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# EU greenhouse gas emissions: Well reported, but better insight needed into future reductions

EUROPEAN
COURT
OF AUDITORS

# Contents

# Executive summary

I The EU, as a party to the Kyoto Protocol (1997) and the Paris Agreement (2015), is committed to take part in the global effort to reduce greenhouse gas emissions. In line with these agreements, the EU is aiming for a 20 % reduction in greenhouse gases by 2020, a 40 % reduction by 2030 and an 80-95 % reduction by 2050. To assess progress towards these targets, the Commission needs estimates of past and projected emissions, and of the effects of policies and measures aimed at reducing emissions. Our landscape review on EU action on energy and climate change of 2017 identified inventories of greenhouse gas emissions as an area of potential risk in which limited audit work had taken place.

II Our audit focused on efforts of the Commission, assisted by the European Environment Agency (EEA), to ensure the quality of the EU greenhouse gas inventory and of the information on future emission reductions. We found that the EU emission data is appropriately reported, but that the Commission needs better insight into future greenhouse gas emission reductions.

III The Commission reports on greenhouse gases to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat in line with international requirements, and provides additional data to the European Parliament and the Council. To ensure the quality of this data, the Monitoring Mechanism Regulation and its implementing rules set out an EU system for reviewing Member States' greenhouse gas inventories. Our work showed that the Commission, assisted by the EEA, verifies satisfactorily the reported emissions and that the EU greenhouse gas inventories have improved over time. However, for the land use, land-use change, and forestry (LULUCF) sector, the reviewers do not perform the same types of checks as for other sectors. This sector is particularly relevant not only for the 2030 targets, but also because the LULUCF data has a high statistical uncertainty.

IV The Monitoring Mechanism Regulation also established an EU system for reviewing data on Member States' projections. The Commission and UNFCCC review both identified fewer issues in 2017 than in 2015, indicating an improvement in national projections. However, the Commission did not assess the risk of significant deviations from the EU reference scenario.

**V** For achieving emission reductions, the EU has put in place targets which include most of the reported data. For the LULUCF sector the first EU targets are for 2030, while for international shipping the internationally agreed target is for 2050. International aviation is already included in the EU 2020 targets.

**VI** We found that long-term sectoral roadmaps cover almost 70 % of the emissions reported. Such specific roadmaps are crucial for the development of the respective sectors in a sustainable way. However, there are no specific roadmaps for some key sectors, such as agriculture and LULUCF. This affects the sectoral shorter-term policies and measures.

**VII** Mitigation policies and measures aim to reduce future emissions. The Commission and the EEA have introduced checks on the quality of the information submitted by Member States on their mitigation policies and measures. However, the Commission did not report estimates for some EU policies and measures' impacts on emissions.

**VIII** Based on these findings, we make recommendations to the Commission aimed at improving:

(a) the Commission review process for the LULUCF sector;

(b) the framework for future emission reductions.

# Introduction

## International context

**01** Greenhouse gases absorb and release heat (infra-red radiation from the sun) in the atmosphere. The Intergovernmental Panel for Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. It estimates that human-induced greenhouse gas emissions have caused global temperatures to rise by approximately 1.0 °C above pre-industrial levels to date. The subsequent effects of this increase include sea level rises and more extreme weather events.

**02** In 1992, the global nations signed the United Nations Framework Convention on Climate Change (UNFCCC), aiming to stabilise greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system". Further steps were taken in 1997 with the Kyoto Protocol, which put measures in place and introduced binding emission reduction targets for the developed countries that signed it. As part of the Kyoto Protocol, the developed countries also committed to setting out policies and measures to support the achievement of the emission reduction targets in the Protocol in a sustainable way. The UNFCCC Secretariat monitors and reports on the Convention and the Kyoto Protocol's enforcement.

**03** The Paris Agreement (2015) was signed by 197 countries. The aim of the agreement is to limit the increase in the global average temperature to "well below" 2 °C above pre-industrial levels, and to promote efforts to limit the global average temperature increase "even further", to 1.5 °C above pre-industrial levels. The Paris Agreement does not introduce binding emission reduction targets for the signatory parties; instead, it imposes nationally determined contributions to the overall goal to limit the increase in global temperature. These contributions include both the countries' reductions in man-made emissions at their source and removals ("carbon sinks") of greenhouse gases.

**04** Efforts to reduce greenhouse gas emissions, and thus to limit global warming, are helped by having accurate information about emission levels, trends, and the policies and measures aimed at improving them. This requires a sound framework for monitoring and reporting on greenhouse gas emissions, as well as reliable information on projected changes in emissions resulting from existing and planned policies and measures.

**05** Both the Kyoto Protocol and the Paris Agreement set out such frameworks. The Kyoto Protocol's framework is valid until the reporting of emissions for 2020 (in 2022). The Paris Agreement's framework will first be used for the reporting of emissions for 2021 (to be published in 2023). These frameworks include quality assurance procedures (i.e. a review of the data by the UNFCCC Secretariat and its expert teams), and are supported by guidelines from the UNFCCC and the International Panel for Climate Change.

## European context

**06** EU Member States account for 6.9 % of the global population and for 21.8 % of the world's gross domestic product[1]. They generated around 8.4 % of global greenhouse gas emissions in 2017[2].

**07** The EU agreed to reduce its greenhouse gas emissions[3] by 20 % by 2020, by 40 % by 2030 and by 80 % to 95 % by 2050 compared to 1990. ***Figure 1*** below shows the trend in emissions to date and estimated progress towards 2050. Up until 2017, the EU reduced its emissions by 21.7 %[4] on 1990 levels. Most of the greenhouse gases under the Kyoto Protocol followed this downward trend (see ***Figure A*** in the ***Annex***).

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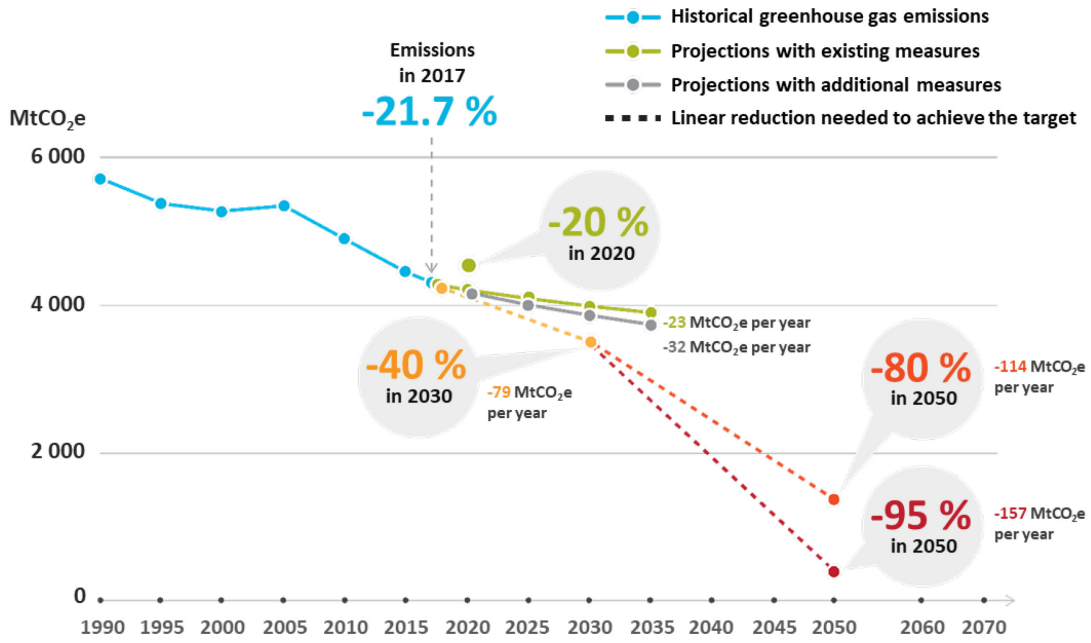
1 Eurostat report "The EU in the world", 2018.

2 EU inventory report of 2019.

3 European Council Conclusions of 8/9 March 2007, of 4 February 2011 and of 23/24 October 2014.

4 This figure includes international aviation, to ensure comparability with the data reported as part of the EU targets.

## Figure 1 – Estimates of past and future emissions compared to the emission reduction targets




*Source*: European Court of Auditors, based on EU Inventory Report of 2019 (2017 emission data), the 2017 EU National Communication and Biennial Report to the UNFCCC (projections data) and the EEA "Trends and projections in Europe 2018 – Tracking progress towards Europe's climate and energy targets" (yearly reductions needed to achieve the targets).

**08** To achieve these reductions, and to comply with the international rules, the EU and its Member States have committed to reporting their final greenhouse gases emissions to the UNFCCC each year. They do so in the form of "greenhouse gas inventories" (see ***Box 1***). For any given year, the European Environment Agency publishes interim EU inventories, usually in October of the following year (N+1), and final inventories six months later, in May N+2[5].

[5] For example, the inventories for 2017 were published in May 2019.

**Box 1**

## What are greenhouse gas inventories?

Greenhouse gas inventories are a quantified estimation of annual emissions produced by human activities on a country's territory. The aggregated EU inventory is the sum of the Member States' inventories, and also contains the emissions produced by Iceland.

The quantified estimates are calculated by multiplying activity data by emission factors. The UNFCCC defines *activity data* as the magnitude of human activity resulting in emissions or removals taking place during a given period of time in a specific sector. An example of activity data for transport is the sales volume of fuel. *Emission factors* are the average rate of emission of a given greenhouse gas by a given source, relative to units of activity. For example, an emission factor can correspond to the emissions generated from burning one tonne of brown coal.

The resulting emissions estimates are expressed as carbon dioxide ($CO_2$) equivalents (see ***Figure B*** in the ***Annex***), using conversion factors, depending on each gas's global warming potential. As an example, the warming potential of one tonne of $NF_3$ is equivalent to that of 16 100 tonnes of $CO_2$.

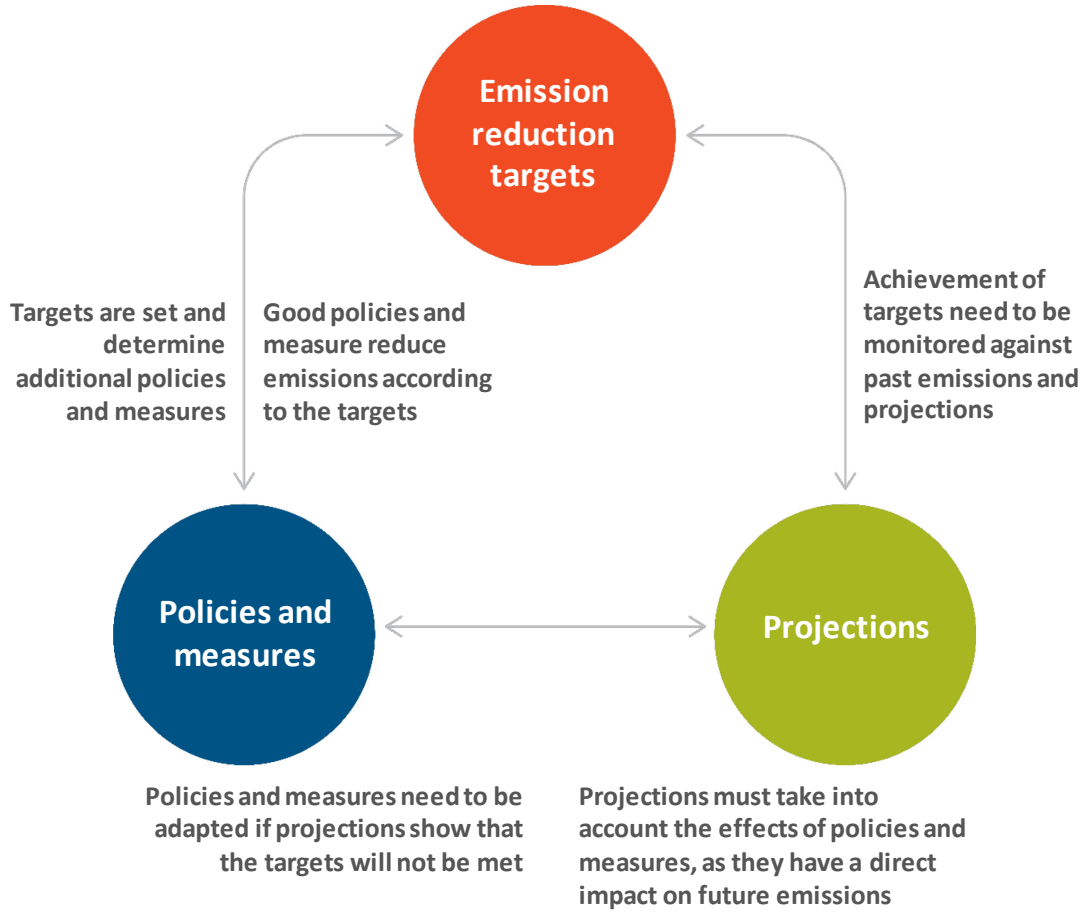
**09** On the basis of the Kyoto Protocol and the UNFCCC Convention, the EU and its Member States also report the following information to the UNFCCC Secretariat.

(a) Projections of future emissions, accompanied by information on how these projections have been arrived at (e.g. modelling tools used and factors influencing them).

(b) Information on mitigation policies and measures that support the sustainable achievement of emission reductions, including the scope of such measures; their links to EU policies; *ex ante* and, where applicable, *ex post* information on their impact; and how national policies and measures contribute to the achievement of national long-term low-carbon development strategies.

**10** Projections are used to estimate future progress in reducing emissions, and indicate whether mitigation policies and measures will be effective. ***Figure 2*** explains the links between targets, projections, and policies and measures. Projections do not only consider the results of mitigation policies and measures, but also a larger set of assumptions and parameters, which are not represented in the figure.

## Figure 2 – Links between EU targets, projections, and policies and measures




*Source*: European Court of Auditors.

**11** To achieve its emission reduction commitments and implement its monitoring and reporting commitments by 2020, the EU has adopted the following specific legislation, which is binding on Member States.

(a) The Monitoring Mechanism Regulation[6] and its implementing rules[7], which establish the general accounting and reporting framework for EU man-made

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[6] Regulation (EU) No 525/2013 of the European Parliament and of the Council 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 (OJ L 165, 18.6.2013, p. 13).

[7] Commission Implementing Regulation (EU) No 749/2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation

greenhouse gases, projections, low-carbon development strategies and mitigation policies and measures.

(b) The Emissions Trading Scheme[8], which sets out a framework and targets for reducing emissions from large-scale energy and industrial installations[9], as well as a specific cap and a monitoring and reporting framework for aviation emissions within the European Economic Area.

(c) The Effort-Sharing Decision[10], setting binding annual emission reduction targets for each Member State in the energy, industry, agriculture and waste sectors, for activities which do not fall under the scope of the Emissions Trading Scheme or of other specific legislation (as identified in (d) below).

(d) Specific monitoring, reporting and accounting legislation for emissions and removals of carbon dioxide from land use, land use change and forestry

(EU) No 525/2013 of the European Parliament and of the Council and Commission Delegated Regulation (EU) No 666/2014 establishing substantive requirements for a Union inventory system and taking into account changes in the global warming potentials and internationally agreed inventory guidelines pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council.

[8] Directive 2003/87/EC of the European Parliament and of the Council establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (Text with EEA relevance) (OJ L 275, 25.10.2003, p. 32).

[9] Previous ECA audits have covered components of the Emissions Trading Scheme; see special report 06/2015 “on the Emissions Trading Scheme” and special report 24/2018 “Demonstrating carbon capture and storage and innovative renewables at commercial scale in the EU: intended progress not achieved in the past decade”.

[10] Decision No 406/2009/EC of the European Parliament and of the Council 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 (OJ L 140, 5.6.2009, p. 136).

(LULUCF)[11], and for emissions from international maritime shipping (ships calling at ports in the European Economic Area)[12].

**12** As a response to the Paris Agreement and the EU emission reduction targets beyond 2020, the EU updated its legislative framework as follows:

(a) In 2018, it adopted a new accounting and reporting framework for anthropogenic greenhouse gases, emission projections, low-carbon development strategies and mitigation policies and measures, applicable from 2021 (the Regulation on the Governance of the Energy Union and Climate Action[13]).

(b) It modified the Emissions Trading Scheme and adopted new legislation on national emissions reduction targets for each year until 2030 (the new Effort Sharing Regulation[14]).

(c) It adopted new rules on monitoring, reporting and accounting for emissions and removals of carbon dioxide from the LULUCF sector[15].

(d) In 2019, the Commission adopted a proposal to revise the EU's system for monitoring, reporting and verifying $CO_2$ emissions from maritime transport

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[11] Decision No 529/2013/EU of the European Parliament and of the Council of 21 May 2013 on accounting rules on greenhouse gas emissions and removals resulting from activities relating to land use, land-use change and forestry and on information concerning actions relating to those activities (OJ L 165, 18.6.2013, p. 80).

[12] Regulation (EU) 2015/757 of the European Parliament and of the Council on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC (OJ L 123, 19.5.2015, p. 55).

[13] Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action (OJ L 328, 21.12.2018, p. 1).

[14] Regulation (EU) 2018/842 of the European Parliament and of the Council on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement (OJ L 156, 19.6.2018, p. 26).

[15] Regulation (EU) 2018/841 of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (OJ L 156, 19.6.2018, p. 1).

to align it with the global data collection system for the fuel oil consumption of ships introduced by the International Maritime Organisation.

**13** EU legislation provides a framework to ensure the quality of data on past emissions, on projections and of the information on policies and measures. ***Figure 3*** below shows how the data is collected, verified and reported. In the centre, it shows Commission and European Environment Agency (EEA) responsibilities for the quality of Member States' estimates, in preparing aggregated EU data and in submitting this information to the UNFCCC. The Commission is also planning EU emission reductions by proposing adequate strategies and policies and measures, based on scenario analysis.

**14** The EEA assists the European Commission (Directorate-General for Climate Action – DG CLIMA) in ensuring the quality of the aggregated EU inventory and projections[16]. These are based on the information submitted by Member States. Other experts (such as the Joint Research Centre (JRC) and the European Topic Centre for Air pollution and Climate change Mitigation) support the EEA and the Commission in this work. In this report we refer to this work as "Commission review" since the Commission remains ultimately responsible for the quality of this data.

**15** Eurostat publishes a separate dataset on emissions generated by EU consumption (called carbon footprint). This dataset derives from the national air emission accounts[17], which are in turn based on the greenhouse gas inventories.

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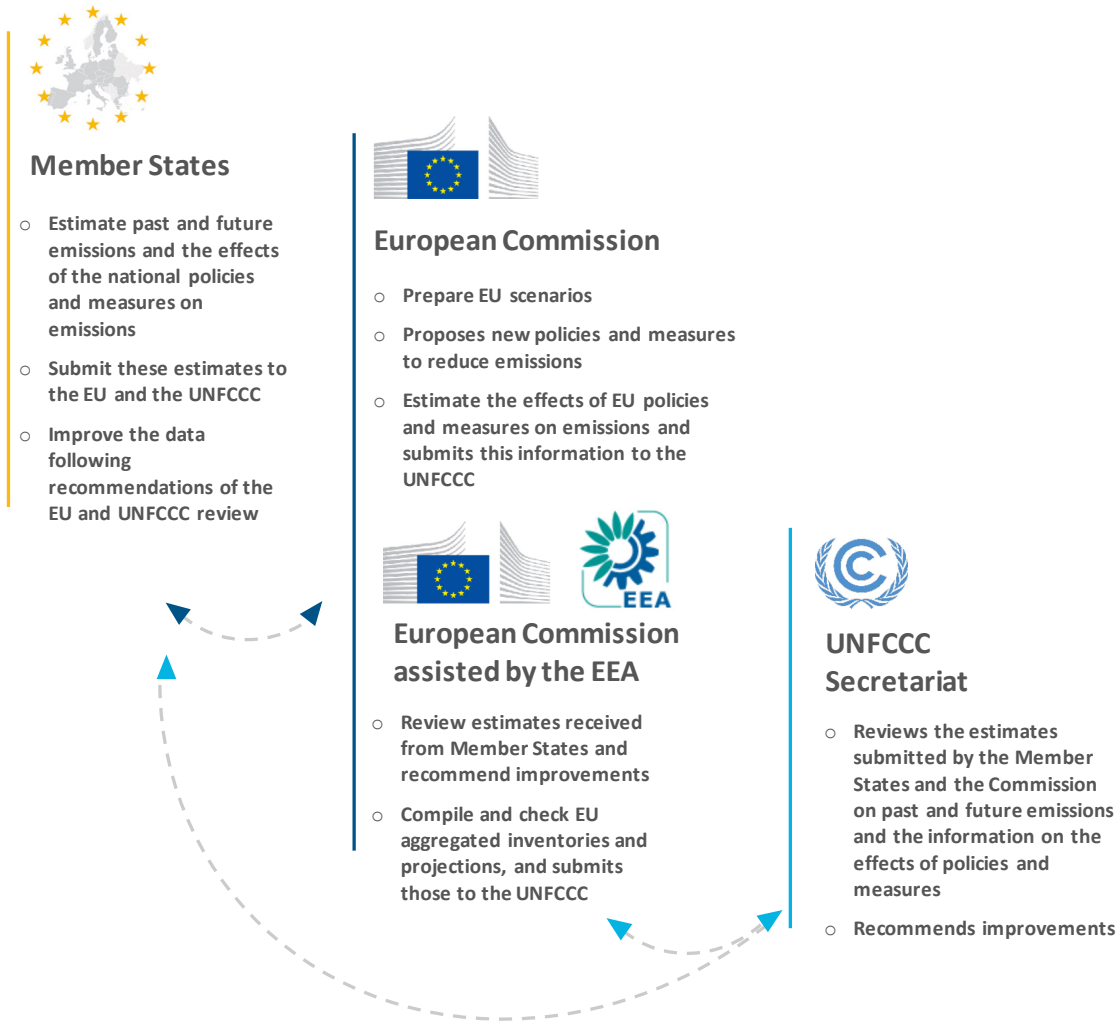
[16] In accordance with Article 24 of the Monitoring Mechanism Regulation (EU) No 525/2013 and Article 42 of the Governance Regulation (EU) No 2018/1999.

[17] See also our special report 16/2019 "European Environmental Economic Accounts: usefulness for policymakers can be improved".

## Figure 3 – Responsibilities for inventories, projections, policies and measures




- **Preparation and submission of data on past and future emissions and on policies and measures**
- **Providing insight into future emission reductions**



*Source*: European Court of Auditors.

# Audit scope and approach

**16** Our audit covered the design and functioning of the EU's reporting and quality assurance framework for data reported since 2015 under the Kyoto protocol and the EU Monitoring Mechanism Regulation.

**17** We carried out this audit because our landscape review on EU action on energy and climate change of 2017 identified inventories of greenhouse gas emissions as an area of potential risk in which limited audit work had taken place. We expect our conclusions and recommendations to provide a useful input for the improvement of the Commission review process of greenhouse gas emission data and of the framework for future emission reductions.

**18** Our overall audit question was:

**Does the Commission appropriately check the EU greenhouse gas inventory and the information on future emission reductions?**

**19** To answer our overall audit question, we:

(a) assessed the quality checks done on the EU greenhouse gas inventory;

(b) examined the additional information on planned reduction of EU greenhouse gas emissions (EU projections and reference scenario, long-term strategies, quantification of the effects of EU policies and measures).

We did not directly check the information and estimates produced by Member State authorities.

**20** We checked the functioning of the EU quality assurance process for inventories, projections, policies and measures put in place by the Monitoring Mechanism Regulation and its implementing rules, through a sample of six Member States. The main criteria for selection were the annual emissions in 2016 and the number of UNFCCC recommendations from the 2015-2017 annual reviews of the national inventories. The Member States in the sample were Czechia, Germany, France, Italy, Poland and Romania. They produced 56 % of EU emissions in 2016.

**21** We collected and analysed our audit evidence by:

(a) reviewing the Commission quality control and assurance documents (manuals, checklists, databases of findings and recommendations, review reports) corresponding to the 2015-2018 annual reviews of national and aggregated EU inventories and biennial reviews of national projections, policies and measures;

(b) reviewing relevant documentation (supporting studies, impact assessments and evaluations, and their quality assurance documentation) for the EU reference scenario (projections) of 2013 and 2016 (which were the basis for defining EU mitigation policies and measures for achieving the EU 2020 and 2030 targets), and for the EU policies and measures communicated to the UNFCCC during the audited period (i.e. in 2015 and 2017);

(c) interviewing staff of DG CLIMA, the JRC, the EEA, and Eurostat to obtain information on the management of EU data on emissions, projections, policies and measures, and analysing this information;

(d) analysing the replies to a questionnaire we sent to the six Member States in our sample to obtain additional information on the quality of and improvement to the national greenhouse gas inventories, projections, policies and measures;

(e) holding interviews with representatives of stakeholders[18] and three Member States, which we selected based on good practices identified in their replies to the questionnaire (Czechia, France and Poland). We sought to obtain information on the Commission reviews of the national and aggregated EU inventories, policies and measures, and on using infrastructures and modelling tools for the in situ and satellite monitoring of the greenhouse gases and of their flows.

[18] The UNFCCC Secretariat, the World Meteorological Organisation (WMO) and the Integrated Carbon Observation System (ICOS), an EU-wide project funded by the 7th Framework Programme for Research.

# Observations

## The Commission checks and reports EU emission data appropriately

**22** We assessed the extent to which the range of emission data reported by the EU meets international requirements. We also examined the operation and results of the quality review of the EU and Member States' inventories, and assessed whether the EU inventory had improved over time.

### EU reports meet and exceed international requirements

**23** The Kyoto Protocol requires the EU and each of its Member States to reduce their emissions of the seven main greenhouse gases by 20 % by 2020: carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride ($SF_6$), and nitrogen trifluoride ($NF_3$). The full range of gases and agreements is detailed in ***Figure C*** and ***Figure D*** of the ***Annex***. The IPCC guidelines specify methods for estimating the emissions and removals of these gases, originating from sources and sinks that must be considered under the Kyoto Protocol: Energy, Industrial Processes and Product Use, Agriculture, LULUCF and Waste. We found that the EU and the Member States complied with these requirements.

**24** The EU and the Member States' inventories are also required to include gases, sources and sinks which are not covered by the Kyoto Protocol emissions reduction commitments, but which fall under the UNFCCC reporting rules. These gases, sources and sinks are reported as "memorandum items". They concern emissions from international shipping, international aviation, and biomass for energy use. The aggregated EU inventory includes data on emissions for all of these memorandum items, in accordance with the UNFCCC reporting rules.

**25** The EU Monitoring Mechanism Regulation (see paragraph ***11***) establishes reporting rules beyond those set out in international agreements. The Regulation requires the Commission to report on black carbon (soot) emissions[19] and the non-$CO_2$

[19] Fine particulate matter which has both a cooling and a warming effect on the atmosphere.

impacts of EU civil aviation on climate[20]. The Commission publishes an EU aggregate for black carbon on the basis of data provided by the Member States. The Commission also reports on the non-$CO_2$ impacts of aviation[21]. According to the 2019 European Aviation Environmental Report, the non-$CO_2$ impacts of aviation exceed the $CO_2$ impacts. However, the scientific data currently available on such impacts is insufficient to quantify them precisely[22].

**26** The Commission also prepares data on emissions generated by the consumption of goods and services within the EU (including imports, but excluding exports). This information, called carbon footprint, allows for a complementary understanding of the economic drivers of air emissions, and in particular, of the EU impact on global emissions. It can encourage new approaches in policy-making and contribute to defining indicators of sustainable production and consumption[23].

**27** Eurostat has estimated the EU carbon footprint to be 7.2 tonnes of $CO_2$ per person (2017). However, the underlying calculation for the carbon footprint is complex[24].

## The Commission and EEA quality review of the reported emissions is satisfactory

**28** The Commission and EEA quality review process of national greenhouse gas inventories focuses on categories of emissions which, if over- or underestimated, could have a significant effect on Member States' inventories and on the aggregated EU inventory. The review process focuses on the quality criteria defined by the UNFCCC guidelines: transparency, completeness, consistency, comparability and accuracy. The review is complemented by the follow-up of previous Commission and UNFCCC recommendations. The UNFCCC also reviews the estimates submitted by the Member States and the Commission (see ***Figure 3***).

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[20] Such as aerosols and cloud formation, with an indirect warming effect on the atmosphere.

[21] Report COM/2018/716 from the Commission to the European Parliament and the Council "EU and the Paris Climate Agreement: Taking stock of progress at Katowice COP".

[22] The European Aviation Environmental Report of 2019. https://www.easa.europa.eu/eaer/.

[23] EEA technical report No 20/2013: "European Union $CO_2$ emissions: different accounting perspectives".

[24] See also Box 3 in our special report 16/2019 "European Environmental Economic Accounts: usefulness for policymakers can be improved".

**29** The review process consists of automated and manual checks. Automated checks identify missing data and potential discrepancies in emissions, emission factors and trends. Expert reviewers perform manual checks, judging whether the findings of the automated checks are real issues or not, and whether the data and methods are plausible, i.e. not leading to over- or underestimations of emissions. The reviewers work in teams, and the findings of a reviewer are always corroborated by a second reviewer.

**30** In the first step of the review process, reviewers verify estimates for all sectors of the greenhouse gas inventories: energy, industrial processes and product use, agriculture, LULUCF and waste. The reviewers document the results of their checks and communicate their observations to the Member States. In the second step, the reviewers verify the compliance issues not solved in the first step that would have a significant effect on the final emission estimate and may address recommendations on improving the inventories. However, the Commission reviewers do not document well their follow-up of previous Commission recommendations or their work on less significant issues detected by automated checks. We also found that the Commission's follow-up on unresolved issues identified by the UNFCCC reviews was based on incomplete information reported by the Member States. In 2018, for our selection of Member states, we found documentation that the Commission reviewers followed up on 11 issues raised in the 2016 UNFCCC review reports. However, the UNFCCC reviewers had identified 64 persisting issues in their 2016 reviews.

**31** The LULUCF sector (see ***Box 2***) is not covered by the EU 2020 target. While LULUCF is included in the first step of the review, the Commission does not currently make recommendations, nor follow-up on most UNFCCC recommendations addressed to Member States. The LULUCF data reported in the aggregated EU inventory indicates that this sector currently removes more $CO_2$ from the atmosphere than it emits (removal of 5.54 % of the EU emissions in 2017; see ***Figure 6***). Thus, the LULUCF sector is considered a net carbon sink. However, the LULUCF data has a relatively high statistical uncertainty[25]. Following the recent adoption of the LULUCF Regulation No 841/2018 that incorporates the sector in the 2030 target, the Commission plans to perform a complete review process for this sector starting with emissions reported in 2023 for the year 2021.

[25] See EU inventory report of 2019.

## Box 2

### Relevance and reporting of the LULUCF sector

Atmospheric $CO_2$ accumulates as carbon in vegetation and soils in terrestrial ecosystems. The land use, changes in land use and the forests affect the levels of atmospheric $CO_2$. Forests remove $CO_2$ from the atmosphere by growing additional vegetation above and below ground. However, when grasslands are ploughed, trees are harvested for energy, or a forest is replaced by grasslands or a settlement, $CO_2$ is emitted. All these removals and emissions of atmospheric $CO_2$ are reported in the greenhouse gas inventories, as part of the LULUCF sector.

The EU reports as part of its Kyoto Protocol and UNFCCC commitments emissions and removals from changes in forest lands (e.g. planting a forest or deforestation). If these changes store more $CO_2$ than they emit, the inventories present the total emissions reduced with the net removals.

The aggregated EU inventory reports additional data on emissions and removals from forest management, grasslands, croplands, wetlands and settlements, although this is not mandatory under the Kyoto Protocol. Under the new LULUCF Regulation, adopted following the entry into force of the Paris Agreement (see paragraph ***12***) emissions and removals from all these accounting categories will be part of the mandatory reporting requirements.

**32** The EU Monitoring Mechanism Regulation and its Implementing Regulation[26] require inventories to be verified for consistency with data from other sources such as data reported for the ETS, energy statistics, air pollution and fluorinated gases regulation. The Commission reviewers check the consistency of inventories with the required data, and use additional methods to verify that the estimations are reasonable[27].

**33** Satellite data, together with in situ monitoring data, has potential to improve activity data, verify reported data and provide additional information on emissions and removals for sectors where estimates tend to be less certain (see ***Box 3***).

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[26] Commission Implementing Regulation (EU) No 749/2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 (OJ L 203, 11.7.2014, p. 23).

[27] The reviewers compare the Member States' data with data on activity (existence and size i.e. output) relative to different emission sources. This data is taken from European and international statistics, from global industry organisations, from Eurocontrol and from EU projects aimed at collecting and modelling such activity data.

**Box 3**

### Data from satellites and from in-situ monitoring stations can help verify emission estimates

Activity-based greenhouse emission estimations can be verified through atmospheric observations using a combination of satellite monitoring, in situ monitoring stations and modelling. Projects are ongoing in the EU (e.g. two projects called "VERIFY" and "ICOS") to improve the quality of monitoring data. This could potentially enable the EU to perform verifications using this data.

*Satellite atmospheric monitoring services* can provide information on greenhouse gas concentrations and on activity data. Actual greenhouse gas emissions, and sources of emissions, can be determined by different modelling procedures.

*In situ monitoring stations* locally measure greenhouse gas emissions and removals and their flow with relatively high accuracy (compared to estimates). This may produce new information which can improve estimations for the agriculture, waste and LULUCF sectors, estimations which have a high degree of uncertainty.

*Land cover-based monitoring* using satellites such as Copernicus, and other remote sensing techniques is possible, and encouraged by the new LULUCF regulation (2018/841).

**34** One Member State (the United Kingdom) has used satellite data to verify data concerning the LULUCF sector; in particular, changes in forest coverage. It also performed verification of emission estimates using in situ monitoring data for certain gases in the national inventory. These verifications led to better estimation of methane and certain hydrofluorocarbon emissions, which had been overestimated in the inventories, and of nitrous oxide emissions, which had been underestimated. The Commission does not currently use satellite data to verify emission estimates or LULUCF data.

## The EU greenhouse gas inventory has improved over time

**35** The Commission reviewers draft observations when their checks identify instances where the Member States' estimations of greenhouse gas emissions are not in line with the reporting requirements, or where there are potential over- or underestimations of emissions.

**36** Member States either reply to such observations during the review, or revise their estimates. If the Member States' replies do not address the issues raised by the reviewers, the reviewers propose technical corrections of the estimates (adjusted figures meant to replace the original estimates) or recommendations for future improvements.

**37** For our sample of Member States, most of the observations raised during the Commission review were solved during the review process and in 2018 did not require Member States to correct estimates.

**38** The methodology for calculating greenhouse gas emissions (see ***Box 1***) has an inherent degree of uncertainty. The Member States reported an increased use of more precise ("higher tier") estimation methodologies for their most significant emission sources. Overall, the uncertainty of aggregated EU inventory decreased from 6.2 % in 2016 to 5.8 % in 2018. The UNFCCC also noted the Commission's progress in addressing the recommendations for the EU inventory raised in its previous review reports.

**39** The Commission (DG CLIMA) and the EEA took various measures to improve the quality of the Member States' inventories:

(a) organising regular working group meetings and capacity-building seminars with other Commission Directorates-General and the Member States to support the review process and help Member States improve their data;

(b) organising a number of capacity-building visits to interested Member States[28];

(c) drafting guidance documents, and encouraging knowledge-sharing on specific methodological issues;

(d) setting up a system for reviewing and improving the aggregated EU inventory, with the help of Member State and other experts.

**40** The six Member States we surveyed replied that the Commission's efforts to promote knowledge-sharing and guidance had been useful, and that the EU's review and associated guidance had contributed to improving their inventories. They also

[28] Bulgaria (2018), Estonia (2018), Cyprus (2018), Malta (2017 and 2018).

identified areas where they considered that additional guidance was needed (see ***Box 4***).

**Box 4**

**Support for additional guidance and information**

Certain Member States stated that additional guidance and information from the Commission would be useful in one or more of the following areas:

(a) accounting for gas leaks in international territories, by applying improved methods in respect of gas transport though pipelines;

(b) developing methods for emissions related to biogas installations using livestock manure, and related to the combustion of liquid fuels;

(c) improving statistical data on land use change;

(d) improving scientific information on carbon stored in the soil;

(e) improving the comparability of the databases of fluorinated gases.

## The EU needs better insight into future greenhouse gas emission reductions

**41** We examined the operation and the results of the Commission quality review of the EU and Member States' projections of future greenhouse gas emissions. We also assessed the extent to which the reported emission data is included in the 2020 and 2030 targets for the EU as a whole. In addition, we examined the Commission work on EU strategies, policies and measures for emission reductions.

### The Commission and EEA help Member States improve the quality of their projections

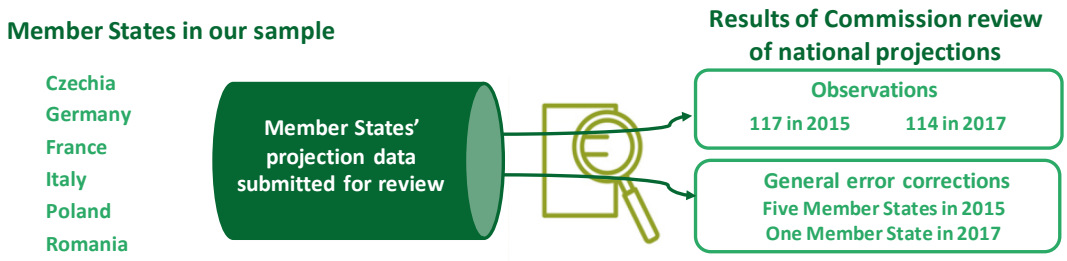
**42** Projections are an important part of the progress assessment and policy development cycle. They can indicate the need for additional mitigation policies and measures in order to reach the intended reduction target (see paragraph ***10***). Member States and the EU build their projections using modelling tools, based on assumptions and parameters, which include inter alia the effects of all their policies and measures on emissions (e.g. including policies linked to infrastructure and transport development).

**43** The Commission, assisted by the EEA, reviews and adds up Member States projections to give aggregated EU projections. We checked the design and operation of the quality review system to ensure that the projections comply with the international requirements, and improve over time.

**44** The Commission review of national projections in our sample of six Member States addressed all the quality principles identified in UNFCCC guidelines. In general, the reviewers reported on these criteria in a clear manner and communicated their findings to the Member States transparently, taking into account the findings of previous Commission reviews.

**45** The Commission review's results for the six Member States included in our sample showed that only one Member State needed to make a general error correction in 2017, compared to five in 2015. Commission checks were more thorough in 2017 than in 2015, and the number of findings arising in the review decreased marginally over the same period (see ***Figure 4***). The UNFCCC, in its reviews of national communications and biennial reports, made fewer recommendations in 2017 than in 2015 on Member States' projections, indicating that these had improved.

## Figure 4 – Improvements in projections for the six Member States in our sample




*Source*: Commission review results, as communicated to Member States.

**46** Five of the six Member States stated in reply to our questionnaire that they considered that the Commission's and the European Environment Agency's guidance and assistance (see ***Box 5***) had indeed facilitated improvements in national projections.

**Box 5**

### Most Member States valued the Commission's guidance on projections

Member States can decide which methods, modelling tools, assumptions and parameters they use for compiling their national projections. However, common approaches are useful to ensure a higher level of consistency when projections are aggregated at EU level. Every two years, the Commission develops a set of harmonised parameters. The Commission recommends that Member States use these parameters and their values. Ten of the 28 Member States used all of them.

Five of the six Member States in our sample considered that EU guidance was useful and sufficient. However, in their opinion, an EU modelling tool would add value and further improve the national projections. The Commission is already testing a new modelling tool called POTEnCIA. The Commission plans to provide Member States with open access to this tool.

## The Commission did not assess the risk of significant deviations from the EU reference scenario

**47** The EU projections aggregate Member State projections (based on each Member State's assumptions). The Commission also produces separate projections based on its own assumptions[29] regarding the evolution of the EU energy and transport systems and their impact on greenhouse gas emissions. These include specific sections on emission trends not related to energy, and on the various interactions among policies in these sectors. The Commission projections form the EU reference scenario. Based on the EU reference scenario and the greenhouse gas emission reduction objectives, the Commission assesses the need for additional EU mitigation policies and measures.

**48** The Commission produces the EU reference scenario[30] for the future under the assumption of full enforcement of the current mitigation policies and measures, and achievement of the emission reductions proposed by these measures. The information reported by the Commission to the UNFCCC indicates that the aggregated Member States' projections beyond 2023 show lower emission reductions than the Commission's 2016 reference scenario for the same period (see ***Figure 5***).

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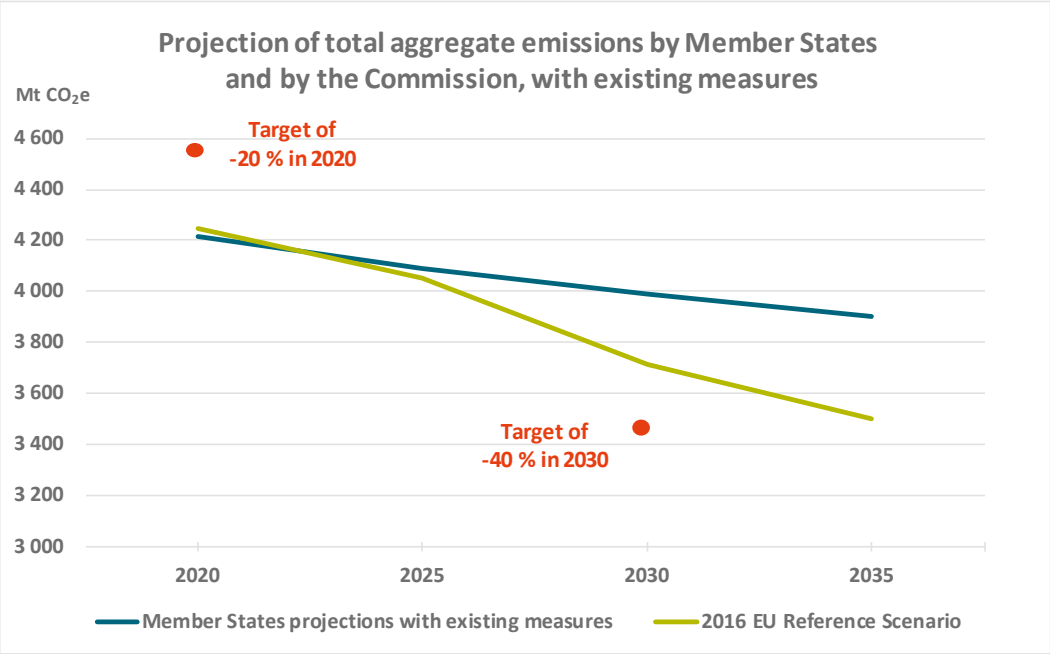
[29] The Commission consults all Member States when defining these assumptions.

[30] The latest EU reference scenario is from 2016. The previous one referred to 2013.

## Figure 5 – Commission projections in the 2016 EU Reference Scenario differ from aggregated Member States' projections in the medium term




*Source*: European Union's Seventh National Communication and Third Biennial Report to the UNFCCC (submitted in 2017).

**49** The EU agreed the current EU 2020 emission reduction targets in 2007 and achieved the target in 2014. We have already reported[31] that the 2030 and 2050 targets will not be achieved without significant additional efforts (see also ***Figure 1***).

**50** Beyond 2023, if the aggregated EU projections materialize, the EU mitigation policies and measures will need to be stricter than those proposed today based on the reference scenario. The UNFCCC recommends the use of a sensitivity analysis for projections[32]. The Commission makes such analyses when developing new policies. However, the Commission did not assess the risk of significant deviations from the EU reference scenario.

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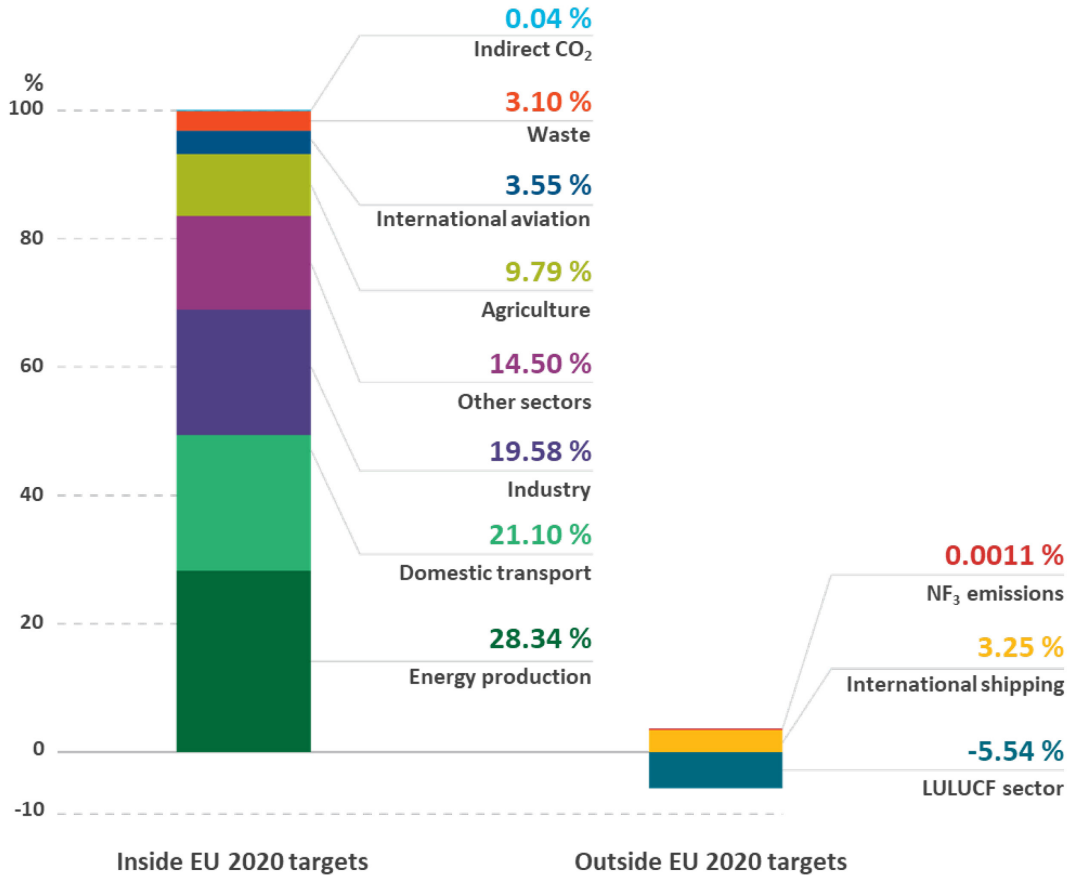
[31] Landscape review on EU action on energy and climate change, 2017.

[32] According to Report on the workshop on emission projections from Parties included in Annex I to the Convention (FCCC/SBSTA/2004/INF.15 of 20 October 2004), such analysis would be useful "because of the need to understand the impact of changes in key parameters and assumptions".

## EU 2020 emission targets cover most of the sectors for which data is available

**51** The EU has put in place targets against which it monitors emission reductions (see paragraph *07*). *Figure 6* below presents the data reported by the EU in its inventory, split into two groups: emissions included in the EU 2020 targets and emissions not included in these targets.

### Figure 6 – Emissions inside and outside the EU 2020 targets




*Source*: Aggregated EU inventory as reported to the UNFCCC in 2018 (emissions of 2017).

**52** The EU 2020 targets are in line with the Kyoto Protocol commitments and include most of the key sectors reported: energy, industrial processes and product use, agriculture and waste. In addition, the EU targets include international aviation (all outgoing flights), a memorandum item under the UNFCCC reporting rules and thus not part of the Kyoto Protocol commitments. This sector accounted for 3.55 % of EU emissions in 2017. The EU has included this sector in its overall reduction targets.

These emissions are relevant, as the International Civil Aviation Organization forecasts that, by 2040, they could grow by 300 % globally compared to 2005 levels[33].

**53** The EU has rules for monitoring and reporting emissions from shipping, aiming to complement inventory data (see paragraph ***11(d)***). International shipping is not currently part of the EU emission reduction targets, but the Commission worked with the International Maritime Organization, a UN agency responsible for regulating shipping, which has adopted an international commitment to reduce emissions by at least 50 % by 2050 compared to 2008 levels. As members of the International Maritime Organization, the EU Member States need to act on this commitment.

**54** The Commission in 2011[34] proposed reducing emissions from this sector by 2050. In 2018, the ships calling at European Economic Area ports[35] started to monitor and report their emissions, but no intermediate EU targets or reduction measures exist for international shipping. Emissions from international shipping, designated under the UNFCCC reporting rules as a memorandum item, represented 3.25 % of EU emissions in 2017. They are relevant because emissions from ships arriving in EU ports represent a significant part of global shipping emissions[36]. The International Maritime Organization estimates that global shipping emissions could grow between 50 % and 250 % by 2050[37].

**55** The EU 2020 targets did not include any commitments for the LULUCF sector. In its 2030 targets[38] the EU introduced the requirement that Member States have no increase in the emissions from this sector, compared to a baseline (known as the 'no

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[33] European Commission, Climate action, *Reducing emissions from aviation*.

[34] White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system", COM(2011) 144 final of 28 March 2011.

[35] Regulation (EU) 2015/757 of the European Parliament and the Council on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport (OJ L 123, 19.5.2015, p. 55).

[36] According to a 2009 study commissioned by DG Environment: "Technical support for European action to reducing greenhouse gas emissions from international maritime transport", using data from 2006, they represented 27 % of global shipping emissions.

[37] Third International Maritime Organization Greenhouse Gas Study, 2014.

[38] Regulation (EU) 2018/841.

debit rule'). Where an increase of emissions is accounted by a Member State, these should be entirely compensated (by an equivalent removal of $CO_2$ from the atmosphere through action in this sector, or by the deduction of the volume of the increase from the national annual emission allocations under the Effort Sharing Regulation (EU) 2018/842.

## The Commission has developed sectoral roadmaps covering almost 70 % of emissions

**56** Stable long-term strategies and roadmaps are crucial to contribute towards economic transformation, jobs, growth and the achievement of broader sustainable development goals, as well as to move in a fair and cost-effective manner towards the long-term goal set by the Paris Agreement (see paragraph ***12***)[39].

**57** The Kyoto Protocol requires parties to report on their long-term low-carbon development strategies[40]. The Commission presented an EU roadmap towards a low carbon economy by 2050 in 2011[41], setting out potential actions for reducing emissions and covering all sectors. The Commission developed it in line with the best-case scenario of the global EU strategy for 2050[42]. At the request of the European Parliament and the European Council, and as provided for by the Paris Agreement, the Commission presented at the end of 2018 a strategic long-term vision to become climate neutral by 2050[43]. This update includes the analysis of eight potential pathways to reduce emissions or achieve climate neutrality by 2050.

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[39] Recital (35) of Regulation (EU) 1999/2018 on the Governance of the Energy Union and Climate Action.

[40] In accordance with Article 2 of the Kyoto protocol and UNFCCC Decision 1/CP.16.

[41] The "Roadmap for moving to a competitive low carbon economy in 2050". Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2011) 112 final of 8 March 2011.

[42] "EU Renaissance: A successful roadmap to low-carbon Europe" of European Commission report "Global Europe 2050" (2012). https://ec.europa.eu/research/social-sciences/pdf/policy_reviews/global-europe-2050-report_en.pdf.

[43] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank: "A Clean Planet for All – A European strategic long-

**58** The Commission also developed several roadmaps for the development of sectors accounting for almost 70 % of emissions, such as for transport[44] and energy[45]. Such roadmaps define the long-term objectives for the sustainable development of these sectors, in accordance with the EU 2050 climate commitments, and set a direction for shorter-term sectoral policies and measures. However, there are no such specific roadmaps for other key sectors such as agriculture and LULUCF (see ***Box 6*** below).

**Box 6**

**The EU does not have long-term roadmaps for some key sectors**

For agriculture, a key part of the EU budget, the Commission does not have a long-term vision up to 2050. The EU Common Agricultural Policy is defined on a 7-year cycle. The current policy framework covers the period from 2014 until 2020, and the next one from 2021 to 2027. One of the aims of the Common Agricultural Policy is to contribute to climate action, but it does not contain any specific emission reduction commitments.

The current EU forests strategy also applies from 2013 until 2020: a relatively short period. The Commission has not yet published an update of this strategy. A medium- and long-term strategy would be a relevant further step, particularly in view of including the LULUCF sector in the 2030 targets.

## Reporting on EU policies and measures is incomplete

**59** According to Article 2(3) of the Kyoto Protocol, countries should strive to implement policies and measures to minimize the effects on climate. The UNFCCC guidelines require the countries to report every two years information on the estimated impacts of their mitigation policies and measures.

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term vision for a prosperous, modern, competitive and climate neutral economy", COM/2018/773 final of 28 November 2018.

[44] White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system", COM(2011) 144 final of 28 March 2011.

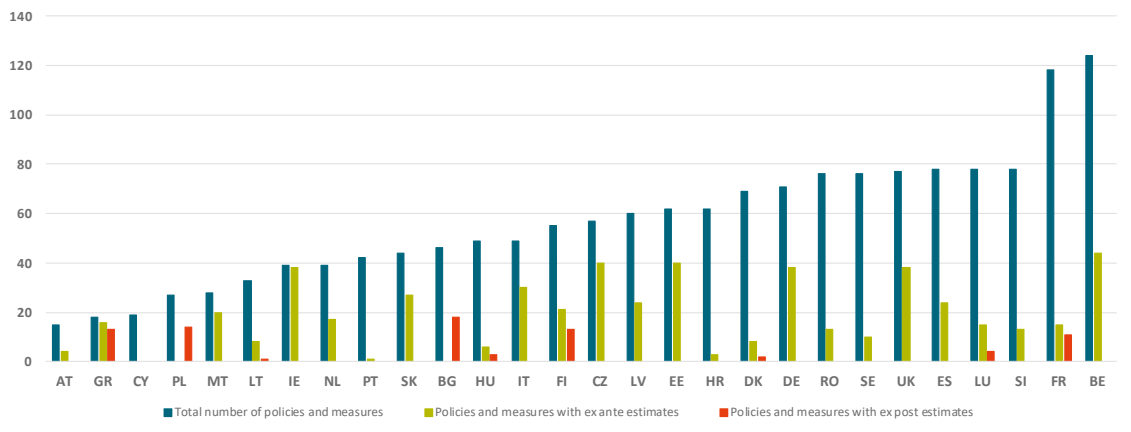
[45] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions "Energy roadmap 2050", COM(2011) 885 final of 15 December 2011.

**60** The Monitoring Mechanism Regulation and its implementing rules have put in place a quality assurance and quality control system to ensure that both the Commission and the Member States report the information required by the UNFCCC guidelines on their mitigation policies and measures. The reporting should include data on the estimated *ex ante* and *ex post* effects of the policies and measures (see paragraph ***09***). This information is relevant for monitoring the effectiveness of the mitigation policies and measures. Information on the effects of mitigation policies and measures is also relevant for projections (see paragraph ***42***).

**61** The Commission reviewers verified the quality of the information submitted by the Member States on their mitigation policies and measures in 2015 and 2017 (mandatory submission years). The review resulted in fewer findings relating to Member States' policies and measures in 2017 (416 findings) as compared to 2015 (714 findings).

**62** The Commission review identified that Member States reported in some cases little information on the estimated (*ex ante* or *ex post*) effects of the national mitigation policies and measures on emissions (see ***Figure 7***).

## Figure 7 – Member States did not report on the effects of some policies and measures (PaMs)




*Source*: EEA's policies and measures data viewer.

**63** As part of its policy-making process, the EU needs to assess *ex ante* and *ex post* any significant environmental and climate impacts of EU policies. The Commission estimated such effects *ex ante* (at the time of the impact assessment) for around two thirds of the EU climate mitigation policies and measures listed in the EU national communication and biennial report to the UNFCCC of 2017. The Commission evaluated these effects *ex post* for around two fifths of the climate mitigation policies and

measures, for which, at the time of their evaluation, sufficient time had passed to allow this.

**64** The United Nations Environment Programme also recommends using *ex ante* and *ex post* climate indicators[46]. Climate-related indicators may refer to quantified emission reductions achieved by policies and measures. Indicators are useful tools to inform policy making and decision-making and to measure progress towards a resource-efficient, low-carbon economy. However, the European Environment Agency signalled in 2014 that there was still a need for such indicators[47]. We found this still to be the case during our audit[48].

**65** The Commission reported to the UNFCCC, in the EU national communications and biennial reports of 2015 and 2017, a list of mitigation policies and measures and information on their effects, including estimates of the cumulative impact of EU policies and measures on emissions resulting from modelling. The UNFCCC reviews of the EU's national communications and biennial reports indicate that the Commission reported quantified impacts for some of the individual EU policies and measures communicated to the UNFCCC (see ***Table 1***). We note that, in 2017, the UNFCCC review reports indicated that the Commission had provided an estimation of impacts for fewer policies and measures than in 2015.

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[46] UNEP guide for Green Economy Indicators.

[47] EEA Technical Report 08/2014 "Digest of EEA indicators".

[48] In addition to this, in our special report 16/2019 "European Environmental Economic Accounts: usefulness for policymakers can be improved" we found that Commission had not clearly expressed data needs for environmental policy analysis.

## Table 1 – Results of the UNFCCC reviews on the EU's reporting of the estimated effects of its sectoral policies and measures

| Sectors | Policies and measures considered by UNFCCC review | Estimated mitigation impact by 2020 (kt $CO_2e$) | | Estimated mitigation impact by 2030 (kt $CO_2e$) | |
|---|---|---|---|---|---|
| | | 2015 | 2017 | 2015 | 2017 |
| **Cross-sectoral** | Climate and energy package 2020 | NE* | NE | NE | NE |
| | ETS | NE | NE | NE | NE |
| | ESD | NE | NE | NE | NE |
| **Energy** | Energy Union Strategy | NE | NE | NE | NE |
| | Renewable energy directive | NE | NE | NE | NE |
| **Energy Efficiency** | Energy efficiency directive | 750 000 | NE | NE | NE |
| | Energy performance of buildings directive | 185 000 | 185 000 | NE | NE |
| | Energy labelling regulation | NE | NE | NE | NE |
| **Transport** | Regulation on $CO_2$ emissions from cars | 24 900 | NE | 43 600 | NE |
| | Regulation on $CO_2$ emissions from vans | 1 900 | NE | 5 300 | NE |
| | Fuel quality directive | NE | 48 000 | NE | NE |
| **Industrial processes and product use** | F-gas regulation | NE | NE | 72 000 | 72 000 |
| | Mobile air-conditioning systems directive | 13 000 | 13 000 | NE | NE |
| | Industrial emissions directive | NE | NE | NE | NE |
| **Agriculture** | EU common agricultural policy | NE | NE | NE | NE |
| | Nitrates directive | NE | NE | NE | NE |
| | Soil thematic strategy | NE | NE | NE | NE |
| **LULUCF** | LULUCF accounting decision | NE | NE | NE | NE |
| **Waste** | Landfill directive | 44 000 | 44 000 | NE | NE |
| | Waste framework directive | 40 100 | 40 100 | NE | NE |

* NE = not estimated

*Source*: UNFCCC Secretariat's review reports of the EU national communications and biennial reports submitted by the Commission in 2015 and 2017.

# Conclusions and recommendations

**66** Our main audit question was "Does the Commission appropriately check the EU greenhouse gas inventory and the information on future emission reductions?" We found that the EU's emission data is appropriately reported, but that the Commission needs better insight into future greenhouse gas emission reductions.

**67** The greenhouse gas inventories of the Member States, aggregated to give an EU inventory, report emission estimates on all gases, sources and sinks defined in the Kyoto Protocol commitments and the Monitoring Mechanism Regulation. The aggregated EU inventories included memorandum items. Taken as a whole, EU rules and the Commission reporting to the Parliament and the Council meets and exceeds the requirements of international rules (paragraphs ***23*** to ***27***).

**68** The Commission, assisted by the EEA, reviews the Member States' inventories addressing the main sectors and key categories, and uses automated checks corroborated by expert judgement. The reviewers verify the parameters used for estimates with external sources of information. However, for the LULUCF sector, the reviewers do not perform the same types of checks as for other sectors.

**69** The LULUCF sector is particularly relevant and has been incorporated into the EU's 2030 targets in 2018. The aggregated EU inventory indicates that it is a net carbon sink in the EU, however, the statistical uncertainty around the data is high (paragraphs ***28*** to ***34***).

**70** The quality of the inventories has improved over time. For our sample of Member States, most of the observations raised during the Commission review were solved during the review process and, in 2018, the Commission did not require Member States to correct estimates. The overall level of uncertainty for the aggregated EU inventory decreased in the period 2016-2018 (paragraphs ***35*** to ***40***).

## Recommendation 1 – Improving the Commission review process for the LULUCF sector

The Commission should update its review guidelines for inventories to strengthen checks in the LULUCF sector and align them with those made in the other sectors.

**Timeframe: 2022.**

**71** The Commission and the EEA, also check the quality of Member State projections. The review identified fewer issues in 2017 compared to 2015, indicating an improvement in national projections. To date, the aggregated EU projections are based on national models and assumptions. The Commission will make available a modelling tool to harmonize the process for interested Member States (paragraphs ***42*** to ***46***).

**72** The Commission produces a separate EU reference scenario based on their own assumptions. The Commission makes sensitivity analyses when developing new policies. However, the Commission did not assess the risk of significant deviations from the EU reference scenario (paragraphs ***47*** to ***50***).

**73** The Commission uses the data from the main sources of emissions to assess progress towards the reduction targets. The 2020 target established at EU level excluded LULUCF emissions and removals, as well as emissions from international shipping (but included those from international aviation). The scope of the EU 2030 target has been extended to the LULUCF sector, but not to international shipping. The International Maritime Organization committed to halving emissions by 2050. However, there are no EU intermediate targets or reduction measures for this sector. Vessels calling to ports in the European Economic Area represent 27 % of emissions from international shipping. Studies project these emissions to increase significantly (paragraphs ***51*** to ***55***).

**74** The Commission presented in 2018 a Communication on achieving climate neutrality by 2050, covering all sectors. The Commission adopted long-term sectoral roadmaps covering almost 70 % of the emissions reported. Such specific roadmaps define the objectives for the sustainable development of these sectors, in accordance with the EU 2050 climate commitments, and set a direction for shorter-term sectoral policies and measures. However, the Commission did not propose specific roadmaps for certain key sectors such as agriculture and LULUCF (paragraphs ***56*** to ***58***).

**75** The Commission did not report estimates for some mitigation policies and measures' impacts on emissions. As a result, the reports to the UNFCCC do not present a complete view of the contribution of EU and national mitigation policies and measures to the intended emission reductions for 2020, 2030 and 2050 (paragraphs ***59*** to ***65***).

## Recommendation 2 – Improving the framework for future emission reductions

The Commission should improve the framework for future emission reductions by:

(a) assessing the case for introducing intermediate measures and milestones at EU level for international shipping in line with the global commitment to achieve at least 50 % reduction in emissions by 2050 in this sector.

(b) ensuring that the strategic plans for agriculture and LULUCF contribute to achieving the 2050 reduction targets, and verifying that Member States set out appropriate policies and measures for these sectors in line with their long term strategies.

(c) assessing and reporting to the UNFCCC the impacts on emissions of key EU policies and measures, such as the Emissions Trading Scheme, the Regulations on $CO_2$ emissions from road transport, and other sectors covered by the Effort-Sharing Decision.

**Timeframe: 2023.**

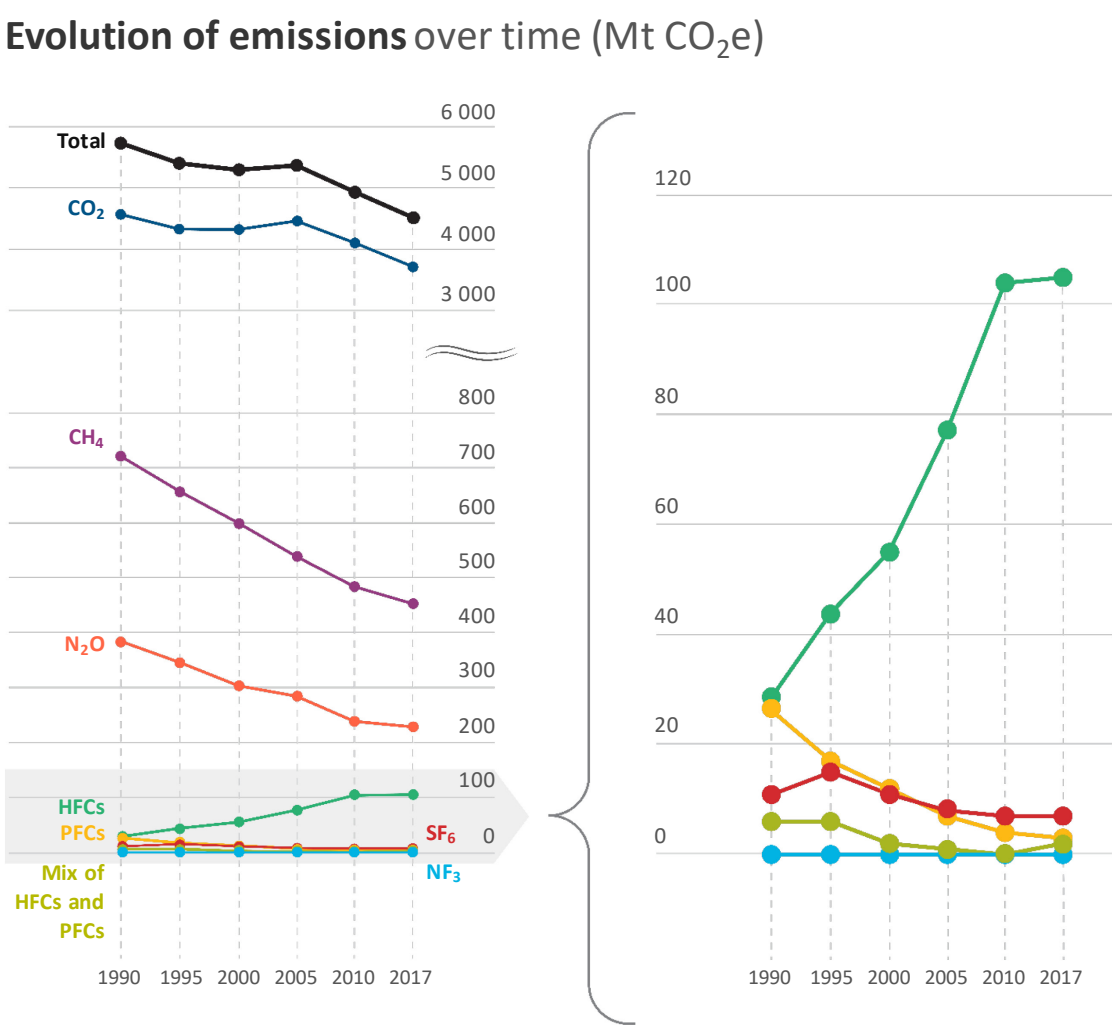
This Report was adopted by Chamber I, headed by Mr Nikolaos MILIONIS, Member of the Court of Auditors, in Luxembourg on 25 September 2019.

*For the Court of Auditors*

Klaus-Heiner LEHNE
*President*

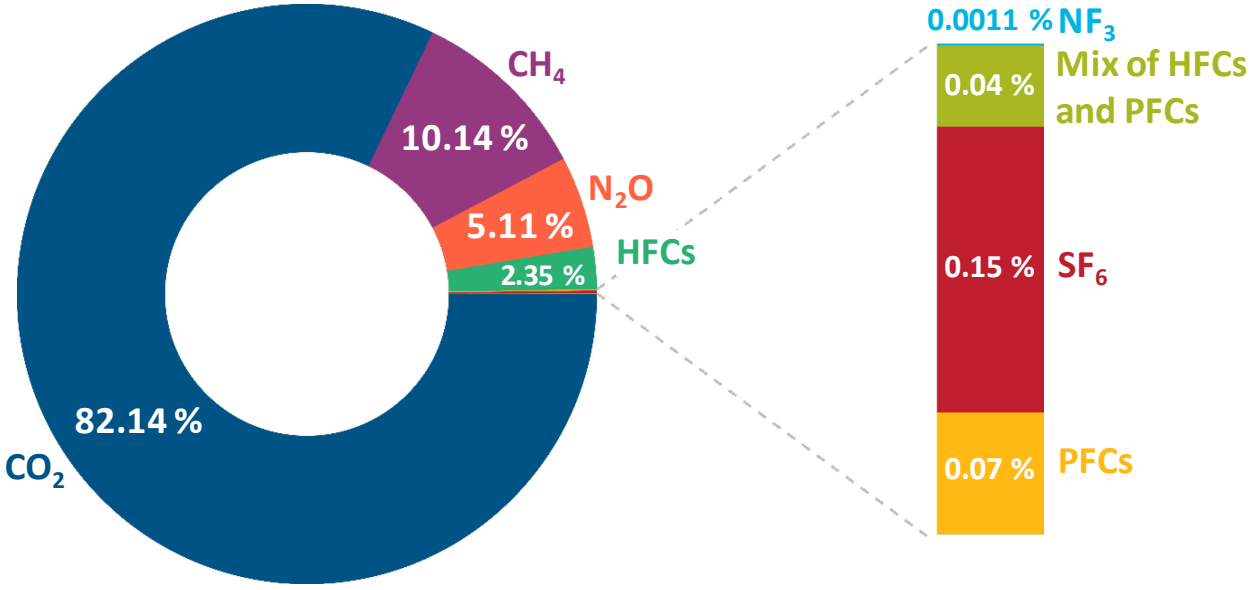
# Annex – Information on greenhouse gases

## Figure A – Emissions of main greenhouse gases decreased in general since 1990



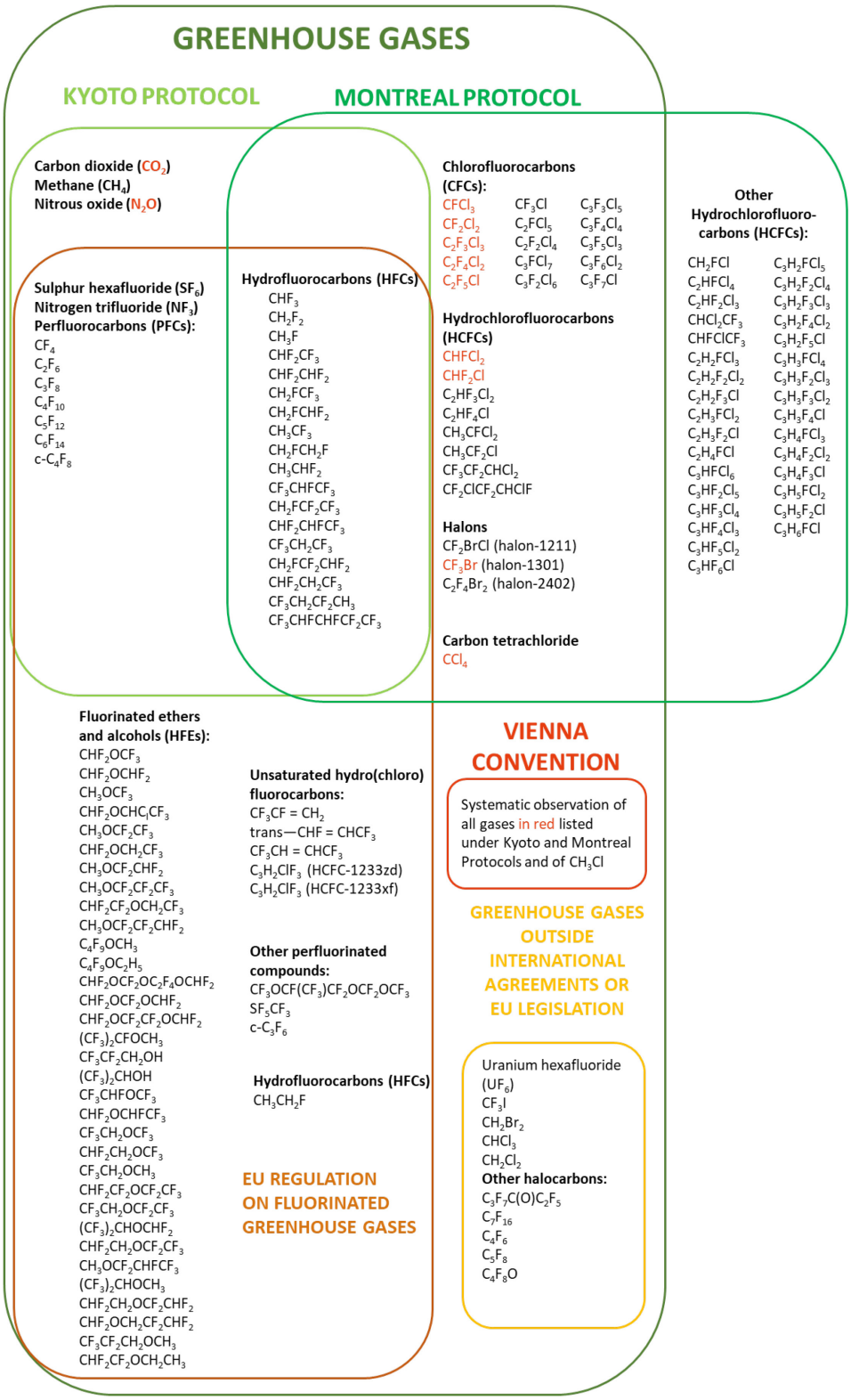

*Source*: Aggregated EU inventory reported to the UNFCCC in 2019 (1990-2017 data).

**Figure B – 2017 emissions of greenhouse gases by type of gas in $CO_2$ equivalents**




*Source*: Data on emissions from the aggregated EU inventory reported to the UNFCCC in 2019.

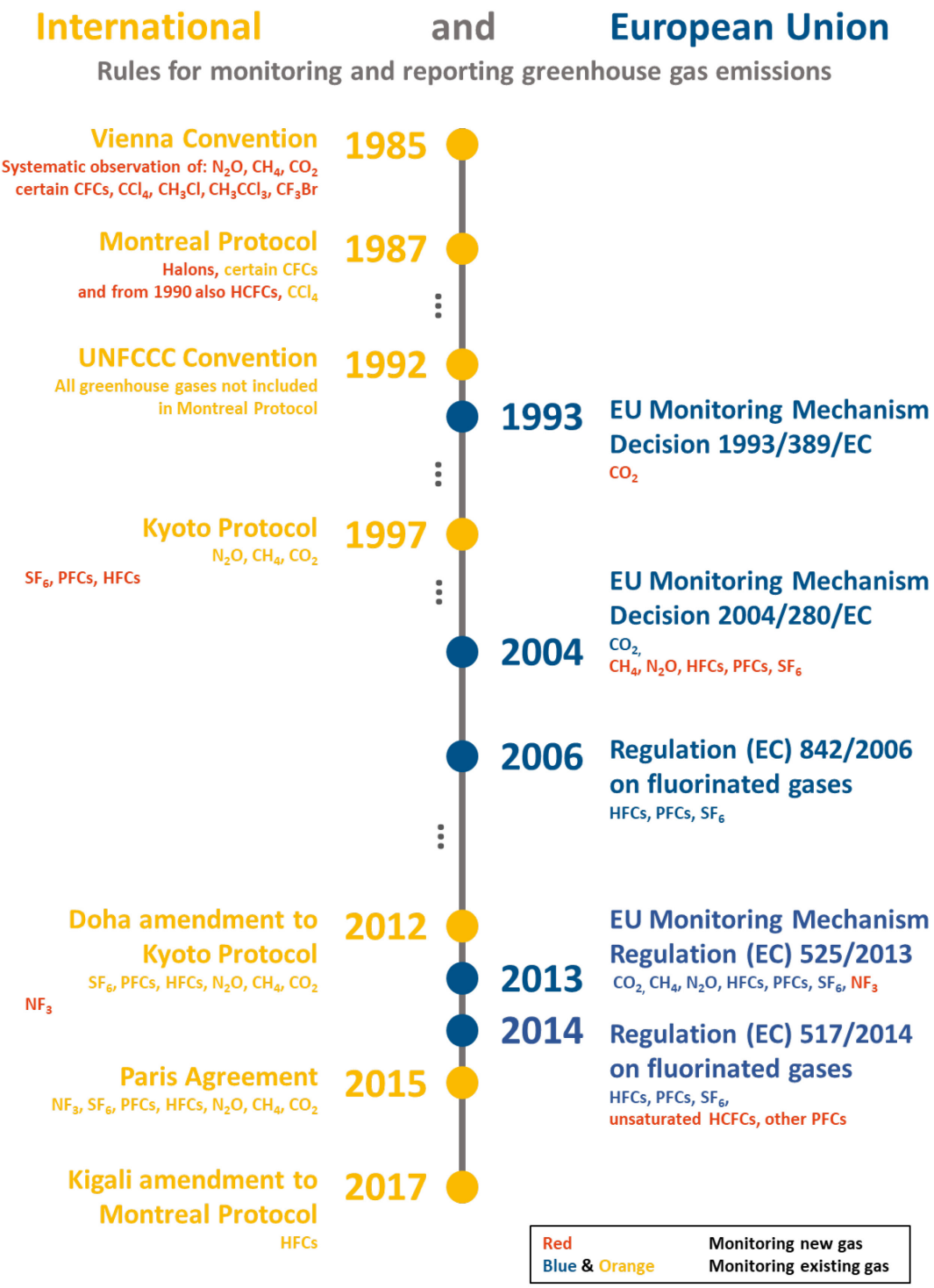
## Figure C – Most greenhouse gases are monitored and reported




*Note:* The Montreal Protocol on Substances that Deplete the Ozone Layer is the landmark multilateral environmental agreement that regulates the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances (UN Environment).

*Source*: EU legislation and international treaties.

## Figure D – International and EU monitoring and reporting rules




*Source*: European Court of Auditors.

# Acronyms and abbreviations

**CFCs:** Chlorofluorocarbons

**$CH_4$:** Methane

**$CO_2$:** Carbon dioxide

**DG CLIMA:** European Commission's Directorate-General for Climate Action

**EEA:** European Environment Agency

**ETS:** Emissions Trading Scheme

**Halons:** Compounds of carbon with bromine and other halogens

**HCFCs:** Hydro chlorofluorocarbons

**HFCs:** Hydrofluorocarbons

**HFEs:** Fluorinated ethers and alcohols

**IPCC:** The Intergovernmental Panel on Climate Change

**JRC:** The European Commission's Joint Research Centre

**LULUCF:** Land use, land use change and forestry

**$NF_3$:** Nitrogen trifluoride

**$N_2O$:** Nitrous oxide

**PaMs:** Policies and measures

**PFCs:** Perfluorocarbons

**$SF_6$:** Sulphur hexafluoride

**UNFCCC:** The United Nation's Framework Convention for Climate Change

# Glossary

**Carbon sink:** any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere. In particular forests, soil and oceans, remove and store $CO_2$ from the atmosphere, i.e. are carbon sinks.

**Emissions trading scheme:** an international emissions trading system put in place within the European Union. It aims at reducing emissions by setting a cap on the total amount of certain greenhouse gases that can be emitted by installations covered by the system. The cap is reduced over time so that total emissions fall.

**EU emissions reduction targets:** Objectives to reduce emissions by a certain extent and by a certain date (e.g. by 20 % by 2020).

**EU quality control and assurance (Commission review):** planned system of review procedures to ensure that data reported satisfy certain quality criteria and represent the best possible estimates. Quality control procedures are internal (by the Commission for the aggregated EU inventory), while quality assurance review is performed by an external reviewer (by the Commission for Member States' inventories).

***Ex ante* and *ex post* estimation of the climate impacts of policies and measures:** The EU needs to evaluate impacts of its policies and measures, including climate impacts (effects), before adopting them *(ex ante)* and after implementation *(ex post)*.

**Greenhouse gases:** Greenhouse gases are emissions of gases and other gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.

**Greenhouse gas inventories:** Greenhouse gas inventories are recorded estimates of past greenhouse gas emissions, accompanied by descriptive information on their compilation and quality assurance.

**Greenhouse gas projections:** Projections represent estimates of future greenhouse gas emissions, accompanied by descriptive information on their compilation and quality assurance.

**LULUCF:** Greenhouse gas inventory sector that covers emissions and removals of greenhouse gases resulting from direct human-induced land use, land-use change and forestry activities.

**Mitigation policies and measures:** Policies and measures are actions put in place to reduce emissions and thus mitigate climate change.

**National communication and biennial report:** Report to the UNFCCC secretariat detailing information on inventories, projections, policies and measures.

**Sensitivity analysis:** An analysis of the impact of the parameters and of the assumptions used on the outcome of the projection.

# REPLIES OF THE COMMISSION TO THE SPECIAL REPORT OF THE EUROPEAN COURT OF AUDITORS

## "EU GREENHOUSE GAS EMISSIONS: WELL REPORTED, BUT BETTER INSIGHT NEEDED INTO FUTURE REDUCTIONS"

## EXECUTIVE SUMMARY

II. The Commission agrees that further improving insights in future greenhouse gas emission reductions is of importance and continues to undertake such efforts. The Commission pays high attention to this task and is also in a continuous dialogue with Member States to further improve the capacity to project future emissions and the impact of policies.

The Commission is also committed to continue improving the quality of the EU greenhouse gas inventory.

IV. The Commission applies the EU reference scenario as a baseline, integrating existing policies, for assessing future policies at EU level. When developing new policies, the Commission is basing its analysis on projections, including sensitivity analysis, and alternative assumptions in the projections used for the assessment of these policy proposals to see what their impact is on achieving the objective under consideration for that policy.

VI. In 2011, the Commission developed an economy-wide roadmap that included all sectors, as well as separate specific sectoral roadmaps for transport and energy.

The more recent Communication on "*A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy*", adopted in 2018, covers all sectors including agriculture; land use, land use change and forestry (LULUCF); energy and transport.

VII. The Commission agrees that regular and adequate assessment of the effects of Member States and EU policies and measures on greenhouse gas emissions is important to evaluate their progress and effectiveness. While there are particularities of Union policies and their implementation in Member States that create challenges for a Union-wide comparison, the Commission will continue to work with Member States on improving estimates of the impact of policies and measures on greenhouse gas emissions.

VIII. The Commission accepts the recommendations and refers to its replies in the conclusion and recommendations section of this report.

## OBSERVATIONS

**25**. The Commission has initiated a study on non-$CO_2$ effects of aviation under the mandate provide by Article 30(4) of the revised EU Emissions Trading Scheme (ETS) Directive. The objective is to take stock of the most recent research on these impacts and on potential policy action to reduce them. Results are expected during the first half of 2020.

**30**. The review experts follow up consistently on the implementation of recommendations made by the United Nation's Framework Convention for Climate Change (UNFCCC) to the Member States according to the information reported by the latter, as laid down in the Monitoring Mechanism Regulation.

**31**. It could be noted that such statistical uncertainties are not limited to the LULUCF inventory sector. For example, uncertainties are also high in the agriculture and waste sectors. The Commission

follows up on the UNFCCC's recommendations to Member States, which may affect the aggregated EU inventory.

**Box 2 - Relevance and reporting of the LULUCF sector**

Member States already report individually on LULUCF under the Kyoto Protocol and in accordance with an EU Decision since 2013.

Moreover, the new regulation extends the scope from forests to all land uses, including wetlands from 2026.

**Box 4 - Support for additional guidance and information**

The Commission is helping Member States to improve their systems to monitor and mitigate emissions from land-use and land use change, such as from grassland to croplands.

The Commission also supports a specific monitoring tool, LUCAS (land use/cover area frame statistical survey), as an EU-wide source of data on land use change and soil organic carbon.

The European Environment Agency (EEA) is currently developing recommendations on how to make use of the fluorinated greenhouse gas (F-gas) data reported under the EU F-gas Regulation to contribute to national Greenhouse gas inventories and the EU's reporting of F-gas emissions to the UNFCCC.

**The EU needs better insight into future greenhouse gas emission reductions**

**47**. The Commission shares its EU reference scenario assumptions, discusses them comprehensively with Member States in an iterative process, and adapts them in a coherent manner when needed.

**48**. The reference scenario shows what existing policies and measures and EU legislation would achieve.

Member States' aggregated projections do not always meet all future EU legislated targets, and thus may indicate that additional actions will be needed in Member States to achieve agreed legislation.

**50**. The Commission applies the EU reference scenario as a baseline, integrating existing policies, for assessing future policies at EU level. When developing new policies, the Commission is basing its analysis on projections, including sensitivity analysis and alternative assumptions in the assessment of these policy proposals to see what their impact is on achieving the objective under consideration for that policy. For example, the impact assessment accompanying the 2050 Energy Roadmap includes a sensitivity analysis looking at Gross Domestic Product (GDP) and Energy Prices (see section 2.4.4 of SEC(2011) 1565/2).

In applying this approach for its projections, the Commission follows its Better Regulation Guidelines.

**53**. The Commission is committed to support the swift implementation of the initial greenhouse gas strategy adopted by the International Maritime Organization.

**Box 6 - The EU does not have long-term roadmaps for some key sectors**

The Communication on *"A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy"* covers all sectors, including LULUCF and agriculture.

**62**. The Commission and the EEA are supporting Member States to improve their reporting of ex ante and ex post effect of national mitigation policies by providing guidance and methodologies for quantifying costs and effects of such policies. The Commission is also organising sharing of good practices for ex post evaluation among Member States.

**63**. The Commission agrees that regular and adequate ex ante and ex post assessment of the effects of EU policies and measures on greenhouse gas emissions is important to evaluate their progress and effectiveness.

To assess the impacts of EU mitigation policies, the Commission and the EEA publish annual climate action progress reports assessing EU progress towards its Greenhouse gas emission reduction targets with details on EU-wide, sector and Member State emission trends.

However, owing to the complexity of the EU policymaking system and the particularities of each EU policy, aggregated data per EU policy as implemented by Member States often cannot be compiled in a useful way at the EU level.

There are several reasons for this complexity. The impact assessments accompanying Commission legislative proposals contain quantification of estimated climate impacts for policies aiming to reduce greenhouse gas emissions. Yet the final results adopted in legislative procedure may not correspond to any of the options initially assessed by the Commission due to changes introduced by the co-legislators. Different policies may also have overlapping impacts. Moreover, some EU policies represent minimum level of ambition, which may be increased by some Member States when they implement the legislation on national level.

**65**. For the reasons explained above, full quantification of effects of policies may not always be possible for evaluating and reporting. Therefore, the Commission has also reported to the UNFCCC on a broad range of EU policies that reduce climate impacts to demonstrate the comprehensiveness of EU climate action.

## CONCLUSIONS AND RECOMMENDATIONS

**68**. The Commission has begun discussions with the EEA on how to better integrate LULUCF inventory checks alongside the same checks for other sectors (i.e. second step of the EU review process).

**Recommendation 1 – Improving the Commission review process for the LULUCF sector**

The Commission accepts the recommendation.

The Commission has begun discussions with the EEA on how to better integrate LULUCF inventory checks alongside the same checks for other sectors, thereby providing a unified and standardised approach. However, this effort will depend on sufficient resources being available under the next multiannual financial framework, which is not yet decided.

**72**. The Commission applies the EU reference scenario as a baseline, integrating existing policies, for assessing future policies at EU level. When developing new policies, the Commission is basing its analysis on projections, including sensitivity analysis and alternative assumptions in the assessment of these policy proposals to see what their impact is on achieving the objective under consideration for that policy. For example, the impact assessment accompanying the 2050 Energy Roadmap includes a sensitivity analysis looking at GDP and Energy Prices (see section 2.4.4 of SEC(2011) 1565/2).

In applying this approach for its projections, the Commission follows its Better Regulation Guidelines.

**74**. Both the EU roadmap presented in 2011, as well as its more recent Communication on "*A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy*", adopted in 2018, cover all sectors including agriculture, LULUCF, energy and transport.

**75**. On the ETS, the Commission did not provide quantified estimates on the impacts of emissions since 2005 to the UNFCCC so far. Given that the EU ETS emissions have been consistently below the cap, which decreases every year, the ETS is fulfilling its objective to contribute to the overall EU emissions targets. There has been a significant decrease of emissions over the course of phase 3 (2013-2020).

**Recommendation 2 – Improving the framework for future emission reductions**

**a)** The Commission accepts the recommendation.

In line with the EU ETS Directive[1], action from the International Maritime Organisation or the European Union should start, including preparatory work on adoption and implementation and due consideration being given by all stakeholders.

**b)** The Commission accepts the recommendation.

The Commission agrees that the development of policies for key sectors, such as agriculture and LULUCF, should be consistent with the long-term perspective as presented in the Commission vision for the EU to become climate neutral by 2050. This long-term vision will inform future EU policies linked to agriculture and LULUCF.

Agriculture and LULUCF are an integrated part of the national energy and climate plans (NECPs) that Member states have to prepare and regularly update. Member States submitted draft NECPs in January 2019, which were thoroughly assessed by the Commission by June 2019.

Moreover, Member States have to submit long-term strategies to meet their commitments under the UNFCCC and the Paris Agreement, including sectoral aspects, by 1 January 2020.

In addition, the Commission in the context of the Common Agricultural Policy (CAP) has proposed that Member States prepare CAP strategic plans in the coming years

**c)** The Commission accepts the recommendation.

The Commission agrees that regular and adequate reporting and assessment of the effects of EU climate policies and measures on greenhouse gas emissions is important to evaluate their progress and effectiveness.

The Commission assesses the impacts of EU mitigation policies and measures on emissions ex ante. It also regularly conducts ex post evaluations, in particular when preparing policy revisions. It is working continuously to improve methodologies for assessment of the mitigation effects of individual policies.

The Commission is currently finalising a report to the UNFCCC. It expects to complete the following report by early 2023.

[1] Recital 4 of Directive (EU) 2018/410.

# Audit team

The ECA's special reports set out the results of its audits of EU policies and programmes, or of management-related topics from specific budgetary areas. The ECA selects and designs these audit tasks to be of maximum impact by considering the risks to performance or compliance, the level of income or spending involved, forthcoming developments and political and public interest.

This performance audit was carried out by Audit Chamber I Sustainable use of natural resources, headed by ECA Member Nikolaos Milionis. The audit was led by ECA Member Nikolaos Milionis, supported by Kristian Sniter, Head of Private Office and Matteo Tartaggia, Private Office Attaché; Robert Markus, Principal Manager; Oana Dumitrescu, Head of Task; Lucia Roşca, Liia Laanes, Natalia Krzempek and Bertrand Tanguy, Auditors. Richard Moore and Michael Pyper provided linguistic support.

*From left to right:* Kristian Sniter, Oana Dumitrescu, Michael Pyper, Nikolaos Milionis, Matteo Tartaggia, Lucia Roşca, Natalia Krzempek.

# Timeline

| Event | Date |
|---|---|
| Adoption of Audit Planning Memorandum (APM) / Start of audit | 4.7.2018 |
| Official sending of draft report to Commission<br>(or other auditee) | 28.6.2019 |
| Adoption of the final report after the adversarial procedure | 25.9.2019 |
| Commission's (or other auditee's) official replies received in all languages | 24.10.2019 |

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**The EU takes part in the global efforts to reduce the greenhouse gas emissions, aiming for a 20 % reduction of its emissions by 2020, a 40 % reduction by 2030 and an 80-95 % reduction by 2050.**

**The Commission is responsible for reviewing the data reported by Member States on the current and projected emissions and for proposing EU policies and measures to reach the reduction targets.**

**We found that the EU emission data is appropriately reported, but that the EU needs better insight into future greenhouse gas emission reductions.**

**We make recommendations aimed at improving the Commission review process of greenhouse gas emission data for the land use, land-use change and forestry (LULUCF) sector and the framework for future emission reductions.**

**ECA special report pursuant to Article 287(4), second subparagraph, TFEU.**

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