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Emission trends under the Effort Sharing legislation

An analysis of sectoral trends covered by the Effort Sharing legislation

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Summary

- Estimates for 2017 indicate that total EU greenhouse gas (GHG) emissions increased by 0.6 % on 2016 levels. Whereas from 1990 to 2016 total EU GHG emissions decreased by 22.4 %. Most reductions (16 %) have occurred since the onset of the EU Emission Trading System (ETS) in 2005, while emissions decreased only by 6 % between 1990 and 2005.
- Emissions reported under the EU ETS fell by 26% between 2005 and 2017 while Effort Sharing related emissions only have been reduced by 10 %. On the EU level ETS emissions have plateaued since 2016 while emissions under the Effort Sharing decision (ESD) have been increasing since 2014.
- Emissions covered under both sectors are developing very differently due to many reasons: The decrease since 2005 was mostly driven by reductions in emissions related to power generation, which is mainly covered under the EU ETS. The reduction in emissions was largely the result of changes in the combination of fuels used to produce heat and electricity. In addition, the reduced production volumes led to reductions in emissions in this sector, too. Emissions covered under the EU ETS are clearly linked to a price signal for CO_2 while those under the ESD are not, at least not on European level. While there are about 14 000 actors which are responsible for the reduction of GHG emissions under the EU ETS, the sources of ESD emissions are even more diverse and are related to the use of energy and other consumption habits of all EU residents.
- The transport sector is the most important ESD sector with one third of ESD emissions in 2017 and in most Member States the share is even higher. In many Member States emissions in the transport sector are increasing because demand keeps growing - in spite of legislation to reduce the carbon intensity of passenger cars (and soon of HDVs) and improved energy efficiency.
- The highest ESD emission reductions between 2005 and 2017 took place in the residential and commercial sector, also called the ‘Buildings’ sector. Emissions in this sector increased in only four countries, mainly due to emission increases in the commercial sector. It has to be kept in mind that annual emission changes in this sector are to a certain extent related to heating and cooling degree days. Nevertheless it can be shown in detailed analysis for selected Member States that observed emission decreases for some Member States are higher than those related to changes in heating degree days.
- A sector with low attention but gaining importance is the sector of energy industries and industrial processes not covered by the EU ETS (‘industry and other’). Emissions in this sector increased in 13 Member States since 2005, same as in the transport sector. There could be a risk that parts of industrial production tend to choose to not be covered under the ETS by reducing the size of the installation or using high-carbon intensive fuels. Increased use of air conditioning with related higher F-gas emissions is also playing an important role in this sector.
- Agriculture sector emissions are about on the same level as emissions under the ‘industry and other’ sector. EU agriculture sector emissions have been flat since 2005 and are projected to stay there with latest GHG projections. Even so, this sector needs higher attention because between 2005 and 2017emissions increased in 14 Member States, mainly in the subsector of agricultural soils.
- With the first estimate for 2017 emissions, six Member States (Germany, the United Kingdom, France, Italy, Spain and Poland) contributed to 71 % of the total EU ESD emissions. Two of those (Germany and Poland) exceed annual ESD targets in several years while projections submitted in 2017 showed lower ESD emissions compared to latest historic

development. On the other hand Italy, the United Kingdom, Spain and France are the four countries with highest projected surpluses in absolute terms until 2020.

- A detailed analysis for the six countries with higher ESD emissions than ESD targets in 2016 (Belgium, Ireland, Finland, Germany, Ireland, Malta and Poland) shows that all of these countries have increasing emissions in the 'industry and other' sector and that the share of emissions on total ESD emissions in this sector increased in all these countries between 2005 and 2017. Another common denominator is that emissions from agriculture stayed constant or even increased since 2005 and that emission projections with existing and adopted policies and measures in this sector do not show relevant effects until 2030.
- All but six Member States (Bulgaria, Croatia, Greece, Hungary, Portugal and Slovakia) are expected to have AEA deficits in the period 2021-2030 based on GHG projections submitted in 2017. But these projections do not include latest policies and measures and new climate and energy targets for 2030. These projections can be seen as the starting point to define additional measures to reach GHG targets of the EU in 2030, especially in ESD sectors. In March 2019 Member States will report new GHG projections which will likely include these latest developments.
- Additional polices and measures with high reduction effects are needed to specifically target ESD emissions. Ongoing emission increases in this sector show that sufficient incentives to decrease emissions in ESD sectors are still missing.
- This report mainly provides detailed assessments which are used in other EEA reports, mainly the EEA Trends and Projections report. For more information about historical and projected development of GHG emissions on EU-level, for methodological details and data sources used for the analysis in both reports, refer to the Trends and Projections report.

1 Introduction

This report supports the EEA Trends and Projections report 2018 with additional analysis on sectoral developments in the Effort Sharing sector on EU level and on the level of selected Member States. Please refer to the EEA Trends and Projections report 2018 with regard to details on targets, data sources and methodologies.

1.1 Overview: EU progress towards GHG targets

Across the European Union emissions show a decline between 1990 and 2017 with reductions in both EU Emissions Trading Scheme (ETS) and Effort Sharing (ESD/ESR) sectors (Figure 1-1). Most reductions (16 %) have occurred since the onset of the EU Emission Trading System (ETS) in 2005, while emissions decreased only by 6 % between 1990 and 2005. Between 2005 and 2017 ETS emissions have shown a more significant decline than ESD emissions, and this trend is projected to continue:
Emissions reported under the EU ETS fell by 26 % between 2005 and 2017 while Effort Sharing related emissions only have been reduced by 10 %[1]. On the EU level ETS emissions have plateaued since 2016 while emissions under the Effort Sharing decision (ESD) have been increasing since 2014. Nevertheless, according to the projected trends, ETS and ESD 2020 targets will be overachieved. Between 2005 and 2020 ESD[2] emissions are projected to decline by 15 % compared to 30 % for ETS emissions, so the reduction rate for ETS emissions is projected to be twice as high.

However, neither the Effort Sharing nor the ETS sector is on track to meet the 2030 targets: Between 2005 and 2030 Effort Sharing emissions are projected to decline by only 20 %, which is 10 % percentage points less than defined as target. In the same time ETS emissions are projected to decrease by 35 %, which would result in a gap to target of 8 percentage points.

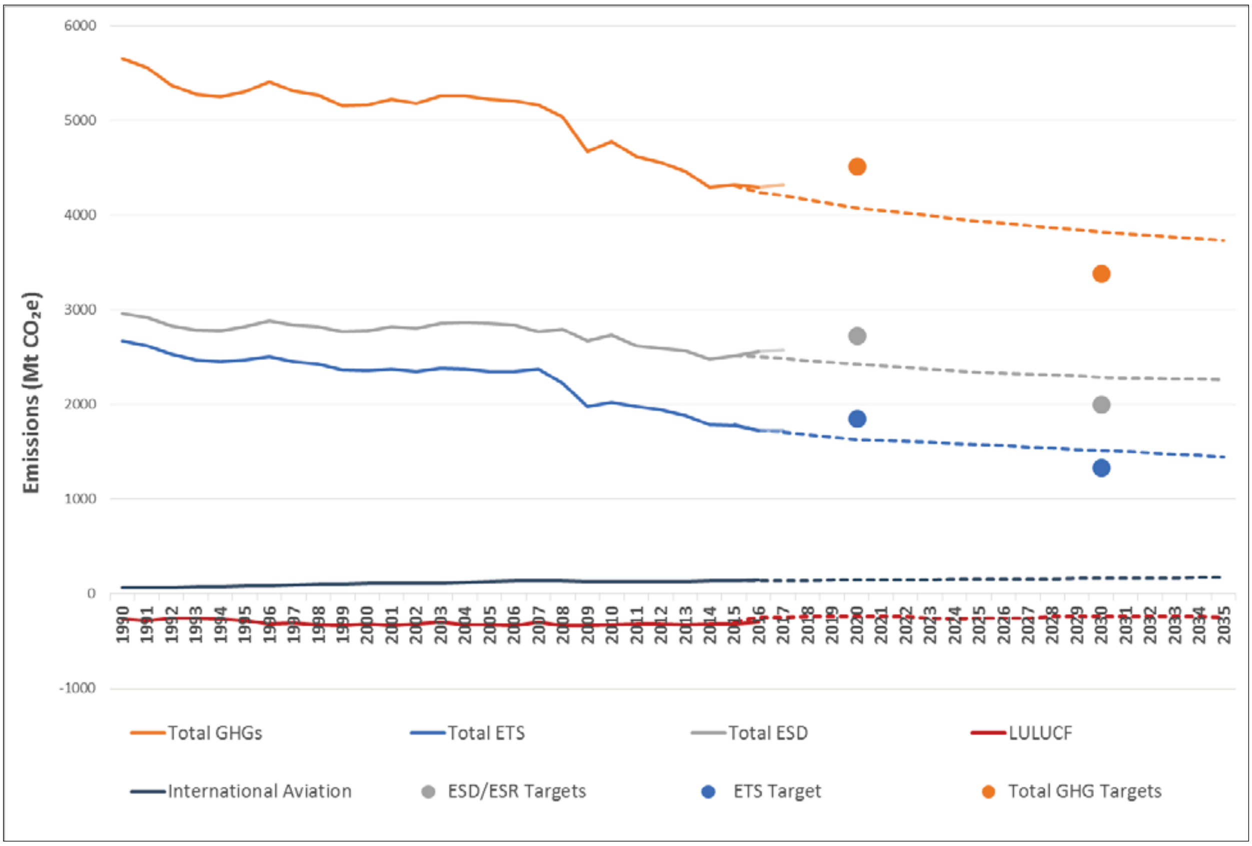
If additional policies and measures are taken into account as reported by some Member States in 2017 in their submission on GHG projections, these mainly show effect in the ETS sector, but there would still be a considerable gap to the ETS target.

Nevertheless even with additional policies and measures, total GHG emissions are projected to be higher by 8 percentage points compared to the target in 2030, mainly due to slow process under ESD/ESR. It has to be kept in mind, that most GHG projections have been submitted in 2017, considering existing policies and measures in place in 2016. This means, that latest policies and measures on European and national level to reach the new energy and climate related targets are not considered. Due to this, projected emissions might be somewhat higher than they would be with more updated projections.

In addition with latest approximated GHG emissions for the year 2017 it became obvious that there is an increasing trend of ESD emissions since 2014 which was mostly not reflected in GHG projections. Also ETS emissions stayed constant in 2017 instead of decreasing further.

[1] If not explicitly mentioned, percentages of ESD emissions in this report refer to calculated ESD emissions 2005, not to ESD base year emissions as used in the EEA Trends and Projections Report. Please see there in the Annex to learn more about the differences.
[2] From 2021 on, emissions are no longer called ESD emissions (from Effort Sharing Decision) but ESR emissions, as the Effort Sharing Regulation is in force from 2021 on. In this report these emissions are called “ESD” emissions, if only the first period 2013-2020 or both periods 2013-2030 are meant.

Figure 1-1 ETS, ESD and LULUCF split of emission trends 1990 – 2035



Note: Emissions from 2005 to 2016 are historic emissions. Emissions in 2017 are approximated as reported by Member Stated or as calculated by ETC/ACM in July 2018. Projections have been reported by Member States under MMR Article 14 in March 2017, only Cyprus and Ireland reported updates in March 2018.

Sources: EEA, 2018a, 2018b, 2018c, 2018d

Emission projections and compliance under the EU ETS and ESD/ESR

National emission projections consider full compliance under the EU ETS and the ESD/ESR:

GHG projections of Member States are led by an activity based approach, taking into consideration national assumptions about CO_2 prices under the EU ETS, which indirectly reflect the availability of EUA on the market. This means, that these CO_2 prices try to reflect GHG projections of other Member States and their effects on the amount of EUA. But there is no confirmation process after submission of these GHG projections, so ETS CO_2-prices show a wide range across projections of Member States. In addition these prices do not reflect latest ETS reforms which now reduce total amounts of EUA available on the market.

This means, GHG projections are considering that ETS certificates are available on the market to estimated prices, but there is no overall safety valve that total ETS emissions are below the number of certificates available. This is no problem as long as there is such a high surplus of certificates on the market as it was the case in 2017.

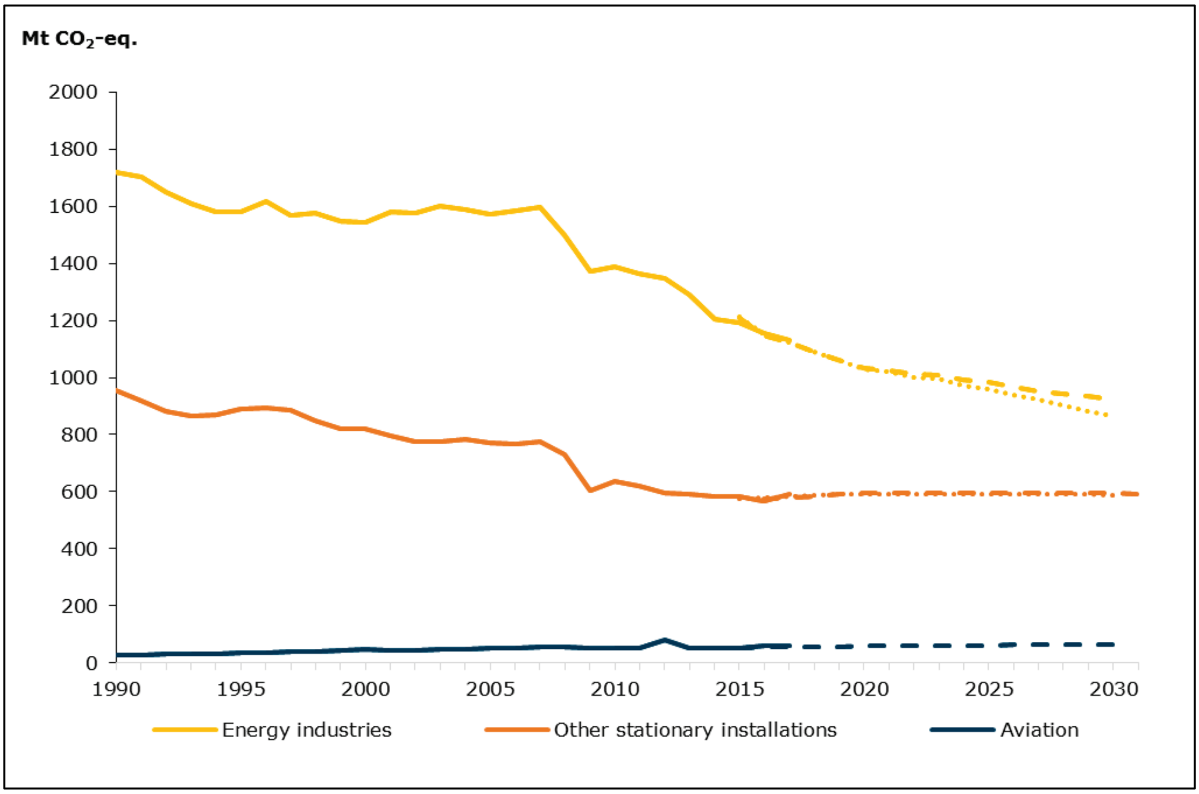
The situation is similar for emissions under the ESD/ESR. Until 2020 a huge amount of surplus allowances under the ESD are available, which do not imply a relevant price signal for the projection of ESD emissions. This situation might become different with national targets under the ESR which have not been known in 2017. With these, no surplus of AEA is expected until 2030 and the consideration of CO_2-prices for emissions covered under the ESR might become relevant for future projections. But again, assumptions about these prices can not consider GHG projections of other Member States, submitted at the same time. In addition they are even more delicate as the number of players on the market is so much lower than under the EU ETS.

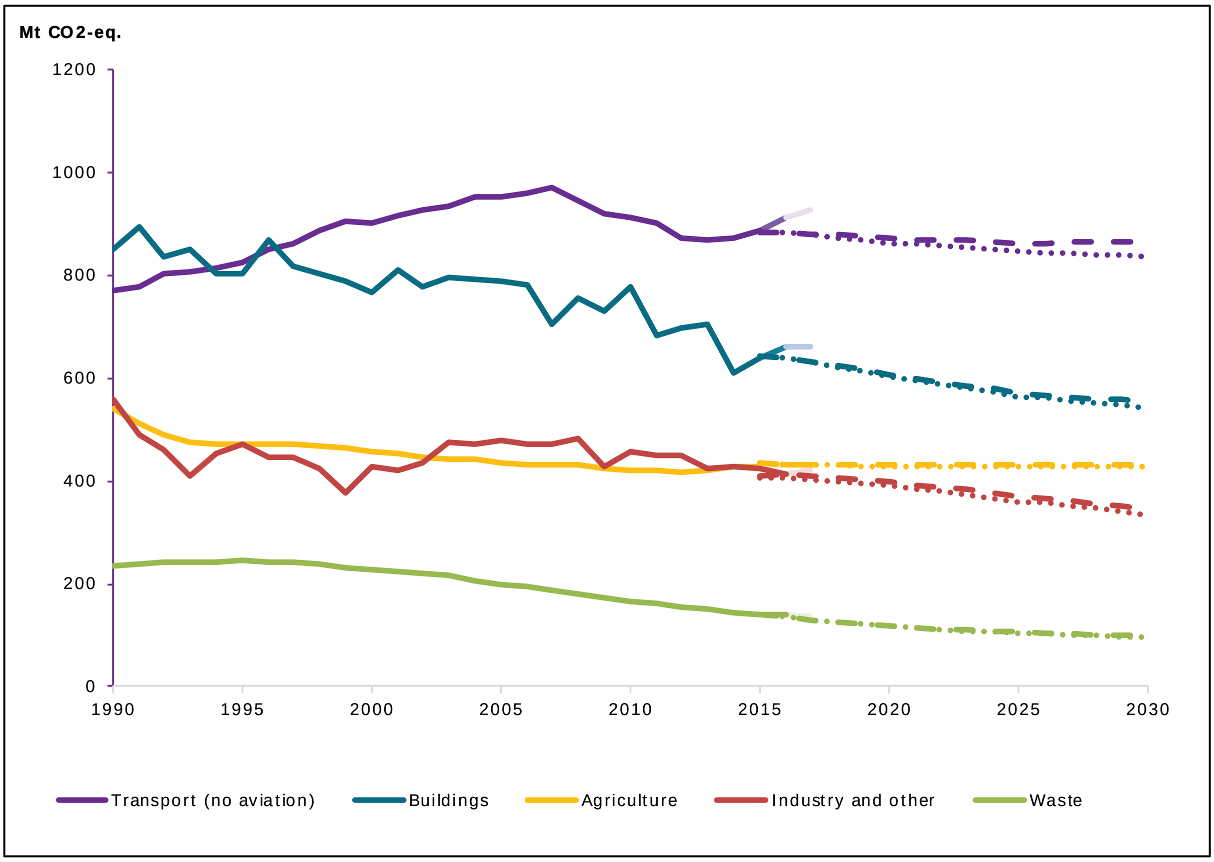
In addition to this general point, compliance under the EU ETS and ESD/ESR does not ensure that EU targets in 2030 are met, because these refer to single year targets while EU ETS and ESD/ESR are budget based for 8 or 10 year periods.

1.2 ESD and ETS Sectoral Trends

Figure 1-2 shows trends in emissions by the main ETS and ESD sector groups.
Developments of emissions covered under the EU ETS are grouped into emissions from Energy Industries, Manufacturing and Construction and Industrial Processes. Significant long-term trend reductions obviously took place in energy industries covered under the ETS. Between 2005 and 2030 annual emissions covered under the ETS are projected to fall by 35 %.
These long-term downward trends in the ETS energy industries are being off-set in the latest emission developments by faltering trends in the Effort Sharing sector. Emissions in sectors covered under the Effort Sharing Legislation increased since 2014 on EU-level, mainly due to increases in the sectors transport and Buildings, while emissions in agriculture, ESD-Industries and waste remained about stable. Annual emissions under the ESD are projected to decrease between 2017 and 2030, but at a slower rate than the ETS sectors. Main emission reductions are projected to occur in the buildings sector, while there are nearly no reductions projected in the sectors of transport and agriculture. Highest divergences between projected values and latest historic developments become visible in the transport and building sector. An analysis of the Member States which have the greatest contributions to these trends is provided below.

Figure 1-2 EU28 ETS (top) and ESD (bottom) emissions split by the most significant sector emission trends 2005 – 2035





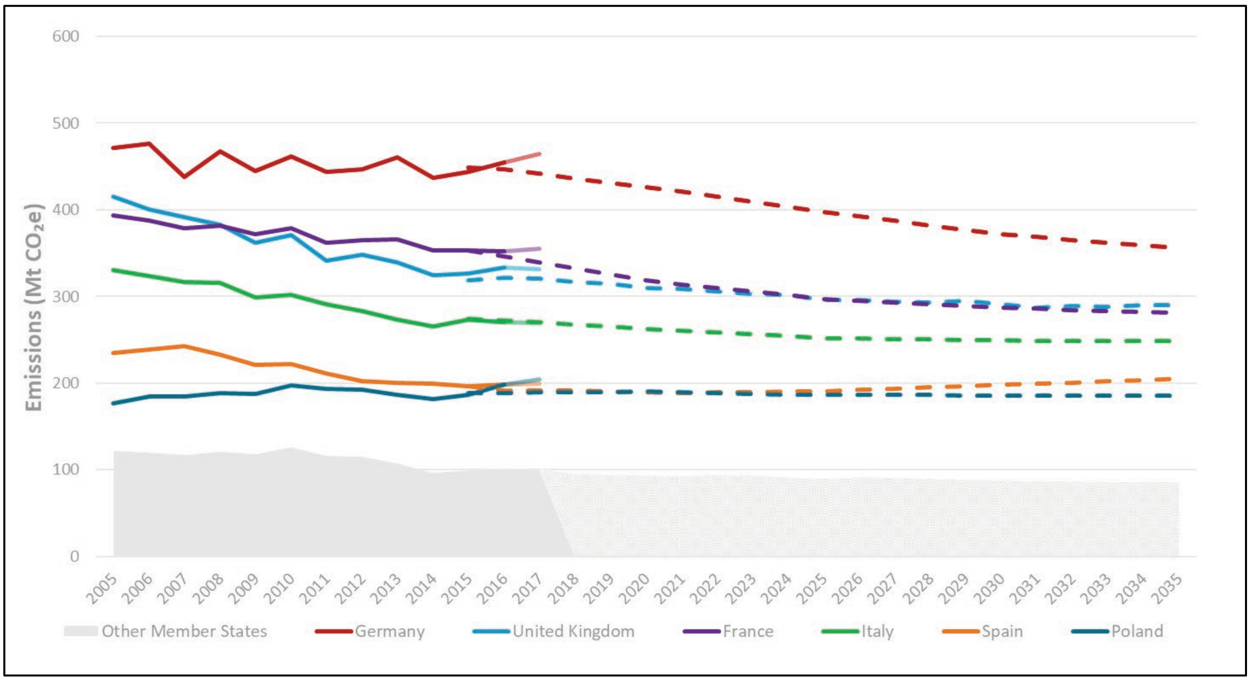
Sources: EEA, 2018d, 2018c, 2018e, ETC/ACM calculation

1.3 Overview: Member State progress towards ESD Targets 2016 and 2017

The trends for the Member States which dominate EU ESD emissions are shown in Figure 1-3. In the first estimate for 2017 emissions, the six largest Member States (Germany, the United Kingdom, France, Italy, Spain and Poland) contributed to 71 % of the total EU ESD emissions. Their contribution is expected to remain relatively constant throughout the time series, remaining at 67 % in 2030.

For Italy, Spain and the United Kingdom, ESD emissions are projected to reduce at a slower rate between 2030 and 2017 compared to 2005 and 2017, a trend that is reflected also in the majority of EU Member States. In contrast, ESD emissions in Germany and France are projected to decrease at a faster rate between 2030 and 2017 compared to 2017 and 2005. In both countries this already optimistic assumption in GHG projections for the timeframe 2015-2030 became even more ambitious with latest increases in GHG emissions, especially in 2017. Poland, together with Bulgaria, Czechia, Lithuania and Malta saw emissions increase between 2005 and 2017 but expect emissions to decrease in future years.

Figure 1-3 ESD emissions split by Member State 2005 – 2035

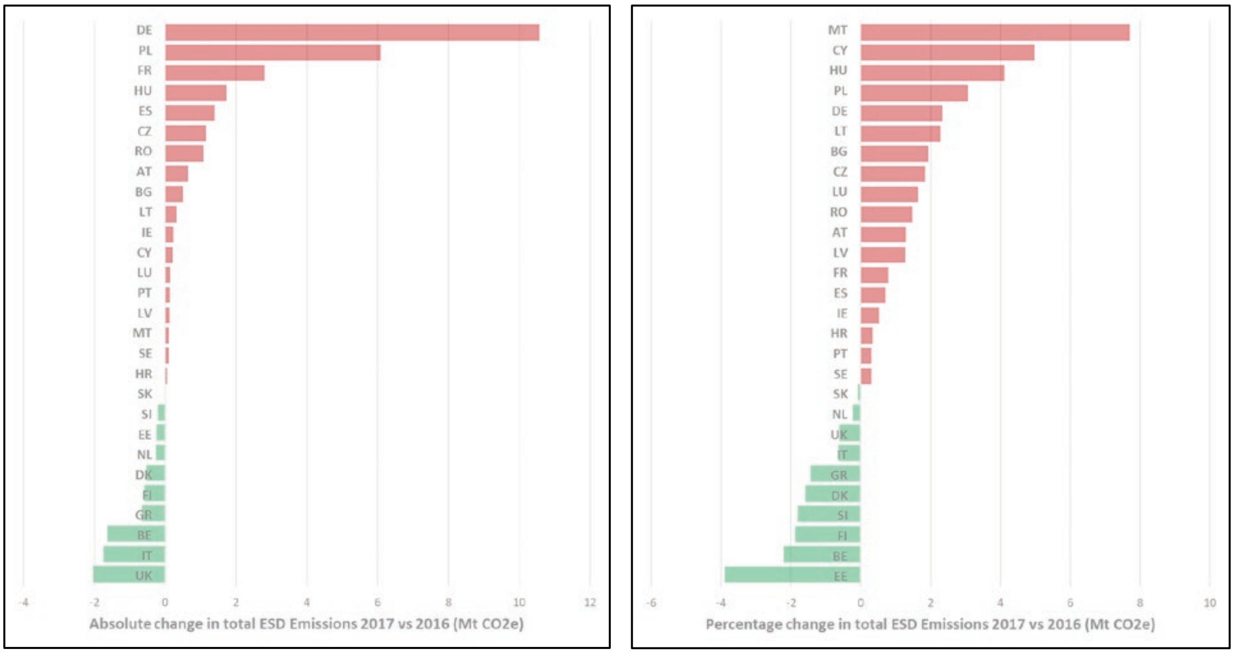


Note**:** 'Other Member States' represents the range of their emissions, not the sum of those Member States.

Sources: EEA, 2018d, 2018c, 2018e

The short-term trends 2016 – 2017 (see in Figure 1-4 below) for ESD show an upturn in emissions with almost all Member States showing an increase in emissions (up to 8 %). Four out of the six biggest contributors to the ESD emissions saw an increase in emissions between 2016 and 2017. What this means for the ESD annual emission allocations (AEAs) and targets is discussed in the Trends and Projections Report.

Figure 1-4 ESD emissions change 2016 – 2017 split by Member State in absolute and relative terms

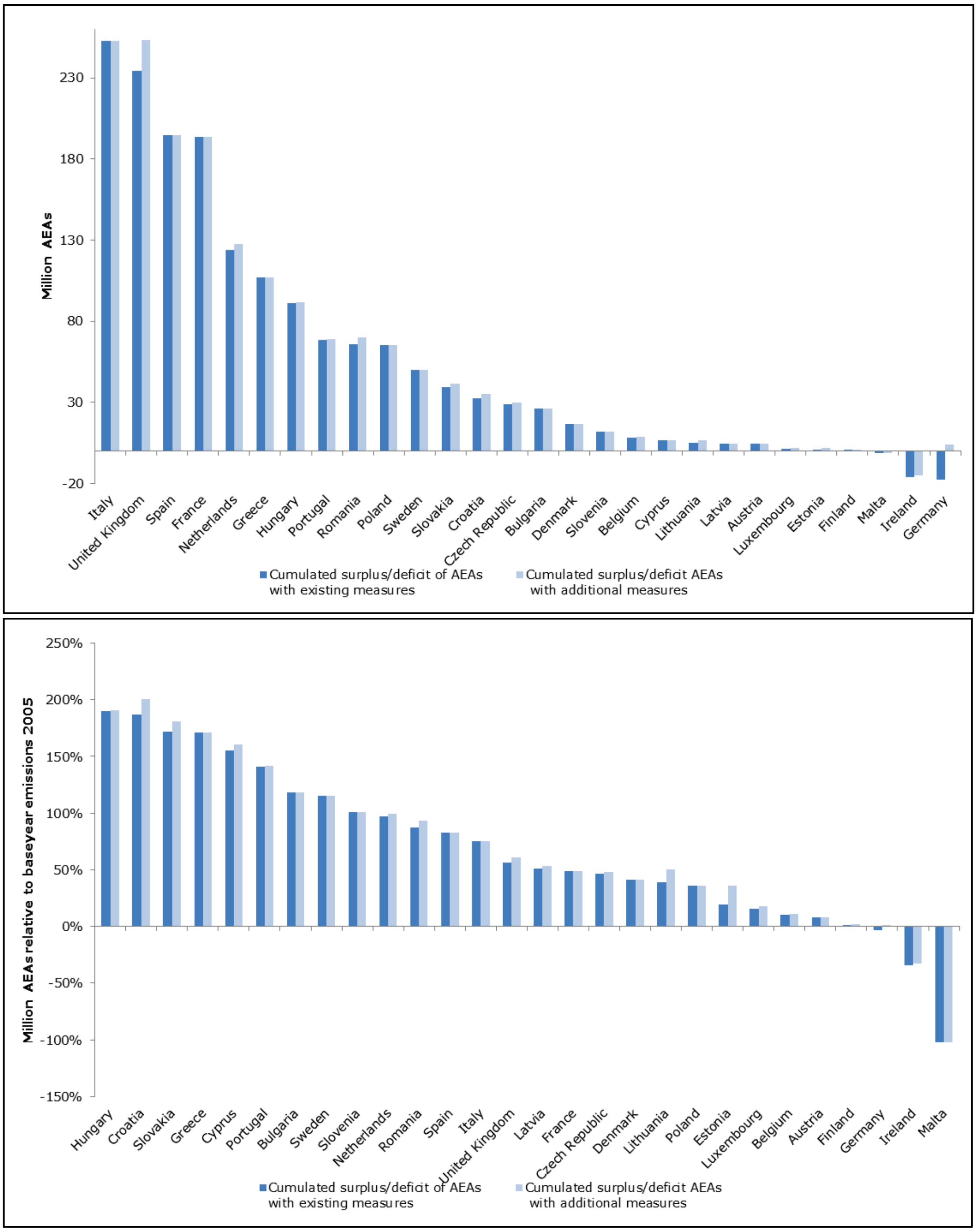


Sources: EEA, 2018d, 2018c

A crucial element with respect to the ESD is Member States' progress in meeting their AEAs. The overall progress in the years 2013 to 2017 and projections 2018 to 2020 for Member State emissions in comparison to their 2013 – 2020 ESD targets is presented in Figure 1-5. Historic ESD emissions 2013 to

2016, proxy estimations for the year 2017 and projected ESD emissions 2018 to 2020 from with existing measures (WEM) and with additional measures (WAM) scenarios are summed up and compared to the total amount of AEA for the period 2013-2020. The difference is shown in Figure 1-5. Positive differences mean that total AEA are higher than ESD emissions.

Figure 1-5 Projected cumulative differences between emissions Effort Sharing Decision targets, 2013-2020 in absolute und relative terms



Note: 2013-2016 ESD emissions are historical values, fixed after ESD reviews. 2017 ESD emissions result from approximated GHG emissions as reported by MS or calculated be ETC/ACM (for Bulgaria, Cyprus, Romania). 2018-2020 ESD emissions are from WEM projections as submitted under the MMR in 2017 (2018 for Cyprus and Ireland)

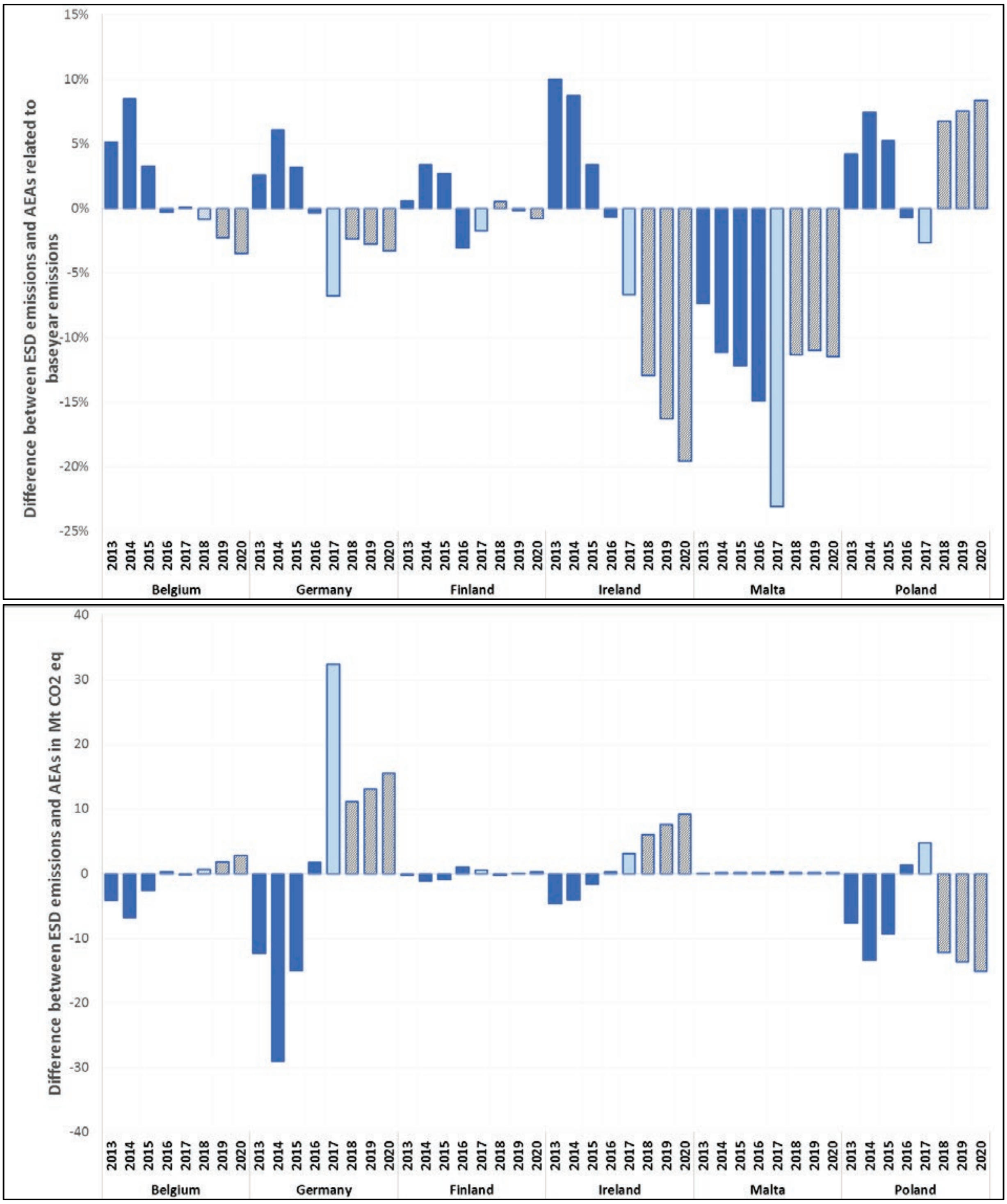
Sources: EC, 2017, 2013a, 2013b; EEA, 2018d, 2018b, 2018e, 2018f, based on Member States' submissions.

Two of the six Member States with highest ESD emissions (Germany and Poland) have been identified as exceeding ESD targets between 2013 and 2020 at least for one year. The projected cumulated deficit of Germany and Ireland is highest in absolute terms for WEM scenarios. For Ireland also the projected relative deficit is the highest after the one of Malta. The four other Member States (United Kingdom, France, Spain and Italy) are projected to stay well below annual ESD targets 2013-2020 and to contribute substantially to the high surplus of AEA until 2020.

Figure 1-6 shows the Member States with higher ESD emissions in 2016 than their annual ESD targets. Belgium, Germany, Finland, Ireland and Malta are projected to exceed their AEAs in 2020. Poland's ESD emissions are projected to stay below the ESD targets from 2018, but latest trends show a considerable different trend. The following chapters discuss these Member States in more detail to identify the trends which result in the exceedance of the ESD targets.

With proxy ESD emissions for 2017 all these countries apart from Belgium will again exceed their annual ESD target. In addition five other Member States (Austria, Bulgaria, Cyprus, Estonia and Lithuania) are expected to have higher ESD emissions than their annual target,

Figure 1-6 **Percentage (top) and absolute (bottom) difference between ESD emissions and AEAs for selected Member State 2013 – 2020**



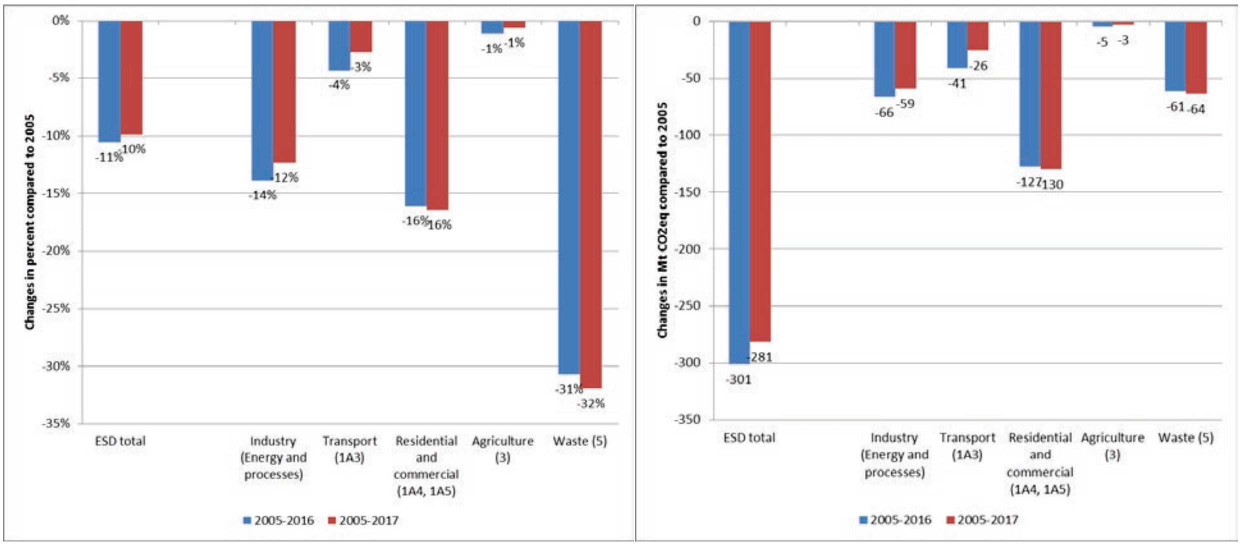
Note: Positive values denote where emissions are lower than AEAs**.**

Sources: EC, 2017, 2013a, 2013b; EEA, 2018d, 2018b, 2018e, 2018f, based on Member States' submissions.

2 Historical sectoral developments in ESD sectors

This chapter highlights the development in ESD sectors between 2005 and latest years. On EU-level, highest emission reductions took place in the residential and commercial sector (also called 'buildings' sector). Lowest emission reductions took place in the agriculture sector, see Figure 2-1.

Figure 2-1: Change of emissions in ESD sectors in EU-28 between 2005 and 2016/2017 compared to 2005



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

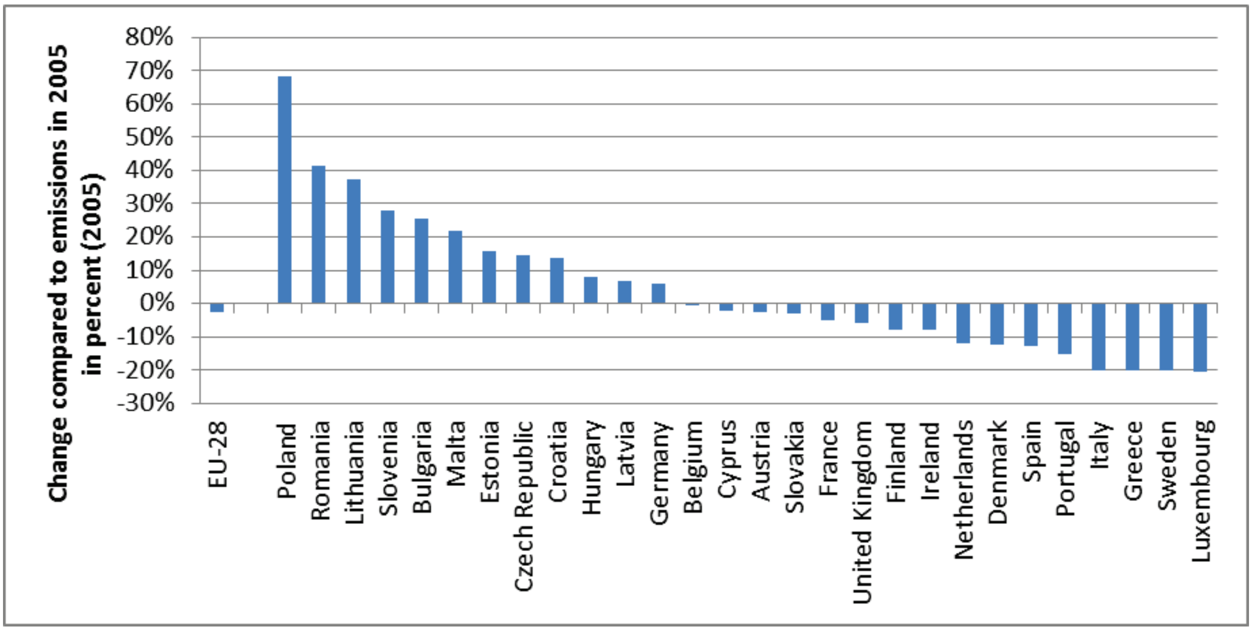
The development in Member States is shown in the following figures.

2.1 Transport sector

The transport sector is responsible for the majority of ESD emissions in the EU. Total emission reductions between 2005 and 2017 are very low with 26 Mt CO_2 eq. 13 Member States show an increase of emissions in this sector, with Poland and Germany contributing most to this increase in absolute terms. Highest relative emission reductions of about 20 % compared to emissions in 2005 are to be seen in Italy, Greece, Sweden and Luxembourg. In many Member States emissions in the transport sector are increasing in spite of improved energy efficiency due to the legislation to reduce the carbon intensity of passenger cars (and soon of HDVs) because transport demand keeps growing.

ESD emissions in the transport sector do not include domestic aviation. ETS shares are low, with a maximum of 3 % (Slovakia) due to emissions from gas transport.

Figure 2-2 **Change of emissions in the transport sector in all Member States between 2005 and 2017 compared to 2005**



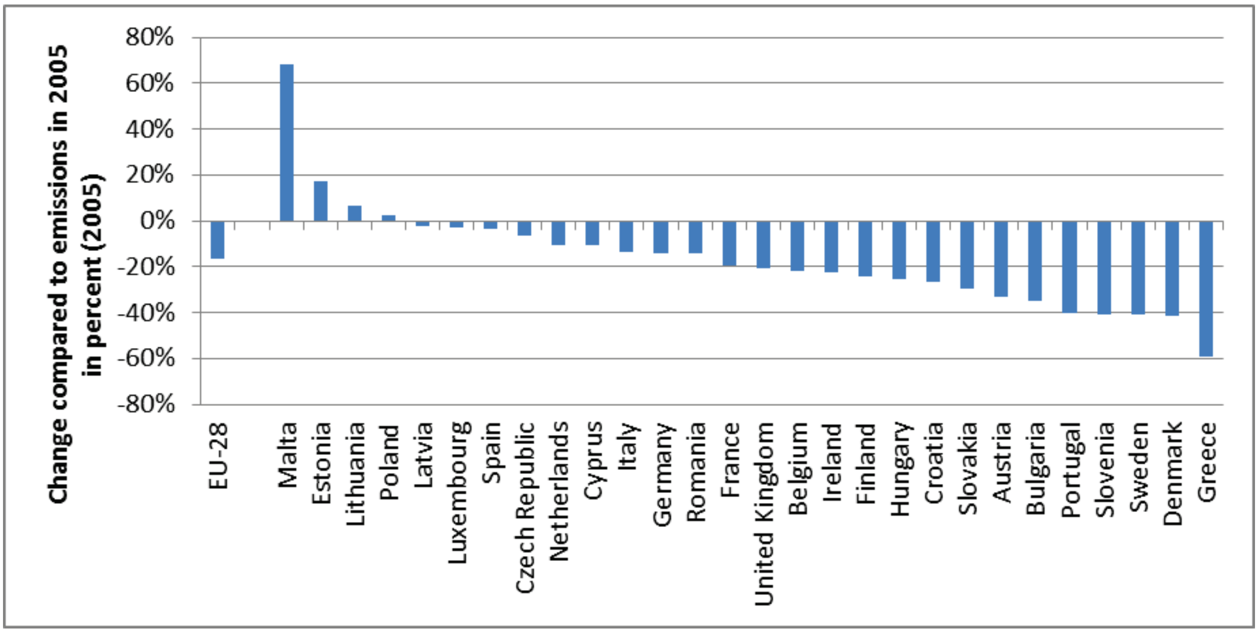
Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

2.2 Residential and commercial (Buildings) sector

Emissions from the building sector (also named 'residential and commercial' sector) show the second highest ESD emissions on EU level. Highest emission reductions in EU-28 took place in in this sector with total emission reductions between 2005 and 2017 of 130 Mt CO_2 eq. Changes of emissions in Member States between the years 2005 and 2017 are presented in Figure 2-3. While emissions increased in only four countries (Malta, Estonia, Lithuania, Poland), emissions decreased partly up to 60 % in other Member States. The increase of emissions in these four countries only adds up to 1.7 Mt CO_2eq, compared to an overall reduction of 130 Mt CO_2eq for EU-28. This sector aggregates CRF sectors 1.A.4 and 1.A.5. It mainly includes emissions due to heating of buildings but also from the commercial sector (see box on details). Annual emission changes in this sector are to a certain extent related to heating and cooling degree days. Nevertheless it can be shown in detailed analysis for selected Member States that observed emission decreases for some Member States are higher than those related to changes in heating degree days (see section 4).

CRF sector 1A4 includes emissions from 'small scale fuel combustion' used for space heating and hot water production in commercial and institutional buildings, households, agriculture and forestry. It includes also emissions from mobile machinery used within these categories (e.g mowers, harvesters, tractors, chain saws, motor pumps) as well as fuel used for grain drying, horticultural greenhouse heating or CO2 fertilisation and stall heating. It also includes emissions from domestic inland, coastal, deep sea and international fishing.
Source category 1A5 Other includes emissions from stationary and mobile military fuel use including air craft.
Basing on GHG projections for the year 2015 the share of ETS emissions is 0-1 % in most Member States, highest shares are 14 % in Bulgaria and 5 % in Latvia with only small changes along the timeseries.

Figure 2-3 Change of emissions in the building sector in all Member States between 2005 and 2017 compared to 2005



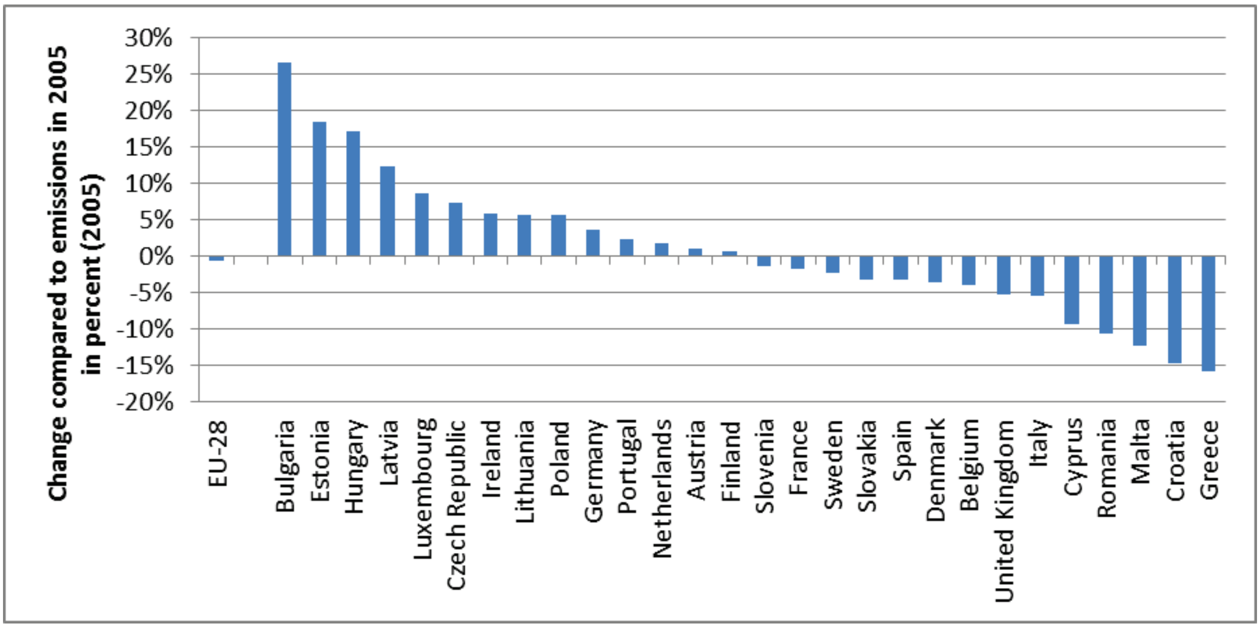
Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

2.3 Agriculture sector

The lowest emission reduction on the EU-level can be observed in the agriculture sector, with an almost negligible decrease of 3 Mt CO_2 eq. Figure 2-4 shows the distribution of changes across Member States. It is striking that there is nearly an equal distribution between the number of Member States with relative increases and decreases during this timeframe. Emissions in this sector increased most in Bulgaria (27 %) and decreased most in Greece (-16 %). Main emission increases took place in the sector of agricultural soils.

The share of emissions covered in this sector is very different across Member States depending on the landscape, climate conditions, farm structure and farming practices. The share of ETS emissions is zero in all Member States.

Figure 2-4 **Change of emissions in the agriculture sector in all Member States between 2005 and 2017 compared to 2005**



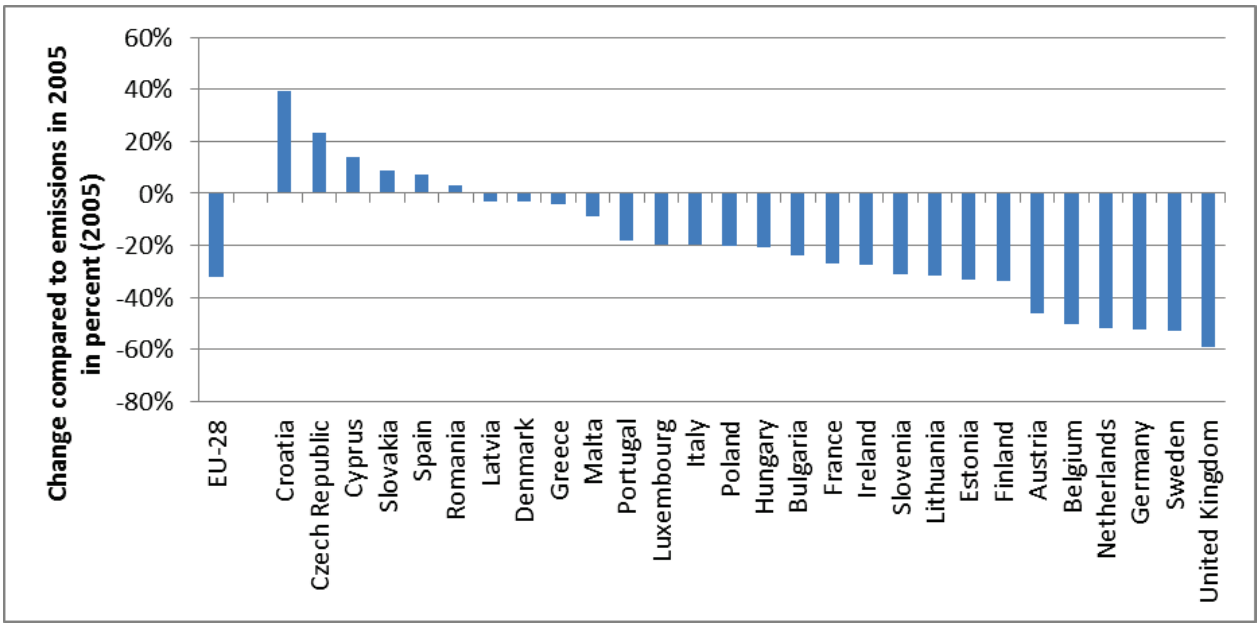
Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

2.4 Waste sector

Emission reductions 2005-2017 on the EU level are highest in relative terms with a reduction of 32 %, but similar to those in 'industry and other' in absolute terms with an absolute emission reduction of 64 Mt CO_2 eq. (see Figure 2-1). Emissions increased in six Member States, with an almost 40 % increase in Croatia (see Figure 2-5). In most Member States emissions decreased with highest decreases in relative terms in the United Kingdom (59 %).

Emissions in these sectors are completely covered under the ESD, only Belgium reports a share of ETS emissions of 13 % in GHG projections due to the allocation of flaring in the chemical industry under this sector.

Figure 2-5 **Change of emissions in the waste sector in all Member States between 2005 and 2017 compared to 2005**



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

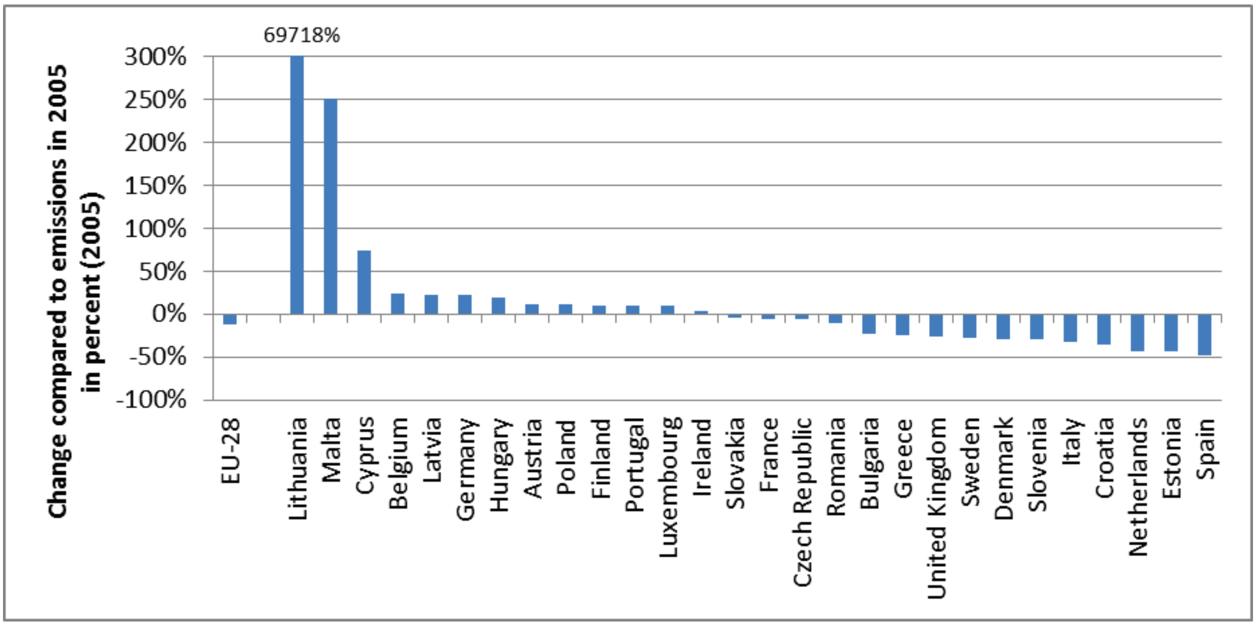
2.5 Industry and other

Emissions in the sector of 'industry and other' decreased on EU-level between 2005 and 2017 by 59 Mt CO_2eq. (see Figure 2-1). Nevertheless some Member States see a high increase of these emissions, especially in relative terms due to the small size of the country and low historic emissions in this sector (Lithuania and Malta). Highest emission reductions in relative terms can be seen in Spain), see Figure 2-6. In this sector it is striking that five of those countries with highest ESD emissions are those with highest absolute increases (Germany and Poland) and highest absolute decreases (Italy, Spain and the United Kingdom), see Figure 2-6, below.

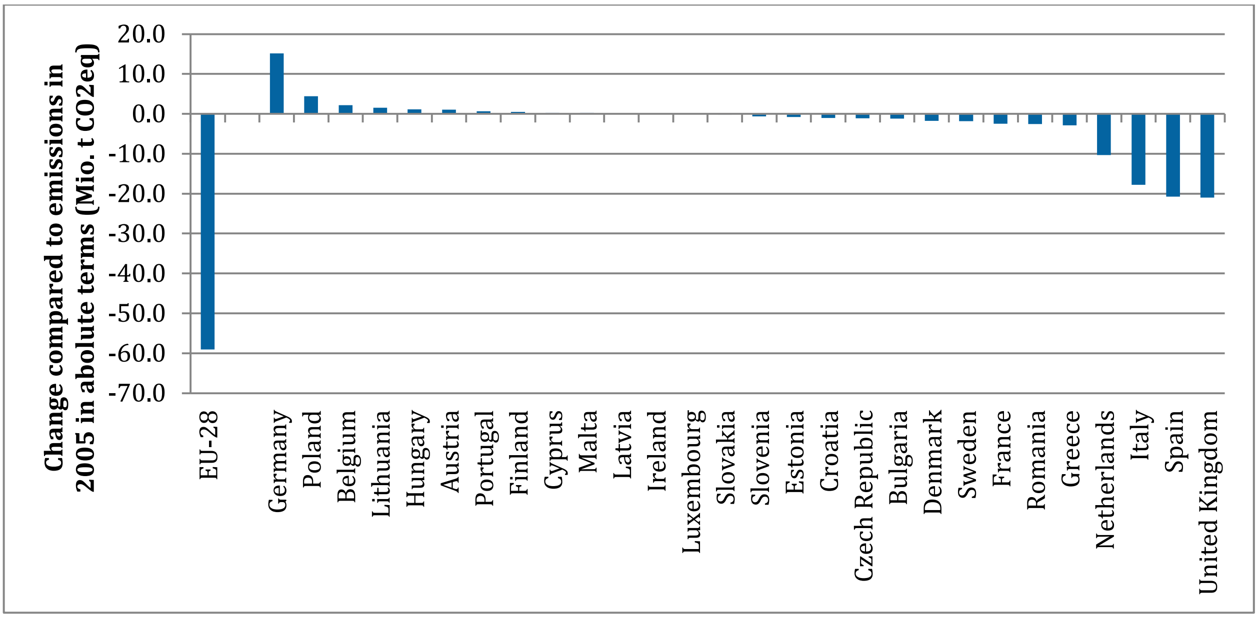
This sector is an aggregation of CRF categories 1.A.1 (Energy industries), 1.A.2 (Manufacturing and production), 1.B (Fugitive emissions from fuels) and 2 (Energy processes)[3]. These sectors usually have higher shares of ETS emissions, but they are very dependent on the energy and industry structure of Member States. There is no public information available about ETS shares in these sectors for historic years, only projected shares can be used for a detailed analysis. As these ETS shares can change along the timeseries to a high extent (e.g. due to a new chemical installation in a small country), these sectors are considered on an aggregated level only. This aggregated level can be judged to be reliable as it reflects the difference between total ESD emissions and the previously mentioned sectors with low shares of ETS emissions (transport, buildings, agriculture and waste).

[3] 1.C (CO_2 Transport and Storage) are not occurring in EU Member States, but would be included here, too.

Figure 2-6 **Change of emissions in the 'Industry and other' sectors in all Member States between 2005 and 2017 compared to 2005 (in relative and absolute terms)**



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

Sources of emission increases in this sector are diverse and highly depending on the situation of Member States. In some Member States the main driver is increasing emissions in industrial processes (including F-Gases). In other Member States it is the trend to a more decentralised energy system with smaller plant sizes. Another trend which leads to higher emissions under 'industry and other' is the increasing incineration of waste to produce energy, which is highly related to decreasing emissions under the waste sector.

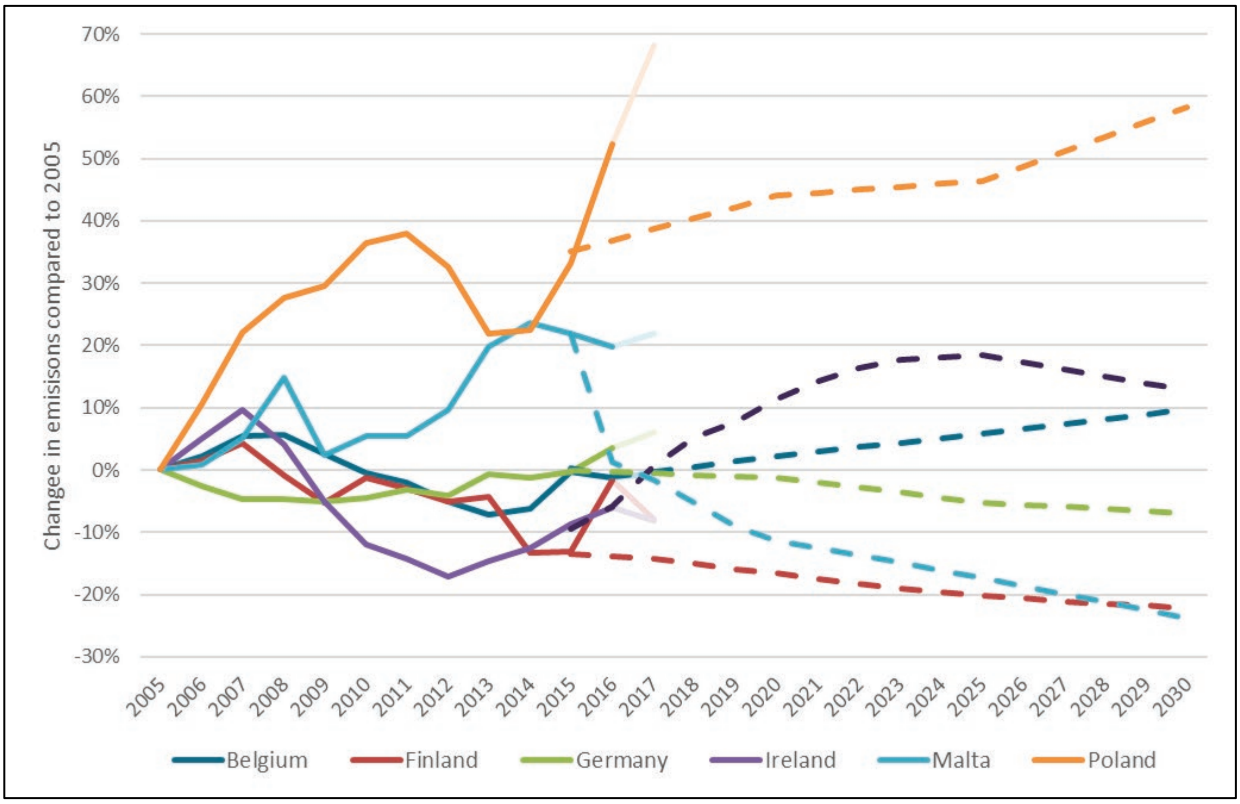
3 Overview of selected Member States

This section provides an overview of six Member States: Belgium, Germany, Finland, Ireland, Malta and Poland, which exceed their AEAs for the year in 2016. While Malta encounters higher ESD emissions than AEA targets for every year since 2013, the five other Member States didn't exceed their AEAs until 2016. These countries have been selected for an in-depth analysis to detect and understand eventual common or specific challenges with the reduction of ESD emissions. An analysis for each of these Member States is provided in Sections 4.2. to 4.7.

3.1 Index of emission trends 2005-2017 of specific countries

There is a large annual variability in emissions from the transport sector between 2005 and 2030 (Figure 3-1). In Poland, Malta and Germany transport emissions increased between 2005 and 2017 and between 2016 and 2017. Malta and Germany didn't project an increase of transport emissions in the latest projections, while the increase in Poland since 2015 was much higher than projected. The increase of transport emissions is very high in Poland with close to 70 % in 2017 compared to 2005.
Across the time series Poland, Ireland and Belgium project emissions to increase compared to 2005 levels, whilst the other Member States project a reduction in emissions.

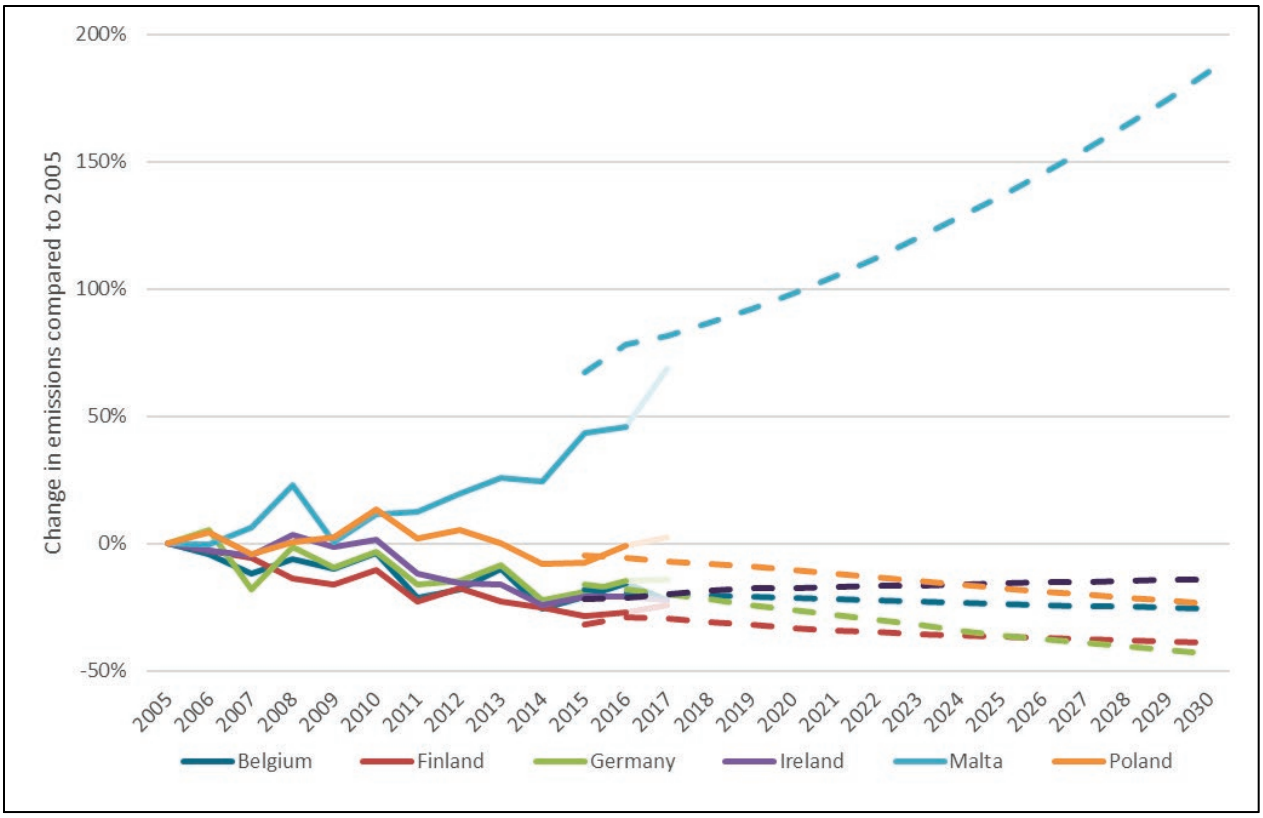
Figure 3-1 Index of ESD emissions- transport sector



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

With the exception of Malta, all Member States project a reduction in emissions from the building sector between 2005 and 2030 (Figure 3-2), ranging from 14 % in Ireland to 43 % in Germany. Emissions from the Building sector in Malta are projected to continually increase, almost doubling in 2030 compared to 2005 levels, mainly due to emission increases in the commercial/institutional subsector. See section 4.6.3 for more information about this development in Malta.

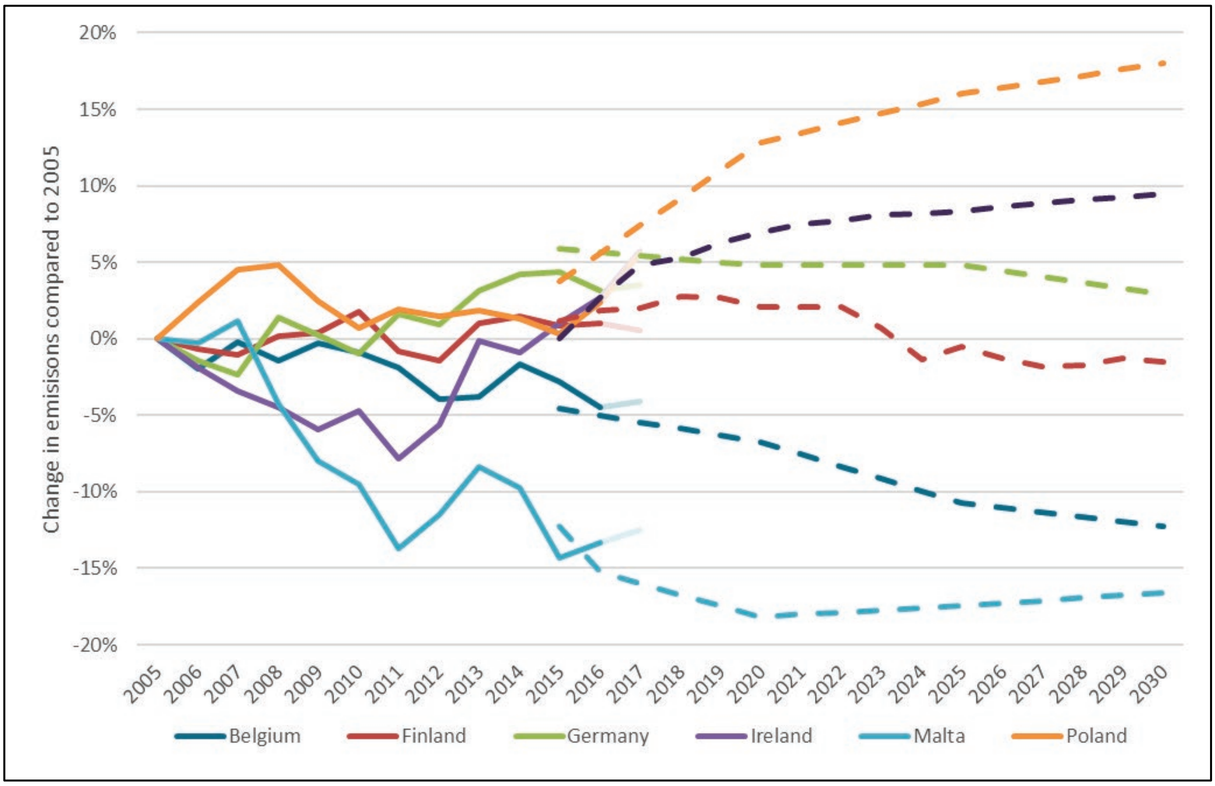
Figure 3-2 Index of ESD emissions- residential and commercial ('building') sector



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

As shown in Figure 3-3, there is a large variability in the emissions trends for the agriculture sector in the selected Member States, with half projecting emissions to increase (Germany, Ireland and Poland) and half projecting emissions to decrease (Belgium, Finland and Malta).

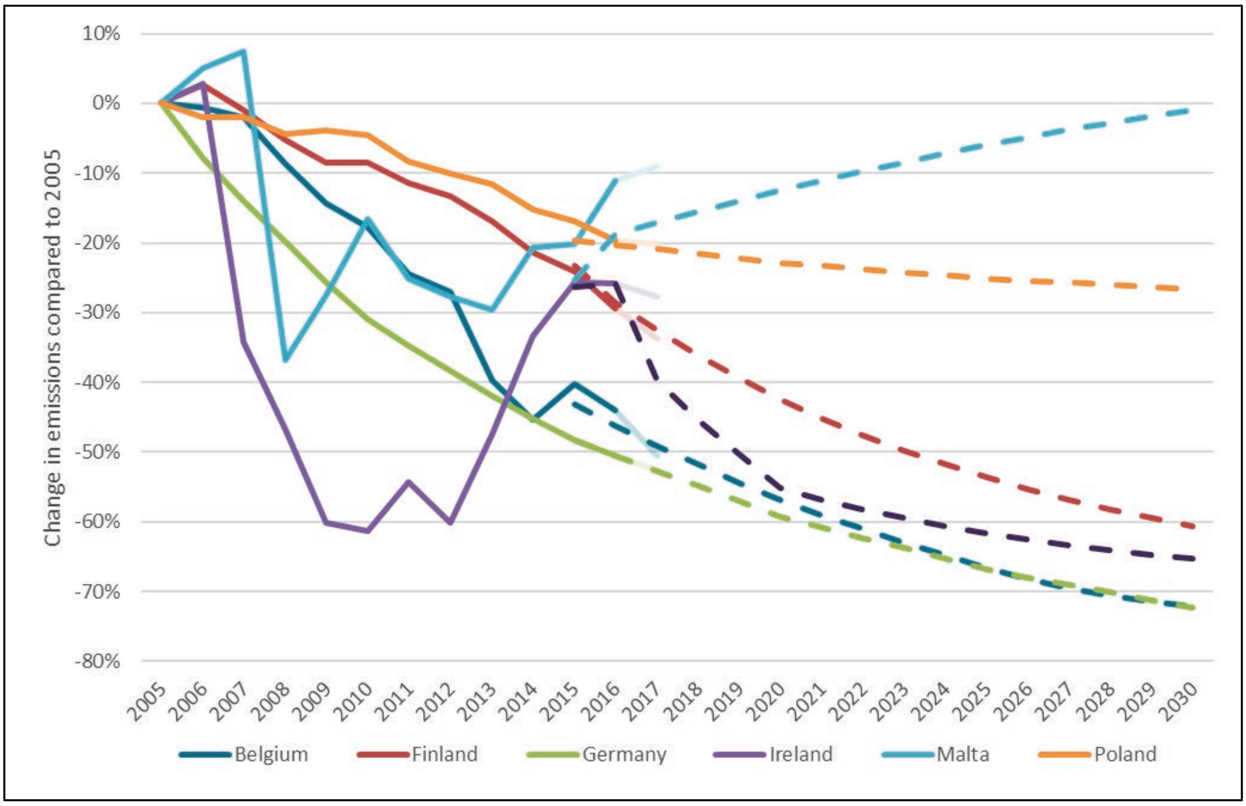
Figure 3-3 Index of ESD emissions- agriculture sector



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

The waste sector is the only ESD sector for which all six Member States project emissions to remain below 2005 levels up to 2030 (Figure 3-4). However, in Malta emissions from the waste sector are projected to increase to within -1 % of 2005 levels by 2030. In contrast, emissions from the waste sector in Finland, Germany and Ireland are projected to decline by more than 60 % in 2030 compared to 2005 levels and historic development is well matching to projected trends.

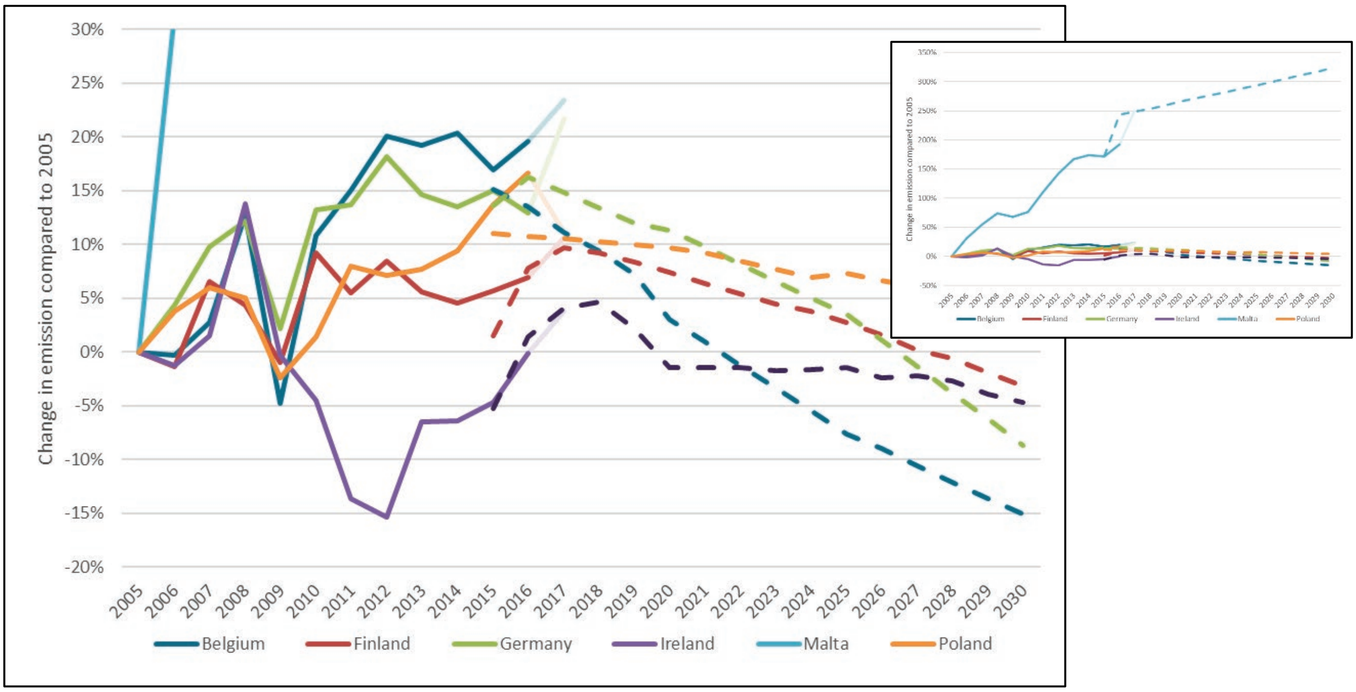
Figure 3-4 Index of ESD emissions- waste sector



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

The 'industry and other' sector includes emissions from energy and processes which are not included under the ETS. For all Member States the emissions from the 'industry and other' sectors fluctuate across the time series (Figure 3-5). Malta's emissions from the 'industry and other'sectors are projected to more than triple between 2005 and 2030. In contrast, the greatest reduction in annual emissions in 2030 compared to 2005 levels is seen for Belgium (-15 %). There is a large discrepancy between the 2017 proxy data from Belgium and Germany and the projections.

Figure 3-5 Index of ESD emissions- 'Industry and other' sector



Source: EEA, 2018d, 2018e, 2018c, ETC/ACM calculation

As mentioned above there are many reasons for increasing emission trends under this sector.
One of these is the installation of waste incineration plants which help to reduce emissions under the waste sector. Table 3-1 shows the amounts of waste which have been used in selected Member States since 2005. In all Member States but Malta numbers increased considerably, leading to higher emissions under 1.A.1.a but outside of coverage of the ETS.

Table 3-1 Waste incineration with energy recovery

	2005	2010	2011	2012	2013	2014	2015	2016
	1000 t waste							
Belgium	1.885	1.975	2.041	2.047	2.146	2.090	2.055	2.125
Finland	227	556	678	925	1.137	1.316	315	1.515
Germany	14.208	18.256	18.358	17.192	16.707	16.318	15.985	16.095
Ireland	-	109	196	427	427	893	:	:
Malta	-	-	2	1	1	1	1	1
Poland	44	39	45	51	766	1.560	1.439	2.266

Source: Eurostat (Disposal - incineration (D10) and recovery - energy recovery (R1))

3.2 Belgium

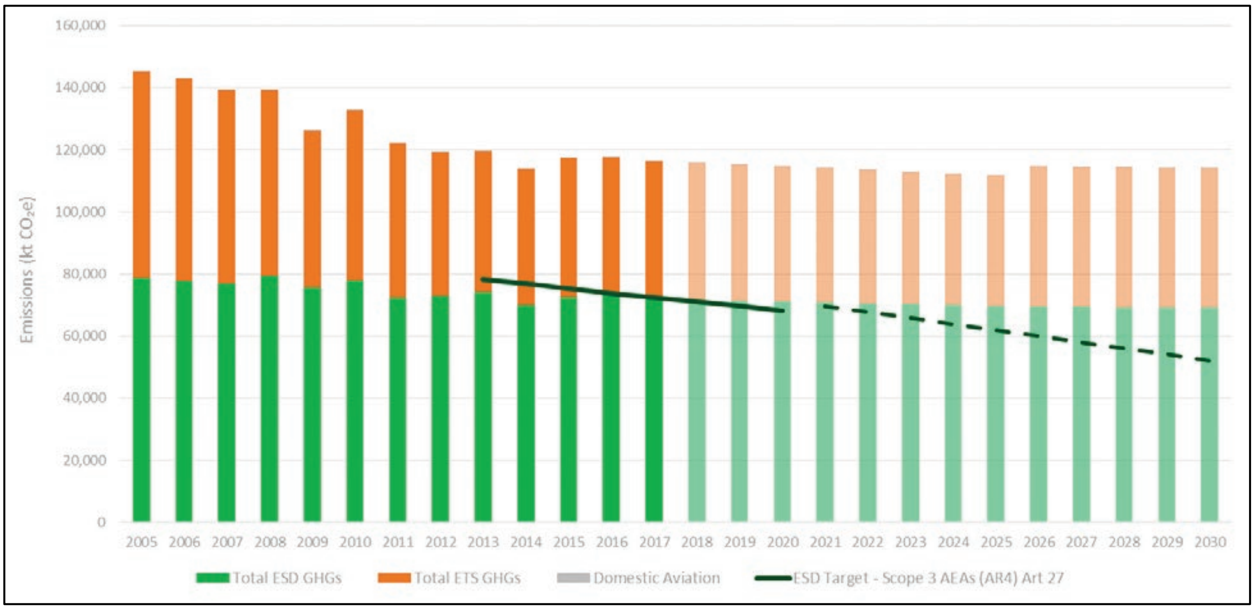
1. Total ESD emissions in Belgium saw a decline between 2005 and 2017 (-8 %), but are projected to level-off from 2017 with a further small decline until 2030.
2. ESD emissions in Belgium are dominated by the transport and residential sectors. Whilst there is an overall decline in these sectors in 2017 compared to 2005, emissions from transport increase from 2013 whereas residential emissions continue to decrease albeit at a slower rate.
3. The 'industry and other' sector is of lower absolute importance but shows relevant increases compared to 2005 and seems to develop in contrary to the projected trend.

4. In order to stay within its AEAs, the increasing trend in the transport and 'industry and other' sectors needs to be reversed together with an increased rate of reduction in the residential/ commercial sector. Based on current projections, in 2030 the residential/ commercial and transport sector alone will account for almost all (within 1 %) of Belgium's AEA.

3.2.1 Overview of emission trends in ETS and ESD since 2005

Total GHG emissions in Belgium have fallen between 2005 and 2017 with emissions in 2017 one fifth lower than the 2005 levels (Figure 3-6). This reduction in emissions is primarily due to decreased emissions from the ETS sectors which fell by 34 % over this time period, four times the reduction seen in the ESD sectors. From 2017, emissions in Belgium are projected to level-off with total GHGs expected to decline by only 1 % in 2030 compared to 2005 levels. Between 2017 and 2030, emissions from ETS sectors are projected to slightly increase, counterbalanced by a larger reduction (-4 %) in the ESD sectors. Throughout the time series the majority of emissions are generated from ESD sectors, as ETS emissions fall between 2005 and 2017 the contribution of ESD sectors to total emissions rises from 55 % to 62 %.

Figure 3-6 ESD, ETS and domestic aviation emissions in Belgium 2005 to 2030 with ESD targets highlighted



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

3.2.2 ESD emissions compared to ESD targets

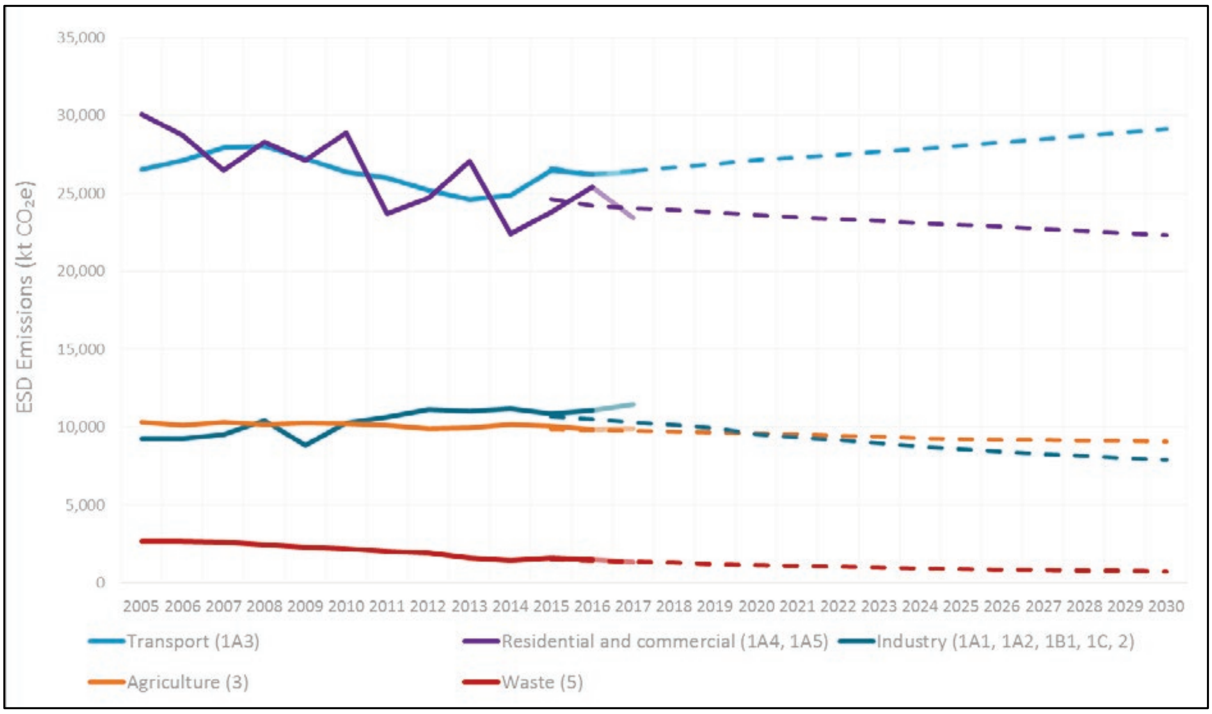
Belgium stayed below its AEAs between 2013 and 2015, but slightly exceeded its AEAs in 2016 (see Figure 1-6). The 2017 proxy data shows emissions to stay just below the 2017 AEAs, but Belgium is projected to exceed its AEAs from 2018 onwards. Due to emissions being projected to level-out from 2017, the difference between emissions and AEAs is expected to increase. By 2030, Belgium's emissions are projected to be 21 % above the AEA, relative to base year emissions. Emissions from the transport and residential/commercial sector alone are currently estimated to account for almost all of Belgium's AEAs in 2030.

Belgium submitted a projection with additional measures. With these additional measures the difference between emissions and AEA in 2030 of 17 Mt CO_2eq (21 % of base year emissions) is reduced by only 1 Mt CO_2eq. These additional reductions are mainly related to the transport sector but no related PaM was reported. However, in the projections report[4] it is explained that the WAM scenario includes increased blends of biodiesel.

3.2.3 ESD emissions by sector

The largest ESD sectors in Belgium are transport and residential/ commercial (Figure 3-7). In 2005, the majority of emissions are generated from the residential/ commercial sector which fluctuated between 2005 and 2017 but saw a general decline in emissions. In 2017, residential/ commercial emissions were 22 % lower than the 2005 levels. This reduction is projected to slow in subsequent years with only an 8 % reduction expected between 2017 and 2030. A similar emissions reduction is seen in the transport sector until 2013 when emissions begin to increase and continue increasing up to 2030. Between 2017 and 2030 emissions from the transport sector increase by 10 %. Emissions from agriculture and 'industry and other' have a similar contribution to total emissions in Belgium. However, whilst agriculture sees a steady decline in emissions between 2005 and 2030 with emissions reducing on average annually by 1 %, emissions from 'industry and other' increased between 2005 and 2017. As shown in Figure 3-5, from 2017 on, Belgium is projected to have the fastest rate of declining emission from 'industry and other' out of the six Member States with a 38 % reduction in 2030 compared to 2005 levels. However, there is a large disparity between the 2017 proxy data and the projections (Figure 3-7) resulting in uncertainty as to whether these reductions will be realized. Obviously although GHG projections submitted in 2017 fitted well to trends until 2015, policies and measures considered in these projections did not show the effects or other parameters did not materialize as estimated.
Between 2005 and 2016 the proportion of ESD sectors to total ESD emissions shifts with a decrease in the proportion of waste and residential/commercial emissions and a subsequent increase in 'industry and other' and transport emissions (Figure 3-8). The waste sector has the smallest contribution to total ESD emissions. Between 2017 and 2005, emissions from the waste sector halve, and an additional 22 % reduction is projected in 2030 compared to 2017 levels.

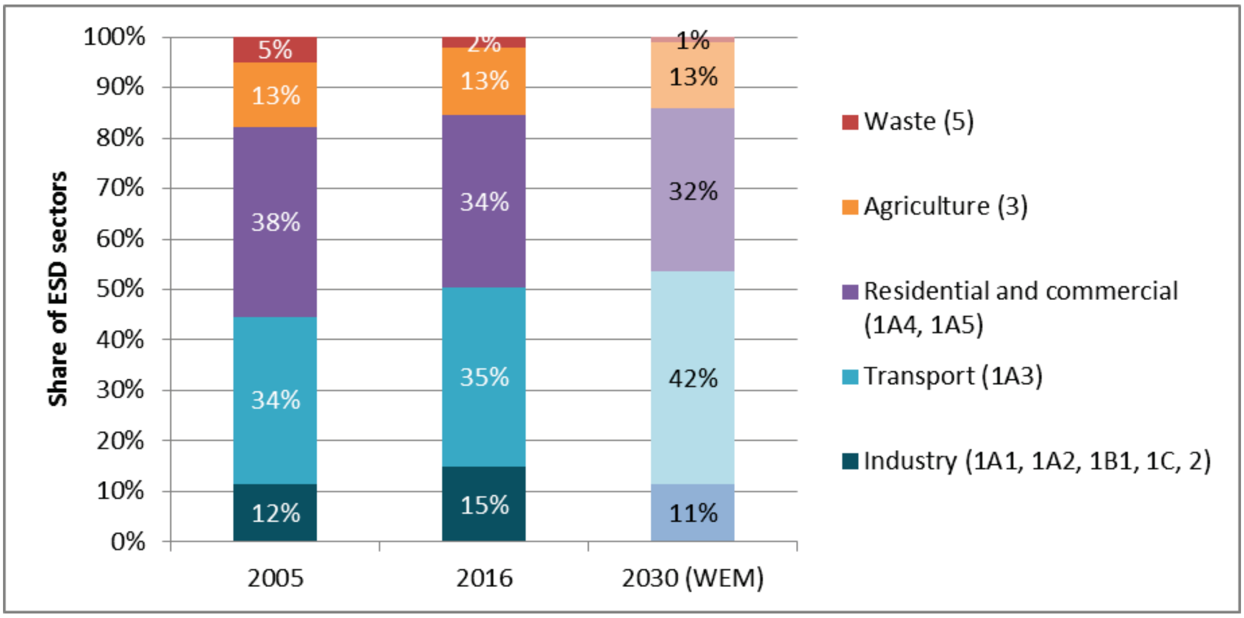
Figure 3-7 ESD emissions in Belgium 2005 to 2030 by sectors[5]



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018, ETC/ACM calculation

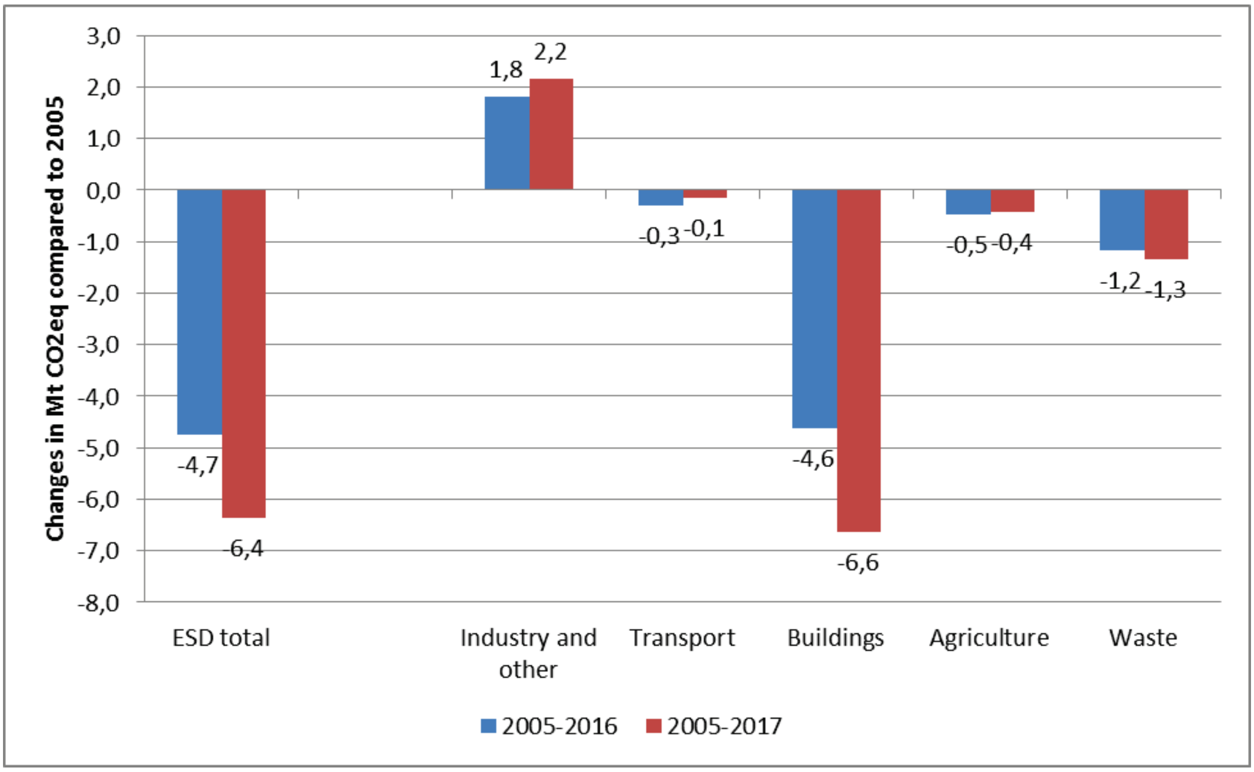
[4] http://cdr.eionet.europa.eu/be/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwlwmrg/Report_projections_Belgium_2017.pdf/manage_document
[5] In this and the following figures the buildings sector is named 'residential and commercial' sector, the 'industry and other' sector is named 'industry'.

Figure 3-8 Share of ESD emissions in Belgium in 2005 and 2016 by sectors



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018, ETC/ACM calculation

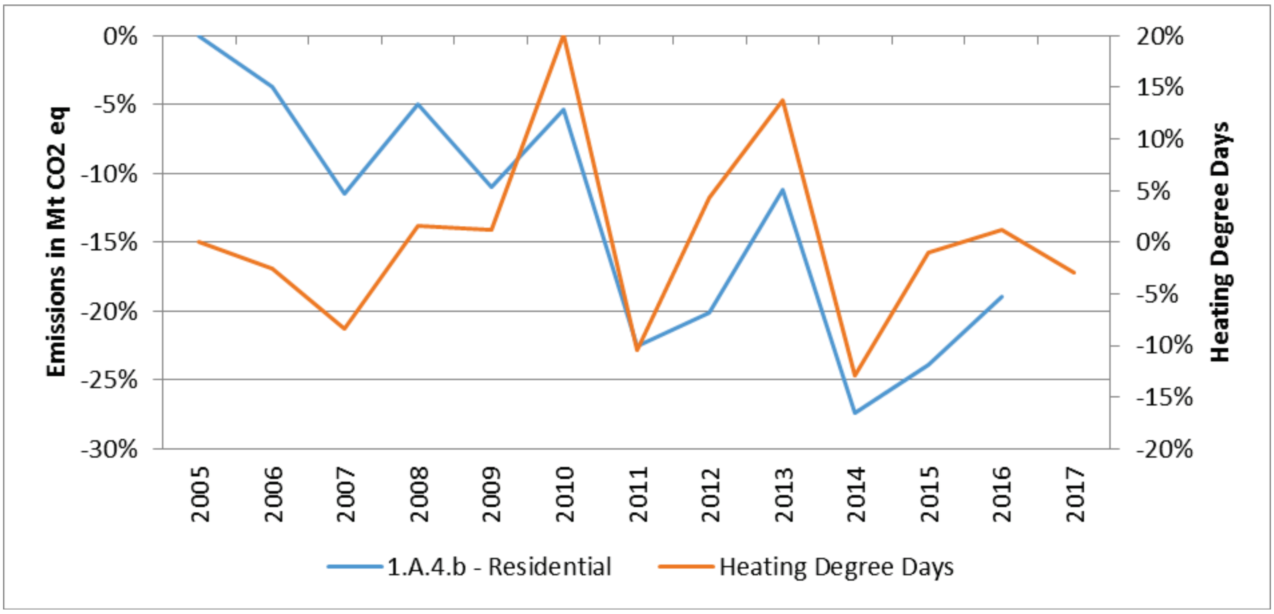
Figure 3-9 Absolute change in annual ESD emissions in Belgium between 2005 and 2016/17



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018, ETC/ACM calculation

Historical emissions from the residential/commercial sector are dominated by the residential sector. The fluctuation in the time series of emissions from the residential sector correlates with the heating degree days, especially since 2009. In warmer years there are fewer emissions from household heating (Figure 3-10). But apart from this correlation in single years, a clear trend to decreasing emissions is visible: While heating degree days are about at the same level in 2005 and 2017, there was a decrease in emissions from the residential sector by about 20 % in 2016. There has been an additional emission reduction in this sector independent from the influence of the heating degree days. This means that the reduction in emissions in this sector between 2005 and 2017 shown in Figure 3-9 can only partly be linked to the trend in heating degree days. Belgium has been identified as one of the Member States with the most existing energy efficiency policies and measures in buildings, but together with Luxembourg had the highest consumption per building in 2012 (after adjustment to the EU average climate)[6]. It is difficult to determine to what extend the realized reduction in emissions from the residential/ commercial sector is linked to the introduction of building efficiency policies, but obviously it is not only caused by a warmer climate.

Figure 3-10 Changes of residential emissions by category and Heating Degree Days compared to 2005

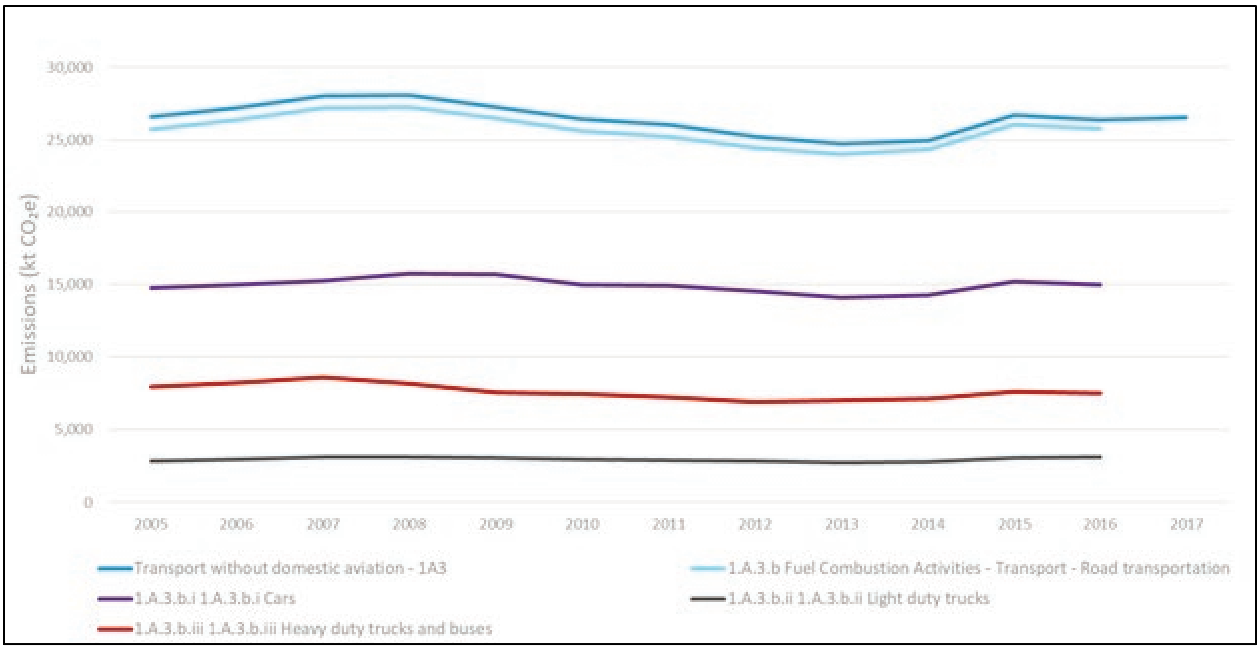


Sources: EEA, 2018e; Eurostat, 2018

The transport sector becomes increasingly important in Belgian ESD emissions. The share of transport emissions increased between 2005 and 2017 (Figure 3-8) and is projected to increase further (Figure 3-7). This increase in emissions from transport, specifically road transport (Figure 3-11), is projected to have the greatest impact on the relatively constant total ESD emissions between 2005 and 2030. Emissions are expected to reduce from all other sectors and therefore the increasing emissions from transport, the largest ESD sector, are considered the greatest barrier to Belgium meeting its ESD targets. There are some existing policies in Belgium targeting road transport such as the implementation of Low Emission Zones (LEZs), but whilst these are expected to have a significant impact on improving air quality, their impact on GHG emissions is limited[7]. If Belgium is to meet its AEAs in the future, the increasing trends in emissions from road transport should be reversed (Figure 3-1).

[6] https://acm.eionet.europa.eu/reports/docs/EIONET_Rep_ETCACM_2018_2_energy_efficiency_buildings.pdf
[7] http://cdr.eionet.europa.eu/be/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwlwmrg/Report_projections_Belgium_2017.pdf

Figure 3-11 Transport emissions by category in Belgium 2005 - 2017



Sources: EEA, 2018e

Another sector with emission increases in latest years is the 'industry and other' sector. Emissions are increasing since 2015, showing highest increases of all sectors since 2005 (Figure 3-9), in contrary to the projected trend. The source of this emission increase could be located in the development of F-Gases: These emissions have increased by 1.6 Mt CO_2eq between 2005 and 2016, while total 'industry and other' emissions increased by 1.8 Mt CO_2eq. F-Gases are mainly excluded from the coverage of the EU-ETS. Increases in this sector should be assessed in more detail.

In the WAM scenario Belgium reports additional emissions reductions in the transport and Energy sector, but in the latter mostly only for ETS emissions. Only one single PaM is reported for the WAM scenario which is related to buildings ("Energy performance and certification of buildings (services and communities sectors)"). It is expected to contribute to a reduction of 91 kt CO_2eq by 2030. In the transport sector a reduction of additional 865 kt CO_2eq shall be achieved by 2030, but there is no related PaM reported. However, in the projections report[8] it is explained that the WAM scenario includes increased blends of biodiesel.

3.3 Finland

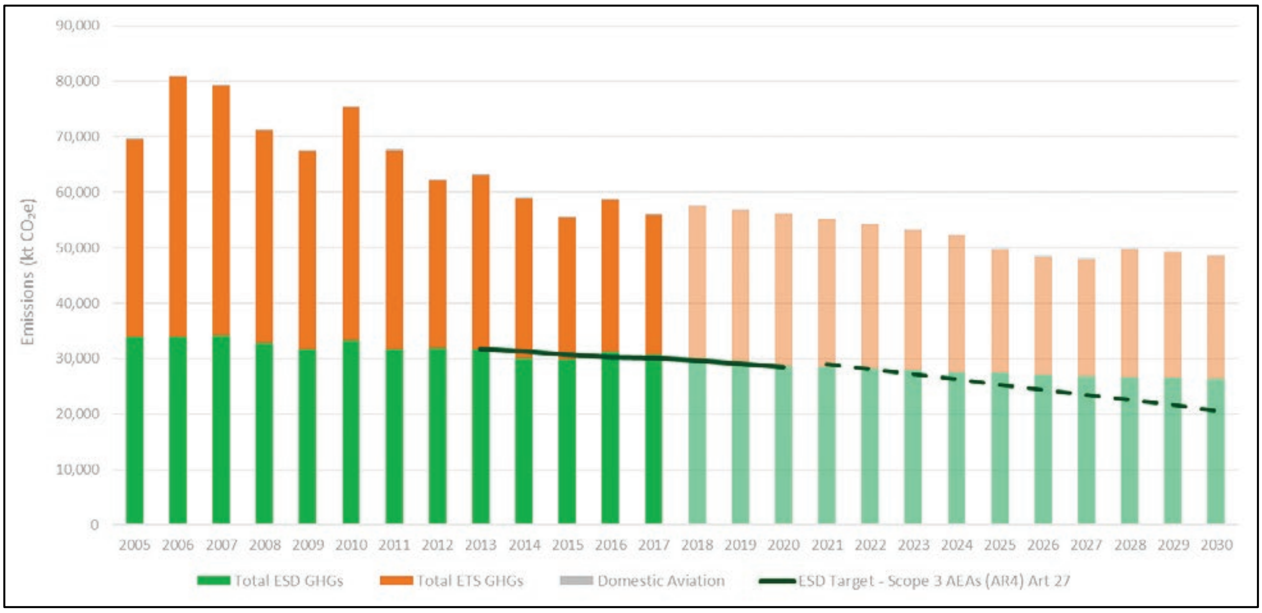
1. Total ESD emissions show a slight rise in 2016 and 2017 that take Finland above its AEAs in these years.
2. The gap between Finland's AEAs and WEM projections is estimated to increase from 2% in 2017 to 17% in 2030. This gap decreases considerably if additional measures are considered.
3. Emissions in Finland are dominated by the transport sector, which accounts for 40% of the 2016 total and by the agriculture sectors (16 % of the 2016 total).
4. With existing measures, emissions in all ESD sectors are projected to remain fairly stable in coming years, except for the agriculture sector, where static projected emissions lead to an increasing sector share by 2030. Another sector with increasing importance in future years is the sector of 'industry and other'.

[8] http://cdr.eionet.europa.eu/be/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwlwmrg/Report_projections_Belgium_2017.pdf/manage_document

3.3.1 Overview of emission trends in ETS and ESD since 2005

The overall emissions in Finland show a decreasing trend since 2005 (Figure 3-12), although it is notable that the ETS sector is subject to a much stronger decrease (-30 %) than the ESD sector (-9 %). Since the year 2012 the ETS emissions are lower than the ESD emission and this decreasing trend is continued in the projections whereby the ESD sector is expected to decrease at a much lower rate which underlines the importance of the ESD sector for further emission reductions in Finland.

Figure 3-12 ESD, ETS and domestic aviation emissions in Finland 2005 to 2030 with ESD targets highlighted



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

3.3.2 ESD emissions compared to ESD targets

Although there is a slightly declining trend, the ESD emissions exceed Finland's target in the years 2016 and 2017 (following proxy estimate). According to the GHG projections submitted in 2017, 2019 and 2020 ESD emissions are also projected to be higher than the ESD target (Figure 3-12 and Figure 1-6). For the current ESD period (2013 to 2020) the levels of exceedance are in the range of 0.2 and 3 % of base year emissions to. The projections are substantially above the emission targets for all years apart from 2021 in the period 2021 to 2030 with a projected exceedance of 6 Mt CO_2 eq. above the target value in 2030 (17 % compared to ESD base year emissions 2005).

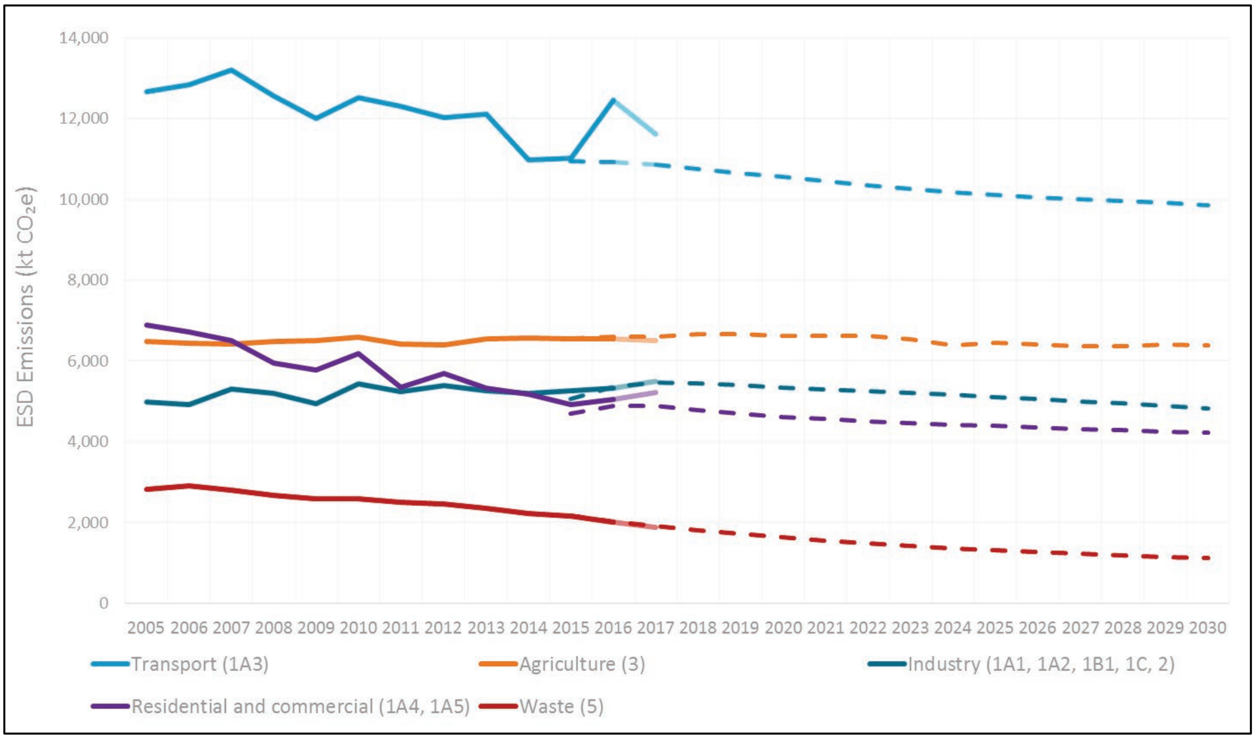
Finland also reported a scenario with additional measures (WAM) in 2017. With additional policies and measures considered, the gap to ESD target in 2030 reduces to 2 Mt CO_2eq. These additional measures mainly address the transport sector, but also small reductions for the 'industry and other' sector and the residential and commercial sector have been reported.

3.3.3 ESD emissions by sector

The overall historical emissions of the ESD sectors decreased since 2005, showing a stable decline in the sector waste but also in the residential and commercial sector (Figure 3-13), where policies show their effect. Although transport emissions constantly declined from 2005 to 2014, they increased sharply between 2015 and 2016 returning emissions from the sector close to those observed in 2005. Emissions from the second largest sector, agriculture, are very stable and there is no substantial increase or decrease in emissions compared to 2005. 'Industry and other' emissions slightly increased between 2005 and 2017.

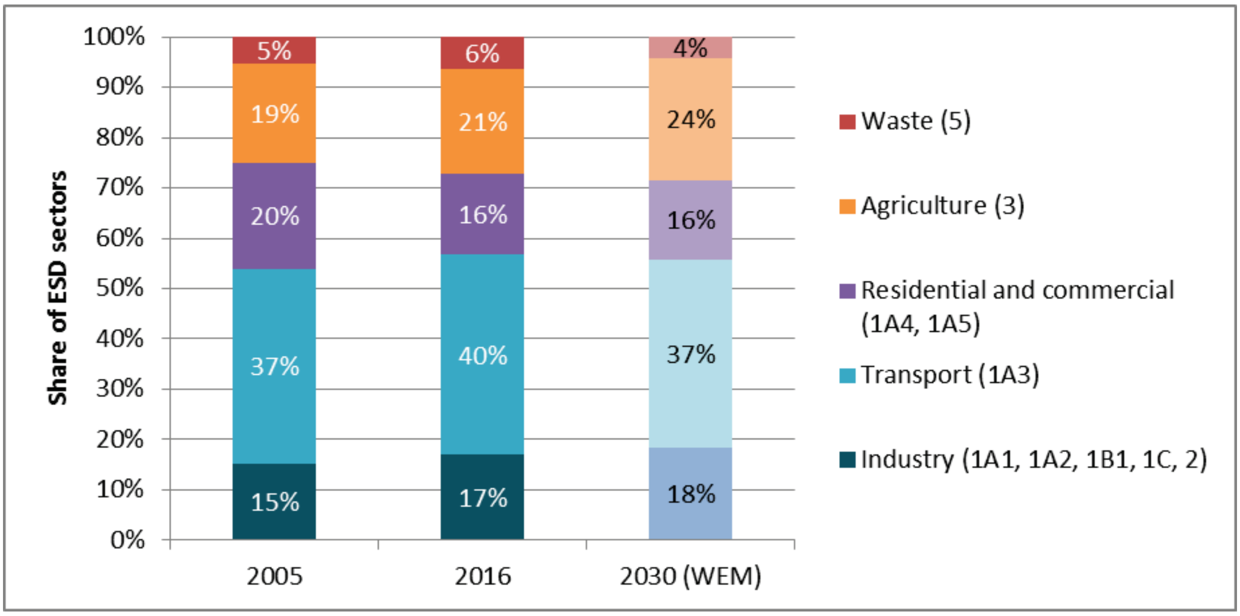
According to the GHG projections reported by Finland in 2017 (WEM scenario), the transport emissions are expected to stay on the 2015 level and continue to slightly decline until 2030 (Figure 3-14). However, due to the recent inventory data, it will be interesting to see how the updated projections to be reported in 2019 will reflect the observed sharp increase to 2016 emissions from the sector. Between 2015 and 2020 small increases have been projected in the residential and 'industry and other' sectors (Figure 3-15). While latest emission developments in the latter matches well to projected values, the increase in the residential sector is slightly higher than expected, which might result from a cold winter (Figure 3-16). The emissions from the residential sector are projected to slightly decrease until 2030, similar to projected emissions in the 'industry and other' sector. The emissions from the waste sector are expected to further decrease on a relatively constant rate as in the historical inventory. Emissions from agriculture are also projected to continue to stay about constant, which reflects the historical trend.

Figure 3-13 ESD emissions in Finland 2005 to 2030 by sectors



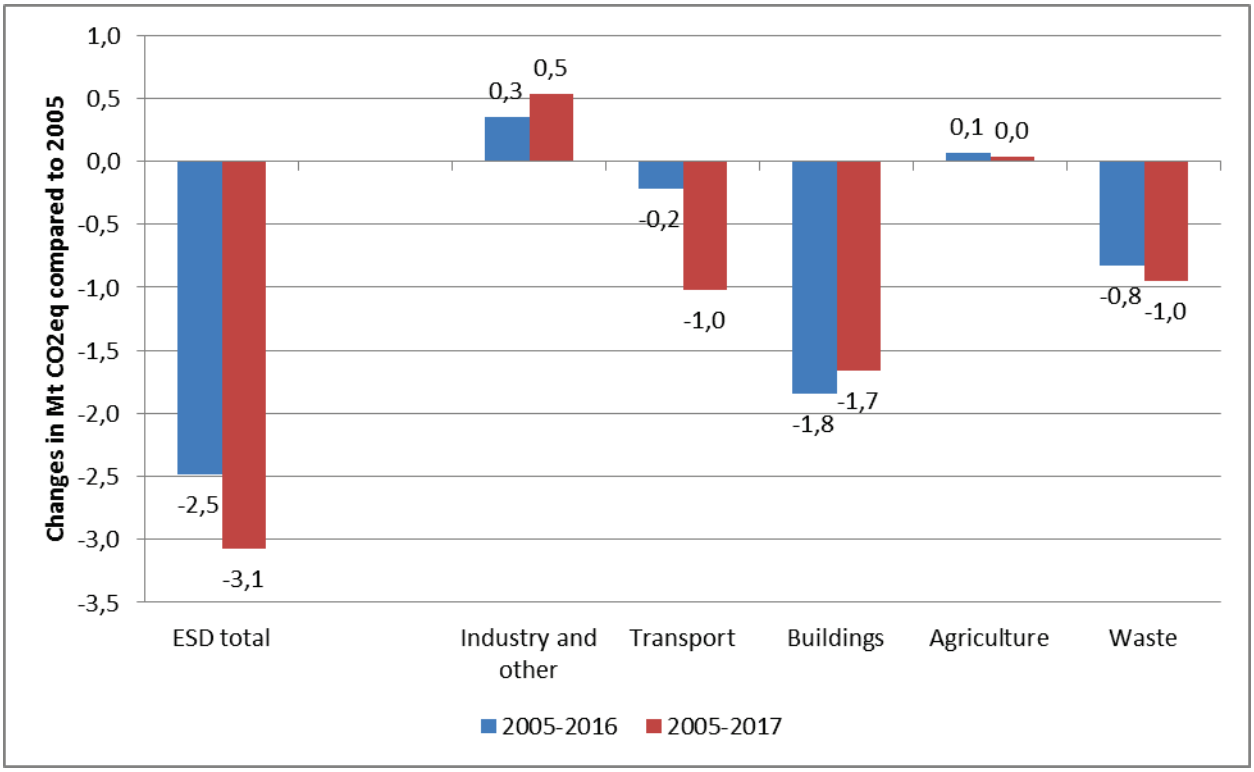
Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-14 Share of ESD emissions in Finland in 2005 and 2016 by sectors



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-15 Absolute change in annual ESD emissions in Finland between 2005 and 2016/17

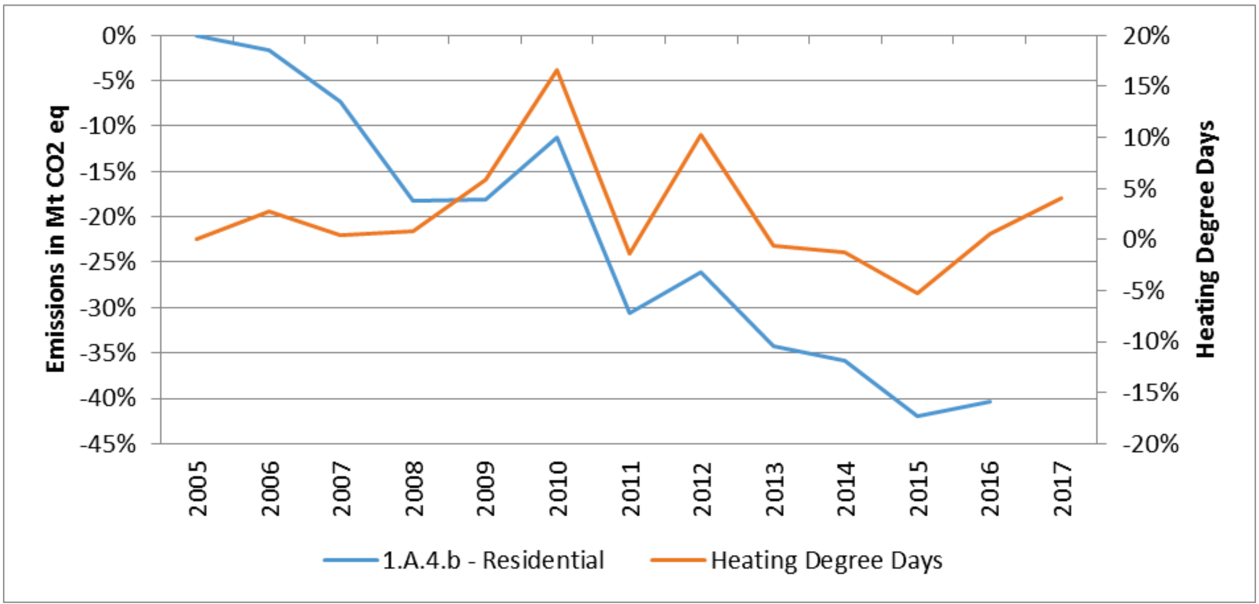


Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

The main reason for not reaching the ESD targets in recent years (2016 and the proxy 2017) is the emission increase in the transport, residential and 'industry and other' sectors. Related to the transport sector Finland explains in its National Inventory Report (NIR) that the consumption of biofuels in transport fell by 64 % in 2016 compared to the previous two years which were on a record level. This annual variation is caused by Finland's biofuel legislation "which allows the distributors to fulfil the bio obligation flexibility in advance" (Finland's NIR 2018). This decrease in the biofuel share caused a substantial increase in diesel oil consumption from 86 PJ in 2015 to 106 PJ in 2016, whereby liquid biofuels decreased from 21 PJ in 2015 to 7 PJ in 2016. So it can be concluded that the biofuels policy is a key policy for the transport sector. This is also underlined by the fact that for this policy the largest effects in the WEM and WAM scenario are reported (1.4 Mt CO_2eq by 2030 for WEM and additional 1.4 Mt CO_2eq by 2030 for WAM).

Emissions in the residential sector always show a high correlation to heating degree days, which contributed to emission increases in this sector in 2016 and 2017 (see Figure 3-16). Nevertheless this figure proves that emissions in this sector decreased since 2005 although the number of heating degree days did not change on average. Finland reports quite many existing measures of which many are not quantified and those that are estimated, are expected lead to an emission reduction in the residential and commercial sector, amounting to approximately 0.8 Mt CO_2eq by 2030. However, for the WAM scenario no prominent measures for this sector could be identified.

Figure 3-16 Changes of residential emissions by category and Heating Degree Days compared to 2005



Sources: EEA, 2018e; Eurostat, 2018

Emissions from the ‘industry and other’ sector might show an increase between 2005 and 2017 due to increased rates of waste incineration (see Table 3-1). Incinerated amounts increased from 0.2 Mt waste to 1.5 Mt between 2005 and 2016. As emissions of waste incineration plants are not covered under the EU ETS, this increase is expected to have effects on ‘industry and other’ emissions. In addition the energy system of Finland is specifically decentralized. Leading to smaller plant sizes which are not covered under the EU ETS, either.

The level of emissions above 2030 AEA targets (6 Mt CO_2eq) is similar to annual emissions from the agriculture sector. Ambition levels in the WEM scenario are rather low, especially in the major sectors (transport and agriculture). The dynamics in the transport sector show that the biofuel policy has a strong impact but other measures in this sector will also become necessary. It will be necessary to increase ambition in all sectors to achieve substantial emission reductions to achieve the ESD targets.

As mentioned before, the additional policies and measures considered in WAM projections submitted in 2017, reduce the gap to ESD target 2030 by two third, to 2 Mt CO_2eq. They mainly address the transport sector, but also small reductions for the ‘industry and other’ sector and the residential and commercial sector are reported (in total 0.6 Mt CO2eq).

3.4 Germany

1. The three main ESD sectors in Germany are transport, buildings and ‘industry and other”. These show particularly strong increasing trends in recent years with transport and ‘industry and other’ both facing increasing emissions since 2005. The source of emission increases in the transport sector is road transport, especially from heavy duty vehicles and busses. The reason for emission

increases in the 'industry and other' sector might be due to the increased implementation of waste incineration plants and other heat and power generation and industrial process installations which are not covered under the EU ETS.

2. Emissions from the agriculture sector also increased since 2005 and are projected to stay about constant until 2030.
3. Main emission reductions since 2005 can be observed from the buildings sector but these are partly related to lower heating degree days, not only to effective policies and measures.
4. ESD emissions 2016 are clearly above AEAs which was not expected with projections submitted in 2017. The difference between projections and approximated ESD emissions for 2017 even increased. With projections reflecting existing or adopted policies and measures, ESD emissions are projected to stay above AEA until 2030, apart from the years 2021. Submitted projections with additional measures do not reduce the gap between emissions and AEA considerably.

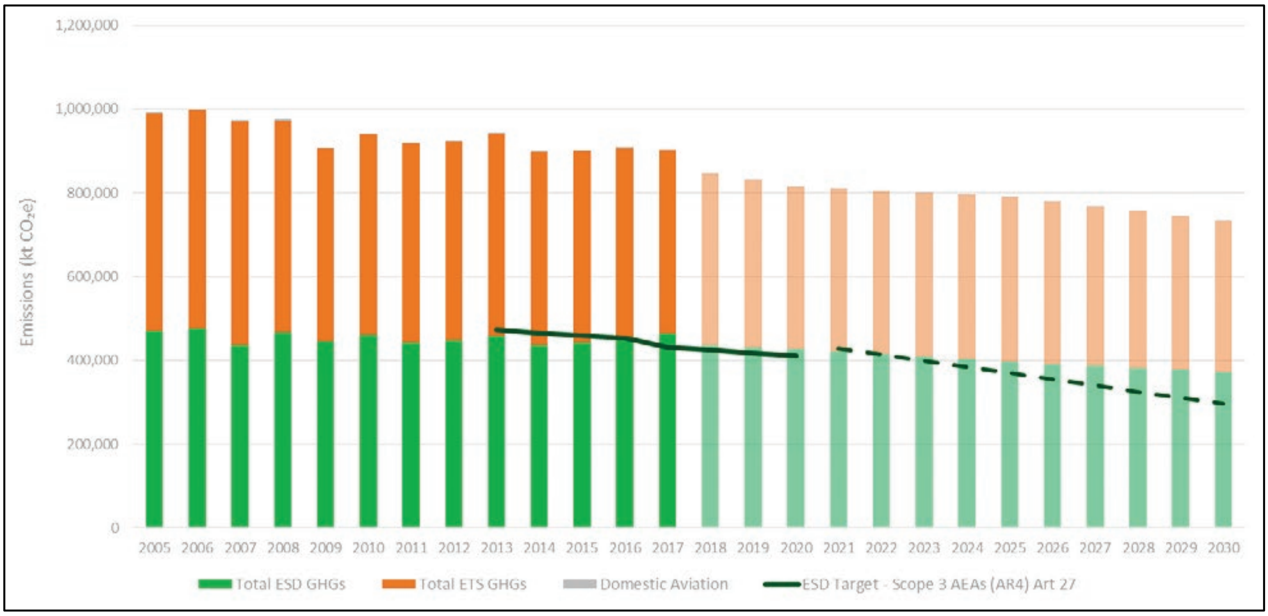
3.4.1 Overview of emission trends in ETS and ESD since 2005

Compared to most other countries, Germany has a high ETS share of overall GHG emissions. Emissions from ETS sectors are projected to continuously decrease up to 2030 (Figure 3-17). The decrease of ETS emissions between 2005 and 2017 is considerably faster (10 times) than in the ESD sector. ETS emissions decreased by 16 % between 2005 and 2017, whilst ESD emissions only decreased by 2 %, with an increasing trend between 2014 and 2017. This increase is not reflected in projections which show a steadily decline with emissions in 2030 projected to be 20 % below 2017 levels.

This latest raise in GHG emissions surely has many reasons. For ESD emissions population and economic developments are highly relevant if consumption habits do not change significantly. The development of both factors has been projected differently compared to latest historical developments: While the population has been projected to decrease until 2017 by 0.4 % (considering a linear development between the reference year 2014 and the first projected year 2020), population increased by 2.2 % according to Eurostat numbers[9]. In addition the real GDP growth rate has been projected to be at 1.3 % until the year 2020, whereas historical growth rates between 2014 and 2017 have been between 1.7 and 2.2 %, according to Eurostat[10].

[9] http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_gind&lang=en
[10] https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tec00115&language=en

Figure 3-17 ESD, ETS and domestic aviation emissions in Germany 2005 to 2030 with ESD targets highlighted



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

3.4.2 ESD emissions compared to ESD targets

ESD Emissions have been below annual ESD targets in the years 2013 to 2015, but from 2016 on it is expected that ESD emissions will be above annual AEA apart from the year 2021. The difference between proxy ESD emissions in 2017 to projected values is 24 Mt CO_2eq. This leads to the assumption that emission reductions until 2020 are overestimated in GHG projections, which have been submitted in 2017.

Germany submitted a projection with additional measures. With these additional measures the difference between emissions and AEA in 2030 of 76 Mt CO_2eq (16 % of base year emissions) is reduced to 53 Mt CO_2eq (11 % of base year emissions). Half of this reduction is related to an additional policy targeting the transport sector while the other half is related to a bunch of PaM targeting the residential and commercial Sector.

3.4.3 ESD emissions by sector

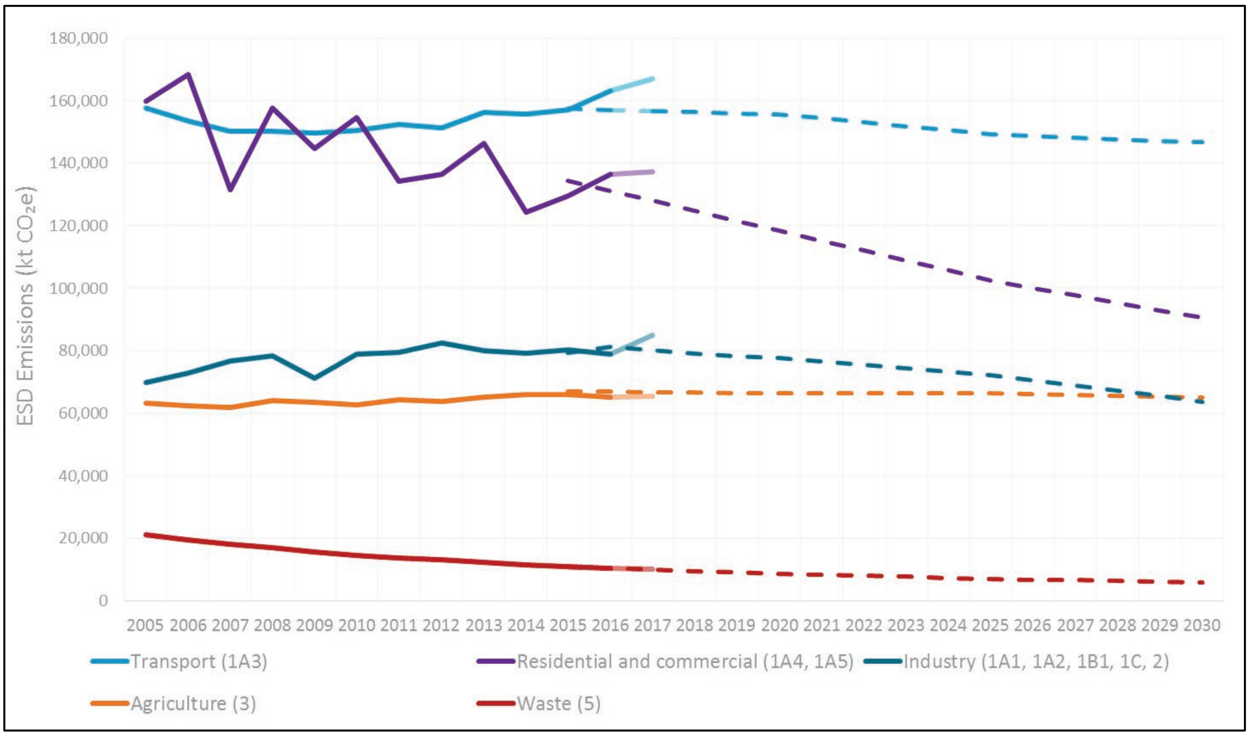
The three most important sectors are the transport, residential/commercial and the ‘industry and other’ sectors (see Figure 3-18 and Figure 3-19). Emissions in the transport and the ‘Industry and other’ sector increased relatively steadily compared to 2007, with a strong increase in latest years. A remarkable decrease of emissions took place in the residential/commercial sector since 2005, but since 2014 emissions are again increasing. Emissions from agriculture are about constant since 2005 and waste emissions are decreasing constantly.

In all three most important ESD sectors, latest GHG projections with existing and adopted policies and measures (WEM) show decreasing trends while emissions increased, especially with 2017 proxy results (see Figure 3-20).

To understand these divergent developments it is important to notice, that the projection report submitted in 2017 used 2014 as a reference year. This means that emission developments after 2015 have not been taken into account. During the QA/QC process conducted by ETC/ACM, the reference year has been changed to 2015 to align the projection with other MS projections to an aggregated EU projection.

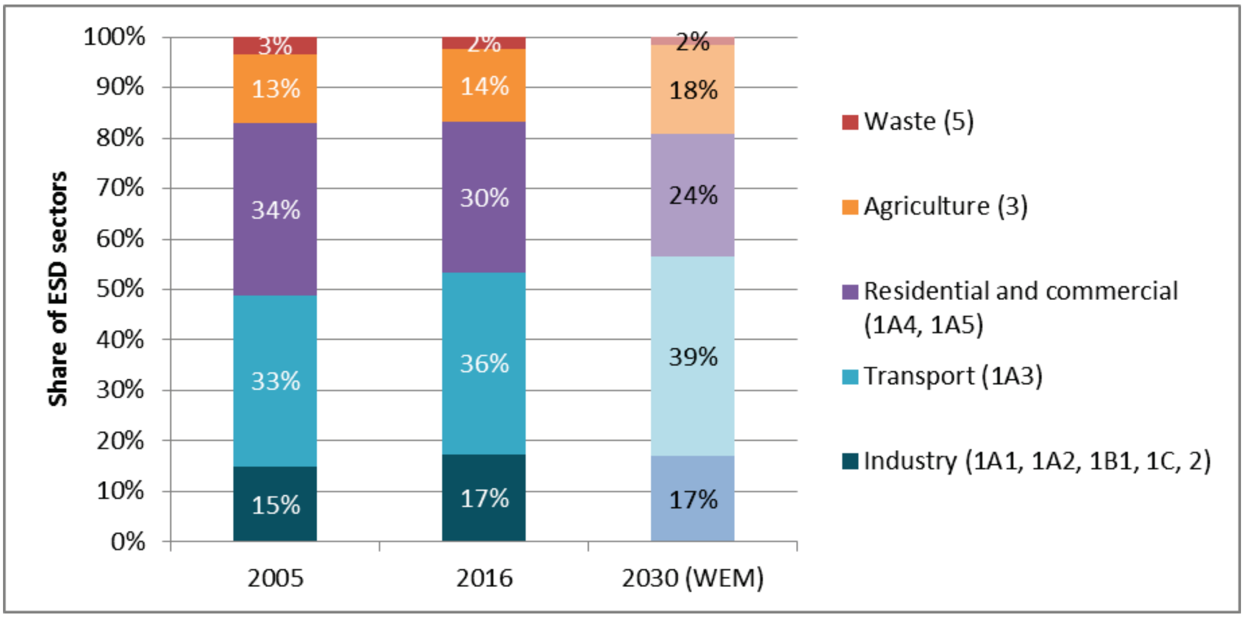
Historical emission trends in both less important ESD sectors are in line with projections: agriculture emissions are projected to stay about constant until 2030 and waste emissions are projected to further decrease.

Figure 3-18 ESD emissions in Germany 2005 to 2030 by sectors



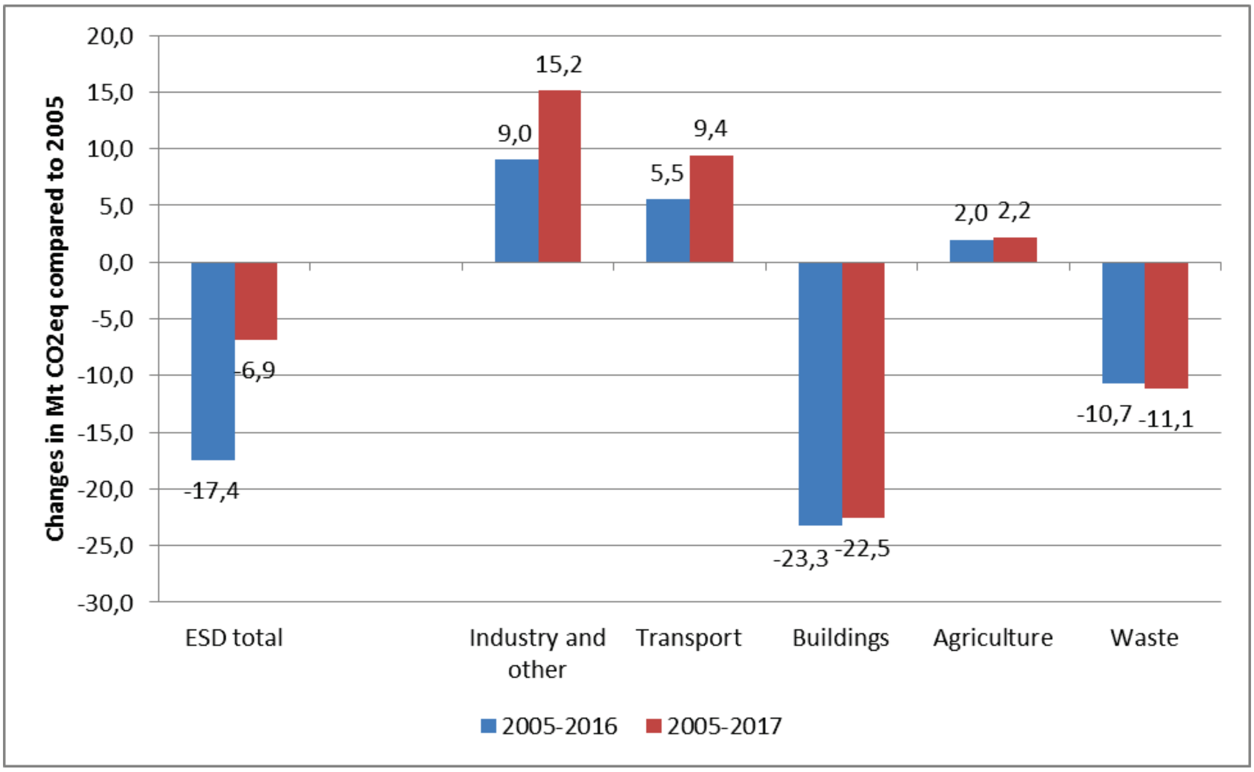
Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-19 Share of ESD emissions in Germany in 2005 and 2016 by sectors



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-20 Absolute change in annual ESD emissions in Germany between 2005 and 2016/17



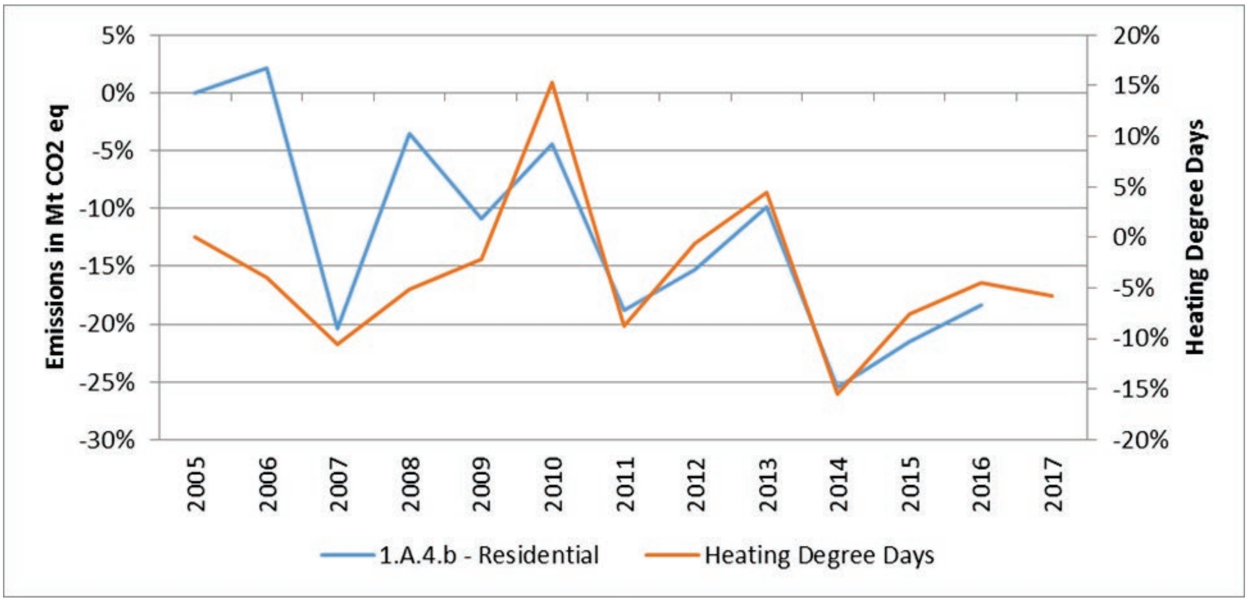
Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

The highest share of emissions under the sector residential/commercial is located under the residential sector 1.A.4.b so that emission increases in this subsector are responsible for the emission increase observed in the sector residential/commercial since 2014.

Even with increasing emissions in this subsector since 2014, emissions decreased by about 20 % between 2005 and 2016 (see Figure 3-21). In this figure a strong correlation between heating degree days and emissions becomes obvious. So emission reductions are partly related to decreasing heating degree days and vice versa. But in 2016 and 2017 heating degree days are lower by only 5 % compared to 2005, while emission reductions are about 20 %. This leads to the assumption that there was a considerable emission reduction in this subsector independently from heating degree days.

With WEM projection submitted in 2017, emissions from the residential/commercial sector are projected to decrease by 34 Mt CO_2eq between 2014 and 2030, the highest and most important reduction for ESD emissions in this country. There are currently several policies and measures (WEM) in place. The largest emission reductions are related to building measures, e.g. Grants for efficient heat pumps and solar heating installations, KfW programme to support energy standards for new buildings and the tightening of minimum energy requirements for new buildings. They are expected to reduce emissions by 28.3 Mt CO_2eq by 2030. Other relevant measures in the ESD sector are aiming at the reduction of F-gases (SF6 ban, Limitation of HFCs in passenger cars and HFC phase-down), which are estimated to reduce emission by another 15.5 Mt CO_2eq by 2030. On the other hand, for the most significant ESD sector transport only four PaMs are reported which contribute to emission reductions of only 0.6 Mt CO_2eq by 2030. Germany states in its projections report that the increase in traffic volume is not fully compensated by efficiency measures.

Figure 3-21 Changes of residential emissions by category and Heating Degree Days compared to 2005

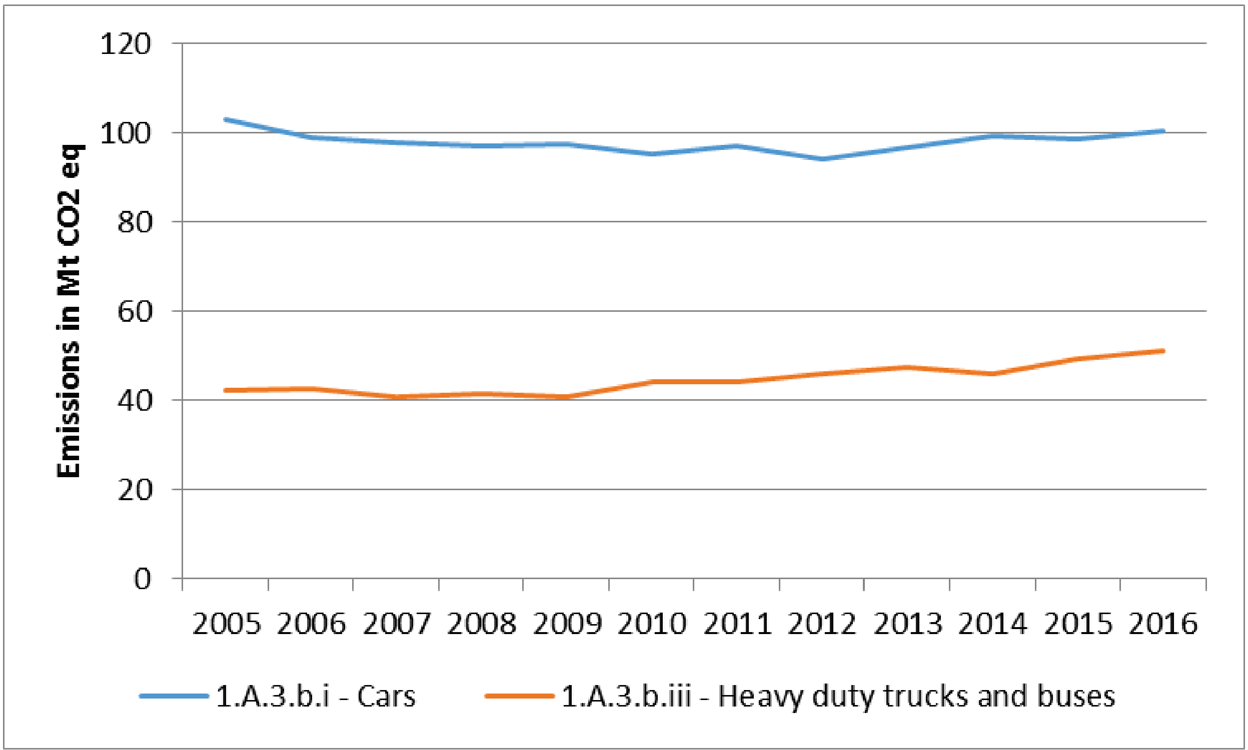


Sources: EEA, 2018e; Eurostat, 2018

The increase of emissions under the aggregation of ESD-Industries is difficult to locate. No specific sector covered under this sum shows an increasing trend which can be easily attributed to the overall 'industry and other' trend: On the one hand it is a steady increase since 2005 which might be due to the ongoing decentralisation process of the energy system in Germany. While this is an important aspect for the *Energiewende* (energy transition), this trend might lead to smaller plant sizes, which are not covered under the EU ETS. In addition emissions from the 'industry and other' sector might show an increase between 2005 and 2017 due to increased rates of waste incineration (see Table 3-1). Incinerated amounts increased from 14.2 Mt to 16.1 Mt between 2005 and 2016. As emissions of waste incineration plants are not covered under the EU ETS, this increase is expected to have effects on 'industry and other' emissions. As activity data for 2017 are still missing, the expected high increase of emissions under this sector from 2016 to 2017 with proxy emissions is difficult to explain in the moment of writing.

Emissions under the transport sector are dominated by emissions from cars and heavy duty trucks and buses. Especially the later shows constant and high increases since 2005 (see Figure 3-22)
Obviously policies and measures targeting this sector did not show relevant effects until now. With existing policies and measures as reported in WEM scenario submitted in 2017, emissions are projected to decrease by 10 Mt CO_2eq compared to 2014, which is not a relevant contribution considering the high share of emissions of this sector in Germany. In addition emissions in this sector increased by 10 Mt CO_2eq between 2014 and 2017.

Figure 3-22 **Emissions from cars and heavy duty trucks and buses in Germany**



Source: EEA, 2018e

Following the results of the WAM scenario, additional 23 Mt CO_2 eq shall be reduced in the Effort Sharing sector due to the implementation of additional measures until 2030. Most of this reduction can be attributed to PaMs directly related to the ESD sector. The most important PaM within this context is a PaM targeting the transport sector: "Continuing the CO_2 regulations for newly registered cars" with an additional effect of 11.4 Mt CO_2eq by 2030. There are several policies addressing the residential and commercial sector, but with a rather small effect (approx. 8 Mt CO_2eq by 2030).
Even if existing policies and measures partly have increased energy efficiency in recent years (see e.g. BMWi, 2018), the effects to reduce absolute emissions have not been sufficient to reduce ESD emissions below ESD targets. Considering the latest increasing trends of ESD emissions and the low success in reduction efforts, projected emission reductions even with additional measures will not be sufficient to fill the gap of 76 Mt to ESD target 2030.

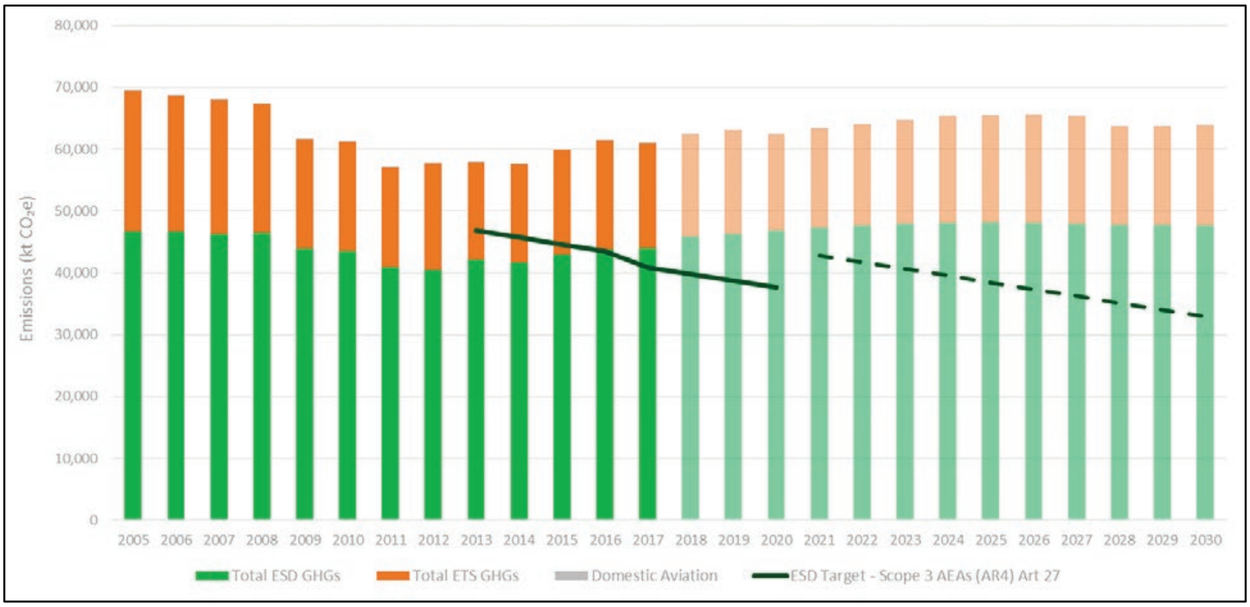
3.5 Ireland

1. Total ESD emissions slightly declined between 2005 and 2017 (-6 %) with lowest emissions in 2011, assumingly as a result of the economic crisis. As ESD emissions level off in 2018, Ireland is expected to exceed its AEAs from 2016 onwards.
2. ESD-Emissions in Ireland are dominated by the agriculture sector where emissions are projected to increase with 2030 levels expected to be 9 % higher than in 2005. This increase is primarily due to an increase in beef cattle across the time series.
3. Emissions from transport decreased between 2005 and 2017 but there is an increasing trend since 2012 and emissions are also projected to increase primarily due to an increase of diesel consumption in road transport. From 2025 transport emissions begin to decline due to the uptake of electric vehicles, but remain over 10 % greater than 2005 levels in 2030.

3.5.1 Overview of emission trends in ETS and ESD since 2005

Ireland's total GHG emissions show a considerable drop of emissions in 2011, mainly due to the economic crisis, and afterwards again an increase of emissions. In 2005, ESD emissions contributed to approximately two thirds or Ireland's total GHG emissions (Figure 3-23). With higher emission decreases in the ETS sector (-26 %) than in the ESD sector (-6 %), the share of 72 % is now the fourth highest ESD share across Member States, only Luxembourg (85 %), Latvia (82 %) and France (77 %) have higher ESD shares with 2017 proxy estimates. Considering historic and projected development until 2030, the lowest annual total GHG emissions would have occurred in 2011. Emissions from ESD sectors are projected to slightly increase until 2030, with even slightly higher projected ESD emissions in 2030 than in 2005. Emissions from ETS sectors are projected to remain about stable across the time series. As a result of the reduction in ETS emissions across the time series, the proportion of ESD emissions increases to 75 % of total GHG emissions by 2030.

Figure 3-23 ESD, ETS and domestic aviation emissions in Ireland 2005 to 2030 with ESD targets highlighted



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

3.5.2 ESD emissions compared to ESD targets

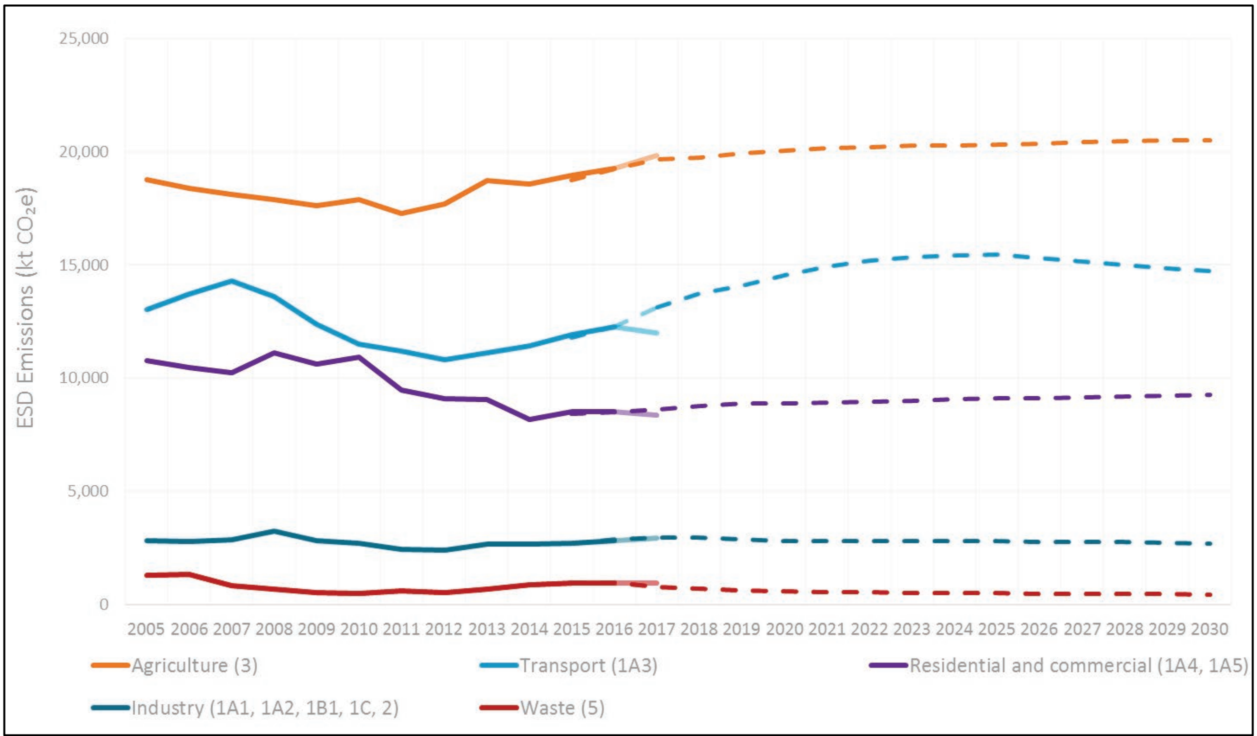
Ireland stayed below its AEAs between 2013 and 2015, but slightly exceeded the 2016 target (by 0.6 % compared to ESD base year emissions). With proxy emissions for 2017, Ireland exceeds its ESD target by 7 %. With GHG projections submitted in 2018, emissions remain about constant. With decreasing ESD targets ESD emissions are projected to stay above ESD targets up to 2030 (see Figure 3-23). In order to achieve the 2030 ESD emissions target, emissions of Ireland need to be reduced by about 15 Mt CO_2 eq. (31 % of base year emissions), about the size of emissions from the transport sector.

Ireland submitted a projection with additional measures. With these additional measures the difference between emissions and AEA in 2030 is only reduced by 1 Mt CO_2eq which does not appear to be enough to reduce Effort Sharing emissions below AEA.

3.5.3 ESD emissions by sector

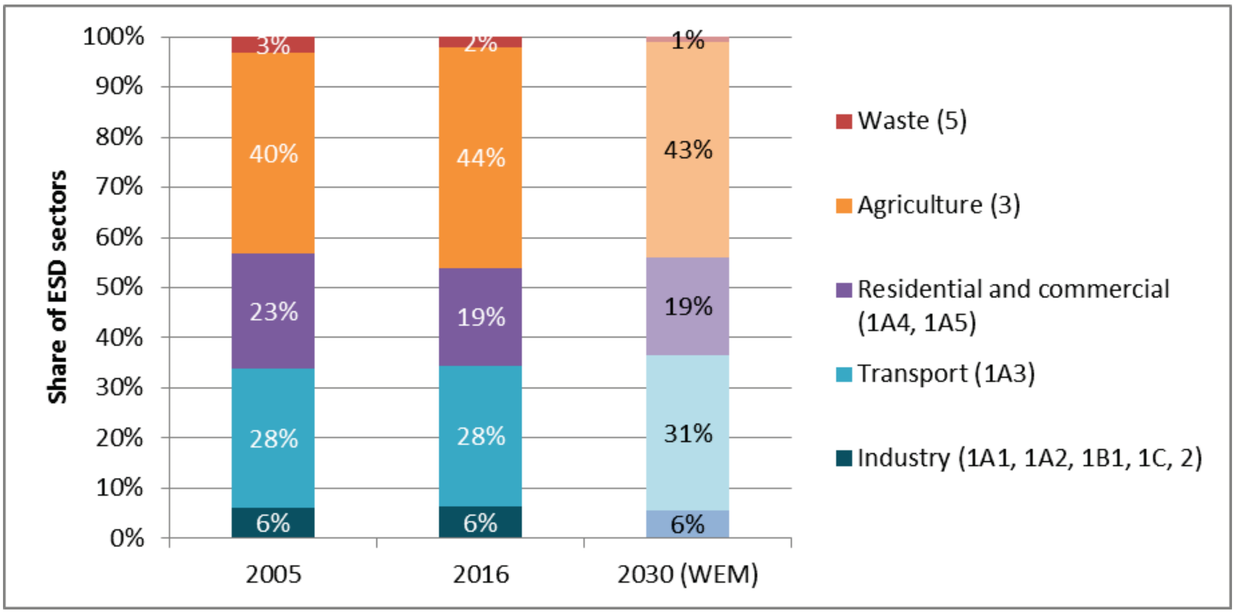
ESD emissions in Ireland are dominated by the agriculture sector (Figure 3-24 and Figure 3-25) where they have increased between 2005 and 2017 (Figure 3-26) and is expected to continue increasing up to 2030. Between 2005 and 2016, the relative share of the sectors remain relatively constant with a slight increase of the proportion of emissions from agriculture and a corresponding decrease in emissions from residential/ commercial (Figure 3-25). The transport and residential/ commercial sectors account for approximately half of Ireland's ESD emissions. Between 2005 and 2017, annual emissions from these sectors decreased (see Figure 3-26). From 2016, transport emissions are projected to increase with emissions peaking in 2025 having increased by one third compared to 2017 levels. In the residential/ commercial sector, annual emissions are projected to peak in 2008 and remain constant from 2018, remaining below the 2005 emission levels in 2030 by one fifth. Emissions from 'industry and other' sector are projected to remain constant across the time series whereas annual emissions from the waste sector are projected to decrease by two thirds the 2005 levels by 2030. Between 2016 and 2017, emissions increases from agriculture and 'industry and other' results in an overall increase in ESD emissions despite reduced emissions in the transport, residential/ commercial and waste sectors (see Figure 3-26).

Figure 3-24 ESD emissions in Ireland 2005 to 2030 by sectors



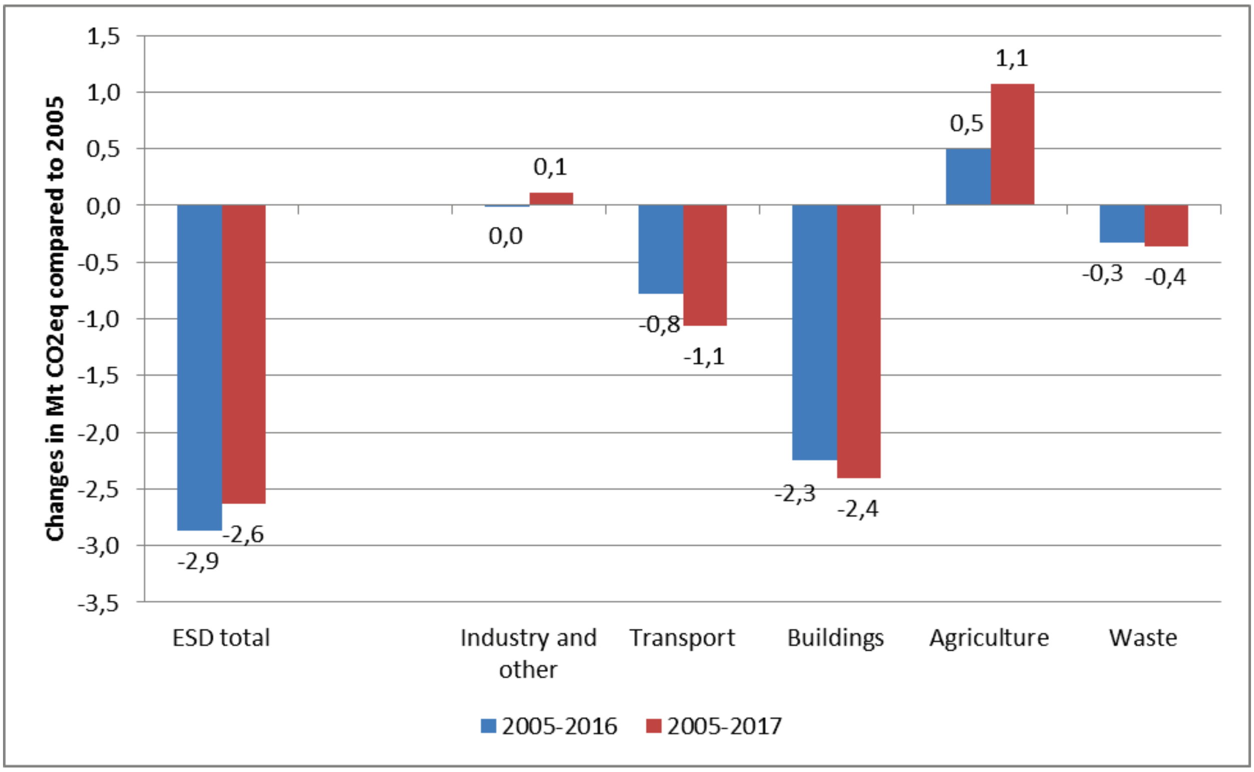
Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-25 Share of ESD emissions in Ireland in 2005 and 2016 by sectors



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-26 **Absolute change in annual ESD emissions in Ireland between 2005 and 2016/17**

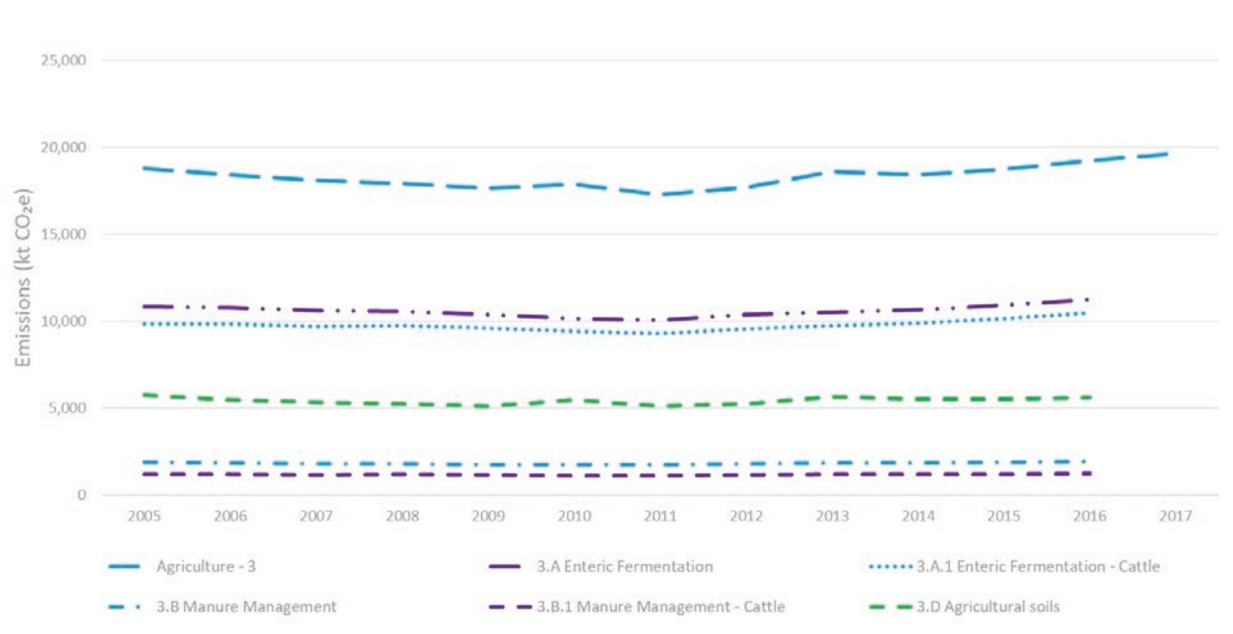


Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Agriculture is the most significant sector contributing to the increased ESD emissions between 2005 and 2030 and the exceedance of Ireland’s AEAs between 2017 and 2030. Most emissions are from enteric fermentation from cattle followed by agricultural soils (Figure 3-27). These emissions have remained constant between 2005 and 2016. The projected increases in agriculture emissions are primarily due to the expected increases in the number of beef cattle which is projected to rise by 10 % and 22 % in 2020 and 2030 respectively compared to current levels[11]. Only a slight increase in dairy cattle is projected between 2018 and 2020 and 2030. It is remarkable is that for the WEM scenario no PaMs are reported for the sector agriculture.

[11] http://cdr.eionet.europa.eu/ie/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwxk0vg/IE_GHG_Projections_Technical_and_Methodological_Approach_2018_Final.pdf

Figure 3-27 Agriculture emissions by category in Ireland 2005 - 2017

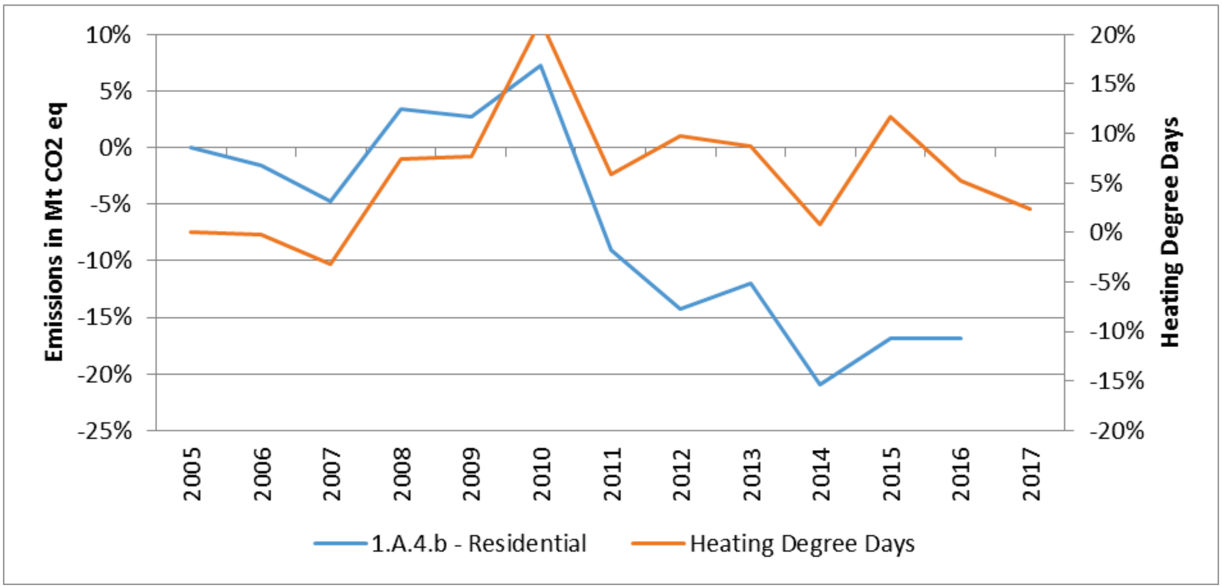


Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Emissions from the transport sector, the second largest sector, decreased between 2005 and 2017 by 1 Mt CO_2 eq., with lowest emissions in 2012, assumingly as a result of the economic crisis which had high negative impacts on the Irish economy. But emissions in this sector are also projected to increase between 2015 and 2025. This is due to an increase in diesel fuel combustion up to 2025. From 2025 annual emissions are projected to slightly decrease by an average of 1 % up to 2030. The main policies reported in the transport sector for the WEM scenario are: Biofuels (0.5 kt CO2eq in 2030), Improved fuel economy of private cars (0.2 Mt CO_2eq in 2030) and VRT and Motor tax changes (0.2 Mt CO_2eq in 2030).

Emissions decreases in the residential sector took place although there is a high correlation between emissions and heating degree days: While heating degree days increased between 2005 and 2017, emissions in the residential sector decreased as can be seen in Figure 3-28. This can be related to the quite large amount of existing building policies reported for the WEM scenario. The 15 PaMs contribute to a reduction of approximately 2.4 Mt CO_2eq in 2030.

Figure 3-28 Changes of residential emissions by category and Heating Degree Days compared to 2005



Sources: EEA, 2018e; Eurostat, 2018

The additional policies and measures reported by Ireland, lead to major reductions in the ETS sector, whereby for the ESD sectors emissions are projected to be reduced by only 1 Mt CO_2 eq. by 2030. The reported additional policies of the WAM ESD sectors, however, only amount to 0.5 Mt CO2eq, which might be due to cross-cutting effects of the building policies with the ETS sector. The promotion of biofuels in the transport sector is the WAM measure with the highest effect (0.2 Mt CO2eq by 2030). For the sector agriculture Ireland reports a PaM related to the efficient use of nitrogen fertilizers which is expected to reduce emissions by 0.16 Mt CO2eq by 2030. It can be concluded that rather strong additional efforts would be required to meet the ESD targets, as the WAM potential does not seem to be very ambitious.

3.6 Malta

1. Emissions from energy industry and processes which are not covered under the ETS (aggregated under the ‘industry and other’ sector) increased considerably compared to 2005. These sectors encounter the highest absolute increase of ESD emissions in Malta between 2005 and 2017 and become increasingly important for Malta, with a projected share of 30 % of total ESD emissions in 2030.
2. The second highest increase of ESD emissions is located in the residential/commercial sector. Of the six countries considered, Malta is the only country with emission increases in this sector since 2005, and emissions are projected to continually increase further, almost doubling in 2030 compared to 2005 levels.
3. Transport is the most important sector in absolute terms. This sector showed a considerable increase of emissions between 2005 and 2016, with an additional increase in 2017 proxy estimates. Strong emission reductions have been projected in GHG projections submitted in 2017 but with emission increases in latest years, reduction effects did not take place as projected. As a main measure in GHG projections, a modal shift from private vehicle use to public transport use has been considered, which is largely depending on the willingness of inhabitants.
4. Malta is in the particular situation inherent in small countries, where a single emission source or, the non-implementation of a particular measure, can have a significant impact on the country’s

total emissions. It is also clear that increasing tourism and GDP appear to be significant drivers of emissions for the island.

3.6.1 Overview of emission trends in ETS and ESD since 2005

Total GHG emissions decreased considerably since 2005, but with 2017 proxy emissions, a first increase of emissions since 2012 is expected (see Figure 3-29). This increase takes mainly place in the ETS sector. In 2017 Malta commissioned its first natural-gas fired power station which is combined with an LNG terminal. These two installations are accounted for under the ETS and subsequently increased energy industry emissions by 13 % driving the recent increase in ETS emissions.

While ETS emissions decreased considerably from 2005 to 2017 (-63 %), ESD emissions increased steadily by 42 %.

GHG Projections have been submitted in 2017, with 2015 as the reference year. A decrease of ETS emissions starting in 2015 has been projected but did not take place to the extent expected. ESD emissions have been projected to stay about constant until 2020 but instead proxy emissions 2017 show a considerably increase.

ESD emissions are projected to increase slightly until 2030, while ETS emissions slowly decrease, summing up to close to constant total GHG projections until 2030.

Figure 3-29 ESD, ETS and domestic aviation emissions in Malta 2005 to 2030 with ESD targets highlighted

Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

3.6.2 ESD emissions compared to ESD targets

Since 2013 ESD emissions are above annual ESD targets, between 2013 and 2017 a deficit of 800 kt will have been aggregated.

While Malta had a growth target for the ESD period by 5 %, resulting in close to constant annual ESD targets, there is a reduction target of -19 % for the year 2030. The deficit is expected to increase, especially with projected growing ESD emissions. In 2030, the difference between ESD emissions and AEA is projected to be about 0.5 Mt CO_2 eq., 46 % of base year emissions. These projections only consider existing and adopted policies and measures; no scenario with additional policies and measures has been submitted.

3.6.3 ESD emissions by sector

Historically emissions have been dominated by emissions from the transport sector; however these are projected to decrease. In the projection report a high amount of policies are mentioned which are targeting this sector (see Figure 3-30).

In the residential/commercial sector a strong increase in historic and projected emissions can also be observed. This is in contrary to the development in most other Member States (see Figure 2-3). Both transport and building sectors are highly dependent on population and GDP.

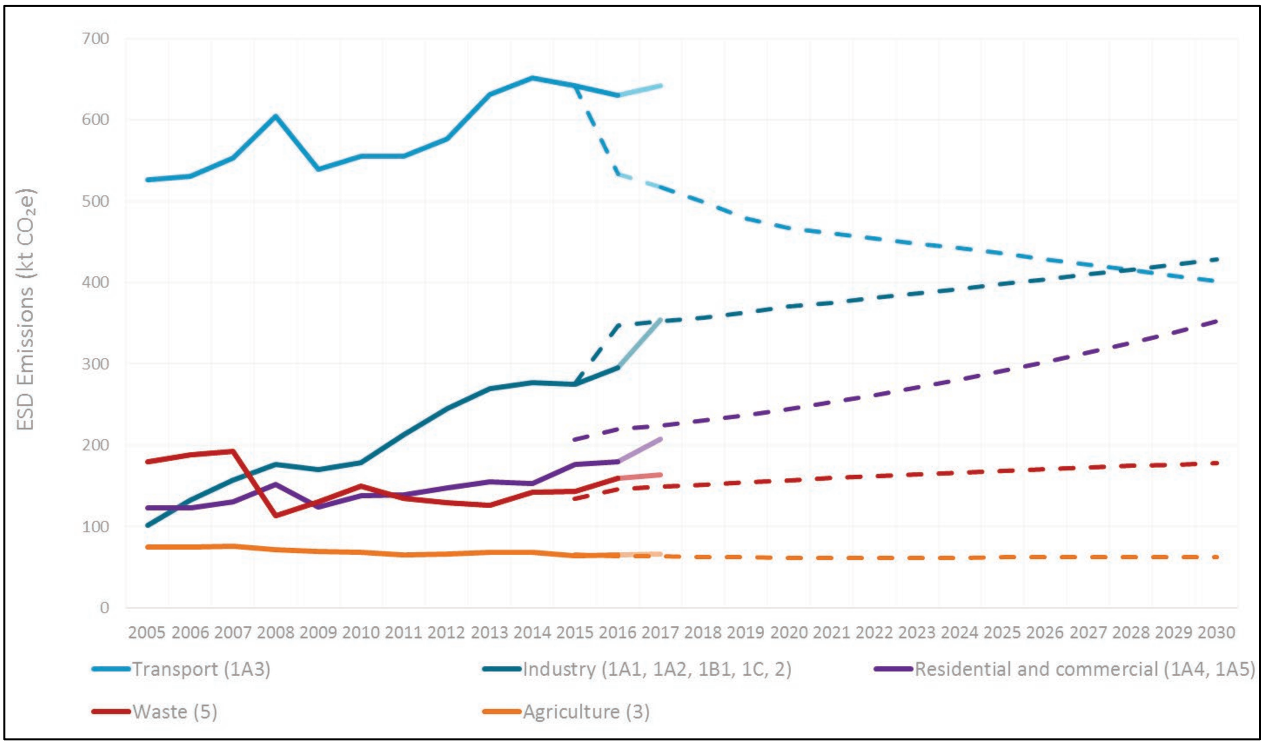
'industry and other' emissions nearly triplicated between 2005 and 2017. The main increase results from the development of F-Gases, which makes up nearly the total of process emissions in this country. HFC emissions in Malta increased from 42 kt in 2005 to 257 kt. This might be the result of an increased application of air conditioning systems.

A further driver of emissions is the increase of cooling degree days, which can be seen in Figure 3-34. Higher cooling degree days increase the use of air conditioning. This leads to higher electricity consumption which might mainly show effects in the ETS, if power generation installations are larger than 20 MW. This might be questioned for Malta. In addition it increases the need for these applications, which are filled with HFC, covered under the ESD.

Malta encounters highest emission reductions in the agricultural sector compared to the other five Member States between the years 2005 and 2017 (see Figure 3-32), but the share of this sector on total ESD emissions is very low (see Figure 3-31). Agriculture emissions are decreasing mainly due to decreasing N_2O emissions from the use of fertilizer as improved cultivation practices are adopted, mainly through the Nitrates Action Program.

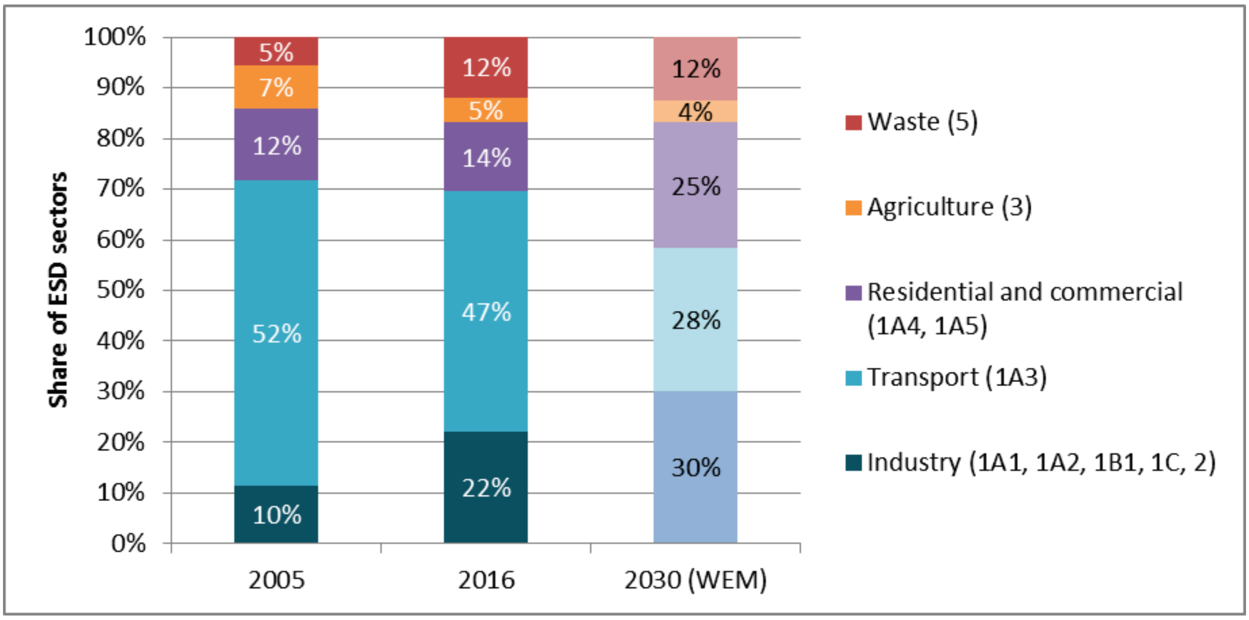
Waste emissions are projected to increase after a solid reduction of emissions in this sector. Higher transport, 'industry and other', building but also waste emissions might all be due to an increasing number of tourists. Eurostat numbers show an increase of 25 % in nights spent at hotels between 2005 and 2017, which might be highly relevant with regard to emissions for a small island (see Figure 3-34).

Figure 3-30 ESD emissions in Malta 2005 to 2030 by sectors



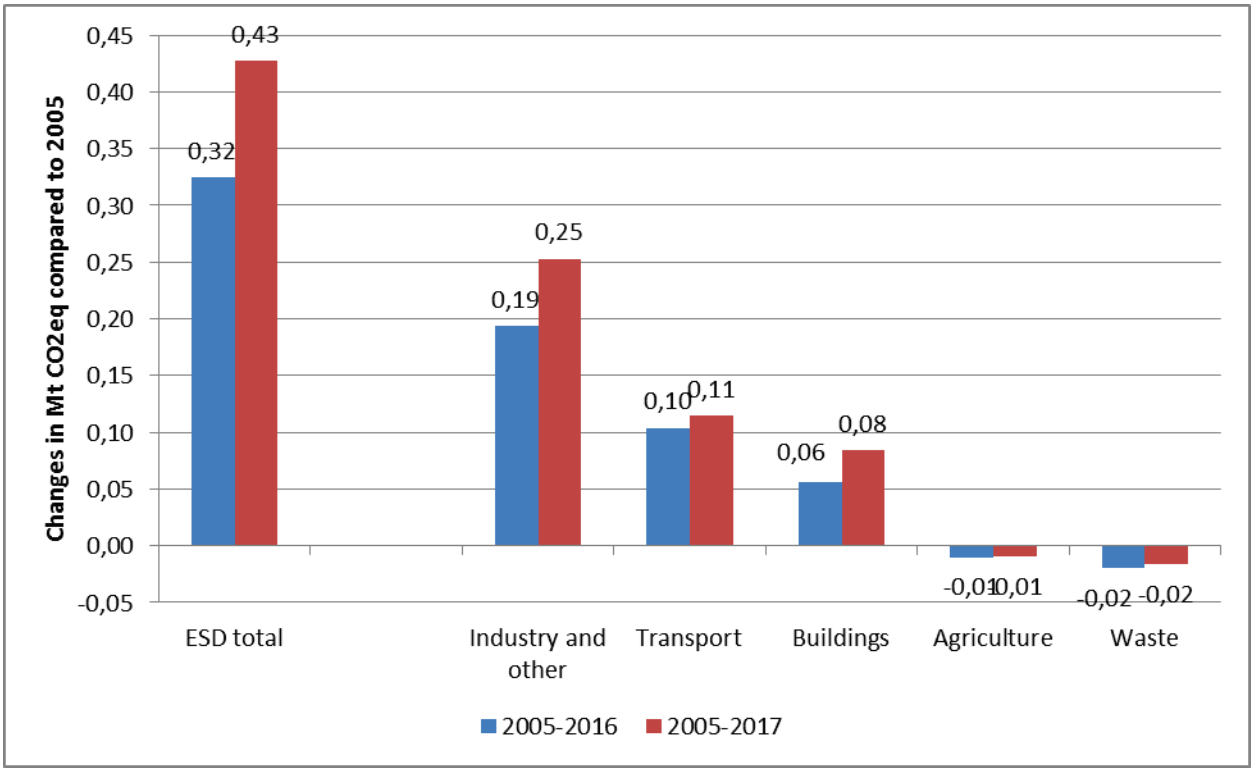
Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-31 Share of ESD emissions in Malta in 2005 and 2016 by sectors



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

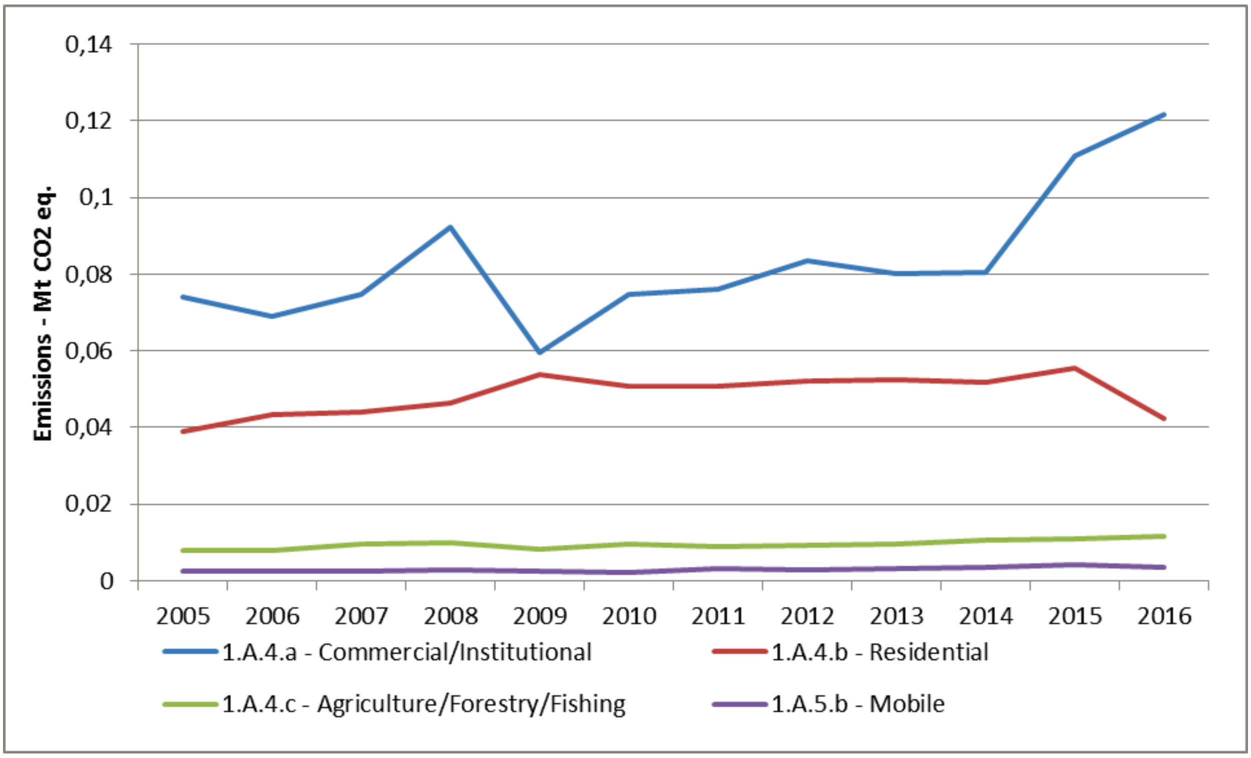
Figure 3-32 Absolute change in annual ESD emissions in Malta between 2005 and 2016/17



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

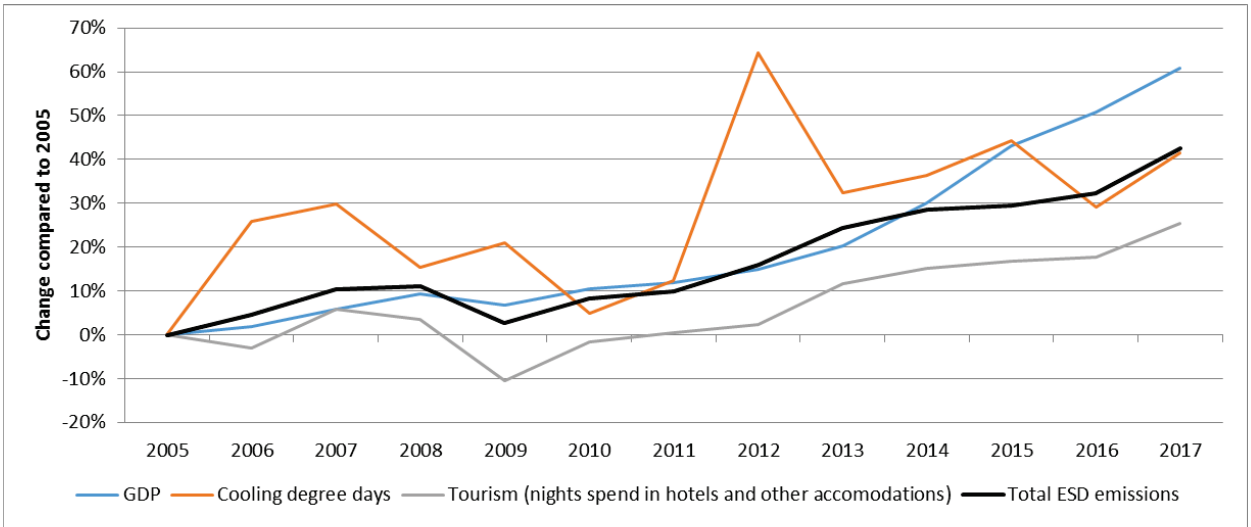
In Figure 3-33 the emission development in subsectors of the residential/commercial sectors are presented. It becomes obvious, that the main increase of GHG emissions took place in the commercial sector, where emissions increased considerably since 2014.

**Figure 3-33	Emission development in the residential/ commercial sector**



Source: EEA GHG dataviewer

**Figure 3-34	Historical total ESD emissions trends compared to emission drivers**



Sources: Eurostat, EEA GHG dataviewer

3.7 Poland

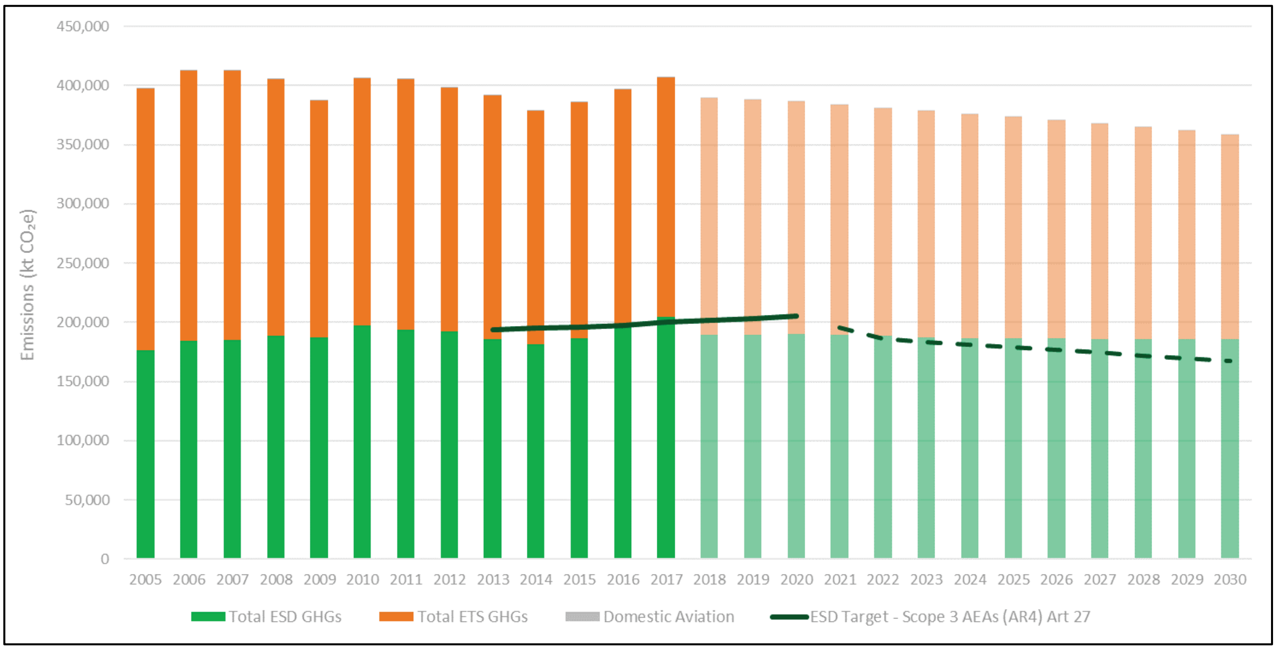
1. Total ESD emissions show a rise between 2014 and 2017 that take Poland above its AEAs in both 2016 and 2017.
2. The gap between Poland's AEAs and projections is estimated to increase from 2 % in 2017 to 11 % in 2030.
3. Emissions in Poland are dominated by the residential and commercial sector, although the important of the transport sector has risen sharply in recent years.

4. The transport sector is projected to increase in future years, in contrast to other sectors, to the point where it becomes the most important sector by 2030.

3.7.1 Overview of emission trends in ETS and ESD since 2005

In 2017 ETS emissions of Poland slightly declined by 9 % since 2005, whereby ESD emissions increased by 16 % in the same time (Figure 3-35), predominantly due to increases from the transport sector. In the year 2016 ETS and ESD each contributes half of the total emissions of Poland. The long-term trend shows that ESD emissions are expected to stay on a constant level. A very slight decrease of -6 % is projected for the year 2030 compared to 2005.

Figure 3-35 ESD, ETS and domestic aviation emissions in Poland 2005 to 2030 with ESD targets highlighted



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

3.7.2 ESD emissions compared to ESD targets

Poland has a growth target for the current ESD period; however, current inventory data (2016 and 2017 proxy) show that emissions have increased at a rate that leads to emissions above the target in these two years. For the other years between 2005 and 2020, historical and projected ESD emissions as submitted in 2017 are well below the target. On the contrary, for the ESR period 2021 to 2030 Poland will have a reduction target and current projections show that for almost all years (expect for 2021) the ESR emissions are above this target line.
In 2030, the difference between ESD emissions and AEA is projected to be about 19 Mt CO_2 eq., 10 % of base year emissions. These projections only consider existing and adopted policies and measures; no scenario with additional policies and measures has been submitted.

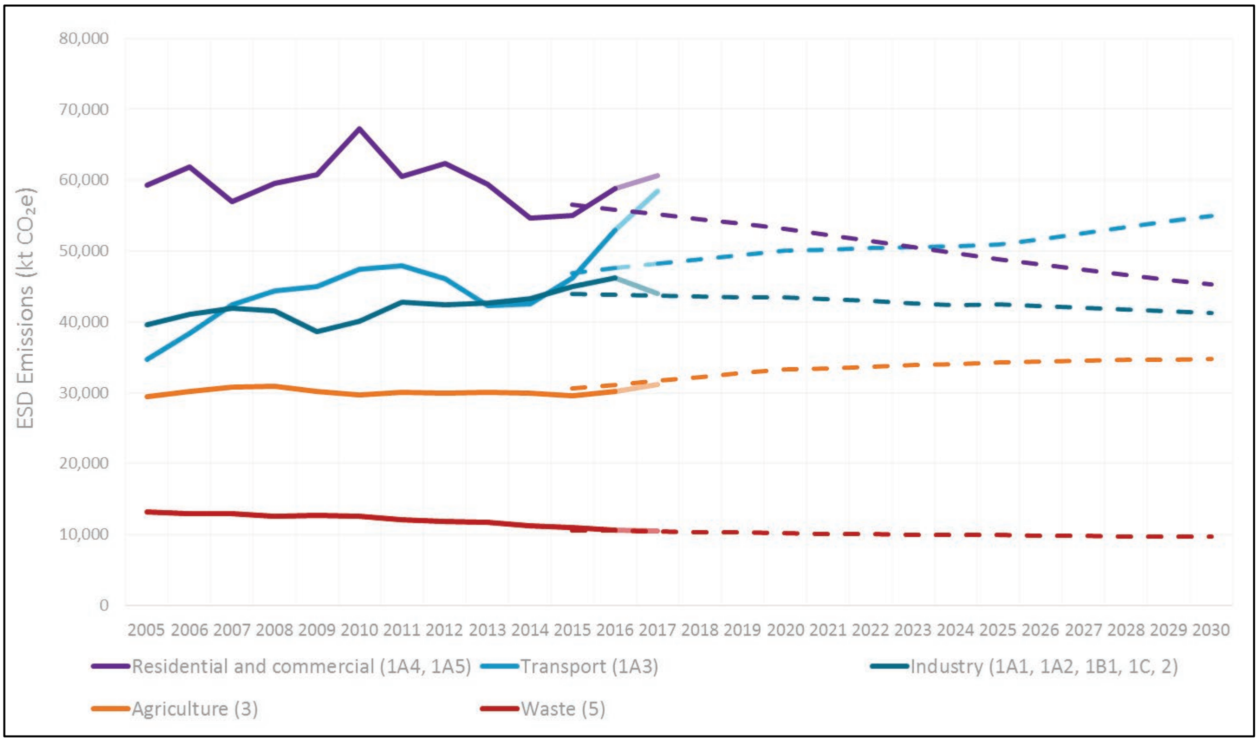
3.7.3 ESD emissions by sector

The largest contributor to ESD emissions is the residential/commercial sector (30 % in 2016), followed by transport (27 %) and ‘industry and other’ (23 %) (see Figure 3-37). Regarding the historic trend, emissions in the residential sector are on a relatively constant level with some annual variations caused by the heating needs and varying weather. However, in recent years (2016 and 2017) the emissions have increased substantially (see Figure 3-36).

The emissions from agriculture remained static in the period from 2005 to 2016/2017. The waste sector is the only sector where historical emissions declined substantially (by 20 %), but emissions are on a low absolute level. For the transport sector, a strong emission increase was reported (+52 % in 2016 compared to 2005) with a further increase estimated with proxy emissions for 2017. Emissions from 'industry and other' increased moderately by 17 % between 2005 and 2016.

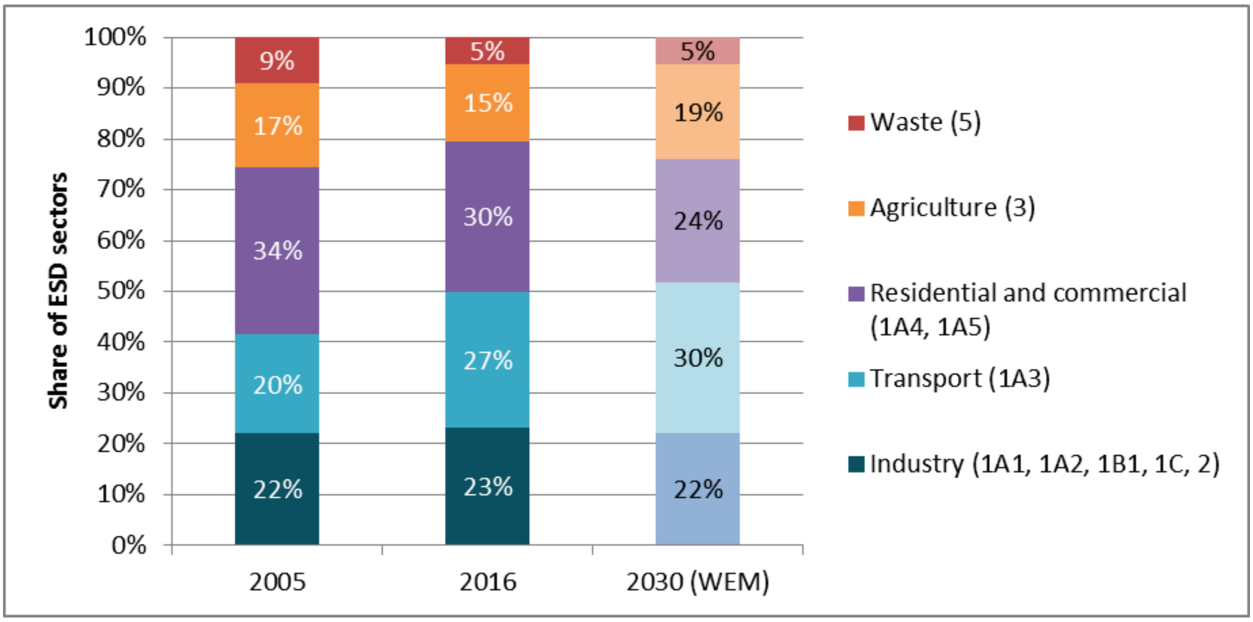
In the long-term trend, the ESD projections of Poland remain on a constant level in total with the WEM scenario submitted in 2017. However, residential/commercial emissions are projected to decline significantly by 2030. On the contrary, emissions from the transport sector are expected to increase in this period by about the same amount, such that it becomes the dominant sector by 2030. Projected increases are also reported for the agriculture and 'industry and other' sectors. Waste emissions are projected with a continued decrease.

Figure 3-36 ESD emissions in Poland 2005 to 2030 by sectors



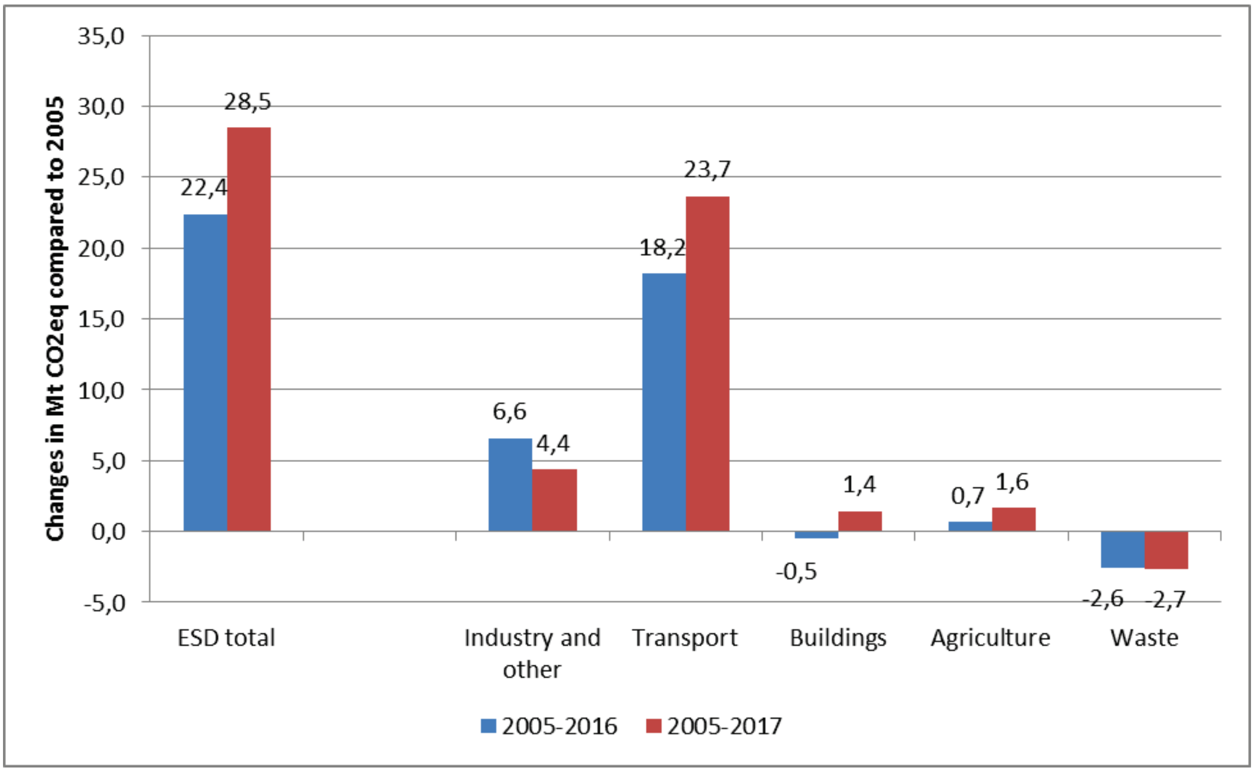
Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-37 Share of ESD emissions in Poland in 2005 and 2016 by sectors



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

Figure 3-38 Absolute change in annual ESD emissions in Poland between 2005 and 2016/17



Source: EC, 2017; EEA, 2018a, 2018d, 2018b, 2018e, 2018c; EU, 2018

For the most recent years (2016 and 2017 proxy), substantial emission increases compared to 2005 can be observed in the sector transport and 'industry and other'. Emissions in the transport sector increased by 7 Mt CO_2eq from 2015 to 2016 (see Figure 3-38). This jump can be explained by a revision of the methodology to calculate emissions from road transport in the Polish emission inventory. This revision does not allow the recalculation of the whole time series which is the reason for the particular high jump in latest years.

There is no detailed explanation provided in the NIR, however the activity data shows that there was a:

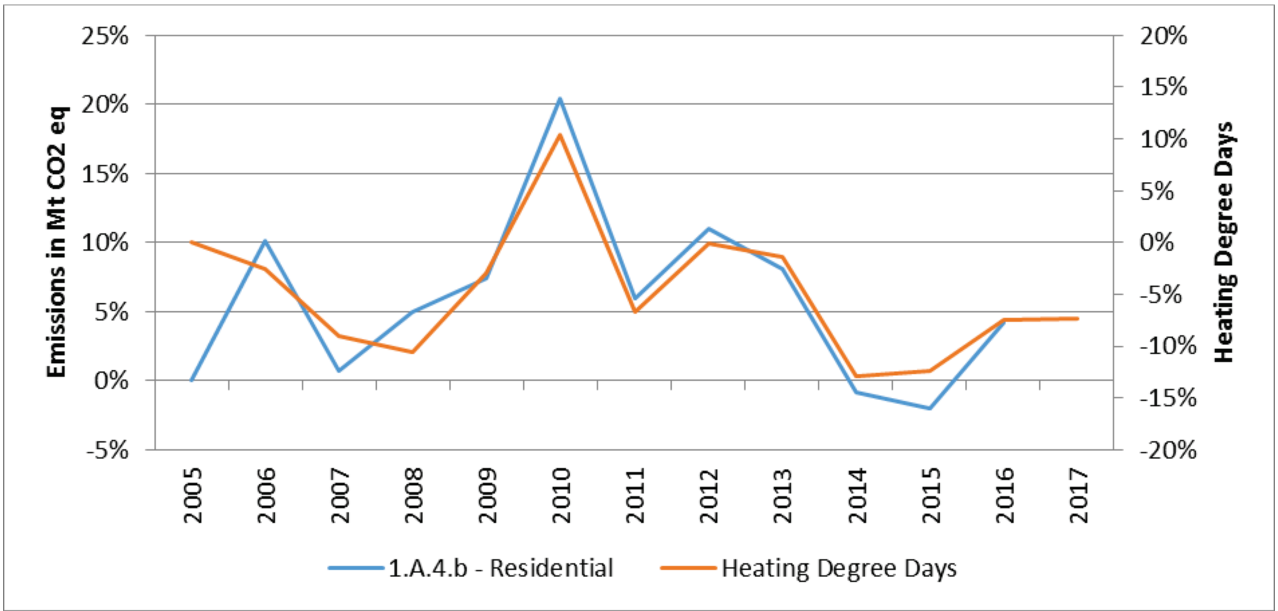
- high increase of diesel oil from 407 PJ to 484 PJ,

- slight increase of motor gasoline and LPG: + 14 PJ
- decline of biofuels by 14 PJ between the years 2015 and 2016.

(Source: Table 3.2.8.5, p. 81 in the NIR 2018)
In addition, Figure 3.2.8.5 of the Polish NIR 2018, shows that the number of vehicles has constantly increased since 1990, especially private cars.

The second highest increase of ESD emissions compared to 2005 level can be seen in the 'industry and other' sector. While emissions increase in total by 6.6 Mt CO_2 eq., 4.5 Mt CO_2 eq. might result from increasing F-Gas emissions which are mostly not covered under the EU ETS.
In the residential/commercial sector emissions increased from 2015 to 2016, however there is also no explanation for this trend provided in the NIR. The data shows that fossil fuel consumption has increased in 2016 in the residential and commercial subsector, from 417 PJ to 447 PJ (7 %) and from 117 to 128 PJ (9 %), respectively.
If emissions from the residential sector alone (1.A.4.a) are compared to heating degree days it becomes obvious, that there is a strong relation between both timeseries since 2009 which seems to not show any separation of these lines due to the effect of policies and measures for the reduction of emissions in this sector in latest historical years (see Figure 3-39). This is different to other Member States with a clear correlation between emissions and heating degree days, which have been assessed above.

Figure 3-39 Changes of residential emissions by category and Heating Degree Days compared to 2005



Sources: EEA, 2018e; Eurostat, 2018

The long-term emission projections show decreases in emissions from the main sector (residential/commercial), however, these efforts seem to be compensated by substantial emission increases in the transport sector, where measures seem to be not effective enough to lead to absolute emission decreases. An absolute emission reduction becomes even more difficult with latest emission developments in this sector. Currently Poland reports measures for all ESD sectors, but no reduction potentials are provided for the PaMs. However, from the input data provided in the projections report (Table 4.1), it can be seen that in the 1A4 sector hard coal consumption is projected to be reduced significantly (from 281 in 2015 to 184 PJ in 2030), whereby the other fuels remain on a rather constant level. For the transport sector the activity data for passenger cars show a doubling of Biodiesel and Bioethanol is assumed to increase by a factor of 4, but in absolute terms their contribution remains on a rather low level, because on the other hand, the total fuel consumption of road transport the diesel consumption is projected to increase by 24% by 2030.

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