of this report in order to ensure complete transparency regarding the available GHG estimates.

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2016 — 13 pp. — 21 x 29.7 cm

ISBN 978-92-9213-813-4
doi:10.2800/105561

TH-AL-16-022-EN-N
doi:10.2800/105561

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