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Trends and projections in Europe 2018

Tracking progress towards Europe's climate and energy targets

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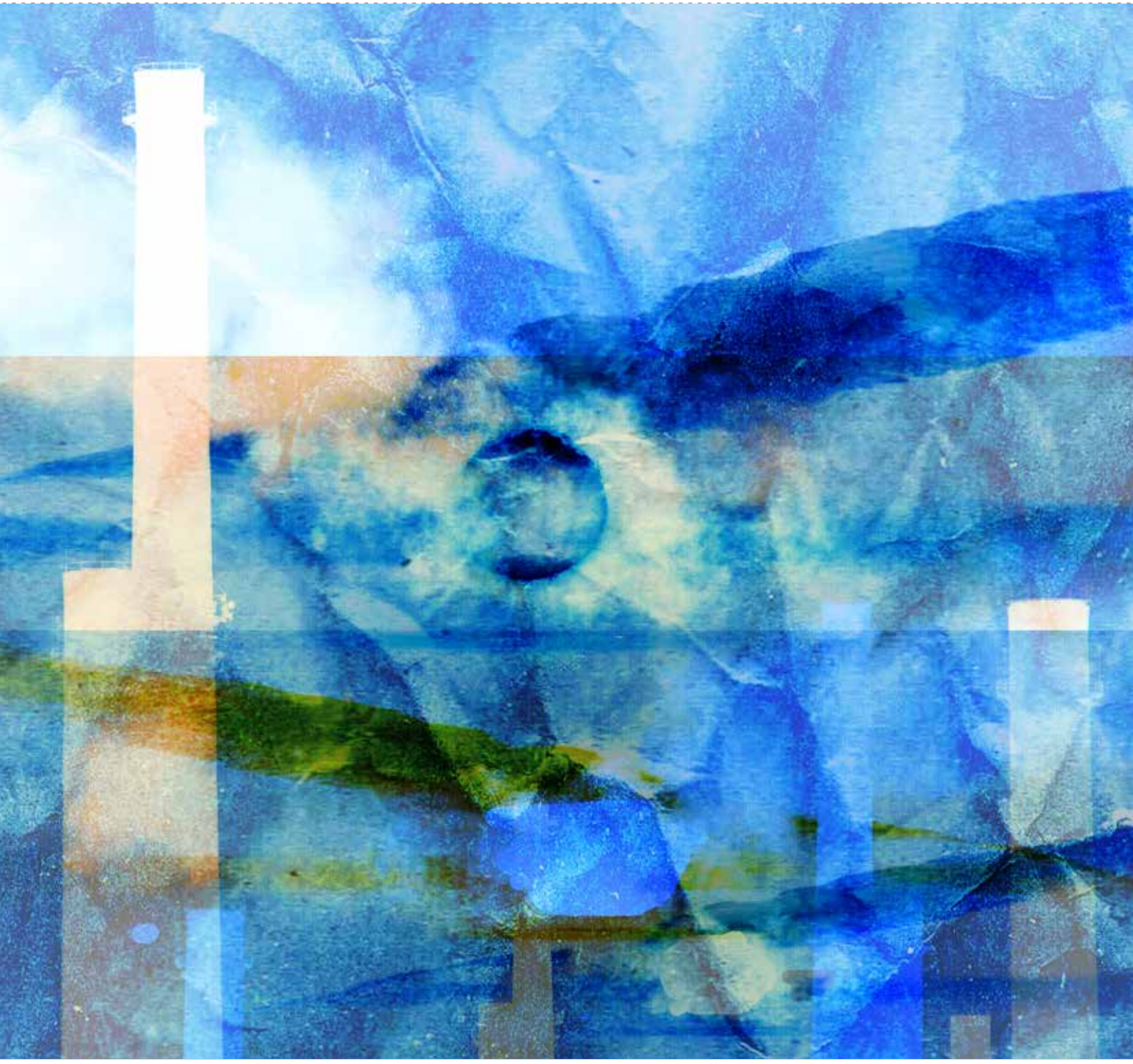

European Environment Agency

Trends and projections in Europe 2018

Tracking progress towards Europe's climate and energy targets

European Environment Agency

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

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

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The overall coordination of the report was carried out by Melanie Sporer, Suzanne Dael (EEA) and the ETC/ACM task manager, Sabine Gores (Öko-Institut).

The authors were, in alphabetical order, Suzanne Dael (EEA), Hannah Förster, Sabine Gores, Christian Nissen (Öko-Institut), Larissa Pupo Nogueira de Oliveira, Nele Renders (Vito), Melanie Sporer and Mihai Tomescu (EEA).

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Executive summary

With sights now set on the new 2030 targets for greenhouse gas emission reductions, renewable energy and energy efficiency, renewed efforts towards achieving these targets will be necessary.

Following the political agreements between the European Parliament, the Council of Ministers and the European Commission reached in June 2018, the EU now has full clarity on its climate and energy targets for 2030. These include:

- a binding target of at least a 40 % reduction in domestic greenhouse gas (GHG) emissions (compared with 1990 levels), with binding annual GHG emission reduction targets for EU Member States from 2021 to 2030 for the sectors not covered by the EU Emissions Trading System (ETS);
- a binding target to increase the share of renewable energy sources (RES) in the EU to at least 32 % of gross final energy consumption by 2030;
- an indicative target of at least a 32.5 % improvement in energy efficiency in 2030 at EU level (compared with the Commission's 2007 Energy Baseline Scenario).

According to Member States' most recent projections reported in 2017 and 2018, an EU-wide **reduction in GHG emissions** by 2030 may reach 30 % below 1990 levels based on existing mitigation measures, and 32 % when additional planned mitigation measures are considered. The projected reductions fall short of the 40 % domestic reduction target for 2030. Future cuts in GHG emissions are mainly expected in the sectors covered by the ETS; in the sectors covered by the Effort Sharing legislation, the projected reductions for 2030 are smaller. Only six Member States project emission levels in Effort Sharing sectors below their respective 2030 Effort Sharing targets. Achieving these targets will require new and focused efforts across Europe to address emissions in the Effort Sharing sectors (e.g. road transport, buildings and agriculture).

Increasing the current average pace of **renewable energy deployment** across Europe to 2030 would not enable the EU to achieve the new RES target of 32 % at the end of the next decade. So far, the EU has steadily increased the contribution of RES to gross final energy consumption, but annual increases in RES shares have been relatively small in the last 5 years. The growth rate has slowed in some years, and renewed RES uptake will be necessary to ensure that the EU meets its 2030 target.

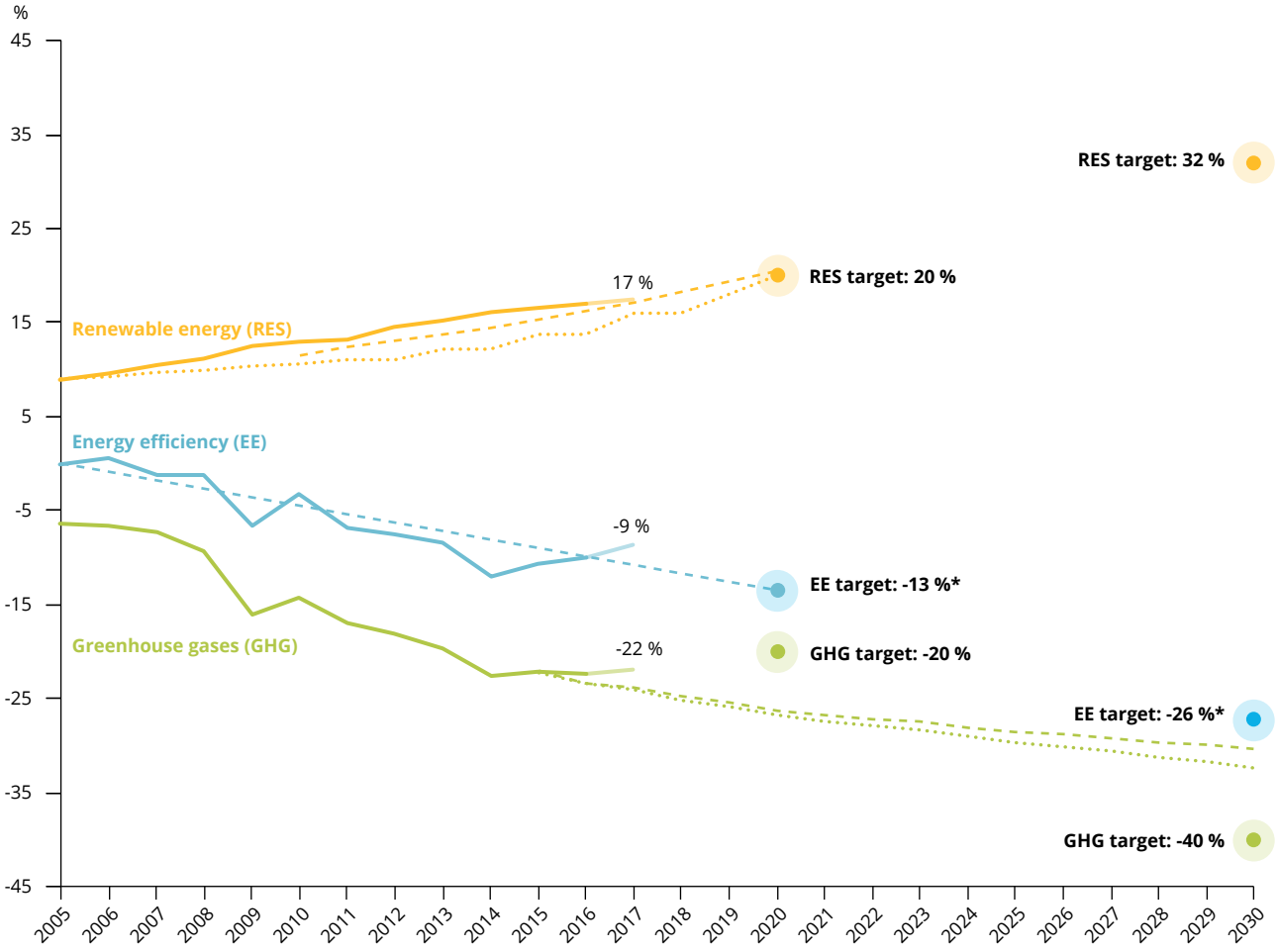
Good progress towards the **energy efficiency** targets was made between 2005 and 2014, but the pace has slowed in recent years as energy consumption has grown. This makes it more uncertain that the EU's 2020 energy efficiency objectives and, to an even greater degree, the target for 2030 will be met. Member States will need to implement relevant policies and measures to keep energy consumption in check on the path to the 2030 target.

The package of legislation proposals on climate and energy agreed at EU level in recent months, as well as further pieces of legislation still under discussion, must be rapidly implemented by Member States to set the EU on the right track for achieving its 2030 goals. By the end of 2018, Member States will have submitted their first draft national energy and climate plans (NECPs), which shall include climate and energy objectives and policies for 2021-2030 that take the longer term perspective into account.

Progress towards the three EU targets on climate and energy for 2020 is slowing down, in particular due to rising energy consumption.

While previous years' reports have confirmed that the EU was overall on track to meet its climate and energy targets for 2020 (despite contrasting situations at Member State level), preliminary data for 2017 reveal that this is no longer as widely the case (see Figure ES.1). In 2017, GHG emissions increased, although only moderately; progress in the deployment of renewable energy slowed; and, for the first time since 2010, primary and final energy consumption rose to levels above the trajectory required to meet the 2020 targets. Current projections indicate narrower, but expected, achievement of the 2020 targets for emission reductions and renewable energy. Recent increasing trends in energy consumption will need to be reversed if the 2020 target for energy efficiency is to be met.

Figure ES.1 EU progress towards 2020 and 2030 targets on climate and energy



Renewable energy (RES). Share of renewable energy in gross final energy consumption
Trajectory from national action plans
Trajectory from Renewable Energy Directive

Energy efficiency (EE). Primary energy consumption reduction compared to 2005 levels
Linear target path

Greenhouse gases (GHG). Emissions reduction compared to 1990 level
GHG projections with existing measures
GHG projections with additional measures

Notes: * The energy efficiency targets for 2020 and 2030 are defined as absolute targets, set at 20 % and 32.5 % below the level in primary and final energy consumption projected for 2020 and 2030 in the European Commission's 2007 Energy Baseline Scenario. In this figure, the target is expressed as a relative change compared with 2005 levels of primary energy consumption in the EU to show the required reduction in primary energy consumption over time. The year 2005 was chosen because it is used as a base year for GHG emissions (in the EU ETS and under the Effort Sharing Decision (ESD)) and renewable energy targets; this base year is not set in the energy efficiency legislation. It also corresponds to a peak in energy consumption in the EU.

The 'with existing measures' (WEM) scenario reflects existing and adopted policies and measures, whereas the 'with additional measures' (WAM) scenario considers the additional effects of planned measures reported by Member States.

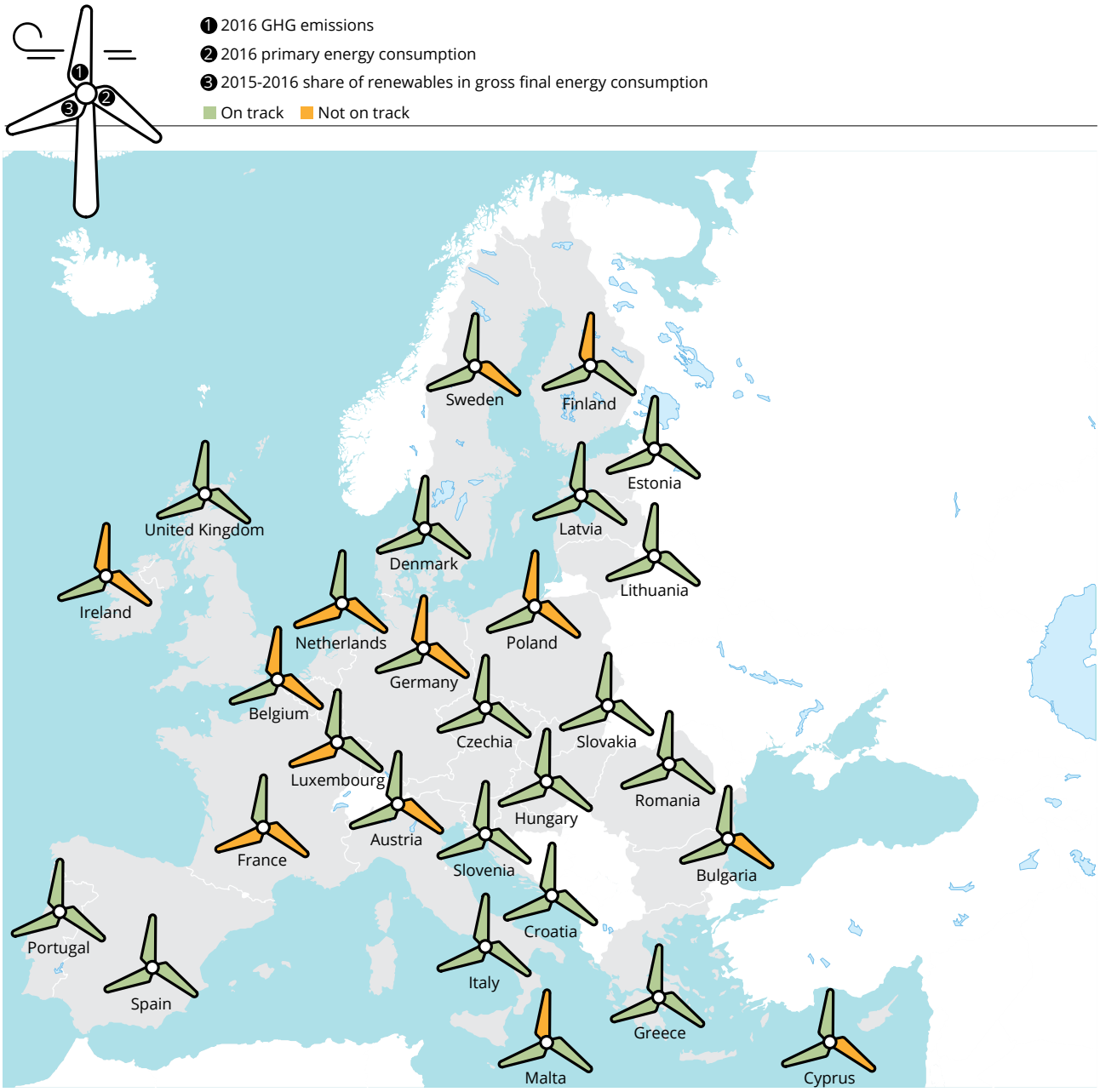
Sources: EC, 2013a, 2007; EEA, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2011; EU, 2012, 2009a; Eurostat, 2018a, 2018b, 2018c.

At the national level, 15 Member States were considered on track towards all three of their national climate and energy targets for 2020, based on their progress up until 2016. For 2017, preliminary estimates indicate that this number declined by a further six Member States (see Table ES.1 for further details).

Greenhouse gas emissions

In 2016, the EU achieved a **reduction in GHG emissions** of 22.4 % below 1990 levels. Approximated estimates for emissions in 2017 indicate an increase of emissions of 0.6 % compared with 2016. However, the overall

Figure ES.2 Current progress of Member States towards 2020 climate and energy targets



Notes: The colours indicate whether countries are considered on track or not towards their 2020 climate and energy targets. For greenhouse gases, orange means that 2016 emissions covered by the Effort Sharing Decision (ESD) were above the 2015 national ESD target. For renewable energy, orange means that the 2015-2016 share of energy from renewable sources (RES) in gross final energy consumption was below the indicative level from the Renewable Energy Directive. For energy efficiency, orange means that the 2016 consumption in primary energy was above a linear indicative trajectory between the 2005 level and the 2020 national target. Further methodological details on how progress is measured are provided in Annexes 1, 2 and 3.

Sources: EEA, 2018a, 2018b, 2018f, 2011; EU, 2017a, 2013b, 2012, 2009a, 2009c, Eurostat 2018a, 2018b, 2018c, 2018e.

21.9 % reduction still achieved between 1990 and 2017 remains sufficient for the EU to meet the 20 % reduction target set for 2020.

While emissions in the EU Emission Trading System (ETS) sector remained rather stable in 2017, emissions in sectors covered by the Effort Sharing Decision (ESD) increased, especially those from road transportation.

Altogether, 22 Member States met their annual GHG emission targets set for 2016 under the ESD. According to approximated estimates for 2017,

Figure ES.3 Projected progress of Member States towards 2030 climate targets

Gap to 2030 Effort Sharing target with existing measures (in percentage points)

On track
Not on track

Sources: EEA, 2018m; EU, 2018b.

18 Member States with GHG emissions in Effort Sharing sectors met their targets in 2017.

Renewable energy

Continued **deployment of renewable energy** sources in the EU's energy mix resulted in a 17.0 % share of renewables in gross final energy consumption provided in 2016. This 2016 RES share remained compatible with the indicative trajectory towards the 20 % target for 2020. However, the pace of deployment has slowed in recent years, with only a marginal increase (from 17.0 % to 17.4 %) estimated to have happened between 2016 and 2017. There has also been insufficient progress towards the 10 % target for renewables in the transport sector by 2020. With 2020 approaching, the trajectories needed to meet the national targets are becoming steeper. Increasing energy consumption and persisting market barriers are hindering the uptake of an increased share of renewables in several Member States. If this trend is not reversed, the EU target for 2020 may not be met.

At the Member State level, approximated data for 2017 show that 20 countries were on their indicative

trajectories for renewable energy deployment towards the 2020 target. This represents a decline from 2016, when 25 countries were on track. In many countries, the slowing of progress towards this target can be accounted for by increases in total energy consumption, which has caused the share of renewables in energy consumption to fall.

Energy efficiency

In most years since 2005, the EU's primary energy consumption has generally decreased at a pace compatible with achievement of the EU's 2020 targets on energy efficiency. Final energy consumption had even declined below the targeted 2020 level by 2015, but it rose above that level in 2016. The EEA's preliminary estimates for 2017 indicate that both primary energy consumption and final energy consumption now lie above the indicative trajectory towards 2020. This continued increase makes achieving the 2020 target increasingly uncertain. Member States need to enhance their efforts to bring the EU back on track and reverse the trend towards increasing energy consumption.

Preliminary data for 2017 show that, among Member States, 13 are expected to have increased their primary energy consumption to levels above the linear trajectories to their 2020 targets. This is an increase of three countries from the previous year.

Furthermore, although the aggregated level of ambition of Member States on energy efficiency (based on their self-set targets for 2020) is broadly in line with the EU's 2020 target for final energy consumption set out in the Energy Efficiency Directive, a 3 % shortfall in Member States' ambition level persists for primary energy consumption.

Focusing on sectoral trends and projections could help identify effective mitigation options. The transport sector, where emissions have been increasing over the last three years, requires urgent action.

Total GHG emissions from the sectors covered by the EU ETS have decreased almost continuously since 2007, despite a 0.2 % increase in emissions from **stationary installations** in 2017. Emissions from energy industries were at their lowest level since the start of the ETS scheme in 2005. Emissions from the other **industrial activities** covered by the EU ETS have also decreased since 2005 but have remained stable in the current trading period (2013-2017). Emissions from **aviation**, however, have increased by about 10 % since 2005 and nearly doubled between 1990 and 2017. They are expected to increase further.

Emissions from sectors covered by the ESD are not demonstrating the same decline as emissions in the ETS sectors. Effort Sharing emissions increased for the third year in a row in 2017, as emissions from the buildings and especially **transport** sectors have risen in recent years. The performance of the buildings sector can be explained by colder average winter temperatures since 2014 (EEA, 2018g). Increased activity in the transport sector played a determinant role in increasing the final energy consumption from all sectors in recent years. Renewable energy sources account for only a very small share in transport and, so far, their slow growth has not been compatible with achievement of the 10 % renewables target for the sector by 2020. Provisional data for 2017 show that, for the first time since monitoring started under current EU legislation in 2010, the average CO_2 emissions of new cars sold in the EU has increased. New legislation in the areas of heavy-duty vehicle emissions and real driving emissions are expected to help reverse the current upwards trend in transport emissions. Attempts to find more sustainable fuel alternatives for transport use have so far mainly prompted an increase in the use of biofuels. To ensure their sustainability and emission savings, criteria have been set in place to promote advanced biofuels and to exclude unsustainable biofuels from counting towards the renewables target.

In the land use, land use change and forestry (LULUCF) sector, afforestation and moderate harvest rates contributed to a net removal of CO_2 from the atmosphere in 2017 (before the application of accounting rules). However, this was slightly less than the average annual removal reported in GHG inventories since 2000. The decline in the LULUCF sink in 2017, as in several years prior, is attributed to land conversion, especially because of deforestation, conversion of organic soils to cropland and conversion of land to settlements. An expected increase in demand for wood for material uses and energy production in coming years will result in a substantial decline in the LULUCF sink in managed forestland over the coming decade. This will be sought offset through, inter alia, the new LULUCF Regulation, which will require Member States to ensure that accounted GHG emissions from land use are entirely compensated for by an equivalent accounted removal of CO_2 from the atmosphere in other Member States or correspondingly lower emissions in Effort Sharing sectors.

Table ES.1 Member States' progress to targets on greenhouse gas emissions, renewable energy and energy efficiency

Member State	GHG emissions				Renewable energy		Energy efficiency	
	Gap to ESD emission target (2016)	Gap to ESD emission target (2017)	Gap to 2020 ESD target (WEM)	Gap to 2030 ESD target (WEM)	Gap to 2015-2016 RED trajectory (average 2015-2016 RES share)	Gap to 2017-2018 RED trajectory (2017 RES share)	Gap to 2016 PEC indicative linear (2016)	Gap to 2017 PEC indicative linear (2017)
	Share of 2005 base year emissions (percentage points)				Share of renewable energy in gross final energy consumption (percentage points)		Share of 2005 primary energy consumption (percentage points)	
Austria	0.6	-3.1	-2.4	-14.5	5.0	3.5	-0.3	-3.4
Belgium	-0.3	0.1	-3.5	-21.1	1.2	0.2	-6.3	-5.9
Bulgaria	9.7	-0.9	21.7	-0.5	6.1	5.0	-1.2	-6.9
Croatia	24.0	15.1	23.5	1.1	12.7	11.3	24.3	26.5
Cyprus	43.4	-2.9	-12.5	-47.4	1.9	-0.3	-4.47	-6.39
Czechia	3.0	2.0	8.5	-2.3	5.7	4.5	9.1	5.1
Denmark	2.5	5.4	2.3	-15.0	8.7	8.3	1.8	0.7
Estonia	2.8	-0.9	0.3	-26.0	7.6	5.0	1.3	-7.1
Finland	-3.1	-1.7	-0.7	-16.7	6.2	5.2	6.4	7.9
France	6.9	0.9	6.1	-9.0	-0.5	-2.4	-1.8	-3.1
Germany	-0.4	-6.8	-3.3	-15.8	3.4	1.4	-2.6	-4.0
Greece	24.0	23.8	17.8	6.8	3.4	1.4	8.9	4.1
Hungary	24.3	13.1	28.6	10.8	6.1	3.5	2.8	-0.5
Ireland	-0.6	-6.7	-19.5	-31.2	0.4	-0.7	-3.1	-4.1
Italy	9.4	8.8	8.5	-7.5	7.0	4.9	8.7	5.8
Latvia	5.0	5.9	9.2	-19.4	1.4	0.8	19.0	22.0
Lithuania	0.7	-0.9	12.6	-14.6	7.1	5.6	11.2	9.1
Luxembourg	4.1	0.7	-2.6	-20.3	-0.2	-1.8	8.3	6.6
Malta	-14.9	-23.1	-11.5	-46.5	1.0	0.5	14.2	3.8
Netherlands	11.6	10.1	10.0	-5.2	-1.7	-3.4	-2.9	-4.9
Poland	-0.7	-2.7	8.4	-10.3	0.8	-1.0	-0.3	-3.6
Portugal	17.6	12.8	17.6	7.4	3.0	1.2	4.1	-2.1
Romania	10.6	13.1	17.6	-12.5	4.3	3.2	27.4	25.0
Slovakia	23.3	23.1	25.2	0.2	2.4	0.3	6.9	4.2
Slovenia	9.9	9.9	13.3	-0.2	1.5	-0.9	6.1	2.4
Spain	9.9	7.8	9.9	-9.9	2.9	1.6	6.5	2.3
Sweden	16.5	11.7	14.8	0.2	9.9	9.0	-4.6	-5.5
United Kingdom	2.7	6.8	9.9	-6.6	1.4	-0.3	3.6	3.5

Notes: PEC, primary energy consumption; RED, Renewable Energy Directive; WEM, with existing measures.

Sources: EC, 2013a, 2007; EEA, 2018a, 2018b, 2018c, 2018d, 2018e, 2018f, 2011; EU, 2012, 2009a; Eurostat, 2018a, 2018b, 2018c.

Tracking sectoral trends will be an important element in supporting the implementation of 2030 targets for emission reductions, renewable energy uptake and increases in energy efficiency. **Transparent access to up-to-date climate and energy data and information** is therefore key to helping to ensure that the EU and its Member States are on track to meet their targets. In the coming years, the EEA will work to support this objective through a renewal of its climate and energy communications in a way that makes key information easily accessible for experts, policy-makers and concerned citizens alike.

1 Introduction

1.1 Objective

This 2018 edition of the EEA report *Trends and projections in Europe* updates the annual progress assessment of the EU and European countries towards their climate mitigation and energy targets. Information in this report is based on the latest official data for 2016, as reported by Member States to the European Commission and the EEA. These are complemented with preliminary ('proxy') estimates for 2017 that have been prepared by the EEA based on Member States' most recent information.

The report addresses progress towards each of three energy and climate objectives: greenhouse gas (GHG) emissions, renewable energy sources (RES) and energy efficiency, the '20-20-20' targets:

- the EU's unilateral commitment to reduce its GHG emissions by 20 % compared with 1990 levels;
- the binding targets to increase the share of energy from renewable sources in the EU's gross final energy consumption to 20 %, with a minimum of a 10 % share of renewables in the transport sector;
- the target of a 20 % reduction in energy consumption compared with baseline projections for 2020.

To help Member States meet 2020 GHG targets, the EU adopted a climate and energy package in 2009. The package defined a single EU target for GHG emissions covered under the Emission Trading Scheme (ETS) and a set of national target trajectories for 2013-2020 for emissions within the scope of the Effort Sharing Decision (ESD). Regarding renewable energy, the Renewable Energy Directive (RED) set binding targets for each Member State and provided indicative trajectories for 2011-2020. For energy efficiency, Member States set their own non-binding targets according to the Energy Efficiency Directive (EED).

For 2030, the EU has subsequently endorsed targets for at least a 40 % reduction in domestic GHG emissions compared with 1990 levels, a level of renewable energy consumption of at least 32 % and a minimum 32.5 % reduction in energy consumption across the EU (compared with the 2007 EU Reference Scenario).

1.2 Structure of this report

Chapters 2, 4 and 6 provide detailed information on EU-wide progress towards GHG, RES and energy efficiency targets, respectively. The report also presents some analysis on the progress made at EU level in meeting the targets of the EU's 2030 climate and energy framework, as well as its longer term policy objective for 2050.

Chapters 3, 5 and 7 analyse progress made individually by the EU's Member States, again addressing each of the three policy objectives.

Chapter 8 focuses on trends and projections in EEA member countries that are not part of the EU, i.e. Iceland, Liechtenstein, Norway, Switzerland and Turkey.

Annexes 1, 2 and 3 provide more information on data sources and methodology.

Annexes 4 and 5 provide more detailed information and overview tables on domestic and international climate and energy targets in the EU.

1.3 Data sources

Information in this report is based on the latest data reported by European countries under the Monitoring Mechanism Regulation (MMR). The countries submit their information to the EEA's e-reporting environment, Reportnet ([1]), after which the EEA, supported by its

([1]) https://www.eionet.europa.eu/reportnet

European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), performs quality control procedures in consultation with individual countries. The EEA and ETC/ACM then compile the reported data and publish data sets, data viewers and related products on the EEA website.

Data sets regarding energy are reported by European countries to Eurostat under the Energy Statistics Regulation.

The following data sets are highlighted in this report:

- GHG emission inventory for the period 1990-2016, reported under the MMR in March 2018;
- Effort Sharing emission data for the period 2013-2016 (2016 data reviewed in 2018);
- ETS emission data for the years 2005-2017, European Union Transaction Log (EUTL), extracted in July 2018;
- GHG emission projection data until 2035, mostly reported in March 2017 and updated by two countries (Ireland and Cyprus) in March 2018;
- approximated ('proxy') GHG emission data, renewable energy shares and energy consumption for the year 2017, partly reported by Member States in August 2018 and gap-filled with estimates by the EEA.
- share of energy from renewable sources related to renewable energy use in Europe, reported under the Energy Statistics Regulation and the RED, and published by Eurostat in its SHARES tool in 2018 (Eurostat, 2018b);
- primary and final energy consumption, reported in the Energy Statistics Regulation and published by Eurostat in its energy statistics database, extracted in May 2018 (Eurostat, 2018a, 2018b, 2018c).

2 Progress of the European Union towards its greenhouse gas emission targets

- Although the 2020 reduction target is still expected to be met, the policies and measures currently accounted for in national projections will not be enough to deliver the savings needed to achieve the EU's reduction target of at least 40 % by 2030 (compared with 1990 levels).
- The latest official data show that the EU remains on track to exceed its 20 % GHG reduction target set for 2020 (compared with 1990 levels). In 2016, GHG emissions were 22 % lower than 1990 levels, and the new approximated data indicate that this increased again in 2017, although only moderately. National projections available from Member States indicate that EU GHG emissions are expected to remain below the 2020 target.
- The pace of GHG emission reductions is projected to slow after 2020. Continuing at this slower pace will not be sufficient to achieve the EU's target of a 40 % domestic reduction by 2030 (compared with 1990 levels). Even assuming that the 2030 target is met, faster decreases in GHG emissions will be necessary to achieve an 80 %, or even a 95 %, decrease by 2050.
- In 2017, emissions from stationary installations under the EU ETS remained 26 % lower than 2005 levels — about the same reduction level as in 2016. These reductions were mainly the result of lower emissions in the energy industrial sector.
- Emissions covered by the ESD decreased by 11 % in 2016 compared with 2005. Preliminary estimates suggest that emissions increased in 2017, with a net decrease in emissions to 10 % below 2005 levels. This change is mainly attributed to increasing emissions from transport and energy industries and industrial processes not covered under the EU ETS.

2.1 Progress in reducing total greenhouse gas emissions in the European Union

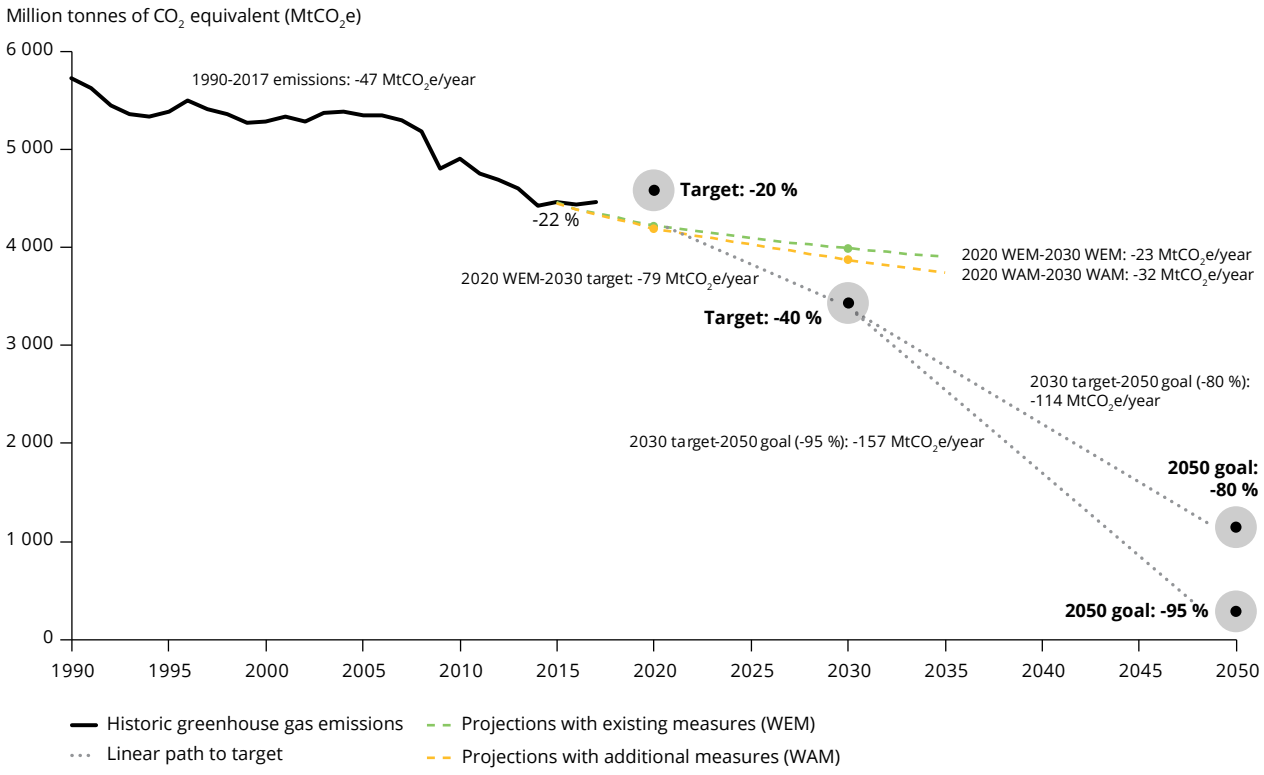
In 2016, the EU's total GHG emissions were 4 441 megatonnes (Mt) carbon dioxide equivalent (CO_2e), which is 22 % less than 1990 levels ([2]). According to preliminary estimates, emissions increased by 0.6 % from 2016 to 2017. Despite this increase, the EU remains on track to achieve its GHG emission reduction target of a 20 % decrease by 2020, compared with 1990 levels. Figure 2.1 illustrates the variability in emission reductions in recent years, and the expected increase between 2016 and 2017, which was preceded by a similar increase between 2014 and 2015.

In 2018, only two Member States reported updates of their national GHG projections (Cyprus and Ireland). Therefore, the aggregated EU emissions did not change significantly compared with the aggregation conducted in 2017. According to these national projections, the EU's GHG emissions are expected to decrease until at least 2035 (see Figure 2.1).

- According to the scenario 'with existing measures' (WEM), which reflects the effects of all adopted and implemented measures at the time the projections were prepared, GHG emissions will be reduced by 26 % by 2020 and by 30 % by 2030 (compared with 1990 levels).

([2]) The EU's total GHG emissions excludes emissions from land use, land use change and forestry (LULUCF) and includes all emissions from aviation (including international flights), covered under the EU target.

Figure 2.1 Greenhouse gas emission trends, projections and targets in the EU, 1990-2050



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

Sources: EEA, 2018h, 2018b, 2018c, 2018f.

- According to the scenario 'with additional measures' (WAM), which also takes into account the measures that were at planning stage at the time the projections were prepared ([3]), GHG emissions will decrease by 27 % by 2020 and by 32 % by 2030 (compared with 1990 levels).

Although it is expected that the 2020 reduction target will still be met, the policies and measures currently accounted for in national projections alone will not be sufficient to deliver the savings needed to achieve the EU's reduction target of at least 40 % by 2030 (compared with 1990 levels). The pace of GHG emission reductions is currently projected to slow after 2020, and achieving the mid- and long-term targets/goals will require much faster reductions.

Assuming that 2020 emission targets will be met and 2020 emissions will be as projected by the current WEM scenario, then, between 2020 and 2030, emissions need to decrease by 786 $MtCO_2e$ to reach the 2030 target. This means an average emission reduction of -79 $MtCO_2e$ in every year between 2020 and 2030, an amount comparable to the total emissions of Austria in 2015. The average annual reduction expected to be achieved with currently adopted climate mitigation measures accounts for about one third of the emission savings needed (-23 $MtCO_2e$ per year). If savings from policies and measures still at the planning stage were included, the average annual reduction would amount to -32 $MtCO_2e$ per year. This is less than half of the reduction needed to achieve the 2030 target (see Figure 2.1).

The European Commission has developed several policy proposals to achieve the EU's 2030 targets on climate and energy. Some of these already have been adopted:

([3]) Not all Member States reported a WAM scenario. For further information on reporting of projections, please refer to Annex 1, A1.2.8.

- a reform of the EU ETS to include a more stringent cap reduction after 2020 (EU, 2003);
- new annual binding GHG emission targets for Member States for the period 2021-2030, specifically covering emissions that are not covered by the EU ETS (a new 'Effort Sharing' between Member States), as well as new flexibilities to achieve these targets (EU, 2018a);
- the integration of the land use, land use change and forestry (LULUCF) sector into the EU 2030 climate and energy framework (EU, 2018b);
- a revision of the Energy Performance of Buildings Directive (EPBD).

Some proposals were provisionally agreed in June 2018 and their adoption is expected in the coming months:

- a proposal for the governance of the Energy Union that, in particular, requires Member States to submit draft National Energy and Climate Plans (NECPs) by 31 December 2018 (EC, 2016a);
- a revision and extension of the RED in June 2018, with a binding EU-level target to increase the share of renewable energy in the energy mix to 32 %, including an upwards revision clause by 2023 (EC, 2016a);
- an update of the EED, with an indicative target at EU level of at least 32.5 % by 2030, also with a clause for an upwards revision by 2023 (EC, 2016a).

In addition, based on the European strategy to cut emissions from the transport sector (EC, 2016b), several transport-related policies have been proposed, including CO_2 emission standards for cars, vans and lorries.

Even if the 2030 GHG target is achieved, a faster pace of reductions in emissions would still be required if the EU is to reach its long-term decarbonisation objective — a reduction of EU GHG emissions by 80-95 % by 2050, compared with 1990 levels. Achieving a reduction of 80 % in 2050 would require a reduction of 2 288 $MtCO_2e$ in total emissions between 2030 and 2050. This is equivalent to an average annual reduction of 114 $MtCO_2e$. An emission reduction of 95 % in 2050 would require a total of 3 146 $MtCO_2e$ to be reduced between 2030 and 2050. This translates to an average annual emission saving between 114 and 157 $MtCO_2e$ per year between 2030 and 2050 required for the EU's long-term decarbonisation objective.

Such a reduction can take place only in the context of a major transformation of the EU's socio-technical systems, such as the energy, food, mobility and urban systems. As the effects of policies and measures often take time to materialise (e.g. increases in energy efficiency in buildings), long-term action should not be delayed, and lock-in effects of investments should be considered. Far-reaching measures with long-term effects are often postponed because of high initial costs or political controversies related to their implementation. However, investing in such measures can make sense in the short term if benefits of avoiding damages are taken into account in mitigation costs (see suggested damage cost rates, e.g. in UBA, 2014).

2.2 Reducing greenhouse gas emissions in key sectors

To achieve short-term GHG emission targets, the emissions covered by the EU ETS are subject to an EU-wide cap, whereas non-ETS emissions are subject to national targets as stated in the Effort Sharing legislation. From 2021 they will be accompanied by national 'no-debit' commitments with respect to LULUCF.

- Emissions from large point sources, mostly from power and heat production and industrial installations, are covered by the EU ETS (EU, 2003). These currently represent about 40 % of EU GHG emissions, of which a large proportion stems from the power generation sector. Other activities covered by the EU ETS include cement production, iron and steel production and oil refining. Since 2012, the EU ETS covers GHG emissions from aviation (EU, 2009b). The mitigation of all ETS emissions is being addressed at EU level through a single ETS-wide emission cap ([4]) and a 'carbon market' through which emission allowances can be traded.
- GHG emissions not covered by the EU ETS are mainly addressed by the ESD (EU, 2009c). These emissions are produced by a more diverse range of sectors and activities, including road transport, energy consumption in buildings, agriculture (cattle and soils), industrial installations and waste management. Since 2013, the ESD has set annual targets for each Member State from 2013 until 2020 that should not be exceeded.

([4]) The cap has been set for all participants in the EU ETS, including the EU as well as Iceland, Liechtenstein and Norway. These three countries participate in the EU ETS as members of the European Economic Area.

Mitigation actions therefore take place at national level through a combination of EU-driven policies and measures, and national initiatives. Member States are responsible for meeting their emission reduction commitments under the ESD.

- GHG emissions and removals from the LULUCF sector are not covered under the EU ETS or the ESD. LULUCF emissions and removals as reported under the GHG inventories for the United Nations Framework Convention on Climate Change (UNFCCC) represent a net carbon sink. These removals can contribute to a certain extent to achieve the Kyoto Protocol commitments but are not included in the EU's target under the 2020 climate and energy package. With the rules set in the new LULUCF Regulation (EU, 2018b) and the new Effort Sharing Regulation (ESR) (EU, 2018a), this sector will be integrated into the EU 2030 climate and energy framework from 2021 onwards. The ESR establishes a limited flexibility with net removals from the LULUCF sector that can be used to meet Member States' targets under this regulation. The LULUCF Regulation sets a 'no-debit' commitment for each Member State and defines harmonised EU-wide accounting rules to measure anthropogenic influence on emissions and removals in the sector. Higher emission reductions under the ESR can be used to cover LULUCF emissions, and additional sinks from the LULUCF sector can be accounted under the ESR under certain circumstances.

In EU ETS sectors and Effort Sharing sectors GHG emissions have been following different trends since 1990 ([5]). The projections reported by Member States also show differences between the two sectors (see Figure 2.2). Emission trends in the ETS, ESD and LULUCF sectors are described and analysed in the following three sections.

2.3 Emission trends under the European Union Emissions Trading System

Total GHG emissions from the sectors covered by the EU ETS have decreased significantly since 1990 (see Figure 2.3). The EU ETS target was defined to reduce emissions by 21 % between 2005 and 2020. In 2017, EU ETS emissions from Member States' stationary installations had already decreased by 26 % since 2005 ([6]). The decrease since 2005 was mostly driven by reductions in emissions related to power generation. *Ex post* evaluation of climate policies shows that the reduction in emissions was largely the result of changes in the combination of fuels used to produce heat and electricity. In particular, the fuels combination entailed a decrease in the use of hard coal and lignite fuels, better and more efficient installations, and a substantial increase in electricity generation from renewables, which almost doubled over the period. In addition, the reduced production volumes led to reductions in emissions in this sector, too. Emissions from the other industrial activities covered by the EU ETS have also decreased since 2005, but they remained stable in the current trading period (2013-2017) (see Figure 2.3).

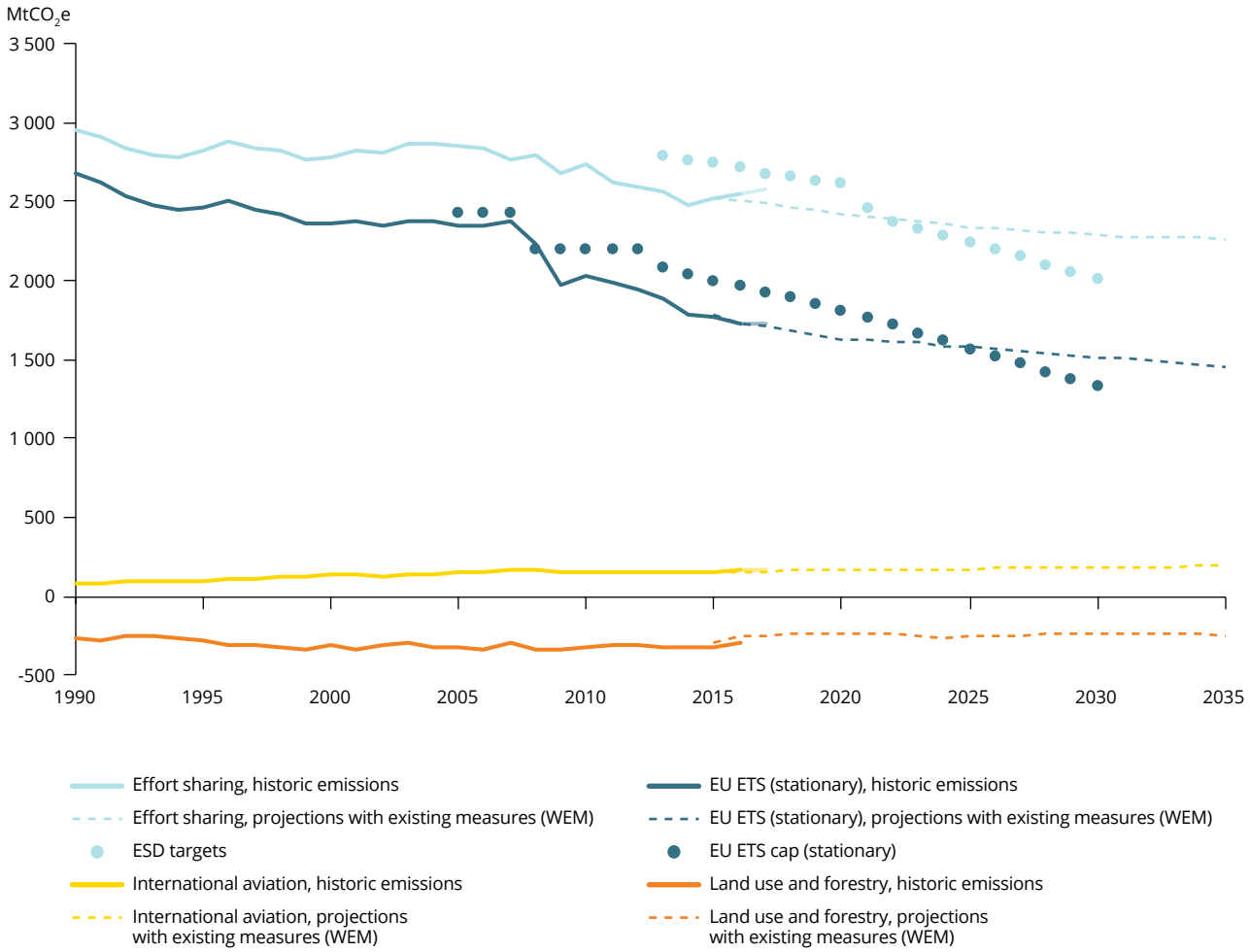
According to the projections submitted by Member States in 2017, future cuts in national GHG emissions will take place mainly under the EU ETS. With existing measures in place at the time of the calculation of GHG projections, emissions from stationary installations under the EU ETS are projected to decrease by 5 % between 2017 and 2020, and by 7 % between 2020 and 2030. According to scenarios that consider planned measures, reductions of an additional three percentage points are projected for 2020 and 2030, compared with the reductions predicted by the WEM scenario. Most of the projected reductions between 2020 and 2030 are expected to occur in the energy industries sector, whereas emissions from other activities are envisaged to remain stable during this period. Recent agreement on reforms to the EU ETS for the fourth trading period such as the strengthening of the Market Stability Reserve have not been considered in these projections. The emissions from international aviation, however, nearly doubled between 1990 and 2014 and are expected to increase further by 2030.

2.4 Emission trends under the Effort Sharing Decision

Total GHG emissions from sectors covered by the ESD have decreased since 1990, albeit at a slower rate than those covered under the EU ETS. This reflects the diversity of the sectors covered by the ESD and their mitigation potentials. In 2016, Effort Sharing emissions were 11.5 % below 2005 levels ([7]), which is a greater reduction than the 9.3 % needed to reach national targets for Effort Sharing emissions by 2020. However, 2017 is the third year in a row in which Effort Sharing emissions have increased. According to preliminary estimates, emissions increased from

([5]) Although the ETS was introduced in 2005 and the ESD in 2013 (i.e. no ETS or ESD emissions existed before 2005), it is possible to reconstruct a time series dating back to 1990 by drawing up a correlation between ETS/ESD emissions and the source categories used to officially report national GHG inventories under the UNFCCC.
([6]) These values were derived to include an estimate to reflect the current scope of the EU ETS.
([7]) This is equivalent to a reduction of 10.5 % compared with estimated scope-corrected ESD emissions 2005. See Annex A.1.2.7.

Figure 2.2 Effort Sharing, ETS, LULUCF and aviation emission trends and projections, 1990-2035



Notes: Net removals from LULUCF correspond to reported values to the UNFCCC, which differ from values relevant to 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 latest available data.

The WEM scenario reflects existing policies and measures.

Sources: EC, 2015a; EEA, 2018b, 2018c, 2018i, 2018a, 2018f; EU, 2017a, 2013a, 2009d.

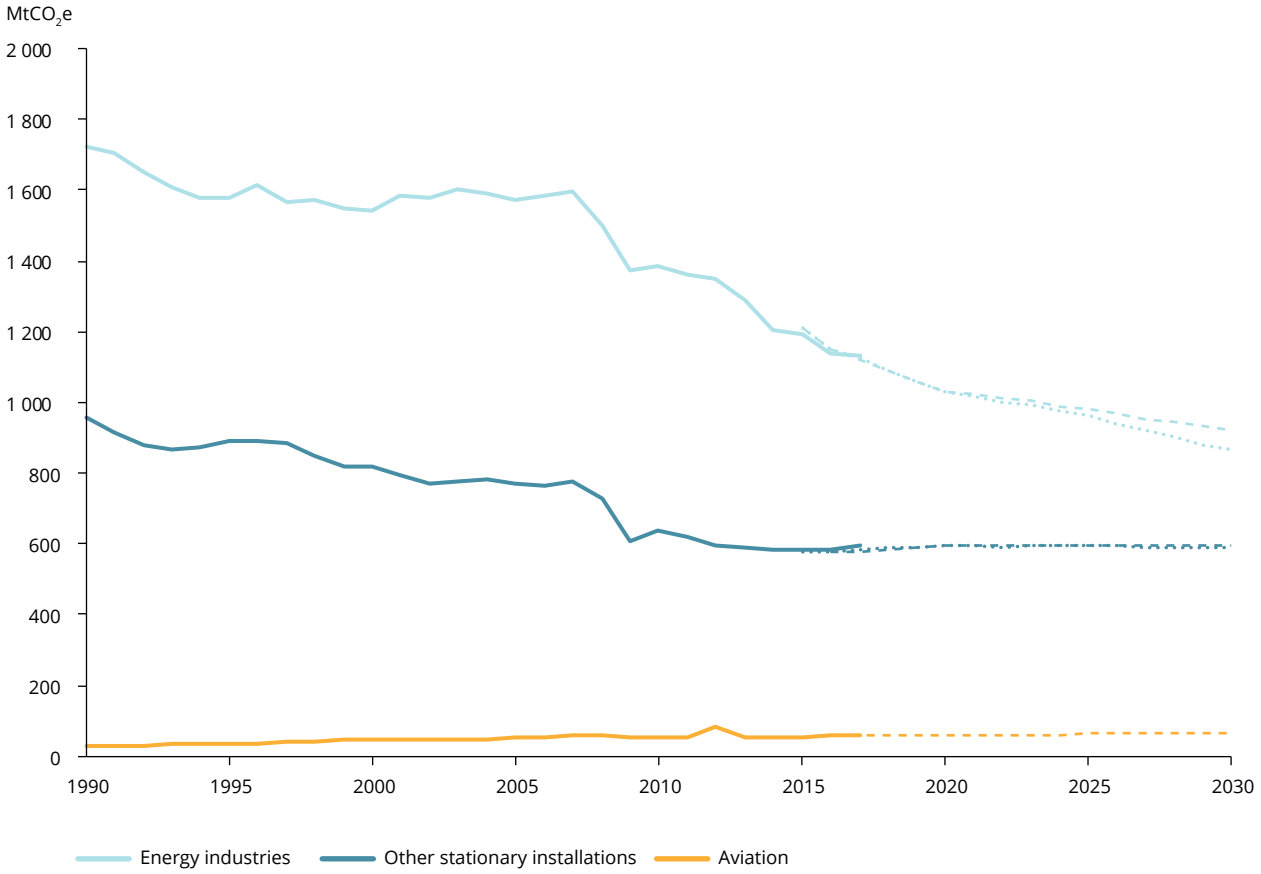
2016 to 2017 at a lower rate of 0.8 % compared with previous years. Figure 2.4 illustrates the Effort Sharing emission trends in recent years and demonstrates that emissions in the transport sector have risen in recent years after previous downward development.

According to national projections based on the WEM scenario, Effort Sharing emissions could be 193 $MtCO_2e$ below the Effort Sharing target for 2020, and cumulative Effort Sharing emissions in the EU for the whole period 2013-2020 could be lower than the overall emission budget for all Member States under the ESD by 1 600 $MtCO_2e$ ([8]). In addition, if planned measures are considered, this cumulative surplus could increase to over 1 659 $MtCO_2e$. Despite the overall decrease in emissions at EU level, certain Member States have more difficulties than others do in achieving their Effort Sharing targets (see Chapter 3).

For 2030, aggregated Member State projections result in a 21 % reduction of Effort Sharing emissions compared with 2005 base year emissions in the WEM scenario, and a 23 % reduction in the WAM scenario.

([8]) According to Decision 2017/1471 of 10 August 2017 (EU, 2017a) annual emission allocations (AEAs) for the years 2017-2020 were recalculated to adapt to updated GHG inventory methodologies and figures.

Figure 2.3 Greenhouse gas emission trends and projections under the scope of the EU ETS, 1990-2030



Notes: Solid lines represent historical GHG emissions (available for the period 1990-2017). Dashed lines represent projections for the scenario with existing measures (WEM). Dotted lines represent projections for the scenario with additional measures (WAM). The EU ETS GHG emissions presented were estimated based on the attribution of GHG emissions, reported by source categories in national GHG inventories and national projections, to EU ETS sectors and/or Effort Sharing sectors.

Sources: EEA, 2018a, 2018f, 2018b, 2018c.

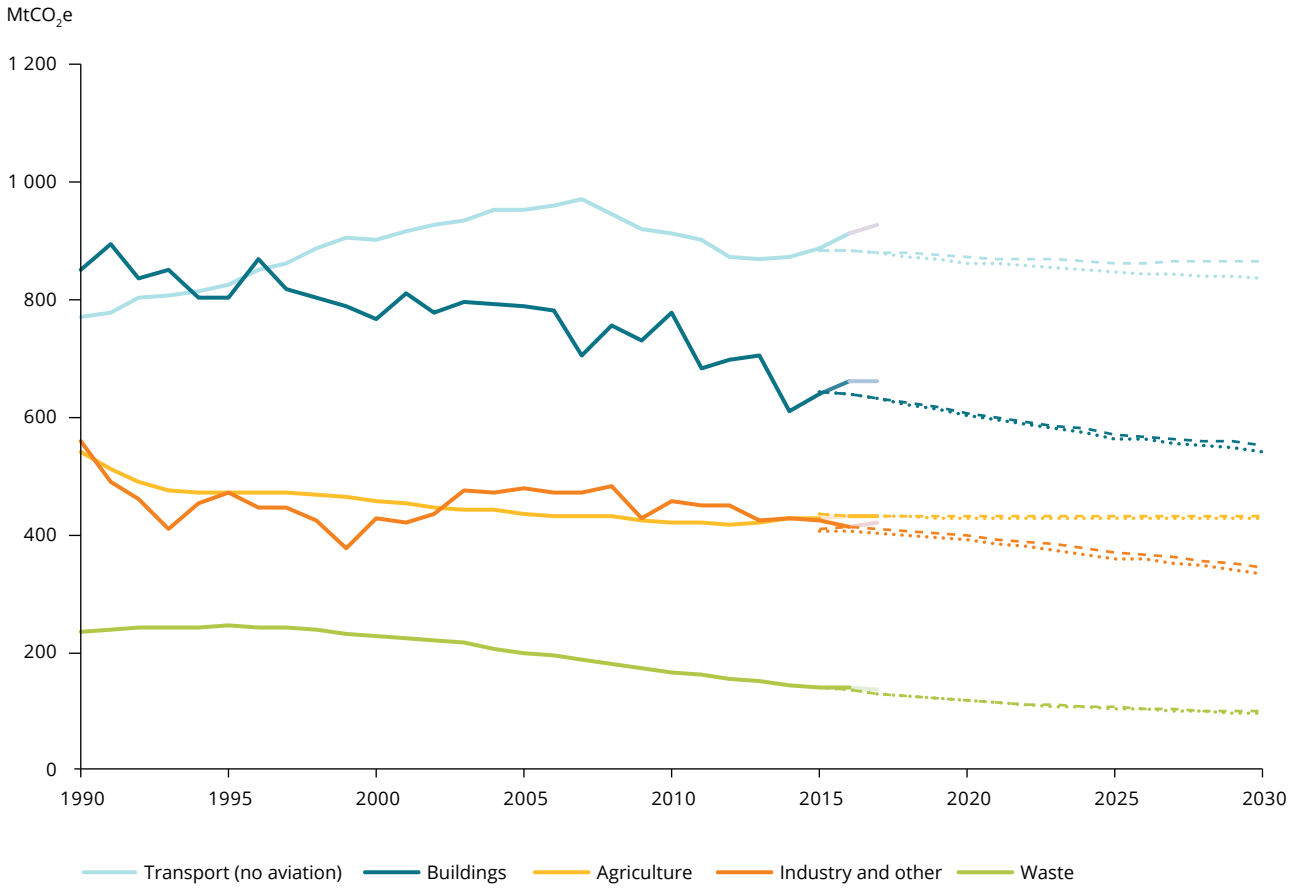
These reductions remain insufficient compared with the 30 % reduction that non-ETS sectors should achieve by 2030, as a contribution to delivering the EU target of at least a 40 % domestic reduction in GHG emissions by 2030 compared with 1990 (see Figure 2.4). The 2030 targets thus require efforts from Member States that go beyond the measures currently implemented or planned.

Since 1990, the building sector has contributed most to absolute emission reductions in the sectors covered by the ESD. However, emissions slightly increased in 2015 and in 2016 and remained stable in 2017.

Emissions from the transport sector, which is the largest contributor to GHG emissions under the ESD, increased continuously between 1990 and 2007. After a decrease between 2007 and 2013, emissions from this sector have been increasing continuously since 2014.

Member States have projected only limited decreases in Effort Sharing emissions between 2017 and 2030, particularly after 2020. The largest decreases are expected to take place in the building sector, justified by the availability of marketable technologies that reduce energy demand and for the integration of renewables. In the agricultural sector, emissions are projected to remain relatively stable. Emissions in the transport sector are also expected to remain stable despite CO_2 emission standards for new cars and vans that are expected to reduce emissions by gradually diffusing into the vehicle stock. The largest reductions in relative terms are projected to be achieved in emissions from energy supply, manufacturing and industrial processes and product use not covered

Figure 2.4 Greenhouse gas emission trends and projections under the scope of the ESD, 1990-2030



Notes: Solid lines represent historical GHG emissions (available for the period 1990-2016). Dashed lines represent projections for the scenario with existing measures (WEM). Dotted lines represent projections for the scenario with additional measures (WAM). The Effort Sharing sector emissions presented are estimated based on the attribution of GHG emissions, reported by source categories in national GHG inventories and national projections, to EU ETS sectors and/or Effort Sharing sectors. The sector here summarised as 'industry and other' aggregates emissions of energy supply, manufacturing , industrial processes and product use (GHG inventory source categories 1.A.1, 1.A.2, 1.B, 1.C and 2), which are not covered under the EU ETS.

Sources: EEA, 2018a, 2018f, 2018i, 2018c, 2018b, based on Member States' submissions.

under the EU ETS (mostly fluorinated gases (F-gases), aggregated as 'industry and other') and waste between 2017 and 2030. Implementing additional measures (i.e. at the planning stage up to early 2017) would lead to further minor decreases in emissions, especially in the transport sector (see Figure 2.4)

2.5 Emissions from land use, land use change and forestry

LULUCF activities, which include the management of soils, trees, plants, biomass and timber, can result in both emissions (source) and removals (sink) of CO_2. In 2016, the EU's LULUCF sector ([9]) represented a net reported carbon sink of about 302 $MtCO_2e$. This was despite reports from Cyprus, Denmark, Ireland, Malta and the Netherlands on net positive emissions from their LULUCF sectors. Over the past decade, the relatively large proportion of young forests and moderate harvest rates have led to an increased net carbon accumulation in European forests, which means that more carbon is removed from the atmosphere than is released.

While being a net sink, the sector was also a source of CO_2 emissions for some sub-categories. The largest source was land conversion, especially from deforestation, emissions from organic soils converted to cropland and land converted to settlements. Since 2000, the net reported annual LULUCF sink has been on average 320 $MtCO_2e$, with an unfavourable declining

([9]) As reported under the UNFCCC, without any accounting rules applied.

trend over the past 6 years. According to the EU Reference Scenario 2016 (EC, 2016c), the net reported LULUCF sink in the EU is expected to shrink by about 10 % between 2010 and 2020. This is attributed partly to increased harvest rates and partly to forests getting older, with associated reduced growth rates in some forest types.

The main component of the LULUCF sink is the carbon sink in managed forestland (-376 $MtCO_2e$ in 2016). The managed forestland sink is mainly driven by the balance of forest harvest and forest increment rates (accumulation of carbon in forest biomass as a result of tree growth). In 2030, forest harvest is projected to increase over time from 516 million m^3 in 2005 to 565 million m^3, owing to growing demand for wood for material uses and energy production. Along with the ageing of EU forests (which reduces the capacity of forests to sequester carbon), the forest increments are projected to decrease from 751 million m^3 in 2005 to 725 million m^3 in 2030. Consequently, the rate of accumulation of carbon and therefore the main component of the EU's reported LULUCF carbon sink in managed forestland will decline by 32 % until 2030. This is expected to be partially compensated for by the continuation of increasing carbon removals from afforestation, and a decreasing trend in emissions from deforestation, which are projected to decline from 63 $MtCO_2e$ in 2005 to 20 $MtCO_2e$ in 2030 (EC, 2016c) ([10]).

To address the unfavourable projected decrease in the EU's LULUCF net sink and to account properly for anthropogenic emissions and removals within the LULUCF sector, the new LULUCF Regulation implements a binding no-debit rule for each Member State. It also provides updated accounting rules to identify anthropogenic changes in the carbon balance of forests and soils, which are used to determine compliance with this commitment (EU, 2018b). In particular, debits and credits for managed forestland are accounted against so-called forest reference levels, which makes it possible to isolate the impact of management-induced changes. Therefore, the above-reported sink value of -376 $MtCO_2e$ should not be confused with a possible credit volume generated through managed forestland.

The LULUCF Regulation requires each Member State to ensure that accounted GHG emissions from land use are entirely compensated for by an equivalent accounted removal of CO_2 from the atmosphere in other land use sectors, by credits from other Member States or by corresponding lower emissions in Effort Sharing sectors (the no-debit rule). For instance, if a Member State converts forests to other land uses (deforestation) or increases emissions from cropland, it must compensate for the resulting emissions by planting new forests (afforestation), enhancing removals and decreasing emissions for managed forests, croplands and grassland, covering with unused ESR allocations or agreeing to buy credits from other Member States.

The LULUCF Regulation is expected to improve the identification of additional mitigation action, and to thereby enhance the contribution of the sector to climate action. Stronger incentives for action are also provided by enabling trade between Member States within the LULUCF sector and by creating a limited flexibility for the use of certain, robust LULUCF credits in other non-ETS sectors.

([10]) To evaluate the overall carbon effect of forest and wood, it has to be considered that when wood is used — e.g. as construction material for buildings — the carbon remains stored over the use phase of the resulting products (carbon stock in harvested wood products). Therefore, the UN accounting rules and the new LULUCF Regulation also consider the change in carbon stock in harvested wood products. In addition to these storage effects, using wood can avoid or reduce the release of GHGs by replacing fossil fuels (energy substitution) and energy-intensive materials with an unfavourable environmental impact assessment and carbon footprint (material substitution).

3 Progress towards Member States' greenhouse gas emission targets

- In 2016, 22 Member States met their annual Effort Sharing targets. In Belgium, Finland, Germany, Ireland, Malta and Poland, Effort Sharing emissions were higher than the national Effort Sharing targets. While Malta has been missing its targets every year since 2013, 2016 was the first time that Belgium, Finland, Germany, Ireland and Poland missed their Effort Sharing targets.
- According to preliminary estimates, 10 Member States (Austria, Bulgaria, Cyprus, Estonia, Finland, Germany, Ireland, Lithuania, Malta and Poland) exhibited emissions higher than their Effort Sharing targets in 2017.
- According to GHG projections available from Member States, with existing national policies and measures in place, 2020 Effort Sharing emissions are expected to be lower than the 2020 targets in 20 Member States. In eight Member States (Austria, Belgium, Cyprus, Finland, Germany, Ireland, Luxembourg and Malta), existing measures will not be enough to meet their 2020 Effort Sharing targets. Currently reported additional measures do not change this prospect.
- If no domestic measures are implemented beyond those already included in projections, six Member States (Austria, Belgium, Cyprus, Finland, Germany and Luxembourg) could close the projected gap between the emission target in 2020 and their actual emissions by transferring surplus annual emission allocations (AEAs) from earlier years to the later years of the period 2013-2020. Ireland and Malta would need to rely on additional flexibilities to close their gaps, such as buying AEAs from other Member States.
- With the continuation of existing measures and the implementation of additional measures as reported in 2017, current projections indicate that only six Member States (Croatia, Greece, Hungary, Portugal, Sweden and Slovakia) would keep their Effort Sharing emissions below their emission targets until 2030.

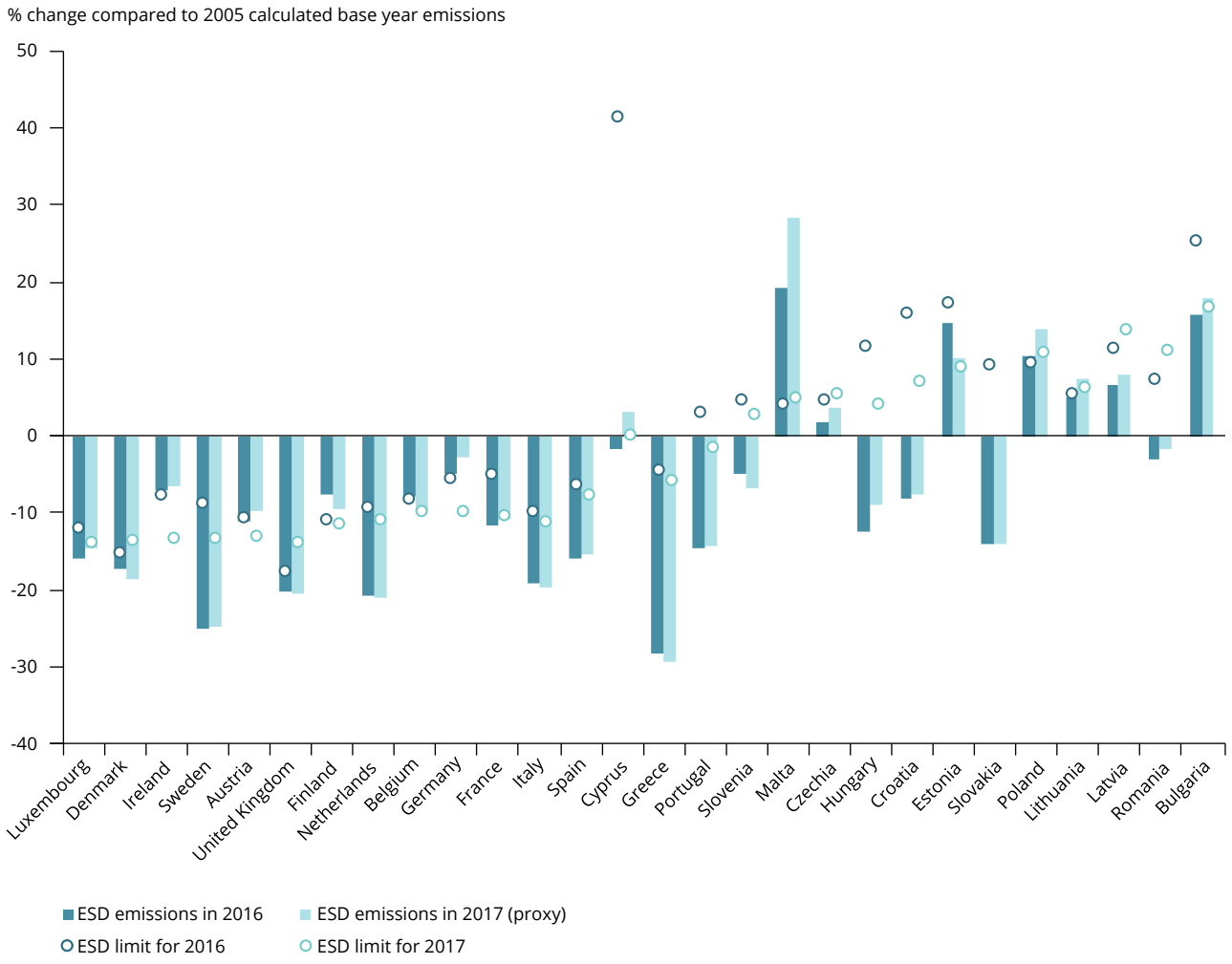
3.1 Current progress towards annual targets under the Effort Sharing Decision

To achieve the EU's objective of a 20 % reduction in total GHG emissions by 2020 compared with 1990 levels, the ESD (EU, 2009c) sets national targets for each Member State for GHG emissions not covered by the ETS (EU, 2003) ([11]). National Effort Sharing targets cover sectors such as transport, buildings, agriculture and waste management. Together, these sectors account for 60 % of total EU GHG emissions. Mitigation actions take place at national level through a mix of EU-driven policies and measures and national initiatives. Effort Sharing targets range from 20 % reductions (Denmark, Ireland and Luxembourg) to 20 % allowed increases (Bulgaria) compared with 2005 base year levels. Taken together, the aggregated Effort Sharing targets for 2020 represent a 9.3 % reduction at EU level compared with 2005 base year levels. The ESD also sets annual targets for the period 2013-2020 to monitor progress across the EU, allow for corrective action and ultimately ensure that the EU attains its GHG emission target by 2020. This section reviews the status of Member States' achievement of 2016 Effort Sharing emission targets.

In 2016, nine Member States (Croatia, Cyprus, Greece, Hungary, the Netherlands, Portugal, Romania, Slovakia and Sweden) overachieved their 2016 Effort Sharing target by more than 10 percentage points. The largest overachievements in absolute terms for the period

([11]) Consequently, there are no national targets on GHG emissions set at EU level that cover total (economy-wide) emissions. LULUCF emissions are not covered by the ESD.

Figure 3.1 Current progress of Member States towards their Effort Sharing targets



Notes: 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. Following the 2016 comprehensive review of Member States' historical GHG inventory estimates, the AEAs for the period 2017-2020 were recalculated to reflect updates in methodologies for reporting of GHG inventories (EU, 2017a). This recalculation ensures that the originally intended level of effort (as a percentage) is maintained for each Member State in the ESD (see also the Annex A1.2.6).

Sources: EEA, 2018j, 2018f; EU, 2017a, 2013a, 2013b.

2013-2016 were made in Italy (138 $MtCO_2e$), France (123 $MtCO_2e$) and Spain (104 $MtCO_2e$).

Six Member States (Belgium, Finland, Germany, Ireland, Malta and Poland) had 2016 Effort Sharing emissions above their respective Effort Sharing emission targets (see Figure 3.1).

Malta is the only country for which emissions have remained above its Effort Sharing targets since 2013. In 2016, emissions were higher than annual allocations by 0.2 million AEAs, which is equal to a gap of 15 %. For the other Member States with 2016 emissions higher than their Effort Sharing targets, the gaps are smaller than 3.1 %. In absolute numbers, the gaps sum up to less than 5 million AEAs compared with a cumulative overachievement by other Member States of 178 million AEAs.

Based on approximated estimates for 2017, the number of Member States meeting their Effort Sharing targets decreased from 22 in 2016 to 18 in 2017. For the remaining 10 Member States (Austria, Bulgaria, Cyprus, Estonia, Finland, Germany, Ireland, Lithuania, Malta and Poland), Effort Sharing emissions were above their 2017 targets.

To comply with the ESD, Malta has been balancing its surplus emissions with AEA purchases from Bulgaria, which had overachieved with respect to its targets.

While Malta will again need to pay for its surplus emissions, the other Member States can comply with the ESD by using their banked AEAs from their own overachievements in the period 2013-2015.

3.2 Insights into Effort Sharing sectors and their current development

At Member State level the importance and the development of Effort Sharing sectors' emissions varies. Six Member States (Germany, the United Kingdom, France, Italy, Spain and Poland) are estimated to have contributed 71 % to total EU Effort Sharing emissions in 2017. The following information relates to emission estimates for 2017 in line with an EEA ETC/ACM report (EEA, 2018i) in which further details are laid out.

At EU level the transport sector showed only negligible emission reductions compared with 2005 (-3 %). Despite important reductions between 2007 and 2013, transport emissions have been rising again in recent years. Between Member States, the changes in this sector vary from a 68 % increase (Poland) to a 21 % decrease (Luxembourg). Altogether 12 Member States exhibit increased transport emissions compared with 2005.

In the buildings sector, Effort Sharing emissions at EU level decreased by 16 % compared with 2005. Only four Member States (Malta, Estonia, Lithuania and Poland) increased buildings emissions compared with 2005. The other Member States decreased their Effort Sharing emissions in this sector by up to 59 % (Greece).

Agriculture emissions at EU level have slightly decreased since 2005 (by 1 %). At Member State level the emission changes since 2005 have ranged from a 27 % increase (Bulgaria) to a 16 % decrease (Greece).

The waste sector is the smallest Effort Sharing sector. At EU level, emissions are estimated to have decreased by around 32 % since 2005. While six Member States exhibit increased emissions since 2005 (Croatia, Czechia, Cyprus, Slovakia, Spain and Romania), the other Member States have decreased their emissions up to nearly 59 % (United Kingdom).

The remaining Effort Sharing emissions, grouped in the 'industry and other' sector, have declined at EU level (by 12 % since 2005). However, this sector shows very different developments across Member States. A total of 13 Member States are estimated to have increased their emissions compared with 2005. Three Member States (Lithuania, Malta and Cyprus) increased their emissions by more than 50 %. Most emission decreases since 2005 have been below 50 %.

3.3 Projected progress towards 2020 Effort Sharing targets

National GHG projections submitted by Member States in 2017 and updated submissions from Cyprus and Ireland in 2018 show diverse expectations regarding Effort Sharing emission trends for the period 2017-2020. For many Member States, projections are consistent with past trends and show decreases in Effort Sharing emissions between 2017 and 2020.

- A total of 16 Member States project a decrease in their Effort Sharing emissions until 2020 (Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, the Netherlands, Portugal, Slovenia, Spain, Sweden and the United Kingdom).
- Nine Member States projected an increase in their Effort Sharing emissions until 2020 (Croatia, Cyprus, Czechia, Greece, Ireland, Latvia, Poland, Romania and Slovakia).
- Projected emissions in Lithuania, Luxembourg and Malta remain nearly constant.

Based on these national projections, 20 Member States expect their Effort Sharing emissions to stay below their annual targets under the ESD in 2020, based on the WEM scenario (see Figure 3.2).

Conversely, for eight Member States (Austria, Belgium, Cyprus, Finland, Germany, Ireland, Luxembourg and Malta), national projections submitted under the MMR suggest that emissions could exceed their AEAs (i.e. annual emission allocations under the ESD) by 2020 (see Table A1.4).

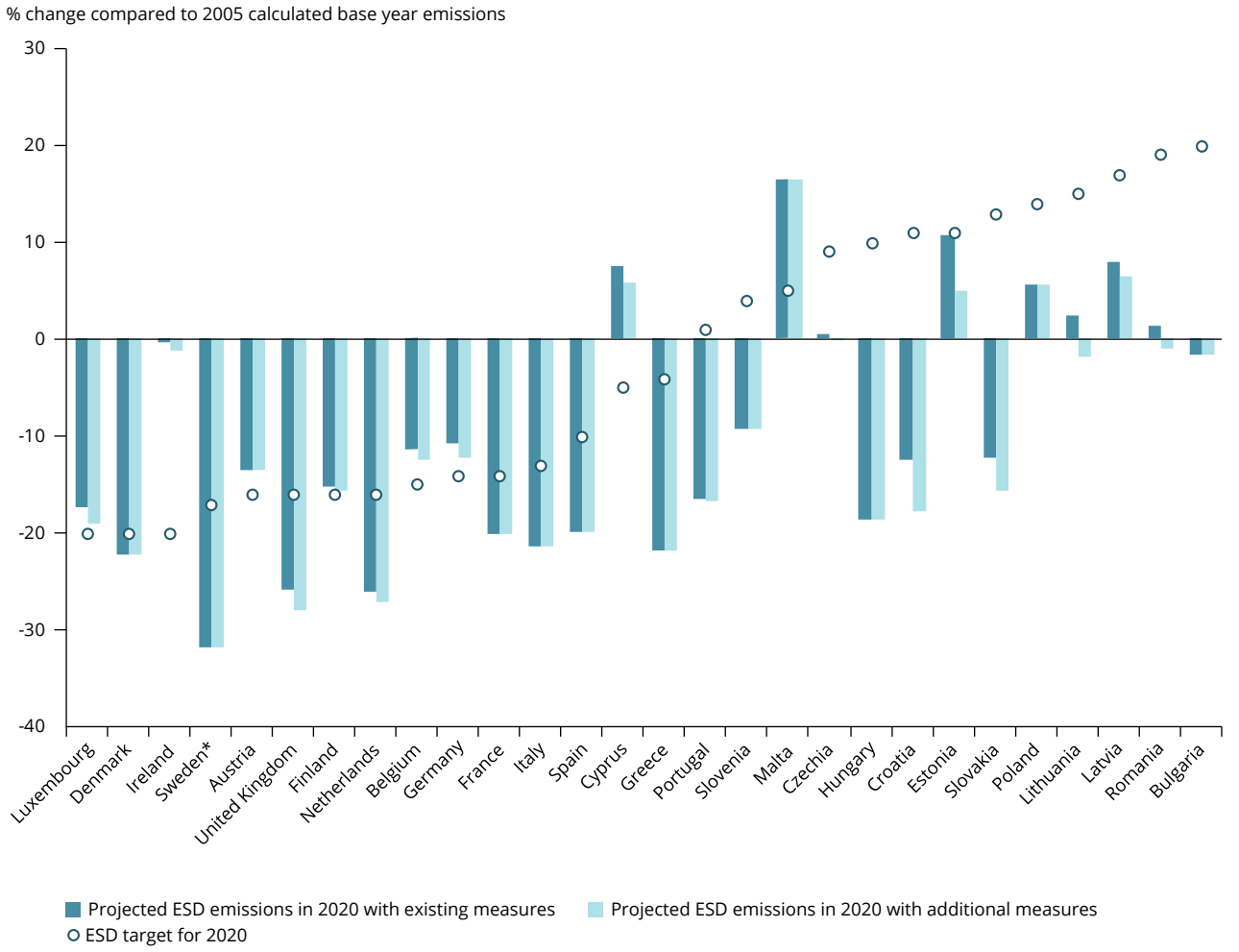
In 21 Member States, approximated ESD emissions in 2017 are higher than projected emissions. In four Member States (Bulgaria, Estonia. Lithuania and Poland), approximated emissions in 2017 show levels that exceed the trajectory required to meet 2020 targets. However, projections for the years up to 2020 show a fall in expected emissions levels that bring

these four Member States back on track toward their Effort Sharing targets. (see Table A.1.4 in Annex 1).

Effort Sharing emission targets, expressed in quantities of AEAs, can be considered as annual emission budgets that can be partly transferred from one year to another, as well as between Member States, under certain rules defined in the ESD. It is therefore possible to define an overall emission budget under the ESD for the whole period 2013-2020 for each Member State and at EU level. As historical and projected Effort Sharing emissions at EU level are below Effort Sharing targets, an overall surplus between about 1 600 and 1 700 million AEAs is expected by 2020 at EU level (see Annex 1, Section A1.5).

At Member State level, the size of the expected cumulative AEA surpluses or deficits by 2020 differs greatly (see Figure 3.3). The largest cumulative surpluses are projected for Italy, the United Kingdom, Spain and France. Only two Member States (Ireland and Malta) expect a deficit of AEAs over the whole period. For Ireland, this is so even in the case of a WAM scenario that considers additional measures. Currently planned or further additional measures will have to be implemented in due course or these Member States

Figure 3.2 Projected progress of Member States towards their 2020 ESD targets



Notes: 17 Member States submitted a scenario with additional measures (WAM). For the other Member States (Austria, Bulgaria, Denmark, France, Greece, Italy, Malta, Poland, Slovenia, Spain and Sweden), the scenario with existing measures (WEM) is shown instead. Denmark submitted a WAM scenario that was identical to its WEM scenario.

*Sweden has cancelled its AEA surpluses for the period 2013-2015. This is not reflected in the graph and would reduce Sweden's surplus by around 19 million AEAs.

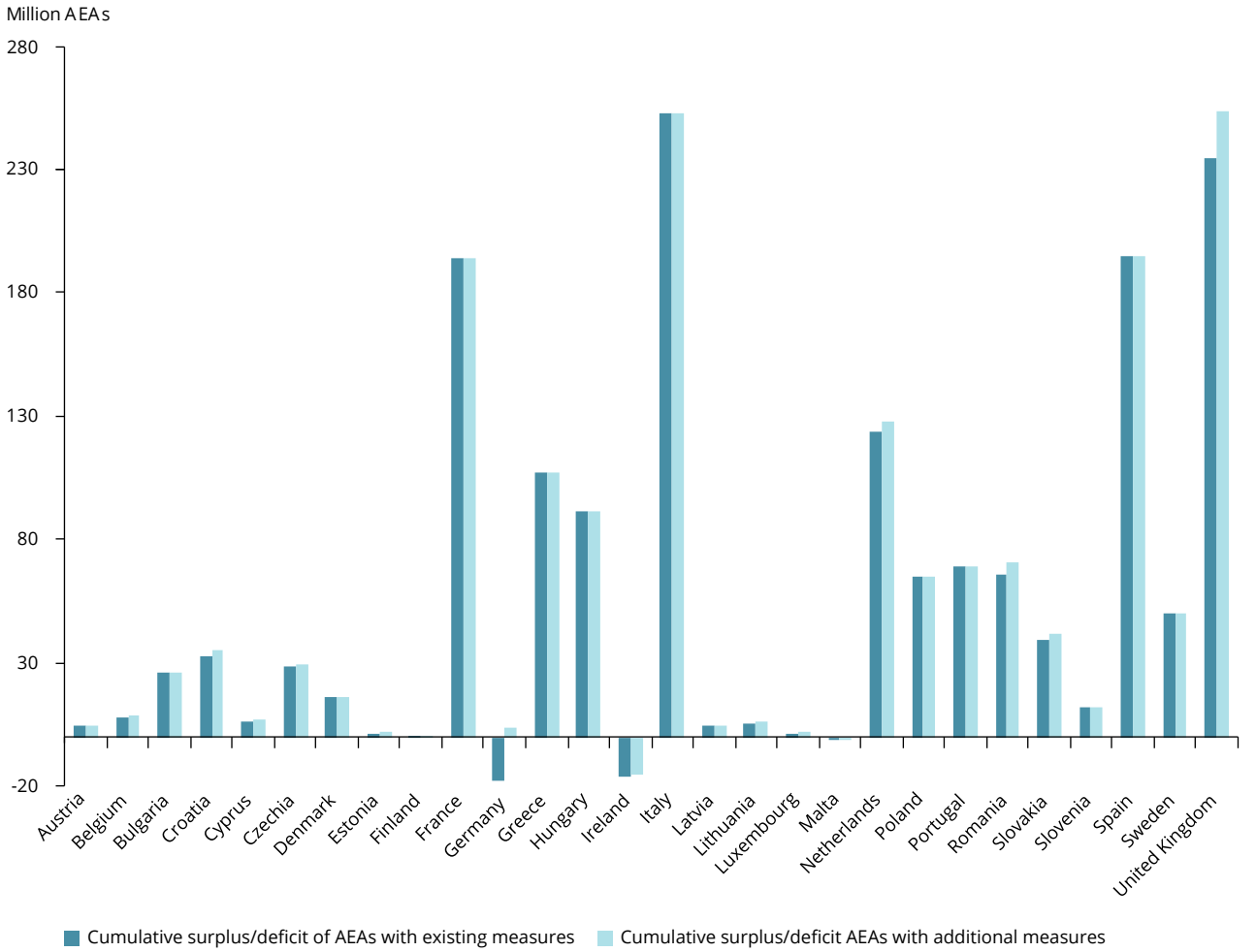
Sources: EEA, 2018c; EU, 2017a, 2013a, 2013b, based on Member States' submissions.

will need to purchase AEAs from other Member States or international project credits.

Overall, based on historical emissions, including approximated Effort Sharing emissions for 2017 and the latest national GHG projections submitted under the MMR until 2020, a net surplus of between 1 600 and 1 659 million AEAs (depending on the scenario considered) could accumulate by 2020 if all unused AEAs were carried over to subsequent years within the compliance period from 2013 to 2020. This projected surplus is slightly lower than that calculated in the 2017 assessment (1 700 to 1 800 million AEAs) (EEA, 2017a). The quantity of surplus AEAs would be more than enough to cover the potential deficits observed or expected in a limited number of Member States.

So far, the European Commission has performed compliance checks for the period 2013-2015. Malta balanced its respective surplus emissions of 0.08, 0.12 and 0.14 $MtCO_2e$ with AEA purchases from Bulgaria, which had overachieved its targets. Bulgaria declared that it would disburse the financial revenues from these AEA transfers solely to subsidise and administer activities aimed at climate change mitigation or adaptation. All other Member States except Sweden transferred surplus AEAs to subsequent years. Sweden invited Member States to follow its example by increasing ambitions under the ESD through annual cancellation of surplus AEAs. For the period 2013-2015, Sweden has cancelled its annual surpluses. For these years they add up to 19.4 million AEAs (see EC, 2018a).

Figure 3.3 Projected cumulative differences between emission ESD targets, 2013-2020



Notes: A positive value represents a surplus of AEAs. A negative value represents a shortfall of AEAs. A total of 17 Member States submitted a scenario with additional measures (WAM). For the other Member States (Austria, Bulgaria, Denmark, France, Greece, Italy, Malta, Poland, Slovenia, Spain and Sweden), the scenario with existing measures (WEM) is shown instead. Denmark submitted a WAM scenario that was identical to its WEM scenario.

Sources: EEA, 2018a, 2018b, 2018c, 2018f, 2018j; EU, 2017a, 2017b, 2017c, 2016a, 2013a, 2013b, based on Member States' submissions.

No additional use of flexible mechanisms (transfer of AEAs between Member States or additional flexibility through the purchase of emission credits outside the EU) has been reported.

Situations of eight Member States at risk of missing their 2020 Effort Sharing targets

National projections suggest that Effort Sharing emissions will exceed Effort Sharing targets by 2020 in Austria, Belgium, Cyprus, Finland, Germany, Ireland, Luxembourg and Malta. These Member States can still meet their obligations under the ESD by enhancing national efforts to reduce their domestic emissions to levels below Effort Sharing target levels by 2020, as well as by using the flexibilities provided for under the ESD (see Table A3.4), as described in the following paragraphs.

For **Austria**, a deficit of AEAs is projected for 2020 in the WEM scenario. A WAM scenario has not been submitted. Several policies that were reported under the WAM scenario in 2015 are now included in the WEM scenario, as they have been implemented. With no additional measures, Austria could achieve its Effort Sharing targets by using AEAs accumulated between 2013 and 2016. According to projection for the period 2018-2020, this would be enough to close the gap in Effort Sharing targets by 2020. Proxy emissions in 2017 are higher than projected numbers by nearly 2 $MtCO_2e$, mainly because of higher emissions from transport. If this difference in projections remains, the surplus accumulated until 2016 might not be sufficient to comply with the ESD without the purchase of surplus AEAs from other Member States.

For **Belgium**, projections indicate that, in addition to deficits in 2016 (which may be due in part to a colder than average winter), deficits in AEAs could occur between 2018 and 2020 in the WEM scenario, with an estimated gap of 2.8 million AEAs in 2020. WAM scenario projections show that this deficit could be reduced to 2.0 million AEAs in 2020 by implementing additional measures. Belgium could achieve its Effort Sharing targets for the whole period by using surplus AEAs already accumulated between 2013 and 2015. Effort Sharing emissions turned out to be higher than expected in 2016. This also holds true for approximated 2017 Effort Sharing emissions compared with projected 2017 Effort Sharing emissions but to a lesser extent. Therefore, the projected Effort Sharing emissions until 2020 might also be higher than expected and gaps in later years might be greater than projected.

For **Cyprus**, a deficit of AEAs is estimated for 2017 and projected every year from 2018 to 2020 under both the WEM and WAM scenarios. The flexibilities of carrying forward AEAs from previous years, however, seem to be sufficient for Cyprus to stay within its given budget for the period 2013-2020.

Finland projects its emissions to slightly exceed allocated AEAs in the period 2019-2020 (WEM scenario) or 2020 (WAM scenario). According to the most recent projections, surplus AEAs from previous years are sufficient to compensate for this deficit under both scenarios. However, Effort Sharing emissions turned out to be higher than projected in 2017, especially in the transport sector. This also holds true for approximated 2017 Effort Sharing emissions compared with projected 2017 Effort Sharing emissions, which are higher by more than 1 $MtCO_2e$. Therefore, the projected Effort Sharing emissions until 2020 might also be higher than previously expected and gaps in later years might be higher than suggested in projections submitted in 2017.

Germany's WEM projections indicate a deficit of 15.6 million AEAs in 2020. Considering additional measures of the WAM scenario, this deficit falls to 8.1 million AEAs in 2020. With GHG projections submitted in 2017 for the period 2017-2020, gaps from 2016 onwards could be compensated for by using accumulated surplus AEAs from the period 2013-2015. However, Effort Sharing emissions turned out to be higher than expected in 2016. This also holds true for approximated 2017 Effort Sharing emissions compared with projected 2017 Effort Sharing emissions. Approximated emissions are more than 20 $MtCO_2e$ higher than the projected emissions. The increasing trend in Effort Sharing emissions since 2014 may imply that projected Effort Sharing emissions until 2020 might also be higher than expected, so that gaps in later years will be higher too. The most important Effort Sharing sectors are transport, 'industry and other' and buildings. The transport, 'industry and other' and agriculture sectors are encountering increasing emissions since 2005. The main emission reductions since 2005 have been achieved in the buildings sector. For buildings, marketable technologies that reduce energy demand as well as enabling integration of renewables in buildings are already available and already economically advantageous. Considering the importance of the buildings sector in energy consumption, efforts to reduce emissions in this sector should be further intensified.

For **Ireland**, projections show deficits under both scenarios until 2020. With updated projections in 2018, the deficit increased. Transferring surplus AEAs accumulated between 2013 and 2015 would not be enough for Ireland to comply each year until 2020. Most Effort Sharing emissions arise from agriculture

and transport. In both sectors, emissions are projected to increase in coming years if only existing policies and measures are considered. Ireland will therefore need to successfully implement further measures to those reported in its WAM scenario, or purchase AEAs or international credits. As reported by Ireland in 2018, additional measures that would contribute to closing the gap in Effort Sharing sectors include a further increase in the deployment of electric vehicles compared with the WEM scenario and efficiency gains in the use of fertilisers in the agricultural sector. The residential sector measures include the extension of several existing schemes laid out in Ireland's National Mitigation Plan. Additional measures in the commercial sector include the extension of several measures, including the Accelerated Capital Allowance Scheme, the Excellence in Energy Efficiency Design (EXCEED) Programme, the Energy Supplier Obligation Scheme, the Sustainable Energy Authority of Ireland's Small to Medium-sized Enterprise (SME) Programme, the Public Sector Building Demonstration and Public Sector Programmes and the Better Energy Scheme.

For **Luxembourg**, deficits are projected for the year 2020, with a gap of 0.3 million AEAs (WEM scenario) and 0.1 million AEAs (WAM scenario) in 2020. This gap could be filled with the use of surplus AEAs from preceding years. The main source of Effort Sharing emissions in Luxembourg is transport, in which emissions are projected to stay about constant in coming years. Submitted projections in 2017 match quite closely the latest emissions developments.

For **Malta**, deficits are projected for every year until 2020, with an annual gap of 0.1 million AEAs (WEM scenario). Malta has not submitted a WAM scenario. Malta already complied with its legal obligations in relation to 2013, 2014 and 2015 by purchasing surplus AEAs from Bulgaria. According to the inventory for 2016, approximated Effort Sharing emissions for 2017 and the national projections up to 2020, each year Malta will further need additional flexibility mechanisms such as purchasing AEAs from Member States that have overachieved their targets. Malta has exhibited emission increases since 2005 in all three main Effort Sharing sectors (transport, 'industry and other' and buildings). These trends might partly result from increasing tourism, which can have a large impact on such a small country (Eurostat, 2018d). This increase goes along with an increase in buildings, transport, waste and also air conditioning systems. While air conditioning systems lead to emission increases in the electricity sector, they also influence the consumption of F-gases, which is included in the 'industry and other' sector.

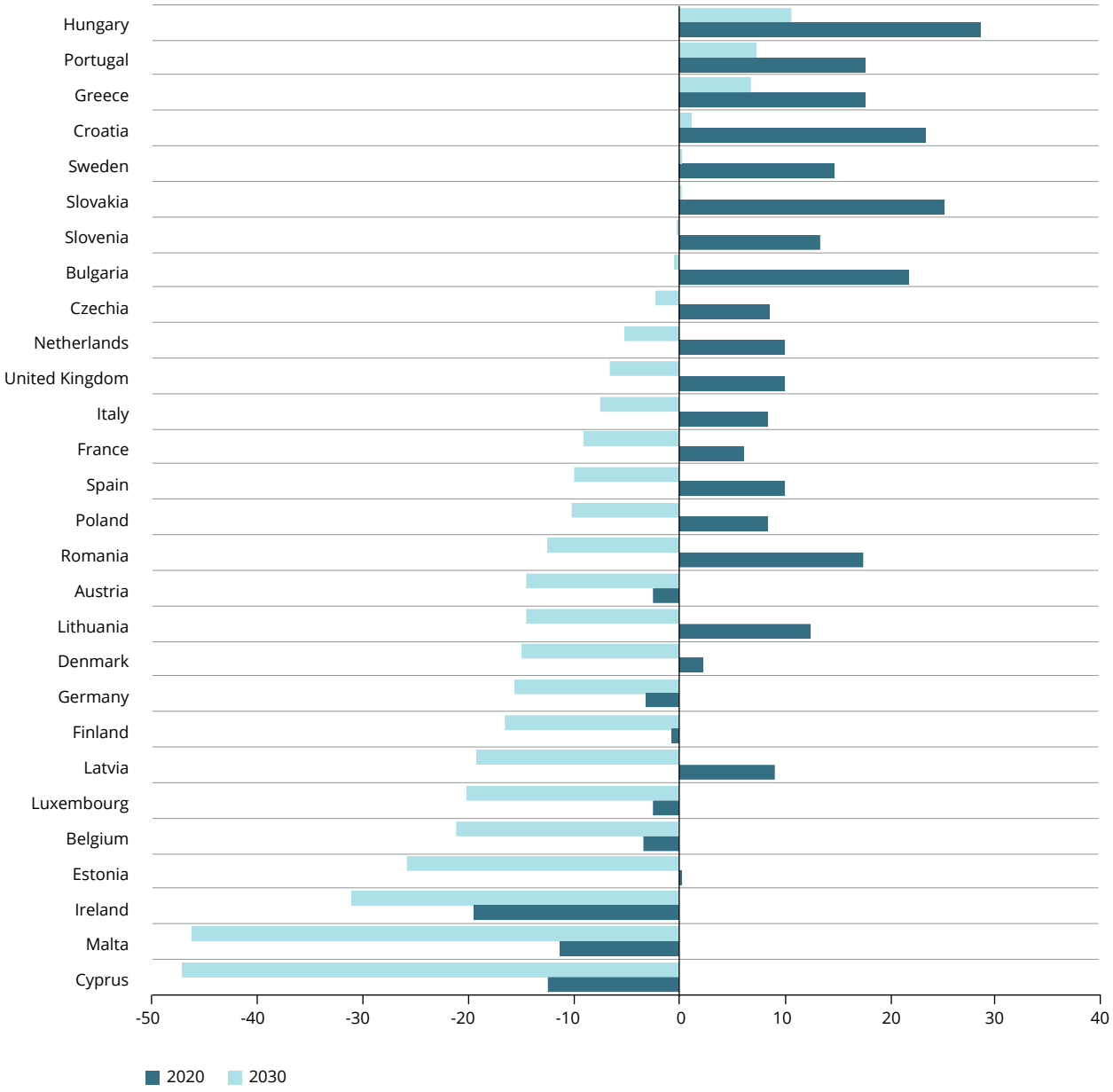
3.4 Projected progress towards 2030 targets under the Effort Sharing Regulation

In the WEM scenario, 20 Member States are projected to stay below their annual emission allocations for 2020. Extending the perspective until 2030, this holds true for only six Member States (Croatia, Greece, Hungary Portugal, Sweden and Slovakia). Figure 3.4 shows projected progress of Member States towards their 2020 and 2030 Effort Sharing targets based on existing measures.

Additional policies and measures are expected to assist Member States to better meet their 2030 targets. In particular, Cyprus and Estonia expect additional measures to reduce the gap between their emissions and 2030 targets by 30 and 24 percentage points, respectively. In 2018, Member States will submit their draft NECPs, in which they will detail which policies and measures they expect to implement to achieve their 2030 targets. The current analysis of Member States' prospects towards reaching their 2030 targets is based on existing and additional policies and measures in place or anticipated in 2016.

Figure 3.4 **Projected progress of Member States towards their 2020 and 2030 ESD/ESR targets with WEM scenarios**

Difference between annual emissions and ESD/ESR target relative to 2005 base year emissions (%)



Sources: EEA, 2018c; EU, 2018a, 2017a, 2013a, 2013b, based on Member States' submissions.

4 Progress of the European Union towards its renewable energy targets

- The share of energy in the EU's gross final energy consumption that is generated by renewable sources has almost doubled since 2005 and reached 17.0 % in 2016, exceeding the indicative EU trajectory set out in the RED (13.8 %).
- Preliminary estimates from the EEA show that renewable energy use in the EU is expected to have increased to 17.4 % of gross final energy consumption in 2017.
- Although the gross final consumption of renewable energy increases year on year, the annual increase in the share of energy from renewable sources has slowed down in recent years, especially because of the relative increase in final energy consumption. If this trend observed over the last 3 years is not reversed, it could jeopardise the achievement of both the renewables and the energy efficiency targets at EU level.
- The consumption of renewable energy in the transport sector in the EU reached a share of 7.1 % in 2016 and 7.2 % in 2017, according to EEA preliminary estimates. Although the share increased considerably between 2015 and 2016, insufficient progress has been achieved so far towards the 10 % target set for the transport sector for 2020.
- If Member States fully delivered on their National Renewable Energy Action Plans (NREAPs), the EU would slightly overachieve its renewable energy target for 2020 by about 1 %. Subsequently, annual increases to reach the 2030 target would need to be in the magnitude of 1.2 percentage points.
- If the EU manages to step up its effort this way and meets the 2030 target for renewable energy, it will have better prospects in the long term. After 2030, a RES share of 55 % can be achieved with constant annual increases of around 1.2 percentage points. However, this is a larger growth rate than has been observed between 2005 and 2016, at 0.7 percentage points per year.
- Achieving the 2030 RES target will require an increased pace of deploying renewables coupled with additional efforts to increase investors' confidence in renewables and tackle energy demand. The political agreements reached on governance, energy efficiency and renewable energy aim to provide the necessary elements for such investor confidence and energy savings.

4.1 Current progress on renewable energy

The EU's current share of renewable energy consumption is above the level indicated in the RED for the period 2015-2016 ([12]). In 2016, the use of RES in the EU, as a proportion of gross final energy consumption, continued its growth, standing at 17.0 % of gross final energy consumption. However, this is an increase of only 0.4 percentage points from the previous year, the lowest increase since 2012. According to preliminary estimates from the EEA, the share of energy from renewable sources in the EU's gross final consumption of energy is expected to reach a level of 17.4 % in 2017 (EEA, 2018d). If the growth in the RES share is not increased in the coming years while total energy consumption continues to increase, the EU will miss its 2020 renewable energy target.

([12]) Gross final energy consumption represents the energy delivered to end users (industry, transport, households and services including public services, agriculture, forestry and fisheries), as well as the consumption of electricity and heat by the energy sector for electricity and heat production. It also includes losses of electricity and heat during distribution and transmission.

The RED sets binding national targets for 2020 for all Member States (EU, 2009b). These national targets, ranging from 10 % for Malta to 49 % for Sweden, reflect differing national circumstances and starting points. To ensure that these 2020 targets are achieved, the RED also sets indicative trajectories for the period 2011-2018. Member States may reach their indicative RED targets domestically (by establishing adequate RES support measures) and through cooperation with other countries (between local, regional and national authorities, planned statistical transfers or joint projects ([13])).

The RES share of 17.0 % achieved by the EU in 2016 exceeds the average EU share for the two consecutive years 2015 and 2016, in accordance with the indicative trajectory resulting from the RED (13.8 %) for these years.

Preliminary estimates by the EEA indicate that the EU achieved a 17.4 % RES share in 2017, exceeding the average share of its indicative trajectory derived from the RED for the years 2017 and 2018 (16.0 %).

The RES share of 17.0 % in 2016 is also higher than the aggregate ambition levels that Member States had planned to achieve by 2016 (16.1 %), according to the roadmaps reported in their 2010 NREAPs and assessed by the EEA (EEA, 2018a).

Between 2005 and 2016, the use of energy from renewable sources, as a proportion of gross final energy consumption, increased on average by 0.7 percentage points every year. This steady increase reflects a combination of two trends:

1. dynamic developments in the use of renewable energy (in absolute terms);

2. a decrease in final energy consumption.

While the consumption of renewable energy grew by 77 % between 2005 and 2016, total gross final energy consumption decreased by 6 % during the same period (see Figure 4.1). However, an increase in the latter can be observed since 2015, which hinders RES share growth and good progress to energy efficiency targets (see also Chapter 6).

Between 2015 and 2016, the consumption of renewable energy increased by 8 Mt of oil equivalent (Mtoe) (from 188 Mtoe to 195 Mtoe). The 15 % decrease in the gross final energy consumption of non-renewable sources between 2005 and 2016 clearly indicates a progressive substitution of fossil and nuclear fuels by renewables. However, between 2014 and 2016, the consumption of non-renewable sources as well as total final energy consumption increased from 923 to 952 Mtoe, and from 1 101 to 1 147 Mtoe, respectively. Thus, the overall trend to reduce energy consumption shifted. In absolute terms the consumption of fossil fuels increased by more than that of RES.

4.2 Projected progress towards 2020 targets in the deployment of renewable energy sources

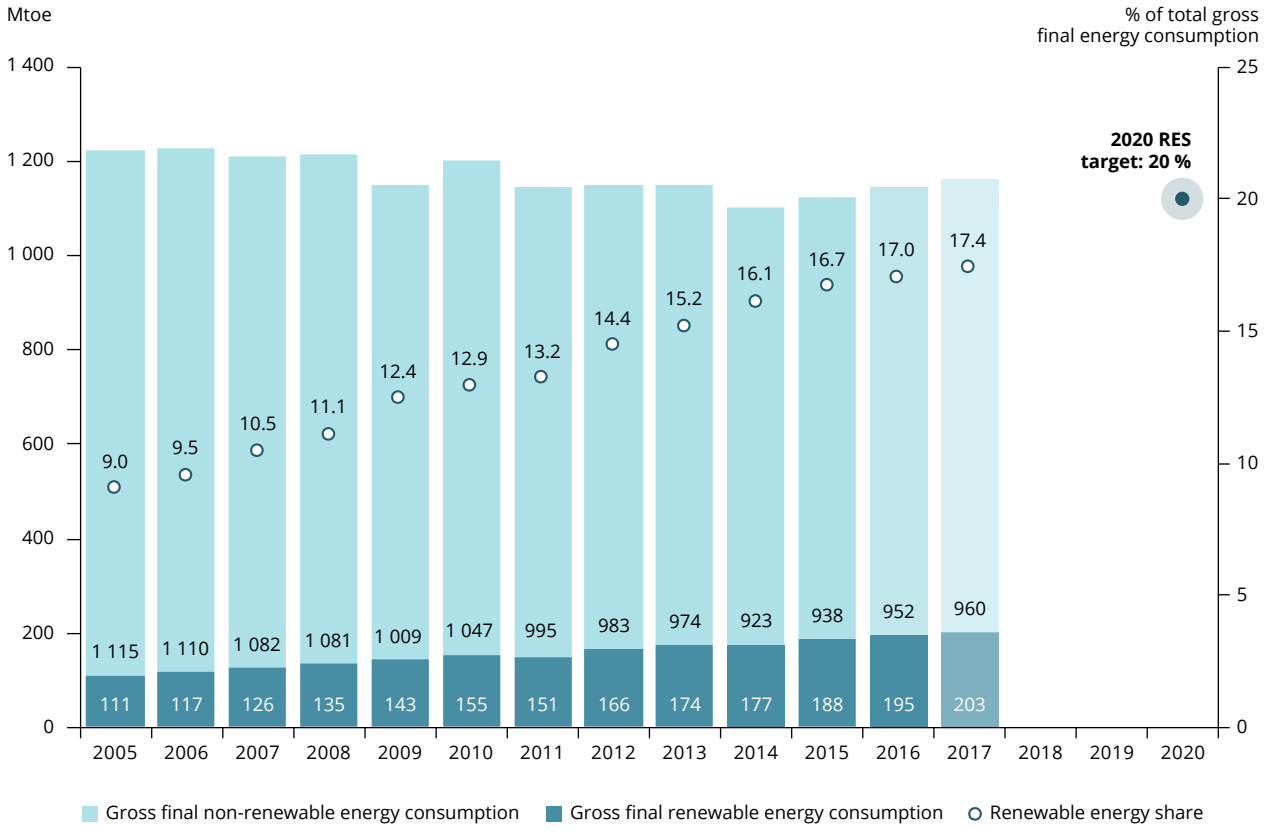
If the average annual percentage point increase in RES share observed between 2005 and 2016 were to be maintained until 2020, the EU would achieve its 2020 target; however, increasing total energy consumption and several other complex factors are at play with uncertain outcomes. This includes the outdated structure of the electricity market, which prevents certain market players and consumers from participating actively in the market, the sub-optimal use of cross-border opportunities and the slow expansion of the grid infrastructure, which at times prevents contributions from a growing share of centralised and decentralised RES. The changes in national RES-supporting policies over past years may have caused some investors to hold back at present. However, the legislative initiatives in the 'European Commission Clean Energy for all Europeans' package will bring in necessary new momentum. In combination with the elements proposed in the Commission's Multiannual Financial Framework — such as Connecting European Facility's Energy, the new Invest EU Fund and the new sub-programme on energy transition in the LIFE Programme — they will improve the framework for renewable energy investments. At the same time, costs for new RES capacity continue to decrease through economies of scale, better knowledge integration and increasing experience.

According to their 2010 action plans and the subsequent biennial progress reports ([14]), Member States plan to increase the share of energy from renewable sources at EU level to approximately 21 % by 2020, as analysed by the EEA (EEA, 2017b). However,

([13]) The RED anticipates three main cooperation mechanisms among Member States in their pursuit of their national targets: 'statistical transfers', in which Member States agree to reattribute renewable energy production among themselves in their statistical accounting for target compliance, without any physical energy exchanges taking place; 'joint projects', in which the renewable energy from a particular project is shared between the parties, with or without a physical flow of the energy produced; and 'joint support schemes', in which Member States co-finance their renewable energy production independent of its location (within their territories).

([14]) For the years up to 2020, Member States must report, in their RED progress reports, the estimated excess/deficit production of energy from renewable sources relative to their national indicative RED trajectory.

Figure 4.1 Gross final energy consumption from RES and non-RES, 2005-2017



Notes: Eurostat calculates the shares of RES consumption, and as part of this process normalises wind power and hydroelectricity generation, which are part of the RES share numerator. However, the total consumption of electricity included in the denominator is not normalised. In the figure above, non-normalised gross final energy consumption is displayed together with shares of RES consumption, in which the numerator has been normalised.

Sources: EEA, 2018d; EU, 2009b; Eurostat, 2018b.

not all Member States reported RES projections, or specified the status of the policies and measures (e.g. existing or planned) on which their projections were based. This makes it difficult to use the RES projections to assess progress towards RES targets for all Member States in a consistent manner, as is done for GHG emissions.

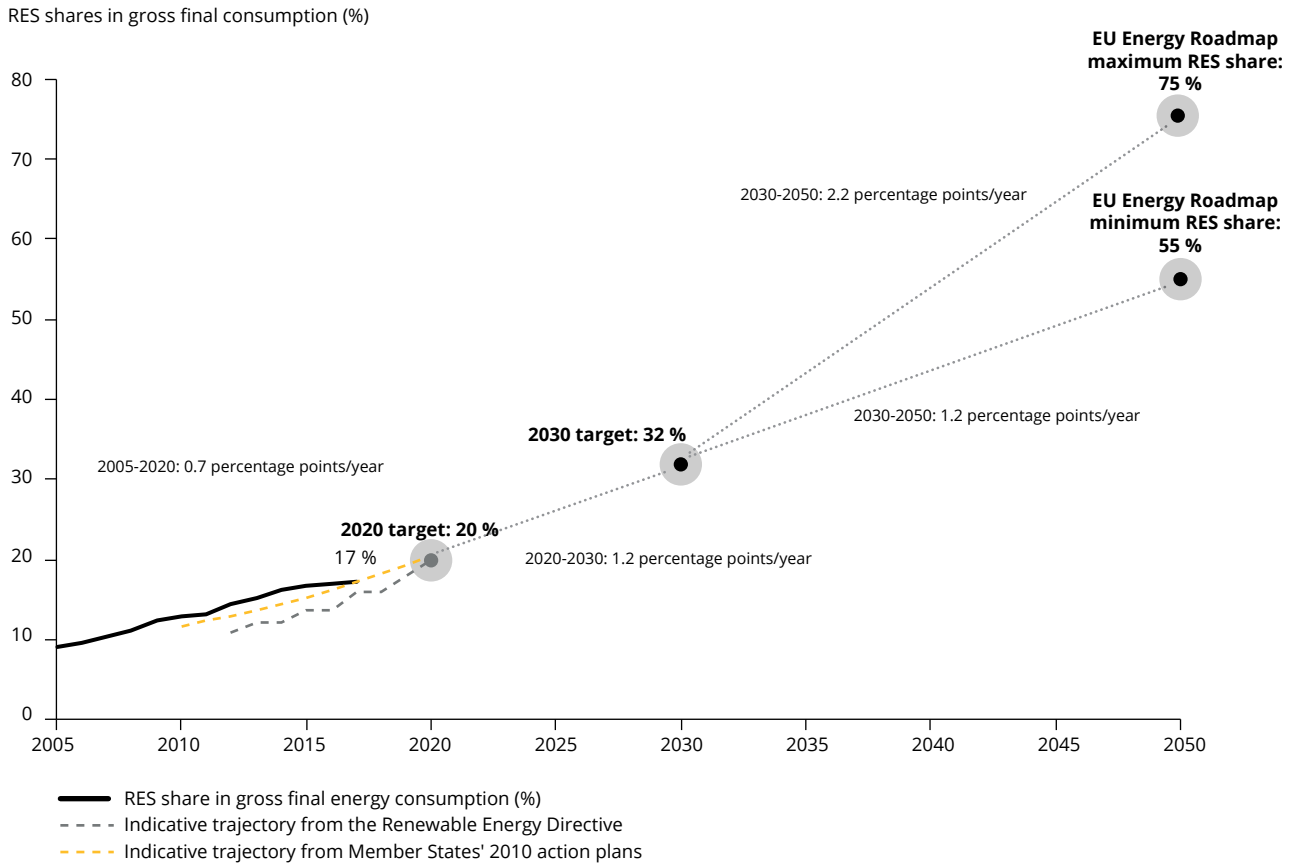
4.3 Projected progress towards 2030 targets in the deployment of renewable energy sources

The revised RED confirms the objective of increasing the EU-wide share of RES consumption to a binding level of at least 32 % by 2030. This 2030 target requires higher annual increases in the share of renewable energy compared with that observed since 2005. Current national documents offer limited information regarding the continuation of efforts envisaged by Member States after 2020. However, based on the Governance Regulation for the Energy Union, Member States are required to submit draft national integrated energy and climate plans by the end of this year. These draft NECPs will outline countries' envisaged efforts post-2020. The NECPs shall be finalised by the end of 2019, and they will provide greater clarity on the approaches that Member States intend to adopt to achieve their 2030 targets.

4.4 Future progress towards 2050 targets in the deployment of renewable energy sources

Beyond 2030, the EU has no quantified target for renewable energy. However, to achieve the goal of reducing EU-wide GHG emissions by 80-95 % compared with 1990 levels by 2050, the EU-wide share of RES will need to increase significantly. This increase would amount to levels between 55 % and 75 % of gross final energy consumption (see Figure 4.2), in accordance with the decarbonisation scenarios presented in the European Commission's communication *Energy*

Figure 4.2 Share of energy from RES in the EU's gross final energy consumption, 2005-2050



Sources: EC, 2013b, 2013c, 2011a, 2011b; EEA, 2018d; EU, 2009b; Eurostat, 2018b.

Roadmap 2050 (EC, 2011a, 2011b, 2011c). Achieving a 75 % RES share calls for considerably greater efforts now and after 2030. Stepping up near-term efforts to deploy renewables would balance the pace of growth required between 2030 and 2050.

The transport sector represents a challenge due to its significant reliance on fossil fuel-based technologies and infrastructure. Progress in increasing the use of renewable energy consumption in this sector has been relatively limited in the EU to date, with consequences for the sector's GHG emissions.

4.5 The development of renewable energy for electricity, heating and cooling, and transport

RES are used in power generation, for heating and cooling, and in the transport sector. In addition to the overall 20 % target for renewable energy use in all sectors by 2020, the RED sets a 10 % target in the transport sector at EU and Member State level. With the new regulation having been agreed, EU Member States should ensure via obligations on fuel suppliers that between 2021 and 2030, at least 14 % of transport fuels stem from renewable sources (EEAS, 2018). The contribution from conventional biofuels is capped at a maximum share of 7 %. Generally, progress in the transport sector is much slower compared with overall RES growth rates for all sectors.

Between 2005 and 2016, the share of electricity from renewable sources consumed in the EU grew at an average of 1.3 percentage points per year. In 2016, about 30 % of the electricity consumed in the EU was generated from renewables, with the most important sources being hydropower (36 %), wind (32 %), solar photovoltaic (PV) energy (12 %) and solid biomass (10 %) (EEA, 2017b). About 44 % of renewable electricity came from variable sources such as wind and solar power (Eurostat, 2018b). For 2017, the EEA's

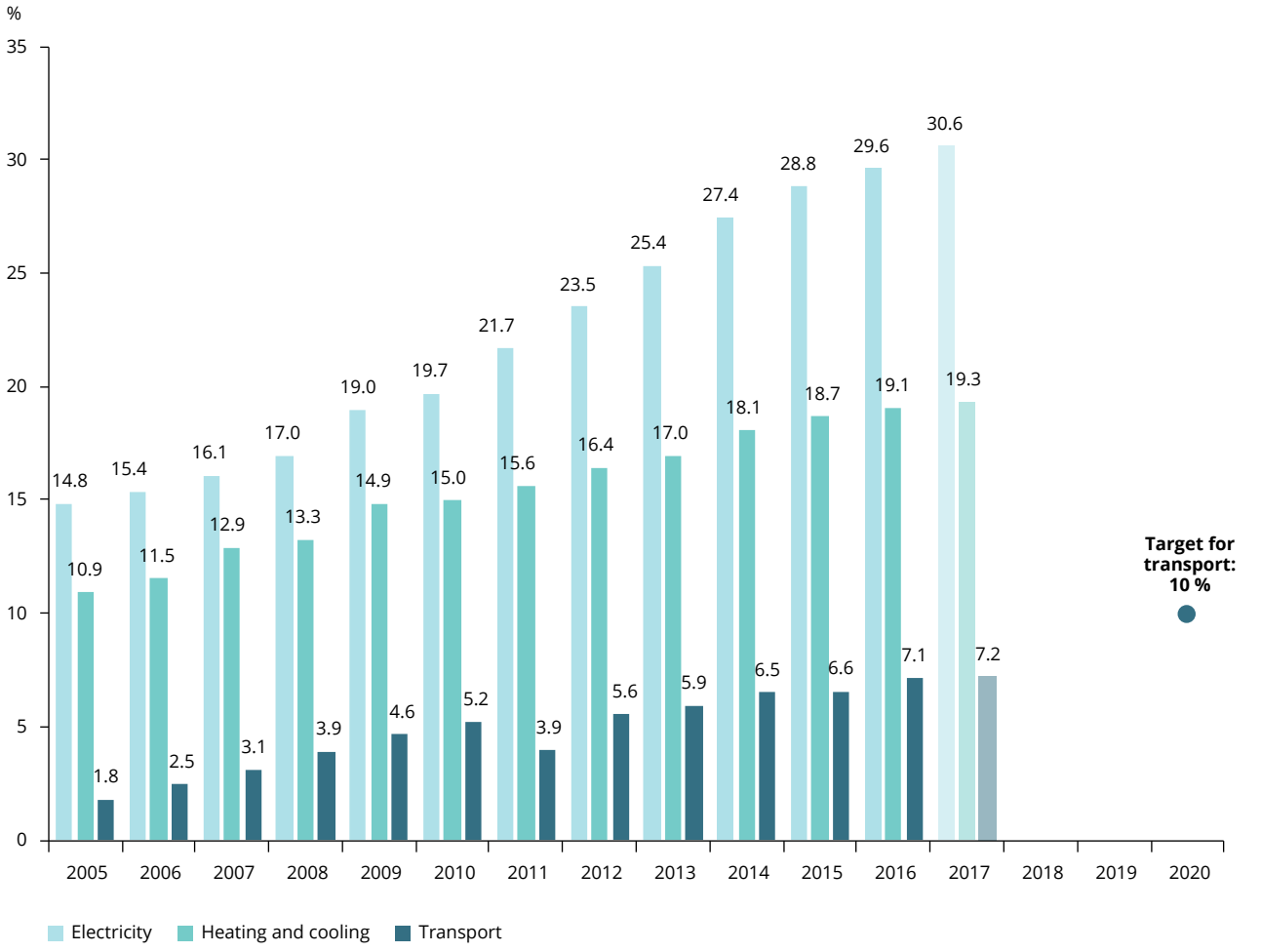
approximated estimates indicate that about 31 % of total electricity consumed was derived from RES, with more than 45 % of this share from wind (34 %) and solar power (12 %) (EEA, 2018d).

In the EU heating and cooling sector, the RES share grew by 0.7 percentage points per year, on average, between 2005 and 2016. The greatest sources for renewable heating and cooling throughout the EU are solid biomass, heat pumps and biogas, followed by solar thermal collectors (EEA, 2017a). The share of energy from renewable sources used in this sector amounted to 19.1 % in 2016 and was estimated to increase in 2017 (19.4 %). Heating from renewable sources is increasingly being used as a cost-efficient and secure alternative to fossil fuels (mainly natural gas) in Member States for district heating and at local levels.

In 2016, renewable energy represented only 7.1 % of energy consumption in the transport sector (see Figure 4.3). According to preliminary estimates from the EEA, this proportion was 7.2 % in 2017. After rapid growth between 2005 and 2010, the proportion of RES in transport (RES-T) dropped in 2011 and has been increasing at a slower pace since 2012. This can be explained by several factors, including:

- Some Member States were late in transposing and implementing the legal provisions meant to ensure biofuel sustainability under the RED.
- The debate concerning the future of biofuel policy, in the light of the indirect displacement effects of conventional crop-based biofuels on other land uses. Studies showed that there is a risk of high GHG emissions caused by indirect land use change induced by biofuels. To avoid further risks, a political agreement led to a cap on the use of these fuels in 2015. Accordingly, such fuels should account for a maximum of 7 % of gross final energy consumption in transport by 2020 (EU, 2015a, 2015b). The Indirect Land Use Change (ILUC) Directive (EU, 2015b) also sets an indicative target of 0.5 % use for advanced biofuels by 2020 (e.g. fuels made from waste or algae). The recast of the RED requires Member States to promote targets for advanced biofuels post-2020 (0.2 % of transport fuels by 2021, rising to 3.5 % by 2030). It requires them to cap conventional crop-based biofuels at the level consumed in each Member State in 2020, with an additional 1 percentage point allowed over present consumption but with a maximum up to the overall cap of 7 %. After 2019, criteria for riskiness of crop-based biofuels are to be reviewed and crop-based biofuels with high ILUC risk will need to be decreased to 0 % by the end of 2030 (EEAS, 2018).
- The use of biofuels to reduce GHG emissions remains a relatively high-cost climate mitigation option. For example, it is estimated that the mitigation costs of biodiesel (not considering the indirect emissions related to land use change) would be in the range of EUR 100 to EUR 330 per tonne of CO_2 avoided; for bioethanol fuels from sugars and straw, costs would range from EUR 100 to EUR 200 per tonne of CO_2 avoided (EC, 2015b). These estimates depend to a large extent on the cost differentials between fossil fuels and biofuels. Nonetheless, biofuels and other renewable liquid fuels may have to be used in emission-intensive sectors such as aviation and shipping to substitute fossil fuels.

Figure 4.3 Shares of energy use from renewable sources by sector in the EU



Notes: Percentages indicate the share of energy from renewable sources in gross final energy consumption of the corresponding sector. Values for 2017 are approximated.

Sources: EEA, 2018d; EU, 2009b; Eurostat, 2018b.

5 Progress towards Member States' renewable energy targets

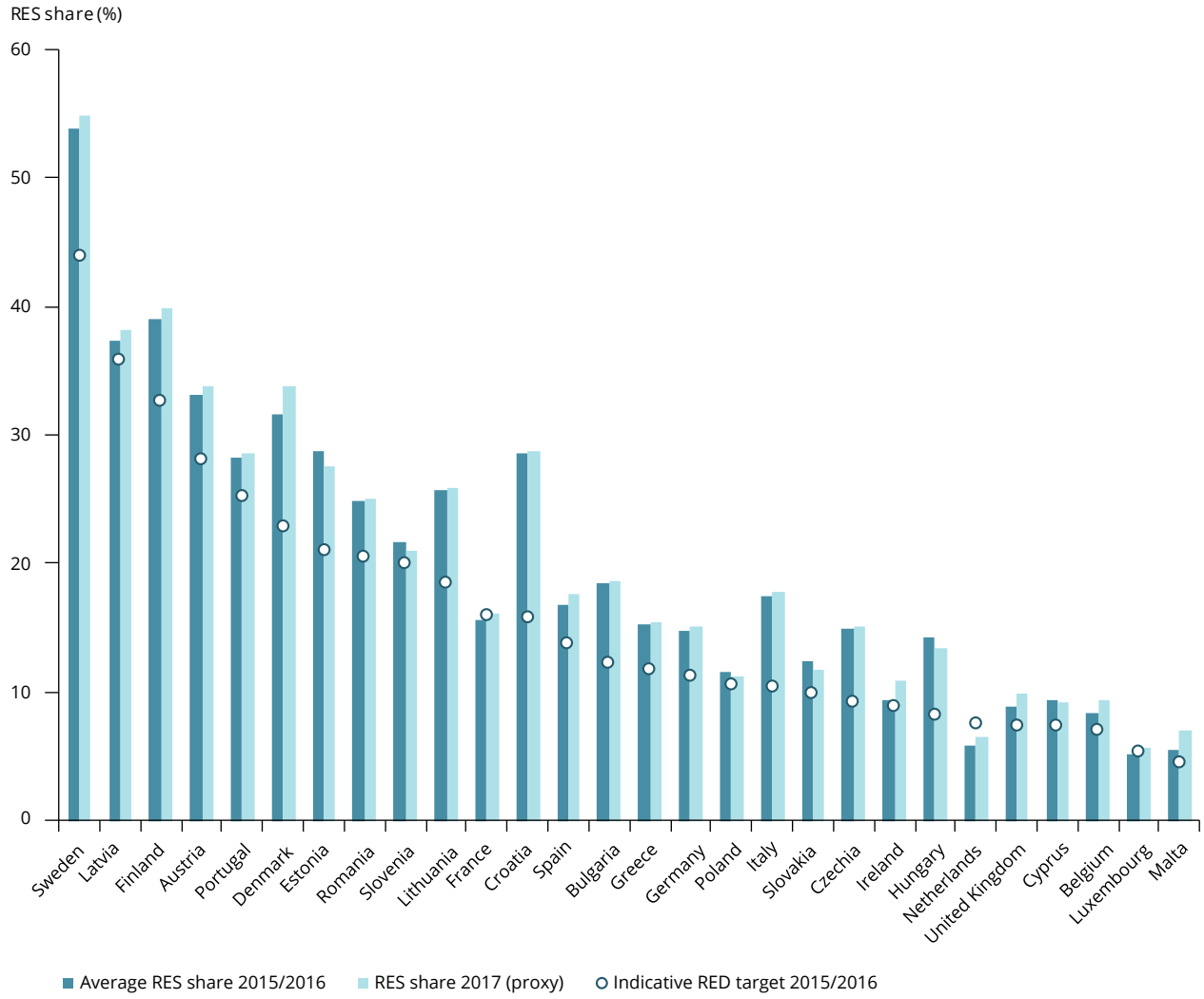
- In all Member States except three (France, Luxembourg and the Netherlands), the average RES share 2015-2016 was equal to, or higher than, the average for this period based on the indicative trajectories set under the RED. According to preliminary EEA estimates for 2017, all but eight Member States (Cyprus, France, Ireland, Luxembourg, the Netherlands, Poland, Slovenia and the United Kingdom) showed higher RES shares than their indicative trajectory set for 2017/2018.
- Regarding the progress of Member States based on their own national plans, 19 Member States (all except Cyprus, France, Ireland, Malta, the Netherlands, Poland, Portugal, Slovenia and Spain) reached or exceeded their adopted NREAP trajectories for 2016. According to preliminary estimates, this number is expected to decrease to 16 Member States (all except Belgium, Cyprus, France, Germany, Ireland, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovenia and Spain) in 2017.
- In 11 Member States (Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania and Sweden), the proportion of RES use in 2016 already exceeded the 2020 RED targets. Preliminary estimates for 2017 indicate that these Member States' achievements remained the same in 2017.
- Excess RES capacity may be used for transfers to support Member States facing difficulties in reaching their targets. The trading options provided for under the RED could provide benefits to the countries involved and help the EU achieve its 2020 RES target more cost-effectively. A total of 15 Member States (Bulgaria, Cyprus, Czechia, Denmark, Estonia, Germany, Greece, Italy, Luxembourg, Poland, Portugal, Romania, Slovakia, Spain and Sweden) expect to produce more energy from renewable sources than planned in at least one year before 2020. In principle, this excess capacity can be transferred to other Member States. In 2017, Luxembourg signed agreements with Lithuania and Estonia to statistically transfer excess renewable energy that can be counted towards Luxembourg's RES target.
- While the EU has a binding 2030 target for RES shares in place (at least 32 %), this target is not broken down to Member State level. Therefore, Member States' individual progress towards 2030 RES targets cannot be measured at this time without introducing assumptions.

5.1 Current progress towards renewable energy source targets

To achieve the EU's objective of a 20 % share of energy from renewable sources in its gross final energy consumption by 2020, the RED sets national targets for each Member State for 2020 (EU, 2009b). These targets range from 10 % (Malta) to 49 % (Sweden). To monitor progress towards these 2020 targets, the RED sets out indicative trajectories for the period 2011-2020. These indicative trajectories are expressed as average shares for 2-year periods, from 2011 to 2018, in addition to the 2020 target. Member States also set their own estimated trajectories in their NREAPs, reported in 2010 and updated by some Member States thereafter.

The RED requires Member States to amend and resubmit their national plans, should their respective RES shares fall below their indicative national trajectories in the immediately preceding 2-year period (see RED Art. 4.4). Nevertheless, the Commission may release these Member States from their obligations to resubmit their plans, taking due account of current and future measures set out by these countries. The average RES share in 2015 and 2016 for all Member States except three (France, Luxembourg and the

Figure 5.1 National shares of energy from renewable sources in relation to indicative RED trajectories



Sources: EC, 2013c; EEA, 2018d; EU, 2009b; Eurostat, 2018b.

Netherlands) exceeded their indicative trajectories set in the RED for the period 2015-2016 (see Figure 5.1).

The EEA's early renewable energy estimate for 2017 indicates that this pattern of exceeding the national indicative trajectories still holds true for 20 Member States' average RES shares in 2017-2018.

Considering RES shares in relation to 2020 targets, in 2016, 11 Member States already exceeded their national targets for 2020 set under the RED. These countries were Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania and Sweden (see Annex 3).

5.2 Progress towards the objectives of national action plans

Member States also adopted their own national trajectories to 2020 as part of their NREAPs, which they reported in 2010 and which some Member States have subsequently updated. These action plans concern the development of renewable energy at the national

level, and they include expected trajectories as well as planned RES shares in specific market sectors: RES in transport (RES-T), RES in heating and cooling (RES-H/C) and RES in electricity (RES-E).

For most Member States, these NREAP trajectories are more ambitious than the indicative trajectories defined in the RED ([15]). For example, the indicative RES target for the period 2015-2016 set out in the RED for Denmark is 22.9 %, whereas this country planned to achieve a share of 28.2 % for energy from renewable sources in 2016, according to its NREAP. In contrast, Greece, Latvia, Luxembourg, Romania, Slovakia and the United Kingdom have designed trajectories in their NREAPs that, from 2016, are lower than those set out in the RED.

In 2016, 19 Member States reached or exceeded the RES targets outlined in their NREAPs for that year (see Figure 5.2), while the RES shares in nine Member States (Cyprus, France, Ireland, Malta, the Netherlands, Poland, Portugal, Slovenia and Spain) were below the trajectories laid out in their respective NREAPs.

As of 2016, ten Member States had already attained their anticipated RES share for 2020: Bulgaria, Croatia, Denmark, Czechia, Estonia, Finland, Lithuania, Italy, Romania and Sweden.

Preliminary estimates by the EEA indicate that, in 2017, 16 Member States are expected to reach or exceed their NREAP trajectories. In addition to the countries that did not reach their NREAP trajectories in 2016, three further Member States (Belgium, Germany and Luxembourg) are expected to be below their NREAP trajectories in 2017.

5.3 Deployment of renewable energy between 2005 and 2016

The RES shares represent the ratio between renewable energy use and gross final energy consumption, at country and EU level. Accordingly, the growth in the RES share in the Member States during the period 2005-2016 is a combined result of the development (in absolute terms) of renewable energy use and changes in gross final energy consumption. The latter has declined in 22 Member States since 2005 (see Figure 5.3). Aggregated at EU level, the gross final consumption of energy declined by 6 % between 2005 and 2016, while renewable energy consumption grew by 77 % over the same period (see Section 4.1).

Compared with last year's report, gross final energy consumption increased over the whole period not only in Malta and Poland, but also in four additional countries (Austria, Estonia, Finland and Lithuania).

5.4 Progress towards renewable energy source targets in the transport sector

The 10 % RES-T target at EU level translates into RES-T targets of 10 % for all Member States. In 2016, only Austria (10.6 %) and Sweden (30.3 %) had RES-T shares of more than 10 %. In the other Member States, RES-T shares varied from 0.4 % (Estonia) to 8.9 % (France).

In several Member States, the use of biofuels compliant with sustainability criteria ([16]) increased considerably in 2016. At the same time, in many other Member States it decreased significantly. This volatility contributed to variations in the RES-T share. The most notable examples are Finland and Spain, where the RES-T share decreased by 14 percentage points between 2015 and 2016 (Finland) and grew by 4 percentage points (Spain) between these years. The reason for the increase in Spain is that a new information system has been implemented to register biofuel certification, which was necessary for accounting biofuels towards the target. In Finland, there was a drop in the national use of biodiesel in parallel with higher exports in 2016. The reason for this is that the yearly values vary, since operators have some flexibilities. For example, they can fill the yearly quota in advance (statistical transfers between years, transference of the obligation

([15]) In its 2015 progress report on the promotion and use of energy from renewable sources submitted under Article 22 of the RED, Italy presented an updated RES trajectory because of the unexpectedly quick development of the use of renewable energy compared with that expected in the 2010 NREAP. This was a consequence of the reduction in total final energy consumption and of the greater than anticipated increase in power generation from renewable sources. Such development is expected to continue until 2020. For the present assessment, the original NREAP trajectory was considered.

([16]) Only biofuels and bioliquids that comply with sustainability criteria defined at EU level can receive government support or count towards national renewable energy targets. These criteria ensure that the use of biofuels (in transport) and bioliquids (for electricity and heating) is done in a way that guarantees actual carbon savings and protects biodiversity. To be considered sustainable, biofuels must achieve minimum GHG savings in comparison with fossil fuels: they cannot be grown in areas converted from land with previously high carbon stock, such as wetlands or forests, and they cannot be produced from raw materials obtained from land with high levels of biodiversity, such as primary forests or highly biodiverse grasslands.

to another operator and variation in blends between gasoline and diesel). Thus, the yearly share may vary significantly.

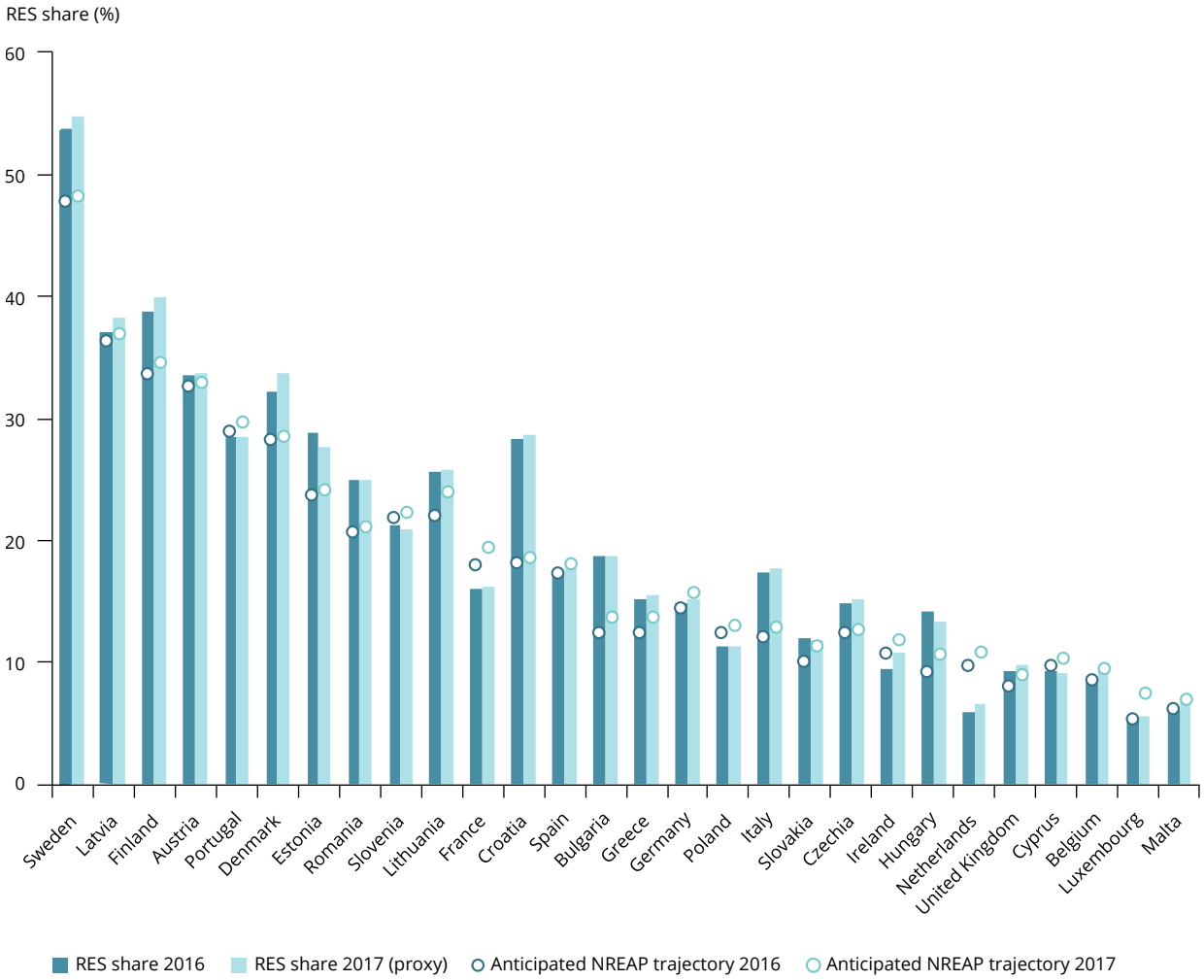
Calculating renewable energy shares in the transport sector is particularly challenging. Compliant biofuels, for example — listed in Annex IX of Directive (EU) 2015/1513, which amends the RED — are counted twice when calculating the renewable energy share in the transport sector. This means that their energy content is considered twice in the numerator, thus increasing the renewable energy share.

In 2017, preliminary estimates indicate that the situation remained similar to that in 2016. Apart from Austria and Sweden, RES-T shares ranged from 0.4 % (Estonia) to 8.7 % (France) in the other Member States.

5.5 Regional cooperation and statistical transfers

According to the latest progress reports on renewable energy submitted by Member States in 2017, 15 Member States (Bulgaria, Cyprus, Czechia, Denmark, Estonia, Germany, Greece, Italy, Luxembourg ([17]), Poland, Portugal, Romania, Slovakia, Spain and Sweden) expect to produce more energy from renewable sources than planned, for at least 1 year, until 2020. These Member States could, in

Figure 5.2 National shares of energy from renewable sources in relation to trajectories from NREAPs



Notes: The Member States are ranked by decreasing 2020 RES target levels. For Croatia, data revision, which took place in 2016, revealed significantly higher amounts of biomass consumption, which drove the proportion of renewable energy use upwards.

Sources: EC, 2013c; EEA, 2018d; EU, 2009b; Eurostat, 2018b.

([17]) Only for 2020.

Figure 5.3 **Gross final energy consumption (total and from renewable sources) and shares of energy from renewable sources in the Member States, 2005-2016**

Member State	Gross final energy consumption	Gross final energy consumption from renewable sources	Renewable energy share
	Total change 2005-2016 (%)	Total change 2005-2016 (%)	Percentage points change 2005-2016
Austria	3	46	9.8
Belgium	-1	266	6.3
Bulgaria	-4	94	9.4
Croatia	-8	9	4.5
Cyprus	-3	191	6.2
Czechia	-5	100	7.8
Denmark	-5	91	16.2
Estonia	1	67	11.3
Finland	2	37	9.9
France	-6	57	6.4
Germany	-1	119	8.1
Greece	-20	74	8.2
Hungary	-4	96	7.3
Ireland	-8	206	6.6
Italy	-14	98	9.9
Latvia	-6	8	4.9
Lithuania	4.7	60	8.8
Luxembourg	-12	240	4.0
Malta	33	5 801	5.9
Netherlands	-9	116	3.5
Poland	13	85	4.4
Portugal	-16	23	9.0
Romania	-9	32	7.7
Slovakia	-11	69	5.6
Slovenia	-0.05	33	5.3
Spain	-16	73	8.8
Sweden	-1	31	13.2
United Kingdom	-12	520	8.0

Notes: In Malta, there was an increase in gross final energy consumption from renewable sources of 5 801 % between 2005 and 2016, as renewable energy represented only a tiny fraction of the country's gross final energy use in 2005. At the same time, because of the very small absolute size of the country's renewable energy use in 2005, the data may not be fully representative and are thus not represented above. The data on total gross final energy consumption take into account adjustments regarding the amounts of energy consumed in aviation, as stipulated under the RED.

Source: Eurostat, 2018b. Figure created from data in that source.

principle, transfer any excesses to other Member States experiencing deficits.

Lithuania and Luxembourg signed an agreement in 2017 in which Lithuania agrees to make a statistical transfer of renewable energy to Luxembourg to help the latter reach its 2020 target of 11 % (EC, 2017a). Luxembourg is not only supported by Lithuania. Estonia too has agreed to statistically transfer renewable energy to Luxembourg from 2018 to 2020, for EUR 10.5 million (EC, 2017b; ENDS Europe, 2017; EWPA, 2017).

The agreement between Lithuania and Luxembourg was the first between two EU Member States. However, statistical transfers already took place regularly between Norway and Sweden from 2012 to 2016. This is because of their joint electricity certificate market scheme, which started trading in 2012. According to this scheme, an electricity certificate issued in one country can be used to meet the quota obligation in the other country, and vice versa. The agreement between Norway and Sweden was updated in May 2017. Sweden has decided on a new national target in 2030 and will therefore extend the electricity

certificate scheme for 10 more years. Norway will stop adding new projects to the scheme after 2021. The two countries will still have a common certificate scheme until 2045 (Swedish Energy Agency, 2017; The Norwegian Water Resources and Energy Directorate, 2017).

Other similar cooperation initiatives may be on their way too. In 2016, Denmark and Germany launched a first cross-border auction for ground-mounted PV installations (Edgar Meza, 2016). France and Germany have recently agreed on jointly developing a concept for holding a joint renewables auction for PVs (German Federal Ministry for Economic Affairs and Energy, 2017).

The Nero project offers 3 TWh of renewable energy produced by a 1 GW wind power plant in Romania to count towards the Dutch renewable energy target. This would hold true for the full lifetime of the project. According to the project, this could help the Netherlands to lower its gap to its 2020 target by approximately 30 % (Nero Renewables, 2017).

6 Progress of the European Union towards its energy efficiency targets

- Primary energy consumption in the EU increased by 0.7 % between 2015 and 2016. Preliminary estimates from the EEA indicate that primary energy consumption continued to rise between 2016 and 2017.
- Final energy consumption in the EU also increased in 2016, rising to 2 % above the 2020 target level. This increase reverses an earlier trend towards a reduction in final energy consumption at EU level, as consumption was below the indicative target in 2014 and 2015.
- 2017 was the first time since 2010 that both primary and final energy consumption rose above the indicative trajectory towards the 2020 targets.
- If energy consumption were to continue growing at its current rate, the EU would not meet its 20 % energy efficiency target for 2020. This underlines a critical need for new and renewed efforts to put the EU back on track towards the 2020 targets on energy efficiency.
- The recent increase in final energy consumption can largely be attributed to growing demands for energy in the transport sector, which in 2016 accounted for 33 % of final energy consumption at EU level. Similarly, growth in final energy consumption in the services sector has continued, albeit at a markedly slower pace than in the transport sector.
- Since 2005, substantial strides in energy efficiency have been made in the industries sector. Final energy consumption in households has returned to 1990 levels and shows a continued trend towards increasing efficiency.
- The new 2030 target of at least a 32.5 % improvement in energy efficiency will require primary and final energy consumption to fall by 26 % and 20 %, respectively, compared with 2005 levels.
- Achieving the 2030 targets will require new and expanded policies and approaches to energy efficiency in the Member States that can keep their energy consumption in check.

6.1 Current progress in reducing energy consumption

The EED defines the EU energy efficiency target for 2020, which can be expressed in terms of either primary energy consumption or final energy consumption (EU, 2012). Meeting both targets requires a reduction in primary ([18]) and final ([19]) energy consumption by 20 % compared with levels projected for 2020 in the European Commission's Energy Baseline Scenario (EC, 2008).

The EU legislation does not set any specific indicative trajectory to monitor the progress of the EU towards the 2020 target. This analysis uses an indicative linear trajectory between primary energy consumption levels in 2005 and the 2020 target level. By comparing the primary energy consumption of the latest available

([18]) Primary energy in the context of the EED means gross inland energy consumption minus non-energy use. Primary energy consumption measures the total energy demand of a country. It covers consumption of the energy sector itself, losses during transformation (e.g. from oil or gas into electricity) and distribution of energy, and final consumption by end users. It excludes energy carriers used for non-energy purposes (such as petroleum used not for combustion but for producing plastics).

([19]) Final energy consumption includes all energy delivered to the final consumer's door (in industry, transport, households and other sectors) for all energy uses. It excludes deliveries for transformation and/or own use of the energy-producing industries, as well as network losses.

year with this linear trajectory, progress towards the energy efficiency target can be tracked. If the EU's primary energy consumption is on or below the linear trajectory, it is considered to be on track towards meeting its 2020 target. Conversely, if the EU's primary energy consumption level is above the linear trajectory, it must decrease at a faster pace to meet the 2020 objective. While the EEA's methodology to track progress focuses on primary energy consumption, developments concerning final energy consumption complement the analysis in relation to the 2020 target. Further details on the methodology are described in Annex 3.

The EU's 2020 target expressed in terms of primary energy consumption is equivalent to a 13.4 % reduction from 2005 levels. In 2016, the EU's primary energy consumption was 10.0 % lower than in 2005, decreasing at an annual average rate of 0.9 %. This is the minimum rate required to achieve the 2020 target. Moreover, the primary energy consumption level in 2016 was almost level with the indicative linear trajectory (at only 0.11 % below). In 2016, final energy consumption rose above the 2020 target (see Figure 6.1).

Preliminary estimates from the EEA show that the EU's primary and final energy consumption increased for the third consecutive year in 2017 (by 1.4 % and 1.1 %, respectively, compared with 2016) (EEA, 2018c, 2018k). For the first time since 2010, the EU's primary and final energy consumption in 2017 were above the indicative trajectories to 2020 (EEA, 2018k). Member States therefore need to step up their efforts to keep the EU on track towards its 2020 targets.

In fact, both primary and final energy consumption levels have been increasing since 2014, in part due to continued economic growth, relatively colder winters and lower fuel prices (EC, 2017c). These external factors offset energy savings, leading to increased energy consumption in this period (Odyssee-Mure, 2018).

Elements that played a role in the evolution of final energy consumption between 2005 and 2015 were, among others, structural shifts from high to low energy intensity sectors and weather conditions, which contributed to a reduction in final energy consumption of 2 % each (EC, 2017d). The most recent energy decomposition analysis published by the European Commission (EC, 2017d) provides insights on the main drivers of final energy consumption through 2015.

- The final energy consumption in the commercial sector, comprising industries, services and agriculture, forestry and fishing, decreased by 11 %, driven by energy intensity improvements offsetting increased demand due to economic growth. Structural effects have also contributed to the reduction due to the increase in gross value added (GVA) (by 14 %) of the services sector. Because it accounts for around 75 % of the commercial sector's value added and is less energy intensive than industries, the services sector's contribution to the commercial sector's total GVA contributed significantly to its lower energy consumption levels. Energy efficiency improvements — when measured using energy intensity — were observed in all sectors, except for wood, paper and construction. Energy efficiency improvements have been obtained in all sectors, but other drivers have overrun the effects of energy efficiency.

- Energy consumption in the residential sector has also decreased by 11 % due to energy intensity improvements combined with warmer winters. More recently, however, between 2014 and 2015, the weather had the opposite effect, leading to an increase in the sector's energy consumption.

- The transport sector has the most modest result regarding energy intensity. Energy consumption between 2005 and 2015 was reduced by 2 %, led by lower activity in freight transport.

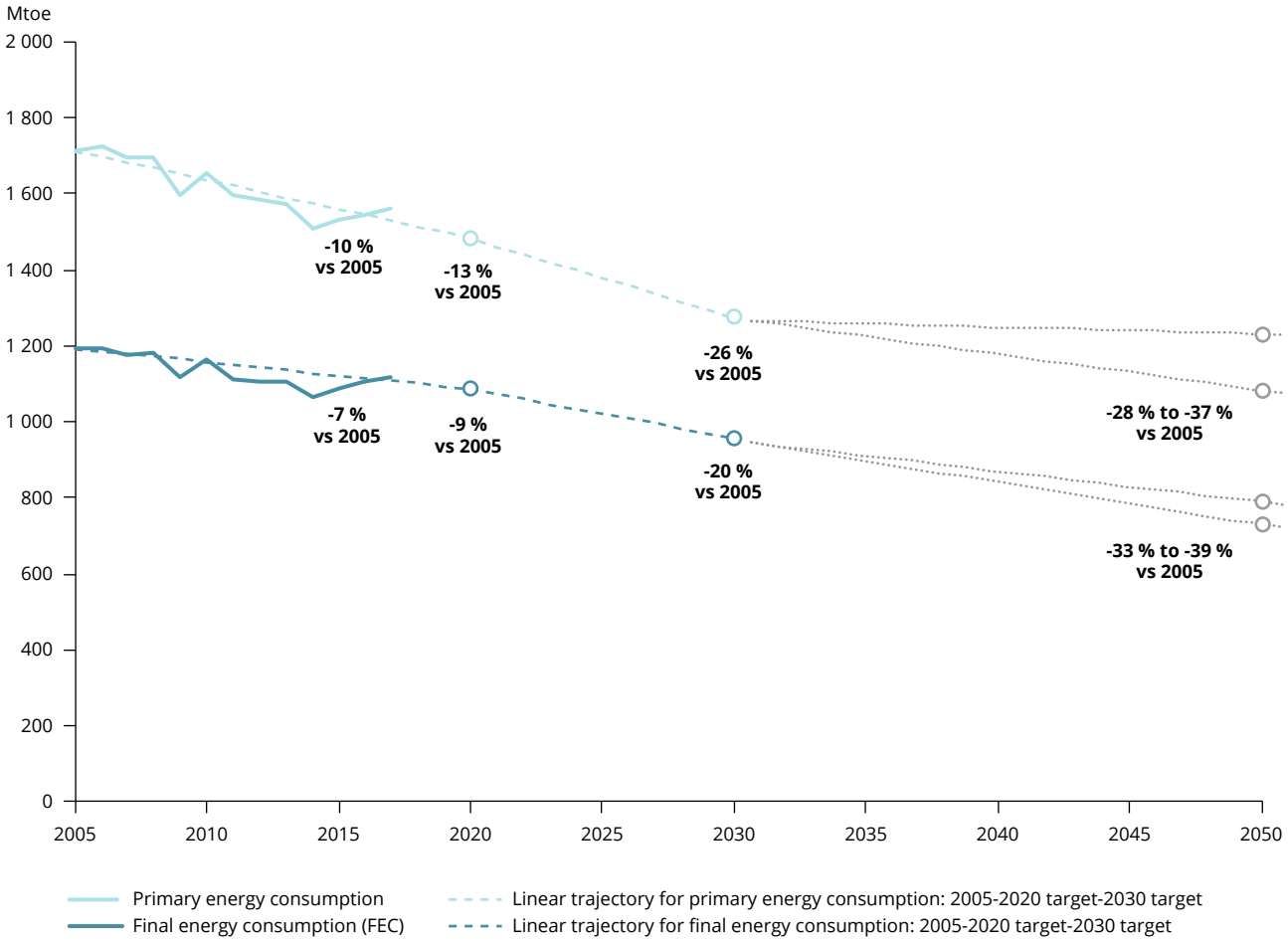
An update of this analysis is pending. Recent statistical data, however, indicate that the energy consumption of the residential sector increased by 3.1 % between 2015 and 2016, which is explained by a colder winter. The transport sector and the commercial sector both showed a small increase in final energy consumption in the same period: 2.6 % and 1 %, respectively (Eurostat, 2018e).

6.2 Projected progress towards the European Union's 2020 energy efficiency target

No policy and measures scenarios have to be reported by the Member States in the framework of the EED. Therefore, based on currently reported information, it is not possible to assess and aggregate to EU level the projected progress of Member States towards their energy efficiency targets.

Therefore, only an assessment based on past trends can be provided. The EU can achieve its 2020 target for energy efficiency expressed as primary and final energy consumption if the recent increasing trend is limited. It means limiting the reversal trend in primary and final energy consumption that started in the period 2014-2016.

Figure 6.1 **Primary and final energy consumption in the EU, 2005-2016, 2020 and 2030 targets and 2050 indicative levels of the EU energy roadmap**



Notes: The 2020 target represents energy savings of 20 % from levels projected for 2020 in the Commission's Energy Baseline Scenario (EC, 2008). The indicative 2030 energy efficiency target represents an improved energy efficiency of at least 32.5 % compared with 2030 projections in the same Energy Baseline Scenario. The indicative 2050 primary and final energy consumption levels represent the indicative highest and lowest levels in 2050 as stated in the decarbonisation scenarios of the 2011 EU energy roadmap.

Sources: EC, 2011c, 2008; European Council, 2014; Eurostat, 2018f, 2018c, 2018a; EEA, 2018e.

Regarding final energy consumption, the EU will have to accelerate its efforts, because the recent increase observed in 2016 resulted in final energy consumption above the 2020 target. Moreover, the preliminary projections of primary and final energy consumption in 2017 indicate that it will be challenging to remain below the indicative trajectory levels. Particular challenges include the effects of the observed economic recovery and the fact that the energy efficiency targets of Member States, aggregated to EU level, remain less ambitious than the target set for the EU as a whole (see Chapter 7 for detailed analysis).

For the primary and final energy targets to be fulfilled, more effort must be made at Member State level to implement and further develop current policy frameworks.

6.3 The 2030 targets on energy efficiency in the context of Energy Union

In November 2016, the European Commission released the Clean Energy for All Europeans package consisting of legislative proposals on energy efficiency, renewable energy, electricity market design, security of electricity

supply and governance aspects. One of the main goals of that package remains to 'put energy efficiency first', emphasising the relevance of energy savings and efficiency improvements for the sustainable energy transition (EC, 2016d).

In June 2018, a preliminary agreement on at least a 32.5 % energy efficiency target for 2030 was reached between the Council and the European Parliament (EC, 2018b). This target is set on the projections for 2030 modelled in the 2007 Reference Scenario of the European Commission (European Council, 2014) and may be subject to an upward revision in 2023, in the case of substantial cost reductions or where needed to meet international commitments for decarbonisation. It translates into an absolute primary energy consumption of 1 273 Mtoe and an absolute final energy consumption of 956 Mtoe by 2030. These correspond to 26 % and 20 % reductions in primary and final energy consumption, respectively, relative to 2005 levels.

6.4 The 2050 targets on energy efficiency in the context of the EU 2050 energy roadmap

By the end of 2018, the Commission is expected to issue an update of the EU long-term strategy that will account for GHG emission reductions in accordance with the Paris Agreement. In that sense, new long-term projections for primary and final energy consumption will consider the latest trends and policies, such as the efforts underlying the winter package.

Until now, the long-term goals have focused on scenarios leading to an 80-95 % reduction in GHG emissions by 2050 (EC, 2011d). In the EU energy roadmap, different assumptions regarding energy technology availability and support measures are considered. Among the roadmap's scenarios is a 'high energy efficiency' scenario, which includes a strong commitment to high energy savings and reductions of primary and final energy consumption by 2050 of 37 % and 39 % below 2005 levels, respectively (see Figure 6.1). The roadmap shows that minimum reductions of 28 % of primary energy consumption and 32 % of final energy consumption relative to 2005 levels are required to meet the 2050 climate goals ([20]).

These indicative long-term scenarios show that EU levels of primary and final energy consumption will have to be progressively reduced to reach the EU's decarbonisation targets. Action, particularly on the demand side, will be necessary to achieve annual average reductions of final energy consumption between 0.7 % and 1.2 % from 2030 to 2050 as decided by Member States.

([20]) The upper levels of primary and final energy consumption in Figure 6.1 correspond to the 'diversified supply technologies' scenario, under which all supply technologies compete at market level to meet the long-term decarbonisation goals based on carbon price.

7 Progress towards Member States' energy efficiency targets

- In 2016, 18 Member States had reduced or limited the increase in their primary energy consumption to a level below their linear trajectories towards the 2020 targets. Ten Member States (Austria, Belgium, Bulgaria, Cyprus, France, Germany, Ireland, the Netherlands, Poland and Sweden) had not achieved enough savings in primary energy consumption to stay below their linear trajectory levels — five more than in last year's assessment (EEA, 2017c).
- According to preliminary data from the EEA, three additional countries (Estonia, Hungary and Portugal) can be expected to rise above their linear trajectory thresholds for primary energy consumption in 2017.
- For final energy consumption, 19 Member States were on or below their target paths in 2016. Austria, Belgium, Bulgaria, France, Germany, Hungary, Lithuania, Slovakia and Sweden had not sufficiently reduced their final energy consumption to stay below their final energy trajectories.
- When added together, the Member States' 2020 energy efficiency targets as identified in the national energy efficiency action plans (NEEAPs) submitted in 2017 are higher than the EU targets for energy consumption levels in 2020. The sum of Member States' targets is 3.3 % higher than the EU target for primary energy consumption, whereas their combined final energy consumption targets are 0.1 % lower than the EU target level.

7.1 Progress towards national primary energy consumption targets

Member States set their own national non-binding targets for energy efficiency for 2020, which can be based on absolute primary or final energy consumption, on absolute or relative primary or final energy savings or on energy intensity. The EED requires, however, that when doing so, Member States also express those targets in terms of absolute levels of primary and final energy consumption in 2020 (EU, 2012) ([21]).

For primary energy consumption, the targets range from a 20.3 % reduction (United Kingdom) to a 20.6 % increase (Estonia) compared with 2005 levels. A total of 18 Member States have set targets to decrease primary energy consumption. The other eight Member States (Croatia, Czechia, Estonia, Finland ([22]), Latvia, Poland, Romania and Slovenia) have set targets that are higher than their 2005 primary consumption levels ([23]). Member States can also revise their targets and projections upwards or downwards at any point in time. In fact, the 2017 NEEAPs available from Member States show that several countries appear to have revised their 2020 targets expressed in primary and final energy consumption to higher absolute values ([24]).

As neither Member States nor EU legislation set any indicative trajectory to monitor the progress of Member States towards their national 2020 targets, the analysis in this report tracks progress towards energy efficiency targets by:

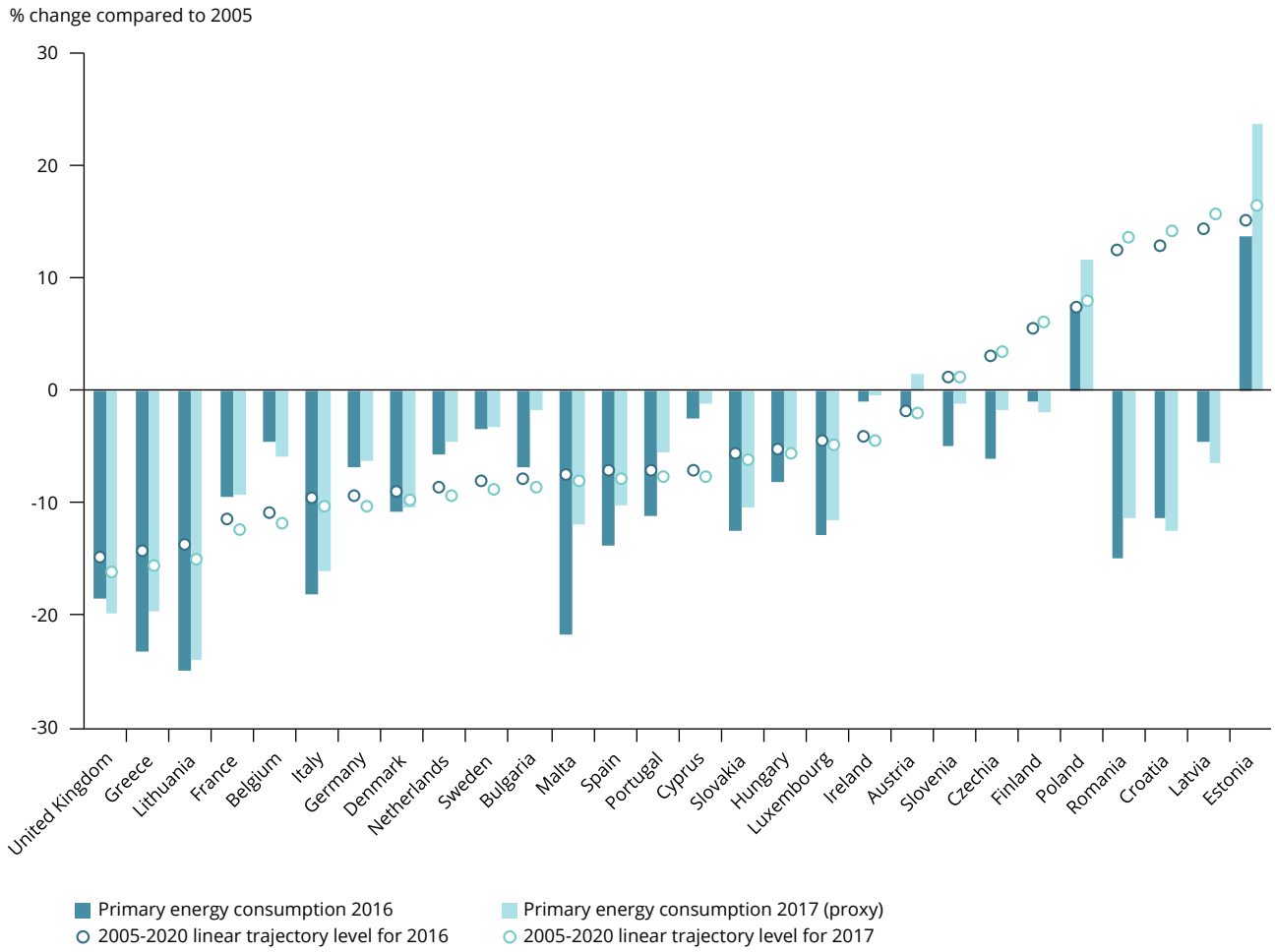
([21]) Together these targets should contribute to achieving the EU's objective of reducing energy consumption by 20 % by 2020. However, a challenge in assessing EU progress is that the aggregation of individual Member States' targets does not add up to a 20 % EU-level reduction in energy consumption by 2020.
([22]) For Finland, this is explained by exceptionally low energy consumption in 2005 compared with other years.
([23]) The absolute levels of primary and final energy consumption in 2020 reported by Member States under the EED allow the EEA to assess progress towards energy efficiency targets consistently across Member States. Member States themselves may monitor their progress towards achieving the target following a national approach.
([24]) It is possible that Member States report revised primary and final energy consumption levels and state the same energy efficiency target. This would depend on the choice of the official energy efficiency target, such as energy savings or energy intensity, and on how they estimate absolute primary and final energy consumption.

- considering, for each Member State, an indicative linear trajectory between primary energy consumption levels in 2005 and 2020 targets;
- comparing the absolute levels of primary energy consumption in the assessment year with this linear trajectory.

According to the EEA's methodology, a country is considered to be on track towards meeting its 2020 target if its primary energy consumption for 2016 is on or below its linear trajectory. Conversely, a country with primary energy consumption levels above its linear trajectory is considered not on track and needs to reduce or limit its energy consumption at a faster pace to meet its 2020 objective. Final energy consumption trends are also discussed in Section 7.2, below, to provide insights into energy consumption trends that are as complete as possible. However, final energy information is not used to track progress in the present assessment.

Between 2005 and 2016, primary energy consumption decreased in 26 Member States and increased in only Estonia and Poland. A total of 18 Member States reduced (or limited the increase in) their primary energy consumption to levels below their corresponding linear trajectories in 2016 (see Figure 7.1). The index decomposition analysis developed by the European Commission (EC, 2017d) shows that this downward trend in results for primary energy consumption at Member State level was

Figure 7.1 Primary energy consumption and linear trajectory levels, 2016 and 2017



Notes: The figure compares, for each Member State, primary energy consumption levels for a given year and the level of the indicative linear trajectory between 2005 and the relevant 2020 target on primary energy consumption.

Sources: EC, 2018c, 2017e; EEA, 2018l, 2018e; Eurostat, 2018c, 2018a.

attributed to energy intensity improvements in all cases except Poland. Economic activity partially offset these energy savings, except in Greece, Italy and Portugal.

If maintained until 2020, the pace of reductions (or limited increases) observed since 2005 should allow those 18 Member States to meet their 2020 targets. However, recent trends in primary energy consumption in several countries ([25]) raise uncertainty as to whether the 2020 targets will be met. In ten countries (Austria, Belgium, Bulgaria, Cyprus, France, Germany, Ireland, the Netherlands, Poland and Sweden), primary energy consumption in 2016 was above these countries' linear trajectories. This was already the case in 2015 for Bulgaria, Germany and the Netherlands. Conversely, while Estonia was above the linear trajectory in 2015, its primary energy consumption in 2016 was below the trajectory.

In 2016, 17 Member States were already below their 2020 targets. The exceptions were Austria, Belgium, Bulgaria, Cyprus, Denmark, France, Germany, Ireland, the Netherlands, Sweden and the United Kingdom. Austria was below its 2020 targets in 2015, but it increased its primary energy consumption in 2016.

According to preliminary EEA data for 2017 on primary energy consumption, three further countries (Estonia, Hungary and Portugal) exceeded their linear trajectory threshold in 2017, in addition to the above-mentioned countries that were not on track in 2016.

7.2 Trends towards national final energy consumption targets

National indicative 2020 targets for final energy consumption set by Member States under the EED range from -23.2 % (Hungary) to +36.5 % (Malta), compared with 2005 levels. Some Member States have revised their absolute levels for final energy consumption in their 2017 NEEAPs upwards or downwards because of, for example, revised macroeconomic assumptions or new methods of calculation ([26]).

In 2016, 19 Member States were in line with or below their linear final energy consumption trajectories. However, Austria, Belgium, Bulgaria, France, Germany, Hungary, Lithuania, Slovakia and Sweden had not sufficiently reduced their final energy consumption to stay below their linear trajectories. This is different from 2015, when all 28 EU Member States stayed below their trajectories.

7.3 Aggregated ambition level of Member States' national 2020 targets

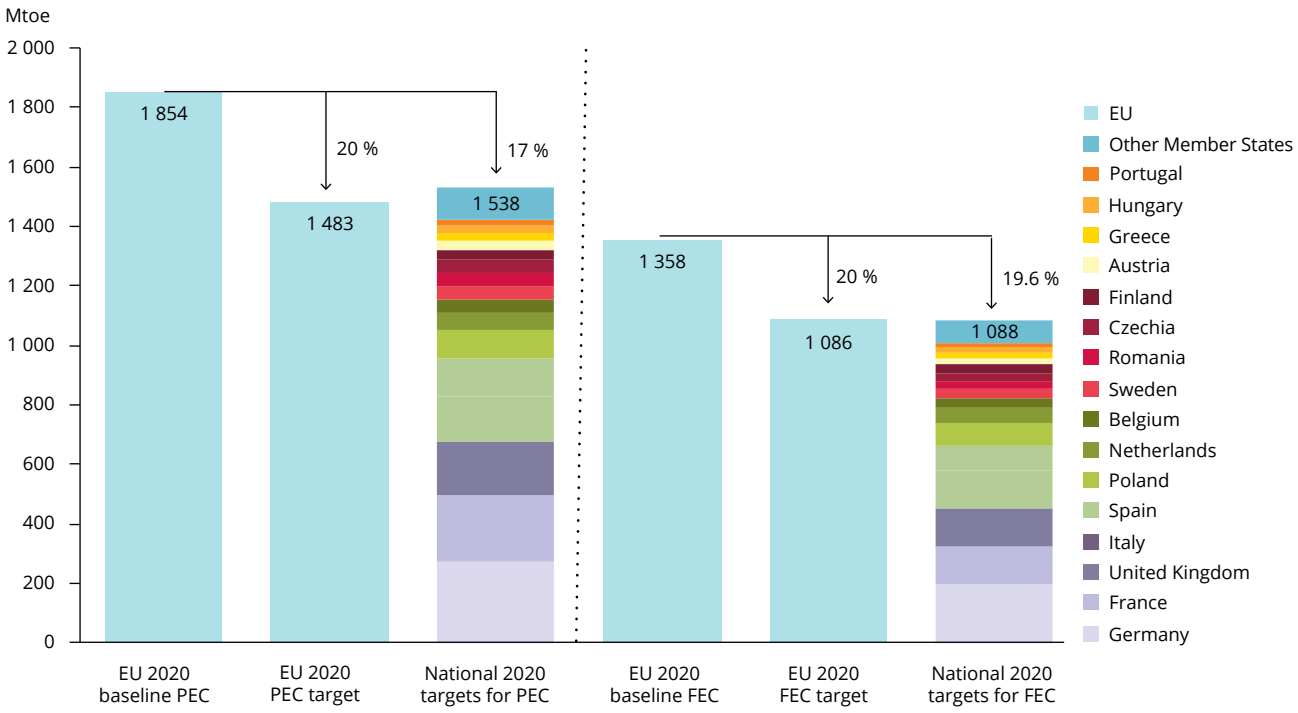
In the NEEAPs submitted by Member States in 2017, absolute target levels for primary and final energy consumption have been revised to higher values in several cases, signalling that efforts to meet European targets have to be greater.

Taken together, the sum of all individual 2020 targets for primary energy consumption add up to 1 533 Mtoe, which is 3.3 % higher than the EU target (1 483 Mtoe) (see Figure 7.2).

Therefore, achieving these national targets remains insufficient to reach the EU-level target for primary energy consumption. This reflects the 2017 revision of primary and final energy consumption estimates by Member States and introduces further uncertainty to the tracking of progress at the EU level.The sum of individual final energy consumption targets add up to a 1 085 Mtoe, which is slightly lower than the EU target (1 086 Mtoe).

([25]) In 2016, 19 of the 28 Member States increased their primary energy consumption relative to 2015.
([26]) The absolute levels of primary and final energy consumption in 2020 reported by Member States under the EED allow the EEA to assess progress towards energy efficiency targets consistently across Member States. Member States themselves may monitor their progress to target following a national approach.

Figure 7.2 Overall ambition level of national targets for primary and final energy consumption by 2020



Note: The Member States grouped as 'Other Member States' are those that have a 2020 target for primary energy consumption lower than 20 Mtoe and a 2020 target for final energy consumption lower than 15 Mtoe. In order of decreasing magnitude of 2020 targets, these Member States are Denmark, Bulgaria, Slovakia, Ireland, Croatia, Slovenia, Estonia, Lithuania, Latvia, Luxembourg, Cyprus and Malta.

Sources: EC, 2018c, 2017e; EU, 2012.

8 Trends and projections in Iceland, Liechtenstein, Norway, Switzerland and Turkey

- Iceland, Liechtenstein, Norway, Switzerland and Turkey are member countries of the EEA but not of the EU. These countries share several environmental commitments with EU Member States, either under international conventions or by direct participation in EU policies.
- None of these countries has achieved substantial emission reductions since 1990. For some, GHG emissions have increased significantly.
- Renewable energy use, as a proportion of final energy consumption, is higher in Iceland and Norway than in any EU Member State.

8.1 Greenhouse gas emissions

Iceland, Liechtenstein, Norway, Switzerland and Turkey are all Annex I countries in the UNFCCC. Iceland, Liechtenstein and Norway also have a closer association with the EU regarding several commitments to reduce GHG emissions. In particular:

- As members of the European Economic Area, Iceland, Liechtenstein and Norway have participated in the EU ETS since 2008. Switzerland and the EU recently agreed to link their emissions trading systems.
- Iceland and the EU decided to jointly fulfil commitments made by the EU and its Member States to the UNFCCC in the second commitment period of the Kyoto Protocol, i.e. to reduce Iceland's GHG emissions by 20 % by 2020 compared with 1990 levels.
- Norway and Iceland have submitted commitments to reduce GHG emissions by 40 % by 2030 compared with 1990 levels in their respective nationally determined contributions (NDCs) under the Paris Agreement. They intend to fulfil their commitments jointly with the EU (Iceland, 2015). They are in dialogue with the EU to participate in the joint efforts in the EU to reduce emissions from sectors covered under the Effort Sharing and LULUCF legislation, in addition to the EU ETS. As Member States' targets under the Effort Sharing legislation range from 0 to -40 % ,based on gross domestic product (GDP) per capita, the Commission indicated that Norway would be allocated an estimated numerical reduction target of 40 % below 2005 levels, and flexibility mechanisms will be available for Norway and Iceland as they are for Member States.

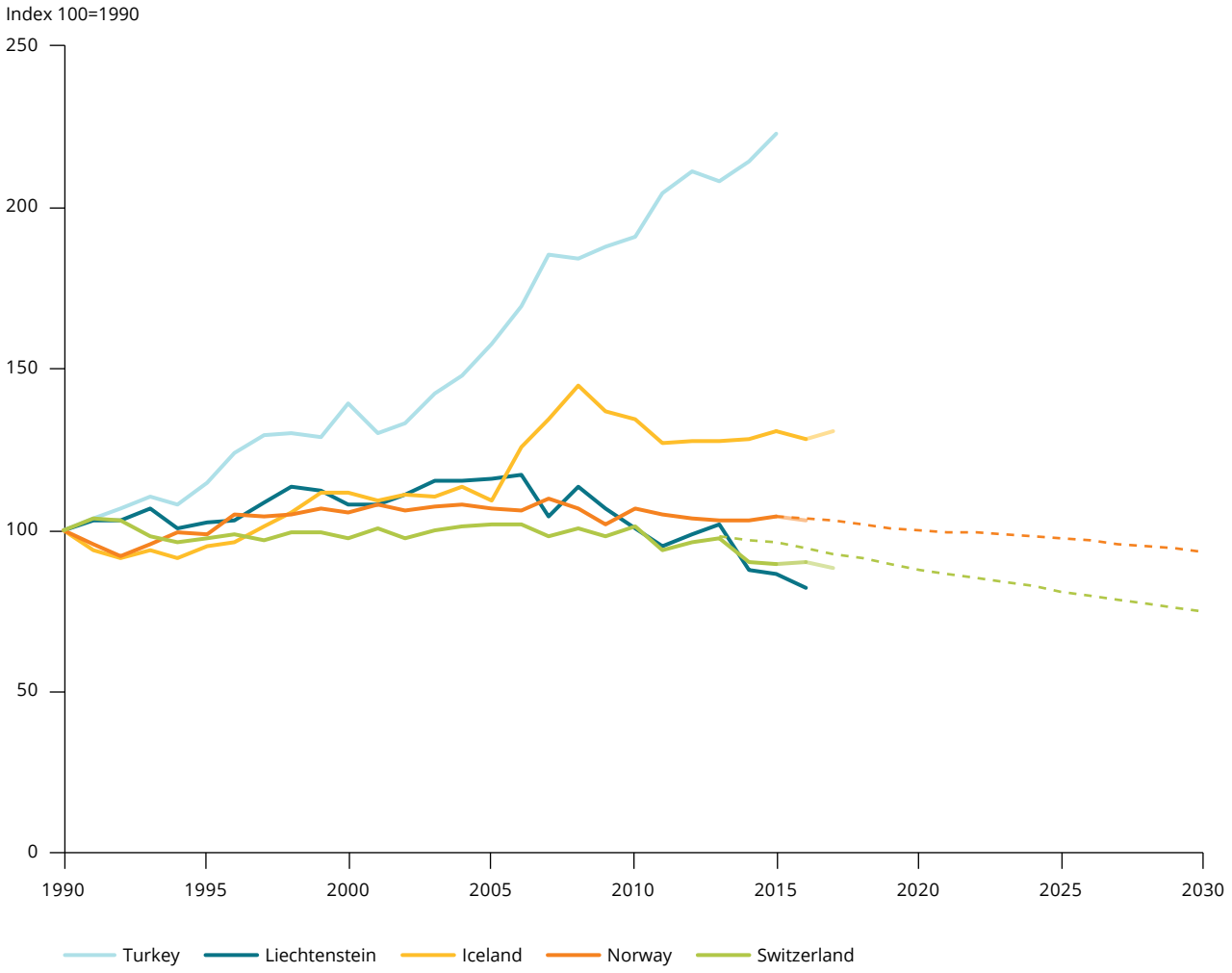
Historical GHG emissions in Iceland, Liechtenstein, Norway, Switzerland and Turkey followed very different trends between 1990 and 2016 (see Figure 8.1).

Iceland also set a long-term GHG mitigation target of between 50 % and 75 % by 2050 compared with GHG emissions in 1990. In 2016, Iceland's emissions had increased by 28 % compared with 1990 levels. Therefore, Iceland does not currently seem to be on track to reach its target for 2020.

Liechtenstein also aims to attain at least a 40 % reduction in GHG emissions in 2030 compared with 1990 (Liechtenstein, 2015) ([27]). To attain this target, Liechtenstein has also set itself a sectoral goal: GHG emissions from the energy sector will decrease by 20 % between 1990 and 2020. In 2016, Liechtenstein's emissions were 18 % lower than in 1990. Additional efforts are therefore necessary if Liechtenstein is to reach its 2020 target.

([27]) Including emissions and removals from LULUCF.

Figure 8.1 Total GHG emission trends and projections in Iceland, Liechtenstein, Norway, Switzerland and Turkey, 1990-2030



Notes: Projections display total GHG emissions excluding LULUCF and international aviation. Solid lines represent historical values; dashed lines represent projections with existing measures (WEM). For Switzerland, WEM projections depicted here exclude domestic compensation. Domestic compensation is not allocated to any sector and is assumed to contribute 1 516 $ktCO_2$ in 2020.

Values shown for Iceland include inventory data, taking into account total CO_2 emissions from industrial processes. Iceland excluded these emissions for compliance in the first commitment period of the Kyoto Protocol.

Norway's INDC includes emissions and removals from LULUCF, which are not shown in this figure.

Sources: EEA, 2018d; Iceland, 2018; Liechtenstein, 2018; Norway, 2018; Switzerland, 2018, 2016; Turkey, 2018.

Norway's target is to reduce its GHG emissions by 30 % in 2020 compared with 1990. According to its intended nationally determined contribution (INDC) (Norway, 2015), Norway aims to reduce its GHG emissions by at least 40 % by 2030 compared with 1990 ([28]). Norway also aims to reduce emissions by the equivalent of 100 % of its own emissions by 2050, thus becoming climate neutral. This is to be achieved through emissions trading in the EU, international cooperation on emission reductions, other forms of emissions trading and project-based cooperation. In 2016, GHG emissions had increased by 3 % compared with 1990.

Switzerland's target is to reduce its GHG emissions by 20 % by 2020 compared with 1990. Like Norway, it has also set a more ambitious GHG reduction target of 30 % by 2020 compared with 1990, provided that the international community agrees on a stricter climate policy. For 2030, Switzerland submitted an INDC to the UNFCCC that states its intention to reduce its

([28]) How emissions and removals from LULUCF will be accounted for is to be determined later. Norway's position is that the choice of accounting approach should not change the ambition level compared with when LULUCF is not included.

GHG emissions by 50 % compared with 1990 levels. This target will be partly reached using carbon credits from international mechanisms (Switzerland, 2016). In 2016, emissions in Switzerland were reduced by 10 % compared with 1990 levels.

Turkey has submitted an INDC to the UNFCCC secretariat with up to a 21 % economy-wide cut in GHG emissions by 2030, compared with a business-as-usual scenario, with a conditional part (Turkey, 2015). Turkey aims to also use carbon credits from international market mechanisms.

8.2 Renewable energy

The RED is a text with 'EEA relevance', i.e. it is relevant to member countries of the European Economic Area (not to be confused with the European Environment Agency). In accordance with the RED, Iceland and Norway submitted NREAPs to the European Commission with 2020 targets and details of development steps.

Iceland's 2020 target for RES under the RED was set at 64 % of gross final energy consumption and the national target under the NREAP was set at 76.8 % by 2020 (see Table 8.1). Although these targets are higher than for most Member States, the binding target is lower than Iceland's current share of RES consumption (73 % in 2016). Iceland has an exceptional potential for hydropower and geothermal energy. To date, these energy sources are mainly used for district heating and producing electricity.

Norway's binding RED target for 2020 is that renewable energy should account for 68 % of gross final energy consumption. Norway is ahead of its indicative RED trajectory for 2017-2018 and its NREAP trajectory for 2016. In 2016, renewable energy accounted for 69 % of gross final energy consumption in Norway and, therefore, Norway had already exceeded its 2020 RES target by one percentage point in 2016.

The NREAP for Turkey, announced to the public on 9 February 2015, has the characteristics of a roadmap for rigorous planning and efficient development of renewable energy until 2023. The plan was prepared in accordance with the RED (European Parliament Directive 2009/28/EC, dated 23 April 2009), and it focuses on exploring RES in support of energy generation and consumption. The NREAP is open to the public and an international document that describes Turkey's planned development and essential measures taken to sustain planned development in a transparent fashion (Turkey, 2014).

No information is available from EU sources on the proportions of RES use and targets for Liechtenstein or Switzerland.

8.3 Energy efficiency

Statistics on energy consumption are available from the European Commission for Iceland, Norway and Turkey (see Figure 8.2). Between 1990 and 2016, primary energy consumption increased in these three countries, although to greatly varying extents. Over the same period, primary energy consumption in the EU increased by 2 % (Eurostat, 2018c, 2018a). Although Norway and Turkey experienced a relatively steady increase over the whole period, Iceland experienced a pronounced jump in primary energy consumption after 2005. Between 2005 and 2016, the primary energy consumption of Iceland, Norway and Turkey increased by 74 %, 5 % and 63 %, respectively.

In Switzerland, final energy consumption decreased by 3 % between 2005 and 2016 (SFOE, 2018).

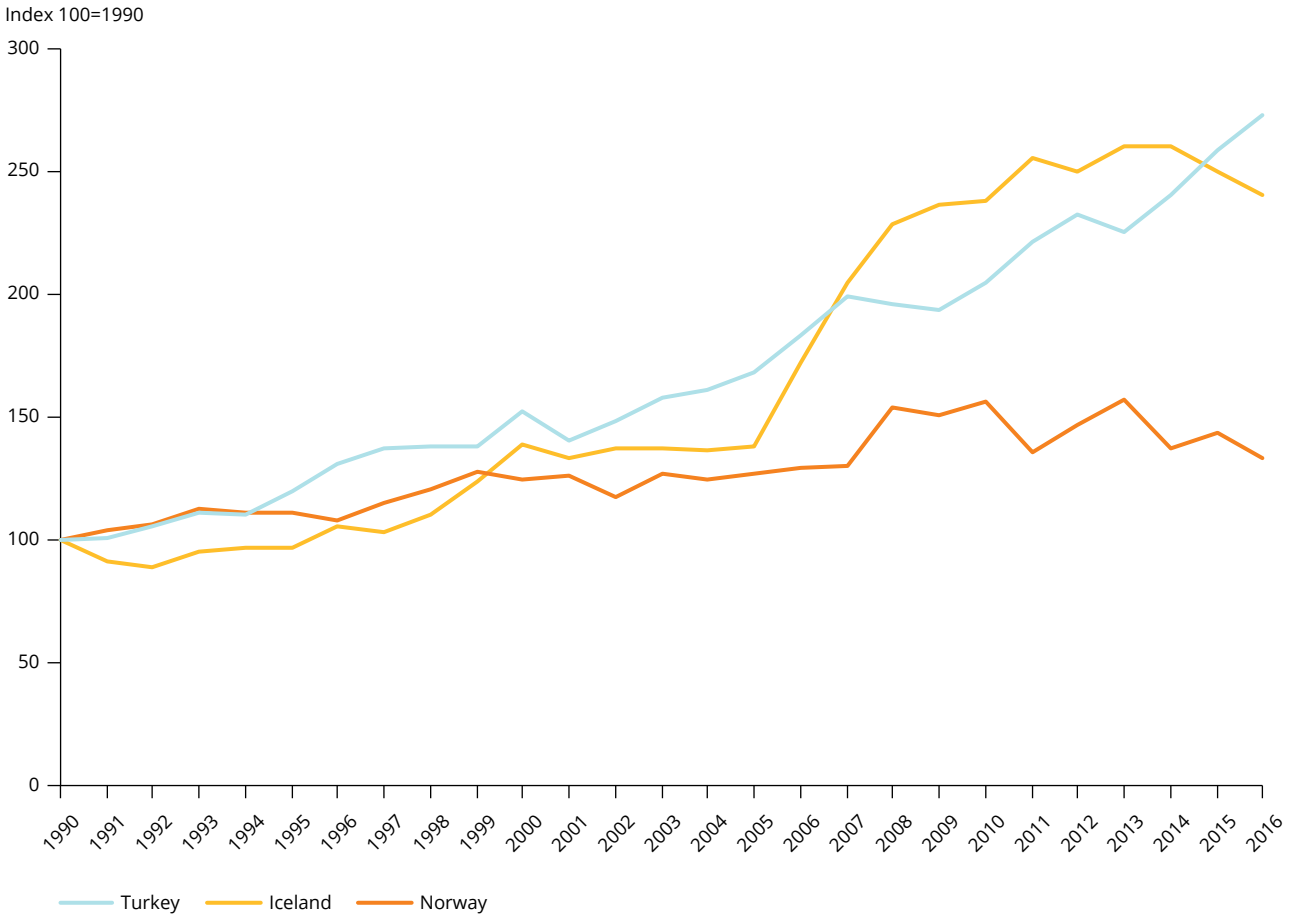
Table 8.1 Iceland, Norway and Turkey's progress on renewable energy

Country	2016 share of RES (%)	2020 target under the RED (%)	2020 target under NREAP (%)	Distance to 2020 target in 2016 (percentage points)
Iceland	72.6	64.0 (a)	76.8	8.6
Norway	69.4	68	67.5	1.4
Turkey	16.2	-	19.3	3.1

Note: (a) Although Iceland indicates in its 2014 NREAP that it assumes a national overall target of 72 % for the share of energy from renewable sources in gross final energy consumption as its target for 2020 under the RED, a 64 % RES target by 2020 is mentioned as the binding target for Iceland in Annex IV (Energy) of the Agreement on the European Economic Area.

Sources: EU, 2009a; Eurostat, 2018b; Iceland, 2014; Norway, 2013; Turkey, 2014.

Figure 8.2 Primary energy consumption in Iceland, Norway and Turkey, 1990-2016



Sources: Eurostat, 2018c, 2018a.

References

Council of the European Union, 2007, Presidency Conclusions (7224/1/07 Rev 1).

EC, 2006, Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions — Limiting global climate change to 2 degrees Celsius — The way ahead for 2020 and beyond (COM(2007) 2 final).

EC, 2007, Presidency conclusions — Brussels 8/9 March 2007 (7224/1/07 REV 1).

EC, 2008, *European energy and transport — Trends to 2030 — Update 2007*, European Commission.

EC, 2011a, Commission staff working paper — Impact Assessment accompanying the document 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 PART 1/2 (SEC(2011) 1565 final).

EC, 2011b, Commission staff working paper — Impact Assessment accompanying the document 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 PART 2/2 (SEC(2011) 1565).

EC, 2011c, 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).

EC, 2011d, 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 — Commission Staff Working Paper SEC(2011) 1565 Part 2/2 (SEC(2011) 1565).

EC, 2013a, Commission staff working document — Elements of the Union greenhouse gas inventory system and the Quality Assurance and Control (QA/QC) programme (SWD(2013) 308 final).

EC, 2013b, *EU energy, transport and GHG emissions — Trends to 2050 — Reference Scenario 2013*, Publications Office of the European Union.

EC, 2013c, 'National Action Plans' (https://ec.europa.eu/energy/en/topics/renewable-energy/national-action-plans) accessed 31 August 2018.

EC, 2013d, 'National Renewable Energy Action Plan (NREAP) data from Member States' (http://ec.europa.eu/energy/renewables/action_plan_en.htm) accessed 7 April 2018.

EC, 2015a, Elements of the Union system for policies and measures and projections and the quality assurance and control (QA/QC) programme as required under regulation (EU) No 525/203 (525/2013).

EC, 2015b, Proposal for a Directive of the European Parliament and of the Council amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments (COM(2015) 337 final).

EC, 2015c, The impact of biofuels on transport and the environment, and their connection with agricultural development in Europe (IP/B/TRAN.IC/2012_117).

EC, 2016a, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — A European strategy for low-emission mobility (COM(2016) 501 final).

EC, 2016b, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the regions and the European Investment Bank — Clean energy for all Europeans (COM(2016) 860 final).

EC, 2016c, EU Reference Scenario 2016 — Energy, transport and GHG emissions — Trends to 2050, Publications Office of the European Union.

EC, 2016d, Proposal for a Regulation of the European Parliament and of the Council on binding annual greenhouse gas emission reductions by Member States

from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change (COM/2016/0482 final - 2016/0231 (COD)).

EC, 2016e, Proposal for a Regulation of the European Parliament and of the Council on the Governance of the Energy Union, amending Directive 94/22/EC, Directive 98/70/EC, Directive 2009/31/EC, Regulation (EC) No 663/2009, Regulation (EC) No 715/2009, Directive 2009/73/EC, Council Directive 2009/119/EC, Directive 2010/31/EU, Directive 2012/27/EU, Directive 2013/30/EU and Council Directive (EU) 2015/652 and repealing Regulation (EU) No 525/2013 (COM(2016) 759 final/2).

EC, 2017a, 'Absolute level of energy consumption in 2020 [Mtoe] as notified from Member States in 2013, in the NEEAP 2014, Annual Reports or in separate notifications to the European Commission in 2015 and 2016' (https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive) accessed 11 September 2018.

EC, 2017b, 'Agreement on statistical transfers of renewable energy amounts between Lithuania and Luxembourg' (https://ec.europa.eu/info/news/agreement-statistical-transfers-renewable-energy-amounts-between-lithuania-and-luxembourg-2017-oct-26_en?pk_campaign=ENER_Newsletter_November_2017) accessed 29 June 2018.

EC, 2017c, *Assessing the progress towards the EU energy efficiency targets using index decomposition analysis*, JRC Science Policy Report No EUR 2871 0 EN.

EC, 2017d, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank — Second Report of the state of the Energy Union (COM/2017/053 final).

EC, 2017e, Report from the Commission to the European Parliament and the Council — 2016 assessment of the progress made by Member States in 2014 towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU as required by Article 24 (3) of the Energy Efficiency Directive 2012/27/EU (COM(2017) 56 final).

EC, 2017f, Report from the Commission to the European Parliament and the Council — 2017 assessment of the progress made by Member States towards the national energy efficiency targets for 2020 and towards the implementation of the Energy Efficiency Directive 2012/27/EU as required by Article 24 (3) of the Energy Efficiency Directive 2012/27/EU (COM(2017) 687 final).

EC, 2017g, 'Second agreement on statistical transfers of renewable energy amounts between Estonia and Luxembourg' (https://ec.europa.eu/info/news/second-agreement-statistical-transfers-renewable-energy-amounts-between-estonia-and-luxembourg-2017-nov-13_en) accessed 16 May 2018.

EC, 2017h, Study on technical assistance in realisation of the 2016 Report on Renewable Energy, in preparation of the Renewable Energy Package for the period 2020-2030 in the European Union (ENER/C1/2014-688).

EC, 2018a, 'Energy Efficiency Directive' (https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive) accessed 30 August 2018.

EC, 2018b, Energy efficiency first — Commission welcomes agreement on energy efficiency (STATEMENT/18/3997).

EC, 2018c, 'European Union Transaction Log (EUTL) — ESD Compliance Dashboard — Sweden', Climate Action — European Union Transaction Log (http://ec.europa.eu/environment/ets/transactionsCompliance.do?languageCode=en&esdRegistry=SE&esdYear=&search=Search&currentSortSettings) accessed 25 September 2018.

EC, 2018d, 'National Energy Efficiency Action Plans and Annual Reports' (https://ec.europa.eu/energy/

en/topics/energy-efficiency/energy-efficiency-directive/national-energy-efficiency-action-plans) accessed 7 November 2018.

Ecofys, 2012, 'Understanding the full impact of the Energy Efficiency Directive' (http://www.ecofys.com/en/blog/the-energy-efficiency-directive-save-energy-create-jobs-and-compete) accessed 26 August 2014.

Edgar Meza, 2016, 'Germany launches first cross-border PV auction with Denmark', PV Magazine, 12 October 2016 (https://www.pv-magazine.com/2016/10/12/germany-launches-first-cross-border-pv-auction-with-denmark_100026478) accessed 27 June 2018.

EEA, 2011, 'National Renewable Energy Action Plan (NREAP) data from Member States' (https://www.eea.europa.eu/data-and-maps/figures/national-renewable-energy-action-plan) accessed 11 September 2018.

EEA, 2014, *Trends and projections in Europe 2014*, EEA Report No 6/2014, European Environment Agency.

EEA, 2017a, *Renewable energy in Europe 2017 — Recent growth and knock-on effects*, EEA Report No 3/2017, European Environment Agency.

EEA, 2017b, *Trends and projections in Europe 2017 — Tracking progress towards Europe's climate and energy targets*, EEA Report No 17/2017, European Environment Agency.

EEA, 2017c, *Trends and projections in the EU ETS in 2017 — The EU Emissions Trading System in numbers*, EEA Report No 18/2017, European Environment Agency.

EEA, 2018a, *Annual European Community greenhouse gas inventory 1990-2016 and inventory report 2018*, EEA Report No 5/2018, European Environment Agency.

EEA, 2018b, *Annual European Union greenhouse gas inventory 1990-2016 and inventory report 2018*, EEA Report No 5/2018, European Environment Agency.

EEA, 2018c, 'Approximated estimates for the primary and final consumption of energy in 2017 (EEA 2017 proxies on primary and final energy consumption)' (https://www.eea.europa.eu/data-and-maps/data/approximated-estimates-for-the-primary-1) accessed 11 September 2018.

EEA, 2018d, 'Approximated estimates for the share of gross final consumption of renewable energy sources in 2017 (EEA 2017 RES share proxies)' (https://www.eea.europa.eu/data-and-maps/data/approximated-estimates-for-the-share-1) accessed 10 September 2018.

EEA, 2018e, *Approximated EU GHG inventory: Proxy GHG emission estimates for 2018* (forthcoming), EEA Report No 17/2018, European Environment Agency.

EEA, 2018f, 'EEA greenhouse gas — data viewer' (https://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer) accessed 7 April 2018.

EEA, 2018g, 'Eionet reporting obligations database (ROD) — Deliveries for projections' (http://rod.eionet.europa.eu/obligations/697/deliveries) accessed 7 April 2018.

EEA, 2018h, 'Energy intensity' (https://www.eea.europa.eu/data-and-maps/indicators/total-primary-energy-intensity-3/assessment) accessed 16 May 2018.

EEA, 2018i, *Emission trends under the Effort Sharing legislation*, Eionet Report-ETC/ACM 2018/11, European Environment Agency/European Topic Centre on Air Pollution and Climate Change Mitigation.

EEA, 2018j, 'EU Emissions Trading System (ETS) data viewer' (http://www.eea.europa.eu/data-and-maps/data/data-viewers/emissions-trading-viewer) accessed 7 April 2018.

EEA, 2018k, 'Final energy consumption by sector and fuel' (https://www.eea.europa.eu/data-and-maps/indicators/final-energy-consumption-by-sector-9/assessment-1) accessed 7 November 2018.

EEA, 2018l, 'Greenhouse gas emissions under the Effort Sharing Decision (ESD)' (https://www.eea.europa.eu/data-and-maps/data/esd-1) accessed 10 September 2018.

EEA, 2018m, 'Member States' greenhouse gas (GHG) emission projections' (https://www.eea.europa.eu/data-and-maps/data/greenhouse-gas-emission-projections-for-1) accessed 31 August 2018.

EEA, 2018n, 'Primary energy consumption by fuel' (https://www.eea.europa.eu/data-and-maps/indicators/primary-energy-consumption-by-fuel-6/assessment-1) accessed 7 November 2018.

EEAS, 2018, 'Phasing out of crop-based biofuels by 2030 in the EU Renewable Energy Directive (RED II) — Fact sheet', European Union External Action Service (https://eeas.europa.eu/sites/eeas/files/20180625_timeline_biofuels_red2_en.pdf) accessed 7 November 2018.

ENDS Europe, 2017, 'Creative accounting used to meet 2020 RES target' (https://www.endseurope.com/

article/50963/creative-accounting-used-to-meet-2020-res-target) accessed 16 May 2018.

EU, 2003, Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, pp. 32-46).

EU, 2008, Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics (Text with EEA relevance) (OJ L 304, 14.11.2008, pp. 1-62).

EU, 2009a, 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 (OJ L 140, 5.6.2009, pp. 136-148).

EU, 2009b, Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003 87 EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community (OJ L 8, 13.1.2009, pp. 3-21).

EU, 2009c, Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (OJ L 140, 5.6.2009, pp. 16-62).

EU, 2009d, Directive 2009/29/EC amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community (OJ L140, 5.6.2009, pp. 63-87).

EU, 2009e, Directive 2009/30/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 98/70/EC as regards the specification of petrol, diesel and gas-oil and introducing a mechanism to monitor and reduce greenhouse gas emissions and amending Council Directive 1999/32/EC as regards the specification of fuel used by inland waterway vessels and repealing Directive 93/12/EEC (OJ L 140/88, 5.6.2009, pp. 88-113).

EU, 2009f, Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles (OJ L 140, 5.6.2009, pp. 1-15).

EU, 2010a, Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products (recast) (OJ L 153, 18.6.2010, pp. 1-12).

EU, 2010b, Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (OJ L 153, 18.6.2010, pp. 13-35).

EU, 2012, Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC (OJ L 315/1, 14.11.2012, pp. 1-56).

EU, 2013a, 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 (notified under document C(2013) 1708) (OJ L 90, 28.3.2013, pp. 106-110).

EU, 2013b, 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 (OJ L 292, 1.11.2013, pp. 19-22).

EU, 2013c, Decision No 529/2013/EU of the European Parliament and 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, pp. 80-97).

EU, 2013d, 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 (OJ L 165, 18.6.2013, pp. 13-40).

EU, 2014a, Commission Delegated Regulation (EU) No 666/2014 of 12 March 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 (OJ L 179, 19.6.2014, pp. 26-30).

EU, 2014b, Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council (OJ L 203, 11.7.2014, pp. 23-90).

EU, 2014c, Regulation (EU) No 421/2014 of the European Parliament and of the Council of 16 April 2014 amending Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community, in view of the implementation by 2020 of an international agreement applying a single global market-based measure to international aviation emissions (OJ L 129, 30.4.2014, pp. 1-4).

EU, 2015, Council Directive (EU) 2015/652 of 20 April 2015 laying down calculation methods and reporting requirements pursuant to Directive 98/70/EC of the European Parliament and the Council relating to the quality of petrol and diesel fuels (OJ L 107, 25.4.2015, pp. 26-67).

EU, 2016a, Commission Implementing Decision (EU) 2016/2132 of 5 December 2016 on greenhouse gas emissions for each Member State for the year 2013 covered by Decision No 406/2009/EC of the European Parliament and of the Council (OJ L 331, 6.12.2016, pp. 9-11).

EU, 2016b, Council Decision (EU) 2016/1841 of 5 October 2016 on the conclusion, on behalf of the European Union, of the Paris Agreement adopted under the United Nations Framework Convention on Climate Change (OJ L 282, 19.10.2016, pp. 1-3).

EU, 2017a, Commission Decision (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020 (OJ L 209, 12.8.2017, pp. 53-55).

EU, 2017b, Commission Implementing Decision (EU) 2017/1015 of 15 June 2017 on greenhouse gas emissions covered by Decision No 406/2009/EC of the European Parliament and of the Council for the year 2014 for each Member State (OJ L 153, 16.6.2017, pp. 38-40).

EU, 2017c, Commission Implementing Decision (EU) 2017/2377 of 15 December 2017 on greenhouse gas emissions covered by Decision No 406/2009/EC of the European Parliament and of the Council for the year 2015 for each Member State (notified under document C(2017) 8476) (OJ L 337, 19.12.2017, pp. 80-82).

EU, 2017d, Regulation (EU) 2017/2392 of the European Parliament and of the Council of 13 December 2017 amending Directive 2003/87/EC to continue current limitations of scope for aviation activities and to prepare to implement a global market-based measure from 2021 (OJ L 350, 29.12.2017, pp. 7-14).

EU, 2018a, Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 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, pp. 1-25).

EU, 2018b, Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 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 and amending Regulation (EU) No 525/2013 (OJ L 156, 19.6.2018, pp. 26-42).

European Council, 2014, European Council (23 and 24 October 2014) — Conclusions on 2030 Climate and Energy Policy Framework (SN 79/14).

European Council, 2017, Increased energy efficiency: ensuring progress towards EU's climate and energy goals, (http://www.consilium.europa.eu/en/press/press-releases/2017/06/26-increased-energy-efficiency/) accessed 11 September 2018.

Eurostat, 2018a, 'Final energy consumption — Simplified energy balances — annual data [nrg_100a] code B_101700' (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_100a&lang=en) accessed 7 November 2018.

Eurostat, 2018b, 'Final non-energy consumption — Simplified energy balances — annual data [nrg_100a] code B_101600' (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_100a&lang=en) accessed 27 June 2018.

Eurostat, 2018c, 'Gross inland energy consumption — Simplified energy balances — annual data [nrg_100a] code B_100900' (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_100a&lang=en) accessed 27 June 2018.

Eurostat, 2018d, 'Nights spent at tourist accommodation establishments [tour_occ_ninat]' (http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=tour_occ_ninat&lang=en) accessed 9 June 2018.

Eurostat, 2018e, 'SHARES 2016 results' (http://ec.europa.eu/eurostat/web/energy/data/shares) accessed 29 June 2018.

Eurostat, 2018f, 'Simplified energy balances — annual data [nrg_100a]' (http://appsso.eurostat.ec.europa.eu/nui/show.do?wai=true&dataset=nrg_100a) accessed 10 September 2018.

EWPA, 2017, 'Estonia, Luxembourg sign EUR 10.5 mln renewable energy agreement', Estonian Wind Power Association (http://www.tuuleenergia.ee/en/2017/11/estonia-luxembourg-sign-eur-10-5-mln-renewable-energy-agreement) accessed 16 May 2018.

German Federal Ministry for Economic Affairs and Energy, 2017, 'Zypries vereinbart im Rahmen des Deutsch-Französischen Ministerrats konkrete Fortschritte in der Zusammenarbeit' (http://www.bmwi.de/Redaktion/DE/Pressemitteilungen/2017/20170713-zypries-deutsch-franzoesischer-ministerrat.html) accessed 27 June 2018.

Iceland, 2014, The Icelandic National Renewable Energy Action Plan for the promotion of the use of energy from renewable sources in accordance with Directive 2009/28/EC and the Commission Decision of 30 June 2009 on a template for the national renewable energy action plans, Ministry of Petroleum and Energy.

Iceland, 2015, Iceland's intended nationally determined contribution (INDC), (https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Iceland/1/INDC-ICELAND.pdf).

Iceland, 2018, *National Inventory Report — Emissions of greenhouse gases in Iceland from 1990 to 2016*, Environment Agency of Iceland.

IPCC, 2007, *Climate change 2007 — The physical science basis — Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK and New York, NY.

Liechtenstein, 2015, Liechtenstein's intended nationally determined contribution (INDC), (https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Liechtenstein/1/150422_INDC_FL.pdf) accessed 11 September 2018.

Liechtenstein, 2018, *National Inventory Report — Emissions of greenhouse gases in Liechtenstein from 1990 to 2016*, Office of Environment, Principality of Liechtenstein.

Nero Renewables, 2017, 'European Joint Project supports the Netherlands to reach its international renewable energy targets' (https://www.nerojp.nl/european-joint-project-supports-the-netherlands-to-reach-its-national-renewable-energy-targets) accessed 27 June 2018.

Norway, 2013, National Renewable Energy Action Plan under Directive 2009/28/EC, Ministry of Petroleum and Energy.

Norway, 2015, Norway's intended nationally determined contribution (INDC), (https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Norway/1/Norway%20INDC%2026MAR2015.pdf) accessed 11 September 2018.

Norway, 2018, *National Inventory Report — Emissions of greenhouse gases in Norway from 1990 to 2016*, Norwegian Environment Agency.

Odyssee-Mure, 2018, 'Decomposition Tool' (http://www.indicators.odyssee-mure.eu/decomposition.html) accessed 7 November 2018.

SFOE, 2018, 'Overall energy statistics — Schweizerische Gesamtenergiestatistik 2017', Swiss Federal Office of Energy (http://www.bfe.admin.ch/themen/00526/00541/00542/00631/index.html?lang=en&dossier_id=05071) accessed 4 October 2018.

Switzerland, 2016, *Switzerland's Second Biennial Report under the UNFCCC*, Federal Office for the Environment FOEN.

Switzerland, 2018, *National Inventory Report — Emissions of greenhouse gases in Switzerland from 1990 to 2016*, Federal Office for the Environment, Switzerland.

Turkey, 2014, National Renewable Energy Action Plan for Turkey, European Bank for Reconstruction and Development (EBRD); The Government of the Kingdom of Spain; Deloitte.

Turkey, 2015, Turkey's intended nationally determined contribution (INDC), (https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Turkey/1/The_INDC_of_TURKEY_v.15.19.30.pdf) accessed 11 September 2018.

Turkey, 2018, *National Inventory Report — Emissions of greenhouse gases in Turkey from 1990 to 2016*, Turkish Statistical Institute.

UBA, 2014, Best-practice cost rates for air pollutants, transport, power generation and heat generation — Annex B to 'Economic Valuation of Environmental Damage — Methodological Convention 2.0 for Estimates of Environmental Costs', (http://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/economic_valuation_methods_-_annex_b.pdf) accessed 11 September 2018, German Federal Environment Agency (UBA).

UNFCCC, 2012a, Decision 2/CMP.7 — Land use, land-use change and forestry (FCCC/KP/CMP/2011/10/Add.1).

UNFCCC, 2012b, Doha amendment to the Kyoto Protocol, (http://unfccc.int/files/kyoto_protocol/application/pdf/kp_doha_amendment_english.pdf).

UNFCCC, 2013, Decision 24/CP.19 — Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention.

Abbreviations, symbols and units

AAU	Assigned amount unit
AEA	Annual emission allocation
AR4	Fourth Assessment Report
ARD	Afforestation, reforestation and deforestation
CDM	Clean development mechanism
CER	Certified emission reduction
CH_4	Methane
CM	Cropland management
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COP	Conference of the Parties
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CRF	Common Reporting Form
EEA	European Environment Agency
EED	Energy Efficiency Directive
EEO	Energy Efficiency Obligation
EPBD	Energy Performance of Buildings Directive
ERU	Emission reduction unit
ESD	Effort Sharing Decision
ESR	Effort Sharing Regulation
ETC/ACM	European Topic Centre for Air Pollution and Climate Change Mitigation
ETS	Emissions Trading System
EU	European Union

EU-28	28 Member States of the European Union
EUA	European Union Allowance
EUAA	European Union Aviation Allowance
EUR	Euro
EUTL	European Union Transaction Log
EXCEED	Excellence in Energy Efficiency Design
F-gas	Fluorinated gas
FEC	Final Energy Consumption
FM	Forest management
GDP	Gross domestic product
GHG	Greenhouse gas
GM	Grazing-land management
GVA	Gross value added
GW	Gigawatt
GWP	Global warming potential
HFC	Hydrofluorocarbon
ICAO	International Civil Aviation Organization
ILUC	Indirect Land Use Change (Directive)
INDC	Intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
$KtCO_2$	Kiloton carbon dioxide equivalent
LDC	Least developed country
LMU	Land mitigation units
LULUCF	Land use, land use change and forestry
MMR	Monitoring Mechanism Regulation
Mt	Megatonnes
Mtoe	Million tonnes of oil equivalent
$MtCO_2e$	Megatonnes carbon dioxide equivalent

NDC	Nationally determined contribution
NECP	National energy and climate plan
NEEAP	National energy efficiency action plan
NF_3	Nitrogen trifluoride
NREAP	National renewable energy action plan
PEC	Primary Energy Consumption
PFC	Perfluorinated compound
PRIMES	Price-driven and Agent-based Simulation of Markets Energy System Models
PV	Photovoltaic
QA/QC	Quality assurance and quality control
QELRC	Quantified emission limitation or reduction commitment
RED	Renewable Energy Directive
RES	Renewable energy sources
RES-E	Renewable energy sources in electricity
RES-H/C	Renewable energy sources in heating and cooling
RES-T	Renewable energy sources in transport
RMU	Removal units
RV	Revegetation
SF_6	Sulphur hexafluoride
SIDS	Small island developing state
SME	Small to medium-sized enterprise
TFEU	Treaty on the Functioning of the European Union
UNFCCC	United Nations Framework Convention on Climate Change
WAM	With additional measures
WEM	With existing measures

Annex 1 Progress towards greenhouse gas emission targets: data and methodology

A1.1 Reporting requirements for greenhouse gas emissions

The assessments of progress towards GHG emission targets presented in this report are based, for the most part, on information submitted by Member States under Regulation (EU) No 525/2013, the Monitoring Mechanism Regulation (EU, 2013c).

The purposes of the reporting requirements stipulated in the MMR are to enable the EU to complete its reporting commitments under the UNFCCC, and to evaluate the projected progress of the EU and its Member States towards fulfilling their GHG mitigation commitments under the Kyoto Protocol, in annual reports prepared by the European Commission and the EEA.

Implementing provisions (EU, 2014a) provide a structure and format for the reporting of GHG inventories and approximated GHG inventories, information on policies and measures, GHG projections and the use of auctioning revenue and project credits, and they are used for the purposes of the LULUCF Decision (EU, 2013d). Furthermore, a delegated act (EU, 2014b) defines the substantive requirements for an EU inventory system to fulfil the obligations pursuant to Decision 19/CMP.1.

A1.2 Data sources for greenhouse gas emissions

The analysis presented in this report is based on several sets of GHG emission data.

A1.2.1 Historical trends in greenhouse gas emissions

GHG emission data for the period 1990-2016 are official data reported by the EU and Member States under the UNFCCC in their corresponding GHG inventory reports (EEA, 2018a, 2018b, EEA, 2018f). The EEA is responsible for the compilation of the EU GHG inventory. Together with the European Topic Centre for Air Pollution and Climate Change Mitigation ([29]), the EEA implements a quality assurance and quality control (QA/QC) procedure (EC, 2013b) to ensure the timeliness, completeness, consistency, comparability, accuracy and transparency of the inventories reported by Member States that are used in this report. In 2016, a comprehensive review of GHG emission data took place under Article 19 of the MMR, in the context of the annual compliance cycle under the ESD. This concerned the years 2005, 2008-2010, 2013 and 2014. The years 2015 and 2016 were reviewed in 2017 and 2018 during the annual review cycle under Article 19 of the MMR.

From 2015 onwards, Member States' GHG inventories are based on the use of global warming potentials (GWPs) from the Intergovernmental Panel on Climate Change (IPCC)'s Fourth Assessment Report (AR4) (UNFCCC, 2013). Thus, all the emission estimates used in this report were calculated using GWPs from the IPCC's AR4.

A1.2.2 Approximated greenhouse gas emissions for 2017

Early 'approximated' (proxy) estimates of 2017 GHG emissions were reported by Member States to the European Commission under the MMR by 31 July 2018. These estimates were aggregated to EU level by the EEA (EEA, 2018f). Bulgaria, Cyprus and Romania did not submit proxy GHG inventories. For those countries, proxies have been calculated by the EEA and the ETC/ACM. The methodology and data sources are laid out in detail in (EEA, 2018f).

A1.2.3 Greenhouse gas emissions in the European Union Emissions Trading System since 2005

Data in the EU ETS are used to analyse emission trends and to determine the level of emissions covered under the ESD. For the years 2005-2012, ETS emissions include estimates to reflect the scope of the EU ETS

([29]) The ETC/ACM is a consortium of European institutes contracted by the EEA to carry out specific tasks in the fields of air pollution and climate change mitigation.

for the third trading period. These data are publicly available from the EUTL ([30]) and the EEA ETS data viewer (EEA, 2018i). The data considered in the analysis were extracted from the EUTL on 10 July 2018.

A1.2.4 Emissions covered under the Effort Sharing Decision

For analysing emission trends in the ESD, historical Effort Sharing emissions are calculated using the latest GHG inventory data, from which ETS emissions, CO_2 emissions from domestic aviation and nitrogen trifluoride (NF_3) emissions are subtracted. ETS emissions include EEA estimates to reflect the scope of the EU ETS for the third trading period for the years 2005-2012.

The Effort Sharing GHG emission data for the years 2013 and 2016 are consistent with the outcome of the 2016, 2017 and 2018 reviews of national GHG inventory data pursuant to Article 19 of the MMR. The data used by the European Commission to determine Member States' compliance under the ESD for 2013, 2014 and 2015 are publicly available (EU, 2017b, 2017c, 2016a); the data for 2016 are expected to be published in autumn 2018.

A1.2.5 Long-term historical trends in Emissions Trading System and Effort Sharing Decision emissions

For Figures 2.3 and 2.4, GHG emissions for the years 1990-2016 are split into those covered by the EU ETS and those covered by the ESD. These splits are based on the application of a percentage for each of the main source categories defined by the IPCC for the reporting of national GHG inventories, based on Member States' projections submitted in 2017 and 2018. Projections for ETS and ESD are reported by source categories in Member States' submissions.

The 'industry and other' sector in Figure 2.4 aggregates Effort Sharing emissions of energy supply, manufacturing and industrial processes and product use, i.e. inventory source categories 1.A.1, 1.A.2, 1.B and 2.

A1.2.6 Annual emission targets (annual emission allocations) under the Effort Sharing Legislation

The AEA values for the period from 2013 to 2020 were defined in Commission Decision No 2013/162/EU (EU, 2013a) and adjusted in accordance with Commission Implementing Decision No 2013/634/EU (EU, 2013b) to reflect the change in scope of the EU ETS in 2013.

Following the 2016 comprehensive review of Member States' historical GHG inventory estimates, the AEAs for the years 2017-2020 were recalculated to reflect updates in methodologies for reporting of GHG inventories (EU, 2017a). This recalculation ensures that the originally intended level of effort (as a percentage) is maintained for each Member State in the ESD. The recalculation also ensures consistency between the targets and the emissions reported by the Member States for compliance with the ESD, as the current reported emissions already consider the methodological updates.

Effort Sharing base year emissions for 2005 and AEA values for 2017-2020 used throughout this report follow Commission Decision (EU) 2017/1471 (EU, 2017a) and Decision No 2013/634/EU (EU, 2013b).

The Effort Sharing Regulation (ESR) (EEA, 2018b) defines Member States' minimum contributions to achieve the EU's 2030 target of a 30 % emission reduction compared with 2005 in ESR sectors (see Figure A4.1). Absolute AEA values for the period from 2021 to 2030 will be published in the year 2020, when final Effort Sharing emissions for the period 2016 to 2018 are available. Average Effort Sharing emissions for these years are necessary to define the starting point for the calculation of AEAs in the period from 2021 to2030.

The best currently available Effort Sharing emission data have been used for an estimation of future AEAs, as follows.

- 2005: base year emissions from 2016 comprehensive ESD review (EEA, 2017c).

([30]) The EUTL automatically checks, records and authorises all transactions in the EU ETS.

- 2016: final ESD review reports sent to each Member State on 29 June 2018 (EEA, 2018i).
- 2017: proxy inventory (submitted under MMR by 31 July 2018) and verified ETS emissions (EEA, 2018f).
- 2018: Member State's own projections (EEA, 2018c).

To estimate AEA for this period, reviewed Effort Sharing emissions for the years 2005 and 2016, proxy Effort Sharing emissions for 2017 and Effort Sharing emissions of the latest WEM scenarios for 2018 have been used. The adjustments pursuant to Article 10(2) listed under Annex IV of the ESR are already considered in the AEA amounts for 2021 for the eligible Member States.

Other flexibilities that might have increasing effects on the total amount of AEAs have not been considered:

- a maximum of 100 million AEAs resulting from voluntary cancellation of ETS allowances (ESR Article 6);
- the use of land mitigation units (LMUs) from net removals from afforested land, managed cropland and managed grassland corresponding to a maximum of 280 million AEAs (ESR Article 7).

In total, these sum to 380 million AEAs and LMUs that might be used under certain conditions by Member States to comply under the ESR. Additional allocations might be available under Article 10(1b) owing to credits from projects under ETS Directive Articles 24 and 24a, but the relevant legislative setting is not yet in place. Conversely, if a Member State incurred LULUCF debits, ESR allocations would be a means of compensating for them.

A1.2.7 The 2005 Effort Sharing Decision base year emissions

The 2005 'Effort Sharing base year emissions' are calculated by the EEA, to be consistent with both:

- the relative 2020 Effort Sharing target (as a percentage of 2005 emissions) defined in the ESD (EU, 2009c);
- the absolute 2020 Effort Sharing target determined by the European Commission (EU, 2017a, 2013a, 2013b).

The EEA calculates 2005 Effort Sharing base year emissions as follows:

Effort Sharing base year emissions = 2020 absolute target/(1 + % of 2020 Effort Sharing target).

These calculated Effort Sharing base year emissions can also be used, for example, to compare relative changes in Effort Sharing emissions with 2020 Effort Sharing targets expressed as percentages.

In this report, calculated 2005 Effort Sharing base year emissions are used to express the distance between Effort Sharing emissions and Effort Sharing targets in a normalised way (see, for example, Figures 3.1 and 3.2). The distance, calculated as the absolute difference between emissions and targets divided by 2005 base year emissions, is expressed in percentage points (a proportion of 2005 base year emissions). It is then directly comparable with targets and reductions as percentages of 2005 levels and allows relevant comparisons between Member States.

These calculated 2005 Effort Sharing base year emissions reflect the current scope of the EU ETS (EU, 2013b) and the outcome of the comprehensive ESD review in 2016 and may therefore differ, sometimes significantly, from actual historical 2005 emissions, today falling under the scope of the ESD based on the latest GHG inventories.

A1.2.8 Projections of greenhouse gas emissions

This report uses GHG projection data that are reported by Member States under the MMR (EEA, 2018c). Mandatory reporting of WEM scenarios takes place every 2 years (2015, 2017, etc.). Member States must also report substantial changes to projections every other year (2014, 2016, 2018, etc.). In 2017, all 28 Member States and Norway submitted projections under the MMR. In 2018, Cyprus and Ireland submitted updates to their previous projections.

Under the MMR, Member States report projections in two scenarios:

- A WEM scenario, which considers the implementation of existing (already implemented) measures.

- If available, a WAM scenario is reported too. It considers the implementation of additional measures (at planning stage). In 2017, 18 Member States reported projections based on such WAM scenarios: Belgium, Croatia, Cyprus, Czechia, Denmark ([31]), Estonia, Finland, Germany, Hungary, Ireland, Latvia, Lithuania, Luxembourg, the Netherlands, Portugal, Romania, Slovakia and the United Kingdom. For the aggregation of a WAM scenario at EU level, Member States that have not reported a WAM scenario have been gap-filled using the WEM scenario. In 2018, the two Member States that submitted updates to their projections also submitted a WAM scenario.

An overview of projected emissions for both scenarios is published by the EEA (EEA, 2018m).

Member States reported projections for total and sectoral GHG emissions by source categories as well as a split of these projections between those covered by the EU ETS and those covered by the ESD. Total GHG projections are used to assess the progress towards the EU's 20 % reduction target by 2020, and 'Effort Sharing projections' are used to assess the Member States' progress towards their national 2020 targets, set under the ESD.

The EEA, together with its ETC/ACM, implements a QA/QC procedure to ensure timeliness, completeness, consistency, comparability, accuracy and transparency of the projections reported by Member States and used in this report. This procedure is described in *Elements of the Union system for policies and measures and projections and the quality assurance and control (QA/QC) programme as required under Regulation (EU)* No 525/2013 (EC, 2015c). If significant discrepancies can be observed between the inventory value for the reference year and that for the projected year, an alignment of the level of projections is performed. Such calibration is performed to match national projections with a common reference year for aggregated EU projections, which is the year 2015. In 2017 and 2018, for both projection updates, no such calibration took place.

A1.3 Historical and projected total GHG, ETS and Effort Sharing emissions by sector for 2005-2030 and annual AEA targets 2013-2030

Member States report historical Effort Sharing emissions on an aggregated level. To better understand the overall developments of emission trends, it is helpful to split Effort Sharing emissions into source sectors. This has been accomplished by the EEA and its ETC/ACM.

Total Effort Sharing and ETS emissions, and projected shares of ETS emissions by source categories as reported in GHG projections, have been considered to disaggregate ETS and Effort Sharing emissions by source categories according to the Common Reporting Format (CRF) of the IPCC. The shares of ETS emissions are mostly negligible for the agriculture, waste, transport and buildings sectors, which leads to robust assumptions on Effort Sharing emissions for these sectors. For the sectors of energy industries, manufacturing (CRF 1.A.1, 1.A.2, 1B) and process emissions and product use (CRF 2), the shares are considerably higher, specifically in some Member States. Therefore, these sectors were aggregated to a sector called 'industry and other'. The sum of Effort Sharing emissions from energy industries, manufacturing and process emissions and product use provides a more robust number. CRF sectors 1.A.4 and 1.A.5 are summed under the category 'buildings'. The following tables provide an overview for all 28 Member States of the EU (EU-28) and each Member State on emissions developments and annual Effort Sharing targets.

([31]) Denmark submitted a WAM scenario that is equal to its WEM scenario.

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
EU-28	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**5 220**	**4 777**	**4 620**	**4 557**	**4 462**	**4 291**	**4 319**	**4 293**	**4 317**	**4 161**	**4 119**	**4 071**	**4 048**	**4 019**	**3 999**	**3 965**	**3 937**	**3 914**	**3 888**	**3 867**	**3 849**	**3 824**
Emissions Trading System (stationary installations)	2 345	2 024	1 984	1 943	1 882	1 787	1 776	1 724	1 727	1 680	1 656	1 630	1 623	1 608	1 605	1 588	1 580	1 565	1 549	1 539	1 527	1 516
Energy Industries	1 574	1 386	1 363	1 349	1 290	1 203	1 191	1 141	1 132	1 090	1 062	1 032	1 026	1 011	1 008	990	983	967	952	943	933	923
Other stationary installations	771	638	621	594	592	585	585	583	595	590	594	598	597	597	597	597	598	597	597	595	594	593
Effort Sharing Decision and Regulation	2 856	2 735	2 618	2 597	2 567	2 478	2 519	2 555	2 574	2 466	2 447	2 425	2 408	2 394	2 377	2 360	2 340	2 333	2 322	2 311	2 305	2 291
Transport	953	914	902	874	869	872	888	912	927	878	875	872	870	869	867	865	862	863	864	864	865	866
Buildings	790	778	684	699	704	610	640	663	660	625	617	606	601	593	586	581	570	568	563	559	558	551
Agriculture	435	420	420	418	422	427	427	430	432	432	432	431	431	431	431	431	432	432	432	432	432	432
Waste	200	166	160	156	149	143	140	138	136	126	122	118	115	112	110	108	106	104	103	101	100	99
Industry and other	479	458	451	450	423	426	424	412	420	405	402	398	391	388	382	376	370	366	361	355	350	343
AEA under Effort Sharing Decision and Regulation					2 791	2 770	2 749	2 728	2 679	2 659	2 639	2 618	*2 496*	*2 406*	*2 358*	*2 309*	*2 261*	*2 213*	*2 164*	*2 116*	*2 067*	*2 019*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Austria	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**92.7**	**84.9**	**82.4**	**79.9**	**80.2**	**76.4**	**78.9**	**79.7**	**81.9**	**77.0**	**76.4**	**75.4**	**74.4**	**74.1**	**73.8**	**73.5**	**72.7**	**72.1**	**71.6**	**71.0**	**70.4**	**69.8**
Emissions Trading System (stationary installations)	36.1	32.8	32.5	30.2	29.8	28.1	29.5	29.0	30.6	27.5	27.0	26.2	25.7	25.7	25.7	25.7	25.5	25.2	25.2	25.2	25.1	25.0
Energy Industries	13.6	11.4	11.2	9.9	9.1	7.7	8.6	8.5	8.8	7.5	7.2	6.5	6.1	6.1	6.1	6.1	5.9	5.7	5.7	5.6	5.6	5.5
Other stationary installations	22.5	21.4	21.2	20.3	20.7	20.3	20.9	20.5	21.8	20.0	19.8	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.5	19.5	19.5
Effort Sharing Decision and Regulation	56.5	52.0	49.9	49.6	50.1	48.2	49.3	50.6	51.3	49.4	49.3	49.1	48.6	48.4	48.1	47.7	47.2	46.7	46.3	45.7	45.2	44.6
Transport	24.2	21.9	21.2	21.0	22.1	21.5	21.9	23.0	23.5	22.0	22.2	22.3	22.3	22.3	22.3	22.2	22.0	21.9	21.7	21.5	21.3	21.0
Buildings	13.6	11.3	9.8	9.4	9.5	8.5	8.8	9.0	9.1	8.9	8.6	8.4	8.1	7.9	7.7	7.5	7.3	7.1	6.9	6.7	6.5	6.3
Agriculture	7.1	7.1	7.1	7.1	7.0	7.2	7.2	7.3	7.2	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.4	7.4	7.4	7.4
Waste	2.8	2.2	2.0	1.9	1.8	1.7	1.7	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1	1.0	1.0	1.0	1.0	0.9
Industry and other	8.9	9.7	9.7	10.2	9.7	9.3	9.7	9.8	10.0	9.8	9.8	9.9	9.6	9.6	9.6	9.6	9.4	9.4	9.3	9.2	9.1	9.0
AEA under Effort Sharing Decision and Regulation					52.6	52.1	51.5	51.0	49.5	48.9	48.3	47.8	*48.3*	*47.0*	*45.7*	*44.4*	*43.0*	*41.7*	*40.4*	*39.0*	*37.7*	*36.4*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Belgium	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**145.4**	**132.7**	**122.1**	**119.3**	**119.7**	**114.0**	**117.6**	**117.7**	**116.2**	**115.9**	**115.3**	**114.7**	**114.1**	**113.5**	**113.0**	**112.4**	**111.9**	**114.7**	**114.5**	**114.3**	**114.2**	**114.1**
Emissions Trading System (stationary installations)	66.6	54.7	49.6	46.4	45.2	43.9	44.7	43.7	43.8	44.1	43.9	43.6	43.3	43.0	42.8	42.5	42.2	45.0	45.0	45.0	45.0	45.0
Energy Industries	28.8	24.8	21.3	20.7	19.3	18.4	19.2	17.8	17.8	17.6	17.1	16.5	16.3	16.1	15.9	15.6	15.4	18.3	18.2	18.2	18.2	18.2
Other stationary installations	37.8	29.9	28.3	25.7	25.9	25.5	25.5	25.9	26.0	26.5	26.8	27.1	27.0	27.0	26.9	26.8	26.8	26.8	26.8	26.8	26.8	26.8
Effort Sharing Decision and Regulation	78.8	78.0	72.4	72.9	74.3	70.1	72.7	74.1	72.4	71.7	71.5	71.0	70.8	70.5	70.2	69.9	69.7	69.6	69.4	69.3	69.2	69.2
Transport	26.5	26.4	26.0	25.2	24.6	24.9	26.5	26.2	26.4	26.7	26.9	27.1	27.3	27.5	27.7	27.9	28.1	28.3	28.5	28.7	28.9	29.1
Buildings	30.0	28.9	23.7	24.7	27.1	22.4	23.8	25.4	23.4	23.9	23.8	23.6	23.5	23.3	23.2	23.1	23.0	22.9	22.7	22.6	22.5	22.3
Agriculture	10.3	10.2	10.1	9.9	9.9	10.1	10.0	9.9	9.9	9.7	9.7	9.6	9.5	9.5	9.4	9.3	9.2	9.2	9.2	9.1	9.1	9.1
Waste	2.7	2.2	2.0	1.9	1.6	1.5	1.6	1.5	1.3	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.8	0.8	0.7
Industry and other	9.3	10.3	10.7	11.1	11.0	11.1	10.8	11.1	11.4	10.1	9.9	9.5	9.3	9.1	8.9	8.8	8.6	8.4	8.3	8.1	8.0	7.9
AEA under Effort Sharing Decision and Regulation					78.4	76.9	75.3	73.8	72.5	71.1	69.7	68.2	*69.7*	*67.7*	*65.8*	*63.8*	*61.9*	*60.0*	*58.0*	*56.1*	*54.1*	*52.2*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Bulgaria	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**63.9**	**60.5**	**65.8**	**60.8**	**55.5**	**58.6**	**61.7**	**59.1**	**61.0**	**59.1**	**59.1**	**59.0**	**58.4**	**57.7**	**57.0**	**56.3**	**55.7**	**55.6**	**55.6**	**55.6**	**55.5**	**55.5**
Emissions Trading System (stationary installations)	37.9	35.0	41.5	36.4	32.7	34.3	36.3	33.4	34.9	36.9	37.1	37.3	36.6	35.9	35.2	34.5	33.8	33.7	33.6	33.5	33.3	33.2
Energy Industries	27.5	30.0	36.2	31.4	27.6	29.1	30.5	27.3	28.7	31.1	31.3	31.5	30.7	30.0	29.3	28.5	27.8	27.6	27.4	27.3	27.1	26.9
Other stationary installations	10.4	5.0	5.3	5.0	5.1	5.2	5.8	6.1	6.2	5.8	5.8	5.8	5.9	5.9	5.9	6.0	6.0	6.1	6.1	6.2	6.2	6.3
Effort Sharing Decision and Regulation	26.0	25.5	24.3	24.4	22.2	22.9	25.4	25.6	26.1	22.2	22.0	21.7	21.8	21.8	21.8	21.8	21.8	21.9	22.0	22.1	22.2	22.2
Transport	7.8	8.0	8.1	8.5	7.2	7.9	9.1	9.2	9.8	7.4	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.4	6.4	6.3	6.2
Buildings	2.2	1.8	2.1	2.0	1.7	1.4	1.9	1.9	1.4	1.9	1.9	2.0	2.1	2.2	2.3	2.4	2.5	2.7	2.8	3.0	3.1	3.3
Agriculture	5.2	5.5	5.1	5.2	5.6	5.9	6.2	6.5	6.5	5.0	5.0	5.0	5.1	5.1	5.2	5.2	5.2	5.3	5.3	5.3	5.4	5.4
Waste	5.4	4.6	4.6	4.4	4.4	4.1	4.2	4.0	4.1	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.7
Industry and other	5.5	5.6	4.5	4.2	3.3	3.6	4.1	4.0	4.2	3.8	3.7	3.7	3.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
AEA under Effort Sharing Decision and Regulation					26.9	27.2	27.5	27.7	25.9	26.1	26.3	26.5	*25.8*	*24.0*	*23.8*	*23.5*	*23.3*	*23.1*	*22.8*	*22.6*	*22.4*	*22.1*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM													
Croatia	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**29.9**	**28.0**	**27.6**	**25.8**	**24.6**	**23.7**	**24.2**	**24.3**	**24.5**	**23.9**	**23.9**	**24.0**	**24.0**	**24.1**	**24.1**	**24.1**	**24.2**	**24.3**	**24.4**	**24.5**	**24.6**	**24.7**
Emissions Trading System (stationary installations)	12.4	10.5	10.4	9.5	8.8	8.4	8.4	8.3	8.4	8.7	8.7	8.7	8.7	8.6	8.6	8.6	8.5	8.5	8.6	8.6	8.6	8.6
Energy Industries	6.4	5.4	5.7	5.3	4.7	4.3	4.3	4.4	4.1	4.3	4.3	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.9	3.9	3.9
Other stationary installations	6.0	5.2	4.8	4.3	4.0	4.1	4.1	3.9	4.2	4.4	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.6	4.6	4.7	4.7	4.7
Effort Sharing Decision and Regulation	17.5	17.4	17.2	16.2	15.1	14.7	15.6	16.0	16.1	15.2	15.2	15.2	15.3	15.4	15.5	15.5	15.6	15.7	15.8	15.8	15.9	16.0
Transport	5.5	5.9	5.8	5.6	5.4	5.3	5.8	6.1	6.3	5.5	5.4	5.4	5.4	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Buildings	4.4	4.0	3.8	3.4	3.1	2.8	3.2	3.3	3.2	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Agriculture	3.3	3.0	3.1	3.0	2.7	2.6	2.8	2.9	2.8	2.5	2.5	2.5	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.7	2.7	2.7
Waste	1.3	1.7	1.7	1.7	1.6	1.7	1.8	1.8	1.9	1.8	1.8	1.9	1.9	1.9	2.0	2.0	2.1	2.1	2.1	2.2	2.2	2.3
Industry and other	2.9	2.8	2.8	2.5	2.2	2.2	1.9	1.8	1.8	2.0	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
AEA under Effort Sharing Decision and Regulation					19.6	19.8	20.0	20.2	18.7	18.9	19.1	19.3	*16.9*	*15.8*	*15.9*	*15.9*	*16.0*	*16.0*	*16.1*	*16.1*	*16.1*	*16.2*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM													
Cyprus	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**9.2**	**9.4**	**9.1**	**8.6**	**7.9**	**8.3**	**8.3**	**8.8**	**9.0**	**9.2**	**9.3**	**9.4**	**8.3**	**8.5**	**8.6**	**8.7**	**8.8**	**9.0**	**9.1**	**9.2**	**9.3**	**9.4**
Emissions Trading System (stationary installations)	5.1	5.1	4.6	4.4	4.0	4.5	4.4	4.6	4.7	4.9	4.9	4.9	3.9	3.9	4.0	4.0	4.0	4.1	4.1	4.2	4.2	4.2
Energy Industries	3.5	3.9	3.6	3.5	2.8	3.0	3.0	3.3	3.3	3.3	3.3	3.3	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.4	2.5	2.5
Other stationary installations	1.6	1.2	1.0	0.9	1.2	1.5	1.3	1.3	1.4	1.6	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Effort Sharing Decision and Regulation	4.1	4.4	4.5	4.2	3.9	3.9	4.1	4.1	4.3	4.3	4.4	4.5	4.5	4.6	4.7	4.7	4.8	4.9	4.9	5.0	5.1	5.2
Transport	2.1	2.3	2.2	2.1	1.9	1.9	1.9	2.0	2.0	2.1	2.2	2.3	2.3	2.4	2.4	2.5	2.5	2.6	2.6	2.7	2.7	2.8
Buildings	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5
Agriculture	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Waste	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Industry and other	0.4	0.4	0.6	0.5	0.5	0.5	0.5	0.5	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
AEA under Effort Sharing Decision and Regulation					5.9	5.9	5.9	5.9	4.2	4.1	4.0	4.0	*4.1*	*4.0*	*3.9*	*3.8*	*3.7*	*3.6*	*3.5*	*3.4*	*3.3*	*3.2*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Czechia	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**148.0**	**140.5**	**138.5**	**134.4**	**129.3**	**127.4**	**128.4**	**130.3**	**131.0**	**123.4**	**123.0**	**122.5**	**120.7**	**118.9**	**117.2**	**115.4**	**113.6**	**112.6**	**111.7**	**110.7**	**109.8**	**108.8**
Emissions Trading System (stationary installations)	86.1	78.5	77.1	72.2	67.7	66.7	66.6	67.5	67.0	63.2	61.9	60.5	59.2	57.8	56.4	55.1	53.7	53.8	54.0	54.1	54.2	54.4
Energy Industries	65.2	61.5	60.6	56.4	52.4	51.0	51.1	51.9	51.5	48.1	47.1	46.1	44.8	43.5	42.1	40.8	39.5	39.4	39.2	39.1	39.0	38.9
Other stationary installations	21.0	17.0	16.5	15.8	15.3	15.7	15.6	15.6	15.5	15.1	14.8	14.4	14.4	14.3	14.3	14.3	14.2	14.5	14.7	15.0	15.3	15.5
Effort Sharing Decision and Regulation	61.9	62.1	61.4	62.2	61.5	57.6	61.3	62.8	64.0	60.2	61.1	61.9	61.5	61.1	60.7	60.3	59.9	58.8	57.7	56.6	55.5	54.4
Transport	17.5	17.4	17.2	16.9	16.7	16.0	17.9	18.8	20.1	17.9	18.2	18.5	18.4	18.3	18.2	18.2	18.1	17.6	17.2	16.7	16.3	15.9
Buildings	15.0	15.8	14.8	14.7	14.8	12.6	13.5	14.1	14.0	11.2	11.2	11.3	11.2	11.2	11.1	11.1	11.0	10.9	10.9	10.8	10.7	10.6
Agriculture	8.0	7.6	7.7	7.7	7.9	7.6	8.2	8.6	8.5	8.5	8.6	8.6	8.7	8.8	8.9	9.0	9.1	9.2	9.3	9.5	9.6	9.7
Waste	4.4	4.9	5.0	5.2	5.4	5.2	5.5	5.6	5.4	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.5	4.4	4.3	4.2	4.1
Industry and other	17.0	16.3	16.7	17.7	16.7	16.1	16.2	15.7	15.9	17.5	18.1	18.6	18.3	18.0	17.7	17.4	17.1	16.5	15.9	15.3	14.8	14.2
AEA under Effort Sharing Decision and Regulation					62.5	63.2	64.0	64.7	65.2	65.9	66.5	67.2	*65.4*	*60.1*	*59.2*	*58.3*	*57.4*	*56.5*	*55.7*	*54.8*	*53.9*	*53.0*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Denmark	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**66.3**	**63.3**	**58.1**	**53.4**	**55.2**	**51.0**	**48.5**	**50.5**	**47.8**	**45.3**	**44.9**	**44.8**	**45.4**	**46.0**	**46.9**	**47.4**	**48.7**	**49.1**	**49.6**	**50.5**	**51.0**	**50.9**
Emissions Trading System (stationary installations)	26.5	25.3	21.5	18.2	21.6	18.4	15.8	17.2	15.1	13.3	13.3	13.5	14.2	14.9	15.9	16.5	17.8	18.3	18.8	19.7	20.3	20.3
Energy Industries	21.8	21.8	17.9	14.9	18.1	14.9	12.4	13.5	11.6	10.1	9.9	10.1	10.7	11.3	12.2	12.7	14.0	14.4	15.0	15.8	16.3	16.3
Other stationary installations	4.7	3.5	3.5	3.3	3.5	3.5	3.4	3.8	3.5	3.3	3.3	3.4	3.5	3.6	3.7	3.7	3.8	3.8	3.9	3.9	3.9	4.0
Effort Sharing Decision and Regulation	39.7	37.9	36.5	35.1	33.7	32.6	32.5	33.1	32.6	31.8	31.5	31.1	31.0	31.0	30.9	30.8	30.8	30.7	30.6	30.6	30.6	30.5
Transport	13.7	13.4	13.1	12.5	12.4	12.5	12.7	12.9	12.0	12.2	12.2	12.2	12.2	12.1	12.1	12.1	12.1	12.1	12.0	12.0	11.9	11.9
Buildings	7.7	6.8	6.0	5.6	5.6	4.7	4.8	4.9	4.5	4.5	4.4	4.3	4.3	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.1	4.1
Agriculture	11.0	10.6	10.5	10.5	10.5	10.7	10.5	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.7	10.7	10.7	10.7
Waste	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.3	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Industry and other	5.9	5.9	5.6	5.3	4.0	3.6	3.4	3.4	4.2	3.7	3.7	3.5	3.5	3.5	3.4	3.3	3.3	3.3	3.3	3.3	3.3	3.2
AEA under Effort Sharing Decision and Regulation					36.8	35.9	35.0	34.1	34.8	33.9	33.0	32.1	*31.3*	*30.5*	*29.8*	*29.0*	*28.3*	*27.5*	*26.7*	*26.0*	*25.2*	*24.4*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Estonia	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**19.1**	**21.1**	**21.2**	**20.1**	**21.8**	**21.1**	**18.0**	**19.6**	**20.6**	**18.8**	**19.1**	**19.3**	**19.3**	**19.2**	**19.1**	**19.1**	**19.0**	**18.6**	**18.2**	**17.8**	**17.4**	**17.0**
Emissions Trading System (stationary installations)	12.9	14.5	14.8	13.5	15.9	15.0	11.9	13.4	14.7	12.8	13.0	13.3	13.2	13.2	13.1	13.0	12.9	12.5	12.1	11.7	11.3	10.9
Energy Industries	12.1	14.0	14.1	12.7	15.0	14.2	11.4	12.9	13.9	11.8	11.9	12.1	12.0	11.9	11.8	11.7	11.6	11.2	10.8	10.3	9.9	9.5
Other stationary installations	0.7	0.5	0.7	0.9	0.9	0.7	0.5	0.6	0.7	0.9	1.1	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4
Effort Sharing Decision and Regulation	6.3	6.6	6.3	6.5	5.8	6.1	6.1	6.2	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.1	6.1	6.1	6.1	6.1	6.1
Transport	2.1	2.3	2.3	2.3	2.2	2.3	2.3	2.4	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5	2.5	2.6	2.6	2.6
Buildings	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Agriculture	1.1	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.6	1.6
Waste	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Industry and other	1.8	2.0	1.8	1.9	1.3	1.4	1.4	1.5	1.0	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9
AEA under Effort Sharing Decision and Regulation					6.3	6.3	6.3	6.4	5.9	6.0	6.0	6.0	*6.0*	*5.7*	*5.6*	*5.5*	*5.4*	*5.2*	*5.1*	*5.0*	*4.8*	*4.7*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Finland	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**69.8**	**75.5**	**67.8**	**62.3**	**63.1**	**58.9**	**55.4**	**58.8**	**56.1**	**57.7**	**57.0**	**56.3**	**55.3**	**54.4**	**53.4**	**52.5**	**49.8**	**48.6**	**48.2**	**49.9**	**49.4**	**48.8**
Emissions Trading System (stationary installations)	35.6	42.0	35.7	30.2	31.5	28.8	25.5	27.2	25.1	28.0	27.7	27.3	26.6	26.0	25.3	24.8	22.3	21.3	21.1	23.0	22.6	22.2
Energy Industries	21.4	29.3	23.5	19.3	20.6	19.2	16.1	17.5	15.9	18.1	17.8	17.4	16.8	16.1	15.5	14.9	12.4	11.5	11.3	13.2	12.9	12.5
Other stationary installations	14.2	12.7	12.3	10.8	10.9	9.5	9.3	9.8	9.2	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.8	9.8	9.8	9.8	9.7
Effort Sharing Decision and Regulation	33.8	33.3	31.8	32.0	31.6	30.1	29.9	31.4	30.8	29.4	29.1	28.8	28.5	28.2	27.9	27.5	27.4	27.1	26.9	26.7	26.6	26.4
Transport	12.7	12.5	12.3	12.0	12.1	11.0	11.0	12.4	11.6	10.8	10.7	10.6	10.5	10.4	10.3	10.2	10.1	10.0	10.0	9.9	9.9	9.8
Buildings	6.9	6.2	5.3	5.7	5.3	5.2	4.9	5.0	5.2	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.4	4.3	4.3	4.2	4.2
Agriculture	6.5	6.6	6.4	6.4	6.5	6.6	6.5	6.5	6.5	6.7	6.7	6.6	6.6	6.6	6.5	6.4	6.4	6.4	6.4	6.4	6.4	6.4
Waste	2.8	2.6	2.5	2.5	2.4	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4	1.3	1.3	1.2	1.2	1.1	1.1
Industry and other	5.0	5.4	5.2	5.4	5.3	5.2	5.3	5.3	5.5	5.4	5.4	5.3	5.3	5.2	5.2	5.2	5.1	5.1	5.0	4.9	4.9	4.8
AEA under Effort Sharing Decision and Regulation					31.8	31.3	30.8	30.3	30.2	29.6	29.1	28.5	*29.1*	*28.1*	*27.2*	*26.3*	*25.3*	*24.4*	*23.5*	*22.6*	*21.6*	*20.7*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
France	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**553**	**512**	**484**	**485**	**484**	**454**	**458**	**458**	**466**	**441**	**436**	**430**	**426**	**421**	**417**	**412**	**407**	**405**	**403**	**401**	**398**	**396**
Emissions Trading System (stationary installations)	154	128	117	115	115	100	100	102	107	104	106	107	107	106	106	106	105	105	105	105	105	104
Energy Industries	64	55	48	48	47	36	37	40	43	41	42	43	43	43	43	43	43	43	43	43	43	43
Other stationary installations	90	73	69	67	67	64	62	61	63	63	63	64	64	63	63	63	62	62	62	62	62	62
Effort Sharing Decision and Regulation	394	379	362	365	366	354	353	352	355	332	325	318	314	310	306	302	297	295	293	291	289	287
Transport	135	128	128	127	127	128	127	128	128	118	115	111	111	110	109	108	108	108	108	107	107	107
Buildings	114	109	94	99	102	86	88	90	92	77	74	71	69	68	66	65	64	63	62	61	60	59
Agriculture	78	77	77	76	76	79	78	77	77	77	76	75	75	75	75	74	74	74	74	74	73	73
Waste	22	20	20	19	19	19	17	16	16	16	15	15	15	14	14	13	13	13	13	12	12	12
Industry and other	45	45	43	44	43	42	43	41	42	44	45	46	44	43	42	40	39	38	37	37	36	35
AEA under Effort Sharing Decision and Regulation					394	389	384	379	358	353	348	342	*332*	*323*	*314*	*305*	*296*	*287*	*278*	*269*	*260*	*251*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Germany	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**993**	**943**	**920**	**925**	**942**	**903**	**907**	**909**	**905**	**848**	**832**	**816**	**812**	**807**	**802**	**798**	**793**	**781**	**770**	**758**	**746**	**735**
Emissions Trading System (stationary installations)	519	479	474	475	481	461	456	453	438	409	398	388	389	390	391	392	394	387	380	374	367	360
Energy Industries	370	341	338	347	349	328	316	313	291	277	266	255	258	260	263	265	267	262	257	252	247	242
Other stationary installations	149	138	135	128	132	133	140	140	146	132	132	132	131	130	129	127	126	125	123	122	120	119
Effort Sharing Decision and Regulation	472	461	444	447	460	437	444	454	465	436	431	426	421	415	409	403	397	392	387	382	377	372
Transport	158	150	152	151	156	156	157	163	167	156	156	156	154	153	152	151	149	149	148	148	147	147
Buildings	160	155	134	136	146	124	130	137	137	125	122	118	115	112	109	106	102	100	98	95	93	91
Agriculture	63	63	64	64	65	66	66	65	65	67	66	66	66	66	66	66	66	66	66	66	65	65
Waste	21	15	14	13	12	12	11	10	10	10	9	9	8	8	8	7	7	7	7	6	6	6
Industry and other	70	79	79	83	80	79	80	79	85	79	78	78	77	76	74	73	72	71	69	67	65	64
AEA under Effort Sharing Decision and Regulation					473	466	459	452	432	425	418	411	*428*	*414*	*399*	*384*	*370*	*355*	*340*	*326*	*311*	*296*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Greece	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**136.3**	**118.4**	**115.4**	**112.1**	**102.5**	**99.1**	**95.3**	**91.6**	**94.2**	**93.9**	**92.8**	**91.5**	**91.9**	**92.2**	**92.7**	**93.2**	**93.4**	**91.9**	**90.4**	**88.9**	**87.5**	**86.0**
Emissions Trading System (stationary installations)	73.7	62.1	61.0	63.4	58.6	55.4	49.9	46.3	49.6	45.1	43.6	42.0	42.5	43.0	43.5	44.0	44.5	43.0	41.6	40.1	38.6	37.2
Energy Industries	59.2	51.9	52.9	54.4	49.4	45.8	40.7	36.9	40.6	35.8	34.1	32.5	32.8	33.2	33.5	33.8	34.1	32.4	30.8	29.1	27.4	25.7
Other stationary installations	14.5	10.2	8.1	9.0	9.3	9.5	9.2	9.4	9.0	9.4	9.4	9.5	9.7	9.9	10.0	10.2	10.4	10.6	10.8	11.0	11.3	11.5
Effort Sharing Decision and Regulation	62.1	55.8	53.8	48.2	44.2	44.4	45.4	44.9	44.3	48.2	48.7	48.9	48.8	48.6	48.6	48.6	48.3	48.2	48.2	48.2	48.2	48.3
Transport	21.4	22.0	19.6	16.3	16.4	16.6	16.9	17.0	17.1	17.9	18.2	18.6	18.5	18.4	18.3	18.2	18.1	18.0	17.9	17.8	17.7	17.6
Buildings	15.2	10.2	11.4	9.7	5.4	5.3	6.7	6.2	6.2	7.4	7.7	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.0	8.0	8.0
Agriculture	9.0	8.8	8.6	8.5	8.5	8.2	7.9	7.8	7.5	8.8	9.0	9.2	9.2	9.3	9.3	9.4	9.4	9.5	9.5	9.5	9.6	9.6
Waste	4.8	4.8	4.6	4.3	4.5	4.6	4.6	4.5	4.6	4.7	4.7	4.7	4.7	4.7	4.6	4.6	4.6	4.6	4.5	4.5	4.6	4.6
Industry and other	11.8	10.0	9.7	9.4	9.3	9.7	9.4	9.3	8.9	9.4	9.0	8.5	8.5	8.4	8.5	8.6	8.4	8.4	8.4	8.4	8.4	8.4
AEA under Effort Sharing Decision and Regulation					59.0	59.3	59.6	59.9	59.1	59.4	59.7	60.0	*46.4*	*47.1*	*47.8*	*48.5*	*49.1*	*49.8*	*50.5*	*51.2*	*51.9*	*52.5*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Hungary	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**75.8**	**65.3**	**63.8**	**60.1**	**57.3**	**57.9**	**61.0**	**61.5**	**64.4**	**59.3**	**58.6**	**58.0**	**57.7**	**59.0**	**59.1**	**59.0**	**59.2**	**59.2**	**59.3**	**59.1**	**59.0**	**58.8**
Emissions Trading System (stationary installations)	29.5	23.0	22.5	21.3	19.1	18.8	19.6	19.4	20.6	19.3	19.1	18.9	19.0	19.2	19.3	19.4	19.6	19.5	19.5	19.4	19.4	19.3
Energy Industries	20.9	17.3	16.7	16.0	13.7	12.9	13.2	13.1	13.4	12.3	12.0	11.7	11.8	11.8	11.8	11.9	11.9	11.7	11.6	11.4	11.3	11.1
Other stationary installations	8.7	5.7	5.8	5.3	5.4	6.0	6.4	6.3	7.3	6.9	7.0	7.1	7.3	7.4	7.5	7.6	7.7	7.8	7.9	8.0	8.1	8.2
Effort Sharing Decision and Regulation	46.2	42.3	41.3	38.8	38.4	38.4	41.4	42.1	43.8	40.0	39.5	39.1	38.7	39.9	39.8	39.6	39.6	39.7	39.8	39.7	39.6	39.5
Transport	11.9	11.6	11.0	10.7	10.1	10.9	12.2	12.4	12.9	12.0	11.8	11.7	11.6	13.1	13.3	13.4	13.8	14.1	14.5	14.6	14.7	14.8
Buildings	18.1	14.6	14.1	12.4	12.5	11.2	12.3	13.0	13.6	11.2	11.0	10.7	10.5	10.3	10.1	9.9	9.7	9.5	9.3	9.1	9.0	8.8
Agriculture	6.1	5.6	5.9	5.9	6.4	6.4	6.7	6.9	7.1	7.0	7.1	7.4	7.5	7.5	7.6	7.6	7.7	7.7	7.8	7.8	7.8	7.9
Waste	4.4	4.2	4.1	4.1	3.9	3.7	3.6	3.5	3.5	4.1	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.3
Industry and other	5.7	6.3	6.2	5.7	5.6	6.3	6.7	6.3	6.8	5.7	5.5	5.3	5.2	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.7
AEA under Effort Sharing Decision and Regulation					50.4	51.5	52.6	53.8	50.1	51.0	51.9	52.8	*48.9*	*42.5*	*42.7*	*43.0*	*43.3*	*43.6*	*43.8*	*44.1*	*44.4*	*44.7*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Ireland	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**69.5**	**61.2**	**57.1**	**57.7**	**57.6**	**57.3**	**59.4**	**61.5**	**60.9**	**62.4**	**63.1**	**62.4**	**63.3**	**64.0**	**64.7**	**65.4**	**65.5**	**65.5**	**65.4**	**63.8**	**63.8**	**63.9**
Emissions Trading System (stationary installations)	22.8	17.7	16.1	17.2	15.7	16.0	16.8	17.7	16.9	16.5	16.7	15.6	15.9	16.3	16.8	17.3	17.4	17.5	17.4	15.9	16.0	16.2
Energy Industries	15.9	13.0	11.6	12.6	11.0	10.9	11.6	12.3	11.3	10.9	11.0	9.8	10.0	10.4	10.7	11.1	11.1	11.1	10.9	9.3	9.3	9.4
Other stationary installations	6.9	4.8	4.5	4.7	4.7	5.0	5.2	5.4	5.6	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8
Effort Sharing Decision and Regulation	46.7	43.5	41.0	40.5	42.2	41.7	43.0	43.8	44.0	45.9	46.4	46.8	47.3	47.7	47.9	48.0	48.1	48.0	47.9	47.8	47.7	47.6
Transport	13.0	11.5	11.2	10.8	11.1	11.4	11.9	12.3	12.0	13.7	14.1	14.5	14.9	15.2	15.3	15.4	15.4	15.3	15.1	15.0	14.8	14.7
Buildings	10.8	10.9	9.5	9.1	9.0	8.2	8.5	8.5	8.4	8.8	8.9	8.9	8.9	9.0	9.0	9.1	9.1	9.1	9.2	9.2	9.2	9.3
Agriculture	18.7	17.9	17.3	17.7	18.7	18.6	18.9	19.2	19.8	19.7	19.9	20.1	20.1	20.2	20.3	20.3	20.3	20.4	20.4	20.4	20.5	20.5
Waste	1.3	0.5	0.6	0.5	0.7	0.9	1.0	1.0	0.9	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4
Industry and other	2.8	2.7	2.4	2.4	2.6	2.7	2.7	2.8	2.9	3.0	2.9	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.7	2.7
AEA under Effort Sharing Decision and Regulation					46.9	45.8	44.6	43.5	40.9	39.8	38.7	37.7	*42.8*	*41.7*	*40.6*	*39.5*	*38.4*	*37.3*	*36.2*	*35.1*	*34.0*	*32.9*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Italy	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**581**	**504**	**491**	**472**	**441**	**425**	**433**	**428**	**426**	**429**	**427**	**426**	**422**	**418**	**415**	**411**	**407**	**404**	**401**	**398**	**395**	**392**
Emissions Trading System (stationary installations)	248	200	197	186	165	153	156	155	155	159	160	161	159	158	156	154	153	150	148	145	143	140
Energy Industries	169	140	138	133	114	103	108	106	105	103	102	101	99	98	96	95	94	91	88	85	82	79
Other stationary installations	79	60	59	53	50	49	48	49	50	56	58	60	60	60	60	59	59	59	60	60	60	61
Effort Sharing Decision and Regulation	330	301	291	283	273	265	273	271	269	267	265	263	261	258	256	254	252	251	251	250	250	249
Transport	125	112	111	103	101	104	103	102	100	102	102	102	101	101	101	100	100	100	100	100	100	100
Buildings	97	96	87	87	86	73	82	83	84	82	82	82	81	81	80	79	79	78	78	78	77	77
Agriculture	32	30	30	31	30	29	29	30	30	30	30	31	31	31	31	31	31	31	31	31	31	31
Waste	22	20	20	20	19	18	18	18	18	17	16	15	15	14	14	14	13	13	13	12	12	12
Industry and other	55	44	44	42	39	41	41	38	38	37	35	33	33	32	31	31	30	30	30	30	29	29
AEA under Effort Sharing Decision and Regulation					308	306	304	302	298	296	293	291	*262*	*258*	*254*	*250*	*245*	*241*	*237*	*233*	*228*	*224*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Latvia	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**11.5**	**12.4**	**11.6**	**11.4**	**11.3**	**11.3**	**11.3**	**11.3**	**11.3**	**11.5**	**11.5**	**11.6**	**11.6**	**11.6**	**11.7**	**11.8**	**11.8**	**11.9**	**12.0**	**12.0**	**12.1**	**12.2**
Emissions Trading System (stationary installations)	2.9	3.3	2.9	2.8	2.6	2.4	2.3	2.2	2.0	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5
Energy Industries	1.9	2.1	1.8	1.6	1.6	1.4	1.4	1.4	1.2	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1
Other stationary installations	1.0	1.2	1.1	1.2	1.0	1.0	0.9	0.8	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.2	1.2	1.2	1.3	1.3	1.4	1.4
Effort Sharing Decision and Regulation	8.6	9.1	8.6	8.6	8.8	9.0	9.0	9.1	9.2	9.1	9.2	9.2	9.3	9.3	9.4	9.4	9.5	9.5	9.5	9.6	9.6	9.7
Transport	3.1	3.4	3.0	2.9	3.0	3.1	3.2	3.2	3.3	3.1	3.1	3.0	3.1	3.1	3.1	3.2	3.2	3.2	3.2	3.2	3.2	3.3
Buildings	1.5	1.6	1.5	1.4	1.4	1.4	1.4	1.4	1.5	1.3	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2	1.2	1.2	1.2	1.2
Agriculture	2.3	2.4	2.4	2.5	2.6	2.7	2.7	2.6	2.6	3.0	3.1	3.1	3.1	3.2	3.2	3.3	3.3	3.3	3.3	3.4	3.4	3.4
Waste	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.6	0.7	0.7	0.7	0.7	0.7
Industry and other	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2
AEA under Effort Sharing Decision and Regulation					9.3	9.4	9.4	9.5	9.7	9.8	9.9	10.0	*10.7*	*8.9*	*8.8*	*8.7*	*8.6*	*8.5*	*8.3*	*8.2*	*8.1*	*8.0*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Lithuania	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**22.8**	**20.7**	**21.3**	**21.2**	**19.9**	**19.9**	**20.2**	**20.1**	**20.5**	**20.9**	**21.1**	**21.3**	**21.3**	**21.4**	**21.2**	**21.3**	**21.4**	**21.6**	**21.7**	**21.8**	**22.0**	**22.1**
Emissions Trading System (stationary installations)	11.5	9.3	8.8	8.6	7.5	6.9	6.8	6.2	6.3	7.6	7.8	7.9	8.0	8.1	7.8	7.9	7.9	8.0	8.1	8.2	8.2	8.3
Energy Industries	5.9	5.6	4.3	4.2	3.7	3.1	3.0	2.7	2.5	3.3	3.3	3.4	3.4	3.5	3.2	3.3	3.3	3.4	3.5	3.5	3.6	3.7
Other stationary installations	5.6	3.7	4.5	4.3	3.7	3.8	3.8	3.5	3.8	4.3	4.4	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.7
Effort Sharing Decision and Regulation	11.3	11.4	12.5	12.7	12.4	12.9	13.3	13.9	14.2	13.5	13.6	13.6	13.5	13.5	13.6	13.6	13.7	13.7	13.8	13.8	13.9	14.0
Transport	4.2	4.3	4.4	4.4	4.4	4.8	5.1	5.5	5.8	5.4	5.5	5.6	5.6	5.7	5.8	5.8	5.9	6.0	6.0	6.1	6.2	6.3
Buildings	1.4	1.6	1.6	1.5	1.5	1.4	1.3	1.4	1.5	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Agriculture	4.2	4.2	4.3	4.4	4.3	4.5	4.6	4.4	4.4	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.1	5.1	5.1	5.1
Waste	1.5	1.3	1.2	1.2	1.2	1.1	1.0	1.0	1.0	0.8	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4
Industry and other	0.0	0.0	1.0	1.2	1.1	1.1	1.3	1.6	1.5	1.2	1.2	1.1	1.0	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9
AEA under Effort Sharing Decision and Regulation					12.9	13.3	13.7	14.0	14.1	14.5	14.9	15.2	*15.8*	*13.5*	*13.3*	*13.1*	*12.9*	*12.8*	*12.6*	*12.4*	*12.2*	*12.1*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Luxembourg	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**13.0**	**12.2**	**12.1**	**11.8**	**11.2**	**10.8**	**10.3**	**10.0**	**10.2**	**9.8**	**9.8**	**9.8**	**9.8**	**9.8**	**9.7**	**9.7**	**9.7**	**9.6**	**9.6**	**9.6**	**9.5**	**9.5**
Emissions Trading System (stationary installations)	2.9	2.5	2.3	2.3	1.8	1.9	1.7	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Energy Industries	0.8	0.8	0.6	0.7	0.4	0.4	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other stationary installations	2.1	1.8	1.7	1.6	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Effort Sharing Decision and Regulation	10.1	9.6	9.7	9.5	9.4	8.9	8.6	8.5	8.7	8.4	8.4	8.4	8.4	8.4	8.3	8.3	8.3	8.3	8.2	8.2	8.2	8.1
Transport	7.1	6.5	6.8	6.5	6.4	6.1	5.6	5.5	5.7	5.6	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
Buildings	1.7	1.7	1.4	1.5	1.6	1.4	1.6	1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.2	1.2
Agriculture	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Waste	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Industry and other	0.5	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
AEA under Effort Sharing Decision and Regulation					9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.1	*8.2*	*7.9*	*7.7*	*7.5*	*7.2*	*7.0*	*6.8*	*6.5*	*6.3*	*6.1*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Malta	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**3.0**	**3.0**	**3.0**	**3.2**	**2.9**	**2.9**	**2.2**	**1.9**	**2.2**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.6**	**1.7**	**1.7**	**1.7**	**1.7**
Emissions Trading System (stationary installations)	2.0	1.9	1.9	2.1	1.7	1.7	0.9	0.6	0.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Energy Industries	1.0	1.1	1.1	1.2	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4	1.4
Other stationary installations	0.5	0.6	0.6	0.6	0.6	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Effort Sharing Decision and Regulation	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4
Transport	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Buildings	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Agriculture	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Waste					1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	2.1	1.2	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9
Industry and other	55	44	44	42	39	41	41	38	38	37	35	33	33	32	31	31	30	30	30	30	29	29
AEA under Effort Sharing Decision and Regulation					308	306	304	302	298	296	293	291	*262*	*258*	*254*	*250*	*245*	*241*	*237*	*233*	*228*	*224*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Netherlands	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**214.4**	**213.4**	**199.3**	**194.5**	**194.5**	**186.5**	**194.8**	**195.2**	**192.5**	**178.9**	**174.0**	**172.1**	**172.5**	**175.8**	**176.3**	**175.9**	**175.5**	**176.4**	**175.4**	**174.2**	**173.3**	**171.1**
Emissions Trading System (stationary installations)	91.5	86.4	81.6	77.9	86.9	89.0	94.1	93.9	91.4	82.0	78.1	77.6	78.9	80.2	81.5	82.9	84.2	83.9	83.6	83.3	83.0	82.7
Energy Industries	61.2	59.2	55.1	52.0	59.3	62.7	67.7	66.1	62.0	54.9	51.1	50.7	52.0	53.2	54.5	55.7	57.0	56.9	56.7	56.5	56.4	56.2
Other stationary installations	30.3	27.1	26.5	26.0	27.6	26.3	26.4	27.8	29.3	27.1	27.0	26.9	26.9	27.0	27.0	27.1	27.2	27.0	26.9	26.7	26.6	26.5
Effort Sharing Decision and Regulation	122.8	127.0	117.7	116.5	108.3	97.9	101.1	101.3	101.1	96.9	96.0	94.6	93.6	95.6	94.8	93.0	91.3	92.6	91.8	90.9	90.3	88.5
Transport	35.5	34.8	34.7	33.1	32.6	30.1	30.2	30.2	31.2	30.9	30.7	30.4	30.5	30.5	30.6	30.6	30.7	30.7	30.7	30.8	30.8	30.8
Buildings	38.3	45.5	37.1	39.0	40.2	32.0	34.6	35.2	34.2	33.2	32.8	32.3	31.6	31.2	30.9	30.3	29.9	29.6	29.2	28.9	28.6	28.3
Agriculture	18.4	18.1	17.8	17.6	18.2	18.3	18.7	19.0	18.7	18.7	18.7	18.8	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
Waste	6.4	4.6	4.3	4.1	3.9	3.6	3.4	3.2	3.1	2.8	2.7	2.5	2.5	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.6	1.6
Industry and other	24.2	24.0	23.8	22.8	13.3	13.8	14.1	13.7	13.9	11.2	11.1	10.6	10.3	12.8	12.4	11.2	10.0	11.7	11.3	10.8	10.5	9.1
AEA under Effort Sharing Decision and Regulation					122.9	120.7	118.4	116.1	114.1	111.8	109.6	107.4	*97.1*	*95.4*	*93.7*	*92.0*	*90.3*	*88.6*	*86.9*	*85.2*	*83.5*	*81.8*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Poland	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**398**	**406**	**405**	**398**	**395**	**382**	**385**	**396**	**407**	**389**	**388**	**386**	**384**	**381**	**379**	**376**	**374**	**371**	**368**	**365**	**362**	**359**
Emissions Trading System (stationary installations)	221	209	212	205	206	197	199	198	202	200	198	196	194	193	191	189	187	184	181	179	176	173
Energy Industries	178	165	166	159	161	153	157	155	161	155	154	152	150	148	145	143	141	138	135	132	129	126
Other stationary installations	43	43	46	46	45	44	42	43	41	45	44	44	44	45	45	46	46	46	46	46	46	46
Effort Sharing Decision and Regulation	176	197	193	193	186	182	187	199	205	190	190	190	189	188	188	187	186	186	186	186	186	186
Transport	35	47	48	46	42	43	46	53	58	49	49	50	50	50	51	51	51	52	53	53	54	55
Buildings	59	67	61	62	59	55	55	59	61	55	54	53	52	51	51	50	49	48	47	47	46	45
Agriculture	30	30	30	30	30	30	30	30	31	32	33	33	33	34	34	34	34	34	34	35	35	35
Waste	13	13	12	12	12	11	11	11	11	10	10	10	10	10	10	10	10	10	10	10	10	10
Industry and other	40	40	43	42	43	43	45	46	44	44	44	43	43	43	43	42	42	42	42	42	41	41
AEA under Effort Sharing Decision and Regulation					194	195	196	197	200	202	203	205	*201*	*190*	*187*	*185*	*182*	*179*	*176*	*173*	*170*	*167*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Portugal	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**87.0**	**70.1**	**69.0**	**67.1**	**65.3**	**65.2**	**69.6**	**67.8**	**72.2**	**66.0**	**64.5**	**63.0**	**62.2**	**61.3**	**60.5**	**59.6**	**58.7**	**58.2**	**57.6**	**57.0**	**56.4**	**55.8**
Emissions Trading System (stationary installations)	38.4	25.0	25.7	25.9	24.7	24.2	27.9	25.7	30.1	24.1	23.1	22.0	21.6	21.2	20.7	20.3	19.9	19.6	19.3	19.0	18.7	18.5
Energy Industries	25.6	14.1	15.7	16.8	15.3	14.5	18.0	16.6	20.5	15.3	14.1	13.0	12.6	12.1	11.7	11.3	10.8	10.5	10.1	9.7	9.4	9.0
Other stationary installations	12.8	10.9	9.9	9.1	9.4	9.7	9.9	9.1	9.5	8.8	8.9	9.0	9.0	9.0	9.0	9.1	9.1	9.1	9.2	9.3	9.4	9.4
Effort Sharing Decision and Regulation	48.2	44.7	43.0	40.9	38.6	38.8	40.6	41.6	41.7	41.4	41.0	40.5	40.1	39.6	39.2	38.7	38.3	38.0	37.7	37.4	37.1	36.8
Transport	19.6	18.6	17.3	15.9	15.0	15.2	15.8	16.3	16.6	14.8	14.7	14.5	14.5	14.4	14.4	14.4	14.3	14.3	14.2	14.2	14.2	14.1
Buildings	7.4	5.4	4.8	4.6	4.4	4.3	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.6	4.7	4.7
Agriculture	6.8	6.7	6.6	6.7	6.3	6.4	6.6	6.8	6.9	8.3	8.2	8.1	8.1	8.1	8.0	8.0	7.9	7.8	7.6	7.5	7.4	7.2
Waste	7.7	7.0	7.2	7.0	6.5	6.3	6.4	6.5	6.3	8.6	8.5	8.3	8.1	8.0	7.9	7.7	7.6	7.5	7.3	7.2	7.1	7.0
Industry and other	6.7	6.9	7.0	6.7	6.5	6.6	7.3	7.6	7.4	5.2	5.1	5.1	4.9	4.6	4.4	4.1	3.9	3.9	3.8	3.8	3.8	3.7
AEA under Effort Sharing Decision and Regulation					49.3	49.6	49.9	50.1	47.9	48.3	48.7	49.1	*43.0*	*41.3*	*41.2*	*41.0*	*40.9*	*40.8*	*40.7*	*40.6*	*40.5*	*40.3*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Romania	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**147.8**	**122.2**	**127.9**	**124.8**	**115.3**	**115.4**	**116.2**	**112.5**	**114.9**	**117.4**	**117.8**	**118.2**	**118.4**	**118.4**	**118.6**	**118.8**	**119.0**	**120.5**	**122.0**	**123.4**	**124.9**	**126.3**
Emissions Trading System (stationary installations)	72.2	54.5	58.3	54.6	42.4	42.6	42.4	39.8	40.6	41.8	41.7	41.7	41.2	40.7	40.2	39.6	39.1	39.9	40.7	41.5	42.2	42.9
Energy Industries	43.2	35.3	37.7	35.1	26.7	26.6	26.0	23.7	24.4	25.6	25.2	24.9	24.1	23.3	22.4	21.6	20.8	21.3	21.8	22.3	22.9	23.4
Other stationary installations	29.1	19.2	20.6	19.5	15.7	16.0	16.4	16.1	16.2	16.2	16.5	16.8	17.1	17.4	17.7	18.0	18.4	18.6	18.9	19.1	19.4	19.6
Effort Sharing Decision and Regulation	75.4	67.3	69.3	70.1	72.7	72.5	74.6	73.1	74.2	75.6	76.0	76.5	77.2	77.7	78.4	79.2	79.9	80.6	81.3	82.0	82.7	83.4
Transport	12.4	13.9	14.1	15.1	14.9	15.4	16.0	16.9	17.5	16.9	17.3	17.8	18.1	18.4	18.7	19.0	19.3	19.5	19.7	19.9	20.1	20.3
Buildings	12.1	10.7	10.9	11.5	10.9	10.4	11.0	10.9	10.4	11.2	11.3	11.5	11.6	11.8	12.0	12.2	12.3	12.5	12.7	12.9	13.0	13.2
Agriculture	20.5	17.5	17.8	17.6	18.2	18.1	18.8	18.4	18.3	19.0	19.1	19.2	19.5	19.8	20.0	20.3	20.6	20.8	21.1	21.4	21.7	21.9
Waste	5.7	5.6	5.0	5.6	5.9	5.8	5.9	5.9	5.8	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.6	4.5	4.4	4.4	4.3
Industry and other	24.7	19.7	21.5	20.2	22.8	22.7	22.8	21.0	22.1	23.0	22.9	22.8	22.9	22.9	23.0	23.0	23.0	23.2	23.3	23.4	23.5	23.7
AEA under Effort Sharing Decision and Regulation					75.6	77.5	79.3	81.1	84.1	86.0	87.9	89.8	*85.2*	*74.2*	*74.2*	*74.2*	*74.1*	*74.1*	*74.1*	*74.0*	*74.0*	*74.0*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Slovakia	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**51.1**	**46.3**	**45.3**	**43.0**	**42.6**	**40.5**	**40.9**	**41.0**	**41.8**	**40.4**	**40.4**	**40.3**	**40.3**	**40.3**	**40.3**	**40.4**	**40.4**	**40.4**	**40.5**	**40.5**	**40.6**	**40.7**
Emissions Trading System (stationary installations)	29.0	23.3	23.3	21.9	21.8	20.9	21.2	21.3	22.1	20.4	20.3	20.2	20.2	20.2	20.2	20.3	20.3	20.4	20.4	20.4	20.5	20.6
Energy Industries	10.9	8.1	8.0	7.6	7.4	6.4	6.9	6.8	6.6	5.9	5.8	5.6	5.6	5.6	5.6	5.6	5.6	5.5	5.5	5.5	5.4	5.4
Other stationary installations	18.1	15.2	15.3	14.3	14.4	14.5	14.3	14.5	15.4	14.4	14.5	14.5	14.6	14.6	14.7	14.7	14.8	14.8	14.9	15.0	15.1	15.2
Effort Sharing Decision and Regulation	22.1	23.0	21.9	21.1	21.1	19.8	20.1	19.8	19.7	20.0	20.1	20.2	20.1	20.1	20.1	20.1	20.0	20.1	20.1	20.1	20.1	20.2
Transport	7.5	7.3	6.9	6.8	6.8	6.6	6.8	6.5	7.2	6.7	6.8	6.8	6.9	7.0	7.1	7.2	7.3	7.4	7.5	7.6	7.7	7.8
Buildings	6.8	6.7	5.1	5.6	5.9	4.8	4.9	4.8	4.8	4.6	4.6	4.6	4.6	4.6	4.5	4.5	4.5	4.5	4.4	4.4	4.4	4.4
Agriculture	2.6	2.3	2.4	2.5	2.6	2.7	2.6	2.7	2.5	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7
Waste	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Industry and other	3.9	5.1	6.0	4.6	4.3	4.1	4.2	4.2	3.7	4.2	4.2	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.9
AEA under Effort Sharing Decision and Regulation					24.0	24.4	24.7	25.1	25.0	25.3	25.6	25.9	*22.0*	*19.9*	*19.9*	*20.0*	*20.0*	*20.1*	*20.1*	*20.1*	*20.2*	*20.2*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Slovenia	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**20.5**	**19.7**	**19.7**	**19.1**	**18.4**	**16.7**	**16.9**	**17.7**	**17.6**	**17.9**	**17.9**	**17.9**	**17.7**	**17.6**	**17.4**	**17.3**	**17.2**	**17.0**	**16.8**	**16.6**	**16.5**	**16.3**
Emissions Trading System (stationary installations)	8.8	8.0	7.9	7.6	7.4	6.1	6.1	6.5	6.6	7.1	7.2	7.2	7.1	7.0	6.9	6.8	6.7	6.6	6.5	6.4	6.3	6.2
Energy Industries	6.3	6.2	6.2	5.9	5.6	4.4	4.4	4.8	4.8	5.3	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.4	4.3	4.2	4.0	3.9
Other stationary installations	2.5	1.8	1.7	1.7	1.7	1.8	1.7	1.7	1.8	1.9	1.9	2.0	2.0	2.0	2.1	2.1	2.2	2.2	2.2	2.3	2.3	2.3
Effort Sharing Decision and Regulation	11.8	11.7	11.7	11.5	10.9	10.5	10.7	11.2	11.0	10.7	10.7	10.7	10.7	10.6	10.5	10.5	10.4	10.4	10.3	10.2	10.1	10.1
Transport	4.4	5.3	5.7	5.8	5.4	5.3	5.3	5.7	5.6	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.3	5.3	5.3	5.2
Buildings	2.7	2.3	2.0	1.8	1.7	1.4	1.5	1.6	1.6	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2	1.1	1.1	1.1	1.1
Agriculture	1.8	1.7	1.7	1.7	1.7	1.7	1.7	1.8	1.8	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Waste	0.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Industry and other	2.1	1.8	1.7	1.7	1.6	1.5	1.5	1.6	1.5	1.6	1.6	1.6	1.6	1.6	1.6	1.5	1.5	1.5	1.5	1.5	1.5	1.5
AEA under Effort Sharing Decision and Regulation					12.3	12.4	12.4	12.4	12.2	12.2	12.3	12.3	*11.0*	*10.8*	*10.7*	*10.6*	*10.5*	*10.4*	*10.3*	*10.2*	*10.1*	*10.1*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Spain	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**439**	**356**	**355**	**349**	**322**	**324**	**336**	**325**	**339**	**333**	**333**	**333**	**334**	**335**	**337**	**323**	**324**	**326**	**327**	**329**	**330**	**330**
Emissions Trading System (stationary installations)	200	130	141	144	123	125	137	124	136	139	140	141	142	143	145	129	130	130	130	130	129	129
Energy Industries	120.2	69.5	83.6	88.7	70.6	74.1	86.3	72.6	83.7	84.8	85.2	85.7	86.1	86.6	87.2	70.6	70.7	70.9	71.0	71.2	71.4	71.6
Other stationary installations	80.0	60.6	57.3	54.9	52.2	50.7	51.0	50.9	52.6	54.0	54.9	55.3	55.8	56.4	57.4	58.5	59.4	59.5	59.3	58.7	58.0	57.2
Effort Sharing Decision and Regulation	235	222	211	202	200	200	196	198	200	191	190	189	189	189	190	191	191	192	194	195	197	198
Transport	98	88	83	77	79	79	81	83	86	83	84	84	85	85	85	85	86	86	88	89	91	92
Buildings	43	46	44	43	40	39	40	42	41	40	40	40	40	40	40	41	41	42	42	42	42	43
Agriculture	37	34	33	32	33	34	35	34	35	30	29	28	28	28	28	28	28	28	28	27	27	27
Waste	13	15	15	15	15	14	14	14	14	10	9	8	8	8	8	8	8	7	7	7	7	7
Industry and other	44	40	36	36	33	34	26	25	23	28	28	28	28	28	29	29	29	29	29	29	29	29
AEA under Effort Sharing Decision and Regulation					228	226	224	222	218	216	214	212	*193*	*191*	*189*	*187*	*185*	*183*	*181*	*179*	*177*	*175*

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
Sweden	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**66.7**	**64.4**	**60.3**	**57.0**	**55.4**	**53.9**	**53.8**	**52.9**	**52.2**	**51.4**	**50.7**	**49.9**	**49.5**	**49.0**	**48.6**	**48.1**	**47.7**	**47.3**	**46.9**	**46.4**	**46.0**	**45.6**
Emissions Trading System (stationary installations)	23.4	24.6	21.5	19.7	20.1	19.3	19.2	19.7	18.9	19.5	19.6	19.7	19.7	19.7	19.7	19.7	19.7	19.6	19.5	19.4	19.3	19.2
Energy Industries	10.3	12.9	10.6	9.9	9.9	9.2	9.2	9.3	9.3	9.6	9.7	9.8	9.8	9.8	9.9	9.9	9.9	9.8	9.7	9.7	9.6	9.5
Other stationary installations	13.2	11.7	10.9	9.8	10.3	10.1	10.0	10.4	9.6	10.0	10.0	9.9	9.9	9.9	9.8	9.8	9.8	9.8	9.7	9.7	9.7	9.6
Effort Sharing Decision and Regulation	42.6	39.4	38.3	36.8	35.3	34.5	33.9	32.6	32.7	31.4	30.5	29.7	29.2	28.8	28.4	28.0	27.5	27.2	26.9	26.6	26.3	26.0
Transport	20.4	19.9	19.3	18.1	17.9	17.7	17.3	16.3	16.3	16.0	15.5	14.9	14.7	14.5	14.3	14.0	13.8	13.7	13.5	13.4	13.2	13.1
Buildings	5.9	4.4	4.1	3.8	3.7	3.6	3.5	3.4	3.5	3.0	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5
Agriculture	7.0	6.8	7.1	6.7	7.0	7.1	6.8	6.9	6.9	6.6	6.5	6.4	6.3	6.3	6.2	6.2	6.1	6.1	6.0	6.0	5.9	5.9
Waste	2.7	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.7	0.7
Industry and other	6.6	6.3	5.9	6.4	5.0	4.7	4.8	4.7	4.8	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	4.0	3.9	3.8
AEA under Effort Sharing Decision and Regulation					41.7	41.0	40.4	39.8	37.8	37.2	36.7	36.1	*31.3*	*30.7*	*30.1*	*29.6*	*29.0*	*28.4*	*27.8*	*27.2*	*26.7*	*26.1*

Table A1.1 Projected total GHG, ETS and Effort Sharing emissions by sector, 2005-2030 (cont.)

GHG emissions ($MtCO_2e$)	Historic emissions including proxy 2017									WEM												
United Kingdom	**2005**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total GHG emissions	**693**	**612**	**564**	**581**	**566**	**526**	**508**	**483**	**470**	**461**	**452**	**436**	**433**	**417**	**413**	**414**	**405**	**401**	**397**	**399**	**403**	**403**
Emissions Trading System (stationary installations)	275	239	221	231	225	198	176	147	137	142	136	125	123	110	109	110	107	103	101	104	107	110
Energy Industries	209	184	171	180	172	147	127	102	94	96	89	79	77	65	64	66	63	59	58	61	64	69
Other stationary installations	66	54	50	51	53	51	49	45	43	46	46	46	45	45	45	44	44	43	43	42	42	42
Effort Sharing Decision and Regulation	416	371	341	348	339	324	326	334	332	317	314	309	309	305	303	302	296	296	294	293	295	291
Transport	130	119	117	116	115	116	118	122	122	114	113	112	111	111	110	109	108	108	107	107	106	106
Buildings	114	114	93	102	103	87	90	95	91	97	97	95	97	96	95	97	93	95	95	95	99	97
Agriculture	44	41	41	41	41	42	41	42	42	43	43	42	42	42	41	41	41	41	41	41	41	41
Waste	49	30	28	26	22	20	19	20	20	15	15	14	14	14	13	13	13	13	13	13	13	13
Industry and other	78	67	62	62	57	59	59	56	57	48	47	46	45	44	43	41	40	39	38	37	35	34
AEA under Effort Sharing Decision and Regulation					359	354	350	345	360	357	354	351	*318*	*312*	*306*	*300*	*294*	*287*	*281*	*275*	*269*	*263*

Notes: Transport emissions are related to CRF category 1.A.3 without domestic aviation. Buildings emissions are related to CRF category 1.A.4 and 1.A.5, agriculture to CRF category 3 and waste to CRF category 5. The subsector 'industry and other' includes Effort Sharing emissions covered under CRF categories 1.A.1, 1.A.2, 1.B and 2.

AEAs for the years 2021-2030 are best available estimates. Final AEAs for this period will be determined only in 2020, following a comprehensive review of Member States' GHG inventories.

Sources: EC, 2013a, 2013b, 2017c; EEA, 2018c; EU, 2009c.

A1.4 Tracking progress towards targets under the Effort Sharing Decision

The progress of Member States towards their targets under the ESD is assessed by comparing Effort Sharing GHG emission levels with the relevant annual targets under the ESD. The assessment does not consider the possible use of flexibility options as permitted under the ESD and is therefore not an assessment of compliance under the ESD.

The assessment of current progress towards 2016 Effort Sharing targets is based on a comparison between Effort Sharing GHG emissions and Effort Sharing emission targets (AEAs) for 2016:

- Member States with historical emissions below their annual Effort Sharing emission targets are considered to be currently on track towards their targets under the ESD.
- Member States with historical emissions higher than their Effort Sharing emission targets are considered to be currently not on track towards their targets under the ESD.

The assessment of projected progress towards 2020 Effort Sharing targets is based on a comparison between projected domestic Effort Sharing GHG emissions in the WEM scenario in 2020 and Effort Sharing targets (AEAs) for 2020:

- Member States with WEM projections lower than their 2020 target are projected to be on track towards their targets.
- Member States with WEM projections higher than their 2020 target are projected to be not on track towards their targets.

All the data used for this assessment (Effort Sharing GHG emissions and absolute annual Effort Sharing emission targets (AEAs)) are consistent with the scope of the EU ETS for the period 2013-2020.

The assessment of projected progress towards provisional 2030 ESR targets is based on a comparison between projected domestic Effort Sharing GHG emissions in the WAM scenario in 2030 and provisional ESR targets for 2030.

A1.5 Use of flexibilities under the Effort Sharing Decision

The assessment of progress towards the Effort Sharing targets does not consider the possible use of flexibility options as permitted under the ESD, which can be used by Member States for compliance under the ESD ([32]).

If flexibility options are considered, only Malta will need to buy additional AEAs from other Member States or use international project credits to comply in the years 2013 to 2016.

Considering WEM emissions, for all Member States other than Ireland and Malta the use of the flexibility to carry over AEAs that have not been used in previous years will be enough for compliance in the period 2013-2020.

([32]) A Member State can carry forward (i.e. 'borrow') an emission allocation of up to 5 % from the following year, during the period 2013-2019, to guarantee compliance. A Member State can also carry over from a past year any surplus emission allocations. It is also possible to use other flexibilities under the ESD, such as buying AEAs from other Member States or using international project credits under the Kyoto Protocol up to a certain limit.

Table A1.2 Current progress towards 2016 Effort Sharing targets

Member State	2005	2016 progress under the ESD				2017 progress under the ESD (approximated)			
	Base year emissions	ESD target	ESD emissions	Absolute gap	Relative gap	ESD target	ESD emissions	Absolute gap	Relative gap
	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	% (share of 2005 base year)	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	% (share of 2005 base year)
Austria	56.8	51.0	50.6	0.4	0.6	49.5	51.3	-1.8	-3.1
Belgium	80.3	73.8	74.1	-0.3	-0.3	72.5	72.4	0.1	0.1
Bulgaria	22.1	27.7	25.6	2.1	9.7	25.9	26.1	-0.2	-0.9
Croatia	17.4	20.2	16.0	4.2	24.0	18.7	16.1	2.6	15.1
Cyprus	4.2	5.9	4.1	1.8	43.4	4.2	4.3	-0.1	-2.9
Czechia	61.7	64.7	62.8	1.9	3.0	65.2	64.0	1.2	2.0
Denmark	40.1	34.1	33.1	1.0	2.5	34.8	32.6	2.2	5.4
Estonia	5.4	6.4	6.2	0.2	2.8	5.9	6.0	0.0	-0.9
Finland	33.9	30.3	31.4	-1.0	-3.1	30.2	30.8	-0.6	-1.7
France	398.2	379.4	351.9	27.5	6.9	358.2	354.7	3.5	0.9
Germany	477.8	452.4	454.2	-1.7	-0.4	432.3	464.7	-32.4	-6.8
Greece	62.6	59.9	44.9	15.0	24.0	59.1	44.3	14.9	23.8
Hungary	48.0	53.8	42.1	11.7	24.3	50.1	43.8	6.3	13.1
Ireland	47.1	43.5	43.8	-0.3	-0.6	40.9	44.0	-3.1	-6.7
Italy	334.5	302.3	270.7	31.6	9.4	298.3	268.9	29.3	8.8
Latvia	8.5	9.5	9.1	0.4	5.0	9.7	9.2	0.5	5.9
Lithuania	13.3	14.0	13.9	0.1	0.7	14.1	14.2	-0.1	-0.9
Luxembourg	10.1	8.9	8.5	0.417	4.11	8.7	8.7	0.1	0.7
Malta	1.1	1.2	1.3	-0.2	-14.9	1.2	1.4	-0.3	-23.1
Netherlands	127.8	116.1	101.3	14.8	11.6	114.1	101.1	13.0	10.1
Poland	180.0	197.4	198.7	-1.3	-0.7	200.0	204.8	-4.8	-2.7
Portugal	48.6	50.1	41.6	8.6	17.6	47.9	41.7	6.2	12.8
Romania	75.5	81.1	73.1	8.0	10.6	84.1	74.2	9.9	13.1
Slovakia	23.0	25.1	19.8	5.3	23.3	25.0	19.7	5.3	23.1
Slovenia	11.8	12.4	11.2	1.2	9.9	12.2	11.0	1.2	9.9
Spain	236.0	221.8	198.5	23.3	9.9	218.3	199.9	18.4	7.8
Sweden	43.5	39.8	32.6	7.2	16.5	37.8	32.7	5.1	11.7
United Kingdom	417.8	345.2	333.9	11.3	2.7	360.4	331.9	28.5	6.8
EU	**2 887**	**2 728**	**2 555**	**173**	**6.0**	**2 679**	**2 574**	**105**	**3.6**

Notes: Distances to targets (i.e. surpluses of emission allocations compared with existing emissions) are calculated as 'Effort Sharing target' - 'Effort Sharing GHG emissions'. A positive value indicates a surplus of AEAs (emissions lower than the target); a negative value indicates a shortfall of AEAs (emissions higher than the target).

See Section A1.2 in Annex 1 regarding the calculation of 2005 base year emissions by the EEA.

Sources: EEA, 2018h, 2018b, 2018i, 2018f, 2018j; EU, 2017a, 2013a, 2013b, 2009c, based on Member States' submissions.

Table A1.3 Projected progress towards 2020 ESD targets

Member State	2005	2020 ESD target		Projected progress with existing measures by 2020			Projected progress with additional measures by 2020		
	Base year emissions	Relative target to 2020	Absolute target	ESD emissions	Abolute gap	Relative gap	ESD emissions	Abolute gap	Relative gap
	$MtCO_2e$	%	$MtCO_2e$	$MtCO_2e$	$MtCO_2e$	% (share of 2005 base year)	$MtCO_2e$	$MtCO_2e$	% (share of 2005 base year)
Austria	56.8	-16.0	47.8	49.1	-1.4	-2.4	49.1	-1.4	-2.4
Belgium	80.3	-15.0	68.2	71.0	-2.8	-3.5	70.2	-2.0	-2.5
Bulgaria	22.1	20.0	26.5	21.7	4.8	21.7	21.7	4.8	21.7
Croatia	17.4	11.0	19.3	15.2	4.1	23.5	14.3	5.0	28.9
Cyprus	4.2	-5.0	4.0	4.5	-0.5	-12.5	4.4	-0.4	-10.7
Czechia	61.7	9.0	67.2	61.9	5.3	8.5	61.6	5.6	9.0
Denmark	40.1	-20.0	32.1	31.1	0.9	2.3	31.1	0.9	2.3
Estonia	5.4	11.0	6.0	6.0	0.02	0.3	5.7	0.3	6.1
Finland	33.9	-16.0	28.5	28.8	-0.3	-0.7	28.7	-0.1	-0.4
France	398.2	-14.0	342.5	318.2	24.3	6.1	318.2	24.3	6.1
Germany	477.8	-14.0	410.9	426.5	-15.6	-3.3	419.0	-8.1	-1.7
Greece	62.6	-4.0	60.0	48.9	11.1	17.8	48.9	11.1	17.8
Hungary	48.0	10.0	52.8	39.1	13.7	28.6	39.0	13.8	28.7
Ireland	47.1	-20.0	37.7	46.8	-9.2	-19.5	46.5	-8.8	-18.7
Italy	334.5	-13.0	291.0	262.7	28.3	8.5	262.7	28.3	8.5
Latvia	8.5	17.0	10.0	9.2	0.8	9.2	9.1	0.9	10.5
Lithuania	13.3	15.0	15.2	13.6	1.7	12.6	13.0	2.2	16.9
Luxembourg	10.1	-20.0	8.1	8.4	-0.3	-2.6	8.2	-0.1	-0.9
Malta	1.1	5.0	1.2	1.3	-0.1	-11.5	1.3	-0.1	-11.5
Netherlands	127.8	-16.0	107.4	94.6	12.8	10.0	93.2	14.1	11.0
Poland	180.0	14.0	205.2	190.1	15.1	8.4	190.1	15.1	8.4
Portugal	48.6	1.0	49.1	40.5	8.6	17.6	40.5	8.6	17.7
Romania	75.5	19.0	89.8	76.5	13.3	17.6	74.7	15.1	20.0
Slovakia	23.0	13.0	25.9	20.2	5.8	25.2	19.3	6.6	28.7
Slovenia	11.8	4.0	12.3	10.7	1.6	13.3	10.7	1.6	13.3
Spain	236.0	-10.0	212.4	189.1	23.3	9.9	189.1	23.3	9.9
Sweden	43.5	-17.0	36.1	29.7	6.4	14.8	29.7	6.4	14.8
United Kingdom	417.8	-16.0	350.9	309.4	41.5	9.9	301.2	49.8	11.9
EU-28	**2 887.1**	**-9.3**	**2 618.2**	**2 425.0**	**193.2**	**6.7**	**2 401.3**	**216.8**	**7.5**

Notes: Distances to targets are calculated as 'Effort Sharing target' - 'Effort Sharing GHG emissions'. A positive value indicates a surplus of AEAs (emissions lower than the target); a negative value indicates a shortfall of AEAs (emissions lower than the target).

See Section A1.2 in Annex 1 regarding the calculation of 2005 base year emissions by the EEA.

Sources: EEA, 2018c; EU, 2017a, 2013a, 2013b, 2009c, based on Member States' submissions.

A1.6 Annual and cumulative gaps between emissions and Effort Sharing Decision targets

Table A1.4 Annual distance between historical or projected ESD emissions and annual Effort Sharing targets, 2013-2020

Member State	Scenario	Inventory	Inventory	Inventory	Inventory	Proxy	Projections		
		2013	2014	2015	2016	2017	2018	2019	2020
Austria	WEM	2.5	3.9	2.2	0.4	-1.8	-0.5	-1.0	-1.4
	WAM						-0.5	-1.0	-1.4
Belgium	WEM	4.1	6.8	2.6	-0.3	0.1	-0.7	-1.8	-2.8
	WAM						-0.7	-1.8	-2.0
Bulgaria	WEM	4.7	4.3	2.1	2.1	-0.2	3.9	4.4	4.8
	WAM						3.9	4.4	4.8
Croatia	WEM	4.5	5.1	4.4	4.2	2.6	3.7	3.9	4.1
	WAM						4.3	4.7	5.0
Cyprus	WEM	2.0	2.0	1.9	1.8	-0.1	-0.2	-0.3	-0.5
	WAM						-0.1	-0.3	-0.4
Czechia	WEM	1.0	5.6	2.7	1.9	1.2	5.7	5.5	5.3
	WAM						5.9	5.8	5.6
Denmark	WEM	3.1	3.3	2.5	1.0	2.2	2.1	1.5	0.9
	WAM						2.1	1.5	0.9
Estonia	WEM	0.5	0.2	0.2	0.2	-0.05	-0.1	-0.02	0.02
	WAM						0.2	0.3	0.3
Finland	WEM	0.2	1.1	0.9	-1.0	-0.6	0.2	-0.04	-0.3
	WAM						0.3	0.05	-0.1
France	WEM	28.0	35.9	31.4	27.5	3.5	20.8	22.5	24.3
	WAM						20.8	22.5	24.3
Germany	WEM	12.3	29.0	15.1	-1.7	-32.4	-11.1	-13.1	-15.6
	WAM						-4.2	-5.9	-8.1
Greece	WEM	14.8	14.9	14.2	15.0	14.9	11.2	11.1	11.1
	WAM						11.2	11.1	11.1
Hungary	WEM	12.0	13.1	11.2	11.7	6.3	11.0	12.4	13.7
	WAM						11.0	12.5	13.8
Ireland	WEM	4.7	4.1	1.6	-0.3	-3.1	-6.1	-7.7	-9.2
	WAM						-6.0	-7.4	-8.8
Italy	WEM	34.8	40.9	31.0	31.6	29.3	28.4	28.3	28.3
	WAM						28.4	28.3	28.3
Latvia	WEM	0.5	0.3	0.4	0.4	0.5	0.7	0.7	0.8
	WAM						0.7	0.7	0.9
Lithuania	WEM	0.5	0.4	0.4	0.1	-0.1	1.0	1.3	1.7
	WAM						1.4	1.8	2.2
Luxembourg	WEM	0.2	0.5	0.5	0.4	0.1	0.2	-0.03	-0.3
	WAM						0.2	0.0	-0.1
Malta	WEM	-0.1	-0.1	-0.1	-0.2	-0.3	-0.1	-0.1	-0.1
	WAM						-0.1	-0.1	-0.1
Netherlands	WEM	14.7	22.8	17.3	14.8	13.0	14.9	13.6	12.8
	WAM						16.0	14.8	14.1
Poland	WEM	7.5	13.3	9.4	-1.3	-4.8	12.2	13.6	15.1
	WAM						12.2	13.6	15.1
Portugal	WEM	10.7	10.8	9.2	8.6	6.2	6.9	7.7	8.6
	WAM						6.9	7.7	8.6
Romania	WEM	2.9	4.9	4.7	8.0	9.9	10.4	11.8	13.3
	WAM						11.5	13.3	15.1
Slovakia	WEM	2.9	4.6	4.7	5.3	5.3	5.3	5.6	5.8
	WAM						5.9	6.2	6.6
Slovenia	WEM	1.4	1.9	1.7	1.2	1.2	1.5	1.5	1.6
	WAM						1.5	1.5	1.6
Spain	WEM	27.3	25.9	27.6	23.3	18.4	25.1	23.9	23.3
	WAM						25.1	23.9	23.3

Table A1.4 Annual distance between historical or projected ESD emissions and annual Effort Sharing targets, 2013-2020 (cont.)

Member State	Scenario	Inventory	Inventory	Inventory	Inventory	Proxy	Projections		
		2013	2014	2015	2016	2017	2018	2019	2020
Sweden	WEM	6.4	6.5	6.5	7.2	5.1	5.9	6.1	6.4
	WAM						5.9	6.1	6.4
United Kingdom	WEM	19.3	29.8	23.7	11.3	28.5	40.6	39.7	41.5
	WAM						45.0	46.1	49.8
EU	**WEM**	**223**	**292**	**230**	**173**	**105**	**193**	**191**	**193**
	WAM						**209**	**210**	**217**

Notes: A positive value (green shading) indicates a surplus of AEAs (emissions lower than the target). A negative value (red shading) indicates a shortfall of AEAs (emissions lower than the target). The darker the colour, the larger the gap (red) or the surplus (green). The shading of the colours always refers to the timeline of each individual country. The lowest negative value is the darkest red, the median value and zero is white, and the highest value is the darkest green.

The calculations do not consider any possible use of the flexibilities provided under the ESD (such as trading Effort Sharing emission allocations or buying international certificates). For this calculation, recalculated AEAs for the years 2017-2020 were considered (EU, 2017a).

The data are based on Effort Sharing emissions for 2013, 2014 2015 and 2016 as determined after the reviews of Effort Sharing emissions, approximated data for 2017 and projections for the period 2017-2020. No approximated GHG data were available for Bulgaria, Cyprus and Romania. For these, the EEA GHG emissions proxy was used instead. For the aggregation of projections in the WAM scenario at EU level, WAM projections of Member States which did not report a WAM scenario have been gap-filled using the WEM scenario projections.

Sources: EEA, 2018h, 2018b, 2018c, 2018i, 2018j; EU, 2017a, 2013a, 2013b, based on Member States' submissions.

Table A1.5 Cumulative gaps between historical and projected ESD emissions and annual Effort Sharing targets, 2013-2020

Member State	Scenario	Inventory	Inventory	Inventory	Inventory	Proxy	Projections		
		2013	2014	2015	2016	2017	2018	2019	2020
Austria	WEM	2.5	6.4	8.7	9.0	7.2	6.7	5.8	4.4
	WAM						6.7	5.8	4.4
Belgium	WEM	4.1	10.9	13.5	13.2	13.3	12.7	10.9	8.1
	WAM						12.7	10.9	8.9
Bulgaria	WEM	4.7	9.0	11.1	13.3	13.1	17.0	21.3	26.1
	WAM						17.0	21.3	26.1
Croatia	WEM	4.5	9.6	14.1	18.2	20.9	24.6	28.5	32.6
	WAM						25.2	29.8	34.9
Cyprus	WEM	2.0	4.0	5.8	7.7	7.5	7.4	7.0	6.5
	WAM						7.4	7.1	6.7
Czechia	WEM	1.0	6.6	9.3	11.2	12.4	18.1	23.5	28.8
	WAM						18.3	24.1	29.6
Denmark	WEM	3.1	6.4	8.9	9.9	12.1	14.1	15.6	16.6
	WAM						14.1	15.6	16.6
Estonia	WEM	0.5	0.8	1.0	1.1	1.1	1.0	1.0	1.0
	WAM						1.3	1.6	2.0
Finland	WEM	0.2	1.3	2.2	1.2	0.6	0.8	0.7	0.5
	WAM						0.9	0.9	0.8
France	WEM	28.0	63.9	95.3	122.8	126.3	147.1	169.6	193.9
	WAM						147.1	169.6	193.9
Germany	WEM	12.3	41.4	56.4	54.7	22.3	11.2	-1.9	-17.5
	WAM						18.1	12.2	4.1
Greece	WEM	14.8	29.6	43.8	58.8	73.7	84.9	96.0	107.1
	WAM						84.9	96.0	107.1
Hungary	WEM	12.0	25.1	36.3	47.9	54.2	65.2	77.6	91.3
	WAM						65.2	77.7	91.5
Ireland	WEM	4.7	8.8	10.4	10.1	6.9	0.8	-6.8	-16.0
	WAM						0.9	-6.5	-15.3
Italy	WEM	34.8	75.7	106.7	138.3	167.6	195.9	224.3	252.6
	WAM						195.9	224.3	252.6

Table A1.5 Cumulative gaps between historical and projected ESD emissions and annual Effort Sharing targets, 2013-2020

Member State	Scenario	Inventory 2013	Inventory 2014	Inventory 2015	Inventory 2016	Proxy 2017	Projections 2018	Projections 2019	Projections 2020
Latvia	WEM	0.5	0.8	1.3	1.7	2.2	2.9	3.6	4.4
	WAM						2.9	3.6	4.5
Lithuania	WEM	0.5	0.9	1.3	1.4	1.3	2.2	3.5	5.2
	WAM						2.6	4.4	6.6
Luxembourg	WEM	0.2	0.7	1.2	1.6	1.7	1.9	1.8	1.6
	WAM						1.9	1.9	1.8
Malta	WEM	-0.1	-0.2	-0.3	-0.5	-0.8	-0.9	-1.0	-1.1
	WAM						-0.9	-1.0	-1.1
Netherlands	WEM	14.7	37.5	54.8	69.6	82.5	97.5	111.1	123.9
	WAM						98.5	113.3	127.5
Poland	WEM	7.5	20.9	30.2	29.0	24.2	36.4	50.0	65.1
	WAM						36.4	50.0	65.1
Portugal	WEM	10.7	21.5	30.7	39.3	45.5	52.3	60.0	68.6
	WAM						52.4	60.1	68.7
Romania	WEM	2.9	7.8	12.5	20.5	30.4	40.8	52.6	65.9
	WAM						41.9	55.2	70.3
Slovakia	WEM	2.9	7.5	12.2	17.5	22.8	28.2	33.7	39.5
	WAM						28.7	34.9	41.5
Slovenia	WEM	1.4	3.3	4.9	6.1	7.3	8.8	10.3	11.9
	WAM						8.8	10.3	11.9
Spain	WEM	27.3	53.2	80.8	104.1	122.5	147.6	171.5	194.8
	WAM						147.6	171.5	194.8
Sweden	WEM	6.4	12.9	19.4	26.6	31.7	37.5	43.7	50.1
	WAM						37.5	43.7	50.1
United Kingdom	WEM	19.3	49.1	72.7	84.0	112.6	153.1	192.9	234.4
	WAM						157.6	203.7	253.4
EU	**WEM**	**223**	**515**	**745**	**918**	**1 023**	**1 216**	**1 407**	**1 600**
	WAM						**1 232**	**1 442**	**1 659**

Notes: A positive value (green shading) indicates a surplus of AEAs (emissions lower than the target). A negative value (red shading) indicates a shortfall of AEAs (emissions lower than the target). The darker the colour, the larger the gap (red) or the surplus (green). The shading of the colours always refers to the timeline of each individual country. The lowest negative value is the darkest red, the median value and zero is white, and the highest value is the darkest green.

The calculation of the cumulative gap takes only previous years' gaps into account and does not consider any possible use of the flexibilities provided under the ESD (such as trading Effort Sharing emission allocations or buying international certificates). For this calculation, recalculated AEAs for the years 2017-2020 were considered (EU, 2017a).

The data are based on Effort Sharing emissions for 2013, 2014 2015 and 2016 as determined after the reviews of Effort Sharing emissions, approximated data for 2017 and projections for the period 2017-2020. No approximated GHG data were available for Bulgaria, Cyprus and Romania. For the aggregation of projections in the WAM scenario at EU level, WAM projections of Member States that did not report a WAM scenario have been gap-filled using the WEM scenario projections.

Sources: EEA, 2018h, 2018b, 2018c, 2018i, 2018j; EU, 2017a, 2013a, 2013b, based on Member States' submissions.

Annex 2 Progress towards renewable energy targets: data and methodology

A2.1 Reporting requirements related to renewable energy

Under the RED, Member States need to report on their progress towards the deployment of renewable energies (EU, 2015). Reporting under the RED takes place biennially in a standardised format. Furthermore, under the Energy Statistics Regulation, Member States also report data on their renewable energy deployment to Eurostat.

A2.2 Data sources related to renewable energy deployment

The analysis presented in this report is based on several sources relating to renewable energy use in Europe.

A2.2.1 Historical trends in the share of energy from renewable sources in gross final energy consumption

The assessment of progress towards objectives and targets for the use of RES is based, for the most part, on information reported by Member States to Eurostat under the Energy Statistics Regulation and the RED, and published by Eurostat via its SHARES tool (Eurostat, 2018b).

A2.2.2 Share of RES in gross final energy consumption in 2016

The shares of RES in gross final energy consumption in 2016 were estimated by Eurostat, based on national data transmission under Regulation (EC) No 1099/2008 on energy statistics (EU, 2008). In accordance with the accounting rules in the RED, electricity generated by hydro- and wind power were normalised to account for annual variations (hydropower over 15 years and wind power over 5 years). For details on the normalisation rules, see the SHARES manual provided by Eurostat (Eurostat, 2018b). Because of their insular and peripheral geography, Cyprus and Malta's gross inland consumption is disproportionally high for aviation, and they are thus strongly affected by current technological and regulatory constraints. Therefore, they have exemptions regarding the amounts by which they exceed the EU's average gross final consumption of energy in aviation in 2005 as assessed by Eurostat, i.e. 4.12 %.

A2.2.3 Approximated shares of renewable energy use in 2017

The approximated shares of renewable energy use in 2017 were estimated by the EEA and will be published in 2018 (EEA, 2018d). National estimates have been provided by Belgium, Germany, Ireland and Malta.

A2.2.4 The 2020 RES targets and indicative trajectories for the period from 2011 to 2018

The 2020 RES targets for each Member State were taken from Part A of Annex I of the RED, and the indicative trajectories for the period 2011-2018 were taken from Part B of Annex I of the RED (EU, 2009a).

A2.2.5 National NREAP trajectories for the period 2010-2020

National RES trajectories for the period 2010-2020 were derived from information submitted by Member States to the European Commission in 2010, in the context of their adopted NREAPs, also considering some updates made thereafter. These trajectories reflect how Member States themselves anticipate that their renewable energy deployment will develop up to 2020 (EC, 2013d; EEA, 2011).

A2.2.6 The share of energy from renewable sources on a sectoral level

The report also presents data on RES deployment on a sectoral level (for electricity, heating and cooling, and transport). These data are based on Eurostat's SHARES tool (Eurostat, 2018b). Approximate 2017 values were estimated by the EEA (EEA, 2018d).

A2.3 Tracking progress towards renewable energy targets

The progress of Member States towards their targets under the RED is assessed by comparing the share of energy from renewable sources in gross final energy consumption with the indicative trajectory set under the RED for the period 2015-2016. This assessment is complemented by preliminary estimates for the year 2017.

Assessments of progress are made using the following methodology:

- A Member State is considered to be on track if its average 2015-2016 share of energy from renewable sources matched or exceeded its indicative 2015-2016 indicative trajectory under the RED.
- A Member State is considered to be not on track if its average 2015-2016 share of energy from renewable sources was below its 2015-2016 indicative trajectory set under the RED.

Table A2.1 Current progress towards indicative trajectories under the RED

Member State	RES shares		'Renewable Energy Directive: indicative trajectory'			
			Trajectory shares		Gaps to trajectory	
	2015-2016 average	2017 (approximated)	2015-2016	2017-2018	2015-2016	2017 (approximated) vs. 2017-2018 trajectory
	%	%	%	%	percentage points	percentage points
Austria	33.2	33.7	28.1	30.3	5.0	3.5
Belgium	8.3	9.4	7.1	9.2	1.2	0.2
Bulgaria	18.5	18.7	12.4	13.7	6.1	5.0
Croatia	28.6	28.7	15.9	17.4	12.7	11.3
Cyprus	9.4	9.1	7.4	9.5	1.9	-0.3
Czechia	14.9	15.1	9.2	10.6	5.7	4.5
Denmark	31.6	33.7	22.9	25.5	8.7	8.3
Estonia	28.7	27.6	21.2	22.6	7.6	5.0
Finland	38.9	39.9	32.8	34.7	6.2	5.2
France	15.6	16.1	16.0	18.6	-0.5	-2.4
Germany	14.7	15.2	11.3	13.7	3.4	1.4
Greece	15.3	15.5	11.9	14.1	3.4	1.4
Hungary	14.3	13.4	8.2	10.0	6.1	3.5
Ireland	9.3	10.8	8.9	11.5	0.4	-0.7
Italy	17.5	17.8	10.5	12.9	7.0	4.9
Latvia	37.4	38.2	35.9	37.4	1.4	0.8
Lithuania	25.7	25.8	18.6	20.2	7.1	5.6
Luxembourg	5.2	5.7	5.4	7.5	-0.2	-1.8
Malta	5.5	7.0	4.5	6.5	1.0	0.5
Netherlands	5.9	6.5	7.6	9.9	-1.7	-3.4
Poland	11.5	11.2	10.7	12.3	0.8	-1.0
Portugal	28.2	28.5	25.2	27.3	3.0	1.2
Romania	24.9	25.0	20.6	21.8	4.3	3.2
Slovakia	12.4	11.8	10.0	11.4	2.4	0.3
Slovenia	21.6	21.0	20.1	21.9	1.5	-0.9
Spain	16.7	17.7	13.8	16.0	2.9	1.6
Sweden	53.8	54.8	43.9	45.8	9.9	9.0
United Kingdom	8.9	9.9	7.5	10.2	1.4	-0.3
EU-28	**16.9**	**17.4**	**13.8**	**16.0**	**3.1**	**1.0**
Iceland	71.4	72.9	59.1	60.9	12.3	12.0
Norway	68.9	70.3	62.4	64.2	6.5	6.1

Notes: A distance to trajectory is calculated as 'RES share' - 'RES target'. A positive value indicates a RES share higher than the relevant indicative trajectory.

Sources: EEA, 2018d; EU, 2009a; Eurostat, 2018b.

Table A2.2 Current progress towards national action plan trajectories

Member State	RES shares		National action plan trajectory			
			Trajectory shares		Gaps to trajectory	
	2016	2017 (approximated)	2016	2017	2016	2017 (approximated)
	%	%	%	%	percentage points	percentage points
Austria	33.5	33.7	32.6	32.9	0.9	0.8
Belgium	8.7	9.4	8.6	9.5	0.1	- 0.1
Bulgaria	18.8	18.7	12.4	13.7	6.4	5.0
Croatia	28.3	28.7	18.1	18.6	10.2	10.1
Cyprus	9.3	9.1	9.7	10.4	-0.4	-1.3
Czechia	14.9	15.1	12.4	12.8	2.5	2.3
Denmark	32.2	33.7	28.2	28.6	4.0	5.1
Estonia	28.8	27.6	23.7	24.2	5.1	3.4
Finland	38.7	39.9	33.6	34.7	5.1	5.2
France	16.0	16.1	18.0	19.5	-2.0	-3.4
Germany	14.8	15.2	14.4	15.7	0.4	-0.5
Greece	15.2	15.5	12.4	13.7	2.8	1.8
Hungary	14.2	13.4	9.3	10.7	4.9	2.7
Ireland	9.5	10.8	10.7	11.9	-1.2	-1.1
Italy	17.4	17.8	12.0	12.9	5.4	4.9
Latvia	37.2	38.2	36.3	37.0	0.9	1.2
Lithuania	25.6	25.8	22.0	24.0	3.6	1.8
Luxembourg	5.4	5.7	5.4	7.5	0.0	-1.8
Malta	6.0	7.0	6.1	7.1	-0.1	-0.1
Netherlands	6.0	6.5	9.7	10.9	-3.7	-4.4
Poland	11.3	11.2	12.5	13.1	-1.2	-1.9
Portugal	28.5	28.5	28.9	29.7	-0.4	-1.2
Romania	25.0	25.0	20.6	21.2	4.4	3.8
Slovakia	12.0	11.8	10.0	11.4	2.0	0.4
Slovenia	21.3	21.0	21.8	22.4	-0.5	-1.4
Spain	17.3	17.7	17.3	18.1	0.0	-0.4
Sweden	53.8	54.8	47.7	48.3	6.1	6.5
United Kingdom	9.3	9.9	8.0	9.0	1.3	0.9
EU-28	**17.0**	**17.4**	**16.1**	**17.2**	**0.9**	**-0.2**
Iceland	72.6	72.9	76.1	76.2	-3.5	-3.3
Norway	69.4	70.3	65.2	65.8	4.2	-4.5

Notes: The distance to a trajectory is calculated as 'RES share' - 'RES target'. A positive value indicates a RES share higher than the relevant anticipated trajectory from the NREAP.

Sources: EC, 2013d; EEA, 2018d, 2011; Eurostat, 2018b.

Table A2.3 Renewable energy source shares per sector, 2016 and 2017

Member State	RES-E (%)		RES-H/C (%)		RES-T (%)	
	2016	2017 (proxy)	2016	2017 (proxy)	2016	2017 (proxy)
Austria	72.6	72.0	33.3	34.1	10.6	10.6
Belgium	15.8	17.8	8.1	8.7	5.9	6.0
Bulgaria	19.2	18.8	30.0	30.2	7.3	7.2
Croatia	46.7	49.3	37.6	38.1	1.3	1.3
Cyprus	8.6	9.0	23.0	22.6	2.7	2.5
Czechia	13.6	13.6	19.9	20.5	6.4	6.3
Denmark	53.7	59.5	41.7	43.0	6.8	6.9
Estonia	15.5	16.8	51.2	48.1	0.4	0.4
Finland	32.9	35.2	53.7	55.0	8.4	8.4
France	19.2	19.9	21.1	21.1	8.9	8.7
Germany	32.2	34.6	13.0	12.9	6.9	7.0
Greece	23.8	24.5	24.5	24.5	1.4	1.7
Hungary	7.2	7.2	20.8	20.0	7.4	5.5
Ireland	27.2	30.1	6.8	7.5	5.0	7.2
Italy	34.0	33.2	18.9	19.7	7.2	7.4
Latvia	51.3	53.9	51.9	53.3	2.8	2.7
Lithuania	16.8	18.3	46.5	46.5	3.6	3.7
Luxembourg	6.7	7.4	7.3	7.3	5.9	6.2
Malta	5.6	5.7	15.3	16.6	5.4	6.7
Netherlands	12.5	14.3	5.5	5.4	4.6	6.7
Poland	13.4	14.2	14.7	14.4	3.9	4.5
Portugal	54.1	52.7	35.1	35.3	7.5	8.3
Romania	42.7	42.6	26.9	27.3	6.2	6.4
Slovakia	22.5	21.3	9.9	10.2	7.5	6.7
Slovenia	32.1	31.9	34.0	33.8	1.6	1.5
Spain	36.6	36.4	16.8	17.8	5.3	5.7
Sweden	64.9	66.1	68.6	70.0	30.3	29.4
United Kingdom	24.6	26.5	7.0	7.5	4.9	4.7
EU-28	**29.6**	**30.6**	**19.1**	**19.3**	**7.1**	**7.2**

Sources: EEA, 2018d; Eurostat, 2018b.

Annex 3 Progress towards energy efficiency targets: data and methodology

A3.1 Reporting requirements for energy efficiency/energy consumption

Under Article 3 of the EED (EU, 2012), Member States had to set their own indicative national energy efficiency targets. Depending on country preferences, these targets are based on primary or final energy consumption, primary or final energy savings, or energy intensity. Each national target reflects the specific situation of the Member State that adopted it. In some Member States, the targets may still be subject to change in the coming years.

A3.2 Data sources for energy consumption

The analysis presented in this report is based on several sources relating to energy consumption in Europe.

A3.2.1 Historical trends in primary and final energy consumption

The assessment of progress towards energy efficiency targets is based, for the most part, on information reported by Member States to Eurostat under the Energy Statistics Regulation, and published by Eurostat via its energy statistics database (Eurostat, 2018f, 2018c, 2018a).

A3.2.2 Approximated estimates for primary and final energy consumption in 2017

Early estimates of 2017 primary and final energy consumption were prepared by the EEA (EEA, 2018l; Eurostat, 2018f). National estimates have been provided by Estonia, Germany and Malta.

A3.3.3 National targets on primary and final energy consumption

Article 3 of the EED requires Member States to express their targets in terms of an absolute level of primary energy consumption and final energy consumption in 2020, although Member States can choose the basis of their indicative energy efficiency targets (final or primary energy consumption, savings or intensity). The EEA's assessment of progress towards energy efficiency targets is based on indicative values of primary energy consumption to assess the consistency of progress among Member States. Final energy consumption progress is also monitored. Target values are adopted as notified by Member States in their 2017 NEEAPs or in a separate notification to the European Commission in 2017 and 2018 (EC, 2017f, 2017g).

A3.3 Tracking progress towards energy efficiency targets

Analysis of the progress made towards achieving energy efficiency targets at national levels involves assessing whether or not the efforts undertaken since 2005 have been sufficient to reduce or limit primary energy consumption at a pace sufficient to meet the 2020 target. This question is addressed by comparing 2016 (or 2017) levels with a linear trajectory between 2005 and the 2020 national target.

To remain consistent with the assessments presented for GHG emissions and RES, 2005 was chosen as a single base year, to allow for the comparable assessment of trends across Member States.

This methodology does not consider the level of ambition of the national target (which varies significantly across the EU), nor does it capture the complexity of the national context (economic development, ability to attract financing for energy efficiency projects, etc.). Since the methodology is based on absolute primary energy consumption values, it may differ from the approach adopted by individual Member States themselves.

The numeric results of this assessment per Member State are shown in greater detail in Table A3.1.

Table A3.1 Member States' progress towards their 2020 energy efficiency targets

Member State	Primary energy consumption (Mtoe)			Linear trajectory 2005-2020 target (Mtoe)			Distance to trajectory (% share of 2005 levels)	
	2005	2016	2017 (proxy)	2016	2017	2020	2016	2017 (proxy)
Austria	32.3	31.8	32.8	31.7	31.7	31.5	-0.3	-3.4
Belgium	51.3	49.0	48.3	45.7	45.2	43.7	-6.3	-5.9
Bulgaria	18.9	17.6	18.6	17.4	17.3	16.9	-1.2	-6.9
Croatia	9.1	8.1	8.0	10.3	10.4	10.7	24.3	26.5
Cyprus	2.5	2.4	2.4	2.3	2.3	2.2	-4.5	-6.4
Czechia	42.5	39.9	41.8	43.8	43.9	44.3	9.1	5.1
Denmark	19.2	17.2	17.2	17.5	17.4	16.9	1.8	0.7
Estonia	5.4	6.1	6.7	6.2	6.3	6.5	1.3	-7.1
Finland	33.4	33.1	32.7	35.2	35.4	35.9	6.4	7.9
France	260.2	235.4	236.2	230.6	228.0	219.9	-1.8	-3.1
Germany	317.3	295.8	297.4	287.4	284.7	276.6	-2.6	-4.0
Greece	30.6	23.5	24.6	26.3	25.9	24.7	8.9	4.1
Hungary	25.9	23.9	24.6	24.6	24.5	24.1	2.8	-0.5
Ireland	14.7	14.6	14.7	14.1	14.1	13.9	-3.1	-4.1
Italy	181.5	148.4	152.3	164.3	162.7	158.0	8.7	5.8
Latvia	4.5	4.3	4.2	5.1	5.2	5.4	19.0	22.0
Lithuania	8.0	6.0	6.1	6.9	6.8	6.5	11.2	9.1
Luxembourg	4.8	4.2	4.2	4.6	4.5	4.5	8.3	6.6
Malta	0.9	0.7	0.8	0.8	0.8	0.8	14.2	3.8
Netherlands	68.8	64.8	65.7	62.9	62.3	60.7	-2.9	-4.9
Poland	87.7	94.3	97.8	94.1	94.7	96.4	-0.3	-3.6
Portugal	24.9	22.1	23.5	23.1	23.0	22.5	4.1	-2.1
Romania	36.7	31.3	32.6	41.3	41.7	43.0	27.4	25.0
Slovakia	17.8	15.5	15.9	16.7	16.7	16.4	6.9	4.2
Slovenia	7.0	6.7	6.9	7.1	7.1	7.1	6.1	2.4
Spain	135.9	117.2	122.1	126.1	125.2	122.6	6.5	2.3
Sweden	48.7	47.1	47.2	44.8	44.5	43.4	-4.6	-5.5
United Kingdom	222.8	181.7	178.7	189.7	186.6	177.6	3.6	3.5
EU	**1 713.3**	**1 542.7**	**1 563.8**	**1 544.4**	**1 529.1**	**1 483.0**	**0.1**	**-2.0**

Note: The distance to a trajectory is calculated as 'linear trajectory value' - 'primary energy consumption'. A positive value indicates energy consumption below the linear trajectory.

Sources: EC, 2016e, 2013b; EEA, 2018n, 2018l, 2018e; Eurostat, 2018f, 2018c, 2018a.

Annex 4 Domestic climate and energy targets in the European Union

A4.1 The '20-20-20' targets for 2020

The EU has a long-term goal of reducing Europe's GHG emissions by 80 % by 2050, compared with 1990 levels. In the context of its commitments and the negotiations at international level, in March 2007 the European Council committed the EU to becoming a highly energy-efficient, low-carbon economy by achieving three domestic climate and energy objectives by 2020 (Council of the European Union, 2007):

1. reduce GHG emissions by 20 % compared with 1990 levels;

2. increase to 20 % the share of energy from renewable sources in the EU's gross final energy consumption;

3. improve the EU's energy efficiency by 20 %.

To achieve these domestic commitments, in 2009 the EU adopted the climate and energy package, which comprises various pieces of legislation (EU, 2009d, 2009c, 2009a, 2009e, 2009f). The package introduced a clear approach to achieving the 20 % reduction in total GHG emissions, compared with 1990 levels, which is equivalent to a 14 % reduction compared with 2005 levels. This 14 % reduction objective is to be achieved through a 21 % reduction compared with 2005 levels for emissions covered by the ETS, and a 9 % reduction for sectors covered by the ESD (EU, 2009c).

A revision of the ETS Directive (EU, 2009d) introduced a single 2020 target for all EU emissions covered by the EU ETS (as well as ETS emissions from the three participating non-Member States, namely Iceland, Liechtenstein and Norway). The ETS essentially covers emissions from large industrial installations as well as emissions from aviation. ETS emissions represent about 40-45 % of total EU GHG emissions. The 2020 cap corresponds to a reduction of about 21 % in ETS emissions by 2020, compared with 2005 levels. The sectors covered under the EU ETS are therefore expected to contribute the largest proportion of emission reductions in the context of meeting the EU's 2020 GHG emission target. For allowances allocated to the EU ETS sectors, annual caps have been set for the period from 2013 to 2020; these decrease by 1.74 % annually. For further details on the EU ETS in the period 2013-2020 (EEA, 2018d).

For all other emissions not covered by the EU ETS, the ESD has set annual binding targets for each year of the period 2013-2020, for each Member State.

These internal EU rules under the 2020 climate and energy package underpin the EU implementation of the 2020 target under the UNFCCC (see Annex 5).

A4.2 The 2030 climate and energy framework

The adoption of the Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy (EC, 2018d) underlined the importance of meeting the 2030 targets, as 'Energy Union and Climate' was identified as one of 10 priorities at the start of the Juncker Commission's term. This priority comprises five dimensions (i.e. 'supply security', 'a fully integrated internal energy market', 'energy efficiency', 'climate action — emission reduction' and 'research and innovation'), which have been henceforth reported on annually in the State of the Energy Union (latest report from 2017: EC, 2017h). The annual reporting of progress is considered essential so that issues can be identified in a timely fashion and addressed, if necessary, through further policy interventions.

Following the political agreements between the European Parliament, the Council of ministers and the European Commission reached in May and June 2018, the EU now has full clarity on its climate and energy targets for 2030. These are:

- a binding target of at least a 40 % reduction in domestic GHG emissions (compared with 1990 levels), with binding annual GHG emission reduction targets for EU Member States from 2021 to 2030 for the sectors not covered by the EU ETS;

- a binding target to increase the share of renewable energy (RES) in the EU to at least 32 % of gross final energy consumption by 2030;

- an indicative target of at least a 32.5 % improvement in energy efficiency in 2030 at EU level (compared with the Commission's 2007 Energy Baseline Scenario).

Neither the renewable energy target nor the energy efficiency target will be translated into nationally binding targets. Individual Member States are free to set their own higher national contributions.

This specification refines what was previously agreed in 2014 by EU leaders about the climate and policy framework for the EU (European Council, 2014):

- A binding target of at least a **40 % domestic reduction in GHG emissions**, compared with 1990 levels. This target would 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. These targets have subsequently been implemented by Directive (EU) 2018/410 and Regulations (EU) 2018/841 and 2018/842.

- A target for renewable energy consumption of at least 27 % of total energy consumption was set. This target is binding at EU level, but there are no fixed targets for individual Member States.

- The European Council endorsed a target at EU level of 30 % for improving energy efficiency, compared with projections of future energy consumption, based on the current criteria (i.e. projections of energy consumption in 2030 from the 2007 Energy Baseline Scenario from the European Commission) (European Council, 2017).

The LULUCF sector is integrated into the EU 2030 climate and energy framework from 2021 onwards. The LULUCF Regulation (EU) 2018/841 contains a no-debit rule requiring each Member State to compensate net accounted emissions from the LULUCF sector by removals from LULUCF sectors in other Member States or by corresponding emission reductions in Effort Sharing sectors (see Section 2.5). The proposal also includes modified accounting rules.

A4.3 National targets and compliance under the Effort Sharing Decision

A4.3.1 Targets for 2020

The ESD covers emissions from all sources outside the EU ETS, except for emissions from aviation ([33]) and international maritime transport, and net emissions from LULUCF. The ESD therefore includes a range of diffuse sources in a wide range of sectors such as transport (e.g. cars, trucks), buildings (heating in particular), services, small industrial installations, agriculture and waste. Such sources currently account for almost 60 % of total GHG emissions in the EU.

The ESD sets individual annual binding targets for GHG emissions not covered by the EU ETS (AEAs) for all Member States for the period 2013-2020 (EU, 2009c). In 2013, the European Commission determined the AEAs of Member States for the period 2013-2020, using reviewed and verified emission data for the years 2005, 2008, 2009 and 2010 (EU, 2013a). The AEAs were adjusted in 2013 to reflect the change in the scope of the EU ETS from 2013 onwards (EU, 2013b) ([34]) and in 2017 to reflect updates in methodologies for reporting of GHG inventories (EU, 2017a).

Each Member State will contribute to this effort, according to its relative wealth in terms of GDP per capita. The national emission targets range from a 20 % reduction for the richest Member States to a 20 % increase for the poorest ones by 2020, compared with 2005 levels (see Figure A4.1). At EU level, this will deliver approximately 9.3 % emission reductions by 2020, compared with 2005 levels, from those sectors covered by the ESD. The least wealthy countries can increase emissions in these sectors because their relatively high economic growth is likely to be accompanied by higher emissions. Nevertheless, their targets still represent a limit on emissions, and an effort to reduce them will be required by all Member States; they will need to introduce policies and measures to limit or lower their emissions in the various Effort Sharing sectors.

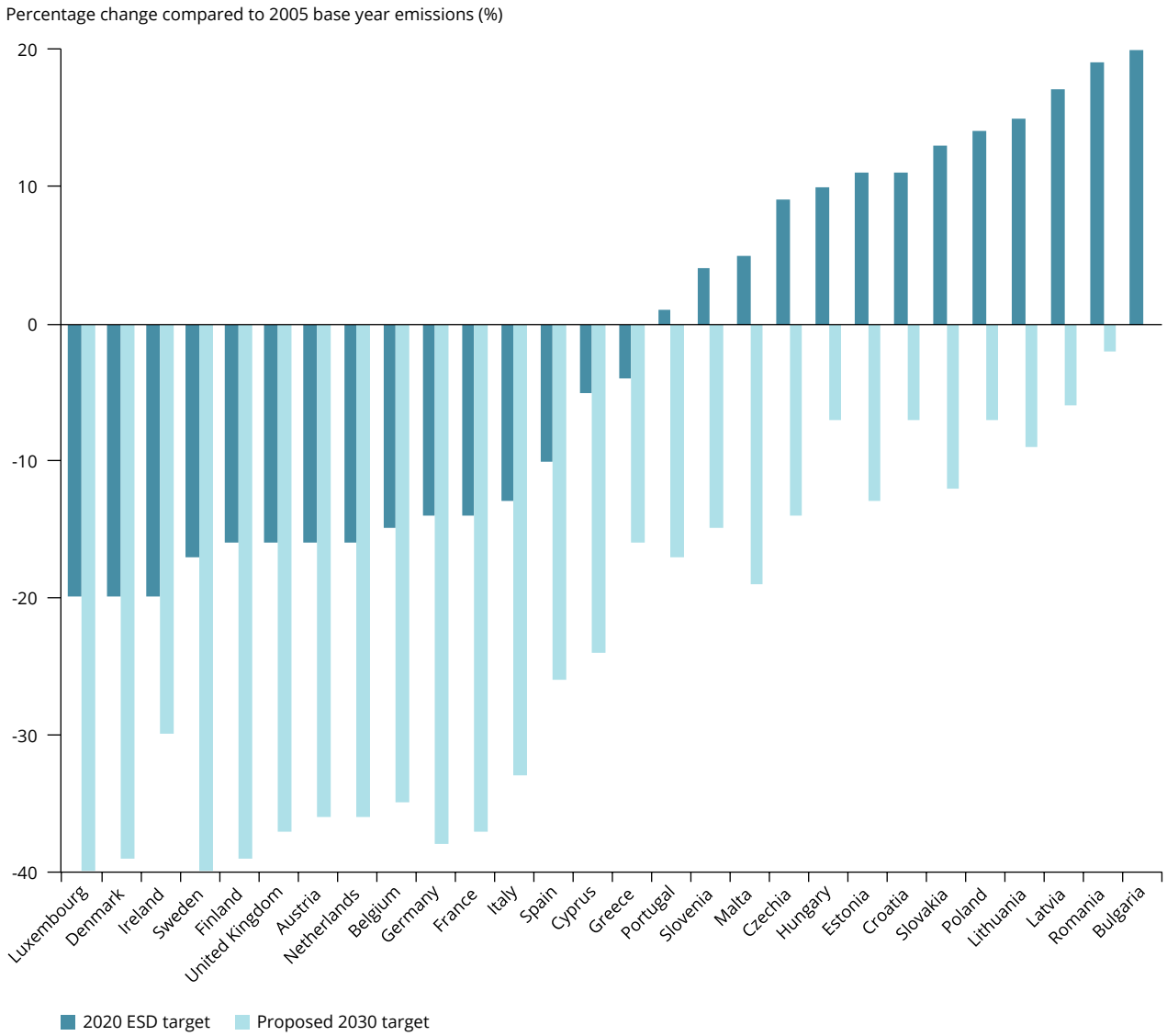
([33]) Emissions from aviation have been included in the EU ETS since 1 January 2012. In principle, the EU ETS should cover all flights departing from and/or arriving at airports in all EU Member States, as well as Iceland, Liechtenstein and Norway and closely related territories. However, since 2012, only flights departing from and arriving at airports located in these countries (and Switzerland in 2012) have been included in the EU ETS. Non-CO_2 emissions from domestic aviation remain covered under the ESD.

([34]) According to Article 27(2) of Regulation (EU) 525/2013, the European Commission is to examine the impact of the use of the 2006 IPCC guidelines for national GHG inventories and significant changes brought about by the UNFCCC methodologies by December 2016, and it may revise Member States' AEAs, as provided in the ESD, accordingly.

A4.3.2 Targets for 2030

The regulation on binding annual emission reductions by Member States from 2021 to 2030 (Regulation (EU) 1018/842, the Effort Sharing Regulation) (EU, 2018a) sets out binding annual GHG emission targets for Member States for the period 2021-2030. This regulation is the follow-up to the ESD, which established national emission targets for Member States in Effort Sharing sectors between 2013 and 2020. The regulation recognises the different capacities of Member States to act by differentiating targets according to GDP per capita across Member States. This ensures fairness, because Member States with the highest incomes take on more ambitious targets than Member States with lower incomes. EU leaders recognised that an approach for high-income Member States based solely on relative GDP per capita would mean that, for some, the costs associated with reaching their targets would be relatively high. To address this, these targets have been adjusted to reflect cost-effectiveness for Member States with an above average GDP per capita while maintaining the overall GDP per capita-based emission reduction required from this group of Member States. The resulting 2030 GHG emission

Figure A4.1 National 2020 and 2030 targets under the ESD and ESR



Note: The targets are expressed relative to 2005 Effort Sharing base year emissions. These base year emissions are calculated based on relative and absolute 2020 targets (for details on Effort Sharing base year emissions, please see Section A1.2 in Annex 1). The same methodology to calculate base year emissions is used under the ESR.

Sources: EU, 2018a, 2009c.

targets range from 0 % to -40 %, compared with 2005 levels (see Figure A4.1).

A4.3.3 Allowed flexibilities under the ESD and the ESR

The ESD allows Member States to use flexibility provisions to meet their annual targets, with certain limitations:

- Within the Member State itself, any overachievement in a year during the period 2013-2019 can be carried over to subsequent years, up to 2020. Up to 5 % of a Member State's AEA may be carried forward to the following year during the period 2013-2019. Where the emissions of a Member State are below that AEA, excess emission reductions can be carried over to the subsequent years.

- Member States may transfer up to 5 % of their AEAs to other Member States, which may use this emission allocation until 2020 (*ex ante*). Any overachievement in a year during the period 2013-2019 may also be transferred to other Member States, which may use this emission allocation until 2020 (*ex post*).

Member States may use emission credits from the Kyoto Protocol's flexible mechanisms in accordance with the following provisions:

- The use of project-based emission credits is capped on a yearly basis up to 3 % of 2005 Effort Sharing emissions in each Member State.

- Member States that do not use their 3 % limit for project-based credits in any specific year can transfer their unused credits for that year to other Member States or bank it for their own use until 2020.

- Member States fulfilling additional criteria (Austria, Belgium, Cyprus, Denmark, Finland, Ireland, Italy, Luxembourg, Portugal, Slovenia, Spain and Sweden) may use credits from projects in least developed countries (LDCs) and small island developing states (SIDS) for up to an additional 1 % of their verified emissions in 2005. These credits are not bankable or transferable.

Overall, a maximum of Kyoto emission credits equivalent to 750 Mt CO_2 at EU level can be used during the period 2013-2020. As most Member States are expected to meet their Effort Sharing targets (see Section 3.1) without the flexibility provisions, whereas other Member States can meet their Effort Sharing targets through intra-EU transfers of AEAs, the use of project credits is expected to be significantly smaller.

Any Member State exceeding its annual AEA, even after considering the flexibility provisions and the use of Kyoto Protocol emission credits, will have to take corrective measures as laid down in the ESD and will be subject to the following consequences:

- A deduction will be made from the AEA for the next year of the excess Effort Sharing emissions multiplied by 1.08 (8 % interest rate).

- A corrective action plan will be developed — the European Commission may issue an opinion, possibly considering comments from the Climate Change Committee.

- The transfer of emission allocations and project-based credits from the account of that Member State will be temporarily suspended while the Member State is in a state of non-compliance with its ESD obligations.

The ESR for 2030 targets maintains existing flexibilities under the current ESD with some limitations:

- Banking of unused AEA is capped by a total amount of 30 % of the cumulative surpluses from 2022 to 2029.

- Borrowing is limited to 10 % from 2021 to 2025 and to 5 % from 2026 to 2029.

- The limit for transfers of unused AEAs to other Member States is increased to 10 % in the years 2026-2030.

- International project credits are excluded as the EU target is to be met domestically.

The ESR provides two new flexibilities to allow for a fair and cost-efficient achievement of the targets. These new flexibilities are as follows:

- A new flexibility to access allowances from the EU ETS. This allows eligible Member States to achieve their national targets by covering some emissions in the Effort Sharing sectors with EU ETS allowances that they would normally auction. The amount of allowances used for that purpose cannot exceed 100 million tonnes of CO_2 over the period 2021-2030 in the whole of the EU. Eligible Member States have to notify the Commission before 2020 of the amount of allowances they aim to use under

this flexibility over the period, with two possibilities for downward revisions for subsequent years in 2024 and 2027. Since the transfer is strictly limited in volume, and decided beforehand, predictability and environmental integrity are maintained.

- A new flexibility to use credits from the land use sector. To stimulate additional action in the land use sector, the proposal allows Member States to use up to 280 million credits over the entire period 2021-2030 in the whole of the EU to comply with their national targets. All Member States are eligible to make use of this flexibility, but more access is available for Member States with a larger proportion of emissions from agriculture. In line with EU leaders' guidance, this recognises that there is a relatively low mitigation potential for emissions from the agriculture sector.

In addition, a safety reserve with a maximal total volume of 105 million AEAs might be used for compliance in 2032 by some Member States subject to the fulfilment of the EU's 2030 target of -30 %. In this case, Member States that have a GDP per capita below the EU average and that have overachieved their Effort Sharing targets for 2013-2020 might use the safety reserve under certain conditions for 2026-2030 compliance as a last resort after the use of all other flexibilities.

A4.4 Renewable energy targets for 2020

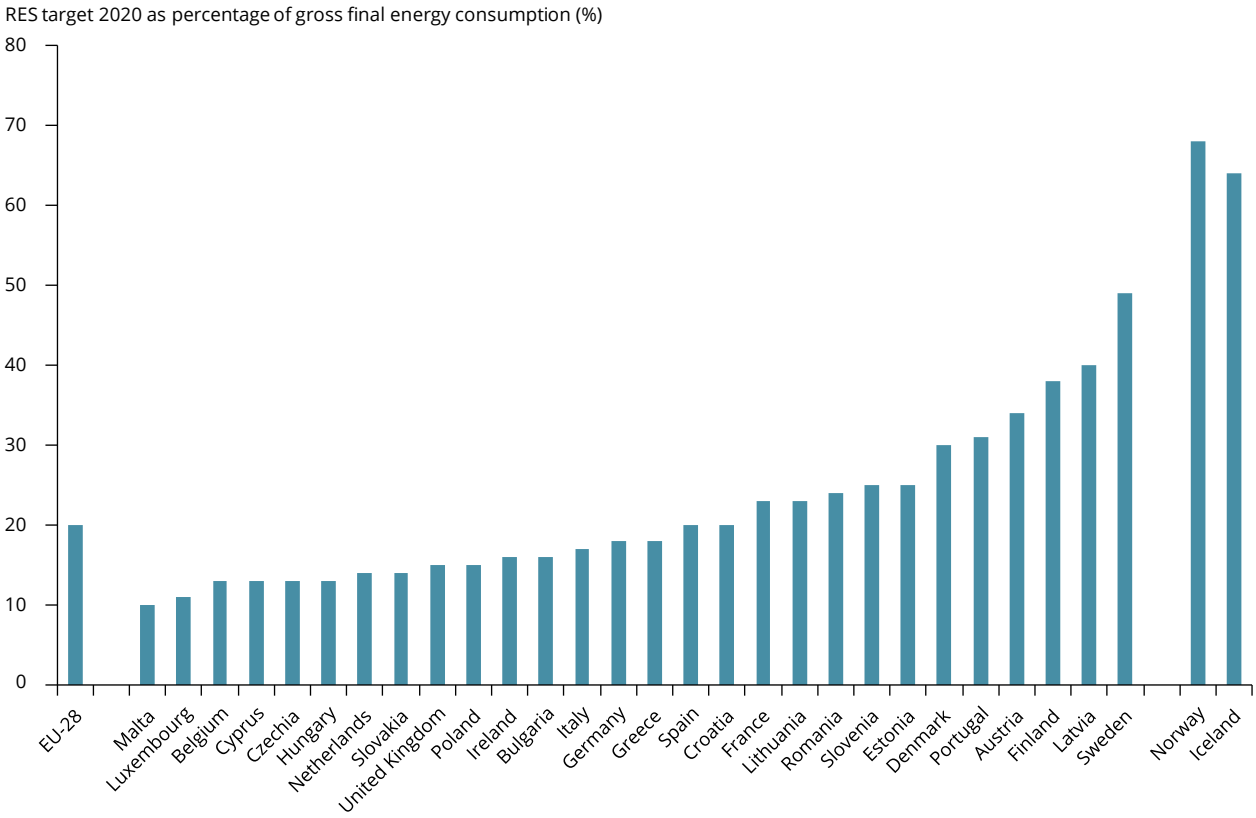
The EU-wide renewable energy target for 2020

To meet its target of increasing the use of RES to 20 % of gross final energy consumption by 2020, the EU adopted the RED (EU, 2009a) as part of the climate and energy package.

National renewable energy targets for 2020

The RED includes legally binding national renewable energy targets for 2020, consistent with an EU-wide

Figure A4.2 National renewable energy targets for 2020



Notes: The targets for Iceland and Norway, which are not EU Member States, were agreed and are included in the annex of the European Economic Area agreement. For the sake of simplicity, the report refers to these as RED targets.

Source: EU, 2009a.

target of increasing RES use to 20 % of gross final energy consumption by 2020, and to 10 % of transport-related fuel consumption by the same year (EU, 2009c). The RED also sets an indicative trajectory for each Member State for the period 2011-2018, intended to ensure that each Member State achieves its 2020 targets. An interim indicative RED target for the EU can be derived from the minimum indicative trajectories of the Member States in the run-up to 2020 (RED, Annex I, Part B).

Under the RED, Member States had to submit NREAPs in 2010 (EEA, 2011). These plans outline the pathways (i.e. the expected trajectories) that Member States anticipate using to reach their legally binding national renewable energy targets by 2020. In 2011 (and every 2 years thereafter), Member States had to report on national progress towards the interim RED and expected NREAP targets. The NREAPs adopted by Member States in 2010 outline the expected trajectories for RES use, as a proportion of gross final energy consumption, towards the legally binding national 2020 RES targets.

A4.5 Renewable energy targets for 2030

In June 2018, the EU endorsed an EU-level, binding renewable energy target of at least 32 % in 2030, measured as a share of the gross final energy consumption (EC, 2016a). This target shall be reached through the collective efforts of all Member States, with countries free to set their own national contributions.

According to the Energy Union Governance Regulation, Member States will need to present, at the end of 2018, draft integrated NECPs (EC, 2016a). These shall include, inter alia, planned national objectives, targets and contributions related to all dimensions of the Energy Union, together with planned policies and measures and the investment needs anticipated to meet the national targets, objectives and contributions.

Concerning RES, the NECPs shall include in particular an indicative trajectory for the national contribution from 2021 onwards, which shall reach the following reference points:

- by 2022, at least 18 % of the total increase in the Member State's RES share between its binding 2020 RES share target and its 2030 contribution;
- by 2025, at least 43 % of the total increase in the Member State's RES share between its binding 2020 RES share target and its 2030 contribution;
- by 2027, at least 65 % of the total increase in the Member State's RES share between its binding 2020 RES share target and its 2030 contribution;
- by 2030, the indicative trajectory shall reach at least the Member States' planned contribution.

The European Commission will assess the draft plans to analyse whether planned collective effort is sufficient to reach an EU-level renewable energy share of 32 % in 2030, and whether the indicative national trajectories, taken together, add up to the European Union's reference points for 2022, 2025 and 2027. If planned effort seems insufficient (ambition gap) the Commission will issue recommendations to Member States to increase their ambition. In addition, Member States shall report biennially estimated trajectories for the period 2021-2030, regarding the evolution of RES-E, RES-H/C and RES-T, as well as the estimated trajectories by individual renewable energy technologies. Together with the other reporting obligations introduced by the EU Governance Regulation, this will allow Member States and the EU to monitor progress towards achieving the Energy Union's goals and objectives.

A4.6 Energy efficiency targets for 2020

In 2007, the European Council stressed the need to increase energy efficiency to achieve the 20 % energy savings target for 2020, for primary energy consumption, and agreed binding targets for GHG emission reductions and renewable energy (EC, 2007). The reduction of primary energy consumption by 20 % by 2020 is a non-binding objective in the EU.

The climate and energy package does not address the energy efficiency target directly, although the CO_2 performance standards for cars and vans (EU, 2009f, 2014a), the revised EU ETS Directive and the ESD all contribute to fostering energy efficiency. Since the adoption of the package, the EU energy efficiency policy framework has advanced in line with the priorities identified in the Action Plan for Energy Efficiency 2006 (EC, 2006). The energy efficiency action plan was reviewed in 2011, after revisions of the following pieces of legislation:

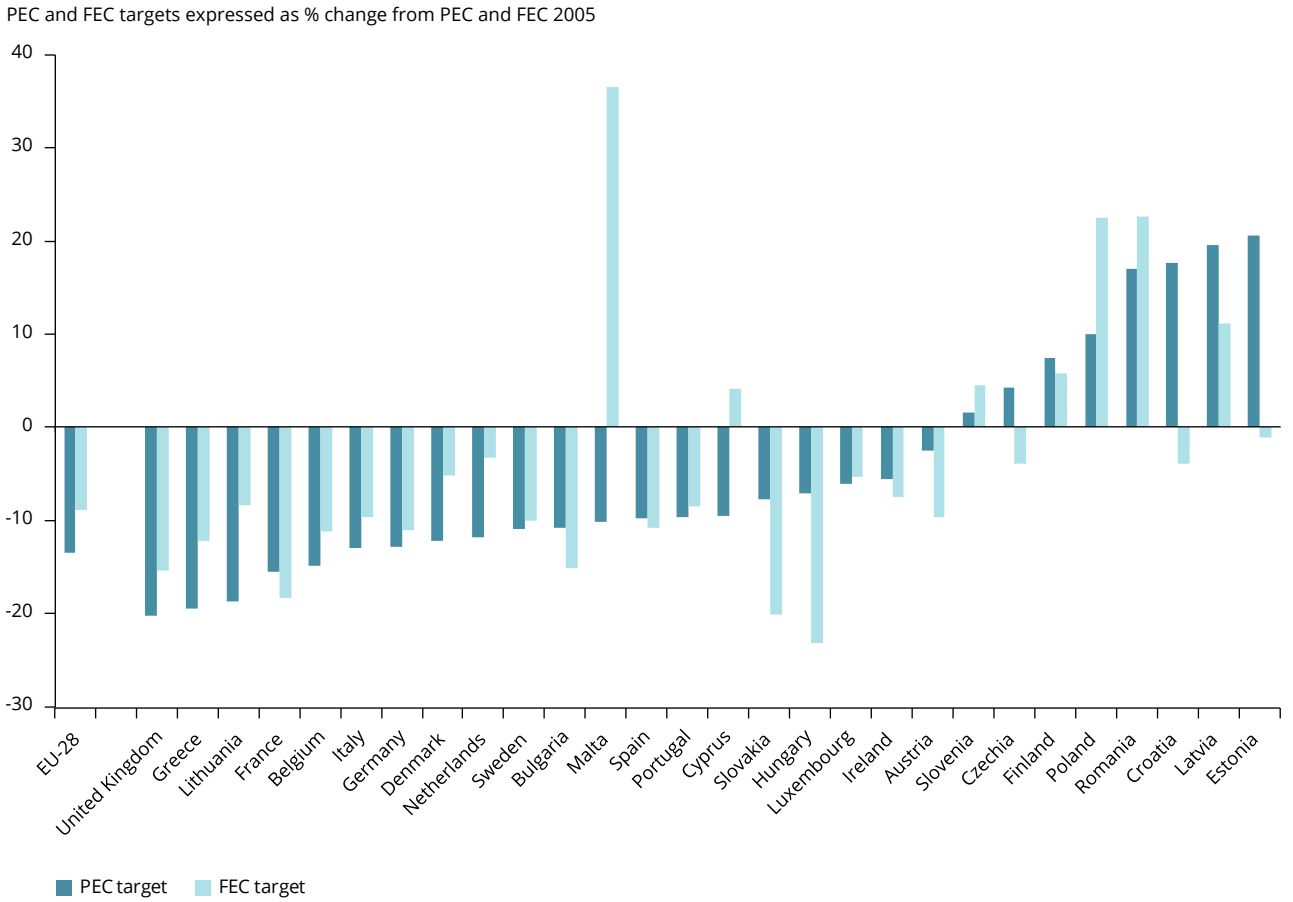
- the Ecodesign Directive (EU, 2012);
- the Energy Labelling Directive (EU, 2010a);
- the EPBD (EU, 2010b).

One of the key developments in the energy efficiency policy framework was the adoption of the EED in 2012 (EU, 2012). The EED establishes a common framework of measures for the promotion of energy efficiency within the EU and aims to help remove barriers and overcome market failures that impede efficiency in the supply and use of energy. The EED stipulates that primary energy consumption in the EU should not exceed 1 483 Mtoe in 2020, and that final energy consumption in the EU should not exceed 1 086 Mtoe in 2020. These absolute targets were set using the European Commission's 2007 Energy Baseline Scenario (EC, 2008), based on the Price-driven and Agent-based Simulation of Markets Energy System Models (PRIMES). Implementing the EED was expected to lead to a 15 % reduction in primary energy consumption compared with the 2007 Energy Baseline Scenario, with an additional 2 % reduction expected from the transport sector (Ecofys, 2012).

Under the EED, Member States had to set indicative national targets and implement a set of mandatory requirements, one of the most significant being the establishment of an Energy Efficiency Obligation (EEO) scheme, or the implementation of alternative measures.

Member States have adopted various base years against which the progress towards national energy efficiency targets will be measured. Member States also chose different approaches for setting national targets, based on primary or final energy consumption, primary or final energy savings or energy intensity. Each national target reflects the specific situation of the Member State that adopted it. Consequently, ambition levels vary greatly. Compared with 2005 levels, currently 18 Member States have aimed to reduce final as well as primary energy consumption; for five Member States, targets show an increase in final as well as primary energy consumption. Five other Member States intend to keep the potential increase in either primary or final energy consumption to a certain limit over the period.

Figure A4.3 National indicative energy efficiency targets for 2020, expressed in primary energy consumption or final energy consumption



Note: The national targets for 2020 reported by Member States under the EED were first calculated in absolute terms and then compared with 2005 levels.

Sources: EC, 2018c, 2018d, 2018d; Eurostat, 2018f, 2018c, 2018a.

Member States can revise their indicative targets and primary or final energy consumption projections when they review their triennial NEEAPs submitted under the EED.

Figure A4.3 shows the national targets set by each Member State under the EED, compared with 2005 levels, for primary and final energy consumption. The year 2005 is used here to serve as a common reference, although the EED does not explicitly use it as a common base year.

In contrast, no national targets for energy efficiency have been set for 2030 under the EED, although the Commission Regulation from 2016 sets an energy efficiency target of 32.5 % (see Section 1.2) (EC, 2016a).

According to the same regulation, by April 2022, Member States shall report to the Commission on the achievements of the 2020 national targets, as well as on the Energy Union's overall targets.

Turkey implemented an NEEAP for the period 2017-2023, aiming to reduce the primary energy consumption of Turkey by 14 % by 2023 through 55 actions defined in six categories, namely buildings and services, energy, transport, industry and technology, agriculture and cross-cutting (horizontal) areas. It is also projected to achieve cumulative savings of 23.9 Mtoe by 2023.

A4.7 Energy efficiency targets for 2030

On 14 June 2018, the Commission, the Parliament and the Council reached a political agreement that includes a binding energy efficiency target for the EU for 2030 of 32.5 %, with a clause for an upwards revision by 2023 (EC, 2016a). The Governance Regulation defines that Member States shall set indicative national energy efficiency contributions to achieve the EU 2030 targets based on primary or final energy consumption, primary or final energy savings or energy intensity. Member States should also set an indicative trajectory for that contribution from 2021 onwards, based on their indicative contributions for the EU 2020 and 2030 targets.

These contributions will be presented in the national energy and climate action plans, for which first drafts must be submitted by the end of 2018. Final plans have to be submitted by the end of 2019. Every 2 years, Member States shall report the status of implementation of the integrated NECPs, including information on the progress accomplished towards reaching the national targets, objectives and contributions. This includes indicative trajectories for primary and final annual energy consumption from 2021 to 2030 as the national energy savings contribution to achieving the EU 2030 target and the underlying methodology.

A4.8 Overview of national climate and energy targets

The main targets that apply to Member States under EU commitments until 2020 are presented in Table A4.1, and their progress towards achieving these targets is presented in Table A4.4.

The scope of existing EU legislation that implements a domestic 20 % target commitment is different from that of the Kyoto target for the second commitment period. For this reason, the total allowed emissions or the 'emissions budget' under the climate and energy package cannot be directly compared with the corresponding quantified emission limitation or reduction commitment (QELRC). Some of the main differences between the climate and energy package and the second commitment period, in terms of emissions included and the methodologies used to determine emissions, relate to the treatment of emissions from international aviation; emissions and removals from LULUCF; the use of units from flexible mechanisms; the coverage of NF_3; flexibilities regarding base years; and the use of GWP. The differences are summarised in Table A4.2. For details, please see *Trends and projections in Europe 2014* (EEA, 2014), as well as Annex 5. In Table A4.2, EU commitments until 2030 are summarised.

Table A4.1 Main national climate and energy targets until 2020

Member State	Participating in EU ETS	ETS target (2020)	Effort Sharing Decision target (2020)	2020 ESD emission allocation	2005 ESD base-year emissions	Renewable target 2020 (RED)	Primary energy target 2020	Final energy target 2020
		% vs. 2005		Mt		% gross final energy consumption	Mtoe	
EU-28		**-21**	**-9**	**2 618.2**	**2 887.1**	**20**	**1 483**	**1 086.0**
Austria	x		-16	47.8	56.8	34	31.5	25.1
Belgium	x		-15	68.2	80.3	13	43.7	32.5
Bulgaria	since 2007		20	26.5	22.1	16	16.9	8.6
Croatia	since 2013		11	19.3	17.4	20	10.7	7.0
Cyprus	x		-5	4.0	4.2	13	2.2	1.9
Czechia	x		9	67.2	61.7	13	44.3	25.3
Denmark [a]	x		-20	32.1	40.1	30	16.9	14.7
Estonia	x		11	6.0	5.4	25	6.5	2.8
Finland	x		-16	28.5	33.9	38	35.9	26.7
France	x		-14	342.5	398.2	23	219.9	131.4
Germany	x		- 14	410.9	477.8	18	276.6	194.3
Greece	x		- 4	60.0	62.6	18	24.7	18.4
Hungary	x		10	52.8	48.0	13	24.1	14.4
Ireland	x		-20	37.7	47.1	16	13.9	11.7
Italy	x		-13	291.0	334.5	17	158.0	124.0
Latvia	x		17	10.0	8.5	40	5.4	4.5
Lithuania	x		15	15.2	13.3	23	6.5	4.3
Luxembourg	x		-20	8.1	10.1	11	4.5	4.2
Malta	x		5	1.2	1.1	10	0.8	0.6
Netherlands	x		-16	107.4	127.8	14	60.7	52.2
Poland	x		14	205.2	180.0	15	96.4	71.6
Portugal	x		1	49.1	48.6	31	22.5	17.4
Romania	since 2007		19	89.8	75.5	24	43.0	30.3
Slovakia	x		13	25.9	23.0	14	16.4	9.2
Slovenia	x		4	12.3	11.8	25	7.1	5.1
Spain	x		-10	212.4	236.0	20	122.6	87.2
Sweden	x		-17	36.1	43.5	49	43.4	30.3
United Kingdom [a]	x		-16	350.9	417.8	15	177.6	129.2

Note: [a] The Faroe Islands and Greenland (Denmark), and the United Kingdom's overseas territories, are not part of the EU and therefore are not covered by the targets presented here.

Sources: EC, 2018c; EU, 2013a, 2013b, 2012, 2009d, 2009c, 2009a.

Table A4.2 Technical details concerning EU climate-related targets

	International commitments			Unilateral EU commitments		
	Kyoto Protocol (CP1)	UNFCCC	Kyoto Protocol (CP2)	2020 climate and energy package		2030 climate and energy framework
				EU Emissions Trading System	Effort Sharing Decision	
Target year or period	First commitment period (2008-2012)	2020	Second commitment period (2013-2020)	2013-2020	2013-2020	2030
Emission target	-8 %	-20 %	-20 %	-21 % compared with 2005 for ETS emissions	Annual targets for Member States. In 2020, -9 % compared with 2005 for ESD emissions	At least -40 %
Other targets		Conditional target of -30 % if other parties take on adequate commitments		RED: renewable energy use — 20 % of gross final energy consumption; EED: increase in energy efficiency by 20 %		Renewable energy use — at least 32 % of energy consumption; at least a 32.5 % increase in energy efficiency
Base year	1990; Kyoto Protocol flexibility rules for fluorinated gases (F-gases) and economies in transition	1990	1990, but subject to flexibility rules. 1995 or 2000 may be used as base year for F-gases or nitrogen trifluoride (NF_3)	1990 for overall emission reduction target; 2005 targets broken down into ETS and non-ETS emissions		1990 for emission reduction target
LULUCF	Included afforestation, reforestation and deforestation (ARD) and other activities if elected	Excluded	Included ARD and forest management (FM), other activities if elected (new accounting rules)	Excluded		No debit rule: emissions do not exceed removals in accounting periods
Aviation	Domestic aviation included; international aviation excluded	Domestic aviation included; international aviation partly included	Domestic aviation included; international aviation excluded	Domestic and international aviation (partly) included in EU ETS	Aviation generally excluded, some domestic aviation included (operators below ETS *de minimis* thresholds)	Not specified yet; expectation of market mechanisms for aviation under the International Civil Aviation Organization (ICAO)
Use of market mechanisms	Use of Kyoto Protocol flexible mechanisms subject to Kyoto Protocol rules	Subject to quantitative and qualitative limits	Use of Kyoto Protocol flexible mechanisms subject to Kyoto Protocol rules	Subject to quantitative and qualitative limits	Subject to quantitative and qualitative limits	None

Table A4.2 Technical details concerning EU climate-related targets (cont.)

	International commitments			Unilateral EU commitments		
	Kyoto Protocol (CP1)	UNFCCC	Kyoto Protocol (CP2)	2020 climate and energy package		2030 climate and energy framework
				EU Emissions Trading System	Effort Sharing Decision	
Carry-over of units from preceding periods	Not applicable	Not applicable	Subject to Kyoto Protocol rules including those agreed in Doha Amendment	Since the second trading period, EU ETS allowances can be banked into subsequent ETS trading periods	No restriction of carry-over within the 2013-2020 period	Full banking in the EU ETS; max. 105 Mio. AEA in total can be transferred from some MS under specific circumstances
Gases covered	Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6)	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3	CO_2, N_2O, PFCs	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 included; NF_3 not included	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, NF_3
Sectors included	Energy, industrial processes and product use (IPPU), agriculture, waste, LULUCF	Energy, IPPU, agriculture, waste, aviation	Energy, IPPU, agriculture, waste, LULUCF	Power and heat generation, energy-intensive industry sectors, aviation	Transport (except aviation), buildings, non-ETS industry, agriculture (except forestry) and waste	100 %
Source for global warming potential values	IPCC Second Assessment Report (SAR)	IPCC SAR; inventory data (including historical data) based on the IPCC Fourth Assessment Report (AR4) from 2015 onwards	IPCC AR4	IPCC AR4		IPCC AR4
Countries included	15 pre-2004 EU Member States (additional Kyoto Protocol targets for the other Member States)	28 EU Member States	28 EU Member States plus Iceland	28 (Iceland, Liechtenstein and Norway also covered under EU ETS)		28 (Iceland and Norway intend to collectively deliver their international commitment with EU)

Table A4.3 Main EU and national climate and energy targets for 2030

	GHG target (2030)	ETS target (2030)	Effort Sharing Decision target (2030)	Renewable target 2030 (RED)	Primary energy target 2030	Final energy target 2030
	% vs. 1990	% vs. 2005		% gross final energy consumption	Mtoe	Mtoe
EU-28	**-40**	**-43**	**-30**	**32**	**1 273**	**956.0**
Austria			-36			
Belgium			-35			
Bulgaria			0			
Croatia			-7			
Cyprus			-24			
Czechia			-14			
Denmark [a]			-39			
Estonia			-13			
Finland			-39			
France			-37			
Germany			-38			
Greece			-16			
Hungary			-7			
Ireland			-30			
Italy			-33			
Latvia			-6			
Lithuania			-9			
Luxembourg			-40			
Malta			-19			
Netherlands			-36			
Poland			-7			
Portugal			-17			
Romania			-2			
Slovakia			-12			
Slovenia			-15			
Spain			-26			
Sweden			-40			
United Kingdom [a]			-37			

Note: [a] The Faroe Islands and Greenland (Denmark), and the United Kingdom's overseas territories, are not part of the EU and therefore are not covered by the targets presented here.

Sources: EU, 2018a; European Council, 2014, EC, 2018d, EC, 2016a.

Annex 5 International climate commitments in Europe

A5.1 The UNFCCC, the Kyoto Protocol and the Paris Agreement

In 1992, countries across the globe adopted the UNFCCC to cooperatively consider options for limiting average global temperature increases and the resulting climate change. Under the UNFCCC, developed country parties (Annex I parties) ([35]) are specifically obliged to commit to adopting national policies and to take corresponding measures for the mitigation of climate change.

The Kyoto Protocol was the first international legally binding agreement signed under the UNFCCC. It specifies the mitigation obligations of the Annex I parties that signed the agreement. It was signed in 1997 and entered into force in 2005. The first commitment period of the Kyoto Protocol ran from 2008 until 2012. In this first period, 37 industrialised countries committed to reducing GHG emissions by an average of 5 % compared with 1990 levels. The EU (comprising 15 Member States at that time) pledged to jointly reduce its GHG emissions by 8 % compared with base year levels. This target was fulfilled.

In Doha, Qatar, in 2012 (at the 18th session of the Conference of the Parties (COP 18) and the eighth Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) (CMP 8)), the second commitment period (2013-2020) was delineated; the Doha Amendment (UNFCCC, 2012a) includes new QELRCs for Annex I parties intending to take part in the second commitment period. Overall, the Doha Amendment sets an emission reduction objective of 18 % less than 1990 levels for all parties to the Kyoto Protocol for the second commitment period. The Doha Amendment's entry into force is subject to acceptance by at least three quarters of the Parties to the Kyoto Protocol ([36]). Although the EU and its 28 Member States, and Iceland, Liechtenstein, Norway and Switzerland (i.e. all EEA countries), agreed on QELRCs for the second commitment period, other countries, such as Canada, Japan, New Zealand and Russia, did not submit targets for the second commitment period (despite having targets under the first commitment period). Overall, emissions by countries with targets for the second commitment period make up only 14-15 % of global emissions (EC, 2013b).

The EU has been at the forefront of international efforts towards a global climate deal. After limited participation in the Kyoto Protocol and a lack of an agreement in Copenhagen in 2009, the EU has been building a broad coalition of developed and developing countries in favour of high ambition; this shaped the successful outcome of the Paris conference (COP 21). The Paris Agreement is a bridge between today's policies and climate neutrality before the end of the 21st century. Governments have agreed on a long-term goal of ensuring that the increase in global average temperature does not exceed 2 ºC above pre-industrial levels, aiming to limit the increase to no more than 1.5 ºC, as this would significantly reduce risks and the impacts of climate change.

Before and during the Paris conference, countries submitted comprehensive national climate action plans (INDCs). These are not yet sufficient to keep global warming levels below 2 ºC, but the agreement will help towards achieving this target. The EU was the first major economy to submit its intended contribution to the new agreement, in March 2015 (EU, 2016b). It is already taking steps to implement its target to reduce emissions by at least 40 % by 2030. The agreement entered into force on 4 November 2016, when 55 countries, which collectively account for at least 55 % of global emissions, had deposited their instruments of ratification. As of July 2018, 178 of 197 countries have ratified the Paris Agreement.

([35]) A party is a state (or regional economic integration organisation such as the EU) that agrees to be bound by a treaty and for which the treaty has entered into force. Annex I parties are those listed in Annex I of the UNFCCC; they comprise industrialised countries that were members of the Organisation of Economic Co-operation and Development (OECD) in 1992, as well as countries with economies in transition (UNFCCC, 2014).

([36]) Since COP 21 in 2015, all necessary decisions on methodological issues have been adopted by the COP. Still, as of 6 July 2017, only 79 countries have ratified the Doha Amendment.

A5.2 Progress of the EU under the second commitment period of the Kyoto Protocol (2013-2020)

For the second commitment period of the Kyoto Protocol, the EU, its 28 Member States and Iceland agreed to a joint QELRC corresponding to a 20 % reduction compared with the base year. They declared that they intended to fulfil this commitment jointly, under Article 4 of the Kyoto Protocol. Three other EEA member countries, Liechtenstein, Norway and Switzerland, also agreed on QELRCs for the second commitment period.

The Council adopted, on 13 July 2015, the legislation necessary for the EU to formally ratify the second commitment period of the Kyoto Protocol. The Council adopted two decisions:

- Council decision on the ratification of the Doha Amendment to the Kyoto Protocol establishing the second commitment period;
- Council decision on the agreement between the EU, its Member States and Iceland, necessary for the joint fulfilment of the second commitment period of the Kyoto Protocol.

In parallel with ratification by the EU, the individual Member States and Iceland will finalise their national ratification processes; as of 12 September 2018, 116 Parties had ratified, including the EU, Iceland and all Member States apart from Poland. Poland has completed its internal ratification procedures and planned to deposit its ratification instrument during the UN General Assembly in September 2018.

Table A5.1 Emission reduction commitments by EU and EEA countries for the Kyoto Protocol's second commitment period (2013-2020)

Party	QELRCs submitted by parties (2013-2020)
	Reduction compared with base year emissions (%)
EU	20.0
Iceland	20.0
Liechtenstein	16.0
Norway	16.0
Switzerland	15.8

Source: UNFCCC, 2012a.

A5.3 Methodological details related to targets under the Kyoto Protocol and the UNFCCC

A5.3.1 Second commitment period

The main amendments to Kyoto Protocol rules for the second commitment period (from 2013 to 2020), compared with the rules that were applicable in the first commitment period (from 2008 to 2012), are as follows:

- In addition to the gases covered in the first commitment period, the target for the second commitment period also covers NF_3.
- An ambition mechanism allows a party to adjust its commitment by increasing its ambition during a commitment period.
- Surplus assigned amount units (AAUs) from the first commitment period of the Kyoto Protocol can be carried over according to specific accounting rules (for further details, see *Trends and projections in Europe 2014* (EEA, 2014)).
- The AAUs of a party for the second commitment period can be adjusted to prevent an increase in its emissions for the 2013 to 2020 period, beyond its average emissions for the years 2008-2010.
- There are new accounting rules for emission removals from LULUCF, in accordance with the relevant decisions made at COP 17 in Durban (UNFCCC, 2012b).
- Emissions of non-CO_2 gases are converted into CO_2 equivalent emissions using the GWP values included in the AR4 (IPCC, 2007).

However, several rules are unchanged for the second commitment period. As in the first commitment period, the target for the second commitment period refers to 1990 as a single base year, but it allows for different base years according to the flexibility rules for F-gases and economies in transition (as described above). For the newly added GHG NF_3, either 1995 or 2000 may be used as the base year. Base years for individual Member States have not yet been set for the second commitment period. The use of certified emission reductions (CERs) from the clean development mechanism (CDM), emission reduction units (ERUs) ([37]) from joint implementation projects

([37]) A Kyoto unit representing an allowance to emit 1 tonne of CO_2e ERUs are issued for emission reductions or emission removals from joint implementation project activities by converting an equivalent quantity of the party's existing AAUs or RMUs.

and the possible recognition of units from new market-based mechanisms are all possible to achieve targets (still capped under EU domestic legislation). Sector coverage remains the same.

A5.3.2 Convention (the United Nations Framework Convention on Climate Change)

In 2010, the EU submitted a pledge to reduce its GHG emissions by 20 % by 2020, compared with 1990 levels. This was intended to contribute to achieving the ultimate objective of the UNFCCC: 'to stabilise GHG concentrations at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system'. In other words, to limit the global temperature increase to less than 2° C above temperature levels before industrialisation. The EU clarified that the accounting rules for its target under the UNFCCC are more ambitious than the current rules under the Kyoto Protocol. For example, international aviation has been included, an annual compliance cycle for emissions under the ESD has been added, and there are higher quality standards for emission credits from the Kyoto Protocol's CDM used under the ETS (UNFCCC, 2013). Accordingly, the following assumptions and conditions apply to the EU's target of a 20 % reduction under the UNFCCC:

- Emissions or removals from LULUCF are not included (but moving to the higher target of 30 % would require some contribution from LULUCF).
- The target refers to 1990 as a single base year, not allowing for different base years for F-gases or economies in transition, as under the Kyoto Protocol.
- Emissions from international and domestic aviation are partly included in the target; furthermore, the target covers the IPCC sectors of energy, industrial processes and product use (IPPU), agriculture and waste.
- A limited number of CERs, ERUs and units from new market-based mechanisms may be used to achieve the target: under the EU ETS, the use of international credits is capped (up to 50 % of the reduction required from EU ETS sectors by 2020 can be achieved using carbon credits). Quality standards also apply to the use of international credits in the EU ETS, including a ban on credits from LULUCF projects and certain industrial gas projects. In the Effort Sharing sectors, the annual use of international credits is limited to up to 3 % of each Member State's Effort Sharing emissions in 2005, with a limited number of Member States being permitted to use an additional 1 % from projects in LDCs and SIDS, subject to conditions. These caps thus define the concept of the supplementary use of market-based mechanisms for the fulfilment of targets. They also indicate that the EU applies more ambitious rules regarding the use of market-based mechanisms towards its target under the UNFCCC than would be applied in the context of the Kyoto Protocol.
- The carry-over of surplus AAUs from the first commitment period of the Kyoto Protocol is not possible (but surplus EU emission allowances allocated under the EU ETS can be banked from the period 2008-2012 into subsequent periods).
- The target covers the gases CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorinated compounds (PFCs) and sulphur hexafluoride (SF_6), consistent with the GHGs covered under the reporting requirements under the convention (UNFCCC, 2013b).

A5.4 Land use, land use change and forestry activities under the Kyoto Protocol

In addition to policies and measures that target sources of GHG emissions, countries can use policies and measures to protect their existing terrestrial carbon stocks (e.g. by reducing deforestation) and to further enhance terrestrial carbon stocks (e.g. by increasing the area or carbon density of forests).

The following LULUCF activities are included under the Kyoto Protocol:

- Afforestation, reforestation and deforestation (ARD) since 1990 (mandatory activities covered by Article 3.3 of the Kyoto Protocol), for land that has been subject to direct, human-induced conversion from a non-forest to a forest state, or vice versa, are included.
- Forest management (FM), cropland management (CM), grazing-land management (GM) and revegetation (RV) are included. Although CM, GM and RV are voluntary, FM has been a mandatory activity since the second commitment period under Article 3.4 of the Kyoto Protocol. These activities pertain to land that has not undergone conversion since 1990 but is otherwise subject

to a specific land activity. Parties account for net emissions or removals for each activity during the commitment period by issuing removal units (RMUs) ([38]), in the case of net GHG removals from LULUCF activities, or by cancelling Kyoto units in the case of LULUCF activities that are a net source of GHG emissions. LULUCF activities can therefore be used to offset emissions from other sources if removals are higher than emissions from this sector. In the first commitment period, the number of RMUs that could be issued by each party under FM was capped. For the second commitment period, FM activities are accounted for against an 'FM reference level', i.e. a country-specific level of business-as-usual emissions or removals. RMUs are issued only if FM removals are higher or emissions are lower than the agreed FM reference level. Otherwise, Kyoto units are cancelled.

Removal units can be accounted for at the end of a commitment period or annually. According to Decision 13/CMP.1, parties must indicate the frequency of accounting with their initial reports. For each activity under Article 3.3 and Article 3.4, parties have elected to account for emissions or removals either annually during the commitment period, or only once at the end of this period. The decision on frequency of accounting determines when parties can issue RMUs or cancel other units in the case of emissions from Article 3.3 and Article 3.4 activities.

For the second commitment period, new accounting rules apply for the accounting of emissions and removals in the LULUCF sector. In particular, additional activities for wetland management can be accounted for on a voluntary basis. Guidelines for these new rules were developed by the IPCC and adopted by the UNFCCC. Subsequently, the rules were almost entirely transferred into EU law in the form of EU Decision 529/2013/EU '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'. This legislation harmonises EU reporting on LULUCF with Kyoto Protocol requirements, but it also goes beyond these requirements. Under EU rules, Member States must also report on agricultural activities (CM and GM), irrespective of whether or not these activities are elected under the Kyoto Protocol.

LULUCF emissions and removals are not included in the EU domestic 2020 target under the climate and energy package. Instead, the rules from the First and Second Commitment Period of the Kyoto Protocol and from Decision 529/2013/EU form the basis for the integration of LULUCF into the EU's 2030 climate framework.

A5.5 Emissions from aviation

Although GHG emissions from domestic and international aviation have been partly included in the EU's target under the UNFCCC since 2012 as part of the EU ETS, only emissions from domestic aviation are included in its targets under the Kyoto Protocol. Domestic aviation from the EU Member States amounts to less than 0.5 % of total GHG emissions without LULUCF, whereas the international aviation of EU Member States totals about 3 % of total emissions.

In principle, the EU ETS covers all flights arriving at, and departing from, airports in all EU Member States, Iceland, Liechtenstein and Norway, and closely related territories. However, since 2012, flights to and from airports in other countries have not been included in the EU ETS. This exclusion, first resulting from the 'stop the clock' decision (EU, 2013d), was made to facilitate the negotiation of a global agreement on aviation emissions in autumn 2013 by the General Assembly of the International Civil Aviation Organization (ICAO). At its 38th meeting in autumn 2013, the ICAO decided on a roadmap for the development of a global market-based mechanism to tackle aviation emissions. In 2016, the ICAO agreed on a Resolution for a global market-based measure to address CO_2 emissions from international aviation as of 2021. The agreed Resolution sets out the objective and key design elements of the global scheme, as well as a roadmap for the completion of the work on implementing modalities. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), aims to stabilise CO_2 emissions at 2020 levels by requiring airlines to offset the growth of their emissions after 2020.

The EU decided to continue with a reduced scope in the period 2013-2016 (EU, 2014c). Only flights between airports located in countries in the European Economic Area are included in this scope. Flights to and from outermost regions, as per Article 349 of the Treaty on the Functioning of the European Union (TFEU), are covered if they occur only in the same outermost

([38]) A Kyoto unit representing an allowance to emit 1 metric tonne of CO_2e RMUs are issued for emission removals from LULUCF activities under Article 3, paragraphs 3 and 4.

region. In light of the progress on the global measure, the European Commission continues the current approach beyond 2016 (EU, 2017d).

More than 1 200 aviation operators are currently included in the EU ETS. The cap for aviation in the EU ETS is based on average historical emissions in this sector between 2004 and 2006 (221.4 $MtCO_2$ for all participating countries) ([39]). The cap for the period 2013-2020 is equivalent to 95 % of baseline emissions (EU, 2009b). Whereas aircraft operators may use EU Aviation Allowances (EUAAs) as well as EU Allowances (EUAs) from the stationary sectors, stationary installations are not permitted to use aviation allowances for compliance. In addition, some international credits can be used by aircraft operators: up to 14 % of their verified emissions in 2012, and, from 2013 onwards, each aircraft operator is entitled to use international credits up to a maximum of 1.5 % of its verified emissions during the period 2013-2020, without prejudice to any residual entitlement from 2012.

([39]) The annual average of CO_2 emissions in the years 2004, 2005 and 2006 forms the baseline for historical aviation emissions, based on data from the European Organisation for the Safety of Air Navigation (Eurocontrol) and fuel consumption information provided by aircraft operators.

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

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

Publications Office

European Environment Agency