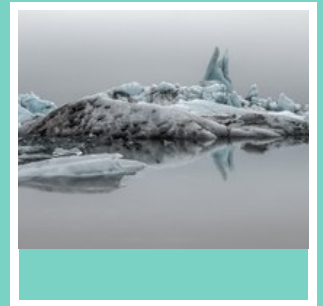
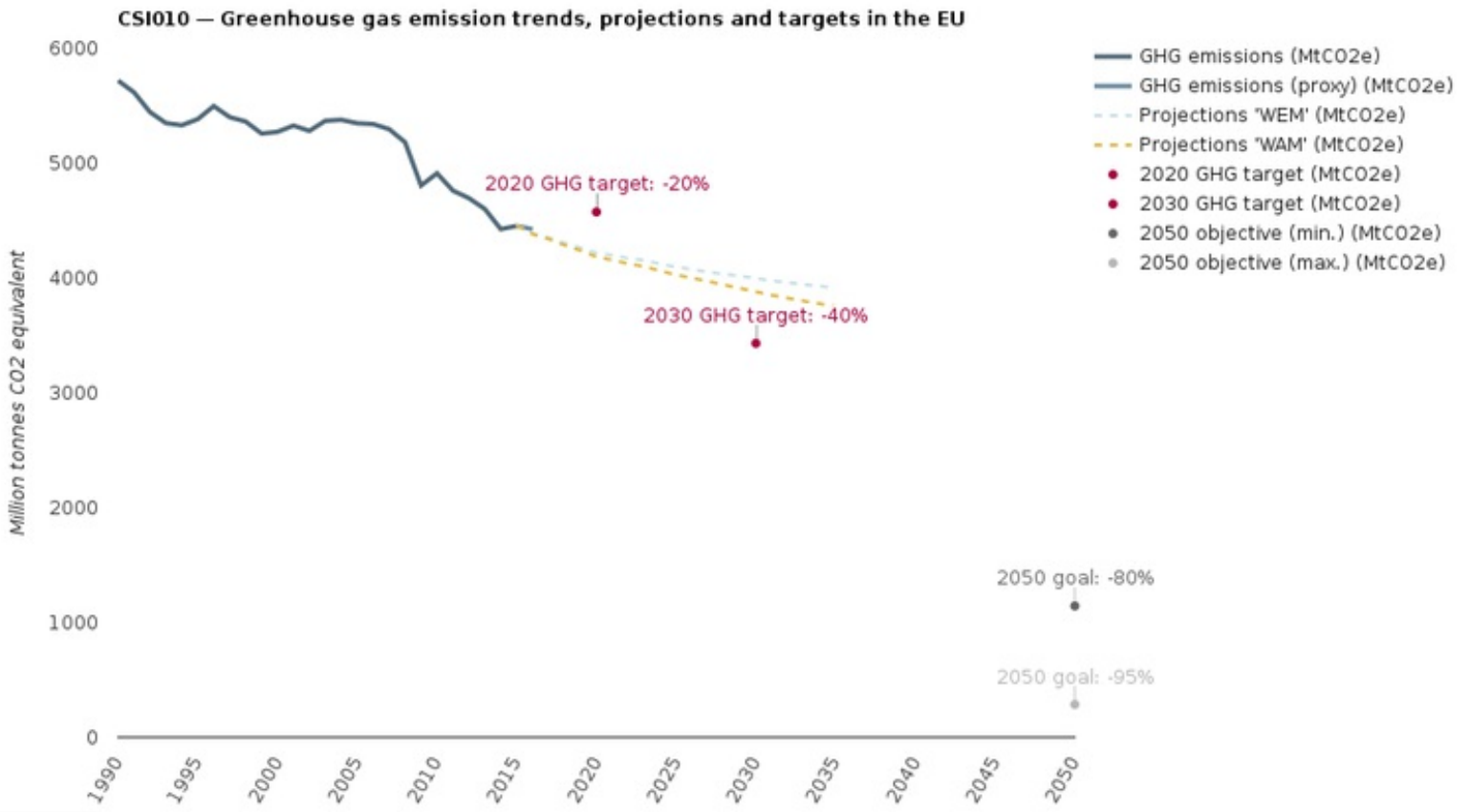


Total greenhouse gas emission trends and projections in Europe



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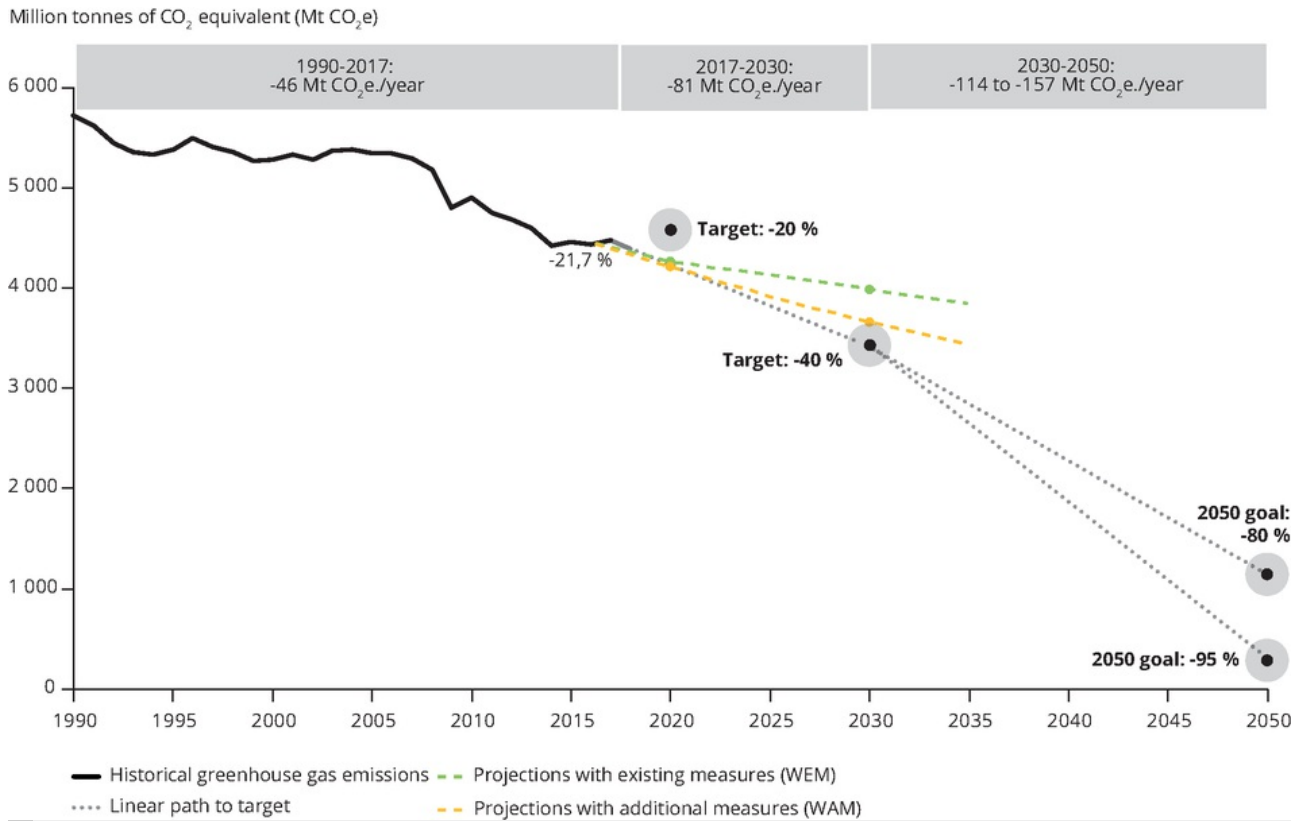
Total greenhouse gas emission trends and projections in Europe

Key messages

- According to preliminary estimates, EU greenhouse gas emissions decreased by 2 % in 2018, following a 0.6 % increase in 2017.
- These 2018 levels correspond to a 23 % reduction from 1990 levels, which is more than the EU reduction target of 20 % by 2020.
- Together, Member States project that current policies and measures can deliver a 30 % reduction by 2030, while the reported additional policies and measures they intend to launch in the coming years can deliver a 36 % reduction by 2030.
- While this presents a more positive outlook compared with projections from 2018, these projections fall short of the 40% target for 2030.

What is the progress in Europe towards international commitments regarding greenhouse gas emissions?

Fig. 1: Greenhouse gas emission trend projections and target

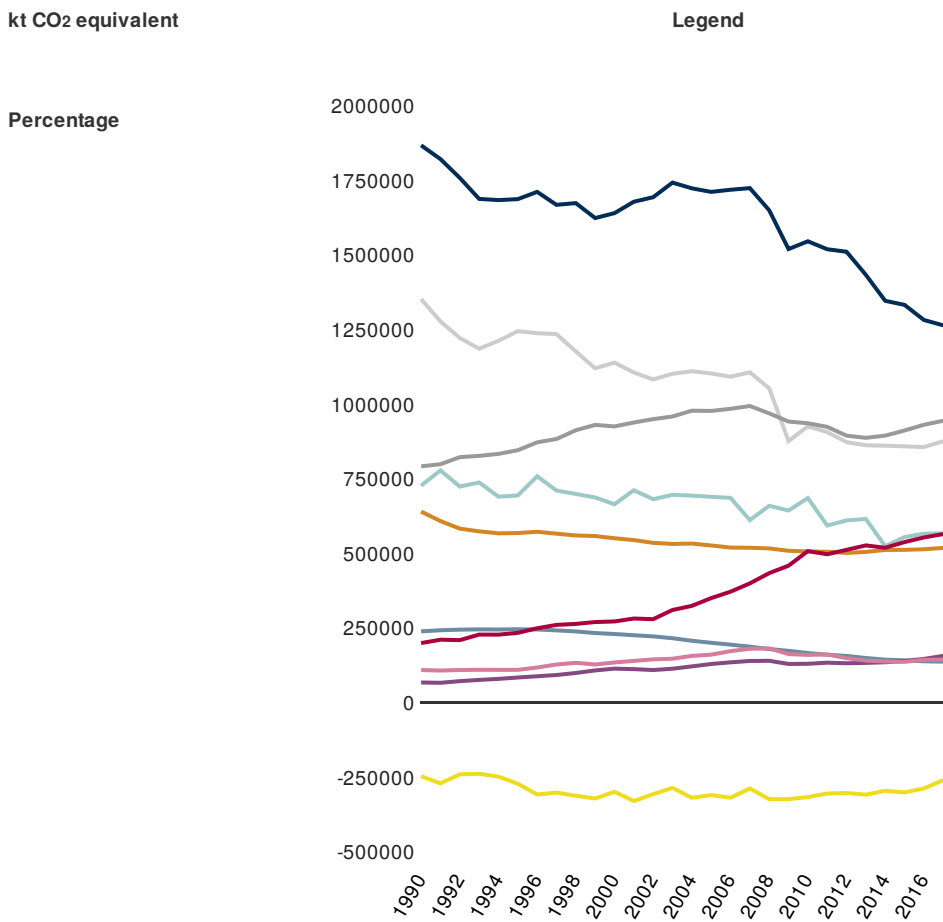


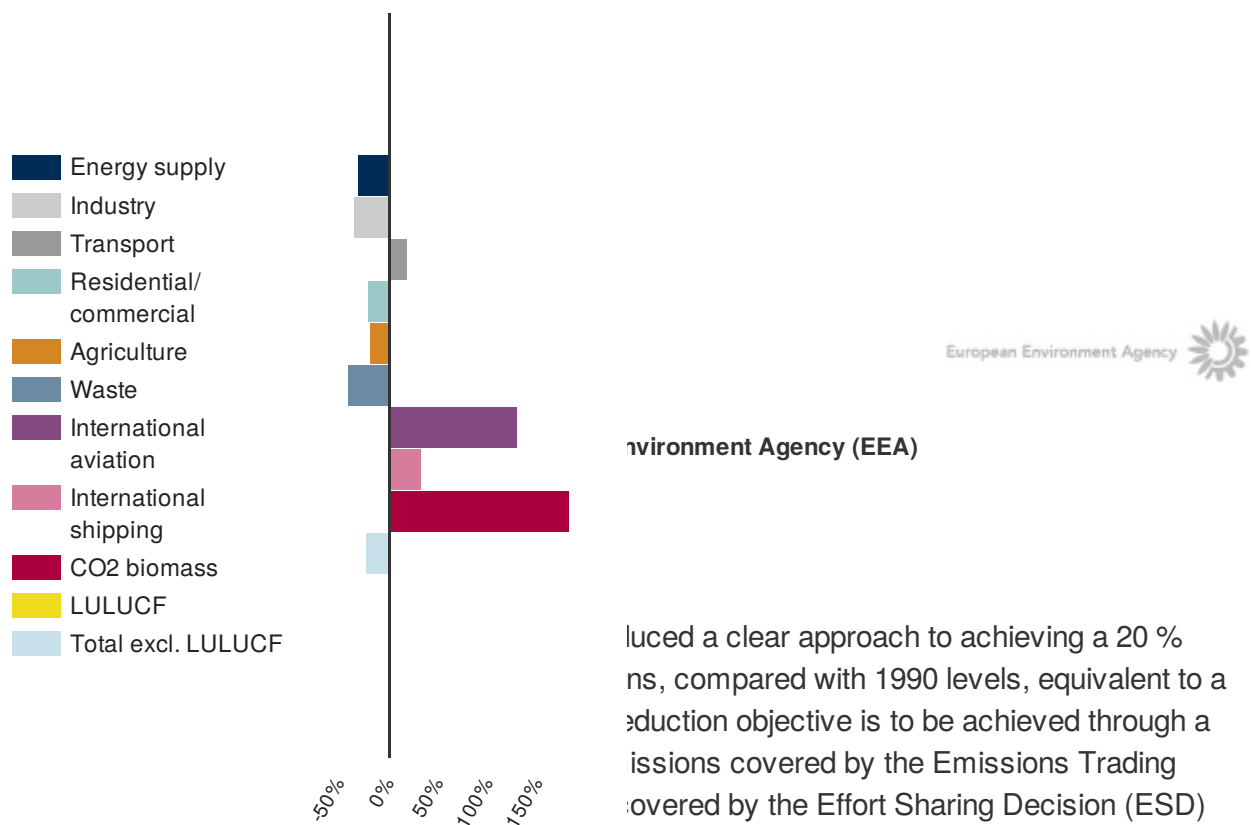
Note: The calculations of GHG emission trends, projections and targets include emissions from international aviation and exclude emissions and removals from the LULUCF sector. The 'with existing measures' scenario reflects existing policies and measures, whereas the 'with additional measures' scenario considers the additional effects of planned measures reported by Member States.

Data source:

- National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism provided by **European Environment Agency (EEA)**
- Member States' greenhouse gas (GHG) emission projections provided by **European Commission**
- Approximated estimates for greenhouse gas emissions provided by **European Commission**

Fig. 2: Greenhouse gas emissions by aggregated sector





To ensure that the EU achieves its 2030 target, the European Council agreed in October 2014, on a 2030 climate and energy framework for the EU and endorsed a binding target of at least a 40 % reduction in GHG emissions, compared with 1990 levels (European Council, 2014). This target will be delivered collectively, with a 43 % reduction in the ETS sectors and a 30 % reduction in the Effort Sharing sectors by 2030, compared with 2005 levels.

In November 2018, the European Commission adopted a strategic long-term vision for a climate neutral economy by 2050, in line with the Paris Agreement objective to keep the temperature increase to well below 2 °C, and pursue efforts to keep it to 1.5 °C.

Historic trends and projected progress of the EU since 1990 in relation to the above targets

In 2017, the EU's greenhouse gas (GHG) emissions were 21.7 % lower than 1990 levels, totaling 4 483 megatonnes (Mt) of carbon dioxide equivalent (CO₂e). According to preliminary estimates, emissions fell by 2 % from 2017 to 2018. With these latest values, the EU was 23.2 % below 1990 levels in 2018 and therefore remained on track to meet its upcoming target of a 20 % reduction in GHG emissions by 2020. Further information can be found in the EEA Report Trends and projections in Europe 2019.

Emission changes by key source in the EU between 1990 and 2017

Figure 2 shows that GHG emissions decreased in the majority of sectors between 1990 and 2017,

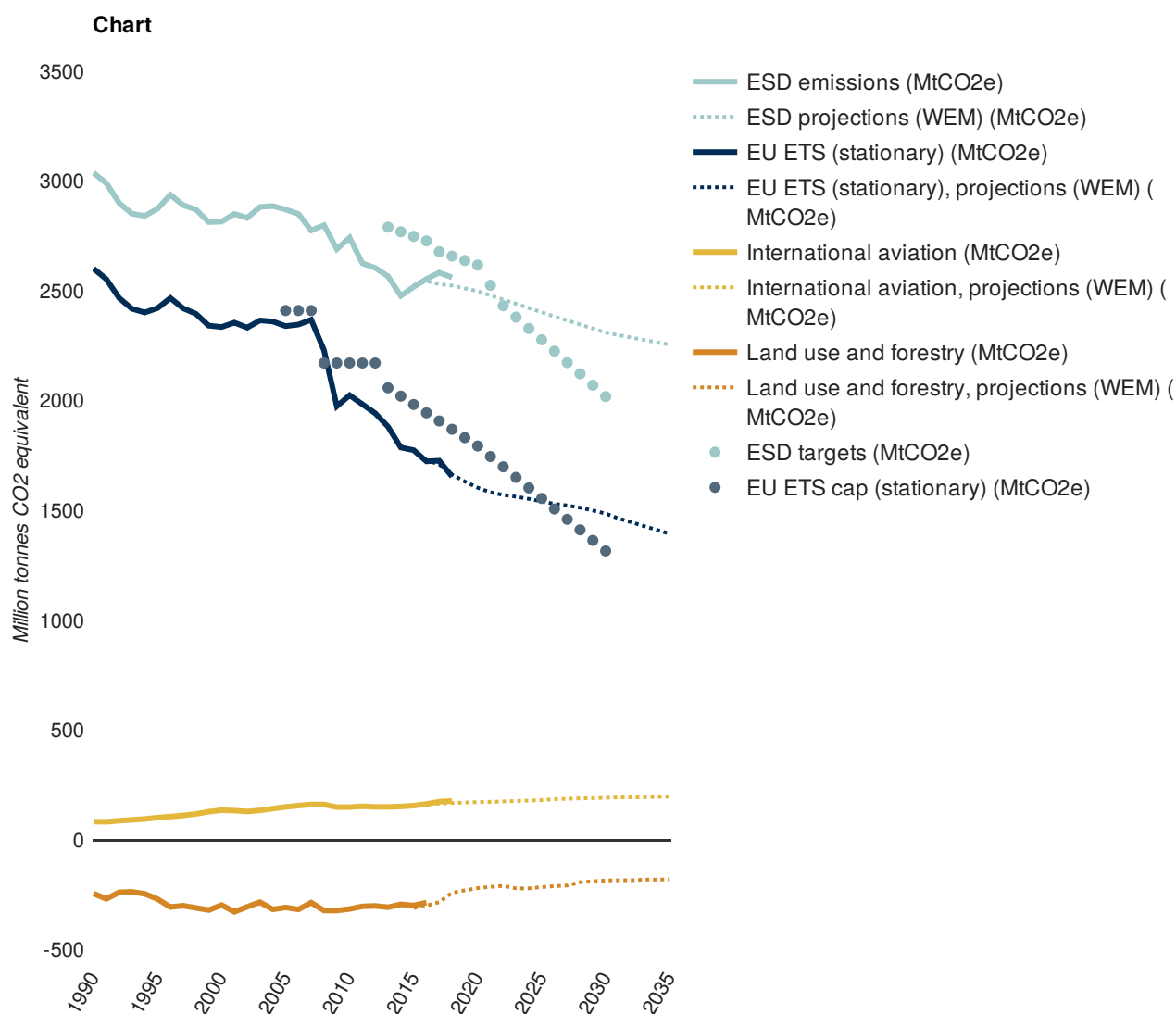
with the exception of transport. The largest decrease in emissions in absolute terms occurred in energy supply and industry, although agriculture, residential and commercial (i.e. buildings), and waste management have all contributed to the positive trend in GHG emissions since 1990. Figure 2 also shows the increase in CO₂ emissions from biomass combustion. Although net removals from land use, land use change and forestry (LULUCF) increased over the period, the strong increase in CO₂ emissions from biomass combustion highlights the rapidly increasing use of biomass in replacing fossil fuel sources in the EU.

Further information can be found in the forthcoming EEA briefing *Analysis of key GHG-emission trends and drivers and the EU's MRV system*.

What is the progress in Europe towards international commitments regarding greenhouse gas emissions?

What is the progress in Europe towards domestic (internal) commitments regarding greenhouse gas emissions?

Fig. 3: ETS, ESD, LULUCF and aviation emission trends and projections, 1990-2035



Notes:

EU ETS (stationary) emissions for the period 2005-2012 were estimated to reflect the current scope (2013-2020) of the EU ETS. Net removals from land use, land use change and forestry (LULUCF) correspond to values reported to the United Nations Framework Convention on Climate Change, which differ from values

relevant to the Kyoto Protocol and LULUCF Regulation commitments. The aggregated Effort Sharing targets for the period 2021-2030 are based on adopted legislation and absolute values are estimated based on the latest available, comprehensively reviewed data. The 'with existing measures' scenario reflects existing policies and measures.

ETS: Emissions Trading Scheme

ESD: Effort Sharing Decision

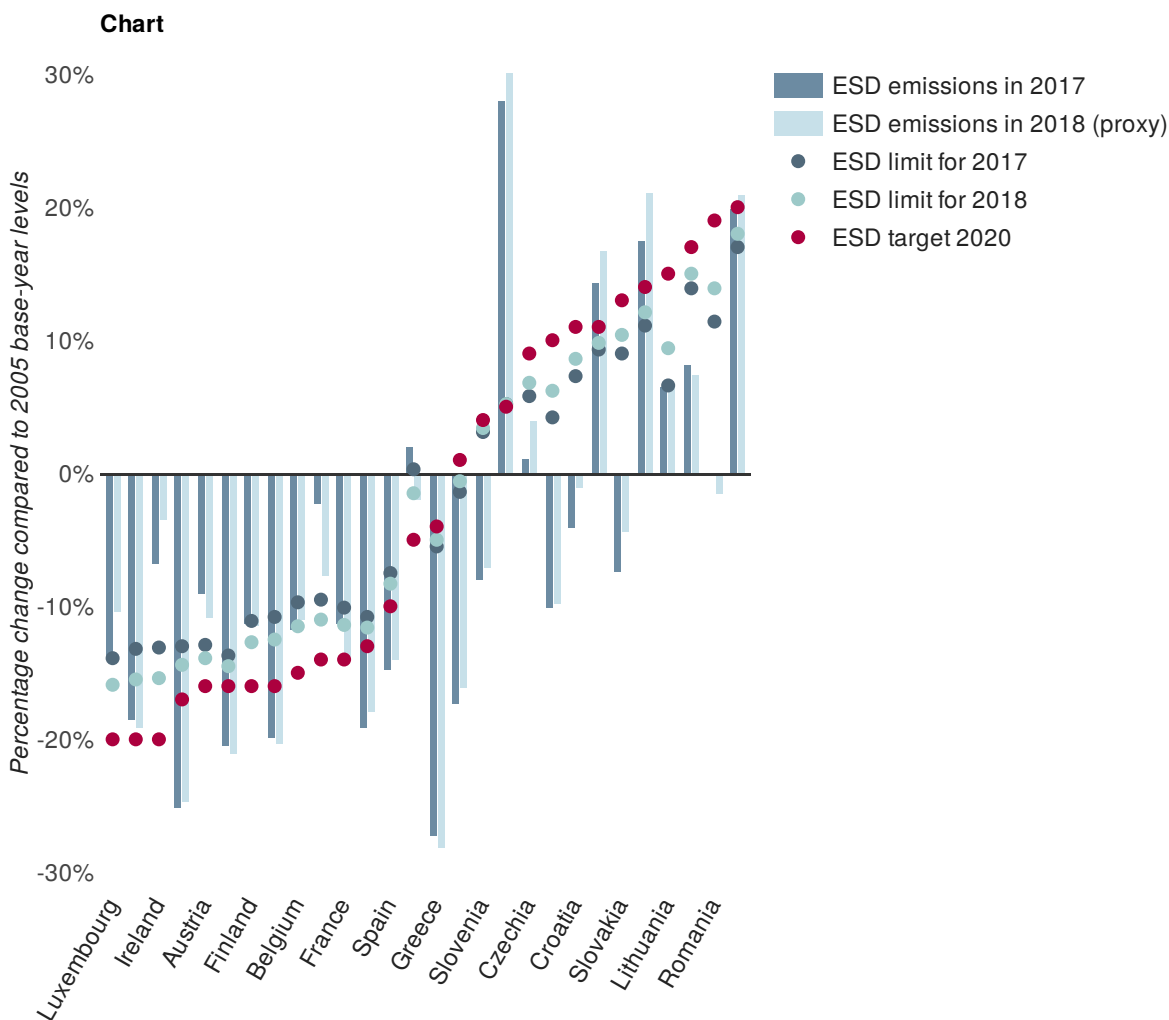
[Explore chart interactively](#)



Data sources:

- Greenhouse gas emissions provided by **European Environment Agency (EEA)**
- Approximated greenhouse gas emissions provided by **European Environment Agency (EEA)**
- Greenhouse gas projections provided by **European Environment Agency (EEA)**
- Verified emissions under the EU ETS provided by **European Commission**
- Estimates of ETS emissions for the period 2005-2012 to reflect the current scope of the EU ETS provided by **European Environment Agency (EEA)**

Fig. 4: Current progress of Member States towards their 2017 and 2018 Effort Sharing targets



Note:

Member States are ranked according to their 2020 Effort Sharing targets, from the largest required reduction (Luxembourg, which has a target of -20 %) to the largest allowed increase (Bulgaria, which has a target of +20 %) compared with 2005 base year levels.

[Explore chart interactively](#)

Data sources:

- Approximated greenhouse gas emissions provided by **European Environment Agency (EEA)**
- Greenhouse gas emissions provided by **European Environment Agency (EEA)**
- Commission Decision 2013/162/EU, Annex II: Member States Annual Emissions Allocation for the year 2013 to 2020 calculated applying global warming potential values from the fourth IPCC assessment report provided by **European Commission**
- Commission Implementing Decision 2013/634/EU, Annex II: Adjustments to Member States' annual emission allocations for each year of the period from 2013 to 2020 calculated applying global warming potential values from the fourth IPCC assessment report provided by **European Commission**
- Commission Decision (EU) 2017/1471: Amending Decision 201/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020 provided by **European Commission**
- Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020 provided by **European Commission**

With policies and measures already in place in Member States — as indicated by the 'with existing measures' (WEM) projections scenario — Member States expect to achieve a 30 % reduction in GHG emissions by 2030 (compared with 1990 levels). With the addition of new, planned policies and measures — as indicated in the 'with additional measures' (WAM) projections scenario — Member States expect to reach emission reductions totaling 36 % by 2030 (compared with 1990 levels). Further information can be found in the EEA Report Trends and projections in Europe 2019.

GHG emissions in the EU Emissions Trading System and the Effort Sharing sectors

GHG emissions in the sectors covered by the EU ETS and in those covered by the Effort Sharing Decision (ESD) have been following different trends since 1990 (see Figure 3). The projections reported by Member States also show differences between the two sectors.

Total GHG emissions from the sectors covered by the EU ETS have decreased significantly since 1990. The EU ETS target was defined to reduce emissions by 21 % between 2005 and 2020. In 2018, EU ETS emissions from Member States' stationary installations had already decreased by 29 % since 2005. The decrease since 2005 was mostly driven by reductions in emissions related to power generation.

According to the projections submitted by Member States in 2019 under the Monitoring Mechanism Regulation (MMR), future cuts in national GHG emissions will mainly take place under the EU ETS. With existing measures in place, emissions from stationary installations under the EU ETS are projected to decrease by a further 174 Mt CO₂e between 2018 and 2030. According to scenarios that consider planned measures, total reductions of 287 Mt CO₂e are projected between 2018 and 2030.

Figure 3 also illustrates the trends and projections in emissions under the Effort Sharing legislation. Effort Sharing emissions have fallen steadily since 1990, albeit at a slower rate than those covered under the EU ETS. This reflects the diversity of the trends in the various sectors covered by the

ESD. The building sector has contributed most to absolute reductions in emissions in the sectors covered by the Effort Sharing legislation since 1990, although its emissions have increased since 2015. Emissions from the transport sector, which is the largest contributor to GHG emissions under the Effort Sharing legislation, have been increasing continuously since 2014.

In 2017, Effort Sharing emissions aggregated at EU level were 10 % below 2005 levels. This decrease is projected to continue and aggregated Member State MMR projections will result in a 13 % reduction of Effort Sharing emissions by 2020 compared with 2005 base-year emissions, where only existing and adopted policies and measures are considered.

By 2030, aggregated Member State MMR projections would result in a 20 % reduction in Effort Sharing emissions, compared with 2005 base-year emissions, where only existing and adopted policies and measures are considered, and a 27 % reduction when additional policies and measures are included. These reductions remain insufficient compared with the 30 % reduction that the Effort Sharing sectors should achieve by 2030. The 2030 targets thus require efforts from Member States that go beyond the measures currently implemented and planned.

Further information can be found in the EEA Report Trends and projections in Europe 2019.

GHG emissions under the Effort Sharing Decision, by country

In contrast to the sectors in the EU ETS — which are regulated at EU level — it is the responsibility of EU Member States to define and implement national policies and measures to limit emissions from the sectors covered by the ESD (i.e. the residential and commercial, transport, agriculture, waste and smaller industrial installation sectors). The national emission targets for 2020 range from a 20 % reduction in emissions (compared with 2005 levels) to a 20 % increase. Less wealthy countries are allowed emission increases in the ESD sectors because their relatively higher economic growth is likely to be accompanied by higher emissions. Nevertheless, their targets represent a limit on their emissions compared with the emissions projected using business-as-usual growth rates. All Member States are therefore required to make an effort to reduce emissions (EC, 2015).

The assessment of current progress towards the ESD targets compares Member States' ESD emissions for each year with the annual national targets. In 2017, most Member States were below their national ESD targets. However, in 2017, emissions in 10 Member States (Austria, Bulgaria, Cyprus, Estonia, Germany, Ireland, Lithuania, Luxembourg, Malta and Poland) were above their national ESD targets. This is four more countries than in 2016.

According to preliminary estimates for 2018, the ESD emissions of 11 Member States were higher than their national targets.

National projections show that in most Member States, ESD emissions will remain below annual ESD targets until 2020. However, ten Member States (Austria, Belgium, Cyprus, Finland, France, Germany, Ireland, Luxembourg, Malta and Poland) will miss their 2020 target considering existing measures.

Further information can be found in the EEA Report Trends and projections in Europe 2019.

Indicator specification and metadata

Indicator definition

The present indicator (CSI010) presents total and sectoral trends of anthropogenic GHG emissions in Europe from 1990 onwards and assesses the progress of the EU, individual Member States and other EEA countries towards their international and internal EU GHG targets.

The indicator provides information on emissions from the main anthropogenic GHG sources, distributed by the main emitting sectors and based on IPCC nomenclature. In addition, the indicator shows past and projected GHG emissions in the Emissions Trading Scheme (ETS) and non-ETS/Effort Sharing Decision (ESD) sectors, in accordance with the EU legal scheme. As a general rule, emissions from international aviation are included in the totals presented in the indicator, consistent with the EU legal scheme ('Domestic scope'). These emissions are not covered by the Kyoto Protocol (KP), in accordance with the UNFCCC guidelines, and therefore they are excluded from the totals under the EU's international reporting of GHG inventories ('International scope'). Unless otherwise mentioned, the indicator does not cover emissions from international shipping. Net land use, land use change and forestry (LULUCF) emissions and/or removals, and CO₂ emissions from the combustion of biomass (including biofuels in transport) are not included in national GHG emission totals, according to UNFCCC Reporting Guidelines.

The indicator covers all 28 Member States of the European Union. The Member States' geographical coverage of the indicator is consistent with the EU coverage under the Kyoto Protocol. When available, information concerning other EEA member countries is also included. Especially when referring to the second commitment period of the KP, the European aggregates are presented for the 28 Member States and Iceland, since the European Union, its Member States and Iceland have agreed to fulfill their quantified emission limitation and reduction commitments jointly.

The indicator covers annual emissions since 1990.

Units

This indicator expresses GHG emissions in 'million tonnes CO₂-equivalent' (Mt CO₂e)

Rationale

Justification for indicator selection

Climate change is one of the greatest environmental, social and economic threats and the warming of the climate system is unequivocal according to the Intergovernmental Panel on Climate Change (IPCC).

In order to prevent the most severe impacts of climate change, countries (referred to as 'Parties') that have signed up to the United Nations Framework Convention on Climate Change (UNFCCC) agreed to cooperate with a view to limiting the increase in global average temperature and the resulting climate change. In this context, industrialised countries need to prepare and submit precise and regularly updated annual inventories of greenhouse gas (GHG) emissions.

Internationally, the main instrument to limit GHG emissions is the Kyoto Protocol, which was adopted in 1997 and sets internationally binding emission reduction targets that its Parties commit to. The Kyoto Protocol runs over two commitment periods; the first started in 2008 and ended in 2012, whereas the second started in 2013 and will end in 2020.

At the same time, the European Union (EU) has set its climate change mitigation objective for 2020, committing itself to reducing its emissions by at least 20 % compared with 1990 levels. The EU has also adopted an objective of a 40 % reduction by 2030 under the 2030 Climate and Energy Framework. This objective is consistent with a cost-effective pathway towards long-term domestic reductions of 80 % by 2050.

In order to assess the progress of the EU and its Member States, as well as that of other EEA member countries, towards their national, European and international commitments, the historic and projected GHG emission trends should be taken into account. These trends are presented in this indicator.

Scientific references

- IPCC Fifth Assessment Report: Climate Change 2014 (AR5) At regular intervals, the Intergovernmental Panel on Climate Change (IPCC) prepares comprehensive Assessment Reports of scientific, technical and socio-economic information relevant to the understanding of human-induced climate change, potential impacts of climate change and options for mitigation and adaptation. Four Assessment Reports have been completed in 1990, 1995, 2001 and 2007. The Fifth Assessment Report (AR5) provides a clear and up to date view of the current state of scientific knowledge relevant to climate change. It consists of three Working Group (WG) reports and a Synthesis Report (SYR) which integrates and synthesises material in the WG reports for policymakers. The SYR of the AR5 can be found here .

Policy context and targets

Context description

The UNFCCC sets an ultimate objective of stabilising GHG concentrations 'at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system.' It also requires precise and regularly updated inventories of GHGs from industrialised countries.

The Kyoto Protocol is an international agreement linked to the UNFCCC, which sets binding targets for industrialised countries and the European Union for reducing GHGs. It runs over two commitment periods; the first started in 2008 and ended in 2012, whereas the second started in 2013 and will end in 2020. The EU and its Member States have signed up to the Protocol.

The European Union, as a party to the UNFCCC and to the Protocol, reports annually on the GHG emissions within the area covered by its Member States. The **Annual European Union greenhouse gas inventory and inventory report**, officially submitted to the UNFCCC Secretariat, is prepared on behalf of the European Commission (DG CLIMA) by the EEA and its European Topic Centre for Air and Climate Mitigation (ETC/ACM), supported by the Joint Research Centre and Eurostat.

In 2007, EU leaders committed to a 20 % reduction in EU GHG emissions by 2020 on the basis of 1990 GHG emissions (or a 14 % decrease in GHG emissions between 2005 and 2020). The EU has also committed to increasing the share of renewable energy in the EU's final energy consumption to 20 % (with a minimum 10 % share in the transport sector), and to save 20 % of the EU's energy consumption through increased energy efficiency (the '20-20-20' objective).

The EU 2020 Climate and Energy Package, adopted in 2009, sets a two-fold legislative framework to achieve the 20 % GHG emission reduction objective: a 21 % reduction of emissions covered under the EU ETS, compared with 2005 levels, to be achieved across the whole EU and an effort to reduce emissions not covered by the EU ETS by about 10 % compared with 2005 levels, shared between the EU Member States through differentiated annual national GHG targets under the ESD.

Building on the 2020 climate and energy package, the European Council recently adopted the **2030 climate and energy framework**, which sets a target of a 40 % reduction in GHG emissions compared with 1990 as well as renewable energy and energy efficiency targets of at least 27 % by 2030. The 2030 framework is an EU priority, which follows the Paris Agreement and is consistent with the longer term objective of the '2050 low-carbon economy roadmap', which sets the EU ambition to reduce its GHG emissions by 80 % compared with 1990, with milestones of 40 % by 2030 and 60 % by 2040.

The current indicator aims to present an assessment of the EU's progress and that of individual countries towards their international and national targets under the Kyoto Protocol (in both commitment periods: 2008-2012 and 2013-2020) and under the ESD respectively. The indicator is based on the official GHG inventories submitted by the EEA countries and the EU to the UNFCCC, as well as on the projected GHG emissions submitted by the Member States under the

Monitoring Mechanism Regulation (Regulation 525/2013, MMR). In order to calculate the distance to the national ESD targets, emissions reported in the EU Emissions Trading System (EU ETS) are also taken into account.

Targets

First commitment period (CP1), 2008-2012

For the first commitment period (2008-2012), the 15 States that were EU members in 1997, when the Kyoto Protocol was adopted, took on an 8 % reduction from the base-year target that was then redistributed among themselves, taking advantage of a scheme under the Protocol known as a 'bubble', whereby countries have different individual targets, which when combined make an overall target for that group of countries. The differentiated targets are set out in Annex II to the Council Decision 2002/358/EC concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the UNFCCC and the joint fulfillment of commitments thereunder.

Under the Kyoto Protocol, the other (non EU-15) Member States (apart from Cyprus and Malta) have individual targets. Bulgaria, Czechia, Estonia, Latvia, Lithuania, Romania, Slovakia and Slovenia have reduction targets of 8 % from the base year, while Hungary and Poland have reduction targets of 6 % and Croatia has a reduction target of 5 %. Of the additional EEA member countries, Norway and Iceland are allowed to increase emissions under the Kyoto Protocol by 1 % and 10 %, respectively, from their base-year emissions. Liechtenstein and Switzerland have reduction targets of 8 %. Turkey is a Party to the Kyoto Protocol but has no reduction target.

Second commitment period (CP2), 2013-2020

The EU, its 28 Member States and Iceland agreed to a joint quantified emission reduction commitment of 80 % under the Kyoto Protocol's second commitment period (2013-2020). This is equivalent to a 20 % reduction compared with base-year levels. The 'initial report' of the EU and Iceland (EU-KP) will contain the assigned amount for the second commitment period, as calculated by the Party and will be submitted to the UNFCCC in 2016.

EU greenhouse gas targets for 2020

The unilateral 20 % GHG reduction target, in the context of the EU Climate and Energy Package, corresponds to a 14 % decrease in emissions between 2005 and 2020. The target is to be achieved both in the sectors covered by the EU ETS (21 % reduction in EU ETS emissions compared with 2005 levels) and in the other sectors covered by national emission targets under the ESD.

The ESD targets used in the indicator are consistent with the EU ETS scope for the third trading period (2013–2020), based on Commission Decision 2013/162/EU of 26 March 2013 on determining Member States' annual emissions allocations for the period 2013-2020, pursuant to

Decision No 406/2009/EC of the European Parliament and of the Council (OJ L 90, 28.3.2013, p. 106–110) and Commission Implementing Decision 2013/634/EU of 31 October 2013 on the adjustments to Member States' annual emissions allocations for the period 2013-2020, pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (OJ L 292, 1.11.2013, p. 19–22).

The ESD targets (2020 percentage target compared with 2005, and annual absolute targets consistent with the 2013-2020 ETS scope and global warming potentials from the IPCC AR4) are presented in the table below:

Country	2020 Target (%)	2013	2014	2015	2016	2017	2018	2019	2020
Austria	-16	52.63	52.08	51.53	50.99	50.44	49.90	49.35	48.80
Belgium	-15	78.38	76.85	75.32	73.79	72.26	70.74	69.21	67.68
Bulgaria	20	26.93	27.20	27.47	27.73	28.00	28.27	28.54	28.80
Croatia	11	19.61	19.81	20.00	20.19	20.38	20.57	20.76	20.95
Cyprus	-5	5.92	5.92	5.93	5.93	5.93	5.94	5.94	5.94
Czechia	9	62.47	63.21	63.95	64.69	65.43	66.17	66.91	67.65
Denmark	-20	36.83	35.93	35.02	34.12	33.21	32.31	31.41	30.50
Estonia	11	6.30	6.32	6.35	6.37	6.39	6.42	6.44	6.47
Finland	-16	31.78	31.29	30.80	30.31	29.82	29.34	28.85	28.36
France	-14	394.08	389.46	384.43	379.40	374.38	369.35	364.32	359.29
Germany	-14	472.53	465.83	459.13	452.44	445.74	439.04	432.34	425.65
Greece	-4	58.96	59.28	59.61	59.94	60.26	60.59	60.92	61.24
Hungary	10	50.40	51.52	52.63	53.75	54.87	55.99	57.10	58.22
Ireland	-20	46.89	45.76	44.63	43.50	42.37	41.24	40.11	38.97
Italy	-13	308.16	306.20	304.23	302.27	300.30	298.34	296.38	294.41
Latvia	17	9.26	9.35	9.44	9.53	9.62	9.72	9.81	9.90
Lithuania	15	12.94	13.30	13.66	14.02	14.38	14.74	15.10	15.46
Luxembourg	-20	9.54	9.34	9.14	8.94	8.74	8.54	8.34	8.14
Malta	5	1.17	1.17	1.17	1.16	1.16	1.16	1.16	1.16

Netherlands	-16	122.95	120.68	118.40	116.13	113.86	111.59	109.31	107.04
Poland	14	193.64	194.89	196.13	197.37	198.61	199.86	201.10	202.34
Portugal	1	49.31	49.59	49.86	50.14	50.41	50.69	50.97	51.24
Romania	19	75.63	77.45	79.27	81.10	82.92	84.74	86.56	88.38
Slovakia	13	24.02	24.38	24.74	25.10	25.46	25.82	26.18	26.54
Slovenia	4	12.32	12.35	12.38	12.41	12.44	12.47	12.50	12.53
Spain	-10	227.56	225.65	223.73	221.82	219.90	217.99	216.07	214.16
Sweden	-17	41.69	41.04	40.40	39.76	39.12	38.48	37.84	37.20
United Kingdom	-16	358.74	354.22	349.70	345.18	340.66	336.14	331.62	327.10

EU greenhouse gas targets post 2020

In October 2015, the European Council adopted the '2030 climate and energy framework', setting a binding target to cut emissions in the EU territory by at least 40 % below 1990 levels by 2030. To achieve this target of at least 40 %:

- EU-ETS sectors would have to cut emissions by 43 % (compared with 2005);
- non-ETS sectors would have to cut emissions by 30 % (compared with 2005).

The 2030 framework is consistent with the longer-term objective of the '2050 low-carbon economy roadmap', which sets the EU ambition to reduce its GHG emissions by 80 % compared with 1990, with milestones of 40 % by 2030 and 60 % by 2060. It is also a milestone for the EU's contribution to the Paris Agreement, which was adopted in December 2015.

Related policy documents

- **Commission Decision 2013/162/EU**
Commission Decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council
- **Commission Implementing Decision 2013/634/EU**
Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council
-  **Council Decision (2002/358/EC) of 25 April 2002**
Council Decision (2002/358/EC) of 25 April 2002 concerning the approval, on behalf of the European Community, of the Kyoto Protocol to the United Nations Framework Convention on Climate Change and the joint fulfilment of commitments thereunder.

- Decision No 406/2009/EC (Effort Sharing Decision)

Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020

- European Council 23-24/10/2014 - Conclusions on 2030 Climate and Energy Policy Framework

Conclusions on 2030 Climate and Energy Policy Framework The European Council endorsed 4 targets: - a binding EU target of 40% less greenhouse gas emissions by 2030, compared to 1990 - a target of at least 27% renewable energy consumption - a 27% energy efficiency increase - the completion of the internal energy market by achieving the existing electricity interconnection target of 10% and linking the energy islands - in particular the Baltic states and the Iberian Peninsula On energy security, the European Council endorsed further measures to reduce the EU's energy dependence and increase the security of its electricity and gas supplies.

- Greenhouse gas monitoring mechanism Decision

Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol

- Kyoto Protocol to the UN Framework Convention on Climate Change

Kyoto Protocol to the United Nations Framework Convention on Climate Change; adopted at COP3 in Kyoto, Japan, on 11 December 1997

- Monitoring Mechanism Regulation 525/2013

REGULATION (EU) No 525/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC

- Paris Agreement

The Paris Agreement. Report of the Conference of the Parties on its twenty-first session, held in Paris from 30 November to 11 December 2015.

-  Presidency conclusions of the Brussels European Council of 8/9 March 2007

Presidency conclusions of the Brussels European Council of 8/9 March 2007

- UNFCCC

UNFCCC reporting guidelines on annual inventories

Methodology

Methodology for indicator calculation

This indicator is based on the official GHG inventories submitted by the EEA countries to the EEA, as well as on the projected GHG emissions submitted by the Member States under the Monitoring Mechanism Regulation (Regulation 525/2013, MMR). The official EU GHG inventory submitted by the EU to the UNFCCC is based on the same data and is also used. The EU ETS emissions, as provided to the European Commission, are also used. When available, approximate estimates of the GHG emissions for the year (X-1) are also presented.

More information on the datasets used is given in the paragraphs below.

Greenhouse gases

In line with the UNFCCC reporting guidelines on annual inventories, the national inventories cover emissions and removals of the following GHGs:

- carbon dioxide (CO₂), including indirect CO₂;
- methane (CH₄);
- nitrous oxide (N₂O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs);
- sulphur hexafluoride (SF₆); and
- nitrogen trifluoride (NF₃)

from six sectors (Energy, Industrial processes and product use, Agriculture, LULUCF, Waste and Other).

The gases do not include the GHGs that are also ozone-depleting substances, which are controlled by the Montreal Protocol (see CSI006).

Emissions from LULUCF are not included in total GHG emissions presented in the indicator. Because of this, CO₂ emissions from the combustion of biomass (including biofuels in transport) are also reported as a memorandum item to avoid double counting of emissions from a reporting perspective. These emissions are not covered by the KP, in accordance with the UNFCCC guidelines, and therefore, they are excluded from the totals under the EU's international reporting of GHG inventories ('International scope'). Unless otherwise mentioned, the indicator does not cover emissions from maritime transport.

In order to be aggregated, non-CO₂ gases are weighted by their respective global warming potential (GWP) and presented in CO₂-equivalent units. Global warming potential (GWP) is a measure of how much a given mass of a GHG is estimated to contribute to global warming on a 100-year horizon.

In accordance with the UNFCCC rules, the GWP values used in this indicator are the ones from IPCC AR4:

Gas	Global warming potential values from IPCC AR2	Global warming potential values from IPCC AR4
	[before 2015]	[after 2015]
Carbon dioxide (CO ₂)	1	1
Methane (CH ₄)	21	25
Nitrous oxide (N ₂ O)	310	298
Sulphur hexafluoride (SF ₆)	23 900	22 800
Nitrogen trifluoride (NF ₃)	–	17 200

HFCs and PFCs comprise a large number of different gases that have different GWPs. The full list of GWPs can be found here: [IPCC AR 4](#)

Greenhouse gas inventories

For the preparation of their national inventories, countries use the methodologies of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Parties have also agreed to use the formats indicated in Decision 24/CP.19. According to this, the reporting of GHG emissions is allocated in six sectors (Energy, Industrial processes and product use, Agriculture, Land use, land use change and forestry (LULUCF), Waste and Other).

In the indicator, GHG emissions are attributed to the main emitting sectors at a disaggregated level, based on the IPCC definition of source categories and the common reporting format (CRF) followed by Parties. For this, the following categories are referenced:

- Energy supply (CRF category 1.A.1 (including emissions from public electricity and heat production, petroleum refining and manufacture of solid fuel and other energy industries) and 1.B ('Fugitives'))
- Industry (CRF category 1.A.2 ('manufacturing industries and construction', referring to emissions from fossil fuel combustion in industries for energy use) and CRF sector 2 ('Industrial Processes and Product use'))
- Transport (CRF category 1.A.3, including road transportation)
- Residential & Commercial (CRF category 1.A.4.a and 1.A.4.b, referring to emissions from the households and commercial sectors)
- Agriculture (CRF category 1.A.4.c, referring to emissions from energy use in agriculture, forestry and fisheries and CRF sector 3 ('Agriculture'))

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- LULUCF (CRF Sector 4)
 - Waste (CRF Sector 5)
 - International aviation (CRF category 1.D.1.a)
 - International shipping (CRF category 1.D.1.b)
 - CO₂ emissions from biomass

Projected greenhouse gas emissions

For projected GHG emissions, information submitted by the EEA countries under the MMR is used. The projected GHG emissions referred to in the indicator are those reported under the 'with existing measures' scenario (WEM) and the 'with additional measures' scenario (WAM).

Emission trading system emissions

Emissions from the EU ETS are also presented in the indicator. The EU ETS runs over three trading periods: Phase I (2005-2007), Phase II (2008-2012) and Phase III (2013-2020).

In 2013, the scope of the EU ETS was expanded to include additional references to (a) the capture, transport and geological storage of GHG emissions; (b) CO₂ emissions from petrochemical, ammonia and aluminium production; (c) N₂O emissions from the production of nitric, adipic and glyoxylic acids; and (d) PFC emissions from aluminium production. Since 1 January 2012, aviation has also been part of the EU ETS.

Since 2013, these emissions have been calculated by the plant operators that fall under the ETS obligations in line with Regulation No 601/2012, whereas in Phase II of the EU ETS (2008-2012), the monitoring and reporting of the operators was based on Commission Decision 2004/156/EU.

Croatia entered the EU ETS Scheme on 1 January 2013.

Approximated greenhouse gas inventory

Finally, whenever relevant, this indicator uses data and estimates from the 'Approximated GHG inventory' for the year (X-1). These 'proxy' inventories are reported by Member States to the EEA and to the Commission under the MMR by 31 July of each year, X, and are calculated at an aggregated level on the basis of the national and international information available for the year (X-1).

Methodology for gap filling

Greenhouse gas inventories (years 1990-(X-2)):

The historic emission data presented in the indicator are based on the information reported by Member States under the MMR. However, should a Member State not submit the inventory data required to compile the EU inventory, the Commission shall prepare estimates to complete the

GHG inventories submitted by Member States in consultation and close cooperation with the Member States concerned. In this case, the Member State shall use the gap-filled inventory in its official submission to the UNFCCC. The basis for these gap-filling processes is described in the Commission Delegated Regulation of 12.03.2014 (http://ec.europa.eu/clima/policies/g-gas/monitoring/docs/c_2014_1539_en.pdf)

Approximated greenhouse gas inventory (year X-1):

Under the MMR, the Commission shall also estimate a Member State's approximated GHG inventory if the Member State does not provide it. These estimates are provided by the EEA and are country-specific. More information on the methodology used for gap-filling is provided in the 'Approximated GHG inventory report' of each year.


Projected greenhouse gas emissions (year X–2035):

In order to ensure the timeliness, completeness, consistency, comparability, accuracy and transparency of the reporting of projections by the EU and its Member States, the quality of the reported projections is assessed by the ETC/ACM on behalf of the EEA. As the Member States' reporting of projections is carried out every 2 years by countries, in certain cases, projections are adjusted to ensure full consistency with historic GHG emission data from the latest GHG inventories. Where a country has not made a submission, data are gap-filled by the ETC/ACM.

Methodology references

- **Annual European Union greenhouse gas inventory and inventory report** All the data used to prepare the indicator are consistent with the latest EU GHG national inventory report (NIR). The main institutions involved in the compilation of the EU GHG inventory are the Member States, the European Commission's Directorates-General Climate Action (DG CLIMA), Eurostat, the Joint Research Centre and the European Environment Agency (EEA) and its European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM). This report is compiled on the basis of the inventories of the EU Member States for the EU-28 (consistent with the EU geographical scope under the UNFCCC), and the EU-28 and Iceland, consistent with the EU's geographical scope under the Kyoto Protocol). The EU GHG inventory is the direct sum of the national inventories. For the EU reference approach, energy data from Eurostat are used for CO₂ emissions from fossil fuels.
- **2006 IPCC Guidelines for National Greenhouse Gas Inventories** The 2006 IPCC Guidelines for National Greenhouse Gas Inventories are the latest step in the IPCC development of inventory guidelines for national estimates of GHGs. These 2006 Guidelines build on the previous Revised 1996 IPCC Guidelines and the subsequent Good Practice reports. They include new sources and gases as well as updates to the previously published methods whenever scientific and technical knowledge have improved since the previous guidelines were issued. From 2015, UNFCCC Parties will have to use the 2006 IPCC Guidelines' methodologies and reporting formats when preparing their inventories, in line with the

UNFCCC reporting guidelines (Decision 24/CP.19).

-  UNFCCC reporting guidelines on annual inventories This document contains the complete updated UNFCCC reporting guidelines on annual inventories for all inventory sectors. It aims to assist Annex I Parties in meeting their commitments under the Convention and in preparing to meet their commitments under the Kyoto Protocol.
- Commission Regulation (EU) No 601/2012 Commission Regulation (EU) No 601/2012 of 21 June 2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council. The regulation sets out the rules for the monitoring and reporting of ETS emissions by plant operators, covering the scope of Phase III of the ETS.
- IPCC Forth Assessment Report (AR4) At regular intervals, the (IPCC) prepares comprehensive Assessment Reports of scientific, technical and socio-economic information relevant for the understanding of human induced climate change, the potential impacts of climate change and options for mitigation and adaptation. Four Assessment Reports have been completed in 1990, 1995, 2001 and 2007. The Fourth Assessment Report 'Climate Change 2007' (AR4) is composed of four volumes and various contributions. The AR4 Synthesis Report is based on the assessment carried out by the three Working Groups of the IPCC. It provides an integrated view of climate change as the final part of the AR4. It is written in a non-technical style suitable for policymakers. It is composed of a longer report and a Summary for Policymakers . The GWP of the AR4 can be found here .

Uncertainties

Methodology uncertainty

Greenhouse gas inventories

(a) Difference in methodologies between countries

Since Member States use different national methodologies, national activity data or country-specific emission factors in accordance with IPCC and UNFCCC guidelines, these different methodologies are reflected in the EU GHG inventory data. The EU believes that it is consistent with the UNFCCC reporting guidelines and the 2006 IPCC guidelines to use different methodologies for one source category across the EU territory, especially if this helps to reduce the uncertainty and improve the consistency of the emission data, provided that each methodology is consistent with the 2006 IPCC guidelines. At the same time, the EU is making an effort to promote and support the use of higher tier methodologies across Member States. At the EU level, and for most of the key categories of the EU inventory, more than 75 % of the EU-KP emissions are calculated using higher tier methodologies, resulting in lower uncertainty rates.

(b) Global warming potential

According to the IPCC, the GWP values used in the IPCC AR4 have an uncertainty of $\pm 35\%$ for the 5-95 % (90 %) confidence range.

Projected greenhouse gas emissions

The methodology proposed consists of simple additions of data reported by Member States. However, uncertainty arises from the following:

- projections can be subject to updates that might not be reflected in the assessment if these updates were recently made;
- the projections taken into account are fully consistent with Member State submissions under the MMR. However, other sets of projections with different data might have been published by countries (e.g. national allocation plans, national communications to the UNFCCC).

Several countries carry out sensitivity analyses on their projections.

Approximated greenhouse gas inventory

The uncertainty ranges estimated in the approximated GHG inventories are derived by comparing the official national data submitted to the UNFCCC in year X with the proxy estimates of the same year. The uncertainty for the approximated emissions at the EU level is estimated as the weighted mean of the differences described: weighted again by the relative contribution that each Member State makes to total EU-28 emissions. More details about these methodologies are provided each year in the 'Approximated GHG inventory report'.

Data sets uncertainty

The 2006 IPCC Guidelines provide approaches on how Parties should estimate uncertainties, suggesting different values for the uncertainty of activity data and emission factors for most of the emission source categories. On the basis of this guidance, EU Member States and other EEA countries perform their own assessment of the uncertainty of reported data and provide an uncertainty analysis in the National Inventory Report to account for uncertainty per source category, as well as the total uncertainty of their national inventory.

Section (1.7) of the annual EU GHG inventory report considers the uncertainty evaluation, describing the methodology used to estimate it. The results suggest that the uncertainty level in the EU is about 6 % for total GHG emissions (including LULUCF).


Total EU-28 GHG emission trends are likely to be more accurate than individual absolute annual emission estimates, because the annual values are not independent of each other. The IPCC suggests that the uncertainty in total GHG emission trends is approximately 4-5 %. For the EU, the trend uncertainty is estimated to be close to 1 %. Total GHG emission estimates are quite reliable and the limited number of interpolations used to build the indicator do not introduce much uncertainty at the EU level.

Uncertainties in the projections of GHG emissions can be significant but have not been assessed.

Rationale uncertainty

The IPCC AR4 (IPCC Fourth Assessment Report 'Climate Change 2007') emphasises that:

- Warming of the climate system is **unequivocal**.
- There is **high agreement** and **much evidence** that with current climate change mitigation policies and related sustainable development practices, global GHG emissions will continue to grow over the next few decades.
- Continued GHG emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would **very likely** be larger than those observed during the 20th century.
- Anthropogenic warming could lead to some impacts that are abrupt or irreversible, depending upon the rate and magnitude of the climate change.

Words in bold represent calibrated expressions of uncertainty and confidence. Relevant terms are explained in the Box 'Treatment of uncertainty' in the introduction to the  AR4 Synthesis Report. In particular, '**very likely**' corresponds to a **probability of occurrence higher than 90 %**. This uncertainty in specific outcomes is assessed using expert judgment and statistical analysis of a body of evidence (e.g. observations or model results).

The high confidence in the responsibility of anthropogenic GHG emissions for the warming of the

climate system re-emphasises the relevance of monitoring and assessing GHG emissions trends in Europe.

Data sources

- National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism
provided by **Directorate-General for Climate Action (DG-CLIMA)** , **United Nations Framework Convention on Climate Change (UNFCCC)**
- European Union Emissions Trading System (EU ETS) data from EUTL
provided by **Directorate-General for Climate Action (DG-CLIMA)**

Metadata

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DPSIR: Pressure

Typology: Performance indicator (Type B - Does it matter?)

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- CLIM 050

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