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# Trends and projections in Europe 2019

## Tracking progress towards Europe's climate and energy targets

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

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

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# Acknowledgements

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

The authors were Hannah Förster, Sabine Gores, Christian Nissen (Öko-Institut); Nele Renders (Vito); Suzanne Dael, Melanie Sporer and Mihai Tomescu (EEA).

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# Executive summary

## 2030 is a key milestone in the EU's push for climate neutrality

Building on its climate change mitigation policies and greenhouse gas emissions reductions over recent decades, the EU aims to become the world's first climate-neutral economy. Achieving climate neutrality will help Europe contribute to the Paris Agreement objectives of limiting global temperature increase to well below 2˚ C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5˚ C, but will require substantial change across Europe. Some of this change has already been initiated and progress towards 2020 and 2030 targets to reduce greenhouse gas emissions is underway. A new long-term strategic vision for 2050, which the European Commission set out in November 2018, provides a range of challenging but feasible pathways for the transition towards climate neutrality. These pathways would all necessitate shifts in many areas of society, not least towards the intensified generation of low- to zero- carbon-based energy, as well as considerable savings in energy consumed.

This report presents an analysis of the progress made in Europe towards 2020 and 2030 targets for climate and energy, based on official statistics on energy and greenhouse gas emissions up to and including 2017, preliminary data for 2018, and national projections of greenhouse gas emissions reported in 2019. The report shows that current efforts by Member States are still insufficient to achieve the EU targets set for 2030. As such, a further gear shift will be needed for the EU and its Member States to deliver collectively on their long-term objectives until 2050.

In general, the 2020 targets appear to be achievable for greenhouse gas emissions reductions while they are just within reach for renewable energy developments. Meeting the energy efficiency target appears increasingly difficult as 2020 approaches. See also Figure ES.1.

## Significant increase in efforts needed over the next decade

Planning and preparation for achieving the 2030 targets is currently underway, with Member States indicating the new policies and measures that will deliver on greenhouse gas reductions, renewable energy and energy efficiency in the mid-term. Specifically, European Member States are planning how to collectively achieve:

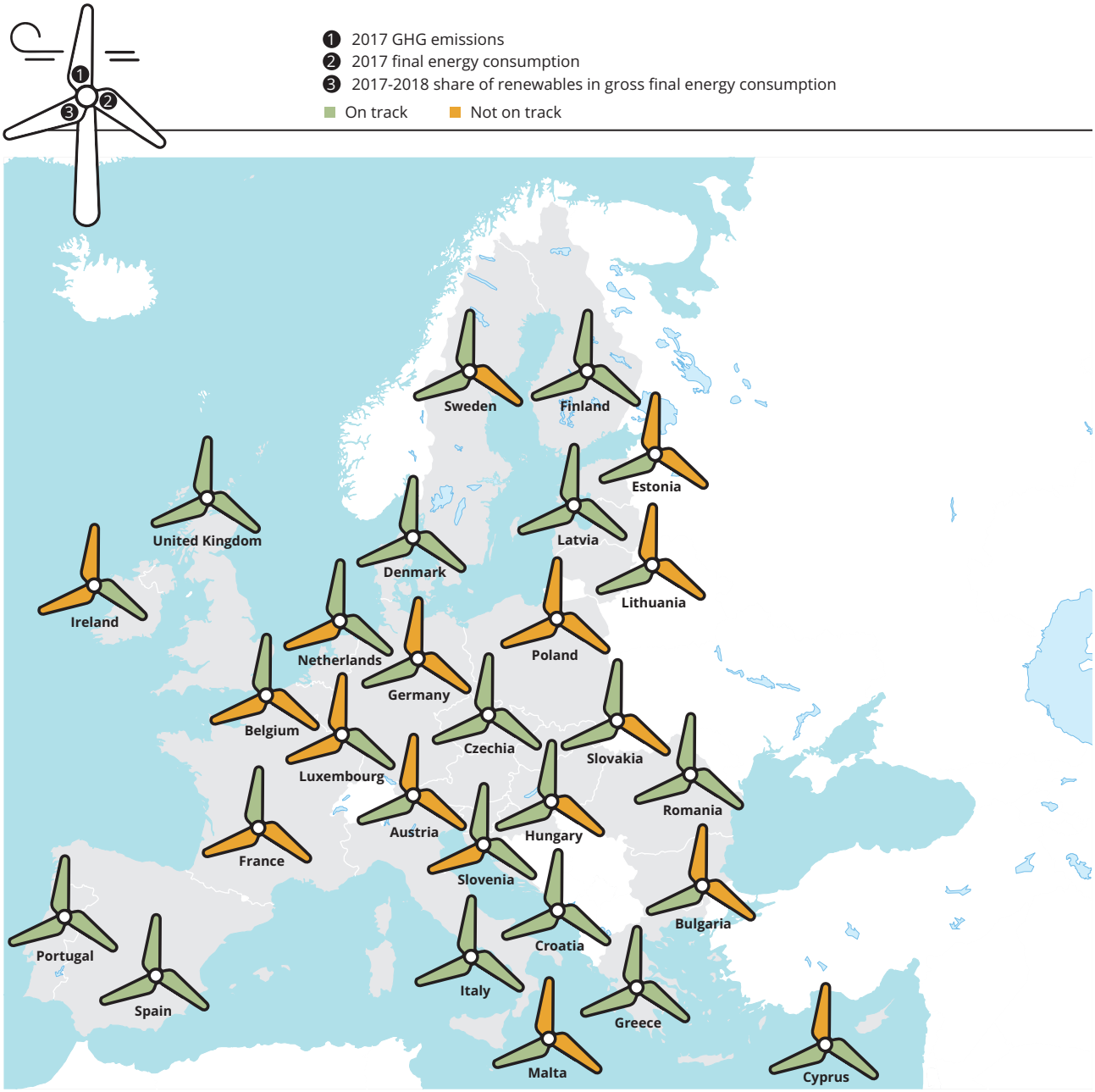
- at least a 40 % reduction in domestic greenhouse gas (GHG) emissions (compared with 1990 levels), with binding annual GHG emission reduction targets for EU Member States from 2021 to 2030 for the sectors not covered by the EU Emissions Trading System (ETS);
- an increase in the share of renewable energy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

The analysis of current progress in each of these three target areas already suggests that securing the EU's mid-term goals remains challenging at this stage.

## Greenhouse gas emissions: on track for 2020, not quite but nearly for 2030

In 2017, greenhouse gas emissions across Europe had already fallen to 21.7 % below 1990 levels. Preliminary data recently reported by Member States show that there was a 2.0 % decrease from 2017 to 2018, bringing collective reductions down to 23.2 % below 1990, well under the 2020 target. While the EU target of reducing its greenhouse gas emissions by 20 % compared with 1990 levels by 2020 appears to be within reach and EU legislation to meet the 2030 GHG target has been adopted, aggregated projections from Member States are not yet in line with the minimum required 40 % reduction target. Together, Member States project that current policies and measures can deliver a 30 % reduction by 2030, while the reported additional policies and measures they intend to launch in the coming years can deliver a 36 % reduction by 2030. While this presents a more positive outlook compared with last year's projections, meeting the 2030 target will demand further efforts.

**Figure ES.1 Current progress of Member States towards 2020 climate and energy targets**



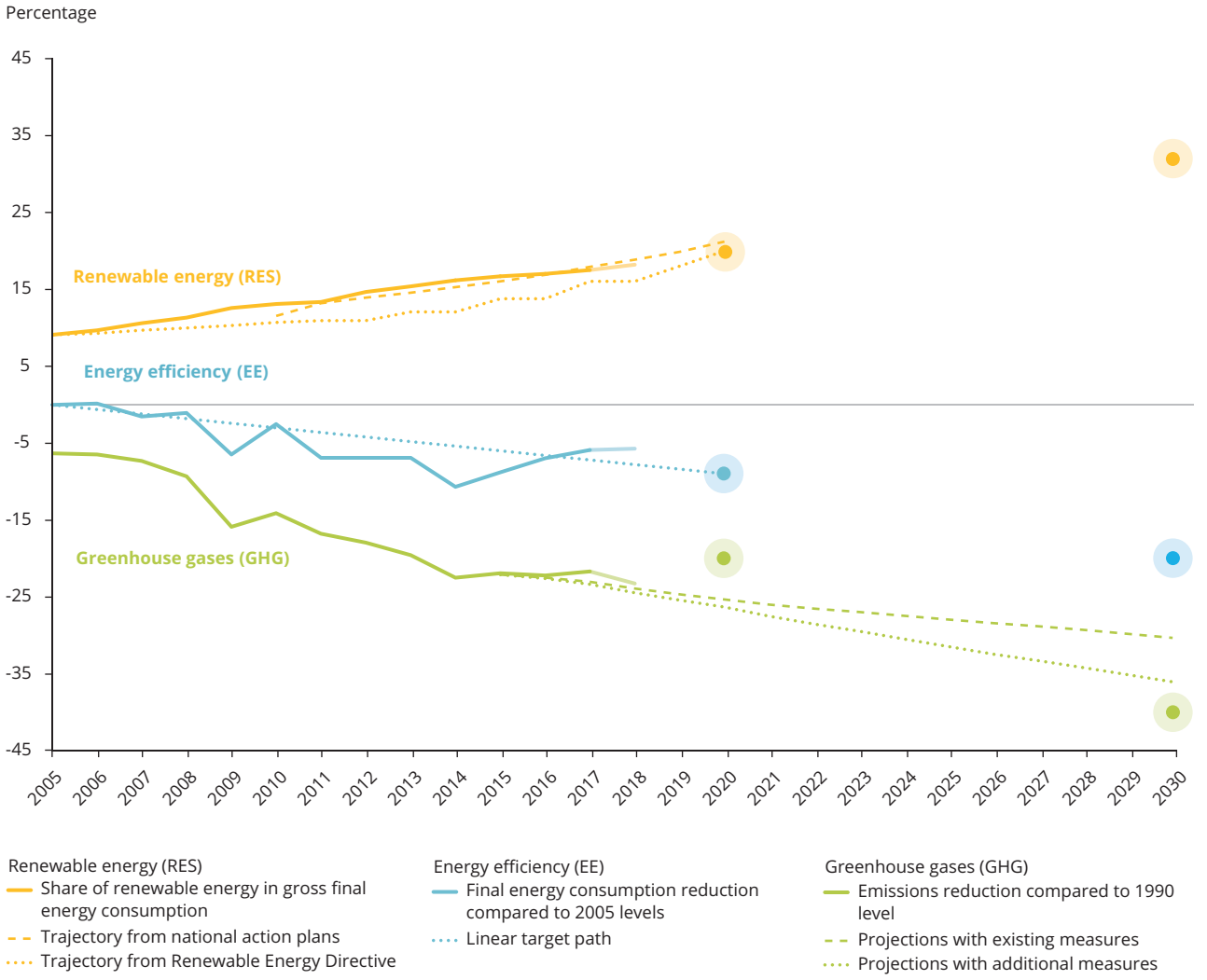

**Note:** The colours indicate whether countries are considered on track or not towards their 2020 climate and energy targets. For greenhouse gases, orange means that 2017 emissions covered by the Effort Sharing Decision (ESD) were above the 2017 national ESD target. For renewable energy, orange means that the 2017-2018 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 2017 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 (2019b, 2019e, 2019f).

On average, EU Member States' past efforts delivered emissions reductions in the order of 46 Mt $CO_2$e per year between 1990 and 2017. Since 2005, average reductions have risen to 73 Mt $CO_2$e per year. To achieve an overall 40 % reduction by 2030, this annual reduction will need to be 81 Mt $CO_2$e per year, on average, from 2017 until the target year of 2030 (Figure ES.2).

Such acceleration is possible and similarly high reduction rates were achieved in certain years over the last three decades. However, the reduction rate until 2030 will need to be sustained year-on-year, drawing on all sectors. In recent years, sluggish emissions reductions in certain sectors have begun to indicate which areas will require particular attention in the coming decade.

**Figure ES.2 EU progress towards 2020 and 2030 targets on climate and energy**




**Note:** For renewable energy, the figure represents the trend in the share of energy from renewable sources in gross final energy consumption since 2005. The 2020 renewable energy target corresponds to a share of 20 %.

The 2020 target for energy efficiency was defined as a 20 % saving in energy consumption compared with baseline projections. This is equivalent to a 13 % reduction of primary energy consumption (or an 8 % reduction in final energy consumption) from 2005 levels. The figure represents the relative change in primary energy consumption since 2005.

The 2020 target for greenhouse gas emissions corresponds to a 20 % reduction from 1990 levels. The trends and projections represented in the figure correspond to relative changes in emissions compared with 1990 levels. The projections are presented in the 'with existing measures' scenario, which reflects existing and currently adopted policies and measures, and the 'with additional measures' scenario, which reflects planned national policies and measures.

**Sources:** EC (2007, 2013c); EEA (2019b, 2019e, 2019f; 2019a; 2019c; 2019b; 2011); EU (2012, 2009b); Eurostat (2019b, 2019c, 2019d).

Among the sectors covered by the EU Emissions Trading System (ETS), continued emissions reductions are expected. However, most of the projected reductions until 2030 are expected to occur in the power sector, whereas emissions from other industrial activities are envisaged to remain stable during this period. The emissions from international aviation, which almost doubled between 1990 and 2017, are expected to increase further by 2030. Member States' most recent projections indicate that total emissions reductions would bring the EU ETS to within 1.3 percentage points of its legislated contribution of a 43 % reduction by 2030, compared with 2005.

Within the sectors covered by the Effort Sharing legislation, which establishes annual binding targets until 2030 at Member State level, emissions have fallen at a slower rate than among the ETS sectors. After a period of steady decline, Effort Sharing emissions began to increase in 2014 — a trend that continued until 2017. The most recent data indicate that total Effort Sharing emissions fell again in 2018, by 0.9 %

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

Gap to 2030 Effort Sharing target with existing measures (in percentage points of ESD 2005 base-year emissions)

On track
Not on track


**Sources:** EEA (2019b, 2019e, 2019f).

from the previous year. This reversal will help to ensure the 2020 Effort Sharing targets — to which Member States currently appear to be collectively on track — are met.

At the national level, current progress is more contrasting. Some Member States have already reduced their emissions to levels below their 2020 target, while for others, the gaps between observed emissions and national targets are widening (see a presentation of progress at country level in Figure ES.3 and Table ES.1). In 2017, 18 Member States had greenhouse gas emissions levels at or below their respective annual Effort Sharing targets, while in 2018, this fell to 17 Member States.

According to the projections submitted by Member States in 2019, only three Member States (Greece, Portugal and Sweden) expect that their current policies and measures will be sufficient to deliver their 2030 Effort Sharing targets on time. An additional seven Member States (Belgium, Croatia, France, Hungary, Italy, Slovakia and Spain) plan to implement additional policies and measures that will help ensure they achieve their 2030 Effort Sharing targets. The remaining eighteen Member States have not yet indicated in their

reported projections how they intend to achieve their Effort Sharing targets.

## Renewable energy: on track for 2020, not for 2030 — the transport sector is lagging

In the areas of renewable energy development and energy efficiency, there are no binding national targets set to ensure that EU-wide 2030 targets in these areas are met. Member States are using their National Energy and Climate Plans — which are to be finalised by the end of 2019 — to set national objectives for their 2030 achievements in these and other areas. Only once these plans are finalised will it be possible to track Member States' progress to their 2030 objectives.

With a 17.5 % share of consumed energy generated by renewable sources in 2017 and an estimated 18.0 % share in 2018 (EEA estimates), the EU remains above the indicative levels for these years set in the Renewable Energy Directive. It appears therefore to be on track to meeting its 2020 target of a 20 % share.

The current pace of deployment of renewable energy remains, however, insufficient to achieve the EU's 2030 target of at least a 32 % renewable energy share. Since 2005, the use of energy from renewable sources as a proportion of gross final energy consumption has been growing at an average rate of 0.7 percentage points every year. To meet the 2030 renewable energy target, the average annual growth of renewable energy use across the EU would have to increase to at least 1.1 percentage points per year over the next decade.

Achieving such growth in the share of renewable energy sources can be achieved both through the further development of renewable energy generation and the reduction of energy consumed from non-renewable sources. In recent years, total energy consumption in the EU grew faster than energy consumption from renewable sources. Such trends will need to be reversed to meet the 2030 target. The 2030 target is also challenged by the slow growth of renewable energy in the transport sector. In 2017, 7.6 % of energy in transport was from renewable sources and the sector remains at risk of missing the 10 % target set for 2020.

In 2017, 21 Member States (24 in 2018, according to recent EEA estimates) indicated a renewable energy share that met or surpassed their respective trajectories towards 2020 targets, as designated by the Renewable Energy Directive. Moreover, the share of consumed energy coming from renewable sources exceeded the respective targets for 2020 for eleven of these Member States in 2017 (Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania and Sweden) and for twelve Member States in 2018 (the same as in 2017, with the addition of Latvia).

## Energy efficiency: risk that 2020 and 2030 targets will not be met

In the area of energy efficiency, targets are expressed — and progress is monitored — in terms of both primary and final energy consumption. Recent data confirm the increasing trend in final energy consumption observed in Europe in recent years, with a further rise of 0.1 % expected for 2018 (EEA estimates). This would make 2018 the fourth consecutive year with increasing final energy consumption. At the same time, a decrease of 0.9 % in primary energy consumption is anticipated for 2018. Unless the recent increasing trend in final energy consumption is reversed very soon, and the decline in primary energy consumption shown in initial indications accelerates, the EU risks missing its 2020 energy efficiency target of a 20 % reduction from baseline energy consumption levels in 2020 (as projected in the 2007 Baseline Scenario of the European Commission).

While a number of factors are at play in the rising energy consumption, the greatest increases have been observed in energy consumption in buildings, which rose by 8.3 % between 2014 and 2017, and in transport, which rose by 5.8 % in the same period. Additional factors, such as lower fuel prices and weather conditions have also affected energy consumption trends in recent years.

To meet the 2030 target for energy consumption reductions of at least 32.5 %, annual reductions in EU energy consumption over the next decade will have to be more than double the average rate of reductions observed between 2005 and 2017. Primary energy consumption across the EU has fallen by an average of 13 Mtoe per year since 2005 and final energy consumption has fallen by 6 Mtoe over the same period. However, to meet the 2030 target annual average savings of 22 Mtoe and 13 Mtoe, respectively, will be required from 2017 until 2030. To reverse these trends in growing energy consumption and achieve the sustained pace required for the EU to meet its 2030 energy efficiency targets, Member States will need to adopt new policies and implement additional measures to those in place today.

Despite overall energy efficiency developments and the risk of missing the 2020 energy efficiency target at EU level, a number of Member States have demonstrated

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

| Member State | Greenhouse gas emissions | | | | Renewable energy | | Energy efficiency | |
|---|---|---|---|---|---|---|---|---|
| | Gap to ESD emission target (2017) | Gap to ESD emission target (2018) | Gap to 2020 ESD target (WEM) | Gap to 2030 ESD target (WEM) | Gap to 2017-2018 of RED trajectory (2017 RES share) | Gap to 2017-2018 of RED trajectory (2018 RES share) | Gap to 2017 FEC indicative linear (2017) | Gap to 2018 FEC indicative linear (2018) |
| | Percentage points (share of 2005 base-year emissions) | | | | Percentage points (share of renewable energy in gross final energy consumption) | | Percentage points (share of 2005 final energy consumption) | |
| Austria | -3.8 | -3.0 | -5.5 | -20.2 | 2.3 | 2.6 | -10.2 | -8.8 |
| Belgium | 2.1 | -0.4 | -4.5 | -21.7 | -0.2 | 0.1 | -7.5 | -9.4 |
| Bulgaria | -2.9 | -3.0 | 5.0 | -8.1 | 5.0 | 5.0 | -9.4 | -11.0 |
| Croatia | 11.6 | 9.7 | 19.2 | -1.2 | 9.9 | 10.3 | 1.2 | 2.0 |
| Cyprus | -1.8 | -1.5 | -8.9 | -24.8 | 0.4 | 0.5 | 2.8 | 2.6 |
| Czech Republic | 4.6 | 2.9 | 6.5 | -1.5 | 4.2 | 4.3 | 0.1 | 1.1 |
| Denmark | 5.2 | 3.6 | 0.5 | -16.2 | 10.3 | 11.0 | 0.2 | -0.2 |
| Estonia | -5.1 | -6.9 | 1.8 | -24.8 | 6.7 | 5.5 | -0.5 | 1.7 |
| Finland | 0.3 | -1.2 | -1.4 | -15.5 | 6.3 | 7.1 | 4.3 | 4.8 |
| France | 1.4 | 2.5 | -0.7 | -13.3 | -2.3 | -1.7 | -7.4 | -4.9 |
| Germany | -7.2 | -3.4 | -5.4 | -16.2 | 1.7 | 2.9 | -8.9 | -8.9 |
| Greece | 21.9 | 23.3 | 21.0 | 9.1 | 2.8 | 2.9 | 10.3 | 9.3 |
| Hungary | 14.4 | 15.9 | 20.3 | -3.0 | 3.4 | 3.7 | -17.3 | -21.2 |
| Ireland | -6.3 | -11.8 | -14.7 | -23.5 | -0.8 | -0.4 | 7.8 | 2.5 |
| Italy | 8.4 | 6.3 | 6.8 | -6.1 | 5.4 | 4.7 | 8.4 | 6.7 |
| Latvia | 5.7 | 7.4 | 10.4 | -2.0 | 1.6 | 2.8 | 9.0 | 6.5 |
| Lithuania | -0.1 | 2.7 | 8.8 | -14.0 | 5.6 | 4.1 | -21.2 | -25.2 |
| Luxembourg | -0.1 | -5.5 | -5.2 | -25.3 | -1.1 | 1.4 | 2.3 | -0.9 |
| Malta | -22.8 | -26.8 | -26.5 | -61.7 | 0.7 | 1.0 | -5.5 | -7.9 |
| Netherlands | 9.2 | 7.8 | 10.4 | -3.6 | -3.3 | -3.0 | 4.1 | 4.3 |
| Poland | -6.4 | -9.0 | -0.2 | -20.9 | -1.4 | -1.3 | -3.3 | -4.2 |
| Portugal | 15.9 | 15.5 | 24.7 | 26.2 | 0.8 | 0.6 | 6.1 | 6.2 |
| Romania | 11.5 | 15.5 | 17.6 | -12.5 | 2.6 | 3.0 | 24.3 | 25.0 |
| Slovakia | 16.5 | 14.9 | 19.7 | -5.4 | 0.0 | 0.2 | -13.8 | -18.7 |
| Slovenia | 11.2 | 10.6 | 13.3 | -0.2 | -0.3 | 0.0 | 4.3 | 4.1 |
| Spain | 7.3 | 5.8 | 4.1 | -9.7 | 1.5 | 1.7 | 5.2 | 2.3 |
| Sweden | 12.1 | 10.4 | 15.3 | 0.1 | 8.7 | 11.2 | -0.1 | -3.4 |
| United Kingdom | 6.8 | 6.7 | 10.7 | -4.9 | 0.0 | 0.9 | 0.4 | -1.8 |

**Sources:** EC (2007, 2013c); EEA (2019b, 2019e, 2019f; 2019a; 2019c; 2019b; 2011); EU (2012, 2009b); Eurostat (2019b, 2019c, 2019d).

notable progress in this area. In the context of the Energy Efficiency Directive, Member States have set their own national non-binding energy efficiency targets for 2020, and 20 of them seek to achieve reductions in their total final energy consumption. However, in 2017, 12 Member States had levels of energy consumption that exceeded a linear trajectory from 2005 levels to their national 2020 targets.

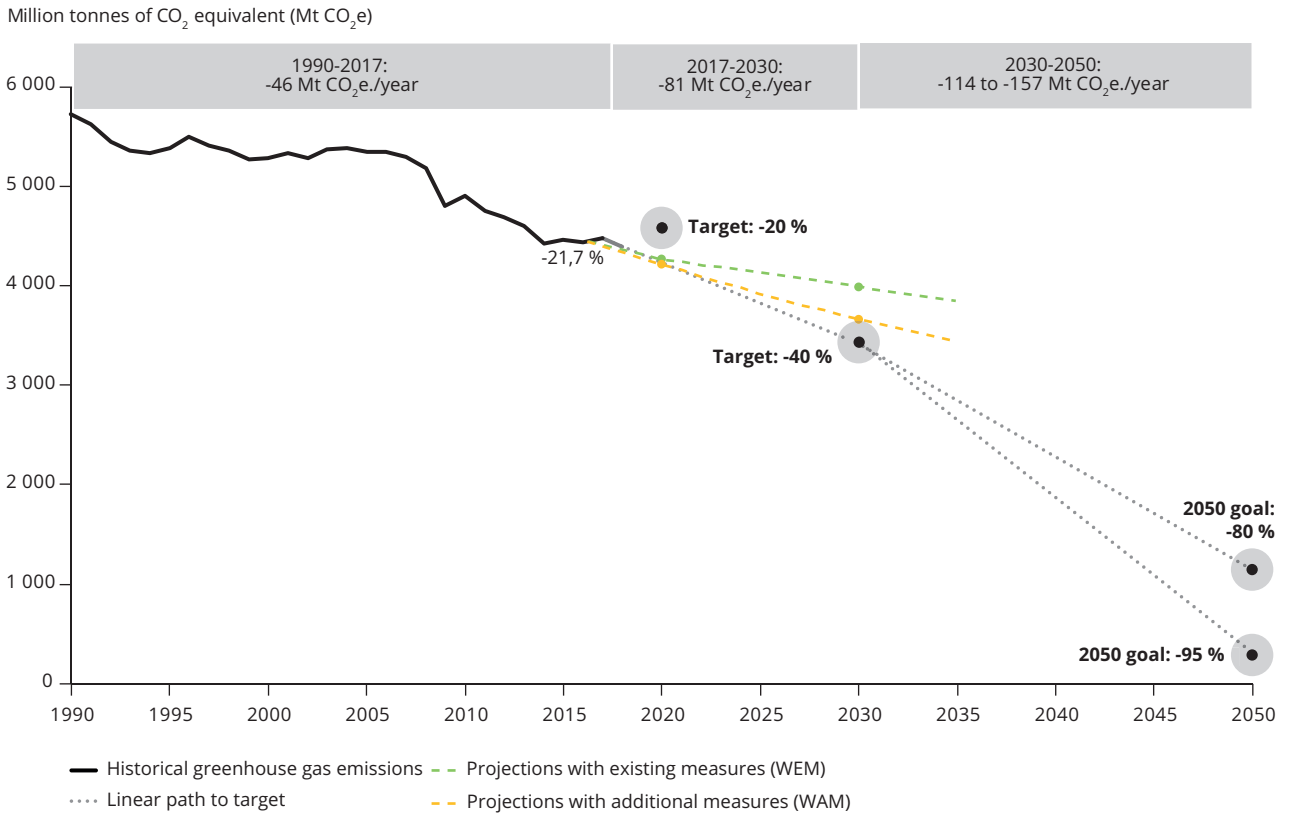
## National policies to meet 2030 targets pave the way for a longer-term transition

In 2019, Member States are drafting long-term strategies for at least the next 30 years and finalising their National Energy and Climate Plans until 2030. These strategies will contribute to GHG emissions reductions and the enhancement of GHG removal by

sinks in line with Member State and EU commitments under Paris Agreement objectives and as part of a highly energy efficient and renewables-based energy system within the EU. Each Member State has a unique starting point and a distinctive resource base upon which to make changes and developments over the next 30 years. As such, these long-term strategies should reflect the combination of emissions reductions and the enhancement of removals that can be sought in a variety of sectors, including electricity, industry, transport, heating, cooling and buildings, agriculture, and waste, as well as land use, land use change and forestry. As substantial change is expected to arise from decarbonisation measures implemented in each Member State, the national long-term strategies will also reflect how decarbonisation measures may affect macroeconomic and social development, as well as health, and environmental protection.

Final National Energy and Climate Plans will be submitted by 31 December 2019 and long-term strategies by 1 January 2020. This concurrence represents an opportunity for Member States to ensure full coherence between the policies they plan to implement to achieve their 2030 objectives and the scenarios they will put forward for contributions to EU climate neutrality in line with the Paris Agreement. Enhanced efforts will be needed after 2030, as illustrated in Figure ES.4, but these could be made easier if Member States design new policies to reach their 2030 targets that also have longer-term targets in perspective.

**Figure ES.4 Greenhouse gas emission trends, projections and targets in the EU**




**Note:** The GHG emission trends, projections and target calculations include emissions from international aviation, and exclude emissions and removals from the LULUCF sector (to avoid the complexity of accounting). 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 (2019b, 2019e, 2019f); EEA (forthcoming) (2019b).

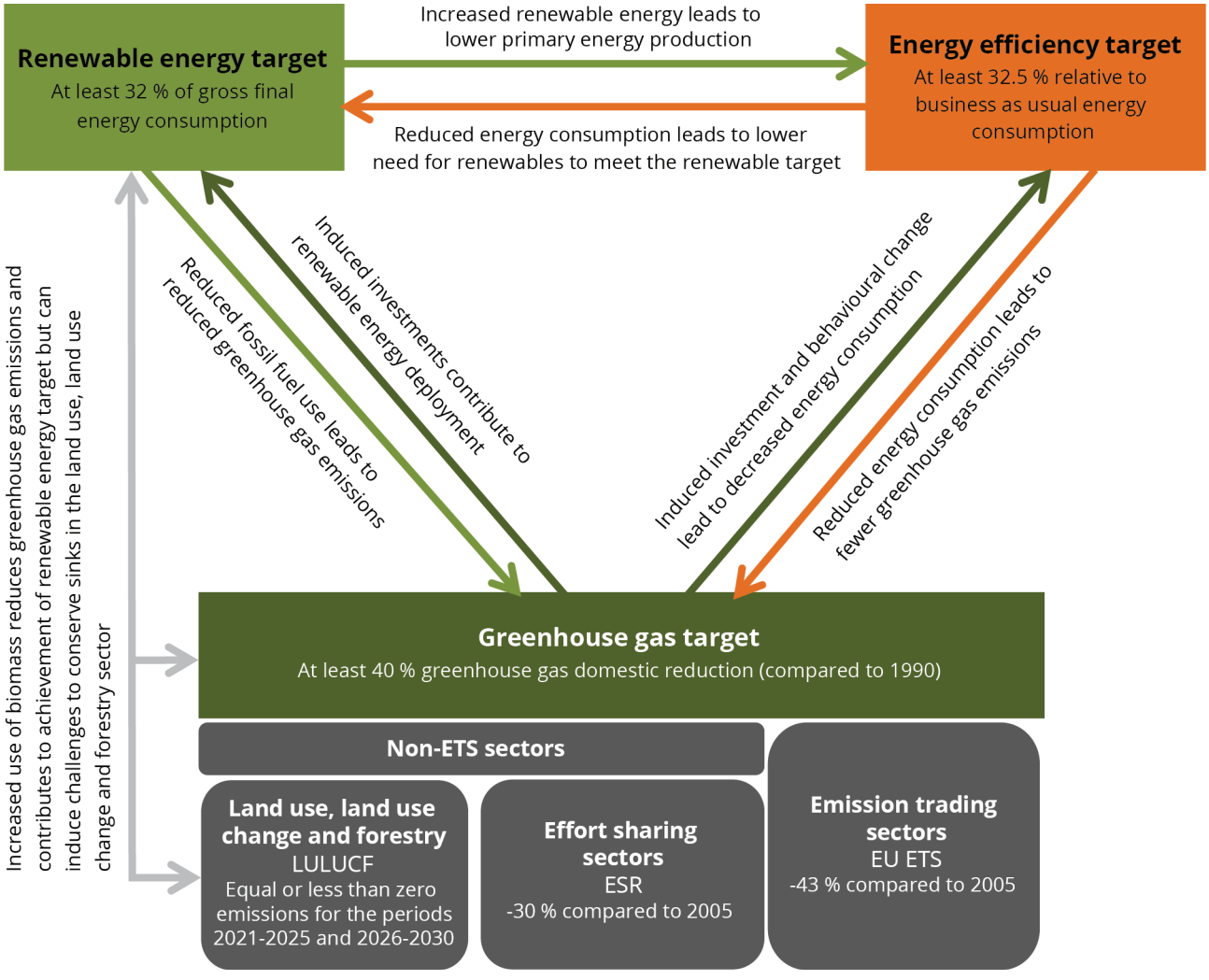
# 1 Introduction

## 1.1 Objective

This 2019 edition of the EEA report *Trends and projections in Europe* provides an annual assessment of the progress of the EU and European countries towards their climate mitigation and energy targets. Specifically, the report addresses European and national progress towards each of three energy and climate objectives: greenhouse gas (GHG) emissions, energy from renewable sources and energy efficiency.

These objectives are interrelated, and shifts in one area can also cause shifts in the others, as illustrated in Figure 1.1. For example, changes in energy use directly affect GHG emissions and statistically affect the share of consumed energy that is generated from renewable sources. Furthermore, EU policies addressing climate mitigation and energy have been increasingly integrated, which is also the case for the targets for 2020 and 2030 described below.

**Figure 1.1 Interaction between climate and energy targets for 2030**



Therefore, the EEA assesses European and national progress towards meeting targets for reducing GHG emissions, deploying renewable energy and developing energy efficiency in concert. Where possible, the assessment identifies possible or likely causes for changes in European or national trends, especially where the trend in one area is related to the development in another. The EEA's annual report *Trends and projections in Europe* has been published every year since 2002, and since 2013 it has addressed trends and projections in all three areas of GHG emissions, renewable energy and energy efficiency.

## 1.2 Context

The publication of this report takes place in the context of a changing landscape of international climate agreements, European legislation and national reporting obligations.

The information in this report is based on the latest official data on GHG emissions and energy consumption in 2017, as reported by Member States to the European Commission and the EEA under the Monitoring Mechanism Regulation (MMR) (EU, 2013d), and to the European Commission under the Energy Statistics Regulation (EU, 2008b), respectively. It also reflects approximated data for GHG emissions in 2018 as reported by Member States under the MMR in July 2019, and early EEA estimates for the renewable energy shares and energy consumption in 2018. Designed to ensure monitoring of GHG emissions and related information that is necessary to track the EU's and Member States' progress towards fulfilling their commitments under the Kyoto Protocol (UNFCCC, 1997), the MMR has been in effect since 2013, replacing the Monitoring Mechanism Decision (MMD) (EU, 2004), which had been in place since 2004.

With the conclusion of the second commitment period under the Kyoto Protocol on 31 December 2020, global monitoring of GHG emissions will transition from the monitoring and reporting requirements of the United Nations Framework Convention on Climate Change (UNFCCC) and of the Kyoto Protocol to a unified monitoring framework under the Paris Agreement for all Parties to that agreement (UNFCCC, 2015). For Europe, this requires adapting the current system for monitoring of GHG emissions under the MMR to comply with the requirements of the Paris Agreement.

In December 2018, new European legislation, Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action (EU, 2018h), established a governance mechanism to ensure the achievement of the EU's 2030 and long-term objectives and targets, in line with the 2015 Paris Agreement. Starting from 1 January 2021 for some areas, Member States will begin tracking and reporting their GHG emissions as described in the Governance Regulation. This progress will be reported in concert with monitoring efforts in related areas, among these developments in renewable energy and achievements in energy efficiency, through biennial integrated progress reports to be submitted starting in 2023.

Preparations for the future monitoring of progress towards the EU's and national-level targets in the areas of GHG emissions, renewable energy deployment and energy efficiency achievements are currently being undertaken at EU and national level. In line with the Governance Regulation, Member States submitted comprehensive draft 10-year national climate and energy plans (NECPs) at the end of 2018. These describe draft national targets and objectives for 2030, in line with the EU's 2030 and long-term objectives and targets. Final NECPs will be submitted by the end of 2019, and in January 2020 they will be complemented by the submission of national long-term strategies with perspectives of at least 30 years.

Therefore, the trends in and projections of European and national progress towards meeting targets for 2020 and 2030 in this report are based on information and projections reported under the MMR and address where relevant draft projections for GHG emissions up until 2030 that Member States have submitted in their draft NECPs.

Much like the changing legislative landscape for tracking progress in emissions, renewable energy and energy efficiency, the targets and goals towards which the EU and its Member States are working in these areas are also entering a new phase.

### *1.2.1 2020 targets*

For 2020, the EU and Member States are currently working towards the so-called '20-20-20' targets. These include targets by 2020 to:

- reduce GHG emissions by 20 % compared with 1990 levels;
- increase to 20 % the share of energy from renewable sources in the EU's gross final energy consumption, with a minimum of a 10 % share of renewables in the transport sector; and
- reduce energy consumption by 20 %, compared with 2007 baseline projections for 2020.

These targets have been in effect since 2007, when the European Council committed the EU to becoming a highly energy-efficient, low-carbon economy by 2020 (Council of the European Union, 2007). To help Member States to meet the 2020 targets for GHG emissions, the EU adopted a climate and energy package in 2009. The package defined a single EU target for GHG emissions covered under the Emissions Trading System (ETS) (EU, 2003) and a set of national target trajectories for 2013-2020 for emissions within the scope of the Effort Sharing Decision (ESD) (EU, 2009a). Regarding renewable energy, the Renewable Energy Directive (RED) (EU, 2009b) 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) (EU, 2012).

In 2010, the EU submitted a pledge to the UNFCCC to reduce its GHG emissions by 20 % by 2020, compared with 1990 levels. This was intended to contribute to the ultimate objective of the UNFCCC: to stabilise global GHG concentrations 'at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system' (UN, 1992) — in other words, to limit the global temperature increase to less than 2° C above average temperature levels before industrialisation. The EU clarified that its accounting rules for its target under the UNFCCC are more ambitious than the current rules under the Kyoto Protocol. For example, international aviation is 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 Clean Development Mechanism (CDM) used under the ETS (UNFCCC, 2013).

With the target year of 2020 imminent, this report uses the most recent available information to assess progress towards meeting the 20-20-20 targets. It includes data on emissions, energy consumption and renewable energy shares in 2017, approximated data for the year 2018 and projected data for greenhouse gas emissions. Recent trends are used to illustrate the pace and direction of reductions in GHG emissions, deployment of renewable energy and gains in energy efficiency towards meeting the 2020 targets. Additionally, projection results for 2020 are used to assess the Member States' progress to national GHG targets.

### *1.2.2 2030 targets*

In 2015, the framework strategy for a resilient energy union with a forward-looking climate change policy (EC, 2015a) described the interlinkages between a number of energy and climate policy areas, including decarbonisation (covering reductions in GHG emissions and developments in renewable energy), energy efficiency, energy security, the internal energy market and research, innovation and competitiveness. Each year, the Commission issues a report on progress in these dimensions in the *Report on the state of the energy union*, most recently published in 2019 (EC, 2019e).

This report describes how current trends and developments may contribute to achieving the 2030 targets for reducing GHG emissions, deploying renewable energy and making energy efficiency gains at European level, and also for reducing GHG emissions at Member State level. The 2030 targets for GHG emissions, renewable energy and energy efficiency are:

- A binding target of at least a 40 % reduction in the EU's domestic GHG emissions (compared with 1990 levels). A binding emission cap is set for the sectors covered by the EU ETS (EU, 2018b) and binding annual minimum targets for reducing GHG emissions from 2021 to 2030 are set for EU Member States for the sectors not covered by the EU ETS (EU, 2018g). Furthermore, the Land use, land use change and forestry (LULUCF) Regulation (EU, 2018f) stipulates that 'EU Member States have to ensure that GHG emissions from land use, land use change or forestry are offset by at least an equivalent removal of $CO_2$ from the atmosphere in the period 2021 to 2030' (EC, 2018c).

- A binding target to increase the share of energy from renewable sources in the EU to at least 32 % of gross final energy consumption by 2030, including an upwards revision clause by 2023, set in the Renewable Energy Directive (EU, 2018d).

- A target of at least a 32.5 % improvement in energy efficiency by 2030 at EU level (compared with the Commission's 2007 energy baseline scenario), with a clause for an upwards revision by 2023, set in the Energy Efficiency Directive (EU, 2018e).

Although the above all include EU-wide targets for 2030, only GHG emission reduction targets have been set for 2030 at national level. In this report, progress towards meeting the national 2030 GHG emission targets can therefore be measured, as these are established and binding at national level. National, non-binding contributions in the areas of renewable energy deployment and energy efficiency contributions are being set by Member States in the context of the 10-year NECPs, which they have submitted in draft

form and will submit in final versions by the end of 2019. Individual Member States are free to set their own higher national contributions and to adjust these upwards in the 2024 updates of their NECPs.

### *1.2.3 2050 goals*

Although the 2030 targets provide a concrete objective in the medium term, they also provide a milestone towards achieving longer term goals for greater reductions in GHG emissions in the EU. In 2009, the European Council supported an EU objective of emissions reductions of at least 80-95 % by 2050 compared with 1990 levels (in the context of necessary reductions according to the Intergovernmental Panel on Climate Change, IPCC, by developed countries as a group). The Council articulated that 'such objectives should provide both the aspiration and the yardstick to establish mid-term goals' (European Council, 2009). This long-term goal was further consolidated in the *Roadmap for transforming the European Union into a competitive low-carbon economy by 2050*, which was adopted by the Commission in 2011 and provided guidance for long-term planning and policy development at EU and Member State levels (EC, 2011c).

In November 2018, the European Commission presented its Communication *A clean planet for all — A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy* (EC, 2018a), which aims for the EU to be climate neutral by 2050. This long-term vision is accompanied by an in-depth analysis describing a number of 'pathways', or scenarios, by which Europe can reduce its GHG emissions by 2050 to levels consistent with the objectives of the Paris Agreement (EC, 2018b). Each scenario provides for a unique level of reductions in GHG emissions to be achieved, depending on the combination of measures encompassed. These range from a baseline scenario of 62 % reductions, assuming current targets and technological developments, to six scenarios that would achieve 80-90 % reductions through various technological and combined approaches. Two final scenarios describe how climate neutrality can be achieved by 2050, with net-zero emissions levels and a consistent European contribution to limiting global temperature rise to 1.5 °C. For further description of the Commission's long-term vision and the accompanying scenario descriptions, please refer to Section 2.1 of this report.

**Box 1.1 Links and trade-offs between climate mitigation and air pollution policies**

Climate and air pollution policies are also strongly linked because most of the GHGs and air pollutants are emitted from the same sources. Both the 2030 targets and the 2050 goals will have significant positive impacts on emissions of air pollutants. This due to a reduction in energy consumption as well as the shift away from fossil fuels (EC, 2018b). At the same time, there are at present some trade-offs between climate and air pollution policies, for example the negative impact on air quality from diesel cars and the increased combustion of biomass without adequate emission controls. For more information, see also the report *Air quality in Europe — 2018 report* (EEA, 2018a).

When describing projections of future progress towards 2050 goals for decarbonisation in the EU, this report tracks specific progress towards meeting the already established long-term goal of 80-95 % reduction in GHG emissions by 2050. When referring to the scenarios accompanying the Commission's long-term vision for achieving climate neutrality by 2050, the report describes the ranges covered by these scenarios rather than specific values.

## 1.3 Data sources

Information in this report is based on the latest data reported by European countries under the MMR (see also Section 1.2), while data sets regarding energy are reported by European countries to Eurostat under the Energy Statistics Regulation.

The MMR-related data are submitted by countries to the EEA's environment data repository, Reportnet ([1]), after which the EEA, supported by its European Topic Centre on Climate Change Mitigation and Energy (ETC/CME), performs quality control procedures in consultation with individual countries. The EEA and ETC/CME then compile the reported data and publish data sets, data viewers and related products on the EEA's website.

The following data sets are highlighted in this report:

- GHG emission inventory for the period 1990-2017, reported under the MMR in March 2019;

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

- Effort Sharing emission data for the period 2013-2017 (2017 data reviewed in 2019);
- ETS emission data for the years 2005-2018, the European Union Transaction Log (EUTL), extracted in July 2019;
- GHG emission projection data up until 2035, reported under the MMR in March 2019;
- approximated ('proxy') GHG emission data, renewable energy shares and energy consumption for the year 2018, partly reported by Member States in July 2019 and gap-filled with estimates by the EEA. National proxy data were provided by Cyprus, Bulgaria and Romania.
- 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 2019 (Eurostat, 2019d);
- EEA early estimates for the share of energy from renewable sources in gross final energy consumption in 2018.
- primary and final energy consumption (indicators FEC2020-2030, PEC2020-2030), reported in the Energy Statistics Regulation and published by Eurostat in its energy statistics database, extracted in May 2019.
- EEA early estimates for the primary and final consumption of energy in 2018.

## 1.4 Geographical scope

This report describes the progress towards meeting climate mitigation and energy targets in Europe. While the report focuses mainly on aggregated and national progress in the 28 EU Member States, a number of additional European countries provide the EEA with data and information on their own national achievements in these areas. These countries (Iceland, Liechtenstein, Norway, Switzerland and Turkey) are EEA member countries but not EU Member States, and they report their climate and energy information in the same format as the EU Member States do. A dedicated section in each chapter of the report describes trends and projected progress in Iceland, Liechtenstein, Norway, Switzerland and Turkey in the areas of reducing emissions, energy from renewable sources and energy efficiency.

## 1.5 Structure of this report

Chapters 2, 3 and 4 provide detailed information on EU-wide and national-level progress towards meeting targets for GHG emissions, energy from renewable sources and energy efficiency, respectively. Annexes 1, 2 and 3 provide more information on the data sources and methodology used in Chapters 2, 3 and 4, respectively. Annex 4 highlights country progress that can be found in the interactive country profiles available online at: https://www.eea.europa.eu/themes/climate/trends-and-projections-in-europe/climate-and-energy-country-profiles.

# 2 Progress towards meeting greenhouse gas emission targets

**2020**

- In 2017, the EU's greenhouse gas (GHG) emissions were 21.7 % lower than 1990 levels. Preliminary estimates from Member States indicate that, in 2018, GHG emissions were 23.2 % lower than 1990 levels. Therefore, the 2020 GHG emission reduction target of 20 % can reasonably be expected to be met.
- The number of Member States whose Effort Sharing emissions exceed their Effort Sharing targets increased from one in 2013 to 10 in 2017. In Austria, Bulgaria, Cyprus, Estonia, Germany, Ireland, Lithuania, Luxembourg, Malta and Poland, Effort Sharing emissions in 2017 were higher than their respective Effort Sharing targets for that year. Although Malta has missed its targets every year since 2013, 2017 was the first time that Austria, Bulgaria, Cyprus, Estonia, Lithuania and Luxembourg missed their Effort Sharing targets; the last two did so only slightly, by 0.05 % and 0.06 %, respectively. According to preliminary estimates, 11 Member States (Austria, Belgium, Bulgaria, Cyprus, Estonia, Finland, Germany, Ireland, Luxembourg, Malta and Poland) exhibited emissions higher than their Effort Sharing targets in 2018.

**2030**

- Based on existing national policies and measures and the latest projected data from Member States, the EU is not projected to reach its 40 % GHG emission reduction target by 2030. The projections submitted under the Monitoring Mechanism Regulation (MMR) in 2019 indicate a reduction in emissions by 2030 of 30 % compared with 1990 levels.
- Twenty-five Member States (all except Greece, Portugal and Sweden) project their Effort Sharing emissions to be higher than their national 2030 targets (although Slovenia, with a gap of 0.2 %, is very close to reaching its target). Member States will need to considerably increase their efforts to bridge these gaps. The cited projections reported under the MMR are not necessarily aligned with the national energy and climate plans (NECPs) currently under development and to be published by 31 December 2019 by all Member States.
- Additional policies and measures are projected to further reduce the EU's GHG emissions to 36% below 1990 levels by 2030. These represent policies and measures being prepared or planned as of early 2019. This is a better outlook than in last year's assessment, yet it will not be sufficient to deliver the savings needed to achieve the EU's reduction target of 40 %. According to national projections with additional policies and measures, EU Emissions Trading System emissions could still reach a level 1.3 percentage points above the targeted 43 % reduction by 2030 compared with 2005 levels. Similarly, more effort will be required to close the gap of 3.1 percentage points to reach the EU's Effort Sharing emission reduction target of 30 % by 2030 (compared with the 2005 base-year emissions). It is crucial that Member States implement further additional policies and measures and that these are taken into account in the final NECPs to be submitted at the end of 2019, in order to better ensure delivery of the EU's 2030 targets.

**2050**

- To achieve an emission reduction objective of 80-95 % by 2050, after having reached its 40 % reduction target in 2030, the EU will need to reduce its emissions by, on average, 114-157 Mt $CO_2$e ($CO_2$ equivalent) every year between 2030 and 2050. In comparison, the EU secured average annual reductions in GHG emissions of 46 Mt $CO_2$e between 1990 and 2017. Between 2005 and 2017, these reduction have averaged 73 Mt $CO_2$e. In order to reach its 2030 target for GHG emissions, the EU would need to achieve average reduction rates of 81 Mt $CO_2$e per year, starting in 2017. According to Commission projections, full achievement of the 2030 targets, including those for renewable energy and energy efficiency, would lead to even faster reductions, of approximately 100 Mt $CO_2$e per year (EC, 2019h). Such an increased pace reduces the challenge of reaching climate neutrality (including emission sinks) in 2050, as presented in the Commission's strategic long-term vision for decarbonisation in Europe. Member States will need to lay down their national long-term strategies at the beginning of 2020.

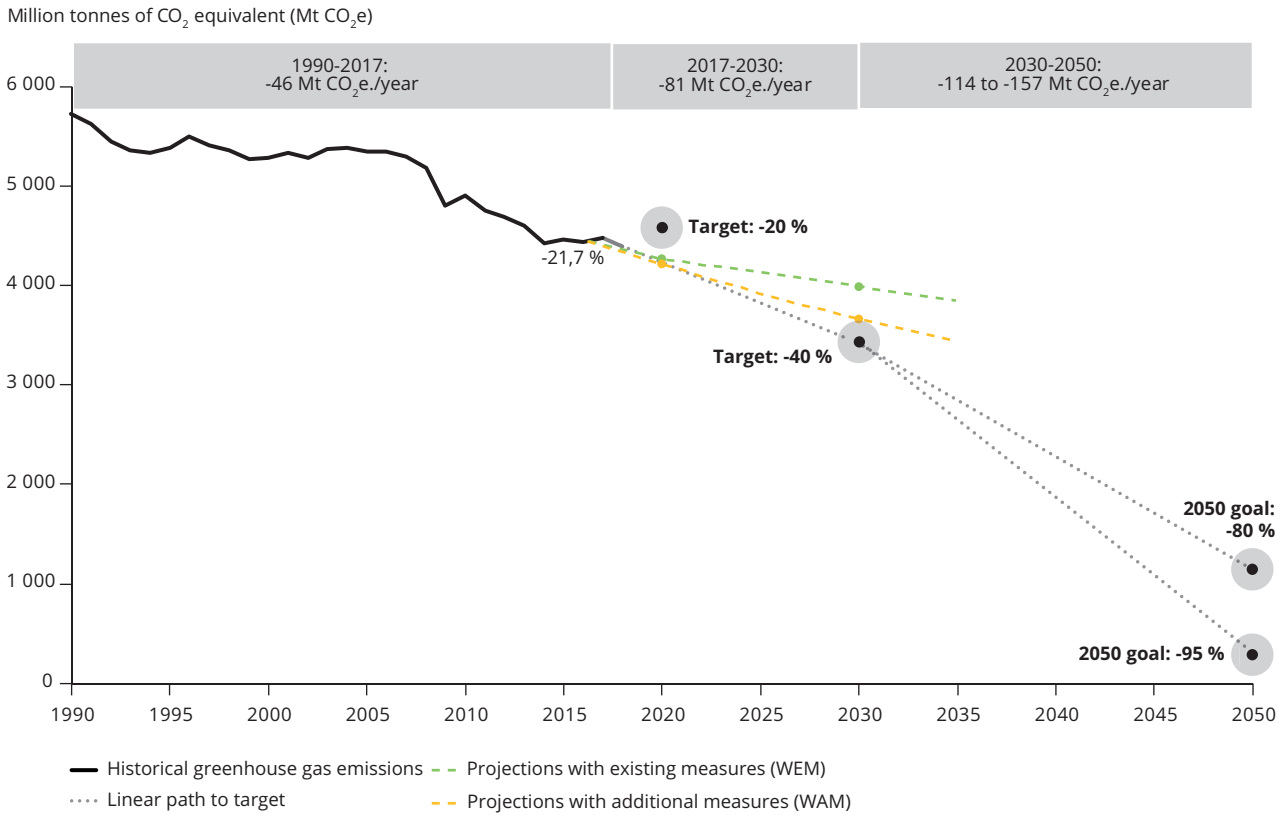
## 2.1 Progress and required pace towards meeting the EU's greenhouse gas emission targets

In 2017, the EU's greenhouse gas (GHG) emissions were 21.7 % lower than 1990 levels, totalling 4 483 megatonnes (Mt) of carbon dioxide equivalent ($CO_2e$) ([2]) ([3]). According to preliminary estimates, emissions fell by 2 % from 2017 to 2018. With these latest values, the EU was 23.2 % below 1990 levels in 2018 and therefore remained on track to meet its upcoming target of a 20 % reduction in GHG emissions by 2020.

Although the short-term prognosis is a positive one, the pace of reducing GHG emissions across Europe is projected to slow after 2020. This is largely visible in EU Member States' projected data, which indicate expected levels of GHG emissions up until 2035. According to these most recent updates, the EU's total GHG emissions are expected to decline up until 2030 (see Figure 2.1), albeit at a slower pace (38 Mt $CO_2e$ per year with existing measures, and 63 Mt $CO_2e$ per year with additional measures) than that needed to achieve the 2030 target (81 Mt $CO_2e$ per year).

With policies and measures already in place in the Member States, as indicated by the projections scenario 'with existing measures' (WEM) ([4]), Member States expect to achieve a 30 % reduction in GHG emissions by 2030 (compared with 1990 levels). With the addition of new, planned policies and measures as

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




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

**Sources:** EEA (2019b, 2019e, 2019f); EEA (forthcoming) (2019b).

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

([3]) All emission estimates used in this report were calculated using global warming potentials (GWPs) from the Intergovernmental Panel on Climate Change (IPCC)'s Fourth Assessment Report (AR4) (UNFCCC, 2013).

([4]) The 'with existing measures' scenario reflects the effects of all adopted and implemented measures at the time the projections were prepared.

indicated in the projections scenario 'with additional measures' (WAM) ([5]) ([6]), Member States expect to reach emission reductions totalling 36 % by 2030 (compared with 1990 levels).

These projections reported under the Monitoring Mechanism Regulation (MMR) indicate that the existing and additional policies and measures currently accounted for in the national projections 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). This means that achieving the 2030 targets will require a focused effort across the EU, and achieving the long-term goals of even greater levels of decarbonisation will require faster rates of reduction than those currently projected.

In addition to updating their national projected data under the MMR in 2019, Member States also submitted draft national energy and climate plans (NECPs) detailing how they intend to achieve, inter alia, the 2030 emission reductions targets. These draft NECPs include projected data for expected emissions in the coming years, and these projections differ for some Member States from those reported under the MMR. According to the Commission's assessment of Member States' draft NECPs, based on the planned measures or stated ambitions for national reductions in GHG emissions included in the draft NECPs (and on the basis of conservative assumptions for the countries that submitted neither planned measures nor stated ambitions), the overall GHG emission reduction by 2030 is expected to meet the 40 % GHG emission reduction target compared with 1990 levels (EC, 2019b).

The difference between the expected 36 % reductions indicated by the aggregated MMR projections with additional measures and the expected 40 % reductions indicated by the aggregated draft NECP projections can to a large extent be explained by differences in the 'with additional measures' scenario submissions of Member States and the differences in gap-filling methodologies used by the Commission and the EEA. Notably, Germany, the Netherlands and Poland show the largest differences between their MMR and NECP projections for 2030 (see Annex 1, Table A1.1).

### *2.1.1 Required pace towards meeting 2030 targets and beyond*

Figure 2.1 above provides a short-term outlook to 2020 and longer term prospects to 2030 and 2050. To reach its 2030 target, the EU needs to reduce its emissions by 81 Mt $CO_2$e in every year between 2017 and 2030, which is a rate almost twice as high as the 46 Mt $CO_2$e in reductions that have been achieved per year since 1990. These reductions have averaged 73 Mt $CO_2$e since 2005. However, if all of the energy union targets for energy efficiency and renewable energy are met and policies are fully implemented, projections by the European Commission indicate that reductions in GHG emissions of 45.6 % could be attained by 2030 (EC, 2019h). This would represent average annual reductions of around 100 Mt per year between 2017 and 2030. It can be expected that annual reductions will fluctuate due to factors such as weather-dependent heating and cooling of buildings, meaning that the average annual reduction is an indicative value that will probably be exceeded in some years and not achieved in others.

The annual average reduction in emissions of 81 Mt $CO_2$e required across the EU by 2030 is comparable to the total annual emissions of a country such as Austria. Currently adopted national climate mitigation measures across the EU account for only an average reduction of about 38 Mt $CO_2$e per year, while planned but not yet implemented policies and measures included in Member States' projections 'with additional measures' can extend the average annual reduction to 63 Mt $CO_2$e per year (see Figure 2.1). This reduction rate remains substantially below an average reduction rate of 81 Mt $CO_2$e per year. This demonstrates that the EU, its Member States and citizens need to step up their joint efforts to meet the 2030 target and longer term climate neutrality goals.

Achieving the established long-term decarbonisation goals of an 80-95 % reduction in GHG emissions by 2050 (compared with 1990 levels), as supported by the European Council in October 2009, will require an even faster pace of reducing emissions (European Council, 2009). A reduction of 80 % by 2050 would require a reduction of 2 889 Mt $CO_2$e starting in 2030,

([5]) The 'with additional measures scenario' takes into account the measures that were at the planning stage at the time the projections were prepared.

([6]) No projected data were received from Romania. Not all Member States reported a 'with additional measures' scenario under the Monitoring Mechanism Regulation. For further information on reporting of projections, please refer to Annex 1, Section A1.2.8.

assuming achievement of the 40 % target for GHG emissions. This is equivalent to average reductions of 114 Mt $CO_2$e every year from 2030 to 2050. Similarly, a reduction in emissions of 95 % by 2050 would require 3 148 Mt $CO_2$e to be saved between 2030 and 2050, an average annual emission saving of 157 Mt $CO_2$e per year (see Figure 2.1).

At European level, a number of EU-wide policies have been adopted in recent years to achieve mid- and long-term reductions in GHG emissions. Box 2.1 describes some of these.

### *2.1.2 The EU's strategic long-term vision*

In 2018, the European Commission published a strategic long-term vision for a climate-neutral economy by 2050, *A clean planet for all — A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy* (EC, 2018a). The in-depth analysis accompanying this vision (EC, 2018b) describes how climate neutrality could be achieved by 2050, rendering GHG emissions net zero, including land use, land use change and forestry (LULUCF) contributions as well as negative emissions technology, e.g. in the form of bioenergy combined with carbon capture and storage (CCS). In total, the in-depth analysis describes eight separate scenarios that would contribute to achieving long-term reductions in emissions. These would achieve reductions in emissions by 2050 (compared with 1990 levels) up to 94 % excluding LULUCF emissions. When LULUCF emissions are included, the net reductions could reach 100 %. Under well-defined circumstances, the LULUCF sector can act as a carbon sink for GHG emissions, and it is therefore expected to play an increasingly prominent role in achieving climate neutrality in the long term. Further details on the eight scenarios are provided in Box 2.2 and Figure 2.2.

**Box 2.1 Policies to achieve reductions in emissions to meet the 2030 climate and energy targets**

Several legislative acts renewing or amending the climate and energy policy framework have recently been adopted to achieve the EU's 2030 targets. These include a reform of the EU Emissions Trading System (ETS) to include a more stringent cap reduction after 2020 (EU, 2018b) as well as new, binding annual GHG emission targets for Member States for the period 2021-2030. The latter include 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, 2018g). Furthermore, the LULUCF Regulation now in place integrates the land use, land use change and forestry (LULUCF) sector into the EU 2030 climate and energy framework and defines new accounting rules for 2012-2030 in these areas (EU, 2018f).

Further emissions reductions toward 2030 are expected from a decline in the use of fluorinated gases, which have been introduced into a number of industrial processes in recent decades, but which have a much greater effect on global warming than $CO_2$. Reductions in F-gas emissions are expected to reach a level of 1.5 GT $CO_2$ eq. by 2030, constituting a decline by two-thirds compared to 2014 levels. F-gas emissions reductions are regulated and driven by Regulation (EU) No 517/2014 on fluorinated greenhouse gases (F-gas Regulation) that entered into force on 1 January 2015 (EU, 2014c).

A new energy rulebook, *The clean energy for all Europeans package*, includes eight legislative acts, several of which are of central importance for reaching the EU's 2030 targets on energy and climate. These include a revision and extension of the Renewable Energy Directive, with a binding EU-level target to increase the share of renewable energy in the energy mix to at least 32%, with a possible upwards revision by 2023 (EU, 2018d); an update of the Energy Efficiency Directive, with an indicative target at EU level of reduced energy consumption by least 32.5% by 2030, with a possible upwards revision by 2023 (EU, 2018e); and measures to reduce the energy consumption of the building sector in a revision of the Energy Performance of Buildings Directive (EU, 2018c). Furthermore, under the Regulation on the Governance of the Energy Union and Climate Action, Member States are establishing 10-year national energy and climate plans (NECPs) for the period from 2021 to 2030 (EU, 2018h).

Recent transport-related policy developments have sought to support further emissions reductions in this sector. In April 2019, new regulation set $CO_2$ emission performance standards for new passenger cars and for new light commercial vehicles (vans) in the EU for the period after 2020 (EU, 2019b). These targets require average 2030 emission levels from new cars to be 37.5 % lower than 2021 levels. Similarly, average $CO_2$ emissions from new vans must fall by 31 % by 2030 compared with 2021. An intermediary 15 % reduction for both cars and vans must be reached by 2025. Together, these efforts can result in a decline in GHG emissions from road transport of 23 % by 2030, compared with 2005 levels.

For heavy-duty vehicles, legislation adopted in June 2019 sets the first-ever $CO_2$ emission standards for these vehicles in the EU. The legislation introduces targets of 15 % emissions reductions from 2025 onwards, and 30 % reductions from 2030, compared with the average $CO_2$ emission levels monitored in the reference period (1 July 2019–30 June 2020) (EC, 2019b; EU, 2019b).

**Box 2.2 Scenarios in Europe's strategic long-term vision**

The in-depth analysis that accompanies the Commission's strategic long-term vision (EC, 2018b) explores eight different scenarios that describe possible future developments based on what are known as 'no-regret policies'.

Five of these scenarios explore how much GHG emissions could be reduced by different combinations of technologies and actions. The sixth scenario combines, cost-efficiently, the elements from the five previous scenarios.

The seventh scenario includes all zero-carbon energy carriers ([7]) and assumes increased energy efficiency. It includes the use of bioenergy carbon capture and storage (BECCS).

The eighth scenario includes the elements of the seventh scenario in a highly circular economy, with fewer carbon-intensive consumer choices and lifestyle changes (such as dietary changes), limited growth in air travel, increased car-sharing and more rational use of heating and cooling. This scenario also focuses on how to strengthen the carbon sink to reduce the need for CCS and BECCS.

The results of the scenarios highlight the complexity at play when aiming for net-zero GHG emissions and highlight the importance of sinks:

- The first five 'technology-driven' scenarios reach around an 80 % reduction in GHG emissions compared with 1990, excluding the LULUCF sector.
- The sixth scenario includes all the technologies and actions from the first five scenarios and achieves a 90 % reduction in GHG emissions including LULUCF.
- The seventh and eighth scenarios would achieve net-zero GHG emissions in 2050, i.e. a net reduction of 100 % compared with 1990 levels, due to the LULUCF sector acting as a sink. While the seventh scenario focuses more on technology options, the eighth scenario also considers lifestyle changes as an important element.

**Figure 2.2 The assumptions taken into account in the eight long-term vision scenarios**

**Long Term Strategy Options**

| | Electrification (ELEC) | Hydrogen (H2) | Power-to-X (P2X) | Energy Efficiency (EE) | Circular Economy (CIRC) | Combination (COMBO) | 1.5°C Technical (1.5TECH) | 1.5°C Sustainable Lifestyles (1.5LIFE) |
|---|---|---|---|---|---|---|---|---|
| **Main Drivers** | Electrification in all sectors | Hydrogen in industry, transport and buildings | E-fuels in industry, transport and buildings | Pursuing deep energy efficiency in all sectors | Increased resource and material efficiency | Cost-efficient combination of options from 2°C scenarios | Based on COMBO with more BECCS, CCS | Based on COMBO and CIRC with lifestyle changes |
| **GHG target in 2050** | -80% GHG (excluding sinks) ["well below 2°C" ambition] | | | | | -90% GHG (incl. sinks) | -100% GHG (incl. sinks) ["1.5°C" ambition] | |
| **Major Common Assumptions** | • Higher energy efficiency post 2030<br>• Deployment of sustainable, advanced biofuels<br>• Moderate circular economy measures<br>• Digitilisation | | | | • Market coordination for infrastructure deployment<br>• BECCS present only post-2050 in 2°C scenarios<br>• Significant learning by doing for low carbon technologies<br>• Significant improvements in the efficiency of the transport system. | | | |
| **Power sector** | Power is nearly decarbonised by 2050. Strong penetration of RES facilitated by system optimization (demand-side response, storage, interconnections, role of prosumers). Nuclear still plays a role in the power sector and CCS deployment faces limitations. | | | | | | | |
| **Industry** | Electrification of processes | Use of H2 in targeted applications | Use of e-gas in targeted applications | Reducing energy demand via Energy Efficiency | Higher recycling rates, material substitution, circular measures | Combination of most Cost-efficient options from "well below 2°C" scenarios with targeted application (excluding CIRC) | COMBO but stronger | CIRC+COMBO but stronger |
| **Buildings** | Increased deployment of heat pumps | Deployment of H2 for heating | Deployment of e-gas for heating | Increased renovation rates and depth | Sustainable buildings | | | CIRC+COMBO but stronger |
| **Transport sector** | Faster electrification for all transport modes | H2 deployment for HDVs and some for LDVs | E-fuels deployment for all modes | Increased modal shift | Mobility as a service | | | • CIRC+COMBO but stronger<br>• Alternatives to air travel |
| **Other Drivers** | | H2 in gas distribution grid | E-gas in gas distribution grid | | | | Limited enhancement natural sink | • Dietary changes<br>• Enhancement natural sink |

**Source:** EC (2018b, p. 56).

([7]) This includes sources of renewable energy but also nuclear (fission) energy.

#### *2.1.3 Avoiding lock-in in the long-term*

Achieving climate neutrality 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. However, the effects of policies and measures often take time to materialise (e.g. increases in energy efficiency in buildings), and therefore, long-term action should not be delayed, and the lock-in effects of current investments should be considered.

Often far-reaching technical measures with long-term effects are 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 the benefits of avoiding damages are taken into account in mitigation costs (see, for example, suggested damage cost rates (UBA, 2014)). For example, expensive investments in extending railway infrastructure have the potential to avoid large amounts of $CO_2$ emissions by shifting transport from road to rail. Lifestyle changes will also need to be addressed, and these are not necessarily associated with large monetary costs; other objections such as concerns about reduced comfort or freedom in making consumer choices may pose obstacles in this area.

## 2.2 Progress towards EU greenhouse gas emissions targets in the Emissions Trading System, Effort Sharing and LULUCF sectors

Three key policies address GHG emissions and removal in the EU, each covering different sources and sinks. These are the EU Emissions Trading System (ETS), the Effort Sharing legislation and the legislation on emissions and removals from LULUCF. As Figure 2.3 indicates, GHG emissions covered by the EU ETS sectors and those covered by the Effort Sharing legislation have followed different trends since 1990, as EU ETS emissions show a much stronger decrease than other emissions ([8]). Likewise, reported projections indicate a stronger anticipated reduction in EU ETS emissions than in the Effort Sharing sectors. With the rules set in the new LULUCF Regulation (EU, 2018f, 2018g), this sector was integrated into the EU 2030 climate and energy framework from 2021 onwards. The reported trends in net removals from the LULUCF sector show a progressive historical reduction in the EU carbon sink since 2010, and this trend is projected to persist through the coming decade.

The following three sections describe and analyse the emission trends in the ETS, Effort Sharing Decision (ESD) and LULUCF sectors.

#### *2.2.1 Emission trends under the EU Emissions Trading System*

Emissions from activities included in the EU ETS are governed by the EU ETS legislation and subject to an EU-wide cap on emissions. Emissions from large stationary installations, 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 stem 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 has also covered GHG emissions from aviation (EU, 2008a). The EU ETS mainly covers $CO_2$ emissions, but it also includes emissions of nitrous oxide ($N_2O$) and perfluorocarbons (PFCs). With these selected emission sources, the system covers sectors and gases that can be measured, reported and verified with a high level of accuracy. The mitigation of ETS emissions is being addressed at EU level through a single ETS-wide emission cap ([9]) and a 'carbon market' through which emission allowances can be traded.

The EU ETS specific targets were set to reduce emissions by 21 % between 2005 and 2020 and by 43 % by 2030 compared with 2005 levels. These EU ETS specific targets were set in line with the EU's overall emission reduction targets of 20 % by 2020 and 40 % by 2030. The most recent inventories and ETS data demonstrate that GHG emissions from the sectors covered by the EU ETS have decreased significantly since 1990 (see Figure 2.4). In 2018, EU ETS emissions from EU Member States' stationary installations had already fallen by 29 % since 2005 ([10]).

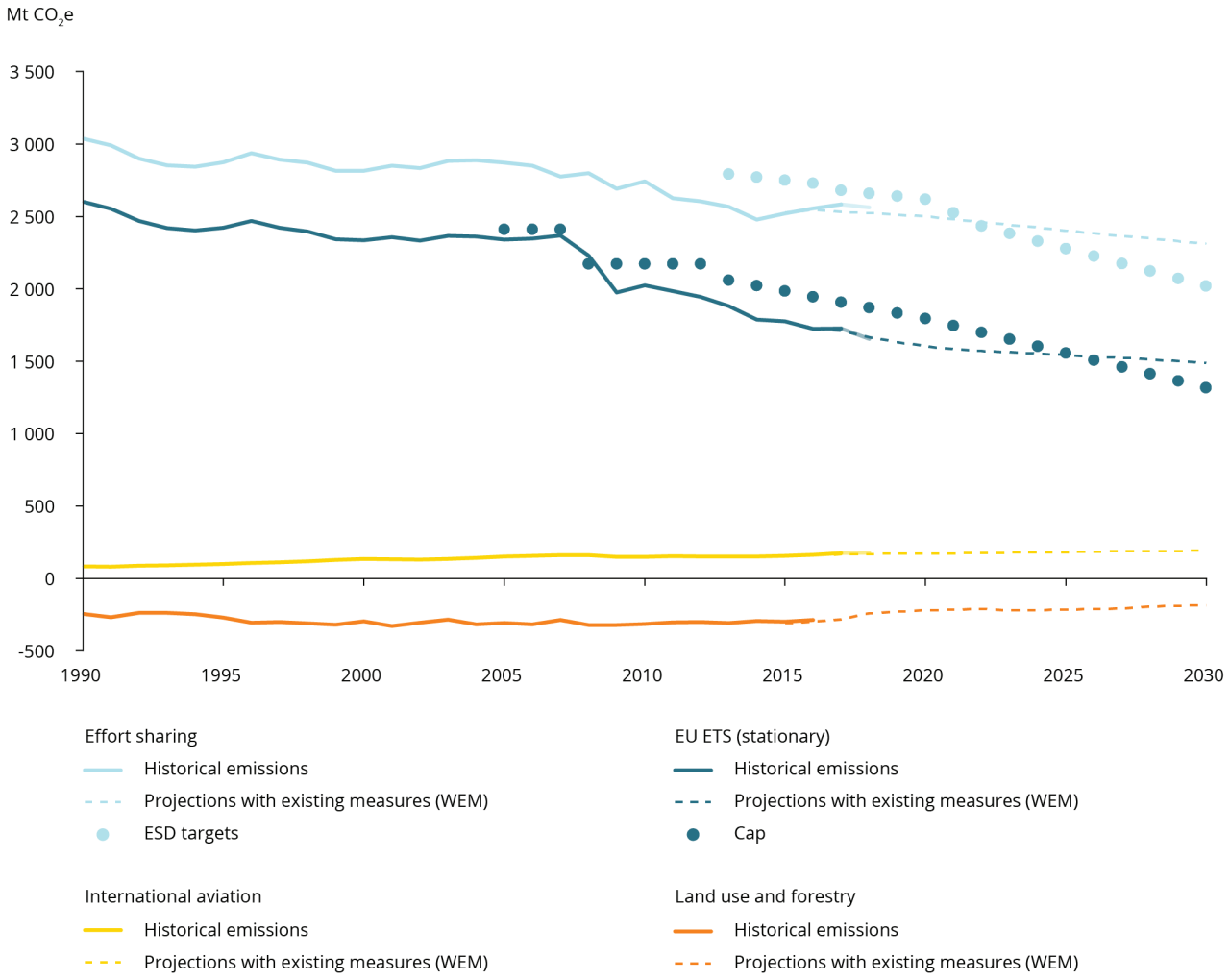
The substantial reductions in ETS emissions since 2005 have been largely driven by reductions in emissions related to power generation. The reduction

([8]) Although the ETS was introduced in 2005 and the Effort Sharing Decision (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 and ESD emissions and the source categories used to officially report national GHG inventories under the United Nations Framework Convention on Climate Change.

([9]) 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.

([10]) These values include an estimate to reflect the current scope of the EU ETS in 2005 (ETC/CME, 2019).

**Figure 2.3 Effort Sharing, ETS, LULUCF and aviation emission trends and projections in the EU, 1990-2030**




**Notes:** EU ETS (stationary) emissions for the period 2005-2012 were estimated to reflect the current scope (2013-2020) of the EU ETS, see also Annex 1 (Sections A1.2.3 and A1.2.5).
Net removals from LULUCF correspond to reported values to the United Nations Framework Convention on Climate Change, which differ from values relevant to the Kyoto Protocol and LULUCF Regulation commitments.
The aggregated Effort Sharing targets for the period 2021-2030 are based on adopted legislation, and absolute values are estimated based on the latest available, comprehensively reviewed data.
The 'with existing measures' scenario reflects existing policies and measures.

**Sources:** EC (2015c); EU (2017a, 2013b, 2018g); EEA (2019b, 2019e, 2019f, 2019g); EEA (forthcoming) (2019b).

in emissions was largely the result of changes in the combination of fuels used to produce heat and electricity. In particular, the combination of fuels 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, reduced production volumes of electricity and heat led to reductions in emissions in that sector. Emissions from other industrial activities covered by the EU ETS have also decreased since 2005. Lower levels of output following the economic recession in 2008 led to reductions in emissions in the second trading period, accompanied by improvements in energy efficiency and increased use of biomass and waste as energy sources in production. Since 2016, emissions have increased alongside improvements in economic conditions and output (see Figure 2.4).

According to the projections submitted by Member States in 2019 under the MMR, future cuts in national GHG emissions will mainly take place 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 a further 174 Mt $CO_2$e (10 %) between 2018 and 2030. According to scenarios that consider planned measures, total reductions of 287 Mt $CO_2$e (14 %) are projected between 2018 and 2030.

National MMR projections based on the 'with additional measures' scenario show that the EU ETS emissions could total 1 364 Mt $CO_2$e in 2030. This would be 1.3 percentage points higher than the EU ETS specific target of -43 % for 2030 (in comparison with 2005).

Most of the projected ETS reductions up until 2030 are expected to occur in the energy industries sector, whereas emissions from other activities are envisaged to remain stable during this period. The emissions from international aviation, however, nearly doubled between 1990 and 2017 and are expected to increase further by 2030. In April 2018, important reforms to the ETS entered into force. They establish the rules for the fourth trading period (2021-2030) and include the strengthening of the market stability reserve (MSR). National projections submitted in 2019 reflect national measures in the ETS sectors but do not usually include the effects of these reforms yet. Total EU ETS emissions in 2030 are 3 % higher compared with projections with existing measures submitted earlier and at the same level compared with the most recent projections with additional measures.

More detailed information on trends and projections in the EU ETS sector are presented in the EEA briefing on the EU Emission Trading System in 2019 and the ETC/CME report accompanying the briefing (EEA (forthcoming), 2019d, 2019e).

### *2.2.2 Emission trends under the Effort Sharing legislation*

The Effort Sharing legislation covers emissions that are neither covered under the EU ETS nor related to the LULUCF sector. These emissions are produced by a diverse range of sectors and activities, including road transport, energy consumption in buildings, agriculture (animals and soils), smaller industrial installations, smaller energy generation facilities and waste management. This represents altogether about 58 % of total EU GHG emissions.

The legislation sets annual emission trajectories for each Member State for the periods 2013-2020 (ESD) (EU, 2013a, 2013b, 2017a) and 2021-2030 (Effort Sharing Regulation, ESR) (EU, 2018g). These are translated into national annual emission allocations (AEAs) by implementing regulations. Member States should stay within the limits of their allocations or can make use of several flexibilities stipulated in the corresponding legislation. Responsibility lies with Member States to implement a combination of national

**Box 2.3 Coverage of emissions from aviation**

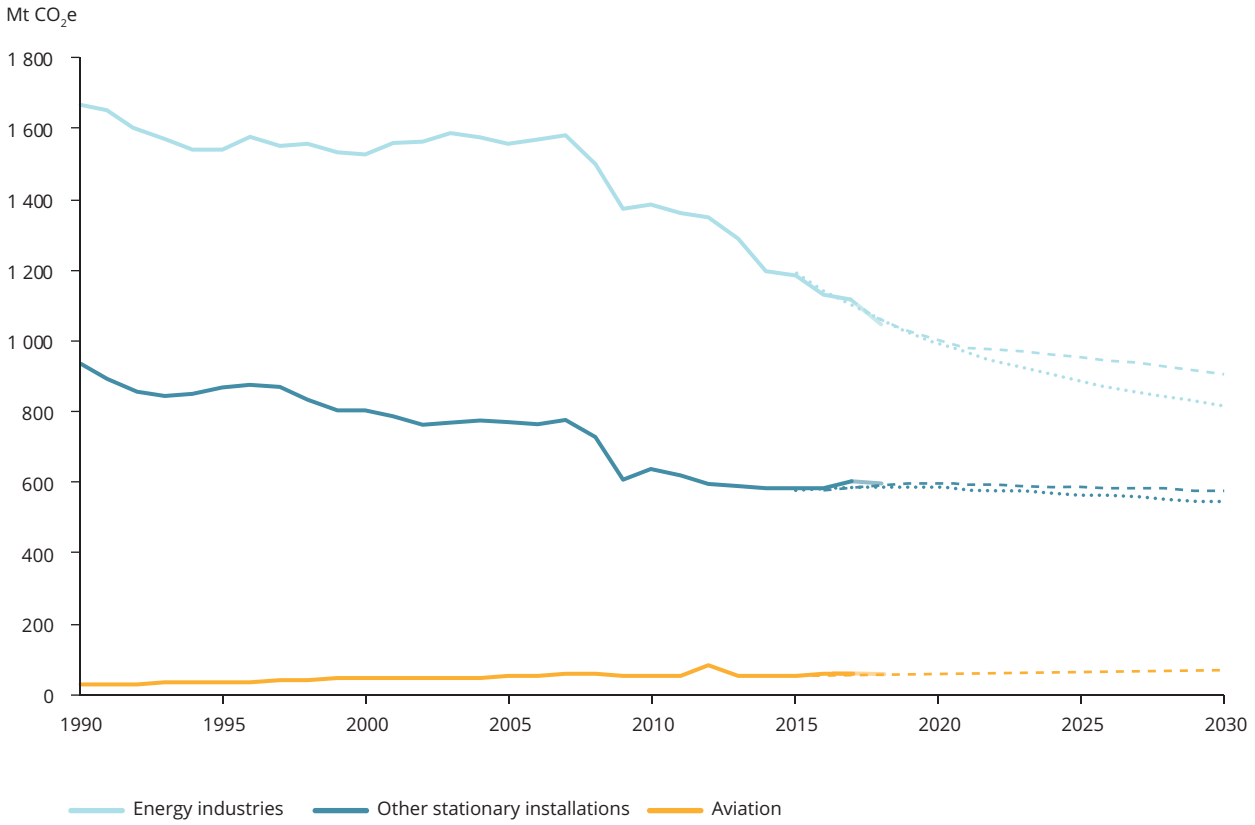
Although GHG emissions from domestic aviation, and partly from international aviation, have been included in the EU's 2020 target under the United Nations Framework Convention on Climate Change (UNFCCC), only emissions from domestic aviation are included in its targets under the Kyoto Protocol. Domestic aviation in the EU Member States amounts to less than 0.5 % of total GHG emissions without LULUCF, whereas international aviation from and to EU Member States accounts for 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, 2013c), 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). The EU decided to continue with a reduced scope in the period 2013-2016 (EU, 2014c), restricted to flights between airports located in countries in the European Economic Area or flights within the outermost regions. 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 in their emissions after 2020. In the light of these developments, the EU decided to maintain the geographic scope of the EU ETS limited to intra-EEA flights from 2017 onwards and to review the EU ETS in relation to the operationalisation of the CORSIA in 2024 (EU, 2017d).

More than 1 200 aircraft 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 Mt $CO_2$ for all participating countries), with a cap for the period 2013-2020 equivalent to 95 % of baseline emissions (EU, 2008a). Whereas aircraft operators may use EU aviation allowances (EUAAs), EU allowances (EUAs) from the stationary sectors and international credits, stationary installations are not permitted to use aviation allowances in order to comply.

**Figure 2.4 Greenhouse gas emission trends and projections under the scope of the EU ETS in the EU, 1990-2030**




**Notes:** GHG emission trends and projections depicted here represent EU-28 wide data. Iceland, Liechtenstein and Norway are part of the EU ETS, but are not depicted above. 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 MMR projections, to EU ETS sectors and/or Effort Sharing sectors. Emissions for the period 2005-2012 were estimated to reflect the current scope (2013-2020) of the EU ETS, see also Annex 1 (Sections A1.2.3 and A1.2.5).

Solid lines represent historical GHG emissions (available for the period 1990-2017) and approximated estimates for the year 2018. Dashed lines represent projections for the scenario with existing measures. Dotted lines represent projections for the scenario with additional measures. See Annex 1 (Section A1.2) for additional information on data sources for GHG emissions.

**Sources:** EEA (2019b, 2019e, 2019f); EEA (forthcoming) (2019b).

and EU-driven policies and measures in order to meet their commitments under the Effort Sharing legislation. In 2018, a 2030 target and the starting point for the 2021-2030 trajectory were agreed for each Member State in the context of the ESR.

Figure 2.5 illustrates the trends and projections in the emissions under the Effort Sharing legislation. Effort Sharing emissions (i.e. emissions from the sectors covered by the ESD in 2013) have fallen steadily since 1990, albeit at a slower rate than those covered under the EU ETS. This reflects the diversity of the trends in the various sectors covered by the ESD. The building sector has contributed most to absolute reductions in emissions in the sectors covered by the Effort Sharing legislation since 1990, although its emissions have increased since 2015. Emissions from the transport sector, which is the largest contributor to GHG emissions under the Effort Sharing legislation, increased continuously between 1990 and 2007. Following a decline between 2007 and 2013, emissions from this sector have been increasing continuously since 2014.

In 2017, Effort Sharing emissions aggregated at EU level were 10 % below 2005 levels, which is a greater reduction than the average reduction corresponding to achieving all national targets for Effort Sharing emissions by 2020 ([11]). Yet, the year 2017 was the third

([11]) The reduction in 2017 is equivalent to a reduction of 10.5 % compared with base year ESD emissions 2005. The respective average reduction corresponding to the achievement of all national Effort Sharing targets is 9.3 %. See Annex 1, Section A.1.2.7

year in a row in which total Effort Sharing emissions increased. According to preliminary estimates, Effort Sharing emissions fell by 0.9 % from 2017 to 2018. This decrease is projected to continue and aggregated Member State MMR projections result in a 13 % reduction of Effort Sharing emissions by 2020 compared with 2005 base-year emissions where only existing and adopted policies and measures are considered.

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

In its assessment of the Member States' draft NECPs, the Commission states that an aggregation of the planned measures provided in the draft NECPs shows that the EU could achieve a 28 % reduction in emissions in non-ETS sectors (EC, 2019b). The small difference of 1 percentage point compared the assessment based on MMR projections can be explained by differences in the 'with additional measures' scenario submissions under MMR and draft NECPs and the gap-filling methodology used for the Effort Sharing emissions by the Commission. Differences in WAM submissions have the most notable impact for calculations of Poland's contributions, while for Bulgaria, Portugal, Slovenia and Sweden, the missing scenarios were gap-filled with the EU reference scenarios 2016, as no Effort Sharing projection was provided in the draft NECPs (EC, 2019b).

Member States have projected only limited decreases in Effort Sharing emissions between 2017 and 2030. The largest decreases are expected to take place in the building sector, justified by the availability of marketable technologies that reduce energy demand and integration of renewables. In contrast to other sectors, emissions from the agricultural sector are not projected to decrease, even under the scenario with additional measures. Emissions in the transport sector are also expected to remain nearly stable in the scenario with existing measures 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 between 2017 and 2030 in emissions from energy supply, waste, manufacturing and industrial processes, as well as product use not covered under the EU ETS (mostly fluorinated gases, or F-gases as regulated in the F-gas regulation, and aggregated as 'industry and other').

Implementing additional measures (i.e. at the planning stage up to early 2019) would lead to further decreases in emissions. In projections submitted in 2019, this is especially evident in the transport sector, where additional measures are project to result in a significant reduction in emissions, with an increasing difference between the scenario with existing measures and the scenario with additional measures over the coming decade. As illustrated in Figure 2.5, additional measures are projected to deliver a further 102 Mt $CO_2$e in emissions reductions from the transport sector, compared with the scenario with existing measures.

To learn more about trends and projections in the Effort Sharing sector, see the EEA briefing on Effort Sharing emissions (EEA (forthcoming), 2019c). The EEA database on climate change mitigation policies and measures in Europe (EEA, 2019d) can be consulted for further information on policies and measures reported under the MMR, as can recent EEA briefings on the reported climate mitigation policies and measures (EEA, 2018d).

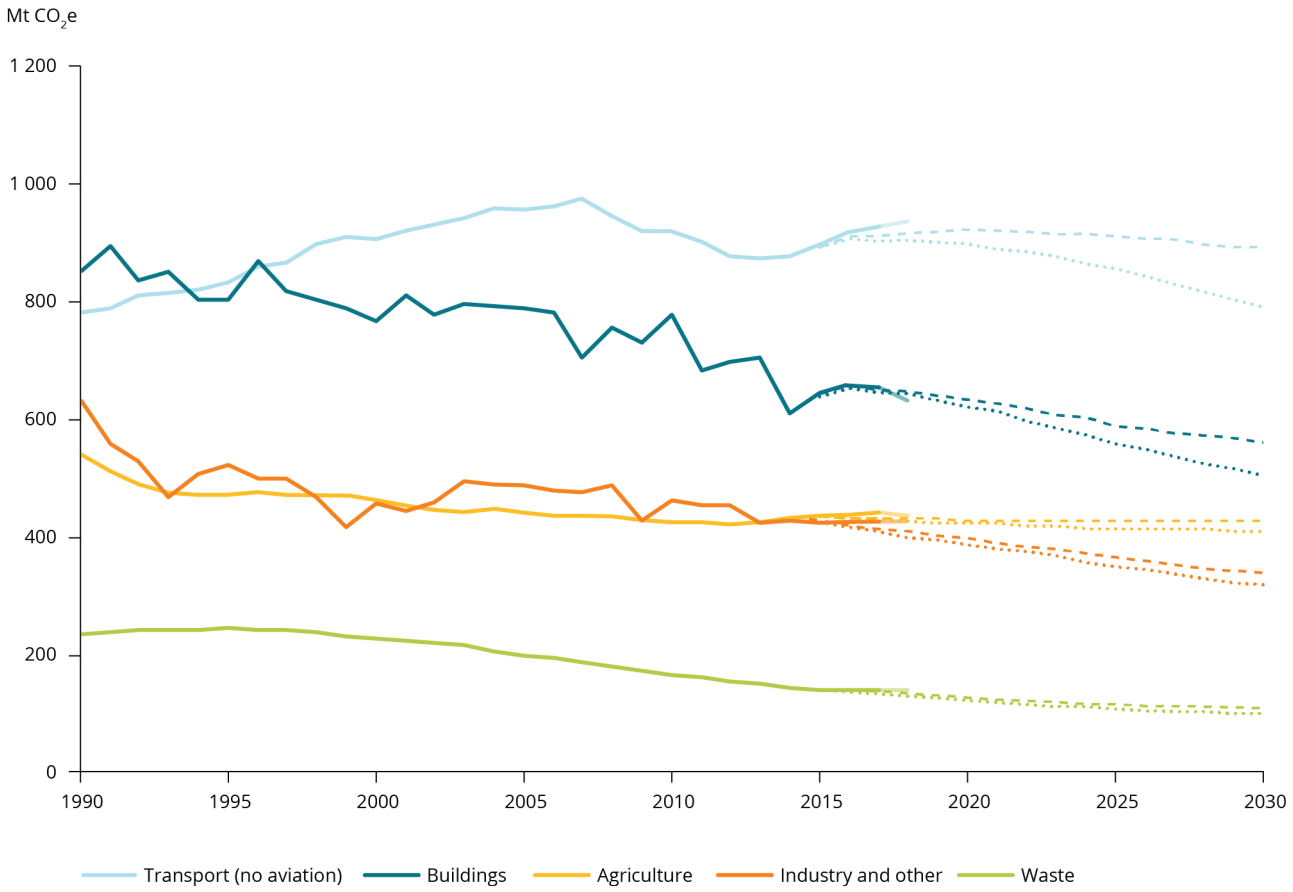
### *2.2.3 Emissions from land use, land use change and forestry*

Currently, LULUCF represents a net carbon sink at EU level. GHG emissions and removals through LULUCF, which are partly accounted for to assess Member States' compliance with their Kyoto Protocol targets, are not included in the EU's 2020 climate targets. With the rules set in the new LULUCF Regulation (EU, 2018f) and the new ESR (EU, 2018g), this sector will be integrated into the EU 2030 climate and energy framework from 2021 onwards.

The LULUCF Regulation defines harmonised EU-wide accounting rules to measure anthropogenic influence on emissions and removals in the sector. Starting in 2021, national 'no-debit' commitments will be in place with increasing importance related to accounting for reductions in emissions (see Box 2.4). The ESR establishes limited flexibility for net accounted removals from the LULUCF sector that can be used under certain circumstances to meet Member States' targets. Greater reductions in emissions under the Effort Sharing sectors can also be used to comply with the need to account properly for anthropogenic emissions and removals within the LULUCF sector.

Carbon stock changes in the LULUCF sector take place on managed land and are the result of human

**Figure 2.5** **Greenhouse gas emission trends and projections under the scope of the Effort Sharing legislation**




**Notes:** Solid lines represent historical GHG emissions (available for the period 1990-2018). Dashed lines represent projections for the scenario with existing measures. Dotted lines represent projections for the scenario with additional measures.
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 MMR projections, to EU ETS sectors and/or Effort Sharing sectors. See Annex 1 (Section A1.2) for additional information on data sources for GHG emissions.
The sector summarised here as 'industry and other' aggregates emissions from 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 (2019e, 2019b, 2019g); EEA (forthcoming) (2019b).

interventions that impact the carbon stored in three main terrestrial pools (i.e. living biomass, dead organic matter and soils). Carbon stock changes can result in both emissions of GHGs (source) or removals of $CO_2$ (sink), in the form of terrestrial carbon sequestration. $CO_2$ emissions and removals on agricultural land are attributed to the LULUCF sector and not to the agricultural sector.

In 2017, the EU's LULUCF sector presented a net reported carbon sink of about 258 Mt $CO_2$e ([12]). Most EU Member States report a net carbon sink from LULUCF, with the exception of Denmark, Ireland, Malta, the Netherlands and Portugal. Iceland and Liechtenstein also report net emissions from this sector. It is important to note that the LULUCF sector is accounted for as a net aggregate of reported sinks and sources neither for the Kyoto Protocol nor for the LULUCF Regulation.

Although it is a net emission sink, the sector was also a net emission source of $CO_2$ emissions for some land use subcategories, as illustrated in Figure 2.6. The largest sources are represented by the conversion of forests (i.e. deforestation) to other forms of land use that take up lower levels of GHGs and by organic soils, especially when they are subject to agricultural activities that enhance carbon oxidation. Moreover, natural disturbances such as fires or windthrow play important roles in the overall carbon budget of this sector and its interannual variability.

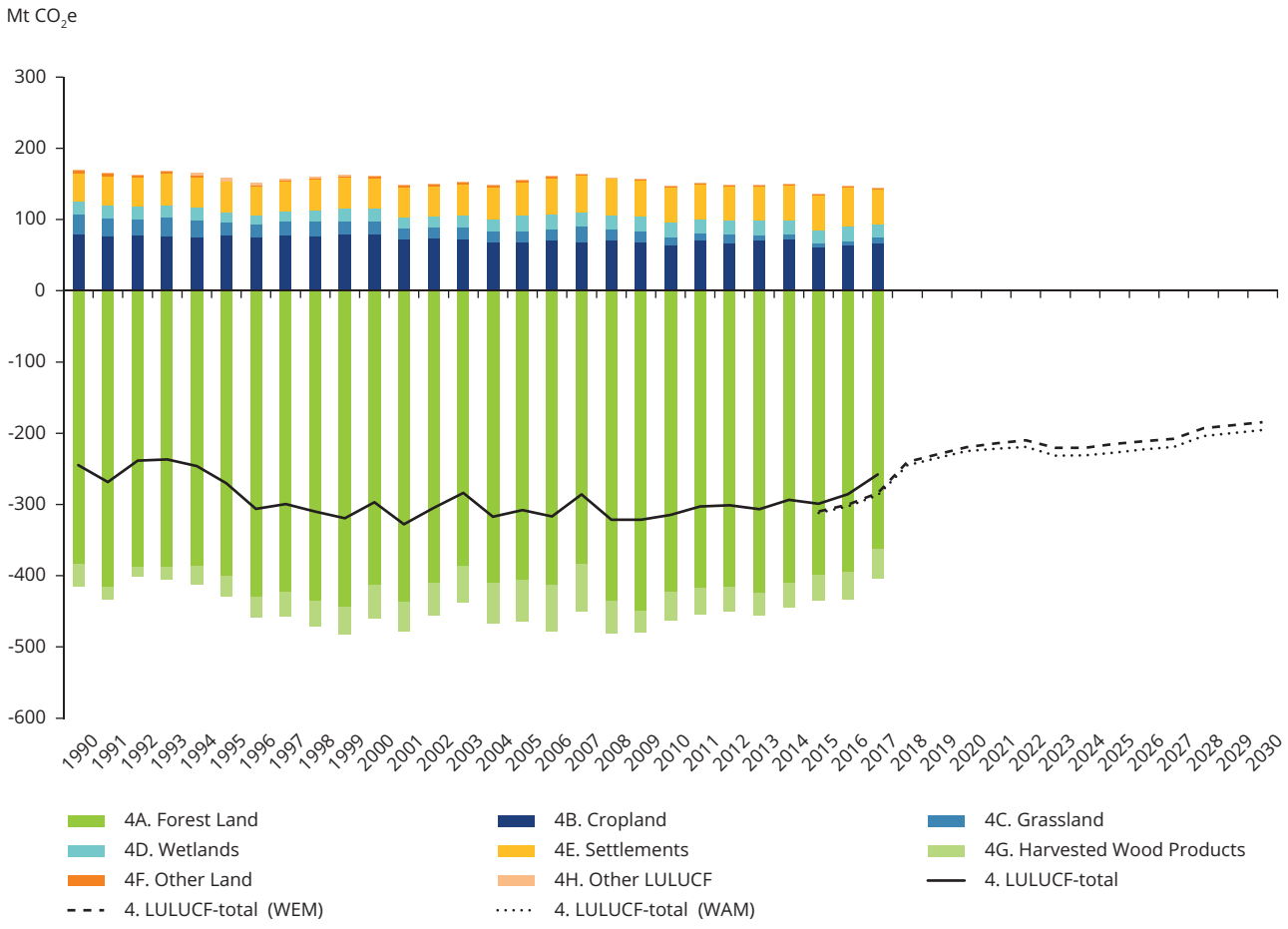
([12]) As reported under the United Nations Framework Convention on Climate Change, without any accounting rules applied.

The main component of the overall carbon sink reported in the LULUCF sector comes from forest land (363 Mt $CO_2$e in 2017), which largely offsets the emissions reported under the other land use categories (see Figure 2.6). The managed forest land sink is mainly driven by the balance between forest harvest (extraction of carbon from the forest, which is reported as returning to the atmosphere) and forest increment (accumulation of carbon in forest biomass as a result of tree growth, which is reported as an increase in carbon stock) rates.

Since 2000, the net reported annual LULUCF sink has been 302 Mt $CO_2$e on average, with an unfavourable declining trend over the past 8 years (with an exception in 2013), as illustrated in Figure 2.6. According to the EU reference scenario 2016 (EC, 2016a), the net reported LULUCF sink in the EU is expected to shrink by about one third between 1990 and 2030. This is attributed partly to increased harvest rates and partly to forests getting older, with associated reduced growth rates — and hence biomass availability — in some forest types.

The reference scenario projects an increase in forest harvest over time, from 516 million $m^3$ in 2005 to 565 million $m^3$ in 2030, resulting from 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), 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 % by 2030. Continued and increased carbon removals through afforestation are expected to partially compensate for this trend, coupled with an expected decline in

**Figure 2.6 Reported EU LULUCF emissions and removals by land-use categories**




**Sources:** EEA (2019e, 2019f); EEA (forthcoming) (2019b).

**Box 2.4 The no-debit rule and the difference between reported and accounted LULUCF emissions**

The LULUCF Regulation requires each Member State to ensure that GHG emissions accounted for from a land use category are entirely compensated for by an equivalent accounted for removal of $CO_2$ from the atmosphere in other categories of the sector, 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 cropland area, it must compensate for resulting increases in emissions by planting new forests (afforestation), enhancing removals and decreasing emissions from managed forests, croplands and grassland, covering the emissions with unused ESR allocations, or agreeing to buy credits from other Member States.

In order to better identify anthropogenic changes in the carbon balance of forests and soils, reported LULUCF emissions and removals are transformed by applying specific reference values according to the accounting rules laid out in the LULUCF Regulation. The accounting rules establish a historical baseline or period for managed cropland, grassland and wetland, as well as forest reference levels for managed forest land that are nationally determined according to a specific methodology.

The rules have been introduced to better identify the impact of human-induced land use changes after 2009 and to resolve geographical variability between Member States in terms of size and land cover. Any possible credits or debits derive from the distance between a Member State's reported emissions and the relevant reference values. For more details, see also EC (2019a).

**Box 2.5 The growing importance of the LULUCF sector in view of climate neutrality**

In the European Commission's strategic long-term vision for a climate-neutral economy by 2050 (EC, 2018a), climate neutrality is also described as achieving net-zero GHG emissions. In a net-zero scenario, sinks of GHG emissions balance out emissions from the other sectors that cannot be reduced to zero. However, as sinks cannot be expanded limitlessly, achieving net-zero emissions requires strong emission reductions in all other areas.

In the in-depth analysis accompanying the Commission's 2050 long-term vision, LULUCF plays a considerable role in all of the eight scenarios. While the effects of LULUCF are similar across all eight scenarios in the years up to 2030, contributions from the LULUCF sector strongly increase after 2030, especially in the scenarios in which other sectors' emissions decrease less significantly. This is particularly true in the two most ambitious scenarios, which include negative emission technology, carbon capture and storage, and LULUCF (1.5 TECH, 1.5 LIFE) (EC, 2018b).

Most European Member States have indicated in their draft NECPs that they aim to comply with the no-debit rule in the two compliance periods up until 2030. Several Member States have communicated in their draft NECPs that climate neutrality plays a role in their long-term ambition (Denmark, France, Portugal and Sweden), but they provide only limited detail on the planned contribution of or accounting for the LULUCF sector. More detailed information may be expected in the national long-term strategies, due by 1 January 2020.

emissions from deforestation from 63 Mt $CO_2$e in 2005 to 20 Mt $CO_2$e in 2030 (EC, 2016a) ([13]).

The LULUCF Regulation is expected to improve the identification of additional action to mitigate climate change, and thereby to enhance policy design and the overall contribution of the sector to climate action. Stronger incentives for action are provided by enabling trade between Member States within the LULUCF sector and by creating a limited national flexibility for the use of certain, robust LULUCF credits in Effort Sharing sectors. Also in the longer term, LULUCF can play an important role in achievement of climate neutrality, as described in Box 2.5.

As the LULUCF sector's role in achieving net reductions in GHG emissions gains attention, due in part to the LULUCF Regulation and accentuated by discussions on net-zero emission goals, additional planned policies and measures in this area are becoming increasingly

([13]) To evaluate the overall carbon effect of forest and wood, it has to be considered that when wood is used — e.g. as a construction material for buildings — the carbon remains stored over the use phase of the resulting products (carbon stock in harvested wood products). Therefore, the United Nations' 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).

important. Several Member States (Czechia, France, Finland, Hungary, Latvia, Lithuania, Portugal, Romania, Slovakia and Spain) have considered additional measures in the LULUCF sector in their 2019 MMR submissions (see also Box 2.6). These are projected to result in 11 Mt $CO_2$e additional reductions in emissions in 2030 than those achieved under the existing measures scenarios. These numbers do not necessarily relate directly to future accounted for values, as GHG projections currently reflect only reported emissions and sinks.

The policies and measures included in the scenario with additional measures may provide insights into which actions in the LULUCF sector may prove useful in view of more stringent climate goals, such as providing enhanced sinks.

## 2.3 Member States' progress towards national greenhouse gas emissions targets

While the preceding sections of this chapter examine past trends and projected future targets at European level, this section examines the European Member States' individual trends and progress, revealing how the Member States' performance in reducing GHG emissions has developed compared with the national targets set specifically under EU Effort Sharing legislation. Mitigation actions take place at national level through a mix of EU-driven policies and measures and national initiatives.

The national Effort Sharing targets for 2020 vary among the Member States. In Denmark, Ireland and Luxembourg, the 2020 targets are set at 20 % reductions; in Bulgaria, the 2020 targets permit a 20 % increase 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. Effort Sharing targets for 2030 range from 0 % (Bulgaria) to -40 % (Luxembourg, Sweden) compared with base-year levels, resulting in a combined effort to reduce emissions by 30 % compared with base-year levels.

### *2.3.1 Progress towards 2017 and 2018 Effort Sharing targets*

In addition to reduction targets for 2020, the national Effort Sharing targets are also broken down into annual targets. In 2017, 18 Member States (Belgium, Croatia, Czechia, Denmark, Finland, France, Greece, Hungary, Italy, Latvia, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom) met their annual Effort Sharing targets without making use of flexibilities. Eight Member States (Croatia, Greece, Hungary, Portugal, Romania, Slovakia, Slovenia and Sweden) overachieved their 2017 Effort Sharing targets by more than 10 percentage points. Greece is the only Member State that had already achieved its reduction target for 2020 by 2017, while 12 Member States (Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia and Slovenia) had 2017 emissions at levels below their 2020 emission targets, which had been formulated as growth targets.

Meanwhile, 10 Member States (Austria, Bulgaria, Cyprus, Estonia, Germany, Ireland, Lithuania, Luxembourg, Malta and Poland) had 2017 Effort Sharing emissions levels greater than their respective annual Effort Sharing emission targets (see Figure 2.7). The year 2017 was the first time that Austria, Bulgaria, Cyprus, Estonia, Lithuania and Luxembourg reported emissions above their Effort Sharing target,

**Box 2.6 Additional policies and measures in the LULUCF sector reported under the MMR**

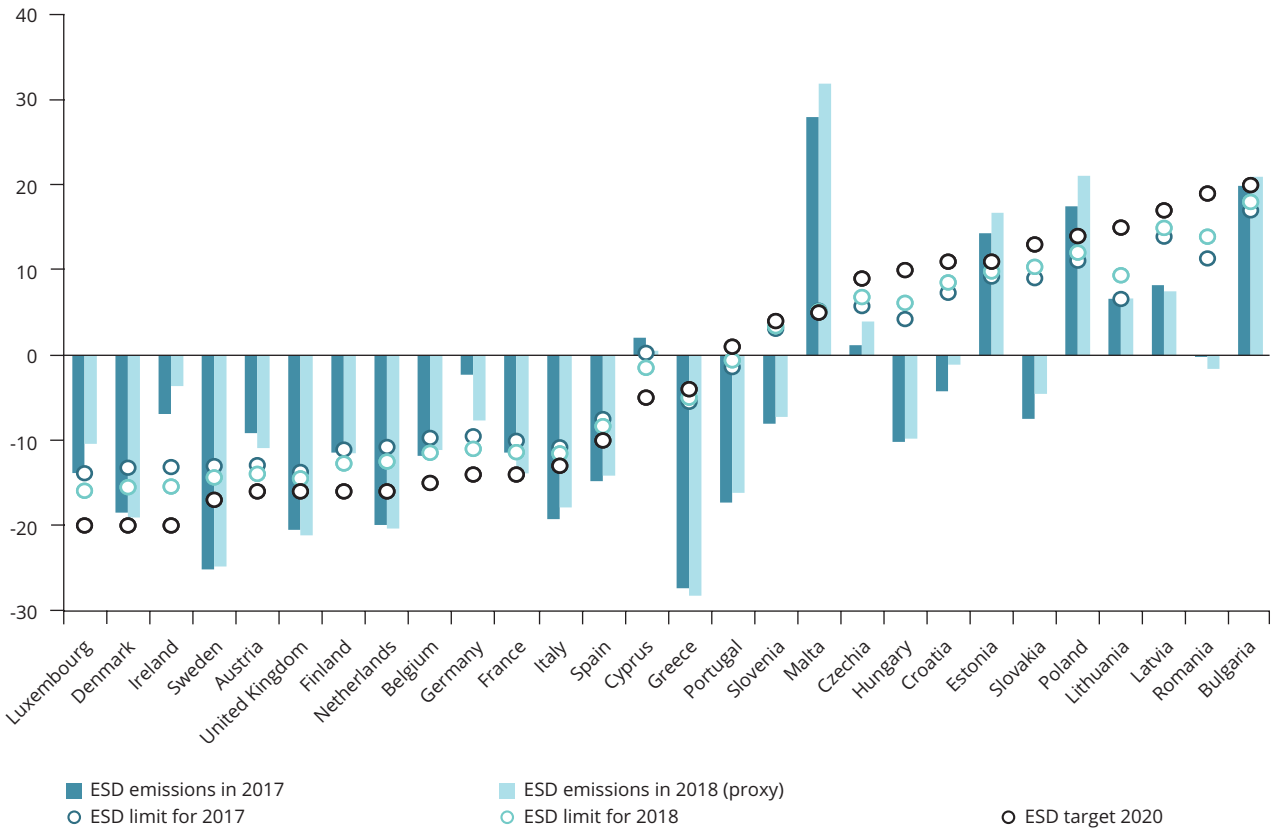
LULUCF-related policies and measures included in the MMR projections scenario that includes additional measures mainly include forestry and, to a limited extent, improved agricultural management. Natural forest expansion, lower harvest rates, increased afforestation rates and afforestation of areas beyond those accounted for in the MMR scenario with existing measures are among the additional measures reported by Member States for the LULUCF sector.

Increasing no-till cropping, drainage of organic soils and conversion of cropland to grassland are among those measures that relate to agricultural practices. These changes in farming practices are intended to increase the carbon sink, which would in turn help compensate for GHG emissions from other sources, as well as to reduce $N_2O$ emissions from organic soils. To account for these measures, monitoring of carbon sequestration in agricultural soils needs to be improved.

Several Member States reported changes in LULUCF emissions from additional policies and measures, and carbon sinks in this sector are projected to grow in Finland, France, Hungary, Latvia, Lithuania, Portugal, Slovakia and Spain. In Czechia and Romania, the sinks are projected to decline because of the effects of additional measures in other sectors, such as increased biomass use.

**Figure 2.7 Progress of Member States towards their 2017 and 2018 Effort Sharing targets**

Percentage change compared to 2005 calculated base year emissions




**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. (See also Section A1.2.6 in Annex 1).

**Sources:** EEA (forthcoming) (2019f); EEA (2019g, 2019e); EEA (forthcoming) (2019b).

although the latter two did so by only 0.1 %. In all 10 Member States but Malta, the 2017 gaps between emissions and annual allocation of ESD base-year emissions are 7 % or less. Malta has missed its targets every year since 2013; by 2017, the cumulative difference between Malta's emissions and its annual allocations amounted to 0.8 million AEAs — a gap of 13 % between emissions and annual allocations between 2013 and 2017. In absolute numbers, the total gaps for 2017 add up to 52 million AEAs, while the cumulative overachievement by other Member States totals 147 million AEAs.

Based on approximated estimates for 2018, 17 Member States met their annual Effort Sharing targets (Croatia, Czechia, Denmark, France, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom). For the remaining Member States, Effort Sharing emissions were above their 2018 targets, although Belgium with 0.4 % is only slightly above.

So far, the European Commission has performed Effort Sharing compliance checks for the period 2013-2016. Malta has balanced its 2013-2016 surplus emissions 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 aiming to mitigate or adapt to climate change. All other Member States except Sweden transferred their own 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 2013-2016, Sweden cancelled its annual surpluses and intends to do so for 2017. For the years 2013-2017, these will add up to 31.9 million AEAs (see EC, 2018a, 2019d).

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

**Box 2.7 Twelve Member States with Effort Sharing emissions above targets in 2017 and/or 2018**

The latest available inventory data for the year 2017 and approximated estimates for 2018 show that 12 Member States exceeded their annual targets in one or both of these years under the Effort Sharing Decision.

This analysis is based on the difference between AEAs and ESD emissions in 2017 and 2018 respectively, and divided by 2005 base-year emissions to allow comparability across Member States. Absolute values refer to a straightforward comparison of emissions versus 'target'.

**Austria** exceeded its ESD target in 2017 by 2.1 Mt $CO_2$e or 4 %. Approximated emissions data for 2018 illustrate a similar gap in that year. Austria accumulated a surplus of 9 million AEAs between 2013 and 2016, and this surplus is sufficient to cover the gaps to Austria's 2017 and 2018 annual targets. If emissions continue to rise, the remaining surplus in 2018 would be 5.1 million AEAs, and this may not be sufficient to help Austria to comply with its annual ESD targets through 2020 without purchasing surplus AEAs from other Member States.

For **Belgium**, emissions were below the country's annual ESD target in 2017, while approximated estimates for 2018 emissions demonstrate that Belgium exceeded its AEAs slightly, by 0.4 % or 0.3 million AEAs. Even with this estimated deficit, Belgium would continue to have a surplus of 14.6 million AEAs in 2018.

For **Bulgaria**, emissions in 2017 exceeded the country's annual ESD target by 0.6 Mt $CO_2$e or 3%. The gap between emissions and AEAs in 2018 is estimated to be in the same range. Bulgaria accumulated surplus AEAs up until 2016, and these are sufficient to cover the gaps to its ESD targets in 2017 and 2018. With approximated ESD emissions in 2018 taken into account, Bulgaria's AEA surplus in 2018 totalled 11.9 million.

Emissions in **Cyprus** exceeded AEAs by 0.1 Mt $CO_2$e or 2 % in 2017. Approximated emissions estimates for 2018 indicate that Cyprus' emissions were still above the annual target in that year. The flexibilities afforded by carrying forward AEAs from previous years would currently suffice for Cyprus to stay within its given budget. There is an estimated surplus of 7.5 million AEAs in Cyprus in 2018.

**Estonia's** emissions exceeded its ESD target in 2017 by 0.3 Mt $CO_2$e or 5 %. The gap between emissions and AEAs in 2018 is estimated to be in the same range. Surplus emissions accumulated up until 2016 would currently be sufficient to cover the gap towards reaching its 2017 and 2018 targets. However, the remaining surplus is estimated to be only 0.5 million AEAs in 2018. If emissions do not decline, the surplus may not be sufficient to ensure Estonia compliance with ESD targets up until 2020 without the purchase of surplus AEAs from other Member States.

For **Finland**, emissions in 2018 exceeded AEAs by 0.4 Mt $CO_2$e or 1.2 %, after emissions in 2017 remained below the annual AEA target. Finland has accumulated surplus AEAs that are currently sufficient to cover the gap to its ESD target. In 2018, the remaining surplus is estimated to be 0.9 million AEAs. If emissions rates in Finland do not decline, the surplus may not be sufficient to ensure Finland compliance with its ESD targets up until 2020 without the purchase of surplus AEAs from other Member States.

**Germany's** emissions exceeded its 2017 emissions budget by 35 Mt $CO_2$e or 7 %. Preliminary estimates for 2018 indicate a decline of ESD emissions by 5 % compared to 2017 levels. Surplus AEAs accumulated up until 2016 would currently suffice to cover the gaps in both years, with a remaining surplus in 2018 estimated to be 4.2 million AEAs. ESD emissions need to decrease strongly in the remaining years up until 2020 in order for Germany to comply with its ESD targets without having to purchase AEAs from other Member States.

In **Ireland**, annual emission allocations were exceeded in 2017 by 3 Mt $CO_2$e or 6 %. Recent ESD emissions estimates indicate that the gap nearly doubled in 2018. Surplus allowances accumulated between 2013 and 2015 are currently still sufficient to cover the gap towards achieving Ireland's ESD target, but emissions have been steadily rising since 2014. The remaining surplus in 2018 is estimated to be 1.6 million AEAs. Ireland's ESD emissions need to decrease strongly in remaining years up until 2020, if Ireland is to avoid having to purchase AEAs from other Member States in order to comply with its ESD targets.

**Lithuania** marginally exceeded its ESD target in 2017 by 0.01 Mt $CO_2$e or 0.1 %. Approximated ESD emissions in 2018 were well below the annual AEA target for that year. Lithuania's AEA surplus in 2018 is estimated to be 1.7 million AEAs.

For **Luxembourg**, emissions in 2017 exceeded AEAs marginally by 0.006 Mt $CO_2$e or 0.06 % compared with 2005 base-year emissions. Approximated emissions estimates for 2018 indicate that the gap between emissions and AEAs increased to 0.6 Mt $CO_2$e or 6 % in 2018. To comply with its ESD targets, Luxembourg's accumulated surplus AEAs are sufficient to cover the gaps in 2017 and 2018, with a remaining AEA surplus of 1 million AEAs in 2018.

**Box 2.7 Twelve Member States with Effort Sharing emissions above targets in 2017 and/or 2018 (cont.)**

For **Malta**, comparing 2017 emissions with allocated emission allowances for that year yields a deficit of 0.3 Mt $CO_2$e or 23 %. A similar gap is estimated for 2018 based on approximated ESD emissions for that year. Malta has not accumulated surplus AEAs over past years and the cumulative gap increased to -1.1 Mt $CO_2$e in 2018. Malta has been purchasing surplus AEAs from Bulgaria to comply with its legal obligations under the ESD, and in the coming years, it can be expected that Malta will need to make further use of additional flexibility mechanisms such as purchasing AEAs from Member States that have overachieved their targets.

**Poland's** emissions exceeded its ESD allowances by 6 % or 12 Mt $CO_2$e in 2017. The gap between emissions and the annual ESD target increased to 9 % in 2018 based on approximated emissions estimates of 16 Mt $CO_2$e. Currently, accumulated surplus allowances will be sufficient to cover the gaps towards reaching Poland's target, but emissions have been rising since 2014. The remaining surplus in 2018 is estimated to be 1.1 million AEAs. ESD emissions need to decrease strongly in the remaining years up until 2020 if Poland is to avoid the purchase of AEAs from other Member States in order to comply with the ESD.

### *2.3.2 Projected progress towards meeting 2020 Effort Sharing targets*

Member States' greenhouse gas projections for the year 2020 confirm the general picture of the assessment of progress towards the annual targets for 2017 and 2018. Ten Member States (Austria, Belgium, Cyprus, Finland, France, Germany, Ireland, Luxembourg, Malta and Poland) miss their 2020 target considering existing measures. However, France and Poland would miss their target with relatively small gaps (compared to 2005 base-year emissions, see also Table A1.2 in Annex 1) of 0.9 % and 0.2 %, respectively. Belgium and France have already planned additional measures that if fully implemented would help them achieving their targets by 2020.

### *2.3.3 Projected progress and required pace towards meeting 2030 Effort Sharing targets*

Effort Sharing targets for 2030 range from 0 % to 40 % reductions compared with 2005 levels, with the lowest levels for Bulgaria and Romania (0-5 %), and the highest for Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, the Netherlands, Sweden and United Kingdom (35-40 %).

According to national GHG projections, most Member States, with the exception of Bulgaria, Croatia, Cyprus, Estonia, Hungary, Malta and Romania, project a reduction in their Effort Sharing emissions over the period 2021-2030, based on their existing measures. Four Member States (Greece, Luxembourg, Poland and Slovakia) project almost no changes in 2030 compared with 2021. This is illustrated in Figure 2.8.

Based on national projections with existing measures, only three Member States (Greece, Portugal, Sweden) expect their Effort Sharing emissions to stay below their ESR target in 2030 (see Figure 2.9). The remaining 25 Member States project that their existing measures will not be enough to meet their 2030 Effort Sharing targets (although Slovenia with a gap of 0.2 % is very close to reaching its target).

Additional policies and measures are expected to assist Member States to meet their 2030 targets more effectively. With planned additional measures, seven Member States (Belgium, Croatia, France, Hungary, Italy, Slovakia and Spain) expect to change this prospect and ensure that they achieve their 2030 Effort Sharing targets. However, Latvia and Czechia, with gaps of 0.3 % and 0.5 %, respectively, are rather close to meeting their 2030 targets with planned additional measures.

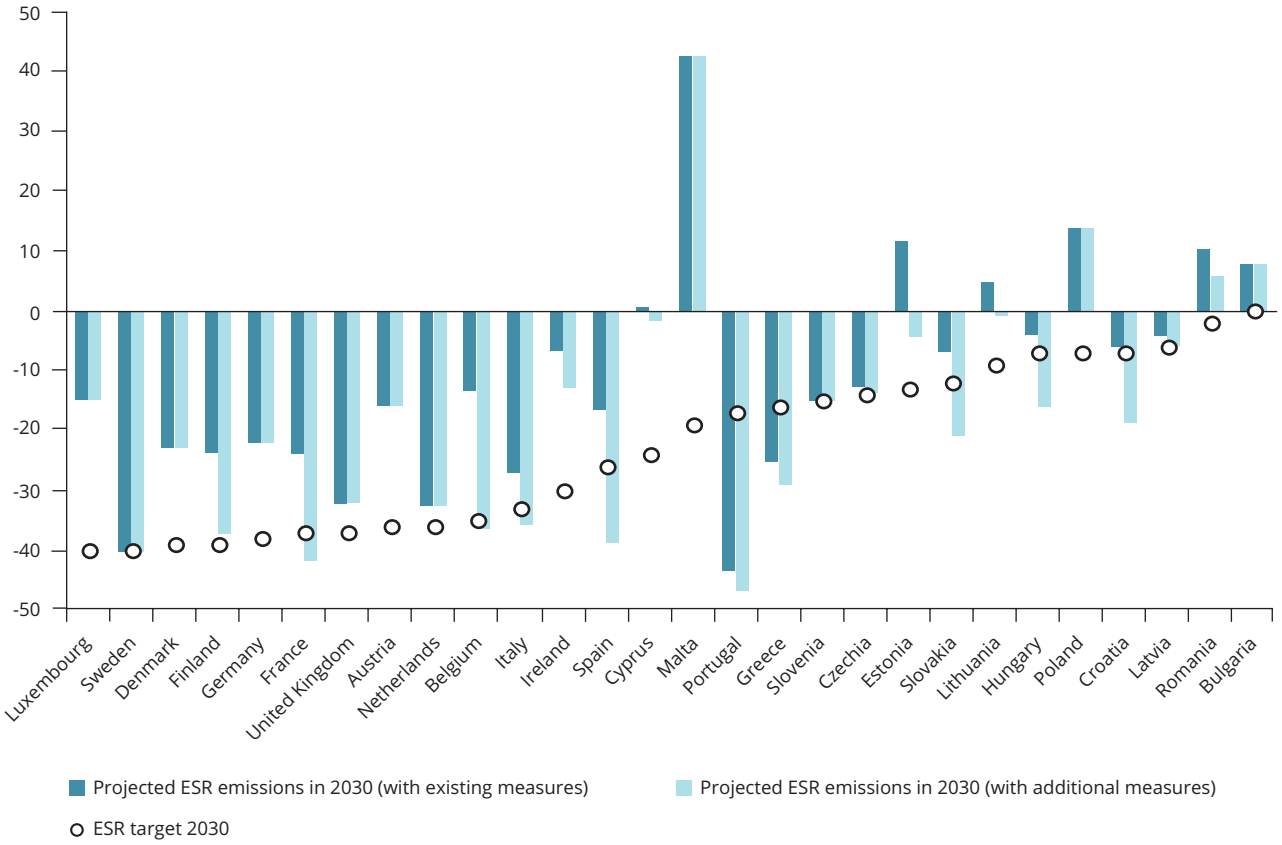
According to their projections based on existing and additional measures, 18 Member States project emissions larger than their AEAs in 2030 ([14]) (Austria, Bulgaria, Cyprus, Czechia, Denmark, Estonia, Finland, Germany, Ireland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Romania, Slovenia and United Kingdom).

The analysis of projected progress towards 2030 targets is based on information submitted by Member States under the MMR in 2019 and on the 2030 ESR targets prescribed by the ESR.

([14]) For those Member States that have not submitted a WAM scenario with additional measures, the scenario with existing measures was used instead.

**Figure 2.8 Projected progress of Member States towards their 2030 Effort Sharing targets**

Percentage change compared to 2005 calculated base year emissions




**Notes:** 17 Member States submitted a scenario with additional measures. For the other Member States (Austria, Bulgaria, Denmark, Germany, Luxembourg, Malta, Netherlands, Poland, Slovenia, Sweden), the scenario with existing measures is shown instead. Romania did not submit a projection in 2019, so its 2017 submission is shown instead.

**Sources:** EU (2017a, 2013a, 2013b, 2018g); EEA (2019f). Based on Member States' submissions.

### *2.3.4 Comparison between historical and required effort levels in the Effort Sharing sectors*

To meet their national Effort Sharing targets for 2030, a large number of Member States will have to achieve greater average annual reductions in emissions in the years up until 2030 than they achieved between 2005 and 2017, or they will have to make use of flexibilities. For Croatia, Greece, Hungary, Italy, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom, the average annual effort needed to meet the national 2030 ESR target is equal to or smaller than that observed in the past since 2005.

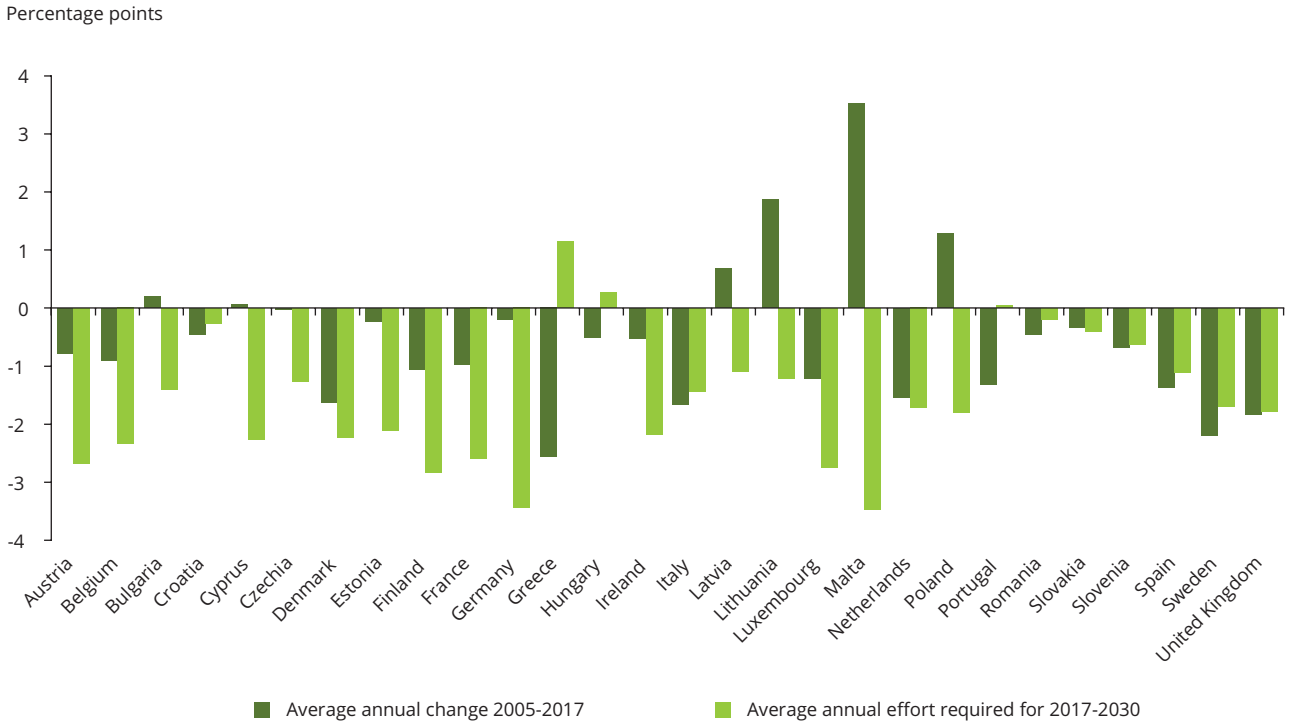
For all 18 Member States requiring higher average annual reductions in emissions in the future than they had achieved in the past, it is important to ensure that sufficient additional measures are planned and fully implemented in due time to bridge the gap to the 2030 targets and the EU's decarbonisation ambitions in the long-term. The greatest increases required in average annual reductions in emissions will need to occur in Cyprus, Germany, Lithuania, Malta and Poland.

## 2.4 Emissions in other European countries

This section looks at the specific situations of Iceland, Liechtenstein, Norway, Switzerland and Turkey, which are not EU Member States but nevertheless EEA member countries. These countries are all United Nations Framework Convention on Climate Change (UNFCCC) Annex I countries. 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 agreed in 2017 to link their emissions trading

**Figure 2.9** **Average annual reductions in emissions required in order to stay below the 2030 Effort Sharing targets, compared with past efforts**




**Note:** Dark bars show the historical average annual change in Effort Sharing emissions relative to 2005. Transparent bars show the comparable average annual change required to achieve the 2030 Effort Sharing target 2030. Some countries could achieve their targets even with small average annual increases,

**Sources:** Compiled from data in EEA (2019b) and EU (2018g).

systems. The agreement was recently approved by the Swiss Parliament and is expected to enter into force on 1 January 2020 (Switzerland, 2019a).

- 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. Both intend to fulfil their commitments jointly with the EU (Iceland, 2015). They are in dialogue with the EU to participate in the EU's joint efforts 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. The target for Iceland will most likely be 29 % compared with 2005 levels. Flexibility mechanisms will be available for Norway and Iceland, as they are for Member States (Iceland, 2019b).

- Iceland decided to 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.

Historical GHG emissions in Iceland, Liechtenstein, Norway, Switzerland and Turkey followed very different trends between 1990 and 2017 (see Figure 2.10).

Iceland set a long-term GHG mitigation target of between 50 % and 75 % by 2050 compared with GHG emissions in 1990. In 2017, Iceland's emissions had increased by 32 % compared with 1990 levels. Up until 2030 it aims jointly to achieve a 40 % reduction in emissions together with the EU, as submitted in its NDC under the Paris Agreement, and Iceland aims to achieve carbon neutrality no later than 2040.

This is in accordance with Iceland's governmental agreement (Iceland, 2017) and its climate action plan (Iceland, 2018), which was published in accordance with Iceland's Climate Change Act No 70/2012 (Iceland, 2012).

Liechtenstein aims to attain at least a 40 % reduction in GHG emissions in 2030 compared with 1990 levels (Liechtenstein, 2015) ([15]). To achieve 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 2017, Liechtenstein's emissions were 15 % lower than in 1990, 5 percentage points below the level of emissions it aims for in 2020, and 25 percentage points below the level of emissions it aims to achieve in 2030. The scope of the targets is comparable.

According to its NDC (Norway, 2015), Norway aims to reduce its GHG emissions by at least 40 % by 2030 compared with 1990 ([16]). In its Climate Change Act of 2017, Norway set the target to reduce GHG emissions by 80-95 % compared with 1990 levels (Norway, 2017). In 2016, Norway's parliament also agreed on a goal to reduce GHG emissions to net zero by 2030 (Norway, 2017), but this has not been laid down in climate legislation. This goal is to be achieved through emissions trading in the EU, international cooperation on reducing emissions, other forms of emissions trading and project-based cooperation. In 2017, GHG emissions had increased by 3 % compared with 1990 levels.

For 2030, Switzerland submitted an NDC to the UNFCCC that states its intention to reduce its GHG emissions by 50 % compared with 1990 levels. This target will be reached partly by using carbon credits from international mechanisms (Switzerland, 2015). In 2017, emissions in Switzerland had decreased by 12 % compared with 1990 levels.

Turkey has submitted an NDC to the UNFCCC secretariat of up to a 21 % economy-wide cut in GHG emissions by 2030, compared with a business-as-usual scenario, including a conditional part (Turkey, 2015). Turkey also aims to use carbon credits from international market mechanisms. According to its intended nationally determined contribution (INDC), Turkey is planning to increase its capacity to generate electricity from solar energy to 10 GW and from wind energy to 16 GW by 2030 (Turkey, 2015).

([15]) Including emissions and removals from LULUCF.
([16]) 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 level of ambition compared with that when LULUCF is not included.

**Figure 2.10 Total greenhouse gas emission trends and projections in Iceland, Liechtenstein, Norway, Switzerland and Turkey**


**Notes:** Projections display total GHG emissions excluding LULUCF and international aviation. Solid lines represent historical values; dashed lines represent projections with existing and projections with additional measures.

Values shown for Iceland include inventory data, taking into account total $CO_2$ emissions from industrial processes. Iceland excluded these emissions in order to comply 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 (2019e); Iceland (2019a); Liechtenstein (2019); Norway (2019); Switzerland (2018, 2019b); Turkey (2019).

# 3 Progress towards meeting renewable energy targets

**2020**

- The share of energy generated from renewable sources in the EU's gross final energy consumption has been increasing year on year to reach 17.5 % in 2017, exceeding the level of the indicative trajectory of 16 %, as set out in the Renewable Energy Directive for the years 2017 and 2018. Preliminary estimates from the EEA indicate that the EU's share of renewable energy sources (RES) also continued to increase in 2018, when it reached 18.0 %. The EU therefore appears to be on track to meet its 20 % target for renewable energy for 2020. However, increases in final energy consumption during recent years have negatively affected the annual increase in the share of renewable energy. Continuing at the current pace of renewable energy growth and final energy consumption could put the EU at risk of slightly missing its 20 % target in 2020.
- Despite the overall progress observed on renewable energy, in particular electricity, insufficient progress has been achieved so far towards meeting the 10 % renewable energy target set for the transport sector. The consumption of renewable energy in the transport sector reached a share of 7.6 % in 2017 and 8.1 % in 2018, according to EEA preliminary estimates.
- In 2017, all but seven Member States (Belgium, France, Ireland, Luxembourg, Netherlands, Poland, Slovenia) were on track towards their 2020 RES targets, with RES shares equal to or higher than their indicative trajectories set under the RED. In 11 Member States (Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania, Sweden), the proportion of RES used in 2017 already exceeded the 2020 RED targets.
- According to preliminary EEA estimates for 2018, the situation improved, with the number of Member States with RES shares below their indicative trajectories decreasing from seven to four (France, Ireland, Netherlands, Poland).
- Regarding the progress of Member States against their own national plans, 16 Member States (all except Austria, Belgium, Cyprus, France, Germany, Ireland, Luxembourg, Netherlands, Poland, Portugal, Slovenia, Spain) reached or exceeded their anticipated national renewable energy action plan trajectories for 2017. This number is expected to stay the same at 16 Member States (all except Austria, Belgium, Cyprus, France, Ireland, Malta, Netherlands, Poland, Portugal, Slovenia, Spain) in 2018.

**2030**

- The EU has established a binding 2030 target of achieving a RES share of final energy consumed of at least 32 %. To achieve this minimum level, the average RES share in the EU would need to increase by 1.1 percentage points per year from 2017 to 2030. This is more than the average increase of 0.7 percentage points per year that has been achieved since 2005.

**2050**

- The EU 2030 RES target represents only a milestone towards a fuller transformation of the EU energy system. If Member States step up their efforts so that the EU meets its 2030 target, further increases of around 3.4 percentage points per year, on average, after 2030 will be needed to achieve full decarbonisation by 2050.

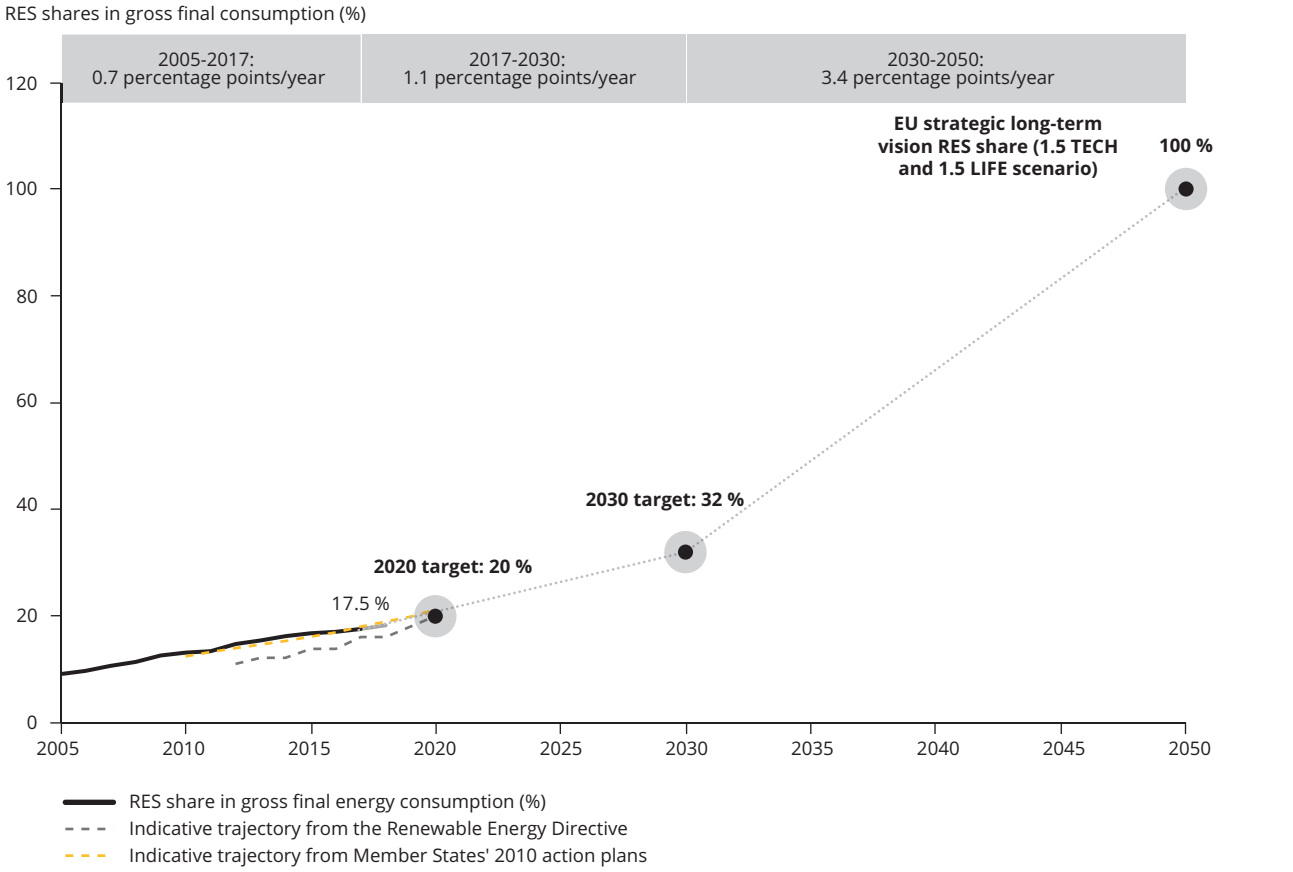
## 3.1 Progress and required pace towards meeting the EU's renewable energy targets

In 2017, the EU-wide use of renewable energy, as a proportion of gross final energy consumption, continued to rise, reaching a share of 17.5 % across Europe and exceeding the indicative trajectory set at 16 % in the Renewable Energy Directive (RED). According to their 2010 national renewable energy action plans (NREAPs), Member States had planned to achieve an aggregated renewable energy share of 17.2 % in 2017, so the current rate of progress exceeds the expected achievements set out in the RED and the NREAPs (EEA, 2019b).

According to preliminary estimates from the EEA, the share of renewable energy sources (RES) continued to grow and reached a level of 18.0 % in 2018 (EEA (forthcoming), 2019a).

Despite continued increases in Europe's share of renewable energy, a faster pace of renewable energy development will be necessary in 2019 and 2020 if the EU is to meet its 2020 renewable energy target. This conclusion was confirmed by the European Court of Auditors in its recent detailed report *Wind and solar power for electricity generation: significant action needed if EU targets to be met* (ECA, 2019).

**Figure 3.1 Share of energy from renewable energy sources in the EU's gross final energy consumption, 2005-2017, 2020 and 2030 targets and 2050 scenario for reaching carbon neutrality, under the EU's long-term vision**




**Notes:** The 2050 value represents the indicative share of renewable energy in the EU's gross final consumption that, combined with energy efficiency and other climate mitigation measures, would allow the EU to reach carbon neutrality by 2050. The 2050 value is consistent with the carbon neutrality scenarios '1.5 TECH' and '1.5 LIFE' in the in-depth analysis accompanying the Commission's recent strategic long-term vision for a climate-neutral economy by 2050. The renewable energy shares in the figure follow the accounting methodology put forward under Directive 2009/28/EC.
pp = percentage points If extended into the future, the 0.7 percentage point average growth rate of renewable shares observed annually since 2005 will be insufficient to reach the EU's 2030 target.
Growth rates = own calculations.

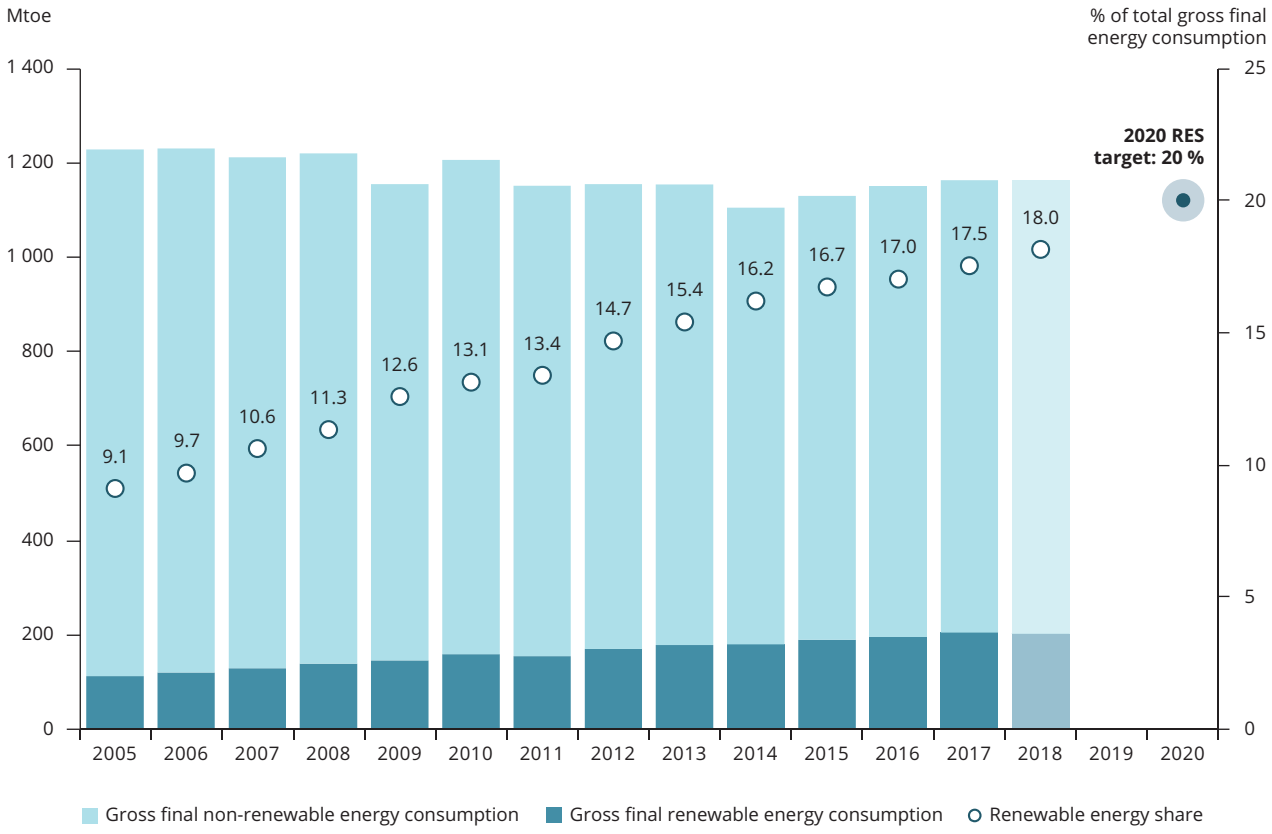
**Sources:** EC (2013a, 2013b, 2011a, 2011b); EEA (2011); EEA (forthcoming) (2019a); EU (2008a, 2018d); Eurostat (2019d).
Growth rates = own calculations.

### *3.1.1 Development of renewable energy and energy consumption between 2005 and 2017*

Between 2005 and 2017, 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 (see Figure 3.1). This steady increase reflects a combination of two trends: first, the increase in renewable energy production in absolute terms; and, second, the decline in final energy consumption over the same period.

Although the consumption of renewable energy grew by over 80 % between 2005 and 2017, gross final energy consumption from all sources ([17]) fell by 5 % (see Figure 3.2). The decrease in the gross final energy consumption from non-renewable sources between 2005 and 2014 corresponds to a progressive substitution of fossil and nuclear fuels by renewables. However, between 2014 and 2017, the consumption of energy from non-renewable sources increased from 925 to 958 Mtoe (million tonnes of oil equivalent), while total final energy consumption grew from 1 104 to 1 162 Mtoe. Increasing gross final energy consumption levels since 2015 hinder both the growth in the share of renewable energy and making good progress towards meeting energy efficiency targets (see also Chapter 4). Thus, the overall trend to reduce energy consumption shifted to the detriment of the RES share and of climate mitigation efforts: since 2015, in absolute terms, the consumption of fossil fuels has increased faster than the consumption of energy from renewable sources.

**Figure 3.2 Gross final energy consumption from renewable and non-renewable energy sources, 2005-2017 and proxy 2018**

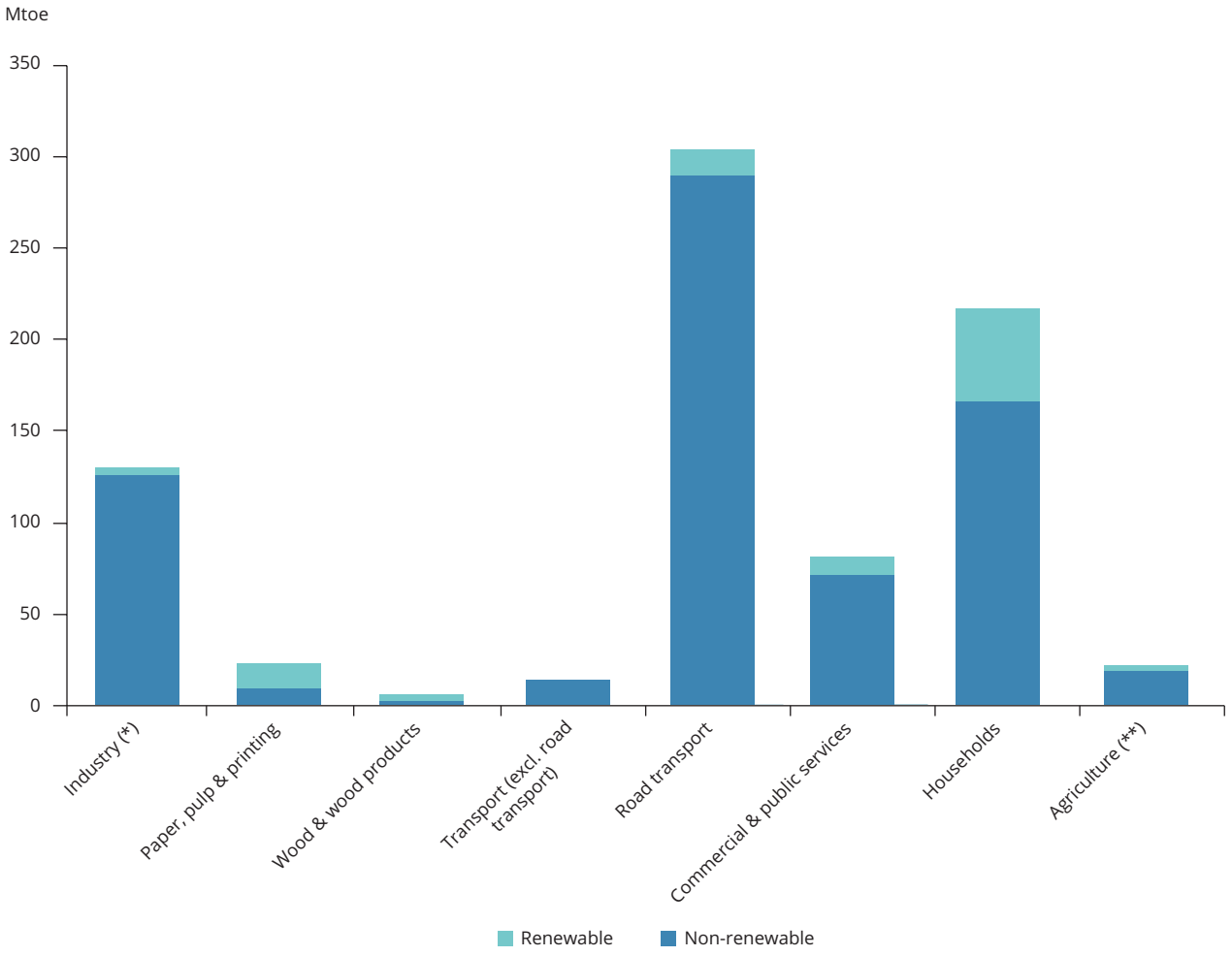



**Notes:** Eurostat calculates the shares of RES consumption, and as part of this process normalises wind power and hydroelectricity generation, which are part of the RES share numerator. However, the total consumption of electricity included in the denominator is not normalised. In the figure above,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

**Sources:** EEA (forthcoming) (2019a); EU (2008a); Eurostat (2019d).

([17]) Gross final energy consumption as defined in Article 3 of Directive 2009/28/EC and including the adjustment for aviation in conformity with Article 5(6) of that directive.

**Figure 3.3 Renewable and non-renewable final energy consumption in the EU by sector, 2017**




(*) The aggregation excludes the subsectors paper, pulp & print and wood & wood products.
(**) The aggregation includes forestry and fishing.

**Notes:** (*) The aggregation excludes the subsectors paper, pulp and printing, and wood and wood products.
(**) The aggregation includes forestry and fishing.

**Source:** Compiled from data in Eurostat (2019a).

### *3.1.2 The necessary pace of renewable energy development between 2017 and 2030*

The revised RED sets the objective of increasing the EU-wide share of RES consumption at a binding level of at least 32 % by 2030, with a possible upwards revision of this target by 2023. To meet this 2030 target, the pace of growth of RES consumption would need to be 1.1 percentage points per year from 2017 onwards.

For long-term investment decisions in renewables across the EU, it will be essential to increase investors' confidence in renewables, reduce the demand for energy, adapt the functioning of the energy markets to the reality of growing shares of renewables from various/intermittent production sources and to address local and regional environmental needs. Recent political agreements reached on governance, renewable energy, energy efficiency and energy markets acknowledge this interconnectivity of climate, renewable and energy efficiency targets and are expected to provide the necessary elements to achieve investors' confidence and energy savings.

A recent EEA report (EEA, 2019a) underlines a need for the EU energy system to become more climate resilient. Addressing adaptation needs at the outset of the clean energy transition, even where this may increase initial uncertainty, will allow investments in renewable energy to be more efficient and effective in the medium and long term and will maximise the resilience of energy infrastructures.

Beyond 2030, the EU has no quantified, binding target for renewable energy. However, the recently published long-term strategic vision for 2050 (EC, 2018a) calls for achieving climate neutrality in the EU in 2050. In the two scenarios that achieve carbon neutrality, as described in the in-depth analysis accompanying the long-term vision, the EU-wide RES share increases to 100 % of gross final energy consumption when calculated in accordance with the methodology introduced by the RED (EC, 2018b). To reach full decarbonisation of the energy system, RES shares would need to grow by about 3.4 percentage points per year after 2030. Stepping up near-term efforts to deploy renewables is thus vitally important to prepare for the pace of growth required between 2030 and 2050.

When assessed by sector, in 2017, the largest final energy consumers were road transport, households, and commercial and public services. The shares of renewable energy in these sectors in 2017 were 5 %, 23 % and 12 %, respectively. Across the sectors of the economy, the amount and type of renewable energy deployed varies (see Figure 3.3).

In sectors in which the main consumption of energy is related to the building stock (households; commercial and public services), mitigation options include the use of renewable electricity, and heating and cooling technologies, such as primary solid biofuels, heat pumps and solar photovoltaic power.

In the transport sector, blended biofuels are an important mitigation option. In the energy-intensive industries such as iron and steel, chemical and petrochemical, non-ferrous metals, paper, pulp and printing, the three most prominent RES in 2017 were primary solid biofuels, renewable municipal waste and biogases. (Eurostat, 2019a).

## 3.2 Progress towards meeting the EU's renewable energy targets in the electricity, heating and cooling, and transport sectors

RES contribute to energy needs for electricity generation, heating and cooling, and transport. 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 levels.

Between 2005 and 2017, the share of electricity from renewable sources consumed in the EU grew at an average of 1.3 percentage points per year, with about 31 % of the electricity consumed in the EU in 2017 having been generated from renewables. The most important RES are hydropower (35 %), wind (34 %), solar photovoltaic (12 %) and solid biomass (9 %) (Eurostat, 2019d) (EEA, 2018c). Roughly half of renewable electricity came from variable sources such as wind and solar power (Eurostat, 2019d), representing approximately 46 % of all electricity generation. In 2018, the EEA's approximated estimates indicate that about 32 % of total electricity consumed was derived from RES, with more than 48 % of this share from wind (36 %) and solar power (12 %) (EEA (forthcoming), 2019a).

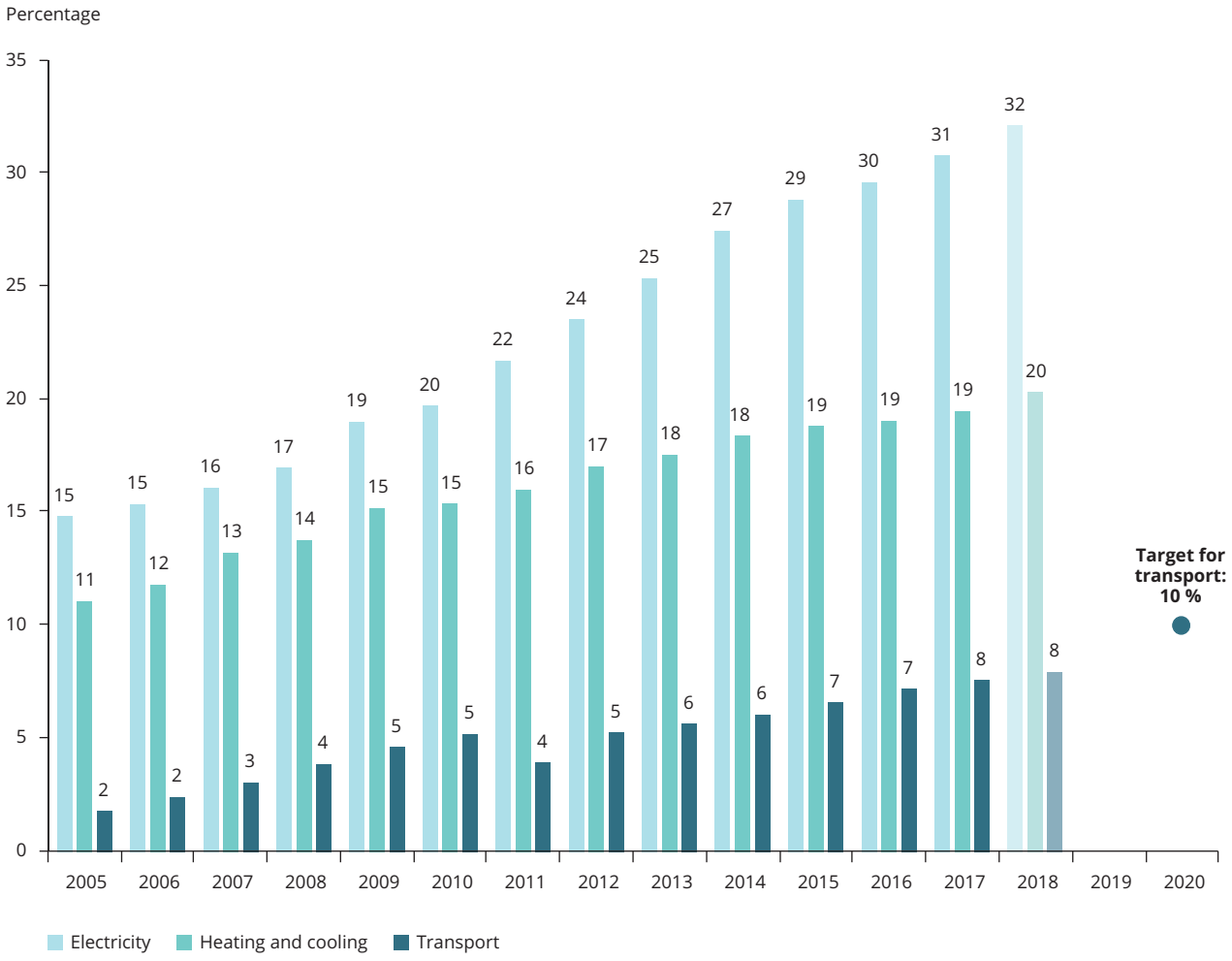
In the heating and cooling sector, the share of renewable contributions across the EU grew by an average of 0.7 percentage points per year between 2005 and 2017. The major sources for renewable heating and cooling throughout the EU are solid biomass, heat pumps and biogas, followed by solar thermal collectors (EEA, 2017a). The share of energy from renewable sources used in this sector amounted to 19.5 % in 2017 and was estimated to have increased in 2018 (20.3 %). Heating from renewable sources is increasingly being used as a cost-efficient and secure alternative to fossil fuels, and natural gas in particular, for district heating and at local levels.

In the transport sector, renewable energy represented only 7.6 % of energy consumption in 2017 (see Figure 3.4). According to preliminary estimates from the EEA, this proportion was 8.1 % in 2018.

After rapid growth between 2005 and 2010, the proportion of RES in transport dropped in 2011 and has been increasing at a slower pace since 2012. This can be explained by several factors. Some Member States were late in transposing and implementing the legal provisions meant to ensure compliance with sustainability criteria set under the RED, and different rules in different Member States have created a fragmented market. The debate concerning the future of biofuel policy, in the light of the effects on indirect land use change of conventional crop-based biofuels, is also a contributor to the slower rates of developing renewables in transport. Studies showed that there is a risk of high greenhouse gas (GHG) emissions caused by indirect land use change induced by conventional 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 of advanced biofuels by 2020 (e.g. fuels made from waste or algae). The recast of the RED requires Member States to promote advanced biofuels after 2020 (0.2 %

**Figure 3.4 Shares of energy use from renewable sources by sector in the EU, 2005-2017 and proxy 2018**




**Note:** Percentages indicate the share of energy from renewable sources in gross final energy consumption of the corresponding sector.

**Sources:** EEA (forthcoming) (2019a); EU (2008a); Eurostat (2019d).

of transport fuels by 2021, rising to 3.5 % by 2030) and limits the contribution of conventional crop-based biofuels towards meeting the renewable energy targets to the level consumed in each Member State in 2020, with an additional 1 percentage point allowed over present consumption but with a maximum of the overall cap of 7 %. Furthermore, the contribution of crop-based biofuels with a high risk of indirect land use change will be frozen at the 2019 level and, as of 2023, will gradually decrease to 0 % by the end of 2030, unless they are certified as fuels with a low risk of indirect land use change. In March 2019, the Commission adopted a delegated Regulation (EU, 2019a) setting out criteria for determining fuels with a high risk and certifying biofuels with a low risk of causing indirect land use change.

Furthermore, the use of biofuels to reduce GHG emissions remains a relatively high-cost climate mitigation option (see also the EEA report on the GHG intensities of transport fuels (EEA (forthcoming), 2019g). 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 100-330 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, 2015d). These estimates depend to a large extent on the cost differentials between fossil fuels and biofuels. At present, biomethane from waste streams and biogas is the cheapest biofuel available, with costs around EUR 40-50/MWh, and can compete with fossil fuels in certain niche markets. Overall, the majority of biofuels can be expected to remain more expensive than fossil fuels unless the costs of mitigating climate change are factored into the cost of fossil fuels. Nonetheless, biofuels and other renewable fuels will need to be used in emission-intensive sectors such as aviation and shipping to substitute fossil fuels (EC, 2017b).

According to the Fuel Quality Directive (98/70/EC) (EU, 1998), a reduction target for fuel suppliers has been set to reduce the life cycle GHG intensity of fuels used in road and non-road mobile machinery by a minimum of 6 % by 2020 compared with 2010 levels. According to data reported by 22 Member States, the average GHG intensity of the fuels consumed in these countries in 2017 (excluding the indirect land use change emissions intensity for biofuels) was 3.4 % lower than 2010 levels. This corresponds to a saving of 29 Mt $CO_2$e in 2017. With linear reductions from 2010 to 2020, the fuel intensity level in 2017 should have been 4.7 %, indicating a need for further efforts by 2020 (EEA (forthcoming), 2019g).

The EU is lagging behind its 2020 target for the GHG intensity of fuels, as the projected reduction in 2020 is 4.7 % excluding indirect land use change, assuming a constant rate of reduction between 2010 and 2020. It should be noted that no upstream emission reductions were reported in 2017. These are expected to contribute to the reduction target only in the year 2020 (EEA (forthcoming), 2019g).

Looking forward, new regulation requires that, between 2021 and 2030, Member States will use obligations on fuel suppliers to ensure that at least 14 % of transport fuels stem from renewable sources (EU, 2018d). Member States are not required to include conventional biofuels in the obligation. The contribution from conventional biofuels is capped at a maximum share of 7 %, and Member States can reduce the 14 % target accordingly if they remain below the 7 % maximum threshold share set for conventional biofuels. Generally, progress in the transport sector is much slower compared with overall RES growth rates for all sectors.

## 3.3 Progress towards national renewable energy targets

In addition to setting the EU-wide targets for renewable energy deployment, the RED also sets binding national targets for all Member States for 2020 (EU, 2009b). These national targets range from 10 % for Malta to 49 % for Sweden and reflect differing national circumstances and starting points.

To ensure that the 2020 targets are achieved, the RED also sets indicative trajectories for the period 2011-2018. Member States may reach their indicative RED targets domestically, e.g. by establishing adequate RES support measures or through cooperation with other countries (between local, regional and national authorities, planned statistical transfers or joint projects ([18])). Member States also set their own estimated trajectories in their NREAPs, reported in 2010 and updated by some Member States thereafter.

### *3.3.1 Deployment of renewable energy between 2005 and 2017*

The growth in the RES share in the Member States during the period 2005-2017 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 20 Member States since 2005 (see Figure 3.5), yet only slightly so in several Member States. Compared with last year's report, *Trends and projections in Europe 2018* (EEA, 2018c), increases in gross final energy consumption since 2005 were seen not only in Austria, Estonia, Finland, Lithuania, Malta and Poland but also in Cyprus and Germany (very slightly at 0.03 %).

### *3.3.2 Current progress against national targets until 2020*

In 2017, the RES share had already progressed to levels above the 2017-2018 indicative trajectories set in the RED (see Figure 3.6) in all Member States except seven (Belgium, France, Ireland, Luxembourg, Netherlands, Poland, Slovenia).

Taking into account the EEA's early renewable energy estimate for 2018, the pattern of exceeding the national indicative trajectories holds true for 22 Member States, based on average RES shares in 2017-2018 (all except Belgium, France, Ireland, Netherlands, Poland, Slovenia).

Considering RES shares in relation to the 2020 targets, in 2017, 11 Member States were already above their national target levels for 2020 set under the RED. These countries were Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania and Sweden (see Annex 2).

([18]) The RED anticipates three main cooperation mechanisms among Member States in their pursuit of their national targets: (1) '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; (2) '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 (3) 'joint support schemes', in which Member States co-finance their renewable energy production independent of its location (within their territories).

**Figure 3.5** **Gross final energy consumption (total and from renewable sources) and shares of energy from renewable sources in the Member States, 2005-2017**

| Member State | Gross final energy consumption<br>Total change 2005-2017 (%) | Gross final energy consumption from renewable sources<br>Total change 2005-2017 (%) | Renewable energy share<br>Percentage points change 2005-2017 |
|---|---|---|---|
| Austria | 4.5 | 44 | 8.9 |
| Belgium | -2.1 | 280 | 6.7 |
| Bulgaria | -1.2 | 98 | 9.4 |
| Croatia | -4.3 | 10 | 3.5 |
| Cyprus | -0.8 | 217 | 6.7 |
| Czechia | -2.5 | 103 | 7.7 |
| Denmark | -4.6 | 114 | 19.8 |
| Estonia | 2.8 | 73 | 11.8 |
| Finland | 1.3 | 44 | 12.2 |
| France | -4.7 | 62 | 6.7 |
| Germany | 0.03 | 117 | 8.3 |
| Greece | -19.8 | 94 | 9.9 |
| Hungary | -0.9 | 91 | 6.4 |
| Ireland | -8 | 247 | 7.8 |
| Italy | -14.6 | 107 | 10.7 |
| Latvia | -1.3 | 19 | 6.7 |
| Lithuania | 9.6 | 69 | 9.1 |
| Luxembourg | -10.3 | 308 | 5.0 |
| Malta | 33 | 7 184 | 7.0 |
| Netherlands | -8 | 143 | 4.1 |
| Poland | 20.3 | 90 | 4.0 |
| Portugal | -13.8 | 24 | 8.6 |
| Romania | -5.7 | 34 | 7.2 |
| Slovakia | -4.4 | 73 | 5.1 |
| Slovenia | -1 | 33 | 5.5 |
| Spain | -13.8 | 79 | 9.1 |
| Sweden | -1.1 | 33 | 14.0 |
| United Kingdom | -12.6 | 577 | 8.9 |

**Notes:** In Malta, there was an increase in gross final energy consumption from renewable sources of 7 184 % between 2005 and 2017, 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 cannot be accurately represented in the figure and are thus not shown above. In Belgium, Luxembourg and the United Kingdom the share of energy from renewable sources in gross final energy consumption also grew from very small levels in 2005 (from 1 to 3 Mtoe, from 0.06 to 0.25 Mtoe and from 1 to 3 Mtoe, respectively).

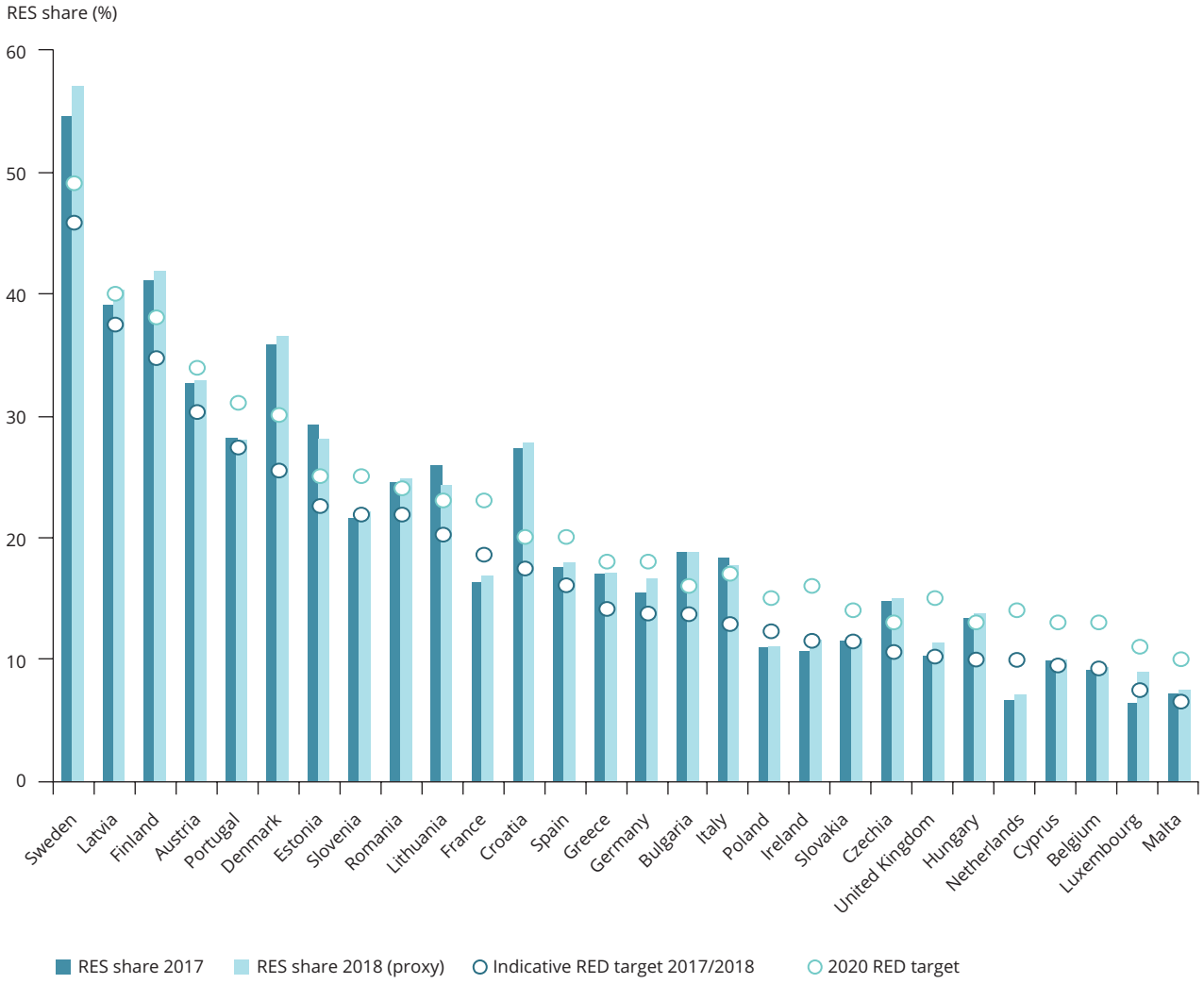
The data on total gross final energy consumption take into account adjustments regarding the amounts of energy consumed in aviation, as stipulated under the RED.

**Source:** Eurostat (2019d).

### *3.3.3 Progress towards the objectives of national renewable energy action plans up until 2020*

Member States have 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 deployment of renewable energy at the national level, and they include expected trajectories as well as planned RES shares in specific market sectors: in transport (RES-T), in heating and cooling (RES-H&C) and in electricity (RES-E). Developments in each of these sectors at Member State level are illustrated in Table 3.1.

**Figure 3.6** **National shares of energy from renewable sources in relation to indicative trajectories set out in the Renewable Energy Directive**




**Sources:** EC (2013b); EEA (2019c); EU (2008a); Eurostat (2019d).

For most Member States, these NREAP trajectories are more ambitious than the indicative trajectories defined in the RED ([19]). For example, the indicative RES target for the period 2017-2018 set out in the RED for Denmark is 25.5 %, whereas the country planned to achieve a share of 28.6 % of energy from renewable sources in 2017, according to its NREAP. In contrast, Greece, Latvia, Romania, Slovakia and the United Kingdom have designed trajectories in their NREAPs that are lower than those set out in the RED in 2017.

In 2017, 16 Member States reached or exceeded the RES targets outlined in their NREAPs for that year, while the other 12 Member States (Austria, Belgium, Cyprus, France, Germany, Ireland, Luxembourg, Netherlands, Slovenia, Poland, Portugal, Spain) did not.

Renewable shares in the transport sectors of Finland and Sweden exceeded 10 % in 2017. In the 26 other Member States, the shares ranged from 0.4 % (Estonia) to 9.7 % (Austria).

([19]) 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 rapid development of the use of renewable energy compared with that expected in its 2010 NREAP. This was a consequence of a reduction in total final energy consumption and of a greater than anticipated increase in power generated from renewable sources. Such development is expected to continue until 2020. For the present assessment, the original NREAP trajectory was considered.

**Table 3.1 Renewable energy shares by sector across Member States 2005-2017**

| | RES-E | | | RES-H/C | | | RES-T | | |
|---|---|---|---|---|---|---|---|---|---|
| Member State | 2005 | 2017 | Proxy 2018 | 2005 | 2017 | Proxy 2018 | 2005 | 2017 | Proxy 2018 |
| Austria | 61.9% | 72.2% | 77.3% | 21.9% | 32.0% | 31.9% | 5.1% | 9.7% | 10.1% |
| Belgium | 2.4% | 17.2% | 18.2% | 3.4% | 8.0% | 8.1% | 0.6% | 6.6% | 6.8% |
| Bulgaria | 9.3% | 19.1% | 20.0% | 14.3% | 29.9% | 30.0% | 0.8% | 7.2% | 8.0% |
| Croatia | 35.4% | 46.4% | 48.2% | 30.0% | 36.5% | 36.9% | 1.0% | 1.2% | 1.1% |
| Cyprus | 0.0% | 8.9% | 9.2% | 10.0% | 24.5% | 24.6% | 0.0% | 2.6% | 2.5% |
| Czechia | 3.8% | 13.7% | 13.9% | 10.9% | 19.7% | 20.0% | 0.9% | 6.6% | 6.8% |
| Denmark | 24.6% | 60.4% | 63.0% | 22.8% | 46.5% | 48.0% | 0.4% | 6.8% | 5.2% |
| Estonia | 1.0% | 17.0% | 17.6% | 32.2% | 51.6% | 51.8% | 0.2% | 0.4% | 0.4% |
| Finland | 26.9% | 35.2% | 36.1% | 39.1% | 54.8% | 55.3% | 0.9% | 18.8% | 17.3% |
| France | 13.7% | 19.9% | 21.0% | 12.4% | 21.3% | 22.0% | 2.1% | 9.1% | 9.2% |
| Germany | 10.5% | 34.4% | 37.8% | 7.7% | 13.4% | 13.9% | 4.0% | 7.0% | 7.9% |
| Greece | 8.2% | 24.5% | 26.2% | 12.8% | 26.6% | 27.2% | 0.1% | 4.0% | 4.1% |
| Hungary | 4.4% | 7.5% | 8.3% | 9.9% | 19.6% | 19.8% | 0.9% | 6.8% | 8.4% |
| Ireland | 7.2% | 30.1% | 33.2% | 3.4% | 6.9% | 6.5% | 0.1% | 7.4% | 7.2% |
| Italy | 16.3% | 34.1% | 32.4% | 8.2% | 20.1% | 19.4% | 1.0% | 6.5% | 6.7% |
| Latvia | 43.0% | 54.4% | 53.9% | 42.7% | 54.6% | 56.2% | 2.4% | 2.5% | 5.1% |
| Lithuania | 3.8% | 18.3% | 18.4% | 29.3% | 46.5% | 45.2% | 0.6% | 3.7% | 4.3% |
| Luxembourg | 3.2% | 8.1% | 7.9% | 3.6% | 8.1% | 8.6% | 0.1% | 6.4% | 6.3% |
| Malta | 0.0% | 6.6% | 7.7% | 1.0% | 19.8% | 19.9% | 0.0% | 6.8% | 6.1% |
| Netherlands | 6.3% | 13.8% | 14.9% | 2.4% | 5.9% | 6.0% | 0.4% | 5.9% | 6.8% |
| Poland | 2.7% | 13.1% | 13.9% | 10.2% | 14.5% | 14.6% | 1.6% | 4.2% | 3.6% |
| Portugal | 27.7% | 54.2% | 53.0% | 32.1% | 34.4% | 34.8% | 0.5% | 7.9% | 7.5% |
| Romania | 26.9% | 41.6% | 42.4% | 17.9% | 26.6% | 26.6% | 1.6% | 6.6% | 7.6% |
| Slovakia | 15.7% | 21.3% | 24.5% | 5.0% | 9.8% | 9.8% | 1.6% | 7.0% | 7.9% |
| Slovenia | 28.7% | 32.4% | 32.9% | 18.9% | 33.2% | 33.4% | 0.8% | 2.7% | 3.1% |
| Spain | 19.1% | 36.3% | 35.6% | 9.4% | 17.5% | 18.3% | 1.3% | 5.9% | 7.1% |
| Sweden | 50.9% | 65.9% | 68.7% | 51.8% | 69.1% | 69.5% | 6.2% | 38.6% | 45.1% |
| United Kingdom | 4.1% | 28.1% | 31.2% | 0.8% | 7.5% | 8.1% | 0.5% | 5.1% | 4.9% |
| EU-28 | 14.8% | 30.7% | 32.1% | 11.1% | 19.5% | 19.8% | 1.8% | 7.6% | |

**Note:** The colour gradient for each Member State reaches from white to green, where white indicates the least renewable energy share in the corresponding time series and green the largest renewable energy share in the time series. Figures for Sweden were updated by Eurostat since the date of extraction of the data.

**Sources:** EEA (forthcoming) (2019a); Eurostat (2019d).

In several Member States, the use of biofuels compliant with sustainability criteria put forward by the Renewable Energy Directive increased considerably in 2017, whereas it decreased in many other Member States. This volatility contributed to variations in the share of renewables in transport across Europe, with the most notable examples being Sweden and Finland:

- In Sweden, the share of renewables in transport increased by 13.5 percentage points between 2016 and 2017. This increase was mainly due to the enhanced use of renewable diesel fuels from hydrotreated vegetable oil (HVO) (Bioenergy International, 2018). This development has been possible against the background of rather stable policies regarding bioenergy over a long period of time. A carbon tax has been in place since 1991, and variable energy taxes and fees on sulphur and nitrous oxide emissions are established as well. Biofuels have received tax exemptions since 2007; however, in 2018 the legislation had to be changed because giving tax exemptions to 'food crop-based' biofuels is limited under EU state aid regulations for energy (IEA Bioenergy, 2018).

- Conversely, in Finland, the share decreased by 6 percentage points between 2016 and 2017. The annual variation in the consumption of biofuels is affected by the country's biofuel legislation. It allows distributors to provide the mandatory share of biofuels flexibly in advance (Statistics Finland, 2017).

Calculating renewable energy shares in the transport sector is particularly challenging. Compliant biofuels, for example — listed in Annex IX of Directive (EU) 2009/28/EC (EU, 2009b), 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 mathematically in order to incentivise their use. In 2018, preliminary estimates indicate that the renewable energy share in transport was equal to 8.1 %.

## 3.4 Renewable energy in other European countries

The RED is a text with relevance to member countries of the European Economic Area ([20]). In accordance with the RED, Iceland and Norway submitted NREAPs to the European Commission with 2020 targets and details of the steps to achieve these targets.

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 3.2). These targets are higher than for most Member States, as Iceland has an exceptional potential for hydropower and geothermal energy. To date, these energy sources are mainly used for district heating and producing electricity. Iceland's current share of RES in gross final energy consumption was 72 % in 2017 and thus above its binding national target level under the RED.

Norway's binding RED target for 2020 is to achieve a share of renewable energy that accounts for 67.5 % of gross final energy consumption. Norway is ahead of its indicative RED trajectory for 2017-2018 and its NREAP trajectory for 2017. In 2017, renewable energy accounted for 71 % of gross final energy consumption. Thus, Norway had already exceeded its 2020 RES target level by 3 percentage points in 2017.

The NREAP for Turkey, announced in 2015, has the characteristics of a roadmap for rigorous planning and efficient development of renewable energy up until 2023. The plan was prepared in accordance with the RED and focuses on exploring RES in support of energy generation and consumption. The NREAP is available to the public and describes Turkey's planned development and essential measures taken to sustain this path.

No information is available from EU sources on the shares of RES used or targets for Liechtenstein or Switzerland.

**Table 3.2 Iceland, Norway and Turkey's progress on renewable energy**

| Country | 2017 share of RES (%) | 2020 target under the RED (%) | 2020 target under NREAP (%) | Distance to 2020 target in 2017 (percentage points) |
|---|---|---|---|---|
| Iceland | 71,6 | 64.0 ([a]) | 76,8 | 7,6 |
| Norway | 70,8 | 67,5 | 67,5 | 3,3 |
| Turkey | 13,2 | N/A | 19,3 | -6,1 |

**Notes:** 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 (2009b); Eurostat (2019d); Iceland (2014); Norway (2013); Turkey (2014).

([20]) In addition to the 28 EU Member States, the European Economic Area also includes Iceland, Norway and Lichtenstein.

# 4 Progress towards meeting energy efficiency targets

**2020**

- The EU's energy efficiency targets are expressed in terms of both primary and final energy consumption. Despite improvements expected in 2018, the increasing trends in energy consumption observed over recent years put the EU at risk of missing its 2020 energy efficiency target. They also undermine efforts to increase the share of renewable energy in EU energy consumption and to reduce greenhouse gas emissions.
- EU primary energy consumption increased by 0.9 % between 2016 and 2017. Overall, preliminary estimates from the EEA indicate a decrease for primary energy consumption in 2018 of 0.9 % compared with 2017 levels. However, despite the recent reduction, primary energy consumption levels still remain above an indicative linear trajectory between the 2005 level and the 2020 EU target for primary energy consumption.
- In 2017, 18 Member States reduced, or limited, the increase in their primary energy consumption to levels below their respective indicative linear trajectories between 2005 levels and 2020 targets. However, Austria, Belgium, Bulgaria, Cyprus, Denmark, France, Germany, the Netherlands, Poland and Spain have not sufficiently reduced their primary energy consumption. According to preliminary EEA data, Ireland and Hungary were above their linear trajectories in 2018 as well.
- EU final energy consumption increased by 1.1 % between 2016 and 2017, and preliminary EEA estimates indicate a further increase in 2018 by 0.1 % compared with 2017. This makes 2018 the fourth consecutive year with increasing final energy consumption. Final energy consumption levels in the EU remain above an indicative linear trajectory between the 2005 level and the relevant 2020 EU target.
- In 2017, 12 Member States (Austria, Belgium, Bulgaria, Estonia, France, Germany, Hungary, Lithuania, Malta, Poland, Slovakia, Sweden) had not made enough savings in final energy consumption to stay below their linear trajectory levels (EEA, 2017) — three more than in last year's assessment (EEA, 2018c). According to preliminary data from the EEA, a total of 14 Member States can be expected to exceed their linear trajectory thresholds in 2018.

**2030**

- The EU has a binding 2030 target to improve its energy consumption by at least 32.5 %. Between 2005 and 2017, EU primary energy consumption fell on average by 13 Mtoe (million tonnes of oil equivalent) per year and final energy consumption by 6 Mtoe per year. In order to meet the 2030 target, annual reductions in energy consumption will have to reach, over the next decade, more than double the average rate of reductions achieved between 2005 and 2017.

**2050**

- The in-depth analysis accompanying the EU's strategic long-term vision for 2050 includes eight scenarios that describe how greenhouse gas emissions can be significantly reduced by 2050. For the EU to achieve climate neutrality by 2050, the Commission scenarios 1.5 TECH and 1.5 LIFE indicate that the EU would need to reduce its primary energy consumption by 4 to 14 Mtoe per year respectively, and its final energy consumption by 14 to 16 Mtoe per year, on average, between 2030 and 2050.

## 4.1 Progress and required pace towards meeting the EU's energy efficiency targets

The Energy Efficiency Directive (2012/27/EU) defines the EU energy efficiency target for 2020, which can be expressed in terms of either primary energy consumption ([21]) or final energy consumption ([22]). Meeting the 2020 energy efficiency target requires a reduction in primary or final energy consumption (EU, 2018e), by 20 %, compared with levels projected for 2020 in the European Commission's 2007 baseline scenario. In equivalent terms, the 2020 target for primary energy consumption equals a 13.8 % reduction from 2005 levels and, for final energy consumption, a reduction of 9 % from 2005 levels.

Both primary and final energy consumption levels ([23]) increased continuously from 2014 to 2017, contrary to the aim to achieve greater levels of energy efficiency and reductions in energy consumption. The most recent data reveal that, in 2017, the EU's primary energy consumption was 9.2 % (or 158 Mtoe, or million tonnes of oil equivalent) lower than in 2005 (EC, 2008). Preliminary estimates from the EEA show that, in 2018, the EU's primary energy consumption decreased by 0.9 % compared with 2017, following three consecutive years of increasing consumption. On the other hand, final energy consumption increased in 2018 by 0.1 % compared with 2017, marking the fourth consecutive year of final energy consumption increases (EEA, 2019c).

To monitor progress towards the energy efficiency targets, the EEA uses an indicative linear trajectory between the 2005 levels of energy consumption and the level of the target in 2020. This is illustrated in Figure 4.1. If the energy consumption levels are at or below the linear trajectory, the EU is considered to be on track towards meeting its energy efficiency targets. Conversely, if the primary or final energy consumption levels are above the linear trajectories, EU energy consumption must decrease at a faster pace to meet the targets. Further details of the methodology are described in Annex 3.

As illustrated in Figure 4.1, the most recent data indicate that in 2017, the EU's final energy consumption rose above the indicative trajectory to 2020 for the first time in 7 years. 2017 primary energy consumption levels were at 2.0 % (or 31 Mtoe) above the indicative linear trajectory, and final energy consumption in 2017 was 1.4 % (or 15 Mtoe) above the indicative linear trajectory. Furthermore, preliminary EEA estimates of primary and final energy consumption in 2018 indicate levels that continue to exceed the indicative trajectories to the 2020 targets, both at 2.2 % above the linear trajectories.

As 2017 and 2018 energy consumption levels exceed the indicative trajectory, achieving the 2020 targets is increasingly uncertain, and this also underlines the challenges of later achieving the more ambitious 2030 targets for energy efficiency. The EU energy efficiency target for 2030 of at least 32.5 % (compared with 2007 PRIMES projections) was set in the revised Energy Efficiency Directive ((EU) 2018/2002). The legislation also includes a clause for a possible upwards revision of the target by 2023. To reach the target of 32.5 %, the EU must achieve levels of 1 237 Mtoe or less for primary energy consumption and of 956 Mtoe for final energy consumption by 2030 (EU, 2018e). These targets for 2030 correspond to 26.0 % and 19.9 % reductions in EU primary and final energy consumption, respectively, relative to 2005 levels. To reach the 2030 targets, the EU will need to achieve an annual reduction of 22 Mtoe (primary energy consumption) and 13 Mtoe (final energy consumption) from the 2017 levels each year until 2030 — more than twice the average pace than that achieved between 2005 and 2017.

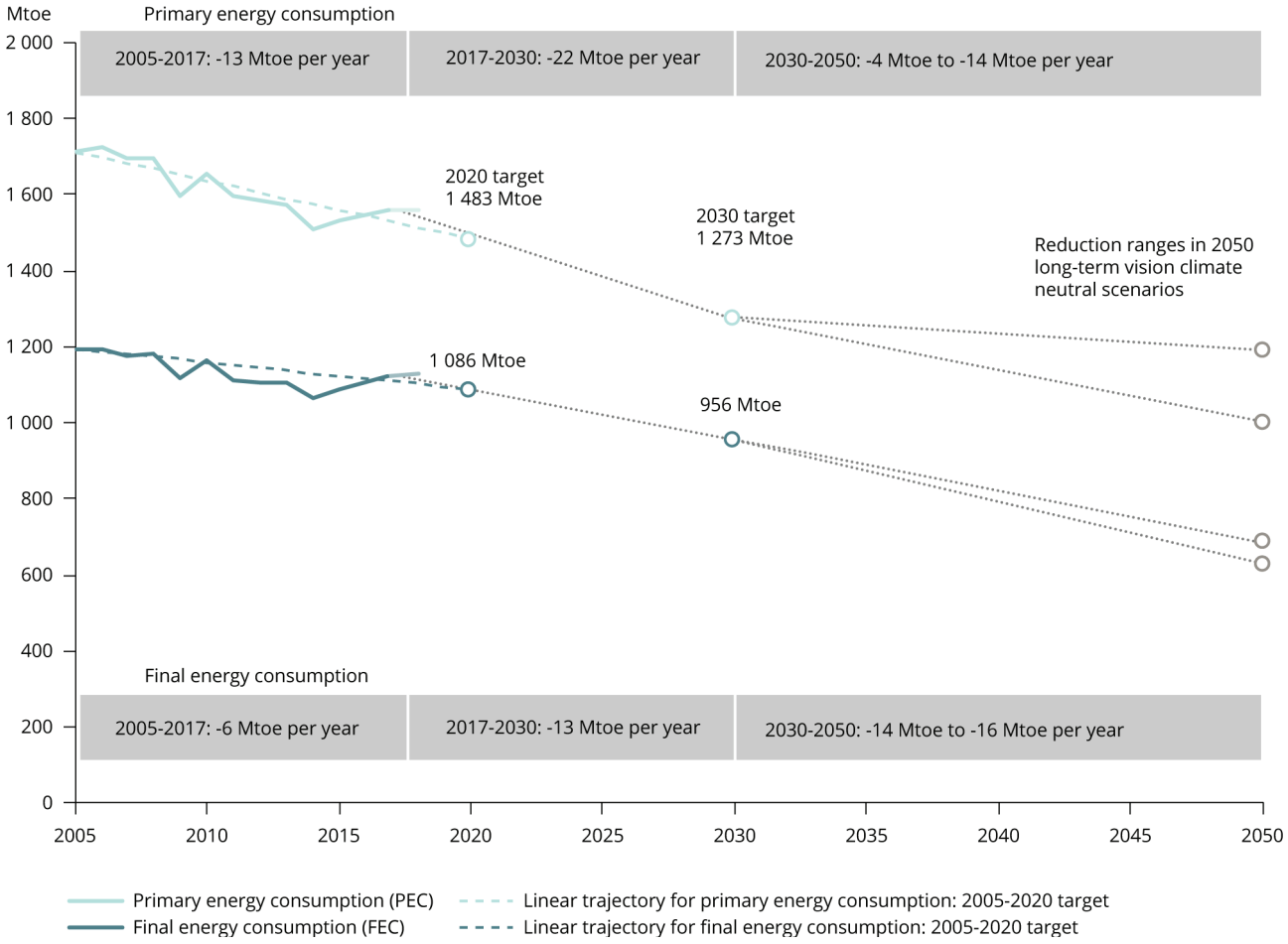
Looking towards 2050, the Commission's strategic long-term vision illustrates the contributions that energy efficiency can make towards achieving climate neutrality. All eight of the scenarios included in the in-depth analysis accompanying the long-term vision try to take into account the 'energy efficiency first' principle, in order to drive down final energy consumption and, in turn, reduce primary energy consumption (EC, 2018a, 2018b). However, the level of energy efficiency required by each scenario in the long-term vision varies. Figure 4.1 illustrates how EU energy consumption may evolve towards the two carbon-neutral scenarios: 1.5 TECH and 1.5 LIFE. According to the 1.5 LIFE scenario, the reduction by 2050 compared with 2005 amounts to 42 % for

([21]) Primary energy in the context of the Energy Efficiency Directive means gross inland energy consumption minus non-energy use. Primary energy consumption measures the total energy demand of a country. It covers consumption by 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 (e.g. petroleum used not for combustion but for producing plastics).

([22]) 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.

([23]) Throughout this report, primary and final energy consumption are defined in accordance with the methodology that underpinned the energy efficiency targets for 2020 and 2030, and they correspond to the PEC2020-2030 and FEC2020-2030 indicators from Eurostat.

**Figure 4.1** **Primary and final energy consumption in the EU, 2005-2017, 2020 and 2030 targets and 2050 scenario ranges for reaching carbon neutrality under the long-term vision**




**Notes:** The 2020 target represents energy savings of 20 % from levels projected for 2020 in the Commission's 2007 energy baseline scenario (EC, 2008). The indicative energy efficiency target for 2030 represents an improved energy efficiency of at least 32.5 % compared with 2030 projections using the same energy baseline scenario. The 2050 values represent indicative ranges for primary and final energy consumption that, combined with very high shares of energy from renewable sources in the energy mix, would allow the EU to reach carbon neutrality by 2050. The 2050 values are drawn from the carbon neutrality scenarios '1.5 TECH' (upper limit) and '1.5 LIFE' (lower limit) in the in-depth analysis accompanying the Commission's recent strategic long-term vision for a climate-neutral economy by 2050.

**Sources:** EC (2008, 2011d, 2018b); EEA (forthcoming) (2019a); EU (2018e); European Council (2014); Eurostat (2019b, 2019c).

primary energy consumption and 47 % for final energy consumption. Reductions of 31 % and 43 % are required in the 1.5 TECH scenario for primary and final energy consumption, respectively. Although these two scenarios would deliver net-zero emissions by 2050, some of the other scenarios describe energy efficiency gains to greater and lesser degrees.

For primary energy consumption, the 'high energy efficiency' scenario described in the in-depth analysis would require the greatest reduction by 2050: 50 % compared with 2005 levels. This is expected to be driven largely by efficiency improvements to the final energy consumed across all sectors. At the other end, primary energy use in the 'power-to-X' scenario would be reduced by only 22 % by 2050 compared with 2005 levels; this scenario assumes an intensive use of e-fuels, i.e. synthetic fuels made with renewable power, so a large amount of electricity would have to be produced.

For final energy consumption, the scenarios include requirements that range from a minimum 30 % reduction in the 'power-to-X' scenario to a 47 % reduction in the '1.5 °C sustainable lifestyles' scenario. The lowest required reductions are achieved in scenarios with alternative zero-carbon/carbon-neutral energy carriers (EC, 2018b).

Regardless of their differences, all long-term scenarios indicate that EU levels of primary and final energy consumption will have to be progressively reduced to reach the EU's decarbonisation targets. In particular,

intensifying the efficiency gains on the demand side will be necessary to realise the long-term vision by 2050.

#### *4.1.1 Analysis of the EU-wide trends in energy efficiency*

Developments in primary and final energy consumption in recent years are linked to a number of related factors, including economic growth, relatively colder winters compared with the warm winter of 2014 and lower fuel prices (EC, 2019g). A sectoral breakdown of recent developments in energy consumption reveals that the highest increase in energy consumption between 2014 and 2017 was seen in buildings (residential and services, +8.3 %). This was followed by energy consumption increases in transport (+5.8 %) as well as energy consumption in industry (+2.5 %) (Eurostat, 2019f).

The European Commission's Joint Research Centre has developed a detailed quantitative analysis of the factors behind the changes in energy consumption over the period 2005-2016, in the decomposition analysis (Economidou and Roman Collado, 2019).

According to this study, the main factor in reducing primary energy consumption (by -171.4 Mtoe) between 2005 and 2016 was the drop in final energy demand due to improvements in final energy intensity (by -122 Mtoe). It was sufficient to offset the increase in energy consumption due to economic growth (+117.4 Mtoe), and contributed to the total drop in primary energy from 2005 to 2016, which is equivalent to 7 % of the primary energy consumption in 2005.

Concerning final energy consumption, in addition to improvements in energy intensity, structural shifts towards more energy-efficient sectors and milder winters (of -9.1 Mtoe and -13.1 Mtoe, respectively) accounted for a drop in final energy consumption. Together, these factors contributed to a total drop in final energy consumption of 76 Mtoe across the EU during the period 2005-2016, assuming that everything else did not change.

Improvements in transformation efficiency accounted for a drop of 39 Mtoe in primary energy consumption during the period 2005-2016, partially explained by the increasing share of renewable energy in gross final energy consumption (from 9 % in 2005 to 17 % in 2016 at EU level). However, the increasing use of electricity had a counterbalancing effect, so overall the transformation efficiency effect ([24]) of -39 Mtoe (equivalent to a 2 % decline compared with 2005 primary energy consumption) was rather moderate. Decreases in distribution losses and conversion sector consumption ([25]) produced an additional reduction (of 9.5 Mtoe) in primary energy consumption.

To discuss the growing energy consumption trends and identify possible solutions to put the EU back on track to achieving the 2020 targets, the Commission created a dedicated task force including representatives of Member States in 2018. The task force identified additional causes for the growth in energy consumption related to national contexts: delayed implementation of energy efficiency policies within Member States; differences between estimated energy savings and actual energy savings achieved; insufficient consideration of the impact of behavioural aspects (e.g. rebound effects); the lack of funding for energy efficiency policies; and restrictions related to EU state aid rules (EC, 2019g).

## 4.2 Progress towards national energy efficiency targets

Member States set their own national non-binding targets for energy efficiency for 2020, as well as for 2030. These targets can be based on absolute primary or final energy consumption, on absolute, relative primary or final energy savings, or on energy intensity. The Energy Efficiency Directive requires, however, that when doing so, Member States also express those targets in terms of absolute levels of primary and final energy consumption (EU, 2012, 2018e, 2018h) ([26]). In the context of the 2030 framework, Member States have to report an indicative trajectory for their targets from 2021 onwards.

National indicative 2020 targets for final energy consumption set by Member States under the Energy Efficiency Directive range from -23.2 % (Hungary) to +36.5 % (Malta), compared with 2005 levels. A total of 20 Member States have set targets to decrease final energy consumption. The other eight Member States (Croatia, Czechia, Estonia, Finland, Latvia, Poland,

([24]) The transformation effect accounts for the average efficiency of the whole energy transformation system, providing an indication of the quantity of energy lost in the conversion/transformation processes. Cases that cause an improvement in the transformation effect include increased penetration of energy from renewable sources and efficiency gains in conventional condensing power plants.

([25]) The distribution and own conversion effect captures efficiency gains in the distribution system and is improving when losses during distribution processes and/or reduction in energy sector consumption are realised.

([26]) Together these targets should contribute to achieving the EU's objective of reducing energy consumption by 20 % by 2020 and 32.5 % by 2030. 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.

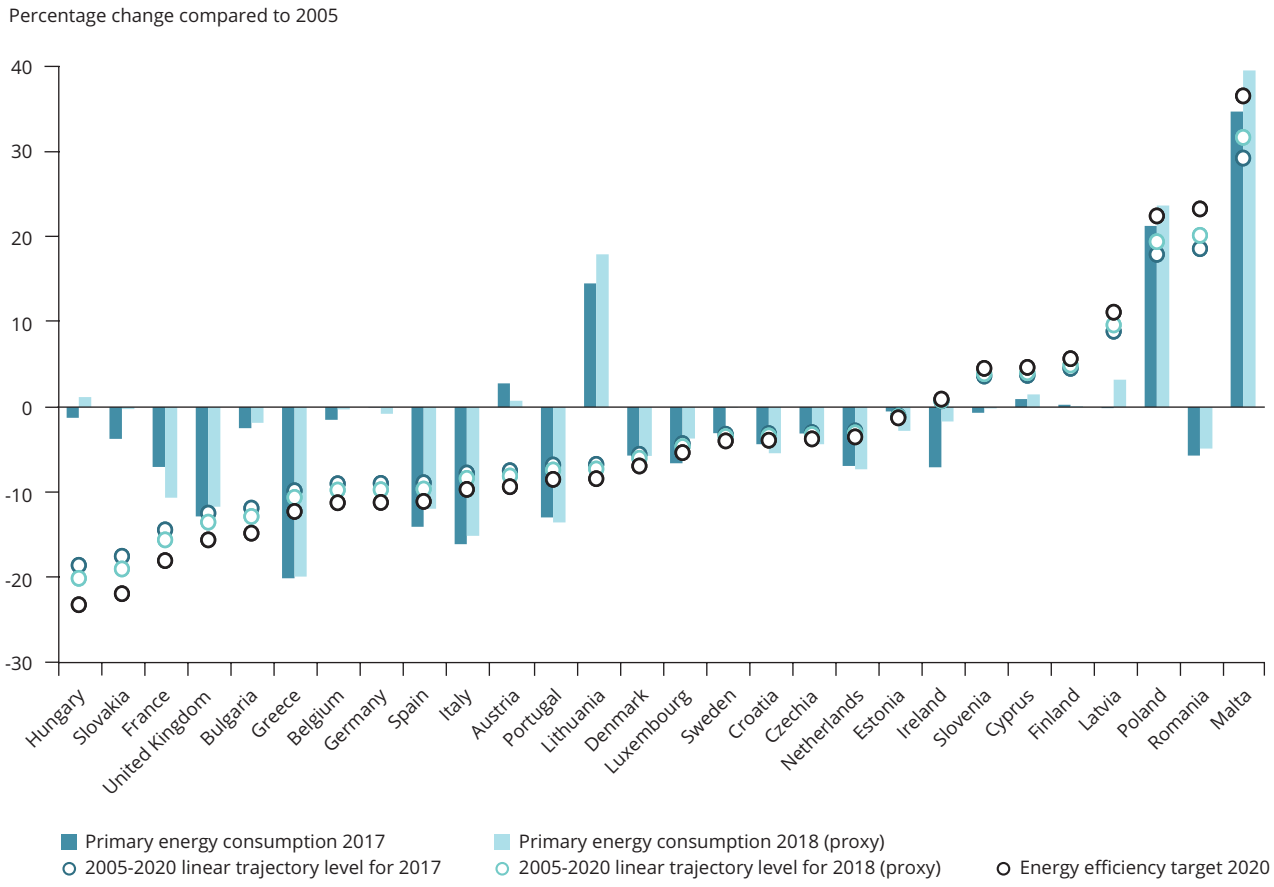
Romania, Slovenia) have set targets that are higher than their 2005 primary consumption levels. Member States can also revise their targets and projections upwards or downwards at any point in time because of, for example, revised macro-economic assumptions or new methods of calculation. In fact, the 2017 national energy efficiency action plans 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 ([27]).

### *4.2.1 Current progress towards energy efficiency targets*

Neither Member States nor EU legislation set an indicative trajectory to monitor the progress of Member States towards their national 2020 targets. The analysis in this report of Member States' progress towards the 2020 national energy efficiency targets uses, for each Member State, an indicative linear trajectory between primary and final energy consumption levels in 2005 and 2020 targets, comparing the absolute levels of energy consumption in the most recently reported year with this linear trajectory.

In 2017, 16 Member States were in line with or below their linear trajectories for final energy consumption (see Figure 4.2). If maintained until 2020, the pace of reductions (or limited increases) observed since 2005 should allow these 16 Member States to meet their 2020 final energy targets. However, Austria, Belgium, Bulgaria, Estonia, France, Germany, Hungary, Lithuania, Malta, Poland, Slovakia and Sweden had not reduced their final energy consumption enough

**Figure 4.2 Final energy consumption and linear trajectory levels to reach 2020 targets, 2017 and 2018**




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

**Sources:** EC (2017c, 2019c, 2019f); EEA (forthcoming) (2019b); Eurostat (2019b, 2019c).

([27]) 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.

to stay below their linear trajectories. This constitutes a decline from 2016, when 19 Member States stayed below their trajectories, whereas in 2015 all 28 EU Member States were on track compared to their linear trajectories.

According to preliminary EEA data for 2018 on final energy consumption, the number of Member States that have sufficiently reduced their consumption decreased even further to 14 Member States (Croatia, Cyprus, Czechia, Estonia, Finland, Greece, Ireland, Italy, Latvia, Netherlands, Portugal, Romania, Slovenia, Spain) (EEA, 2019c). In Malta, the continued growth in final energy consumption in 2018 was anticipated, as the trend towards substantial population and economic growth has continued from recent years.

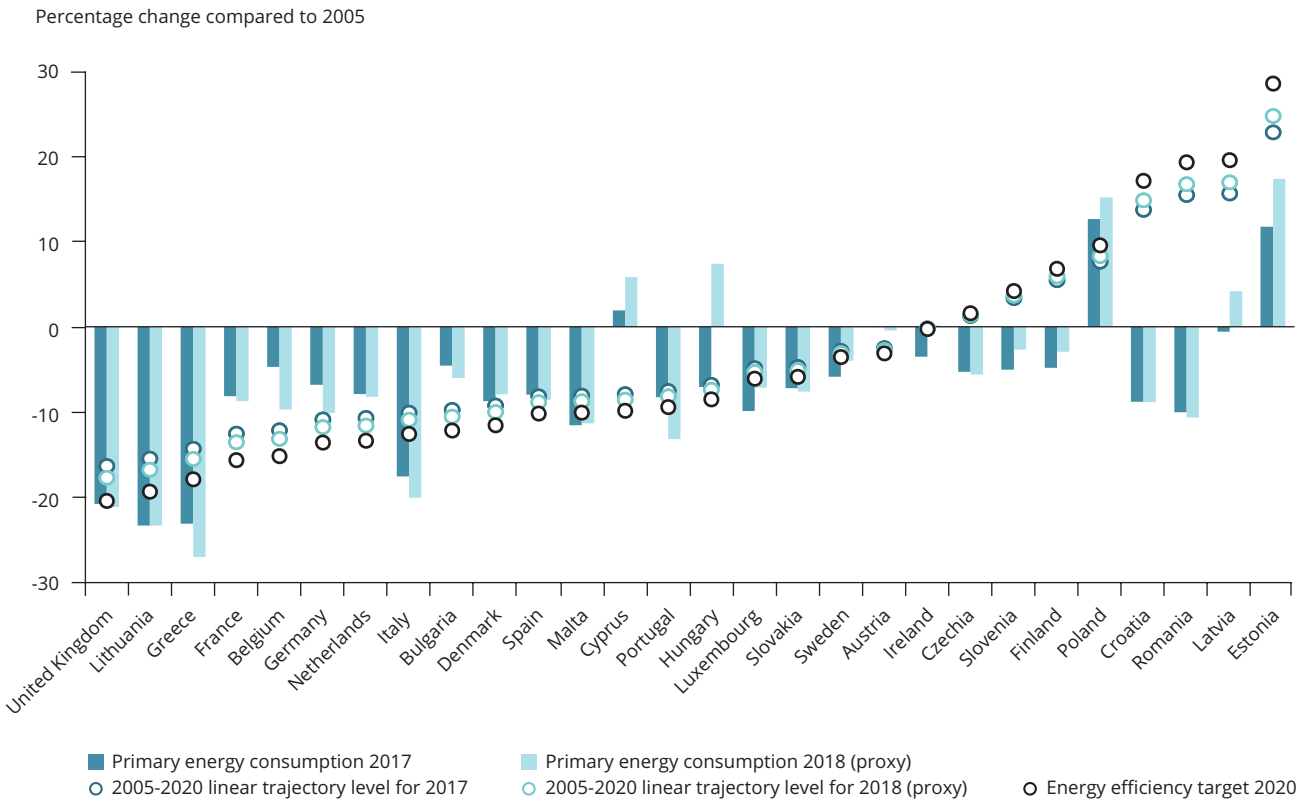
Between 2005 and 2017, final energy consumption decreased in 22 Member States and increased in six Member States (Austria, Cyprus, Finland, Lithuania, Malta, Poland). The greatest increases were observed in Poland (+21.3 %) and Lithuania (+14.5 %), and can be attributed to the dominant activity effect (economic growth), which is not completely compensated for by intensity and structural effects (EC, 2017a).

For primary energy consumption, the targets range from a 20.5 % reduction (United Kingdom) to a 28.6 % increase (Estonia) compared with 2005 levels. This range is illustrated in Figure 4.3. Between 2005 and 2017, primary energy consumption decreased in 25 Member States and increased in only Cyprus (+1.9 %), Estonia (+11.8 %) and Poland (+12.7 %). As in 2016, a total of 18 Member States reduced (or limited the increase in) their primary energy consumption to levels below their corresponding linear trajectories in 2017. However, Austria, Belgium, Bulgaria, Cyprus, Denmark, France, Germany, the Netherlands, Poland and Spain have not sufficiently reduced their primary energy consumption. According to the preliminary EEA data for 2018, two additional countries, namely Ireland and Hungary, were above their linear trajectories for primary energy consumption as well.

## 4.3 Trends in energy consumption in other European countries

Statistics on energy consumption are available from the European Commission for Iceland, Norway and Turkey (see Figure 4.4 and Figure 4.5). Between 1990

**Figure 4.3 Primary energy consumption and linear trajectory levels to reach 2020 targets, 2017 and 2018**




**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 for primary energy consumption.

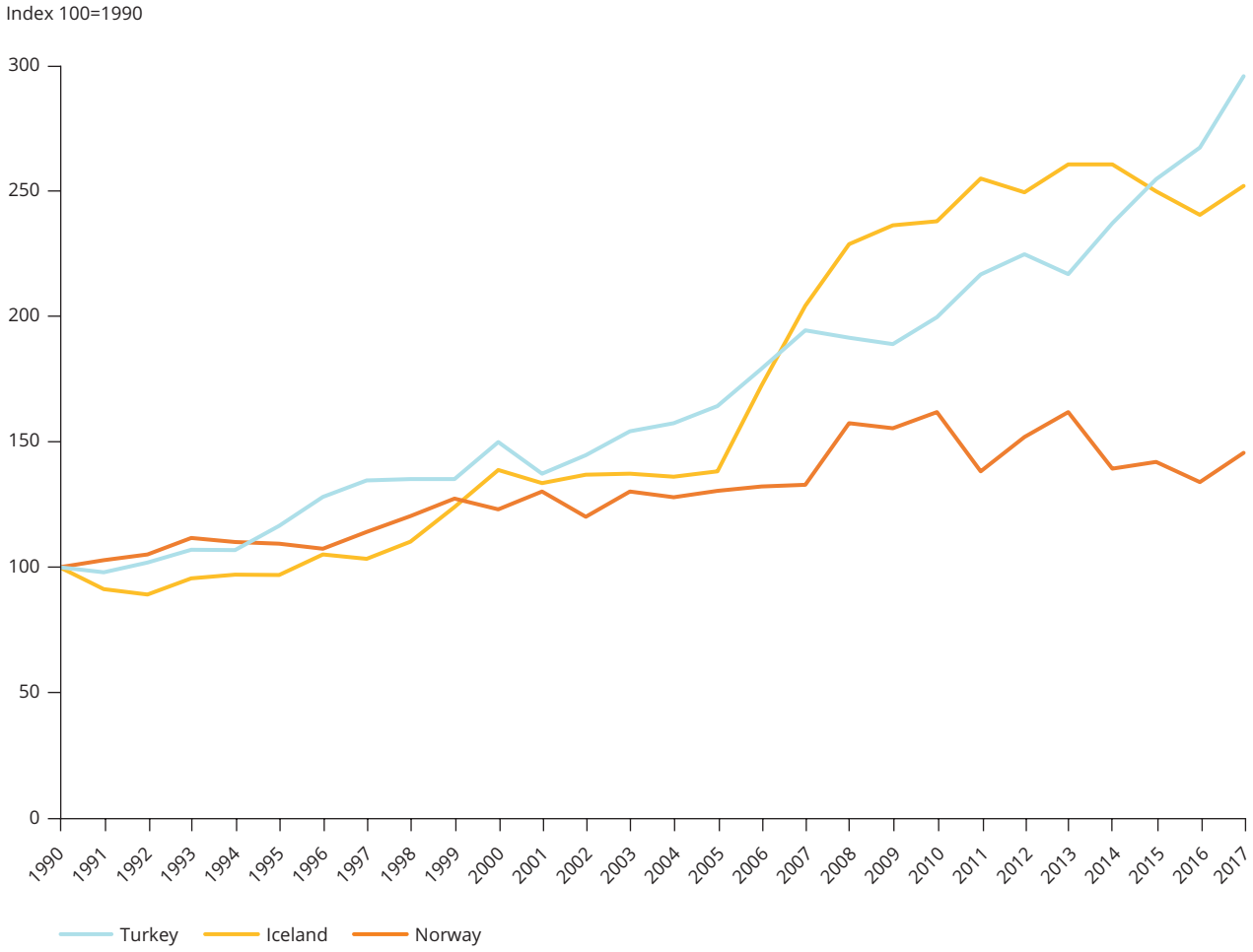
**Sources:** EC (2017c, 2019c, 2019f); EEA (forthcoming) (2019a, 2019f); Eurostat (2019b, 2019c).

and 2017, primary energy consumption as well as final energy consumption increased in these three countries to greatly varying extents. Over the same period, primary energy consumption in the EU decreased by 0.4 % and final energy consumption by 3 % (Eurostat, 2019b, 2019c). Although Turkey experienced a relatively steady increase over the whole period and Norway a limited increase over the years, Iceland experienced a pronounced jump after 2005, mainly for primary energy consumption. Between 2005 and 2017, the primary energy consumption (final energy consumption) of Iceland, Norway and Turkey increased by 82 % (67 %), 12 % (1 %) and 80 % (68 %), respectively.

In Switzerland, final energy consumption increased by 7 % between 1990 and 2017 but decreased by 3 % between 2005 and 2017 (SFOE, 2018).

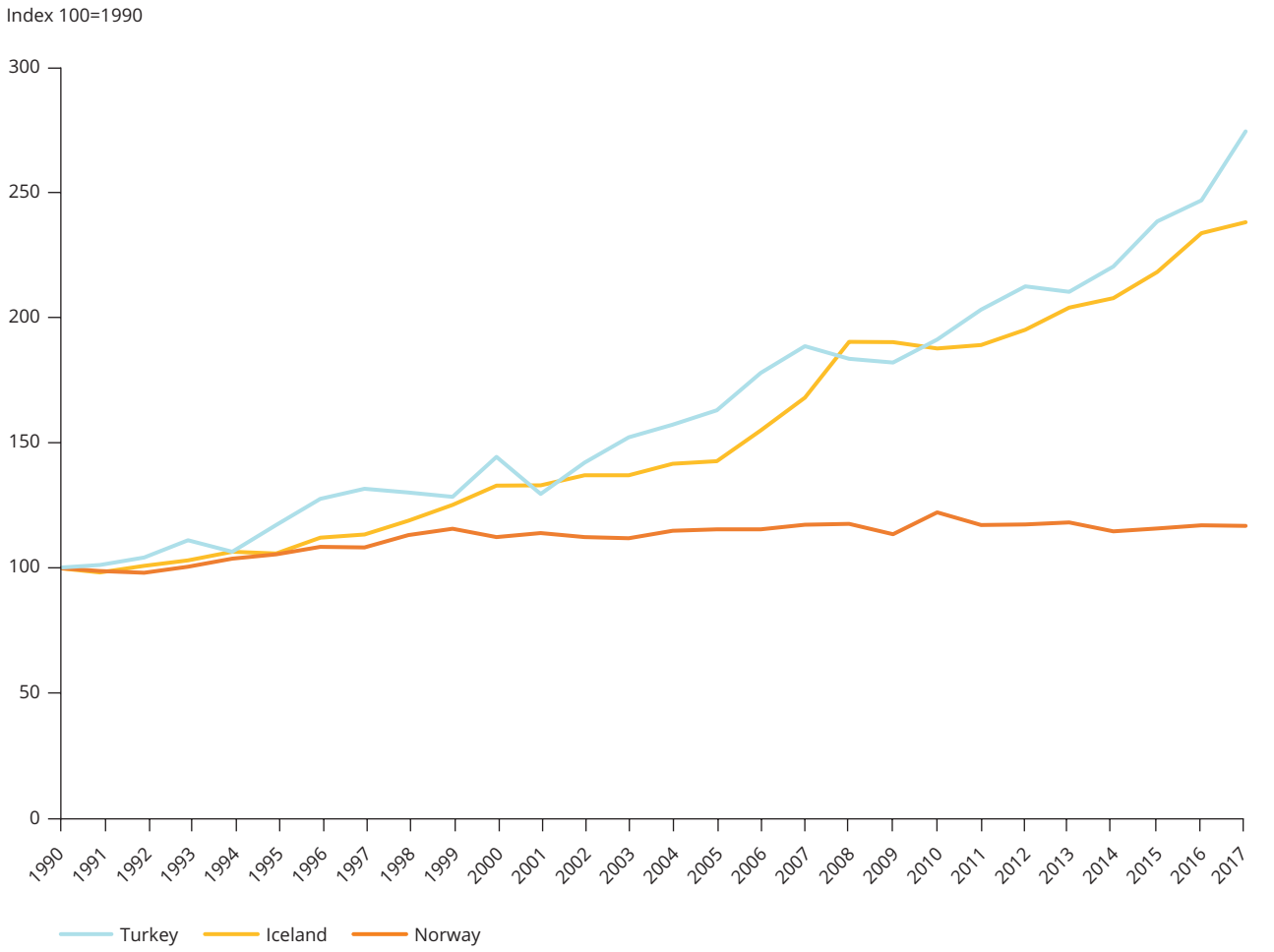
In relation to energy efficiency targets, Turkey implemented a national energy efficiency action plan for the period 2017-2023, aiming to reduce the primary energy consumption of Turkey by 14 % by 2023 through 55 actions defined in six categories, namely buildings and services, energy, transport, industry and technology, agriculture, and cross-cutting (horizontal) areas. It is also projected to achieve cumulative savings of 23.9 Mtoe by 2023 (Turkey, 2018).

**Figure 4.4 Primary energy consumption in Iceland, Norway and Turkey**




**Sources:** Eurostat (2019b, 2019c).

**Figure 4.5 Final energy consumption in Iceland, Norway and Turkey**




**Sources:** Eurostat (2019b, 2019c).

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# Abbreviations

| | |
|---|---|
| AEA | Annual emission allocation |
| AR4 | Fourth Assessment Report |
| CDM | Clean development mechanism |
| $CO_2$ | Carbon dioxide |
| $CO_2e$ | Carbon dioxide equivalent |
| CORSIA | Carbon Offsetting and Reduction Scheme for International Aviation |
| CRF | Common reporting format |
| EEA | European Environment Agency |
| EED | Energy Efficiency Directive |
| EEO | Energy efficiency obligation |
| EPBD | Energy Performance of Buildings Directive |
| ESD | Effort Sharing Decision |
| ESR | Effort Sharing Regulation |
| ETC/CME | European Topic Centre for Climate Change Mitigation and Energy (from 1 January 2029) |
| 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 |
| F-gas | Fluorinated gas |
| FEC | Final energy consumption |
| GDP | Gross domestic product |
| GHG | Greenhouse gas |

| | |
|---|---|
| GW | Gigawatt |
| GWP | Global warming potential |
| ICAO | International Civil Aviation Organization |
| ILUC | Indirect Land Use Change (Directive) |
| INDC | Intended nationally determined contribution |
| IPCC | Intergovernmental Panel on Climate Change |
| LMU | Land mitigation units |
| LULUCF | Land use, land use change and forestry |
| MMR | Monitoring Mechanism Regulation |
| MSR | Market stability reserve |
| Mt | Megatonnes |
| Mtoe | Million tonnes of oil 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 | Perfluorocarbon |
| PRIMES | Price-driven and Agent-based Simulation of Markets Energy System Models |
| QA/QC | Quality assurance and quality control |
| 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 |
| SME | Small to medium-sized enterprise |
| 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 greenhouse gas (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, 2013d).

The purposes of the reporting requirements stipulated in the MMR are to enable the EU to complete its reporting commitments under the United Nations Framework Convention on Climate Change (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, 2014b) 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 Land use, land use change and forestry (LULUCF) Decision (EU, 2013c). Furthermore, a delegated act (EU, 2014a) 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 1990-2017 are official data reported by the EU and Member States under the UNFCCC in their corresponding GHG inventory reports (EEA, 2019b, 2019e). The EEA is responsible for the compilation of the EU GHG inventory. Together with the European Topic Centre on Climate Change Mitigation and Energy (ETC/CME) ([28]), the EEA implements a quality assurance and quality control (QA/QC) procedure (EC, 2013a) 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, 2016 and 2017 were reviewed in 2017, 2018 and 2019 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 2018*

Early 'approximated' (proxy) estimates of 2018 GHG emissions were reported by Member States to the European Commission under the MMR by 31 July 2019. These estimates were aggregated to EU level by the

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

EEA (EEA (forthcoming), 2019b). Cyprus, Bulgaria and Romania did not submit proxy GHG inventories. For those countries, proxies have been calculated by the EEA and the ETC/CME. The methodology and data sources are laid out in detail in the above EEA report (EEA (forthcoming), 2019b).

### *A1.2.3 Greenhouse gas emissions in the EU 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

**Box A1.1 Targets for 2020 and 2030**

**2020**

The Effort Sharing Decision (ESD) covers emissions from all sources outside the EU Emissions Trading System (ETS), except for emissions from aviation ([29]) 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 – so-called annual emission allocations (AEAs) - for all Member States for the period 2013-2020 (EU, 2009a). 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) and in 2017 to reflect updates in methodologies for reporting of GHG inventories (EU, 2017a) ([30]).

Each Member State will contribute to this effort, according to its relative wealth in terms of gross domestic product (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 Table A4.1). At EU level, this will deliver approximately a reduction in emissions of 9.3 % 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.

**2030**

The regulation on binding annual emission reductions by Member States from 2021 to 2030 (Regulation (EU) 1018/842, the Effort Sharing Regulation) (EU, 2018g) 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 reduction in emissions required from this group of Member States. The resulting 2030 GHG emission targets range from 0 % to -40 %, compared with 2005 levels.

([29]) 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.

([30]) 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 Intergovernmental Panel on Climate Change 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.

emissions include estimates to reflect the scope of the EU ETS for the third trading period (2013-2020). These data are publicly available from the European Union Transaction Log (EUTL) ([31]) and the EEA ETS data viewer (EEA, 2019g). The data considered in the trend analysis were extracted from the EUTL on 2 July 2019, data used to determine the ESD emissions 2013-2017 were extracted from the EUTL on 8 March 2019 (as agreed in Working Group 1 under the Climate Change Committee in its session on 18 May 2015).

#### *A1.2.4 Emissions covered under the Effort Sharing Decision*

For analysing emission trends in the ESD, historical Effort Sharing emissions 2005-2012 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 (ETC/CME, 2019).

ESD emissions 2005 calculated with the latest inventory are different from ESD base-year emissions, which are used to compare Member States' progress to national targets and between Member States. The calculation of base-year emissions is explained in section A1.2.7.

The Effort Sharing GHG emission data for the years 2013 to 2017 are consistent with the outcome of the 2016, 2017, 2018 and 2019 reviews of national GHG inventory data pursuant to Article 19 of the MMR. These data, which are used by the European Commission to determine Member States' compliance under the ESD for 2013, 2014, 2015 and 2016, are laid down in implementing decisions (EU, 2017b, 2017c, 2016); the data for 2017 are expected to be published in autumn 2019.

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

Figure 2.4 and Figure 2.5, GHG emissions for the years 1990-2017 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 Intergovernmental Panel on Climate Change (IPCC) for the reporting of national GHG inventories, based on Member States' projections submitted in 2019. Projections for ETS and ESD are reported by source categories in Member States' submissions.

The 'industry and other' sector in Figure 2.5 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.

EEA estimates to reflect the scope of the EU ETS for the third trading period for the years 2005-2012 (ETC/CME, 2019) are included here, too.

#### *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) defines Member States' minimum contributions to achieve the EU's 2030 target of a 30 % emission reduction compared with 2005 in ESR sectors (see Table A4.1). Absolute AEA values for the period from 2021 to 2030 will be determined and 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 to 2030.

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

**Box A1.2 Flexibility mechanisms**

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. 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*).

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

- 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.
- There is a new flexibility to access allowances from the EU ETS. A maximum of 100 million AEAs can be used over the period 2021-2030 by eligible Member States to achieve their national targets if an equivalent amount of ETS allowances is cancelled. As the transfer is strictly limited in volume, and decided beforehand, predictability and environmental integrity are maintained.
- There is a new flexibility to use credits from the land use sector. Land mitigation units (LMUs) from afforested land, managed cropland and managed grassland allow 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.

The best currently available Effort Sharing emission data have been used for a preliminary estimation of future AEAs:

- 2005: base-year emissions calculated on the basis of the 2016 comprehensive ESD review and following the methodology presented in A1.2.7 (EU, 2017a).
- 2016: final ESD emissions (EU, 2018a).
- 2017: ESD emission dataset according to the final review reports sent by the EEA review secretariat to the European Commission and each Member State on 28 June 2019 (EEA, 2019h).
- 2018: proxy inventory (submitted under MMR by 31 July 2019) and verified ETS emissions (EEA, 2019c).

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.

### *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, 2009a);
- 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, Figure 2.7). The distance, calculated as the absolute difference between emissions and targets divided by 2005 base-year emissions, is expressed in percentage points (a share 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 ESD emissions for the year 2005 that are calculated based on the latest GHG inventories and ETS data.

### *A1.2.8 Projections of greenhouse gas emissions*

This report uses GHG projection data that are reported by Member States under the MMR in 2019 (EEA, 2019f; EEA (forthcoming), 2019h). Mandatory reporting of projections that reflect existing measures (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 2019, 27 Member States (all except Romania, for which the 2017 submission was used instead) and Norway and Switzerland submitted projections under the MMR.

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

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

- If available, a WAM scenario with additional measures (WAM) is reported too. It considers the implementation of additional measures (at the planning stage). In 2019, 17 Member States reported projections based on such WAM scenarios: Belgium, Croatia, Cyprus, Czechia, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Portugal, Slovakia, Spain 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.

An overview of projected emissions for both scenarios is published by the EEA (EEA (forthcoming), 2019h).

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 Effort Sharing sectors. Total GHG projections are used to assess the progress towards the EU's 40 % reduction target by 2030, and 'Effort Sharing projections' are used to assess the Member States' progress towards their national 2030 targets, set under the ESR.

The EEA, together with its ETC/CME, implements a quality assurance/quality control (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, 2015b). If significant discrepancies can be observed between the inventory value for the reference year and that for the projected year, the level of projections is aligned. Such calibration is performed to match national MMR projections with a common reference year for aggregated EU projections, which is the year 2015. In 2019, no such calibration took place.

By the end of 2018, Member States submitted draft national energy and climate plans (NECPs) to the Commission including draft GHG projections that differ slightly from the projections Member States reported under the MMR in March 2019. Differences in total emissions for the year 2030 can be explained by differences in the 'with additional measures' scenario provisions under the MMR and in draft NECPs as well as the gap-filling methodologies used by the Commission and the EEA.

In general, both the Commission and the EEA take the approach of gap-filling missing WAM scenarios with WEM scenarios. Poland submitted a WAM scenario in its draft NECP but did not report such a scenario under the MMR, which EEA gap-filled with the WEM scenario. In cases in which a scenario with planned measures was not provided and a national point estimate for additional reductions in 2030 or a national GHG target was available, this was used by the Commission as a gap-filling method for the 2030 EU aggregation (Denmark, Germany, and Netherlands). Some missing WAM scenarios in particular for ESD emissions were gap-filled by the Commission with the 2016 EU reference scenarios (Bulgaria, Malta, Portugal, Slovenia, and Sweden) (EC, 2019b).

Germany, Netherlands and Poland show the largest differences between MMR and NECP projections for 2030 (see Table A1.1).

**Table A1.1 Greenhouse gas projections reported by Member States in their national climate and energy plans and under the Monitoring Mechanism Regulation, 2030**

| Mt $CO_2e$ | 2030 MMR projections | | 2030 NECP projections |
|---|---|---|---|
| **Member State** | **Total WEM** | **Total WAM** | **Total WAM** |
| Austria | 76.4 | 76.4 | 76.5 |
| Belgium | 128.1 | 107.6 | 108.4 |
| Bulgaria | 59.1 | 59.1 | 55.4 |
| Croatia | 23.9 | 21.2 | 21.7 |
| Cyprus | 9.1 | 9.0 | 9.4 |
| Czechia | 110.8 | 110.2 | 110.5 |
| Denmark | 54.5 | 54.5 | 42.0 |
| Estonia | 15.0 | 13.5 | 17.2 |
| Finland | 46.5 | 41.2 | 42.1 |
| France | 437.8 | 327.9 | 330.1 |
| Germany | 762.1 | 762.1 | 588.7 |
| Greece | 83.3 | 78.3 | 73.7 |
| Hungary | 63.5 | 56.1 | 57.1 |
| Ireland | 67.8 | 58.0 | 58.1 |
| Italy | 396.2 | 340.0 | 338.9 |
| Latvia | 10.9 | 10.7 | 10.9 |
| Lithuania | 20.7 | 20.0 | 22.4 |
| Luxembourg | 12.3 | 12.3 | 11.3 |
| Malta | 3.3 | 3.3 | 2.0 |
| Netherlands | 170.5 | 170.5 | 123.4 |
| Poland | 412.5 | 412.5 | 369.1 |
| Portugal | 45.6 | 41.0 | 41.4 |
| Romania | 127.0 | 123.5 | 119.5 |
| Slovakia | 41.6 | 34.2 | 38.8 |
| Slovenia | 16.4 | 16.4 | 16.3 |
| Spain | 329.5 | 242.0 | 244.9 |
| Sweden | 49.2 | 49.2 | 48.3 |
| United Kingdom | 415.2 | 411.5 | 399.4 |
| **EU-28** | **3 988.8** | **3 662.2** | **3 377.4** |

**Note:** Total greenhouse gas emissions with international aviation and without LULUCF.

**Sources:** EC (2019c); EEA (forthcoming) (2019h).

## A1.3 Historical and projected total greenhouse gases, Emissions Trading Scheme and Effort Sharing emissions

Table A.1.2 provides an overview of projected emissions (without LULUCF and without international aviation), as well as emissions split by Emission Trading and Effort Sharing sectors.

## Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **EU-28** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **4 319** | **4 120** | **3 961** | **3 814** | **3 667** | **4 319** | **4 064** | **3 762** | **3 491** | **3 275** |
| Energy supply | 1 334 | 1 147 | 1 091 | 1 035 | 945 | 1 334 | 1 139 | 1 016 | 935 | 848 |
| Manufacturing and construction industries | 483 | 478 | 463 | 452 | 446 | 483 | 468 | 444 | 420 | 406 |
| Transport | 911 | 940 | 931 | 908 | 891 | 911 | 918 | 876 | 805 | 747 |
| Residential and commercial | 642 | 636 | 594 | 562 | 537 | 642 | 627 | 562 | 507 | 468 |
| Industrial processes and process use | 378 | 367 | 344 | 325 | 321 | 378 | 365 | 340 | 318 | 311 |
| Agriculture | 430 | 427 | 425 | 426 | 427 | 430 | 423 | 414 | 408 | 406 |
| Waste | 141 | 125 | 114 | 106 | 99 | 141 | 123 | 109 | 98 | 89 |
| Emissions Trading System (stationary installations) | 1 778 | 1 604 | 1 542 | 1 486 | 1 394 | 1 778 | 1 588 | 1 456 | 1 364 | 1 269 |
| Effort Sharing Decision and Regulation | 2 526 | 2 500 | 2 403 | 2 311 | 2 256 | 2 526 | 2 460 | 2 290 | 2 111 | 1 991 |
| Land use, land-use change and forestry | -310 | -220 | -215 | -185 | -180 | -312 | -225 | -227 | -196 | -201 |
| International Aviation | 141 | 155 | 164 | 175 | 179 | 141 | 154 | 162 | 171 | 169 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Austria** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **78.9** | **79.7** | **76.6** | **74.0** | **72.3** | **78.9** | **79.7** | **76.6** | **74.0** | **72.3** |
| Energy supply | 11.2 | 10.3 | 8.5 | 7.6 | 7.0 | 11.2 | 10.3 | 8.5 | 7.6 | 7.0 |
| Manufacturing and construction industries | 10.5 | 11.6 | 11.9 | 12.1 | 12.5 | 10.5 | 11.6 | 11.9 | 12.1 | 12.5 |
| Transport | 22.7 | 24.5 | 24.5 | 23.7 | 22.9 | 22.7 | 24.5 | 24.5 | 23.7 | 22.9 |
| Residential and commercial | 9.1 | 8.6 | 8.0 | 7.4 | 6.8 | 9.1 | 8.6 | 8.0 | 7.4 | 6.8 |
| Industrial processes and process use | 16.6 | 16.0 | 15.1 | 14.7 | 14.5 | 16.6 | 16.0 | 15.1 | 14.7 | 14.5 |
| Agriculture | 7.2 | 7.5 | 7.5 | 7.6 | 7.7 | 7.2 | 7.5 | 7.5 | 7.6 | 7.7 |
| Waste | 1.6 | 1.3 | 1.1 | 0.9 | 0.8 | 1.6 | 1.3 | 1.1 | 0.9 | 0.8 |
| Emissions Trading System (stationary installations) | 29.5 | 28.7 | 26.8 | 26.1 | 25.7 | 29.5 | 28.7 | 26.8 | 26.1 | 25.7 |
| Effort Sharing Decision and Regulation | 49.3 | 50.9 | 49.8 | 47.9 | 46.5 | 49.3 | 50.9 | 49.8 | 47.9 | 46.5 |
| Land use, land-use change and forestry | -4.6 | -4.2 | -3.5 | -2.7 | -3.1 | -4.6 | -4.2 | -3.5 | -2.7 | -3.1 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Belgium** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **117.1** | **113.7** | **117.2** | **123.1** | **125.6** | **117.1** | **108.9** | **107.1** | **102.6** | **97.9** |
| Energy supply | 21.9 | 16.8 | 21.8 | 28.1 | 30.4 | 21.9 | 16.5 | 22.3 | 26.5 | 26.4 |
| Manufacturing and construction industries | 13.6 | 14.0 | 14.0 | 14.2 | 14.3 | 13.6 | 13.6 | 13.3 | 12.9 | 12.7 |
| Transport | 26.7 | 27.5 | 28.0 | 28.7 | 29.2 | 26.7 | 25.1 | 22.6 | 19.5 | 18.2 |
| Residential and commercial | 23.5 | 24.3 | 23.7 | 23.3 | 22.9 | 23.5 | 23.0 | 19.9 | 16.4 | 13.7 |
| Industrial processes and process use | 19.8 | 20.1 | 19.3 | 18.8 | 18.7 | 19.8 | 19.9 | 19.0 | 18.2 | 18.1 |
| Agriculture | 10.1 | 9.8 | 9.4 | 9.2 | 9.2 | 10.1 | 9.5 | 8.9 | 8.3 | 7.9 |
| Waste | 1.6 | 1.3 | 1.0 | 0.8 | 0.8 | 1.6 | 1.3 | 1.0 | 0.8 | 0.8 |
| Emissions Trading System (stationary installations) | 44.7 | 41.9 | 46.9 | 53.5 | 55.9 | 44.7 | 41.1 | 47.1 | 51.4 | 51.3 |
| Effort Sharing Decision and Regulation | 72.4 | 71.8 | 70.3 | 69.6 | 69.7 | 72.4 | 67.8 | 60.0 | 51.2 | 46.6 |
| Land use, land-use change and forestry | -0.5 | -0.7 | -0.9 | -1.2 | -1.4 | -0.5 | -0.7 | -0.9 | -1.2 | -1.4 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Bulgaria** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **60.5** | **71.3** | **61.5** | **58.4** | **51.5** | **60.5** | **71.3** | **61.5** | **58.4** | **51.5** |
| Energy supply | 31.5 | 39.6 | 32.7 | 29.6 | 22.8 | 31.5 | 39.6 | 32.7 | 29.6 | 22.8 |
| Manufacturing and construction industries | 2.9 | 4.4 | 3.8 | 3.3 | 3.3 | 2.9 | 4.4 | 3.8 | 3.3 | 3.3 |
| Transport | 9.2 | 10.4 | 9.6 | 10.0 | 9.4 | 9.2 | 10.4 | 9.6 | 10.0 | 9.4 |
| Residential and commercial | 1.9 | 1.9 | 1.5 | 1.1 | 1.1 | 1.9 | 1.9 | 1.5 | 1.1 | 1.1 |
| Industrial processes and process use | 5.8 | 5.3 | 5.0 | 5.1 | 5.3 | 5.8 | 5.3 | 5.0 | 5.1 | 5.3 |
| Agriculture | 5.1 | 6.0 | 5.3 | 5.8 | 6.3 | 5.1 | 6.0 | 5.3 | 5.8 | 6.3 |
| Waste | 4.2 | 3.7 | 3.5 | 3.4 | 3.3 | 4.2 | 3.7 | 3.5 | 3.4 | 3.3 |
| Emissions Trading System (stationary installations) | 36.9 | 45.8 | 38.0 | 34.4 | 27.7 | 36.9 | 45.8 | 38.0 | 34.4 | 27.7 |
| Effort Sharing Decision and Regulation | 23.6 | 25.4 | 23.5 | 23.9 | 23.8 | 23.6 | 25.4 | 23.5 | 23.9 | 23.8 |
| Land use, land-use change and forestry | -9.2 | -8.4 | -7.7 | -7.2 | -6.8 | -9.2 | -8.4 | -7.7 | -7.2 | -6.8 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Croatia** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **24.7** | **23.4** | **23.4** | **23.5** | **23.2** | **24.7** | **22.5** | **21.6** | **20.9** | **19.5** |
| Energy supply | 5.3 | 3.9 | 3.9 | 3.8 | 3.5 | 5.3 | 3.9 | 3.8 | 3.6 | 3.1 |
| Manufacturing and construction industries | 2.2 | 2.3 | 2.3 | 2.3 | 2.2 | 2.2 | 2.3 | 2.3 | 2.2 | 2.1 |
| Transport | 6.0 | 6.3 | 6.0 | 5.6 | 5.3 | 6.0 | 6.3 | 5.9 | 5.6 | 5.1 |
| Residential and commercial | 3.2 | 2.8 | 2.9 | 2.9 | 2.8 | 3.2 | 2.8 | 2.7 | 2.7 | 2.5 |
| Industrial processes and process use | 2.8 | 2.9 | 3.0 | 3.1 | 3.2 | 2.8 | 2.5 | 2.6 | 2.6 | 2.7 |
| Agriculture | 2.9 | 2.7 | 2.8 | 2.9 | 3.0 | 2.9 | 2.4 | 2.5 | 2.6 | 2.7 |
| Waste | 2.2 | 2.4 | 2.7 | 2.9 | 3.1 | 2.2 | 2.3 | 1.9 | 1.6 | 1.4 |
| Emissions Trading System (stationary installations) | 8.4 | 7.4 | 7.2 | 7.1 | 6.8 | 8.4 | 7.2 | 6.9 | 6.7 | 6.2 |
| Effort Sharing Decision and Regulation | 16.2 | 16.0 | 16.2 | 16.4 | 16.4 | 16.2 | 15.3 | 14.7 | 14.2 | 13.3 |
| Land use, land-use change and forestry | -5.4 | -4.2 | -3.1 | -2.5 | -2.1 | -5.4 | -4.2 | -3.1 | -2.5 | -2.1 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Cyprus** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **8.3** | **8.6** | **8.2** | **8.2** | **7.2** | **8.3** | **8.5** | **8.1** | **8.1** | **7.1** |
| Energy supply | 3.0 | 2.7 | 2.3 | 2.4 | 1.6 | 3.0 | 2.7 | 2.3 | 2.4 | 1.6 |
| Manufacturing and construction industries | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 |
| Transport | 1.9 | 2.1 | 2.1 | 2.1 | 2.1 | 1.9 | 2.1 | 2.1 | 2.1 | 2.1 |
| Residential and commercial | 0.6 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.6 |
| Industrial processes and process use | 1.2 | 1.4 | 1.5 | 1.5 | 1.5 | 1.2 | 1.4 | 1.4 | 1.4 | 1.4 |
| Agriculture | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| Waste | 0.5 | 0.5 | 0.4 | 0.4 | 0.3 | 0.5 | 0.5 | 0.4 | 0.3 | 0.2 |
| Emissions Trading System (stationary installations) | 4.4 | 4.3 | 3.9 | 4.0 | 3.2 | 4.4 | 4.3 | 3.9 | 4.0 | 3.2 |
| Effort Sharing Decision and Regulation | 3.9 | 4.3 | 4.3 | 4.2 | 4.0 | 3.9 | 4.3 | 4.2 | 4.1 | 3.9 |
| Land use, land-use change and forestry | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Czechia** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **127.6** | **126.3** | **114.6** | **109.8** | **99.6** | **127.6** | **125.9** | **114.2** | **109.2** | **98.4** |
| Energy supply | 58.1 | 55.5 | 46.4 | 45.5 | 39.5 | 58.1 | 55.5 | 46.4 | 45.5 | 39.5 |
| Manufacturing and construction industries | 9.7 | 9.9 | 9.8 | 9.7 | 9.6 | 9.7 | 9.9 | 9.8 | 9.7 | 9.6 |
| Transport | 17.7 | 17.9 | 17.4 | 16.1 | 14.3 | 17.7 | 17.6 | 17.0 | 15.7 | 13.9 |
| Residential and commercial | 13.4 | 13.2 | 12.0 | 10.8 | 9.7 | 13.4 | 13.2 | 12.0 | 10.8 | 9.7 |
| Industrial processes and process use | 15.0 | 16.0 | 15.3 | 14.4 | 13.8 | 15.0 | 16.0 | 15.3 | 14.4 | 13.8 |
| Agriculture | 8.2 | 8.4 | 8.8 | 9.1 | 9.1 | 8.2 | 8.4 | 8.8 | 9.1 | 9.1 |
| Waste | 5.5 | 5.4 | 4.8 | 4.2 | 3.6 | 5.5 | 5.4 | 4.8 | 3.9 | 2.8 |
| Emissions Trading System (stationary installations) | 66.6 | 63.1 | 56.2 | 55.9 | 49.9 | 66.6 | 63.1 | 56.2 | 55.9 | 49.9 |
| Effort Sharing Decision and Regulation | 61.0 | 63.2 | 58.3 | 54.0 | 49.7 | 61.0 | 62.9 | 58.0 | 53.3 | 48.5 |
| Land use, land-use change and forestry | -6.5 | 0.6 | -1.7 | -1.6 | -1.7 | -6.5 | 1.2 | -1.1 | -0.5 | -0.6 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Denmark** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **48.1** | **43.6** | **46.4** | **51.4** | **55.7** | **48.1** | **43.6** | **46.4** | **51.4** | **55.7** |
| Energy supply | 13.6 | 9.5 | 11.9 | 17.2 | 21.6 | 13.6 | 9.5 | 11.9 | 17.2 | 21.6 |
| Manufacturing and construction industries | 3.8 | 3.5 | 3.8 | 4.0 | 4.2 | 3.8 | 3.5 | 3.8 | 4.0 | 4.2 |
| Transport | 12.7 | 13.0 | 13.1 | 12.9 | 12.8 | 12.7 | 13.0 | 13.1 | 12.9 | 12.8 |
| Residential and commercial | 4.7 | 4.1 | 4.0 | 3.6 | 3.4 | 4.7 | 4.1 | 4.0 | 3.6 | 3.4 |
| Industrial processes and process use | 1.8 | 2.1 | 2.0 | 2.0 | 2.0 | 1.8 | 2.1 | 2.0 | 2.0 | 2.0 |
| Agriculture | 10.4 | 10.4 | 10.5 | 10.7 | 10.7 | 10.4 | 10.4 | 10.5 | 10.7 | 10.7 |
| Waste | 1.1 | 1.0 | 0.9 | 0.9 | 1.1 | 1.1 | 1.0 | 0.9 | 0.9 | 1.1 |
| Emissions Trading System (stationary installations) | 16.1 | 11.6 | 14.6 | 20.3 | 25.1 | 16.1 | 11.6 | 14.6 | 20.3 | 25.1 |
| Effort Sharing Decision and Regulation | 31.9 | 31.9 | 31.6 | 31.0 | 30.4 | 31.9 | 31.9 | 31.6 | 31.0 | 30.4 |
| Land use, land-use change and forestry | 3.6 | 2.6 | 1.9 | 1.9 | 0.8 | 3.6 | 2.6 | 1.9 | 1.9 | 0.8 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Estonia** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **18.1** | **19.7** | **18.2** | **14.8** | **14.0** | **18.1** | **19.4** | **17.2** | **13.3** | **12.8** |
| Energy supply | 12.3 | 13.8 | 12.1 | 8.6 | 7.7 | 12.3 | 13.6 | 11.5 | 7.9 | 7.3 |
| Manufacturing and construction industries | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 | 0.5 | 0.6 | 0.6 | 0.7 | 0.7 |
| Transport | 2.3 | 2.2 | 2.3 | 2.4 | 2.5 | 2.3 | 2.1 | 1.9 | 1.7 | 1.8 |
| Residential and commercial | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.8 | 0.7 | 0.6 | 0.6 | 0.6 |
| Industrial processes and process use | 0.5 | 0.7 | 0.7 | 0.7 | 0.6 | 0.5 | 0.7 | 0.7 | 0.7 | 0.6 |
| Agriculture | 1.4 | 1.4 | 1.5 | 1.6 | 1.6 | 1.4 | 1.4 | 1.5 | 1.6 | 1.6 |
| Waste | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.2 | 0.2 |
| Emissions Trading System (stationary installations) | 11.9 | 13.7 | 12.2 | 8.7 | 7.8 | 11.9 | 13.6 | 11.7 | 8.1 | 7.5 |
| Effort Sharing Decision and Regulation | 6.2 | 5.9 | 6.0 | 6.1 | 6.2 | 6.2 | 5.9 | 5.5 | 5.2 | 5.3 |
| Land use, land-use change and forestry | -2.3 | -1.4 | -0.1 | -0.2 | 0.2 | -2.3 | -1.4 | -0.1 | -0.2 | 0.2 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Finland** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **55.1** | **52.4** | **48.3** | **44.4** | **42.8** | **55.1** | **52.1** | **45.6** | **39.1** | **37.5** |
| Energy supply | 17.9 | 16.4 | 13.9 | 11.4 | 10.3 | 17.9 | 16.4 | 13.9 | 10.7 | 9.9 |
| Manufacturing and construction industries | 6.9 | 5.8 | 5.3 | 4.9 | 4.6 | 6.9 | 5.8 | 5.2 | 4.6 | 4.3 |
| Transport | 10.9 | 11.4 | 10.7 | 10.3 | 10.0 | 10.9 | 11.1 | 8.8 | 7.1 | 6.4 |
| Residential and commercial | 4.9 | 4.3 | 4.0 | 3.8 | 3.7 | 4.9 | 4.3 | 3.7 | 3.4 | 3.2 |
| Industrial processes and process use | 5.9 | 6.3 | 6.6 | 6.6 | 6.9 | 5.9 | 6.3 | 6.4 | 6.4 | 6.8 |
| Agriculture | 6.5 | 6.6 | 6.4 | 6.3 | 6.4 | 6.5 | 6.6 | 6.4 | 5.8 | 6.0 |
| Waste | 2.1 | 1.6 | 1.3 | 1.1 | 0.9 | 2.1 | 1.6 | 1.3 | 1.1 | 0.9 |
| Emissions Trading System (stationary installations) | 25.5 | 23.2 | 20.8 | 18.2 | 17.4 | 25.5 | 23.2 | 20.7 | 17.6 | 17.0 |
| Effort Sharing Decision and Regulation | 29.4 | 29.0 | 27.3 | 26.0 | 25.2 | 29.4 | 28.7 | 24.7 | 21.3 | 20.3 |
| Land use, land-use change and forestry | -20.1 | -30.5 | -31.4 | -29.9 | -34.4 | -20.1 | -30.5 | -31.4 | -30.9 | -35.4 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **France** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **458.1** | **461.3** | **434.4** | **416.5** | **406.2** | **458.1** | **434.4** | **365.3** | **306.5** | **247.3** |
| Energy supply | 46.0 | 59.5 | 58.7 | 57.2 | 56.6 | 46.0 | 51.4 | 35.5 | 30.0 | 19.2 |
| Manufacturing and construction industries | 52.4 | 47.7 | 47.0 | 47.0 | 46.9 | 52.4 | 43.6 | 38.8 | 31.5 | 24.1 |
| Transport | 132.3 | 134.2 | 127.6 | 125.5 | 125.1 | 132.3 | 126.5 | 111.0 | 94.3 | 71.5 |
| Residential and commercial | 88.6 | 86.4 | 75.4 | 65.4 | 59.7 | 88.6 | 83.6 | 65.7 | 47.2 | 36.1 |
| Industrial processes and process use | 43.7 | 42.7 | 36.3 | 33.0 | 31.6 | 43.7 | 41.4 | 33.0 | 27.4 | 24.4 |
| Agriculture | 77.8 | 75.3 | 74.4 | 73.3 | 72.6 | 77.8 | 73.6 | 69.0 | 65.2 | 62.1 |
| Waste | 17.2 | 15.5 | 15.0 | 15.0 | 13.7 | 17.2 | 14.3 | 12.3 | 11.0 | 9.8 |
| Emissions Trading System (stationary installations) | 99.6 | 111.2 | 109.3 | 107.9 | 106.7 | 99.6 | 100.8 | 82.2 | 69.4 | 54.9 |
| Effort Sharing Decision and Regulation | 353.9 | 345.4 | 320.4 | 303.9 | 294.7 | 353.9 | 328.9 | 278.5 | 232.6 | 188.4 |
| Land use, land-use change and forestry | -40.8 | -38.5 | -31.6 | -29.0 | -25.2 | -40.8 | -39.0 | -37.7 | -40.2 | -45.2 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Germany** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **906.8** | **835.6** | **800.4** | **730.0** | **697.6** | **906.8** | **835.6** | **800.4** | **730.0** | **697.6** |
| Energy supply | 347.5 | 293.4 | 297.4 | 261.8 | 254.2 | 347.5 | 293.4 | 297.4 | 261.8 | 254.2 |
| Manufacturing and construction industries | 126.8 | 118.0 | 112.0 | 107.1 | 103.4 | 126.8 | 118.0 | 112.0 | 107.1 | 103.4 |
| Transport | 162.8 | 171.2 | 166.5 | 160.3 | 152.1 | 162.8 | 171.2 | 166.5 | 160.3 | 152.1 |
| Residential and commercial | 131.0 | 122.9 | 103.3 | 88.4 | 76.4 | 131.0 | 122.9 | 103.3 | 88.4 | 76.4 |
| Industrial processes and process use | 60.9 | 58.2 | 52.4 | 45.4 | 44.5 | 60.9 | 58.2 | 52.4 | 45.4 | 44.5 |
| Agriculture | 66.7 | 63.2 | 62.0 | 61.5 | 61.5 | 66.7 | 63.2 | 62.0 | 61.5 | 61.5 |
| Waste | 11.1 | 8.6 | 6.8 | 5.5 | 5.4 | 11.1 | 8.6 | 6.8 | 5.5 | 5.4 |
| Emissions Trading System (stationary installations) | 455.8 | 396.6 | 394.0 | 354.1 | 343.4 | 455.8 | 396.6 | 394.0 | 354.1 | 343.4 |
| Effort Sharing Decision and Regulation | 448.6 | 436.6 | 404.1 | 373.6 | 351.9 | 448.6 | 436.6 | 404.1 | 373.6 | 351.9 |
| Land use, land-use change and forestry | -14.5 | 29.5 | 11.3 | 19.0 | 18.8 | -14.5 | 29.5 | 11.3 | 19.0 | 18.8 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Greece** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **95.3** | **89.3** | **82.7** | **79.9** | **75.1** | **95.3** | **89.0** | **80.3** | **74.9** | **70.2** |
| Energy supply | 42.0 | 34.3 | 28.1 | 25.0 | 19.6 | 42.0 | 34.0 | 26.2 | 22.3 | 17.8 |
| Manufacturing and construction industries | 5.2 | 5.6 | 5.6 | 5.7 | 5.9 | 5.2 | 5.6 | 5.5 | 5.6 | 5.8 |
| Transport | 17.1 | 17.7 | 17.9 | 17.4 | 17.0 | 17.1 | 17.7 | 17.7 | 16.3 | 15.4 |
| Residential and commercial | 6.7 | 8.2 | 8.1 | 8.1 | 8.4 | 6.7 | 8.2 | 7.8 | 7.1 | 7.0 |
| Industrial processes and process use | 12.0 | 10.7 | 9.9 | 10.0 | 10.1 | 12.0 | 10.7 | 9.9 | 10.0 | 10.1 |
| Agriculture | 7.8 | 8.1 | 8.6 | 9.1 | 9.7 | 7.8 | 8.1 | 8.6 | 9.1 | 9.7 |
| Waste | 4.5 | 4.8 | 4.6 | 4.4 | 4.3 | 4.5 | 4.8 | 4.6 | 4.4 | 4.3 |
| Emissions Trading System (stationary installations) | 49.8 | 41.8 | 35.5 | 32.4 | 27.3 | 49.8 | 41.5 | 33.7 | 29.8 | 25.6 |
| Effort Sharing Decision and Regulation | 45.1 | 46.9 | 46.7 | 46.8 | 47.1 | 45.1 | 46.9 | 46.0 | 44.5 | 44.0 |
| Land use, land-use change and forestry | -3.7 | -1.6 | -1.1 | -0.6 | -0.2 | -3.7 | -1.6 | -1.1 | -0.6 | -0.2 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Hungary** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **60.8** | **63.9** | **64.7** | **62.6** | **60.6** | **60.7** | **63.2** | **59.3** | **55.3** | **51.3** |
| Energy supply | 14.6 | 14.7 | 13.8 | 9.5 | 5.2 | 14.6 | 14.6 | 11.8 | 8.1 | 4.4 |
| Manufacturing and construction industries | 4.2 | 4.9 | 5.3 | 5.6 | 5.8 | 4.2 | 5.0 | 5.0 | 5.0 | 5.1 |
| Transport | 12.2 | 14.2 | 16.1 | 18.3 | 20.5 | 12.2 | 13.6 | 14.6 | 15.7 | 16.7 |
| Residential and commercial | 12.3 | 12.6 | 12.6 | 12.4 | 12.3 | 12.2 | 12.5 | 11.0 | 9.7 | 8.3 |
| Industrial processes and process use | 7.3 | 7.1 | 6.5 | 6.5 | 6.4 | 7.3 | 7.1 | 6.5 | 6.5 | 6.4 |
| Agriculture | 6.7 | 7.2 | 7.5 | 7.8 | 8.0 | 6.7 | 7.2 | 7.5 | 7.8 | 8.0 |
| Waste | 3.5 | 3.2 | 2.9 | 2.6 | 2.3 | 3.5 | 3.2 | 2.9 | 2.6 | 2.3 |
| Emissions Trading System (stationary installations) | 19.6 | 20.8 | 20.2 | 16.5 | 12.8 | 19.6 | 20.8 | 18.2 | 14.9 | 11.6 |
| Effort Sharing Decision and Regulation | 41.2 | 43.1 | 44.4 | 46.1 | 47.8 | 41.1 | 42.4 | 41.1 | 40.4 | 39.7 |
| Land use, land-use change and forestry | -5.4 | -2.3 | -1.4 | -0.5 | 0.4 | -5.4 | -2.8 | -2.4 | -2.0 | -1.6 |

Note: Reported projections calibrated by EEA to align them with historic emissions.

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ireland** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **59.2** | **61.5** | **63.8** | **64.3** | **61.3** | **59.2** | **60.5** | **61.4** | **54.6** | **55.2** |
| Energy supply | 11.9 | 12.3 | 14.8 | 15.4 | 12.5 | 11.9 | 12.0 | 13.7 | 8.6 | 10.4 |
| Manufacturing and construction industries | 4.5 | 3.9 | 3.8 | 3.6 | 3.7 | 4.5 | 3.9 | 3.7 | 3.4 | 3.5 |
| Transport | 11.8 | 12.9 | 13.0 | 13.4 | 13.0 | 11.8 | 12.7 | 12.5 | 11.9 | 11.0 |
| Residential and commercial | 8.4 | 8.5 | 7.9 | 7.3 | 7.0 | 8.4 | 8.3 | 7.4 | 6.1 | 5.4 |
| Industrial processes and process use | 3.1 | 3.4 | 3.6 | 3.8 | 4.2 | 3.1 | 3.4 | 3.6 | 3.8 | 4.2 |
| Agriculture | 18.5 | 20.0 | 20.3 | 20.4 | 20.5 | 18.5 | 19.8 | 20.1 | 20.2 | 20.3 |
| Waste | 0.9 | 0.6 | 0.5 | 0.4 | 0.4 | 0.9 | 0.6 | 0.5 | 0.4 | 0.4 |
| Emissions Trading System (stationary installations) | 16.8 | 16.9 | 19.5 | 20.3 | 17.9 | 16.8 | 16.5 | 18.4 | 13.4 | 15.7 |
| Effort Sharing Decision and Regulation | 42.4 | 44.6 | 44.3 | 44.0 | 43.4 | 42.4 | 44.0 | 43.0 | 41.1 | 39.5 |
| Land use, land-use change and forestry | 4.7 | 4.0 | 6.7 | 8.1 | 8.0 | 4.7 | 4.0 | 6.7 | 8.1 | 8.0 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Italy** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **434.0** | **419.0** | **398.3** | **383.2** | **371.4** | **434.0** | **406.2** | **358.1** | **327.0** | **322.1** |
| Energy supply | 113.4 | 99.8 | 89.1 | 88.7 | 85.3 | 113.4 | 97.2 | 69.0 | 64.2 | 65.9 |
| Manufacturing and construction industries | 51.0 | 56.4 | 55.7 | 53.4 | 52.1 | 51.0 | 53.1 | 51.6 | 48.4 | 52.9 |
| Transport | 106.0 | 102.9 | 103.3 | 96.0 | 95.3 | 106.0 | 98.0 | 95.1 | 82.2 | 78.3 |
| Residential and commercial | 82.5 | 81.4 | 75.4 | 73.6 | 70.3 | 82.5 | 79.3 | 67.5 | 60.9 | 56.5 |
| Industrial processes and process use | 32.6 | 32.2 | 30.4 | 28.5 | 27.7 | 32.6 | 32.2 | 30.4 | 28.5 | 27.7 |
| Agriculture | 30.1 | 30.6 | 30.3 | 30.0 | 29.6 | 30.1 | 30.6 | 30.3 | 30.0 | 29.6 |
| Waste | 18.6 | 15.7 | 14.1 | 12.8 | 11.2 | 18.6 | 15.7 | 14.1 | 12.8 | 11.2 |
| Emissions Trading System (stationary installations) | 156.2 | 148.5 | 138.0 | 136.5 | 133.8 | 156.2 | 143.7 | 115.4 | 109.3 | 114.0 |
| Effort Sharing Decision and Regulation | 275.6 | 268.1 | 258.0 | 244.4 | 235.3 | 275.6 | 260.2 | 240.3 | 215.5 | 205.7 |
| Land use, land-use change and forestry | -39.9 | -26.0 | -22.8 | -23.4 | -26.2 | -39.9 | -26.0 | -22.8 | -23.4 | -26.2 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Latvia** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **11.3** | **11.8** | **11.2** | **10.4** | **9.2** | **11.3** | **11.6** | **11.0** | **10.3** | **9.1** |
| Energy supply | 1.9 | 2.1 | 1.9 | 1.5 | 1.2 | 1.9 | 1.9 | 1.7 | 1.4 | 1.1 |
| Manufacturing and construction industries | 0.7 | 0.8 | 0.7 | 0.7 | 0.7 | 0.7 | 0.9 | 0.7 | 0.7 | 0.6 |
| Transport | 3.2 | 3.1 | 3.0 | 2.8 | 2.1 | 3.2 | 3.1 | 3.0 | 2.8 | 2.1 |
| Residential and commercial | 1.4 | 1.6 | 1.4 | 1.3 | 1.2 | 1.4 | 1.5 | 1.4 | 1.3 | 1.2 |
| Industrial processes and process use | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 | 0.8 |
| Agriculture | 2.7 | 2.9 | 3.1 | 3.1 | 3.1 | 2.7 | 2.9 | 3.0 | 3.0 | 3.0 |
| Waste | 0.7 | 0.5 | 0.4 | 0.3 | 0.3 | 0.7 | 0.5 | 0.4 | 0.3 | 0.2 |
| Emissions Trading System (stationary installations) | 2.3 | 2.6 | 2.6 | 2.2 | 1.8 | 2.3 | 2.5 | 2.5 | 2.2 | 1.8 |
| Effort Sharing Decision and Regulation | 9.0 | 9.1 | 8.6 | 8.2 | 7.4 | 9.0 | 9.1 | 8.5 | 8.0 | 7.3 |
| Land use, land-use change and forestry | 0.7 | 2.1 | 3.6 | 4.6 | 4.4 | 0.7 | 2.1 | 3.4 | 4.3 | 4.1 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Lithuania** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **20.2** | **20.5** | **20.4** | **20.4** | **20.9** | **20.2** | **20.4** | **19.7** | **19.6** | **20.1** |
| Energy supply | 3.5 | 2.8 | 2.9 | 3.2 | 3.7 | 3.5 | 2.8 | 2.9 | 3.2 | 3.7 |
| Manufacturing and construction industries | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 | 1.2 | 1.3 | 1.3 | 1.3 | 1.3 |
| Transport | 5.1 | 5.6 | 6.0 | 6.3 | 6.7 | 5.1 | 5.6 | 5.7 | 6.0 | 6.4 |
| Residential and commercial | 1.3 | 1.5 | 1.3 | 1.0 | 0.8 | 1.3 | 1.5 | 1.2 | 1.0 | 0.8 |
| Industrial processes and process use | 3.5 | 4.0 | 3.9 | 3.8 | 3.6 | 3.5 | 4.0 | 3.9 | 3.8 | 3.6 |
| Agriculture | 4.6 | 4.4 | 4.3 | 4.2 | 4.3 | 4.6 | 4.3 | 4.0 | 3.9 | 3.9 |
| Waste | 1.0 | 0.8 | 0.7 | 0.5 | 0.4 | 1.0 | 0.8 | 0.6 | 0.5 | 0.4 |
| Emissions Trading System (stationary installations) | 6.8 | 6.4 | 6.4 | 6.5 | 6.7 | 6.8 | 6.4 | 6.3 | 6.5 | 6.7 |
| Effort Sharing Decision and Regulation | 13.3 | 14.1 | 14.0 | 13.9 | 14.1 | 13.3 | 14.0 | 13.4 | 13.2 | 13.4 |
| Land use, land-use change and forestry | -6.1 | -2.8 | -1.3 | 0.4 | 2.6 | -6.1 | -2.8 | -1.4 | 0.1 | 2.4 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Luxembourg** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **10.3** | **10.1** | **9.9** | **10.1** | **10.3** | **10.3** | **10.1** | **9.9** | **10.1** | **10.3** |
| Energy supply | 0.5 | 0.3 | 0.3 | 0.3 | 0.3 | 0.5 | 0.3 | 0.3 | 0.3 | 0.3 |
| Manufacturing and construction industries | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 |
| Transport | 5.7 | 5.6 | 5.5 | 5.8 | 6.2 | 5.7 | 5.6 | 5.5 | 5.8 | 6.2 |
| Residential and commercial | 1.6 | 1.7 | 1.6 | 1.5 | 1.4 | 1.6 | 1.7 | 1.6 | 1.5 | 1.4 |
| Industrial processes and process use | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 | 0.6 | 0.6 | 0.5 | 0.5 | 0.4 |
| Agriculture | 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 |
| Emissions Trading System (stationary installations) | 1.7 | 1.5 | 1.4 | 1.4 | 1.4 | 1.7 | 1.5 | 1.4 | 1.4 | 1.4 |
| Effort Sharing Decision and Regulation | 8.6 | 8.6 | 8.5 | 8.7 | 8.9 | 8.6 | 8.6 | 8.5 | 8.7 | 8.9 |
| Land use, land-use change and forestry | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 | -0.4 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Malta** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **2.2** | **2.4** | **2.6** | **2.7** | **2.7** | **2.2** | **2.4** | **2.6** | **2.7** | **2.7** |
| Energy supply | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 |
| Manufacturing and construction industries | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| Transport | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.6 | 0.6 |
| Residential and commercial | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Industrial processes and process use | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 | 0.2 | 0.2 | 0.3 | 0.3 | 0.4 |
| Agriculture | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Waste | 0.1 | 0.3 | 0.3 | 0.3 | 0.2 | 0.1 | 0.3 | 0.3 | 0.3 | 0.2 |
| Emissions Trading System (stationary installations) | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 | 0.9 | 1.0 | 1.0 | 1.1 | 1.1 |
| Effort Sharing Decision and Regulation | 1.3 | 1.5 | 1.5 | 1.6 | 1.6 | 1.3 | 1.5 | 1.5 | 1.6 | 1.6 |
| Land use, land-use change and forestry | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Netherlands** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **195.1** | **169.7** | **168.0** | **157.9** | **151.0** | **195.1** | **169.7** | **168.0** | **157.9** | **151.0** |
| Energy supply | 71.1 | 53.0 | 53.8 | 48.0 | 44.3 | 71.1 | 53.0 | 53.8 | 48.0 | 44.3 |
| Manufacturing and construction industries | 24.1 | 23.9 | 24.2 | 23.4 | 21.6 | 24.1 | 23.9 | 24.2 | 23.4 | 21.6 |
| Transport | 31.2 | 29.5 | 29.7 | 29.1 | 29.7 | 31.2 | 29.5 | 29.7 | 29.1 | 29.7 |
| Residential and commercial | 34.4 | 30.9 | 28.6 | 26.0 | 24.0 | 34.4 | 30.9 | 28.6 | 26.0 | 24.0 |
| Industrial processes and process use | 11.7 | 11.0 | 11.0 | 11.0 | 11.5 | 11.7 | 11.0 | 11.0 | 11.0 | 11.5 |
| Agriculture | 19.2 | 18.8 | 18.7 | 18.7 | 18.7 | 19.2 | 18.8 | 18.7 | 18.7 | 18.7 |
| Waste | 3.4 | 2.5 | 2.0 | 1.6 | 1.3 | 3.4 | 2.5 | 2.0 | 1.6 | 1.3 |
| Emissions Trading System (stationary installations) | 94.1 | 75.5 | 77.2 | 71.5 | 66.7 | 94.1 | 75.5 | 77.2 | 71.5 | 66.7 |
| Effort Sharing Decision and Regulation | 100.9 | 94.1 | 90.7 | 86.3 | 84.2 | 100.9 | 94.1 | 90.7 | 86.3 | 84.2 |
| Land use, land-use change and forestry | 6.7 | 6.3 | 6.4 | 6.8 | 6.7 | 6.7 | 6.3 | 6.4 | 6.8 | 6.7 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Norway** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **54.5** | **50.8** | **48.0** | **45.3** | **42.5** | **54.5** | **50.8** | **48.0** | **45.3** | **42.5** |
| Energy supply | 19.1 | 18.6 | 17.7 | 16.8 | 15.9 | 19.1 | 18.6 | 17.7 | 16.8 | 15.9 |
| Manufacturing and construction industries | 4.0 | 4.1 | 3.9 | 3.7 | 3.5 | 4.0 | 4.1 | 3.9 | 3.7 | 3.5 |
| Transport | 14.3 | 11.4 | 10.3 | 9.1 | 7.9 | 14.3 | 11.4 | 10.3 | 9.1 | 7.9 |
| Residential and commercial | 2.8 | 2.7 | 2.6 | 2.4 | 2.3 | 2.8 | 2.7 | 2.6 | 2.4 | 2.3 |
| Industrial processes and process use | 8.5 | 8.3 | 8.1 | 7.8 | 7.5 | 8.5 | 8.3 | 8.1 | 7.8 | 7.5 |
| Agriculture | 4.4 | 4.6 | 4.6 | 4.6 | 4.7 | 4.4 | 4.6 | 4.6 | 4.6 | 4.7 |
| Waste | 1.3 | 1.1 | 0.9 | 0.8 | 0.6 | 1.3 | 1.1 | 0.9 | 0.8 | 0.6 |
| Emissions Trading System (stationary installations) | 25.6 | 25.7 | 24.8 | 23.9 | 23.0 | 25.6 | 25.7 | 24.8 | 23.9 | 23.0 |
| Effort Sharing Decision and Regulation | 27.7 | 23.8 | 22.0 | 20.1 | 18.2 | 27.7 | 23.8 | 22.0 | 20.1 | 18.2 |
| Land use, land-use change and forestry | -23.7 | -23.5 | -22.4 | -21.3 | -20.2 | -23.7 | -23.5 | -22.4 | -21.3 | -20.2 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Poland** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **385.8** | **398.9** | **407.6** | **409.9** | **375.9** | **385.8** | **398.9** | **407.6** | **409.9** | **375.9** |
| Energy supply | 186.4 | 179.3 | 183.7 | 185.0 | 153.8 | 186.4 | 179.3 | 183.7 | 185.0 | 153.8 |
| Manufacturing and construction industries | 28.1 | 29.2 | 28.4 | 27.5 | 26.6 | 28.1 | 29.2 | 28.4 | 27.5 | 26.6 |
| Transport | 46.6 | 62.1 | 65.4 | 67.2 | 66.4 | 46.6 | 62.1 | 65.4 | 67.2 | 66.4 |
| Residential and commercial | 54.9 | 56.1 | 55.2 | 54.1 | 52.7 | 54.9 | 56.1 | 55.2 | 54.1 | 52.7 |
| Industrial processes and process use | 28.5 | 29.2 | 30.9 | 31.9 | 32.6 | 28.5 | 29.2 | 30.9 | 31.9 | 32.6 |
| Agriculture | 29.6 | 31.0 | 32.0 | 32.3 | 32.1 | 29.6 | 31.0 | 32.0 | 32.3 | 32.1 |
| Waste | 11.6 | 11.9 | 11.9 | 11.8 | 11.7 | 11.6 | 11.9 | 11.9 | 11.8 | 11.7 |
| Emissions Trading System (stationary installations) | 198.7 | 193.2 | 199.6 | 204.7 | 171.5 | 198.7 | 193.2 | 199.6 | 204.7 | 171.5 |
| Effort Sharing Decision and Regulation | 187.0 | 205.5 | 207.9 | 205.0 | 204.2 | 187.0 | 205.5 | 207.9 | 205.0 | 204.2 |
| Land use, land-use change and forestry | -28.8 | -21.8 | -18.4 | -13.8 | -11.8 | -28.8 | -21.8 | -18.4 | -13.8 | -11.8 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Portugal** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **69.4** | **63.2** | **56.6** | **42.4** | **37.3** | **69.4** | **63.1** | **48.9** | **37.8** | **29.0** |
| Energy supply | 19.6 | 16.2 | 13.5 | 6.5 | 4.1 | 19.6 | 16.2 | 5.8 | 4.5 | 2.2 |
| Manufacturing and construction industries | 7.9 | 7.6 | 6.0 | 6.4 | 6.1 | 7.9 | 7.6 | 5.8 | 5.9 | 4.3 |
| Transport | 16.4 | 16.3 | 16.7 | 11.2 | 10.3 | 16.4 | 16.3 | 17.1 | 9.3 | 7.2 |
| Residential and commercial | 4.4 | 4.8 | 4.4 | 4.3 | 3.7 | 4.4 | 4.7 | 4.3 | 4.2 | 2.3 |
| Industrial processes and process use | 7.8 | 7.0 | 5.9 | 5.2 | 4.7 | 7.8 | 7.0 | 5.9 | 5.2 | 4.7 |
| Agriculture | 6.7 | 6.8 | 6.2 | 5.6 | 5.7 | 6.7 | 6.8 | 6.1 | 5.5 | 5.5 |
| Waste | 6.6 | 4.4 | 3.8 | 3.3 | 2.8 | 6.6 | 4.4 | 3.8 | 3.3 | 2.8 |
| Emissions Trading System (stationary installations) | 27.9 | 25.8 | 21.5 | 14.7 | 11.6 | 27.9 | 25.1 | 12.9 | 11.7 | 8.3 |
| Effort Sharing Decision and Regulation | 41.1 | 37.1 | 34.9 | 27.6 | 25.5 | 41.1 | 37.7 | 35.8 | 25.9 | 20.6 |
| Land use, land-use change and forestry | -8.5 | -4.6 | -5.8 | -6.9 | -7.4 | -8.5 | -4.6 | -9.0 | -6.9 | -9.9 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Romania*** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **116.5** | **118.2** | **119.0** | **126.3** | **130.9** | **116.5** | **116.3** | **116.2** | **122.9** | **126.0** |
| Energy supply | 41.1 | 38.8 | 34.7 | 37.8 | 38.2 | 41.1 | 38.5 | 34.4 | 37.6 | 38.0 |
| Manufacturing and construction industries | 12.5 | 13.0 | 13.5 | 14.0 | 14.8 | 12.5 | 12.7 | 13.3 | 14.0 | 14.1 |
| Transport | 15.7 | 17.8 | 19.3 | 20.3 | 20.9 | 15.7 | 17.4 | 18.9 | 19.9 | 20.5 |
| Residential and commercial | 10.8 | 11.5 | 12.3 | 13.2 | 13.9 | 10.8 | 11.3 | 12.0 | 12.5 | 13.3 |
| Industrial processes and process use | 11.9 | 12.7 | 13.9 | 14.8 | 15.6 | 11.9 | 12.7 | 13.9 | 14.8 | 15.6 |
| Agriculture | 18.7 | 19.2 | 20.6 | 21.9 | 23.4 | 18.7 | 18.4 | 19.1 | 19.9 | 20.6 |
| Waste | 5.8 | 5.2 | 4.6 | 4.3 | 4.1 | 5.8 | 5.2 | 4.6 | 4.3 | 4.0 |
| Emissions Trading System (stationary installations) | 42.3 | 41.7 | 39.1 | 42.9 | 44.3 | 42.3 | 41.5 | 39.0 | 42.9 | 43.9 |
| Effort Sharing Decision and Regulation | 74.2 | 76.5 | 79.9 | 83.4 | 86.6 | 74.2 | 74.7 | 77.2 | 79.9 | 82.1 |
| Land use, land-use change and forestry | -18.3 | -17.0 | -18.1 | -16.5 | -16.8 | -18.3 | -16.0 | -12.8 | -9.9 | -10.6 |
| Romania* did not report a projection in 2019, figures are related to submitted GHG projection of 2017. | | | | | | | | | | |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Slovakia** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **41.6** | **42.4** | **42.0** | **41.4** | **39.5** | **41.6** | **41.2** | **38.8** | **34.0** | **31.7** |
| Energy supply | 9.2 | 9.0 | 8.7 | 8.9 | 7.9 | 9.2 | 8.7 | 7.0 | 5.7 | 5.0 |
| Manufacturing and construction industries | 6.8 | 6.8 | 6.6 | 6.8 | 6.5 | 6.8 | 6.8 | 6.3 | 5.4 | 4.7 |
| Transport | 7.3 | 7.8 | 8.5 | 8.8 | 8.8 | 7.3 | 6.9 | 7.1 | 7.1 | 6.9 |
| Residential and commercial | 5.0 | 5.5 | 5.4 | 5.4 | 5.3 | 5.0 | 5.5 | 5.4 | 4.9 | 4.7 |
| Industrial processes and process use | 9.2 | 9.4 | 9.1 | 8.1 | 7.7 | 9.2 | 9.4 | 9.2 | 7.5 | 7.0 |
| Agriculture | 2.5 | 2.4 | 2.4 | 2.4 | 2.5 | 2.5 | 2.4 | 2.4 | 2.4 | 2.5 |
| Waste | 1.7 | 1.6 | 1.3 | 1.0 | 0.9 | 1.7 | 1.6 | 1.3 | 1.0 | 0.9 |
| Emissions Trading System (stationary installations) | 20.9 | 20.9 | 20.1 | 20.0 | 18.7 | 20.9 | 20.9 | 18.9 | 15.8 | 14.4 |
| Effort Sharing Decision and Regulation | 20.8 | 21.4 | 21.9 | 21.4 | 20.8 | 20.8 | 20.3 | 19.9 | 18.2 | 17.3 |
| Land use, land-use change and forestry | -6.6 | -6.1 | -5.0 | -4.4 | -4.2 | -6.6 | -6.2 | -5.1 | -4.5 | -4.2 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Slovenia** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **16.7** | **17.9** | **17.2** | **16.3** | **15.3** | **16.7** | **17.9** | **17.2** | **16.3** | **15.3** |
| Energy supply | 4.8 | 5.8 | 5.1 | 4.3 | 3.9 | 4.8 | 5.8 | 5.1 | 4.3 | 3.9 |
| Manufacturing and construction industries | 1.5 | 1.7 | 1.9 | 2.1 | 2.2 | 1.5 | 1.7 | 1.9 | 2.1 | 2.2 |
| Transport | 5.3 | 5.4 | 5.4 | 5.2 | 4.7 | 5.3 | 5.4 | 5.4 | 5.2 | 4.7 |
| Residential and commercial | 1.6 | 1.4 | 1.2 | 1.1 | 1.0 | 1.6 | 1.4 | 1.2 | 1.1 | 1.0 |
| Industrial processes and process use | 1.2 | 1.3 | 1.3 | 1.3 | 1.2 | 1.2 | 1.3 | 1.3 | 1.3 | 1.2 |
| Agriculture | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 |
| Waste | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 | 0.5 | 0.4 | 0.4 | 0.4 | 0.3 |
| Emissions Trading System (stationary installations) | 6.0 | 7.2 | 6.7 | 6.2 | 5.8 | 6.0 | 7.2 | 6.7 | 6.2 | 5.8 |
| Effort Sharing Decision and Regulation | 10.7 | 10.7 | 10.4 | 10.1 | 9.4 | 10.7 | 10.7 | 10.4 | 10.1 | 9.4 |
| Land use, land-use change and forestry | -1.7 | -1.7 | -1.7 | -1.7 | -1.7 | -1.7 | -1.7 | -1.7 | -1.7 | -1.7 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Spain** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **335.8** | **331.7** | **315.7** | **310.6** | **299.0** | **335.8** | **327.4** | **266.3** | **226.7** | **204.1** |
| Energy supply | 90.8 | 76.9 | 60.8 | 60.2 | 53.8 | 90.8 | 81.2 | 43.8 | 35.4 | 34.5 |
| Manufacturing and construction industries | 40.5 | 42.0 | 42.2 | 41.2 | 40.9 | 40.5 | 40.5 | 37.2 | 33.5 | 30.7 |
| Transport | 83.2 | 89.9 | 91.9 | 92.1 | 90.5 | 83.2 | 85.7 | 74.6 | 57.7 | 45.8 |
| Residential and commercial | 40.1 | 43.5 | 43.7 | 42.6 | 40.7 | 40.1 | 40.7 | 37.0 | 32.7 | 28.6 |
| Industrial processes and process use | 32.3 | 31.0 | 29.5 | 27.8 | 27.4 | 32.3 | 31.0 | 29.5 | 27.8 | 27.3 |
| Agriculture | 34.5 | 34.6 | 34.6 | 34.5 | 34.0 | 34.5 | 34.6 | 32.3 | 30.0 | 29.2 |
| Waste | 14.4 | 13.8 | 13.1 | 12.2 | 11.7 | 14.4 | 13.7 | 11.9 | 9.6 | 7.9 |
| Emissions Trading System (stationary installations) | 137.3 | 126.3 | 111.2 | 110.0 | 103.9 | 137.3 | 129.1 | 90.7 | 79.5 | 76.5 |
| Effort Sharing Decision and Regulation | 196.1 | 202.6 | 201.5 | 197.5 | 191.8 | 196.1 | 195.7 | 173.1 | 144.7 | 125.2 |
| Land use, land-use change and forestry | -42.0 | -35.3 | -32.5 | -31.6 | -31.4 | -44.1 | -41.4 | -39.8 | -36.0 | -33.8 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sweden** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **53.5** | **49.7** | **47.7** | **46.1** | **45.6** | **53.5** | **49.7** | **47.7** | **46.1** | **45.6** |
| Energy supply | 9.7 | 10.0 | 10.0 | 9.9 | 9.9 | 9.7 | 10.0 | 10.0 | 9.9 | 9.9 |
| Manufacturing and construction industries | 7.0 | 6.7 | 6.4 | 6.1 | 6.0 | 7.0 | 6.7 | 6.4 | 6.1 | 6.0 |
| Transport | 17.8 | 14.8 | 13.9 | 13.4 | 13.2 | 17.8 | 14.8 | 13.9 | 13.4 | 13.2 |
| Residential and commercial | 3.3 | 2.8 | 2.5 | 2.5 | 2.5 | 3.3 | 2.8 | 2.5 | 2.5 | 2.5 |
| Industrial processes and process use | 7.3 | 7.7 | 7.5 | 7.3 | 7.2 | 7.3 | 7.7 | 7.5 | 7.3 | 7.2 |
| Agriculture | 6.9 | 6.7 | 6.4 | 6.2 | 6.1 | 6.9 | 6.7 | 6.4 | 6.2 | 6.1 |
| Waste | 1.4 | 1.1 | 0.9 | 0.7 | 0.6 | 1.4 | 1.1 | 0.9 | 0.7 | 0.6 |
| Emissions Trading System (stationary installations) | 19.3 | 19.7 | 19.6 | 19.5 | 19.4 | 19.3 | 19.7 | 19.6 | 19.5 | 19.4 |
| Effort Sharing Decision and Regulation | 33.7 | 29.4 | 27.4 | 26.0 | 25.5 | 33.7 | 29.4 | 27.4 | 26.0 | 25.5 |
| Land use, land-use change and forestry | -45.5 | -41.4 | -42.5 | -40.6 | -39.0 | -45.5 | -41.4 | -42.5 | -40.6 | -39.0 |

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Switzerland** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **48.0** | **45.9** | **43.5** | **41.7** | **0.0** | **48.0** | **45.7** | **40.0** | **35.0** | **0.0** |
| Land use, land-use change and forestry | -0.9 | 1.0 | 1.0 | 0.9 | 0.0 | -0.9 | 1.9 | 2.6 | 2.5 | 0.0 |

**Table A1.2 Historical and projected total greenhouse gas, Emissions Trading System and Effort Sharing emissions (cont.)**

| GHG emission projections (Mt $CO_2e$) | WEM scenario | | | | | WAM scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **United Kingdom** | **2015** | **2020** | **2025** | **2030** | **2035** | **2015** | **2020** | **2025** | **2030** | **2035** |
| **Total GHG emissions** | **507.8** | **414.4** | **384.6** | **375.6** | **364.9** | **507.8** | **414.0** | **385.3** | **371.8** | **358.2** |
| Energy supply | 144.4 | 69.6 | 59.1 | 56.4 | 45.2 | 144.4 | 69.2 | 60.0 | 52.9 | 39.0 |
| Manufacturing and construction industries | 56.4 | 54.3 | 48.9 | 47.3 | 48.0 | 56.4 | 54.2 | 48.8 | 47.2 | 47.7 |
| Transport | 121.0 | 113.2 | 106.4 | 102.3 | 99.9 | 121.0 | 113.2 | 106.4 | 102.3 | 99.9 |
| Residential and commercial | 91.3 | 94.8 | 95.6 | 99.5 | 104.3 | 91.3 | 94.8 | 95.4 | 99.3 | 104.0 |
| Industrial processes and process use | 33.7 | 26.5 | 21.9 | 18.6 | 16.7 | 33.7 | 26.5 | 21.9 | 18.5 | 16.7 |
| Agriculture | 42.1 | 39.5 | 38.2 | 37.8 | 37.7 | 42.1 | 39.5 | 38.2 | 37.8 | 37.7 |
| Waste | 19.0 | 16.5 | 14.6 | 13.7 | 13.2 | 19.0 | 16.5 | 14.6 | 13.7 | 13.2 |
| Emissions Trading System (stationary installations) | 177.8 | 106.4 | 92.3 | 89.7 | 79.3 | 177.8 | 105.3 | 92.5 | 85.5 | 72.3 |
| Effort Sharing Decision and Regulation | 328.5 | 306.0 | 290.3 | 283.7 | 283.5 | 328.5 | 306.7 | 290.8 | 284.1 | 283.7 |
| Land use, land-use change and forestry | -15.1 | -15.7 | -14.1 | -10.7 | -8.3 | -15.1 | -15.7 | -14.1 | -10.7 | -8.3 |

**Note:** In 2019, 17 Member States reported WAM scenarios: Belgium, Croatia, Cyprus, Czechia, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Portugal, Slovakia, Spain and the United Kingdom. Member States that have not reported a WAM scenario have been gap-filled using the WEM scenario.

**Sources:** EEA (2019e); EEA (forthcoming) (2019h).

### *A1.3.1 Tracking progress towards targets under the Effort Sharing legislation*

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

The assessment of current progress towards 2017 Effort Sharing targets is based on a comparison between Effort Sharing GHG emissions and Effort Sharing emission targets (AEAs) for 2017:

- Member States with historical emissions below their annual Effort Sharing emission targets are considered to be currently on track towards their targets under the Effort Sharing legislation.

- 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 Effort Sharing legislation.

The assessment of projected progress towards 2030 Effort Sharing targets is based on a comparison between projected domestic Effort Sharing GHG emissions in the WEM scenario in 2030 and Effort Sharing targets (AEAs) for 2030:

- Member States with WEM projections lower than their 2030 target are considered to be on track towards their targets.

- Member States with WEM projections higher than their 2030 target are considered to be not on track towards their targets.

The comparison of the 2030 Effort Sharing target and the WAM scenario is complementary to the assessment based on the WEM.

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

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

**Table A1.3 Current progress towards Effort Sharing targets**

| Member State | 2005 | 2017 progress under the ESD | | | | 2018 progress under the ESD (approximated) | | | | 2020 progress under the ESD (WEM scenario) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Base-year emissions | ESD target | ESD emissions | Absolute gap | Relative gap | ESD target | ESD emissions | Absolute gap | Relative gap | ESD target | ESD emissions | Absolute gap | Relative gap |
| | Mt $CO_2$e | Mt $CO_2$e | Mt $CO_2$e | Mt $CO_2$e | % (share of 2005 base year) | Mt $CO_2$e | Mt $CO_2$e | Mt $CO_2$e | % (share of 2005 base year) | Mt $CO_2$e | Mt $CO_2$e | Mt $CO_2$e | % (share of 2005 base-year) |
| Austria | 56.8 | 49.5 | 51.7 | -2.1 | -3.78 | 48.9 | 50.6 | -1.7 | -3.0 | 47.8 | 50.90 | -3.15 | -5.5 |
| Belgium | 80.3 | 72.5 | 70.8 | 1.7 | 2.07 | 71.1 | 71.4 | -0.3 | -0.4 | 68.2 | 71.83 | -3.58 | -4.5 |
| Bulgaria | 22.1 | 25.9 | 26.5 | -0.6 | -2.93 | 26.1 | 26.8 | -0.7 | -3.0 | 26.5 | 25.44 | 1.11 | 5.0 |
| Croatia | 17.4 | 18.7 | 16.7 | 2.0 | 11.56 | 18.9 | 17.2 | 1.7 | 9.7 | 19.3 | 15.97 | 3.35 | 19.2 |
| Cyprus | 4.2 | 4.20 | 4.27 | -0.07 | -1.8 | 4.12 | 4.2 | -0.06 | -1.52 | 4.0 | 4.35 | -0.37 | -8.9 |
| Czechia | 61.7 | 65.2 | 62.4 | 2.8 | 4.57 | 65.9 | 64.1 | 1.8 | 2.9 | 67.2 | 63.20 | 4.01 | 6.5 |
| Denmark | 40.1 | 34.8 | 32.7 | 2.1 | 5.24 | 33.9 | 32.4 | 1.4 | 3.6 | 32.1 | 31.86 | 0.21 | 0.5 |
| Estonia | 5.4 | 5.9 | 6.2 | -0.3 | -5.09 | 6.0 | 6.3 | -0.4 | -6.9 | 6.0 | 5.93 | 0.10 | 1.8 |
| Finland | 33.9 | 30.2 | 30.1 | 0.1 | 0.34 | 29.6 | 30.0 | -0.4 | -1.2 | 28.5 | 29.00 | -0.48 | -1.4 |
| France | 398.2 | 358.2 | 352.8 | 5.4 | 1.35 | 352.9 | 343.1 | 9.9 | 2.5 | 342.5 | 345.45 | -2.97 | -0.7 |
| Germany | 477.8 | 432.3 | 466.9 | -34.5 | -7.22 | 425.2 | 441.2 | -16.0 | -3.4 | 410.9 | 436.63 | -25.72 | -5.4 |
| Greece | 62.6 | 59.1 | 45.4 | 13.7 | 21.88 | 59.4 | 44.9 | 14.6 | 23.3 | 60.0 | 46.89 | 13.16 | 21.0 |
| Hungary | 48.0 | 50.1 | 43.1 | 6.9 | 14.41 | 51.0 | 43.3 | 7.7 | 15.9 | 52.8 | 43.06 | 9.77 | 20.3 |
| Ireland | 47.1 | 40.9 | 43.8 | -2.9 | -6.25 | 39.8 | 45.4 | -5.6 | -11.8 | 37.7 | 44.57 | -6.92 | -14.7 |
| Italy | 334.5 | 298.3 | 270.1 | 28.1 | 8.40 | 295.8 | 274.8 | 21.1 | 6.3 | 291.0 | 268.13 | 22.88 | 6.8 |
| Latvia | 8.5 | 9.7 | 9.2 | 0.5 | 5.69 | 9.8 | 9.2 | 0.6 | 7.4 | 10.0 | 9.10 | 0.89 | 10.4 |
| Lithuania | 13.3 | 14.1 | 14.1 | -0.01 | -0.05 | 14.5 | 14.1 | 0.4 | 2.7 | 15.2 | 14.07 | 1.17 | 8.8 |
| Luxembourg | 10.1 | 8.7 | 8.7 | -0.006 | -0.06 | 8.5 | 9.1 | -0.6 | -5.5 | 8.1 | 8.65 | -0.53 | -5.2 |
| Malta | 1.1 | 1.2 | 1.4 | -0.3 | -22.75 | 1.2 | 1.5 | -0.3 | -26.8 | 1.2 | 1.47 | -0.30 | -26.5 |
| Netherlands | 127.8 | 114.1 | 102.3 | 11.7 | 9.17 | 111.8 | 101.8 | 10.0 | 7.8 | 107.4 | 94.13 | 13.24 | 10.4 |
| Poland | 180.0 | 200.0 | 211.5 | -11.5 | -6.41 | 201.7 | 218.0 | -16.3 | -9.0 | 205.2 | 205.51 | -0.33 | -0.2 |
| Portugal | 48.6 | 47.9 | 40.2 | 7.7 | 15.89 | 48.3 | 40.8 | 7.5 | 15.5 | 49.1 | 37.07 | 12.01 | 24.7 |
| Romania | 75.5 | 84.1 | 75.4 | 8.7 | 11.52 | 86.0 | 74.3 | 11.7 | 15.5 | 89.8 | 76.53 | 13.28 | 17.6 |
| Slovakia | 23.0 | 25.0 | 21.2 | 3.8 | 16.51 | 25.3 | 21.9 | 3.4 | 14.9 | 25.9 | 21.42 | 4.53 | 19.7 |
| Slovenia | 11.8 | 12.2 | 10.9 | 1.3 | 11.17 | 12.2 | 11.0 | 1.3 | 10.6 | 12.3 | 10.73 | 1.58 | 13.3 |
| Spain | 236.0 | 218.3 | 201.1 | 17.2 | 7.27 | 216.3 | 202.7 | 13.6 | 5.8 | 212.4 | 202.64 | 9.75 | 4.1 |

**Table A1.3 Current progress towards Effort Sharing targets (cont.)**

| Member State | 2005 | 2017 progress under the ESD | | | | 2018 progress under the ESD (approximated) | | | | 2020 progress under the ESD (WEM scenario) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Base-year emissions | ESD target | ESD emissions | Absolute gap | Relative gap | ESD target | ESD emissions | Absolute gap | Relative gap | ESD target | ESD emissions | Absolute gap | Relative gap |
| | Mt $CO_2e$ | Mt $CO_2e$ | Mt $CO_2e$ | Mt $CO_2e$ | % (share of 2005 base year) | Mt $CO_2e$ | Mt $CO_2e$ | Mt $CO_2e$ | % (share of 2005 base year) | Mt $CO_2e$ | Mt $CO_2e$ | Mt $CO_2e$ | % (share of 2005 base-year) |
| Sweden | 43.5 | 37.8 | 32.5 | 5.3 | 12.12 | 37.2 | 32.7 | 4.5 | 10.4 | 36.1 | 29.44 | 6.64 | 15.3 |
| United Kingdom | 417.8 | 360.4 | 332.1 | 28.4 | 6.79 | 357.2 | 329.4 | 27.8 | 6.7 | 350.9 | 306.02 | 44.91 | 10.7 |
| **EU-28** | **2 887** | **2 679** | **2 584** | **95** | **3.3** | **2 659** | **2 562** | **97** | **3.4** | **2.618** | **2.500** | **118** | **4.1** |

**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 A1.2.7 regarding the EEA's calculation of 2005 base-year emissions.

**Sources:** EU (2009a, 2013b, 2017a). Based on Member States' submissions.

## Table A1.4 Projected progress towards 2030 Effort Sharing Regulation targets

| Member State | 2005 | 2030 ESR target | | Projected progress with existing measures by 2030 | | | Projected progress with additional measures by 2030 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Base-year emissions | Relative 2030 target | Absolute 2030 target | ESD emissions | Abolute gap | Relative gap | ESD emissions | Abolute gap | Relative gap |
| | Mt $CO_2$e | | Mt $CO_2$e | Mt $CO_2$e | Mt $CO_2$e | % (share of 2005 base-year) | Mt $CO_2$e | Mt $CO_2$e | % (share of 2005 base-year) |
| Austria | 56.8 | -36.0 | 36.4 | 47.9 | -11.5 | -20.2 | 47.9 | -11.5 | -20.2 |
| Belgium | 80.3 | -35.0 | 52.2 | 69.6 | -17.4 | -21.7 | 51.2 | 1.0 | 1.2 |
| Bulgaria | 22.1 | 0.0 | 22.1 | 23.9 | -1.8 | -8.1 | 23.9 | -1.8 | -8.1 |
| Croatia | 17.4 | -7.0 | 16.2 | 16.4 | -0.2 | -1.2 | 14.2 | 2.0 | 11.6 |
| Cyprus | 4.2 | -24.0 | 3.2 | 4.2 | -1.0 | -24.8 | 4.1 | -0.9 | -22.4 |
| Czechia | 61.7 | -14.0 | 53.0 | 54.0 | -0.9 | -1.5 | 53.3 | -0.3 | -0.5 |
| Denmark | 40.1 | -39.0 | 24.4 | 31.0 | -6.5 | -16.2 | 31.0 | -6.5 | -16.2 |
| Estonia | 5.4 | -13.0 | 4.7 | 6.1 | -1.34 | -24.8 | 5.2 | -0.5 | -8.8 |
| Finland | 33.9 | -39.0 | 20.7 | 26.0 | -5.3 | -15.5 | 21.3 | -0.6 | -1.9 |
| France | 398.2 | -37.0 | 250.9 | 303.9 | -53.0 | -13.3 | 232.6 | 18.2 | 4.6 |
| Germany | 477.8 | -38.0 | 296.2 | 373.6 | -77.3 | -16.2 | 373.6 | -77.3 | -16.2 |
| Greece | 62.6 | -16.0 | 52.5 | 46.8 | 5.7 | 9.1 | 44.5 | 8.0 | 12.9 |
| Hungary | 48.0 | -7.0 | 44.7 | 46.1 | -1.5 | -3.0 | 40.4 | 4.3 | 8.9 |
| Ireland | 47.1 | -30.0 | 32.9 | 44.0 | -11.0 | -23.5 | 41.1 | -8.1 | -17.3 |
| Italy | 334.5 | -33.0 | 224.1 | 244.4 | -20.3 | -6.1 | 215.5 | 8.6 | 2.6 |
| Latvia | 8.5 | -6.0 | 8.0 | 8.2 | -0.2 | -2.0 | 8.0 | 0.0 | -0.3 |
| Lithuania | 13.3 | -9.0 | 12.1 | 13.9 | -1.9 | -14.0 | 13.2 | -1.1 | -8.3 |
| Luxembourg | 10.1 | -40.0 | 6.1 | 8.7 | -2.6 | -25.3 | 8.7 | -2.6 | -25.3 |
| Malta | 1.1 | -19.0 | 0.9 | 1.6 | -0.7 | -61.7 | 1.6 | -0.7 | -61.7 |
| Netherlands | 127.8 | -36.0 | 81.8 | 86.3 | -4.5 | -3.6 | 86.3 | -4.5 | -3.6 |
| Poland | 180.0 | -7.0 | 167.4 | 205.0 | -37.6 | -20.9 | 205.0 | -37.6 | -20.9 |
| Portugal | 48.6 | -17.0 | 40.3 | 27.6 | 12.8 | 26.2 | 25.9 | 14.4 | 29.6 |
| Romania | 75.5 | -2.0 | 74.0 | 83.4 | -9.4 | -12.5 | 79.9 | -5.9 | -7.9 |
| Slovakia | 23.0 | -12.0 | 20.2 | 21.4 | -1.2 | -5.4 | 18.2 | 2.0 | 8.8 |
| Slovenia | 11.8 | -15.0 | 10.1 | 10.1 | 0.0 | -0.2 | 10.1 | 0.0 | -0.2 |
| Spain | 236.0 | -26.0 | 174.6 | 197.5 | -22.8 | -9.7 | 144.7 | 29.9 | 12.7 |
| Sweden | 43.5 | -40.0 | 26.1 | 26.0 | 0.1 | 0.1 | 26.0 | 0.1 | 0.1 |
| United Kingdom | 417.8 | -37.0 | 263.2 | 283.7 | -20.5 | -4.9 | 284.1 | -20.9 | -5.0 |
| **EU-28** | **2 887,1** | **-30.1** | **2 019.1** | **2 311.1** | **-292.0** | **-10.1** | **2 111.5** | **-92.4** | **-3.2** |

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

See Section A1.2.6 and A1.2.7 regarding the EEA's preliminary estimate of absolute values for the AEA 2021-2030 and the calculation of 2005 base-year emissions.

a The UK reported higher effort sharing emissions under WAM scenario than under WEM scenario. The difference is related to a methodological issue, linked to how total greenhouse gas emissions are split between ETS and ES, mostly in the sector manufacturing industries and constructions (1A2).

**Sources:** EU (2009a, 2013b, 2017a). Based on Member States' submissions.

### *A1.3.2 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 2013-2017.

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.

### *A1.3.3 Annual and cumulative gaps between emissions and Effort Sharing Decision targets*

**Table A1.5 Annual distance between Effort Sharing emissions and annual Effort Sharing Decision targets**

| Member State | Mt $CO_2e$ | | | | | Proxy |
|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| Austria | 2.5 | 3.9 | 2.2 | 0.4 | -2.1 | -1.7 |
| Belgium | 4.1 | 6.8 | 2.6 | -0.3 | 1.7 | -0.3 |
| Bulgaria | 4.7 | 4.3 | 2.1 | 2.1 | -0.6 | -0.7 |
| Croatia | 4.5 | 5.1 | 4.4 | 4.2 | 2.0 | 1.7 |
| Cyprus | 2.0 | 2.0 | 1.9 | 1.8 | -0.1 | -0.06 |
| Czechia | 1.0 | 5.6 | 2.7 | 1.9 | 2.8 | 1.8 |
| Denmark | 3.1 | 3.3 | 2.5 | 1.0 | 2.1 | 1.4 |
| Estonia | 0.5 | 0.2 | 0.2 | 0.2 | -0.3 | -0.4 |
| Finland | 0.2 | 1.1 | 0.9 | -1.0 | 0.1 | -0.4 |
| France | 28.0 | 35.9 | 31.4 | 27.5 | 5.4 | 9.9 |
| Germany | 12.3 | 29.0 | 15.1 | -1.7 | -34.5 | -16.0 |
| Greece | 14.8 | 14.9 | 14.2 | 15.0 | 13.7 | 14.6 |
| Hungary | 12.0 | 13.1 | 11.2 | 11.7 | 6.9 | 7.7 |
| Ireland | 4.7 | 4.1 | 1.6 | -0.3 | -2.9 | -5.6 |
| Italy | 34.8 | 40.9 | 31.0 | 31.6 | 28.1 | 21.1 |
| Latvia | 0.5 | 0.3 | 0.4 | 0.4 | 0.5 | 0.6 |
| Lithuania | 0.5 | 0.4 | 0.4 | 0.1 | -0.01 | 0.36 |
| Luxembourg | 0.174 | 0.482 | 0.534 | 0.417 | -0.006 | -0.560 |
| Malta | -0.1 | -0.1 | -0.1 | -0.2 | -0.3 | -0.3 |
| Netherlands | 14.7 | 22.8 | 17.3 | 14.8 | 11.7 | 10.0 |
| Poland | 7.5 | 13.3 | 9.4 | -1.3 | -11.5 | -16.3 |
| Portugal | 10.7 | 10.8 | 9.2 | 8.6 | 7.7 | 7.5 |
| Romania | 2.9 | 4.9 | 4.7 | 8.0 | 8.7 | 11.7 |
| Slovakia | 2.9 | 4.6 | 4.7 | 5.3 | 3.8 | 3.4 |
| Slovenia | 1.4 | 1.9 | 1.7 | 1.2 | 1.3 | 1.3 |
| Spain | 27.3 | 25.9 | 27.6 | 23.3 | 17.2 | 13.6 |
| Sweden | 6.4 | 6.5 | 6.5 | 7.2 | 5.3 | 4.5 |
| United Kingdom | 19.3 | 29.8 | 23.7 | 11.3 | 28.4 | 27.8 |
| **EU-28** | **223** | **292** | **230** | **173** | **95** | **97** |

**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 higher than the target). The darker the shading, the larger the gap (red) or the surplus (green). The colour shading 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, 2016 and 2017 as determined after the reviews of Effort Sharing emissions, and approximated data for 2018. No approximated data for GHG emissions were available for Bulgaria, Cyprus or Romania. For these countries, the EEA GHG emissions proxy was used instead. No projected assessment is provided this year. This is to avoid near-term uncertainties in (e.g. weather-related uncertainties in the coming 2 years that cannot be considered in projections)

**Sources:** EU (2013b, 2017a). Based on Member States' submissions.

**Table A1.6 Cumulative gaps between historical and projected Effort Sharing emissions and annual Effort Sharing Decision targets, 2013-2018**

| Member State | Mt $CO_2e$ | | | | | Proxy |
|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| Austria | 2.5 | 6.4 | 8.7 | 9.0 | 6.9 | 5.1 |
| Belgium | 4.1 | 10.9 | 13.5 | 13.2 | 14.9 | 14.6 |
| Bulgaria | 4.7 | 9.0 | 11.1 | 13.3 | 12.6 | 11.9 |
| Croatia | 4.5 | 9.6 | 14.1 | 18.2 | 20.3 | 21.9 |
| Cyprus | 2.0 | 4.0 | 5.8 | 7.7 | 7.6 | 7.5 |
| Czechia | 1.0 | 6.6 | 9.3 | 11.2 | 14.0 | 15.7 |
| Denmark | 3.1 | 6.4 | 8.9 | 9.9 | 12.0 | 13.4 |
| Estonia | 0.5 | 0.8 | 1.0 | 1.1 | 0.9 | 0.5 |
| Finland | 0.2 | 1.3 | 2.2 | 1.2 | 1.3 | 0.9 |
| France | 28.0 | 63.9 | 95.3 | 122.8 | 128.2 | 138.1 |
| Germany | 12.3 | 41.4 | 56.4 | 54.7 | 20.2 | 4.2 |
| Greece | 14.8 | 29.6 | 43.8 | 58.8 | 72.5 | 87.1 |
| Hungary | 12.0 | 25.1 | 36.3 | 47.9 | 54.9 | 62.5 |
| Ireland | 4.7 | 8.8 | 10.4 | 10.1 | 7.1 | 1.6 |
| Italy | 34.8 | 75.7 | 106.7 | 138.3 | 166.4 | 187.5 |
| Latvia | 0.5 | 0.8 | 1.3 | 1.7 | 2.2 | 2.8 |
| Lithuania | 0.5 | 0.9 | 1.3 | 1.4 | 1.4 | 1.7 |
| Luxembourg | 0.174 | 0.656 | 1.190 | 1.607 | 1.601 | 1.041 |
| Malta | -0.1 | -0.2 | -0.3 | -0.5 | -0.8 | -1.1 |
| Netherlands | 14.7 | 37.5 | 54.8 | 69.6 | 81.3 | 91.3 |
| Poland | 7.5 | 20.9 | 30.2 | 29.0 | 17.4 | 1.1 |
| Portugal | 10.7 | 21.5 | 30.7 | 39.3 | 47.0 | 54.5 |
| Romania | 2.9 | 7.8 | 12.5 | 20.5 | 29.2 | 40.9 |
| Slovakia | 2.9 | 7.5 | 12.2 | 17.5 | 21.3 | 24.8 |
| Slovenia | 1.4 | 3.3 | 4.9 | 6.1 | 7.4 | 8.7 |
| Spain | 27.3 | 53.2 | 80.8 | 104.1 | 121.3 | 134.9 |
| Sweden | 6.4 | 12.9 | 19.4 | 26.6 | 31.9 | 36.4 |
| United Kingdom | 19.3 | 49.1 | 72.7 | 84.0 | 112.4 | 140.2 |
| **EU-28** | **223** | **515** | **745** | **918** | **1 013** | **1 110** |

**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 higher than the target). The darker the shading, the larger the gap (red) or the surplus (green). The colour shading 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, 2016 and 2017, as determined after the reviews of Effort Sharing emissions, and approximated data for 2018. No approximated GHG data were available for Bulgaria, Cyprus or Romania. For these countries, the EEA GHG emissions proxy was used instead. No projected assessment is provided this year. This is to avoid near-term uncertainties in (e.g. weather-related uncertainties in the coming 2 years that cannot be considered in projections)

**Sources:** EU (2013b, 2017a). 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 Renewable Energy Directive (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 for 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, 2019d).

### *A2.2.2 Share of energy from renewable sources in gross final energy consumption in 2016*

The shares of RES in gross final energy consumption in 2016 were estimated by Eurostat, based on

**Box A2.1 Renewable energy targets**

**The EU-wide renewable energy target for 2020**

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

The RED includes legally binding national renewable energy targets for 2020, consistent with an EU-wide 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, 2009a). 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 national renewable energy action plans (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.

**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, 2016b). This target will be reached through the collective efforts of all Member States, and countries are free to set their own national contributions.

According to the Energy Union Governance Regulation, Member States will need to present, at the end of 2019, final integrated national energy and climate plans, or NECPs (EC, 2016b). These will 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.

national data transmission under Regulation (EC) No 1099/2008 on energy statistics (EU, 2008b) — the Energy Statistics Regulation. 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, 2019d). 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 2018*

The approximated shares of renewable energy use in 2018 were estimated by the EEA and will be published in 2019 (EEA (forthcoming), 2019a). National estimates have been provided by Germany, Ireland, Latvia and Lithuania.

#### *A2.2.4 The 2020 targets for energy from renewable sources 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, 2009b).

#### *A2.2.5 National renewable energy action plan 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, 2013c; 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, 2019d). Approximate 2018 values were estimated by the EEA (EEA (forthcoming), 2019a).

### 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 2017-2018. This assessment is complemented by preliminary estimates for the year 2018 and is illustrated in Table A2.1.

Assessments of progress are made using the following methodology:

- A Member State is considered to be on track if its average 2017 share of energy from renewable sources matched or exceeded its 2017-2018 indicative trajectory under the RED.
- A Member State is considered to be not on track if its average 2017 share of energy from renewable sources was below its 2017-2018 indicative trajectory set under the RED.

Similarly, Member State progress toward their national action plan trajectories are calculated and illustrated in Table A2.2.

## Table A2.1 Current progress towards indicative trajectories under the Renewable Energy Directive

| Member State | RES shares | | Renewable Energy Directive: indicative trajectory | | | |
|---|---|---|---|---|---|---|
| | | | Trajectory shares | | Gaps to trajectory | |
| | 2017 | 2018 (approximated) | 2017-2018 | | 2017 | 2018 (approximated) vs 2017–2018 trajectory |
| | % | % | % | % | Percentage points | Percentage points |
| Austria | 32.6 | 32.9 | 30.3 | 30.3 | 2.3 | 2.61 |
| Belgium | 9.1 | 9.3 | 9.2 | 9.2 | -0.2 | 0.1 |
| Bulgaria | 18.7 | 18.7 | 13.7 | 13.7 | 5.0 | 5.0 |
| Croatia | 27.3 | 27.7 | 17.4 | 17.4 | 9.9 | 10.3 |
| Cyprus | 9.9 | 9.9 | 9.5 | 9.5 | 0.4 | 0.5 |
| Czechia | 14.8 | 14.9 | 10.6 | 10.6 | 4.2 | 4.3 |
| Denmark | 35.8 | 36.4 | 25.5 | 25.5 | 10.3 | 11.0 |
| Estonia | 29.2 | 28.1 | 22.6 | 22.6 | 6.7 | 5.5 |
| Finland | 41.0 | 41.7 | 34.7 | 34.7 | 6.3 | 7.1 |
| France | 16.3 | 16.8 | 18.6 | 18.6 | -2.3 | -1.7 |
| Germany | 15.5 | 16.6 | 13.7 | 13.7 | 1.7 | 2.9 |
| Greece | 17.0 | 17.0 | 14.1 | 14.1 | 2.8 | 2.9 |
| Hungary | 13.3 | 13.7 | 10.0 | 10.0 | 3.4 | 3.7 |
| Ireland | 10.7 | 11.0 | 11.5 | 11.5 | -0.8 | -0.4 |
| Italy | 18.3 | 17.6 | 12.9 | 12.9 | 5.4 | 4.7 |
| Latvia | 39.0 | 40.2 | 37.4 | 37.4 | 1.6 | 2.8 |
| Lithuania | 25.8 | 24.3 | 20.2 | 20.2 | 5.6 | 4.1 |
| Luxembourg | 6.4 | 8.9 | 7.5 | 7.5 | -1.1 | 1.4 |
| Malta | 7.2 | 7.5 | 6.5 | 6.5 | 0.7 | 1.0 |
| Netherlands | 6.6 | 7.0 | 9.9 | 9.9 | -3.3 | -3.0 |
| Poland | 10.9 | 10.9 | 12.3 | 12.3 | -1.4 | -1.3 |
| Portugal | 28.1 | 27.9 | 27.3 | 27.3 | 0.8 | 0.6 |
| Romania | 24.5 | 24.8 | 21.8 | 21.8 | 2.6 | 3.0 |
| Slovakia | 11.5 | 11.7 | 11.4 | 11.4 | 0.0 | 0.2 |
| Slovenia | 21.5 | 21.9 | 21.9 | 21.9 | -0.3 | 0.0 |
| Spain | 17.5 | 17.8 | 16.0 | 16.0 | 1.5 | 1.7 |
| Sweden | 54.5 | 57.0 | 45.8 | 45.8 | 8.7 | 11.2 |
| United Kingdom | 10.2 | 11.1 | 10.21 | 10.2 | 0.0 | 0.9 |
| **EU-28** | **17.5** | **18.0** | **16.0** | **16.0** | **1.5** | **2.0** |
| | | | | | | |
| Iceland | 71.6 | 0.0 | 60.9 | | 10.7 | 0.0 |
| Norway | 70.8 | 0.0 | 64.2 | | 6.5 | |

**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 (forthcoming) (2019a); EU (2009b); Eurostat (2019d).

## Table A2.2 Current progress towards national action plan trajectories

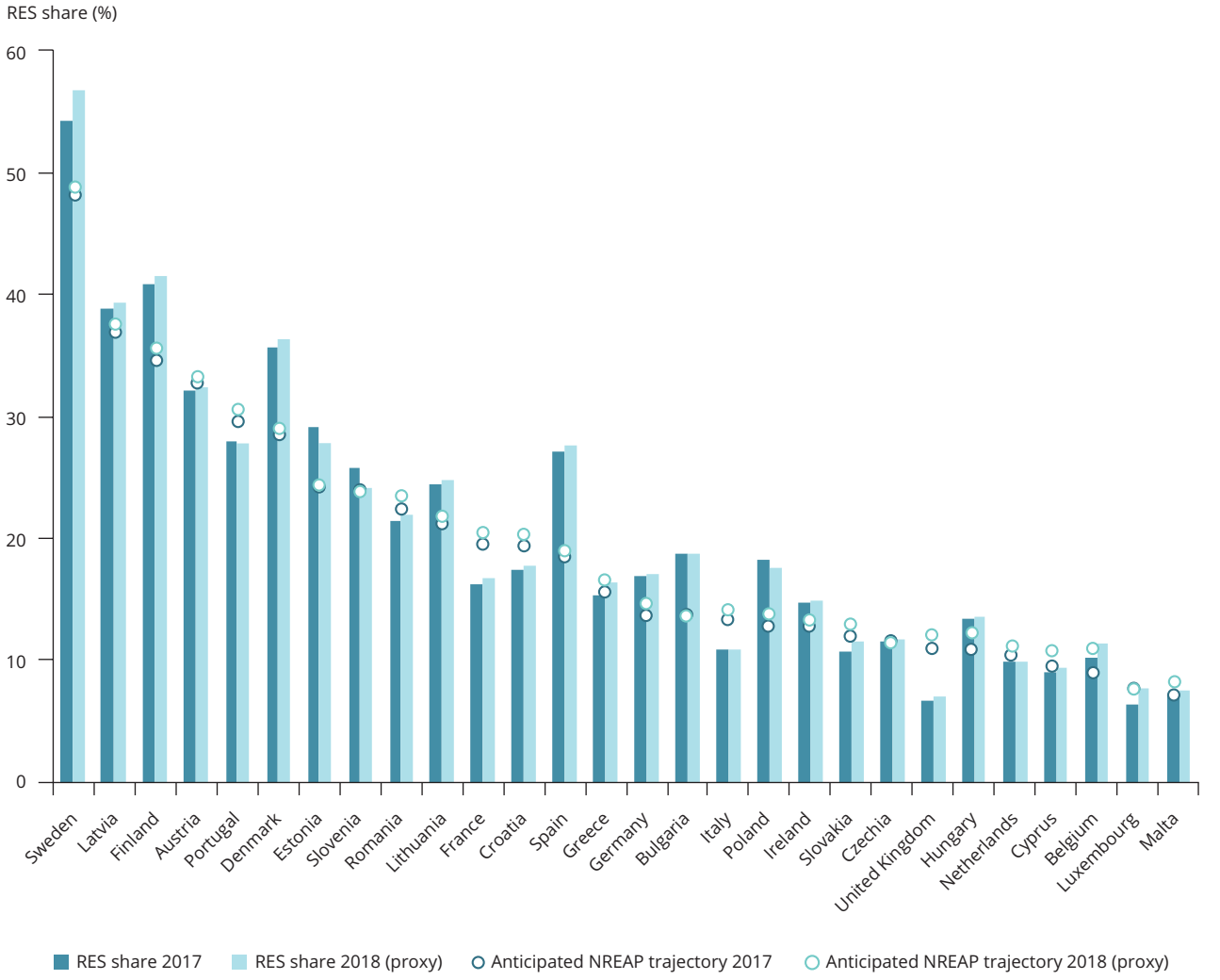
| Member State | RES shares | | National action plan trajectory | | | |
|---|---|---|---|---|---|---|
| | | | Trajectory shares | | Gaps to trajectory | |
| | 2017 | 2018 (approximated) | 2017 | 2018 | 2017 | 2018 (approximated) |
| | % | % | % | % | Percentage points | Percentage points |
| Austria | 32.6 | 32.9 | 32.9 | 33.3 | -0.3 | -0.4 |
| Belgium | 9.1 | 9.3 | 9.5 | 10.7 | -0.4 | -1.4 |
| Bulgaria | 18.7 | 18.7 | 13.7 | 13.7 | 5.0 | 5.0 |
| Croatia | 27.3 | 27.7 | 18.6 | 19.1 | 8.7 | 8.6 |
| Cyprus | 9.9 | 9.9 | 10.4 | 11.2 | -0.5 | -1.3 |
| Czechia | 14.8 | 14.9 | 12.8 | 13.3 | 2.0 | 1.6 |
| Denmark | 35.8 | 36.4 | 28.6 | 29.1 | 7.2 | 7.3 |
| Estonia | 29.2 | 28.1 | 24.2 | 24.5 | 5.0 | 3.6 |
| Finland | 41.0 | 41.7 | 34.7 | 35.7 | 6.3 | 6.0 |
| France | 16.3 | 16.8 | 19.5 | 20.5 | -3.2 | -3.7 |
| Germany | 15.5 | 16.6 | 15.7 | 16.7 | -0.2 | -0.1 |
| Greece | 17.0 | 17.0 | 13.7 | 14.6 | 3.3 | 2.4 |
| Hungary | 13.3 | 13.7 | 10.7 | 12.3 | 2.6 | 1.4 |
| Ireland | 10.7 | 11.0 | 11.9 | 13.0 | -1.2 | -2.0 |
| Italy | 18.3 | 17.6 | 12.9 | 13.8 | 5.4 | 3.8 |
| Latvia | 39.0 | 40.2 | 37.0 | 37.7 | 2.0 | 2.5 |
| Lithuania | 25.8 | 24.3 | 24.0 | 24.0 | 1.8 | 0.3 |
| Luxembourg | 6.4 | 8.9 | 7.5 | 7.5 | -1.1 | 1.4 |
| Malta | 7.2 | 7.5 | 7.1 | 8.3 | 0.1 | -0.8 |
| Netherlands | 6.6 | 7.0 | 10.9 | 12.1 | -4.3 | -5.1 |
| Poland | 10.9 | 10.9 | 13.4 | 14.1 | -2.4 | -3.2 |
| Portugal | 28.1 | 27.9 | 29.7 | 30.6 | -1.6 | -2.7 |
| Romania | 24.5 | 24.8 | 21.2 | 21.8 | 3.3 | 3.0 |
| Slovakia | 11.5 | 11.7 | 11.4 | 11.4 | 0.1 | 0.3 |
| Slovenia | 21.5 | 21.9 | 22.4 | 23.6 | -0.9 | -1.7 |
| Spain | 17.5 | 17.8 | 19.4 | 20.4 | -1.9 | -2.6 |
| Sweden | 54.5 | 57.0 | 48.3 | 49.0 | 6.2 | 8.0 |
| United Kingdom | 10.2 | 11.1 | 9.0 | 11.0 | 1.2 | 0.1 |
| **EU-28** | **17.5** | **18.0** | **17.9** | **18.9** | **-0.4** | **-0.84** |
| | | | | | | |
| Iceland | 71.6 | | 76.2 | 76.2 | -4.6 | |
| Norway | 70.76 | | 0.0 | 0.0 | 70.8 | |

**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 (2013); EEA (2011); Eurostat (2019d); EC (2013c); EEA (forthcoming) (2019a); Eurostat (2019d).

### *A2.3.1 Progress towards the objectives of national renewable energy action plans*

**Figure A2.1 National shares of energy from renewable sources in relation to trajectories from national renewable energy action plans**




**Sources:** EC (2013c); EEA (forthcoming) (2019a); EU (2009b); Eurostat (2019d); EEA (2011).

# Annex 3 Progress towards energy efficiency targets: data and methodology

## A3.1 Reporting requirements for energy efficiency/energy consumption

Under Article 3 of the Energy Efficiency Directive (EED) (EU, 2018e), Member States have to set their own indicative national energy efficiency targets for 2020 as well as for 2030. 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. Related to the 2030 targets, the revised EED 2018/2002 (EU, 2018e) asks Member States not only to set indicative national energy efficiency contributions towards the EU's 2030 targets (notified as part of their national energy and climate plans, or NECPs) but also to set an indicative trajectory for primary and final energy consumption for that contribution from 2021 onwards.

**Box A3.1 Energy efficiency targets**

**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 reductions in emissions of greenhouse gases (GHGs) and renewable energy (Council of the European Union, 2007). Reducing 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, 2009d, 2014b, 2019b), the revised EU Emissions Trading System (ETS) Directive and the Effort Sharing Decision (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 2006 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 Energy Performance of Buildings Directive (EU, 2010b).

One of the key developments in the energy efficiency policy framework was the adoption of the EED in 2012, which was updated in 2018 (EU, 2018e). The EED establishes a common framework of measures for promoting 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 PRIMES (Price-driven and Agent-based Simulation of Markets Energy System) model. 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 establishing an energy efficiency obligation (EEO) scheme or implementing alternative measures.

**Box A3.1 Energy efficiency targets (cont.)**

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 and primary energy consumption; however, five Member States' targets indicate an increase in final and 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 2005-2020.

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

**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 (EU, 2018e). The Governance Regulation states 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.

## 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, 2019b, 2019c, 2019e).

### *A3.2.2 Approximated estimates for primary and final energy consumption in 2018*

Early estimates of 2018 primary and final energy consumption were prepared by the EEA (EEA, 2019c; Eurostat, 2019e). National estimates have been provided by Estonia, Germany and Malta.

### *A3.2.3 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 the 2020 energy efficiency targets is based on indicative values of final energy consumption to assess the consistency of progress among Member States. Primary 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, 2019f).

## A3.3 Tracking progress towards energy efficiency targets

Analysis of the progress made towards achieving the 2020 energy efficiency targets at national levels involves assessing whether or not the efforts undertaken since 2005 have been sufficient to reduce or limit final energy consumption at a pace sufficient to meet the 2020 target. This question is addressed by comparing 2017 (or 2018) levels with a linear trajectory between final energy consumption levels in 2005 and the 2020 national targets. To remain consistent with the assessments presented for GHG emissions and energy from renewable sources, 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.). As the methodology is based on absolute final 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 | Final energy consumption (Mtoe) | | | Linear trajectory 2005-2020 target (Mtoe) | | | Distance to trajectory (% share of 2005 levels) | |
|---|---|---|---|---|---|---|---|---|
| | 2005 | 2017 | 2018 (approx.) | 2017 | 2018 | 2020 | 2017 | 2018 (approx.) |
| Austria | 27.7 | 28.4 | 27.9 | 25.6 | 25.4 | 25.1 | -10.2 | -8.8 |
| Belgium | 36.6 | 36.1 | 36.5 | 33.3 | 33.0 | 32.5 | -7.5 | -9.4 |
| Bulgaria | 10.1 | 9.9 | 10.0 | 8.9 | 8.8 | 8.6 | -9.4 | -11.0 |
| Croatia | 7.2 | 6.9 | 6.8 | 7.0 | 7.0 | 7.0 | 1.2 | 2.0 |
| Cyprus | 1.8 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 2.8 | 2.6 |
| Czechia | 26.3 | 25.5 | 25.1 | 25.5 | 25.4 | 25.3 | 0.1 | 1.1 |
| Denmark | 15.5 | 14.6 | 14.6 | 14.6 | 14.6 | 14.4 | 0.2 | -0.2 |
| Estonia | 2.9 | 2.9 | 2.8 | 2.9 | 2.8 | 2.8 | -0.5 | 1.7 |
| Finland | 25.2 | 25.3 | 25.2 | 26.4 | 26.5 | 26.7 | 4.3 | 4.8 |
| France | 160.2 | 148.9 | 143.2 | 137.2 | 135.2 | 131.4 | -7.4 | -4.9 |
| Germany | 218.7 | 218.7 | 217.0 | 199.2 | 197.6 | 194.3 | -8.9 | -8.9 |
| Greece | 21.0 | 16.8 | 16.8 | 18.9 | 18.7 | 18.4 | 10.3 | 9.3 |
| Hungary | 18.7 | 18.5 | 19.0 | 15.3 | 15.0 | 14.4 | -17.3 | -21.2 |
| Ireland | 12.7 | 11.8 | 12.4 | 12.7 | 12.8 | 12.8 | 7.8 | 2.5 |
| Italy | 137.2 | 115.2 | 116.5 | 126.6 | 125.8 | 124.0 | 8.4 | 6.7 |
| Latvia | 4.0 | 4.0 | 4.1 | 4.4 | 4.4 | 4.5 | 9.0 | 6.5 |
| Lithuania | 4.7 | 5.3 | 5.5 | 4.4 | 4.3 | 4.3 | -21.2 | -25.2 |
| Luxembourg | 4.5 | 4.2 | 4.3 | 4.3 | 4.3 | 4.2 | 2.3 | -0.9 |
| Malta | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | -5.5 | -7.9 |
| Netherlands | 54.1 | 50.3 | 50.1 | 52.6 | 52.5 | 52.2 | 4.1 | 4.3 |
| Poland | 58.5 | 70.9 | 72.3 | 69.0 | 69.9 | 71.6 | -3.3 | -4.2 |
| Portugal | 19.0 | 16.6 | 16.4 | 17.7 | 17.6 | 17.4 | 6.1 | 6.2 |
| Romania | 24.6 | 23.2 | 23.4 | 29.2 | 29.6 | 30.3 | 24.3 | 25.0 |
| Slovakia | 11.6 | 11.1 | 11.5 | 9.5 | 9.4 | 9.0 | -13.8 | -18.7 |
| Slovenia | 4.9 | 4.9 | 4.9 | 5.1 | 5.1 | 5.1 | 4.3 | 4.1 |
| Spain | 98.1 | 84.3 | 86.4 | 89.4 | 88.7 | 87.2 | 5.2 | 2.3 |
| Sweden | 33.7 | 32.6 | 33.6 | 32.6 | 32.5 | 32.3 | -0.1 | -3.4 |
| United Kingdom | 153.0 | 133.3 | 135.1 | 134.0 | 132.4 | 129.2 | 0.4 | -1.8 |
| **EU-28** | **1 192.8** | **1 122.8** | **1 124.2** | **1 107.4** | **1 100.2** | **1 086.0** | **-1.3** | **-2.0** |

**Notes:** The distance to a trajectory is calculated as 'linear trajectory value' – 'final energy consumption'. A positive value indicates energy consumption below the linear trajectory and a negative value (in red) indicates consumption above the linear trajectory. Mtoe, million tonnes of oil equivalent.

**Sources:** EC (2019f); EEA (2019c); EEA (forthcoming) (2019b); EU (2018e); Eurostat (2019b, 2019c, 2019e).

# Annex 4 National targets and country profiles

## A4.1 National targets until 2020 and 2030

The tables below (Tables A4.1 and A4.2) provide an overview of the EU and national targets for each of the topic areas covered in this report – GHG emissions, renewable energy and energy efficiency. They reflect the information provided throughout the report and are included here as a comprehensive reference.

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

| Member country | Annex I Party to the Convention | 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** | **2618.2** | **2.887.1** | **20** | **1.483** | **1.086.0** |
| Austria | x | x | | -16 | 47.8 | 56.8 | 34 | 31.5 | 25.1 |
| Belgium | x | x | | -15 | 68.2 | 80.3 | 13 | 43.7 | 32.5 |
| Bulgaria | x | since 2007 | | 20 | 26.5 | 22.1 | 16 | 16.9 | 8.6 |
| Croatia | x | since 2013 | | 11 | 19.3 | 17.4 | 20 | 10.7 | 7.0 |
| Cyprus (b) | - | x | | -5 | 4.0 | 4.2 | 13 | 2.2 | 1.9 |
| Czechia | x | x | | 9 | 67.2 | 61.7 | 13 | 44.3 | 25.3 |
| Denmark (a) | x | x | | -20 | 32.1 | 40.1 | 30 | 17.2 | 14.4 |
| Estonia | x | x | | 11 | 6.0 | 5.4 | 25 | 6.5 | 2.8 |
| Finland | x | x | | -16 | 28.5 | 33.9 | 38 | 35.9 | 26.7 |
| France | x | x | | -14 | 342.5 | 398.2 | 23 | 219.9 | 131.4 |
| Germany | x | x | | -14 | 410.9 | 477.8 | 18 | 276.6 | 194.3 |
| Greece | x | x | | -4 | 60.0 | 62.6 | 18 | 24.7 | 18.4 |
| Hungary | x | x | | 10 | 52.8 | 48.0 | 13 | 24.1 | 14.4 |
| Ireland | x | x | | -20 | 37.7 | 47.1 | 16 | 14.9 | 12.8 |
| Italy | x | x | | -13 | 291.0 | 334.5 | 17 | 158.0 | 124.0 |
| Latvia | x | x | | 17 | 10.0 | 8.5 | 40 | 5.4 | 4.5 |
| Lithuania | x | x | | 15 | 15.2 | 13.3 | 23 | 6.5 | 4.3 |
| Luxembourg | x | x | | -20 | 8.1 | 10.1 | 11 | 4.5 | 4.2 |
| Malta | x * | x | | 5 | 1.2 | 1.1 | 10 | 0.8 | 0.6 |
| Netherlands | x | x | | -16 | 107.4 | 127.8 | 14 | 60.7 | 52.2 |
| Poland | x | x | | 14 | 205.2 | 180.0 | 15 | 96.4 | 71.6 |
| Portugal | x | x | | 1 | 49.1 | 48.6 | 31 | 22.5 | 17.4 |
| Romania | x | since 2007 | | 19 | 89.8 | 75.5 | 24 | 43.0 | 30.3 |
| Slovakia | x | x | | 13 | 25.9 | 23.0 | 14 | 16.4 | 9.0 |
| Slovenia | x | x | | 4 | 12.3 | 11.8 | 25 | 7.1 | 5.1 |
| Spain | x | x | | -10 | 212.4 | 236.0 | 20 | 122.6 | 87.2 |
| Sweden | x | x | | -17 | 36.1 | 43.5 | 49 | 47.6 | 32.3 |
| United Kingdom (a) | x | x | | -16 | 350.9 | 417.8 | 15 | 177.6 | 129.2 |
| **EEA member countries** | | | | | | | | | |
| Iceland | x | since 2008 | | | | | | | |
| Liechtenstein | x | since 2008 | | | | | | | |
| Norway | x | since 2008 | | | | | | | |
| Switzerland | x | - | | | | | | | |
| Turkey (d) | x | - | | | | | | | |

**Notes:** (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.

Mtoe, million tonnes of oil equivalent; RED, Renewable Energy Directive; ×, yes; -, no.

**Sources:** EC (2019f); EU (2009a, 2009b, 2009c, 2012, 2013a, 2013b).

## Table A4.2 Main EU and national climate and energy targets for 2030

| Member country | GHG target (2030) | ETS target (2030) | Effort Sharing Decision target (2030) | Renewable target 2030 | Primary energy target 2030 | Final energy target 2030 |
|---|---|---|---|---|---|---|
| | % vs. 1990 | % vs. 2005 | | % gross final energy consumption | Mtoe | |
| **EU-28** | **-40** | **-43** | **-30** | **32** | **1.273.0** | **956.0** |
| Austria | | | -36 | 45-50 | 30.0 | 25.0 |
| Belgium | | | -35 | 18 | 39.0 | 33.1 |
| Bulgaria | | | 0 | 25 | 17.7 | 8.7 |
| Croatia | | | -7 | 36 | 8.2 | 6.9 |
| Cyprus (b) | | | -24 | 19 | 2.6 | 2.2 |
| Czechia | | | -14 | 21 | 41.3 | 23.7 |
| Denmark (a) | | | -39 | 55 | 18.6 | 15.8 |
| Estonia | | | -13 | 42 | 5.5 | 2.7 |
| Finland | | | -39 | 50 | 36.1 | 26.2 |
| France | | | -37 | 32 | 201.8 | 124.9 |
| Germany | | | -38 | 30 | Not reported | Not reported |
| Greece | | | -16 | 31-32 | 25.0 | 18.1 |
| Hungary | | | -7 | 20 | 27.0 | 18.6 |
| Ireland | | | -30 | 15.8-27.7 | 15.9 | 13.0 |
| Italy | | | -33 | 30 | 125.0 | 103.8 |
| Latvia | | | -6 | 45 | 4.3 | 3.6 |
| Lithuania | | | -9 | 45 | 10.2 | 8.0 |
| Luxembourg | | | -40 | 23-25 | 3.5 | 3.3 |
| Malta | | | -19 | 10.6-13.3 | 1.2 | 0.9 |
| Netherlands | | | -36 | 27-35 | 46.6 | 44.5 |
| Poland | | | -7 | 21 | 90.9 | 66.2 |
| Portugal | | | -17 | 47 | 20.2 | 17.7 |
| Romania | | | -2 | 28 | 36.7 | 27.5 |
| Slovakia | | | -12 | 18 | 16.2 | 10.8 |
| Slovenia | | | -15 | 27 | 7.1 | Not reported |
| Spain | | | -26 | 42 | 98.2 | 74.4 |
| Sweden | | | -40 | 65 | 42.5 | 32.3 |
| United Kingdom [a] | | | -37 | Not reported | Not reported | Not reported |
| **EEA member countries** | | | | | | |
| Iceland | | | | | | |
| Liechtenstein | | | | | | |
| Norway | | | | | | |
| Switzerland | | | | | | |
| Turkey (d) | | | | | | |

**Notes:** [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.
MS, Member State; Mtoe, million tonnes of oil equivalent; RED, Renewable Energy Directive.

**Sources:** EU (2018g); European Council (2014); EC (2019b).

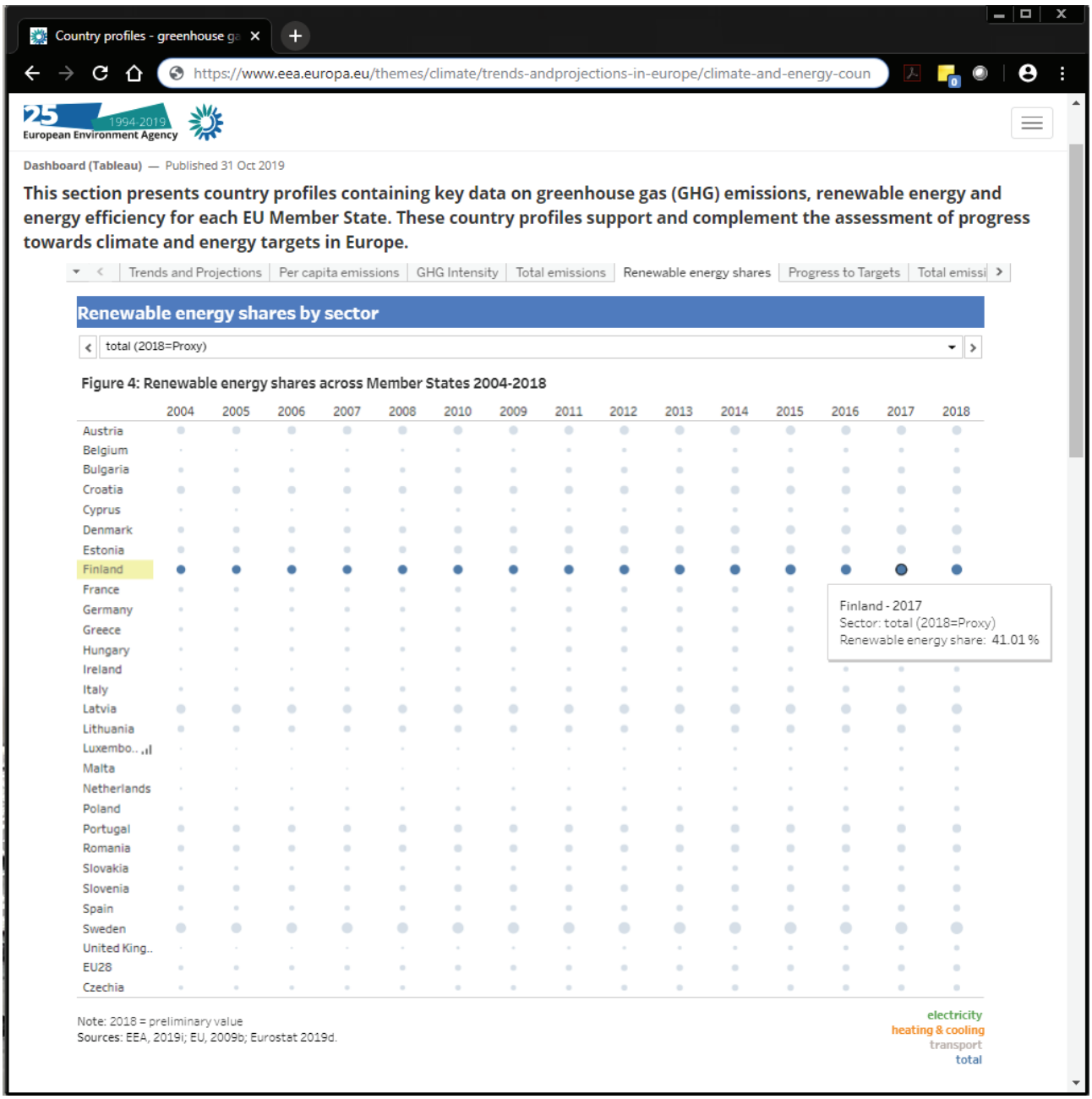
## A4.2 Country profiles

In the past, the Trends and projections in Europe report included a final annex with country profiles that provided further details on each EU Member State's progress in each of the topic areas covered by the report.

These country profiles are now available in an interactive online format, and the user can customise the visualisation of any Member State's progress in the areas of GHG emissions, renewable energy and energy efficiency.

The country profile viewer can be found at: https://www.eea.europa.eu/themes/climate/trends-and-projections-in-europe/climate-and-energy-country-profiles.

**Figure A4.1 Extract from the country profile data viewer**



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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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