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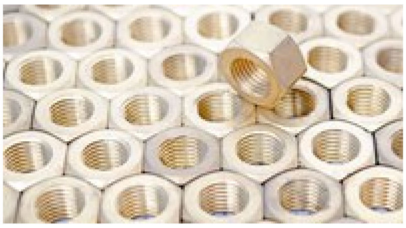
# EEA Environmental indicator report 2018 – in support to the monitoring of the Seventh Environment Action Programme

**Supplementary information to Priority Objective 2 of the Seventh Environment Action Programme** 'to turn the Union into a resource-efficient, green and competitive low-carbon economy' – online briefings underpinning the monitoring of Priority Objective 2:

Resource efficiency and low carbon economy

# Resource efficiency



| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Resource productivity | ▲ | Improve economic performance while reducing pressure on natural resources — Roadmap to a resource efficient Europe | ● |

Resource productivity — economic output per unit of material used — increased in the period between 2000 and 2017. The rate of increase of resource productivity has slowed down since 2013. Resource productivity is expected to continue to increase in the coming years albeit at a reduced rate of just below 1 % per year.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) includes the objective to improve resource efficiency by 2020. Increasing resource efficiency can lower environmental burdens by reducing the overall consumption of materials; at the same time it helps to sustain economic development by securing the supply of resources. Resource productivity is a proxy for overall resource efficiency in the economy. Between 2000 and 2017, resource productivity in the EU increased by 39 %. This is a positive development. Some of the increase was the result of a structural decline in the use of fossil fuels. However, most of the resource productivity gain occurred since 2008 and resulted mainly from a decline in the use of non-metallic minerals, primarily because of the reduced activity in the material-intensive construction industry, which was strongly affected by the 2008 economic downturn. With the return of economic growth and a rise in the use of materials mostly for construction purposes, the rate of improvement in resource productivity has slowed since 2013. The longer term improving trend in resource productivity is expected to continue until 2020.

## Setting the scene

The 7th EAP priority objective 2 (EU, 2013) includes the objective that by 2020 the resource efficiency of the EU has to improve. Improvements in resource efficiency can result in lower pressures on the environment by reducing the overall consumption of materials in the economy. It can also help to sustain economic development by securing the appropriate supply of resources and investments in innovation, while increasing global competitiveness (OECD, 2015). This briefing presents trends in resource productivity. Since resource productivity measures the quantity of economic output produced using a certain amount of material resources, it is used as a proxy for resource efficiency by the European Commission. It effectively measures the decoupling of material use from economic growth. However, under conditions of relative decoupling, overall material use can increase despite an increase in resource productivity. Absolute decoupling means that resource use declines or remains stable under conditions of economic growth.

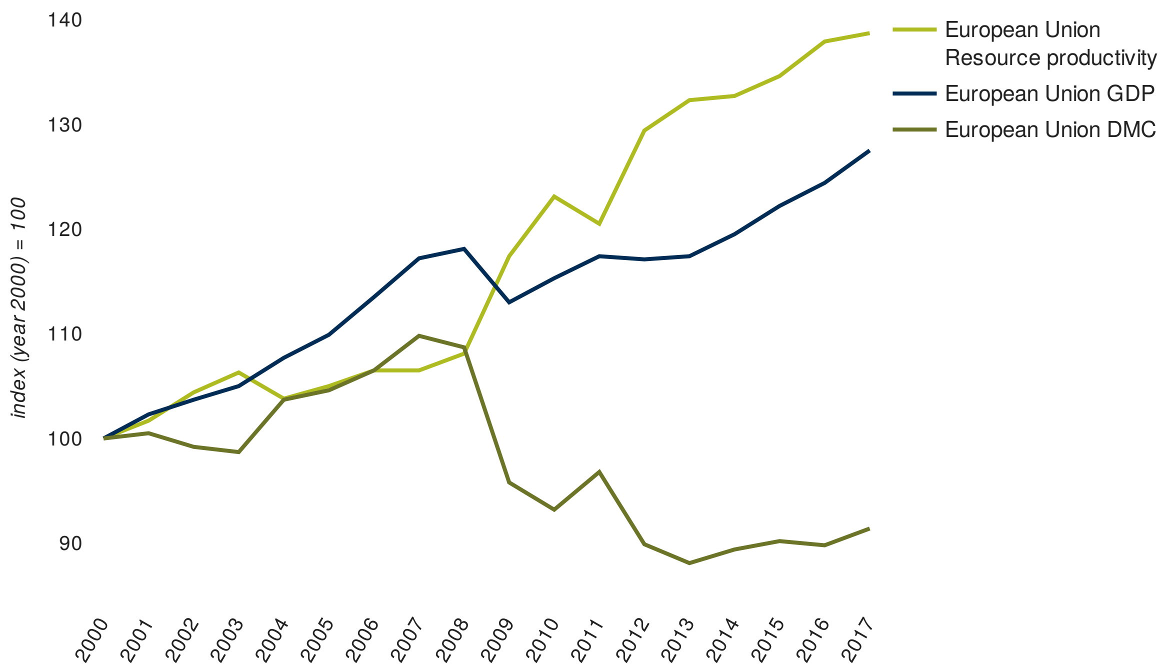
## Policy targets and progress

The ‘Resource-efficient Europe’ flagship initiative (EC, 2011a) of the Europe 2020 Strategy is aimed at promoting the decoupling of economic growth from resource use.

The broad objectives of the ‘Resource-efficient Europe’ flagship initiative become operational in the Roadmap to a Resource Efficient Europe (EC, 2011 b), the goal of which is to ensure increasing economic performance while reducing pressure on natural resources. Resource efficiency is viewed as the means to achieve this objective and resource productivity is the lead indicator for monitoring the progress of the actions in the roadmap. Neither the roadmap nor any other EU policy or strategy sets quantitative targets for improvements in resource productivity, although some Member States have adopted national targets (see country-level information section).

The Roadmap to a Resource Efficient Europe committed the European Commission to discussing and agreeing on resource efficiency indicators and targets. The 7th EAP recognised that ‘Resource efficiency indicators and targets ... would provide the necessary guidance for public and private decision-makers in transforming the economy. Once agreed at Union level, such indicators and targets will become an integral part of the 7th EAP.’ While targets have not been defined to date, a set of indicators has been published since 2013 in the form of the Resource Efficiency Scoreboard (EC, 2015a). Additional insights on raw material supply are provided in the Raw Materials Scoreboard (EC, 2018).

## Figure 1. Trends in resource productivity, domestic material consumption (DMC) and gross domestic product (GDP) in the EU




**Data sources:** a. Eurostat. Material flow accounts (env_ac_mfa) b. Eurostat. GDP and main components (nama_10_gdp)
c. Eurostat. Resource productivity (env_ac_rp)

**Note:** Resource productivity is measured in euros (chain-linked volumes, reference year 2010) per kilogram of domestic material consumption (euroCLV2010/kg DMC).

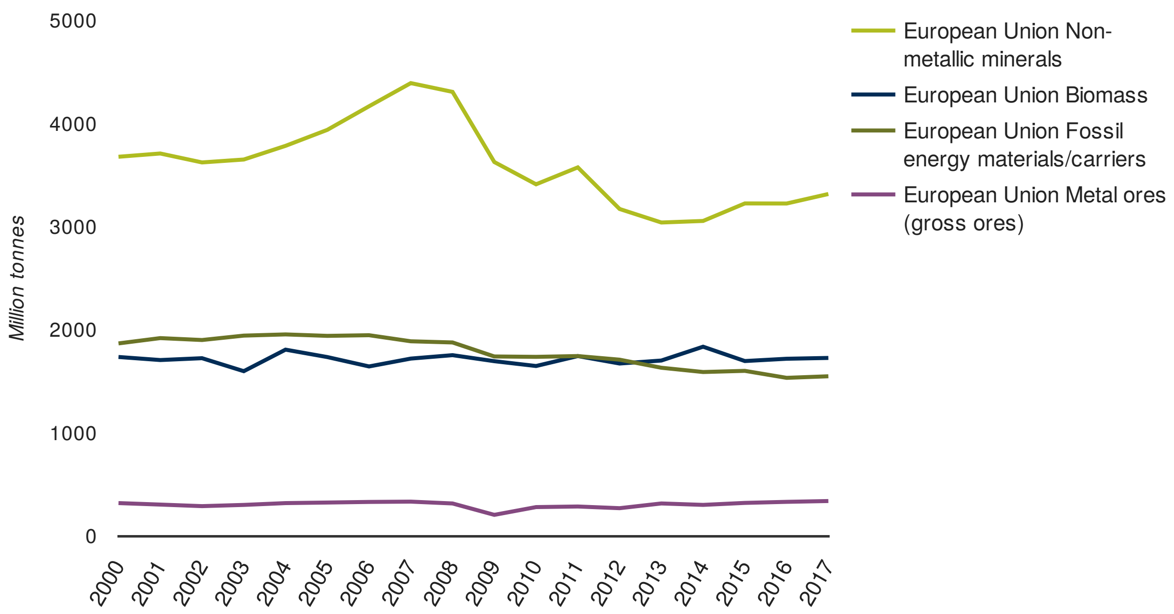
Figure 1 shows that resource productivity increased by 39 % between 2000 and 2017, with most of the improvement occurring after 2008. Although there were some fluctuations, 2000-2007 was a period during which material use (domestic material consumption, DMC) saw relative decoupling from economic growth (gross domestic product, GDP). In other words, material use grew but at a slower rate than that of the economy. The period from 2007 to 2013 is characterised by absolute decoupling, as material use declined while GDP increased. Finally, since 2013 there has been a relative decoupling again, as material use slowly increased.

Overall, the EU appears to be extracting more value from the material resources it uses. While this is indeed a positive development, it would not be justified to attribute this entirely to the success of environmental policies. Other economic and technical factors seem to have played a role, including the impact of the 2008 economic downturn, the changing structure of countries' economies, globalisation and increasing reliance on imports, and even the nature of the indicator itself (EEA, 2016).

From 2008 to 2013, a very important factor in resource productivity improvement was the 2008 economic downturn that followed the 2007/2008 global financial and economic crisis and lasted mainly until 2013. The economic downturn affected the material-intensive manufacturing and construction industries more than it affected services, which typically are less material intensive (Eurostat, 2018a).

While total material use (DMC) fell by 9 % between 2000 and 2017, it fell by 19 % between 2008 and 2013. This drop in the 2008-2013 period was largely due to a 29 % decline in the demand for non-metallic minerals over the same period (Figure 2), which was mainly caused by a slump in the construction sector where gross value added (in chain-linked volumes,referenceyear2010) fell by about 13 % over the same period (Eurostat, 2018b).

### Figure 2. Domestic Material Consumption (DMC) by type of material in the EU




**Data sources:** Eurostat. Material flow accounts (env_ac_mfa)

A slowdown in construction activity can have significant implications for the resource productivity of the economy as a whole. In 2008, the construction sector was responsible for more than one third of total material use in the EU (Eurostat, 2018c) but contributed only 6.3 % of its total economic output (and 5.3% in 2013) (Eurostat, 2018b). Therefore, this sector had a relatively low resource productivity, compared with the economy as a whole. The shrinkage in this sector that occurred between 2008 and 2013, therefore led to an increase in the resource productivity of the economy as a whole.

Another factor contributing to the resource productivity improvements is the 21 % decline in the consumption of fossil fuels between 2004 and 2017. While this decline accelerated immediately after the economic downturn, it is also the result of an increasing shift from fossil fuels to renewable energy and of overall improvements in energy efficiency in the economy as a whole (EEA, 2016). These latter developments can be expected to continue to 2020 and beyond in response to EU and national climate and energy policies.

A further cause of the underlying increase in resource productivity may be the long-term shift of the EU towards a service economy. For example, services increased their contribution to the EU economy from 71.8 % in 2006 to 73.9 % in 2016 (Eurostat, 2017).

There is currently insufficient information to determine the possible impact on resource productivity from the outsourcing of material-intensive production to other parts of the world. Further investigation is necessary to determine its effects (Eurostat, 2018a).

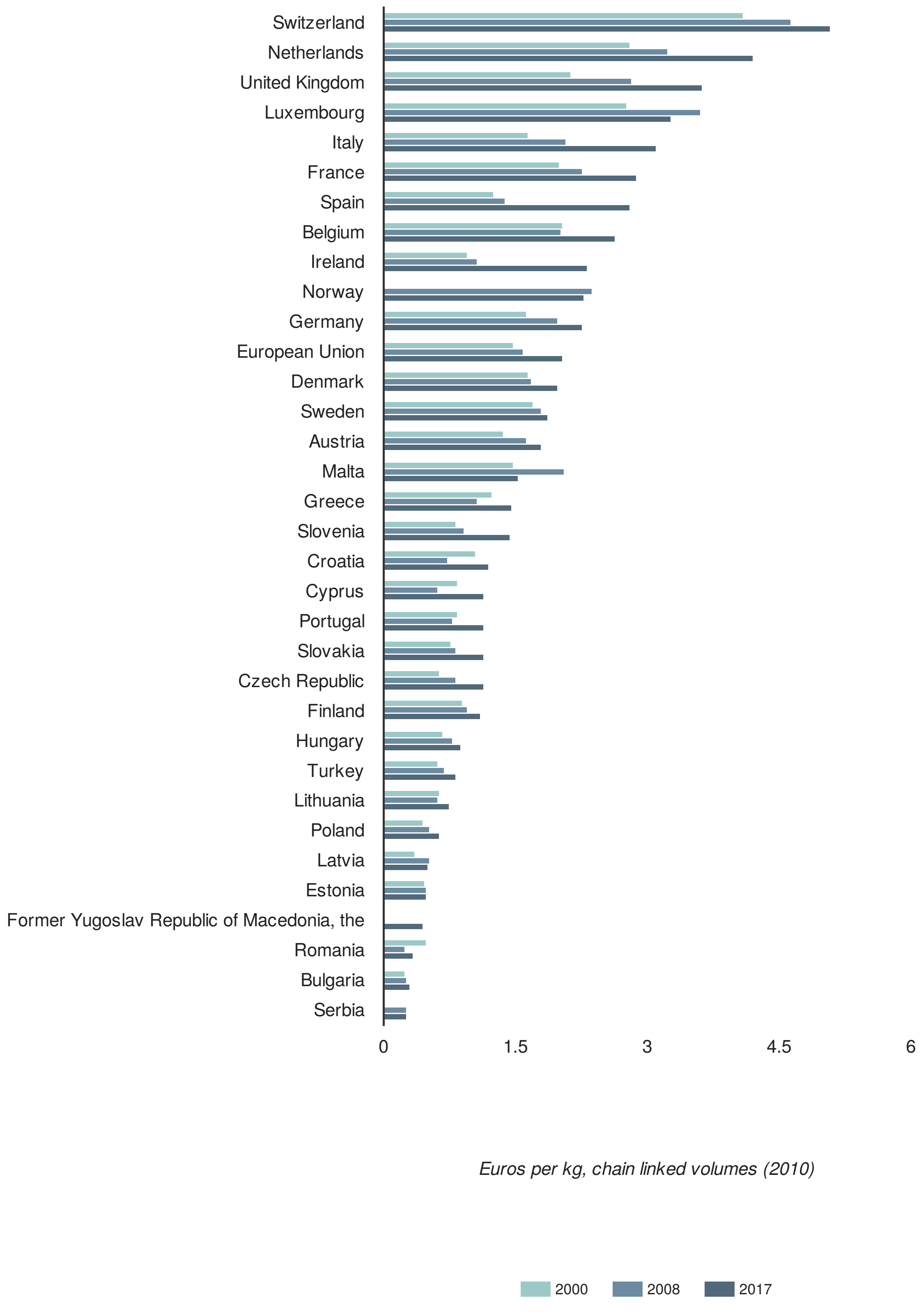
Finally, it should be noted that the rate of increase in resource productivity has slowed since 2013. This is because total material use increased between 2013 and 2017 as a result of an increase in non-metalic minerals for construction purposes that was triggered by the return of economic growth.

Detailed projections of material use within the four main material groups from 2012 to 2030 have been carried out for the European Commission, to explore possible developments of EU resource productivity. A wide range of factors was modelled, including technological developments, policy in energy and climate, agriculture, transport and the manufacturing sector, and demographic and economic trends. The modelling analysis projects a 0.7 % rise in material use per year but a higher rate of growth in GDP, resulting in a 0.9 % increase in resource productivity per year (Cambridge Econometrics, 2014). This is similar to the rate observed between 2000 and 2008. The projections would suggest that the 7th EAP 2020 objective of increasing resource efficiency should be met.

# Country level information

Resource productivity varies between countries by a factor of about 14 within the EU (and by a factor of 18 if other European countries are taken into the account). This variation not only reflects how resource-efficient an economy of one country is compared with another, but is also influenced by the types of material resources available in the country and the structure of its economy. Countries with service-based economies will tend to have higher resource productivity than economies with a high proportion of heavy industry, since service industries typically have a lower demand for material inputs (EEA, 2013). It is nevertheless noteworthy that over the 2000-2017 period, the five countries with the highest resource productivity levels since 2000 demonstrated much higher resource productivity improvement rates compared with the five countries with the lowest resource productivity levels since 2000, which resulted in the increasing gap between the two groups (EEA calculation based on Eurostat, 2018a).

## Figure 3. Resource productivity by country



**Data sources:** Eurostat. Resource productivity (env_ac_rp)

**Note:**
1. Resource productivity is measured in Euros (chain-linked volumes, reference year 2010) per kilogram of domestic material consumption (euroCLV2010/kg DMC). Differences between individual countries would be smaller if resource productivity was measured using GDP in purchasing power standards. However, for the sake of consistency with the rest of the briefing, which primarily focuses on trends over time, Figure 3 shows resource productivity in Euro CLV2010.
2. 2015 is the latest data year for Switzerland and Turkey, and 2016 is the latest year for the former Yugoslav Republic of Macedonia, Norway, and Serbia; 2000 is missing for the former Yugoslav Republic of Macedonia, Norway and Serbia.

Switzerland has long held the top position for resource productivity in Europe. Within the EU, the country with the highest resource productivity is the Netherlands, followed by United Kingdom, Luxembourg and Italy, with values more than 50 % higher than the EU-28 average. Resource productivity improved in all countries but Romania between 2000 and 2017. Ireland and Spain recorded the biggest improvement over the period, (140 % and 122 % respectively), while Estonia and Malta recorded the lowest improvement (4 % each).

For many countries, gains in resource productivity have been most prominent since 2008. These have largely been caused by a drop in demand for non-metallic minerals, as a result of a post-downturn slump in the construction sector, and in part are also due to long-term reductions in the consumption of fossil fuel carriers. The countries that experienced the sharpest decline in material use for non-metallic minerals between 2008 and 2017 were: Spain, Greece, Italy, Cyprus, Croatia Portugal, Ireland and Slovenia, ranging from a 68 % reduction in the case of Spain to a 43 % reduction in the case of Ireland and Slovenia.

It is difficult to assess the impact of current policies on increasing resource productivity, because of a variety of other factors at play (e.g. geography, climate, structure of the economy, energy mix, trade patterns, etc.).

As of 2016, only three countries (Austria, Finland and Germany) and two sub-national regions (Flanders and Scotland) adopted dedicated strategies for resource efficiency. A number of other countries incorporate resource productivity concepts into other strategies and policies, including those on waste, energy and industrial development, or national reform programmes (EEA, 2016). National efforts to improve resource productivity are based on a mixture of economic and environmental considerations. The most prominent factors are the need to increase competitiveness and secure access to raw materials and energy (or reduce reliance on imports), while lowering pressures on the environment. In addition, a number of European countries have already developed, or are planning to develop, national raw material strategies (EEA, 2016). Notable in the last couple of years is the drive in several EU Member States to develop a national circular economy action plan or roadmap, following to the European Commission adoption of the action plan on circular economy (EC, 2015b). As of summer 2018, several Member States had already adopted various national action plans or roadmaps for developing the circular economy, including Belgium/Flanders, Finland, France, Italy, the Netherlands,  Portugal, and the United Kingdom, while others, including Denmark, Poland and Spain, were in the process of formulating such documents  (EEA communication with the Environment Information Observation Network).

Moreover, several EU Member States have adopted national resource productivity targets. These vary somewhat in their scope, format and time frames, but all aim to achieve improvements in resource productivity. It is difficult to compare the ambitions of these targets between countries because of the varying time periods over which they have to be achieved and the different starting levels in terms of resource productivity (Figure 3).

It is worth noting that improving resource productivity does not necessarily lead to reduced overall material use. Of the 27 EU Member States whose resource productivity improved between 2000 and 2017, 12 have experienced an increase in demand for materials over the same period. In some cases, the increase was substantial: Malta 71 %, Estonia 70 %, Lithuania 63 %, Bulgaria 46 %, Luxembourg 34 %, Poland 33 %, Slovakia 32 % and Sweden 31 %. In general, policies and targets for reducing overall material use are far less common than those aimed at increasing resource productivity.

# Outlook beyond 2020

The long-term vision of the 7th EAP includes the goal that Europe's growth should be decoupled from resource use. This means not only improvements in resource productivity but also absolute reductions in material use.

Achieving efficient use and sustainable management of natural resources by 2030 are amongst the targets of the 2030 Agenda for Sustainable Development (Sustainable Development Goal 8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation(…) andSDG 12.2: By 2030, achieve the sustainable management and efficient use of natural resources) (UN, 2015). The resource productivity indicator is used to measure progress towards these targets at the global and EU level.

The EU has been forecast, under certain conditions, to increase its resource productivity by 14 % between 2014 and 2030 (Cambridge Econometrics, 2014). Through specific policies to promote the transition to a more circular economy, this rate could possibly double. While contributing significantly to the sustainability dimension of growth, increasing resource productivity by 30 % could also have a positive impact on job creation and GDP growth (EC, 2014).

Industry already recognises the strong business case for improving resource productivity. It is estimated that resource efficiency improvements along the whole value chain could reduce the need for material inputs by 17-24 % by 2030 (Cambridge Econometrics, 2014). Better use of resources could represent an overall savings potential of EUR 630 billion per year for the European manufacturing industry (INNOVA, 2012).

Among those countries that have adopted resource productivity targets, five included targets beyond 2020: Austria, France, Latvia, Portugal and Slovenia (EEA, 2016). Austria aims to achieve a four- to ten-fold increase in resource productivity above 2008 levels by 2050. Germany, in its revised ProgRess II strategy, adopted a target to maintain until 2030 an average annual increase of 1.5% in total raw material productivity, defined as (GDP+ monetary value of imports)/raw material input. More recently, the Dutch Government Programme for a Circular Economy included an (interim) objective of a 50% reduction in the use of primary raw materials (minerals, fossil materials and metals) compared with 2014 by the year 2030.

Such ambitious targets and a more resource-efficient EU will require further fundamental changes in production and consumption patterns. The adoption of the Circular Economy Package (EC, 2015b) and recent efforts by some countries to analyse their material resource availability and needs, and to develop raw material strategies, demonstrate that Member States are strengthening their approach to the use of materials.

## About the indicator

Resource productivity is measured here as the economic output (GDP) in euros (chain-linked volumes, reference year 2010) per unit weight (kilograms) of material used, expressed as domestic material consumption (DMC). DMC comprises the consumption of fossil energy carriers, biomass, metal ores and non-metallic minerals, such as sand and gravel used in construction. DMC is measured as the used weight of domestically extracted material, plus the direct weight of imports, minus the direct weight of exports.

A potential weakness of using DMC in a resource productivity indicator is that DMC excludes the raw materials extracted in non-EU countries and embedded in imported goods. An alternative to DMC as a resource productivity indicator is raw material consumption (RMC). RMC presents the import and export flows expressed in their raw material equivalents. These are currently estimated with models and are still under development. RMC has been developed by Eurostat for the EU but is not yet available for individual Member States. Some European countries, including Austria, Belgium, Denmark, Finland, France, Germany, Switzerland and United Kingdom, compile, however, national RMC indicators on a pilot basis, and/or include RMC in official statistics.

DMC is available for all Member States, has a long time series and is disaggregated into material components. Moreover, DMC and RMC have exhibited similar trends since at least 2002, and therefore the choice of one or the other will have had little effect on trends to date in resource productivity (EEA, 2015; Figure 2).

Last but not least, it should be kept in mind that economy-wide material flow indicators do not fully capture environmental pressures caused by material use. Both in DMC and RMC, all material types are given equal significance and are measured in tonnes, even though there are large differences in their scarcity or in the impacts related to their extraction and use. Different tools can be used for specific analysis of impacts or pressures of individual materials.

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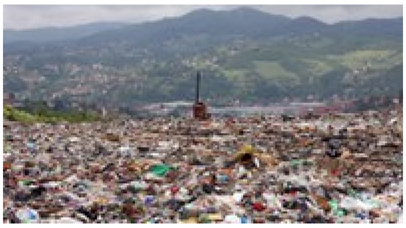
Resource efficiency and low carbon economy

# Waste generation



| Indicator | Indicator past trend | | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|---|
| Waste generation in Europe (excluding major mineral wastes) — absolute and per capita levels | EU | EEA | Reduce absolute and per capita waste generation — 7th EAP | |

The past trend (2010-2016) shows an increase in waste generation. The outlook towards 2020 remains, however, uncertain since the examined past time series is short and the increase relates mostly to just one data point (2014-2016).

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) states that, by 2020, absolute and per capita waste generation should be in decline. A society that meets its needs while producing less waste is more resource efficient, with lower environmental risks from waste management. The total amount of waste generated, excluding major mineral wastes, is used as the indicator to track progress towards a reduction in waste generation. The amount of this waste in the EU increased by 5.1 % in absolute amounts and by 3.6 % per capita between 2010 and 2016. The key driver behind the increase in waste generation seems to be the increase in the generation of secondary waste, triggered by a move away from landfilling towards recycling and incineration. The prospects of waste generation declining by 2020 are uncertain as the increase in waste generation is associated mainly with only one data point (2014-2016) and because there are methodological uncertainties (short time series — only four data points — and some data collection improvements in waste statistics) related to the past trend. There is, however, a risk that waste generation continues to increase in line with economic growth. On the other hand, there is an expectation that the measures in the Circular Economy Package will contribute to a reduction in waste generation in the longer term.

## Setting the scene

The 7th EAP includes an objective that, by 2020, absolute waste and per capita waste generation are in decline and waste is managed safely as a resource (EU, 2013). The waste hierarchy is the central framework for EU and national waste policies. This hierarchy gives the highest priority to waste prevention, followed by preparing for reuse, recycling, other recovery and finally disposal. Reducing the amount of waste generated means that there is less waste to manage and also, potentially, that the demand for material and energy resources and associated environmental impacts has been reduced (AIRS_PO2.1, 2018). This briefing examines the trends in waste generation by using the total amount of waste generated, excluding major mineral wastes, as an indicator. For terminology and rationale of choice, see the 'About the indicator' section at the end of the briefing.

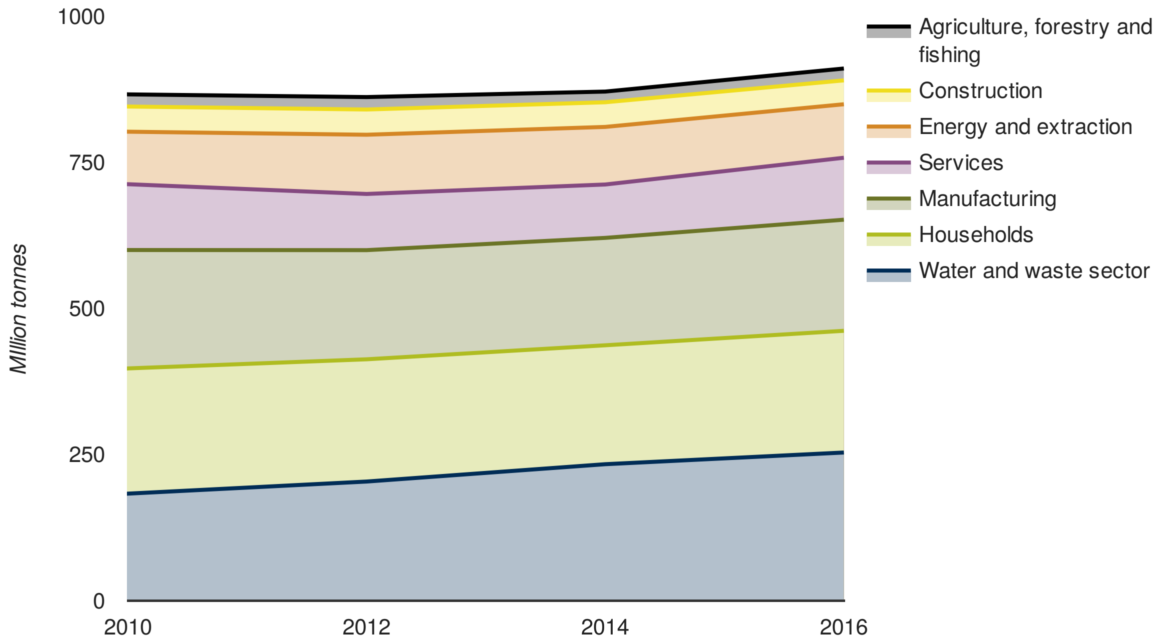
## Policy targets and progress

The Roadmap to a Resource Efficient Europe contains several waste-related milestones to be met by 2020, including one that requires waste generated per capita to be in absolute decline (EC, 2011).

Waste prevention and the use of waste as a resource is becoming increasingly important, not only in environmental policy but also in industrial and raw materials policy. In December 2015, the European Commission published 'Closing the loop — An EU action plan for the circular economy' (EC, 2015), otherwise known as the Circular Economy Package. Unlike the traditional linear take–make–consume–dispose approach, a circular economy seeks to respect planetary boundaries by increasing the proportion of renewable or recyclable resources while reducing the consumption of raw materials. Approaches such as eco-design and sharing, reuse, repair and refurbishing will play a significant role in maintaining the utility of products and components, and reducing the generation of waste (EEA, 2016, 2017, 2018).

The Waste Framework Directive (EU, 2008) obliges EU Member States to adopt and implement waste prevention programmes. The revised Waste Framework Directive (EU, 2018) strengthens this requirement but does not introduce binding quantified targets for waste prevention. A review of available programmes indicates that countries use a broad range of measures with a focus on information-based instruments and, to a lesser extent, regulatory and economic instruments. A total of 17 out of 27 waste prevention programmes analysed include quantitative targets (EEA, 2015).

## Figure 1. Generation of waste, excluding major mineral wastes, EU




**Data sources:** Eurostat. Statistics on waste (env_wasgen)

**Note**: The data were extracted on 12 October 2018. The 2016 data are Eurostat estimates.

The total amount of waste generated in the EU, excluding major mineral wastes, increased by 5.1 % between 2010 and 2016 (Figure 1)[1]. The total amount of waste, excluding major mineral wastes, increased by 6.9 % over the same period when Iceland, Liechtenstein, Norway and Turkey — the four other EEA member countries for which data are available — were added to the EU total (EEA calculations based on Eurostat, 2018a).

In 2016, the highest absolute levels of waste generation (excluding major mineral wastes) in the EU were recorded for the water and waste sector, for households, and for the manufacturing sector.

Between 2010 and 2016, there were some shifts in waste generation between sectors in the EU. Most prominently, waste generated in the water and waste sector increased by 38 %, while in the energy and extraction sector it increased by 2 %. Over the same period, waste generation decreased by 6 % in the services, manufacturing and construction sectors and by 3 % in the agriculture, forestry and fishing, and households sectors.

The waste includes secondary waste, which is mainly generated in the 'water and waste sector'. The increase in secondary waste seems to be the main factor in the increasing overall trend in waste generation in the 2010-2016 period. This waste is generated during the treatment of waste and comprises, for example, sorting residues, sludges and incineration ashes. More complex waste management such as recycling and incineration usually results in more secondary waste. The EU is moving away from landfilling of waste towards more recycling and incineration. For example, the share of landfilled waste (excluding major mineral wastes) decreased from 28 % to 24 % in the 2010-2016 period (EEA calculation based on Eurostat, 2018b). This development led to an increase in the amount of secondary waste generated, which increased from a share of 12 % of total waste in 2010 to 18 % in 2016, excluding major mineral wastes.

The overall improvements and the shifts between sectors are probably due to a combination of factors including efficiency improvements in production processes and management, and changes in the structure of the economy. The overall improvements and the shift between sectors may also be because of methodological changes in data collection and should therefore be interpreted with caution.

In conclusion, the overall amount of waste generated increased between 2010 and 2016. However, only four data points were used to assess the past trend — earlier data were available but were strongly influenced by adjustments in data collection methods and were therefore not used in this indicator. Methodological adjustments may have also influenced the four data points to some degree. Furthermore, the increase in waste generation is primarily associated with only one data point (2014-2016). As a result of these uncertainties, the outlook towards reducing waste generation within the period of the implementation of the 7th EAP (2014-2020) is also uncertain. There is nevertheless a risk that waste generation increases along with economic growth. On the other hand, measures in the Circular Economy Package and the waste prevention programmes in the EU Member States should contribute to a reduction in waste generation.

# Country level information

In 2016, the EU per capita generation of waste — excluding major mineral wastes — amounted to 1 783 kg. This is 63 kg more than in 2010; an increase of 3.7 % over the 2010-2016 period. When Iceland, Liechtenstein, Norway and Turkey (the four other EEA member countries for which data are available) are included in EU per capita waste generation, the trend over the 2010-2016 period remains similar, with an increase of 4.4 % (EEA calculations based on Eurostat, 2018a).

Figure 2 shows that the majority of European countries generate between 1 and 2 tonnes of waste (excluding major mineral waste) per person per year. Between 2010 and 2016, half of the EU countries reduced their per capita waste generation, while the other half increased it. The high figures for Estonia are because of energy production based on oil shale (Eurostat, 2018c).

## Figure 2. Waste generation (excluding major mineral wastes) per capita, by country


**Data sources:** Eurostat. Generation of waste excluding major mineral wastes, kg per capita (t2020_rt100)

**Note**: The data were extracted on 17 October 2018. For 2016, data for Albania, Greece and Ireland were not available and data for 2014 were used instead. Eurostat data estimates for 2016 were used for the EU-28

## Outlook beyond 2020

The long-term prospects for reducing the waste generated in the EU are uncertain. A shift to a circular economy, with increased reuse of goods and materials, has the potential to reduce waste generation. The waste prevention programmes adopted by the EU Member States, Iceland and Norway can be expected to take effect towards 2020. However, the effectiveness of many of the waste prevention measures in the programmes can currently not be assessed for the EU and Europe as a whole. The Circular Economy Package (EC, 2015) includes a number of measures that aim to reduce waste generation beyond 2020. These include concrete measures to promote reuse and stimulate industrial symbiosis — turning one industry’s by-product into another industry’s raw material — and economic incentives for producers to put greener products on the market and support recovery and recycling schemes (e.g. for packaging, batteries, electric and electronic equipment, and vehicles). The success of these measures will be key to the medium- to long-term prospects for reducing waste generation.

## About the indicator

This indicator is defined as the weight of waste generated per year, excluding major mineral wastes (mineral construction and demolition waste, other mineral waste, dredging spoils and soils). Although the indicator focuses mainly on non-mineral wastes, which represent approximately 35 % of the total waste generated in the EU, ‘it is considered to reflect the general trend in waste generation more accurately and in a more comparable way than the generated total including mineral wastes’ (Eurostat, 2018d). This exclusion enhances the quality of the indicator as the uncertainty over major mineral waste data and associated statistics (in particular construction and mining) is rather high, while for some waste streams (for example contaminated soils) the key aim is to remediate these waste streams rather than to count them as waste. The exclusion also enhances comparability across countries, as mineral waste accounts for very high quantities in some countries and for some economic activities, such as mining and construction.

Waste generation data by economic sector are published by Eurostat every 2 years. These are grouped for the purpose of the indicator in the following way: agriculture; forestry and fishing; energy and extraction; water and waste; manufacturing; construction; services; and households.

The water and waste sector includes water collection, treatment and supply, sewerage and three waste sector categories (waste collection, treatment and disposal activities, materials recovery, remediation activities and other waste management services; and wholesale waste and scrap). The data, especially for the water and waste sector, include secondary waste, i.e. material that is the output of waste treatment (secondary waste) (Eurostat, 2018e). Progress in the (pre-) treatment of waste may result in an increase in generated waste in the indicator because waste is counted twice; as primary and as secondary waste.

The energy and extraction sector includes electricity, gas, steam and air conditioning supply plus non-mineral wastes from mining and quarrying. Manufacturing includes food, textiles, wood, paper, coke, chemicals, metals, electronics, transport equipment and other machinery.

The data used in this indicator are based on reporting according to the EU Waste Statistics Regulation (EU, 2002). The first reporting year was 2004 and data quality has been improving since then. In particular, during the 2004-2008 period, many countries implemented methodological changes in their data collection, including allocation of waste to sectors, reclassification from unspecific waste codes to more specific ones and exclusion of by-products from waste reporting. In 2010, a major revision of the Waste Statistics Regulation took effect, enabling a more precise calculation of the waste category ‘waste excluding major mineral wastes’ and the separate identification of secondary wastes. For all these reasons, the indicator in this briefing uses 2010 as a base year. It should be kept in mind that an analysis of trends that is based on four data points only (2010, 2012, 2014, 2016) is, nevertheless, rather uncertain.

# Footnotes and references

[1] According to the methodology used across this series of briefings (that supports the monitoring of the 7th EAP), a change of less than 3 % in the indicator value from the base year to the year with the latest available data is considered insignificant and the trend is assessed as being relatively stable. A change of more than 3 % represents a significant trend (improving or deteriorating depending on the case). Last year's trend was assessed as being stable, since there was an increase of less than 3 %, while this year's trend was judged as being deteriorating since the increase was 5.1 %, i.e. more than 3 %.

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**AIRS briefings**

AIRS_PO2.1, 2018, Resource efficiency.

> Environmental indicator report 2018 – In support to the monitoring of the 7th Environment Action Programme, EEA report No19/2018, European Environment Agency

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Resource efficiency and low carbon economy

# Recycling of municipal waste

| Indicator | Indicator past trend | | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|---|
| Recycling of municipal waste | EU | EEA | 50 % of selected materials in household and similar waste to be recycled by each EU Member State — Waste Framework Directive | |

The amount of municipal waste being recycled has been steadily increasing. The outlook for all Member States meeting the 2020 target is mixed. Several Member States have achieved, or are well on course to achieving the target. However, the target is some way off for others.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) contains the objective that waste is safely managed as a resource — this should help Europe to extract more value from the resources it uses, reduce the environmental impacts associated with waste management and create jobs. In this regard it is important to further increase municipal waste recycling rates. The Waste Framework Directive sets a target of 50 % of municipal waste (specific types of household and similar wastes) to be prepared for reuse and recycled by 2020 in EU Member States. The amount of municipal waste being recycled has been steadily increasing in Europe thanks to investments in appropriate collection and handling, financial incentives to move away from landfilling of waste and landfill bans. The performance of EU Member States on the recycling of municipal waste varies, although the comparability of data is hindered by variation in data collection and definitions. Despite a strong performance from some countries and clear progress being made in nearly all since 2004, in a number of Member States significant efforts are still needed to achieve the 2020 target.

## Setting the scene

The 7th EAP states that, by 2020, waste should be 'safely managed as a resource', 'landfilling [is] limited to residual (i.e. non-recyclable and non-recoverable waste)' and 'energy recovery [is] limited to non-recyclable materials' (EU, 2013). The overarching logic guiding EU policy on waste is the waste hierarchy, which prioritises waste prevention, followed by preparing for reuse, recycling, other recovery and finally disposal, including landfilling as the least desirable option. This briefing presents trends on the recycling of municipal waste. An improvement in the proportion of waste that is recycled indicates that waste management is moving up the waste hierarchy. Recycling allows the generation of more value from resources and creates jobs. It can also reduce the demand for raw materials and the environmental impacts associated with meeting this demand (AIRS_PO2.1, 2018).

## Policy targets and progress

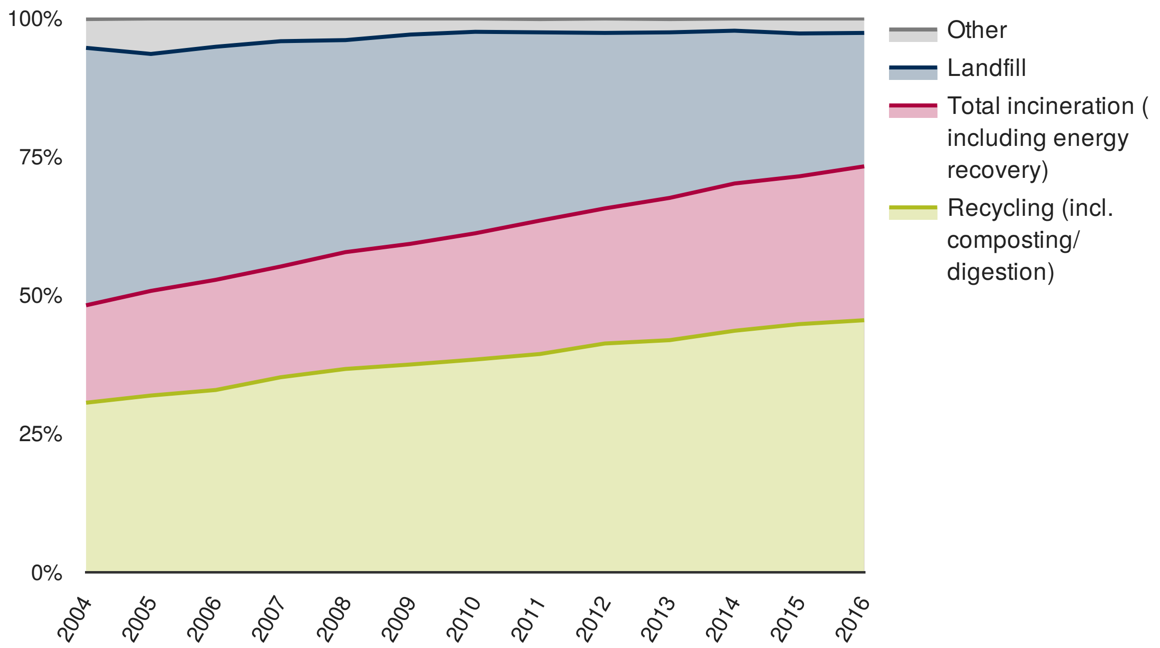
The EU has introduced multiple waste policies and targets since the 1990s.

The Waste Framework Directive (EU, 2008, 2018a) sets a target of 50 % of municipal waste to be recycled and prepared for reuse by 2020 in EU Member States, for at least four categories (i.e. paper, glass, metals, plastics) of waste. Countries can choose from four alternative calculation methods to measure progress towards the target (EU, 2011). In December 2015, the European Commission published 'Closing the loop — An EU action plan for the circular economy' (EC, 2015), also known as the Circular Economy Package. The package sets out a large number of initiatives and led to the adoption of new targets: 55 % of municipal waste to be recycled and prepared for reuse by 2025, 60 % by 2030 and 65 % by 2035 (EU, 2018a). These targets are based on just one calculation method (more ambitious than the one used in Figures 1 and 2 of this briefing), although some countries have the option of altering the timescale.

As can be seen in Figure 1, the overall rate of recycling (material recycling, composting and digestion) for the EU increased from 31 % in 2004 to 45 % in 2016. The increase was from 28 % to 41 % if data from non-EU, EEA member countries (Iceland, Liechtenstein, Norway, Switzerland and Turkey) are added to the aggregated EU country data. This improvement comes from a combination of a reduction in the amount of municipal waste generated and an increase in the total quantity undergoing material recycling, composting and digestion. This increase is viewed as one of the success stories of environmental policy in Europe so far (EEA, 2016b).

Around two thirds of the progress in enhanced recycling rates between 2004 and 2016 was primarily because of more material recycling. Increased composting and digestion was responsible for the remaining third (EEA calculation based on Eurostat, 2018a).

### Figure 1. Proportion of municipal waste treated by different methods, EU




**Data sources:** Eurostat. Municipal waste by waste operations (env_wasmun)

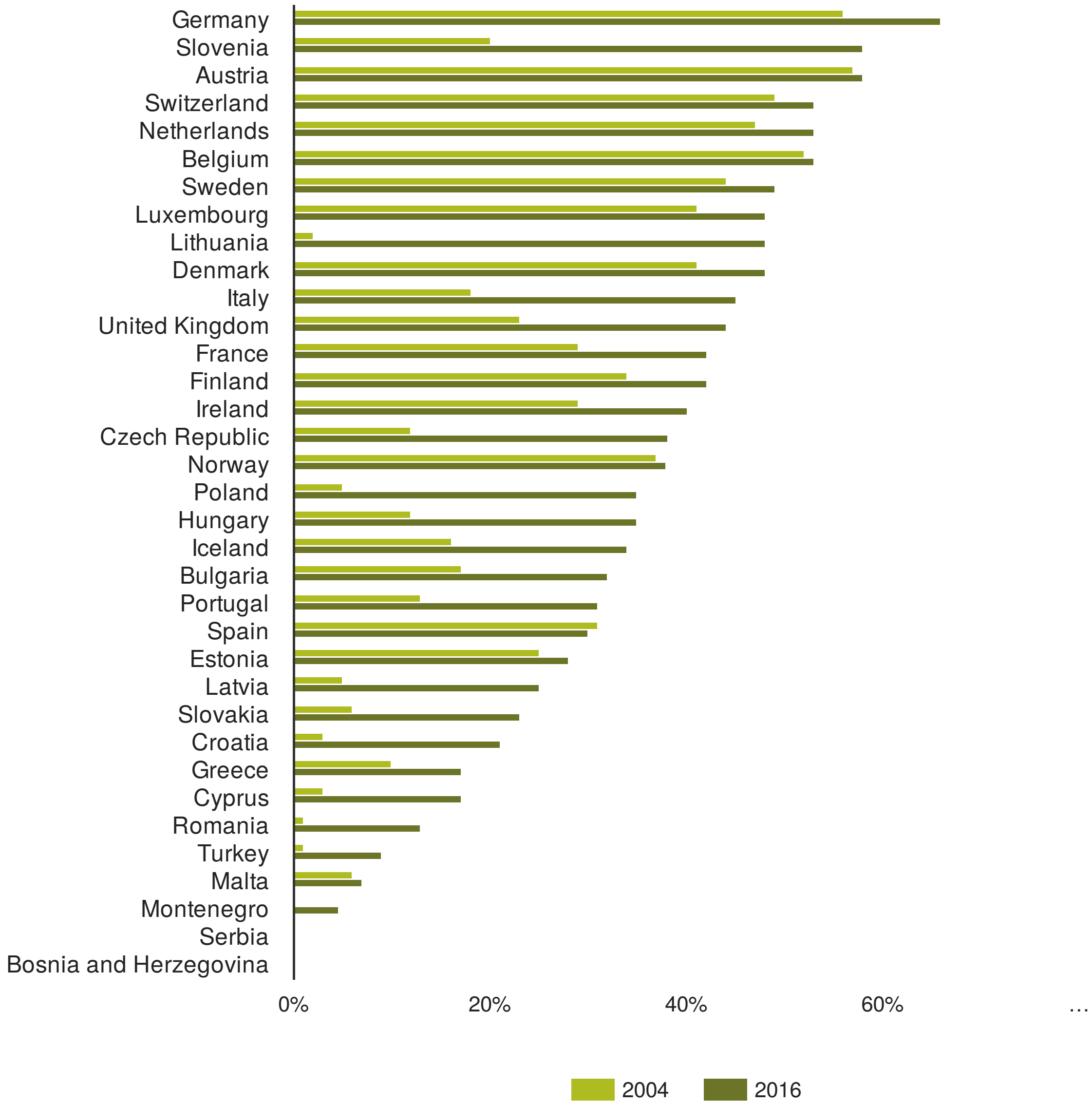
**Note:**
The treatment shares relate to waste generated. Recycling of municipal waste includes material recycling and composting/anaerobic digestion and might also include preparing for reuse. Data for 2004-2006 exclude Croatia. 'Other' includes, inter alia, mass losses during pre-treatment, storage and waste generated but not collected.

Figure 1 shows the trend in municipal waste recycling in the context of other municipal waste treatment methods. It is apparent that, as a whole, the EU is moving away from landfilling but that the share of incineration is also growing, with a 57 % increase between 2004 and 2016, compared with a 48 % increase for recycling (including composting and digestion).

## Country level information

Over the examined period (2004-2016), some countries show high (and sustained) levels of municipal waste recycling and many others show strong improvement (Figure 2). Despite this, as shown in Figure 2, the low rates of recycling and/or slow progress made in some countries, suggest that not every country is likely to achieve the Waste Framework Directive target by 2020. Analysis by the European Commission (EC, 2018) and by the ETC/WMGE for the EEA (ETC/WMGE, 2018) indicate that 14 EU Member States are at risk of not meeting the target.

## Figure 2. Municipal waste recycling rate (including composting and digestion) by country




**Data sources:** a. Eurostat. Municipal waste by waste operations (all countries except of Czech Republic)
b. Ministry of the Environment of the Czech Republic. Waste Management Information System (data for the Czech Republic)

> **Note:**
> The recycling rate is calculated as the percentage of municipal waste generated that is recycled, composted and anaerobically digested, and might also include preparing for reuse. Changes in reporting methodology mean that 2016 data are not fully comparable with 2004 data for Austria, Belgium, Croatia, Cyprus, Estonia, Lithuania, Italy, Norway, Malta, Poland, Romania, Slovakia, Slovenia and Spain. 2005 data were used instead of 2004 data for Poland because of changes in methodology. On account of data availability, instead of 2004 data, 2003 data were used for Iceland, 2007 data for Croatia, and 2006 data for Serbia; and instead of 2016 data, 2014 data were used for Ireland, and 2015 data for Montenegro. 2016 data for Cyprus, Czech Republic, Germany, France, Luxembourg, Poland, Slovenia and Turkey include estimates.

There were large differences in performance among those countries with the highest and lowest recycling rates. Germany, Austria, Belgium, Switzerland, the Netherlands and Slovenia recycled at least half of their municipal waste in 2016. The highest increases in recycling rates between 2004 and 2016 occurred in Lithuania, Poland, Slovenia, Italy, Hungary, the Czech Republic, the United Kingdom and Latvia, ranging from 46 (Lithuania) to 20 (Latvia) percentage points. Overall, in 19 out of 35 countries, the increase in recycling rates was at least 10 percentage points during this period. Meanwhile, in Bosnia and Herzegovina, Estonia, Malta and Serbia, the very low proportion of recycled municipal waste barely changed. Comparability of 2004 and 2016 data is limited for Austria, Belgium, Croatia, Cyprus, Estonia, Lithuania, Italy, Norway, Malta, Poland, Romania, Slovakia, Slovenia and Spain because of methodological improvements in data collection.

While most of the recycled waste is collected separately, another part comes from extracting recyclables from mixed municipal waste in pre-treatment plants. This usually results in lower quality recycled materials and may enhance the risk of contaminating material cycles and the environment. There has been an increase in the capacity for such pre-treatment of mixed municipal waste in some countries (ETC/WMGE, 2018). In Figure 2, the increases in the recycling rates in some of the countries may, therefore, not fully translate into strong benefits for the environment.

The recycling rates shown in Figure 2 cannot be used to assess EU Member States' progress against the target of 50 % of waste to be recycled and prepared for reuse set by the Waste Framework Directive, because Member States can choose between four different methods to calculate compliance with the target (EU, 2011). Figure 2 shows recycling rates calculated following the most demanding method, i.e. recycled and composted/digested municipal waste as a share of total generated municipal waste.

There is a clear link between increasing recycling rates and declining rates of landfilling. In countries with high municipal waste recycling rates, landfilling is declining much faster than recycling is growing, as waste management strategies usually move from landfilling towards a combination of recycling and incineration, and in many cases also mechanical–biological treatment (EEA, 2013).

Almost without exception, the countries that are performing better in terms of recycling have a wider range of measures and instruments in place than the poorer performing ones. Measures have included landfill bans on biodegradable waste or non-pre-treated municipal waste; mandatory separate collection of municipal waste types, especially biowastes; well-functioning extended producer responsibility schemes; and economic instruments such as landfill and incineration taxes and waste collection fees that strongly encourage recycling (such as pay-as-you-throw schemes). Other factors that can also contribute to high recycling rates in the countries include high levels of national environmental awareness as well as effective implementation of waste management legislation by the country (EEA, 2016a).

# Outlook beyond 2020

The 7th EAP describes a number of steps that are required to achieve its objective of waste being managed as a resource. The Waste Framework (EU, 2018a), Landfill (EU, 2018b) and Packaging and Packaging Waste (EU, 2018c) Directives were amended in 2018 to include, inter alia, a number of new targets and measures beyond 2020, which should move the EU towards this objective:

- targets to increase preparing for reuse and recycling of municipal waste to at least 55 % of municipal waste by 2025, 60 % by 2030 and 65 % by 2035;
- targets to increase recycling of packaging waste to at least 65 % by 31 December 2025 and 70 % by 31 December 2030;
- a target to reduce landfill to a maximum of 10 % of generated municipal waste by 2035;
- a ban on landfilling of waste suitable for recycling effective from 2030;
- mandatory separate collection of bio-waste by 31 December 2023 and of textiles and hazardous waste from households by 1st of January 2025;
- minimum requirements for all extended producer responsibility schemes;
- simplified and improved definitions and harmonised calculation methods for recycling rates throughout the EU.

The success of these targets and measures will be key to the medium- to long-term prospects for achieving an innovative circular economy in which nothing is wasted, as envisaged by 2050 in the 7th EAP.

# About the indicator

This indicator focuses on the recycling of municipal waste. Despite the fact that it represents only around 10 % (Eurostat, 2018b) of total waste generation in the EU, municipal waste is very visible and its reduction has the potential to reduce environmental impact, not only in the consumption and waste phases but also over the whole life cycle of the products consumed. Municipal waste consists to a large extent of waste generated by households, but it may also include similar wastes generated by small businesses and public institutions that are also collected by municipalities.

Recycling of waste is defined as any recovery operation by which waste materials are reprocessed into products, materials or substances, whether for the original or other purposes. It includes the reprocessing of organic material (e.g. by composting or digesting) but does not include energy recovery or reprocessing into materials that are to be used as fuels or for backfilling operations (EU, 2008).

The recycling rate is calculated as the percentage of municipal waste generated that is subsequently recycled (including composting and digesting). There are limitations in the comparability of data between countries and over time. There are also variations in what countries classify as municipal waste and, in some cases, these definitions have changed over time. In addition, there are also variations in the calculation method, for example whether or not the weight of material collected but discarded during the recycling process is included and how inputs and outputs of pre-treatment are allocated.

Finally, the indicator shows the recycling rate of municipal waste calculated using a consistent method, although Member States can choose between four different methods to monitor recycling rates in order to meet the target of 50 % of waste to be recycled and prepared for reuse (EEA, 2015).

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AIRS_PO2.1, 2018, Resource efficiency, European Environment Agency.

Environmental indicator report 2018 – In support to the monitoring of the 7th Environment Action Programme, EEA report No19/2018, European Environment Agency

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Resource efficiency and low carbon economy

# Freshwater use

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Use of freshwater resources | | Water abstraction should stay below 20 % of available renewable freshwater resources — Roadmap to a resource efficient Europe | |

While the area in the EU that was affected by water stress decreased, hotspots for water stress conditions are likely to remain given continued pressures such as climate change, increasing population, urbanisation and agriculture.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) aims to ensure that, by 2020, water stress — stress on renewable freshwater resources — is prevented or significantly reduced in the EU. Freshwater is an essential component for preserving biodiversity and maintaining other freshwater ecosystem services such as water supply. Freshwater also serves as a vital input to economic activities across Europe, including agriculture, energy, industrial activities and tourism. While freshwater is relatively abundant in the EU, water availability, population and socio-economic activity are unevenly distributed, leading to major differences in water stress levels across the continent. Water stress occurs in several areas of the EU, in particular in the south and in densely populated areas across the EU, because they are confronted with a difficult combination of both a lack of freshwater and a high demand for it. Overall, the EU area affected by water stress decreased over the period 2000-2015. A key reason for this was a decrease in water abstraction as a result of efficiency gains in agriculture, public water supply, and the manufacturing and construction industries. While efficiency gains in water abstraction are likely to continue in the period to 2020, hotspots for water stress conditions are nevertheless likely to remain, given continued pressures such as climate change, increasing population and ongoing urbanisation. It therefore remains uncertain whether or not water stress can be prevented or significantly reduced by 2020 across the EU. It is indeed important that water abstraction respects available renewable resource limits in order to prevent or significantly reduce water stress.

## Setting the scene

The 7th EAP aims to ensure that, by 2020, stress on renewable freshwater resources is prevented or significantly reduced in the European Union (EU, 2013). This briefing presents trends in the use of freshwater resources. Freshwater is an input to key economic sectors such as agriculture, energy, industry and tourism, and it is an essential component for preserving biodiversity and maintaining other freshwater ecosystem services such as provisioning water supply. It is therefore important that freshwater use respects the limits of available renewable freshwater resources in order for water stress to be prevented or significantly reduced. The briefing uses the Water Exploitation Index plus (WEI+) to discuss the freshwater use trends. For more information on WEI+, see the 'About the indicator' section of this briefing.

## Policy targets and progress

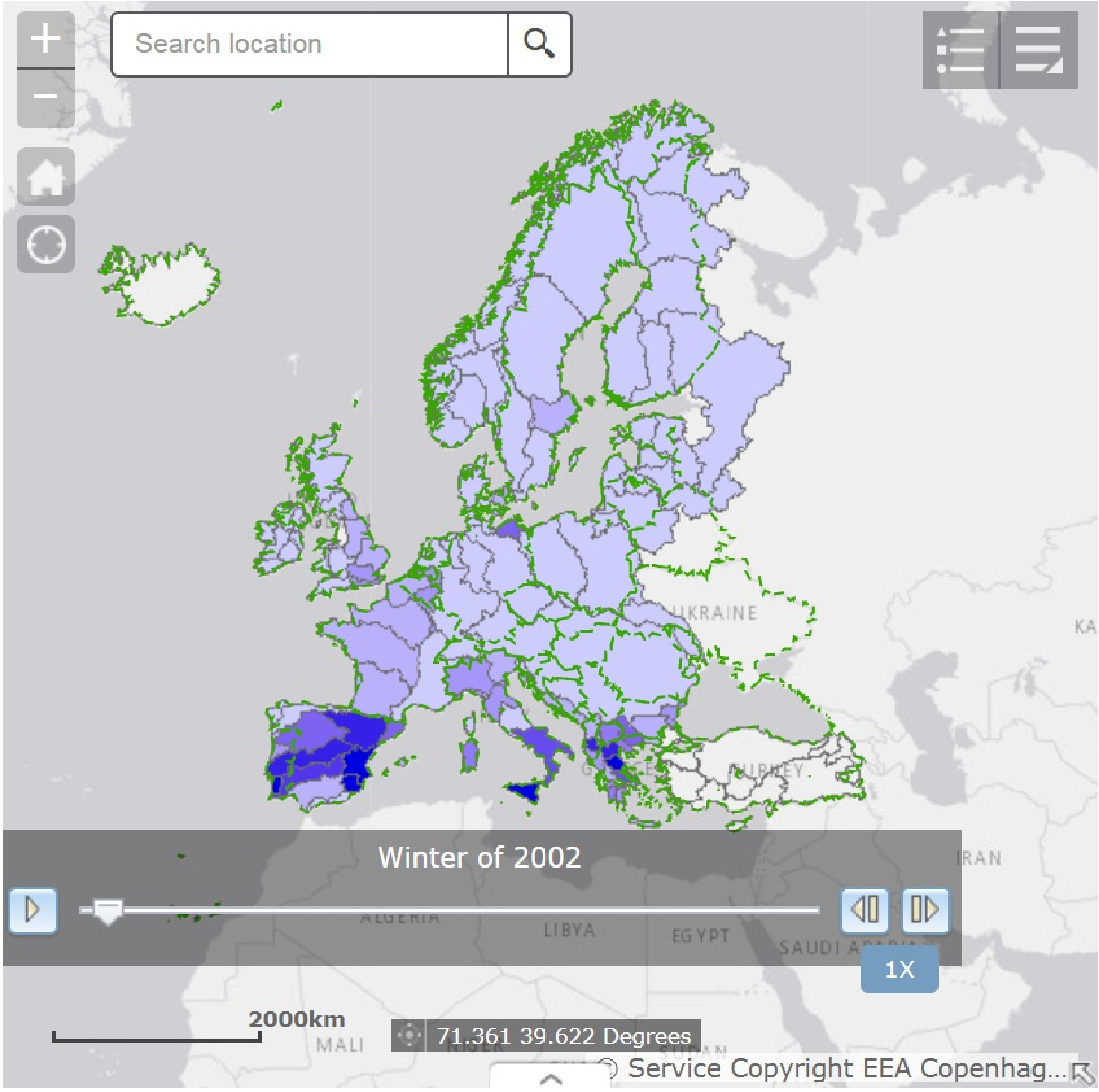
The EU's Roadmap to a Resource Efficient Europe (EC, 2011) includes a milestone for 2020 that 'water abstraction should stay below 20 % of available renewable freshwater resources'. As quantity and quality of freshwater are closely linked, achieving 'good' status under the Water Framework Directive (see Surface waters briefing, AIRS_PO1.9, 2018) also requires ensuring that there is no overexploitation of water resources.

The EU territory affected by water stress decreased over the 2000-2015 period. Over this period, according to the EEA's own estimates, at river basin district level, the average amount of EU territory affected was 14 % (1) of the total EU territory. The highest values were observed in 2000 (21 %) and in 2015 (20 %). The relatively high percentage of the EU territory affected by water stress in 2015 represents a significant increase from previous years (for instance the territory affected in 2014 was 12 %). The increase in 2015 was mainly because of the extreme conditions in 2015 compared with 2014 (namely lower precipitation and higher actual water evapotranspiration that contributed to fewer available renewable water resources) (EEA, 2018a).

Overall, water stress is driven by two important factors: (1) climate, which controls availability of renewable water resources and seasonality in water supply, and (2) water demand, which is largely driven by population density and related economic activities.

On average, in the EU, freshwater is relatively abundant (EEA, 2015). However, water availability, population and socio-economic activity are unevenly distributed across the EU, leading to major differences in water stress levels within the EU. Except in some northern and sparsely populated areas that possess abundant freshwater resources, water stress occurs in several parts of the EU, in particular in densely populated areas as well as in the southern EU (Mediterranean region) (Figure 1).

## Figure 1. Water Exploitation Index plus for Europe, 1990 - 2015



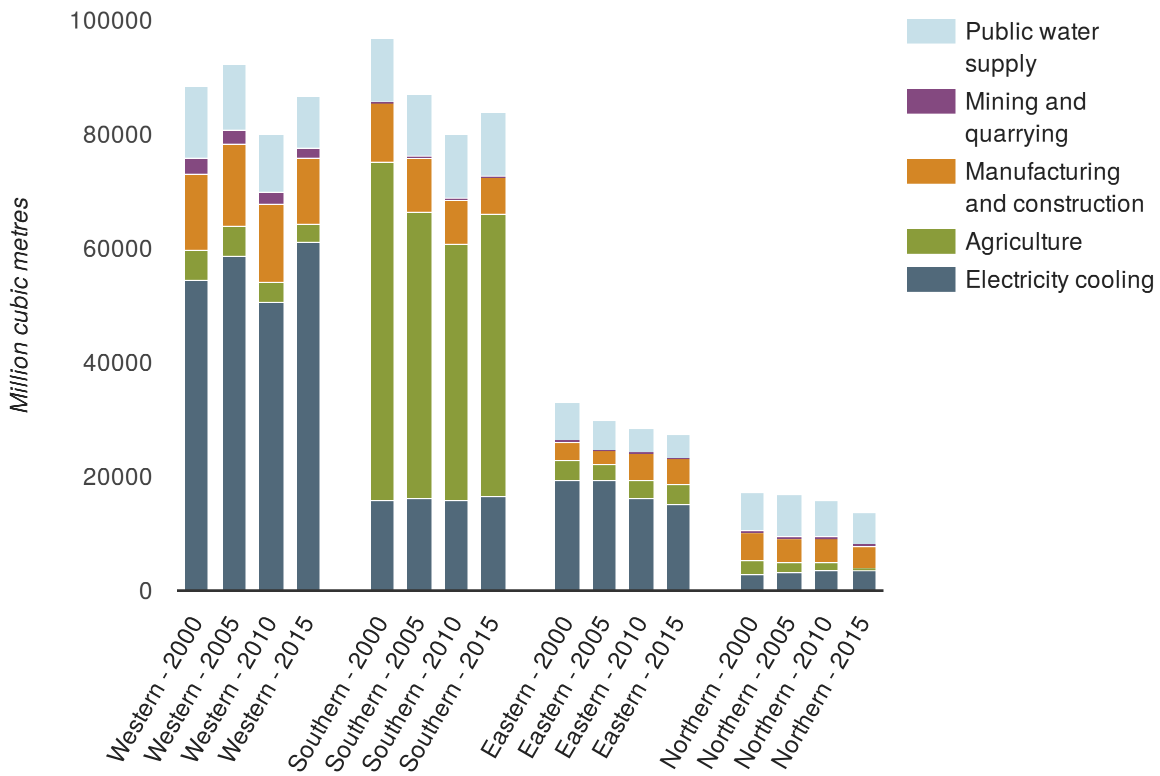

**Source:** a) The European Pollutant Release and Transfer Register (E-PRTR), Member States reporting under Article 7 of Regulation (EC) No 166/2006, b) Waterbase - UWWTD: Urban Waste Water Treatment Directive – reported data, c) Waterbase - Water Quantity, d) European catchments and Rivers network system (Ecrins), e) E-OBS gridded data, f) water statistics – Eurostat, f) LISFLOOD, Distributed Water Balance and Flood Simulation Model – JRC, g) OECD water database, h) FAO Aquastat database.

**Note:** The Water Exploitation Index Plus is presented at river basin district level (including sub basin scale) on seasonal resolution. The reference year is 2015 (Q1: January, February, March; Q2: April, May, June; Q3: July, August, September; Q4: October, November, December). The spatial reference data used when estimating the WEI+ is the ECRINS (European Catchments and Rivers Network System). The ECRINS delineation of sub basin and basin river district differs from those defined by Member States under the Water Framework Directive, particularly for transboundary river basin districts.

Summer is the period when most water stress occurs. This is due to a combination of factors. Water availability decreases because of hotter and drier conditions, while water abstraction substantially increases during the summer compared with winter, because people and sectors, such as agriculture and industry as well tourism that draws from the public water supply, require more freshwater. Around 36 river basin districts, mainly in Greece, Italy, Malta, Portugal, Spain and the United Kingdom experienced water stress conditions during the summer months in 2015 (2).

Figure 2 looks in detail at water abstraction by sector. Sectorial demand on water abstraction varies among different regions in the EU. For instance, while agriculture is the main pressure on water resources in southern Europe, water abstraction for electricity cooling is the main pressure in the western Europe.

### Figure 2. Water abstraction by sector in the EU




**Data sources:** a. Eurostat. Annual freshwater abstraction by source and sector ( env_wat_abs)
b. Eurostat. NATIONAL STATISTICAL OFFICES

> **Note:**
> - Eastern EU: Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia
> - Northern EU: Denmark, Estonia, Finland, Ireland, Latvia, Lithuania, Sweden, United Kingdom
> - Southern EU: Croatia, Cyprus, Greece, Italy, Malta, Portugal, Slovenia, Spain
> - Western EU: Austria, Belgium, France, Germany, Luxembourg, the Netherlands
> Data show the five main sectors.

According to Figure 2, water abstraction decreased in the EU by approximately 10 % between 2000 and 2015. This was mainly because of efficiency gains in agriculture, public water supply, and the manufacturing and construction industries.

The decrease in water abstraction played a key role in the decrease in the EU territory affected by water stress observed over the period 2000-2015.

Looking towards 2020, while efficiency gains in water abstraction at sector level are likely to continue to improve, hotspots for water stress conditions are likely to remain. These will be primarily in the southern EU as well as in a number of highly densely populated areas of the EU. This is because of ongoing and projected pressures from climate change — such as increasing droughts in several parts of Europe (EEA, 2017a) — increasing population and ongoing urbanisation. It therefore remains uncertain whether or not water stress can be prevented or significantly reduced across the EU. It is indeed important that water abstraction respects available renewable resource limits in order to prevent or significantly reduce water stress.

## Outlook beyond 2020

The long-term vision of the 7th EAP is for an innovative economy in which natural resources are managed sustainably. This includes water resources. However, in the coming years, the consequences of various drivers and pressures including climate change, increasing population and continued urbanisation will increase the likelihood of droughts and water scarcity in several regions of Europe (EEA, 2017a). There are many indications that water bodies already under stress are highly susceptible to climate change impacts and that climate change may hinder attempts to restore some water bodies to good status (EEA, 2017a and ETC ICM, 2017).

# About the indicator

The water exploitation index plus (WEI+) aims to illustrate pressure on renewable freshwater resources of a defined territory (river basin, sub-basin etc.) in a given period (e.g. seasonal, annual) as a consequence of water use for socio-economic activities. Water use is defined as the water that was abstracted minus the water that was returned back to the environment. The WEI+ shows the percentage of the total available renewable freshwater resources used. A percentage above 20 % implies that a water resource is under stress, while above 40 % indicates severe stress and clearly unsustainable use of the resource (Raskin et al., 1997).

WEI+ data are available at fine spatial (i.e. river basin and sub-basin) and temporal (monthly or seasonal) scales to better capture local and seasonal variation in the pressure on renewable freshwater resources. The indicator focuses on water quantity. For some aspects of freshwater quality, see the Surface waters briefing (AIRS_PO1.9, 2018).

Data on water use have been derived from the following sources: The European Pollutant Release and Transfer Register (EEA, 2018b), Waterbase - UWWTD: Urban Waste Water Treatment Directive (EEA, 2017b), Waterbase - Water Quantity (EEA, 2016), Annual freshwater abstraction by source and sector (Eurostat, 2017), OECD water database (OECD, 2018), FAO Aquastat database (FAO, 2017) and National statistical office websites (Eurostat, 2018). The data were integrated into the internal EEA water accounts production database.

For further information on the methodology of the WEI+ see EEA, 2018a and ETC ICM, 2017.

## Footnotes and references

(1) The estimates regarding the EU territory affected by water stress that are presented in this briefing are not comparable with the estimates that were presented in the 2017 briefing. The estimates in this briefing correspond to a time period extending from 2000 to 2015 and a geographical scope of EU Member States only. The estimates presented in the 2017 briefing corresponded to a time period of 2002-2014 and a geographical scope that included not only the EU but also Iceland, Norway and Switzerland.

(2) For technical reasons, the 2015 WEI+ for Cyprus could not be calculated. It should be noted, however, that the WEI+ for Cyprus has been very high over the 2000-2014 period pointing to severe water stress.

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Resource efficiency and low carbon economy

# Greenhouse gas emissions

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Total greenhouse gas emission trends and projections | ▲ | Reduce greenhouse gas emissions by 20 % compared with 1990 levels — 2020 Climate and Energy Package | ● |

The decreasing trend in greenhouse gas emissions and their future evolution, as projected by the EU Member States, indicate that the 2020 greenhouse gas emission reduction target will be met. However, progress has slowed down since 2014 and preliminary estimates suggest that emissions increased in 2017.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) supports the objective of reducing EU greenhouse gas emissions by 20 % (compared with 1990) by 2020. Total EU greenhouse gas emissions in 2016 were 22.4 % below 1990 levels, which is already below the 2020 target level. The main reasons for the reduction in greenhouse gas emissions from 1990 to 2016 are improved energy efficiency, switching to less carbon-intensive fuels — namely from coal to gas — and an increase in the use of renewable energy sources. Structural changes in the economy, milder winters and reduced economic activity as a result of the 2008 economic downturn also played important roles in the reduction in greenhouse gas emissions over the 1990-2016 period. Greenhouse gas emissions in 2016 decreased by 0.4 % compared with 2015. The 2016 decrease was mainly because less coal was used to produce heat and electricity.

According to national projections aggregated at EU level, greenhouse gas emissions are expected to decrease further by 2020. However, since 2014 progress in reducing greenhouse gas emissions has slowed down and preliminary 2017 results show an increase in emissions of 0.6 % compared with 2016. This was mainly because of an increase in the emissions of the transport sector year–on-year for the last 4 consecutive years and of the manufacturing and construction sector in 2017. Renewed efforts by Member States are therefore needed to ensure that the EU remains on track to meet its 2020 20 % target.

The EU also has a longer-term objective of reducing greenhouse gas emissions by 80–95 % by 2050 and an agreed target of a 40 % reduction by 2030 compared with 1990 levels. EU Member States expect that planned policies will result in reductions in EU emissions of 30-32 % below 1990 levels by 2030, falling short of the 40 % reduction target. However, these projections may not reflect the latest policy developments linked to the implementation of the 2030 target.

## Setting the scene

The 7th EAP includes the objective for the EU to meet its 2020 climate and energy targets and to work towards reducing greenhouse gas emissions by 80–95 % by 2050, compared with 1990 levels (EU, 2013). Greenhouse gas emissions are the primary cause of climate change. Climate change will further aggravate environmental problems by causing prolonged droughts and heatwaves, floods, storms, forest fires, and soil and coastal erosion, as well as new or more virulent forms of human, animal or plant disease. Climate change is also expected to significantly increase the pressure on Europe's water resources (EEA, 2016a).

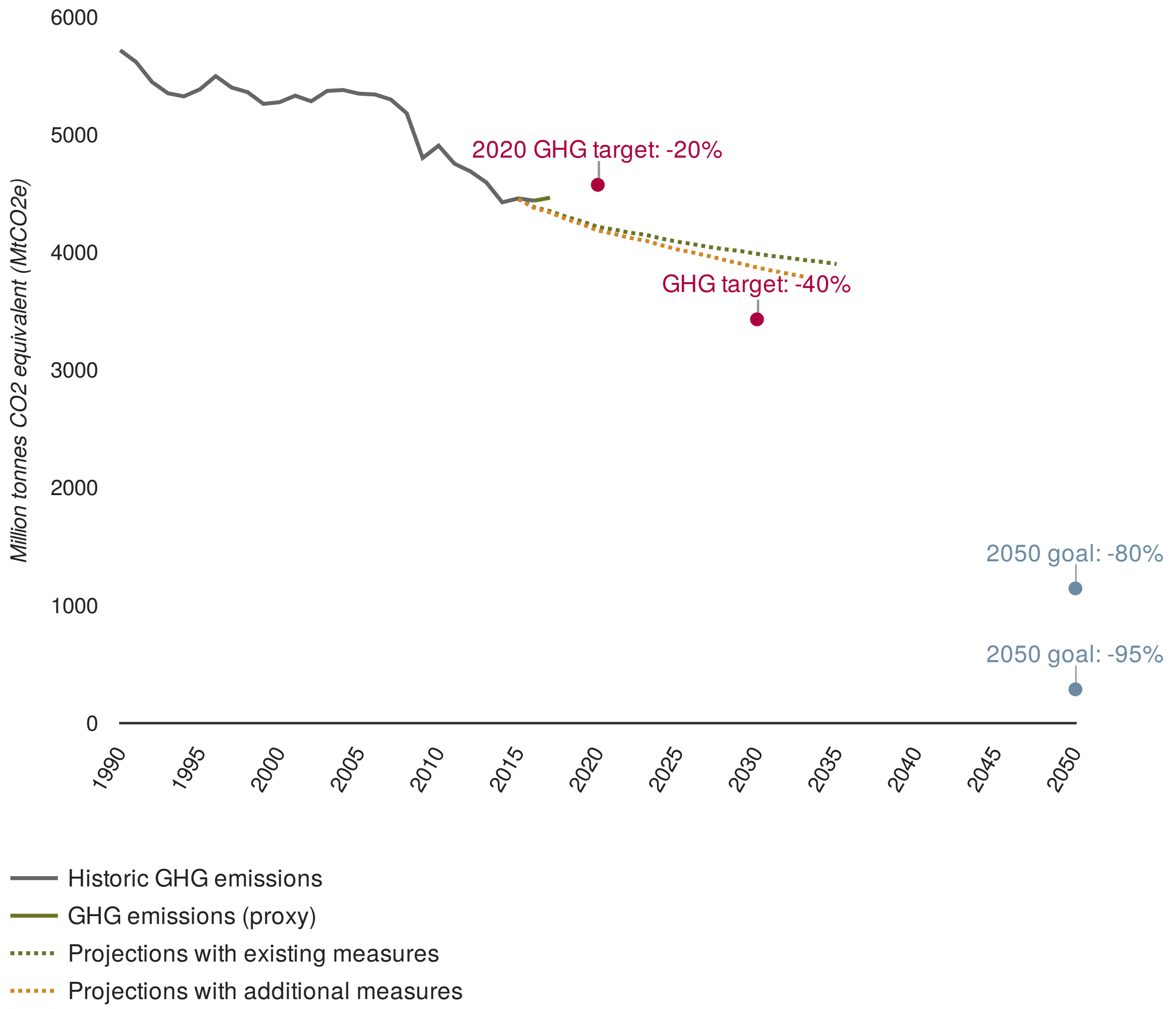
## Policy targets and progress

The EU has committed to achieving a reduction in its greenhouse gas emissions of at least 20 % by 2020, compared with 1990 levels (EEA, 2016b). This objective is embodied in both European and international commitments and targets, which clearly align with the objectives of the 7th EAP described above.

The overall emission reduction target is separated into one EU-wide target for large industrial installations, covered by the European Union Emissions Trading System (EU ETS) (EU, 2009a) and 28 binding national targets for all emissions not covered by the EU ETS. These national targets, set under the Effort Sharing Decision (ESD) (EU, 2009b), cover sectors such as residential, buildings, transport, agriculture, services, waste and smaller industrial installations. The EU ETS is expected to deliver a 21 % reduction in its emissions and the non-ETS sectors should reduce emissions by about 10 % by 2020 (both compared with 2005 levels). Together, these will lead to a reduction of 20 % in overall greenhouse gas emissions by 2020 compared with 1990 levels.

Within the ETS system, the EU sets limits on emissions from high-emitting industry sectors. With these limits as a reference, companies can buy and sell emission allowances as needed. This 'cap-and-trade'' approach gives companies the flexibility they need to cut their emissions in a cost-effective way. The EU ETS covers more than 11 000 power stations and manufacturing plants in the 28 EU Member States, as well as in Iceland, Liechtenstein and Norway. Emissions from commercial aircraft flying within and between these countries are also covered. In 2016, EU ETS emissions represented around 40 % of total EU greenhouse gas emissions.

## Figure 1. Greenhouse gas (GHG) emission trends, projections and targets in the EU




**Data sources:**

a: European Environment Agency (EEA) National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism

b: European Environment Agency (EEA) Approximated greenhouse gas emissions

c: European Environment Agency (EEA) Greenhouse gas projections

d: European Environment Agency (EEA) EEA – Indicator CSI 010

**Notes:**

1. The 2017 data are preliminary estimates.
2. EU targets and goals are expressed against 1990 levels.
3. Projections 'WEM' are projections 'with existing measures'.
4. Projections 'WAM' are projections 'with additional measures'.

In 2016, EU greenhouse gas emissions were already 22.4 % below 1990 levels (see Figure 1).

The EU improved its energy intensity over the 1990-2016 period examined. This was because of energy efficiency improvements and structural changes in the economy, as well as reduced energy consumption as a result of the 2008 economic downturn (for more information, see the Energy efficiency briefing AIRS_PO2.7, 2018). Reductions in greenhouse gas emissions can also be explained by changes in the mix of fossil fuels used — more gas and less coal — as well as by the increasing use of renewable energy sources (RES) (for more information, see the Renewable energies briefing AIRS_PO2.6, 2018). These changes reflect the effects of policies and measures supporting the deployment of RES (e.g. feed-in tariffs), the establishment of a carbon price through the EU ETS and external factors such as fluctuations in fossil fuel prices (EEA, 2018a). Demand for energy to heat households was also lower during this period, as Europe has experienced milder winters on average since 1990 (EEA, 2018b).

Greenhouse gas emissions decreased by 0.4 % in 2016 compared with 2015. This was mainly because less coal — a carbon intensive fuel — was used to produce heat and electricity. However, emissions from road transportation increased for the third year in a row as a result of the higher transport demand and increased economic growth (AIRS_PO2.1, 2018; AIRS_PO2.9, 2018). Emissions from the residential sector also increased in 2016 mainly because the slightly colder winter conditions in 2016 compared with 2015 (EEA, 2018b) increased the demand for heating, which in turn increased the use of gas for heating purposes.

Greenhouse gas emissions for the EU — aggregated from the EU Member State reported projections — are expected to decrease further to 26 % by 2020 with the current measures that are already in place. Additional measures (currently planned by Member States) could further reduce emissions to 27 % below 1990 levels. Most of the savings in greenhouse gas emissions are expected to take place within the EU ETS sectors (EEA, 2018a).

However, since 2014 progress in reducing greenhouse gas emissions has slowed down. Although this can be attributed to the fast pace of emission reductions in the period 1990-2014, the slower pace of progress after 2014 was not anticipated to this extent in the reported projections. In addition, preliminary estimates of greenhouse gas emissions for 2017 indicate an overall increase of 0.6 % compared with emissions in 2016 (EEA, 2018d). The increase in emissions in 2017 was because of increased energy demand and higher emissions from the transport, and manufacturing and construction sectors, in the context of stronger economic growth in 2017 compared with 2016 (EEA, 2018d; AIRS_PO2.1, 2018).

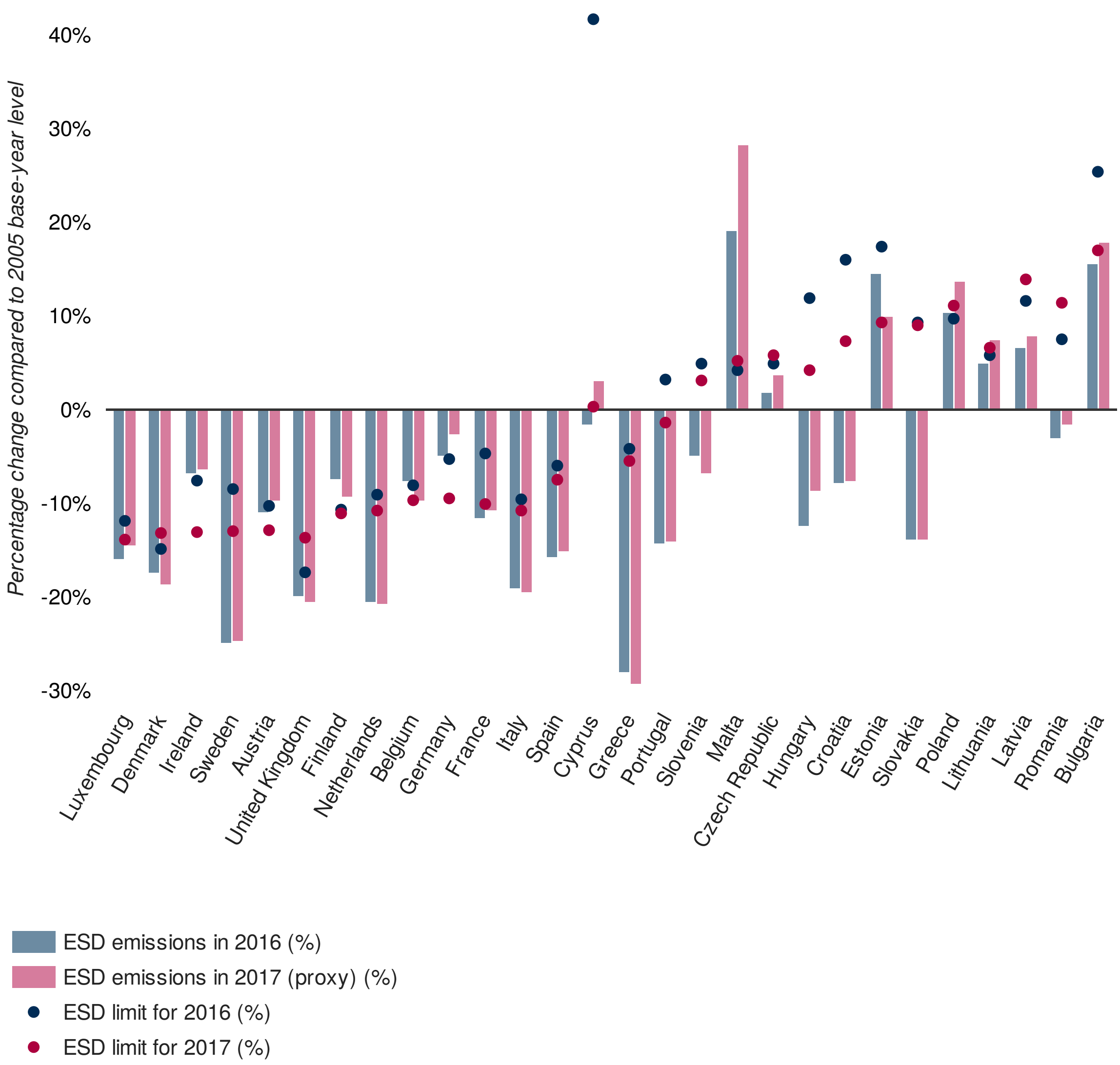
Renewed efforts by Member States are needed to ensure the EU remains on track to meet its 2020 20 % target. This is especially the case for the transport sector where emissions increased year-on-year for the past 4 years.

## Country level information

As mentioned in the previous section, in contrast to the sectors in the EU ETS— which are regulated at EU level — it is the responsibility of EU Member States to define and implement national policies and measures to limit emissions from the sectors covered by the ESD (i.e. the residential and commercial, transport, agriculture, waste and smaller industrial installation sectors).

In 2016, greenhouse gas emissions from the ESD sectors represented approximately 60 % of total EU greenhouse gas emissions.

## Figure 2. Greenhouse gas emissions under the Effort Sharing Decision (ESD), by country




**Data sources:**

a: European Environment Agency (EEA) Approximated greenhouse gas emissions

b: European Commission Verified emissions under the EU ETS

c: European Environment Agency (EEA) Effort Sharing Decision (ESD)

d: European Commission Commission Decision 2013/162/EU

e: European Commission Commission Implementing Decision 2013/634/EU

The national emission targets for 2020 range from a 20 % reduction in emissions (compared with 2005 levels) to a 20 % increase. Less wealthy countries are allowed emission increases in the ESD sectors because their relatively higher economic growth is likely to be accompanied by higher emissions. Nevertheless, their targets represent a limit on their emissions compared with the emissions projected using business-as-usual growth rates. All Member States are therefore required to make an effort to reduce emissions (EC, 2015).

Examples of potential policies and measures that could be implemented to reduce emissions include reducing transport demand, promoting public transport, a shift away from transport based on fossil fuels, support schemes for the retrofitting of building stock, more efficient heating and cooling systems, renewable energy for heating and cooling, more climate-friendly farming practices and the conversion of livestock manure to biogas (EC, 2015).

The assessment of current progress towards the ESD targets compares Member States' ESD emissions for each year with the annual national targets. In 2016, most Member States were below their national ESD targets. However, in 2016, emissions in six Member States (Belgium, Finland, Germany, Ireland, Malta and Poland) were above their national ESD targets. This is four more countries than in 2015.

According to preliminary estimates for 2017, 10 Member States exhibited ESD emissions higher than their national targets (Figure 2).

National projections show that, in most Member States, ESD emissions will remain below annual ESD targets until 2020. However, in seven Member States (Austria, Belgium, Finland, Germany, Ireland, Luxembourg and Malta) emissions in 2020 could exceed targets if no additional measures are implemented (EEA, 2018a).

## Outlook beyond 2020

The EU supports the long-term goal of reducing the EU greenhouse gas emissions by 80–95 % by 2050 compared with 1990 levels in context of similar reductions to be taken by developed countries as a group (EU, 2018). To ensure that the EU is on a cost-effective track towards meeting this objective, the European Council adopted, in 2014, a new set of climate and energy targets for 2030 (EC, 2014). This includes a binding target of reducing greenhouse gas emissions by at least 40 % compared with 1990 levels.

Looking towards 2030, projections from Member States show that both the current measures in place and the additional national measures that were in the planning stage at the time projections were made will not be able to deliver sufficient savings to enable the EU to achieve the reduction target of 40 % below 1990 levels (Figure 1). The pace of greenhouse gas emission reductions is projected to slow down after 2020, despite the fact that mid- and long-term targets will require more rapid reductions. Existing policies and measures are expected to result in a reduction in emissions of 30 % by 2030, compared with 1990 levels, and the implementation of additional measures could lead to a 32 % reduction. However, these projections, reported in 2017, may not reflect the positive effect of the latest policy developments — such as the revisions and consequent strengthening of the renewable energies and the energy efficiency directives that were in advance stage of political discussions but, formally, were only adopted in 2018 (EEA, 2018a).

Following a decision by EU leaders in March 2018 (EU, 2018), the European Commission proposed in November 2018 an EU strategy for long-term EU greenhouse gas emission reductions. The strategy provided options for reducing greenhouse gas emissions between 80 % and up to net zero emissions by 2050 (EC, 2018). The strategy is considered central to achieving the objectives set out in the Paris Agreement (UNFCCC, 2015).

## About the indicator

This indicator presents past and future trends for anthropogenic greenhouse gas emissions in Europe. In line with the United Nations Framework Convention on Climate Change and the 2006 Intergovernmental Panel on Climate Change (IPCC) guidelines, the indicator covers the following greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. These are weighted by their global warming potential, aggregated and presented in $CO_2$-equivalent units. The list of gases does not include those greenhouse gases that are ozone-depleting substances and which are controled by the Montreal Protocol. The national greenhouse gas totals include indirect $CO_2$, when reported by the countries, as well as emissions from international aviation, whereas they exclude emissions or removals from land use, land-use change and forestry, and international shipping. For the past, the indicator uses the greenhouse gas inventory and ETS data. It also uses projection data reported by EU Member States in two scenarios: a 'with existing measures' (WEM) scenario and a 'with additional measures' (WAM) scenario. The WAM scenario takes into account measures planned but not yet adopted. However, not all EU Member States reported a WAM scenario, so the predicted reduction might not take all planned measures into account and therefore may be an underestimate.

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## Annual Indicator Report Series (AIRS)

### Briefings

AIRS_PO2.7, 2018, Energy efficiency, European Environment Agency

AIRS_PO2.9, 2018, Renewable energies, European Environment Agency

> Environmental indicator report 2018 – In support to the monitoring of the 7th Environment Action Programme, EEA report No19/2018, European Environment Agency

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Resource efficiency and low carbon economy

# Renewable energy sources

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Share of renewable energy in gross final energy consumption | | Reach a 20 % share of renewable energy in gross final energy consumption — Renewable Energy Directive | |

The EU has steadily increased the share of renewable energy in its gross final energy consumption, although the rate of progress has been decreasing year-on-year since 2012. The EU continues to remain on course to meet its 2020 renewable energy target.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) supports the EU's objective of meeting the 20 % renewables target by 2020. The Renewable Energy Directive specifies that, by 2020, 20 % of the EU's gross final energy consumption must be renewable. Thanks to national support schemes and significant cost reductions achieved by some renewable energy technologies, the EU increased steadily the contribution that renewable energy sources made to its gross final energy consumption over the 2005-2016 period examined. In 2016, the share of renewable energy sources in the EU's gross final energy consumption reached 17 % and the EU remains on track to meet its 2020 renewable energy target. Nevertheless, in the early 2010s, changes to support mechanisms for renewables — in particular retroactive cuts in feed-in tariffs in some Member States — led to uncertainty on the market and may have caused some investors to hold back. The rate of increase of the share of renewable energy sources in the EU's gross final energy consumption has slowed since 2012, year-on-year. This slowing down was more pronounced in 2015 and 2016 as gross final energy consumption increased in both of these years. EEA preliminary estimates for 2017 show that although the share of renewable energy sources in gross final energy consumption will increase to 17.4 %, there has been a further slowing down in the annual pace of progress, compared with 2016. More action may be necessary to ensure that the EU remains on target.

## Setting the scene

The 7th EAP (EU, 2013) supports the EU's objective of meeting its 2020 renewable energy target (EU, 2009). In comparison with fossil fuels, using renewable energy results in reduced greenhouse gas emissions and can reduce air pollution, environmental and health impacts, and dependency on energy imports.

## Policy targets and progress

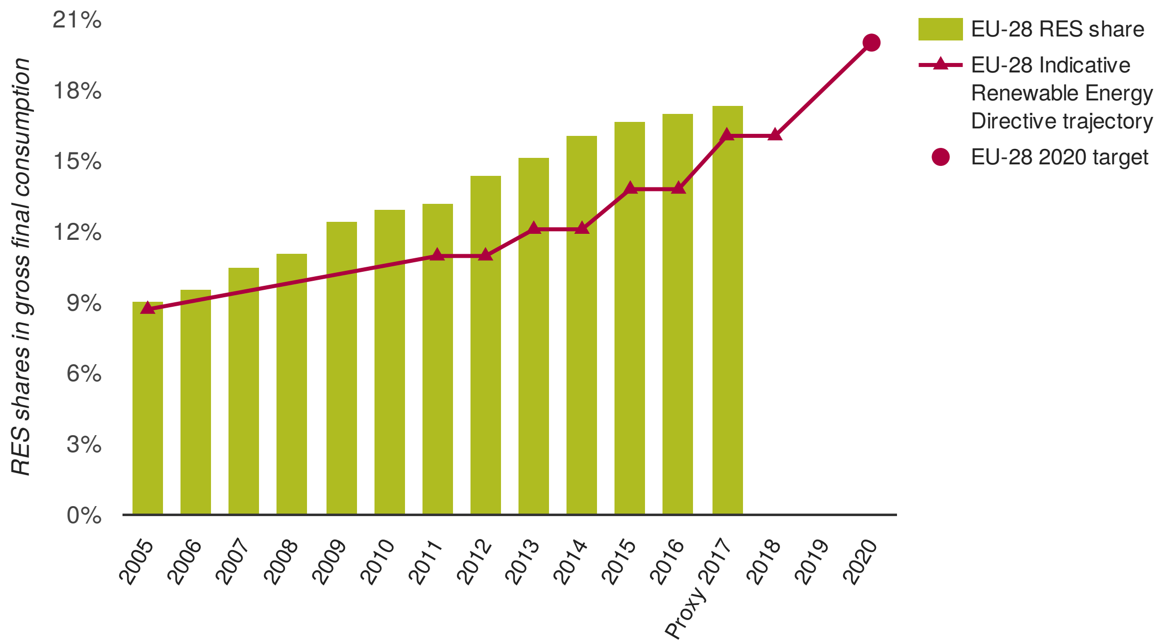
The EU legislation concerning renewable energy — both the initial Renewable Energy Directive (EU, 2009) and the recast (EU, 2018a) — commit the EU to reaching a figure of 20 % renewable energy in gross final energy consumption by 2020. The 2009 directive also sets binding national targets for renewable energy consumption in 2020 and prescribes minimum indicative trajectories for each Member State in the run-up to 2020 to ensure that national targets will be met. It also requires Member States to adopt national renewable energy action plans that outline expected trajectories for the national share of renewable energy sources (RES) from 2010 to 2020, and sets provisions for biennial national reporting on progress towards the indicative trajectories and the trajectories in the national action plans.

The recast Renewable Energy Directive also commits the EU to achieve a share of 32 % of renewable energy sources in gross final energy consumption by 2030 — for further information on this see the section 'Outlook beyond 2020'.

As can be seen in Figure 1, the share of renewable energy in gross final energy consumption increased continuously between 2005 and 2016 to reach 17 % in 2016.

The increase was mainly the result of various support schemes that were put in place by Member States, such as feed-in tariffs, feed-in premiums, auction/tender systems, quotas, tax credits and grants (EEA, 2017a).  Shrinking production costs due to the scaling up of global production volumes and technological advances, along with a reduction in capital costs, have also played an important role in renewable energy deployment (IRENA, 2016a; EC, 2015a). Photovoltaics (technologies that transform solar energy to electricity) have experienced the largest reduction in costs, with costs per kilowatt hour decreasing by 73 % between 2010 and 2017 (IRENA, 2018).

**Figure 1. Share of renewable energy sources (RES) in gross final energy consumption, EU**




**Data sources:** a. European Commission. Indicative trajectories for the share of energy from renewable sources in gross final consumption of energy, from national renewable energy action plans (NREAPs)
b. Eurostat. SHARES Results (nrg_ind_335a)
c. EEA. Approximated estimates for the share of gross final consumption of renewable energy sources in 2017 (EEA 2017 RES share proxies)
d. EEA. Share of renewable energy in gross final energy consumption (ENER028)
e. EEA – Indicator ENER028

Solar electricity, wind power, biogas for heat and electricity generation and biofuels for transport grew fastest during the 2005-2016 period, not least as these technologies started from low initial levels (EEA, 2017b). In absolute terms, however, hydropower and biomass fuels (for heat and electricity generation) could remain the most important single RES up to 2020, despite a decrease in their contribution to the overall energy produced by renewable sources (EEA, 2017b). In 2016, hydropower accounted for 15 %, and biomass fuels for 56 %, of final gross renewable energy consumption.

In terms of installed and connected renewable electricity capacity, the EU was second to China in 2016. With respect to new renewable electricity installed capacity, the EU has been gradually losing ground in recent years to non-European markets, such as China, Japan and the United States (EEA, 2017b). Since 2013, Europe's share in global investments in renewable energy projects has decreased. For example, in 2016 it decreased by 3 percentage points compared with the previous year (Frankfurt School-UNEP Centre/BNEF, 2017). This reflected not only falling technology and capital costs but also a slow down by some Member States that have already met or almost met their 2020 targets, as well as some uncertainty surrounding the transition to auction-based support mechanisms (Frankfurt School-UNEP Centre/BNEF, 2014). Regarding subsidy programmes, in the early 2010s, cuts in feed-in tariffs in some Member States applied retroactively (i.e. to existing plants) may have caused some investors to hold back (EC, 2015a). Nevertheless, auction-based programmes have already replaced the initial subsidy-based support measures in the EU and, increasingly, globally and are pushing renewable energy projects to become more cost-competitive. In turn, this contributes to further reductions in the costs of renewable energy projects (Frankfurt School-UNEP Centre/BNEF, 2017).

Over the period 2005-2016, the share of renewable energy sources in the EU's gross final energy consumption increased, on average, by 5.9 % annually. Since 2012, the annual growth rate of the share of renewable energy sources has decreased slightly, year-on-year. In 2015 and 2016, increases in energy consumption from all sources contributed to this trend.

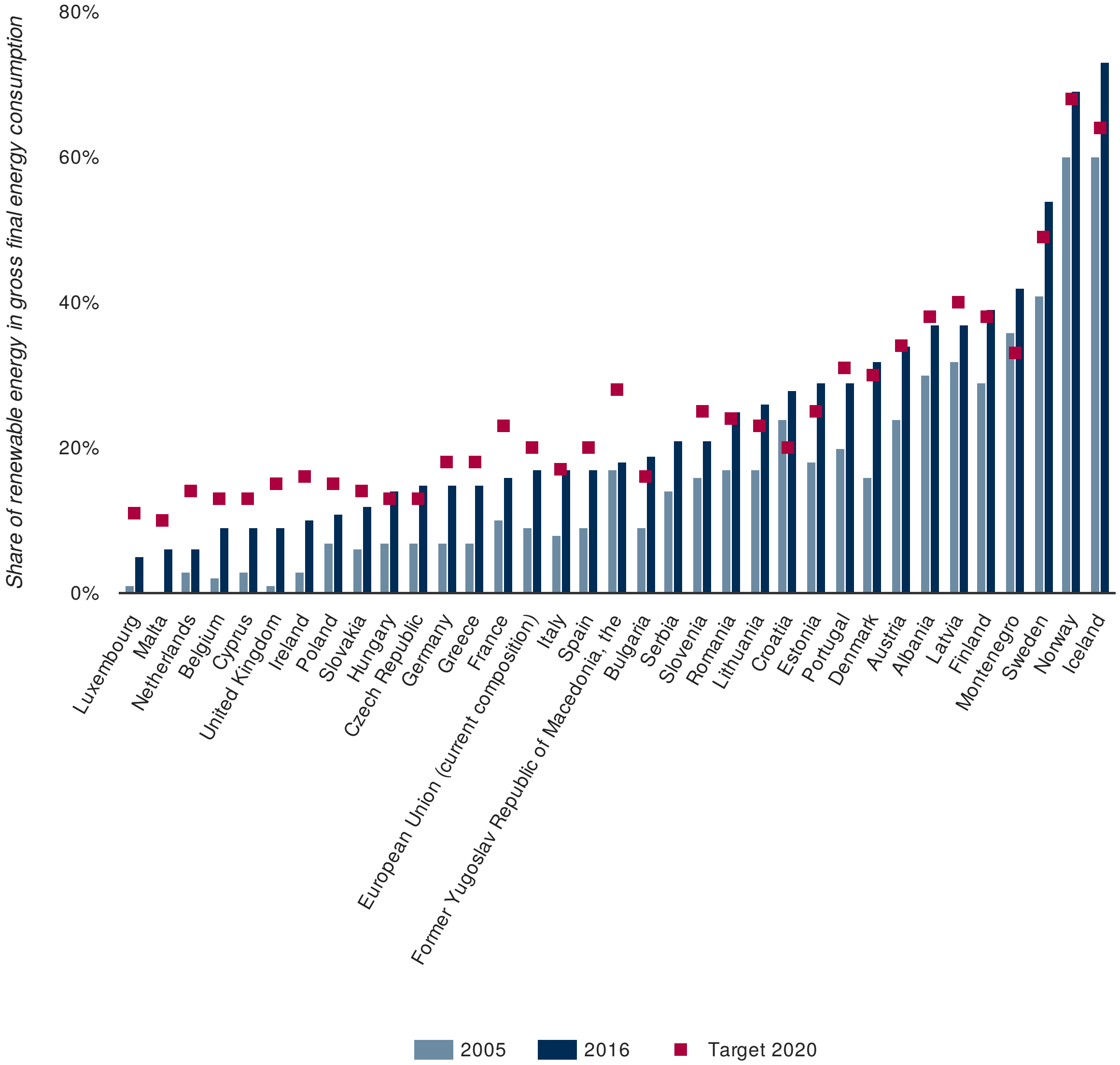
Preliminary EEA estimates for 2017 show that the share of renewable energy sources in the EU's gross final energy consumption will increase further and reach circa 17.4 % (EEA, 2018). However, this corresponds to a further deterioration of the growth rate of the share of renewable energies in gross final energy consumption in 2017 compared with 2016, bringing the annual average growth rate of the share of renewable energy sources in the EU's gross final energy consumption down to 5.6 % for the 2005-2017 period. Similar to 2015 and 2016, the lower rate of growth in 2017 can be attributed, among other factors, to the increase in the EU's gross final energy consumption compared with 2016 (EEA, 2018; AIRS_PO2.7, 2018).

Despite the recent slowing down of the rate of growth of the share of renewable energy sources in the EU's gross final energy consumption, overall the increase of the share of renewable energies has so far been more rapid than the target path prescribed by the Renewable Energy Directive. This means that the EU remains on track to meet its 2020 renewable energies target. However, given the slowing down of the growth rate of the renewable energy sources share in the EU's gross final energy consumption, additional action from Member States may be required to ensure that the EU remains on the path to the 2020 target.

A number of European governments have introduced measures such as premiums on spot market prices, competitive tenders or capacity-dependent feed-in tariffs to help protect and increase the market penetration of renewable energy operators (EC, 2015a). In addition, several Directives and Regulations that have just been adopted will support the future expansion of renewable energy. Although the focus of these legislative documents is primarily post 2020, their anticipation has been enhancing investor predictability and will help to maintain momentum in meeting the 2020 renewable energy sources target. For further information on these Directives and Regulations please see the section 'Outlook beyond 2020'.

# Country level information

### Figure 2. Share of renewable energy sources (RES) in gross final energy consumption, by country




**Data sources:** Eurostat. Share of renewable energy in gross final energy consumption

As can be seen in Figure 2, the contribution of RES to gross final energy consumption varies greatly between countries in Europe. This reflects different starting points in the deployment of renewables in each country and differences in the availability of natural resources to produce renewable energy. It also reflects, to some extent, differences in policies to stimulate renewables.

Between 2005 and 2016, 15 EU countries at least doubled their renewable energy shares and Bulgaria, Croatia, the Czech Republic, Denmark, Estonia, Finland, Hungary, Italy, Lithuania, Romania and Sweden, as well as Iceland and Norway, have already reached their targets for 2020[1].

In 2016, as in 2015, the countries that are the furthest from their targets are France, Ireland, Luxembourg, the Netherlands and the United Kingdom (EEA, 2018). Their progress in the deployment of renewable energy will play an important role in the prospects of the EU meeting its overall target.

## Outlook beyond 2020

Additional deployment of RES beyond 2020 is vital if the EU is to achieve its aim of reducing its greenhouse gas emissions by 80–95 % by 2050 compared with 1990 levels — an aim that is key to the 7th EAP's long-term vision of low-carbon growth decoupled from resource use well before 2050. EU countries have already agreed in June 2018 on a new, EU-wide renewable energy target of at least 32 % of gross final energy consumption by 2030 (EU, 2018a).

Challenges for further progress in renewable energy are multiple. For instance, a key challenge is to arrive at a more unified and comprehensive European market design for energy — one that is able to maximise the use of intermittent renewable energy sources through cross-border interconnections, energy storage, wholesale trading and a flexible consumer demand — that lowers our need to invest in back-up power plants to meet peak demands. Specifically in the case of biomass, there is a need to source and use this renewable energy source sustainably.

The Energy Union strategy (EC, 2015b) aims to ensure a secure, sustainable and affordable energy supply for all EU citizens and includes a number of energy and greenhouse gas emission targets for 2020, 2030 and 2050. The expansion of renewable energy sources is a key element of the strategy. More specifically, in order to overcome the expansion challenges of renewable energy and to meet the new EU 2030 renewables target, in 2016, the European Commission proposed a series of legislative measures. The recast of the Renewable Energy Directive has just been adopted and the new Regulation on the internal market for electricity (EC, 2016a) is in the final stages of negotiation between the European Parliament and the Council. Both of these documents aim to increase investment certainty for private operators, provide a more level playing field for energy technologies and for the deployment of renewables, and grant consumers a greater role in the development of renewable energy sources. The Renewable Energy Directive recast also includes new sustainability criteria for bioenergy. The Energy Union Governance Regulation (EU, 2018b) was also recently adopted and it will require Member States to prepare integrated national energy and climate plans that set out individual national climate, energy efficiency and renewable energy contributions by 2030 in order to reach the targets of the Energy Union Strategy. It is expected that these legislative measures —complemented by several others such as the revised Energy Efficiency Directive (EU, 2018c), which was recently adopted and which requires the EU to meet a 32.5 % energy efficiency target by 2030 — will trigger significant increases in the share of renewable energy sources in the EU's gross final energy consumption in the future.

## About the indicator

This indicator is defined as the share of renewable energy in gross final energy consumption. Gross final energy consumption is defined as 'energy commodities delivered for energy purposes to industry, transport, households, services including public services, agriculture, forestry and fisheries, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission' (EU, 2009). The indicator includes the contribution of renewable sources to all of the final uses of energy (electricity, transport, and heating and cooling). RES include wind, solar, aerothermal, geothermal, hydro, ocean energy sources, biomass and the biodegradable fraction of waste.

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Resource efficiency and low carbon economy

# Energy efficiency

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Progress on energy efficiency in Europe | ▲ | Improve energy efficiency by 20 % (compared with a business-as-usual scenario) — Energy Efficiency Directive | ● |

Primary energy consumption in 2016 was lower than in 2005. However, energy consumption increased both in 2015 and in 2016, and according to preliminary estimates also in 2017. It is uncertain that the EU will meet its energy efficiency target.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) requires that the EU meet its energy efficiency target of reducing primary energy consumption by 20 % by 2020 (compared with a business-as-usual scenario). Primary energy consumption decreased over the 2005-2016 period examined. Together with progress in implementing energy efficiency policies, improvements in the efficiency of energy transformation, structural changes towards less energy intensive industries and the economic downturn of 2008 have contributed to this development. However, the EU primary energy consumption increased both in 2015 and in 2016. This was mainly because of increased activity levels, lifestyle changes and slightly colder winters compared with the previous years. Preliminary results for 2017 indicate a further increase in primary energy consumption. These results also show that the level of primary energy consumption in 2017 was higher than that corresponding to the linear reduction trajectory for meeting the energy efficiency target by 2020. This makes the prospects of the EU meeting the energy efficiency target by 2020 uncertain.

## Setting the scene

The 7th EAP requires that the EU meet its 2020 climate and energy targets (EU, 2013). This briefing addresses the issue of energy efficiency, with greenhouse gas emissions (AIRS_PO2.5, 2018) and renewable energy (AIRS_PO2.6, 2018) being considered in two other related briefings. Meeting the energy efficiency target requires a reduction in energy consumption. This should lead to a reduction in environmental pressures associated with the production and consumption of energy. It will also contribute to a reduction in dependence on energy imports and support the achievement of renewable energy and greenhouse gas targets.

## Policy targets and progress

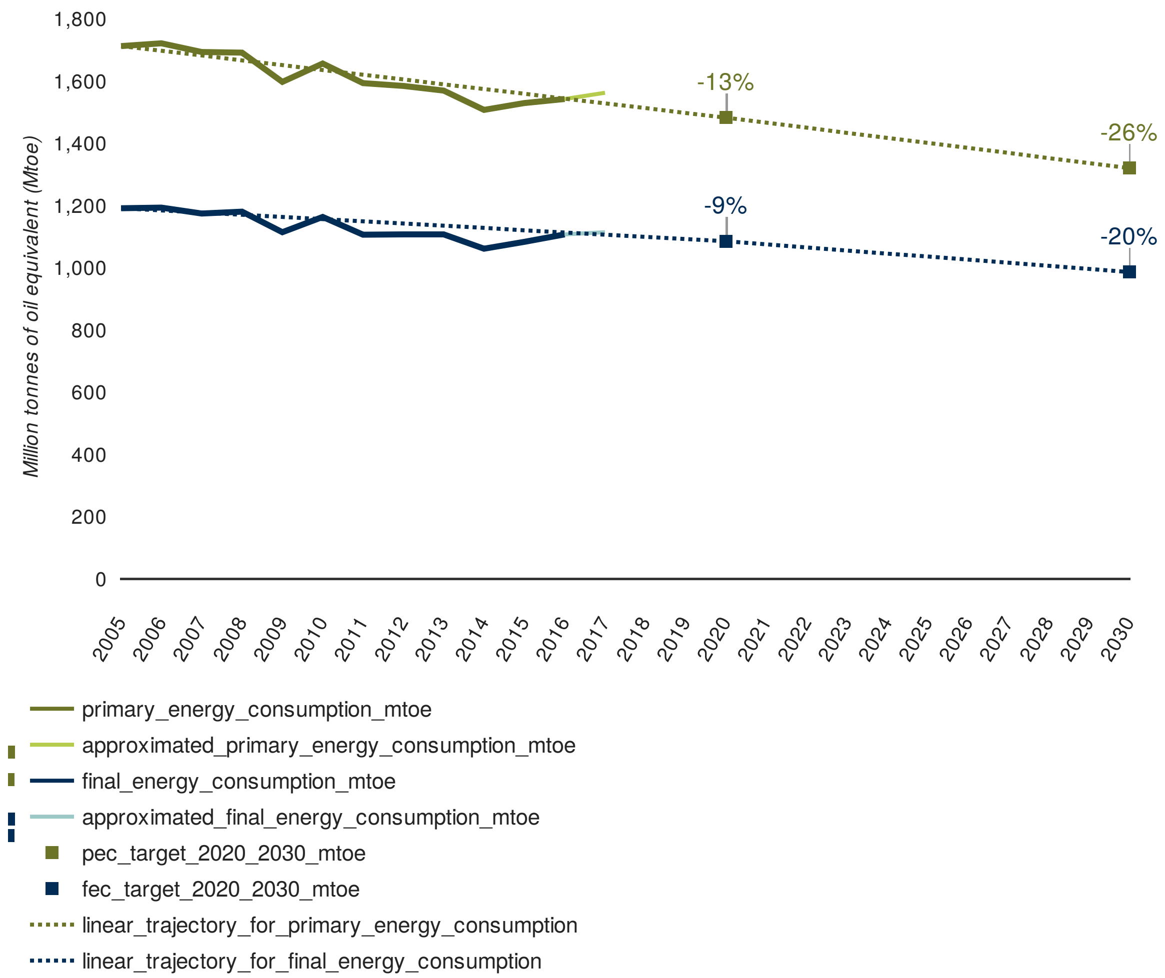
The Energy Efficiency Directive (EED) (EU, 2012) includes the target that energy efficiency should increase by 20 % by 2020 compared with a business-as-usual scenario (EC, 2011).

The EED translates this into two separate 2020 energy consumption reduction targets for the EU: a primary energy consumption of 1 483 million tonnes of oil equivalent (Mtoe), representing a 13 % reduction compared with 2005 levels, and a final energy consumption of 1 086 Mtoe, representing a 9 % reduction compared with 2005 levels. Primary energy consumption covers the consumption of the energy sector itself, the losses during the transformation and distribution of energy as well as the final energy consumption. Final energy consumption covers consumption by end users (e.g. households, industry, services, agriculture) once the energy has been delivered to them. This briefing focuses on the 2020 primary energy consumption target as primary energy consumption encompasses final energy consumption.

In 2016, primary energy consumption in the EU was 10 % lower than in 2005 (see figure 1). The reduction in the EU primary energy consumption over the 2005-2016 period was mainly the result of decreases in final energy consumption, changes in the fuel mix used to produce electricity and heat (higher penetration of renewable and gas energy) and improved efficiency in the conversion of primary energy sources (e.g. coal and gas) into final energy (EEA, 2018a, 2018b and 2018c).

In 2016, final energy consumption in the EU was 7 % lower than in 2005 (see figure 1). The main drivers of the decrease over the 2005-2016 period were the implementation of energy efficiency policies, structural changes towards less energy-intensive industrial sectors and the 2008 economic downturn (EEA, 2018a). The biggest contributors to the final energy consumption decrease were the industrial and household sectors that together were responsible for approximately 90 % of the decrease (EEA, 2018c).

## Figure 1. Primary and final energy consumption including targets for 2020 and 2030, EU




**Note:**
The Primary Energy Consumption (PEC) and Final Energy Consumption (FEC) numbers shown for 2020 and 2030

**Data source:**

**a:** Eurostat. Simplified energy balances - annual data (nrg_100a)

**b:** Eurostat Complete energy balances - annual data (nrg_110a)

**c:** European Commission. Directive 2012/27/EU

**d**: European CommissionEnergy Efficiency Directive

**Note:** The Primary Energy Consumption (PEC) and Final Energy Consumption (FEC) numbers shown for 2020 and 2030 represent the EU targets compared with 2005.

In addition to the EED, there are several other EU policies and measures that have contributed towards the 20 % reduction target and will continue to do so.

These include:

- The Energy Performance of Buildings Directive (EU, 2018);
- Product regulations laying down minimum energy performance standards and requirements for energy labelling (the Ecodesign Directive (EU, 2009a) and the Labelling Directive (EU, 2017);
- $CO_2$ performance standards for cars and vans (EU, 2009b and 2011);
- Increased financing through EU structural and investment funds, Horizon 2020 and dedicated facilities, such as European Local Energy Assistance (ELENA) and the European Energy Efficiency Fund;
- The EU Emissions Trading Scheme (ETS) and the Effort Sharing Decision for non-ETS sectors (EU, 2009c, 2009d).

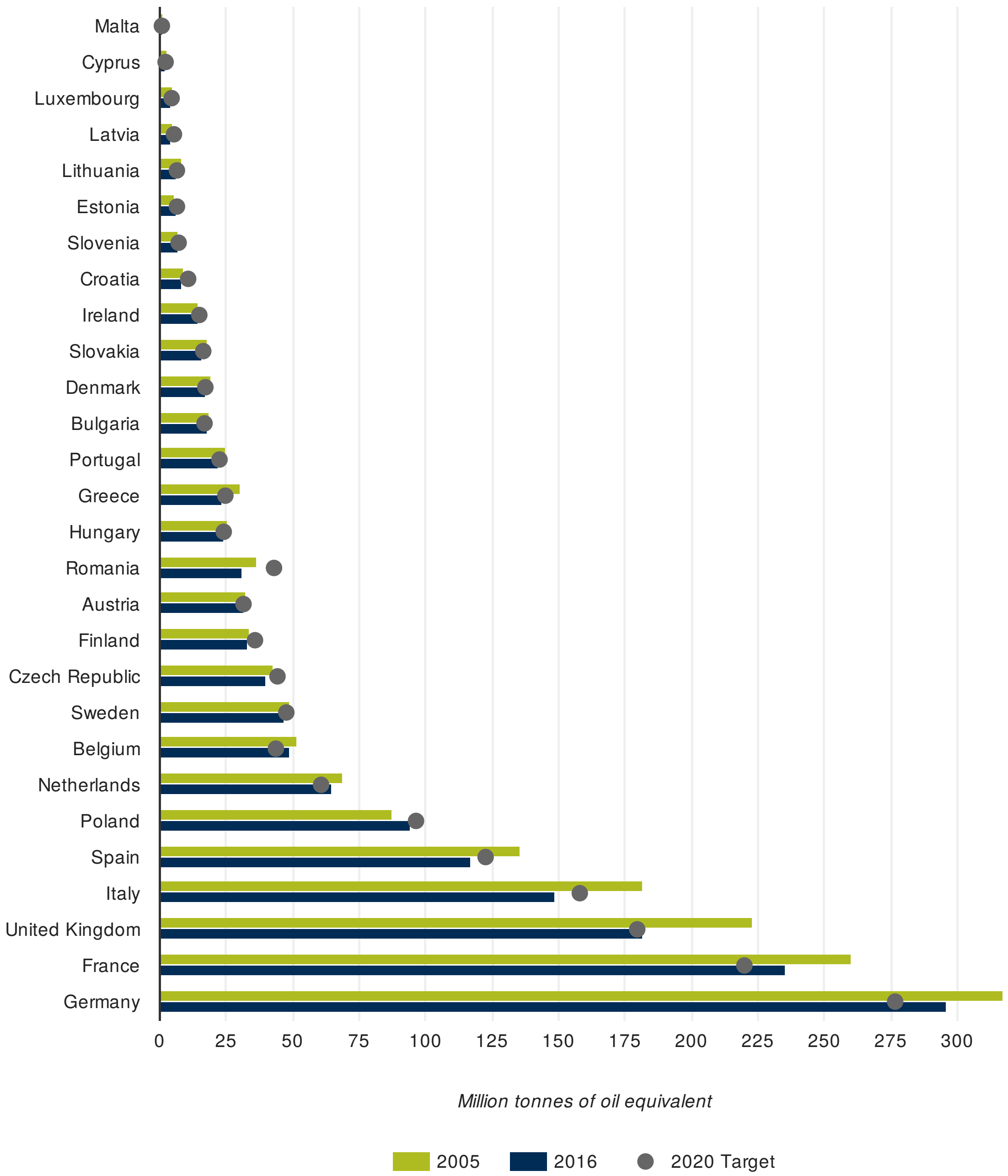
Nevertheless, the EU primary energy consumption increased both in 2015 (by 1.5 %) and in 2016 (by 0.7 %) year-on-year. The increase took place despite energy efficiency improvements, mainly because of increased economic activity levels (Odyssee-Mure, 2018) most likely driven by the high economic growth over this period (AIRS_PO2.1, 2018). In the household sector, more appliances and dwellings, and changes in heating behaviour contributed to the increase in energy consumption (Odyssee-Mure, 2018). Finally, the winters of 2015 and 2016 were slightly colder compared with those of 2014 and 2015, respectively (EEA, 2018d), which also increased energy consumption (Odyssee-Mure, 2018). It should be noted however that the winter temperatures in 2015 and 2016 were above the average winter temperature of the 2005-2016 period (EEA, 2018d). Overall, all sectors increased their energy consumption in 2015 and 2016. However, more than 80 % of the increase in primary energy consumption over these 2 years was because of the increases in the household and in the transport sectors (Eurostat, 2018).

Preliminary results show a further increase in primary energy consumption of circa 1.4 % in 2017 compared with 2016. The increase may have been driven by increases in activity levels triggered by higher economic growth in 2017 compared with 2016 (AIRS_ PO2.1, 2018) and by a slightly colder winter in 2017 compared with 2016 (EEA, 2018d). In any event, the EU's primary energy consumption in 2017 was above the pathway of the linear reduction over the 2005-2020 period corresponding to the EU meeting its energy efficiency target by 2020 (see figure 1). This makes the prospects of meeting the EU energy efficiency target by 2020 uncertain and points to the need to implement further energy efficiency policies at the national level.

The EED is currently in the final stages of being updated and a political agreement between the European Parliament and the Council was reached in June 2018, whereby the updated Directive will require the EU to meet a more ambitious energy efficiency target of at least 32.5 % by 2030 (EC, 2018) in addition to the existing 2020 energy efficiency targets. This may help to keep the momentum towards increasing energy efficiency.

# Country level information

## Figure 2. Primary energy consumption and estimated targets for 2020, by country




**Data sources:** a. Eurostat. Simplified energy balances - annual data (nrg_100a)
b. Eurostat. Complete energy balances - annual data (nrg_110a) c. Directive 2012/27/EU
d. European Commission. Energy Efficiency Directive

In 2016, 18 Member States were considered to be on track towards meeting their 2020 energy efficiency targets as they reduced or limited their increase in primary energy consumption to a level below their linear trajectories drawn between their 2005 primary energy consumption levels and their 2020 energy efficiency targets. Ten Member States (Austria, Belgium, Bulgaria, Cyprus, France, Germany, Ireland, the Netherlands, Poland and Sweden) had not achieved in 2016 sufficient savings in primary energy consumption to stay below their linear trajectory levels – five more than in 2015 (EEA, 2018a).

In 2017, according to EEA preliminary estimates, three additional countries (Estonia, Hungary and Portugal) can be expected to rise above their linear trajectory thresholds (EEA, 2018a).

## Outlook beyond 2020

Continued improvements in energy efficiency will be needed well beyond 2020 if the 7th EAP's 2050 vision of Europe, in which 'low-carbon growth has long been decoupled from resource use', is to be achieved. As already mentioned, within the context of updating the Energy Efficiency Directive a political agreement was reached whereby the EU should meet an energy efficiency target of at least 32.5 % by 2030; the updated Directive (EC, 2016a) is expected to be adopted in the coming months. Buildings are responsible for circa 40 % of the EU’s final energy consumption. An update of the Directive on the energy performance of buildings, adopted in May 2018 (EU, 2018), will enable the adaptation of the building sector to smart technologies. Finally, a new finance initiative for smart buildings was launched by the European Commission in November 2016 (EC, 2016) to support the process of modernisation of buildings over the 2021-2030 period. These recent policy developments aim to accelerate the pace of energy efficiency improvements.

## About the indicator

Improving energy efficiency means using less energy for the same output or producing more with the same energy input. The 2020 target for energy efficiency has been interpreted to mean reductions in primary and final energy consumption. The indicator tracks levels of primary and final energy consumption in million tonnes of oil equivalents. Primary energy in this context covers the consumption of the energy sector itself, losses during the transformation (for example, from oil or gas into electricity) and distribution of energy, and final consumption by end users. It excludes energy carriers used for non-energy purposes (such as petroleum used for producing plastics). Final energy consumption is the total energy consumed by end users, such as households, industry, services, agriculture and fisheries. It is the energy that reaches the final consumer's door and excludes the energy used by the energy sector itself and in deliveries to the transformation sector.

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## Annual Indicator Report Series (AIRS)

### AIRS briefings

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AIRS_PO2.5, 2018, Greenhouse gas emissions, European Environment Agency.

AIRS_PO2.6, 2018, Renewable energy, European Environment Agency.

> Environmental indicator report 2018 – In support to the monitoring of the 7th Environment Action Programme, EEA report No19/2018, European Environment Agency

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Resource efficiency and low carbon economy

# Household energy consumption

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Energy consumption by households | | Reduce the overall environmental impact of production and consumption in the housing sector - 7th EAP | |

The energy consumption of households in the EU decreased between 2005 and 2016. It is, however, uncertain whether household energy consumption will decline during the Seventh Environment Action Programme period (2014-2020) since it increased both in 2015 and 2016.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) includes the objective that the environmental impact of housing should be reduced. Energy consumption in the use phase of housing causes the largest environmental impacts. Overall, the energy consumption of households in the EU declined by 8 % between 2005 and 2016. This shows that policies on the energy performance of buildings and appliances are having an effect. Nevertheless, these efficiency gains have been partly offset by lifestyle changes such as an increasing number of electrical appliances, larger and more homes. Climatic conditions also play an important role in the energy consumption of households. Household energy consumption increased both in 2015 and 2016 mainly because the 2016 winter was slightly colder than that of 2015, which was in turn a bit colder than that of 2014. Lifestyle changes also had an impact. It is uncertain whether the energy consumption of households will decrease during the 7th EAP period (2014-2020) as energy efficiency improvements over this period may not be enough to counteract the opposite effects of lifestyle or weather changes.

## Setting the scene

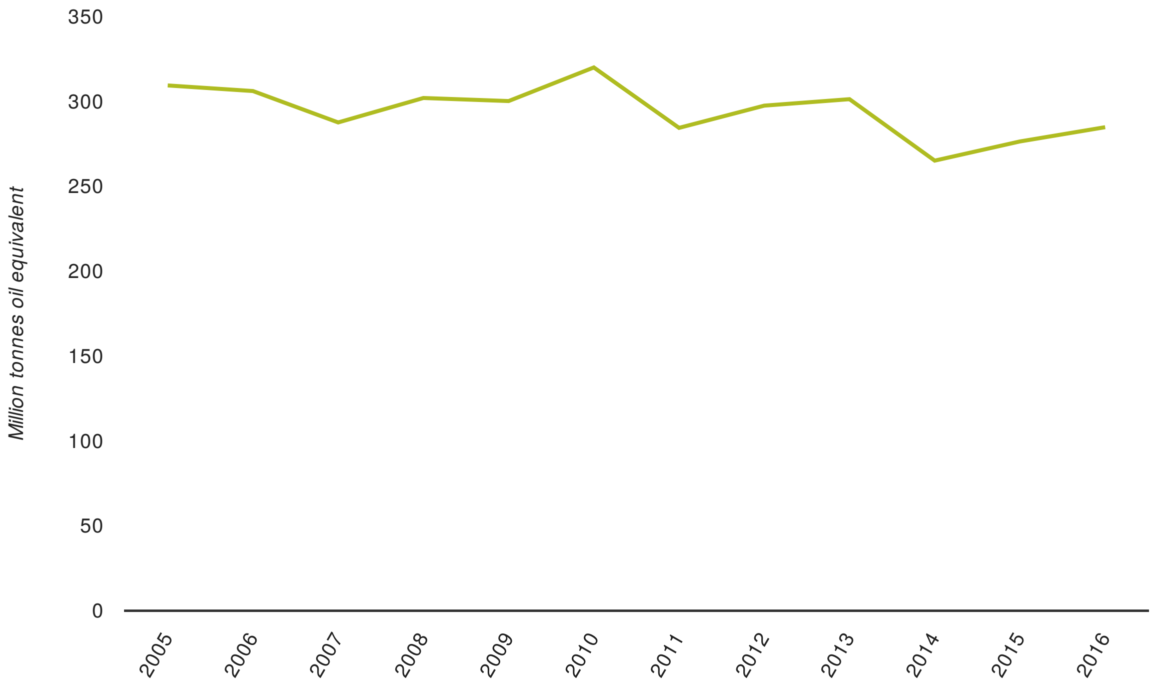
The 7th EAP calls for 'structural changes in production, technology and innovation as well as consumption patterns and lifestyles to reduce the environmental impact of production and consumption in the food, housing and mobility sectors' (EU, 2013). This briefing focuses on housing aspects, while food (AIRS_PO2.10, 2018) and mobility (AIRS_PO2.9, 2018) are dealt with in two other related briefings. The construction and use of housing leads to a number of environmental impacts ranging from land take and the consumption of resources, to the production of waste during construction and demolition. The largest environmental impacts arguably result from energy consumption during the use phase.

## Policy targets and progress

There is no environmental acquis equivalent to the 7th EAP selected objective. The key EU policies that have influenced household energy use are the Energy Performance of Buildings Directive (EPBD) (EU, 2018a), the Energy Labelling Directive (EU, 2010), the Ecodesign Directive (EU, 2009) and the Energy Efficiency Directive (EU, 2018b). The EPBD requires, inter alia, all new buildings to be near zero energy by 2020. The provisions of this Directive were strengthened and modernised this year, which will help promote the use of smart technology in buildings and more generally help improve further the energy performance of buildings. The Energy Efficiency Directive sets energy efficiency targets for reducing energy consumption and, in this context, encourages the renovation of the building stock. The provisions of the Directive were reinforced this year in order to achieve higher energy efficiency levels including, for example, improving metering and billing of energy consumption for heating and cooling consumers. The Energy Labelling Directive aims to encourage producers and consumers to favour more energy-efficient appliances, while the Ecodesign Directive sets minimum standards for a growing number of appliances and other energy-related products.

Figure 1 shows that the final energy consumption of households in the EU has declined by 8 % over the 2005–2016 period examined (see also EEA, 2018a). Space heating accounts for approximately two thirds of energy used by households in the EU. A key reason for the observed high consumption in Figure 1 for the years 2005, 2010 and 2013, for example, was that these years had relatively cold winters. Similarly, the low consumption for the years 2007, 2011, 2014 and 2015, was, inter alia, because of relatively mild winters (EEA, 2016, 2018b).

**Figure 1. Final energy consumption in the households sector, EU**




**Data sources:** Eurostat. Energy statistics - Supply, transformation and consumption

During the 2005-2016 period, energy efficiency improvements in space heating and the use of more efficient electrical appliances, as well as behavioural changes driven by higher energy prices and the 2008 economic downturn all contributed to reductions in overall energy consumption in the households sector. Increases in the number of appliances, average size of dwellings and number of dwellings partially offset these improvements (EEA, 2018c).

Household energy consumption increased both in 2015 (by 4 %) and in 2016 (by 3 %) compared with 2014 and 2015 respectively. The relatively colder winters in these two years contributed to these increases (EEA, 2018b). However, lifestyle changes such as more dwellings, more appliances per dwelling, changes in heating behaviour (e.g. higher home temperatures) also contributed. Energy efficiency improvements were not significant enough to counteract these effects. In fact, since 2013 a slow down in the rate of the annual energy efficiency improvement has been observed year-on-year compared with the average annual rate of the 2005-2016 period (Odyssee-Mure, 2018).

On 25 February 2015, the Commission adopted 'A framework strategy for a resilient energy union with a forward-looking climate change policy' (EC, 2015). This Energy Union strategy framework creates the momentum to bring about a transition to a low-carbon, secure and competitive energy system. The strategy triggered, among other things, and as mentioned at the start of this section, the reinforcement in 2018 of the directives on energy performance of buildings and on energy efficiency. However, these initiatives mainly have 2030 or longer term objectives and it is unlikely that the implementation of specific actions will be in place before 2020.

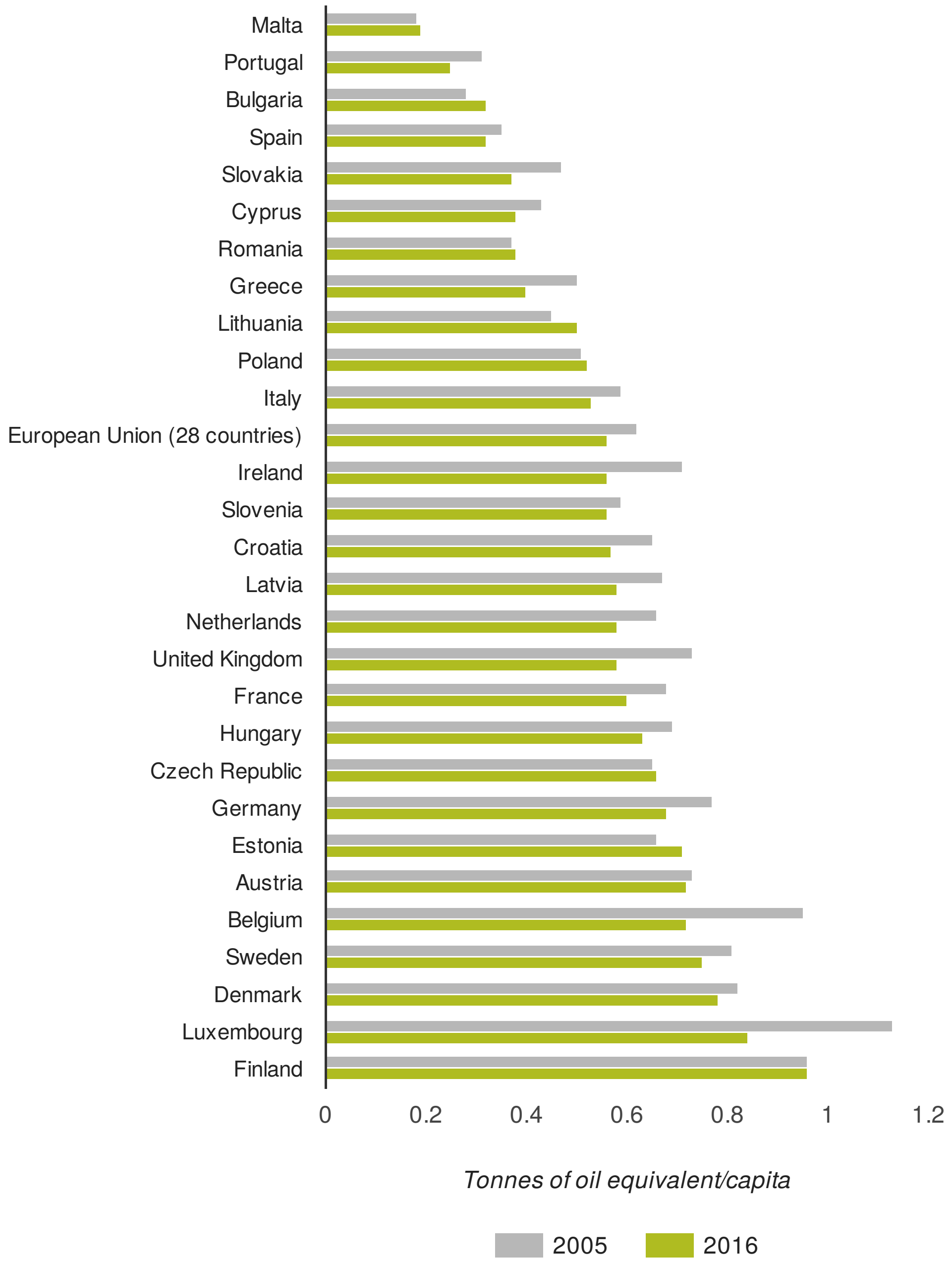
In conclusion, it is uncertain whether the energy consumption of households will decrease over the 7$^{th}$ EAP period (2014-2020). This is because energy efficiency improvements may — similarly to 2015 and in 2016 — not be enough to counteract increases in household energy consumption driven by lifestyle- or weather-related changes.

## Country level information

Figure 2 shows the per capita household energy consumption in the EU countries in 2005 compared with 2016.

Energy use in the household sector differs widely between countries because of weather conditions, the state and age of the building stock and household appliances, the average size of the dwellings, the heating/cooling systems used, behaviour (particularly with respect to cooking) and the level of implementation of energy efficiency measures. In 2016, per capita energy consumption in the household sector of the EU countries ranged from 0.2 tonnes of oil equivalent per capita (toe/capita) in Malta to 1 toe/capita in Finland.

### Figure 2. Per capita final energy consumption of the households sector, by country




**Data sources:** a. Eurostat. Statistics on population (tps00001)
b. Eurostat. Simplified energy balances - annual data (nrg_100a)

## Outlook beyond 2020

Energy use in households accounts for about one quarter of all energy used in the EU. Therefore, reductions in household energy consumption are necessary if Europe is to achieve the low-carbon growth envisaged in the long-term vision of the 7th EAP.

The reinforced directives on energy performance of buildings and on energy efficiency that were adopted in 2018, and more broadly the Energy Union process, should drive further reductions in the energy consumption of households. This includes an energy efficiency target of at least 32.5 % for the EU as a whole by 2030. It also includes the Heating and Cooling Strategy (EC, 2016) that should help reduce the energy consumption of households and their impact on the environment by promoting the increased use of district heating and better integration of renewable energy sources.

In the long run, the environmental impacts of housing will depend not only on the enforcement of the policy measures and goals that have been set, but also on lifestyle choices (e.g. in terms of living space, consumption patterns, etc). This would, inter alia, depend on whether more possibilities for pursuing sustainable solutions would continue to be available to people, entrepreneurs and local authorities. For example, reducing energy consumption in existing buildings presents a major challenge as the turnover of the building stock is slow. Progress can be achieved by making better use of climate finance and revenues from energy taxation, for instance, to support large-scale renovation and local authorities, and by encouraging changes in consumer behaviour through the creation of framework conditions that can better enable the consumer to participate in the energy market (OpenExp, 2016).

## About the indicator

Figure 1 represents final energy consumption by households at EU level. This is the total energy consumed each year by the household sector. It excludes energy lost in the production and transport of the energy to households, as well as the energy consumption of household members for transport. Figure 2 represents the per capita energy consumption of the household sector by country.

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Resource efficiency and low carbon economy

# Transport greenhouse gas emissions

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Greenhouse gas emissions from transport | ▲ | Reduce the overall environmental impact of production and consumption in the mobility sector - 7th EAP | ● |

Past transport greenhouse gas emissions increased from 1990 to 2016 despite a decline between 2008 and 2013 following the economic downturn. It is unlikely that emissions will decrease during the Seventh Environment Action Programme period (2014-2020) since emissions rose in each of the last 3 years (2014-2016) and preliminary results show an increase in emissions also in 2017.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) includes the objective of reducing the environmental impact of mobility (i.e. transport). Transport is the cause of significant environmental pressures including greenhouse gas emissions, habitat fragmentation, air pollution and noise. Greenhouse gas emissions from the transport sector are used here as a proxy indicator for the overall environmental impacts of the transport sector. Greenhouse gas emissions from transport have increased in the EU since 1990 in line with trends in economic growth and transport demand. Improvements in vehicle efficiency have nevertheless helped to limit the overall increase. It is unlikely that the EU transport related greenhouse gas emissions will decline during the implementation period of the 7th EAP (2014-2020) since these emissions increased in each of the last 3 years (2014-2016) and preliminary results show an increase also in 2017.

## Setting the scene

The 7th EAP calls for a reduction in the environmental impact of mobility (EU, 2013). The transport sector is a major contributor to climate change, air pollution, noise, natural resource depletion and land fragmentation. Reducing the environmental impact of transport can be addressed by reducing the demand for travel, introducing new, cleaner technologies and shifting towards less environmentally damaging transport modes. Greenhouse gas emissions from the transport sector are used in this briefing as a proxy indicator for the overall environmental impacts of the transport sector. These emissions reflect the level and efficiency of the sector's activity as well as the mix of transport modes. In addition, climate change (and therefore greenhouse gas emissions) is one of the most significant environmental issues and transport contributes about one quarter of the EU's total greenhouse gas emissions.

## Policy targets and progress

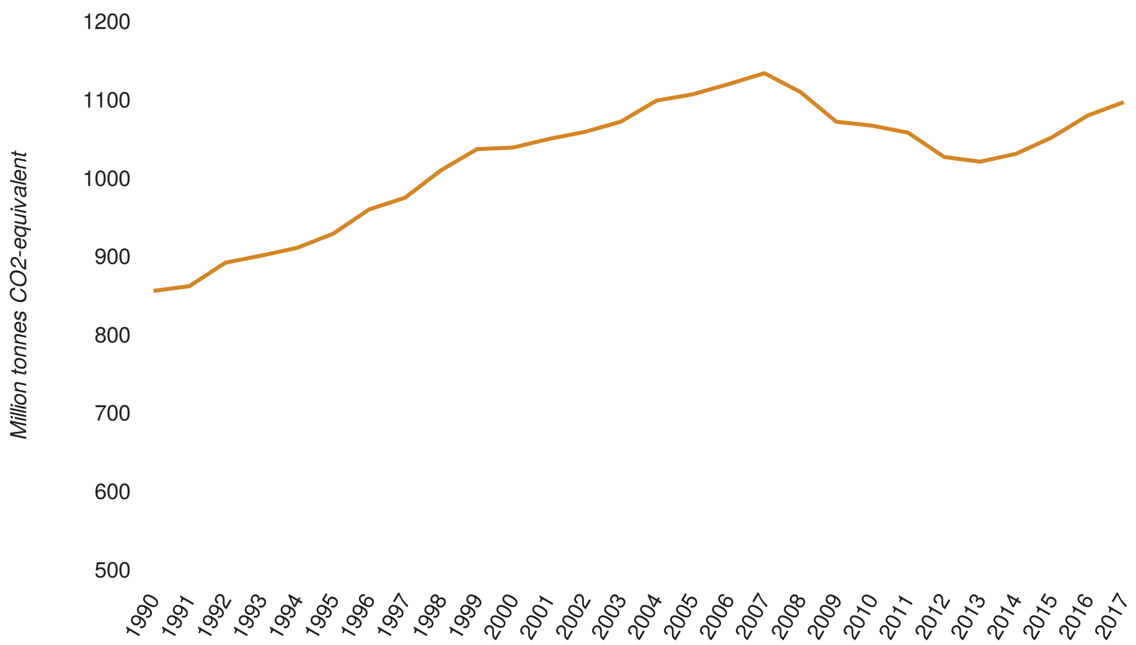
The European Commission's 2011 Transport White Paper entitled Roadmap to a Single European Transport Area — Towards a competitive and resource efficient transport system (EC, 2011) still remains an important reference point because it contains a numerical transport sector target. It formulates the long-term ambition to reduce greenhouse gas emissions from transport by at least 60 % by 2050 compared to 1990. The more recent European strategy for low-emission mobility reiterates this target and identifies priority areas for action (EC, 2016).

Figure 1 shows the evolution of EU greenhouse gas emissions from transport (including international aviation and excluding international shipping) over the 1990-2016 period as reported by Member States. The emissions increased by 26 % compared with 1990 levels. This increase comes despite past improvements in the efficiency of transport and is broadly in line with increases in the level of economic activity as measured by gross domestic product (GDP) as well as increases in demand for transport (both freight and passenger) (EEA, 2018a).

Road transport accounts for 72 % of total greenhouse gas emissions of the sector (EEA, 2018b). Ongoing energy efficiency improvements in road transport have played a key role in limiting the increase of road transport emissions. Such improvements were brought about in part by means of increasingly stringent technical standards, including the fleet average $CO_2$ emission requirements for new passenger cars (EU, 2009) and vans (EU, 2011).

Figure 1 shows that greenhouse gas emissions from transport decreased between 2008 and 2013. This was mainly because of lower levels of economic activity — manifesting also in lower levels of freight transport (EEA, 2018a) — following the 2008 economic downturn, as well as further implementation of transport efficiency measures.

## Figure 1. Greenhouse gas emissions from transport, EU




**Data sources:** a. EEA. National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism
b. EEA – Indicator TERM002

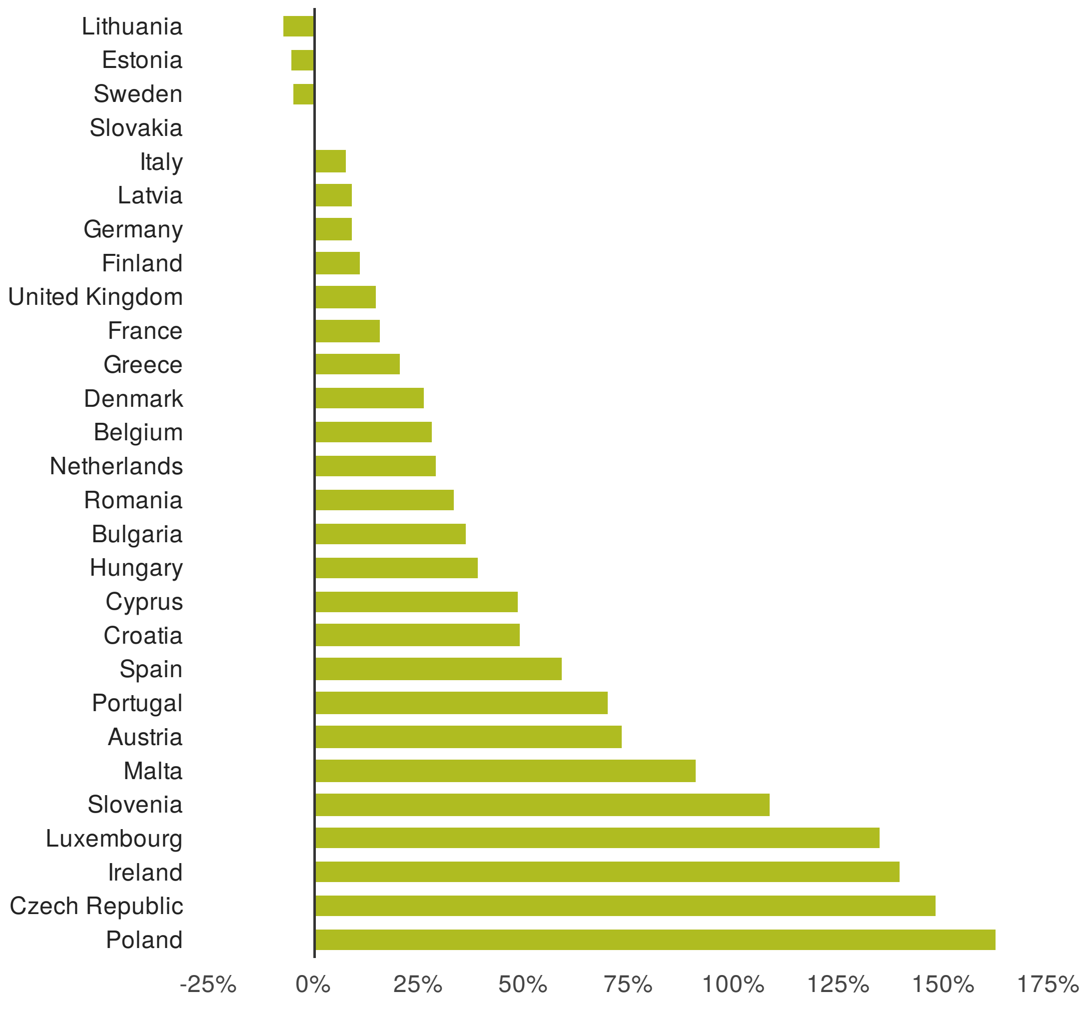
**Note**: Greenhouse gas emissions show total emissions from transport including from international aviation and excluding from international shipping.

Greenhouse gas emissions from transport increased in 2014, 2015 and 2016 (by 1 %, 2 % and 2.6 % respectively, year-on-year). The transport greenhouse gas emission increases over the 2014-2016 period were mainly because of increased activity levels in the transport sector driven by economic growth and took place despite energy efficiency improvements and technological advances in the sector (Odyssee-Mure, 2018).

The official projections by the EU Member States show that the EU transport greenhouse gas emissions (including international aviation but excluding international shipping) will decrease slightly between 2015 and 2020 in the two scenarios used: with existing measures and with additional measures (EEA, 2018c). However, EU transport greenhouse emissions (including international aviation but excluding international shipping) reported by the Member States have increased for 3 years in a row (2014-2016) and preliminary estimates show an increase also in 2017 by 1.5 % compared with 2016 (EEA, 2018d). This means that transport GHG emissions would need to fall at an annualised rate of above 2% during the 2018-2020 period in order to reach a level that is below the one in 2014. Such a development is incompatible with the most recent projections (2018c). It therefore seems unlikely that over the 7th EAP implementation period (2014-2020) EU transport greenhouse gas emissions will decrease.

# Country level information

### Figure 2. Change in greenhouse gas emissions from transport, 1990 to 2016, by country




**Data sources:** a. EEA. National emissions reported to the UNFCCC and to the EU Greenhouse Gas Monitoring Mechanism
b. EEA. TERM 002 indicator

> **Note:** Greenhouse gas emissions show total emissions from transport including from international aviation and excluding from international shipping.

Figure 2 shows the change in transport greenhouse gas emissions between 1990 and 2016 at country level. Over this period, a few countries saw a slight decrease in emissions while in the majority of the countries greenhouse gas emissions increased significantly. An increase in car ownership rates resulting in bigger car fleets is a key reason for transport greenhouse gas emission increases (EEA 2018e). Car ownership growth was particularly strong in the countries joining the EU since 2004, many of which started from a very low level in 1990. Countries with a strong growth in transport greenhouse gas emissions typically also experienced the strongest expansion in transport demand (EEA, 2018a) in tandem with a declining share of rail transport.

## Outlook beyond 2020

The 10 goals set by the European Commission White Paper on Transport (EC, 2011) are expected to lead to the future introduction of new EU policies to increase the efficiency of Europe's transport sector. The main target of the White Paper is to reduce greenhouse gas emissions by 60 % compared with 1990 levels, by 2050. A key assumption in the White Paper is that technologies that contribute to lower greenhouse gas emissions, such as the electrification of road transport and development of sustainable fuels, will be increasingly available, especially after 2030. More recently, the European Commission has also published a 'European Strategy for Low-Emission Mobility' (EC, 2016a) that identifies three priority areas for action:

1. [Further] increasing the efficiency of the transport system;
2. Speeding up the deployment of low-emission alternative energy for transport; and
3. Moving towards zero-emission vehicles.

A modal shift away from road transport is a key element of the EU's decarbonisation ambitions. The White Paper explicitly states the ambition to shift 30 % of road transport for distances over 300 km to rail and waterborne transport by 2030, and more than 50 % by 2050.

Nevertheless, total transport demand is predicted to continue growing during the 2020-2030 period in line with 2010-2020 patterns (1 % a year for passenger transport (passenger km) and 1.5 % for freight transport (tonne km)) and at lower rates between 2030 and 2050 (0.7 % a year for passenger transport and 0.8 % for freight transport) (EC, 2016b).

Integrated measures addressing both production and consumption would therefore be needed in the long run in order to, inter alia, contain the expected increase in transport demand and reduce the greenhouse gas emissions from transport by 60 % by 2050.

## About the indicator

This indicator presents the total EU greenhouse gas emissions from transport including emissions from international aviation but excluding emissions from international maritime transport. Greenhouse gas emissions from transport activities include carbon dioxide, methane and nitrous oxide. The individual gases were converted into greenhouse gas emissions by being weighted according to their global warming potentials following the relevant guidelines of the Intergovernmental Panel on Climate Change. For further information on the indicator and on the method used, please see the indicator specification of the EEA indicator TERM (Transport and Environment Reporting Mechanism) 002 (EEA, 2018e).

The indicator does not include greenhouse gas emissions from the construction of transport-related infrastructure or from the production of transport vehicles within and outside the EU.

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Resource efficiency and low carbon economy

# Food consumption – animal based protein

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Animal product consumption (animal protein) | | Reduce the overall environmental impact of production and consumption in the food sector - 7th EAP | |

Per capita consumption of total protein from animal products (meat, dairy, eggs, and fish and seafood) remained relatively stable in the EU over the period examined (2000-2013). Per capita animal based product consumption is expected to increase over the 2014-2020 period for the vast majority of animal product categories and sub-categories.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) aims to reduce the overall environmental impact of production and consumption in the food sector. Animal products have been found to cause high environmental impacts, primarily related to their production. For example, meat and dairy products contribute on average 24 % of the environmental impacts from total final consumption in the EU. Therefore, reducing the consumption of animal products and shifting to other sources of protein has the potential to reduce environmental impacts related to food production and consumption. Per capita total protein consumption from animal products (meat, dairy, eggs and fish and seafood) has been used here as a proxy indicator for the overall environmental impacts from food production and consumption. The per capita protein consumption from animal products remained relatively stable in the EU between 2000 and 2013 with a modest increase up to 2007 followed by a slight decrease to 2013. During the implementation period of the 7th EAP (2014-2020), the per capita consumption of animal-based products is expected to increase in the majority of the animal product categories and sub-categories.

## Setting the scene

The 7th EAP calls for changes in consumption patterns and lifestyles to reduce the overall environmental impact of production and consumption, in particular in the food, housing and mobility sectors (EU, 2013). Meat and dairy products contribute around 6 % of the economic value but 24 % of the environmental impacts caused by total final consumption in the EU, based on a life cycle assessment method (Weidema et al., 2008). The food sector contributes strongly to climate change, eutrophication, land take and a host of other environmental problems (Bailey et al., 2014). This briefing presents trends in the consumption of protein from animal-based food products (meat, dairy, eggs, fish and seafood), as a reduction in the demand for these products and a shift to other sources of protein has the potential to reduce the EU's environmental footprint while also delivering health benefits to parts of the population (EuroHealthNet, 2013). For the housing and mobility sectors, please see the Household energy consumption briefing (AIRS_PO2.8, 2018) and the Transport greenhouse gas emissions briefing (AIRS_PO2.9, 2018).

## Policy targets and progress

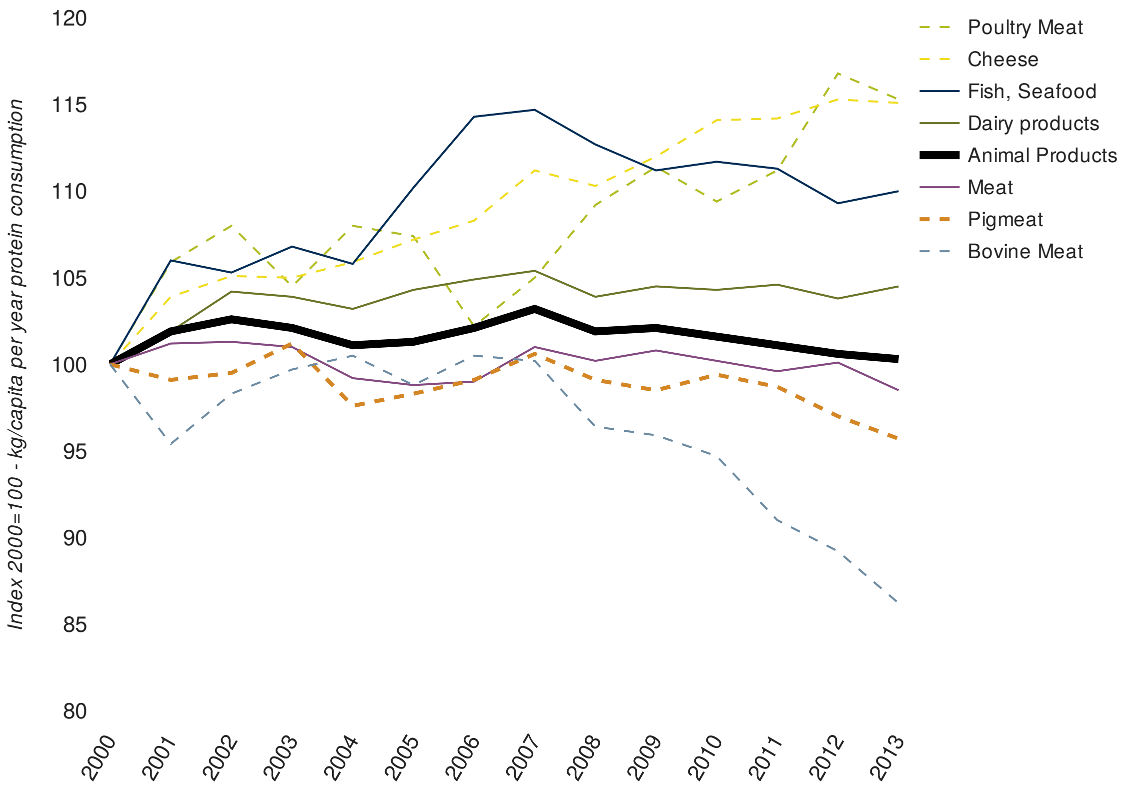
The food system is a major driver of environmental change, with implications for energy and water security. Although the EU has no explicit food policy, the food system cuts across a wide range of policy areas including agriculture, fisheries, biodiversity and health. The 7th EAP and the Roadmap to a Resource Efficient Europe (EC, 2011) share the objectives of reducing the impact of food production and consumption and reducing resource inputs by tackling food waste in particular[1].

Diets characterised by a high intake of animal products often result in consumption of saturated fat and red meat in quantities that exceed dietary recommendations. Consequently, dietary changes to a more varied diet, including shifting to non-animal based sources of protein, may have positive health effects for parts of the population. In addition, the production of animal products such as meat and dairy requires large areas of land and results in high greenhouse gas and nutrient emissions. In fact, a large proportion of the nutrient losses in Europe are related to the livestock sector. Next to improvements in nutrient use efficiency in all food chain activities and reduction of waste throughout the food chain, changing diets towards lower consumption of livestock products have been identified as the main levers to reduce nutrient losses (EEA, 2017a). Production of fish and seafood, on the other hand, especially impact marine but also freshwater ecosystems, while fish and seafood is recommended as part of a healthy diet, and aquaculture represents the most efficient method by which to convert feed to edible animal protein (EEA, 2016).

Overall, reducing the environmental pressures from food will require changes along the whole food value chain, starting with a more sustainable agriculture, sustainable food processing and transport, as well as diets that rely less on foodstuffs with high environmental impacts.

Figure 1 shows indexed EU trends over the 2000-2013 period for the per capita total animal protein consumption as well as for the most important animal based product (meat, dairy, and fish and seafood) categories and key subcategories.

**Figure 1. Trends in per capita animal based protein consumption, total and by selected animal product category, EU**




**Note**:
Dotted lines show key sub-categories of the aggregated animal product categories.

**Data sources:** a. FAO. Food Supply - Livestock and Fish Primary Equivalent b. EEA – Indicator SCP020

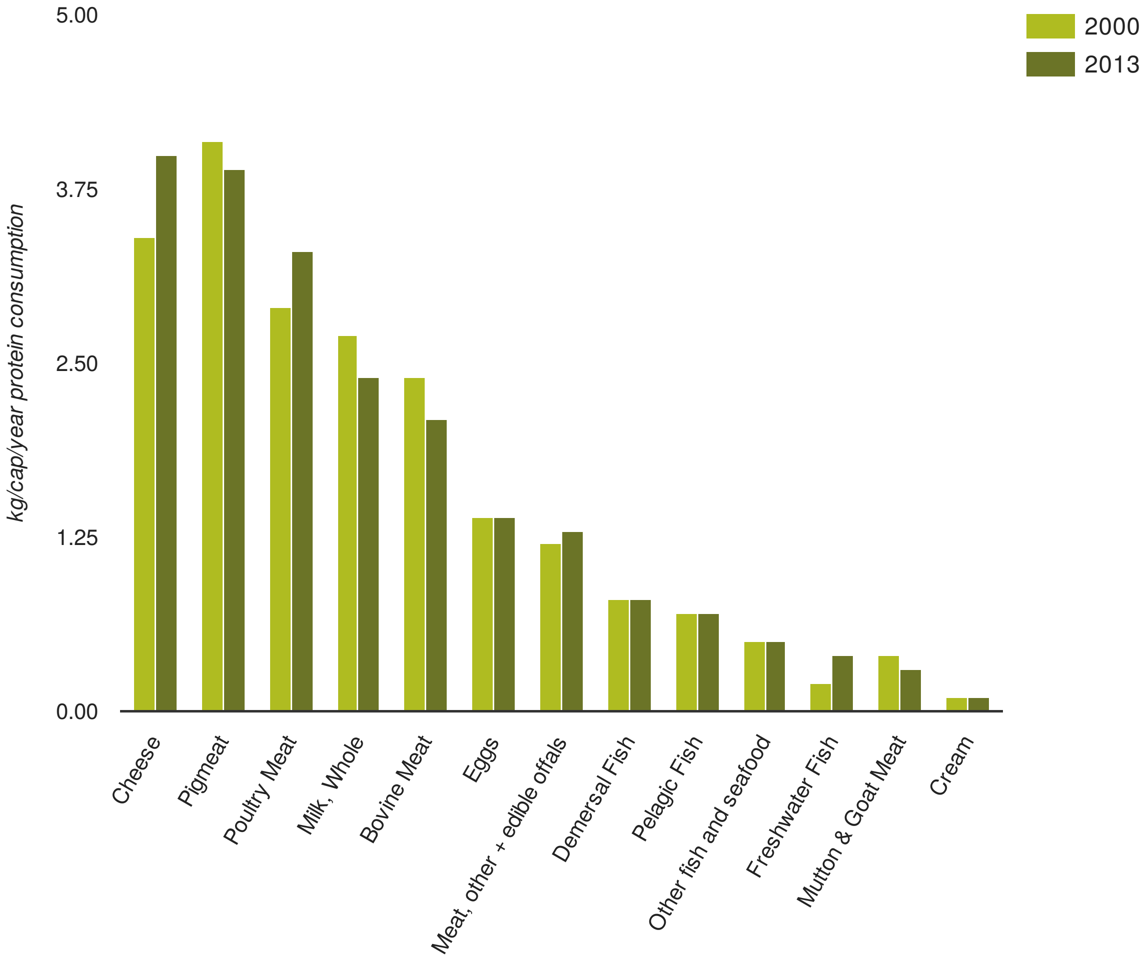
**Note**: Dotted lines show key sub-categories of the aggregated animal product categories.

The per capita total animal protein consumption in the EU remained relatively stable from 2000-2013. It increased modestly up to 2007 and reduced slightly after that year. This trend masks a diverging trend in consumption of protein from different types of animal products: consumption of protein from cheese and poultry increased by about 15 % while bovine meat decreased by nearly 14 %. EU citizens on average also covered more of their protein needs with fish and seafood in 2013 than in 2000.

European dietary changes may have been brought about by increasing awareness of healthier diets, as well as price changes. Beef prices, for example, reached record highs in 2013 (EC, 2014).

Figure 2 shows the EU per capita protein consumption for 2000 and 2013 for several meat, dairy, egg, and fish and seafood products. Cheese and pig meat are the preferred animal based protein sources, followed by poultry, milk and bovine meat. Fish and seafood contribute 11 % to animal based protein supply.

**Figure 2. Average per capita protein consumption of selected meat, fish, seafood, eggs and dairy products, EU**




**Data sources:** a. FAO. Food Supply - Livestock and Fish Primary Equivalent b. EEA – Indicator SCP020

On average, an EU citizen consumed 22 kg per year of animal-based proteins and 16 kg per year of plant-based proteins (FAOSTAT, 2018).

Different food products have very different environmental footprints. Intensively farmed beef has a carbon footprint seven times that of poultry. Land use and eutrophication loading are six times and four times higher, respectively, per kilogram. The environmental footprint of pork lies somewhere between the two for most impact categories (Weidema et al., 2008). Animal welfare issues related to intensive methods of poultry rearing are also a consideration when evaluating impact. In addition, while grazing animals can contribute positively to the biodiversity of agricultural land, overgrazing contributes to the lack of improvement in the conservation status of habitats associated with agricultural ecosystems; see EU protected habitats briefing (AIRS_PO1.8, 2018).

In terms of consumption amounts of animal products (i.e. not just protein), the average EU citizen ate 2.2 kg less beef in 2013 than in 2000 (a 13 % decrease), but 3.0 kg more poultry (a 15 % increase), with pork consumption remaining relatively stable (EEA, 2017b). This shift will have led to a reduction in environmental impacts but this may have been somewhat offset by a 2.2 kg per capita increase in cheese consumption. The shift from beef to poultry is also in line with health guidelines in guarding against cardiovascular disease (EuroHealthNet, 2013).

The EU citizen ate on average about 1.7 kg more fish and seafood in 2013 than in 2000, an 8% increase. About 1.5 kg of this increase was consumption of fish. The remaining increased fish and seafood consumption comprised mainly of crustaceans (e.g. prawns, mussels) and cephalopods (e.g. squid). The increase in the consumption of fish and seafood during this period is in line with healthy eating advice, as long as the fish and seafood are not too heavily contaminated with hazardous substances.

It is difficult to assess the environmental implications of this trend. The EU imported around 55 % of its fish and seafood in 2013 from all continents of the world, with northern Europe being the largest supplier of fish and seafood. More and more fish is produced in aquaculture. Aquaculture generates, inter alia, emissions of nutrients, antibiotics and fungicides and relies on capture fisheries for feed (EEA, 2018); however, aquaculture is still one of the most efficient methods to convert feed into edible animal protein (EEA, 2016). Globally, aquaculture production has been increasing steadily while capture production has stabilised since the 1990s (EEA, 2016).

About 67 % of commercial fish and shellfish stocks in Europe’s seas are not in good environmental status while fishing beyond sustainable levels is one of the reasons for this; for further information on the status of commercial fish stocks please see the Marine fish stocks briefing (AIRS_PO1.5, 2018). Although the situation has started to improve, in particular in the North-East Atlantic Ocean and the Baltic Sea, the progress may be compromised by the increasing consumption of fish, depending on the species consumed.

Looking towards 2020, the 2013 Common Agricultural Policy (CAP) reform is more neutral with respect to particular agricultural products than earlier CAPs. However, the EUR 500 million aid package for farmers that was adopted in 2015 is aimed specifically at supporting cattle and pig farmers (EC, 2015b).

Projections by the European Commission Directorate General for Agriculture and Rural Development (EC, 2017) show that the per capita consumption of the vast majority of the examined animal-based product categories is expected to increase over the 2014-2020 period. This includes cream, cheese, butter, skimmed milk powder, whole powdered milk, sheep and goat meat, poultry meat and eggs. Per capita consumption of yoghurt, beef and veal meat and of pig meat is expected to remain more or less stable, while the consumption of fresh milk is expected to decrease. Fish and seafood consumption were not examined.

Different food products have very different environmental footprints. Nevertheless, the vast majority of the examined animal-based product categories is expected to increase and the consumption of the high environmental footprint veal meat and pig meat is expected to remain stable. Further implementation of the environmental acquis and some efficiency gains in the food sector should limit some of the environmental impacts associated with the expected increase in the consumption of animal based products. However, there is no sufficient evidence that, by 2020, such improvements will outweigh the environmental impacts associated with the expected increases in consumption and will reduce the overall environmental impact of the food sector. In fact, both ammonia and greenhouse gas emissions from agriculture increased year-on year in the 2014-2016 period (see AIRS_PO3.2, 2018 for ammonia emissions and Eurostat, 2018 for greenhouse gas emissions); ammonia and greenhouse gas emissions from agriculture are dominated by emissions associated with livestock. There was also no discernible improvement at EU level in the nitrogen balance from agricultural land in 2014 and in 2015 which was the latest available year (see AIRS_PO1.2, 2018).

Finally, the increasing focus at both EU and Member State levels on reducing food waste through actions in the Circular Economy Package (EC, 2015a), the revised Waste Framework Directive (EU, 2018) and Member States' waste prevention programmes is, nevertheless, a positive development.

# Outlook beyond 2020

As a major greenhouse gas emitter, the food sector may need to undergo significant changes if the EU is to meet its 2050 target for an 80–95 % reduction in greenhouse gas emissions. Current policies aimed at reducing the impact of food are mostly focused on the production side, e.g. reducing inputs and better manure and slurry management. On the consumption side, the policy focus is largely limited to labelling schemes and reducing food waste. Given the health relevance and implications of meat, dairy, fish and seafood consumption for the population, potential environmental and health co-benefits, as well as conflicts and trade-offs, should be explored when considering options to reduce environmental pressures related to food consumption. However, tackling meat and dairy consumption will be important for both achieving the gains needed by 2050 in reducing greenhouse gas emissions (Weidema et al., 2008; Bailey et al., 2014) and reducing reactive Nitrogen to sustainable levels (Sutton et al., 2011).

## About the indicator

The indicator shows indexed and absolute levels of protein per capita consumption of selected meat, dairy, eggs, and fish and seafood products in the EU between 2000 and 2013. The indicator also shows in indexed form the total per capita EU consumption of animal protein for 2000 to 2013. The data were extracted from the Food and Agriculture Organization of the United Nations (FAO) statistics database (FAOSTAT, 2018). The indicator is defined as the supply of these products to the final consumer. The amount of animal protein actually consumed may be lower than the quantity shown in the indicator because of wasted edible food by households and other final consumers. The FAO uses national food composition data to calculate the protein content of different foodstuffs and the resulting protein consumption (FAOSTAT, 2001).

## Footnotes and references

[1] Halving food waste per capita at the retail and consumer level, and reducing food losses along production and supply chains has been adopted as a target within the UN Sustainable Development Goals (UN, 2015), and was confirmed as an EU goal in the 2015 Circular economy action plan (EC, 2015a). The revised Waste Framework Directive (EU, 2018) requires EU Member States to address food waste prevention in their waste prevention programmes and to monitor food waste generation, starting in 2020.

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Resource efficiency and low carbon economy

# Environmental and labour taxation

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Share of environmental and labour taxes in total tax revenues | | Shift taxation from labour towards the environment — 7th EAP | |

For the EU as a whole, there has been no positive progress over the period examined and there are no indications of any change in the coming years.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) calls for a shift in taxes from labour towards pollution and resource use as a means of helping to achieve environmental objectives and stimulating employment and green growth. Revenues from labour taxation remain eight times higher than the revenues generated by environmental taxes in the EU. These relative shares in overall taxes have changed very little over the years and only a limited number of EU countries have decreased their share of labour taxes while increasing their share of environmental taxes. The main reasons for this lack of progress appear to be a combination of the political difficulty of making any changes to a country's tax system, along with the real and perceived economic and social challenges regarding environmental taxes. Research and analysis suggest that, in order for it to be successful, this type of fiscal reform requires careful planning to avoid any negative economic and social impacts, and widespread consultation that reflects good governance principles. There are no current indications from the vast majority of Member States that they intend to shift taxes from labour towards the environment, so the outlook for 2020 appears negative.

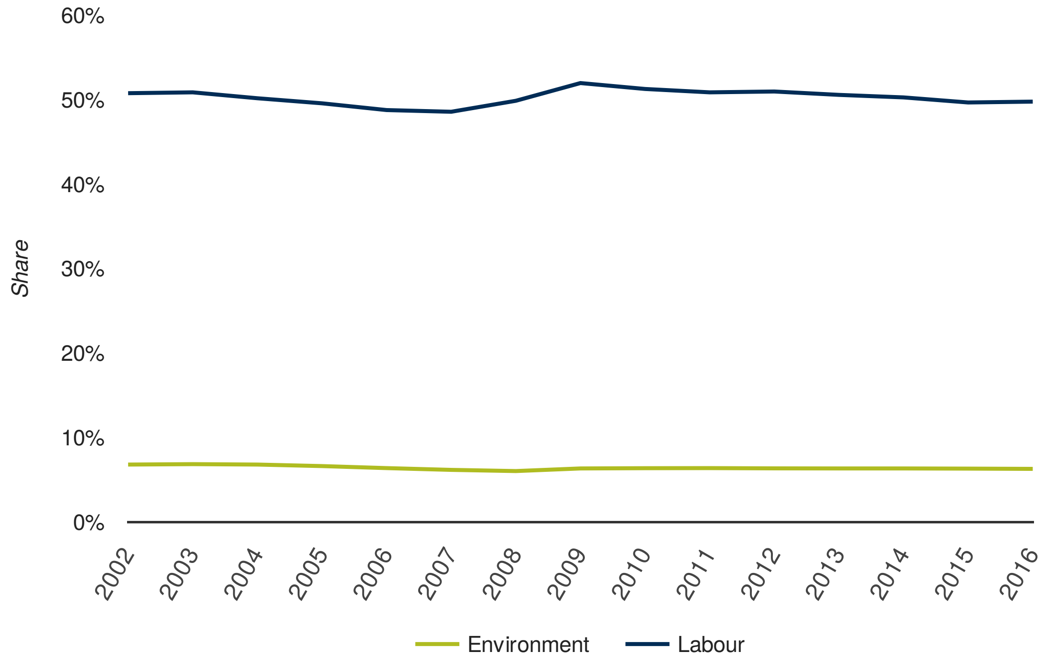
## Setting the scene

The 7th EAP calls on the EU and Member States to consider 'fiscal measures in support of sustainable resource use such as shifting taxation away from labour towards pollution' (EU, 2013). This briefing presents trends in the shares of environmental and labour taxes in total tax revenues. The reasoning that it is more environmentally and economically sound to tax pollution and resource use than to tax labour is based on the theory that increased taxes on resources should incentivise a reduction in their use. Environmental taxation can allow fiscal consolidation while, at the same time, encouraging restructuring that moves towards a resource-efficient economy (EC, 2011). Reducing taxation on labour can also encourage economic growth and, through targeted investment, can encourage the creation of jobs, for example in the recycling and energy efficiency sectors (EEA, 2013). Increasing environmental taxes and reducing labour taxes while keeping the overall tax burden constant is widely known as environmental fiscal reform.

## Policy targets and progress

The Roadmap for a Resource Efficient Europe (EC, 2011) includes a milestone that, by 2020, a major shift of taxation from labour towards the environment will lead to a substantial increase in the share of environmental taxes in government revenues, in line with the best practice of Member States.

**Figure 1. Shares of environmental and labour taxes in total revenues from taxes and social contributions, EU**




**Note: Total revenues from taxes and social contributions exclude imputed social contributions.**

**Data sources:** Eurostat. Shares of environmental and labour taxes in total tax revenues

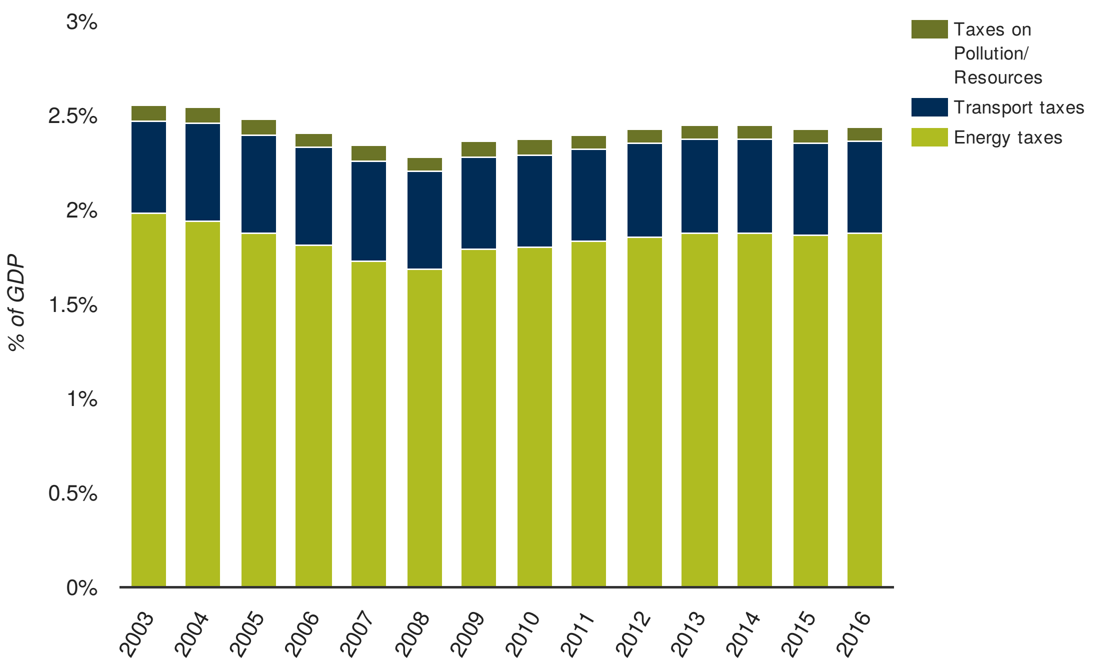
**Note**: Total revenues from taxes and social contributions exclude imputed social contributions.

For the EU as a whole, there has been no progress over the period examined (2002-2016) (Figure 1). The share of total revenues from taxes on labour has remained at approximately eight times that of revenues from environmental taxes. The revenues from labour taxes relative to environmental taxes were slightly lower in the early years (2002-2006) compared with the rest of the period examined. The revenues from labour taxes relative to environmental taxes increased during the years of the economic downturn (2008 and 2009), decreased slightly immediately after that and remained fairly stable after 2011 (see also EC, 2018).

The years following the 2008 economic downturn offered the opportunity to use environmental fiscal reform to address rising unemployment, i.e. to increase environmental taxes by reducing labour taxes and thereby encourage employment creation. The lack of any progress in such a tax shift at the EU level indicates that this opportunity has not been capitalised upon. This lack of progress comes in spite of renewed interest in environmental fiscal reform, driven by various factors including the push for fiscal consolidation and the growing recognition of the financial burden of certain measures such as fossil fuel subsidies. The recent sharp fall in global oil prices is seen by some as providing an opportunity to reform fiscal measures targeted at the production and consumption of energy from conventional sources (notably fossil fuels), e.g. by reinforcing carbon-pricing mechanisms and revisiting fossil fuel subsidies (IEEP, 2015).

In addition to taxing energy and carbon, pollution and resource taxes offer opportunities to further reduce environmental pollution and improve material resource efficiency (see the Resource efficiency briefing (AIRS_PO2.1, 2018)). Such taxes are still largely unused in the EU, comprising only 3.4 % of revenues from all environmental taxes in 2016, which corresponds to around 0.08 % of gross domestic product (GDP) in the EU (Figure 2). Over recent years, there has been no sign of an increase in the share of pollution and resource taxes in environmental taxes. This is despite an increasing focus on material resources in EU policy, represented, for example, by the 2011 Roadmap to a Resource Efficient Europe (EC, 2011) and the 2015 Circular Economy Package (EC, 2015a). Transport taxes, such as sales taxes on vehicles or annual vehicle taxes, are the second most important category in terms of revenue generation and their share was rather stable between 2003 and 2016.

**Figure 2. Environmental taxes by type, as share of GDP, EU**




**Data sources:** Eurostat. Environmental tax revenues (env_ac_tax)

The lack of progress with environmental fiscal reform may be a result of a number of obstacles in relation to implementing environmental taxation.

In its 2015 review of tax reforms in Member States (EC, 2015b), the European Commission refers to three such key barriers: (1) the potentially regressive nature of environmental taxes and possible associated equity issues; (2) the potentially harmful effect on the competitiveness of the sectors concerned; and (3) the administrative and enforcement costs of raising these taxes. The Commission, nevertheless, offers successful implementation strategies, namely transparency and early engagement with those affected by the tax, gradual implementation of the tax according to a pre-announced schedule and making such tax measures part of a broader policy package designed to achieve the specific environmental objective.

Analysis by the European Commission also suggests that higher energy taxes (a form of environmental taxes), compensated for by a reduction in labour taxation, can, in fact, improve competitiveness (Barrios et al., 2014). However, the administrative and enforcement costs must be in proportion to the political and environmental objectives that the tax aims to achieve. Other studies also suggest that any potentially negative impacts of environmental taxes can be reduced or addressed through the careful design and implementation of tax adjustments (IEEP, 2015).

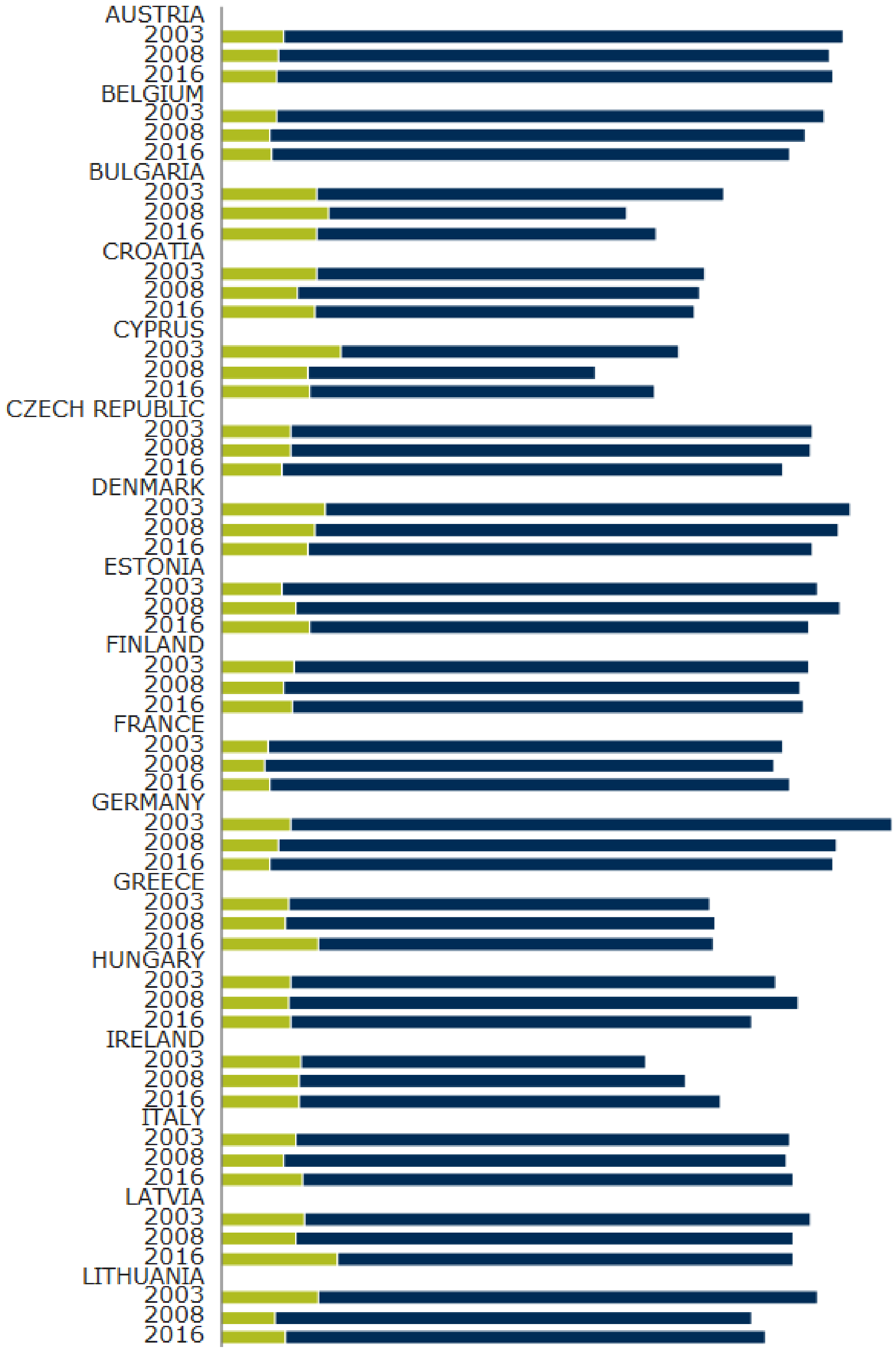
Another factor that limits changes to the relative levels of taxes is the high level of political attention that is generated by any changes to a country’s tax system. This can make any changes difficult and will tend to slow the pace of change. The political difficulties of modifying the fiscal system are reflected in a recent study by the European Commission, which assessed the environmental fiscal reform potential of the EU for different scenarios of political acceptance in various Member States (EC, 2016).

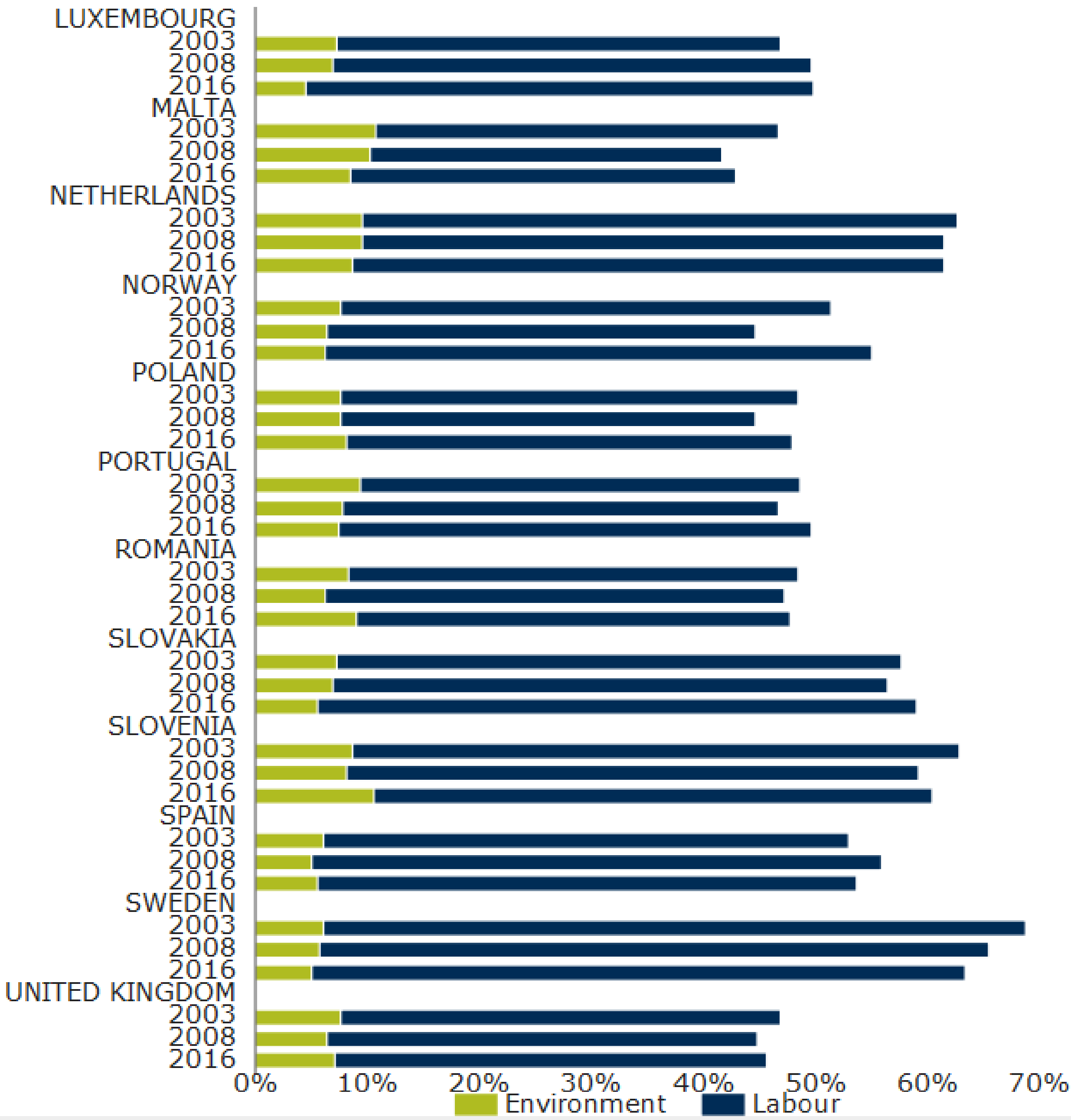
The absence of policies promoting a shift of the tax base from labour to environmentally damaging goods and practices over past years, and the lack of plans by the vast majority of Member States to implement these changes, make it unlikely that the 2020 objective will be met.

## Country level information

When comparing the levels of environmental taxation across European countries, differences should be analysed with caution. For example, low revenues from environmental taxes can result from relatively low environmental tax rates, or from modified behavioural patterns resulting from high tax rates. On the other hand, higher levels of environmental tax revenues in a country could result from low tax rates that incentivise non-residents to purchase taxed products from the other side of a border (as is the case for petrol or diesel) (Eurostat, 2018).

**Figure 3. Shares of environmental and labour taxes in total revenues from taxes and social contributions**






**Data sources:** European Commission. Data on taxation

Figure 3 illustrates the large differences among countries in the shares of both labour and environmental taxation in the total revenues from taxes and social contributions. In 2016, the labour tax shares ranged from 34 % in Bulgaria to 58.3 % in Sweden, while the environmental tax shares ranged from 4.6 % in Luxembourg to 11.7 % in Latvia.

In 2016, in only two EU Member States (Latvia and Slovenia) was the share of total revenues from taxes and social contributions made up of environmental taxes greater than 10 %.

Nine EU Member States shifted taxation away from labour and towards the environment between 2003 and 2016 (Bulgaria, Estonia, Greece, Hungary, Italy, Latvia, Poland, Romania and Slovenia). Six Member States moved in the opposite direction (Cyprus, Ireland, Luxembourg, Portugal, Slovakia and Spain) as well as Norway; however, some of these changes were quite small.

The 2015 review of tax reforms in Member States by the European Commission (EC, 2015b) identified a group consisting of approximately one third of EU Member States where there is particular scope for improving the design of environmental taxes. Suggested ways forward include restructuring vehicle taxation, indexing environmental taxes to inflation and adjusting fuel excise duties to reflect the carbon and energy content of different fuels.

## Outlook beyond 2020

A recent report by the European Commission analysed the extent to which environmental taxes could be increased, based on good practice (EC, 2016). This report found that environmental taxes could increase across the EU from an average of 2.5 % in 2013 to 3.6 % of GDP by 2030. Countries reported that politically feasible increases in environmental taxes, especially energy taxes, are lower than estimated optimal rates. However, this gap reduces as one looks further into the future. The report concluded that while, in the short term, the good-practice scenario is viewed as challenging, over the long term nearly all the suggested modifications to the national tax systems can be viewed as politically feasible.

The fiscal outlook in Europe has heightened political interest in the potential of environmental fiscal reforms. Longer term developments, including demographic changes and technological breakthroughs on energy and transport in the transition to a low-carbon, green economy, will contribute to the erosion of the current tax bases in European countries. These expected trends challenge the overall basis of current thinking on tax shifts. Much more work needs to be done on the design of resilient, long-term tax systems in Europe in the face of such systemic challenges (EEA, 2016).

## About the indicator

Environmental taxes are defined as taxes whose tax base is a physical unit (or proxy of it) of something that has a proven, specific negative impact on the environment. Current environmental tax revenues stem from four types of taxes: energy taxes, transport taxes, pollution taxes and resource taxes.

Taxes on labour are defined as all personal income taxes, payroll taxes and the social contributions of employees and employers that are levied on labour income (both employed and non-employed).

Since 2013, Eurostat has collected data on environmental taxes by economic activity at a detailed level under Regulation (EU) No 691/2011 on European environmental economic accounts. The methodological basis is outlined in the Eurostat publication ‘Environmental taxes — A statistical guide’ (Eurostat, 2013). In addition, Eurostat uses information in the National Tax Lists (NTL), supplied by EU Member States within the European System of Accounts transmission programme, to compile the data on total environmental taxes and their major categories. The NTL data are available sooner than the detailed data on environmental taxes collected under Regulation (EU) No 691/2011 and are fully in line with key macroeconomic indicators. In order to ensure coherence between the two reporting systems, small adjustments are made by Eurostat.

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Resource efficiency and low carbon economy

# Environmental Goods and Services Sector: employment and value added

| Indicator | EU indicator past trend | | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|---|
| Employment and value added in the environmental goods and services sector (EGSS) compared with the whole economy | Employment in the EGSS as a share of employment in the whole economy ▲ | EGSS value added as a share of Gross Domestic Product ▲ | Promote a larger market share of green technologies in the Union and enhance the competitiveness of the European eco-industry — 7th EAP | ● |

Employment and value added in the environmental goods and services sector have been growing faster than in the rest of the economy between 2003 and 2015, although since 2012 growth in the sector's value added slowed and employment remained more or less stable. The 2020 prospects for continued higher growth and employment creation in the sector compared with the rest of the economy are uncertain. They are also dependent on the sector competing with equivalent sectors in China and the USA, and on continuing ambitious renewable energy and green growth policies in Europe.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) calls for strengthening the market share of green technologies and enhancing the competitiveness of eco-industries by 2020. Indeed, the EU environmental goods and services sector (EGSS) has grown faster than the rest of the EU economy in terms of both employment and value added over the period examined (2003-2015). During this period, EGSS value added grew by 63 % and employment by 38 %, while overall the economy grew by 16 % and employment by 6 %. The main driver of the expansion of the EGSS was growth in the renewable energy and energy efficiency sectors, while an increase in public sector spending on green infrastructure also played a role. Since 2012, the growth in value added in the EGSS slowed and employment creation remained relatively stable mainly as a result of increasing global competition and a reduction in domestic investments in renewable energy. The EGSS will need to retain global competitiveness to achieve the 2020 7th EAP objective. This could be aided by continuing ambitious renewable energy and green growth policies in Europe.

# Setting the scene

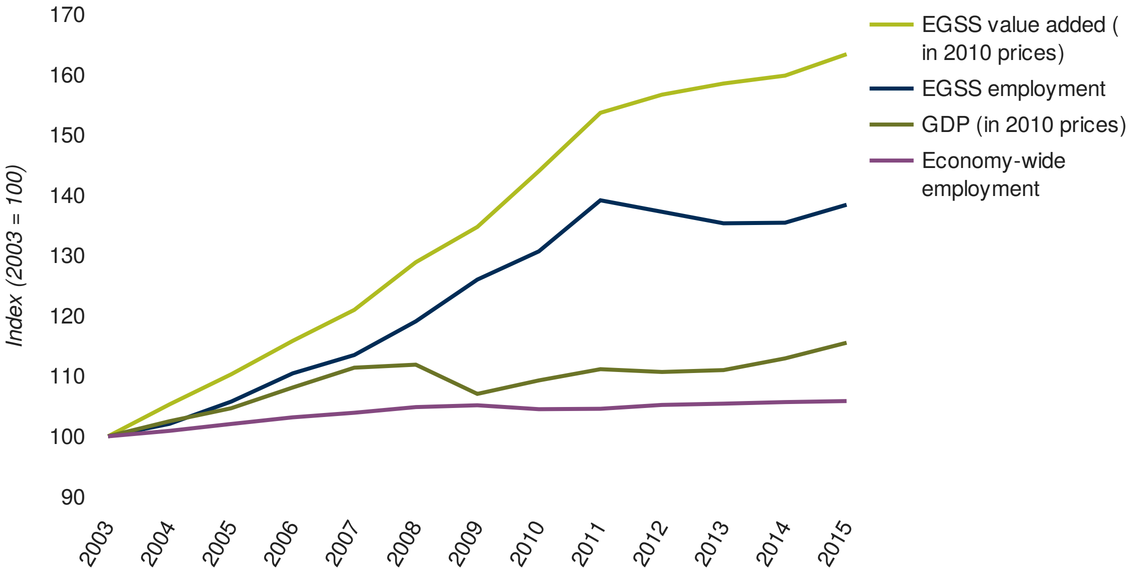
In the context of globalisation and technological change, the green economy offers potential for growth. The 7th EAP reflects the objectives of the Europe 2020 growth strategy towards a sustainable economy (EC, 2010), including growing employment in the green economy (EC, 2012). The 7th EAP (EU, 2013) calls for strengthening the market share of green technologies in the European Union and enhancing the competitiveness of European eco-industries. This will not only reduce the environmental pressures arising from economic activities but could also have important socio-economic benefits in terms of value added and employment. This briefing presents trends in value added and employment in the Environmental Goods and Services Sector (EGSS).

# Policy targets and progress

The increased awareness of the need to combat environmental pollution and preserve natural resources as well as obligations to comply with the environmental acquis has led to an increase in the supply and demand of environmental goods and services, i.e. products to prevent, measure, control, limit, minimise or correct environmental damage and resource depletion.

The Europe 2020 strategy (EC, 2010) does not include quantitative targets for increasing employment or for output from the EGSS. Nevertheless, the EGSS's environmental–economic accounts enable trends in headline macroeconomic indicators for the EGSS, such as value added and employment, to be reported, providing information on progress towards a green economy. The EGSS encompasses **environmental protection activities** — related to preventing, reducing and eliminating pollution and any other degradation of the environment — and **resource management activities** — which mainly include management of energy resources (renewable energy production, and equipment and installations for heat and energy saving).

## Figure 1. Employment and value added in the EU environmental goods and services sector (EGSS) compared with the whole economy




**Data sources:** a. Eurostat. Production, value added and exports in the environmental goods and services sector (env_ac_egss2)
b. Eurostat. Employment in the environmental goods and services sector (env_ac_egss1)
c. Eurostat. Employment and activity by sex and age - annual data (lfsi_emp_a )
d. Eurostat. GDP and main components (output, expenditure and income - nama_10_gdp)

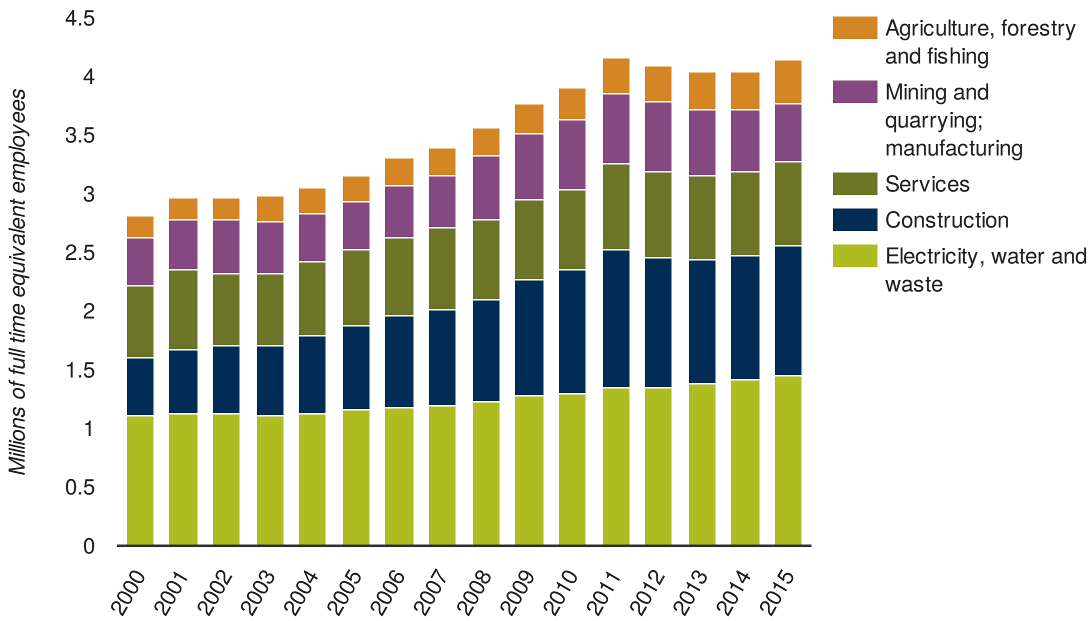
**Note:** The GDP and EGSS value added was deflated to 2010 values using the GDP deflator.

Figure 1 shows that, on average, since 2003, the EGSS has seen faster growth in employment and value added than the total EU economy. The sector's contribution to gross domestic product (GDP) grew from 1.5 % in 2003 to 2.1 % in 2015, while the sector's contribution to employment grew from 1.3 % in 2003 to 1.7 % in 2015.

The value added in the EGSS increased by 63 % in the 2003-2015 period and reached EUR 286 billion (at 2010 prices) in 2015. Growth in the value added of environmental protection and of resource management activities has been strong. It has been particularly high in resource management, whose value added grew from EUR 50 billion in 2003 to EUR 126.7 billion in 2015 (at 2010 prices), an increase of 153 %. The growth in the value added of resource management was mainly because of growth in the renewable energy sector as well as in investments in energy efficiency (energy efficiency and energy saving activities and products). The value added of environmental protection activities still represent the major element of the value added of EGSS (EUR 159.4 billion in 2015 at 2010 prices). The relative contribution of these activities in EGSS growth, however, decreased considerably over the 2003-2015 period. The value added of the environmental protection activities increased by 28 % between 2003 and 2015.

Employment in the EGSS increased by 38 % in the 2003-2015 period and reached 4.1 million full time equivalent employees in 2015 (Figure 2). Employment trends were mainly driven by the growing importance of activities that manage energy resources, in particular the production of energy from renewable sources, the production of wind and solar power stations, and equipment and installations for heat and energy saving (Eurostat, 2018a).

### Figure 2. Employment by industry groups in the EU environmental goods and services sector




**Data sources:** Eurostat. Production, value added and employment by industry groups in the environmental goods and services sector (env_ac_egss3)

**Note:** The 'electricity, water and waste' category includes: electricity, gas, steam and air conditioning supply; water supply; sewerage, waste management and remediation activities.

The value added and employment of the EGSS continued to grow relatively fast even in the years immediately after the 2008 economic downturn. This resulted partially from innovation and Europe's competitiveness in the global market, but was also supported by public spending on environmental protection and renewable energy (Görlach et al., 2014; AIRS_PO2.13, 2018). Some of the most successful government interventions have been investment support schemes, which have provided investors with a high degree of investment certainty. Especially in difficult economic times, governments can play a significant role in supporting private investment in the EGSS by guaranteeing the certainty needed by investors (Görlach et al., 2014).

Despite the successes of the sector, recent trends are not so positive, with employment creation stagnating more or less and growth in value added having slowed in the sector since 2012. This may be explained by increasing competition from the United States and China (Görlach et al., 2014). It can also be explained by a decrease in domestic investments in renewable energy as a result of ongoing uncertainty over the future of support mechanisms and lower investment capacity in some EU Member States (Frankfurt School-UNEP Centre/BNEF, 2016), as well as because of a slow down by some Member States that have already met or are about to meet their 2020 renewable energy targets (AIRS_PO2.6, 2018).

Overall, the future prospects for growth of the EGSS remain uncertain and are strongly dependent on continuing ambitious renewable energy and green growth policies in Europe and how these impact on competition with the United States and China. It is nevertheless encouraging that compared with 2014 the EGSS (value added and employment) grew by 3 % in 2015 – mainly thanks to growth in energy efficiency and energy saving activities and products.

## Outlook beyond 2020

An expanding EGSS is a key factor in the transition to a low-carbon economy that is decoupled from resource use, as envisaged in the 7th EAP. Policies on energy efficiency and renewable energy (EC, 2015a; AIRS_PO2.7, and AIRS_PO2.6, 2018), and waste recycling (EC, 2015b; AIRS_PO2.3, 2018) cover a period beyond 2020, suggesting that there could be long-term growth in the EGSS. Further expansion of the EGSS could be assisted through ambitious renewable energy and green growth policies at the EU and national levels but also via more direct assistance such as investment support schemes that provide investors with a high degree of investment certainty.

# About the indicator

This briefing uses data from the EGSS account, which is a module of the European environmental–economic accounts. Environmental accounts analyse the interaction between the economy and the environment by organising environmental information in a way that is consistent with national accounts. The EGSS is defined as that part of a country's economy that is engaged in producing goods and services that are used in environmental protection activities and resource management either domestically or abroad. The income created by the EGSS is expressed in terms of gross value added (at 2010 prices), which is the difference between output and intermediate consumption. Employment in the EGSS is expressed in terms of full-time equivalent jobs.

The data are broken down by industry (e.g. services, construction, etc.); environmental protection activity (e.g. wastewater management, waste management, protection of biodiversity and landscapes); and resource management activity (e.g. water management, energy resource management). Eurostat's estimates of the EGSS value added and employment at the EU level comprise all environmental protection activities and the key resource management activities, i.e. production of energy from renewable energy, energy efficiency and water management. Further efforts are being made to extend the scope of the EGSS sector towards a more complete and accurate accounting of EGSS activities (Eurostat, 2018b).

Regulation (EU) No 691/2011 sets out the european environmental economic accounts. From 2017, reporting of data on the EGSS is mandatory with regard to market output; the reporting of non-market output, output for own-final use and ancillary output is still voluntary. Current data are a combination of Eurostat estimates with some Member State data reported through voluntary surveys. There are some comparability issues at country level, for example some environmental activities and/or products may not be fully covered and time series may not be available prior to 2014 which is why only EU-28 data are presented in this briefing. For more information please see Eurostat, 2016a, 2016b, 2018a and 2018b.

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Resource efficiency and low carbon economy

# Environmental protection expenditure

| Indicator | EU indicator past trend | Selected objective to be met by 2020 | Indicative outlook for the EU meeting the selected objective by 2020 |
|---|---|---|---|
| Environmental protection expenditure in Europe (deflated absolute value) | | Increase in public and private sector funding for environment- and climate-related expenditure — 7th EAP | |

Environmental protection expenditure has increased over the years and this seems likely to continue to 2020, strengthened by the EU's decision that at least 20 % of its 2014-2020 budget should be used on climate change activities.

For further information on the scoreboard methodology please see Box I.3 in the EEA Environmental indicator report 2018

The Seventh Environment Action Programme (7th EAP) identifies the need to increase environment and climate-related expenditure if its environment and climate objectives are to be met. Environmental Protection Expenditure (EPE) — which does not capture investment in renewables, energy efficiency and climate adaptation — increased in the EU in real terms by 9 % between 2006 and 2017. To date, the highest EPE and the largest growth in EPE has been in waste management. Since at least 20 % of the EU budget should be spent on climate change activities until 2020, it is likely that EPE will grow further.

## Setting the scene

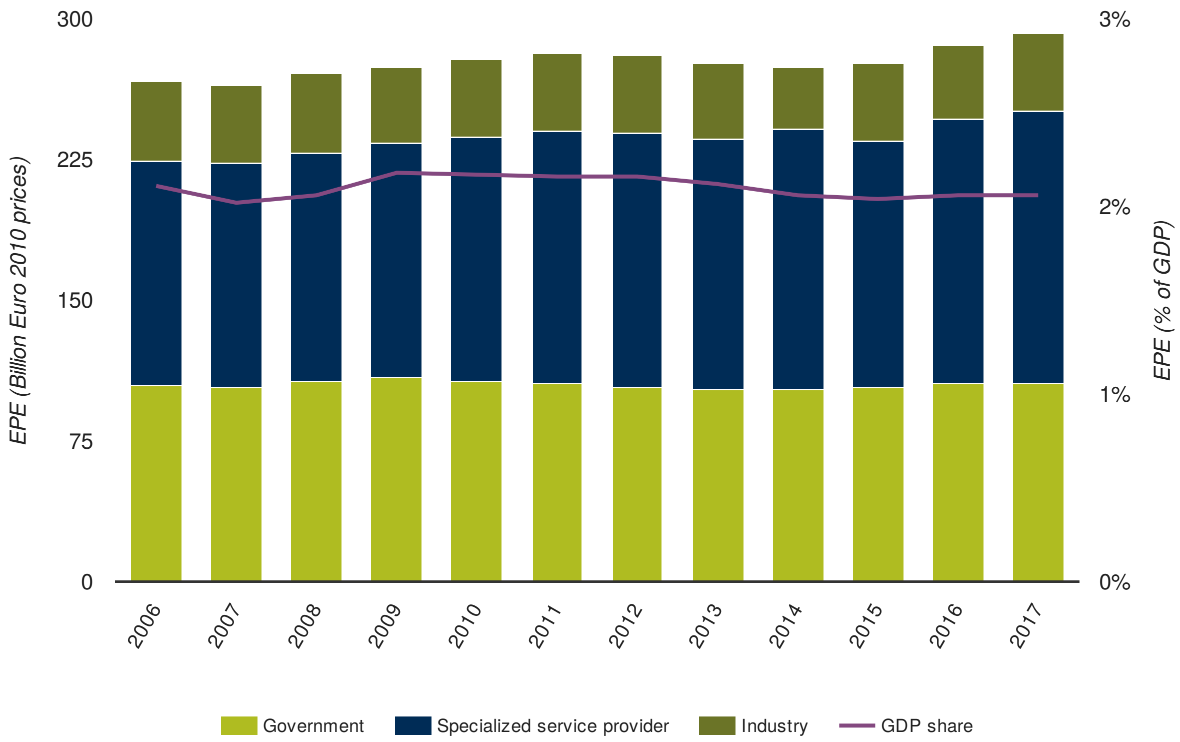
The 7th EAP calls for an increase in both public and private sector environment- and climate-related expenditure to achieve environment and climate objectives (EU, 2013). This briefing presents trends in Environmental Protection Expenditure. Promoting activities and technologies aimed at preventing pollution and environmental degradation can reduce the environmental and climate impacts of economic activity. These activities and technologies can themselves have a positive impact on economic development and create business opportunities and jobs in the environmental goods and services sector (AIRS_PO2.12, 2018). However, increased spending can also reflect responses to growing environmental pressures and impacts on the environment.

## Policy targets and progress

The 7th EAP Priority Objective 6 (to secure investment for environment and climate policy and address environmental externalities) identifies the need to increase both public and private sector environment and climate-related expenditure. This is key to the achievement of the 7th EAP Priority Objective 2 (to turn the Union into a resource-efficient, green and competitive low-carbon economy), the monitoring of which this briefing contributes to. It is for this reason that EPE is examined here.

EPE has grown over the 2006-2017 period by 9 % in real terms and in 2017 it reached an estimated amount of EUR 292 billion (deflated to 2010 prices) (Figure 1). The shares of public sector (i.e. government), industry and specialised producer (a mixture of public and privately run environmental specialist services such as waste and wastewater companies) expenditure remained relatively constant over the period. In 2017, specialised producers accounted for about 50 % of total EPE, the public sector for 36 % and industry for 14 %. Almost all of the increase in total EPE over the 2006-2017 period was driven by specialised producers. Their contribution, deflated to 2010 prices, increased by EUR 27 billion over the period. The public sector's contribution to the overall EPE remained relatively stable while the contribution of the industry sector dropped by around EUR 2 billion between 2006 and 2017.

## Figure 1. Environmental protection expenditure by institutional sector and as percentage of GDP, EU



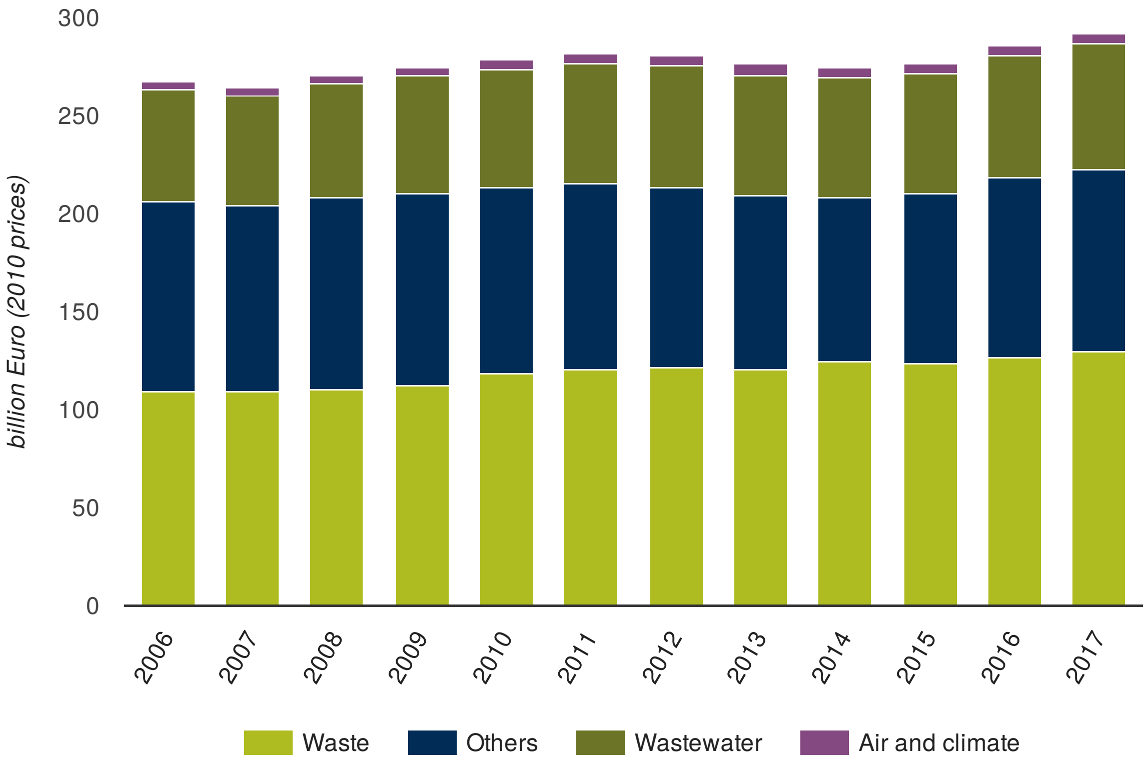

**Data sources:** a. Eurostat. Production of environmental protection services of general government by economic characteristics [env_ac_pepsgg]
b. Eurostat. Production of environmental protection services of corporations as specialist producers by economic characteristics
c. Eurostat. Production of environmental protection services of corporations other than specialist producers by economic characteristics and NACE Rev. 2 activity

**Note**:

1. Values are deflated to 2010 prices by the EEA using the GDP deflator.
2. Data correspond to the national expenditure on environmental protection data.

The share of overall EPE in GDP decreased by 0.05 percentage points, from 2.11 % of GDP in 2006 to 2.06 % of GDP in 2017. The share slightly increased during the period of the 2008 economic downturn, reaching a peak of 2.19 % in 2009. This was because public expenditure increased during and immediately following the economic downturn as governments in EU Member States tried to stabilise their economies by increasing investments, including green investments (Görlach et al., 2014).

## Figure 2. Environmental protection expenditure by environmental domain, EU




**Data sources:** a. Eurostat. Production of environmental protection services of general government by economic characteristics [env_ac_pepsgg]
b. Eurostat. Production of environmental protection services of corporations other than specialised producers by economic characteristics and NACE Rev. 2 activity [env_ac_pepsnsp]
c. Eurostat. Production of environmental protection services of corporations as specialised producers by economic characteristics [env_ac_pepssp]
d. Eurostat. GDP and main components (output, expenditure and income) [nama_10_gdp]

**Notes:**

1. Values are deflated to 2010 prices by the EEA using the GDP deflator.
2. The domain 'Other' includes the following environmental protection activities as classified under the Classification of Environmental Protection Activities: 'protection and remediation of soil, groundwater and surface water', 'noise and vibration abatement', 'protection of biodiversity and landscapes', 'protection against radiation', 'environmental research and development' and 'other environmental protection activities'.
3. Data correspond to the national expenditure on environmental protection data.

Figure 2 shows EPE estimated levels (deflated to 2010 prices) at EU level broken down by environmental domain in the same 2006-2017 period. Most expenditure was on waste management, followed by waste water treatment. Growth in EPE was driven primarily by growth in waste management expenditure (absolute values), although expenditure on air and climate increased by 31 % during the 2006-2017 period compared with a relative increase of 19 % for expenditure on waste management.

EPE only partly captures climate-related expenditure. Nevertheless, since the EU decision that at least 20 % of its 2014–2020 budget will be used on climate change activities (EC, 2013), it seems likely that environmental protection expenditure will increase by 2020.

## Country level information

Examining the 2014 and 2015 (Eurostat, 2018) country data, it can be seen that the EPE-to-GDP ratio varies greatly across countries. While on average in the 2014-2015 period, EU EPE was about 2 % of GDP, in Bulgaria, the Czech Republic and Estonia, for instance, it was more than 3 %, and in Luxembourg and Finland it was about 1 %. The wide gaps reflect differences in economic structure (e.g. type of industry, type of energy source used). However, comparison between counties should be interpreted with caution due to discrepancies in the coverage of the full range of environmental protection activities.

## Outlook beyond 2020

Progress towards a circular economy will require increases in investment and current expenditure in the waste management sector, but also within the business sector as a whole, to close resource loops. The EU intends to invest EUR 5.5 billion of structural funds on accelerating the circular economy (EC, 2015). This could also provide a catalyst for expenditure by the public sector and businesses in Member States up to and beyond 2020.

The EU’s agreed long-term target (EC, 2014) for further reducing greenhouse gas emissions (a 40 % reduction compared with 1990 by 2030) also implies additional investments, not all of which will be captured by the EPE indicator — given the definition and scope of the EPE. The air pollutant emission reduction commitments for 2030 that were adopted under the new National Emissions Ceiling Directive (EU, 2016) could also lead to an increase in EPE beyond 2020. Additional efforts will be needed beyond 2020 to achieve the water quality targets of the Water Framework Directive (EU, 2000), which are also likely to be reflected in an increase in EPE.

## About the indicator

The environmental protection expenditure indicator uses data from the environmental protection expenditure account (EPEA), which is one of the European environmental economic accounts. Environmental economic accounts analyse the interaction between the economy and the environment by organising environmental information in a way that is consistent with national accounts. EPE measures investments aimed at preventing, reducing and eliminating pollution and environmental degradation. The EPE indicator estimates country spending on these activities in deflated prices (2010 is used as the reference year) in euros and as a percentage of GDP.

EPE data are available by environmental domain (protection of ambient air and climate; waste water management; waste management; protection and remediation of soil, groundwater and surface water; noise and vibration abatement; protection of biodiversity and landscape; protection against radiation; research and development; and other environmental protection activities). EPE data are also available by institutional sector (public, industrial and specialist producers, which can be a mixture of public and privately run specialist environmental services such as waste management companies etc.). EPE can also be split between investments and current (ongoing) expenditure (Eurostat, 2017).

Regulation 691/2011 establishes the European environmental economic accounts. From 2017, reporting of data on the EPEA is mandatory and standardised and it is therefore expected that this will further improve the quality of the data. Before 2017, data were reported by countries on a voluntary basis. Eurostat has been producing estimates at EU level through gap filling and early estimates.

Although the EPE includes investment in reducing air pollutants (including greenhouse gases), it does not capture investment in renewable energy and energy efficiency as EPE does not cover resource management activities or any form of climate adaptation. Therefore, other data sources should be mobilised in order to fully capture expenditure with a view to achieving climate policy objectives.

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